

- 13 Podetia mostly long streaked, without cups (then with ± inwards curved ends) or with narrow, toothed or off shooting cups, 3-10 cm, ends strongly browned, axils closed. Pycn. gelatin colorless. Barbatic acid * **C. amaurocraea**
- 13* Podetia ± forked (rarely branched to 4), without cups, 1-3 (5) cm, often producing dense turfs or "hedgehog like" cushions. End branches often somewhat curved toward the outside, pointed, scarcely to definitely browned, axils open or closed. Pycn. gelatin red. ± Squamatic acid. * **C. uncialis**

Cladonia PT 2: Red Fruited Species

- 1 Primary squamules and podetia K+ definitely yellow, P+ (yellow) orange, ± gray-greenish to gray (when sorediate often even almost white). Thamnolic acid . 2
- 1* Primary squamules and podetia K-, P-, ± yellowish-green or gray, sorediate parts even whitish 5
- 2 Primary squamules usually large, -1 cm, broadly rounded, coarse, with upward curved margins, commonly mealy-sorediate at the margin and underside, toward the base the underside often orange, close standing, often over lapping, gray to greenish-gray. Podetia very diversely developed, lacking or short peg-form to horn-form with indefinite cups to with definite, little deepened cups with finger-like upright continuations toward the outside, above all with cortex in the lower part, above partially or entirely mealy sorediate. Sorediate part whitish * . **C. digitata**
- 2* Primary squamules with smaller, -3(4) mm, mostly incised, undersides not or sparsely sorediate 3
- 3 Podetia usually the margin toothed to finger-like proliferations or deformed cups, but also partially simple and without cups, light gray to whitish, for the most part mealy to coarse granular sorediate, at times squamulose. Primary squamules up to 3 mm, sometimes somewhat sorediate, not rounded, but incised, steel-gray, underside sometimes orange toward the base. * . **C. polydactyla**
- 3* Without cups, podetia peg-form to horn-form or sparsely branched above, with cortex of finely mealy or coarsely sorediate, 1-2 (3) cm high . 4
- 4 Podetia partially with cortex, partially coarse granular (granules with cortex), also protruding foliate or entirely with cortex, unbranched or with a few short, ± equal length branches, commonly with conspicuous, projecting head-like, knobby ap. Primary squamules often small and relatively less conspicuous. K-, P-, rarely K+ yellow, P+ orange. Barbatic acid, ± Thamnolic

acid, ± Didymic acid. On thin soils and peat, very rarely on wood

C. macilenta ssp. **floerkeana**

- 4! Podetia almost throughout finely mealy sorediate (soredia ca 40 µm), rarely granular, basal region often small foliate (rarely higher regions foliate), light gray, whitish in the sorediate parts (to light gray). Ap. often lacking, commonly relatively small and scarcely projecting. Primary squamules often very numerous. K+ yellow, P+ yellow to orange, or K-, P-. Usually with Thamnolic acid, often Barbatic acid, rarely Didymic acid, Squamatic acid

C. macilenta ssp. **macilenta**

- 4* Podetia usually at least with isolated proliferations or deformed (often inconspicuous) narrow cups, but when young or reduced development even only simple and without cups and then difficult to distinguish from the previous, for the most part (granular) sorediate, often intermixed with squamules. Primary squamules usually very numerous, thick, up to about 3 mm, sometimes somewhat sorediate, not rounded, steel-gray. K+ yellow P+ orange. K+ yellow, P+ orange. Thamnolic acid. On decayed wood, base of trees, rarely on thin soils and peat .

C. polydactyla

- 5 Podetia and primary squamules pure gray to (sorediate parts) whitish, peg-form or sparsely branched above, podetia KC-, without Usnic acid (*C. macilenta*) . 4
- 5* Podetia and primary squamules with yellow-green tinge, KC+ yellow, with Usnic acid 6
- 6 Primary squamules underside richly sorediate, numerous, thick standing, -3(4) mm, often distorted and erect, incised, closely observed upper surface often appearing sorediate. Podetia very short, -5 mm high, usually curved, clavate or flattened, without cups, often becoming distorted and sparse. Usnic acid, Squamatic acid. Usually on peat walls **C. incrassata**
- 6* Underside of primary squamules not strongly sorediate, podetia higher, with or without cups, not clavate and distorted 7
- 7 Podetia with warty upper surface or squamulose, not sorediate, but sometimes partially without cortex 8
- 7* Podetia at least in the upper part with sorediate upper surface . 12
- 8 Podetia stretched, 2-6 cm long, without cups or rarely with very narrow cups, usually thickly covered with projecting foliate squamules, above often partially without cortex. UV+ white. Usnic acid, Squamatic acid . **C. bellidiflora**
- 8* Podetia with broad cups, -2(3) cm high, when only with apparent cups, then with decorticate blackened regions and with Didymic acid 9
- 9 Podetia slender, with mostly relatively clearly set off from the stem, often distorted cups, partially decorticate and there usually blackened, partially

corticate and thick standing squamulose-foliate, above sometimes even partially granular. Primary squamules up to 4 mm in size, UV+ white. Usnic acid, Didymic acid, Squamatic acid

C. metacorallifera

9* Podetia commonly not with blackened decorticate parts. Cups broad (1 cm), ± uniformly narrowing to the stalk. The stalk short. UV-. Without Didymic acid, and Squamatic acid. *C. coccifera* s.l. . 10

10 With Barbatic acid, and Usnic acid, without Zeorin. Podetia smooth to areolate (clody) corticate (areoles not or only slightly projecting), at the base slightly projecting squamulose, above and in the cup with contiguous flat rounded clods, sometimes proliferating from the cup margin. Primary squamules up to 10 mm in size

C. borealis

10* Without Barbatic acid, with Zeorin, and Usnic acid, ± Porphyrylic acid. Podetia more robust erect squamulose or covered with projecting clods or granules. A difficult group 11

11 Podetia covered with contiguous clods, even in the interior of the cups, or above all in the lower part thickly covered with projecting, ± toward lower showing squamules (“leaflets”), cups -1.5 cm wide. Primary squamules up to 8 mm in size.

* **C. coccifera**

11* Upper surface of the podetia sorediate, but in richly fruiting specimens soredia often sparse (at best only in the interior of the cups) and the upper surface almost entirely corticate and partially covered by decorticate granules and warts. Cups up to 1.5 cm wide. Thallus squamules up to 4(6) mm. * . **C. pleurota**

12 Podetia granular sorediate (soredia usually over 80 µm), above all in the interior of the cups, short, mostly -2 cm high, rarely higher, with broad cups, in the lower part flecked decorticate. Herbarium specimens often covered by Zeorine crystals. Zeorine, Usnic acid, ± Porphyrylic acid

C. pleurota

12* Podetia finely mealy sorediate (soredia ca. 50 µm), often higher than 2 cm, with few of the stems bearing cups or without cups, only the base entirely corticate (the distinction of the following species upon a purely morphological basis – the chemical characteristics do not parallel the morphological). *C. deformis* s.l. . 13

13 Podetia with definite, mostly trumpet-form, ± uniformly broad cups, yellowish, green- to gray-yellowish, in the herbarium after a long time thallus whitish because of fine Zeorine crystal needles (visible in the stereo microscope). Primary squamules small, 0.5- -3 mm, even almost lacking. UV-, Zeorine, and Usnic acid .

C. deformis

13* Podetia commonly without cups and skewer form or with ragged, split open, with long narrow cups, sulfur-yellow to green-yellowish, after a

long time in the herbarium the thallus whitish or not, UV- or UV+ white. Primary squamules often rather coarse, 2-8 mm. Zeorine or Squamatic acid, Usnic acid **C. sulphurina**

Cladonia PT 3: Species with brown Apothecia or without Apothecia

1 Podetia at least partially covered with soredia, i.e. partially or completely clearly mealy to granular sorediate . 2

1* Podetia not sorediate . 27

2 Podetia pale yellow, sulfur-yellow, green-yellow or gray-yellow (with Usnic acid), mealy sorediate, rarely fruiting. Ap. yellow- brown to flesh colored, often lacking (when ap. lacking and also no brown punctiform pycn. on the cup margin see PT 2/12). Frequent species only in the Alps . 3

2* Podetia whitish, gray, gray-brown, without yellow tint (without Usnic acid). Ap. dark to light brown (rarely yellow-brown: *C. norvegica*) . 5

3 Podetia with broad, often provided with teeth at the margin or with short proliferations, light greenish-yellow to pale gray-yellowish (to light gray), transparent when moist, mealy sorediate in the upper part, -2 cm. Cup-form, abruptly translated into the stalk. Ap. coarse. KC+ yellow. Zeorine, very rarely Barbatic acid

C. carneola

3* Podetia always without cups. Rarely fruiting – arct-bor-alp – Alps . 4

4 Podetia 3-8 cm long and slender, simple or branched, pointed, yellowish above, toward the bottom gray to bluish-gray. Over mosses, raw humus, e.g. peat bog. Barbatic acid, ± Zeorine * **C. cyanipes** (Sommerf.) Nyl.

4* Podetia 1-3 cm, peg-form, yellowish, but like *C. macilenta*. on rotten wood. Barbatic acid * **C. bacilliformis** (Nyl.) Dalla Torre & Sarnth.

5 Thallus P-, K- . 6

5* Thallus P+ clearly yellow, orange, or red . 11

6 Podetia at the top rather densely covered with spreading squamules, pointed or open, often toothed, -2 mm wide ends, gray-green to green-brown, commonly partially decorticate (white), uneven and often granular, not typically sorediate, UV+ white. Squamatic acid, see *C. squamosa*

6* Podetia commonly not covered with spreading squamules at the top, clearly sorediate surface . 7

7 Podetia with definite, broad to moderately broad, interior of the cups closed or open . 8

7* Podetia predominantly without cups, slender, -2 mm thick, simple or branched, toward the top thinning and pointed or **isolated** even with

- apparent narrow, irregular, proliferating, closed or open cups . 9
- 8 Podetia with broad cups with closed interior (chemical races of *C. pyxidata* ssp. *grayi*, the P-reaction). Podetia stalk corticate (sometimes only half), sorediate in the upper part or at least in the cups. Soredia mealy or larger (granular). Cups often over 5 mm wide, usually gradually narrowing toward the stalk, ± trumpet-like (*C. pyxidata*-group) 26*
- 8* Podetia at the top broadening into a moderately broad, open cup, robust, stubby, generally unbranched, finely mealy sorediate surface, light gray to browned, cup margin curved toward the interior, often irregularly proliferating. UV+ white. Squamatic acid **C. cenotea**
- 9 Rare montane lichens on stumps and at the base of trees. With Barbatic acid. Podetia entirely mealy-sorediate, numerous, -3 cm, like *C. coniocraea*, gray to greenish-gray, unbranched, rarely branched, awl-like to cylindric, in fertile stands broadening toward the ends (even with apparent narrow cups), ap. yellowish to light brown. Basal squamules 2-4 mm, spreading, crenate to deeply divided, on the underside of the ends sometimes sorediate, often red flecked on the upper side (especially visible when moist). UV+ white . **C. norvegica**
- 9* Widespread lichens, on soil, rarely wood. Ap. brown to dark brown, rare. Basal squamules not red flecked, usually inconspicuous or sparse. Without Barbatic acid. Podetia extensively decorticate and sorediate, corticate at the base. Almost always UV+ white/blue-white (when UV- or UV+ weakly bluish-white, usually with red pycn. see *C. macilenta* PT 2/4) . 10
- 10 Podetia coarse granular to mealy sorediate, usually dirty brownish, greenish-brown, awl-like pointed or with blunt ends or rarely with narrow (4mm wide), often irregular and proliferating cups, -3(5) cm. Medulla UV+ white, rarely UV-. Homosekicaic acid, ± Fumarprotocetraric acid. On open soils, usually on disturbed habitats **C. rei**
- 10* Podetia granular sorediate, in the upper part mostly squamulose (rarely entirely covered with squamules), simple to little branched (3 branches), white-gray to gray, awl-like pointed, often with inconspicuous elongate furrows, very rarely with narrow implied cups, -5 cm. Squamatic acid. on sandy and gravelly soils and on rotten tree stumps . **C. glauca**
- 11 Podetia without cups, or cups very narrow and not thicker than the podetia 12
- 11* Podetia at least partially with definite cups 20
- 12 Podetia and thallus squamules K+ clearly yellow, with Thamnolic acid 13
- 12* Not K+ clearly yellow, without Thamnolic acid . 14
- 13 Podetia usually for the most part mealy sorediate, peg-form, simple to sparsely branching, not with brown pycnidia/ap . * **C. macilenta** (PT 2/4)
- 13* Podetia usually granular and partially decorticate, partly covered with small spreading leaflets, mostly very thin, irregularly branched, grooved and often perforated, -0.5(1) cm, often with brown pycn./ap., standing between very thick turfs, spreading, strongly incised, at the margin granular or mealy sorediate basal squamules . * **C. parasitica**
- 14 Podetia almost entirely mealy to finely granular sorediate (soredia however often partially deteriorated, predominantly 30-90 µm), only basally corticate and squamulose. Fumarprotocetraric acid 15
- 14* Podetia not entirely mealy to finely granular sorediate, usually in the lower third to lower half corticate or podetia with squamulose- coarse granular upper surface and partially corticate. Fumarprotocetraric acid 17
- 15 Primary squamules usually richly occurring, often sorediate. Podetia usually 1-2.5 cm high, almost always simple, pointed of blunt ended or with very narrow short cups of the thickness of the podetium, with or without squamules, light gray(green) to pale greenish. Above all on tree stumps and trunks . * **C. coniocraea**
- 15* Primary squamules sparse or lacking. Podetia usually 2-6(10) cm high, usually branched, without cups and pointed on the ends or with moderate to very narrow, on the margin often long awl-shaped or peg-like proliferations, often incomplete cups. Above all on soil 16
- 16 UV-. P+ orange-red, podetia usually 2.5-6 (10) cm, cups often proliferating, without squamules or basally even sparsely squamulose, commonly light gray . * **C. subulata** (23)
- 16* UV+ almost always white (medulla). P+ yellow, then slowly orange-red, or equally orange-red, podetia -4(5) cm high, branching, dirty brownish, gray-greenish or gray, granular sorediate above, rarely mealy, rarely with cups. Homosekicaic acid . * **C. rei**
- 17 Podetia finely sorediate in the upper half, otherwise smooth corticate, unbranched, pointed above, (green)brownish, whitish to gray-greenish above, -4(6) cm. Primary squamules small. P+ red. Ap. almost always lacking . * **C. cornuta**
- 17* Podetia otherwise, not smoothly corticate in the entire lower half, podetia unbranched to commonly in part branched . 18
- 18 Podetia of the habit of *C. furcata* (↑), repeatedly in part dichotomously branched, 2-6 cm, slender, with pointed to blunt ends, partially decorticate and isidiate to coarse granular-squamulose, coarse-granular sorediate toward the points, partially smooth corticate, gray-white, (greenish)gray, rarely brownish. Axils sometimes

- open. Primary squamules sparse to lacking. UV-
* . **C. scabriuscula**
- 18* Podetia of other habits, unbranched to sparsely branched **19**
- 19 Primary squamules usually sparse. Podetia ± slender, -4(5) cm, basally corticate, above it mealy to granular sorediate (not squamulose-lumpy), simple to at least partially in one race with 1-2(3) branches, medulla almost always UV± white. Ap. rather rare. Homosekicaic acid
* **C. rei** (16)
- 19* Primary squamules usually richly developed, small. Podetia stubby, -2(3) cm, not or sparsely branched above, with pointed to blunt ends, squamulose-lumpy, partially granular, flecked more or less corticate, very variable and relatively difficult to address, frequently with pale brown, transparent when moist, globular ap. Medulla UV-. Without Homosekicaic acid
* **C. ramulosa**
- 20 Podetia partially without cups, blunt to pointed ends **21**
- 20* Podetia as a rule all with cups **24**
- 21 Podetia squamulose-lumpy, partially granular, partially corticate, not or sparsely branched above, pointed or with implied narrow cups, which in fruiting specimens often are covered with globular ap. P+ red, Fumarprotocetraric acid **C. ramulosa** (19)
- 21* Podetia otherwise, granular- to mealy-sorediate, not squamulose-lumpy and partially decorticate **22**
- 22 Primary squamules usually not sparse, greenish, sometimes sorediate. Podetia usually only up to 3(4) cm, sometimes sorediate. Podetia usually only up to 3(4) cm, unbranched, for the most part fine mealy, base and the cups corticate, often also under the ap. Cups very narrow, abruptly joined, (cup-like), scarcely proliferating, often covered by (sometimes globular) ap. P+ red. Fumarprotocetraric acid. Above all on stumps and at the base of tree trunks .
C. coniocraea: "C. ochrochlora"
- 22* Primary squamules often sparse. Podetia usually 2.5-6(8) cm, often branched. Ap. rather rare, often on the cup margins, below it podetia often corticate. Above all on soil **23**
- 23 Commonly UV+ white: with Homosekicaic acid, Fumarprotocetraric acid, P+ yellow, then slowly red or red at the same time. Podetia -3(5) cm high, rarely with irregular, scarcely proliferating cups, dirty brownish, granular sorediate above, rarely mealy, corticate in the lower region **C. rei**
- 23* UV-, P+ rapidly red, with only Fumarprotocetraric acid. Podetia -6(10) cm, without cups and pointed on the ends or with moderately to rather narrow, on the margin often long awl-like or peg-like proliferations, often imperfect, -5(9) mm wide cups, without squamules or basally sparse squamulose, commonly light gray- green to light gray **C. subulata**
- 24 Podetia with very narrow, cups which scarcely surpass the stalk thickness, usually on tree trunks or stumps . **C. coniocraea** (22)
- 24* Podetia with relatively broad cups . **25**
- 25 Podetia almost entirely uniformly mealy sorediate, possibly the entire base somewhat corticate and occasionally squamulose, pale greenish to gray-white, -3 cm high, slender, regularly formed, uniformly colored. Cups ± cup-like, long stalked, abrupt transition to the stalk, mostly -5 mm wide. Margin entire, toothed or with short stalked apothecia. Soredia up to ca. 30(40)µm. Fumarprotocetraric acid. (when podetia short stalked, K+ yellow, see. *C. humilis*)
C. fimbriata
- 25* Podetium stalk at least in the lower region (2.3 mm) corticate, in the upper part or at least the cups sorediate. Soredia mealy or coarser (granular). Cups often over 5 mm wide, often more trumpet-like: *C. pyxidata* group. Very difficult. Evaluation of the taxon problematic. Not able to be determined without chemical investigation **26**
- 26 Soredia about 30-70 µm, podetia mealy sorediate only basal (1-2 mm) corticate, usually pale greenish, even gray, the stalk relatively thick and short, with rather abrupt transition, non proliferating cups, sometimes cups almost seeming without stalks. Primary squamules often large, -5 mm, usually ± rounded. P+ strongly red, KC-, K+ yellow. Fumarprotocetraric acid, Atranorin **C. humilis**
- 26* Soredia about 50-120 (200) µm, podetia granular sorediate to coarsely granular, partially to almost entirely corticate, but sorediate at least in the cups, gray-greenish to often partially gray-brownish to brown (above all on well lighted sites), sorediate part usually pale greenish, cups gradually narrowed to the stalk, often proliferating at the margin. Ap. sessile or stalked. Primary squamules usually small, ± erect. P- or P+ red, KC- or KC+ red. Very form rich, numerous chemotypes **C. pyxidata**
The chemo- and morphotypes of the form series of *C. pyxidata* have been very distinctly evaluated taxonomically by the author. Here the species is very broadly presented.
ssp. **chlorophaea** is the most frequent chemotype, containing only Fumarprotocetraric acid (P+ red, K-, C-, KC-, UV-), the podetia often proliferate, are usually pale greenish, greenish-gray, rarely strongly browned. all the remaining chemotypes are here included in ssp. *grayi*; which contains (in addition to the usually occurring Fumar-protocetraric acid) other substances: the cups are often more narrow than in the case of ssp. *chlorophaea*, the podetia more frequently browned; reactions P- to P+ orange-

- red, C-/C+ yellow or red, KC- to KC+ red, UV+ weakly yellowish, weakly bluish to intensively blue-white. A morphologic differentiation in some cases seems not possible, on the other hand there are ecological and geographic trends.
- ssp. **grayi**. There are within the ssp. *grayi* the following various chemotaxa:
- C. cryptochlorophaea*: with Cryptochlorophaeaic acid (K+ yellow-red, P+ red, C- or C+ yellowish to reddish, UV+ pale yellow). Often richly sorediate, often pale greenish.
- C. grayi* s.str.: with Grayanic acid (K-, C-, KC-, P+ red or P-, UV+ blue-white). Usually richly sorediate.
- C. merochlorophaea*: with Merochlorophaeaic acid and 4-O-Methylcryptochlorophaeaic acid (K-, P+ red or P-, C+ red, KC+ red, UV+ weakly blue). Often not sorediate, but coarse warty corticate.
- C. novochlorophaea*: with Sekicaic and Homosekicaic acid (K-, C+ yellow, KC-, P+ red or P-, UV+ white). Often not sorediate, but coarse warty corticate.
- 27 Podetia without cups . 28
- 27* Podetia at least with isolated definite cups 56
- 28 Primary squamules very richly developed and dominating the aspect of the thallus, podetia sparse or small . 29
- 28* Podetia dominating the aspect of the thallus . 39
- 29 On mineral soils or raw humus . 33
- 30 Thallus P-. Podetia usually 1-3 cm, as a rule covered densely with gray-green to pale green, rarely brownish, incised squamules, therefore decorticate and whitish, rarely granular-small fine squamulose and areolate, with open ends, awl-like pointed, narrowly funnel-like to with apparent, indefinite separate cups. Primary squamules usually very numerous and dense. Very variable. As a rule P-, K-, C-, Squamatic acid: var. *squamosa* . **C. squamosa**
- 30* Thallus P+ orange to (orange)red, C- . 31
- 31 Thallus K-, P+ red. Primary squamules usually light greenish-gray, producing thick carpet to cushions, ascending, elongate, usually strongly crenate-toothed, not sorediate. Podetia up to 4 mm high, the primary squamules scarcely overriding, whitish, without scales or even scaly, as a rule with (often bulging light brown) ap., these apparently sessile on the primary squamules. Fumarprotocetraric acid . **C. caespiticia**
- 31* Thallus K- yellow, P+ orange, with Thamnic acid 32
- 32 Primary squamules -5 mm, strongly incised to almost coralloid, with sorediate or granular margins, erect, elongate, producing extensive carpets. Podetia -5 (10) mm. *. Almost only on oak stumps, rarely at the base of living oaks, rarely on Scots pine **C. parasitica**
- 32* Primary squamules -2(3) mm, not strongly incised, not coralloid, commonly without sorediate margins. Podetia commonly over 5 mm high. *. On various substrates **C. squamosa**
- 33 Primary squamules brownish-green to gray-greenish, C+ conspicuously verdigris green, P+ yellow, K-, -4 mm long, rounded or elongate, producing thick cushions. Podetia rare, with non uniform cups or unbranched turgid structures, corticate and covered with scales. Strepsilin, (Baeomycesic acid, Squamatic acid) **C. strepsilis**
- 33* Primary squamules not C+ oxidized green 34
- 34 Primary squamules K- 35
- 34* Primary squamules K+ clearly yellow, later as a rule (not always) at least partially red, P+ slowly orange or red, ca. 3-10 x 3-5 mm, underside white, upper side gray, gray-, bluish-green . 38
- 35 Thallus P+ orange-red (Fumarprotocetraric acid). Primary squamules mostly light greenish-gray, producing thick carpets to cushions, erect, elongate (mostly 2-5 mm long, -1.5 mm wide), ± incised, not sorediate. Podetia up to 4 mm high, not rare, the primary squamules scarcely overriding, as a rule with (often bulging light brown) ap., these apparently sessile on the primary squamules . **C. caespiticia**
- 35* Thallus P+ yellow, or P-, without Fumarprotocetraric acid. On acid soils . 36
- 36 Thallus P+ yellow, UV-. Primary squamules 3-6 mm in size, -2 mm wide. Podetia -4(6) cm high, simple to little divided, greenish- gray to brownish, with large ap. or sterile, often partially decorticate, covered with ± thick with central outgrowing concave to flat squamules, often longitudinally split or perforated, pycn. frequent. Psoromic acid **C. macrophylla**
- 36* Thallus P-, UV+ white . 37
- 37 Very rare. With Grayanic acid. Podetia up to 1.5 cm high, thinning above, often branched, with open axils, often basally blackened with age. Primary squamules ± erect, usually - 3 mm long, narrow, gray- green, olive, often brown tinted, very fragile, scattered to thick standing **C. fragilissima**
- 37* Frequent. With Squamatic acid. Podetia usually 1-3 cm, as a rule thickly covered with gray-green to pale green, rarely brownish, incised squamules, thereby decorticate and whitish, rarely granular-small squamulose and areolate with open ends, awl-like pointed or narrowly funnel like to having apparent, indefinite cups. Primary squamules usually very numerous and thick standing. Very variable form. As a rule P-, K-: var. *squamosa* .. **C. squamosa**
- 38 Not rare in lime regions. Podetia commonly lacking (irregularly divided to almost cup-like, ± regularly corticate). Primary squamules gray to greenish-gray, undersides whitish, 2-6 x 2-4 mm, in the dry condition turned upward, at times bending back and showing the underside, usually

- scarcely longer than wide. Color reactions above all on the squamule margins definite, K+ slowly and often only fleck wise red. Atranorin, ± Norstictic acid **C. symphyrcarpa**
- 38!** Very rare above all in sandy regions. Podetia frequent, robust, thickened above, smooth to perforate, even squamulose, simple to little branched. Primary squamules (when podetia sparse, then thick standing) olive green above, undersides whitish to usually pale brownish or pale red- brownish, ascending to upright, elongate, 3-15 x 1-4 mm, K+ yellow, then rapidly red. Norstictic acid **C. polycarpoides**
- 38*** On acid substrates. Of the aspect of *C. squamosa* (37). K+ remaining yellow. Thamnolic acid **C. squamosa** var. **subsquamosa**
- 39** K+ yellow, then rapidly red **C. polycarpoides (38)**
- 39*** Lichen not K+ rapidly red . **40**
- 40** Podetia outer surface smooth, with decorticate places, with or without scattered squamules growing out from the cortex, cortex not granular-warty or erupting squamulose. Cortex one colored or variegated **41**
- 41** Thallus P-. Podetia -6 cm, with or without few squamules **42**
- 41*** Thallus P+ yellow to red **44**
- 42** Primary squamules numerous, olive, brown-green, or gray-green. Podetia -1.5 cm, simple to usually branched above, smooth to channeled cortex, but also erupting. Medulla UV+ blue-white. Grayanic acid. On acid soils. Very rare . **C. fragilissima**
- 42*** Primary squamules often sparse and soon disappearing. Podetia as a rule reaching over 1.5 cm high. Without Grayanic acid **43**
- 43** Podetia richly branching, K+ yellow, usually erect and occurring in thick trufs, ends pointed, closed. Branches relatively strongly diverging (spreading), often repeatedly forked, therefore often without a continuing main stem, whitish-gray, or pale greenish-gray, the ends strongly browned, cortex variegated, dark areoles (algae groups showing through) separated by light lines. Ap. (almost) always lacking. Commonly on base rich soil. UV-, Atranorin, Rangiformic acid **C. rangiformis**
- 43*** Podetia sparse or irregularly branched, K-, with open, at the margin ± toothed ends, with usually a definite main stem and little diverging branches, brown to gray-green, cortex not or weakly variegated. Ap. moderately frequent. Primary squamules often soon disappearing. On acid soils. UV+ white. Squamatic acid, ± Barbatic acid . **C. crispata**
- 44** Podetia ± richly dichotomously branching, narrow, ± erect, 2-6 cm high, always without cups. Widespread and frequent, variable lichens. Fumarprotocetraric acid . **45**
- 44*** Podetia only sparsely branching, if stronger branching, then decumbent-ascending . **46**
- 45** K+ yellow. Branches relatively strongly diverging (spreading). Podetia often repeatedly forked, therefore often without a continuing main stem, with (v.) scattered squamules, whitish-gray, pale greenish-gray, the ends strongly browned, cortex variegated. Atranorin, Rangiformic acid, (relatively rare chemical race with Fumarprotocetraric acid) . **C. rangiformis**
- 45*** K- or greenish to brownish, rarely yellowish. Podetia without squamules to loosely squamulose, in many (often richly fruiting) forms longitudinally split in places and then only cracked, little to strongly branched (often dichotomously), commonly ± erect, gray-white to gray-greenish to dark brown. Branches usually forked, often even becoming rather angular pointed. Very variable forms. Without Rangiformic acid, very rarely with Atranorin * . **C. furcata** ssp. **furcata**
- 46** In calcareous dry turfs. Podetia commonly decumbent to erect, sparsely squamulose, usually dark brown to olive brown, frequently cracked at the base and with white erupting bulges, loosely branched, with open axils, never with cups, branches pointed, often almost becoming right angular. Primary squamules commonly disappearing. K+ yellow to K-. Atranorin, Fumarprotocetraric acid, ± (Bourgeanic acid) . **C. furcata** ssp. **subrangiformis**
- 46*** Not in calcareous dry turfs. Podetia without erupting bulges. When podetia decumbent, then in cool moist, heavy snow mountain sites. Axils closed. Fumarprotocetraric acid **47**
- 47** Podetia thin, usually 1-1.5 mm thick, 2.5-6(8) cm high, erect, thick standing, usually with primary squamules, pointed, commonly with apparent at least isolated, very narrow, ± toothed cups (search for them!), gray-green to dark brown. Very variable * . **C. gracilis (68)** (Beware of confusing with sparsely branched *C. furcata*, which does not have cups and often has open branch axils)
- 47*** Podetia robust, 2-5 mm thick. Lichens of high montane to alpine sites . **48**
- 48** Dying basal part not yellowish, but gray to blackish. Podetia decumbent to erect, 2-12 cm long, often as though bloated, not or very sparsely squamulose, brown to brown-gray, often shiny, cups relatively rare. K indefinite to + yellow. * . In alpine sites in exposed turfs up into small snow valleys. Alpine . **C. macroceras** (Delise) Havaas (*C. gracilis* v. *m.* (Delise) Flotow)
- 48*** Dying basal part usually yellowish, not blackish. Podetia usually ± erect, 3-10(12) cm high, pale gray, blue-gray, even pruinose, dull, mottled, whitish reticulate between the flicks, with or without squamules, unbranched or branched,

- elongate pointed or with narrow proliferating cups, K+ clearly yellow. Atranorin *. On long time snow covered sites in the alpine zone, in cold boulder declivities – arct-alp – Alps .
- C. ecmocyna** (Gray) Leighton (in north Europe, with scarcely or without white reticulate cortex, like *C. gracilis*, with essentially more robust, cups usually rather rare, distorted and proliferating, ± Atranorin *: **C. maxima** (Asah.) Ahti)
- 49 Ap. beige, rose-brownish to pale brown, always occurring, capitate at the end of the podetia. Podetia yellow tinted, yellowish- gray to pale yellow-greenish, peg-form to at the top divided in small, ± equal height ends of the branches, -1(1.5) cm, with warty areolate upper surface. KC+ light yellow. Primary squamules inconspicuous. Barbatic acid, ± Usnic acid. Very rare species above all on the cross-section of stumps . **C. botrytes**
- 49* Ap. brown to dark brown (only lighter when moist) or lacking. Podetia not yellow tinted (at best yellowish at the base) **50**
- 50 Podetia not open, ± cylindrical to funnel-like ends or with cups open at the base, as a rule thickly covered with gray-green to pale green, rarely brownish, incised squamules, decorticate between them and whitish, rarely granular small squamulose and perforate, awl-like pointed, narrowly funnel-form to with suggested, indefinitely laid down cups. Primary squamules usually very numerous and thick standing. Very variable structures. As a rule P-, K-: var. *squamosa* (Squamatic acid); P+ orange, K+ yellow; var. *subsquamosa* (Thamnolic acid) . **C. squamosa**
- 50* Podetia otherwise (ends and axils not open) **51**
- 51 Podetia simple or open branching, ± corticate or with squamules on decorticate white upper surface, above all black thin walled toward the base. with numerous olive, brown-green to gray green colored primary squamules. R-, UV+ white. Grayanic acid . ↑ **C. fragilissima**
- 51* Podetia elongate cracked or clearly elongate grooved or broken through (hyphae of the medulla in longitudinally ordered, often recognizable long strands), often relatively thick walled, simple peg-form to branched above. Cortex of the podetia areolate to lumpy or ± disintegrated. Without Grayanic acid . **52**
- 52 Podetia K+ yellow, P- or + orange-red, C-, 0.5-2 cm, branched above and branches for the most part ± ending at equal height (“umbelate”) and with large projecting terminal ap, partially decorticate and clearly elongate cracked to mostly perforate and slit, sometimes granular to lumpy corticate, gray-green to gray. Atranorin, ± Fumarproto-cetraric acid, ± Norstictic acid .
- C. cariosa**
- 52* Podetia K-, simple or less branched above **53**
- 53 P+ red, with Fumarprotocetraric acid. Podetia gray-white, gray or brownish green- gray, usually simple, granular-warty, partially decorticate, ± elongate cracked, -1.5 cm, always with one terminal ap. Primary squamules small, about 1 mm, often with pycn . **C. peziziformis**
- 53* P- or P+ deep yellow, without Fumarprotocetraric acid **54**
- 54 P-, with Perlatolic acid. Podetia 1-4 cm high, 0.5-2 mm thick, white-gray to gray (brownish), with lumpy organized cortex, lumps growing into squamules and are easily loosened, somewhat granular sorediate between the squamules. Looks like *C. macrophylla* **C. decorticata**
- 54* P+ deep yellow, with Psoromic acid. Podetia rather robust, gray-white to brown tinted gray, warty-lumpy corticate to squamulose . **55**
- 55 Primary squamules usually large, 3-6(8) mm long, podetia -4(6) cm high, 1-5 mm thick, simple and with large capitate ap. or little divided and then often sterile and awl-like ended, greenish-gray to brownish and often partially decorticate, ± thickly covered with centrally growing concave to flat squamules, often elongate slit or perforate, pycn. frequent UV- . **C. macrophylla**
- 55* Primary squamules smaller, -3 mm, podetia -8 mm high, simple or sparsely divided, always with ap. Like *C. macrophylla*, independence questionable **C. brevis**
- 56 Primary squamules lying flat or only somewhat ascending at the margins, closely coalescing to overlapping and producing one apparent decumbent, rather thick, lobed at the margin, usually brownish to brown- greenish thallus. Podetia short, flat and broad cupped (5-10 mm wide, usually only up to 1.5 cm high), lumpy to flat-warty or coarsely granular cortex, lumpy-warty in the cups. Fumarprotocetraric acid, ± Atranorin. On calcareous soils . **C. pyxidata ssp. pocillum**
- 56* Primary squamules small producing a coherent thallus . **57**
- 57 Podetia in the upper part covered with coarsely granular, granular-warty or with ± contiguous (partially removed) lumps (definite at least in the interior of the cups), -2.5(3) cm **58**
- 57* Podetia in the upper part ± smoothly corticate (but often somewhat checkered by a fine light net), not granular, commonly not covered with contiguous lumps, but often with projecting squamules **60**
- 58 Cups usually narrow and irregular to only suggested, proliferating at the margin or covered with heaped ap. Podetia at times blunt ended (without cups), warty-lumpy or covered with squamules, almost always partially granular toward the top, flecked corticate, very variable, frequently with pale brown, transparent when

- moist, knobby ap. Primary squamules usually richly developed, small: Fumarprotocetraric acid
C. ramulosa
- 58*** Cups always occurring, definitely developed, broad, sometimes proliferating from the margin (*C. pyxidata* s.l.) . **59**
- 59** Often with Fumarprotocetraric acid, always with additional lichen substances. Cups commonly partially granular see **C. pyxidata** ssp. **grayi** (**26**)
- 59*** Only with Fumarprotocetraric acid. Podetia covered by coarse contiguous lumps or coarse warty corticate, partially sometimes even decorticate, on no part granular, gray, green-gray, or brownish. Ap. frequent, often on short stalks
C. pyxidata ssp. **pyxidata**
- 60** Primary squamules very large (mostly over 10 mm), dominant aspect, thick turf, K+ yellow, P+ orange-red. Fumarprotocetraric acid, Atranorin. In high mountain or very rare . **61**
- 60*** With other characteristics. If thallus K+ yellow, then primary squamules small . **62**
- 61** Not in the high mountains. Primary squamules large, elongate, up to 20 x 4 mm, dominant aspect, ± uniformly forked, ± erect, blue-gray, lead-gray, underside gray to whitish, often black toward the base. Podetia short, usually -1 cm, irregularly bloated, often with longitudinal cracks, with relatively broad, deformed, cups proliferating from the margins (also from the center). ***. C. subcervicornis**
- 61*** Lichens of the high mountains, primary squamules rounded to elongate, -15 mm long, 5-10 mm wide, lobed or incised, concave or rolled back, erect, gray-green, bluish gray-green, undersides white, podetia -15 mm, with often weakly developed, short, flat, broad cups, sometimes proliferating from the center
***. C. macrophyllodes** Nyl.
- 62** Podetia cups ± uniform, often proliferating from the center . **63**
- 62*** Cups not proliferating from the center. Primary squamules occurring or disappearing . **65**
- 63** High mountain lichens, K+ yellow, P+ red. Atranorin, Fumarprotocetraric acid .see **C. ecmocyna** (**48**)
- 63*** From the lowlands up into the mountains, K-, P+ yellow or red. Podetia ± smooth or flat-warty corticate, gray-green to brown. Primary squamules as a rule clearly, coarse, elongate, dense standing, ± erect and rolled back, in the case of stronger development of podetia often sparse. P+ yellow or red. Without Atranorin. *C. cervicornis* **64**
- 64** P+ deep yellow. Podetia often weakly developed, relatively rarely multistoried, more narrow than ecologically similar ssp. *verticillata*, cup margin irregularly toothed. Primary squamules thick standing, up to 5 x 1 mm. Psoromic acid **C. cervicornis** ssp. **pulvinata**
- 64*** P+ red. Cups rather broad, regular, with margin smooth or ± toothed by pycnidia or ap. Primary squamules relatively sparse and podetia well developed and often multistoried (ssp. *verticillata*) or primary squamules robust, dense, -10 mm long and then podetia often weakly developed (ssp. *cervicornis*). Fumarprotocetraric acid . **C. cervicornis**
- 65** P-. Podetia at times cupless, at times with very narrow, indefinitely formed cups, often strongly branched, brown, often in dense stands
C. crispata var. **cetrariiformis** (Delise) Vainio
- 65*** P+ red. Fumarprotocetraric acid **66**
- 66** Podetia K+ yellow, usually 6-12 cm high, 2-4(5) mm thick, pale gray, blue-gray, even when pruinose, dull, checked, whitish net between the flicks, with or without squamules, unbranched or branched, longitudinally split or with narrow, often irregular cups proliferating at the margin, toward the base often yellowish. Primary squamules sparse to lacking. Atranorin *. On long-time snow covered sites in the alpine zone, in cold boulder declivities – arct-alp – Alps
C. ecmocyna (Gray) Leighton
- 66*** Podetia K- . **67**
- 67** Podetia speckled-checked at the base, with lighter (corticate) areoles on ± apparent blackened decorticate regions, very variable in form. Cups as a rule variable (often multistoried) proliferating on the margin, toothed, often split, ragged, indefinitely formed, at times only implied, ± smooth, but ± checked (darker flecks = algae groups, between them lighter and often very finely felty), cups and basal part of the podetia often squamulose. Primary squamules often lacking ***. C. phyllophora**
- 67*** Podetia not conspicuously speckled at the base (handlens), often partially split, gray- green to mostly brown-green to brown, often slightly areolate by lighter lines **68**
- 68** Podetia robust, 2-5 mm thick. Lichens of high montane to alpine sites **48**
- 68*** Podetia very narrow and thin, 1-2 mm thick, often conspicuously upright, at least with isolated cups, usually scarcely branched (when branching, then axils as a rule closed), smooth, in the cup region scarcely squamulose, (2.5)3-6(8) cm. Cups mostly rather regular, mostly very narrow, -2 mm, often toothed by pycnidia, isolated proliferations from the margin. Primary squamules usually permanent. Variable species
***. C. gracilis**

Cladonia PT 4: Species Frequently without Podetia (Selection of More Frequent or Characteristic Species)

- 1 Squamules C+ conspicuously corroded green, coarse, closely crowded, often cushion like .
C. strepsilis (PT 3/33)
- 1* Squamules not corroded copper green . 2
- 2 Thallus K+ yellow, then at least flecked red. Soil dwelling 3
- 2* Thallus K- or K+ yellow 4
- 3 Thallus K+ yellow, sporadically slowly red, P+ yellow to red. Atranorin, Norstictic Acid. On base-rich soils **C. symphycharpa (11)**
- 3* Thallus K+ yellow, then rapidly K+ red throughout, squamule undersides whitish, pale brownish, pale red-brownish. Norstictic acid. Usually on sandy and gravel soils .
C. polycarpoides (PT 3/38)
- 4 On wood and bark . 5
- 4* On soil, raw humus, or mossy rocks . 9
- 5 Thallus K+ yellow, Thamnic acid 6
- 5* Thallus K-, squamules usually only -2 mm, turf 8
- 6 Squamule sorediate on the underside and margin, often curved shell-like, broadly rounded, -1 cm wide, scarcely divided, K+ yellow, underside often yellowish at the base ***C. digitata (PT 2/2)**
- 6* Squamules smaller, -4(5) mm, turfs, at most sorediate at the margin, then however not broadly rounded, but crenate divided 7
- 7 Squamule margins strongly constructed, granular-coralloid, ± sorediate, squamules up to 5 x 1 mm. * **C. parasitica (PT 3/13)**
- 7* Squamule margins incised, but not granular-coralloid. Squamules usually -2 x 1 mm. * **C. macilenta (PT 2/4)**
- 8 Thallus P-, UV+ white, squamules -2 mm, elongate, usually thick turfs. Squamatic acid .
C. squamosa (PT 3/30)
- 8* Thallus P+ orange-red: difficult to distinguish when sterile, above all *C. coniocraea*, *pysidata* ssp. *chlorophaea* (both with usually slightly greenish squamules), more rarely *C. macilenta* (with gray squamules), *C. caespiticia*
- 9 On lime-rich soils, on mosses over calcareous rock 10
- 9* As a rule on acid soils, or mossy silicate rock . 13
- 10 Squamules closely coalescing, flattened, crust-like squamules, often rosetted, producing an effigurate thallus at the margin. Fumarprotocetraric acid **C. pyxidata** ssp. **pocillum (PT 3/56)**
- 10* Squamules not closely coalescing, separated, ± upright . 11
- 11 Squamule undersides white, upper side light gray to (greenish)gray, without marginal fibrils, (dry) upward curved, 2.5-6 mm long, 2.5-4 mm wide. K+ yellow, P-. Atranorin **C. symphycharpa**
- 11* Squamule undersides ± light yellow, repeatedly divided, erect, ends rolled back and the underside showing, often with small bushy short bristles at the margin (*C. foliacea* s.l.). Usnic acid 12
- 12 Squamules very large, foliose lichen-like, 15-40 x 2-10 mm, with usually very scattered (even lacking) whitish fibrils at the margin, usually producing loose turfs * **C. convoluta**
- 12* Squamules rather large, 4-15 x 1-3 mm, at times with blackish fibrils at the margin, producing crowded turfs. Rarely going over to calcareous soils * . **C. foliacea** s.str.
- 13 Squamules P- . 14
- 13* Squamules P+ yellow, orange, or red . 17
- 14 Squamules with slight yellowish tint, usually green-yellowish, underside white, but often yellow at the base. Often with red pycnidia. With Usnic acid. (Red fruited species, PT 2) 15
- 14* Squamules without yellowish tint, crenate, thick turf to almost cushion-like. Pycn. brown. without Usnic acid . **C. squamosa**
- 15 With Squamatic acid, UV+ white, see above all *C. incrassata*, *C. bellidiflora*, *C. sulphurina* (very rarely also *C. luteoalba*)
- 16 Squamules green-yellow, with pale gold, woolly-cob webby (handlens) underside, bending backward in the dry condition. * Zeorine, ± Porphyrilic acid. On peat soils, or raw humus – arct-alp . **C. luteoalba** Wheldon & A. Wilson
- 16* With other characteristics, underside of the squamules not woolly- cob webby. * **C. coccifera**-group (PT 2/9)
- 17 Squamules sorediate on the underside and at the margin, often (shell-like) curved, broadly rounded, -8(10) mm wide, scarcely divided, robust, K+ yellow, underside yellowish at the base. Thamnic acid. Above all on raw humus, or peat . **C. digitata (PT 2/2)**
- 17* Squamule underside not sorediate 18
- 18 Squamule underside white to light gray, without marginal fibrils. Without Usnic acid . 19
- 18* Squamule underside ± light yellow, upper side yellowish olive green, P+ red, K-, KC+ light yellow, repeatedly divided, erect, ends rolled back and the underside showing, often with blackish fibrils at the margin, rather large, 4-15 x 1-3 mm, producing crowded trufs. Usnic acid **C. foliacea** s.str.
- 19 Squamule underside gray to gray-violet, thallus K+ yellow, P+ red, producing cushions to thick turfs 20
- 19* Squamule underside white, rarely gray (then K-) . 21
- 20 Squamule underside gray-violet, 4-10 mm, upper side gray-green, elongate, ascending and bending back. Fumarprotocetraric acid, Atranorin, ± Rangiformic acid. Ecology like *C. foliacea* -- . **C. firma** (Nyl.) Nyl.
- 20* Squamule underside white to pale gray, at best gray to blackened at the base, upper side ± bluish-gray to lead-gray, dichotomously divided, ± erect, -2(3) cm long. Atranorin, Fumarprotocetraric acid . **C. subcervicornis (PT 3/61)**

- 21 Thallus K+ yellow . 22
 21* Thallus K- 25
 22 High mountain lichens, on long time snow covered, cool sites. Primary squamules rounded to elongated, -15 mm long, 5-10 mm wide, ± lobed or incised, concave or recurved, ascending, gray-green, bluish gray-green, underside white. Atranorin, Fumarprotocetraric acid
C. macrophyllodes Nyl.
 22* On other habitats. Primary squamules smaller 23
 23 On base-rich soils on warm habitats, e.g. over SiO₂ poor silicate rock. Squamules 2.5-6 mm long, 2.5-4 mm wide, under sides white, upper sides light gray to (greenish) gray, (dry) conspicuously curved up, P-/P+ yellow to orange. Atranorin, ± Norstictic acid
C. symphycarpa
 23* On other habitats. Squamules smaller, -2 mm, indented. With Thamnic acid 24
 24 Squamules gray, often relatively loose standing
C. macilenta (PT 2/4)
 24* Squamules greenish gray to brownish, crenate, thick turfs . ↑ **C. squamosa** ssp. **subsquamosa**
 25 Primary squamules -4(5) mm long, not elongated, ends recurved, gray-green to gray-brown, undersides white, but often even slightly gray-, brown- to violet tinted, somewhat felty . 26
 25* Primary squamules mostly smaller, ends not bent back, undersides white, P+ red. Fumarprotocetraric acid 27
 26 Thallus P+ deep yellow. Psoromic acid .
C. cervicornis ssp. **pulvinata (PT 3/64)**
 26* Thallus P+ red. Fumarprotocetraric acid
C. cervicornis (PT 3/64)
 27 Primary squamules producing a thick, low mat, irregularly incised, mostly elongated, mostly with single veiled, apparent sessile brown ap. on the squamules. ***C. caespiticia (PT 3/31)**
 27* With other characteristics. * Difficult to determine, e.g. *C. coniocraea*, *C. pyxidata*, *C. fimbriata*

Ecology and Distribution of the Species

Cladonia amaurocraea (Flörke) Schaerer
 In subalpine to alpine, very high precipitation sites on nutrient poor, but often rather base rich, humus soils, e.g. on cool sandy loam soils in openings of dwarf shrub associations, over moist raw humus and mosses on and between rocks and boulders, always on sites with rather long snow covering, on well lighted, but never strong sun, often only moderately wind exposed habitats, long lasting and frequent water supply guaranteed, m.-e.acidoph., Char. Cladonietum stellaris – arct-bor-mieur-alp – v.rare (1); Vog,

süSch (Feldberg), Al, Ts (Feldberg), BayW, Th129W, Hz

Cladonia arbuscula (Wallr.) Flotow (C. sylvatica auct., Cladina a. (Wallr.) Hale & W.Culb
 Above all in dwarf shrub heath of the alpine zone, like *Cetraria niv.* (↑) – mieur(-alp) – rare (O); Ju
 ssp. **mitis** (Sandst.) Ruoss C. mitis Sandst., Cladina mitis Sandst.) Hustich
 in alpine sites more frequent than ssp. *squarrosa*; in lower sites in south Germany rare (Rh-Mn-T, Mn, Sch, Ju, Ts, He) – arct-mieur(-smed-mo) - (2)
 ssp. **squarrosa** (Wallr.) Ruoss
 Up above the tree line, on cool to dry, usually nutrient poor, acid, humus sandy rocky soil, flat sandy loam soils, on peat soils and on raw humus cover on pine straw, over mosses on and between silicate rocks, especially in montane to sub alpine high precipitation sites, distributed on sandy regions even in the lowlands, in the mountains above all in setaceous grass turfs and dwarf shrubby heath (with huckleberry), on mossy peat blocks and boulder fields, at forest margins, in peatland forests, in north Germany above all in sandy conifer forests, on rather poorly lighted to very (usually rather) well lighted habitats. Principal habitat conditions: guaranteed frequent soaking, e.g. through high precipitation, moderately competitive with higher plants, as e.g. by nutrient deficit and extreme low elevation. Commonly between openings in phanerogam vegetation, not on soil cracks, or slopes; e.-m.acidoph.(-subneutroph.), Char. Cladonion arb. – (arct-)bor-mieur(-smed-mo) – (r.)rare (3); Vog. Sch, Rhön, PfW, RhSch, ThW, Erz; also usually rare (e.g. O, Ju, He)

Cladonia bellidiflora (Ach.) Schaerer
 In subalpine and alpine sites, rarely lower, like *C. amaurocraea*, yet on humid and substrate moist, wind sheltered habitats, predominantly between mosses and over moist (raw) humus between rocks as well as on cool humus mineral soils (e.g. with *Lecidoma*) – arct-bor-mieur-alp – v.rare (1); Bog, süSch (Feldberg region), BayW, Erz, Hz, Al

Cladonia borealis Stenroos
 Up into the montane region, often in relatively mild winter humid regions on mossy boulders and rocks as well as on meager acid soils on well lighted habitats, e.g. boulder fields (like *C.*

gracilis) – arct-mieur(mo) – rare (3); O, SFW, Sch, Westf

Cladonia botrytes (Hagen) Willd.

Very like *C. carneola* (↑), often in association with it – bor-mieur-h'mo (-smed-h'mo) – v.rare (0); Ju (Ortenberg), süRhön (Thulba, +?), FrJu, Obay

Cladonia brevis (Sandst.) Sandst.

Like *C. verticillata*, on deep sand and sandy loam soils, probably more in high precipitation sites – mieur-subatl – v.rare (0); süSch (Feldberg, Schramberg)

Cladonia caespiticia (Pers.) Flörke

Up into the montane zone, above all in mild winter regions, on humus poor, sandy and rocky loam soils, on open slopes on roadways, on fine soil between rocks, on lime-poor, m.-r.acid, often nutrient poor substrates on m.-very well lighted, mostly sunny, m.r.dry habitats, often at the margin of or in oak-beech forests, at the margin or in openings of heath (e.g. winged gorse heath), especially inn sandstone regions, over orthogneis, or granite (subneutroph.-)m.-r.(v.)acidoph., often with *C. subulata*, in the Lecideetum ulig. – mieur-subatl-smed(-med-mo) – r.rare; Sch (up to ca. 900 m), Vog, Pf, RhSch, Lahn, He, ThW, Th, Erz, O, Sp. SFW, Ne (Keuper region), süHü, MI

Cladonia cariosa (Ach.) Sprengel

In hilly and submontane, rarely montane sits on base-rich, lime-free to rather lime-rich (delimed upper surface), humus poor to humus, usually permeable (e.g. sandy) soils, e.g. between rocks, on gravely, stony, fine-soil-rich, m.-r.nutrient rich sites, on compact road margins, on old fire sites, in old gravel pits and stone quarries, on mine dumps, also on dolomite sand, on rather warm dry, sunny habitats, m.(r)acidoph.-neutroph – arct-smed-mo(-med-mo) – rare (2); süSch, nöSch, Vog, Eif, nöRh, Rh-Mn-T, HeBgl, O, Sp, SFW, Ju, Al, usually only a few found

Cladonia carneola (Fr.) Fr.

In high montane, (v.)high precipitation sites up to the tree line, more rarely in the montane zone, on rather to very decayed wood which holds moisture for a long time, especially rotten stumps, on raw humus, in open conifer forests, on the Moors, on the margin of scrawny willow, on moderately to very well lighted, cool-moist to

sunny fluctuating moisture habitats, r-e.acidoph., r.substrathygroph., anitroph., in high montane forms of the Cladonietum cen. (with *C. sulphurina*) – (arct-)bor-mieur-h'mo – v.rare (2); Sch, SFW, ThW, Erz, Al

Cladonia cenotea (Ach.) Schaerer

Above all in high montane and montane, high precipitation sites up to the tree line, yet also penetrating further, on rather to very decayed wood especially on stumps, more rarely on acid, humus heath and peat soils, the ecological amplitude of *C. carneola* and including the greatest part of *C. macilenta*, yet avoiding moderately decayed wood as well as relatively dry habitats, e.-r.acidoph., m.-r.substrathygroph., Char. Cladonietum cen. – (arct-)bor-smed-mo(-med-mo) – r.rare; Sch, Vog and Al scattered over 800 m, Av, do, ThW, Erz, BayW, additionally (v.)rare (e.g. SW-Ju, Ts, He)

Cladonia cervicornis (Ach.) Flotow

ssp. **cervicornis**

Substrate ecology like ssp. *verticillata*, more in mild sites – bor-med, subatl – rare, e.g. RhSch, Th, ThW

ssp. **pulvinata** (Sandst.) Ahti (*C. rappii* auct.)

↑ ssp. *cervicornis* – mieur-atl-med – rare

ssp. **verticillata** (Hoffm.) Ahti (*C. verticillata* (Hoffm.) Schaerer)

In sub- to high montane sites, rarely lower, on acid, m.nutrient rich sandy loam, rarely sandy soils, over fine gravel weathered layer or fine soil on silicate rocks (even on slightly irrigated surfaces), on naked soil on road way margins and banks, not on raw humus, above all in setaceous grass, winged broom and dwarf shrub heath, optimal on sunny, high precipitation sites with often varying moisture conditions, m.-r.acidoph., r.-v.photoph. – arct-med – r.rare (3); süSch, Vog, nöPf, RhSch, ThW, Erz, also v.rare (nöSch, O, Sp, nöRh, Rh-Mn-T, Lahn, Rhön, Ne, Ju, SFW, Do, Av)

Cladonia ciliata Stirton (*C. tenuis* (Flörke)

Harm., *Cladina c.* (Stirton) Trass, with var. *ciliata* and var. *tenuis* (Flörke) Ahti)

Up into the montane zone on nutrient poor, but often base-rich, usually dry sandy and stony soils level sandy and stony loam soils, e.g. in the region of sandstone layers of the Keuper, in very open, poor oak-hornbeam and beech forests (Luzulo-Gagion) and on acid thin turfs, but also on lime-rich raw soils in calcareous thin turfs and

Scot's pine forests, rarely on peat soils; a relatively modest species in respect to the moisture conditions, above all in moderately high precipitation regions to rather precipitation poor sites, r.acidoph.-neutroph., in association with Cladonion arb. – bor-atl-mieur-subatl-med-atl – rare (2); RhSch, Sch rather rare, but rare to very rare, e.g. O, Sp, nöRh, Rh-Mn-T, Lahn, Th, Erz, nöPf, Mn, Ne, SFW, süHü, Sju, Al

Cladonia Coccifera (L.) Willd. (incl. *C. diversa* Asperges)

In montane to alpine, humid, usually high precipitation sites, rare (on cool-moist sites) lower, above all on lime-free, but relatively base-rich, moderately nutrient-rich, humus, cool, sandy to stony soils, on thinner humus fine soil layer over silicate rock, rarely directly on rock, predominantly on overhanging rock, on rock piles and boulders in dwarf shrub heaths and thin turfs, often on long time dew moistened sites, m.-r.acidoph., m.-r.substrathygroph., in the region above all in mossy rock association, in the Parmelietum omph., Umbilicarietum deustae, in the Cladonion arb. – (s')bor-(subatl)-mieur(subatl)-med-mo – r.rare: Sch, Vog, Rhön, Al, also (v.)rare (O, Sp, SFW, RhSch, Pf, Av)

Cladonia coniocraea auct.

Widely distributed lichen of broad ecological amplitude, like *C. macilenta*, *C. pyxidata* ssp. *grayi*, *C. digitata*, especially at the base of trees and on decayed wood, on acid soil banks and over mosses, Char. Cladonion con. – bor-smed (-med) – frequent(-v.frequent), more sparse in calcareous regions

Cladonia convoluta (Lam.) Anders (C. endiviifolia (Dickson) Fr.)

In hilly, warm, low precipitation regions on dry, warm habitats on calcareous, (m.)level, stony soils on open to moderately dense growing sites on dry and semi dry turfs (Bromion, Gentiano-Koelerietum) as well as on the margin of Scot's pine forests, contrary to *Fulgensia fulgens* usually on lower based, more strongly carpeted sites, tolerating less warm sites, but the ecological amplitude strongly overlapping, subneutroph.-m.basiph., xeroph., Char. Cladonietum conv., Toninion sed. – s'mieur-subko-med – rare (2); Mn(-süRhön), Th, süHü-süRh, Ju*, Eif, Hz

Cladonia cornuta (L.) Hoffm.

In montane to subalpine sites, rarely lower, on usually cool habitats on pervious sand and sandy loam soils, on raw humus and decayed wood, in dwarf shrubby heaths and open (pine-) forests, r.-e.acidoph., in the Cladonion arb. – (arct-)bor-mieur-mo – rare (2); Sch, Al, but probably v.rare (Sb, O, Sp, Ts, Vgb, SFW, Av, Eif, ThW)

Cladonia crispata (Ach.) Flotow

In montane to alpine, high precipitation sites on acid, stony, sandy and sandy-loam humus soils and on straw, especially in openings of dwarf shrubby heaths on m.-r. open to the wind, commonly well lighted habitats, r.-e.acidoph., above all in the Cladonietum mitis – arct-mieur – rare-v.rare (1), strongly threatened outside the alpine region; Sch, Av-Do, Al, Ju?, Eif, Sp?, O?, Fr, ThW, Th, Hz, BayW

Cladonia decorticata (Fl148rke) Sprengel

Up into subalpine sites on acid, sandy, permeable soils on open sites, on road banks, more rarely on raw humus, rotted stumps, on occasionally irrigated soil encrusted rock surfaces, m.-v.acidoph. – bor-mieur – v.rare (0); nöRh

Cladonia deformis (L.) Hoffm

Up into montane sites to the tree line on acid, nutrient poor, largely humus, especially sandy soils, on peat and raw humus, e.g. in vegetation openings of dwarf shrubby heaths, in open conifer forests, more rarely on r.-v.decayed wood, commonly on m.-v.well lighted habitats with frequent varying moisture conditions, e.-r.(m.)acidoph., substrathygroph., in the Cladonietum stellaris, also in the Cladonietum mitis, Cladonietum cen. – (arct-)bor-mieur – rare (3); Sch distributed in the Sch and Vog. above 700 m, RhSch, ThW, Al, rarer e.g. Av-Do, PFW, SFW, Sp, Rhön, v.rare in dry warm sites and lime regions (e.g. Rh-Mn-T)

Cladonia digitata (L.) Hoffm.

Widely distributed up to perhaps the tree line, above all on m.-v.decayed tree stumps, rotted wood and on cracked bark at the foot of trees (in lower places above all on Scot's pine), on raw humus, peat soils, over soil-, raw humus-, wood- and rock dwelling mosses, on humus rich to rarely humus poor mineral soils (e.g. on road grades, of wider ecological amplitude, even on rather dry habitats, e.-m.acidoph., m.-r.substrathygroph., Char. Cladonion conv., often in often penetrating into mossy associations – bor-med – frequent, only more sparse in lime

regions and dry-warm regions, with spreading tendencies

Cladonia fimbriata (L.) Fr. (C. major (Hagen) Sandst.)

Especially from the hilly up into the high montane zone on acid, nutrient poor to m.nutrient rich sandy loam soils, humus sandy soils, rarer on decayed wood, at the base of trees, rarely on v.acid substrates, scarcely on raw humus and peat, often as an ephemeral pioneer, as on open slopes, path ways, in thin turfs and dwarf shrubby heaths, on naked soils in open forests (e.g. Luzulo-Fagion), on mostly open habitats, often in association with *C. subulata* and *Sacomorpha icm.*, in association acid soil ridges, in the Cladonietum cen., subneutroph. – r.(s.)acidoph. – (arct-)bor-med – r.frequent, more sparse in lime regions

Cladonia foliacea (Hudson) Willd. (C. alcornis (Leightf.) Fr.)

In hilly and submontane, (often) low precipitation sites on sunny habitats, on lime-free to rarely lime-rich, nutrient poor, but often ± base-rich soils, especially sandy soils and gravely and stony raw soils, on overhanging rocks, on dunes, in sand plains, in the Sedo- Sclerantheta association, rarely in openings of stony calcareous dry turfs (with lichens of the Toninion sed.), neutroph.-m.(r.)acidoph., r.xeroph, Char. Cladonietum fol. – mieur-subatl-med – rare (2)*; scattered RhSch and nöPf, He, Th, also rare to v.rare (Vog, PfW, nöRh, nöHü-O, Rh-Mn-T, Sp, Mn, süRhön, Erz)

Cladonia fragillissima Osth. & P.James

Like *C. subulata* and *C. fimbriata* (↑), but also on shaded mossy rocks and peat – mieur-subatl – Eif

Cladonia furcata (Hudson) Schrader

ssp. **furcata**

Strongly competitive lichen of very broad ecological amplitude, on soil, straw, (mossy) silicate rock, in lower rock-poor sites especially at forest margins and in open forests (above all oak-beech forests, Scot's pine forests) on stony, sandy and sandy loam soils, rare in calcareous dry turfs, even on rather grassy sites, in higher sites especially in dwarf shrubby heaths, on overhanging rocks, in moss rich forests, the ecological valence perhaps embracing that of *C. fimbriata*, *C. arbuscula*, *C. gracilis* etc., the high

point upon m.-r.acid substrates, in the Cladonion arb., in Phanerogam- and moss association. – bor-med – rather frequent, rarer in the calcareous regions

ssp. **subrangiformis** (Scriba ex Sandst.)

Abbeyes *C. subrangiformis* sandst.)

In calcareous dry turfs, as *C. rangiformis* and *C. symphyc.* (↑), Char. Toninion sed. – mieur-med – (m.frequent-) r.rare (lime regions)

Cladonia glauca Flörke

Like *C. subulata* (↑), but also on rotted tree stumps (like. *C. macilenta* ↑) – (s'bor-)mieur – r.rare; widespread, in lime regions ± lacking, above all Sch, Pf, RhSch, He, Th, ThW, O, Ne (Keuper region), SFW

Cladonia gracilis (L.) Willd.

Strongly competitive lichen of wide ecological amplitude, from the (hilly up to) submontane zone to above the tree line, optimal on high precipitation or cool-moist habitats in moss rich boulder heaps and in openings in dwarf shrubby heath on rocky, not full sunny slopes, similar associated as *C. arbuscula* (↑) and *C. coccifera*; e.-m.acidoph., above all in Cladonietum mitis – arct-smed-mo – r.rare (3); Sch, Vog, RhSch, Rhön, Pf, ThW, Erz, BayW, additionally usually rarer, as O, Sp, nöRh, Rh-Mn-T, He, Av-Do, SFW

Cladonia humilis (Wirth.) Laundon (C.

conoidea Ahti, *C. conistea* (“Delise”) Asah.)

On subneutral to acid, humus, above sandy soils, on mossy silicate rocks, on decayed wood, above all in forests, shady valleys, in high precipitation sites even completely light exposed, substrate ecology like *C. fimbriata* (↑) – mieur-med, subatl – e.g. Eif, Ts, Mrh, Rh-Mn-T, He, Sch, Sb, Vog

Cladonia incrassata Flörke

In hilly to montane, moderately to very high precipitation sites on peat, especially on the steep sides of older peat blocks and gravel, v.-e.acidoph., photoph., substrathygroph., often with *C. deformis* – mieur-subatl(-smed) – v.rare (3); Av-Do, Rhön, Sp?, Erz

Cladonia macilenta Hoffm.

ssp. **macilenta** (C. macilenta s.str., *C. bacillaris* (Leighton) Arnold)

Up perhaps into the subalpine zone on m.-v.decayed, usually dry rotted wood especially of old tree stumps, additionally on acid-humus, permeable soils, on often drying out raw humus

soils and on peat soils, on humus soil layers on silicate rocks, rarely over mosses or on cracked bark at the base of trees, scarcely on naked, humus-poor mineral soils, usually on well lighted sites, even on dry habitats, in lower places preferring oak stumps, e.-r(m.)acidoph., Char Cladonietum con., even in other Cladonion associations. – s'bor-smed(-med) – m.frequent; rarer in lime regions

ssp. **floerkeana** (Fr.) V.Wirth (C. f. (Fr.) Flörke)
In contrast to ssp. *macilenta* more on humus sand- and on peat soils, rarer on decayed wood, less shade tolerant, like e.g. *Cetraria acul.*, above all in the Cladonietum mitis – s'bor-smed – rare; e.g. nōRh, Sch, O, Sp, Pf

Cladonia macrophylla (Schaerer) Stenh. (C. alpicola (Flotow) Vainio)

In (high) montane to alpine, high precipitation sites usually over raw humus or flat acid humus fine layers on silicate rocks, in cool-moist boulder fields or on rocks on well lighted sites, e.-r.acidoph., r.photoph. – arct-mieur(-alp) – v.rare (2); Sch, ThW, Erz, Sauerl, Hz, Al

Cladonia Metacorallifera Asah.

In high montane and alpine sites on cold-moist, long snow covered places, like *C. stellaris* (↑), *C. bellidiflora* (↑) – bor9atl)-mieur(-alp) – v.rare (2); süSch

Cladonia norvegica Tonsberg & Holien

In montane and high montane, high precipitation, cool sites in spruce- and fir (beech) forests at the base of spruce, fir and on stumps, rather like *C. polydactyla* (↑), v.acidoph., m.photoph.-r.skioph., r.-v.hygroph., in the Cladonietum cen. – s'bor-mieur-mo(-med-atl), subatl – rare (R); nōSch

Cladonia parasitica (Hoffm.) Hoffm. (C. delicata auct.)

In submontane and hilly, rarely montane sites almost always on old, m.-r.decayed stumps of oak (rarely on spruce, Scot's pine) in dryer oak-beech- and oak-hornbeam forests, rarely basal on living trees, r.v.acidoph., Char. Cladonietum paras. (usually with *C. digitata* and *coniocraea*) – bor-mieur-subatl(-med-mo) – rare (3); scattered, above all Sch, Ju, Ne, Obay

Cladonia peziziformis (With.) Laundon (C. capitata (Michaux) Sprengel, C. leptophylla (Ach.) Flörke)

In hilly and submontane sites on nutrient poor, m.-r.acid soils, e.g. sandy loam soils, on summer warm, rather dry habitats in open forests (oak-beech forests, Scot's pine forests, over fine soil between silicate rocks, m.-r.(v.)acidoph., r.-v.photoph. –mieur-subatl – v.rare (0), probably even overlooked; Ne, O, Sp, Eif, l, Bo, Sch, Ju

Cladonia phyllophora Hoffm. (C. degenerans (Flörke) Sprengel)

Up perhaps to the tree line on humus poor to humus, acid, usually nutrient poor sand- and sandy loam soils, e.g. with *C. cervicornis* var. *vertic.*, . *subulata* or *Cetraria isl.*, in openings in dwarf shrubby heath, also in open forests, m.-r.acidoph., e.g. in the Cladonietum mitis – bor-mieur – r.rare, often overlooked (2); scattered throughout the entire region, above all RhSch, He, ThW, Erz, very rare in the lime region

Cladonia pleurota (Flörke) Schaerer (C. coccifera s.l.)

In montane to alpine, high precipitation sites, rare (on cool-moist, relatively shady habitats) lower above all on lime-free, often base-rich, moderately nutrient rich, humus, cool, sandy to stony soils, over thin humus fine soil layer and mosses on silicate rock, even directly on silicate rock, avoiding extremely acid substrate, predominantly on overhanging rocks, on stone heaps and boulders in dwarf shrubby heath and thin turfs, boulder concentrations, even on slightly irrigated surfaces, m.-v.acidoph., m.-r.substrathygroph., e.g. in rock moss associations, in the Parmelietum omph., Umbilicarietum deustae and other silicate lichen associations, also in the Cladonion arb. – arct-mieur(-med-alp) – r.rare; Sch, Vog, Rhön, RhSch, Pf, ThW, Al, in addition (v.)rare (O, Sp, Lahn, He)

Cladonia polycarpoides Nyl. (C. subcariosa auct.)

Up into (sub)montane sites on relatively warm, sunny habitats on mostly base-rich, lime-poor, sandy and flat, stony, sandy-loam soils, even over dolomite sand, usually on overhanging rock in silicate regions or in sand fields, e.g. similar to *C. cervic.*, neutroph.-m.acidoph., photoph., r.xeroph., e.g. in the Cladonietum fol. –mieur-subatl – v.rare-rare (2); nōRh, süSch, Ne, Av, SJu, MI

Cladonia polydactyla (Flörke) Sprengel (C. flabelliformis Vainio)

Above all in high precipitation sites in mountain forests influenced by conifers, on stumps and decayed wood, on raw humus and peat soils, rather like *C. cenotea* and the mountain forest habitats of *C. digitata*, but exacting hygrophytically e.g. in the Cladonietum cen., v.acidoph., m.photoph.-r.skioph. – mieur(subatl)(-med-mo) – rare; Sch, Vog, PFW, Eif, Ts, He, ThW, Erz, O, Sp, SFW, Al

Cladonia portentosa (Dufour) Coem. (*C. impexa* Harm., *Cladina p.* (Dufour) Follm.)
On habitats similar to that of *C. arbuscula* (↑), yet more frequent than these in lower sites and more toward mild to rather warm habitats, thus e.g. on sunny slopes with winged broom heath, thin pasture, on sunny rock margins with Sedo-Scleranthion communities, also in open forests (Scot's pine, poor oak- and beech forests), yet also on cool moist sites – mieur(-s)med, subatl – r.rare (3); r.rare in Vog, Sch, RhSch, PFW, SFW, ThW, Erz, (v.)rare e.g. O, Sp, He, Ne, Ju, Rh, Av

Cladonia pyxidata (L.) Hoffm.

ssp. **pyxidata**

Up into the alpine zone on lime-rich as well as on lime-free, but base-rich (above all sandy and stony loam-) soils, on mossy lime- and silicate rock, on boulders and stone piles, scarcely on raw humus, peat or straw, more rare than ssp. *chlorophaea* on stumps and mossy stems, on dry as well as on cool substrates, climatically of a very wide ecological amplitude, m.basiph.-m(r).acidoph., in moss, Cladonion and Toninion community – arct-med – moderately to rather frequent

ssp. **chlorophaea** (Flörke ex Sommerf.) V. Wirth (*C. chlorophaea* (Flörke ex Sommerf.) Sprengel)
Up into the alpine zone on generally lime-free, acid, sandy to loamy, humus to humus-poor soils, often on naked soil on disturbed sites (e.g. slopes, roadways, and gravel pits), on mossy rocks, on stumps and tree bark, more rarely on raw humus and peat, m.-v.(e.) acidoph., in the Cladonion arb., Cladonietum rei – arct-med – rather frequent

ssp. **grayi** (G. Merr. ex Sandst. V. Wirth

On r.-v.acid, humus, often sandy soils, on decaying wood of stumps, like *C. coniocraea* (↑), *C. glauca* (↑)

Cladonia grayi Merr. ex Sandst. s.str.

bor-mieur, e.g. Sch, Pf, O, SFW, Av-Do

Cladonia cryptochlorophaea Asah.

s'bor-mieur-subatl, e.g. Sch, Do

Cladonia merochlorophaea Asah.

arct-mieur(-smed), e.g. Sch, O, SFW, Pf
Cladonia m. var. novochlorophaea Sipman

bor-mieur, e.g. Sch

ssp. **pocillum** (Ach.) Dahl (*C. pocillum* (Ach.) O.J. Rich.)

Generally on mosses over limestone (rocks, rock piles) and basic-, usually lime-rich soils, on well lighted, often sunny sites, like *C. symphycarpa* and *C. furcata* ssp. *subrangif.*, e.g. in the Toninion sed. – arct-med – rather rare; above all Ju, SJu, FrJu, Ne, Mn, ± lacking in silicate regions

Cladonia ramulosa (With.) Laundon (*C. anomaea* (Ach.) Ahti & P.James, *C. pityrea* (Flörke) Fr.)

Rather like *C. squamosa*, usually with or over mosses on decaying stumps, on silicate rock, at the base of trees, on peat- and heath soils and on acid soil ridges, r.-v.acidoph., r.photoindiff. – (s'bor-)mieur-smed-subatl(-med) – rare, probably easily overlooked; e.g. Sch, Eif, SFW, O, He

Cladonia rangiferina (L.) Weber ex Wigg.

(*Cladina r.* (L.) Nyl.) – Reindeer lichens

Like *C. arbuscula*, yet hygrophytically somewhat fastidious, gaining somewhat less ground on strongly wind exposed habitats, rarer, concentrated in humid, cool-moist sites, almost lacking in dry warm regions – (arct-)bor-mieur(-smed-mo) – rather rare (3); Vog, Sch, SFW, PFW, RhSch, Rhön, ThW, Erz, BayW, Al, very rare in He, O, Sp, nörh+, Sb, Ju, SJu, Av

Cladonia rangiformis Hoffm.

Up into montane sites on warm, sunny habitats on usually dry, limy, but even lime-free subsoil, but then generally on base-rich silicate soils (e.g. over mineral-rich gneiss and schale), above all on level, rocky slopes in thin turfs (Bromion, Nardo-Galion), neutroph.-m.(r).acidoph., r.-v.photoph., xeroph., e.g. in the Cladonietum conv., *C. foliaceae* or in otherwise lichen-free (or poor) phanerogam associations – s'bor-med – rather rare; RhSch, He, Th, Mn-süRhön, nöPf, Vog, Ju, SJu, süSch, Ne, otherwise usually very rare

Cladonia rei Schaerer (*C. nemoxya* (Ach.)

Arnold)

Up into the montane sites e.g. on sandy, usually relatively humus poor heath soils, gravelly-stony soils (alluvium), over rock, on naked soil on road margins and slopes, forest margins, in plantations, gravel pits, predominantly on disturbed habitats, subneutroph.-m.acidoph.,

Char. Cladonietum rei ass. prov. – s'bor-mieur – rare, overlooked; RhSch, Ts, n148Rh, O, Sp, He, Av, also Al, *Ml*

Cladonia scabriuscula (Delise) Nyl.

Up into the montane sites on humus, sandy, sandy loam and rocky soils, between rocks, in moss rich boulder fields in open forests and heaths, especially in winter-mild humid regions, on cool-moist or high precipitation habitats, ?r.acidoph.-subneutroph. – bor-mieur-subatl – v.rare, probably even overlooked; süSch, *O*, Eif, Mos, Vgb

Cladonia squamosa (Scop.) Hoffm. (with var. *squamosa* and *subsquamosa* (Nyl. & Leighton) Vainio)

Up above the tree line, especially in high precipitation sites and on cool-moist, shady habitats on markedly acid, nutrient-poor substrates, above all on mossy silicate rocks and boulders (especially on mineral poor and rough silicate rocks), on fresh raw humus cover, on the rainy and mossy bases of trees, on decayed tree stumps (in lower sites above all on oak wood in Luzulo-Fagion association), on sandy mineral soils (e.g. soil ridges), even on near bog sites, in forests as well as open, but scarcely sunny sites (above all in dwarf shrubby heaths with *Vaccinium*), avoiding long-time dry sites, r.-e.acidoph., m.-e.hygroph., in moss associations, in the Cladonietum cenoteae, Cladonietum mitis, Parmelietum omph. etc. – arct-med – moderately frequent (-r.rare); moist silicate regions ± frequent, especially on variegated sandstone (thus Sch, Vog, PFW, RhSch, Sp, O, Rhön), otherwise scattered; ± rare in lime region, dry-warm sites

Cladonia stellaris (Opiz) Pouzar & Vèzda (*C. alpestris* auct., *Cladina st.* (Opiz) Brodo)

In high montane to alpine, rather to very high precipitation sites, rare lower, on nutrient poor soils, in cold air containing basins, on sites with very late developing vegetation, in open Moor margin forests and in high Moors, in cool moist boulder fields, on rocky, shady slopes, almost always on sites with long snow cover, in the region usually on rather wind protected sites, on moderately to very radiation exposed habitats, relict, in the Alps usually in openings in dwarf shrubby heath, e.g. Rhododendron-shrub, v.-m.acidoph., Char. Cladonietum stell. (usually with *C. arbuscula* and *rangifer.*). Lichens of the

Friedhof crest – (arct-)-bor-mieur-alp, subko – v.rare (1); Sch, Vog, *Do*, Rhön, BayW, ThW, Erz, Al

Cladonia strepsilis (Ach.) Grognot

Mainly in submontane and montane, high precipitation and winter mild sites, on lime-poor, but often base rich, sandy, gravely, shallow-stony and raw soils, on thin weathered layer of crystalline rock, also on irrigated surfaces, on sunny (above all on high precipitation sites) as well as on cool-moist sites, predominantly on rocky slopes, in openings of heath, in Sedo-Scleranthetea associations, sometimes like *C. cervicornis* ssp. *verticill.*, e.g. with *Polytrichum piliferum*, m.-r.acidoph. – (bor-atl-)-mieur-subatl-smed – rare (0)*; PFW, nöPf, RhSch, Rhön, Meissner, ThW, Hz, Vog, süSch

Cladonia stygia (Fr.) Ruoss

In montane and high montane sites in high-Moor-forest margins and peat removal/dried up high moors, rare also on raw humus cover over boulder accumulations, often in cold air accumulating hollows, v.-e.acidoph., r.-s.photoph., anitroph. – bor-mieur-h'mo – v.rare (2); Sch, *Do*

Cladonia subcervicornis (Vainio) Kernst.

Like *C. strepsilis* (↑) – (arct-)-bor-atl-med – V.rare; PFW (Wasigenstein)

Cladonia subulata (L.) Weber ex Wigg (*C. cornutoradiata* (Coem.) Zopf)

Up into high montane (rarely higher) sites on acid nutrient poor substrates, above all on humus poor, nutrient poor substrates, above all on humus to rather humus rich sand- and sandy loam soils, very often on open slopes on road margins, also in vegetation openings, especially in poor oak-beech forests, in bristle grass turfs and dwarf shrubby heaths (Calluno-Genistion), rarer even on decayed wood, climatically of wider ecological amplitude, like *C. caespiticia*, *C. pyxidata* ssp. *chlorophaea*, *Saccomorpha ulig.*, (subneutroph.)m.-r.acidoph., high point in the Lecideetum ulig. – bor-med – (r.)frequent, above all sand- and loam regions

Cladonia sulphurina (Michaux) Fr. (*C. gonecha* (Ach.) Asah., *C. deformis* var. *gonecha* (Ach.) Arnold)

In montane to alpine, high precipitation sites, above all on raw humus, peat and v.decayed wood), on cool to cold, usually sunny habitats.

– arct-mieur-mo – rare; Sch, Vog, BayW, Erz, Hz, Al

Cladonia symphyocarpa (Flörke) Fr.

From the plains up into the alpine zone on sunny, dry, ± summer warm habitats on usually lime-rich, flat, stony, gravely or sandy soils, even on dolomite sand, on open to moderately thick growing sites on dry and semi dry, alpine lime thin trufs, initial stages of raw soils or over thin soil layer on lime- or dolomite rocks, even going over to moss, m.basiph.-subneutroph., r.xeroph., m.-v.photoph., in the Toninion sed. – arct-med – r.rare; above all Ju, SJu, FrJu, Mn-süRhön, Th, rare in Ne, süHü, RhSch, He, süRh, Av, Al

Cladonia uncialis (L.) Weber ex Wigg.

Penetrating into montane and high montane sites, rather like *C. arbuscula* (↑), in low sites almost only on very nutrient poor, very acid soils – arct-mieur(-smed-alp) – r.rare (3); Sch and Vog scattered (above all over 800 m); RhSch, Rhön, Pf, ThW rather rare; otherwise (v.)rare (e.g. SFW, O, Sp, Lahn, Rh-Mn-T and Ts), also Al

Cladonia zopfii Vainio (*C. destricta* auct.)

In hilly, rather summer warm sites on nutrient poor, acid humus sand soils, on dunes, in very open Scot's pine forests, in the Cladonion arb. – bor-mieur, subatl – v.rare (0); *nöRh* (*Mannheim*)

LIT.: AHTI 1961, AHTI IN POELT & VEZDA 1977, ANDERS 1928, HENNIPMAN 1978, KROG et al. 1980, LEUCKERT et al. 1971, PAUS 1992, PURVIS et al. 1992, RUOSS & AHTI 1989, SANDSTEDE 1931, STENROOS 1989a,b.

Clauzadea Haf. & Bellem.

(Determination ↑ Lecidea PT 3)

Introduction

The species of *Clauzadea* which for a long time belonged to *Lecidea* or *Protoblastenia* have a definite crustose or endolithic thallus, brown-black to black, in the moist condition commonly brown- or red-brown tinged apothecia with (sometimes disappearing) proper margin.

The species or the relatively small genus are dwellers on limestone. *C. monticola* and *C. immersa* grow predominantly on shady, sometimes moist rock margins. *C. metzleri* colonizes above all small stones and smaller

rocks in well lighted sites, likewise also *C. chondrodes*. The species are distributed from the mediterranean region to central Europe (*C. chondrodes*, *C. cyclisca*), south Scandinavia (*C. immersa* and *C. metzleri*) or up into the arctic (*C. monticola*).

Genus Characteristics

Thallus crustose, commonly thin or in the substrate with *Trebouxia*. Ap. dark red-brown to black, sometimes pruinose, with permanent to indefinitely developing proper margin, sessile to sunken into rock pits. Exc. thin to thick, red-brown to dark brown, of radial hyphae. Hyp. almost colorless to red-brown. Hym. I+ orange-red to blue-greenish. Epihym. brown, red-brown, or orange-brown. Paraphyses branched and sparsely anastomosing, often relatively thick, colored above. Asci narrowly clavate, *Porpidia* type. Sp. 1-celled, ellipsoidal, when young surrounded by a perispore. Pycnosp. laterally segmented, short bacillar. Ch-

Ecology and Distribution of the Species

Clauzadea chondrodes (Massal.) Clauz. & Roux (*Lecidea* ch. (Massal.) Malbr., *Protoblastenia* ch. (Massal.) Zahlbr.)

On limestone and dolomite in montane sites, probably like *C. immersa* (↑), *C. metzleri* (↑) – s'mieur-med -- ?rare; *SJu, Ju, FrJu, Al, Th*

Clauzadea cyclisca (Massal.) V.Wirth (*Lecidea* c. (Massal.) Malbr.)

On limestone and dolomite on well lighted habitats – mieur-med – v.rare (?); *SJu, Ju, FrJu*

Clauzadea immersa (Hoffm.) Haf. & Bellem. (*Lecidea* i. (Hoffm.) Ach., *Protoblastenia* i. (Hoffm.) J.Steiner)

Up over the tree line on limestone and dolomite on contiguous rocks and larger boulders, rarely on stones, preferably on nutrient poor, not dust impregnated surfaces, r.euryök, above all on moderate to rather well lighted, ± away from the sun habitats, basiph., ombroph., mesoph. (–r.xeroph.), anitroph., *Verrucarietalia* parm. and *Thelidietalia* dec. – (s'bor-)mieur-med – r.rare; *SJu, Ju, FrJu, Th, Al*

Clauzadea Metzleri (Körber) Clauz. & Roux ex D.Hawksw. (Lecidea m. (Körber) Th. Fr., Protoblastenia m. (Körber) J.Steiner)

Above all up into montane sites on rather lime rich, often only moderately hard limestone (often marl limestone), above all small stones on soil base or lower, often dust impregnated rock layer, on gravel in abandoned gravel pits, in dry turf, on scree slopes, above all on well lighted, ± sunny, often rather long dew moistened habitats, basiph., photoph., m.-r.xeroph., *C. metzleri* association – mieur-med – r.rare; Ju, SJu, FrJu, süRh, süHü, *Rh-Mn-T*, Ne, Mn, Th, Saar, Bit

Clauzadea monticola (Schaerer) Haf. & Bellem. (Lecidea m. Schaerer, Protoblastenia m. (Schaerer) J.Steiner)

Up into the alpine zone on moderate to very .lime-rich rock (limestone, dolomite; marl, calcareous sandstone, calcareous slate), even on concrete, mortar, on small stones as well as on larger rocks (e.g. with *Protoblastenia rup.*), r.euryök, on slightly moist as well as drier surfaces, on climatically very variable, but usually not sunny habitats, basiph., ombroph., a-/m.nitroph., above all Thelidietalia dec. – arct-med – r.rare; above Ju, SJu, FrJu, Th, Al, otherwise rare (above all Hü, Ne, Mn, He, Rh)

LIT.: CLAUZADE & ROUX 1985, FRIES 1874, OZENDA & CLAUZADE 1970.

Clauzadeana Roux

Determination ↑ *Aspicilia*)

Introduction

Clauzadeana macula, which earlier on the basis of the crustose thallus and sunken apothecia was placed in *Aspicilia* is a lichen of harder silicate rock in higher sites; which occurs above all in western and central Europe and is distributed in the north to Scotland and up to northern Scandinavia. The single species has black apothecia and an areolate red-brown thallus.

Genus Characteristics

Thallus crustose, of angular areoles, red-brown, ± shiny. Ap. sunken, aspicilioid, with black, flat to somewhat convex disk and thalloid margin not raised. Hyp. ± colorless. Hym. I+ blue. Epihym. brownish to blue-green. Paraph. richly branched and reticulate, not thickened above. Asci broadly clavate, *Lecanora*-type. Sp. 1-celled. Ch: argopsin.

Ecology and Distribution of the Species

Clauzadeana macula (Taylor) Coppins & Rambold (*Aspicilia morioides* Blomb. ex Arnold, *Lecanora* m. (Blomb. ex Arnold) Blomb.)

In high montane, high precipitation sites and therefore, rare in the montane zone, on very hard crystalline rock usually on rain exposed vertical surfaces of rock, also in open to the light boulder heaps, m.-r.acidoph., in crustose lichen associations. – bor-mieur-h'mo/alp – rare (3); süSch, *BayW*

LIT.: RAMBOLD 1989, ROUX 1983.

Cliostomum Fr.

(Determination ↑ *Catillaria*)

Introduction

The species of the genus are crustose lichens with light thallus, pale yellow or lead-gray, brownish to blackish, margined, long flat permanently biatorine apothecia and two-celled spores. Frequently very large, prominent black pycnidia are produced. The two species occur especially on old oaks and oak wood, rarely also on other trees with acid bark. They are distributed from the mountainous regions to the submediterranean region in the south and central Fennoscandia. *C. griffithii* occurs only in the atlantic region and reaches almost into the region of the east edge of the distribution; in Germany it is frequent only in the region near the sea. In Baden-Württemberg it is known from only a single occurrence in the Black Forest. In the region *C. corrugatum* was found almost exclusively in old oak hornbeam on very old, huge trees, e.g. in association of “dust fruiting”

lichens. Both species are threatened to a high degree in south Germany.

Genus Characteristics

Thallus crustose, cracked to areolate or granular-warty, whitish, light gray, pale yellow, with *Trebouxia*-like photobiont. Ap. commonly concave to flat, light to black, sometimes pruinose, with proper margin. Exc. pale yellow because of a layer of granules, of \pm radial lying hyphae. Hyp. colorless. Hym. I+ blue. Epihym. yellowish to dark brown, often covered with fine granules. Paraphyses simple to sparsely branched, scarcely thickened above. Asci cylindrical-clavate, *Biatora*-type. Sp. 2-celled. Pycn. usually numerous, large and conspicuous, black, microscopic with dark(purple)brown wall. Pycnosp. egg-shaped-cylindric. Ch: Atranorin, Usnic acid, and Fatty acids.

Ecology and Distribution of the Species

Cliostomum corrugatum (Ach.: Fr.) Fr. (*C. graniforme* (Hagen) Coppins, *Catillaria graniformis* (Hagen) Vainio, *C. ehrhartiana* (Ach.) Th.Fr.

In hilly to submontane, rarely montane sites in near natural, open oak- and oak hornbeam forests, above all on very old oak trunks, rarely on other deciduous trees, e.g. ash, even oak wood, e.g. decorticate stumps or (earlier) old boards, r.acidoph., r.skioph.-m.photoph., r.hygroph., anitroph., e.g. in *Chrysotrichetalia*-association. – s'bor-mieur(subatl)(-smed) – rare (2); süHü(-süSch), Ne (above all Sb), *SFW*, Ju, Bo, *Vog*, *nöRh*, *Mn-Rh-T*, O, *Sp*, *Fr*, *h-Ts*, *Lahn*

Cliostomum griffithii (Sm.) Coppins (*Catillaria g.* (Sm.) Malme)

On acid, not or moderately eutrophic bark of deciduous and conifer trees, rarely on wood, in open forests and on free standing trees – s'bor-atl-mieur-atl-med-subatl – v.rare (1); Eif, süSch, more frequent in NW- and N Germany.

LIT.: PURVIS et al. 1992, VAINIO 1934

Collema Weber ex Wigg.

Introduction

The *Collema*-species or gelatin lichens are dark brown to black foliose lichens of gelatinous consistency. In the dry condition the thallus is brittle, swelling more or less strongly on moistening and then they are often olive tinted blackish. In contrast to the genus *Leptogium*, which also are brown to black, yet also include gray gelatinous lichens with chain-form cyanobacteria of the genus *Nostoc*, exhibit no cellular cortex of the thalli. The apothecia have a red- to dark brown, usually deep sessile, bordered disk. Many species generally appear sterile and produce isidia.

Of over 80 species world wide 25 occur in Germany and 22 in the region. They grow on tree bark, soil and rock. The indigenous epiphytes live on deciduous trees with subneutral bark, in part in warm, mild winter (wine growing)-sites (*C. ligerinum*, *C. conglomeratum* and *C. fragrans*) in part in humid, oceanic, usually pronounced high precipitation mountain locations (*C. fasciculare*, *C. furfuraceum*, *C. nigrescens*, even less pronounced *C. occultatum* and *C. flaccidum*). All these (even overgrowing mosses) bark lichens are in strong degree of regression and threatened, only *C. flaccidum*, that occurs also on silicate rock, reacts less extremely. They are in part threatened with extinction, in part already extinct, based on an apparent especially low resistance toward sulfur dioxide and a pH change in the precipitation water. Inside of 20 years the occurrence of *C. nigrescens* and *C. fasciculare* have strongly shrunken.

Typical for many rock dwelling *Collemas* is an open, often sunny habitat, which after a rainfall remains irrigated for a time (e.g. continuing water through a fissure). Especially the calcareous lichens *C. callopisum*, *C. cristatum*, *C. fuscovirens*, *C. multipartitum*, *C. polycarpon* and *C. undulatum* occur under such conditions. *C. fuscovirens* and, less often, *C. polycarpon* frequently reside even on human created substrates, e.g. on walls, the main habitat of *C. crispum* in the region. *C. auriforme* lives predominantly on mosses on shaded limestone. Silicate rock with usually relatively low SiO₂ content or with calcareous inclusions is the substrate for *C. flaccidum* and *C. glebulentum*. Often sufficient also is a supplying with base-rich water. *C. dichotomum* lives in mountain brooks on continuously moist, at times submerged, at times splash-water moistened sites. *C.*

glebulentum and *C. dichotomum* are extremely rare in central Europe and threatened with extinction. Only the species on calcareous substrates seem out of danger. *C. crispum*, *C. limosum*, *C. coccophorum* and *C. tenax* grow on base-rich soils, usually on naked earth.

Several indigenous *Collema*-species have their area of concentration in south- to partially central Europe. The north boundary of the area in the case of *C. ligerinum* and *C. conglomeratum* proceeds through southern and central Europe, in the case of *C. calloposmum* and *C. multipartitum* through southern Scandinavia, in the case of *C. crispum* and *C. auriforme* through central Scandinavia. *C. coccophorum*, *C. cristatum*, *C. flaccidum*, *C. fuscovirens*, *C. occultatum*, *C. polycarpon*, *C. tenax* and *C. undulatum* are distributed from south to far toward north Europe. *C. fragrans* occurs predominantly in west, central, and south Europe. The main point of distribution of *C. glebulentum* lies in north Europe; a few additional occurrence are found in the British Isles, in the Alps, Pyrenees, Sudeten, and the Black Forest. *C. dichotomum* is a universal very rare lichen and has been recorded only from Scotland, the Vosges, from the Black Forest (here probably eradicated through afforestation brook bordered meager turf), from Harz (exterminated), from Rumania, from Caucasus and from Karelia. The epiphytes *C. nigrescens*, *C. furfuraceum* and *C. fasciculare* are oceanic distributed species, which are present in western Scandinavia far toward the north, in central Europe almost only in the mountains and occur in moist regions in south Europe.

Genus Characteristics and Determination

Foliose lichens, rarely placoid crustose- or almost short fruticose lichens of gelatinous consistency, when dry black, brown-black, olive-black, sometimes with isidia, attached to the substrate with attachment organs, rarely with rhizines, without cortex, not layered, with *Nostoc*. Ap. brown, red-brown, black-brown, with thalloid margin. Exc. prosoplectenchymatous to paraplectenchymatous. Hyp. \pm colorless. Hym. colorless, blue. Epihym. colorless, light yellow-brown, or red-brown. Paraphyses simple to branched, often anastomosing, above clavate to capitate. Asci clavate, with thickened I+ blue tholus and toward

the bottom open I+ blue ring structure, with thinner I+ blue cap. Sp. to 8, rarely less or to 16, cross-septate to muriform, ellipsoidal, fusiform, bacillar, needle- or curved worm-form. Pycnosp. short cylindrical, often very slightly swollen toward the ends, -6(8) μ m. Ch-

- | | | |
|----|--|--------------------------|
| 1 | On bark and bark-dwelling mosses . | 2 |
| 1* | On rock, soil, rock- and soil-mosses | 10 |
| 2 | Thallus consisting of scattered to coherent \pm spherical granules, thereby \pm crustose, rarely appearing squamulose (-lobed). Young ap. \pm spherical and punctiform, later with somewhat widened disk. Sp. in aspect nearing rectangular (with rounded angles) or quadratic rounded, weakly muriform | C. occultatum |
| 2* | Thallus not granular. Sp. not rectangular or \pm round | 3 |
| 3 | Thallus \pm thick with soon flattened and squamule-form, covered with horizontal to erect isidia. Lobes thin (membrane-like when dry), -15 mm wide, rounded, underside usually lighter. Ap. rather rare. Sp. 26-34 x 6-6.5 μ m, 4-6 celled | C. flaccidum |
| 3* | With or without spherical to cylindrical or coralloid isidia . | 4 |
| 4 | Thallus sterile, thin, with little width, rounded, overlapping lobes, with definite radially ordered elongate bulges (ribs) and pustules, usually isidiate, dark olive-green, brown-olive, blackish (if without elongate bulges see <i>C. auriforme</i> (35), in the calcareous regions rarely even going over to mossy tree bases . | 5 |
| 4* | Thallus as a rule with ap . | 6 |
| 5 | Center of the thallus (above all on the elongate bulges) thickly covered with fine cylindrical to branched isidia. Thallus usually 2-5 cm, thin, \pm compressed, like <i>C. nigrescens</i> . Ap. very rare. Sp. 5-6 celled, 40-80 x 3-6.5 μ m . | C. furfuraceum |
| 5* | With or without spherical isidia. In the case of older thalli, often yellowish-brown between the bulges. Normally fruiting | C. nigrescens (9) |
| 6 | Sp. 15-30 μ m long, 2-, 4-celled or weakly muriform. Thallus very small, -1 cm, but often more closely adjoined, dark olive(green) to brown or blackish. Ap. usually numerous. Very rare species in warm to mild sites, above all on walnut and elm | 7 |
| 6* | Sp. 50-96 μ m long, narrow, usually broader at one end. Ap. numerous, crowded. Species of very moist oceanic sites . | 9 |
| 7 | Sp. weakly muriform, 16-30 x 8.5-17 μ m, \pm ellipsoidal. Thallus very small, -0.5 cm, with 0.3-1.5 mm wide lobes, almost navel-like attached, not or weakly cushion-like. Ap. numerous, -0.7 mm, above all in the center of the | |

- thallus (if sp. 17-27 x 6.5-8.5 μm , thallus almost cushion-like, see *C. ligerinum* (8)) **C. fragrans**
- 7* Sp. 2- or 4-celled, up to 8.5 μm broad. Ap. 0.5-1.5 mm, the thallus thickly covered. Thallus almost crustose to short lobed, often almost cushion-like and navel-like attached **8**
- 8 Sp. 2-celled, 15-24 x 3-4.5 μm .
C. conglomeratum
- 8* Sp. 4-celled, 17-24 x 6.5-8.5 μm (very rarely with 1 longitudinal wall) **C. ligerinum**
- 9 Thallus usually indefinitely lobed to almost crustose, -1.5(2.5) cm, strongly swollen when fresh and almost cushion-like (10mm high and lobed -1mm thick). Ap. 0.8-2mm. Sp. s-shaped curved, rarely straight, 10-17 celled, 4.5-5 μm wide .
C. fasciculare
- 9* Thallus deeply lobed, usually covered with 2-5 cm wide, with pustules and \pm regularly radial, narrow bulges, sometimes with spherical isidia, thin (when moist -0.15 mm), broad, overlapping, rounded lobes, dark olive-green to brownish (in the case of older thalli often yellowish-brown between the bulges). Ap. 0.6-1 mm. Sp. 6-13 celled, needle-, rarely bacillar, 3-4.5 μm broad
C. nigrescens
- 10 On soil and soil mosses **11**
- 10* On rock and rock mosses . **21**
- 11 With ap . **12**
- 11* Sterile **17**
- 12 Sp. 2-celled, 15-24 x 6.5-8.5 μm . Thallus small, -2.5 cm, rounded, foliose to almost crustose. Lobes 0.5-3 mm broad, thickened on the ends, compressed to ascending. Ap. 1.1.5 mm, numerous to sparse
C. coccophorum
- 12* Sp. multicellular **13**
- 13 Thallus crustose, undifferentiated, membrane-like, not lobed, indefinite border, dark olive-green, blue-green, brown-black, smooth to warty, without isidia, 1-3 cm, often collective thalli coalescing. Ap. \pm numerous, usually close standing, 1-3 mm. Sp. to 4, ca. 26-34 x 10-15 μm , muriform
C. limosum
- 13* Thallus clearly lobed, not membrane-like, sp. to 8 . **14**
- 14 Lobes rather narrow, channeled and long streaked. Thallus deeply divided. Exc. of many angled to spherical cells. Ap. 1-3 mm. In dry calcareous turfs on stones, mossy soil see *C. cristatum* (34)
- 14* Lobes not narrow and long streaked and channeled. Exc. not of many angled- spherical cells **15**
- 15 Sp. 15-26(30) x 6.5-10.5(13) μm , 4-celled to weakly muriform. Ap. margin smooth. Lobes cylindric or flat to \pm concave, but not channeled. Thallus very variable, usually ca. 1.5-4 cm, compressed on the substrate or partially erect and \pm bush like, scarcely single layered to \pm deeply divided, with or without spherical isidia, rather thick, strongly swelling. Ap. 1.5-3 mm, numerous to lacking. Exc. scarcely developed or thin, of parallel hyphae with \pm angular cells
C. tenax
- 15* Sp. ca. 26-34 x 10-15 μm . Ap margin granular, coarsely crenate or covered with small lobules **16**
- 16 Ripe sp. colorless, 4-celled, rarely weakly muriform, constricted at the ends, ends rounded. Ap. margin often with small concave lobules .
C. crispum (25)
- 16* Ripe sp. pale yellow-brownish, usually with 3 cross- and 1(2) long-septa, commonly not constricted, ends pointed, rarely somewhat rounded. Lobes \pm numerous, radially arranged, 2-4 mm broad, flat, commonly slightly concave, strongly swollen when moist, margins nodular to coarsely warty (warts becoming small lobules). Ap. margin crenate to coarse warty, even with small lobules. FrJu .
C. bachmannianum (Fink) Degel.
- 17 Exceptionally species crossing over onto soil/soil mosses with deeply divided thallus, either with spherical or clavate isidia and usually finely streaked upper surface or with rather narrow, channeled lobes **18**
- 17* Wide spread and relatively frequent species with other characteristics **19**
- 18 Lobes rather narrow, channeled, with \pm wavy margins. In calcareous dry turfs on stones, mossy soil see *C. cristatum* (34)
- 18* Thallus usually of little rounded, 2-5(7) mm broad lobes, with spherical to clavate surface standing isidia. Upper surface often finely streaked. On shaded, mossy sites, see *C. auriforme* (35)
- 19 Thallus loose on the soil (commonly in large numbers), with -1(1.5 cm) broad, rounded lobes, when dry membrane-like, when moist dark olive green, olive-brown to olive-black, lobe ends not thickened, without erect lobules, little organized. In squash preparation without hyphae. Usually on road margins, gravel pits, rock fissures
Algae genus Nostoc
- 19* Thallus commonly attached. Lichens (with hyphae) **20**
- 20 Thallus with squamule-form isidia, which grow to small rounded, often shell- to ear-like concave lobules, which often stand shingle-like and may extensively cover the true broad rounded thallus lobes, weakly swollen when moist. Lobe ends not thickened (but often curved upward)
C. crispum
- 20* Thallus very variable, indefinitely to definitely deeply lobed, decumbent to erect or \pm bushy, with or without small, mostly erect lobules, strongly swollen when moist. Isidia lacking or \pm spherical, large. Lobe ends thickened
C. tenax (33)
- 21 Thallus very small, -1 cm, rarely -1.5 cm, almost crustose-placoid or squamulose to very small

- cushion-like. Lobules, when recognizable, -3.0 mm wide. On naked limestone **22**
- 21*** Thallus foliose lichen-like lobed, becoming broad over 1.5 cm in size. Lobes at least 1 mm broad **23**
- 22** Thallus almost crustose-placoid, -1(1.5) cm, with radial, convex to flat, 0.2-0.3 mm wide, lobes separated to coalescing with one another, dark brown to black. Isidia very small, spherical, -0.05(0.1) mm wide. Ap. unknown **C. parvum**
- 22*** Thallus ± crustose, squamulose to small cushion-like, -0.5 cm, attached navel-like, rounded to somewhat angular, lobules sparse, very narrow (0.2 mm). Ap. sparse. Sp. 17-26 x 8.5-12 µm, weakly muriform **C. callopismum**
- 23** On long time flooded silicate rock in mountain brooks, extremely rare. Thallus deeply divided, lobes linear, often forked divided, ± separated, flat to convex, 0.5-1.5 mm broad, light olive brown to dark green. Sp. 4-celled to usually weakly muriform, 20-30 x 8.5-13 µm **C. dichotomum**
- 23*** With other characteristics **24**
- 24** Thallus with flat to concave, covered with squamule to shell-form isidia or lobules **25**
- 24*** Thallus without such isidia. If isidia occur, then spherical, cylindrical, or coralloid **26**
- 25** Lobes thin (membrane-like when dry), -15 mm wide, rounded, underside usually lighter, with numerous soon flat and squamule-form, horizontal to erect isidia. Sp. 22-36 x 6.75 µm, cross-septate 4-6 celled. On silicate rock **C. flaccidum**
- 25*** Lobes robust, 0.5-6 mm wide, concave, margins often wavy, often covered with numerous rounded, shell- to ear-form lobules (of ± spherical, soon squamule-form isidia coming forth), often shingle-like. Sp. 22-36 x 11-16 µm, 4-celled (rarely weakly muriform), ± constricted at the septa, rounded at the ends. Ap. margin often covered with small lobules. On walls and calcareous rock **C. crispum**
- 26** Thallus with ap **27**
- 26*** Thallus sterile **36**
- 27** Lobes broadly rounded, overlapping one another, with radially lying elongate bulges and pustules. Thallus rounded. Ap. usually numerous. Sp. needle- to bacillar, over 50 µm long, 6-13 cells. Very rare on mossy silicate rock going over to bark dwelling **C. nigrescens (9)**
- 27*** Thallus without radially lying elongate bulges on the upper surface. Sp. commonly shorter, not needle-form (when bacillar, then only 4 celled) **28**
- 28** Sp. commonly 13-16 µm wide, 4-, rarely 5-celled and weakly muriform, ± constricted at the septa **C. crispum (25)**
- 28*** Sp. commonly up to 13 µm wide, 4-celled to weakly muriform **29**
- 29** Sp. cross-septate 4-celled **30**
- 29*** Sp. in part weakly muriform **33**
- 30** Sp. fusiform to linear, blunt ended, sometimes curved, (20)26-43(60) x 4.5-6.5 µm, 4-celled. Lobes richly rached, often separated, partially also fan-form, convex to rarely flat, with finely streaked upper surface, not thickened at the ends. Thallus -6 cm, (often loose) decumbent to erect, very fragile. ap. sparse to very numerous. Cells in the exc. angular (section) **C. multipartitum**
- 30*** Sp. narrow- to broadly ellipsoidal, commonly over 6 µm wide. Lobes without finely streaked upper surface **31**
- 31** Exc. (developed between hym. and thallus margin) made up of angular to rounded cells. Lobes ± concave, with coarse wavy margins, repeatedly forked divided, radial, often overlapping, with smooth upper surface. Thallus usually 3-6 cm, pressed to the surface. Ap. numerous, often closely crowded. sp. narrowly ellipsoidal, 17-30 x 6.5-9 µm. On rock **C. undulatum**
- 31*** Exc. not made up of angular to rounded cells, very weakly developed or of parallel hyphae (section) **32**
- 32** Thallus commonly only in soil filled rock fissures and on walls, very variable. Sp. 15-26(30) x (5-)6.5-8.5 µm **see C. tenax (33)**
- 32*** Thallus attached to naked limestone, rounded, deeply divided, 2-3(5) cm. Lobes numerous, radially arranged, elongate, flattened (above all at the ends) to somewhat channeled, without isidia. Ap. -1mm, numerous, crowded, the thallus extensively covered. Sp. 18-28 x 6.5-8.5 µm **C. polycarpon**
- 33** Thallus commonly only in soil filled rock fissures and on walls, vary variable. Lobes thickened at the ends, flat to concave, but not at the same time long streaked and channeled, strongly swollen when moist. Exc. very weakly developed, not of angular cells. Ap. -3mm. Sp. 17-26(30) x 8.5-10.5(13) µm **C. tenax**
- 33*** On naked limestone or calcareous rock mosses. Thallus deeply divided, 2-5 (8) cm. Exc. clearly developed, of angular to rounded cells (paraplectenchymatous) **34**
- 34** Lobes narrow and channeled, with wavy margins, thereby often ± crinkled, usually rather elongate streaked, ± radially ordered, branched, not thickened at the ends. Ap. sparse to numerous, -3 mm. Sp. 18-32 x 8-13 µm **C. cristatum**
- 34*** Lobes flat to somewhat curved up at the margins and moderately concave, 2-5 mm wide, ± rounded, with numerous, often thick standing, spherical to clavate, -0.3 mm wide isidia. Thallus usually ca. (2)3-6 cm in size. Ap. rare **35**
- 35** Moist thallus moderately strongly swollen, up to 200 µm thick, (dry) usually blackish, rarely dark olive (undersides often relatively light), not streaked, on the young parts often with small pustule-like outgrowths. Lobes with ascending,

often wavy margins, -5 mm wide. Sp. 15-24 x 6.5-13 µm. Usually directly on rock

C. fuscovirens

- 35* Moist thallus strongly swollen, 200-500 µm thick, (dry) dark olive to blackish or black-brown, often very finely streaked, without pustules. Lobe margins little to clearly ascending, -8 mm wide. Sp. 26-36 x 8.5-13 µm. Usually between and over mosses

C. auriforme

- 36 Lobes, above all the younger lobules, narrow and clearly channeled, multiply branched, ± radial, often separate, with ± wavy margins, not thickened at the ends; large thallus dying in the center. Isidia lacking or coarse warty to clavate

C. cristatum (34)

- 36* Lobules not at the same time narrow and channeled 37
37 Without isidia. Lobes polytomous, linear, 0.5-1.5 mm wide, commonly convex, with usually finely streaked upper surface, rather thick, ± depressed. Thallus rather large (if thallus with shell-like, often shingle-like lobules, see *C. crispum*)

C. multipartitum (30)

- 37* With spherical, clavate or coralloid isidia 38
38 Isidia clavate to spherical. Lobules flat to moderately concave because of up turned margins, ends rounded. Usually on limestone 35
38* Isidia coralloid, numerous, often the entire thallus covered. Thallus thin-membranous, ± deeply lobed, with wavy-folded, rounded or elongated lobes. A. unknown **C. glebulentum**

Ecology and Distribution of the Species

Collema auriforme (With.) Coppins & Laundon (*C. auriculatum* Hoffm.)

Up into high montane sites, rarely higher, above all over mosses on carbonate rocks (usually limestone), rarely also calcareous silicate rock, mossy lime soils, mossy tree trunks, on shaded, cool substrate to moist habitats, often in the interior of forests, in valleys, basiph.-neutroph., ombroph., substrathygroph. (-subhydroph.), r.skioph.-m.photoph., with associates, e.g. in the Neckero-Anomodontetum – (bor-atl)-mieur(subatl)-med(mo) – r.rare; SJu-Ju-FrJu, Al moderately frequent, otherwise rare (e.g. süSch, süHü, Ne, Bo, O, Mn, süRhön, Th, Pf)

Collema callopismum Massal.

Up into montane sites on naked calcareous rock, above all limestone, on well lighted, usually sometimes irrigated habitats, basiph., (m.-)r.(v.)photoph., a-/m.nitroph., in the Psorotichion

schaer. – (bor-)mieur-med – rare; SJu, Ju, FrJu, Ne, single collection in Mn, Mos, Fr

Collema coccophorum Tuck.

Above all in hilly and submontane sites on naked to sparse overgrown with ephemeral mosses, clay, loamy to (loamy) sandy, nutrient rich soils in clay pits, on roadsides etc., commonly on well lighted, cool substrate or dew moistened habitats, subneutroph., m.-v.photoph., substrathygroph., synanthrop, weakly competitive, e.g. in the Aloiinetum – bor-med – rare, easily overlooked? (+); Rh, O, nöHü, Ts, Lahn, SFW, Fr

Collema conglomeratum Hoffm.

In hilly (rarely submontane), usually summer warm, precipitation poor sites on trunks of free standing old deciduous trees, preferably in deep cracks of subneutral, often slightly dust impregnated bark, usually on walnut and poplar, in addition willow, chestnut, etc., in fruit orchards, on streets and field margins, subneutroph.-neutroph., r.photoph., mesoph., m.nitroph., e.g. in fissures within Xanthorion-stands – mieur-med – v.rare (0); süHü, süRh, SJu, süSch?, nöHü, Fr, süRhön

Collema crispum (Hudson) Weber ex Wigg.

Predominantly in hilly and submontane sites, but also substantially higher, in the region predominantly on anthropogenic habitats on subneutral to basic substrates, above all on soil crusts or dusty walls (on mortar, calcareous rock, in the case of lime impregnation also on silicate, in soil filled wall fissures), on castle ruins, rarely on naked, calcareous soils (clay, loam, sand) on roadsides, slopes, gravel, clay pits or soil encrusted rocks, above all on shady, but well lighted sties, cool soils or slightly moist walls, regionally introduced, subneutroph.-m.basiph., r.skioph.-r.photoph., substrathygroph., m.-r.nitroph., with mosses, often with *C. tenax* – mieur(subatl)-med – r.rare; above all Ne. Hü, Rh, SFW, Saar, Mos, otherwise rare

Collema cristatum (L.) Weber ex Wigg.

(*C. multifidum* (Scop.) Rabenh.)

Up over the tree line on naked, rarely mossy calcareous rock, above all on weak to moderately strongly irrigated, often drying irrigated surfaces, prefers weathered rocks, rarely on anthropogenic substrates or on rocky soil, basiph., xeroph., (substrathygroph.-) subhydroph., ombroph., m.-v.photoph., a-/m.nitroph., Char. Collemation fusc. – bor-med – r.rare; SJu-Ju-FrJu moderately

frequent, Th, otherwise rare (e.g. Hü, Ne, Mn, He, Bit, Eif), ± lacking in the silicate regions

Collema dichotomum (With.) Coppins & Laundon (C. fluviatile (Hudson) Steudel)

In montane, high precipitation sites on long time flooded silicate rocks in clear, rapidly flowing, very acidic, cool mountain brooks, above all on steep sections, m.acidoph.-subneutroph., v.hygroph., (m.-)r.photoph., anitroph., in the Verrucarion funckii – bor-mieur-mo – v.rare (0); süSch ?+, Vog ?+, Harz +, Riesengeb.

Collema fasciculare (L.) Weber ex Wigg.

In montane (-high montane), high precipitation, oceanic sites on old deciduous trees commonly over mosses, above all in open near natural forests, like *Nephroma bellum* (↑), *Collema nigrescens* (↑), Char. Lobarion – mieur-subatl-med, oz – v.rare (1); süSch, Vog, O+, Al

Collema flaccidum (Ach.) Ach. C. rupestre (Swartz) Rabenh.

In sub- to high montane, usually high precipitation sites on silicate rock or bark, often over mosses, preferable on base-rich, relatively high nutrient, cool to slightly irrigated, commonly even splash water moistened substrates on usually shady habitats, on subneutral (-m.acid) water accumulating bark (above all ash, maple, or old beech), often on somewhat soil encrusted rock of mineral-rich, sometimes slightly calcareous silicate rock, often in humid near natural mountain forests with old trees, on rocks in narrow valleys, in near brook, subneutroph., ombroph., substrathygroph.-subhydroph., r-e.hygroph., r.skioph.-r.photoph., e.g. in the Lobarion, Antitrichion – (arct-)bor-med – rare (3); above all Sch, Vog, SJu, Eif, Al, otherwise rare; süHü, HRh, Bo, Ba, Ne, SFW, Ju, O, Sp. ThW, süRh148n, Ts, MRh, Pf, Eif

Collema fragrans (Sm.) Ach.

(C. microphyllum Ach.)

Like *C. conglomeratum* (↑) and rather like *C. occultatum* (↑) – mieur-subatl-med – (v.)rare (0); süHü, süRh, nöHü-O, Rh-Mn-T, Mos, Eif-RhL, Westf, süRhön, Fr

Collema furfuraceum (Arnold) Du Rietz

Like *C. fasciculare* (↑) and *C. nigrescens* (↑), but more often not mossy bark – bor-atl-mieur-atl-med(mo), oz – v.rare (0); Vog, Pfw, nöSch, süHü

Collema fuscovirens (With.) Laundon (C. tuniforme (ach.) Ach.)

To over the tree line on naked carbonate rock, above all limestone, often even synanthrop, on walls (above all dust impregnated wall crowns), commonly (under lime influence) on silicate rock going over (to most frequently sandstone-walls), on sporadically irrigated or surfaces remaining moist for a long time after rainfall on m.-r.(v)light rich, even r.light poor habitats, basiph., substrathygroph.-subhydroph., Char. Collemation fusc. – arct-mieur-med(mo) – r.rare; SJu, Ju and FrJu moderately frequent, Ne, Mn, Th r.rare, otherwise rare (e.g. Hü, Eif, Sch), (v.)rare in silicate regions

Collema glebulentum (Nyl. ex Crombie) Degel.

In montane to alpine, high precipitation, cool to cold sites on mineral rich, sometimes slightly calcareous silicate rocks on long time irrigated (naked or slightly soil encrusted) or short time flooded surfaces on m.-v.light rich habitats, subneutroph., ombroph., subhydroph., e.g. with *Placynthium flab.* – arch-bor(-mieur-h'mo/subalp) – v.rare (1); süSch (Feldberg-region, Neuenweg)

Collema ligerinum (Hy) Harm.

Like *C. conglomeratum* (↑), yet more strongly limited to popular and walnut, only in warm hilly sites – s'mieur-med – v.rare (1); süRh-süHü-süSch

Collema limosum (Ach.) Ach. (C. glaucescens Hoffm.)

In hilly to montane sites on naked or sparsely mossy, clay, loam, sandy-loam, calcareous soils, on roadsides, dams, clay- and loam pits, typical pioneer, synanthrop, m.basiph.-(sub)neutroph., r.-v.photoph., substrathygroph., nitroph., in ephemeral moss associations., e.g. Aloinetum, often with *C. tenax* (↑) – (bor-)-mieur-submed(-med) – (r.)rare (3), probably often overlooked; süHü, süRh, SJu, Ne, SFW, nöHü, Rh-Mn-T, süRhön, Ts, Th, Pfw, Saar, Mos, Eif

Collema multipartitum Sm.

Up into alpine sites on (above all lime-rich) carbonate rocks on mostly radiation exposed, irrigated habitats, above all in the region of fissures and depressions in rocks, like *C. fuscovirens* (↑), yet more strongly substrathygroph. and photoph.; basiph., subhydroph., r.-v.photoph., Char. Collemation

fusc. – mieu-smed(-med) – rare (3); SJu-Ju-FrJu, Al, otherwise v.rare (süHü, Ne, Eif)

Collema nigrescens (Hudson) DC.

In montane and high montane, oceanic, high precipitation sites, rarely lower, on subneutral (-m.acid), nutrient-rich, often slightly dust impregnated bark of higher water capacity, usually over and between mosses, above all on ash, maple, or beech, especially on older trees in open near natural mountain forests (e.g. sycamore-beech forests), in brook bordering stands, in very high precipitation regions also on free-standing trees (old willow bushes, avenue trees etc.), on often rainy, habitats of ensured frequent soaking, subneutroph.-m.acidoph., m.-r.photoph., v.hygroph., substrathygroph., a-/m.nitroph., above all in the Lobarion, often with *Leptogium sat.*, like *Nephroma*- and *Lobaria* species, yet limited to nutrient-rich habitats – bor-atl-mieu-subatl-med-mo, oz – rare (2); süSch, Vog, SJu, Al; otherwise v.rare and almost overall probably ; *nöSch*, *Bo*, *Ju*, *O*, *Ts*, *Vgb*, *Rhön*, *ThW*

Collema occultatum Bagl. (*C. quadratum* Lahm ex Körber)

In submontane and montane, often high precipitation sites on subneutral, mineral-rich, but commonly not eutrophic, smooth to cracked surfaces water accumulating bark, above all on popular, willow, ash, apple trees, usually in open woodland or on single trees in valleys in near brook, on very humid, well lighted habitats, weakly competitive pioneer, subneutroph, (substrathygroph.), a-/m.nitroph., in the Lobarion (initial stages), e.g. with *Leptogium sat.* (↑), also in hygroph. association of the Xanthiorion – bor-med – rare (2); süSch, Vog, Ju, Ne, süRh+, *O+*, *Mn*, *MI*, *Th*

Collema parvum Degel.

On naked limestone above all in montane to alpine sites, like *C. polycarpon* (↑), in the Collemation fusc. – bor-smed-mo – rare (R); SJu-Ju-FrJu

Collema polycarpon Hoffm.

Like *C. cristatum* (↑), often limited on somewhat less fissured sites, above all on open habitats, Char. Collemation fusc. – arct-med – r.rare; SJu-Ju-FrJu and Al moderately frequent to rather rare; otherwise rare to very rare (süHü, Ne, Mn, Eif, Bit, Bo, Vog, süSch)

Collema tenax (Swartz) Ach. em. Degel (*C. pulposum* (Bernh.) Ach.)

Up over the tree line on naked or sparsely overgrown with mosses and higher plants, soil, on clay, loam to sandy-humus, ± calcareous soils, on fine soil on stony calcareous raw soils and in rock fissures, on soil impregnated, old walls and rocks, rarely directly on limestone, euryök, high point of distribution on shady cool substrate habitats, basiph.-subneutroph., r.skioph.-v.photoph., in moss associations, above all Phascion, further e.g. in the Toninion sed. – Arct-med – moderately frequent, rare (synanthrop) in silicate regions

Collema undulatum Laurer ex Flotow (*C. laureri* (Körber) Leighton)

In montane to alpine sites on mostly naked carbonate rocks, above all limestone, on sporadically irrigated, well lighted habitats (e.g. with *C. polycarpon*), scarcely going over on anthropogenic habitats, usually on stony or rocky calcareous soils, basiph., substrathygroph.-subhydroph., m.-s.photoph., in the Collemation fusc. – arct-mieu-h'mo-med-alp – (v.)rare (R), easily overlooked; Ju rare, SJu and Al r.rare, *MI*

LIT.: DEGELIUS 1954, 1974

Conotrema Tuck.

Introduction

Characteristic habit characters of the crustose lichen genus *Conotrema* are the “urn-form” apothecia with deep sunken black, usually white pruinose disk and carbonaceous involucrellum. The spores are long cylindric, cross-septate.

Of the four species in the genus, only *C. urceolatum* is known in central Europe, however those species occurring still in the east Carpathians and North America have long become extinct. The lichen resides on smooth bark of beech and hornbeam in humid Rhine meadow forests around Karlsruhe and Heidelberg, districts, which are becoming more strongly subject to ecological alteration.

Genus Characteristics

Thallus crustose, with coccoid green algae. Ap. with urn-form deep black (in the case of the indigenous species pruinose) disk and at first an involucrellum enclosing the disk, which may be located as the outer thallus layer. Exc. black-brown, in the case of the indigenous species bowl-form transversing under the hym. Paraphyses simple to forked, thin. Asci thin-walled, thickened above. Sp. to 4 (up to 8 in the non-indigenous species), long bacillar, cross-septate multicellular. Pycnosp. elongate. Ch-

Ecology and Distribution of the Species

Conotrema urceolatum (Ach.) Tuck.
In winter mild hilly (up to submontane) sites on smooth bark of deciduous trees (beech, hornbeam, and young oak) in humid cool oak-hornbeam and beech forests, m.acidoph., hygroph., m.-r.ombroph., m.photoph.-r.skioph., anitroph., in the Graphidion – centr. – v.rare (0); *nöRh* (Karlsruhe, Wolfartsweier), O (Heidelberg)

LIT.: POELT & VÉZDA

Cornicularia (Schreber) Hoffm

(Determined ↑ Cetraria)

Introduction

The single species of the genus is one on silicate rock, fruticose lichen reaching up to about 2 cm high with narrow, flattened, sparsely branched dark brown thallus segments and terminal black apothecia with thalloid margin. The almost cushion-like growing species is distributed from western north Europe (Norway, rare in Sweden) over the British Isles, the oceanic influenced mountains of central Europe (Vosges, Black Forest, Harz, Fichtelgebirge, Böhmerwald, very sparsely in Riesengebirge, also Alps, Tatra) up into the mountains of the mediterranean. In the region the relict species resides on wind exposed rocks on very high precipitation sites. The occurrences in the Black Forest are in the last 20 years in strong regression, mainly because of amelioration (especially “destoning” of thin turfs).

Genus Characteristics

Thallus fruticose-cushion like, dark brown to brown-black, segment flattened, almost decumbent to erect, bilaterally symmetrical, both sides with developed cortex of periclinal hyphae, with *Trebouxia*. Ap. with thalloid margin, black. Asci of the *Lecanora*-type. Sp. 1-celled, ellipsoidal, very small. Pycnosp. weakly dumbbell shaped. Ch-

Ecology and Distribution of the Species

Cornicularia normoerica (Gunn.) Du Rietz
In high montane and alpine, very high precipitation, often oceanic sites, rare in the montane zone, usually on hard silicate rock on rain exposed, rather to very well lighted, rather to very open to the wind, rapidly snow-free habitats with strongly changing moisture conditions, on frequently directly soaked sites, m.-r.acidoph., a-/m.nitroph., Char. Umbilicarium cyl. – arct-alp, subatl – v.rare (2); süSch, Vog, Al, BayW*, Fi*, Hz

LIT.: ANDERS 1929, KEISSLER 1959

Cyphelium Ach.

(Key incl. Microcalicium)

Introduction

The genus *Cyphelium* belongs to the group of coniocarpic or dust-fruiting lichens, whose fruiting bodies are a dust-like mass consisting of spores and remains of asci and commonly are recognized by a stalked, pin-formed fruiting body. In the case of *Cyphelium* the fruiting body sits on a crust thallus upon of sunken into the substrate. The upper side is black, the margin however is often whitish or yellowish pruinose.

In Germany there are nine of the altogether twelve species known. All of the species occurring in the region are very rare and soon potentially threatened. A few taxa occurring especially on older trees are endangered by forestry practices which continually interrupt habitat conditions. *C. inquinans* and *C. karelicum* grow predominantly on old fir and spruce (even on decorticate stems) in near natural

spruce-beech and fir forests, *C. sessile* occurs in oak-hornbeam in mild winter sites. *C. tigillare* resides on hard wood; in the region it has been till now found only on processed wood (e.g. on barns), a habitat type, upon which even *C. inquinans* succeeds. The endangering is here related to the rapid removal of old cabins, untreated board fences, fence posts and shingles. The occurrence of *C. lecideinum*, the single indigenous rock dweller, is one of a few known occurrences of this extremely rare species on the earth. This species and *C. sessile* are indigenous to the subatlantic region of summer green deciduous tree zone and the mediterranean region, the other three species are distributed in the boreal zone and the corresponding central Europe sites (essentially rarer in south Europe).

Genus Characteristics and Determination

Thallus crustose, usually clearly developed, sometimes in the substrate, gray, yellow, greenish, brownish-yellow, ± with cortex. Photobiont *Trebouxia*. ap. sunken to sessile, with sometimes pruinose proper margin, black, with black mazaedium. Exc. black-brown, strongly developed to rather reduced, of uniformly thick or strongly thickened below. Asci cylindric to broadly clavate, disintegrating early. Sp. 2-celled, rarely appearing muriform, dark brown, thick walled, often ornamented. Ch: often Pulvinic acid derivatives.

All species treated in the key have black, but sometimes pruinose ap.

- | | | |
|----|--|---|
| 1 | On silicate rock . | 2 |
| 1* | On bark or wood | 4 |
| 2 | Sp. 1-celled, 6-8(10) x 2.5-4 µm. Without its own thallus, upon the fine mealy whitish to pale (yellow)greenish thallus of <i>Haematomma ochroleucum</i> . Ap. usually sessile, convex. Capitula (squash preparation) K+ reddish reacting, 0.1-0.6 mm wide | |
| | Chaenothecopsis exserta | |
| 2* | Sp. 2-celled, larger, with its own thallus | 3 |
| 3 | Thallus citron yellow to greenish, parasitic on the fine mealy whitish, beige or pale (yellow)-greenish thallus of <i>Haematomma ochroleucum</i> . Sp. 12-16 x 4-6 µm. Ap. short stalked, ± top-shaped, -0.6 mm wide, black. Rhizocarpic acid | |
| | Calicium corynellum | |
| 3* | Thallus gray, warty, riddled with granular crystals, not parasitic, P+ yellow, then red, K+ yellow. Sp. 9-14 x 5-6 µm, upper surface | |

streaked. Ap. sessile, 0.5-0.8 mm, with gray pruinose margin. Norstictic acid, ± Atranorin .

C. lecideinum

- | | | |
|---|---|--|
| 4 | Thallus indefinite. Sp. light colored, slightly green tinted, narrowly ellipsoidal to cylindric, 1-celled or with 1-3 indefinite septa, 9-15 x 3-4 µm (upper surface spirally ribbed). Ap. sessile or very short stalked, -0.5 mm broad, upper side (mazaedium) green tinted black, mazaedium often strongly projecting | |
|---|---|--|

Microcalicium disseminatum

- | | | |
|----|---|---|
| 4* | Thallus clearly developed (or on foreign thallus). Ripe spores dark brown, 2-celled, over 4 µm wide, ellipsoidal | 5 |
| 5 | Thallus intensively yellow to citron yellow (to yellow-greenish) | 6 |
| 5* | Thallus not clearly yellow. Ap. sessile . | 7 |
| 6 | Ap. sunken into thallus warts, however set off from the thallus, -0.8 mm, nonpruinose. Sp. 16-22 x 9-11 µm, smooth. Thallus citron yellow to yellow-green. Rhizocarpic acid, Epanorin | |

C. tigillare

- | | | |
|----|---|--|
| 6* | Ap. sessile, -1mm, margin yellow pruinose. Sp. 17-22 x 8-10 µm, with irregular grooves. Thallus intensively yellow. Vulpinic acid. On older conifer trees, alpine . C. lucidum (Th.Fr.) Th.Fr. | |
| 7 | Ap. at the margin or above (mazaedium) yellowish pruinose, sessile or short stalked, -0.8 mm wide. Thallus light gray or yellowish gray | |

↑ **Calicium adpersum**

- | | | |
|----|--|---|
| 7* | Ap. not yellowish pruinose . | 8 |
| 8 | Usually on whitish to gray-greenish <i>Pertusaria</i> -species on older oaks. Ap. -0.7 mm, only whitish pruinose at the margin when young. Sp. 9-15(18) x 5-8(10) µm, upper surface spirally ribbed-furrowed | |

C. sessile

- | | | |
|----|--|---|
| 8* | Not on other lichens, often on other substrates . | 9 |
| 9 | Sp. almost smooth (finely streaked), 14-19 x 8-11 µm, slightly constricted. Ap. -2(2.5) mm wide, margin (and often also the disk) whitish pruinose, naked when old. Thallus rather thick, warty, light to dark gray. Usnic acid, Placodiolic acid, ± Atranorin | |

C. inquinans

- | | | |
|----|---|--|
| 9* | Sp. (ripe) coarsely warty, clearly constricted at the septum, 13-17 x 8-11 µm, ap. -0.7 mm, often weakly whitish pruinose at the margin. Thallus warty to almost areolate, yellowish-, greenish-, or brownish-gray. Ch- . | |
|----|---|--|

C. karelicum

Ecology and Distribution of the Species

Cyphelium inquinans (Sm.) Trevisan

In high montane and subalpine, high precipitation sites in near natural spruce forests on older spruce and fir as well as older tough decayed wood (above all on the cross-section of wood posts of willow fences), in northern

Germany (earlier also in southern Germany) also in the lowland on older oaks, in the south like *Lecanactis ab.* (↑), in the *Calicietum vir.*, *Lecanactidetum ab.* – bor-smed-h'mo(-med-h'mo) – v.rare (1), in northern Germany somewhat more frequent, but also regressing; süSch (Feldberg), We, *Sp+*, *Fr+*, *Al*

Cyphelium karelicum (Vainio) Räsänen
In montane and high montane, very high precipitation sites on cool (rarely cold), oceanic, very to extremely humid habitats in near natural older beech-fir(-spruce) forests, on stems of older fir, rarer on spruce, rarely on decorticate trees, r.-v.acidoph., r.-v.skioph., r.-v.anombroph., hygrophytically substantially more exacting than *C. inquinans*, in the *Calicietum vir.*, *Lecanactidetum ab.* – bor-mieur-mo(-med.mo), (oc) – v.rare (1); süSch, Sb, probably also Vog

Cyphelium lecideinum (Nyl.) Trevis.
In submontane, mild sites on ± rain sheltered, away from the sun surfaces on silicate rock on humid sites, subneutroph.-m.acidoph., anitroph. – mieur-med,(subatl) – v.rare (1); O

Cyphelium sessile (Pers.) Trevisan
In the foothills, often winter mild sites in oak-hornbeam forests on the trunks of older oaks (v.rarely also on beech) usually parasitic on *Pertusaria* (*pertusa*, *coronata*, *cocc* etc.), r.acidoph., m.ombroph., hygroph., m.photoph.-r.skioph., in the *Pertusarietum hem.* and related associations. – mieur-subatl-med – v.rare (1); Ne, *nöRh*, *Rh-Mn-T*, *Ts*, Mos, *Fr*, Th

Cyphelium tigillare (Ach.) Ach.
In high montane-subalpine sites, rarely lower, on tough decayed wood, decorticate tree stems, stumps, board fences, barns, usually on conifer wood, commonly on habitats with rather changeable moisture conditions, distribution high point near the tree line, r.(-v)acidoph., anitroph., Char. *Xylographetum*, usually with *Calicium trab.*, *Lecanora varia* – bor-smed-h'mo – v.rare (2); Vog, *SFW*, Ju, *Rh-Mn-T+*, *Ts+*, Do, Al

LIT: SCHMIDT 1962, TIBELL 1971, 1980a, 1984*.

Cystocoleus Thwaites

(Key incl. *Racodium*)

Introduction

The Thallus of *Cystocoleus* consists of fine brown-black, thick felt of assembled threads, each of which are constructed a *Trentepohlia*-algal filament with a surrounding hyphal mantle. The single species occurs in cool and temperate regions of the northern hemisphere, thus in north and central Europe. It produces a black carpet on vertical surfaces and under overhangs on very shaded silicate rock, often in association with the similarly constructed *Racodium rupestre*.

Genus Characteristics and Determination

Thallus fine filaments, the dark brown to black filaments of a *Trentepohlia*-algae thread and their surrounding, consisting of a close lying mantle of ± elongate lying, but somewhat twisted brown hyphae. Ap. unknown. Ch-

Both species considered in the key are constructed of one central *Trentepohlia*-algal filament, which is thickly enclosed by fungus hyphae.

- 1 Hyphae of the thallus thread lying parallel to the algal thread, straight, scarcely branched, ± regularly septate (). Thallus black to brown-black, cottony, carpet-like, usually somewhat looser than in the case of *Cystocoleus eb.*, darker under the microscope **Racodium rupestre**
- 1* Hyphae irregularly curved, slanting to slowly (not regularly parallel) developing, in places barrel-like thickened (). Thallus black, carpet-like felty **Cystocoleus ebeneus**

Cystocoleus ebeneus (Dillwyn) Thwaites
(*Cystocoleus niger* auct., *Coenogonium nigrum* auct.)

Up into high montane sites, rarely in lower sites, on rain protected vertical- and overhanging surfaces of silicate rock, in lower sites above all on porous glacial water substrates (sandstone), on cool, very to extremely humid (to rather humid, then however more strongly substrate moistened), wind protected, very shady habitats, usually on contiguous rocks in forests, narrow valleys, on north facing, rarely in boulder fields, high point in high precipitation regions, m.-v.acidoph., anitroph., hygrophytically less exacting than *Racodium* and usually lower elevation, Char. *Cystocoleo-Racodietum* – bor-

mieur – r.rare; above all Sch, Vog, PFW; rare
RhSch, O, Sp, SFW, MFr, ThW, Erz

LIT.: MIGULA 1929-31, SCHADE 1932

Dactylospora Körber em. Haf.

(Determination ↑ Buellia)

Introduction and Genus Characteristics

The *Dactylospora*-species are saprophytic fungi or living on other lichens or fungi with brown to black, usually margined lecideine fruiting bodies. *D. saxatilis* grows on rock dwelling *Pertusaria*-species on mineral rich or calcareous silicate rock, *D. athallina* on *Baeomyces rufus*. Known in the region in addition *D. purpurascens*, which lives on various species.

Without their own thallus, parasymbiotic to saprophytic. Ap. brown to black, usually with definite proper margin. Exc. light to dark brown, paraplectenchymatous. Epithym. brown. Hym. I+ blue. Paraphyses branched, septate, above usually clavate and brown. Asci narrowly to broadly clavate, wall I-, with stronger I+ blue gelatin cap. Sp. brown, 2- to multicellular, cross-septate or weakly muriform.

LIT.: HAFELLNER 1979, TRIEBEL 1989.

Degelia Arv. & Galloway

(Determined ↑ Pannaria)

Introduction

Degelia is distinguished by a marginally leaf-like lobes, interior however almost crustose thallus with bluegreen algae and with biatorine, red to dark brown apothecia. The European species are lead-gray, occasionally even slightly brownish overall and producing rounded-rosetted, thick, fixed crusts. The genus occurring in moist, predominantly warm-temperate regions of both hemispheres includes to this time nine, three in Europe, one in Germany species formerly placed in *Parmeliella*, *D. plumbea*. These species are

distributed from the mediterranean region over western Europe up into the atlantic north Norway and in one small region of north western North America reaching in the region the east boundary of the distribution and is at their single place of growth in the highest degree in danger of extinction. They grow under oceanic climatic conditions in near natural deciduous forests on bark, other places even on rock. The lichen has been able to maintain itself in the Vosges.

Genus Characteristics

Thallus marginally leaf-like lobed to placoid, upper side lead-gray (moist gray-blue), lobes in the case of the indigenous species merging into a shield-like crust, radially folded, even with an apparent concentric folds, marginal lobes rounded. Upper side paraplectenchymatous, underside light, attached with blue-black rhizine felt, (the indigenous species) ± a definite cortex, the European species with *Nostoc* in balls. Ap. sessile, red, red-brown, dark brown, with lighter proper margin. Exc. well developed, of mostly radial structured paraplectenchymous tissue. Hym. yellow brown above, I+ blue. Asci clavate to subcylindric, thickened above and with I+ blue plug. Sp. 1-celled, ellipsoidal. Pycnosp. short bacillar. Ch-.

Ecology and Distribution of the Species

Degelia plumbea (Lightf.) P.M.Jorg. & P.James (Parmeliella p. (Lightf.) Vainio)

On very humid, mild to cool, ± shady habitats on smooth to cracked surface, mineral rich bark with higher water capacity, even over mosses, in the region on ash in river meadows and hanging valleys, subneutroph., s.hygroph., substrathygroph., anitroph., v.oceanic, Char. Nephrometum laevig. --bor.atl-mieur-atl-med – v.rare (1); Ba (Wutch), single (yet?) actual collection in Germany, additionally *Vgb* (*Rödchen*), *nöPf* (*Donnersb.*), Vog (*Schneeberg*, Wildenstein)

LIT.: JORGENSEN 1978, JORGENSEN & JAMES 1990

Dermatocarpon Eschw.

(↑ also *Catapyrenium*)

Introduction

The growth-form of the *Dermatocarpon*-species is reminiscent of the navel-lichens of the genus *Umbilicaria* limited to silicate rock. It was however convergent development. The one to many lobed and then often not typically navel-form thallus is usually gray to brown colored. The fruiting bodies are small perithecia sunken into the thallus with blackish mouth.

The *Dermatocarpon*-species reside on rock; some living on commonly flooded or long time irrigated rocks or boulders, thus the silicate species *D. luridum*, which occurs from central Fennoscandia over central Europe up into the mountains of the Mediterranean. *D. leptophyllum* sits above all on lower calcareous rocks and boulders and is known from central Europe (in the north up to southern Fennoscandia). Several species are limited to the alpine zone and occur in central Europe in the high mountains, e.g. in cold streams.

Genus Characteristics and Determination

Thallus single leafed, attached with a navel, or multileafed and attached in several sites, gray to dark brown, sometimes pruinose, underside in the indigenous species without rhizines, light to dark brown, in other species even with thick rhizines, both sides with cortex. Cortex paraplectenchymatous, of ± right angle oriented hyphae. With coccoid green algae. Per. spherical, sunken, with dark apex. Exc. colorless, brown around the mouth, without involucrellum. With numerous periphyses. Paraphyses lacking in the ripe per. Asci cylindric-clavate to ventricose, K/I-, *Verrucaria*-type. Sp. 1-celled. Pycn. per.-like. Pycnosp. short bacillar. Ch-.

- 1 Moist thallus intensive green, dry light gray-brown to brown, not pruinose, underside light to dark brown, smooth or slightly venose-wrinkled, usually growing thickly crowded and appearing multi-leafed, not or only on one navel, but attached at several sites, relatively elastic. Single thallus usually up to 15 mm, ± convex. On moist sites. Sp. 10-19 x 5-8 µm . **D. luridum**
- 1* Moist thallus not intensive green. Attached by a single navel . 2

- 2 Thallus squamulose (to appearing lobed), single thallus up to ca. 7 mm wide, often with curved margins (± shell-like), robust, (often shiny) red-brown to brown, underside blackish
see **Catapyrenium lachneum**
- 2* Thallus foliose . 3
- 3 On from time to time flooded habitats. Thallus gray- to dark brown, pruinose, underside dark brown to black, single leafed, 3-12(20) mm, rounded to crenate, ± depressed, attached with a central navel, often crowded to overlapping. Sp. 10-18(250 x 5-8(9.5) µm . **D. meiohyllum**
- 3* On dry or only occasionally irrigated habitats 4
- 4 Thallus up to 10 mm wide, single leafed, light gray to brownish, ± thinly pruinose, relatively thin (0.2-4mm). Sp. 6-7(9) x (5)6-7 µm, spherical to broadly ellipsoidal. Yet insufficiently clarified species. Probably Ju .
D. leptophyllum (Ach.) Lang
- 4* Thallus usually larger, 10-40(60) mm, usually concave or with curved margins, thickly white pruinose, thereby usually light gray to brownish-gray, under the pruinosity ± brown, underside rose to brownish, single-leafed, relatively rigid (0.3-0.6 mm thick). sp. 8-16 x 5-8 µm. Very variable . **D. miniatum**
(In the high mountain additional species on from time to time flooded sites on silicate rock, compared with *D. luridum* by ± single leafed, underside ± venose, thallus attached with a navel designated **D. arnoldianum** Degel.: gray-brown, moist green, rigid, underside pale brown, 0.4-0.7 mm thick. sp. 13-15 x 4.5-6.5 µm; **D. rivulorum** (Arnold) DT. & Sarth.: dark gray-brown, moist dark olive-brown, underside dark gray-brown, 0.1-0.3 mm thick. Sp. 13-21 x 6.5-8.5 µm; both species bor-alp/arct-alp)

Ecology and Distribution of the Species

Dermatocarpon luridum (With.) Laundon (D. weberi (Ach.) Mann, D. fluviatile (Weber) Th.Fr., D. aquaticum (Weiss) Zahlbr.)
In sub- to high montane (alpine) sites on silicate rock on clear brooks in the upper amphibious zone or on long time irrigated (then usually ± shady) rocks (above all vertical surfaces), like *Phaeophyscia endoc.* (↑) – s'bor-mieur-smed (alp)-(med-alp) – rare (3); above all Sch, Vog; rare RhSch, He (e.g. Vgb, Rhön), ThW, Erz, O, Sp, nöPf, Al

Dermatocarpon meiohyllum Vainio
On silicate rock on rocks and amphibious boulders on and in cool brooks and rivers – bor-smed – v.rare; Mos, Eif

Dermatocarpon miniatum (L.) Mann

Up into the alpine zone on limestone, rarely also on basic (?lime-free) or slightly calcareous silicate rock, (on silicate almost only on vertical/overhanging surfaces), on sporadically and short-time irrigated sites as well as on somewhat eutrophic surfaces, r.euryök, subneutroph.-basiph., xeroph.(-mesoph.), m.-v.photoph., m.-r.nitroph., above all Collembion fusc., usually with *Collema crist.*, *Placanthium nigrum*, *Schistidium ap.* – arct-med – r.rare; SJu, Ju, FrJu, Al, otherwise rare to v.rare (e.g. süSch, Vog, Mn, Ne, nöPf, Saar, Hu, Ts, MRh, Eif, He, Th)

LIT.: POELT 1969, PURVIS et al. 1992, VAINIO 1921, ZSCHACKE 1934

Dibaeis Clements

(Determination ↑ Baeomyces)

Introduction

Formerly belonging to *Baeomyces* the species of *Dibaeis* are lichens with a crustose thallus and rose colored, almost spherical apothecia on whitish stalks; one exotic species has even almost sessile apothecia. The 14 species at this time comprising the genus are predominantly tropically distributed. The single European species, *D. baeomyces* is found predominantly in thin turf and huckleberry-moor vegetation-heath as well as first resident on open slopes, usually on small stones, smaller rocks and on soil in shaded sites. It is widely distributed in north and central Europe, lacking however in the true mediterranean floral region.

Genus Characteristics

Thallus crustose, whitish to gray, in the case of a few exotic species sorediate, with coccoid green algae. Ap. as a rule stalked, with rose colored, spherical “capillitium”. Stalk tissue ± colorless. Exc. of radial hyphae at right angles to the exterior (in the case of exotic species even of loose, irregularly oriented hyphae). Subhymenium ± colorless. Asci ± thickened

above, I+ blue, tip I+ intensively blue. sp. 1-celled, because of a plasma bridge even appearing 2-celled, ellipsoidal to fusiform. Ch: Depside.

Ecology and Distribution of the Species

Dibaeis baeomyces (L. f.) Rambold & Hertel (*Baeomyces roseus* Pers.)

Up to the tree line, rarely higher, on acid moderately nutrient rich, usually cool to fluctuating cool, packed or loose, sandy and sandy-stony loam soils, above all in openings in bristly grass and dwarf shrubby heath (*Nardo-Callunetea*), on road sides, on level ground sites, especially in bunt sandstone and granite regions, m.-v.acidoph., r.-v.photoph., Char. Baeomycion – (arct-)bor(subatl)-mieur(-smed-mo) – r.rare (3); Sch, Vog, Pf, RhSch, ThW, otherwise (v.)rare (e.g. Rhön, süRhön, Rh-Mn-T, O), Sp, SFW, Ju, Ne, Do0, süHü), Al

LIT.: FREY 2932, GIERL & KALB 1993, MIGULA 1929-32

Dimelaena Norman

(Determination ↑ Buellia, Rinodina)

Introduction

The genus with two species in Europe and a few additional above all distributed in continental regions of the Northern Hemisphere is distinguished by crustose, pale yellow-green or gray areolate thallus with definitely elongated marginal areoles, sunken blackish apothecia with (often indefinite) thalloid margin and two-celled, dark colored spores. *D. oreina* grows on slightly calcareous or intermediary silicate rock on well lighted, relatively dry habitats, commonly on overhanging or vertical surfaces. It is arctic-alpine distributed. The few occurrences of relict character in the upper alpine central Europe lying in the vicinity of the Alps in xerothermic region of Bohemia, Moravia and lower Austria, in the south Black Forest as well as isolated on the Teufelsmauer in the Harz.

Genus Characteristics

Thallus crustose, areolate, effigurate-lobed at the margin, with the entire underside attached, yellow-green to gray, upper side with cortex, with coccoid green algae. Ap. sunken, black, with thalloid margin. Epihym. brown. Hyp. colorless to dark brown. Paraphyses capitate above. Asci clavate, of the *Lecanora*-type. Sp. gray to dark brown, 2-celled, thin walled, smooth to ornamented. Pycnosp. bacillar. Ch: e.g. Usnic acid, Fumarprotocetraric acid.

Ecology and Distribution of the Species

Dimelaena oreina (Ach.) Norm. (Rinodina o. (Ach.) Massal.)

In montane and high montane, outer half of the region above all subalpine and alpine sites on slightly calcareous, hard, crystalline (often feldspar rich) silicate rock on moderately rain exposed to rather rain sheltered, usually south exposure, sunny, relatively warm vertical surfaces and overhangs (at times on moderately dunged bird roosts), m.acidoph.-subneutroph., r.-v.photoph., m.xeroph., in the alpine char. Rhizoplaco-Dimelaenetum oreinae, in the region only in poor stands (with *Xanthoria el.*, *Rhizocarpon geogr.*) or in the Lecanoretum dem. – arct-alp/pralp – v.rare (R); süSch, Ulmer Münster, Fumarprotocetraric acid race, Hz.

LIT.: LEUCKERT et al. 1975**, POELT & VÈZDA 1977

Dimerella Trevisan

Introduction

The approximately 25 species included in the mainly tropical and subtropical distributed genus are distinguished by the crustose thallus with *Trentepohlia* algae, light colored, mostly yellow to orange-red apothecia with (at least when young) concave disk and biatorine proper margin as well as two-celled spores. *D. lutea* and *D. pineti* are the two single central European representatives of the genus. They live commonly on bark and over mosses. *D. pineti* occurs frequently on breaks and cracks at other

times even on smooth tree bark on a wide substrate amplitude. While these species are distributed from the boreal to the mediterranean zone as relatively tolerant to toxins and are frequent in the region, *D. lutea* is an extremely threatened species in oceanic sites, where they occur on subneutral to acid bark. The area stretches predominantly over the western Europe to central Sweden. Almost all occurrences in Germany outside of the Alps are extinct. The populations still existing require the protection of the forest authorities.

Genus Characteristics and Determination

Thallus crustose, thin, film-like to scruffy, gray, gray-green, with *Trentepohlia*. Ap. concave to flat, at least when young concave and with proper margin, whitish to orange-red. Exc. (almost) colorless, colored at the margin, mostly paraplectenchymatous. Hyp. thin, weakly colored (yellowish). Epihym. colorless to yellowish, olive-yellowish. Hym. I+ blue. Paraphyses simple, thickened above. Asci narrowly cylindrical, without tholus, wall K/I+ pale blue. Sp. fusiform to ellipsoidal, 2-celled. Pycn. hemispherical protruding to almost sunken, yellowish to yellow-brownish. Pycnosp. ellipsoidal to elongate. Ch-

- 1 Ap. -0.4(0.5) mm, whitish, above all yellowish to rose in the herbarium. Sp. 9-14 x 2-3.5 µm. Thallus often sterile, only with 0.1-0.2 mm wide, hemispherical, yellow-brown pycn. Pycnosp. 6-7 x 1.8-2.5 µm, constricted in the center .

D. pineti

- 1* Ap. 0.6-1.8 mm, yellow-orange to orange, constricted at the base. Sp. 8-11 x 2-3.5 µm

D. lutea

Ecology and Distribution of the Species

Dimerella lutea (Dickson) Trevisan (Microphiale l. (Dickson) Zahlbr.)

In montane and high montane, usually high precipitation, oceanic sites on bark and flat growing mosses (e.g. *Radula*) on the trunk of older deciduous trees (beech, sycamore, oak) in near natural forests (e.g. beech-spruce forests, or oak-beech forests), e.g. like *Lobaria pulm.* (↑), e.g. in the Lobarion, in *Menegazzia* rich forms of the Thelotremetum, also with *Paromotrema chin.*

(↑) – mieur-subatl-med, (oc) – v.rare (1); süSch, ThW?+, Bo+, Ju, FrJu, O+, Sp*, Ts

Dimerella pineti (Schrader ex Ach.) Vězda (D. diluta (Pers.) Trevisan, Microphiale d. (Pers) Zahlbr.

Up into the high montane zone on deciduous and conifer trees, above all on the stem base and on the middle stem in the region of cracks, even on decayed stumps, rarely on the soil and on mosses, in lower sites usually in valleys near brooks (above all on ash, hornbeam, e.g. with *Micarea prasina*), often at the base of larch and Scots pine, subneutroph.-r.acidoph., r.-v.hygroph., m.substarthygroph., anitroph.-m.nitroph., m.-r.toxitol., e.g. in the Graphidion, often without accompanying lichens – bor-atl-med – moderately frequent

LIT.: LETTAU 1937

Diploicia Massal.

(Determination ↑ Buellia)

Introduction

The two species of the genus occurring in western and southern Europe grow rosette like, gray-white lichens with radiate-lobed at the margin with lecideine black apothecia and brown two-celled spores. *D. canescens*, the single central European species, produces soralia, commonly lacking apothecia. It lives on vertical- and overhanging surfaces on calcareous silicate rock and – above all in near coastal regions – on dust impregnated or subneutral bark. It is distributed in atlantic Europe and the mediterranean region; the occurrences in the region lie near the east boundary of the area; isolated populations are found yet in Silesia, Bohemia and in the Slovachia. In the north it reaches the south tip of Scandinavia.

Genus Characteristics

Thallus crustose, placoid, gray-white to blue tinged gray, with the entire underside attached, with paraplectenchymatous upper cortex. Photobionts coccoid green algae. Ap. black,

with lecideine proper margin. Exc. thin, dark brown. Hyp. brown-black. Epihym. brown-black. Paraphyses simple or occasionally divided, capitate thickened above. Asci clavate, *Lecanora*-type. Sp. gray-green to brown colored, 2-celled, thick walled, between *Physcia*- and *Mischoblastia*-type. Pycnosp. short bacillar. Ch: Atranorin, Diploicin, et al.

Ecology and Distribution of the Species

Diploicia canescens (Dickson) Massal. (Buellia c. (Dickson) De Not)

Up into submontane sites in winter mild sites, e.g. on warm hanging valleys on moderately rain exposed to rain protected vertical surfaces and overhangs on calcareous or -impregnated silicate rock, in the region above all on anthropogenic substrates, as on old mortared natural stone walls (e.g. bunt sandstone), e.g. in castle ruins and vineyards; on near natural habitats usually on calcareous or basic silicate rock, other places (earlier even in the region) on dust impregnated bark of older deciduous trees, subneutroph., m.-r.(v.)photoph., m.-r.nitroph., on walls e.g. in the Caloplacetum sax., on natural rock in Lecanoretum dem., Xanthorietum fall. – mieur-subatl-med – rare (3); above all PfW, nöPf, Mos-Eif; rare to v.rare Ts, MRh, Lahn, He, Rh-Mn-T, Sp, O, Sch, Vog, Vgt

LIT.: HAFELLNER et al. 1979*, PURVIS et al. 1992

Diploschistes Norman

Introduction

The crustose thallus, often rapidly growing and reaching a large diameter, is commonly gray, gray-brownish or chalk white colored. The apothecia are sunken into the thallus "urn-like"; the blackish, often gray pruinose disk sits at least at first clearly concave; the proper margin is often finally surrounded by a thalloid margin. The spores are multicellular, muriform and colored when older.

In Germany three representatives of the ca. 30, of the cosmopolitan genus are found on various substrates. *D. scruposus* lives on silicate rock, *D. cretaceus* on overhangs and steep

surfaces on limestone on shaded places, *D. muscorum*, at first as a parasite, covers with its thallus lichens and mosses over soil, silicate- and lime-stone. All three species are distributed from the boreal to the mediterranean floral regions.

Genus Characteristics and Determination

Thallus crustose, white, gray, yellowish-gray, pale ochre, coherent to warty or cracked areolate, with *Trebouxia*. Ap. at first almost perithecia-like, then opening wider and with urn-form concave disk, black, often pruinose, with (sometimes less definite) thalloid margin and proper margin. Exc. dark brown to black, above with brownish periphyses. Hyp. colorless to black-brown. Epithym. colorless to olive-brown, brown. Hym. I-. Paraph. unbranched, not thickened above. Asci narrowly clavate to almost cylindrical, thickened above, wall I-, ascoplasm I+ orange-red. Sp. usually 4-8, muriform, at first colorless, then brown, dark brown, broadly ellipsoidal. Pycnosp. short cylindrical to elongate-ellipsoidal. Ch: above all Lecanoric and Diploschistes acid.

The species treated have sunken to sessile ap. with wide open disk. Sp. 4-8. Thallus C+ red.

- 1 Thallus on soil, on mosses, in youth parasitic on *Cladonia* (usually thallus squamules) (parasitic lifestyle often not recognized), usually warty-uneven and \pm coherent. Lecanoric acid, Diploschistes acid. Sp. 4, 20-35 x 8-15 μ m, with 5 cross- and 1-2 longitudinal septa

D. muscorum

- 1* Thallus on rock. Sp. 22-40 x 10-20 μ m . 2
- 2 On silicate rock. Thallus gray, as a rule attached flat with the substrate, non-pruinose, cracked to mostly warty areolate, K- or K+ yellow, Lecanoric acid, \pm Diploschistes acid, \pm Atranorin. Sp (4-)8, with (4)5-7 cross- and (1)2-3 longitudinal septa . **D. scruposus**

- 2* On limestone. Thallus whitish to gray, dull, pruinose, attached flat with the substrate or plate-like loosening, indefinite to clearly cracked-areolate, K-, Lecanoric acid. Sp 4, with 4-7 cross- and 1-2 longitudinal septa **D. gypsaceus**

Ecology and Distribution of the Species

Diploschistes gypsaceus (Ach.) Zahlbr.
(*D. cretaceus* (Ach.) Lettau, *D. ochrophanes* Lettau)

Above all in the calcareous mountains on vertical- and overhanging surfaces on shaded to semi-shaded, moderately to rather humid sites, basiph., e.g. like *Acrocordia con.* – bor-med – rare; Ju, SJu, FrJu, Al

Diploschistes muscorum (Scop.) R.Sant.

(*D. bryophilus* (Ehrh. ex Ach.) Zahlbr.)
Up into the alpine zone on *Cladonias* (young parasite), above all *Cladonia pycnidata*-group, and on soil-, rarely rock dwelling mosses, usually on base rich soils in dry turfs, e.g. in the Toninion sed., but also in silicate regions (e.g. Sch, Eif) on humid sites, r.-v.photoph., m.acidoph.-neutroph. – bor-med – above all lime region (SJu-Ju-FrJu moderately frequent, Mn), otherwise usually r.rare (e.g. Eif, He, Th, Ne, süSch) to rare

Diploschistes scruposus (Schreber) Norman

(*D. ptychochrous* Lettau)
Above all in montane sites, on lime-free (or very weakly calcareous) silicate rock on rather warm to cool sites, especially on smaller, rather long time dew moistened rocks or semi-shaded, moderately rain exposed rock walls, rather like *Lasallia* (\uparrow), yet also on more poorly lighted sites, like *Pertusaria aspergilla* (\uparrow), m.acidoph.-r.acidoph., (r.skioph.-)m.r.(v.)photoph., a-/m.nitroph., *Aspicilietalia gibb.*, *Pertusarietum cor.* – bor-med – r.rare; Silicate mountains (above all Sch, Vog, RhSch), in addition as a cyanthrope penetrating even into the lime mountains (e.g. on walls)

LIT.: LETTAU 1932-37, LUMBSCH 1989.

Dirina Fr.

(Determination \uparrow Lecanactis)

Introduction

The *Dirina*-Species (ca. 14) live predominantly in the warm regions of the earth near the seas. It is treated with the crustose lichens with apothecia with darker, pruinose disks with proper- and thalloid margins and four celled spores. *D. stenhammari*, the single central European species, grows on largely rain protected vertical surfaces and overhangs of limestone and

calcareous silicate rocks. It occurs from the mediterranean region up into southernmost Finland and to the isles of Öland and Gotland; in contrast to the non sorediate parallel species, the extensively bound to the near sea region *D. massiliensis*, is distributed more inland.

Genus Characteristics

Thallus crustose, little areolate to fine cracked (the indigenous species) or even cracked areolate, whitish to gray, with definitely developed cortex of anticlinal hyphae, imbedded in a gelatinous mass. Photobionts *Trentepohlia*. Ap. (in the indigenous species lacking) sessile, single or grouped, e.g. gray, with thalloid margin. Exc. lacking or thin. Epithym. brownish. Hyp. dark brown to black. Paraphysoids branched and reticulate bound. Asci clavate, *Opegrapha*-like. Sp. 4-celled, cross-septate, fusiform, straight to curved. Pycnosp. filamentous and curved sickle-like. Ch: Erythrin, often Lecanoric acid.

Ecology and Distribution of the Species

Dirina stenhammari Stenham.) Poelt & Follm. (*D. massiliensis* Durieu & Mont. f. sorediate (Müll.Arg.) Tehler, *Lecanactis* st. (Stenham.) Arnold)

Up into montane, rarely high montane sites on limestone, rarely on weakly calcareous silicate rock, on rather to very rain protected rock surfaces on moderately well lighted to poorly lighted, (moderate) rather humid habitats, usually on rocks in forests, in high precipitation sites even on open sites, basiph., anombroph., (a-/m.)nitroph., Char. Dirinetum st. – mieu-med – rare; SJu-Ju-FrJu scattered, Al, v.rare süSch, O, PfW, Ne, Eif, Th

LIT.: TEHLER 1983.

Eiglera Haf.

(Determination ↑ *Aspicilia*)

Introduction

The thallus of the (till now two) *Eiglera*-species is crustose and contains coccoid green algae. The black apothecia resembling the form of *Aspicilia* or *Hymenelia*, are also more or less sunken in the thallus and have concave to flat disks, but are distinguished anatomically, e.g. in the ascus structure. *E. flavida* inhabits moderately lime-rich to lime-poor rock, e.g. calcareous sandstone and marl in cool sites and is distributed from North Europe into the mountains of South Europe in geologically suitable regions, but rare. The major occurrences in Central Europe lie in the North Alps.

Genus Characteristics

Thallus crustose, thin, with coccoid green algae. Apothecia sunken into the thallus, concave to flat, *Aspicilia*-like, blackish. Exc. very thin, colorless, thicker only in the upper part and dark glue green in color. Epithym. bluish-green. Paraphyses sparsely branched and scarcely thickened on the ends. Asci broadly clavate to bulging, with I+ uniformly blue tholus without ocular chamber, externally with I+ blue, gelatin layer thicker above. Sp. one-celled, ellipsoidal. Pycnosp. short cylindrical.

Ecology and Distribution of the Species

Eiglera flavida (Hepp) Haf. (*Aspicilia* f. (Hepp) Rehm, *Lecanora* f. Hepp)

Up into the alpine sites on usually moderately lime-rich to lime-poor rock, e.g. on calcareous crystalline slate, calcareous sandstone, marl, above all on stones, smaller boulders, m.basiph.-neutroph. – bor-med – rare (0); Ju, Th, Al

LIT.: HAFELLNER 1984*, EIGLER 1969, POELT & VÈZDA 1981.

Endocarpon Hedwig

Introduction

Endocarpon produces small foliose to squamulose, at the upper side with cortex, usually brown thallus, strongly resembling the habit of *Catapyrenium*. The sunken perithecia,

with only the mouth region visible, contain hymenial algae and asci with usually only two large, muriform multicellular spores. The species is almost without exception insufficiently known. They reside on calcareous soil, like *E. pusillum* and *E. adscendens* (also on mosses), or on rock, like the rarer *E. psorodeum*, that is found on neutral or slightly calcareous silicate rock. *E. pusillum* is very widely distributed in Europe.

Genus Characteristics and Determination

Thallus squamulose to rarely small foliose, decumbent to erect, usually brown to red-brown. Upper cortex paraplectenchymatous, lower cortex lacking or sometimes developed. Photobiont *Stichococcus*. Per. sunken into the thallus, apex somewhat projecting, blackish. Exc. surrounding dark, involucrellum lacking. Hym. I+ bluish to reddish, K/I+ blue, with numerous small hym. algae. Paraphyses lacking, periphyses numerous. Asci clavate to bulging (sack-like), thin walled. Sp. 1 to (in the case of the indigenous species) 2, commonly muriform multicellular, with age yellowish to brown. Pycnosp. bacillar. Ch-

- 1 Hym. algae oblong, 4-12 x 2-4 µm. Squamules - 6 mm long, ± erect to almost small fruticose. Sp. 35-65 x 14-30 µm. On limestone, Arct-alp .
E. pulvinatum Th.Fr.
- 1* Hym. algae ± spherical. Squamules clearly foliose-squamulose . 2
- 2 On silicate rock. Squamules -2.5 mm, growing closely shingle-like, without rhizines, rounded, ± crenate lobed, (greenish) gray-brown, underside light to blackish. Sp. 27-48 x 12-22 µm .
E. psorodeum
- 2* On base-rich soil, mosses, limestone, mortar 3
- 3 Thallus squamules erect at the margin, overlapping one another (not so clearly quickly shingle-like as in the case of *E. psorodeum*), 2-7 x 1-3 mm, yellow-brown, brown, dark brown, gray, olive-gray. Underside (with exception of the lighter margins) blackish, without rhizines. Sp. 25-50 x 14-22 µm .
E. adscendens
- 3* Thallus squamules usually depressed, single to somewhat overlapping one another, 1-4 mm, rounded to mostly crenate lobed, light brown, ochre, brown, rarely dark brown to black, with rhizines. Sp. 30-60 x 14-28 µm **E. pusillum**

Ecology and Distribution of the Species

Endocarpon adscendens (Anzi) Müll.Arg. (*E. pallidum* auct.)

Over mosses or soil encrusted calcareous rock on semi-shaded to sunny sites – s’bor-med – MRh, nöPf, Saar, Vog

Endocarpon psorodeum (Nyl.) Blomb. & Forss.

On SiO₂-poor or slightly calcareous silicate rock, above all on rain exposed steep surfaces, even on silicate walls, on rather well lighted habitats – bor-mieur – v.rare (R); Bo, Sch, Ne

Endocarpon pusillum Hedwig

Up above the tree line on calcareous fine soil, above all on stony loam soils in openings of lime meager turfs, over thin soil layers in rock fissures and on soil encrusted walls (above all vineyards), on loess, even going over to low growing moss, like *Catapyrenium squam.* (↑), m.basiph., r.-v.photoph., xeroph., anitroph.-r.nitroph., above all in the Toninion sed. – bor-med – rare (2); Mn, süRhön, Hü, Ne, Ju, Bo, Pf, MRh, Mos, Eif, Rh-Mn-T, He

LIT.: VAINIO 1921, ZSCHACKE 1934

Enterographa Fée

(Determination ↑ Opegrapha)

Introduction

The predominantly tropically distributed, ca. 30 species included in the genus are characterized by a crustose, without cortex, in the fresh condition usually brownish thallus with *Trentepohlia*-algae, black, rounded to elongate streak-form, sometimes branched ascocarp (lirellae), which is often surrounded by an apparent thalloid margin, and by fusiform (to needle-like) cross-septate spores. In contrast to *Opegrapha* no rosette, carbonaceous “receptacle” is developed.

E. zonata resides on shady vertical to overhanging rock of silicate stone on very humid habitats and is indigenous mainly in West-Northwest- and in the mild Central Europe. Similar ecological conditions produce the growth type of *E. hutchinsiae*, which is distributed from

Central Mediterranean over Western Central Europe up to the southern tip of the Scandinavian peninsula. It is however fundamentally to be found more frequently even on smooth bark (in the region above all of hornbeam) and more strictly bound to winter- mild habitats, thereby to be found mainly in lower valleys. It nearly reaches the East boundary of its area in the region. The closely related, essentially epiphytic *E. crassa* is even more strongly limited to the atlantic region (North Germany).

Genus Characteristics

Thallus crustose, smooth to cracked areolate, commonly gray-brown, brown, olive-brown, rarely light gray, commonly with a dark prothallus line, even with soralia (*E. zonata*), with *Trentepohlia*. Ap. sunken, sometimes bordered by the thallus, punctiform-rounded to streaked, ellipsoidal to streak-form, with flat, brown to black disk. Exc. thin to clearly developed, pale brownish to brown. Hyp. ± colorless. Epithym. brown to black-brown. Paraphyses thin, branched, reticulate bound, not thickened above. Asci cylindric to narrowly clavate, fissitunicate, with K/I+ pale blue tholus and surrounded by a small K/I+ more strongly blue ring ocular chamber, interior wall K/I+ pale blue. Sp. 4-16 celled, cross-septate, fusiform (to needle-like). Pycnosp. bacillar. Ch: indigenous species: Confluent acid.

Ecology and Distribution of the Species

Enterographa hutchinsiae (Leighton) Massal. In the foothills, winter mild sites on (often SiO₂ - poor) silicate rock on rather rain protected vertical surfaces/overhangs on moderately cool, oceanic, shaded habitats with ± uniformly high humidity, also going over to smooth bark e.g. hornbeam, like *E. zonata* (↑), yet not on the cooler habitats of this species, Char. Enterographetum zonatae – mieur-subatl-smed – v.rare (3); Eif, O, Sch, süRh, MRh

Enterographa zonata (Körber) Källsten (Opegrapha z. Körber, O. horistica (Leighton) B.Stein)

Up into the (high) montane zone, in high precipitation sites on lime-free (sometimes however basic), hard silicate rock on rather to

very rain protected vertical- and overhanging surfaces on rather to very poorly lighted, very humid, cool, oceanic habitats, above all in gorges, valleys, on north facing, in forests, r.acidoph.-subneutroph., (r.-)v.skioph., v.hygroph., anombroph., anitroph., Char. Enterographetum zon. – (bor-atl-) s'bor-subatl-smed-subatl(-med), (oc) – Sch, Vog, BayW, ThW, (v.)rare Eif, Th, Pf, O, Bo

LIT.: COPPINS & JAMES 1979, REDINGER 1939, TORRENTE & EGEA 1989

Eopyrenula R.Harris

(Determination ↑ Pyrenula)

Introduction

The species of the genus have conspicuous, thin crustose thallus with *Trentepohlia*-algae, dark brown to black perithecia and ellipsoidal, cross-septate brown spores, which in contrast to *Pyrenula* exhibit no strong wall thickening. *E. leucoplaca* occurs on smooth bark of deciduous trees mainly in the zone of summer green deciduous forests.

Genus Characteristics

Thallus simple, thin crustose or in the tree bark, with *Trentepohlia*. Per. ± hemispherical projecting, dark brown to blackish. Exc. ± spherical (or hemispherical in non indigenous species), pale brown to colorless, around it a dark brown (in the case of the indigenous species) a close lying involucrellum. Hym. I+ yellowish or pale bluish. Paraphysoids simple to sparsely branching and bound. Asci subcylindric, I+ light blue, then reddish, K/I- or K/I+ blue. Sp. (2-)4 up to 8 celled, cross-septate, without definite thickening, brown, the outer cells often lighter. Macroconidia. ellipsoidal to cylindric, brown, cross-septate, 2- to multicellular. Microconidia short bacillar to (in the case of the indigenous species) filamentous. Ch-.

Ecology and Distribution of the Species

Eopyrenula leucoplaca (Wallr.) R.Harris
(*Pyrenula l.* (Wallr.) Körber)

On cracked, rarely smooth bark of deciduous trees in the interior of the forest, predominantly probably in the foothills and submontane sites, m.-r.acidoph. – s'bor-mieur – rare (0); süHü-HRh, O, nöRh, Ju

LIT.: HARRIS 1973, POELT & VEZDA 1981, VAINIO 1921

Ephebe Fr.

(Determination ↑ *Polychidium*)

Introduction

The blackish thallus of *Ephebe* is small fruticose or produces a compressed mat of branched, somewhat knobby filaments; which contain filamentous bluegreen algae of the genus *Scytonema*. Frequently the species remain sterile. Of the ca. 12 species included in the genus, the European ones occur in cool and cold regions on irrigated or occasionally flooded silicate rocks. The single species recorded in Germany is distributed in the boreal floral region and rare in high montane Central Europe (Black Forest, Vosges, Riesengebirge, Alps, and Carpathians) to isolated in the high mountains of South Europe. In recent years the lichen is regression in the Black Forest.

Genus Characteristics

Thallus of branching filaments, small fruticose to (in the case of the indigenous species) decumbent and producing tufted-radial mats, blackish, cortex without cellular structure, with central *Stigonema*-filaments; hyphae in younger branches exterior embedded in the gelatin of the algae. Ap. originating from pycnidia, in lateral swellings sunken in the branch, with punctiform disk. Hym. gelatinous, upper part I+ blue-green. Paraphyses sparsely branching, thickened above. Asci thin-walled, without tholus, outer layer K/I+ blue. sp. to 8-16, ellipsoidal, 1(3) celled. Pycnosp. ellipsoidal to short bacillar. Ch-

Ecology and Distribution of the Species

Ephebe lanata (L.) Vainio

In montane and high montane, high precipitation sites on contiguous silicate rocks on slopes, nutrient-rich, sporadically drying irrigated, rarely on spray moistened boulders along brooks, on mostly sunny, but also shaded habitats, in the region mostly in the area of the meager turf (Nardion), subneutroph.-m.acidoph., subhydroph., m.-v.photoph., Char. Ephebetum – bor-smed-mo – rare (2); süSch, Vog, nöPf (v.rare)

LIT.: HENSSEN 1963a.

Epilichen Clem.

(Determination ↑ *Buellia*)

Introduction

The up till now described species of the genus live on *Baeomyces* thalli. In the case of the indigenous species the thallus is crustose and greenish-yellow. The black apothecia have a lecideine proper margin, a dark hypothecium, reticulate bound “paraphyses” and two-celled grown spores. *E. scabrosus* occurs in North- and West Europe and mountain sites of Central Europe; the lichen lives with its host on open slopes and road sides as well as in openings of the silicate meager turf. They are missing from the region.

Genus Characteristics

Thallus crustose, yellow to yellow-green, with coccoid green algae, or thallus lacking. Ap. black, with definite to rapidly disappearing proper margin. Exc. dark brown. Hyp. dark brown, of radial lying hyphae. Epihym. brown to olive-brown. Paraphysoids branched and reticulate bound, scarcely thickened above. Asci like *Catolechia*, exterior with thin I+ blue gelatin cover, in the case of indigenous species with narrow, I+ blue disk-form structure in the tholus tip, tholus otherwise only I+ pale blue, I (concentrated)+ red-brown. Sp. gray-brown to brown, 2-celled, smooth. Ch: in the case of the indigenous species Pulvinic acid-derivatives.

Ecology and Distribution of the Species

Epilichen scabrosus (Ach.) Clem. (Buellia scabrosa (Ach.) Massal.)

Parasitic on *Baeomyces placoph.* and *rufus* (↑), yet not so euryök as these, high point in cool montane and high montane sites – (arct-)bormieur – v.rare (0); süSch, *Vog*, *O*, *Ju*, *Fr*, Meissner, Al

LIT.: HAFELLNER 1978, HAFELLNER IN POELT & VÈZDA 1981

Euopsis Nyl.

(Determination ↑ Porocyphus)

Introduction

The *Euopsis*-species (till now two) are bluegreen algae lichens with crustose red-brown thallus, with punctiform at first sunken lecanorine apothecia, later widening red-brown disk and single-celled spores. *E. pulvinata* is distributed from the arctic into the mountain region of Central Europe. In Germany it is known only from the Black Forest; it grows on silicate rock on irrigated rocks or stones that are long time dew moistened.

Genus Characteristics

Thallus crustose, granular to appearing small squamulose, dark red-brown, when moist ± gelatinous, not layered, with *Gloecapsa* (in the case of the non indigenous species additionally with *Trebouxia*), hyphae reticulate bound around the bluegreen algae, gelatin envelope of the bluegreen algae reddish toward the thallus margin. Ap. with brown disk, with thalloid margin. Exc. narrow, of parallel hyphae. Hym. I-. Epihym. brownish. Hyp. colorless to brownish. Paraphyses thin, sparsely branched. Asci relatively short cylindric, thick walled, outer layer I+ blue, in the upper part around the ascoplasma the same I+ blue, expandable interior layer, which on opening of the ascus everts as a

beak-like structure, tholus I-. Sp. 1-celled, ellipsoidal. Pycnosp. short bacillar. Ch-

Ecology and Distribution of the Species

Euopsis pulvinata (Schaerer) Vainio (Pyrenopsis p. (Schaerer) Th.Fr.)

On lime-free silicate rock, on small, relatively long time dew moistened stones or on occasionally irrigated rock surfaces, usually on sunny sites, e.g. with *Trapelia involuta* (↑), *Stereoc. pil.*, r.acidoph., substrathygroph. – arct-mieur-mo – v.rare (1); süSch (*Feldberg*, Schau Island)

LIT.: HENSSEN et al. 1987

Evernia Ach.

Introduction

The Evernias are pale gray-greenish to yellow-greenish, rarely gray fruticose lichens. Presently the genus consists of two groups: the usually bushy erect *E. prunastri* with band-form, undersides whitish thallus sections, and long pendent beard lichens with angular irregular to reticulate pitted strands (*E. divaricata*-group). The rarely produced apothecia have shiny brown disks surrounded by a thalloid margin. Reproduction is most cases is by soredia and thallus fragments.

There are three species in Germany of the ca. eight included in the genus which is distributed in the traditional setting northern hemispherically to subcosmopolitan; the species grow predominantly on bark, rarely on rock or soil. The two indigenous species live commonly epiphytically. The more frequent *E. prunastri* is entirely lacking in heavy air pollution regions and in arid habitats. *E. divaricata* occurs in foggy, cool to cold habitats in near natural forests and is strongly in regression. Whereas *E. prunastri* is distributed in Europe from northern Fennoscandia into the Mediterranean region, *E. divaricata* penetrates the predominantly boreal-montane only rarely into the mountains of the northern mediterranean region; it avoids the atlantic floral region.

Genus Characteristics and Determination

Thallus fruticose, attached to a site by an attachment “disk”, ascending to usually pendent, yellowish, green-yellowish, rarely gray, of multiply branched, band-form and underside lighter to thick filamentous-angular, all sides equally colored segments, relatively flaccid. Both-/all sides with cortex. Band-form thallus dorsiventrally symmetrical, beard-form filaments thallus ± radially symmetrical (monofasial). With or without soralia or isidia. Photobionts coccoid green algae. Ap. brown, red-brown, with thalloid margin, strongly constricted sessile to short stalked. Asci *Lecanora*-type. Sp. 1-celled, ellipsoidal. Ch: yellow species with Usnic acid, Evermic acid or Divaricatic acid et al.

- 1 Thallus short fruticose, short pendant and ascending, ± richly branched. Segment band-like flattened, pliable, (1)2-3(5) mm wide, upper side gray- to yellow-green (or bluish gray, without usnic acid.: var. *herinii* (Duv.) Maas G.), underside whitish (to partially greenish spotted), weakly channeled and wrinkled, with mealy-granular soralia at the margins. Ap. very rare. Usnic acid, Evermic acid, Atranorin

□ *E. prunastri*

- 1* Thallus as a rule long filamentous-beard like, pointed on the ends. Segment narrow (1-2 mm), elongate pitted or angular, all sides same color, without soralia. Ap. rather rare
 - 2 Thallus light gray, K+ strongly yellow.
- Atranorin, Divaricatic acid . ***E. illyrica***
- 2* Thallus ± green-yellowish to gray-green, K-, conspicuously lax and with very friable cortex, thereby multiply cross-cracked and showing the white medulla. Usnic acid, Divaricatic acid

□ *E. divaricata*

(when with strongly elongated pits, moderately pointed branches with cylindrical sorediate erupting isidia, in continental sites: ***E. mesomorpha*** Nyl.)

Ecology and Distribution of the Species

Evernia divaricata (L.) Ach. (Letharia d. (L.) Hue)

In montane and high montane, high precipitation sites on acid bark, predominantly on branches, on cold, late frost threatened, foggy, v.-e.humid habitats, above all in spruce- fir forests, like *Ramalina thrausta* (↑), Char. Evernietum div. –

bor-smed-mo,(subko) – rare (2); above all süSch (East, Southeast); süSch-Ba, nöSch, Vog, Sju, Al, otherwise (1) to (0): Ne, Ju, Av, ThW+?, Pf+, Eif+

Evernia illyrica (Zahlbr.) Zahlbr.

In the region with and rather like *E. divaricata* (↑), yet above all on cool, not late frost threatened sites in spruce forests – (mieur-atl)smed-mo-med-mo – v.rare (+++); Vog (e.g. Grand Ventron)

Evernia prunastri (L.) Ach., **Oak Moss**

Up to the tree line on acid bark of deciduous and conifer trees, on the trunk and branches, of very broad ecological amplitude, on completely rain exposed to rather rain protected, v.-m.well lighted, m.-v.humid habitats, on free-standing trees as well as in the forest, even on moderately dust impregnated trunks (then like *Ramalina poll.* ↑), in lower sites like *Parmelia glabrata* (↑), in higher like *Pseudevernia* (↑), m.-v.acidoph., anitroph.-m.nitroph., above all in association of the Hypogymnietea. Collected for perfume manufacture (“Mousse de chène”) – bor-med – m.-r.frequent, rare in industrial area.

LIT.: ANDERS 1929, KESSLER 1958, POELT 1969.

Farnoldia Hertel

(Determination ↑ *Lecidea* PT 3)

Introduction

The species of the genus *Farnoldia* are separated from the composite genus *Lecidea* and are recognized by crustose thallus, black, lecidine margined, sessile apothecia with carbonaceous excipulum and single celled spores with a perispore. They live on calcareous rock in alpine and arctic regions. *F. jurana* descends into the higher central mountain sites (such as the Swiss Jura, Schwäbisch-French Alp). The three other species known from Germany (*F. hypocrita*, *F. micropsis*, and *F. similigena*) occur on contiguous rocks in the calcareous Alps, thus even in the Allgäu.

Genus Characteristics

Thallus crustose to indefinite and living in the rock, with coccoid green algae. Ap. black, at least at first with proper margin, sometimes pruinose, smooth to brain-like furrowed. Exc. carbonaceous black. Hyp. colorless to brown-black. Paraphyses thin, partially branched and bound, weakly to strongly thickened above. Asci *Porphidia*-like. Sp. one-celled, ellipsoidal, with thick perispore. Pycnosp. bacillar. Ch-

Ecology and Distribution of the Species

Farnoldia jurana (Schaerer) Hertel (Lecidea j. Schaerer, L. petrosa Arnold, Melanolecia j. (Schaerer) Hertel)

From the montane up into the alpine zone (high point in the alpine region) on pure limestone and dolomite, rarer on rather lime-rich rock (marl, calcareous sandstone), r.euryök, on ± rain exposed surfaces on usually m.-v.light-rich habitats, basiph., a-/m.(r.)nitroph., e.g. in the Hymenelion coer. – arct-mieur-med(alp) – v.rare (R); Ju, Sju, FrJu, Th, Al

LIT.: HERTEL 1967, HERTEL IN POELT & VÈZDA 1981

Fellhanera Vèzda

Introduction

The *Fellhanera*-species are small crustose lichens with biatorin, as a rule orange, yellowish, red-brown, brown or blackish colored apothecia with cellular structured excipulum and two- to four celled, cross-septate spores. Almost all (ca. 20) species live on leaves of trees and shrubs in the tropics. *F. bouteillei* and *F. vezdae* belong to the few species, which occur – in the subatlantic region – (likewise) yet in the region of summer green deciduous forests (up into southern Scandinavia); also in the region they are bound to mild sites. *F. vezdae* resides on trunks and trunk bases of deciduous trees and spruce on shaded, humid, winter mild habitats. *F. bouteillei* grows predominantly on needles and thin branches of spruce. Also *F. subtilis* resides in such a habitat, yet it frequently lives on huckleberry stems. It occurs in subboreal Central

European region, in southern Central Europe it is limited largely to the mountains.

Genus Characteristics and Determination

Thallus crustose, warty, scurfy to powdery, in the case of the indigenous species commonly gray-greenish, with coccoid green algae. Ap. sessile, flat to later convex, in the case of the indigenous species whitish to (above all in the herbarium) yellowish-orange, with lather even disappearing proper margin. Exc. paraplecten-chymatous. Hyp. colorless to orange-brown. Hym. I+ blue, epihym. colorless to yellowish. Paraphyses simple to branched above. Asci clavate, with K/I+ blue tholus with darker blue tubular ring structure and amyloid gelatin envelop. Sp. 2- to 4-celled (or in the case of the exotic species even weakly muriform), ellipsoidal.

- 1 Sp. to 16 µm long. Pycnosp. short, ellipsoidal to drop-form. Hyp. colorless to pale colored. Exc. thin 2
- 1* Sp. at least 16 µm long. Pycnosp. at least 12 µm long, filamentous, straight or curved. Hyp. dark 3
- 2 Sp. ellipsoidal, (2-)4 celled, 10-16 x 2.5-4 µm. With whitish, projecting, at times thorn-like, -0.2 mm wide pycn. Pycnosp. 3.7-4.6 x 1.4-1.7 µm, ellipsoidal to drop-form. Ap. whitish, pale (rose) yellowish to pale brownish (in the herbarium orange), -0.5 mm, at first flat and then whitish margined, later convex marginless, Paraph. sparsely branched and anastomosing. Thallus gray-greenish □ **F. subtilis**
- 2* Sp. 9-15 x 3-6 µm, 2 celled. Pycn. not projecting. Ap. yellowish, pale brownish to pale rose -0.4 mm, whitish margined. Paraph. predominantly scarcely branched. Epihym. ± colorless. Thallus blue-greenish, mealy to finely granular. □ **F. bouteillei**
- 3 Pycn. hemispherical projecting, scattered, wide opened, -2mm wide, 0.3 mm high. Pycnosp. straight to curved and twisted, 20-43 x 0.8-1 µm, simple to indefinitely septate. Sp. 30-42 x 3-4.5 µm, (4)5-7(8) celled, thick needle-like to fusiform, straight to curved. Ap. -0.4 mm, at first thick margined, later convex marginless, rose-brown to gray-brown. Epihym. red-brown, hyp. dark brown. Exc. brown-red. Thallus thin, scurfy-uneven, gray, pale green-gray □ **F. vezdae**

3* Pycn. blackish, punctiform (0.05 mm). Pycnosp. curved or twisted, 12-30 x 0.8 µm. Sp. 16-24 x 3-4 µm, 4-celled. Ap. -0.1 mm, pale gray to brownish, marginless or at first whitish margined, flat, later moderately convex and marginless. Hyp. dark brown to violet. Thallus thin, gray-greenish, in humid sites on *Vaccinium*-shrubs, fir branches, gravel stones. Schleswig-Holstein

F. myrtillicola (Erichsen) Haf.

Ecology and Distribution of the Species

Fellhanera bouteillei (Desm.) Vèzda (Catillaria b. (Desm.) Zahlbr.)

In the foothills up to montane, oceanic or at least mild-winter sites on branches and needles of conifers, above all spruce, rarer on the bark of old deciduous trees, m.-r.acidoph., r.ombroph., (r.-)v.hygroph., r.skioph.-m.photoph., anitroph., Char. Fellhaneretum bout. – mieur-subatl-med-mo – rare (2); süSch(-süHü), HRh, Ju, Ne, SFW, Av, Eif

Fellhanera subtilis (Vèzda) Dieder. & Sérus (Bacidia s. Vèzda)

Up into the subalpine zone, in cool-moist sites on the stems of huckleberry and on conifer branches, in the dwarf heath, fir forests, r.acidoph., m.-r.photoph., anitroph. – s'bor-mieur-subatl – rare (3); Sch, BayW, Alps, Lux, Westf

Fellhanera vezdae (Coppins & P.James)

V.Wirth (Bacidia v. Coppins & P.James)

In the foothills and submontane sites on trunk and at the base of deciduous trees, rarely spruce, rather like *Dimerella pineti* (↑), but limited to more moist regions, e.g. brook meadows, r.-m.acidoph., r.-v.skioph. – mieur-med, subatl – rare; Ne, SFW, Sch

LIT.: DIEDERICH 1989, PURVIS et al. 1992, SANTESSON 1952

Fulgensia Massal. & De Not

Introduction

The Fulgensias are yellow to red-orange colored, crustose-squamulose or marginally lobed and

almost foliose developed lichens with red- to brown-orange colored apothecia with thalloid margin. As in the case of the *Xanthoria*-species all yellow to red parts react deep red with Calcium Hydroxide. In distinction to this genus the *Fulgensia*-species develop one- to two-cells, at no time polar-diblastic spores.

The species of the genus live on base-rich soils, calcareous rocks and on gypsum. They occur mainly in warm and dry regions of the northern hemisphere. Of ca. 15 species five are known from Germany. *F. schistidii*, which is distributed in the lime-mountains of Central Europe and the Mediterranean region, grows on lime mosses; outside of alpine Germany it is extremely rare. *F. fulgens*, a member of the well known colored soil-lichen association, lives in low precipitation summer-warm regions in stony calcareous meager turf, on fine soil between rocks and on loess in the submediterranean region and Central Europe; it reaches the north boundary of its area – like *F. schistidii* – Swedish East Island. In Central Europe the species is distributed mainly in the upper Rhine region, lower France and Thüringen and is strong regression because of common land settlement. The nearest collection location of *F. bracteata* lies in the region of gypsum occurrence in Central France. Even it is threatened in Germany.

Genus Characteristics and Determination

Thallus squamulose to rosetted-placoid or almost foliose, yellow to orange, sometimes pruinose, often with schizidia, underside usually with rhizo-hyphae (felt) (non indigenous species even with rhizine strands) attached by the lower surface, upper side commonly with shiny cortex, rarely with paraplectenchymatous cortex, definite marginal lobes with cortex on both sides. Photobionts coccoid green algae. Ap. orange-brown to red-orange, with thalloid margin, often with proper margin in addition. Paraphyses simple to sparsely branched. Asci of the *Teloschistes*-type. Sp. 1 to rarely 2(4) celled, without wall thickening and without canal in the septum, ellipsoidal to fusiform or asymmetrical with one end constricted. Pycnosp. short bacillar. Ch: Physcione. Yellow to orange-red part K+ purple.

1 Ripe sp. clearly 2-celled, 15-23 x 5-7.5 µm, ± constricted at the septum. Thallus yellow- to red-

orange, not to definitely lobed, thickly covered with (1.5 mm wide) ap., over cushion mosses on limestone . □ **F. schistidii**

- 1* Sp. 1-celled, up to 16 µm long. Thallus white- to orange-yellow, on calcareous soil, mosses. Ap. orange(brown), brown-red, -1.5 mm . 2
- 2 Thallus warty to squamulose, areoles convex, margin, at best, indefinitely enlarged, ± pruinose. Sp. 9-13 x 4-7 µm **F. bracteata**
- 2* Thallus ± rosetted, with definite, concave to moderately convex marginal lobes, almost foliose, interior ± undivided, usually -2.5 cm wide. Sp. 7-16 x 4-6 µm □ **F. fulgens**

Ecology and Distribution of the Species

Fulgensia bracteata (Hoffm.) Räsänen

var. **bracteata**

Like *F. fulgens* (↑), however commonly on gypsum and gypsum soils, in the Toninio-Psoretum – mieur – v.rare (1); Mn, Ries, He (e.g. Meissner-Vorland), Hz

Fulgensia fulgens (Sw.) Elenkin (Caloplaca f. (Sw.) Körber)

In the foothills, warm-summer, low precipitation sites on lime-rich fine soil, going over to mosses, in openings of level, usually stony lime meager turf, on soil encrusted lime beds, in addition on open sites on loess as well as gypsum, secondarily even on road sides; regressing because of meadow utilization and reallocation (above all Hü), subneutroph.-m.basiph., xeroph., thermoph., s.photoph., Char. Toninio-Psoretum – mieur-smed, subko – rare (2); above all Mn-süRhön, Th, additionally süRh, H~, Ne, Ries, Eif+, He, Hz

Fulgensia schistidii (Anzi) Poelt (Caloplaca sch. (Anzi) Zahlbr.)

(High)montane to alpine, over mosses (above all *Schistidium apoc.*, *Grimmia*) on calcareous rock on rather to very well lighted, rain-exposed, often somewhat fissured steep surfaces, neutroph., xeroph. – mieur-med, subalp/alp – v.rare (R); Ju, also Al

LIT.: KÄRNEFELT 1989*, POELT 1965B. POELT & VÈZDA 1977.

Fuscidea V.Wirth & Vèzda

(Key includes *Ropalospora*)

Introduction

The *Fuscidea*-species have thin- to thick crustose, commonly gray to brown-gray thallus with usually clearly developed prothallus and brown to brown-black biatorin apothecia with definite projecting to indefinite proper margin. In the case of a few species the apothecia are surrounded by the thallus. The spores are as a rule single-celled.

The c. 25 species are distributed in the cool and temperate moist regions of the earth, above all in the northern hemisphere. They reside mostly on hard, acid silicate rock, rarely on bark. Nine of the eleven species known from Germany occur in Baden-Württemberg. With the exception of the bark-dwelling species *F. cyanthoides* (also on rock), *F. lightfootii* and probably also *F. pusilla* almost all are restricted to the Black Forest. Here they live especially in the high precipitation ridge sites or on west faces of the mountains on steep surfaces of silicate rocks and in cool-moist boulder fields. *F. lightfootii* has disappeared. The indigenous *Fuscidea*-species are distributed atlantic and subatlantic. *F. kochiana*, *F. cyathoides* and *F. praeruptorum* have a relatively large area extending out into central Fennoscandia and the Mediterranean region. *F. austera*, *F. maculosa* and *F. recens* are distributed in western Europe above all in the region of summer-green deciduous forests and avoiding the warm temperate Mediterranean region. With the exception of *F. austera* whose area is the near coastal regions of northern Scandinavia; these species are predominantly in the oceanic regions in humid and cool sites of the central mountains. *F. oculata* is a member of the *F. intercinct*-group, which is indigenous to atlantic Europe.

Genus Characteristics and Determination

Thallus gray to dark brown, cracked to areolate, usually with dark brown to black prothallus, with coccoid green algae. Ap. sunken to sessile, without thalloid margin or with an *Aspicilia*-like “thallus collar”, with or without proper margin. Exc. strongly developed to almost completely reduced, in the margin region brown to black brown, interior colorless to slightly brownish, rarely brown. Hym. colorless to brownish, I-

Hyp. colorless or light, often of right angled hyphae. Epihym. brown. Paraphyses simple to sparsely branched, with usually thickened, browned ends. Asci clavate to almost cylindric, with interior and exterior K/I+ blue cap, over and above one with K/I+ pale blue gelatinous cap. Sp. 1-celled, rarely 2-celled, ellipsoidal to elongate, straight or curved, colorless or with age slightly browned. Pycnosp. bacillar to ellipsoidal. Ch: often Divaricatic acid, rarely Alecatorialic acid, Fumarprotocetraric acid et al.

- 1 On bark . 2
 1* On silicate rock . 5
 2 Thallus without soralia, cracked areolate, areoles with ± smooth upper surface, gray, gray-brown, often with dark brown to blackish prothallus, medulla P+ red, K-, C-. Ap. -1.5(1.8) mm, black-brown to almost black, brown when moist, with often lighter, often distorted, clearly projecting margin, ± flat. Sp. bean-form curved, 8.5-12(14) x 4-6 µm, 1-celled. Fumarproto-cetraric acid
 □ **F. cyathoides**
 2* Thallus sorediate, soralia and medulla R-, UV+ (blue-)white . 3
 3 Soredia often brownish, commonly granular, 40-100 µm thick. Soralia at first rounded, concave-crater form, then coalescing, whitish to brownish. Ap. -1.2(1.5) mm, dark brown to black (brownish tinted when moist), with usually lighter (brown), often distorted, clearly projecting margin. Sp. constricted in the center, rarely weakly curved or ellipsoidal, 7.5-11 x 3-4.5 µm. Thallus gray to usually brownish-gray, rarely greenish-gray, when moist not definitely green, unevenly warty to rarely areolate, sometimes with gray to brown-black prothallus, -5 cm. Divaricatic acid. Habit sometimes like *Mycoblastus fucatus*, this species P+ red!
 F. lightfootii
 3* Soredia greenish to yellowish, 20-50 µm thick. Thallus almost always sterile, usually only -2 cm. If fertile, then sp. otherwise . 4
 4 Thallus warty, pale greenish, green-gray, when moist commonly clearly green, often with dark brown to black prothallus, usually -2 cm. Soralia originating in the thallus center, irregular, soon coalescing, greenish to yellowish. Soredia 20-30 µm. Thallus in the marginal part almost always of non sorediate convex areoles. Ap. v.rare in the region (sp. 6-8 celled). Perlatolic acid
 □ **Ropalospora viridis**
 4* Very like *Ropalospora viridis*, but thallus still smaller, usually 1 cm. Ap. unknown. Divaricatic acid
 E. pusilla
 5 Thallus sorediate, often sterile . . 6
 5* Thallus not sorediate, with ap 9

- 6 Soralia pale yellowish, whitish or slightly brownish, in the herbarium often rose, C+ red, KC+ red, P+ yellow, UV-± yellowish, -0.5 mm, rounded, scattered. Thallus gray to gray-brown, areolate, areoles rounded to lumpy, on a black prothallus. Ap. rare, -1(1.5)mm, brown-black to black, flat to moderately convex, margined. Sp. 9-12 x 3-5 µm. Alecatorialic acid
 □ **F. praeruptorum**
 6* Soralia whitish, gray, gray-brown, R-, UV+ white. Divaricatic acid 7
 7 Thallus sterile, of elliptical to irregular 1-4 mm, moderately convex areoles (grouped), which are fleck-like ordered scattered on the extensive black prothallus. Areoles cracked to cracked-areolate, white, cream colored, even very slightly brown tinted. Soralia round, concave, erupting in the center of areoles, usually to 1-2, 0.2-1.5 mm wide, whitish to gray. * □ **F. maculosa**
 7* Thallus commonly ± coherent, prothallus visible only isolated between thallus areoles. Ap. rare to frequent 8
 8 Ap. (usually constricted) sitting up, flat to moderately convex, margined, -1(1.2) mm, rare. Sp. bean-form to ellipsoidal, 1-celled, rarely 2-celled, 9-14 x 3-5 µm. Exc. strongly developed, exterior dark brown in a broad region. Soralia scattered to very sparse, -0.7 mm, whitish to soon brownish and coalescing. Thallus light gray, gray, gray-brown, warty areolate to cracked areolate. * . **E. recensa**
 8* Ap. ± sunken into the thallus, only strongly projecting in the older ones, with broad margin, often provided with a thin light inter margin, black (moist black brown), -0.6 mm. Exc. extensively pale. Sp. broadly ellipsoidal, 8-10.5(11.5) x 4-6.5(7) µm. Soralia scattered to very sparse, rounded, concave, ± whitish, gray to slight brownish, -0.6 mm. Thallus brownish gray to gray-brown, areolate to cracked areolate.
 * □ **F. oculata**
 9 Sp. at least partially bean-form curved . 10
 9* Sp. ellipsoidal. Thallus/medulla R- . 11
 10 Medulla P+ red, K-, C-, not UV+ white. Thallus cracked to cracked areolate, areoles with ± smooth upper surface, very rarely with soralia
 F. cyanthoides (2)
 10* Medulla R-, UV+ white. Thallus areolate, areoles convex, uneven, even lumpy, soralia nor rare
 F. recensa (8)
 11 Ap. not or only indefinitely (narrow, nor raised) margined. Hym. only indefinitely separated from the hyp 12
 11* Ap. clearly with bulging margins . 13
 12 Ap. extensively sunken into the thallus, flat to slightly convex, often of irregular angular outline, (dark)brown to brown-black, sometimes slightly pruinose, -1.5(2.5) mm. Thallus rather

thick, light gray, gray, gray-brown, cracked- to warty-areolate. Medulla UV+ (blue)-white. Sp. 7.5-10.5 x 4-7 µm, broadly ellipsoidal.

Divaricatic acid □ **F. kochiana**

12* Ap. sessile to depressed, (brown)black, -0.7 mm, round, flat to convex. Thallus gray, (dark) gray-brown, dark brown, thin, ± cracked to almost undivided, ± smooth, medulla UV-. Sp. 6-9.5 x 5-7 µm, broadly ellipsoidal to almost spherical. Ch- . **F. lygaea** (Ach.) V.Wirth & Vèzda

13 Ap. with bulging, often strongly wavy, usually lighter (± brown) margin, -2 mm, sitting up, flat, brown-black to almost black, sometimes appearing slightly pruinose, often several tightly grouped and producing an aggregate up to 3 mm wide. Thallus rather thin to thickish, scarcely divided to cracked, gray to gray-brown. Sp. ellipsoidal to almost spherical, (6.5)(-12(13) x 6.5-8.5(9) µm. Hym. 55-60(75) µm. Ch- (Divaricatic acid in ap.) □ **F. austera**

13* Ap. smaller, margin commonly not lighter, not strongly wavy, ap. commonly not grouped **14**

14 Thallus thick, cracked to cracked areolate, gray-brown to slightly rose(violet)gray, rarely gray, with (brown-)-black prothallus/ Medulla UV+ (blue)white. Ap. brown-black to black, sometimes appearing slightly pruinose, flat, clearly margined, -1mm. Sp. 7-9.5 x 5-6.5 µm. Divaricatic acid. - arct-alp - Alps **F. mollis** (Wahlenb.) V.Wirth & Vèzda

14* Thallus without handlens appearing smooth, very finely cracked, gray, gray-brown, brown, often with dark brown prothallus. Medulla UV-. Ap. margin thin, soon disappearing **F. lygaea** (12)

Ecology and Distribution of the Species

Fuscidea austera (Nyl.) P.James (Lecidea aggregatilis Grumm., L. aggregata auct. In montane and high montane, high precipitation, oceanic sites, rarely up into the alpine zone, on acid to neutral, hard silicate rock on rain exposed vertical surfaces, above all on rock groups in foggy gypsum rock sites and in cool moist boulder fields, on moderately to rather light-rich, shaded habitats, which guarantee supplying long lasting moisture, m.-r.acidoph., r.ombroph., r.hygroph., anitroph., Char. Lecideetum koch. - mieur-subatl, (oc) - rare (3); Rhön, nöSch, süSch (v.rare), Vog, Fi, BayW, Hz

Fuscidea cyathoides (Ach.) V.Wirth & Vèzda (Lecidea c. (Ach.) Ach., L. stiriaca (Massal.) Jatta, L. rivulosa Ach.)

Predominately in montane, high precipitation, oceanic, rarely sub- or high montane sites on

smooth, usually v.-r.acid, non eutrophic bark (above all beech, birch) as well as on lime-free, acid, often hard silicate rock (above all on rain exposed steep- or vertical surfaces on (mild to usually) cool, oceanic, shaded habitats, usually in open forests, valleys, m.-v.acidoph., r.ombroph., r.hygroph., m.photoph., anitroph., Pertusarietum hem., Fuscideetum koch., Pertusarietum cor., Pertusarietum asperg. - flav. - s'bor-subatl-mieur-subatl-med-mo, (oc) - rare; the bark dwelling form (2); Sch, Vog, RhSch, ThW, O, Erz, BayW, v.rare e.g. SFW+, Rhön, Meissner etc.

Fuscidea kochiana (Hepp) V.Wirth & Vèzda (Lecidea k. Hepp)

Rather like *F. austera*, but with broader ecological amplitude and crossing over to wind exposed habitats, Char. Fuscideetum koch. - s'bor-atl-mieur-subatl-med(subatl)-mo - rare; Sch, Vog, nöPf, Ts, Rhön, ThW, Erz, BayW

Fuscidea lightfootii (Sm.) Coppins & P.James (Catillaria l. (Sm.) Oliv.)

In the foothills up to submontane, winter-mild sites on mild to moderately cool, v.humid, shady habitats on usually smoother, acid, non eutrophic bark, e.g. on birch, probably often on branches, e.g. with *F. cyathoides* (↑), m.-r.(s.)acidoph., m.photoph. (-r.skioph, (r.-) v.hygroph., in the Graphidion - mieur-atl(subatl)-smed(-med) - v.rare (0); *O (Heidelberg)*, Lux

Fuscidea maculosa (H.Magn.) Poelt (Lecidea gothoburgensis H. Magn. f. maculosa H.Magn.)

In montane and high montane, very high precipitation sites on acid, usually hard silicate rock on moderately rain exposed to r. rain sheltered vertical surfaces and overhangs on cool to cold, wind protected, uniformly very humid, rather to very light-poor habitats (forests, gorges, north faces), r.acidoph., anitroph., e.g. in the Enterographetum zon. - (s'bor-atl-)mieur-atl/centr-h'mo, (oc) - v.rare (R); süSch, nöSch, Vog, BayW

Fuscidea oculata Oberh. & V.Wirth (possible to *F. intercincta* (Nyl.) Poelt)

On acid silicate rock in montane, very high precipitation sites on open to the light habitats, like *F. austera* (↑), -- v.rare (R); nöSch

Fuscidea praeruptorum (Du Rietz & H.Magn.) V.Wirth & Vèzda (Lecidea p. Du Rietz & H.Magn.)

In sub- to high montane, usually high precipitation sites on lime-free, hard silicate rock on moderately rain exposed vertical surfaces on cool, r.-v.humid, mostly away from the sun, but usually rather light-rich habitats, e.g. with *F. cyanthoides* (↑), e.g. in the Fuscideetum koch. – s'bor-subatl-med(mo), (oc) – rare; Sch, Vog, nöPf, Rhön, BayW

Fuscidea pusilla Tonsberg

Like *Ropalospora viridis* (↑), limited to mild habitats – bor-subatl-mieur – rare?; Sch

Fuscidea recensa (Stirton) Hertel, V.Wirth & Vězda

Like *F. praeurptorum* (↑), and the rock dwelling form of *F. cyanthoides* (↑), -- s'bor-atl-mieur(-atl) – v.rare; Eif, Sch, O

LIT.: INOUE 1981, JAMES, POELT & WIRTH IN POELT & VÉZDA 1981 MAGNUSSON 1925, OBERHOLLENZER & WIRTH 1984, 1985

Gonohymenia J. Steiner

(Determination ↑ Phyllicum)

Introduction

The *Gonohymenia*-species are attached at a navel-like site, squamulose to deeply divided blackish foliose lichens with bluegreen algae as symbionts. Like many other rock-dwelling blue-green algae lichens they live on sporadically irrigated, light-rich habitats. The greater part of the species is rarely to be found. *G. schleicheri* is in known Germany till now only in the Schwäbisch Alp, *G. nigrifella* till now only in the Allgäu and in the Lahn region. Both species are distributed in the mediterranean and sub-mediterranean zone and reach a single outpost in the Central European floral region.

Genus Characteristics

Thallus foliose and divided lobes to squamulose, attached navel-like, otherwise very like *Lichinella* (↑), unlayered to layered. Photobionts e.g. Entophysalidaceae. Ap. marginal or almost marginal, thallinocarpic, even sunken into the thallus. Exc. not differentiated. Hym. displaying

an unbroken or ± coherent algal layer. Hym. in many species because of a sterile, wedge-form narrowed region toward the under-part, in which algae penetrate, I+ blue, than red, K/I+ blue. Asci cylindrical to clavate, with thin, non amyloid wall and a thicker amyloid gelatin envelope toward the tip. Sp. to 16 and usually more, rarely 8, 1-celled, ellipsoidal to spherical. Pycnosp. ellipsoidal to fusiform. Ch-

Ecology and Distribution of the Species

Gonohymenia nigrifella (Lettau) Henssen (Thyrea n. Lettau)

Up into montane sites on basic silicate rock and limestone on warm, at times irrigated surfaces, like *Thyrea confusa* (↑), -- mieur(-smed) – v.rare; Lahn

Gonohymenia schleicheri (Hepp) Henssen

Up into submontane sites on basic silicate rock and limestone on warm, at times irrigated steep surfaces – s' mieur-med – v.rare (R); Ju, MI

LIT.: HENSSEN & JORGENSEN 1990*, LANGE 1958, 1961, MORENO & EGEA 1992a, VÉZDA 1970.

Graphis Adanson

(Key includes Phaeographis)

Introduction

The crustose, *Trentepohlia*-algae containing thallus of the mainly tropically distributed script-lichens commonly produce streaked, line-like, often twisted and branching black fruiting bodies with a dark receptacle and characteristic fusiform, four-celled, cross-septate spores with lens-form spore compartments.

Of approximately 300 species merely two reach temperate Central Europe: the widely distributed *G. scripta* occurring up into Central Fennoscandia and the atlantic, up into North Germany and with isolated occurrences up into the Vosges, the Black Forest (here disappeared) and Vorarlberg penetrating *G. elegans*. Like the greater part of the species, the indigenous taxa also live on smooth bark. While *G. scripta* in South Germany is still numbered with the more

frequent species, it is in the North already becoming rare.

Genus Characteristics and Determination

Thallus crustose, little differentiated, even in the substrate, with *Trentepohlia*. Ap. commonly long streaked, simple to branching, with narrow crack-form disk and raised margins, without thalloid margin. Exc. usually black (rarely even light). Hyp. pale, thin. Hym. I-. Paraphyses simple, scarcely thickened above. Asci clavate to subcylindric, functionally one layer, I-. Sp. to 1-8, multiply cross-septate, colorless to slightly brownish in old ones, with rounded to lens-form cell lumina, I+ violet. Pycnosp. ± bacillar. Ch- or Norstictic acid.

- 1 Sp. colorless, but overaged, ± shriveled also slightly brownish. Ap. with clearly raised margins, disk crack-form or widened (*Graphis*)
- 1* Sp. light brown to red-brown, often very poorly developed (often only brown, ca. 1 µm thick threads in the hym.). Ap. margin not or only very weakly raised, disk widened, flat. Ap. sunken, very variable, streaked, simple to branched or star-form, but also elliptical to fleck-form, sometimes white pruinose, 0.2-4 mm long, -0.25 mm wide. Exc. closed below. NW-Germany in forests, ecologically like *Pertusaria leioplaca*, but only on climatically very mild, humid habitats (*Phaeographis*)
- 2 Margin of the ap. repeatedly strongly elongate sulcate, robust. Ap. unbranched to branched, with narrow disk. Sp. 32-55 x 6-12 µm, 9-13 celled. Thallus gray, K+ yellow to red, P+ yellow (to orange). Norstictic acid. **G. elegans**
- 2* Margin of the ap. not or only in the older ones occasionally elongate sulcate. Ap. simple to usually branched (up to star-form netted), many shapes, short to long streaked, naked or whitish pruinose, with narrow or relatively broader disk, several mm long. Sp. 25-70 x 6-10 µm, 6-16 celled. Thallus white to gray, Ch- □ **G. scripta**
- 3 Thallus R-. Sp. 16-25 x 7-9 µm, 4-6 celled. Ap. sunken. Hym. 45-70 – mieur-a
Phaeographis inusta (Ach.) Müll.Arg
- 3* Thallus K+ red, P+ yellow to orange. Sp. 26-40 (50) x 7-10 µm, 6-10 celled. Hym. 80-120 µm. Norstictic acid. – mieur-atl-med-subatl
Phaeographis dendritica (Ach.) Müll.Arg

Ecology and Distribution of the Species

Graphis elegans (Borrer ex Sm.) Ach.

On smooth bark of deciduous trees, especially *Ilex*, in very winter-mild, oceanic influenced regions. In the region rather isolated, erratic occurrences – mieur-atl-med-subatl – v.rare (0); *süSch*, (*St. Georges*), *Vog* (*Docelles*), *Lux*

Graphis scripta (L.) Ach., Script Lichen

Up to the tree line on smooth bark of deciduous trees (above all beech, hornbeam, ash, hazel), rarer on spruce, usually in the forest interior, only on very moist sites on free-standing trees, usually on shaded, humid habitats on rain exposed surfaces, (subneutroph.-) m.(r.)acidoph., Char. Graphidion, above all in the Graphidetum, Pyrenuletum n. – s'bor-med – moderately to rather frequent (+)

LIT.: PURVIS et al. 1992

Gyalecta Ach.

(Key includes Bryophagus, Gyalidea, Gyalideopsis, Petractis, Sagirolechia)

Introduction

The genus *Gyalecta* includes crustose lichens with thin, lighter thallus with *Trentepohlia*-algae, bowl- to “urn” form apothecia with mostly yellow to reddish disk and undivided to crenate proper margin. The species grows especially on subneutral to basic substrates, on bark, rock, plant detritus and soils. The ca. 35 species are distributed mainly in temperate regions. In Germany there are 10, seven species are known in the region.

G. jenensis, the most frequent indigenous species, *G. subclausa* and *G. leucaspis* live on calcareous rock on shaded, humid, often also on slightly substrate moistened habitats. *G. geoica* and the arctic-alpine *G. foveolaris* grow on calcareous soils and on dying mosses. *G. ulmi* and *G. flotowii* occur usually on old deciduous trees with subneutral (to weakly acid) bark on slightly rain-protected habitats; under similar conditions *G. truncigena*, is found however usually on moderately aged trees. All bark dwellers are very strongly in regression and strongly threatened. They require for survival careful or entirely unmanaged forests, in which a sufficient number of old trees always exist.

Limited forestry measures and restrictions are important to their preservation. In the subalpine Central Europe *G. leucaspis*, *G. subclausa* and *G. geoica* are very rare and threatened.

G. ulmi is distributed from the Mediterranean up into the southern boreal zone, while *G. flotowii* and *G. truncigena* occur approximately up to the north boundary of the [nemoralen] deciduous forest in South Scandinavia. The area of *G. jenensis* stretches over the greater part of Europe, that of *G. geoica* over North Europe and the mountains of Central and South Europe. *G. leucaspis* and possibly also *G. subclausa* are by comparison limited to the mountains in the region of Central European and mediterranean vegetation zone.

Thallus crustose, usually thin or in the substrate, little differentiated, with *Trentepohlia*. Ap. bowl- to almost urn-form, with flat to strongly concave, usually bright colored (beige, yellow, orange, brown, red-brown to almost red) disk and remaining whitish to gray or colored like the disk, sometimes crenate proper margin, rarely covered on the outside by a light thallus tissue. Exc. strongly developed. Hym. I+ blue. Paraphyses simple, rarely forked above, septate, thickened on the ends. Epiphy. colorless to colored. Asci cylindrical to narrow clavate, thin walled, without tholus, commonly I+ blue. Sp. cross-septate and at least four-celled to muriform, ellipsoidal to fusiform, without definite perispore. Pycn. rare, pycnosp. short bacillar. Ch-.

Genus Characteristics and Determination

Overview of some characters of the former composite genus <i>Gyalecta</i>					
	<i>Gyalecta</i>	<i>Gyalidea</i>	<i>Gyalideopsis</i>	<i>Petractis</i>	<i>Bryophagus</i>
Paraph. branching anastomosing	-	-	+	-	-
Paraph. apically capitate thickened	+	-	-	-	-
Septa swelling in KOH	-	+	+	(+)	-
Hym. I+ blue	+	-	-	+	(+)
Asci with clearly thickened wall above	-	+	+	(-)	-
Spores ± constricted at the septa	-	+	-	-	-
With perispore	-	+	+	±	-
Exc. well developed	+	+	+	-	+
<i>Trentepohlia</i>	+	-	-	±	

- | | |
|--|--|
| <p>1 Thallus on bark 2</p> <p>1* Thallus on rock or soil or soil- and rock-mosses 3</p> <p>2 Ap. dark red-brown to black, -0.3 mm. Thallus on thin fir branches, gray, very thin. Algae true green (<i>Cystococcus</i>). Sp. to 4, rarely 8, 12-19 x 4.5-7 µm, up to 5x cross and 1x long divided</p> <p style="text-align: right;">Gyalideopsis piceicola</p> <p>2* Ap. usually lighter colored, not on thin fir branches. with <i>Trentepohlia</i> 3</p> <p>3 Sp. with 3 horizontal septa, 15-25 x 5-8 µm. Ap. -2mm, with thick, strongly projecting, ± crenate whitish margin and red to red-brown, often whitish pruinose disk. Thallus whitish</p> <p style="text-align: right;">□ G. ulmi</p> <p>3* Sp. otherwise, mostly weakly muriform (□). Ap. -0.7 mm, margin usually not crenate. Thallus thin, whitish, gray to pale greenish . 4</p> | <p>4 Sp. 10-18 x 6-9 µm, with slanting septa and at best 6 cells (in aspect). Ap. -0.4 mm, light ochre, yellowish to orange □ G. flotowii</p> <p>4* Sp. 17-28 x 6-9 µm, with predominantly horizontal septa, muriform (with at least 6 cells), sometimes even parallel 8-12 cells. Ap. 0.3 - 0.5(0.7) mm, light yellow-brown to dark brown, rarely orange . G. truncigena</p> <p>5 On soil- and rock-mosses or directly on soil . 6</p> <p>5* On rock 8</p> <p>6 On acidophilic mosses or acid soils. Thallus gelatinous when moist, deep green, membranous when dry, with <i>Gloeocystis</i> algae (true green). Ap. at first almost perithecia-like and ± sunken, then opening wide, with orange-red to yellowish, deeply concave disk, -0.5 mm. Sp. parallel 4-5 celled, 20-30 x 1.4-2 µm</p> |
|--|--|

Bryophagus gloeocapsa

- 6* On calciphilic mosses or calcareous soils. Thallus not gelatinous, with *Trentepohlia*. Sp. parallel 4-celled . 7
- 7 Ap. -2 mm, with thick, whitish, crenate margin, sessile. Sp. 15-25 x 5-8 µm . **G. ulmi (3)**
- 7* Ap. -0.6 mm, with concave yellow-reddish to orange-brown disk, ± sunken to depressed, close standing. Sp. parallel 4-celled, 10-16 x 4-6 µm, septa at times oblique. Thallus light gray to gray-yellowish . **G. geonica**
(the alpine *G. foveolaris* (Ach.) Schaerer is distinguished by thicker warty thallus, larger ap. and sp. with horizontal septa)
- 8 On silicate rock 9
- 8* On lime-rich rock 12
- 9 Sp. cross-septate 4-celled, 12-20 x 5-7 µm. Ap. 0.8-1.2 mm, brown-rose to light brownish, margin light gray to yellowish-brown. Thallus dark gray to olive-brownish. Algae true green. On moist rock **Gyalidea hyalinescens**
- 9* Sp. muriform . 10
- 10 Sp. conical pointed at the ends to elongated ("lemon-like"), 18-25 x 7-10 µm, weakly muriform. Ap. light yellow-brown, like *G. jenensis*. Very rare on calcareous silicate rock **G. kukriensis**
- 10* Sp. not conical pointed . 11
- 11 Sp. 0.3-0.5 mm, yellow- to black-brown, deeply concave. Sp. 18-35 x 10-16 µm. Thallus very thin, ± smooth. Algae true green. On at times overflowed habitats in cold mountain brooks, like *Ionaspis odora* (↑), BayW **Gyalidea fritzei** (Stein) Vězda
- 11* Ap. 0.4-1.2(1.5) mm, orange, orange-rose, with thick raised, with age crenate or radially streaked, whitish to rose margin. Sp. 13-25 x 7-10 µm. Thallus gray-rose to orange-rose, in the herbarium pale. With *Trentepohlia*-algae . **G. jenensis (16)**
- 12 Ap. black to brown. Sp. with perispore. Epihym. dark brown 13
- 12* Ap. whitish, orange, rose, rose-brownish. Epihym. colorless to pale brownish 14
- 13 Sp. 20-30 x 10-15 µm, muriform. Thallus thin, whitish, with true green algae. Ap. 0.3-0.6 mm, disk reddish-brown, gray-brown to black, deeply concave, margin undivided, brown to black-brown or ± whitish . **Gyalidea lecideopsis**
- 13* Sp. 12-28 x 6-9 µm, parallel 4-celled. Thallus ± endolithic, fresh often ± reddish, bleaching in the herbarium and inconspicuous, with *Trentepohlia*-algae. Ap. 0.4-0.8(1) mm, half sunken, later sitting up, disk black, moist red-brown, moderately concave to flat, later even convex, often navelled, margin black or paler, undivided to 5-10 toothed radially split, receptacle carbonaceous **Sagiolechia protuberans**
- 14 Ap. disk covered by 4-8 three angled, inwards ordered whitish thalloid margin teeth, thereby

- with ± star-form opening, rose to rose-brownish, ap. -0.8 mm, ± sunken into the rock, leaving behind resulting pits. Sp. with perispore, parallel 4-celled (rarely even longitudinally divided), 18-30 x 5-10 µm. Thallus endolithic, cream colored to yellowish-white, with bluegreen algae (*Scytonema*) □ **Petractis clausa**
- 14* Ap. disk not covered by inwards ordered thalloid margin teeth. Sp. without perispore. With *Trentepohlia* 15
- 15 Ripe sp. muriform or at least with a single right-angled septum. Disk orange-rose, orange . 16
- 15* Ripe sp. parallel multicellular, elongate fusiform to almost needle-like. Ap. -0.6 mm 17
- 16 Sp. 13-25 x 7-10 µm, ripe strongly muriform, ellipsoidal. Ap. 0.4-1.2 mm, sessile, margin whitish to light orange-rose, thick, strongly raised, with age radially crenate. Thallus whitish, rose, brown- to gray-yellowish. Paraph. scarcely thickened above, definitely longer than the asci (if sp. conic pointed at the ends, see *G. kukriensis*, 10) □ **G. jenensis**
- 16* Sp. 10-16 x 6-10 µm, weakly muriform, broadly ellipsoid to almost spherical. Ap. -0.3 mm wide, margin commonly not crenate. Thallus whitish to rose. Paraph. usually clavate or capitate thickened above and scarcely longer than the ripe asci . **G. subclausa**
- 17 Ap. thick (gray)white pruinose (ripe disk under the pruinosity brown-rose), sessile, margin with age divided into 5-10 radial teeth. Sp. almost needle-form, 30-50 x 4-4.5 µm, 5-10 celled. Fresh thallus rose or light orange, bleaching to gray-green in the herbarium **G. leucaspis**
- 17* Ap. light orange, at first ± hemispherical and with punctiform openings, ± sunken, with age opening wide, sitting up, with thick, usually undivided thalloid margin. Sp. 20-38 x 4.5-7 µm, 6-10 celled, rarely even divided longitudinally. Thallus thin, whitish(yellow) to rose . □ **Petractis hypoleuca**

Ecology and Distribution of the Species

Gyalecta flotowii Körber

Like *G. ulmi* (↑), often together with it in the *Gyalectetum ulmi* (Char.), especially in bark cracks – mieu-med – (v.)rare (1); süSch, Ju, Ne, nöRh+, O+, FrJu

Gyalecta geonica (Wahlenb. ex Ach.) Ach.

In submontane and montane sites on calcareous stony soils, over dying mosses on calcareous soil, in earth filled fissures of carbonate rocks, commonly on shaded habitats, subneutroph.-m.basiph., m.photoph.(-r.skioph.), anitroph. – arct-smed-mo –v.rare (R); Ju, FrJu, Al

Gyalecta jenensis (Batsch) Zahlbr. (*G. cupularis* (Hedwig) Schaerer)

Up into the alpine zone on moderately to very calcareous, rarely lime-poor rocks, thus e.g. even on calcareous crystalline silicate rock, commonly on porous, rough (long remaining moist) substrates (sandstone, dolomite) or on weathered, fissured rock (especially in the vicinity of the crack on sporadically irrigated sites), in the case of enough substrate moisture even on rain protected overhangs, on shaded, relatively uniformly humid habitats, often at the foot of rocks, in forests, valleys, ravines, even on old walls, basiph., m.photoph.-r.(v.)skioph., r.-v.hygroph., substrathygroph.-subhygroph., a-/m.nitroph., Char. Gyalectetum jen. – (arct-)bor-med-mo – r.rare; m.frequent in Ju, Sju, FrJu, Al, otherwise rare, e.g. SFW, Ne, Bo, Eif, He, Th

Gyalecta kukriensis (Räsänen) Räsänen

In montane sites on mineral-rich or slightly calcareous silicate rock on humid, radiation protected habitats – (s')bor-atl-mieur – v.rare; Eif

Gyalecta leucaspis (Krempelh. ex Massal.)

Zahlbr.

In montane (to alpine) sites, above all on dolomite rocks, rarely on limestone, otherwise like *Petractis hypoleuca* (↑), high point probably on shaded sites, Char. Gyalectetum leuc. –mieur-pralp-med-med/alp – v.rare (R); Ju, FrJu

Gyalecta subclausa Anzi (*G. elegantula* Müll.Arg.)

In montane sites on limestone on ± vertical, away from the sun surfaces in humid valleys and ravines, basiph., m.photoph.-r.skioph., anitroph. – mieur-smed, (pralp) – rare (R); Ju

Gyalecta truncigena (Ach.) Hepp (*G. abstrusa* (Wallr.) Massal.)

Up into the montane, rarely high montane zone on the bark of deciduous trees, predominately in bark cracks of ash, maple and Norway maple, oak, walnut et al. in forests as well as (rarely) on free-standing trees, in moist, shaded valleys, on (r.-)v.humid habitats, subneutroph.-m.acidoph., slightly substrathygroph., a-/m.nitroph., e.g. with *Bacidia rubella* (↑), in the Acrocordietum gemm. – s'bor-med – rare (2); süSch, nöSch, Ju, süHü, Ne, SFW, Bo, Rh, O, Ts, Rh-Mn-T, Vgb, Al, Sju, FrJu, Th, ThW var. **derivata** (Nyl.) Boistel (*G.*

croatica Schuler & Zahlbr.) mieur- subatl-med(mo), (oc) – v.rare; süSch (Notschrei), ThW

Gyalecta ulmi (Sw.) Zahlbr. (*G. rubra* (Hoffm.) Massal.)

In sub- to high montane sites on cracked bark of old deciduous trees, especially oak, elm, sycamore, on moderately rain exposed to rather rain sheltered flanks at the middle and lower trunk, on cool, very humid, shaded habitats in open forests, in forest-like parks, today only yet in near natural woodlands in usually high precipitation regions, m.acidoph., r.skioph.-m.photoph., anitroph., Char. Gyalectetum ulmi – s'bor-med – v.rare (2), earlier scattered throughout the entire region, actually still proven (v.rare) in süSch, Ju, Ne, Bo-Ml and Al, probably even yet Sju

LIT.: LETTAU 1937, VÈZDA 1958

Gyalidea Lettau ex Vèzda

(Determination ↑ Gyalecta)

Introduction

The genus *Gyalidea* includes crustose lichens with bowl-form, rose, brownish, olive or black colored apothecia with thick, often crenate proper margin and consequently very much resemble the genus *Gyalecta*, however it is not related to it. It differs in the fine structure of the apothecia and by the coccoid green alga as a symbiont.

Of the approximately 25 for the most part rare species three are known in Germany. The western European *G. hyalinescens* has been found in Germany only once in the last hundred years in Baden-Baden; it lives on from time to time flooded silicate boulders in brooks. *G. lecideopsis* grows on moist, calcareous rocks on shaded habitats in the alpine mountains (and their vicinity) of the temperate and submediterranean region. Both species are lost. The third species, *G. fritzei*, lives in mountain brooks on frequently flooded silicate rock and is known in Central Europe from the Bohemian Forest, the Riesengebirge and Gesenke

Genus Characteristics

Thallus crustose, thin, little differentiated, with *Cystococcus* or *Leptosira*-like algae. Ap. deeply concave (urceolate) to flat, beige, brown, olive-brown, brown-black, rarely orange to rose, with definite, often darker, exterior often of a thin thallus layer covered proper margin. Exc. strongly developed. Hym. and asci I+ yellow to red-brown. Epihym. colorless to colored. Paraphyses simple, rarely branched and bound below, above not capitate thickened. Asci cylindrical, clavate or bulging, thin-walled, above with weakly developed tholus. Sp. cross-septate to muriform, \pm constricted at the septa, commonly with a thin perispore. Ch-

Ecology and Distribution of the Species

Gyalidea hyalinescens (Nyl.) Vèzda (*Gyalecta* h. Nyl., *G. carnea* (Arnold) Lettau)

In foothills/submontane, winter-mild sites on lime-free silicate rock on often flooded boulders in clear, rapidly flowing brooks on shaded habitats, probably rather like *Bacidina inundata*, m.acidoph.(-subneutroph.), m.photoph.-r.skioph., anitroph. – mieur(atl) – v.rare (0); *nöSch* (*Geroldsau*)

Gyalidea lecideopsis (Massal.) Lettau (*Gyalecta* l. Massal., *G. albocrenata* (Arnold) Lettau)

From the submontane up into the alpine zone on calcareous, often the long-time moisture holding porous sandy or long time dew moistened rock, e.g. on stones on slopes, on moist rocks, in ravines, in forests, commonly on shaded habitats, basiph., substrathygroph., anitroph. – mieur-pralp-smed-mo – v.rare (0); *Ju* (*Wental*), *süSch* (Oberried), *süHü*, *FrJu*, *ThW*, *Al*

LIT.: LETTAU 1937, VÈZDA 1966b, VÈZDA & POELT 1991.

Gyalideopsis Vèzda

(Determination \uparrow *Gyalecta* and Sterile Crustose Lichens)

Introduction

Gyalideopsis, a mainly tropical genus, belongs to the group of crustose lichens with *Gyalecta*-like, i.e. concave, when moist more or less “transparent-glassy” apothecia with proper margin. The thallus of a few species bear singular, e.g. thorn-like structures, the so called hyphophores, which are widely distributed especially in the leaf-dwelling lichens of the tropics, but are unusual in the temperate regions. Under the European species are remarkably many pioneer lichens and species of ephemeral habitats.

Two species are known at this time in the region. The one, *G. piceicola*, dwells on thin fir branches and occurs only in Central Europe and in the southern boreal zone of Scandinavia on foggy cold sites. They are missing in Germany and altogether to a high degree threatened with extinction. The other, *G. anastomosans*, was collected for the first time in a few years in Central Europe and possible first immigrated in the last ten years from the West. It lives on wood and on the acid bark of trees on humid habitats.

Genus Characteristics

Thallus crustose, little differentiated, often film-like, in many species with \pm erect standing, in the case of one indigenous species thorn-like structures (hyphophores), with *Trebouxia*-like photobionts. Ap. orange to blackish, concave to flat, with proper margin. Exc. and hym. of loose reticulate hyphae in a gelatin-like ground substance. Asci cylindrical, clavate, egg-form, thickened at the tip (tholus), wall I-, content I+ brown-red. Sp. to (2)4-8, cross-septate to (as in the case of the indigenous species) muriform, with strongly swelling walls, with sometimes very thin perispore. Pycn. rare (“substituted” by the hyphophores), pycnosp. tear-form. Ch-

Ecology and Distribution of the Species

Gyalideopsis anastomosans P.James & Vèzda

In the foothills and submontane, mild sites (oft basal) on trunk of deciduous-, rare conifer trees, e.g. oak, on tough decayed wood (above all timbers of brook bridges), predominantly in forests in humid sites, r.acidoph., m.photoph. - r.skioph., r.hygroph., anitroph. – mieur-med, (sub-)atl – rare; Lux, Pf, O, Rh, Sch, SFW, Do

Gyalideopsis piceicola (Nyl.) Vězda & Poelt
(Gyalidea p. (Nyl.) Lettau em. Vězda, Gyalecta
p. (Nyl.) Arnold)

In montane sites on thin, usually living fir
branches on cool- to cold-oceanic, very humid
habitats with frequent fog production, like
Byssoloma (↑), -- s'bor-centr – v.rare (0); *süSch*
(*Schramberg*), *Av-Do* (*more than once*), *Ju*
(*Plettenberg*)

LIT.: JAMES 1975, POELT & VÈZDA 1977, VÈZDA 1979,
VÈZDA & POELT 1991.

Haematomma Massal.

(Key incl. *Loxospora*, *Ophioparma*)

Introduction

The *Haematomma*-species are crustose lichens
with mostly white, cream-colored, gray or pale
greenish thallus with red-disk lecanorine
apothecia and cross-septate, elongate fusiform to
almost needle-like spores. The red apothecia
pigment reacts purple with KOH.

The ca. 25 species distributed in the tropics
and temperate regions live on bark and silicate
rock. *H. ochroleucum*, the only one occurring in
Germany, is separated into two color
distinguished chemical races, is sorediate and
grows as well on deciduous trees and spruce as
also on vertical surfaces and overhangs of silicate
rock in humid, away from the sun sites. It is
distributed in atlantic and subatlantic Europe, in
the North to Norway and South Sweden.

Genus Characteristics and Determination

Thallus crustose, with cortex, in the case of the
indigenous species sorediate, with coccoid green
algae. Ap. sessile to sunken, with ± red disk and
definite to (in the case of species with sunken
ap.) receding thalloid margin. Exc. thin. Hyp.
colorless. Hym. I+ blue. Epihym. red, K+ lilac-
red. Paraphyses rather richly branched (above all
above) and bound, not thickened above. Asci
clavate, *Lecanora*-type, with I+ blue, laterally
wide reaching tholus, with ocular chamber and
weakly I+ blue central region, externally with
thin I+ blue gelatin outer layer. Sp. "screw"

ordered in the ascus, fusiform to almost needle-
like, (3- to 25-fold) cross-septate. Pycn. red
above. Pycnosp. filamentous. Ch: Atranorin,
Zeorin, Perlatolic acid.

- | | | |
|----|--|-----------------------------|
| 1 | On silicate rock | 2 |
| 1* | On bark | .3 |
| 2 | Thallus not sorediate, yellowish (-gray, -green),
1-2 mm thick, warty uneven to warty areolate, of
also coarsely cracked, medulla K+/P+ yellow-
orange, C-, cortex K+ yellow-orange. Ap. blood-
to brown-red, depressed to sunken, thalloid
margin later often bent back. Sp. 6-8 celled,
often curved and twisted, 40-55 x 4-5 µm.
Divaricatic acid, Thamnic acid, ± Usnic acid . | |
| | | □ Ophioparma ventosa |
| 2* | Thallus uniformly mealy to granular sorediate up
to the margin, whitish to light gray-green or
yellowish, dull, usually thin, often with whitish
fibrous prothallus. Ap. blood-red, often lacking | |
| | | H. ochroleucum (4) |
| 3 | Ap. brown-red to rose-brownish, whitish
pruinose, at first somewhat concave, then flat,
with whitish, ± irregular thalloid margin, -0.8
mm. Sp. 1-4 celled, spirally twisted, 30-35 x 5-6
µm. Thallus whitish to gray-greenish.
Thamnic acid | Loxospora cismonica |
| 3* | Thallus commonly not fruiting (ap. red), for the
most part mealy to finely granular sorediate . | 4 |
| 4 | Thallus sorediate up to the margin (soredia ca.
30-120 µm), whitish to pale green-gray (without
Usnic acid.: var. <i>porphyrium</i>), yellowish, pale
green-yellow (Usnic acid.: var. <i>ochroleucum</i>), in
the case of better development with whitish,
branched fibrous prothallus, K+ (turbid)
yellowish, P+ yellow. Ap. sunken. Sp. 4-8
celled, 30-70 x 5-7 µm. Atranorin, Zeorin,
Porphyrilic acid . | H. ochroleucum |
| 4* | Thallus commonly not erupting sorediate
(handlens!) to the margin, at least in the margin
portion warty protuberant (lumpy), light gray,
tubercles erupting sorediate (soredia 30-80 µm),
thereby the thallus partly coarsely granular, partly
seemingly finely sorediate (thallus interior as a
rule entirely erupted sorediate). Soralia usually
irregularly bordered to coalescing, cream-colored
to gray-greenish. Thallus without fibrous
prothallus, K+ intensively yellow to orange, C+
yellow, P+ orange. Thamnic acid, ± Elatinic
acid, ±(Squamatic acid) □ Loxospora elatina | |

Ecology and Distribution of the Species

Haematomma ochroleucum (Necker) Laundon
Above all in the submontane and montane zone
on very humid, moderate to very high
precipitation, r.(-s.)light poor-m.light-rich

habitats, often in valleys, in forests, in brook meadows, on the bark of deciduous trees and spruce, additionally on silicate rock on rain sheltered steep surfaces or overhangs (like *Lecanora subcarnea* ↑), m.-r.acidoph., anitroph., in the Lecanoretum or., Pertusarietum amarae, Pertusarietum hem. – s'bor-atl-mieur-subatl-med, (oc) – r.rare; Sch, Vog, Pf, RhSch, Lahn, O, Ne, Sp, Vgb, Rhön, ThW, Erz, BayW
 var. **ochroleucum** (H. coccineum (Dickson) Körber, H. leiphaemum (Ach.) Zopf): predominating form in the region on bark
 var. **porphyrium** (Pers.) Laundon (H. porphyrium (Pers.) Zopf, H. cocc. v. p. (Pers.) Th.Fr.): the predominant form on rock

LIT.: POELT & VÈZDA 1977, ROGERS & HAFELLNER 1988*, TONSBURG 1992

Heppia Naeg.

Introduction

The *Heppia*-species are distinguished by the squamulose to areolate or even granular thallus with bluegreen algae and apothecia sunken into the thallus with red-brown disk as well as single to apparent two-celled spores. They live on rock and above all on the soil and are mainly at home in arid regions. Only *H. lutosa* and *H. adglutinata* penetrate into Central Europe, where they grow in calcareous dry turf and calcareous rock fields on fine soil on dry-warm habitats.

Genus Characteristics and Determination

Thallus squamulose to granular, layered and upper side with paraplectenchymatous cortex to ± unlayered, medulla sometimes cellular; squamules attached to the substrate with hyphae, with *Scytonema*-species algae. Ap. yellow- to red-brown, sunken into the thallus. Exc. very weakly developed. Hyp. colorless. Hym. I+ blue(-green) or red. Epihym. yellow-brown to brown-red, paraphyses simple, sparsely reticulate, rarely branched, capitate thickened above. Asci narrowly clavate to subcylindric, with uniformly thin wall, I-. Sp. 1-celled to apparently 2-celled (plasma bridge). Pycnosp. short bacillar to fusiform. Ch-

- 1 Thallus yellow-olive to brown (scarcely altered when moist), squamulose to almost shield form, squamules with 1 or more ap. Cortex of periclinal hyphae, above ± well developed, below clearly developed and large celled. Hym. I+ soon reddish. Sp. 1-, rarely 2-celled **H. adglutinata**
- 1* Thallus of blackish granules, very rarely brown and very small squamules (squamules -1.2 mm), green when moist. Lichen with cortex, in section algae dominating. A.; flat to concave, often surrounded by granules. Hym. I+ intensively blue, at a later time violet-brown. Sp. 1-celled **H. lutosa**

Ecology and Distribution of the Species

Heppia adglutinata (Krempelh.) Massal.
 Up into the high montane zone on calcareous fine soil, on open loam- and loess soils, on fine soil islands on level, stony raw soils, occasionally in earth filled niches of old walls, usually on well lighted, relatively warm, dry habitats, e.g. in openings of dry turf, boulder fields, subneutroph.-m.basiph., r.xeroph., e.g. in the Toninion sed. – mieur-med – (v.)rare (2); süRh, süHü, nöHü-O, Ju, FrJu, Al

Heppia lutosa (Ach.) Nyl.
 Like *H. adglutinata*, in the region on fine soil over dolomite – mieur-med – (v.)rare (2); Ne

LIT.: HENSSSEN 1994, BÜDEL 1987, MIGULA 1929-31

Heterodermia Trevisan

(Determination ↑ Physcia)

Introduction

The genus is recognized by white to gray foliose lichens with narrow “strap-form”, branched, often elongated thallus lobes, dark disked apothecia with thalloid margin and two-celled, dark colored, ellipsoidal spores. The thallus is corticate at least on the upper side and reacts yellow with KOH; commonly with scattered cilia on the margins.

The ca. 50 species occur on bark and rock and are mainly tropically distributed. The area of *H. speciosa* reaches into northern subatlantic Scandinavia and the oceanic regions of Central

Europe (above all in the mountains). One additional forward occurrence of *H. leucomelos* indigenous essentially to tropical and warm temperate regions of the earth is found on the climatically favored Black Forest slopes in Baden-Baden (on spruce). *H. speciosa* is threatened with extinction in the southern Black Forest, where the lichen was found in near natural mountain forests and on old beech in the region of extensively used high willows in high precipitation oceanic sites. In recent years the occurrence can not be further confirmed. The third species known in Germany, *H. obscurata*, likewise an oceanic lichen, occurs very rarely in the North Alps.

Genus Characteristics

Whitish, rosette to irregularly growing foliose lichens with narrow, often elongated, branching, often broadened fan-like on the ends, decumbent to erect lobes, with or without soralia or isidia, sometimes with marginal light or dark cilia. Underside whitish, gray, brownish to blackish (in the case of extra-European species even yellow to reddish), with lighter to darker, simple to branched rhizines. Upper side with cortex of periclinal hyphae, underside without cortex, rarely (like the upper side) with cortex. Photobionts coccoid green algae. Ap. brown-black to black, with often incurved thalloid margin, in the case of the indigenous species extremely rare. Asci of the *Lecanora*-type. Sp. 2-celled, thick walled, ± brown, with smooth upper surface, like *Physcia*. Ch: Atranorin, often Zeorin et al.

Ecology and Distribution of the Species

Heterodermia leucomelos (L.) Poelt
(*Anaptychia leucomelaena* auct, *H. leucomelaena* (L.) Poelt)
Warm loving, oceanic lichens, in the region on the East boundary of the distribution, on branches of spruce in winter-mile, moderate to rather summer-warm sites in spruce-beech forests, practically in the last hundred years exterminated by collection and forest alteration – s'mieur-med, atl – v.rare (0); *nöSch* (*Baden-Baden, Freudenstadt*), *MI* (*Zurich: Oberuster*)

Heterodermia obscurata (Nyl.) Trevisan
(*Anaptychia* o. (Nyl.) Vainio)
Like *H. speciosa* (↑), yet limited to temperate climatic oceanic, winter-mile habitats – s'mieur-atl-med-mo, oz – evidence (*Sju, Pfw: Bitsch*) uncertain; closest collect discovery Bavaria. Alps (++++)

Heterodermia speciosa (Wulfen) Trevisan
(*Anaptychia* s. (Wulfen) Massal.)
In montane and high montane, usually very high precipitation, oceanic sites on the bark of deciduous trees, often over mosses, even on mossy silicate rock, commonly on beech and sycamore, in sycamore-beech forests, on free-standing willow bushes, above all in the upper stem regions and on branches, on foggy habitats with rather to moderate variable moisture conditions, like *Lobaria amp.* (↑), *L. scrobic.* (↑), Char. Lobarion pulm. – bor-atl-mieur-subatl-med, oz – v.rare (0); *süSch* ?+ (last found ca. 1970), *nöSch*+ (*B.-Baden*), *Vog, Ts+ O+* (*Heidelb.*), ?*Sp+*, *Bo+* (*Konstanz*); *Al* (*Hinterstein*), *MI* (*Zurich: Riffersweil*)

Lit.: LYNGE 1935, POELT 1965a*

Hymenelia Krempelh.

(Determined ↑ *Aspicilia*)

Introduction

Hymenelia-species earlier were often placed with *Aspicilia* rock lichens with endolithic or thin epilithic thallus, light to blackish sunken apothecia with usually concave disk and proper margin, with the above through constricted jointed paraphyses and one-celled spores.

H. coerulea and *H. prevostii* are distributed in the high mountains and their environs in Central and South Europe, recently they have been found very isolated even in Scandinavia. In Central Europe these limestone dwelling species occur in the Alps and very isolated in the Jura mountain section. *H. ceracea* resides as a pioneer on small stones and fresh suitably located surfaces of silicate rock. *H. lacustris* lives amphibiously in clear books or on irrigated rocks; it is distributed in North- and Central Europe and in the mountains of the mediter-

ranean region, whereas *H. ceracea* seems to be very rare in North Europe. *H. ochrolemma* has its high point on occasionally irrigated silicate rocks in the arctic-alpine, has been found in Central Europe in the Tatra, in the Alps and in the Black Forest.

Genus Characteristics

Thallus crustose or endolithic, with coccoid green algae. Ap. sunken into the thallus of rock, with concave to flat disk and proper margin, usually whitish, rose, brown, blackish. Exc. thin, colorless, usually colored above. Hyp. colorless or pale brownish. Hym. usually high. Epihym. almost colorless to rarely colored. Paraphyses embedded in much gelatin, simple to above all above branched-bound, above short celled and shrunken at the septa (moniliform), thickened at the tips. Asci cylindrical to clavate, I-, with thinner I+ blue outer layer, tholus often weakly developed. Sp. 1-celled, spherical to ellipsoidal. Pycnosp. short bacillar. Ch-

Ecology and Distribution of the Species

Hymenelia ceracea (Arnold) Choisy (Aspicilia c. Arnold, Lecanora c. (Arnold) Stizenb.) Especially in sub- to high-montane sites on silicate rock, above all on stones on the road and road margins, on smaller bounders and the foot surfaces of rocks on rather humid, often dew moistened, usually shady sites, pioneer, subneutroph.-m.acidoph., m.photoph.-r.skioph., e.g. in the Porpidietum crust. – bor-smed – r.rare; Sch, Vog, süHü, Bo, Do, O, Rhön, ThW, Th

Hymenelia coerulea (DC.) Massal. (Aspicilia c. (DC.) Dalla T. & Sarth., Lecanora c. (DC.) Nyl.)

In high montane and alpine sites, rarely lower, on ± pure, relatively hard lime, usually on rain exposed vertical and sloping surfaces on rather well lighted, but often away from the sun habitats, basiph., anitroph., Char. Hymenelion coer., e.g. with *Verrucaria dufourii*, *Thelidium decipiens*, *Polyblastia singularis* – mieur-alp/paralp-med-alp/paralp – rare; Ju?, Sju, Al

Hymenelia lacustris (With.) Choisy (Aspicilia l. (With.) Th.Fr., Lecanora l. (With.) Nyl.)

Up into the alpine zone (in the region above all montane-high montane) on usually crystalline silicate rock amphibiously in cool, clear brooks on frequently or long time flooded surfaces, occasionally even on almost continuously moist, shaded rocks (here also in somewhat variant forms “*H. ochracea*” subneutroph., r.-v.hygroph., r.skioph.-r.photoph., Char. Hymenelietea lac., usually with *Bacidina in.* – arct-smed-mo – rare (3); Sch, Vog, Eif, Erz, otherwise v.rare (e.g. Ts)

Hymenelia ochrolemma (Vainio) Gowan & Ahti (Porpidia pseudomelinodes Schwab, P. melinodes auct., Lecidea m. auct.)

In high montane to alpine sites, rarely lower), on usually neutral to basic, even slightly calcareous silicate rock, on smaller rocks, boulders and larger stones on long dew- or occasionally irrigated surfaces on well lighted, usually shaded, long time snow covered habitats, subneutroph. (-m.acidoph.), m.-r.photoph., hygroph., subhygroph./substrathygroph., anitroph., in the Porpidion tuberc. – arct-mieur-h’mo/alp – v.rare (R); süSch, Vog, Rhön?

Hymenelia prevostii (Duby) Krempelh. (Aspicilia p. (Duby) Anzi, Lecanora p. (Duby) Th.Fr.)

Above all in montane to alpine sites on hard (often pure) lime, like *Hymenelia coer.* (↑) -- bor-med-mo – rare (R); Sju, FrJu, Ju, Th, Al

Lit.: EIGLER 1969, GOWAN & AHTI 1993, POELT & VĚZDA 1981

Hyperphyscia Müll. Arg. (Physciopsis Choisy)

(Determination ↑ Physcia)

Introduction

The gray, gray-green to gray-brown colored thallus of the foliose lichen genus *Hyperphyscia* lies remarkably close – almost crustose-like – to the substrate. As in the case of *Physcia* and *Phaeophyscia* the spores are two-celled and brown and have thick walls. The predominantly tropical genus (ca. 11 species) is distributed in Europe only throughout the Central European-mediterranean with the exception of *H.*

adglutinata. It grown in warm and mild regions (in South Germany e.g. in the upper Rhine- and in the Lake Constance region) on subneutral, often dust impregnated bark (above all walnut) and on mineral-rich rock. The species is above all threatened by strong eutrophication and “optimizing” of fruit tree culture.

Genus Characteristics

Thallus foliose, very close lying, gray, gray-brown (brown), with soralia (extra European species even with isidia or without isidia/soralia, underside dark, often lighter toward the periphery, with sparse indefinite (or without) rhizines, upper cortex paraplectenchymatous, lower prosoplectenchymatous. Ap. surface standing, with brown to blackish disk and thalloid margin. Paraphyses often branched above, clavate at the ends, with dark brown cap. Asci of the *Lecanora*-type. Sp. brown, 2-(up to 4-) celled, with unequally thickened walls. Pycnosp. filamentous. Ch-,foreign species often with Skyrin.

Ecology and Distribution of the Species

Hyperphyscia adglutinata (Flörke) Mayrh. & Poelt (Physciopsis a. (Flörke) Choisy, Physcia a (Flörke) Nyl., Ph. elaina auct.)

In the foothills to submontane, mild to warm sites on mineral-rich, often somewhat dust impregnated, smooth to flat-cracked bark free or open standing deciduous trees, above all walnut, poplar, in orchards, on roads, subneutroph., r.photoph., r.thermoph., in the Xanthorion par. – mieur-subatl-med – rare (2); Rh, Hü, Ne, Bo, Sju, HRh, süSch, O, Saar, *Rh-Mn-T*, *MRh*, Eif, Th, Lux

Lit.: HAFELLNER et al. 1979*, POELT 1965a*, POELT & VÉZDA 1981.

Hypocenomyce Choisy

(Determination ↑ Sterile Crustose, Lecidea PT2)

Introduction

The *Hypocenomyce*-species have true crustose to squamulose thallus and black to red-brown apothecia without thalloid margin. There are 9 species in Europe, 6 species verified in Germany. They live above all in cool and temperate regions of both hemispheres on wood and acid bark, a few also on charred wood. *H. scalaris*, *H. friesii* and *H. sorophora* occur in the boreal conifer zone (with the high point in the southern boreal region) and corresponding sites in Central Europe, rarely (above all) in the montane region of the Mediterranean region. *H. praestabilis* probably has a similar area, reaching however the north limit in Central Scandinavia. *H. caradocensis* belongs to the subatlantic element and is distributed in Western Europe from South Sweden and Great Britain over France and Central Europe to North Spain. *H. scalaris* and – temporally delayed and less clearly – also *H. caradocensis* have in connection with forestry utilization of conifer trees strong extension (of area). In the case of *H. caradocensis* a preference for humid sites is yet clearly recognized.

Genus Characteristics and Determination

Thallus implied to clearly squamulose, rarely truly crustose developed, light gray, ochre, olive, brown, red-brown, dark brown, with or without soralia, with (often two layered) upper cortex. Photobionts coccoid green algae. Ap. black to brown-black, sometimes pruinose, rarely even red-brown, with smooth to furrowed disk, with projecting proper margin or marginless. Exc. of radial lying, thin walled hyphae, colorless to dark brown, at the margin green to brown. Hyp. colorless to usually brown. Hym. I+ blue. Epihym. red-brown to green. Paraphyses simple to sparsely branched, rather loose, above weakly clavate to strongly capitate thickened. Asci clavate to cylindrical, I-, with (often indefinite) I+ blue tholus (at times with central non amyloid drop, in part with I+ deep blue tubular structure), exterior sometimes with thin apical amyloid cap. Sp. one-celled to repeatedly cross- septate, rarely well developed. Pycnosp. ellipsoidal, bacillar to short filamentous. Ch: e.g. Lecanoric, Fumarprotocetraric- and Protocetraric-acids.

1	Thallus sorediate	2
1*	Thallus not sorediate	6
2	Thallus C+ red, squamulose to crustose	3

- 2* Thallus C-, K-, squamulose, greenish-brown to brown, almost always on charred wood. Squamules sorediate at the margin, ascending and shingle-like. Ap. convex, marginless, brown, rather rare – bor-mieur-h'mo – Alps . 5
- 3 Thallus K-, P-, squamulose, squamules usually shingle-like and ascending, shell-like convex, at the somewhat curved margin sorediate (lip soralia), light brown, ochre, greenish-gray, -1.2(2) mm. Medulla UV+ white. Soralia at the margin yellow-brown. Ap. rather rare, flat, margined, black, often pruinose, -1.5 mm. Sp. almost never developed. Lecanoric acid et al
□ **H. scalaris**
- 3* Thallus K+ yellow, P+ yellow, crustose to almost squamulose, squamules not shingle-like. Medulla UV-. Soralia pale greenish to pale yellowish or brownish tinted, in the herbarium even reddish. Ap. rare. Alecatorialic acid et al. . 4
- 4 Thallus areolate or indefinite (living in the wood), with often coalescing soralia, yellowish-gray to ochre, rarely light gray. Areoles -0.4 mm, often entirely sorediate. Sp. 6-9 x 2.5-4.5 µm. Pycnosp. rather rare, pycnosp. ellipsoidal to short bacillar, 3.5-5 x 1.5-2.5 µm.
* **H. sorophora**
- 4* Thallus areolate to implied squamulose, areoles with marginal, often lip-form (to almost capitate) soralia, delimited, rounded to irregularly incised, flat to convex, not conspicuously shell-like, gray-white to pale yellowish-gray or pale yellowish-brown, -0.4(1) mm. Ap. and pycn. unknown. *. On acid bark on moderately well lighted habitats -- bor-mieur
H. leucococca R.Sant.
- 5 Squamules P+ red, whitish margin. Young squamules ± concave. Fumarprotocetraric acid, Protocetraric acid .
H. anthracophila
(Nyl. P.James & G.Schneider)
- 5* Squamules P-, with brown margin. Young squamules ± convex. Unknown substances
H. castaneocinerea
(Räsänen) Timdal
- 6 Thallus truly crustose, thallus and medulla C+ red, K+ yellow, P+ yellow. Medulla UV-, areolate, light gray to ochre, areoles -1(1.5) mm. Pycn. frequent, -0.3 mm, at the margin of the areoles, wall muddy green. Pycnosp. 3-5.5 x 1.5-2.5 µm (length/width ratio 1.9-2.7:1, in the case of the related, North European *H. xanthococca* 1.2-1.7:1). Ap. rare. Alecatorialic acid et al .
H. praestabilis
- 6* Thallus squamulose, squamules close lying or irregularly ascending, not shingle-like, -1 (1.5) mm, C-, K-, P-. Ap. flat, margined, black. Unknown substances 7
- 7 Squamules convex to vesicular or unevenly deformed, partially flattened, green-gray, yellow-brown, dark brown, variously colored due to light exposure, dull to weakly shiny. Ap. rather rare, -

0.8 mm, disk at times unevenly furrowed. Sp. 2-, rarely 4-celled, 6.5-14 x 2-4 µm

* □ **H. caradocensis**

- 7* Squamules concave, flat to convex or uneven, with entire, lobed or crenate margin, gray-green to dark brown, shiny. Ap. usually occurring, -1.0 (1.4) mm, with furrowed-uneven disk. Sp. 1 celled 4.5-7.5 x 2.5-3.5 µm. * **H. friesii**

Ecology and Distribution of the Species

Hypocenomyce caradocensis (Leighton ex Nyl.) P.James & G.Schneider (Toninia c. (Leighton ex Nyl.) Lahm)

Penetrating into montane, moderate to rather high precipitation, usually mild sites on conifer, rarely deciduous trees (e.g. oak) and wood, above all on the middle of the stem, in spruce- fir forests, Scot's pine forests, even woodlands, clearly spreading (advancement of coniferous wood and influence of emissions), for a few decades still very rare, moisture requirement as *H. scalaris*, in the Parmelion sax., with *Parmeliopsis ambigua*; r.v.acidoph., m.(-r.)photoph., anitroph. – (s'bor-)mieur-smed, subatl –r.rare; Sch, SFW, Do, Av, Ne, O, Pf, Saar, RhSch, He, Erz

Hypocenomyce friesii (Ach.) P.James & G.Schneider

In spruce- and spruce-fir forests in high montane, cool, humid sites, above on conifer bark and on (especially charred) wood; r.-v. acidoph., m.photoph.-r.skioph., r.-v.hygroph., anitroph. – bor-mieur-mo(-smed-mo) – rare (2); Sch, MRh, Sp, Alps

Hypocenomyce praestabilis (Nyl.) Timdal

In montane sites on tough decayed, hard wood of conifers (vertical surfaces of decorticate stems, on fence posts and boards of barns), very rarely on acid bark (*Pinus*), on open and often open to the wind habitats, r.-v.acidoph., r.photoph., a-/m.nitroph. – s'bor-mieur – rare; Ju, Sch, HRh

Hypocenomyce scalaris (Ach. ex Lilj.) Choisy (Lecidea s. (Liji.) Ach., Psora ostreata Hoffm.) Above all in the foothills to montane zone, above that (up to the tree line) rare, but probably only here naturally, on acid bark of conifers (above all Scot's pine, Larch), rarely on deciduous trees (above all oak), clearly preferring the stem base on moderately rain exposed to rather rain sheltered, moderate to rather well lighted sites,

even on tough decayed wood, rarely on steep surfaces of rocks, strongly anthropogenic furthered and widely spreading, above all in open, acid, permeating Scot's pine, oak-hornbeam and beech-spruce forests and on the margins of fir- and Scot's pine woodlands, natural habitats rare (spruce-fir forests in Sch, Larch forests in the Alps), r.-e.acidoph., anitroph. (-m.nitroph.), toxitol., Char. Hypocenomycetum scal. – bor-med(-mo) –m.-r.frequent, rare only in lime regions, neophyte regionally

Hypocenomyce sorophora (Vainio) P.James & Poelt

In montane and high montane, moderate to very high precipitation sites on conifer trees (bark and wood) in open forests, moors and open land, additionally on processed wood (boards of barns, posts), increasing, r.-e.acidoph., m.-r.photoph., anitroph. – bor-mieur-mo, (subko) – r.rare; Sch, Ne, SFW, Ju, Do, Av, Al

Lit.: TIMDAL 1984a, TONBERG 1992

HYPOGYMNA (NYL.) NYL.

(Key incl. Brodoa, Menegazzia)

Introduction

The *Hypogymnia*-species are deeply lobed foliose lichens with gray to browned, hollow interior, underside black thallus without hold fasts. Frequently soralia are developed on the lobe ends or on the upper surface; these species commonly remain sterile.

The ca. 40 species included in the genus are distributed worldwide, above all in the temperate and cool regions. Six are known in Germany, five species in Baden-Württemberg. They live on acid bark of conifers and deciduous trees, occasionally even going over to silicate rock. *H. physodes* is the most frequent acidophyte and one the most resistant foliose lichens; also *H. tubulosa* is distributed throughout Southwest Germany and is today possibly more frequent than earlier. *H. vittata* and the very rare *H. bitteri* live in mountain forests and above all high montane humid and cool sites. *H. farinacea* is not rare in middle and higher mountain sites. Most of the indigenous species are very widely distributed in Europe, but have their high point in

the mountains. *H. farinacea* and *H. bitteri*, but especially *H. vittata* are rare in the mediterranean region. The sixth species occurring in Germany (*H. austerodes*) is known from the Alps and the Bohemian Forest and lives on conifers in the region of the tree line.

Genus Characteristics and Determination

Thallus foliose, deeply lobed, light gray to gray or with brown tint, underside black, without rhizines, fastened to the substrate with little differentiated attachment site, hollow, often with terminal or surface soralia. Cortex on upper and lower sides. Photobionts coccoid green algae. Ap. brown, flat to concave, with thalloid margin, sitting up with narrowed base. Asci of the *Lecanora*-type. Sp. 1-celled, ellipsoidal to spherical. Pycnosp. bacillar, swollen near the ends. Ch: Cortex with Atranorin, medulla with Physodic acid, sometimes Physodalic acid.

Note: All *Hypogymnia*-species with Atranorin (sometimes in small amounts), Physodic acid; cortex K+ yellow, medulla KC± red (reaction usually indefinite or failing to appear), C-. Underside black, margin region often brown.

- 1 Upper side with scattered fine perforations, commonly with raised, superficial surrounding soralia. Thallus rosetted, ± decumbent, light gray, bluish-gray, lobes ± pinnately divided, hollow, coalescing (ap. very rare, sp. to 2-4), K+ yellow, medulla K+ yellow, P+ yellow-orange, C-, KC-. Atranorin, Stictic acid, Menegazziac acid . □ **Menegazzia terebrata**
- 1* Upper side without perforations . 2
- 2 Without soralia. Medulla P+ orange to red, C-, KC- 3
- 2* Commonly with soralia (when young without soralia), rarely with ap., lobe interior becoming hollow. On bark, rarely on rock, usually light gray to bluish gray, rarely browned . 5
- 3 Lobe interior hollow. Thallus on bark, rarely on rock . **H. physodes** (9)
- 3* Lobe interior not hollow, narrow, -2 mm wide, convex to almost cylindrical, thickly coalescing. Ap. disk shiny brown. Thallus on rock . 4
- 4 Thallus dark gray toward the center, light gray at the margins, outermost lobes browned, rosetted, not with numerous closely crowded narrow lobules. Medulla KC± red, UV+ bluish-white. Lobes 1-2 mm. Atranorin, Physodic acid, Protocetraric acid. – arct-alp – Alps **Brodoa atrofusca**

- 4* Thallus whitish, light gray, above all commonly browned at the margins, rosetted to irregularly growing and the interior usually covered with numerous narrow (usually 0.3-1 mm wide) decumbent lobules, large, in the center often loosely attached, medulla KC-, UV-. Atranorin, Fumarprotocetraric acid
- **Brodoa intestiniformis**
- 5 Thallus upper surface partially erupting sorediate, soralia/medulla P-, K-, C- **6**
- 5* Soralia only at the lobe ends **7**
- 6 Thallus with up to 1mm wide capitate soralia at the ends of short lateral lobes, partially granular sorediate on the surface of the lobes, usually slightly browned and ± oily shine . **H. bitteri**
- 6* Thallus without soralia on the lobe ends, only on the surface (in the center of the thallus) extensively sorediate and partially wrinkled, usually not browned. Lobes flattened toward the ends, -3 mm wide. (When partially browned, oily shining, in continental sites in the Alps, BayW; *H. austerodes* (Nyl.) Räsänen)
- H. farinacea**
- 7 Lobe ends with capitate soralia, soralia/medulla P-, K-, C- **8**
- 7* Lobe ends with lip-(rarely ring-) form soralia. Thallus appressed or only ascending at the ends. P-/P+ red, K-, C- **9**
- 8 Capitate soralia at the ends of smaller appressed side lobes, thallus to a large extent appressed
- H. bitteri (6)**
- 8* Capitate soralia at the ends of the main lobes, coarse. Lobes ascending to erect, curved downward at the sides, from above therefore appearing cylindrical . **H. tubulosa**
- 9 Medulla P-. Lobes at the lateral margins often black bordered, usually elongate streaked, -2mm wide, separated. Upper cortex with round perforation at the bifurcation. Soralia irregularly ring- to lip form. Thallus irregularly rosetted to "turf" growing **H. vittata**
- 9* Medulla P+ (yellow) orange. Lobes commonly not black bordered, coalescing with one another to separated, 1.5-3 mm wide. Lobe ends partially lip-like curved upward and undersides breaking open to lip soralia, young without soralia. Thallus often regularly rosetted, rarely irregular to shingle-like. Physodalic acid, ± Protocetraric acid **H. physodes**

Ecology and Distribution of the Species

Hypogymnia bitteri (Lynge) Ahti (Parmelia obscurata auct.

In the high montane and subalpine sites on acid bark above all on conifers on cold, late frost threatened, foggy and well lighted habitats with moderately to rather changeable moisture

conditions, in near natural fir forests, in the moor margin forest, r.-v.acidoph., m.-r.photoph., anitroph., in the Pseudevernetum, Usneion – bor-mieur-h'mo-smed-h'mo(-med-h'mo) – v.rare (1); süSch, additional Al, BayW

Hypogymnia farinacea Zopf (H. bitteriana (Zahlbr.) Räsänen, Parmelia b. Zahlbr.)

In montane to subalpine, m.-v.high precipitation sites on acid bark of deciduous- and conifer forests, above all in beech-spruce- and fir forests on cool to cold sites, like *Cetraria chlor.* (↑), r.-v.acidoph., anitroph., above all in the Pseudevernetum – s'bor-med-h'mo – r.rare, locally frequent; Sch, Vog, Al, rarer RhSch, otherwise rare (e.g. SFW, Av, O)

Hypogymnia physodes (L.) Nyl. (Parmelia p. (L.) Ach.)

Up to the tree line (and above it) on bark, wood, silicate rock, mosses; euryöke acidophytic species, ± lacking in the case of stronger eutrophication and on subneutral substrate, above all on rain exposed, m.-v. well lighted habitats, often dominating and producing vegetation masses with *Pseudevernia* and *Platismatia*, m.-v.acidoph., mesoph.-hygroph., a-(m)nitroph., relatively toxin tolerant foliose lichen, Char. Hypogymnietea, on rock like *Parmelia omph.* (↑), -- arct-med – v.frequent; possibly the most frequent foliose lichen in the region

Hypogymnia tubulosa (Schaerer) Havaas (Parmelia t. (Schaerer) Bitter)

Up to the tree line on deciduous-, more rarely on conifers, above all on open habitats, thus on free standing trees, in forests in the top of the trees, most frequent on branches, e.g. with *Parmelia exasperatula*, in the last decade increasing in the lower sites, here especially in orchards, (subneutroph.-)m.-r.acidoph., m.-v.photoph., Char. Hypogymnietea, also pioneer lichen in the Lecanorion subf. – bor-med – r.rare to m.frequent, throughout the entire region, rarer in the clean air regions and in the lime regions

Hypogymnia vittata (Ach.) Parr. (Parmelia v. (Ach.) Nyl.)

In high montane (-subalpine), usually high precipitation sites on acid bark, above all on conifers on cold, foggy habitats, especially in near natural mountain forests, like *Mycoblastus sanguinarius* (↑), also going over to moss, in the Pseudevernetum turf. – bor-mieur-h'mo(-smed-

h'mo), subko – rare (3); süSch, nöSch, Vog, BayW, Erz, Al

Lit.: HILLMANN 1936

Icmadophila Trevisan

Introduction

Icmadophila includes only a few (at this time 3), with the related species *Dibaeis*. These have a crustose, little differentiated thallus with rose colored biatorin apothecia, which sit on the thallus with a narrowed base or short stalk. The spores are two- to four-celled. The single European species is circumboreal and is distributed in corresponding sites in the temperate zone to isolated in the mountains of the submediterranean region; also locally occurring in the southern hemisphere. They reside on acid soils, peat walls, mosses, decayed wood and moist, shaded silicate rocks. The lichen is strongly regressing

Genus Characteristics

Thallus crustose, little differentiated, light gray to greenish, with *Coccomyza*. Ap. sessile with a narrowed base to short stalked, light rose to orange-rose, with definite, usually yielding proper- and at first with an apparent thalloid margin, rounded to wavy in outline. Exc. of irregularly entwined hyphae. Hyp. colorless. Epihym. red-brown, with fine crystals. Hym. I+ blue. Paraphyses simple or isolated branching, slightly thickened above. asci cylindric, with tholus of the *Icmadophila*-type, I-, above with smaller I+ blue cap in the inner wall. Sp. cross-septate (1-)2- to 4-celled, fusiform to narrowly ellipsoidal, walls with bipolar perispore. Pycnosp. short bacillar. Ch: Thamnic acid, Perlatolic acid.

Ecology and Distribution of the Species

Icmadophila ericetorum (L.) Zahlbr.

In montane to alpine sites, rarely lower (dying out here), on v.acid, usually moisture storing substrate, on rotten wood (decaying deciduous

stumps), peat soils, raw humus, basally on old trees, rarely on acid silicate rock (e.g. porous sandstone), often going over to moss, on substrates with low water holding capacity only on shaded, uniformly humid sites, usually in conifer forests, high moors, boulder fields, dwarf shrubby heath, r.-e.acidoph., hygroph.-mesoph., substrathygroph., photoindiff., anitroph., e.g. in the Cladonietum cen. – (arct-)bor-mieur-mo(-smed-h'mo) – rare (2); Sch, Vog, BayW, Erz, otherwise v.rare or +, additionally Al

Lit.: FREY 1932, RAMBOLD et al. 1993*.

Immersaria Rambold & Pietschm.

(Determination ↑ Lecidea PT 7)

Introduction

Immersaria athroocarpa is one of the crustose lichens related to *Porpidia* and *Amygdalaria* with areolate gray-brown to brown thallus and sunken dark gray to black apothecia. The species is distributed on silicate rock above all in Central European deciduous forest regions, it is however even established in the mountains of the Mediterranean region.

Genus Characteristics

Thallus crustose, areolate, corticate, with coccoid green algae. Ap. sunken, black to dark gray, with indefinite, later disappearing proper margin. Exc. definite to entirely reduced, exterior dark brown to gray, interior colorless to brownish. Hyp. almost colorless to dark brown. Hym. I+ yellowish to blue. Epihym. dark brown to green-brown. Paraphyses branching and reticulate bound, thickened above. Asci *Porpidia*-like. Sp. 1-celled, ellipsoidal, with perispore. Pycnosp. bacillar. Ch: Confluent acid derivatives.

Ecology and Distribution of the Species

Immersaria athroocarpa (Ach.) Rambold & Pietschm. (Lecidea a. (Ach.) Ach., *Porpidia* a. (Ach.) Hertel & Rambold)

Above all in the montane and high montane zones on lime-free, often mineral-rich silicate rock, especially on boulders and smaller rocks on wind-protected to m.(r.) exposed, cool-humid, even relatively long time dew moistened, m.-r.long time snow covered habitats, ecologically standing somewhat between *Lecidea lithophila* and *Schaereria fuscocin.*, e.g. in the Porpidion tuberc., Rhizocarpetum alp., Pertusario-Ophioparmetum -- (bor-subatl-)mieur-med-mo – rare; Sch, Vog, O, Rhön, ThW, Erz

Lit.: HERTEL 1977, RAMBOLD 1989

Imshaugia S.F.Meyer

(Determination ↑ Parmeliopsis)

Introduction

Imshaugia includes relatively small, rosetted, gray-white, underside whitish to light brown foliose lichens with lecanorine bordered brown apothecia. In Europe only one species (of two) is represented; they reproduce with isidia. They grow on acid bark above all of conifers and on wood on open habitats, especially in winter cold sites. They are distributed in the boreal conifer forest belt, in Central Europe and – here already rare – in the mountain land of the Mediterranean region.

Genus Characteristics

Foliose lichens with rather closely appressed, usually radially arranged lobes, whitish to brown tinted, with (or in the case of extra European species also without) isidia, undersides whitish to slightly brownish, with light, simple rhizines. Both sides with paraplectenchymatous cortex. Epicortex with pores. Photobionts coccoid green algae. Ap. with brown disk and thalloid margin, ± flat. Paraphyses simple. Asci of the *Lecanora*-type. Sp. 1-celled, ellipsoidal. Pycn. marginal, pycnosp. short, straight, one- or both ends thickened. Ch: Atranorin, Thamnic acid.

Ecology and Distribution of the Species

Imshaugia aleurites (Ach.) S.F.Meyer
(Parmeliopsis a. (Ach.) Nyl.)

In the foothills to subalpine, low precipitation to high precipitation, usually winter-cold sites, often on definitely continentally influenced, relatively summer-warm, well lighted habitats, on the middle stem and on the base of conifer trees (above all *Pinus*), on wood, rarely on nutrient poor deciduous tree bark, not concentrated on long time snow covered habitats, but ecological amplitude overlapping with *Parmeliopsis hyperopta*, usually on forest margins and in open forests, in the high moors, r.-v.acidoph., m.-r.photoph., mesoph.-r.xeroph., anitroph., in the Hypocenomycetum, Parmeliopsidetum et al. – bor-med-mo, subko – r.rare; e.g. Sch (above all in the East), Ne, Ju, Sju, SFW, Fr, FrJu, Pf, Ts, rare in the West (e.g. Eif)

Lit.: HILLMANN 1936, MEYER 1985

Ionaspis Th.Fr.

Introduction

The *Ionaspis* species with their “aspicilioid”, sunken into the thallus, rose, brownish, olive to black colored, usually concave disks very strongly resemble the *Hymenelia*-species and are only formally distinguished by algae belonging to other than *Trentepohlia*.

In Germany are six of the perhaps 25 species existing worldwide, in Baden-Württemberg three. They live on away from the sun sites. *I. epulotica* resides on calcareous rock, *I. odora* and *i. chrysophana* or from to time flooded or moist silicate rock in the high mountains. *I. epulotica* and *I. odora* are arctic-alpine, *I. chrysophana* is distributed bore boreal-alpine. *I. odora* is known in addition to the high Black Forest in Central Europe only from the Bohemian Forest, the Giant Mountains and from the Alps. Because of the isolation of the sites and the smallness of the occurrences the Black Forest populations of this glacial relict are to a high degree threatened. *I. heteromorpha* and *I. melanocarpa* predominantly dwelling of dolomite are distributed North Europe and the alpine regions and are established in the Allgäu Alps.

Genus Characteristics and Determination

Very much like *Hymenelia* (↑), but with *Trentepohlia*-algae, thallus in the fresh condition often rose to reddish-gray, in the herbarium whitish or gray. Ch-

- 1 On ± calcareous rock 2
1* On moist or very shady silicate rock. Ap. -0.5 mm 3
2 Ap. ± rose, thick margined, ± sunken into the rock, often separated from the thallus by a thin crack, -0.5(0.7) mm. Sp. 13-22 x 7-12 µm. Hym./epihym. ± colorless. Thallus whitish, light ochre to brown-rose, endolithic to cracked areolate . **I. epulotica** (is like ↑ *Hymenelia prevostii* with coccoid green algae)
2* Ap. black to blue-black, ± sunken into the rock, -0.5 mm. Sp. (10-)14-20 x 8-13 µm. Exc. black-brown. Hym. 180-240 µm, blackish blue-green above. Thallus indefinite or ± endolithic, whitish, yellowish, brown-gray **I. melanocarpa** (Krempelh.) Arnold (when sp. spherical to ellipsoidal, 7-14 x 6-10 µm, exc. blue-green to brown-green, hym. 100-160 µm, thallus light gray to red-brown: **I. heteromorpha** (Krempelh.) Arnold)
3 Ap. blackish, usually margined. Upper half of the hym. ± green-blue, K-. Sp. spherical or ellipsoidal, 6-10 x 5-7 µm. Thallus rose, rose-gray, olive, in the herbarium olive-gray, yellow-brown, thin, cracked to cracked areolate . **I. chrysophana**
3* Ap. rose, orange-brown, olive, discolored, ± sunken into the thallus, usually without definite margin. Hym. colorless above to yellow-olive (-black-olive), K_ violet. Sp. 9-12 x 5-7 µm. Thallus yellow-gray, ochre, olive-gray, dark olive, even rose, cracked to cracked areolate . **I. odora**

Ecology and Distribution of the Species

Ionaspis chrysophana (Körber) B.Stein

(*I. suaveolens* (Schaerer) Stein)

In the subalpine and alpine zones on hard silicate rock on long time snow covered, m.-r well lighted, but shady, humid and long time dew moistened or occasionally water spray moistened to time to time flooded habitats (and then with *I. odora*), readily on smaller rocks, m.acidoph., anitroph., in the Porpidion tub., Ionaspidetum – arct-mieur-alp – v.rare (R); süSch (Feldberg), Vog (Rotenbachkopf), Al

Ionaspis epulotica (Ach.) Arnold

On limestone, above all limestone and dolomite, on shady, cool, humid, often slightly substrate moistened habitats in high montane to alpine sites, rarely lower – arct-h'mo/alp – Sju, *FrJu*, Al

Ionaspis odora (Ach. ex Schaerer) B.Stein

In the subalpine and alpine zones on hard silicate rock on frequent to constant water spray moistened or long time flooded boulders in cold, clear brooks on heavy snow sites, like *Thelidium aeneov.* (↑), in contrast to *I. chrysophana* to a large extent limited to amphibious locales, Char. Ionaspidetum – Arct-mieur-alp – v.rare (R); süSch (Feldberg-Geb.), BayW

Lit.: JORGENSEN 1989, MAGNUSSON 1933, POELT 1696

Julella Fabre

Introduction

Julella includes bark dwelling fungi, which at times behave facultatively with *Trentepohlia*-algae and then are numbered with the lichens. The species have been scarcely observed in all of Germany.

Genus Characteristics and Determination

Thallus crustose, indefinite, not lichenized or facultatively lichenized and with *Trentepohlia*. Per. with blackish apex, rounded to elliptical in outline, with greenish to brown, laterally broadened, bark tissue incorporated into the involucre and thin, colorless to pale exc. ± spherical. Hym. I-. Paraphyses richly branched and bound, flaccid. Asci cylindric to clavate, I-, the inner wall thickened toward the tip, with ± well developed, lower ocular chamber. Sp to (2-)8., weakly to definitely muriform, ellipsoidal, with perispore. Pycnosp. short bacillar. Ch-

- 1 On birch, not lichenized (?). Per. -0.2 mm, rounded to elliptical, surrounded by an elongated black).5-1 mm halo. Sp. 15-21 x 6-11 µm, at first with 4-6 cross-walls, later muriform, colorless . **J. fallaciosa**
1* On deciduous trees, with *Trentepohlia*-algae. Per -0.4 mm. Sp. 20-40 x 12-15 µm, at first few

celled, later muriform, colorless to slightly brownish. Thallus membranous-scruffy, white to gray .

J. lactea

Ecology and Distribution of the Species

Julella lactea (Massal.) Barr (Polyblastiopsis l. (Massal.) Zahlbr.)

On smooth to flat cracked bark of deciduous trees, above all beech, hornbeam, ash, often at the base of the stem, rarely on conifers (e.g. Scot's pine) -- mieur-smed – *nöSch*, *?süHü*, *ML*, *FrJu*

Lit.: BARR 1986, HARRIS 1973, KEISSLER 1937, PURVIS et al. 1992*.

Koerberiella B.Stein

(Determination ↑ *Aspicilia*)

Introduction

The small genus *Koerberiella* (till now 2 species) is represented in Germany by *K. wimmeriana*, a commonly sterile, areolate, light gray to rose tinted light gray crustose lichen with regularly divided isidiate-like outgrowths. These arctic alpine species grow on from time to time irrigated rocks of mineral rich silicate rocks in mountain sites. In Central Europe it is known from outside the alpine mountains only from the Giant Mountains, the Black Forest and the Vosges.

Genus Characteristics

Thallus crustose, areolate, light gray, rose-gray, often with definite blackish prothallus, with cylindric to slightly clavate isidia (the non indigenous species without isidia), ± paraplectenchymatous construction, with *Trebouxia*-like photobionts. Ap. (in the case of *K. wimmeriana*) developing isidia-like outgrowths, with flat to moderately convex, red- to dark brown disk and thalloid margin. Hyp colorless to slightly brownish. Hym. K⁺ bluish brown to orange. Epithym. Brownish. Paraphyses at the least with a few branching and anastomosing, thickened

above. Asci narrow clavate, *Porpidia*-type. Sp. 1-celled, ellipsoidal, when young often with perispore, wall I- (in contrast to *Bellemerea*). Pycn. Sunken in the isidia, pycnosp. short bacillar. Ch: Gyrophoric acid et al., the non indigenous species Ch-.

Ecology and Distribution of the Species

Koerberiella wimmeriana (Körber) B.Stein (*Aspicilia leucophyma* (Leighton) Hue, *Lecanora* l. Leighton)

Like *Placynthium flab.* (↑), -- bor-mieur-alp – v.rare (R); Vog, süSch, Alps

Lit.: NAVARRO-ROSINES & HAFELLNER 1993*, RAMBOLD, HERTEL & TRIEBEL 1990, STEIN 1879

Lasallia Mérat

(Determination ↑ *Umbilicaria*)

Introduction

The *Lasallia*-species are gray to brown or (exotic species) red, often rather large navel lichens whose thallus shows pustule-like arches (with corresponding pits on the underside). The eight species included in the genus are represented in Central Europe only by *L. pustulata*. It grows on sunny silicate rocks on nutrient rich sites. Its area stretches from South Europe up into Northern Scandinavia and Central Finland, it is however in the North already definitely rare.

Genus Characteristics

Thallus ± single lobed, attached with one ± central navel, upper side with numerous rounded to oval vesiculate arches, the indigenous species with isidia, brown-gray to brown, undersides with the cavity, without rhizines, black. Upper cortex paraplectenchymatous, lower cortex paraplectenchymatous, however of very thick walled, baked cells. Photobionts coccoid green algae. Ap. black, with proper margin. Exc. clearly developed, in the case of the indigenous species paraplectenchymatous, light, exterior brown. Asci of the *Umbilicaria*-type. Sp. to 1-

2, muriform divided, light to dark brown, very large. Pycnosp. short bacillar. Ch: Gyrophoric acid (et al.)

Ecology and Distribution of the Species

Lasallia pustulata (L.) Mérat (Umbilicaria p. (L.) Hoffm.)

Up into montane, rarely high montane sites on lime-free silicate rock, above all on rough, m.(-r.) nutrient-rich surfaces (dust impregnated, moderately bird dunged) as well as on rapidly drying irrigated, readily on sunny steep surfaces, like *Parmelia consp.*, but avoiding smooth substrate and first occurring later in the succession, m.(-r.)acidoph., r.-v.photoph., xeroph., (subhydroph.), m.nitroph., Char. Lasalletum -- s'bor-med -- r.rare; Sch, Vog, PfW, BayW, rare-v.rare in nöPf, RhSch, Lahn, ThW, O, Sp, Vgb, Rhön, süRhön, Saar

Lit.: FREY 1933

Lecanactis Körber

(Key incl. Bactrospora, Dirina, Schismatomma)

Introduction

The *Lecanactis*-species are crustose lichens with whitish, gray, brownish and brown-red thallus with *Trentepohlia*-algae, black, often pruinose apothecia with proper margin and rounded to oval outline. The separation from other genera, especially *Opegrapha*, makes a considerable problem.

The Central European species live on humid, little rain exposed to rain protected habitats in the lower stem region of older trees or on vertical- and overhanging surfaces of rocks; the area shows a western high point. *L. abietina* prefers very pronounced old spruce and fir or oaks in near natural forests on cool to cold, foggy habitats, *L. amylacea* old oaks in winter-mild lower ones. Lastly it is strongly in regression because of the normal forestry management methods and now very rare; its area stretches over the summer-green deciduous forest and the hardwood region. *L. abietina* indicates in the region, probably likewise a decimation, yet no restriction of area. It is distributed from Central

Scandinavia over Central Europe (in Southern Central Europe only in the mountain sites) to the moist sites of the Mediterranean region.

The rock dwellers are relatively rare in Central Europe. *L. latebranum*, *L. premnea* and *L. umbrina* grow commonly on lime-free silicate rock. They are mainly in West Europe up into Southern and Central Scandinavia; *L. grumulosa* lives in the region of calcareous silicates, reaching into the Odenwald the east boundary of the area. *L. dilleniana* prefers basic or mineral-rich silicate rock and is indigenous in cool humid sites of North Europe up into the mountains of southern Central Europe.

Genus Characteristics and Determination

Thallus crustose, thin to warty areolate, with *Trentepohlia*. Ap. shield-shape rounded to elongate, brown-black to black, often pruinose, with definite proper margin. Exc. robust, dark brown, bowl shaped continuous under the hym., hyp. as a rule (almost) entirely lacking. Hym. I+ reddish to blue. Epihym. Light- to dark-brown. Paraphysoids branched and bound, usually thickened above. Asci narrowly clavate to cylindrical, with two functionally distinct layers and narrow, I± pale blue tholus and small ocular chamber, inner layer I+ amyloid. Sp. cross-septate multicellular, fusiform to almost needle-like. Pycnosp. short bacillar. Ch: often Lecanoric acid, Schizopeltic acid, Erythrin.

- 1 Thallus covered with ± numerous thallus colored, projecting hemispherical to short cylindrical pycn. (in the case of richly fruiting collections sparse), gray-white to light gray, R-. Pycn. C+ red, 0.2-0.3 mm wide. Ap. 1-2 mm, often sparse, depressed to sessile, thickly white to yellowish-white pruinose, ± flat, with at first thick margin. Sp. 25-46 x 3-6 µm, 4(5) celled, pycnosp. 12-20 x 2-3.5 µm. Lecanoric acid, Schizopeltic acid

L. abietina

(Attention! Sterile thallus resembles *Opegrapha vermicellifera*, but pycnosp. only up to 7 x 1.5 µm, Pycn. C-)

- | | | |
|----|--|----|
| 1* | Thallus without projecting pycn . | 2 |
| 2 | Thallus commonly with ap . | 3 |
| 2* | Thallus sterile, partially soresiate or entirely cottony leprose . | 11 |
| 3 | On rock . | 4 |
| 3* | On the bark of trees, thallus R- | 8 |
| 4 | Thallus C+ (fleeting) red, K-, P-. Ap. disk white to bluish-white pruinose, margin commonly nonpruinose. Ap. sessile | 5 |

- 4* Thallus C-, K-. On silicate rock 6
- 5 Thallus thin, undifferentiated or partially cracked or warty areolate, yellowish or green- gray, medulla I+ blue. Hym. I+ blue. Ap. rounded, - 0.8 mm. Sp. (15)19-23 x 5-7(8) μm , often with definite perispore, 4-6 celled, finally warty and brownish, appearing clavate, somewhat constricted at the septa **L. abscondita**
- 5* Thallus usually in small flecks and thickish, "soft", reddish(brown), brown-gray, in the herbarium pale orange-yellowish to gray-white, medulla I-. Ap. angular to elliptical, -1 x 0.3 mm, even rounded, disk sometimes furrowed. Sp. (3-)4(5) celled, 12-18(23) x 4-5 μm . Lecanoric acid, Erythrin **L. gramulosa**
- 6 Ap. with whitish pruinose (at best old nonpruinose) disk, with entire, often nonpruinose margin, usually 0.3-1(1.5) mm. Sp. 4-celled, 20-32 x 4-5 μm . Thallus rose(-gray) to white-gray, in the herbarium gray-yellowish to white-gray, scruffy-mealy, soft, dull, P+ yellow- orange. Psoromic acid, \pm Schizopeltic acid **L. dilleniana**
- 6* Ap. with nonpruinose (rarely greenish pruinose) disk. Thallus R- 7
- 7 Thallus UV+ ice blue (older herbarium collections even UV+ yellowish), cocoa brown to yellow-brown, uneven, thickish, in the interior often coalescing sorediate and pulverulent, ochre-yellowish (or brownish), often with black prothallus. Ap. rare, rounded, but often irregularly indented, black-brown, with wavy, not cross-cracked margin, -1.5 mm. Sp. 4-celled, slightly curved, 18-27(35) x 3-5 μm . Schizopeltic acid et al **L. umbrina**
- 7* Thallus UV-, usually very thin or indefinite, ochre, gray-greenish, gray. Ap. black (sometimes slightly greenish pruinose), with thick, wavy, often gaping cross-cracked margin, usually 0.5-1.5 mm. Sp. 4-6 celled, 17-27 x 4-7 μm , often curved, with pointed ends. Ch- **L. premnea**
- 8 Sp. 8-18 celled, 50-80 x 1.5-2.5 μm , already in the ascus very easily breaking into one- to many cells, -3 μm size fragments. Ap. nonpruinose, (brown)black, -1 mm, flat to convex, margin very indefinite. Thallus whit **Bactrospora dryina**
- 8* Sp. 4-9 celled, up to ca. 43 μm long, not disintegrating into broken pieces. Ap. nonpruinose or pruinose 9
- 9 Sp. (7)8-9(10) celled, 21-35 x 3-4.5 μm . Ap. rounded to usually broadly elliptical (at times even elongate), with the flat, bluish-white pruinose disk, clearly margined, -1.5 x 0.7 mm. Thallus yellowish-white, moderately to rather thick. Confluent acid, 2'-O-Methylmicrophylinic acid **L. lyncea**
- 9* Sp. 4-celled, rarely 6-celled 10
- 10 Sp. 14-27 x 2-3 μm , 4(6)celled. Ap. -0.5 mm, \pm sunken to closely appressed, flat to concave, white pruinose, with definite, usually nonpruinose margin. Thallus white, thin. Ch+ **L. amylacea**
- 10* Sp. 25-42 x 2.5-4 μm , 4-celled. Ap. -0.8(1) mm, appressed sessile, nonpruinose to slightly pruinose, often surrounded by bulging of the thallus, round to elongate. Fresh thallus usually rose-whitish, in the herbarium gray-white, thin to thickish in places **Schismatomma**
- 11 Thallus C+/KC+ red, K-, P-, on (sometimes weakly) calcareous rock, whitish, thin to thickish, coalescing to cracked, with whitish to slightly brownish, irregularly sorediate, sometimes with blackish flecks (parasites). Erythrin, \pm Lecanoric acid **Dirina stenhammarii**
(in case of occurrence on silicate rock it is difficult to separate from sterile *Lecanactis*-species)
- 11* Thallus R- 12
- 12 Thallus on bark of older trees on scarcely rained on flanks, dirty lilac- to rose-gray, light brownish-gray, \pm cracked, with irregularly bordered soralia. UV-. Fatty acids **Schismatomma decolorans**
- 12* Thallus on silicate rock. Medulla/soralia UV+ blue-white 13
- 13 Thallus crustose, cocoa brown to yellow-brown, sorediate in the interior surface or not sorediate, ochre-yellowish, rarely brownish. Schizopeltic acid **L. umbrina**
- 13* Thallus usually thick (5 mm), cushion-like, fungous-white, gray, violet-gray, often slightly rose-tinted, often with folded upper surface. Lepranic acid, rocellic acid **L. latebrarum**

Ecology and Distribution of the Species

Lecanactis abietina (Ach.) Körber

In montane and high montane, high precipitation regions on old conifers an rain protected surfaces above all in the lower stem region, in fir (-spruce)- and spruce forests on cool to cold, \pm uniform humidity habitats in valleys and (cold air accumulating) basins, rarely on acid bark of deciduous trees or on overhangs on acid silicate rock, in atlantic regions even in lower sites, r.-v.acidoph., r.-v.skioph., v.hygroph., v.anombroph., anitroph., Char. Lecanactidetum ab. -- s'bor-smed(-med), subatl -- rare; Sch, Vog, BayW, otherwise v.rare (PFW, O, Sp. SFW, ThW), additionally Al

Lecanactis abscondita (Th.Fr.) Lojka
(Opegrapha a. Th.Fr.)

Like *L. dilleniana* and (in the region) *L. grumulosa* -- bor-mieur -- v.rare MRh

Lecanactis amylicia (Ehrh. Ex Pers.) Arnold (Opegrapha illecebrosa Duf.)

In the foothills to submontane, winter-mild sites almost only on stem of older oaks, like *Arthonia pruinata* (↑), almost extinct possible because of forestry interference and eutrication, Char. Arthonietum pruin., in species poor stands -- Mieur-med, subatl -- v.rare (1); süHü-HRh earlier scattered, süRh, Bo, Ju, Sb, Th, *Ne*, *nöRh*, *O*, *Mn*, *Sp*, *Rh-Mn-T*, *MRh*

Lecanactis dilleniana (Ach.) Körber

Above all in montane high precipitation or foggy sites on usually mineral-rich or basic to neutral, hard crystalline silicate rock (often basalt) on rain protected overhangs, often in boulder fields, subneutroph., (r.-)s.hygroph., anombroph., anitroph., e.g. in the Enterographetum zon. -- bor-mieur-mo(-smed) -- v.rare (R); He (e.g. Rhön, Meissner), süSch, Fi-Rauher Kulm, BayW

Lecanactis grumulosa (Dufour) Fr. (*L. monstrosa* Bagl.)

In the foothills, very winter mild sites, in the region on (slightly calcareous?) silicate rock, on rain protected surfaces, like *Enterographa hutch.* (↑), otherwise on limestone, mortar -- mieur-atl-med -- v.rare (0); *MRh* (*Lorch*), *O* (*Heidelb.*)

Lecanactis latebrarum (Ach.) Arnold (*Lepraria latebrarum* (Ach.) Ach. ex Sm., *Crocynia hueana* B. de Lesd.)

In submontane to montane, ± mild sites on completely rain protected rock surfaces on/under overhangs on silicate rock, usually in narrow valleys, forests, on humid, v.-r.light poor habitats, often with *Chrysothrix chlorina*, Char. Chysostrichetalia chlorinae, above all in Chysostrichetum chlorinae -- mieur-smed -- rare; Sch, O, Vog, Pf, Eif, ThW, BayW

Lecanactis lyncea (Sm.) Fr. (*Opegrapha l.* (Sm.) Borrer)

Like *Arthonia pruin.* (↑), -- mieur-alt-med(subatl) -- v.rare (+++); nöRh+, *Rh-MN-T+*, *Lower Rhine* (*Bonn+*), Lux

Lecanactis premnea (Ach.) Arnold (*L. plocina* auct.)

In the foothills and submontane sites on lime-free to lime-poor silicate rock, above all on

sandstone, even on walls, on shady, moderately rain exposed to rather rain protected, sometimes slightly moist vertical- and overhanging surfaces, in atlantic regions above all on bark -- mieur-subatl-med, (oc) -- v.rare (R); O (Heidelb.) *Ts-MRh*, *nöSch*, *süSch* (*Kinzigtal*), *Vog*

Lecanactis umbrina Coppins & P.James (*Schismatomma umbrinum* (Coppins & P.James) Jorg. & Tonsberg)

In montane sites on rain protected vertical surfaces and overhangs of silicate rock on cool, light-poor, very humid habitats, like *Opegrapha gyr.* (↑) and *Racodium* (↑), Char. Cystocoleion nigri, m.-r.acidoph., r.-v.skioph., v.hygroph., anitroph. -- s'bor-atl-med -- Sch

Lit.: JORGENSEN & TONBERG 1988, LETTAU 1937, TORRENTE & EGEA 1989

Lecania Massal.

Introduction

The *Lecania*-species are crustose lichens with lecanorine to biatorine, frequently soon strongly convex and marginless apothecia with usually light brown, red-brown, dark brown or blackish colored disks and cross-septate spores.

The species of the genus live predominantly on base-rich substrate, such as dust impregnated or calcareous rock and mineral-rich bark. The distribution of many species is – even in the region – still insufficiently known, since the taxa as a result of the lack of taxonomic work not known or because of being overlooked due to their small size. *L. cyrtella*, *L. fuscella* and *L. koerberiana* grow on base-rich bark, above all on poplar and black elder. *L. cuprea*, *L. nylanderiana*, *L. turicensis* and *L. sylvestris* sit on steep overhanging surfaces of limestone, *L. sylvestris* commonly in forests and gulches. Also *L. suavis*, *L. inundata* and *L. rabenhorstii* reside on calcareous rock; the two latter are found in the region mainly on walls, tombstones and similar habitats made by man. *L. hutchinsiae* and *L. erysibe* s.str. are ecologically yet little known, they also live on nutrient-rich sites such as walls.

L. cuprea, *L. inundata*, *L. koerberiana*, *L. sylvestris* and *L. turicensis* are distributed essentially in South- and Central Europe up to the tree line in the deciduous forest region. *L.*

cyrtella and *L. fuscella* are indigenous even in the southern boreal zone. *L. nylanderiana*, *L. suavis* and *L. erysibe* s.l. are widely distributed in Europe. *L. erysibe* s.str. and *L. hutchinsiae* are known from Central- and South Europe.

Genus Characteristics and Determination

Thallus crustose, clearly developed, granular to cracked areolate, or living in the substrate, usually whitish, gray, greenish-gray, brownish, sometimes with blastidia. Upper cortex of anticlinal hyphae. Photobionts coccoid green algae. Ap. sessile, usually soon convex, yellow-brown, brown, red-brown to brown-black, sometimes pruinose, commonly with thalloid margin. Exc. lecanorine interior of loose hyphal tissue, outer margined (sometimes paraplectenchymatous or of thin hyphae in thick gelatinous substance), sometimes an exc. (proprium) developed or thalloid margin lacking and only exc. proprium occurring, this paraplectenchymous of elongate, radially ordered cells, light to dark. Hyp. colorless to very pale. Hym. I+ blue to soon red-brown, K/I+ blue. Epihym. yellow-brown, orange, brown, red-brown, black-brown, green-black. Paraphyses simple to sparsely branched, thick, usually clearly cellular, often capitate thickened above, often with darker pigmented cap. Asci of the *Bacidia*-type. Sp. to 8, rarely to 16, 2- to 4-, rarely to 8 celled, cross-septate, usually elongate ellipsoidal with rounded ends. Usually Ch-.

- | | | |
|----|--|------------------|
| 1 | On rock . | 2 |
| 1* | On bark | 11 |
| 2 | Sp. (2-)4(6) celled . | 3 |
| 2* | Sp. only 2-celled. Difficult species group . | 6 |
| 3 | Sp. (11)14-21(28) x 2.5-3 µm, (2-)4(6) celled. Epihym. colorless to pale brownish. Ap. biatorin (not algae in the margin), -0.5(0.6) mm, flat to moderately convex, beige, light brown, light to dark reddish-brown, rose, with soon disappearing margin, on moistening margin region darkens. Thallus areolate to granular, gray-green, greenish, pale brown. Hym. 45-70 µm. With whitish pycn., pycnosp. strongly curved, 10-19 x 0.8-1.2 µm | L. cuprea |
| 3* | Sp. broader, 3.4-5 µm, 4-celled. Ap. lecanorine with algae containing margin), but at times only thalloid margin visible. Thallus areolate | 4 |
| 4 | Thallus thick crustose areolate, areoles thickly blastidiate i.e. tiny sprouts segmented off, thereby appearing irregularly granular-sorediate or almost isidiate, yellow-brown to brown-gray. Ap. -1.2 | |

mm, red-brown to black, usually thickly gray pruinose, sessile, flat to moderately convex, with gray-brown, blastidiate margin. Epihym. brown. Hym. 50-60 µm. Paraph. above somewhat shrunken at the septa. Sp. 4-celled, 19-25 x 4-4.5 µm .

- | | | |
|----|---|-----------------------|
| | L. caeruleorubella | |
| 4* | Thallus and thalloid margin of the ap. not blastidiate . | 5 |
| 5 | Areoles moderately to very convex, sometimes almost clody to squamulose or lumpy, green-gray to brown-gray, brown. Ap. -1.2 mm, flat to convex, light to dark brown, sometimes pruinose, with thick, slightly crenate, finally disappearing margin. Sp. (13)16-20(22) x 3.5-4.5 µm, hym. 45-60 µm, paraph. ends very strongly swollen, up to 8-10 µm thick. epihym. orange- to dark brown. Exc. exterior paraplectenchymatous . | |
| | L. suavis | |
| 5* | Areoles flat, thin, sharp angled, whitish to light gray, dull. Ap. -0.7 mm, flat (to moderately convex), dark brown to black, always pruinose, with thin permanent margin. Sp. 12-16(18) x 4-5 µm. Hym. 60-80 µm, epihym. dark brown. Exc. exterior not paraplectenchymatous . | |
| | L. nylanderiana | |
| 6 | Thallus ± thickly blastidiate, therefore in the case of poorer enlargement often appearing ± diffusely sorediate, thin, scruffy, cracked areolate, areoles angular, greenish gray-brown, greenish-yellow to light brownish, with somewhat uneven surface, often sterile, sometimes with bordered soralia. Ap. -0.4 (0.7) mm, commonly without margin, (young sometimes with thin blastidiate thalloid margin), flat to moderately convex, red-brown, light- to dark brown. Hym. 50-0 µm, epihym. yellowish, yellow-brown, greenish dark brown to black-brown. Sp. 9-14 x 3-5 µm . | L. erysibe |
| 6* | Thallus not blastidiate . | 7 |
| 7 | Ap. almost biatorine, only with few algae in the thalloid margin, the exterior of only the young is occasionally visible, convex to almost spherical, nonpruinose. Thallus endolithic or very thin, rarely definite, undivided or slightly areolate, areoles -0.5 mm . | 8 |
| 7* | Ap. lecanorine, with numerous algae in the outer definite or indefinite thalloid margin, flat, moderately to rarely strongly convex, pruinose or nonpruinose. Thallus clearly developed, areolate, areoles 0.3-2 mm wide. Sp. 9-17 x 4-6 µm . | 9 |
| 8 | Thallus endolithic or finely granular or of very small (0.3 mm) areoles. Ap. orange, red- to dark brown, when moist light with darker margin zone, -0.8 mm. Sp. 11-16 x 4-7 µm. On limestone mortar | L. sylvestris |
| 8* | Thallus thin, varnish-like-smooth, finely cracked areolate, areoles 0.2-0.5 mm. Ap. rose-yellowish, light to red-brown, -0.6 mm. Sp. 9-16 x 3-4.5 µm. On silicate rock and lime-poor rock, on brick . | L. hutchinsiae |

- 9 Ap. commonly soon marginless, red-brown to black, pruinose, flat to convex, -0.8 mm, often crowded and deformed, young ap. sometimes with thin whitish margin. Thallus white-gray to light gray, granular to areolate, areoles 0.3-1.5 mm wide, flat, rather smooth. Spores 10.5-13 x 4.5-6 μm . **L. turicensis**
- 9* Ap. almost always with definite thalloid margin, nonpruinose or rarely slightly pruinose, yellow-brown, red-brown to black-brown, -0.8 mm. Thallus yellowish-gray, dark gray, brown, areolate, areole upper surface \pm warty **10**
- 10 Areoles often sharp angular, 0.3-2 mm wide, slightly curved upward at the angles, yellow-gray to brown-gray, sometimes with whitish prothallus. Ap. numerous and often crowded, weakly to moderately convex, margined or unmargined. Sp. 10-13(16) x 4-7 μm **L. rabenhorstii**
- 10* Areoles not angular, 0.2-0.5 mm, with lumpy-warty upper surface. Ap. less numerous, flat to weakly convex, with permanent, relatively thick margin. Sp. 11-18 x 5-6(7.5) μ **L. inundata**
- 11 Ripe sp. 4-celled . **12**
- 11* Sp. (1-)2 celled **14**
- 12 Without algae in the well developed exc. Paraph. -5 μm thickened above . **Bacidia naegeli**
- 12* With algae in the exc., ap. -0.6 mm, at first flat, with thin thalloid margin, soon convex and \pm marginless. Thallus thin, gray-white to (brownish) gray **13**
- 13 Sp. to 8 per ascus, 12-15 x 4-5 μm , usually \pm slightly curved, ap. reddish, later blackish, nonpruinose, at first \pm sunken, soon sessile, -0.6 mm. Paraph. rather loose, strongly (3-7 μm) thickened above **L. koerberiana**
- 13* Sp. to 8, rarely 16 per ascus, 12-23 x 4-6 μm , straight or slightly curved, with conspicuously blunt ends. Ap. at first light brown, rose-brown, red-yellowish, then brown to almost black, pruinose or nonpruinose, sessile, -0.6(0.8) mm. Epithym. pale or brownish to brown-violet. Paraph. rather cemented, slightly thickened above **L. fuscella**
- 14 Without algae in the exc **Catillaria**
- 14* With algae in the margin. Ap. at first flat and with thin thalloid margin, soon convex and \pm marginless. Thallus very thin, gray-white to (brownish) gray **15**
- 15 Sp. definitely bean-form curved, 12-17 x 4-6 μm . Ap. reddish-brown to blackish, -0.5 mm. Closely related to the following **L. dubitans**
Nyl.) A.L.Sm.
- 15* Sp. straight or slightly curved, , 10-17 x (3-)4-5 μm , commonly 2-celled, to 8-12(16) per ascus. Ap. red-brownish, brown to blackish, -0.7 mm, moist \pm transparent, numerous, thalloid margin smooth or crenate . **L. cyrtella**

(Sp. 8-12(15) x 2-3(4) μm , 1- up to (often indefinite) 2-celled, ap. lighter, strongly transparent, on less nutrient-rich sites than the previous, e.g. Sch, Eif . **L. cyrtellina**
(Nyl.) Sandstede)

Ecology and Distribution of the Species

Lecania cuprea (Massal.) v.d.Boom & Coppins (Bacidia c. (Massal.) Lettau, B. cupreorosella (Nyl. ex Sitzenb.) Bausch)
Up into the montane zone on rather(-very) light-poor, humid habitats on lime- more rarely mineral-rich silicate rock, often on vertical surfaces and overhangs, at times even going over to moss, usually in forests, in gulches, even on brick walls, (subneutroph.-)basiph., m.-r.nitroph. – mieur-med – rare; Sju, FrJu, Mn, Ne, süHü, O, MRh, Erz

Lecania cyrtella (Ach.) Th.Fr. (*L. sambucina* (Körber) Arnold)
Up into the high montane zone on subneutral (to moderately acid), usually smooth bark (or on the crosspieces of cracked bark), preferring elder (branches), additionally above all on popular, Norway maple, walnut, usually on free standing trees, often on the branches, scarcely tolerating dunging, disappearing with the appearance of green algae, subneutroph., r.photoph., mesoph.-r.hygroph., anitroph., in the Xanthorion, Lecanoretum sambuci, Lecanoretum symm., usually with *Bacidia naeg.*, *Lecanora samb.*, *Caloplaca cerina*, *C. cerinelloides* – s'bor-med – r.rare (3), in strong regression under intensive agriculture and industrial regions

Lecania erysibe (Ach.) Mudd
Like *L. inundata*, frequent on mineral-rich silicate rock, e.g. sandstone – s'bor-med – r.rare; Rh, Ne

Lecania fuscella (Schaerer) Massal. (*L. syringea* (Ach.) Th.Fr.)
Up into the (sub)montane zone, above all on trunk of walnut and *Populus* in warm summer sites on well lighted habitats, possibly very sensitive to N- dunging, in the Xanthorion association, Physcietum adsc. – s'bor-med – rare (0); e.g. süHü, HRh, Ne, Sch, Th

Lecania hutchinsiae (Nyl.) A.L.Sm.
In mild, foothills sites on humid, radiation protected habitats on silicate rock, above all

sandstone, and on bricks of walls, subneutroph., m.photoph. – mieur-subatl-med – rare, also certainly overlooked; *O*, Lux-Belgium

Lecania inundata (Hepp ex Körber)

M.Mayrhofer

Above all in lower, rarely montane sites on limestone and lime dust impregnated silicate rock (e.g. sandstone), in the region above all synanthropic on walls, thereby going over onto mortar, concrete and bricks, on rain exposed to m.(-r.) rain protected surfaces, on m.-v.light rich, r.-v.dust impregnated or dunged, r.nutrient rich sites, e.g. like *Candelariella medians* (↑), *Caloplaca dec.* (↑), even on sporadically flooded sites on flooded pavement, basiph.-neutroph., m.-v.photoph., r.-v.nitroph., above all in the Caloplacion dec. – (s'bor-)mieur-med – m.-r. frequent, rare in the silicate mountains

Lecania koerberiana Lahm

Very like *L. fuscella* (↑), – mieur-smed – rare (0), e.g. *Sch*, *nöRh*

Lecania nylanderiana Massal.

Up into the montane zone on vertical and overhanging surfaces on limestone, rarely synanthropic on walls on walls, on m.-r. light-rich habitats – bor-med – rare; FrJu, Mos, Al

Lecania rabenhorstii (Hepp) Arnold

Like *L. erysibe* and *L. rabenhorstii* (↑), – s'bor-mieur-subatl – rare; *Ne*, *HRh*, *MI*

Lecania suavis (Müll.Arg.) Migula

(*L. nylanderiana* auct.)

Up into the alpine sites on steep and overhanging surfaces of limestone (often along the cracks) as well as on vertical surfaces of walls on mortar, on m.-r.(v.) light-rich, usually r.nutrient-rich habitats – bor-med – rare (0); süSch., Al, *Ne*, *Do*, *FrJu*, *Rh-Mn-T*

Lecania sylvestris (Arnold) Arnold

On calcareous rock on cliffs, on mortar (walls), m.-r.photoph. – mieur-med – FrJu

Lecania turicensis (Hepp) Müll.Arg. (*L. albariella* (Nyl.) Müll.Arg.)

On vertical- and overhanging surfaces on limestone, rarely on walls, usually on sunny, nutrient-rich (often m.-r. rain protected) habitats; basiph., m.-r.nitroph. – mieur-med – rare (R); *O*, Ju, Ries, FrJu, Sju, *MI*

Lit.: VAN DEN BOOM 1992, MAYRHOFFER 1988.

Lecanora Ach.

(Key incl. Prototarmelia)

Introduction

Lecanora is a very extensive, non uniform, genus containing several related groups. Included in it were species with crustose, partially lobed margins (placoid) thallus with coccoid green algae, with lecanorine apothecia of various coloring (e.g. yellow, greenish, brown, blackish), and single-celled, usually elliptical spores. In most recent time a reorganization has begun using the structure of the ascus to separate out unrelated groups (e.g. *Tephromela*, *Prototarmelia*) from the more than 100 species included in the composite genus, with *Lecanora* in a narrow sense (represented by *L. argentata*). In Germany there are ca. 90 species by the formulation here put forth, in Baden-Württemberg over 60 species are established.

The habitat colonized by the *Lecanora*-species are multifarious in nature. The indigenous species grow predominantly on bark, wood and silicate rock. *L. epibryon*, one of the characteristic arctic-alpine distributed species, grown on dying mosses or plant detritus. *L. agardhiana*, *L. albescens*, *L. dispersa*, *L. crenulata*, *L. pruinosa* and *L. muralis* reside only on lime-rich rock; in the latter case often also occurring on eutrophic silicate rock. *L. albescens*, *L. dispersa* and *L. muralis* are very frequent on habitats created by man (e.g. walls); the latter two are even frequent in towns.

Numerous taxa dwell on silicate rock. Preferring surfaces exposed to rain are the frequent *L. polytropa*, *L. rupicola* as well *L. intricata*, *L. silvae-nigrae* and *L. cenisia* which are limited to mountain sites (above all on steep surfaces). *L. subcarnea*, *L. swartzii*, *L. lojkaeana*, *L. bicincta* and *L. orosthea* reside on overhanging and vertical surfaces of silicate rock in high precipitation or at least humid sites. *L. dimissa* is dependent on dry-warm overhangs and vertical surfaces of intermediate or calcareous silicate rock. *L. campestris* also grows on that kind of rock with an upper surface reaction around the neutral- to subneutral region, but in

the area occurs almost only on anthropogenic habitats, the southern distributed *L. garovaglii* and the extremely rare *L. reagens* and *L. frustulosa*; these two species occur on metamorphic, slightly calcareous silicate rock with very small occurrences in the high Black Forest (on one or two rocks), which at this time is the only one of this arctic-alpine species in Germany. Also the alpine *L. dispersoareolata* requires slightly calcareous rock. *L. gangaleoides* grown only in winter-mild regions; this species distributed in Western Europe from the Mediterranean region up into Southern Scandinavia reaches the east boundary of its area around Baden-Baden. Likewise *L. achariana* has advanced from Baden-Baden toward the east with an isolated occurrence indicated. The warmth loving, southern distributed *L. pseudistera* penetrated up to the Eifel, to the central Rhine and the Oden Wald, where in the last hundred years it was known from a single locality.

L. epanora, *L. gisleriana*, *L. subaruea*, and *L. handelii* are limited to heavy metal rich, at least iron sulfide rich silicate rock. *L. soralifera* and *L. rubida* also reside on ferruginous rock.

L. varia, *L. saligna*, *L. symmicta*, *L. mughicola*, *L. anopta*, *L. hypoptoides*, *L. fuscescens*, *L. piniperda*, *L. sarcopidoides*, *L. pulicaris* and others occur on tough, dry, wood. Many of them reside also on acid bark, above all *L. pulicaris*, *L. saligna*, *L. symmicta* and *L. fuscescens*. *L. conizaeoides*, *L. strobilina* and *L. phaeostigma* are also acidophytic bark lichens. Above all *L. conizaeoidea* and *L. expallens*, and even *L. pulicaria* are numbered on the other hand as acid emissions most resistant bark lichens; which have in the last hundred years strongly spread out. *L. conizaeoidea* was very rare until 50 years ago.

L. chlarotera, *L. hagenii*, *L. persimilis*, *L. sambuci*, *L. allophana*, *L. impudens* and *L. horiza* reside on subneutral, mineral rich or dust impregnated bark. Non eutrophic, commonly moderately acid bark of deciduous trees (above all beech, oak, ash, maple) and spruce are the typical substrates of *L. albella*, *L. argentata*, *L. intumescens*, *L. subrugosa*, *L. glabrata*, *L. circumborealis*, *L. cinerofusca*, *L. nemoralis* and *L. carpinea*; finally they are often to be found even on dust impregnated bark.

Many species of the genus are very widely distributed, many cosmopolitan. Throughout all of Europe up into the northern boreal zone, most of the rock lichens occur up into the Arctic: *L.*

polytropa, *L. intricata*, *L. rupicola*, *L. muralis*, *L. albescens*, *L. crenulata*, *L. dispersa*, *L. hagenii*, *L. campestris*, *L. varia*, *L. symmicta*, *L. saligna*, *L. pulicaris*, *L. intumescens* and *L. allophana*.

To this group may be numbered also the heavy metal lichens *L. epanora*, *L. handelii* and *L. subaurea* as well as *L. cenisia*, which however toward the south are to be found more in the mountains and are very rare. Likewise widely distributed are *L. albella*, *L. argentata*, *L. chlarotera*, *L. expallens*, *L. carpinea*, *L. lojkaeana*, *L. subcarnea* and *L. swartzii*, which are lacking however in the northernmost Scandinavia or are rare there. The area of *L. sulphurea*, *L. orosthea*, *L. gangaleoides*, *L. demissa*, *L. impudens*, *L. glabrata* and *L. sambuci* stretch only somewhat up into southern Fennoscandia. *L. conizaeoides* has a very irregular distribution essentially dependent upon anthropogenic factors and is expanding its area. To a large extent it is lacking in northern Fennoscandia and the Mediterranean region. *L. anopta*, *L. piniperda*, *L. hypoptoides*, *L. phaeostigma*, *L. fuscescens*, *L. subintricata* and *L. circumborealis* occur predominantly in the boreal floral region and in montane sites in Central Europe. *L. soralifera*, *L. rubida*, *L. silvaenigrae* and *L. mughicola* (only in higher sites) appear to have their distribution high point in the Central European floral region. *L. dispersoareolata* occurs in the alpine mountains and surrounding higher central mountains. The area of *L. pruinoso*, *L. aghardiana*, *L. strobilina*, and *L. horiza* stretches over Central and South Europe. The species *L. marginata*, *L. fuscescens* and *L. cinerofusca* are known only in South Germany from the Allgäu.

Genus Characteristics and Determination

Thallus crustose, thin to thick, rarely in the substrate, mostly whitish, gray, yellow-greenish, yellow, often sorediate. Photobionts coccoid green algae, usually *Trebouxia*. Ap. usually depressed to sessile, rather variously colored, commonly with definite, rarely very rapidly disappearing (or without) thalloid margin. Exc. lacking to very weakly developed, rarely definite. Exc. lecanorine (and exc. proprium) colorless, usually only colored at the margin. Hyp. colorless or very pale. Hym. I+ blue. Epithym. usually light to dark brown, yellow-brown, red-brown, olive. Paraphyses usually simple or

forked, septate, scarcely to definitely thickened above. Asci narrowly cylindrical to clavate, *Lecanora*-type, strongly thickened above with I+ blue tholus and broad central non amyloid central core(axial mass), exterior surrounded by an I+ blue gelatin layer. Sp. to 8, rarely to 16 (32), 1-celled, ellipsoidal to spherical. Pycnosp. various forms. Ch: very frequently Atranorin, numerous variable substances in the medulla.

Oversight of the Parts of the Key

- 1 Thallus placoid, i.e. with clearly elongated marginal areoles, apparently lobed, often rosetted, at times almost like a foliose lichen or definitely squamulose . **PT 1**
- 1* Thallus uniformly crustose (areolate to coherent or almost lacking), not lobed at the margin . **2**
- 2 Ap. long time or permanently entirely sunken and with a concave disk. Paraphyses strongly branched and reticulate bound. Medulla hyphae thin walled, hyphal walls usually only very little swollen, therefore exterior definitely bordered. As a rule on rock. Thallus never yellow-greenish **Aspicilia**
- 2* Ap. with flat to convex disk, usually sessile to little sunken. Paraph. only isolated branching, not reticulate. Medulla hyphae thick walled, exterior usually strongly swollen and indefinitely bordered **3**
- 3 Thallus on silicate rock **PT 2**
- 3! Thallus on limestone **PT 3**
- 3* Thallus on bark, wood, mosses of plant detritus **PT 4**

Lecanora PT 1: Species Squamulose or Thallus Lobed at the Margin (Lecanora Sect. Placodium, Squamarina, Rhizoplaca)

- 1 Thallus only attached only ± in the center, clearly foliose, usually light yellowish-green, underside often slightly blue-blackish overlaid, Usnic acid, very rarely Psoromic acid. – Arct-alp, on silicate rock (bird roost). Rhizoplaca **2**
- 1* Not attached in one place only, thallus squamulose or crustose and rosetted and lobed at the margin, usually close lying . **3**
- 2 Ap. rose, red, even beige pruinose. Thallus also ± beige. Placodiolic or Pseudoplacodiolic acid . * **Rhizoplaca chrysoleuca** (Sm.) Zopf (*L. rubina* (“Vill.”) Ach.)
- 2* Ap. yellow-greenish to (blue)blackish. Very rare Placodiolic acid *** Rhizoplaca melanophthalma** (DC.) Leuck. & Poelt (*L. m.*(DC.) Ram.)

- 3 Thallus in the center with concave to flat, sometimes isidiate becoming soralia, brown, yet usually strongly pruinose and then gray-brown to white-gray, usually only up to 1 cm large, closely appressed, rounded, rosetted usually coalescing into large stands, marginal lobes 0.3-0.8 mm wide. Commonly sterile. Caloploicin, Vicanicin . **L. demissa**
- 3* Thallus without soralia, larger (usually 1.5-10 cm), with ap **4**
- 4 Thallus C+ orange or orange-red, P- . **5**
- 4* Thallus C- . **6**
- 5 On limestone. Thallus pruinose, whitish to slightly yellowish or yellow-greenish (moist yellowish), rounded, rosetted, -2 cm wide, K-/+ yellowish, marginal lobes -0.8 mm wide, flat to slightly convex. Ap. -1.5 mm, brown-rose to blackish-brown, pruinose, with scarcely projecting margin, sessile. Sp. 8-13 x 4-7 µm. Arthothelin, Dichlornorlichexanthon **. L. pruinosa**
(it is like **L. reuteri** Schaerer with high convex, crowded, moist ochre colored lobes, ap. with projecting margins, gray-brown, thallus -1 cm, Alps)
- 5* On silicate rock. Thallus only appearing placoid with elongated marginal areoles, whitish to beige, K+ yellow. Atranorin, Sordidon, Rocellic acid **L. swartzii**
- 6 Ap. brown-black, sunken to depressed, thick standing in the center of the thallus. Thallus gray-white, brown-gray to dark gray, pruinose, usually lighter at the marginal lobes than in the center, close lying, rosetted, K+ yellow, than blood red, P+ orange, also K-/P-. Norstictic acid, ± (Atranorin) . **Lobothallia radisoa** (↑ **Aspicilia**)
- 6* Ap. not brown-black. Thallus white-green to pale gray- or yellowish-green, even olive- to yellow-brown, K- or K+ yellowish. Usnic acid **7**
- 7 On walls, bricks, tombstones and other anthropogenic substrates . **11**
- 7* Not on such habitats **8**
- 8 Thallus squamulose, lumpy, if close lying rosetted (radial), then on lime soil, lime mosses. Rare species. Cortex thick, regularly delimiting the algal layer, of perpendicular running, strongly cemented hyphae (*Squamarina*) **9**
- 8* Thallus regularly rosetted, radially lobed at the margin, not squamulose, on silicate- and limestone, white-green, pale yellowish-green, pale gray-green to yellowish, even thickly white pruinose. Cortex thin, often irregularly demarcated toward the algal layer (Sect. *Placodium*) **11**
- 9 Ap. -1.5(rarely -2) mm, usually light brown, flat, with white, finally disappearing margin, thallus clearly rosetted, definitely lobed at the margin, areolate-squamulose in the interior, lobes usually rather narrow, with up curved margin, whitish to

- greenish-white, underside white, medulla P-, K-.
Sp. 9-12 x 4-5 µm. * **S. lentigera**
- 9* Ap. commonly larger, thallus commonly rosetted only when young, not clearly radially lobed at the margin, P+ yellow or P-. Sp. 10-15 x 4-6 µm .10
- 10 Ap. -10mm, usually ochre-yellow, concave to flat, margin soon indefinite. Thallus squamulose. Squamules 2-5 mm in size, (1 mm) thick, concave (raised at the margin), rigid, whitish-green to ochre-olive or ochre, white margined scattered to crowded. Medulla P+ yellow. Psoromic acid, Isousnic acid * **S. gypsacea**
- 10* Ap. -4 mm, brown to red-brown, flat to convex, margin finally disappearing. Thallus squamulose, squamules -0.5 mm thick, convex to concave or irregularly, greenish to green-white, white pruinose or nonpruinose, usually irregularly to roof tile-like ordered. Medulla P- or P+ yellow. ± Psoromic acid . *□ **S. cartilaginea**
- 11 Thallus lobes strongly convex, swollen and curved, often areolate by cross-cracks, with loose to almost hollow medulla. Thallus in the interior more gray-green, toward the margin yellowish, relatively weakly attached (see *L. muralis*). Ap. light to middle brown. Very rare species. Placodiolic acid, Zeorin, ± Isousnic acid * **L. garovaglii**
- 11* Thallus lobes flat to slightly convex 12
- 12 Very rare. Lobes only attached at the base, otherwise free (almost foliose), long and narrow (1-2 mm wide), pale yellowish, yellow-green, gray white, underside whitish, R-. Ap. rose-brown to brown, with projecting, often wavy or crenate margin, sessile to almost stalked. On silicate rock. Zeorin * -- bor-atl-smed(atl) – Vog, ?nöSch **L. achariana** A.L.Sm
- 12* Frequent. Lobes attached up to the margin, at best somewhat raised at the ends, flat, concave, rarely convex, green-white, yellowish, yellow- to slightly gray-green, on lime often strongly white pruinose (var. *versicolor*) P-/K- or + yellowish, C-. Ap. numerous, sessile, thallus color to dark brown. Very variable. ± Atranorin, ± Murolic acid, ± Psoromic acid, Zeorin . * **L. muralis**

Lecanora PT 2: Species on Silicate Rock

- 1 Parasitic on crustose lichens 2
- 1* Not parasitic 5
- 2 Thallus brown, red-brown, dark brown, black-brown . 3
- 2* Thallus otherwise colored or scarcely occurring 4
- 3 Thallus brown to red-brown, areolate, areoles flat to ± convex, on yellow *Rhizocarpon*-species or *Aspicilia*. Ap. dark brown to dark red-brown, at first margined, later convex marginless, -1mm. ± Norstictic acid (*Protoparmelia*) 23
- 3* Thallus areolate. Areoles ± rounded, flat to slightly concave, often crenate margin,

- sometimes squamulose (at first of very small (ca. 0.2 mm), pale margined, brown, ± smooth part areoles mosaic-like), sometimes also blackened in places, sitting on a black “prothallus”, 0.3-1.5(2) mm. ap. rare, -0.6(1.0) mm, often irregular in outline, dark red-brown to black-brown, margin beige. Hyp. colorless, I+ blue. Epiphy. (red)brown, K+ olive. Paraph. thickened above, pigmented. Miriquidic acid
- Miriquidica intrudens**
- 4 Living on sorediate, yellow, yellow-green to gray heavy metal lichens. Ap. brown-red to red, with orange-gray to gray-brownish, often large and irregularly crenate thalloid margin. Thallus usually very reduced. Epiphy. dark brown-red. Sp. pointed at both ends, 8-11 x 4-5 µm. Usnic acid s.l **L. gisleriana**
- 4! Living on whitish to gray *Tephromela*-species. Ap. soon convex marginless, biatorin, lead-gray, discolored brownish, olive to blackish, pruinose. Thallus cracked to areolate, very thick, light yellowish to yellowish gray-green. Epiphy. olive to dirty brownish . **L. sulphurea** (13)
- 4* On *Miriquidica nigroleprosa* (gray lichen with blackish soralia) in high montane and alpine sites. Thallus pale yellow, areolate, -1 cm, K-yellow, C-, P-. Ap. 0.3-2 mm, with black, yellowish pruinose, flat to convex disk with thalloid margin. Epiphy. gray to dark green. Sp. 8-14 x 5-8 µm. Isousnic acid, Zeorin. – bor-alp – BayW, Alps, Giant Mountains **L. latro** Poelt
- 5 Thallus yellow, yellow-greenish, pale green, yellowish gray-green (“Usnea-green”) 6
- 5* Thallus otherwise colored 18
- 6 Thallus sorediate, ap. rare . 7
- 6* Thallus not sorediate, with ap. With Usnic acid . 12
- 7 Thallus in the center soon completely sorediate, otherwise finely cracked areolate and smooth, rarely completely sorediate, pale yellow-greenish, well developed with whitish to blue-gray prothallus, P-, C-, KC+ yellow. Soralia only at first delimited, standing at the margin of the areoles. Ap. rare, convex marginless, gray-blackish to discolored, often gray pruinose. Sp. 8-11(16) x 3-5(7) µm. Usnic acid, Zeorin, ± Skyrin **L. orosthea**
- 7* Soralia delimited, rounded to irregular. Thallus areolate to warty areolate. Commonly on iron-rich rock. Ap. with thalloid margin . 8
- 8 Soralia whitish, very pale green or slightly yellowish. Usnic acid, Zeorin. Thallus K-, P-, C-, KC+ yellow. Ap. -0.5 mm, rare . 9
- 8* Soralia shining yellow to sulfur yellow. Without Usnic acid 0
- 9 Soralia marginal, at times even going over to the upper surface, irregular. Areoles mostly moderately convex, pale gray-greenish to gray, usually scattered or in small groups, ap. sessile,

- discolored gray-, light brownish to blue-blackish. (Atranorin) * □ **L. handelii**
- 9*** Soralia on the upper surface, often slightly yellowish, usually lighter than the thallus, rounded to irregular. Areoles flat, pale gray-greenish or yellow-greenish, -1 mm, often slightly enlarged and crenate at the thaloid margin. Ap. sunken, flat, usually discolored green-black. * □ **L. soralifera** (when areoles strongly convex to wavy deformed, -0.5 mm, erupting into yellowish upper surface soralia, soredia 20-30 µm thick, lichens on rain sheltered surfaces, BayW: **L. chloroleprosa** (Vainio) H.Magn.)
- 10** Thallus P+ red, K-, C-, KC-. Areoles flattened to moderately convex, crenate at the margin, yellow-green to sulfur yellow (also with gray tint). Soralia marginal, later even on the upper surface, sulfur yellow. Ap. brownish to brown-olive. Zeorin, Rhizocarpic acid, Pannarin . □ **L. subaurea**
- 10*** Thallus P- or P+ yellowish. Areoles strongly convex. Soralia mainly on the upper surface . **11**
- 11** Soralia crater-form. Areoles scattered of blackish prothallus, sulfur yellow, K+ yellow **L. reagens**
- 11*** Soralia not crater-form, mostly convex, sometimes coalescing and producing one ± continuous sorediate crust. Areoles yellow to light yellow, K-. Prothallus rarely definite, blackish. Ap. brown, rare. Zeorin, Epanorin, Rhizocarpic acid **L. epanora**
- 12** Ap. soon convex marginless, biatorin, lead-gray, discolored brownish, olive to blackish, pruinose, almost sunken to later projecting. Thallus cracked to areolate, rather thick, light yellowish to yellowish gray-green, K-/K± yellow(-brown), C-, P-. Prothallus gray. Sp. 9-13(16) x 4-6 µm. Epithym. dirty brownish to olive. Zeorin, ± Gangaleoidin, ± α-Collatolic acid, ± Atranorin, Usnic acid □ **L. sulphurea**
- 12*** Ap. not soon marginless, lecanorine. Usnic acid **13**
- 13** Ap. sunken to depressed, usually flat, -1(1.5) mm. Disk almost as high as the thallus upper surface, olive to (green)black, rarely light greenish. Thallus cracked areolate to areolate, areoles flat to appearing squamulose. Prothallus black. Sp. 9-14(15) x 4.5-7 µm. Zeorin * □ **L. intricata**
- 13*** Ap. sessile or, if ± sunken, not olive to black .**14**
- 14** Ap. margin (and ap. medulla) P+ red (at least in section), puffy, often wavy, later receding, light yellow to light sulfur yellow, disk usually yellow-brown, brown, ochre or red-brown. Ap. large, 1-2.5 mm, usually setting up with constricted base. Thallus usually rather indefinite. Rangiformic acid, Protocetraric acid * □ **L. silvae-nigrae**
- 14*** Ap. margin P- or P+ yellowish .**15**
- 15** Ap. (dark) brown to red-brown, at first ± sunken, then sessile, -2 mm. Thallus pale yellow-green to yellowish-white, warty areolate (areoles ± convex, often separated; if areoles coalescing, ap. permanently margined, sp. 9-16 x 6-10 µm. Atranorin, Zeorin, ± Epanorin *; *L. argopholis* Ach.). Sp. 9-17 x 4-7 µm. ± Stictic acid * □ **L. frustulosa**
- 15*** Ap. pale yellowish(green), yellow-brown, ochre, middle brown **16**
- 16** Thallus thick, of ± scattered areoles(groups), they are often blue-gray bordered. Ap. 1-4 mm, often larger than the 1-2 mm wide areoles, brown. Sp. 12-18 x 4-7 µm. Only in subalpine and alpine sites on weakly calcareous rock. Five chemical races. Almost always Rangiformic acid, ± Protocetraric acid, ± Psoromic acid. * . **L. dispersoareolata**
- 16*** With other characteristics. Ap. pale yellowish, pale greenish or pale greenish-brown to brownish, rarely over 1.5 mm. Thallus light greenish to pale green-yellowish or gray-green, rarely slightly brownish, areolate to granular or almost lacking or only when ap. maintaining a margin **17**
- 17** Ap. usually -1(1.5) mm, but in isolated (alpine forms) cases even clearly larger, yellowish, greenish, brownish. Sp. 9-14 x (4.5)5-6.5 µm. Variable species. Thallus yellowish, greenish, gray-greenish, rarely brown-tinted, P-, K± yellow, C-. (±)Rangiformic acid, ±Zeorin, ±Eulecnoral . * □ **L. polytropa**
- 17*** Like *L. polytropa*, but sp. 7-12 x 3-4 µm, ap. -0.8(1) mm, flat to moderately convex, usually pale brown to gray-brown, with scarcely raised, soon disappearing margin. Thallus of scattered to coalescing, rounded granules, brownish-green to green-gray. R-. Rangiformic acid, Zeorin *. Possibly in the region . **L. stenotropa** Nyl.
- 18** Thallus brown . **19**
- 18*** Thallus not brown **25**
- 19** Ap. disk black, at first punctiform, later widening, often strongly uneven warty. Thallus with isidia-like, peg-form to hemispherical outgrowths, often even with whitish, delimited soralia on or using up the outgrowth, (cocoa) brown, rose-brown, gray-brown, yellow-brown, C+ red (Gyrophoric acid), areolate. Hym. blackened above. Sp. 15-30 x 10-14 µm ↑ □ **Rimularia gibbosa**
- 19*** Ap. disk not uneven warty, dark brown to brown-black, often shiny. Epithym. brown to olive-brown. Sp. usually up to 16 µm long, narrowly ellipsoidal to elongate. Pycnosp. bacillar to filamentous. Thallus not sorediate (*Protoparmelia*) . **20**
- 20** Areoles rounded, almost shield-form, concave to moderately convex, scattered on a black, becoming sooty prothallus with (microscopic) dark blue, usually 4-6 celled, 10-12 x 6 µm thallospores. Ap. rare, -0.5 mm, brown, red-brown, black-brown, with thin, raised margin.

- Medulla P+ orange, K+ yellow, C-. Sp. 8-12 x 3-45 µm. Stictic acid **Protoparmelia nephaea**
- 20* Areoles not rounded and ± scattered 21
- 21 Thallus at the margin with clearly enlarged (2.5 x 1.5 mm), almost squamulose, flat to uneven areoles, red-brown to dark brown, often on dark prothallus, interior (cracked-) areolate. Ap. -2 mm, round to sharp angled, flat to moderately convex, black-brown. Sp. 10-17 x 5.5-6 µm. Medulla P+ orange, K+ yellow to red, C-. Norstictic acid, Rangiformic acid. Alpine
- Protoparmelia cupreobadia**
- 21* Thallus margin without clearly enlarged, almost squamulose areoles 22
- 22 Thallus at least at first parasitic, usually little extended . 23
- 22* Thallus as a rule not parasitic, often large, medulla KC± reddish, K-, C-, P-. Ap. usually permanently margined, brown-black . 24
- 23 On *Aspicilia myrinii*. Thallus producing rounded islands, ca. 1-2 cm, yellow-brown to brown, of convex areoles. Ap. often lacking, red- to dark brown, with disappearing margin. Sp. 9-12 x 5-7 µm. Norstictic acid. Alpine
- Protoparmelia phaeonesos** Poelt
- 23* On yellow *Rhizocarpon*-species (youth parasite), brown, copper-brown, areolate, areoles flat to moderately convex, -1 mm, on dark prothallus. Ap. ± sunken to sessile, dark brown to dark red-brown, often shiny, at first margined, later convex-marginless, -1 mm. Sp. 8-15 x 5-7 µm. Medulla K-/K+ yellow to red, P-/P+ yellow to orange, C-. Norstictic acid. (in the exc.), ±Psoromic acid, Rangiformic acid
- **Protoparmelia atriseda**
(see also *Miriiquidica intrudens*, 3)
- 24 Sp. narrowly ellipsoidal to almost cylindrical, rounded at the ends, 10-14 x 3.5-5 µm. Hym. 40-60 µm high. Ap. to a large extent lacking or scattered, rarely numerous, closely depressed, rarely over 1mm. Thallus extensive, dark-brown, rarely gray-brown, with folded-bulging areoles. Lobaric acid . **Protoparmelia picea**
- 24* Sp. fusiform, both ends pointed, 10-16 x 4-7(8) µm. Hym. 60-80 µm. Ap. usually numerous, 1-2.5 mm, depressed to sitting up. Thallus dark brown to olive-brown, even gray, areoles convex, smooth to uneven. Lobaric acid and other substances . □ **Protoparmelia badia**
- 25 Lichen sorediate. Ap. often lacking. Thallus white to light gray, soralia whitish to blue-gray. With Atranorin, K+ yellow (except *L. handelii*), P- or ± yellowish . 26
- 25* Not sorediate. Ap. occurring . 30
- 26 Thallus whitish to cream colored, C+ orange, areoles convex, radially elongated toward the margin of the thallus (often on a whitish, likewise radially elongated prothallus), central areoles with rounded often convex, ± gray soralia.
- Thallus often rounded. Ap. like *L. swartzii*. Sorididon, Roccellic acid (*Glaucomaria* group) * **L. lojkaeana**
- 26* Thallus C- 27
- 27 Soralia flat to convex, not coalescing . 28
- 27* Soralia coalescing. Ap. disk black, hym. entirely red-violet . 29
- 28 Soralia rounded, convex, dark gray, dark blue-gray, on rather convex to knobby areoles. Thallus whitish, gray-white, yellowish-white. Ap. dark brown, black-brown, rare. Not on heavy metal-rich substrate. Gangaleoidin (often in traces), Roccellic acid * **L. pannonica** (Soralia whitish to yellowish-white. Thallus gray, olive-gray, whitish, warty to areolate. Ap. as in the case of *L. cenisia*, rare. Atranorin; Roccellic or Nephrosteranic acid:
- L. caesiosora** Poelt
- 28* Soralia rounded to elongate, not strongly convex, whitish. Areoles convex, light gray-green to gray, scattered to crowded, ap. gray, pale brownish to blue-blackish. On heavy metal containing substrate * □ **L. handelii** (9) (see additionally very rarely occurring sorediate forms of ↑ *L. subcarnea*, *L. rupicola*, *L. bicincta*. Soralia on usually cracked to (cracked) areolate, gray-white to cream-colored thallus, areoles usually not high convex. Without Gangaleoidin, without Usnic acid.)
- 29 Soralia in margin thallus portion usually separated, irregular, whitish, coalescing toward the thallus center and here also gray. soredia (coarse) granular, 150-250 µm. Thallus whitish to white-gray, warty areolate. In higher sites. α-Collatolic acid, Alectoronic acid.
- * **Tephromela pertusarioides**
- 29* Thallus soon sorediate to the margin and because of the soredia gray to dark blue-gray, only in the warty margin not sorediate, usually with blue-black prothallus. Soredia 50-100 µm. Protolichesterinic acid, (α-Collatolic acid) * **Tephromela grumosa**
- 30 Ap. disk black, nonpruinose, thallus K+ yellow (rarely even red), C-. Atranorin 31
- 30* Disk not truly black . 34
- 31 Almost the entire hym. red-violet. Thallus warty areolate to coarsely granular, usually thickish, uneven, white to white-gray, P-. Ap. 1-2.5 mm, flat, finally moderately convex, margin permanent, often wavy. Sp. 10-15 x 5-8 µm. α-Collatolic acid * □ **Tephromela atra**
- 31* Epihym. green, green-blackish, olive, brown, red-brown. Sp. mostly 10-15(18) x 6-8.5 µm 32
- 32 Epihym. red-brown, brown, olive-brown, with granules dissolving in KOH. Ap. -2.5 mm, with thick thalloid margin and on the inner side of the thalloid margin even with an apparent proper margin, blackish, sometimes slightly pruinose. Thallus warty areolate, gray white. In higher sites. ±Roccellic acid, ±Gangaleoidin

- *□ **L. cenisia**
- (see also very dark fruited collections of *L. campestris*)
- 32* Epihym. without granules. As a rule not in higher sites. Ap. without apparent proper margin 33
- 33 Epihym. green, green-blackish, discolored dark brown. Ap. -1.5 mm, with usually crenate thalloid margin (proper margin lacking or very thin), black. Thallus warty areolate to coarse granular, gray-white to gray. Gangaleoidin, Skyrin, ±additional substances. **L. gangaleoides**
- 33* Epihym. pale orange to red-brown. Ap. (brown-red-) black ↑ □ **L. campestris**
- 34 Thallus R-, indefinite or very thin, commonly on calcareous, lime dust impregnated or eutrophied rock, on walls and the like. Epihym. ± light brown, diffuse. Disk gray-brown, yellow-brown to dark brown, red-brown, pruinose or nonpruinose (*L. hagenii*-group), see PT 3
- 34* Thallus K+ clearly yellow or red . 35
- 35 Thallus K+ yellow, then red (crystals), P+ yellow, C-, gray-white, beige, areolate, areoles in the center somewhat immersed and darker, -2 mm. Ap. red brown, brown, dark brown, with wavy curved, finally disappearing thalloid margin, often with proper margin, -1(1.4) mm. Sp. 8-14.5 x 4-6.5 µm. Norstictic acid
- L. rubida**
- 35* Thallus K+ yellow, brown-yellow. With Atranorin 36
- 36 Ap. disk C+ orange or P+ red, usually pruinose and therefore whitish, yellowish-white, gray(blue), under the pruinosity rose-brown, light brown, brown, gray to blackish. Thallus white to light gray, beige, cream-colored, C- to C+ orange(yellow) 37
- 36* Ap. disk C-, P-/P+ yellowish. Thallus C- .. 42
- 37 Disk P+ orange-red, C-, brown-rose to flesh color, thickly white pruinose. Thallus C-, P+ red, gray-white to yellowish-gray, beige, cracked to warty areolate, rarely with coarse, delimited, mealy soralia (var. **soralifera** H.Magn.). Ap. slightly concave to moderately convex, with receding margin, later even strongly convex, -2 mm. Epihym. ± light brown. Sp. 9-14 x 5.5-8 µm. Protocetraric acid., Atranorin
- **L. subcarnea**
- 37* Disk P-, C+ intensively yellow to orange, KC+ orange. Thallus C+ orange/yellow or C-, P- to P± yellow. Epihym. light brown, discolored brown to green-blue, with thick layer of dark crystals. Sp. usually 9-15 x 5.5-7 µm. Sordidon at least in ap., ±Roccellic acid, Atranorin (*Glaucomaria*) . 38
- 38 Ap. soon with black, often wavy proper margin on the inner side of the thalloid margin, usually depressed to sitting up. Disk soon blackish, but ± pruinose and bluish. Thallus cracked-areolate, whitish to weakly blue-gray tinted. Thallus C-, rarely C+ orange. * Alpine species, on vertical surfaces and overhangs **L. bicincta**
- 38* Ap. without definite black proper margin . 39
- 39 Thallus KC-/C- (to slightly yellowish), white to gray, usually cracked areolate, areoles smooth to furrowed. Ap. sunken to depressed, rarely broadly sitting up, flat, rarely convex, rose-brown, brown, often even blackish, ± pruinose, thereby white to bluish, -2 mm.
- * □ **L. rupicola** ssp. **rupicola**
- 39* Thallus (cortex or medulla) KC+ orange, cracked to warty areolate, whitish, cream-colored, rarely gray-white 40
- 40 Ap. sunken to depressed, flat to convex. Areoles flat to slightly convex, usually whitish. Like ssp. *rupicola*. Thiophanic acid
- * **L. rupicola** ssp. **subplanata**
- 40* Ap. clearly projecting, narrowly sessile, with puffy or receding margin, often finally convex, -1 (2mm). Areoles convex to vesicular, often curved, toward the margin the thallus often radially elongated (often of whitish, likewise radially elongated prothallus). Thallus often rounded: **L. swartzii** . 41
- 41 Thallus whitish, cream-colored, slightly yellowish-white or yellowish-gray. Sorididon in the thallus . □ ssp. **swartzii**
- 41* Thallus yellow-greenish. Arthothelin in the thallus ssp. **nylanderii** (Räsänen) Poelt & Leuck.
- 42 Epihym. discolored brown, olive, green-brown, red-brown, with a superimposed layer of granules (soluble in KOH). Ap. dirty yellow, discolored brown, gray-brown, lead-gray to blackish, often weakly pruinose, with thick, puffy, later receding thalloid margin (coloring of the disk sometimes going over to the inside of the thalloid margin), 1-2 mm, sessile. Thallus granular to warty areolate, whitish to slightly yellowish gray, P+ yellow. Roccellic acid, ±Norstictic acid .
- * □ **L. cenisia**
- 42* Epihym. orange-brown, red- to dark brown, without granular layer, without superimposed crystals. Ap. (dark)red-brown, rarely almost black, with ± smooth thalloid margin . 43
- 43 Ap. -1.0 (1.5) mm, soon convex, shiny, (dark)red-brown, with smooth to granular thalloid margin, at times with proper margin on the inside of the thalloid margin. Medulla of the ap. margin with a complex of large crystals. Sp. 10.5-13(14.5) x 5.5-7.5 µm. Thallus of small whitish squamules or scattered convex areoles or granules, white to light gray (often with yellowish tinge), P+ yellowish. Galactinulin
- * **L. pseudistera**
- 43* Ap. usually 0.6-1.4(1.8) mm, flat to finally weakly convex, dark(red-)brown to almost (red)black, often numerous and crowded. Medulla of the ap. margins with many (rarely few) smaller crystals, without larger crystal complex. Sp. 11-14(16.5) x (5)6-8(9) µm.

Thallus granular, wrinkled to warty, white-gray to gray, often rounded, sometimes with whitish prothallus, P- to P+ yellowish. ±Zeorin

* □ **L. campestris**

Further species on the sea coasts: *L. actophila* Wedd. with sessile green-blue tint, blackish, moist like bluish pruinose ap., yellowish-white to gray-green thallus, 8-14 x 5-6 µm spores, with Usnic acid; very similar *L. helicopsis* (Wahlenb.) Ach., but ap. without green-blue tint, thallus gray, without Usnic acid (both species without Atranorin)

Lecanora PT 3: Species on Limestone

- 1 Ap. black, brown-black, (dark)red-brown, pruinose or nonpruinose . 2
- 1* Ap. colored otherwise. Epihym. light to dark brown. Dark brown crystals in the ap. cortex. R- (rarely C+ yellow). *L. dispersa*-group. Taxa difficult to separate 7
- 2 Thallus K+ yellow, C-, P- or weakly yellowish, clearly developed. Ap. nonpruinose . 3
- 2* Thallus R-, commonly thin, ± endolithic, whitish to bluish 5
- 3 Ap. without or only the young with apparent thalloid margin, black, with black proper margin, -1.5(2.5) mm. Epihym. yellow-green to green-black. Thallus yellow to yellowish white, almost undivided to cracked (-areolate), KC+ yellow. Sp. 8-14 x 4.5-7.5 µm. Usnic acid, ±Atranorin. High mountain lichen – arct-alp – Al . **L. margina** (Schaerer) Hertel & Rambold
- 3* Ap. with definite thalloid margin, epihym. definitely other colors. On weakly calcareous substrates . 4
- 4 Ap. dark red-brown to black-brown, numerous, 0.6-1.5 mm. Epihym. red-brown. Medulla and ap. margin densely filled with colorless crystals □ **L. campestris** (PT 2/43)
- 4* Ap. black, shiny. Hym. red-violet □ **Tephromela atra** (PT 2/31)
- 5 Ap. with thick, deeply split thalloid margin **L. crenulata** (7)
- 5* Ap. without thick, deeply split thalloid margin 6
- 6 Epihym. blue-gray, blue-green, discolored brownish, purple with nitric acid. Ap. almost without thalloid margin, with proper margin, black to brown-black, often slightly pruinose, flat, rarely convex, sessile to sunken in pits in the rock, -0.5 mm. Thallus thin, ± endolithic, whitish to bluish. sp. 7-12 x 4-6 µm **L. agardhiana** s.l.
- 6* Epihym. brownish. Ap. red-brown to black-brown, sometimes pruinose, usually -0.5 mm. Thallus thin, often indefinite, medulla of the margin without crystals, see the rarely going over to rock *L. hagenii/umbrina* (PT 4/41)

- 7 Ap. margin very thick, permanent, raised, repeatedly (usually -8 times) deeply split, white, disk pruinose, whitish to blue-gray (under the pruinosity brown-gray to red-brown to blackish), ap. -1 mm. Thallus usually indefinite, rarely granular. Hym. purple or negative with nitric acid. Usually Ch-. Sp. (9)10-12(15) x 4-6 µm .

□ **L. crenulata**

(**L. perpruinosa** Fröberg: Ap. dark red to almost black, blue-white pruinose, margin thin, exc. paraplectenchymatous, paraphyses thick, constricted at the septa)

- 7* Ap. not with coarsely split, puffy margin and at the same time with white pruinose disk. Ap. gray-brown, ochre, olive-brown, olive-greenish, rose-gray, brown, nonpruinose to (usually only slightly) pruinose, -1(1.5) mm. Margin entire or granular. Sp. 8-15 x 4-7 µm 8
- 8 Thallus moderately to rather thick, often round, definitely delimited, sometimes appearing lobed, white-gray to white. Ap. closely crowded, ± flat, yellow-brown, dirty light brown, olive-brown, rose, gray, greenish, often slightly pruinose, usually margin not crenate. Hym. usually weakly purple with nitric acid. 2,7-Dichlor-lichexanthon □ **L. albescens**
- 8* Thallus indefinite, at the worst single areoles occurring. Ap. scattered to close standing, flat, yellow- to olive-brown, olive-yellow, light brown, nonpruinose or rarely whitish pruinose. Margin entire or slightly crenate, whitish or pale yellow-greenish. No reaction of the hym with nitric acid. Ch- or 2,7-Dichlorlichexanthon or Vinetorin/Aotearon □ **L. dispersa** s.l. (Ap. margin yellowish, K-/+ yellow, C+ yellow, usually strongly developed. Ap. sessile, with narrowed base, close standing, disk brown to olive-brown, Vinetorin, Aotearon, on lime-poor rocks: **L. conferta** (Duby ex Fr.) Grognot; Separation from *L. dispersa* problematic)

Lecanora PT 4: Species on Bark, Wood, Mosses, or Plant Detritus

- 1 On plant detritus, soil- and rock mosses . 2
- 1* On bark and wood . 4
- 2 Thallus with rounded to irregular fine granular soralia, gray-white, granular-warty, extensive, K+ yellow, C-, P-. Ap. rare. Atranorin **L. epibryon**
- 2* Thallus without soralia, C-. Ap. red-brown to black. Over mosses and plant detritus in the alpine zone, arct-alp, Alps . 3
- 3 Ap. margin and -disk black-brown to rarely red-brown. Ap. strongly narrowed sitting up, with age of irregular outline and deformed, -2(3) mm. Thallus brown to gray, often indefinite, K+ yellow (to red), P+ orange. Sp. 15-25 x 5-7 µm,

- 1-, rare 2(3) celled. Norstictic acid. Over mosses and plant detritus on acid soils
- Bryonora castanea**
(Hepp) Poelt
- 3* Ap. margin and thallus whitish, K+ yellow, C-, P-. Disk red-brown, shiny, flat to slightly convex, margin often inflexed over the disk. Ap. 1-2 mm. Sp. 14-18 x 8-9.5 µm. Atranorin, ±Zeorin. Over mosses/Plant detritus on lime-rich substrates, Al **L. epibryon**
- 4 Thallus sorediate **5**
- 4* Thallus not sorediate **9**
- 5 Thallus gray-green, greenish, rarely pale green-yellowish (or almost ochre), P+ yellow, then red, K-, C-, very variable, thin to thick, granular or warty, commonly in places up to large surfaces erupting into mealy/finely granular soredia, sometimes even producing a cracked crust. Ap. yellowish-gray to gray-green, gray, dirty rose-gray to light brownish (also black in the case of parasitism with *Lichenocodium lecanorae*), at first somewhat concave, then flat, permanently margined, -1.2(1.5) mm, margin sometimes sorediate, white-gray to mostly thallus color. Epihym. and margin usually covered with fine crystals soluble in KOH. sp. 9-14 x 4-7 µm. Fumarprotocetraric acid, ± Usnic acid
- **L. conizaeoides**
- 5* Thallus P- or slightly yellowish. **6**
- 6 Thallus white to white-gray, smooth to warty, with delimited ± rounded, concave to flat soralia, K+ yellow, C± yellowish. Ap. rare, like *L. allophana*. Atranorin etc. (other materials spectrum as in the case of *L. allophana*; when identical: *L. allophana* f. *sorediata* (Schaerer) Vainio) **L. impudens**
(when thallus conspicuously thick, completely granular sorediate, ap. brown-rose, pruinose, above all on *Pinus mugo* in the moors: **L. mughosphagneti** Poelt & Vězda)
- 6* Thallus with yellowish or green-yellowish tint, with Usnic acid, ±Zeorin, usually soon sorediate surface. **7**
- 7 Ap. rapidly convex marginless, light yellow, beige, rose-brown, yellow-green, olive, brown, discolored, usually closely crowded. Thallus rather variable, sometimes seeming sorediate, C+ orange or C- . ↑ **L. symmicta (10)**
- 7* Ap. not rapidly convex marginless or lichen sterile. epihym. permeated with fine colorless to yellow granules (crystals) soluble in KOH. Sp. 10-16 x 4-7 µm **8**
- 8 Thallus pale gray-yellowish, pale green-yellowish, rarely pale ochre, usually with entirely sorediate upper surface, rarely with discrete soralia, C+ yellow to orange, K+ yellow, in the herbarium sometimes covered with the finest crystallizing needles. Ap. rare, pale yellowish to brownish, -0.8 mm, margined, margin sometimes partially sorediate, disappearing. Epihym. covered with a fine yellow layer of granules soluble in KOH. Thiophanic acid, Zeorin, ±Arthothelin **L. expallens**
- 8* Thallus pale yellowish, pale yellowish-green to whitish (even ochre), granular to irregularly warty or ± coherent, uneven, in the herbarium the upper surface finely dusty to cottony, (binocular) covered with numerous of the finest needle-form crystals, thin, C- to C+ yellowish, K+ yellowish to brownish. Ap. frequent, -0.8 mm, gray-yellow to light brown, with thick, whitish to yellowish, often becoming sorediate margin. ±Zeorin *** L. strobilina**
- 9 Thallus or thalloid margin of the ap. pale yellowish-green, pale gray-greenish, light greenish to yellowish. Epihym. almost colorless, yellowish, light brown, olive, rarely red-brown, commonly with on or interspersed crystals (easily visible in polarized light) (soluble in KOH) **10**
- 9* Thallus not pale yellowish to yellow-greenish **15**
- 10 Ap. biatorin (or with very little algae in the exc.), soon strongly convex, at first with thin, entire, depressed (often light) margin, color very variable, light yellow, yellow-greenish, yellow-brown, olive, discolored brown to blackish, 0.4-1 mm, broadly sessile. Thallus pale green-yellow to pallid yellow or whitish, finely granular, dusty or almost lacking, rarely cracked to cracked areolate, C+ orange or C-, K-, P-. Sp. 9-16 x 3.5-6 µm. Pycnosp. 18-25 x 0.5-1 µm. Usnic acid, Zeorin, Xanthone, ±Thiophanic acid **L. symmicta** s.l.
(Thallus rather thick to indefinite, ap. black, brown-black to olive, black: var. *aitema* -- like *L. symmicta*, but ap. usually from the first marginless, gray-blackish, epihym. without granular layer, olive- to blue-greenish, thallus without soredia: **L. pumilionis** (Arnold) Arnold)
- 10* Ap. lecanorine, ± flat to slightly convex (when strongly convex, then very small) **.11**
- 11 Thallus P+ red, K-, C-, pale gray-greenish to greenish, very variable, granular or warty throughout, sometimes even producing one thickish, cracked crust. Ap. pale gray to gray-green, dirty rose-gray to light brownish, at first somewhat concave, then flat, permanently margined, -1.2(1.5) mm, margin sometimes sorediate, white-gray to thallus color, rarely wavy, commonly not strongly raised. Fumarprotocetraric acid, ± Usnic acid. □ **L. conizaeoides**
- 11* Thallus P+ yellow to P-, C-, K- (to K+ weakly yellowish) . **12**
- 12 Sp. 6-10(12) x 2.5-4.5 µm. Ap. soon convex, yellowish, usually soon brown, olive, lead gray to blackish, -0.5 mm, with delicate, pale yellowish or colored like the disk, disappearing margin. Margin almost biatorin, margined. Epihym. often brown-olive. Pycnosp. 4-7 µm x 1 µm, almost

- straight. Limited to higher sites. Usnic acid. s.l
L. subintricata
- 12* Sp. at least 4 µm thick. Ap. for a long time ± flat and margined (when convex, then ap. brown-red) 3
- 13 Ap. black (-green-black), flat, depressed, numerous, crowded, with yellow-green thalloid margin. -0.7mm. Thallus indefinite, P-. Sp. 12-18 x 4-5 µm. Isousnic acid. Limited to higher sites □ **L. mughicola**
- 13* Ap. not black 14
- 14 Ap. large, usually 0.6-1.2(1.5) mm, often thick standing, flat (at first somewhat concave), with raised, often wavy and inflexed to the disk, pale yellowish, olive-yellowish to yellow-greenish margin. Disk yellowish, olive-yellow, yellow-brown, middle brown. Thallus yellowish, yellow-greenish, greenish-gray, usually clearly developed, granular to areolate, P+ yellow. Hym. usually over 65 µm. Sp. (7)9-13 x 5-7.5 µm. Pycnosp. 12-22 x 0.5-1 µm. Usnic acid, Psoromic acid **L. varia**
- 14* Ap. smaller, usually -0.7 mm, for a long time flat and clearly margined, red-brown, rose-brown, yellow-red, even dark brown-red, margin pale yellowish, yellow-gray, even gray or rarely slightly brownish, often somewhat crenate. Hym. usually up to 60 µm high. Sp. 7-13 x 4-6(7) µm. Pycnosp. very rare, (7)10-12 x 0.7-1.2, curved or 6-8(11) x 1.5-3 µm, fusiform. Thallus definite to indefinite, yellowish, pale greenish, even pale ochre, P-, K- to K+ yellowish. (Margin permanent, often crenate: var. *sarcopis*; margin thin, disappearing, disk finally convex, ap. often very crowded, flattening one another: var. *saligna*). Epithym. brown to brown-red, even olive. Isousnic acid □ **L. saligna**
- 15 Ap. margin brown to black, sometimes soon disappearing, the same color as or somewhat lighter than the disk, appearing biatorin. Ap. -0.8 mm 16
- 15* Ap. with light, sometimes later receding, ± thallus colored margin 24
- 16 On subneutral deciduous tree bark above all on lower and middle sites. Ap. numerous, often crowded laterally flattened, red-brown, brown, flat, when young concave with thick margin, then flat, -0.4 mm. Disk usually shiny, margin light gray to disk colored. Epithym. brown-red, colorless in K. Exc. with crystals, exterior brown, algae abundant under the hyp., in the exc. at most penetrating under it. Thallus very thin, gray to dark blue-gray, even whitish. Sp. 6-10 x 4-7 µm. (when sp. more than 8 see *L. sambuci*) □ **L. persimilis**
- 16* Lichens of higher sites on wood, acid bark, often on conifers 17
- 17 Sp. broadly ellipsoidal, 6-10(13) x 4-7 µm, length to breadth = 1-1.4:1. Young ap partially light, flat, later dark brown to blackish, convex, with same color or somewhat lighter, finally disappearing margin (at times with algae), -0.6 (0.8) mm. Epithym. brown. Paraph. in K loose, thickened above. Hym. 35-50 µm. Thallus thin, warty to granular, light gray, K+ yellow. On rhododendron. Alps **L. fuscescens** (Sommerf.) Nyl.
- (see also Lecidea PT 2)
- 17* Sp. ellipsoidal to narrowly ellipsoidal, Length : breadth = 1.8-2:1 18
- 18 Ap. convex from the first, soon marginless and without algae in the exc., hym. 40-75 µm 19
- 18* Ap. at first flat and clearly margined 22
- 19 Ap. yellowish, light brown, rose-brown, brown, -1 mm. Epithym. yellow-brown to olive, impregnated with yellow-brownish granules soluble in K. Ap. convex to strongly convex, very rapidly marginless and without algae in the exc. (only young ap. with thalloid margin). Thallus whitish, yellowish, greenish, as a rule definite. Sp. 10-17 x 4.5-5.5 µm. Hym. 40-75 µm. Thallus whitish to slightly yellowish **L. symmicta** (10)
- 19* Ap. red-brown, dark brown, black 20
- 20 Thallus whitish to greenish, as a rule definitely developed. Ap. red-brown to black. Epithym. yellow-brown to olive, with granules dissolving in KOH, sp. 10-17 x 4.5-5.5 µm, like *L. symmicta* (19) . **L. symmicta** var. **aitema**
- 20* Thallus commonly indefinite, with other characteristics. Difficult group. Ap. -0.6 mm 21
- 21 Epithym. (discolored) brown, olive-green to black green or bluish, K+ usually green, with granular overlay. Sp. 8-14 x 3-6 µm. Hym. 40-70 µm high. Ap. red-brown, black-brown, almost black, sometimes pruinose, with blackish granules in the margin (section). Sp. 8-14 x 3.5-6 µm, sometimes appearing two-celled. Exc. interior I- **L. anoapta**
- 21* Epithym. without granular overlay, diffuse red-brown, K± olive-brown. Ap. hemispherical convex, brown-black to dark red-brown (to almost black), nonpruinose, with pale brown, soon disappearing proper margin. Exc. exterior light brown, interior colorless. Paraph. simple or sparsely branched, uppermost cell up to 4 µm thick, brown. Thallus indefinite or whitish. Sp. 8-12 x 3-4.5 µm, often slightly gray-brown tinted or appearing 2 celled. Pycnosp. 14-18 x 0.5-1 µm, curved . **Lecidea hypopta**
- 22 Commonly on wood. Epithym. diffusely discolored dark brown-blue to greenish, without granular overlay. Ap. flat and thin margined to convex and marginless, red-brown, black-brown, soon black, -0.5 mm. Margin without blackish granules, with algae below. Sp. 8-14 x 3.5-4.5 µm, sometimes with septum. Exc. interior I+ blue . **L. hypoptoides**
- 22* Usually on bark. Epithym. red-brown, brown. Thallus/exc. K+ red crystals (microscope).

- Norstictic acid. Probably not specifically separable. *L. cadubriae* s.l **23**
- 23** Thallus definite, granular to lumpy, white-gray, like ap. margin K+ yellow, then orange to red, P+ orange. Ap. -0.8 mm, at first cinnamon-brown, flat, with raised, usually definitely lighter margin, later dark brown, convex, biatorin. Epithym. brown, paraph. capitate above, -4 µm. Sp. 7-12 x 3-4.5 µm. Pycn. frequent, black, pycnosp. 4-6 x 1-1.5 µm (↑ *Lecidea* PT 2/44). * ***L. cadubriae***
- 23*** Thallus thin, gray, or lacking, reactions (macroscopic) indefinite. Epithym. red-brown, light brown to brown. Sp. 7-12 x 3-5 µm. Ap. -0.5 mm, brown-black to blackish, moist red-brown to red-black, biatorin, flat, thin margined, soon convex and marginless. Exc. exterior brownish, interior light and I+ blue. Paraph. loose. Pycnosp. 4-5 x 0.3 µm ****L. phaeostigma*** (Körber) Almborn
- 24** Ap. soon convex, yellowish, soon brown, olive, gray, blackish, -0.5 mm, margin delicate, whitish to pale yellowish, soon disappearing. Sp. 6-10 x 2.5-4.5 µm. On wood in higher sites
* ***L. subintricata*** (12)
- 24*** With other characteristics . **25**
- 25** Sp. to (8)12-32 per ascus. Ap. 0.2-0.4(0.6) mm, at first concave, relatively thick margined, later flat to slightly convex, with thin, often slightly granular, usually permanent margin, brown, often very crowded. Sp. 7-12 x 4-6 µm. Esc. with numerous small crystals (insoluble in K), exterior brown. Epithym. red-brown to brown or almost colorless, in K colorless. Thallus usually small, gray, thin, R- □ ***L. sambuci***
- 25*** Sp. to 8 **26**
- 26** Disk black . **27**
- 26*** Disk not black **29**
- 27** Hym. entirely red-violet. Ap. 1-2.5 mm, flat to slightly convex, permanently margined, with usually glossy disk. Thallus whitish, P-, K+ yellow, C-. Atranorin . ↑ □ ***Tephromela atra***
- 27*** Hym. colorless to slightly brownish, epithym. brown, red-brown, olive-brown. Disk dark brown to black. Hym. with fine crystals above between paraph. and on the epithym. Thallus gray to (yellowish-) white ± Roccellic acid, Atranorin **28**
- 28** Thallus, P+ red, K+ yellow/weakly yellow, C-. Ap. 0.5-1.8 mm, with thin to thick margin. Cortex of the ap. 18-25 µm thick.
* ***L. pulicaris*** (37)
- 28*** Thallus P-, K+ yellow (sometimes orange-red), C-, often with blue-black prothallus. Ap. 0.4-1 (1.5) mm. Cortex of the ap. 22-38 µm thick. Sp. (11)13-17.5 x (7)8-11(12) µm, with conspicuously thicker wall (1-1.2 µm)
* ***L. circumborealis***
- 29** Ap. disk C+ intensive yellow to orange. Disk slightly to thickly pruinose, whitish, pale brownish, gray-yellowish, ochre, rose-brown. Thallus C-, K+ yellow. Epithym. with ± thick overlay of brownish crystals. With Atranorin, Sordidon, (Eugenitol) **30**
- 29*** Ap. disk and thallus C- **32**
- 30** Ap. margin and thallus P-. Thallus whitish, smooth to warty. Ap. commonly numerous, often crowded, 0.5-1.2 (1.5) mm. Disk ± ochre, whitish pruinose, thin to thick margined, margin with cortex. Frequent species. Roccellic acid
* ***L. carpinea***
- 30*** Ap. margin P+ intensive yellow to red, young usually thick, later thinning. Ap. -2(2.5) mm. Disk ± pruinose. Thallus white to light gray. Rare species **31**
- 31** Ap. margin P+ intensive yellow to orange. Ap. usually scattered, pale brownish, rose-brown, rose, slightly to thickly pruinose. Sp. 10-12 x 5.5-8 µm. Roccellic acid, Psoromic acid
* □ ***L. subcarpinea***
- 31*** Ap. margin P- to P+ yellowish, cortex indefinite (medulla hyphae running up to about the ap. margin). Disk light brown to light rose. Epithym. ± colorless. Without Psoromic acid. above all on quaking aspen * ***L. leptyroides*** (Nyl.) Degel.
- 32** Disk and/or ap. margin P+ intensively orange-yellow, orange, cinnabar red or red **3**
- 32*** Disk and ap. margin P- or P± yellowish **38**
- 33** Disk and margin P+ orange to red. Thallus K+ yellow **34**
- 33*** Only margin P+ orange to red . **36**
- 34** Disk thickly white pruinose, under the pruinosity rose to rose-brown, flat to slightly convex, crowded, disk often wavy, finally disappearing, decorticate. Ap. -1.5 mm. Thallus whitish. Sp. 9-11(14) x (5)6-8 µm. Epithym. yellowish to brownish, with a layer of fine ± dark crystals soluble in K. Protocetraric acid, Atranorin . □ ***L. albella***
- 34*** Disk not pruinose, (dark)brown to dark red-brown, lighter in deep shade, flat to slightly convex. Margin ± crenate. Epithym. overlaid with relatively large crystals. Ap. margin (medulla) with complexes of very large irregular crystals. Thallus yellowish white to gray. Pannarin, Atranorin. Alpine, oceanic sites . **35**
- 35** Thaloid margin irregularly crenate. Sp. broadly ellipsoidal, rounded, (7.5)10-14.5 x (6)7-8(9.5) µm, wall (0.5-1 µm). Ap. -1.5 mm. ±Placodiolic acid
* ***L. cinereofusca***
- 35*** Thaloid margin made up of relatively few ± warty segments, thereby frequently interrupted. Sp. 14-20 x (8)10-12(15). Wall 1-1.2 µm. Thallus granular. ±Roccellic acid * On spruce. North Alps . ***L. insignis*** Degel.
- 36** Ap. margin P+ (yellow)orange, very thick, often not overtopping the disk, permanent, often incurved, pruinose, decorticate, with marginal differentiation (hyphae of the medulla reaching up to the upper surface of the margin). Disk ± brown, ochre, red-brown, above all slightly

- pruinose when young, -2.5 mm. Epithym. with yellowish/light brownish crystals soluble in K. Thallus usually whitish, robust, undivided to cracked, K+ yellow, P+ deep yellow to orange. Sp. 11-18 x 5-8 μm . Psoromic acid. (above all in the ap.), Atranorin, Zeorin, \pm Norstictic acid etc
- **L. intumescens**
- 36* Ap. margin/thallus P+ (orange)red, not conspicuously thick, decorticate. Fumarprotocetraric acid 37
- 37 Ap. yellowish, olive, gray-greenish, light brown, discolored, margin entire or granular, regular or deformed. Thallus gray-green, green, usually unevenly warty to granular, K-.
- * □ **L. conizaeoides** (5)
- 37* Ap. brown, dark brown, black-brown, -1(1.2) mm. Thallus white, light gray, pale brownish, thin to thick, smooth to granular, K+ yellow/weakly yellow. Thalloid margin usually smooth, regular. Hym. red- to orange-brown above, impregnated by the finest crystals. Sp. (10) 11-15(16) x 7-9.5(10) μm , wall ca. 0.8-1 μm . Atranorin, \pm Roccellic acid. **L. pulicaris**
- 38 Ap. 0.3-0.7 mm, at first pale rose, rose-gray, rose-brown, ochre, later lead-gray, brown to discolored blackish, often bluish-white pruinose, for a long time flat and margined, with age often marginless. Exc. decorticate. Thallus delicate, dusty to cobwebby or almost mold-like, even granular, whitish to gray-yellowish or bluish, K \pm weakly yellowish, P- (to partially red) epithym. brown to olive, with crystals soluble in K. Sp. 7-14(16) x 2.5-4(4.5) μm . Pycnosp. 7-14 x 1-2 μm , curved, or 3-5 x 1 μm , straight (like *L. sarcopoides*: ap. margin at first lighter than thallus, permanent, pycnosp. 3-5 x 1-1.5 μm , straight) **L. piniperda**
- 38* With other characteristics. Coloring of the ap. in the course of development not strongly varying. Exc. with differentiated cortex. Thallus not dusty to cobwebby to almost moldy. Sp. mostly broader 39
- 39 Thallus R- 40
- 39* Thallus K+ yellow, P- to P+ weakly yellowish. Atranorin . 44
- 40 Lichen almost only on quaking aspen, reminiscent of *L. carpinea*. Thallus gray, often with whitish prothallus. ap. -1 mm, pale yellowish-brown, light brown to brown-rose, (young) gray-white pruinose, \pm flat, permanently margined. Epithym. with small crystals. Sp. 10-16 x 6-7 μm . 2,5-Dichlorolichexanthone – bor(mieur) – v.rare; Sju, possibly süSch .
- L. populicola**
(DC.) Duby (*L. distans* (Ach.) Nyl.)
- 40* With other characteristics. Without white prothallus 41
- 41 Ap. often whitish pruinose, sessile (with narrowed base), rose-brown, light to dark brown, brown-gray, numerous, but rarely grouped, 0.3-0.6(0.8) mm, flat to concave, with definite, whitish pruinose, permanent, often granular margin. Thallus whitish to gray, rarely brown-gray. Epithym. brownish. Sp. 7.5-12(15) x 4.5-6 μm . Ch- or Ch as *L. dispersa* . **L. hagenii**
- 41* Ap. nonpruinose, red-brown, brown, yellow-brown, yellow-red, often crowded and laterally touching 42
- 42 Epithym. with overlaid of inspersed small granules, which are soluble in K, red-brown, brown, olive. Ap. pale red-brown, rose-brown, yellow-red, even darker brown-red, usually -0.7 mm, long time flat and clearly margined, margin gray to pale yellowish (as a rule, most ap. with yellowish tinge), rarely greenish to brownish, often somewhat crenate. Hym. usually up to 60 μm high. Sp. 7-13 x 4-6(7) μm . Thallus definite to indefinite. With an abundance of algae in the ap. margin. Isousnic acid **L. saligna** (14)
- 42* Epithym. red-brown (colorless in K), without such granules. Ap. red-brown, brown, broadly depressed sessile, at first concave and thickly margined, later flat, with thin margin. Margin light gray to brown. Thallus thin, whitish to gray. Algae commonly only penetrating into the base of the margin 43
- 43 Sp. to 8-16-32, (6)9-12 x 4-7 μm . Ap. usually with whitish to gray, later irregular, finally disappearing, corticate thalloid margin, -0.6 mm □ **L. sambuci**
- 43* Sp. to 8, 6-10 x 4.5-7 μm . Ap. margin usually of the same color as the thallus, decorticate. Ap. -0.4 mm. Young disk often only □ **L. persimilis**
- 44 Medulla of the ap. margin and lower hym. filled by a small mass and smallest crystals, thereby gray, without large crystal complexes. Epithym. not covered by a layer of fine crystals, brown (unaltered in K) to scarcely colored. With Atranorin only, eventually with additional unknown substances . 45
- (See diagram in text, page 464)
- 44* Medulla of the ap. margin and under the hym. with large, irregular crystals. Atranorin, Gangaloidin, \pm Roccellic acid, \pm Californin 47
- 45 Sp. 9.5-13(14.5) x (5.5)6-8 μm . Ap. -0.6(1.2) mm, soon convex, dark red-brown to almost black. Cortex in the lower part of the receptacle strongly developed (50-100 μm thick), strongly swollen, crystals from the medulla radiating up into the cortex. *! **L. glabrata** (Ach.) Malmé
- 45* Sp. and ap. at least partially larger 46
- 46 Sp. (10)13-19(21) x (6)7-10(11) μm . Ap. (0.6)0.9-2(3) mm, with thick, raised, incurved over disk, usually clearly and irregularly crenate, often wavy distorted margin, with strongly narrowed base. Cortex not clearly separated from the ap. medulla, in places 30-40 μm thick, at the base 50-75(90) μm thick, strongly swollen. Disk

dark red-brown, dark red-orange, flat. Epithym. colorless or red-brown. Thallus moderately to rather thick, whitish, smooth to uneven.

□ **L. allophana**

- 46* Sp. (11)12-15(17) x 5.5-9.5 µm. Ap. smaller, 0.5-1.2 (2.5) mm, margin usually less strongly wavy than in the case of the former, less often incurved. Cortex clearly separated from the ap. medulla, in places 18-20 µm thick, at the base 40-85(150) µm thick. ±Triterpenoide

* **L. horiza**

- 47 Hym. with overlaid brown granules above, which are soluble in K, often scarcely colored. Ap. 0.5-1.0(1.5) mm, pale brown, yellow-brown, beige, brown-orange, red-brown, commonly not pruinose, often even discolored by parasite attack, with usually thick permanent, ± crenate or warty or wavy margin, relatively broadly sessile, often closely crowded. Thallus white, gray to yellowish-gray, coherent, granular warty or of scattered areoles, clearly delimited. Sp. (9)11-15(18) x 6-9(11) µm, wall ca. 1.2-1.4 µm thick

* □ **L. chlarotera**

- 48 Margin usually strongly projecting, soon strongly and regularly crenate, whitish. Ap. 0.8-1.5(2) mm, very numerous, sessile with strongly narrowed base. Thallus usually relatively granular to coarsely warty. Sp. (10)11-16(18) x (6)7-8.5(10) µm, wall (0.8)1-1.2 µm.

* **L. subrugosa**

- 48* Margin usually not strongly projecting, not or only irregularly crenate, commonly not wavy deformed, (crystal complexes sometimes sparse or in the case of forms with small and scattered ap. (f. *glabrata*) almost lacking. Thallus at the margin relatively smooth, toward the center uneven. Sp. (10.5)11.5-14.5(17.5) x (5.5)6.5-8.5 µm, wall 0.6-0.8 µm

* □ **L. argentata**

Ecology and Distribution of the Species

Lecanora agardhiana Ach.

On calcareous rock in submontane to alpine sites on well lighted habitats, like *Caloplaca agardhiana* (↑), *Verrucaria marm.* (↑), above all in the Rinodinion imm. – s'mieur-med(mo) – rare; Sju, Ju, FrJu, Al

Lecanora albella (Pers.) Ach. (*L. pallida* (Schreber) Rabenh.)

Up into the montane, rarely high montane sites on mostly smooth to flat cracked bark of deciduous trees and spruce in the interior of forests or on correspondingly shady habitats, often in moist valleys, stream side stands, meadow trees, beech- and beech-spruce forests, not on eutrophied bark (avenue), m.acidoph., r.-

v.hygroph., m.-r.ombroph., r.skioph.-m.-photoph., anitroph., Graphidion-association, e.g. Graphidetum, Lecanorion subf. – s'bor-med-mo – r.rare (3); in B.-W. scattered, Vog, rare Pf, RhSch, in dry regions ± lacking

Lecanora albescens (Hoffm.) Branth & Rostrup (*L. galactina* Ach.)

Up to above the tree line on moderately to very calcareous rock, dust encrusted silicate rock and artificial stone, even on processed wood, on rather to extremely eutrophic sites, center of concentration on anthropogenic substrates (walls, grave edgings, fence posts, etc.), especially on mortar, stone walls, dust encrusted concrete, asbestos cement, next to *Caloplaca citrina* and *C. decipiens* the most dung tolerant species (next to manure heaps “urine tolerant”), on near natural habitats limited to rain protected up to moderately rain exposed overhangs and vertical surfaces, e.g. with *Caloplaca cirrochroa* (↑), (neutroph.-)basiph., xeroph.-mesoph., photoindiff., Caloplacion dec. – bor-med – frequent

Lecanora allophana Nyl. (with f. *sorediata* Schaerer ex Vainio)

Up into the montane, rarely high montane zone on subneutral to moderately acid, commonly cracked, often moderately dust impregnated bark on free or open standing deciduous trees, above all on ash, Norway maple, elm and poplar, especially on streets, on lower sites often on walnut, rather like *Parmelia acetabulum*, subneutroph.-m.acidoph., r.xeroph.-mesoph., r.photoph., m.nitroph., Xanthorion par. – bor-med – r.rare (3); above all Ju, Ne, Sch, otherwise usually rare

Lecanora anopta Nyl. (*Lecidea a.* (Nyl.) Lettau)

In the high montane-subalpine zone on decaying wood, above all on decorticate trunks, like *Xylographa par.* (↑), rarer on conifer bark, Char. Lecanorion variaie – bor-mieur-mo – rare; süSch, Alps

Lecanora argentata (Ach.) Malme (*L. subfuscata* H.Magn.)

Up into high montane sites on deciduous trees above all with smooth and flat cracked bark (beech, hornbeam, ash) as well as spruce usually in forests and shrubbery, e.g. like *Pertus leiopl.* (↑), *P. flavida* (↑), and *L. intumescens* (↑), but of broader ecological amplitude, optimal on m.acid, moderately to rather well lighted, dust free

habitats, r.photoindiff., a-(m.) nitroph., above all in the Graphidion, Lecanorion subf. – s'bor-med – m.frequent (+)

Lecanora bicincta Ram. (*L. sordida* var. *bicincta* (Ram.) Th.Fr.)

On vertical surfaces and overhangs on hard silicate rock in alpine, rarely high montane sites – bor-alp – v.rare (R); süSch, Alps

Lecanora cadubriae (Massal.) Hedl. (*Lecidea* c. (Massal.) Nyl., possibly *L. phaeostigma* (Körber) Almb., *L. obscurella* (Sommerf.) Hedl.)

In high montane, high precipitation, climatically temperate relatively continental tinged sites on conifer bark (above all on the trunk) as well as on decorticate trees/stumps, in fir forests and (Alps) larch forests, on cold, often foggy habitats, r.-v.acidoph., r.skioph.-m.photoph., r.anombroph., often producing a covering stand, e.g. in the *Lecanorion varia*, *Parmeliopsidetum* – bor-mieur-h'mo, subko – ?süSch, BayW, Alps – The indication of *L. phaeostigma* for *O. nöRh*, *Fr* requires further investigation. The K-reactions indicated in the literature are identical for both species and are based on Norstictic acid

Lecanora campestris (Schaerer) Hue

Foothills to submontane, usually warm and mild sites, rarely higher, on basic or dust impregnated or slightly calcareous silicate rock, almost only on anthropogenic substrates, like *Lecidella carp.* (†), but warmth loving, in the *Lecidelletum carp.* – bor-med – r.rare to m.frequent; above all Ne, SFW, Hü, Fr, Rh, Pf, RhSch, HeBgl, rare in the lime region

Lecanora carpinea (L.) Vainio

Up to the tree line on deciduous trees and spruce, above all on smooth and flat cracked bark, on branches and above all younger stems, optimal on m.acid substrates, especially on ash, hornbeam, sycamore, *Sorbus*, alder, fruit trees, even on wood, r.euryök, r.photoindifferent, r.xeroph.-hygroph., a-/m.(r.)nitroph., toxitol., Char. *Lecanorion* subf., often also in the *Xanthorion* par. – bor-med-mo – frequent

Lecanora cenisia Ach. (incl. *L. atrynea* (Ach.) Nyl. *L. c. f. transcendens* (Nyl.) Migula)

In high montane and alpine, high precipitation, rarely even montane sites, on lime-free silicate rock, predominantly on shady (but often relatively well lighted) vertical surfaces and overhangs, but even in the open, then usually on

very long-time snow covered habitats, or rarely on tough decayed wood (boards, shingles), e.g. with *Lecanora varia*, m.-r.acidoph., r.-v.hygroph., ombroph.-r.anombroph., r.skioph.-r.photoph., a-(m.)nitroph., e.g. *Rhizocarpion* alp., *Chrysotrichetalia chlor.* -- arct-mieur-h'mo/alp(-med-h'mo/alp) – rare; Vog, süSch, nöSch, Ju, Mos, Eif, Erz, BayW, Al

Lecanora chlarotera Nyl. (*L. rugosella* Zahlbr.)

Up into the high montane zone, above all on free standing deciduous trees, v.euryöke lichen, on dusty avenue- and field-trees (above all maple, ash, linden, poplar, pear trees, in orchards, subneutroph.-m.acidoph., like *Lecidella el.* (†), and *L. carpinea* (†), but rarer in forests, above all in the *Physcietalia* adsc., in the *Lecanorion* subf. – bor-med – frequent

Lecanora cinereofusca H.Magn. (*L. degelii* Schauer & Brodo)

In high montane and montane, very high precipitation, oceanic sites on smooth and flat cracked bark of deciduous trees (beech, sycamore), rarely spruce, on habitats like *Lobaria ampl.* (†), *Nephroma* (†), but not going over to mosses – Mieur-pralp-med-mo, oz – v.rare; Al, süSch?

Lecanora circumborealis Brodo & Vitik.

(*L. coilocarpa* auct.)

In montane and high montane, high precipitation sites on processed wood, decorticate stems and acid bark above all on conifers, often on twigs (especially of moor pine, fir, e.g. with *Usnea*-species, *Cetraria sep.*), often on foggy, cold sites, on wood like *Lecidea turg.* (†), *L. varia* (†), m.-v.acidoph., r.photoindiff., anitroph. – bor-smed-h'mo(-med-h'mo), (subko) – rare (2); süSch, Eif, Av, Al

Lecanora conizaeoides Nyl. ex Crombie

(*L. pityrea* Erichsen)

Up into the montane zone on r.-e.acid bark on deciduous- and conifer trees, occasionally even on acid silicate rock, especially on substrates strongly acidic because of acid air pollution (SO₂), climatically v.euryöke, in shady forests as well as free-standing trees, eutrophic bark residing first in the case of stronger acidification, v.toxitol., the most widely penetrating epiphytic lichen into industrial and urban regions, v.xeroph.-r.hygroph., m.ombroph.-r.anombroph., r.photoindiff., anitroph.-m.(r.)nitroph., Char. *Lecanoretum* con.,

penetrating into numerous acidoph. associations – (bor)mieur-smed – r.frequent; v.frequent in air polluted regions, v.rare in clean air regions (under 10 µg SO₂/m³)

On *L. conizaeoides* the fungus □ *Athelia arachnoidea* (Berk.) Jülich and algae of the *Protococcus*-type produce fungus-like, whitish, circular flecks, in which region the attacked lichen and the algae layer die. The infecting fungus reaches over 5 cm in diameter, above all in the autumn in regions near towns.

Ap. infected by the fungus *Lichenocodium lecanorae* (Jaap) Hawksw. are colored blackish

Lecanora crenulata Hooker

Up into alpine sites on calcareous rock, above all on rather rain protected vertical and overhanging surfaces, like *Caloplaca cirr.* (↑), isolated also on walls, in the Caloplacetum cirr., Dirinetum, Caloplacetum sax, etc. – (arct-)bor-med – r.rare; Ju, Sju, FrJu, Mn, Th, otherwise (v.)rare (e.g. Rh, Hü, Ne, Saar, Pf, Eif, He)

Lecanora demissa (Flotow) Zahlbr. (*L. incusa* (Flotow) Vainio)

Up into montane sites on slightly calcareous or distinctly basic silicate rock on warm, m.-r. sunny, m.rain exposed to rain protected, sometimes v. short time irrigated vertical- and overhanging surfaces, usually on a south exposure, subneutroph.-neutroph., r.xeroph. (-mesoph.), thermoph., m.nitroph., Char. Lecanoretum dem. – mieur-subko-smed(-med) – rare; Sch, Bo, Vog, PfW, nöPf, O, Sp, Mos, MRh-Ts, Lahn, Eif, He, Vgt, v.rare Erz

Lecanora dispersa (Pers.) Sommerf.

Very euryöke species on calcareous or (lime) dust impregnated rock, natural and artificial stone, on rocks as well as small stones, mortar, concrete, bricks etc., even on eutrophied wood, like *Candelariella aurella* (↑), *Lecidella stig.* (↑), pioneer, basiph., in the Caloplacion dec., Aspicilion calc. and many other associations. – arct-med – v.frequent and widespread

Lecanora dispersoareolata (Schaerer) Lamy

In alpine, rarely high montane sites on slightly calcareous or basic silicate rock on well lighted habitats, subneutroph.-m.basiph. – mieur-alp – v.rare (R); süSch (Feldberg), Alps

Lecanora epanora (Ach.) Ach.

In sub- to high montane (alpine), usually high precipitation sites usually on distinctly heavy metal rich sites, metamorphic, rarely magmatic silicate rocks on moderately rain exposed to rather rain protected vertical- and overhanging surfaces, even on rarely and short-time irrigated sites, often as a pioneer on exposed rock surfaces, r.-v.(e.)acidoph., r.hygroph., (r.skioph.)m.-r.photoph., a-(m.)-nitroph., Char. Lecanoretum ep. – bor-smed – rare; süSch, BayW, Erz

Lecanora epibryon (Ach.) Ach. (incl. var.

bryopsora Doppelb. & Poelt)

Commonly above the tree line on plant detritus, rarely in montane sites on mossy limestone, on well lighted, but usually not completely sunny habitats, e.g. with *Caloplaca still.* (↑), – mieur-pralp – v.rare (2); Ju, FrJu, He (Meissner foothills), additionally Al

Lecanora expallens Ach. (*L. conizaea* (Ach.) Nyl., non auct.)

Up into montane sites above all on deciduous trees, euryöke lichen, on poorly lighted to well lighted, little rain exposed to rain protected, usually humid habitats on v.acid to subneutral substrates, primarily above all on rather uniformly humid, shady habitats, above all in cool-moist valleys in mild winter regions, strongly spreading in the last ten years, because of the favorable impact of air pollution, v.toxitol., r.skioph.-m.(r.)photoph., hygroph., anitroph.-m.nitroph., e.g. in the Graphidion – s'bor-sub-atl-med, (oc) – frequent

Lecanora frustulosa (Dickson) Ach.

In high montane to alpine sites on slightly calcareous silicate rock, above all on fissured, m.-r.well lighted vertical surfaces – arct-alp (paralp) – v.rare (1); süSch (1x)

Lecanora gangaleoides Nyl.

In foothills and submontane, mild winter sites on lime-free silicate rock, in the region above all on sandstone (porous substrate with higher water capacity), usually on moderately rain exposed vertical surfaces, like *Ochrolechia par.* (↑), e.g. in the Lecanoretum orostheae – mieur(atl)-med-subatl – rare (R)*; PfW, Vog, nöSch, O, Bit, Eif

Lecanora garovaglii (Körber) Zahlbr.

In foothills and submontane sites on slightly calcareous or basic or dust impregnated silicate rock on sunny, warm habitats, usually on

horizontal- and steep surfaces, rather like *Physcia wainioi* (↑), subneutroph.-neutroph., xeroph., Char. Lecanoretum argoph. – s'mieur-med – v.rare (1); Rhön, O, Mn, nöPf, MRh, Mos, Eif

Lecanora gisleriana Müll.Arg. em. J.Steiner (L. gisleri Poelt & Ullrich)
On heavy metal rich rock on the thallus of *L. subaurea* (↑), Char. Acarosporium sin. – bor-mieur – v.rare (1); süSch, Hz, Erz, Alps

Lecanora hagenii (Ach.) Ach. (?L. umbrina (Ach.) Massal.)
On subneutral, mineral rich or correspondingly eutrophied, dusty bark of deciduous trees, above all on avenue- and field trees, on non eutrophic habitats above all on elder, popular (e.g. with *Lecania*-species), concentrated on the base in the case of trees with eutrophied, primarily acid bark, even on wood, occasionally even on calcareous rock, subneutroph.-basiph., m.-v.photoph., r.xeroph.-mesoph., (a-)m.-r(v.)nitroph., in relatively foliose lichen poor Xanthorion-associations., above all Xanthorietum cand., *X. fallax*-stands, in the Lecanoretum samb., Lecanoretum symmictae – bor-med – (r.)frequent; sparse in forested regions

Lecanora horiza (Ach.) Lindsay
In foothills, warm summer sites on m.acid to subneutral or correspondingly eutrophied bark or deciduous, rarely conifer trees on well lighted habitats, usually on dust impregnated avenue trees (e.g. with *Physconia dist.*), but also as a pioneer on branches (e.g. with *L. carpinea*), in the Xanthorion – s'mieur-med, subatl – rare; Rh, Mn

Lecanora hypoptoides (Nyl.) Nyl.
Probably like *Lecidea turgidula* (↑), – bor-mieur-mo(-smed-mo), (subko) – rare; süSch, Eif, *MI*

Lecanora impudens Degel. (L. allophana f. soledata auct. p.p.)
Like *L. allophana* (↑), but avoiding precipitation poor sites, above all on free standing ash, above all in the Parmelietum ac. – mieur-med – (r.) rare (3); e.g. Ju, Sch, Bo, SFW, Ne

Lecanora intricata (Ach.) Ach.
Very euryöke lichen, like *Protoparm. badia* (↑), *Umbilicaria polyph.* (↑), Char. Umbilicarietalia cyl. –arct-bor-h'mo/alp – r.rare (3); Sch, Vog,

BayW, Erz, additionally rare Rhön, ThW, Ts, Eif, Hu, Al, otherwise v.rare (e.g. O, MRh)

Lecanora intumescens (Rebent.) Rabenh.
Predominantly in sub- to high montane sites on smooth and flat cracked bark of deciduous trees, above all on beech, mountain ash, ash, sycamore, subneutral, v.mineral rich as well as avoiding strongly acid bark, usually in the interior of deciduous forests (above all beech- and beech-spruce forests) or on correspondingly shady sites (e.g. brook side tree stands in moist valleys), m.acidoph., r.skioph.-m.(r.)photoph., r.hygroph., anitroph., in the Graphidion, Lecanorion subf. – bor-med-mo – r.rare (+), rare in foothills sites (++)

Lecanora lojkaeana Szat.
Rather like *L. subradiosa* (↑), -- bor-smed – v.rare(R); süSch, *FrJu*

Lecanora mughicola Nyl.
In high montane-subalpine, high precipitation sites on tough wood, hard wood (processed wood, decorticate stems and branches of conifers), like *Xylographa par.* (↑), often with *L. varia*, *L. pulicaris*, *Parmeliopsis amb.*, in the Xylographetum vit. – mieur-h'mo – rare (3); süSch, Al

Lecanora muralis (Schreber) Rabenh. (L. saxicola (Pollich) Ach., Placodium x. (Pollich) Körber)
Euryöke, subneutroph. -basiph., nitroph., v.toxitolerant lichen on calcareous as well as dust impregnated or dunged rock species on m.-very well lighted, rain exposed habitats, above all on steep- and horizontal surfaces of smaller rocks, frequent on wall crowns, tomb stones, fence posts, roof shingles etc., penetrating deep into the city, even on lime-free silicate rock (bird roosts, basic silicate), both on very dry and even on sporadically flooded sites in the uppermost amphibious zone of brooks, rarely also on eutrophied wood or at the base of trees, xeroph. (-mesoph.), (m.)r.-v.nitroph., sociologically widely increasing, e.g. in the Aspicion calc., Lecidelletum carp., Candelarielletum cor. – arct-med – frequent

Lecanora orosthea (Ach.) Ach. (Lecidea o. (Ach.) Ach., L. sulphurea var. 0. (Ach.) Flagey)
Up into (high) Montane sites on r.-v.rain-sheltered vertical- and overhanging surfaces on lime-free silicate rock on r.-v.humid,

m. well lighted habitats, light loving and hygrophytically less demanding than *Psilolechia luc.*, m.-r. acidoph., (r.) m. photoph.-r. skioph., anitroph., -- (s'bor-)mieur-med-mo – r. rare; Sch, Vog, Pf, RhSch, O, Sp, He, ThW, Erz, BayW

Lecanora pannonica Szat.

In the foothills and submontane, rarely montane sites on (often mineral rich) silicate rock especially on moderately rain exposed vertical surfaces on moderately to rather well lighted habitats, entirely predominantly on anthropogenic substrates (above all on tomb stones of sandstone, walls), in the Lecanoretum rup., e.g. with *L. sulphurea*, m. acidoph.-subneutroph., a-/m. nitroph. – mieur – (r.) rare; Ne, SFW, Ju, Sch, O, Rh, Mn, Eif etc.

Lecanora persimilis (Th.Fr.) Nyl.

Up into montane sites on subneutral bark of deciduous trees, above all smooth bark ash, hornbeam, poplar, on well lighted habitats, like *L. sambuci* (↑), -- subneutroph.-neutroph., m.-r. photoph., a-/m. nitroph. -- s'bor-med – r. rare (3); in little air polluted regions, above all Ju, Ne

Lecanora piniperda Körber (*L. glaucella* (Flotow) Nyl.)

On processed wood, on tree stumps, on bark on the stem and often also on the branches of conifers, rarely on deciduous trees with mineral-poor bark, often on *Pinus*, from the sub- up into the high montane zone, r.-v. acidoph., m.-r. photoph., anitroph. – bor-mieur-med-h'mo – rare (2); Ju, Sju, Sch, Av, O, Ts, Th-Mn-T, Eif, Th

Lecanora polytropa (Ehrh. ex Hoffm.) Rabenh.

Euryöke specie commonly on lime-free silicate rock up into the alpine sites, like *Rhizoc. geogr.* (↑), more frequent than it on anthropogenic substrates, Char. Rhizocarpetea – arct-med – m.-r. frequent, frequent in silicate rock regions

Lecanora pruinosa Chaub.

In montane sites on scarcely rain exposed vertical and slightly overhanging surfaces of limestone, basiph., r. photoph., a-/m. nitroph. – mieur-alp/paralp-med – v. rare (R); Ju, additionally Alps, Westf

Lecanora pseudistera Nyl. (*L. riparti* sensu Poelt, non Lamy)

In foothills, warm, lower precipitation sites on mineral-rich or slightly calcareous silicate rock on south exposed, protected, dry-warm habitats, subneutroph., xeroph., e.g. like *Rhizoc. disp.* (↑),

Lecanora dimissa (↑), – s'mieur-med – v. rare (0); Eif, MRh-Mos, O

Lecanora pulicaris (Pers.) Ach. (*L. pinastri* (Schaerer) H. Magn., *L. chlarona* auct.)

Up into the subalpine zone on acid bark and on tough decayed wood, on conifer- and deciduous trees, often also on thin twigs, avoiding eutrophic sites, therefore scarce on dusty avenue trees, secondarily spreading on deciduous trees with bark originally subneutral to m. acid, acidified by emissions, r.-v. acidoph., hygroph.-mesoph., photoindiff., a-(m.) nitroph., above all in the Lecanorion *variae* and *L. subfuscae*, in impoverished Hypogymnieta associations – bor-med-mo – r. frequent; rare in dry-warm regions

Lecanora reagens Norman

On rather rain sheltered, but usually sporadically short-time irrigated overhanging surfaces on slightly calcareous or mineral-rich, often hard silicate rock in subalpine and alpine sites, subneutroph., m.-r. photoph. – bor-mieur-alp – v. rare (1); süSch

Lecanora rubida V. Wirth

On iron-rich rock, like *L. soralifera* (↑), – mieur – v. rare (2); süSch, Vog, Vgb

Lecanora rupicola (L.) Zahlbr. (*L. sordida* (Pers) Th.Fr., *L. rupicola* auct., *L. glaucoma* (Hoffm.) Ach.)

ssp. **rupicola**

Up into the alpine zone on usually lime-free, but mineral-rich silicate rock on horizontal- to vertical surfaces, rarely overhangs, above all on moderately nutrient rich sites, e.g. on bird roosts, slightly dust impregnated rocks, even on wall stones, cross-road markers, etc. (hemerochor in lime regions), like *L. sulphurea*, but of broader ecological amplitude, subneutroph.-m(r.) acidoph., photoph., Char. Lecanoretum rup., in the Candelarielletum cor., Parmeliatum consp. et al. – arct-med – r. rare (-m. frequent); throughout the entire region

ssp. **subplanata** (Nyl.) Leuck. & Poelt (*Lecanora subplanata* Nyl.)

In sub- to high montane sites on hard silicate rock above all on moderately rain exposed vertical surfaces on well lighted, often sunny and warm, but even wind exposed habitats, m. acidoph.-subneutroph., (a-)m. nitroph., e.g. in the Lecanoretum rup., Pertusarietum asp.-flav., Lecanoretum or. – s'bor-med – rare; süSch, Vog, nöPf, Eif, Rhön, He, ThW

Lecanora saligna (Schrader) Zahlbr.

Up into the subalpine zone;

var. **saligna** (L. effusa (Hoffm.) Ach.) above all on tough, hard wood, like *L. varia* (↑), often on cross-cuts; var. **sarcopis** (Ach.) Hillm. (L. sarcopis (Ach.) Ach.) above all on stems of free-standing deciduous trees (street, field, orchard) on slightly eutrophic sites, above all on poplar, linden, pear trees, even oak, r.euryök, e.g. like *Parmelia flav.* (↑), *Physconia perisidiosa* (↑), *Ramalina poll.* (↑), r.toxitolerant, m.-r.acidoph., photoph., xeroph.-mesoph., above all in the Parmelietum cap. and its impoverished forms, Buellietum punct., Physcietum adsc. – bor-med-mo – m.frequent

Lecanora sambuci (Pers.) Nyl.

Up into the (high-) montane sites on subneutral mineral-rich bark (above all elder, poplar, smooth bark ash) or moderately eutrophic bark, like *Lecania cyrtella* (↑), commonly residing in small, smooth sites, regressing in regions with polluted air, Char. Lecanoretum samb. – (s'bor-)mieur-med – r.rare-m.frequent (3); e.g. Hü, Ne, Ju, Rh, Vog, Sch, SFW

Lecanora sarcopidioides (Massal.) A.L.Sm.

(L. metaboloides Nyl.)

Above all on the bark and on wood of conifers, rather like *L. piniperda* (↑), – s'bor-mieur – rare; süHü, süSch, O, Th, Sju

Lecanora silvae-nigrae V.Wirth

In montane to alpine sites on steep- and (rain exposed) vertical surfaces on usually sunny, at least rather well lighted habitats in crustose lichen rich stands, rather like *Umbilicaria cyl.* (↑), – mieur-h'mo/alp-med-alp – rare (2); süSch, Vog, BayW

Lecanora soralifera (Suza) Räsänen (L.

intricata var. s. Suza

Above all in montane and high montane sites on lime-free, iron-rich silicate rock, preferably on smaller rocks, boulders and stones on long time dew moistened or very high precipitation, cool-moist habitats, often in boulder fields, above all on basalt, graywacke, schist, and other mineral-rich rocks, m.-v.acidoph., (substrathygraph.), ombroph., m.-r.photoph., anitroph., Acarosporium sin., Lecideetum lith., Rhizocarpetum alp. – bor-atl-mieur-smed – rare (3); süSch, Vog, He (e.g. Vgb, Rhön, Meissner), Sp, Pf, RhSch, BayW, Erz, Hz

Lecanora strobilina (Sprengel) Kieffer (L. conizaea auct., non (Ach.) Nyl. ex Crombie)

On acid bark of deciduous- and conifer trees and on wood, above all on *Pinus* in open forests, r.-v.acidoph., anitroph. – mieur-med, subatl – (O); Sch, Ju, Hü, Ne, O, Rh, Eif, Lux, Thü, MI

Lecanora subaurea Zahlbr. (L. aurea Eitner, L. hercynica Poelt & Ullrich)

Above all in high precipitation montane sites on heavy metal rich lime-free silicate rock, e.g. on iron-rich basalt, predominantly on smaller boulders and rocks (dew moistened!), rarer on contiguous (sometimes also sporadically slightly irrigated) rocks on m.-v.well lighted habitats, m.-v.acidoph., ombroph., (substrathygraph.), anitroph., Char. Acarosporium sin. – bor-mieur(-med) – rare (2); süSch, Vog, He (e.g. Vgb, Rhön), BayW, Sauerl, Erz, Hz

Lecanora subcarnea (Lilj.) Ach.

Up into montane sites on rain sheltered overhangs on lime-free silicate rock on humid, away from the sun, but relatively well lighted habitats, in moist valleys, in forests, preferably on mild climate, rather oceanic sites, m.-r.acidoph., anombroph., m.photoph.-r.skioph., anitroph., Char. Lecanoretum orosthae, e.g. often with *Haematomma ochr.* – s'bor-subatl-mieur-subatl-med-mo – rare; above all Sch, Vog, Pf, RhSch, additionally O, Lahn, Rhön, ThW, Erz, Th, Al

Lecanora subcarpineae Szat.

(L. nemoralis Makar., L. leptyroides auct. p.p.)

Above all in montane sites on mineral-rich bark, above all quaking aspen, ash, on well lighted, cool to cold, also foggy sites, subneutroph., anitroph., e.g. in the Lecanorion subf. – s'bor-med-mo – (v.)rare (3); süSch, Saar, Eif, He, Do, Al, FrJu

Lecanora subrugosa Nyl.

Up into the high montane zone on bark of deciduous trees and spruce in humid forests, especially on ash in brook border ash stands, on beech, hornbeam, oak, m.acidoph., r.skioph.-m.photoph., in the Lecanorion subf., Graphidion – bor-med – r.rare(-m.frequent) (+); regionally (++)

Lecanora sulphurea (Hoffm.) Ach. (Lecidea s. (Hoffm.) Wahlenb.)

Above all in submontane and montane sites on lime-free, neutral to basic or moderately dunged or slightly calcareous silicate rock, also on calcareous carbonate rock and (rarely) on walls, preferably on crystalline, rather hard rock, on sunny, rather warm steep- to above all moderately rain exposed vertical surfaces, also parasitic (e.g. on *Tephromela atra*, *grumosa*), subneutroph.-m.acidoph., m.ombroph., xeroph., r.-v.photoph., m.nitroph., above all in the Lecanoretum rup. – mieur-med(mo) – (r.)rare (3); Sch, Vog, Ne, Ju, nöHü, nöPf, O, Sp, He, PfW, Pf, RhSch, Al

Lecanora Swartzii (Ach.) Ach. (*L. subradiosa* auct.)

above all in the montane and high montane zones, but also occasionally higher, in lower and middle elevation sites like *L. subcarnea* (↑), *L. orosthea* (↑), yet more frequent also even on moderately rain exposed surfaces, on mild as well as on cold sites, Char. Lecanoretum or. – (arct)bor-med-mo – rare; Sch, Vog, Ju, PfW, O, RhSch, ThW, BayW

Lecanora symmicta (Ach.) Ach. (*Lecidea* s. (Ach.) Ach., *Biatora* s. (Ach.) Fr., incl. var. *symmicta* (Nyl.) Zahlbr.)

var. **symmicta**

Up into the subalpine zone on bark of deciduous and conifer trees and on wood, r.euryöke species, above all on acid, non eutrophic substrates, on smooth to flat cracked bark, on stem and on branches, even readily on shrubs (*Calluna*), (subneutroph.-)m.-r.(-v.)acidoph., above all in the *Lecanoria varia*, *Lecanoria* subf., *Xylographetum* vit. – bor-med – moderately frequent

var. **aitema** (Ach.) Th.Fr. (*L. aitema* (Ach.)

Hepp) In montane and high montane sites on dwarf shrubby heath, above all on *Calluna*, on branches of trees (e.g. *Sorbus*), on wood – bor-mieur-mo – rare; Sch, Vog

Lecanora varia (Hoffm.) Ach.

Up over the subalpine zone on tough, hard wood (decorticate stumps, stems, boards, posts) and on acid, not or only moderately eutrophied, usually smooth and relatively hard bark of deciduous-rarely conifer trees, e.g. readily on mountain ash, on well lighted, rain exposed habitats, today becoming rare on lower sites, (m.)r.-v.acidoph., (M.)r.-v.photoph., xeroph.-mesoph., a-/m.nitroph., Char. *Lecanoria varia* – bor-med-

mo – r.rare (3); above all Sch, Vog, Al, otherwise rare or (+++)

Lit.: BRODO 1984, EIGLER 1969, FRIES 1871, LEUCKERT & POELT 1989, MIGULA 1929-31, POELT 1952, POELT & VEZDA 1977, 1981, PURVIS et al. 1992

Lecidea Ach.

(Key incl. *Biatora*, *Farnoldia*, *Fuscidea*, *Hypocenomyce*, *Lecidella*, *Lecidoma*, *Melanolecia*, *Micarea* p.p., *Miriquidica*, *Psora*, *Rimularia*, *Schaereria*, *Trapelia*, *Trapeliopsis*, *Tremolecia* et al.)

Introduction

The very extensive and heterogeneous composite genus *Lecidea* in the earlier sense was characterized by the character combination crustose thallus, apothecia without thalloid margin and single celled spores. It included thereby numerous different naturally related groups. In the last ten years the most of these groups have become independent genera. The criteria are first of all the character of the ascus-, paraphyses- and construction of the excipulum as well as the chemical domain. Even after dividing out numerous genera there yet remains, , short of a satisfying clarification, a series of additional species in this genus of near *Lecidea*-species in the narrow sense. *Lecidea* in the narrow sense includes on rock-dwelling taxa with black, rarely brown-black apothecia.

Of perhaps 11 (according to other points of view on species 12) verified species of *Lecidea* s.str. in Germany, eight occurring in Baden-Württemberg. They reside consistently on silicate rock. *L. lithophila* and *L. plana* grow above all on smaller rocks and boulders on long time dew moistened or humid habitats, e.g. in boulder fields. First appearing frequently on exposed rocks on embankments and may be counted as a typical pioneer lichen. *L. sarcogynoides*, which likewise grows especially on smaller rocks and boulders, is limited to warm to mild sites. *L. plana* and *L. lithophila* are distributed in North- and Central-Europe with the high point of concentration in the western parts. *L. sarcogynoides* occurs from the Mediterranean region over Western Europe up to South Sweden. *L. confluens* is limited to high

mountain sites and grown on snowy, shaded sites. *L. silacea* claims heavy metal rich silicates and is very rare in extra alpine Central Europe e.g. still occurring in the Harz, Erz Mountains, Bohemian Forest and in the Sudetic Mountains. The area of *L. confluens* and *L. silacea* stretches over the Arctic, the boreal zone and the corresponding sites in Central- and South Europe; here they are strongly disjunct. A similar distribution picture is shown by *L. tessellata* and *L. lapicida*, which at best reside in mountain sites on well lighted habitats. *L. fuscoatra* is widely distributed in the silicate region and has its extensive area on anthropogenic substrates in rock-free regions. *L. speirodes* and *L. umbonata*, lichens with distribution high point in the Central- and South-European alpine mountains, is known from the Allgäu Alps

The additional species still remaining in *Lecidea* are crustose lichens with various colored apothecia with biatorin or lecideine proper margin and single celled (rarely up to two-celled) spores; lacking further common characters.

L. ahlesii, *L. atomaria*, *L. variegatula* are first residents on stones and sunny rocks. *L. fuliginosa* lives on open silicate rocks. These rock dwellers have their distribution concentration in the Central European deciduous forest region. *Lecidea lurida* which is widely distributed in Europe is located on calcareous substrates, above all in fissures of limestone. *L. scabridisca* lives on exposed silicate rocks in mountain sites. *L. albolivida*, *L. betulicola*, *L. nylanderii*, *L. pullata*, *L. turgidula* and *L. plebeja* which is known from the Allgäu are acidophytic bark lichens, which (with the exception of the little known *L. albolivida*, described from Central Europe) are resident in the boreal conifer zone and in corresponding higher sites in Central Europe; in South Europe they are lacking or are very rare. In southwest Germany they grow almost exclusively in mountain forests of the Black Forest and the Austrian Allgäu. *L. hypopta* is a boreal-montane wood dweller. *L. exigua* resides on deciduous tree bark, especially of hornbeam; the lichen is little known and occurs in Central- and South Europe.

Lecidea caesioatra grown on silicate rock dwelling mosses, *L. assimilata* and *L. limosa* live on naked soil and on soil mosses; all three are limited to snowy, cold sites, arctic-alpine distributed and occurring in extra alpine Central Europe as relicts on very few sites, thus *L. limosa* and *L. caesioatra* at Feldberg in the Black Forest

(the latter has disappeared); *L. assimilata* lacking in Baden-Württemberg, was however verified in the Austrian Allgäu.

Genus Characteristics of *Lecidea* s.str.

Thallus crustose, usually gray or brown, thin coherent to areolate, with *Trebouxia*(like) algae. Ap. black, rarely brown-black, the young at least with definite proper margin. Exc. interior ± colorless, the margin region dark, often brown, of radially lying, strongly swollen and cemented hyphae. Hyp. colorless to brown-black. Hym. I+ deep blue. Paraphyses simple, sometimes forked branched, strongly cemented, thickened above, pigmented. Asci (narrowly) clavate, thick walled, *Lecidea*-type; surrounded by a thin amyloid gelatin layer, tholus I+ pale blue, with K+ deep blue, narrow cap in the apex region at the border to the surrounding ascus wall, outer layer I+ blue. Sp. 1-celled, ellipsoidal to elongate, with central plasma bridge (pseudo diblastic). Pycnosp. short bacillar. Ch: often Depside, Depsidone.

Determination of the Species of the Composite Genus

To facilitate determination all the genera have been included in one key, which is divided into partial keys according to easily recognized ecological and morphological characters.

Oversight of the Partial Keys

- | | | |
|----|--|------|
| 1 | On soil, raw humus, plant detritus, mosses (even bark mosses . | PT 1 |
| 1* | On bark, wood or rock | 2 |
| 2 | On bark, wood . | PT 2 |
| 2* | On rock . | 3 |
| 3 | On calcareous rock .. | PT 3 |
| 3* | On silicate rock | 4 |
| 4 | Thallus not recognizable or very indefinite . | PT 4 |
| 4* | Thallus definite . | 5 |
| 5 | Thallus sorediate, with delimited soralia or disintegrating into soralia, or with cephalodia . | PT 5 |
| 5* | Thallus not sorediate, without cephalodia . | 6 |
| 6 | Thallus white, gray to blackish, greenish to yellowish | PT 6 |
| 6* | Thallus brown, gray-brown, ochre, rust color, brown-red, rust-red . | PT 7 |
| | Appendix: Lichen dwelling species . | PT 8 |

- 12 Sp. to 12-16 per ascus, spherical, 5-7 μm . Ap. dark brown to black, high convex, marginless, -0.5 mm, scattered. Hyp. brown, epihym. (often also hym.) brown to red-brown. Thallus very thin, when moist slimy and gray-yellowish to olive green. Ch- **Steinia geophana**
- 12* Sp. to 8 (rarely fewer), not spherical 13
- 13 Hym. in the upper part shining blue-green. Ap. convex-marginless, -1 mm. Hyp. K+ orange. High mountain species . 14
- 13* Hym. brownish to olive-green above 15
- 14 Thallus of small (0.1-0.2 mm thick) granules, rather thick, whitish to (dark)gray, often brown tinted, P-, K \pm yellowish, C-, medulla KC+ orange. Ap. blue-black, blue-gray, hemispherical. Sp. 12-18(25) x 5-7(9) μm . Hyp. colorless to red-brown. Sphaerophorin **L. caesioatra**
(*Micarea incrassata* Hedlund: Ap. without blue tine, algae only 4-7 μm instead of 6-12 μm , hyp. dark red-brown, K-, sp. 12-17 x 4-5 μm . Thallus Ch-, arct-alp, Alps)
- 14* Thallus coarsely warty-granular, areoles ca. 0.2-0.6 mm, whitish to light gray, P+ red, K-, C-, KC-. Ap. black, nonpruinose. Sp. 8-15 x 3.5-5 μm . Hyp. usually flecked brownish. Pannarin **L. limosa**
- 15 Sp. in part at least clearly over 7 μm wide. Commonly on naked soil 16
- 15* Sp. up to 7 μm wide 18
- 16 With *Nostoc*-symbionts. Thallus granular, olive, gray-brown, blue-gray. Sp. 11-19 x 6-9.5 μm .
↑ **Moelleropsis**
- 16* With green algae 17
- 17 Sp. 25-38 x 13-18 μm , colorless to brownish. Ap. hemispherical, marginless, brown to brown-black, -0.6 mm. Thallus finely granular, dark green to greenish brown, \pm gelatinous when moist. R-. Exc. weakly developed. Hym. 150-200 μm , colorless, vertically brown streaked. Hyp. pale brown. Paraph. thick. Ch- **Aphanopsis coenosa**
- 17* Sp. 16-32 x 6-14 μm , colorless. Ap. with robust margin, dark brown to black-brown, -3 mm. Thallus whitish. R- (Ap. C- rose-red in section) **Trapelia geochroa**
- 18 Thallus yellow-brown, brown to black-brown. Hyp. yellow-brown to dark brown. Hym. colorless to pale red-brown. Epihym. and exc. red-brown to brown, exc. paraplectenchymatous. Hymenial gelatin I+ green-blue. Ap. brown, red-brown to black, even rose, dull. Sp. 9-14(17) x 4.5-7 μm (*Saccomorpha*) . 19
- 18* Thallus whitish, gray, gray-greenish (in the case of high mountain lichens even reddish-gray to gray tinted red-brown or brown tinted and almost squamulose see 6), R- . 21
- 19 Thallus small warty to coarsely warty, reddish yellow-brown, when moist with a definite yellowish tone, granules 100-300 μm thick. Ap. flat, later convex, thin margined (first or late also marginless), brown-black, -0.6 mm. Sp. 10-14 x 4.5-6 μm . Ch- .
□ **Saccomorpha oligotropha**
- 19* Thallus very finely granular, fine granular isidiate to finely coralloid or indefinite, dark-brown to black-brown, when moist brown, blackish or pale greenish, granules usually under 100 μm thick. Often sterile 20
- 20 Thallus consisting of spherical to elongated or coralloid granules, granules 25-150(200) x 25-50 μm , light brown to dark brown or greenish, P-, K-, in squash preparation/abraded places C+/KC+ red. Ap., when occurring, scattered, -0.6 mm, commonly with definite, often lighter margin, brown to almost black, in the shade even almost rose-brown. Sp. 8-12 x 4-5 μm . Gyrophoric acid □ **Saccomorpha icmalea**
- 20* Thallus of rounded (never clearly elongated) granules (diameter 25-100 μm), dry often very finely wrinkled (50x enlargement), dark brown, rarely dark green, slightly gelatinous when moist, R-. Ap. numerous, -0.3 (0.4) mm, often coalescing, rose-brown to dark red-brown (to black-brown), soon convex-marginless. Sp. 9-14 (16.5) x (4)5-6(7) μm . Ch- **Saccomorpha uliginosa**
- 21 Hyp. brown, red-brown to black-brown, beyond that often blue-green to brown-green (often flecked). Ap. margined at least at first. Exc. clearly developed. Ap. red-brown to black (when moist (reddish) brown-black), -0.8 mm. Epihym. light brown to red-brown. Ch- 22
- 21* Hyp. colorless to yellowish or light brownish . 24
- 22 Thallus thick, warty-uneven, whitish. Hym. without blue-green to violet granules. Paraph. clavate thickened above, -4(6) μm . Epihym. yellow-brown. Ap. dark brown to brown-black, at first flat and thin margined, soon convex and marginless, -1(1.5) mm. Sp. 9-16(18) x 4-6 μm . Over mosses etc., above all on calcareous subsoil. Al . **Mycobilimbia berengeriana**
- 22* Thallus thin, membranous or thin warty, gray, brown tinted gray. Hym. and Hyp. often with brownish, blue-green to violet granules. Hyp./exc. red-brown to black-brown (often flecked), hyp./subhym. even greenish. Paraph. scarcely thickened above (-3 μm) . 23
- 23 Ap. at first concave, then long time flat to moderately convex and with little raised, finally disappearing, same color as the margin or darker, often shiny, red-brown, brown, dark brown to almost black (when moist red tinged), -0.8(1) mm. Epihym. scarcely colored to yellow- brown. Hyp. even green flecked. Sp. 1 celled, rarely 2 celled, (8)10-15 x 3.5-6 μm . On bark mosses, rarely rock- or soil-mosses **Mycobilimbia sanguineoatra**
- 23* Ap. long time (raised) margined, dark brown to black (brown tinted when moist), -0.8(1.2) mm.

Margin thin, often wavy. Epihym. red-brown to pale brown. Subhym. sometimes blue-green. Sp. (1-)2 celled, rarely 4-celled, 8.5-17(19) x 3.5-6(7) µm. On mosses over (usually calcareous) rocks and base-rich soil

Mycobilimbia hypnorum

- 24 Ap. yellow-red, yellow-brown, light brown, convex, marginless, -0.9 mm, weakly to strongly convex. Exc. cartilaginous, of radial hyphae. Hyp. pale yellowish, epihym. ± colorless. Sp. (10.5)12.5-20 x 4-6 µm, 1(2) celled. Thallus thin, (gray)whitish, coarse granular, usually on mosses, Ch-. In alpine sites, rarely lower. Vog, Alps

Biatora vernalis (L.) Fr.

- 24* Ap. gray-black, dark brown-black, dark brown

- 25 Thallus thin, indefinite, membranous to finely granular, coalescing, dirty loam colored to greenish gray, somewhat slimy when moist. Soralia (often lacking) pale greenish, soon irregular and coalescing. Ap. dull black, gray- to olive-black, dark green-gray, flat, closely appressed, at first usually with thin light not projecting margin, then marginless, -1(1.5) mm. Epihym. usually green to olive, K+ brown. Sp. 8-14 x 4.5-6 µm
- Trapeliopsis gelatinosa**
(Very similar, but ap. pale to red-brown, epihym. colorless to red-brown, loam soils: **Trapeliopsis aeneofusca** (Flörke ex Flotow) Coppins & P.James)

- 25 Thallus definite, areolate to almost squamulose, gray tinged red-brown to violet-gray, gray-brown, without soralia. Ap. brown-black, dark red-brown

Lecidoma demissum (6)

Lecidea PT 2: Lichens on Bark and Wood

(Sterile sorediate species ↑ also keyed with sterile crustose lichens)

- 1 Thallus squamulose . ↑ **Hypocenomyce**
- 1* Thallus not squamulose 2
- 2 Thallus/medulla C+/KC+ red to rose-red or C+ orange/KC+ yellow to orange. For obtaining a definite reaction thicker abrasions or sections . 3
- 2* Thallus/medulla C- to C+ yellowish 16
- 3 Thallus/medulla C+/KC+ red or rose-red . 4
- 3* Thallus/medulla C+ orange or KC+ orange . 10
- 4 Thallus and medulla K+ yellow, P+ yellow. Epihym. green with black-brown amorphous substance, which dissolves violet in K. Hyp. brown. Ap. black, flat, margined. Thallus truly crustose, without soralia or with diffuse soralia, light gray to ochre, often with black pycnidia. Sp. 6-11.5 x 2.5-4.5 µm. Alectorialic acid. et al
- ↑ **Hypocenomyce xanthococca**-Group
- 4* Thallus/medulla K-. Epihym. not K+ violet. Gyrophoric acid 5

- 5 Thallus P+ red, of tiny, at times crenulate squamules (40X), with very isolated, C+ red soralia. Ap. orange, rose-brown, brown. Argospin *. V.rare on old stems in near natural forests ↑ **Biatora fallax**

- 5* Thallus P-, not of such squamules. Without Argopsin 6

- 6 Thallus light brown to dark brown or rarely (in deep shade) greenish, of spherical to mostly elongated or coralloid granules, granules 25-150(200) x 25-50 µm, C+ (at least in squash preparations) red. Ap. usually scattered, -0.6 mm, commonly with definite, often lighter margin, brown to almost black. Sp. 8-12 x 4-5 µm. Hyp. ± brown, hym. I+ greenish-blue, exc. paraplectenchymatous, brown

□ **Sacomorpha icmalea**

- 6* Thallus not brown, nor of elongated to coralloid granules. Hym. light. Exc. not paraplectenchymatous . 7

- 7 Ap. whitish, beige, rose-brown, light brown, moderately convex, with receding, not raised margin, -0.9 mm. Epihym. ± colorless. Thallus thin, granular to warty, with diffuse, yellowish to green-yellowish, in the center of the thallus, often coalescing soralia. Sp. (10)12-17 x 4-5(6) µm. Exc. and Hyp. chondroid. On bark and bark mosses

Biatora chrysantha

- 7* Ap. black, green-black, gray-black, brown-black, olive, if rose, rose-brown or brick-red, then long time flat and margin raised. Hym. usually olive to greenish . 8

- 8 Ap. marginless, usually convex, black, rarely green-black, -0.6 mm (often agglomerated, -1mm). Thallus finely granular, light gray to pale greenish, with mealy pale greenish, irregular, soon coalescing soralia, thereby thallus often of leprose appearance. Sp. 9-12 x 4-5 µm. Hyp. pale

Trapeliopsis viridescens

- 8* Ap. at least when young clearly margined, long time flat, pale to black, dull . 9

- 9 Ap. gray-rose to brick-red, red-brown, olive-brownish, green-gray to almost dull black, often varying even within the same thallus, long time flat and margined, finally often convex, -1.5 mm. Sp. 8-15 x 4-6 µm. Hym. 70-80 µm. Thallus whitish, light gray, ash-gray, partially sometimes rose tinted, coherent granular to warty, often partially sorediate. Soralia relatively irregular and soredia larger than *T. flexuosa*, whitish, yellowish to rarely gray-greenish

Trapeliopsis granulosa

- 9* Ap. dark greenish-gray to black, rarely in deep shade pale colored, -0.7 mm, flat to weakly convex. Sp. 7-9 x 2.5-4 µm. Hym. 40-50 µm. Thallus greenish-gray to gray-green, rarely whitish to light gray, coherent granular (0.08-0.25 mm), at the margin granules often enlarged and flattened (-0.4 mm). Soralia at first delimited, -0.4 mm, later sometimes coalescing,

mealy to finely granular, gray-green to dark green (bluish-green). Usually on wood

Trapeliopsis flexuosa

- 10** Ap. light yellow, yellow-greenish, light yellow-brown, light brown, rose-brown, later however sometimes darker, olive, discolored to blackish, soon convex-marginless, -0.8(1) mm. Epithym. yellowish, yellow-brown, brownish to olive, with granular, gray-yellow to yellow-brown layer, which loses color and dissolves in K. Sp. narrowly ellipsoidal, 9-16 x 3.5-6 µm. Thallus C+/KC+ orange, K-, P-, finely granular to almost lacking, rarely cracked to cracked areolate or almost leprose, pale green-yellow, pallid yellow, without delimited soralia. Hym. 40-70 µm. Pycnosp. 18-25 x 0.5-1 µm. Sometimes algae in the margin. Usnic acid, Zeorin, ±Xanthone, ±Thiophanic acid
- 10*** Ap. brown-black, red-black, black, blue-black, rarely red-brown, yellowish red-brown. Epithym. without such granular over layer. Sp. ellipsoidal to broadly ellipsoidal, if narrowly ellipsoidal, then ap. very small (-0.25 mm), red-brown .**11**
- 11** Epithym. K+ violet-red. Paraph. cemented. Ap. convex and marginless, dark red-brown to almost black (K+ red), -1 mm. Epithym. yellow-greenish to brownish, hyp. colorless, sp. 7-11(13) x 5-8 µm. Thallus greenish-yellow, pale yellowish, brownish-yellow, usually for the most part finely granular mealy (granules -150 µm), often with black prothallus, K and P-/+ weakly yellowish, C+/KC+ orange. Thiophanic acid, Arthothelin, ±Dichlorolorlichexanthon **Pyrrhospora querneae**
- 11*** Epithym. not K+ violet-red. Paraph. (at least in K) loose. Ap. at first flat and marginless .**12**
- 12** Ap. very small, -0.25 mm, but often growing together into large aggregations, red-brown, yellowish brown-red, usually numerous and crowded, when young flat and margined, later moderately convex, indefinitely margined. Thallus C-, KC+ orange, K+ yellowish, P-, cracked areolate, gray-yellowish, dirty whitish. Epithym. red-brown. Paraph. capitate above (-4 µm) and with brown wall, simple to isolated branched above, rather looser in K. Hym. about 60 µm, K+ deep blue, hyp. colorless to yellowish, I+ blue. Sp. 8-12(15) x 4.5-5.5 µm. Very rare
- L. exigua**
- 12*** Ap. as a rule over 0.4 mm, black, rarely red to brown- or blue-black, only in deep shade also ± red-brown, thallus C+ orange to yellow, KC+ yellow. Epithym. and exc. exterior blue to green, violet, dirty reddish, rarely red-brown, often variable. Paraph. (in the case of pressing) rather easily freed. Hyp. brownish to colorless. Sp. 10-17 x 6-9 µm, rarely smaller (*Lecidella*) . **13**
- 13** Thallus without soralia, smooth to cracked areolate, rarely partially mealy-granular, whitish, olive-green, gray-green to yellowish. Ap. -1.2 mm. Arthothelin, Granulosin, ± 4.5-Dichloro-

lichexanthon or Thiophanic acid, Isoarthothelin, Capistraton ↑ □ **Lecidella elaeochroma**

- 13*** Thallus with soralia or entirely granular-sorediate . **14**
- 14** Thallus entirely granular-sorediate (leprose), yellowish-white to yellowish-gray, thin to thick, ± areolate. Ap. -0.5 mm, ± sunken, commonly occurring. Unknown Xanthone, 5/5/5. Very rare, on processed, ± eutrophied wood
- ↑ **Lecidella pulveracea**
- 14*** Thallus with delimited, later even coalescing soralia **15**
- 15** Thallus gray-white (to pale yellowish), with small yellowish to ochre yellowish, rounded to irregular, delimited to coalescing soralia. Soredia 20-30 µm. Ap. -1(1.2) mm, scattered to lacking, often soon convex. Arthothelin, (±) Granulosin
- ↑ **Lecidella flavosorediata**
- 15*** Thallus gray-green to yellow, with yellow, not coalescing soralia. Ap. not rare. Soralia with Lichexanthon. Arthothelin, Granulosin, ±4,5-Dichlorolorlichexanthon (soralia C+ orange) or Thiophanic acid, Isoarthothelin, Capistraton (soralia C-) **Lecidella elaeochroma** f. **soralifera**
- 16** Thallus with delimited, partially coalescing soralia **17**
- 16*** Thallus without soralia, but sometimes uniformly mealy-granular **20**
- 17** Soralia yellowish, yellow-greenish, P+ red, numerous, at first rounded, coalescing in the center of the thallus. Thallus thin crustose, warty surface. Ap. light red-brown, rose-brown, light brown, almost flat to rather convex, margin turned back, not raised, lighter, disappearing, -0.9 mm. Exc. and hyp. chondroid (cartilaginous). Sp. 10-15 x 4-6 µm. Argopsin
- ↑ **Biatora epixanthoidiza**
- 17*** Soralia P-. Ap. otherwise colored **18**
- 18** Ap. marginless, convex, lead-gray, blue-gray, black-gray, rarely brown tinted (usually slightly pruinose), -1 (1.2) mm, commonly occurring, but sparse. Thallus with punctiform, rounded, white- to greenish-gray or brown tinted soralia, gray to brown-gray, thin to thick, ± areolate. Prothallus bluish(-black) or brown. Soralia K± weakly yellow, C-, UV+ white (Sphaerophorin, ± Isosphaerophoric acid). Sp. 9-15 x 4-7 µm. Epithym. pale to olive or green-blue, hym. often bluish-green or brownish, hyp. pale olive to brownish. Paraph. strongly cemented
- L. pullata**
- 18*** Ap. rather long time flat and (often somewhat wavy) margined, black, brown-black, dark gray-brown. Paraph. rather looser . **19**
- 19** Spores constricted in the center, rarely weakly curved or ellipsoidal, 7.5-11 x 3-4.5 µm. Ap. -1.2(1.5) mm, dark brown, dark gray-brown to black, with usually lighter, often curved, clearly projecting margin. Thallus gray to usually brownish-gray, rarely greenish-gray, soralia

- whitish, brownish, yellowish, soon coalescing. R-, UV+ white. Divaricatic acid
- Fuscidea Lightfootii**
- 19* Sp. ellipsoidal, 10-17 x 6-9 µm. Ap. -1 mm, as in the case of the main species. Thallus gray-green to yellow, with yellow, not coalescing soralia. Thallus commonly C+ orange, in the case of lower lichen substance concentration even very weak to failing to appear
- ! Lecidella elaeochroma f. soralifera**
- 20 Sp. clavate, drop-form or clearly curved . 21
- 20* Sp. ellipsoidal to elongate, rarely clavate 22
- 21 Sp. clavate to drop-form, 3-6 x 1-2 µm. Ap. -0.3 mm, gray-brown, olive, blue-gray to blackish, convex marginless. Thallus R
- ↑ **Psilolechia clavulifera**
- 21* Sp. commonly clearly (often kidney-form) curved, 8.5-12(14) x 4-6 µm. Epihym. and exc. exterior brownish, hyp. light. Paraph. becoming ± when pressed in K. Ap. -1.5(1.8) mm, dark brown, brown-black, usually ± flat and raised margin, margin often wavy deformed with age. Thallus light gray to brownish, clearly cracked to cracked areolate, with brown-black prothallus, P+ red, K-/+ yellow brown, C-, Fumarprotocetraric acid . □ **Fuscidea cyathoides** (see also ↑ *Fuscidea lightfootii*, with sorediate thallus
- 22 Sp. to (8)12-16 23
- 22* Sp. to 8 24
- 23 Ap. very small, -0.1 mm, blackish, flat, depressed. Sp. to 8-12, 5-7(9) x 2.5-4 µm. Epihym. dirty olive. Hyp. colorless. Hym. 30-35 µm. On wood **L. luxariensis**
- 23* Ap. clearly larger, -0.7 mm, gray(brown), red-brown to (red-)blackish, flat to convex, with thin, lower, finally disappearing margin, somewhat shiny. Sp. to 12-16, 7-12(14) x 3-4(6) µm. Epihym. colorless to light brownish, paraph. ends usually thickened. Hyp. gray- brownish above (often also the hym. in the lower part), thallus thin, gray-white to greenish-gray **L. betulicola** (when thallus whitish, thin coherent to scattered granular, (K-)/K+ yellow to red, sp. 5.5-12 x 1.6-3.5 µm, ap. gray-olive, see. *L. albolivida*, 28)
- 24 Hyp. brown, red-brown, black-brown (beyond that sometimes even greenish) .25
- 24*Hyp. colorless, yellowish, pale brownish, pale olive . 29
- 25 Ap. -0.3(0.4) mm, in thick, grape-like groups, ± flat, basally constricted, often almost stalked, dark red-brown to black, with very thin, at first whitish, then brown margin. Epihym. brown, yellow-brown, hyp. dark brown. Thallus granular sorediate, gray, gray-brown, olive. Soredia 30-80 µm, R-, medulla UV+ white. Sp. 7-12 x 3-4 µm, isolated 2-celled. Perlatolic acid **L. botryosa**
- 25* Ap. not in thick, grape-like groups, never almost stalked. Thallus not granular sorediate 26
- 26 Thallus fine granular to commonly almost isidiate or elongated to coralloid granules (25-150 (200) x 25-50 µm), brown to black-brown, rarely greenish, at least squash preparations (microscope) C+ red. Ap. (rose) brown, dark red-brown, blackish, margined (margin often incurved), -0.6 mm. Exc. brown, paraplectenchymatous. Sp. 8-12 x 4-5 µm. Gyrophoric acid
- Saccomorpha icmalea (PT 1/20)**
- 26* Thallus not of spherical to elongated or coralloid granules, not brown. C-/C+ yellow. Without Gyrophoric acid 27
- 27 Sp. (wide) ellipsoidal, 10-17 x 6-9 µm, rarely smaller. Paraph. in the case of pressure (at least in K) easily free. Epihym. and exc. exterior blue-green, greenish, violet, red-brown, often variable, hyp. colorless to brownish. Ap. black, at times dark-brown or dark red tinted black, sometimes even middle brown, at least at first flat and thin margined, -1.2 mm. Thallus C- to C+ yellow, gray, whitish, gray-greenish, yellowish, undivided to cracked, smooth to granular. Hym. sometimes inspersed. Arthothelin, Granulosin, ± 4,5-Dichlorlichex-anthon or Thiophanic acid, Isoarthothelin, Capistraton
- **Lecidella elaeochroma**
- (when ap. brown-red to dark brown, always slightly pruinose and thereby somewhat bluish, flat to slightly convex. Thallus whitish, with granular upper surface, C- ↑ *Lecidella laureri*)
- 27* Sp. narrowly ellipsoidal 28
- 28 Sp.(8)10-15 x 3.5-6 µm, one-celled, rarely 2-celled. Ap. red-brown, brown, dark brown to almost black (when moistened red tinged), -0.8 (1) mm, at first concave, then long time flat to moderately convex and with little raised, finally disappearing, same colored or darker, often shiny margin. Epihym. scarcely colored, yellow-brown, rarely red-brown. Hyp./subhym. even green flecked. Hyp./exc. red-brown to black-brown (often flecked). Thallus thin, membranous or thin warty, gray, brown-tinged gray. On bark mosses **Mycobilimbia sanguinea (PT 1/23)**
- 28* Sp. 7-11 x 2.5-3 µm, narrowly ellipsoidal to almost fusiform. Ap. black, flat, very thin margined, at last convex marginless, -0.5 mm. Epihym. brown, paraph. ends clavate. Hym. 40-45 µm. Hyp. dark brown, exc. interior pale to light brown. Thallus indefinite **L. plebeja** (Similar is *Lecidea albolivida*: Thallus whitish, thin coherent to scattered granules, in the case of definite development K+ yellow to red, ap. gray-olive, with thin, not projecting blackish margin. Hyp. dark brown. Exc. dark brown. Paraph. cemented, thickened above. Epihym. colorless, yellowish, olive. Sp. 5.5-12 x 1.6-3.5 µm, to 8(12-16), hym. 40-70 µm)
- 29 Sp. spherical, 5-7 µm, hyp. (almost) colorless 30
- 29* Sp. narrowly ellipsoidal to broadly ellipsoidal 31

- 30 Thallus R-, UV+ white, often entirely finely granular sorediate (similar *Lepraria incana*), rarely with scattered soralia. Ap. brown, red-brown to almost blackish red-brown, long time flat, with thin, lighter margin, finally moderately convex marginless, -0.8(1) mm, rare. Epihym. red-brown. Exc. light brown. Paraph. simple, or capitate thickened, cemented. Thallus thin, often extensive, gray-white, greenish-gray, bluish-gray, brown-gray, sometimes with blue prothallus. Soredia 20-60 μm . Divaricatic acid
L. nylanderii
- 30* Thallus K+ yellowish, P+ orange-red, warty to areolate. Ap. lecanorine, light brown, reddish-brown, rarely black-gray, at first concave, then flat, rarely strongly convex, -0.7 mm. Margin thallus color, lighter than the disk, later pressed back. Epihym. in the case of lighter ap. with fine crystal over lay, red-brown, brown, black-brown. Paraph. at times capitate above and brown pigmented. Thallus warty to smooth, gray-white to gray-green. Fumarprotocetraric acid, Lobaric acid + unknown substance. Alps on branches.
Lecanora boligera
(Norman ex Th.Fr.) Hedlund
(very similar, with identical chemistry but sp. broadly ellipsoidal, margin commonly not lighter than the disk \uparrow *L. fuscescens*)
- 31 Sp. ellipsoidal to broadly ellipsoidal, at best twice as long as wide, 10-16 x 6-9 μm rarely larger) 32
- 31* Sp. narrowly ellipsoidal, commonly more than twice as long as wide. Paraph. usually cemented. Ap. at first flat and margined or convex marginless 35
- 32 Ap. -0.25 mm, but growing into larger aggregations, usually numerous and crowded, red-brown, yellowish brown-red, margined and flat when young, later moderately convex, indefinitely margined. Thallus KC+ orange, K+ yellowish, C-, P-, cracked areolate, gray-yellowish, dirty whitish. Epihym. red-brown. Paraph. capitate above (-4 μm) and with brown walls, simple to isolated branching above, in K rather looser. Hym. about 60 μm , I+ deep blue, hyp. colorless to yellowish, I+ blue. Sp. 8.5-12(15) x 4.5-6 μm . Rare **L. exigua**
- 32* Ap. larger, not growing into such aggregations. Thallus KC- (when KC+ orange, then sp. larger) 33
- 33 Sp. 7.5-9.5 x 4-6.5 μm , broadly ellipsoidal. Ap. -0.5 mm, light brown, later dark brown (to brown-black), at first concave, then flat (margin disk color or somewhat darker, rarely lighter), finally convex marginless. Margin without or with algae below. Epihym. gray-green, gray-brown, dark brown. Hyp. colorless. Thallus whitish-gray to yellow-gray, sometimes almost lacking, K+ yellowish, P+ orange-red. Fumar-protocetraric acid, Lobaric acid. Above all on alpine rose branches **Lecanora fuscensens** (Sommerf.) Nyl.
- 33* Sp. clearly larger, about 10-17(18) x 6-9(12) μm . Ap. -1.2 mm, black, at times dark brown or dark red tinted black, sometimes at first flat and margined. Paraph. if pressed (at least in K) easily free. Epihym. and exc. exterior blue-green, greenish, violet, red-brown, often variable, hyp. colorless to brown(orange). (*Lecidella*) . 34
- 34 Thallus entirely sorediate and whitish, K+ yellow. Sp. 14.5-18 x 10-12 μm , often poorly developed. Hyp. colorless. Very rare \uparrow **Lecidella alba**
- 34* Thallus not or partially sorediate, usually greenish-gray, pale greenish, rarely white-gray, K \pm yellow \uparrow **Lecidella elaeochroma** (27)
- 35 Epihym. pale (colorless, yellowish, brown-yellowish). Ap. beige, light yellow, yellow greenish, light yellow-brown, rose-brown, partially with age even brown or olive 36
- 35* Epihym. red-brown, brown, olive, greenish, bluish 40
- 36 Epihym. colorless, yellowish, yellow-brown to olive, with granular, yellow, golden yellow to yellow brown covering, which as a rule loses color and dissolves in K. Ap. beige, light yellow, yellow-greenish, light yellow-brown, rose-brown, with age partially even brown or olive . 37
- 36* Epihym. without such a granular covering, colorless to yellowish. Ap. rose, yellow-rose, yellow-brown or brown, with retreating, not raised margin. Epihym. colorless to yellowish or pale brownish. Hyp. cartilaginous, colorless to yellowish . 39
- 37 Frequent species. Thallus pale green-yellow, pallid yellow, finely granular, rarely cracked to cracked areolate or almost leprose, even almost lacking, C+/KC+ orange or C-/KC-. Ap. color very variable, light yellow, yellow-greenish, light yellow-brown, brown, olive, convex, at first with thin, entire margin, 0.4-1 mm. Hym. 40-70 μm . Sp. 9-16 x 3.5-6 μm . Epihym. yellowish, yellow-brown, brownish to olive. Pycnosp. 18-25 x 0.5-1 μm . Sometimes with algae in the margin. Usnic acid, Zeorin, \pm Xanthone, \pm Thiophanic acid . \square **Lecanora symmicta**
- 37* Not sufficiently clarified, in the region insufficiently observed species on wood with very indefinite to lacking thallus, KC- 38
- 38 Sp. 9-12 x 3-4.5 μm , in part weakly 2-celled. Ap. -0.6 mm, pale yellow, yellow-brown to red-brown, at first flat to moderately convex and with usually pale margin, later strongly convex marginless. Hym. 40-50 μm . Thallus dirty gray, thin to almost lacking. Pycnosp. 4-6 μm long **L. gibberosa** sensu Th.Fr. (*L. sapinea* sensu Vainio, non (Fr.) Zahlbr.)*
- 39 Thallus of tiny, at times granular, at times crenate squamules (section P+ red). Ap. often

- conspicuously glomerate, convex, rose-yellow, light brown to dark brown. Sp. (10)11-14(17.5) x (3.5)4-5(6) μm . Argopsin, Gyrophoric acid
- Biatora fallax**
- 39* Thallus thin crustose, gray, pale greenish-gray, R-. Ap. 0.3-0.7 mm, depressed, almost flat to moderately convex, finally strongly convex, light brown, yellow brown, rose-brown, later (red) brown, at times coalescing. Sp. (9.5)11-18(22) x (3)3.5-4.5 μm , sometimes 2-celled. Paraph. little thickened above. Hyp. cartilaginous. Ap. section fleeting C+ salmon-red. (Gyrophoric acid in ap.)
- Biatora helvola**
- 40 Hym. greenish above to olive, K+ violet, -35 μm . Ap. -0.3 mm, black, from the first convex marginless. Exc. very narrow. Sp. 6.5-9.5 x 2-3.5 μm , 1(2) celled. Thallus indefinite, often with stalked or sunken black pycn
- Micarea misella**
- 40* Hym. greenish to olive above, K+ violet, -35 μm . Ap. -0.3 mm, black, from the first convex marginless. Exc. very narrow. Sp. 6.5-9.5 x 2-3.5 μm , 1(2) celled. Thallus indefinite, often with stalked or sunken black pycn.
- Micarea misella**
- 41 Ap. very small, -0.1 mm, blackish, flat, depressed. Epithym. dirty olive. Hyp. colorless. Sp. 5-7(9) x 2.5-4 μm . Thallus very indefinite, on wood.
- L. huxariensis**
- 41* Ap. larger 42
- 42 Hym. at least partially blue to blue-green or violet. or epithym. blue-green to blackish-green (in many ap. hym. and epithym. even brownish) . 43
- 42* Hym. or epithym. not blue-green or violet. Epithym. pale to brownish, red-brown or olive-brown 44
- 43 Hym. usually entirely or partially bluish, 70-140 μm . Ap. with thin, depressed, often lighter, finally disappearing margin, moderately to rather convex, black, gray- to bluish-black or lead-gray-brown, nonpruinose, often almost shiny, depressed, -0.8 mm. Epithym. pale to bluish. Hyp. almost colorless to brownish or slightly violet. Paraph. cemented. Sp. 6-13 x 3-4 μm . Thallus thin, gray(white)
- L. ocelliformis**
- 43! Hym. often dirty blue-green, streaked violet or brownish, -50 μm . Ap. marginless, almost flat to usually convex, usually slightly uneven-undulating, black to brown-black, blue streaked when moist, often bluish-gray pruinose, -0.6(0.8) mm. Epithym. brownish, blue-green, olive-blackish, hyp. colorless to slightly brownish. Sp. 6-12(15) x 2.5-4(5) μm . Thallus very thin, inconspicuous .
- L. turgidula**
- 43* Hym. colorless, 40-70 μm . Epithym. olive, with over- and inner-layered granules soluble in
- ↑ **Lecanora symmicta**
- 44 Thallus and ap. margin K+ yellow to orange-red (red crystals under the microscope), P+ orange, granular or lumpy, definite, white-gray, whitish, ap. at first cinnamon brown, with paler, raised margin, flat, later brown to brown-black, convex, -0.8 mm. Ap. margin without algae. Epithym. brown. Paraph. rather cemented, capitate above. Sp. 7-12 x 3-4.5 μm . Norstictic acid
- Lecanora cadubriae**
- 44* Thallus K- or K+ yellowish, P- or thallus indefinite 45
- 45 Hym. over 50 μm . Epithym. with fine granular over layer soluble in K, yellow-brown to olive. Ap. moderately to very convex, brown, olive to black (often in the same thallus, sometimes even in the same ap.), at first margined, -0.8 mm. Thallus usually clearly developed, yellowish-white, sp. 10-17 x 3-5.5 μm .
- Lecanora symmicta** var. **aitema**
- 45* Hym. up to 50 μm 46
- 46 Ap. blackish to brown-black, commonly slightly bluish(gray) pruinose, \pm convex-marginless with often uneven, rough upper surface, -0.5 mm. Epithym. brownish to olive-blackish, never red-brown. Hym. often partially (streaked) colored. Paraph. sparsely branched and reticulate. Hyp. colorless to \pm slightly colored. Sp. 6-12(15) x 2.5-4(5) μm . Thallus usually indefinite, more rarely whitish, granular .
- L. turgidula** (43)
- 46* With other characteristics. Epithym. red-brown to brown . 47
- 47 Exc. K+ yellow solution, then red needles. Thallus often externally lacking, or only with small isolated developed areole groups, K+ yellow (microscopically red needles). Ap. -0.5 mm, young (mostly lighter) margined, soon \pm convex and marginless, black-brown to blackish, when moistened clearly red-brown to dark brown. Pycnosp. 4-5 μm long, ellipsoidal to short cylindrical .
- Lecanora phaeostigma**
(*L. cadubriae* coll.)
- 47* Without such reaction. Thallus R-. Epithym. red-brown, paraph. capitate above, simple, rarely branched. Exc. interior colorless . 48
- 48 Ap. long time flat, at first thin (and often somewhat darker) margined, then convex marginless, -0.8(1) mm, dark red-brown to brown-black, moist somewhat transparent. Exc. exterior red-brown, with swollen hyphae ends. Epithym. K-. Paraph. above -5 μm . Hyp. colorless. Sp. (8)9-16(18) x 3-4.5(5) μm , ellipsoidal-fusiform. Thallus indefinite or thin, whitish
- L. erythrophaea**
- 48* Ap. very soon rather convex to hemispherical, often numerous and thick-standing, nonpruinose, -0.5(0.7) mm, brown-black, dark brown, rarely dark red-brown, at first flat, thin margined. Exc. exterior pale brown. Epithym. K \pm olive-brown. Paraph. above -4 μm , in K easily visible. Hyp. colorless or brownish in the upper part. Sp. 8-12 (14) x 3.5-4.5(5.5) μm , content often brownish.

Pycnosp. 14-18 µm, needle-form, curved.
Thallus indefinite or thin, whitish . **L. hypopta**

Lecidea PT 3: Species on Limestone

- 1 Ap. disk at least when moist not entirely black (then usually red-brownish tinted black), dry black-brown, black, rarely dark brown . 2
- 1* Ap. disk black even when moist, but sometimes pruinose . 9
- 2 Sp. elongate, 10-17(20) x 3-4.5 µm, (at least 3x as long as wide), usually 1-celled, at times appearing 2-celled, without perispore. Ap. dark brown to black, moist brown to red-brown with darker border, flat to soon strongly convex, marginless, -0.8 mm, sometimes coalescing. Epithym. pale brown to colorless. Paraph. simple, only short branching above, only little thickened above. Hyp. brown-black(violet), even so exc., K+ purple violet. Thallus indefinite to thin, mealy-scruffy, white-yellowish to greenish, Ch-
Catillaria picila
- 2* Sp. otherwise, commonly with ± more narrow (in the case of younger spores usually easily, in the case of older often poorly visible) perispore. Ap. disk dry usually black-brown to black, sometimes slightly pruinose. Epithym. brown to red-brown . 3
- 3 Ap. elliptical to angular, in groups in depressions next to each other. Ascus wall I+ blue, rarely red-brown. Hyp. colorless, I-. Sp. 13-17 x 6-8 µm. Exc. weakly developed. Thallus lacking or cartilaginous to chalky and ± uneven. R- .
Clauzadea cyclisca
- 3* Ap. ± round 4
- 4 Sp. 8-11.5(14) x 3.5-6(8) µm. Ap. sessile, flat, margined, rarely convex, black, black-brown, dark red-brown, -0.8 mm, usually of very variable size in the same thallus. Exc. well developed, (red)brown-black, hyp. red-brown, rarely light brown, epithym. orange-brown, red-brown. Ascus gelatin usually I+ red. Thallus lacking or thin, gray to ochre. Habitat similar to *Lecidella stigmatea*. Ch- .
Clauzadea monticola
- 4* Sp. larger, in the center at least 6 µm wide, if more narrow, then ap. ± sunken . 5
- 5 Hym. commonly at least 100 µm (average over 120 µm). Mountain lichens, h'mo-alp. Thallus as a rule strongly developed . 6
- 5* Hym. -105 µm (average under 100 µm). Lichens of lower and higher sites. Thallus indefinite or coherent, white, R-. Ap. -0.8 mm, at least partially ± sunken, in definite to surface pits in the limestone, to depressed sessile, red-brown to black 7
- 6 Young ap. with entire flat, very broad margin and punctiform disk. Hym. 130-190 µm. Thallus weakly cracked. Medulla R-

Stenhammarella turgida (21)

- 6* Young ap. with robust, projecting margin. Hym. 110-145 µm. Thallus usually warty areolate, chalk-white, ochre-white, bluish-white, light gray, chalky-rough, medulla P- or P+ orange, K- or K+ yellow. Ap. 0.5-1.3 (2.0) mm, black to black-brown, not (or at best young somewhat) pruinose, moist dark red-brown, flat to convex, thick margined, young at the margin of (between them) areoles ± sunken, later narrowly sessile. Sp. (16)20-28(33) x 7-14 µm. Exc. very dark. Hyp. brown, red-brown. Stictic acid of Ch-. On (calcareous) silicate rock. Medulla I-
Porphidia superba
- 7 Thallus chalky and cartilaginous-uneven to folded, thickish, tartar-like, whitish, blue-white, dirty yellowish, moist often ± greenish to blue-greenish, prothallus white. Hyp. at least partially I+ blue. Exc. commonly well developed, interior dark red-brown. Ap. 0.5-0.9 mm, moderately sunken to sessile, margin partly raised, partly flat. Hyp. light brown. Sp. 13-16 (22) x 5-7(8.5) µm .
Clauzadea chondrodes
- 7* Thallus endolithic or very thin, whitish. Exc. brown, weakly developed. Hyp. almost colorless to orange-brown, I-. Margin scarcely projecting. Ch-. Closely related 8
- 8 Ap. sunken, usually not or very little rising above the stone upper surface, usually flat, with thin permanent or disappearing margin, -0.8 mm, often pruinose. Epithym. yellow-brown to brown. Sp. 10-16(19) x 6-8(9) µm. Thallus endolithic or whitish
Clauzadea immersa
- 8* Ap. moderately sunken into rock, flat to slightly convex, with thin, usually permanent margin, (brown)black, commonly nonpruinose, -0.8 mm. Epithym. red-brown. Sp. 16-23(27) x 6-10(12) µm, often with oil droplets. Thallus ± endolithic .
Clauzadea metzleri
- 9 Paraph. weakly cemented, with pressure (at least in K) easily free. Hym. without or with oil droplets and then turbid 10
- 9* Paraph. tightly cemented. Hym. not turbid because of oil droplets . 12
- 10 Hym. milky turbid because of small oil droplets, epithym. dark blue-green to gray-green. Sp. 11-19 x 6-10 µm. Ap. shiny black, flat to moderately convex, puffy margin, -2(2.5) mm. Thallus endolithic to thick crustose, chalk white to beige, coherent to cracked, rarely areolate. Zeorin, ± Atranorin, ± Lichexanthon. Bird roosting sites as well as scarcely dunged sites, lime-rich to lime-poor rock – arct-alp, Al .
Lecidella patavina
(Massal.) Knoph & Leuck.
(*Lecidea rolleana* Magnusson, *L. spitsbergensis* (Lynge) Hertel & Leuck.
- 10* Hym. transparent, not turbid . 11
- 11 Frequent lichens. Hyp. colorless to (slightly) brownish. Exc. exterior and epithym. gray-brown

- to violet or blue-green, exc. interior colorless.
Sp. 10-16 x 6-9 µm. ap. -1.2 mm, sessile, flat, margined, later convex, with disappearing margin. Thallus endolithic to clearly developed, gray, gray-brownish, whitish, granular to cracked areolate, K- or K+ yellow. Zeorin, ± Atranorin, ± Lichexanthon □ **Lecidella stigmatea**
- 11*** High mountain lichen. Hyp. olive-brown to blackish. Exc. exterior blackish, interior reddish to rose-brown. Epithym. blue-green, hym. greenish. Paraph. at times strongly swollen above. Sp. 6-11 x 4-6.5 µm. Ap. -0.5 (0.8) mm. Thallus endolithic to thin, cracked areolate, whitish, Ch-. Alpine, lime-rich rock, exposed habitat (above all steep- and vertical surfaces) – arct-alp, Al . **Cephalophysis leucospila** (Ach.) Kiliyas & Scheideg. (*L. ultima* Th.Fr.)
- 12** Thallus endolithic, at best discoloring the rock. Hyp. and exc. dark . **13**
- 12*** Thallus definite, but often thin . **15**
- 13** Sp. (6.5)8.5-15 x 3.5-5.5 µm, elongate to narrowly ellipsoidal. Ap. ± flat, with raised, narrow margin, disk smooth. Hym. 40-70 µm. Epithym. shining green to green-blue. Hyp. and exc. black-brown, K-
- Carbonea vorticosa** (PT 6/35)
- 13*** Sp. broader, ellipsoidal. Hym. at least 70 µm. **14**
- 14** Ap. with smooth or occasionally umbilicate disk, flat to moderately convex, (often shiny) black or pruinose, puffy margin, -1(2) mm. Epithym green, brown-green to black-brown, often in the same ap. Exc. carbonaceous black, strongly developed. Hyp. brown(red)-black to green-black, subhym. green-brown to blue-green. Sp. 12-27(30) x 6-13(16) µm, with thick perispore. Hym. I+ blue . **Farnoldia jurana**
- 14*** Ap. young flat and puffy margin, later convex and with pitted very uneven to brain-like furrowed upper surface, -2.5(3.5) mm, narrowly sessile. Epithym. shining blue-green, never brown. Hyp and exc. red-brown, K+ red-violet. Exc. very thick. Sp. 11-21 x (5)6-9 µm, at times citron-form, young with perispore. Alpine, above on pure limestone, dolomite, on well lighted habitats – arct-alp, Al, Sju **Farnoldia hypocrita** (Massal.) Fröberg (*Lecidea h.* Massal.)
- 15** Parasitic on *Aspicilia*. Thallus light blue-gray, chalky **L. tessellata** (19)
- 15*** Not parasitic . **16**
- 16** Sp. up to 15 µm long . **17**
- 16*** Sp. at least partially over 15 µm long . **21**
- 17** Ap. in the center commonly with regular, large umbilicus, puffy margin, usually angular, flat, later moderately convex, -1.4(2) mm. Epithym. green (to olive and black-brown), hyp. colorless to middle brown. Exc. interior light. Sp. 10-13(15) x 5.5-7(8) µm. Thallus chalk-white, R-, medulla usually I+ violet. Alpine, above all on marly lime – arct-alp, Al . **L. umbonata**
- (Hepp) Mudd
- 17*** Ap. without central umbilicus (if occasionally with umbilicus, then with other characteristics) . **18**
- 18** Hyp. colorless to light ochre (only in old ap. occasionally darker). Exc. interior colorless or weakly colored, not dark brown to black. Alpine, above all on steep and sloping surfaces rather to moderately lime-rich rock (marl-lime, calcareous slate, flinty limestone) – arct-alp, Al **19**
- 18*** Hyp. brown, red-brown, black-brown. Paraph. strongly cemented. Thallus K-/± yellowish, P-, C- . **20**
- 19** Thallus light blue-gray, chalky, in the center very thick, R-. Medulla I+ violet. Prothallus light gray. Ap. scarcely rising over the thallus, -1.8 mm. Epithym. gray- to black-green. Sp. 8-11 x 4.5-6 µm . **L. tessellata** var. **caesia** (Anzi) Arnold
- 19*** Thallus usually pale citron yellow to (yellow tinted) chalk white, rarely full yellow, thick, often injured, K+ yellow, C-, P-, medulla I-. Prothallus whitish. Ap. sitting up, soon convex marginless, -1.5(2.5) mm. Epithym. yellow- to black-green. Sp. 8-14 x 4.5-7.5 µm. Usnic acid, ±Atranorin **Lecanora marginata**
- 20** Epithym. shining emerald green. Sp. 7-13(15) x 3.5-5(6) µm. Thallus usually round, small, white, medulla I-. Exc. carbonaceous. Hyp. brown to red-brown. Ap. depressed to sunken, flat to moderately convex, margined, nonpruinose, -1.3 mm. Alpine, usually on horizontal- and sloping surfaces on rather (moderately) lime-rich, often moderately dunged rock – mieur alp, Al . **Carbonea atronivea** (Arnold) Hertel
- 20*** Epithym. olive to green-black. Sp. 11-17(20) x 5.5-7.5(9) µm, often filled with oil droplets. Thallus chalky white, extensive. Medulla I+ blue. Exc. soon very narrow, brown. Ap. sometimes weakly pruinose, -2(2.5) mm **Porpidia speirea** (23)
- 21** Young ap. with uncommonly broad, completely flat margin and punctiform small disk. Hym. 130-190 µm. Thallus chalk white, R-. Ap. margin as well pruinose, disk black. Exc. carbonaceous black, hyp. light brown to brown, epithym. olive ochre-brown. Sp. 20-35 x 11-19 µm, young with perispore **Stenhammarella turgida** (Ach.) Hertel
- 21*** Young ap. without margin or with puffy raised margin, without conspicuously small disk. Hym. 70-140 µm **22**
- 22** Medulla I+ violet. Hym. 70-130 µm . **23**
- 22*** Medulla I- **25**
- 23** Sp. up to 8 µm wide in the center, 11-17(20) x 5.5-7.5(9) µm. Exc. soon strongly reduced, brown. Epithym. dirty olive to green-black. Ap. not or pruinose when young, -1.2(2.5) mm, ± sunken, often separated from the thallus by a

circular crack or surrounded by a thallus collar. Hym. about 70-105 µm. Thallus white, cracked areolate, finely cracked to almost smooth, usually extensive. Confluent derivatives

Porpidia speirea

(*P. trullisata* is closely related: Ap. strongly pruinose, -3.5 mm. Ch-, I-reaction often weak. Hym. 85-130 µm)

- 23* Sp. over 8 µm wide in the center. Exc. strongly developed, ± uniformly carbonaceous black-brown, not continuously merged into the somewhat lighter hyp. but set off. ap. commonly puffy margined. R- 24
- 24 Thallus well developed, chalk-white or slightly yellow tinted white (or brown-gray), usually warty areolate. Ap. nonpruinose, often somewhat shiny, -2 mm. Epihym. green, black-green. Hyp. light brown to dark brown. Hym. 80-120 µm. Sp. (15)17-23(30) x (7)10-14(16) µm, length to width = 2:1. Above all on marl lime, calcareous sandstone – arct-alp, Al

Farnoldia micropsis (Massal.)

Hertel (*Tremolecia nivalis* (Anzi) Hertel, *L. rhaetica* Hepp ex Th.Fr.)

(Very similar **F. similigena** (Nyl.) Hertel (*L. subrhaetica* Arnold ex Lettau): Sp. 10-22 x 4-6.5 µm, length to width = ca. 3:1)

- 24* Thallus indefinite to thin, ochre-yellowish, yellow-brown, whitish. Ap. pruinose or nonpruinose, -1(2) mm. Epihym. green, brown-green to black-brown, often in the same ap. Hyp. brown(red)black to green-black (subhym. often green-brown to blue-green). Hym. 70-130 µm. Sp. 12-27(30) x 6-13(16) µm

Farnoldia jurana

- 25 Exc. soon strongly reduced and narrow, brown. Sp. 10-16(20) x 5.5-7.5(9) µm. Hyp. black-brown. Thallus white to gray, cracked to warty areolate. Ap. strongly pruinose, 0.5-3.5 mm. Ch- (if Confluent acid derivatives, see *P. speirea*), thallus white, coherent to cracked. Medulla commonly K+ weakly violet

Porpidia trullisata

- 25* Exc. strongly developed. 26
- 26 Thallus indefinite to thin, ochre-yellowish, yellow-brown, whitish. Ap. pruinose or nonpruinose, -1(2) mm. Epihym. green, brown-green to black-brown, often in the same ap. Hyp. brown(red)black to green-black (subhym. often green-brown to blue-green). Hym. 70-130 µm. Sp. 12-27(30) x 6-13(16) µm. Ch-

Farnoldia jurana

- 26* Thallus commonly strongly developed, medulla always I-. Ap. -1.5(2) mm. Hym. 90-140 µm. Sp. 16-30(33) x 7-12(14) µm. Ch- or Stictic acid derivatives 27
- 27 Ap. black, strongly pruinose, moist not brown tinted. Hyp. brown, black-brown, rich in crystals (Polarized). Thallus chalky white, coherent to cracked or warty areolate. Exc. interior brown,

with broad, relatively weakly pigmented outer region. On limestone and calcareous silicate rock

*** Porpidia zeoroides**

- 27* Ap. black to black-brown, not (or at best young somewhat) pruinose, moist usually dark red-brown. Hyp. brown, red-brown, only rarely with crystals. Thallus white, ochre-white, bluish-white, light gray, usually warty areolate, areoles often hemispherical to lumpy. Exc. very dark, without lighter outer region. On (calcareous) silicate rock . *** Porpidia superba**

Lecidea PT 4: Species on Silicate Rock with scarcely Discernible Thallus

- 1 Exc. or hyp. K+ blue-red to purple-violet (under the microscopy the preparation after flooding with K gives a definite color alteration or a blue-red solution exiting the region of the exc.). Ap. black, sometimes pruinose. 2
- 1* Exc. and hym. not K+ red to violet. 5
- 2 Sp. 15-25 x 7-11 µm. Hym. 90-110 µm. Epihym. brownish, hyp. dark brown, exc. brown to black-brown, K+ blue-red (solution). Ap. -2 mm, flat, permanent puffy margin
- Porpidia macrocarpa** (“**nigrocruenta**”)
- 2* Sp. up to 13 µm long. Hym. -60 µm. 3
- 3 Hyp. brown-red to deep red, K+ intensively (violet)red. Ap. -0.8(1.0) mm, usually strongly convex, very indefinite margin to soon marginless. Exc. exterior green-black to blackish blue-green, interior light, narrow. Paraph. branching and anastomosing. Hym. colorless to reddish. Sp. 8-12 x 2.7-3.8 µm, sometimes with apparent 2-part content. Ch-
- L. commaculans**
- 3* Hyp. not red. Ap. long time margined 6
- 4 Hyp. deep brown-black. Hym. delicate violet to reddish. Exc. exterior purple-black, interior usually slightly reddish, K+ purple- violet (color alteration without exiting solution), C-. Ap. -1.5(2) mm, flat, with permanent puffy, often wavy margin, often in groups. Sp. elongate, 7-13 x 2.5-3.5(4) µm. (Terpenoid)
- L. sarcogynoides**
- 4* Hyp. almost colorless to light brownish. Hym. slightly blue-greenish, epihym. dark green to green-black. Exc. K+ blue-red solution, C+ brown-red. Exc. margin gold- brown. Ap. -1.4(1.8) mm, flat, finally even very convex, with often wavy curved margin. Sp. ellipsoidal, 6-11 x 3-4.5 µm. Atranorin, 2-Chlor-Emodin **Adolelecia pilati**
- 5 Hym. milky-turbid because of fine (inspersed) oil droplets. Hyp. gold-brown, epihym. shining green. Paraph. rather looser. Sp. 8-15 x 4-8 µm. Ap. -0.7(0.9) mm, black, shiny,

- margined. Thallus whitish, sometimes almost lacking. Very rare
- Carbonea latypizodes**
- 5* Hym. not interspersed . 6
- 6 Sp. to 12-16 per ascus, ± spherical, 5-7 µm. Ap. strongly convex, marginless, (brown) black. Hyp. brown
- Steinia geophana (PT 1/12)**
- 6* Sp. to 8, ellipsoidal to elongate, in the case of *Lecidella anomaloides* almost spherical . 7
- 7 Hyp. dark colored, usually dark brown, black-brown 8
- 7* Hyp. colorless to soon brownish (at best somewhat darker with age) . 16
- 8 Ap. from the first convex marginless. Exc. reduced or of paraphyses like hyphae. Sp. up to 10 x 4.5 µm **Micarea**
- 8* Ap. at first margined. Exc. usually clearly developed 9
- 9 Sp. over 5.5 µm wide, over 12 µm long, ellipsoidal, often with perispore. Paraph. cemented. Hym. at least 60 µm high 10
- 9* Sp. up to 5.5 µm wide and 16 µm long . 13
- 10 Hym. and Hyp. usually with blue-violet to blackish, K+ green granules. Exc. exterior dark red-brown, interior lighter red-brown to almost colorless, hyp. dark red-brown. Epithym. colorless, yellowish to pale red-brown. Hym. 60-80(90) µm. Ap. -0.6(0.8) mm, red-brown to brown-black, concave to slightly convex. Sp. 11-17 x 6-7(9) µm. Thallus very thin, ± shiny, varnish-like to cracked, gray to gray-green . **L. ahlesii**
- 10* Hym. and hyp. without such granules. Exc. dark brown to black-brown, going over to ± continuous into same color or darker hyp. (*Porpidia*-Type, □ see diagram p. 502). Epithym olive, brown. Hym. (60)70-140 µm. Ap. at first ± flat, margined, later often convex, black to brown-black, often larger . 11
- 11 Epithym. shining emerald green. Ap. -1.5(2.5) mm, with thick, often crenate margin, black. Sp. (14)18-25(30) x (5.5)7-9(10) µm
- Porpidia hydrophila**
- 11* Epithym. green-brown to brown 12
- 12 Ap. 1-3.8 mm (max. diameter), black to brown-black. Maximal width of the margin (top view) 0.13-0.25 mm. Sp. (13)17-27(30) x (6)7-12(14) µm. Hym. (70)80-120(130) µm
- Porpidia macrocarpa**
- 12* Ap. 0.55-1.6 (max. diameter), commonly black. Maximal width of the margin 0.07-0.17 mm. Sp. (10)12-17(20) x (5)6-8(10) µm. Hym. 60-90(110) µm . □ **Porpidia crustulata** (When ap. medulla I+ blue, lichen of higher sites ↑ *L. lapicida*)
- 13 Medulla of the ap. (under the ap. interior region) I-. Hyp dark brown to brown-black. Ap. black 14
- 13* Medulla of the ap. I+ blue/violet 15
- 14 Epithym. shining emerald green to blue-green. Sp. (6.5)8.5-15 x 3.5-5.5 µm. Hym. 40-70 µm. Ap. -1(1.5) mm, flat, with sharp, permanent marg **Carbonea vorticosa (PT 6/35)**
- 14* Epithym. olive-brown to brown-black. Sp. 7-13 x 2.5-3.5 µm. Hym. -50 µm (with light subhym. -75 µm), delicate violet or reddish. Ap. -1.5 mm, with permanent, puffy, often wavy margin, often closely crowded, deformed because of lateral pressure (see also *Micarea erratica*, PT 6/36) **L. sarcogynoides (4)**
- 15 Sp. narrowly ellipsoidal, 8.5-10.2-12 x 2.8-3.8-4.2 µm. Hyp. brown to dark brown, hym. colorless to slightly blue-green, epithym. usually blackish blue-green to brown-green, ap. -2 mm, flat to moderately convex, with regular margin. Exc. in section with semi-circular outline – (bor-)alp – silicate Alps **L. promiscens** Nyl. (Similar *L. auriculata* Th.Fr. but sp. 6.5-8.5-10 x 2.1-2.8-3.6 µm, exc. in section with crenate outline)
- 15* Sp. broader (8)10-16 x 4.5-8 µm. Hyp. light brown to brown . **L. lapicida** var. I. (16)
- 16 Medulla of ap. (below ap. interior region) I+ blue/violet, K± yellowish solution. Sp. ellipsoidal, (8)10-16 x (4)4.5-8 µm, often with bipolar divided content. Ap. often crowded in groups and angular deformed, flat to moderately convex, usually permanently margined, -1.2(2) mm, black. Epithym. green-black, K+ green(blue) . **L. lapicida (PT 6/27)**
- 16* Medulla of the ap. I- . 17
- 17 Sp. broadly ellipsoidal, at best twice as long as thick (5-10 µm thick), relatively thick walled (wall visible is case of stronger enlargement than double contour). Paraph. (squeezed) at least in K easily free. Ap. flat to moderately convex, long time margined, black (*Lecidella*) 18
- 17* Sp. ellipsoidal to elongate, at least twice as long as thick, up to 5(6) µm thick. Paraph. cemented 19
- 18 Exc. only at the margin green-black, brown-black, blue-green etc., interior light. Hym. 60-90 µm. Epithym. variable, dirty reddish to brownish, violet-brown, blue-green, sp. 11-17(19) x 6-9(10) µm. Ap. -1.5 mm, usually dull . □ **Lecidella stigmatea (PT 6/21)**
- 18* Exc. almost entirely or for the most part dark, brown-black. Hym. 40-60 µm. Epithym. dirty green to brown-green, rarely brownish. Sp. (7)8-15 x (5)6-9 µm, broadly ellipsoidal to almost spherical. Ap. -0.7(1) mm, permanently margined, margin often shiny, wavy **Lecidella anomaloides**
- 19 Ap. very small, -0.35 mm, concave to flat, margined, black. Sp. 6-9 x 2-3 µm. Hym. -35

- µm, epihym. shining (emerald) green, exc. in the outer half green-black **L. atomaria**
- 19* Ap. clearly larger, usually -1 mm, permanently flat and margined. Hym. higher. Exc. margin brown- to green-black **20**
- 20 Sp. 8-11(13) x 2.5-5 µm. Hym. 35-50 µm, epihym. intensively green to green-black. Ap. even moist black (when sp. still more narrow, 12-14 x 2.5-3 µm, in the center 2.7 µm thick: **L. leptoboloide**
Nyl., mieur-alp, Vog.).
- Thallus indefinite □ **L. plana (PT 6/26)**
- 20* Sp. (9)10-14(15) x (4)4.5-6 µm. Hym. 50-70 µm. Epihym. brownish to olive. Disk of ap. moist almost always brown tinted. Thallus commonly occurring but thin
□ **L. lithophila (PT 6/32)**

Lecidea PT 5: Lichens on Silicate Rock, Sorediate or with Brown Cephalodia

- 1 Thallus entirely or partially ochre or rust colored, C- **2**
- 1* Thallus not ochre to rust colored **4**
- 2 Thallus usually small, ochre- to rust-brown, areolate, areoles often separate, flat to usually strongly convex, usually with one rounded to almost capitate, rarely crater-form blackish soralia. Medulla around the soralia K+ yellow, P+ orange, otherwise K-, P-. Stictic acid
Miriquidica atrofulva
- 2* Thallus commonly extensive, coherent, cracked to finely cracked areolate, upper surface as a rule even. Soralia gray, dark gray, brown-gray. Medulla I- (when medulla I+ blue: rare, rusty upper surface forms of *Porpidia tuberculosa*, 12) **3**
- 3 Thallus partially rust-brown to ochre, otherwise (above all the margins) gray (bluish gray), soralia K+ yellow, P+ orange, rounded, concave or rising above the thallus, clearly (light) margined, (white) gray to gray or brownish, -0.8(1.2) mm broad. Ap. in the region lacking. Stictic acid
□ **Hymenelia ochrolemma**
- 3* Thallus usually rust colored to ochre throughout, cracked to almost undivided, with smooth upper surface. Soralia commonly K-, P-, very sparse to numerous, dark gray to blackish, rising above the thallus upper surface. Ap. -1.5(3) mm, usually ± sessile, black, disk usually pruinose, margin ± nonpruinose. Hyp. light to dark brown. Sp. (14)18-23(26) x (6.5)8.5-10.5(12.5) µm. Confluent acid derivatives, (± Stictic acid); arct(mieur-alp) **.Porpidia melinodes**
(Körber) Gowan & Ahti

- 4 Thallus or medulla and possibly soralia C+ orange or C+ red **5**
- 4* Thallus and medulla/soralia C- **6**
- 5 Thallus C+ orange, P-/K- or P+/K+ yellow, granular to areolate, yellowish-white, yellowish-gray, light green-gray, with usually scattered, bordered light soralia. Ap. black, scattered, flat, margined, later convex marginless, -1.5 mm. Hyp. brown to reddish-brown, epihym. green, blue-green, black-green. Sp. 10-15(18) x 6-8(10) µm. Atranorin, Arthothelin, Thuringion
Lecidella scabra
- 5* Thallus/medulla (soralia) C+ (rose)red, KC+ red . **6**
- 6 With warty, rough cephalodia. Hyp. dark. Gyrophoric acid . **7**
- 6* Without cephalodia. Hyp. light . **8**
- 7 Ap. very rare, between the areoles. Thallus sorediate, beige, light gray-rose, rose tinted light brown, light brown, yellowish-rose, ± warty areolate, with brown to dark brown-red, 0.5-1.4 mm cephalodia. Areoles ± strongly convex, -1.2 mm, with or without (above all marginally erupting) soralia, soredia brownish to whitish. Prothallus black.
* □ **Amygdalaria panaeola**
- 7* Always with ap., sunken into the thallus areoles to finally somewhat projecting, -1.5 mm, concave to flat, blackish, margin thin to robust, black to white pruinose. Thallus without soralia, whitish, rose-whitish, beige, yellowish-gray, cracked areolate to rarely areolate (areoles flat, rarely convex), very thick, K-, P-, cephalodia thallus colored to later dark red-brown. Hyp. brown-black, epihym. brown. Sp. 18-40 x 10-16 µm.
* **Amygdalaria pelobotryon**
- 8 Soralia P-, K-. Thallus whitish, cream, beige, pall rose, rarely brownish, without dark prothallus, cracked to cracked areolate or warty, partially erupting sorediate. Gyrophoric acid (Lecanoric acid) . ↑ **Trapelia**
- 8* Soralia P+ yellow, K+ yellow. Thallus brownish gray, brown, warty areolate, usually with blackish prothallus, areoles often scattered, erupting into whitish, slightly yellowish-green to brownish, in the herbarium light rose-brownish soralia. Usually in smaller thalli between other crustose lichens. Ap. very rare. Alectorialic acid
□ **Fuscidea praeruptorum**
- 9 Thallus shiny citron- to greenish-yellow, completely mealy, R-. Ap. full yellow, convex marginless, -0.6(0.8) mm. Sp. 4-7 x 1.5-2 (2.5) µm. Rhizocarpic acid
□ **Psilolechia lucida**
- 9* Thallus otherwise colored, whitish, gray, gray-brown, pale gray-greenish. sp. definitely wider

- (when very narrow see *Psilolechia clavulifera*)
- 10** Thallus pale gray-greenish to pale yellowish-green, finely cracked areolate, soralia only at first bordered, standing at the edge of the areoles, above all the center of the thallus soon completely sorediate, margin of the thallus usually remaining soredia free, occasionally with whitish to gray prothallus, P-, C-, KC+ yellow. Ap. rare, convex marginless, gray-blackish to discolored gray-brownish, often gray pruinose. Sp. 8-11(16) x 3-5(7). Usnic acid, Zeorin, ±Skyrin . **10**
- Lecanora orosthea**
- 10*** Thallus white to gray, brownish, with delimited soralia, KC-. Ap., if occurring, black, brown-black . **11**
- 11** Medulla I+ blue/violet, almost always R- **12**
- 11*** Medulla I- . **13**
- 12** Thallus of ± isolated rounded to elongate or sinuous areole groups on extensive black prothallus, with one to several concave, often coalescing soralia, sterile, R-, on steep surfaces in the mountains **Fuscidea maculosa (16)**
- 12*** Thallus not of areole groups on extensive black prothallus. Soralia rounded to irregular, concave to usually somewhat raising above the thallus, -1 mm, whitish to (blue)gray, rarely dark gray. Thallus cracked to cracked areolate, uneven, sometimes with dark prothallus, R-, very rarely medulla K+ yellow, P+ orange. Ap. -1.5 (2.2) mm, flat to convex. Disk often pruinose, margin little set off. Sp. (11)14-20(25) x (6)7-10(12) µm. Confluent acid derivatives, very rarely with Stictic acid
- **Porpidia tuberculosa**
- 13** Soralia blackish. Thallus gray, coarsely cracked areolate to areolate, areoles flat to moderately convex, at times erupting into irregular, flat to moderately convex soralia. Medulla K-, P-/P+ orange. Miriquidic acid, ± Psoromic acid. In exposed mountain sites .
- Miriquidica nigroleprosa**
- 13*** Soralia lighter . **14**
- 14** Medulla UV-. Thallus cracked. Commonly in lower and middle sites. With Stictic acid or Glaucoephaeaic acid. Soralia whitish to greenish-white or gray. Ap. often lacking, black, white pruinose or nonpruinose, with brown to dark brown hyp. Epithym. brown to olive-grown. Hym around or over 100 µm. Sp. over 12 x 6 µm . **15**
- 14*** Medulla UV+ white. Thallus definitely areolate to warty or as small islands on black prothallus, brownish, gray-brown, gray to white-gray, R-. Rare montane species. Divaricatic acid. Ap. often lacking, with colorless to pale hyp. Hym. -110 µm, often difficult to separate from the hyp. Epithym. brownish. sp. -12(14) µm long . **16**
- 15** Thallus commonly very thin crustose, cracked, whitish to light gray. Soralia often sunken, rarely rising over the thallus upper surface, usually without a differentiated margin, P+ orange, K+ yellowish, -0.5 mm. Ap. -1mm, nonpruinose, usually flat, swelling often brown tinted. Sp. 12.5-20 x 6.5-10 µm. Hym. usually about 110-150 µm. Stictic acid
- Porpidia soredizodes**
- 15*** Thallus robust, usually very extensive, white-gray to cream colored, often bordered by a darker prothallus line, fine cracked to cracked (areolate). Multiple sparse soralia often irregularly erupting (often on the cracks), (less on ap. rich portions), P-, K-. Ap. -2(2.3) mm flat to moderately convex, disk pruinose, margin commonly nonpruinose. Hym. usually about 90-190 µm. sp. 15-25 x 5-12 µm. Glaucoephaeaic acid
- **Porpidia glaucophaea**
- 16** Thallus gray-white, as small areoles or areole groups separated island-like on black prothallus, areoles finely cracked, flat to moderately convex, each with one or more concave soralia. Ap. unknown
- * □ **Fuscidea maculosa**
- 16*** Thallus mouse gray to gray-brown, rarely gray-white, cracked to cracked areolate. Areoles usually coalescing. Prothallus not extensive **7**
- 17** Thallus gray, gray-brown, gray-white, warty areolate to cracked areolate. Soralia -0.5(0.7) mm, whitish to soon brownish, soon coalescing. Ap. -1.0(1.2) mm, margined, ± convex, sometimes grouped. Sp. 9-12(14) x 3-4(5) µm. . **7**
- * **Fuscidea recensa**
- 17*** Thallus gray-brown to brown-gray, cracked areolate. Soralia very sparsely and irregularly scattered to numerous, -0.5 mm, usually whitish. Ap. -0.6 mm, sunken, with age occasionally convex projecting, with broad, rounded margin, the interior surrounded by one lighter ring. Sp. 8.5-10.5(11.5) x 4-6 (7.5) µm . **7**
- * □ **Fuscidea oculata**
- Lecidea PT 6: Species on Silicate Rock,
Thallus white, gray to blackish, pale
greenish to yellowish**
- 1** Medulla I+ violet . **2**
- 1*** Medulla I- **7**
- 2** Thallus K+ yellow to red, with Stictic acid derivatives, very rarely with Confluent acid; ap. usually flat. Sp. broadly ellipsoidal, usually 8.5-15 x (4.5)5-7(8) µm. Epithym. black-green, blackish blue-green, rarely olive. Hyp. colorless, pale brownish to brown . **3**
- 2*** Thallus K-, with Confluent acid derivatives, very rarely with Stictic acid derivatives . **5**

- 3 Parasitic on *Lecidea lapicida* (var. *pantherina*), producing small ± rounded, often convex whitish thalli, K+ yellow, then red. Ap. -0.5(0.6) mm, disk often umbilicate. Exc. brown-black. Epithym. brown to olive brown. Hyp. (dark) brown. Sp. 11-16 x 6.5-9 µm. Norstictic acid □ **Cecidonia umbonella**
- 3* Not parasitic. Thallus often large 4
- 4 Thallus K+ (orange to) red, commonly well developed, usually cracked areolate, often rather thick, with usually flat, angular, distinct angular areoles, white, beige, light gray. Ap. sunken to half-sunken, with thin to indefinite margin, -1(1.5) mm, as a rule flat, sometimes slightly pruinose. Norstictic □ **L. lapicida** var. **pantherina**
- 4* Thallus K+ yellow, indefinite to definite and areolate, commonly light gray to gray, often partially rusty overlaid (medulla K+ yellow, sometimes even forming red crystals). Ap. as a rule sessile to half sunken, with usually raised margin, -1.5(2) mm, often accumulated. Stictic acid derivatives, ± Norstictic acid **L. lapicida** var. **lapicida**
- 5 Sp. 11-17(20) x 5.5-7.5(9) µm. Exc. soon strongly reduced, brown. Epithym. dirty olive to green-black. Ap. not or pruinose when young, -1.2-(2.5) mm, ± sunken, often separated from the thallus by a surrounding ring-crack or by a thallus collar. Hym. ca. 70-105 µm. Hyp. black-brown. Thallus white, chalky, cracked areolate, finely cracked to almost smooth, usually extensive. On calcareous silicate rock on higher sites. . * **Porpidia speirea** (*P. trullisata* is closely related: Ap. strongly pruinose, puffy margined; as a rule Ch-, I reaction often relatively weak, hym. 85-130 µm)
- 5* Sp. smaller, -13.5 x 6 µm . 6
- 6 Hyp. dark brown, dark red-brown. Ap. 0.7-1.5 (1.8) mm, sunken at first, soon sessile, single to often grouped, flat to convex, margined, finally with indefinite margin. Sp. 9-13.5 x 4-6 µm, sp. wall thin, -0.6 µm. Exc. exterior usually blue- to black-green, interior usually colorless, rarely brown to brown-green. Thallus (dark) gray to bluish-gray, finely cracked to areolate, areoles usually flat. . * □ **L. confluens**
- 6* Hyp. colorless to light brown. Ap. -1.3(1.5) mm, sunken (to half sunken), always flat, usually angular. Sp. 7.5-11 x 3.5-6(6.5) µm, sp. wall thick (ca 1.1.5 µm). Exc. exterior blue-green to olive, interior colorless. Epithym. olive, black-green to rarely blue-green. Thallus blue-gray to gray-white, rarely with yellowish tint, cracked areolate, areoles flat. Living parasitically (e.g. *Aspicilia*) or autotrophically. **L. tessellata**
- 7 Thallus or medulla K+ red or orange 8
- 7* Thallus/medulla K+ yellow or K- . 9
- 8 Thallus white-yellow, yellow, pale gray-green, K+ yellow-orange to red, KC+ red, C-, medulla P+ yellow, of irregular, flat to convex areoles, in the herbarium ochre, yellow-brown (to red-brown). Ap. -2(2.5) mm, marginless, exc. strongly reduced. Epithym. blue-green to black-green. Paraph. thick, over 3 µm. Hyp. ± colorless. Sp. 7-15 x 3.5-6 µm. Aleoctorialic acid, Protocetraric acid. High mountain lichens **Tephromela armeniaca**
- 8* Thallus brown-gray, medulla K+ yellow, later (partially) red, C-, P+ orange. Ap. with furrowed disk, usually angular, margined. Hyp. dark . **L. scabridisca** PT 7/11
- 9 Thallus C+/KC+ orange or rose-red 10
- 9* Thallus C-/KC- or KC+ yellow (when KC+ red see 8) 14
- 10 Thallus C+/KC+ orange. Ap. at least at first margined, black, flat to moderately convex (rarely slightly pruinose). Paraph. relatively loose, becoming free under pressure. Exc. clearly developed. Sp. ellipsoidal. Thiophanic acid. Very rare species 11
- 10* Thallus C+/KC+ rose-red, P-, K-. Gyrophoric acid . 12
- 11 Thallus gray-yellowish, yellowish-white, cream colored, even yellow-green, finely granular, thin, K-,P-. Hyp. ± colorless. Epithym. olive gray, brown to green. Sp. 9-13 x 5-6.5 µm. Ap. flat to moderately convex, black, sometimes pruinose, thin margined, -0.4 mm. Arthothelin **Lecidella viridans**
- 11* Thallus yellowish-white, cream colored, thin to thick, cracked to areolate, K-/K+ yellow, P-/P+ yellow. Hyp. yellowish to reddish-brown. Epithym. black-green, bluish green, rarely olive. Sp. 11-16 x 6-8 µm. Ap. flat and clearly margined, finally convex and ± marginless, black, nonpruinose, -0.8(1.2) mm. Xanthone, ± Atranorin **Lecidella asema** Gr.
- 12 Hyp. colorless to slightly colored. Ap. brown, red-brown, brown-black, rarely dull black ↑ **Trapelia**
- 12* Hyp. brown-black. Ap. ± black, sometimes pruinose . 13
- 13 Sp. 18-40 x 10-16 µm. Ap. sunken in the thallus areoles to finally somewhat projecting, -1.5 mm, concave to flat, blackish. Hym. over 130 µm. Epithym. brown. Thallus whitish, rose-whitish, beige, yellowish-gray, cracked areolate to rarely areolate, rather thick . * **Amygdalaria pelobotryon**
- 13* Sp. 8.5-17 x 3.5-7 µm. Ap. black, often appearing slightly pruinose, flat to convex. Hym. -60 µm. Epithym. olive-green, olive-brown, green-black. Thallus gray-white to pale brownish, usually cracked areolate, often

- extensive. * Additional characteristics see PT 7/17
- L. fuscoatra f. grisella**
- 14** Ap. from the first marginless and convex to hemispherical or almost spherical, -0.4 mm. Exc. lacking. Paraph. branched and reticulate. Sp. up to 10.5 x 4 µm. R-
- Micarea**
- 14*** Without these character combinations. If ap. soon convex and marginless, then with clearly developed exc. and usually larger **15**
- 15** Sp. commonly clearly curved (± bean shaped), 8.5-12(14) x 4-6 µm. Thallus and exc. (section) P+ red. Epihym. and exc. exterior brownish, hyp. light. Paraph. becoming ± free under pressure in K. Ap. -1.5 (1.8) mm, dark brown, brown-black, fresh brown, usually ± flat, with puffy margin, often somewhat lighter, often wavy with age. Thallus light gray to brownish, clearly cracked to cracked areolate, with brown-black prothallus. Fumarprotocetraric acid . □ **Fuscidea cyathoides**
- 15*** Sp. not curved bean-shaped. Thallus/medulla not P+ red . **16**
- 16** Hym. turbid because of fine oil droplets. Ap. flat, thin margined, -1(1.2) mm. Hyp. colorless to pale brown. Paraph. at least under pressure in K easily free. Sp. 8-15 x 4-8 µm. Thallus white, areolate to appearing small squamulose, K+ (weakly) yellow. Epihym. blue-black. 2'-O-Methylperlatolic acid, Atranorin **Carbonea latypizodes**
- 16*** Hym. not turbid because of oil droplets **17**
- 17** Hyp. colorless, pale brownish, yellowish **18**
- 17*** Hyp. strongly colored, red-brown, brown, brown-black **33**
- 18** Thallus K+ yellow . **19**
- 18*** Thallus K- . **22**
- 19** Thallus light yellowish-gray to yellowish gray-green to light gray-green, relatively thick, cracked to cracked areolate, C-, P-, KC+ yellow. Ap. lead-gray, gray-green, discolored brownish, olive, olive-brown to (blue)black, dull, ± pruinose, fresh "hyaline" with green-tint, at first sunken, then depressed sessile, soon convex-marginless, -1.5(1.8) mm. Exc. well developed. Epihym. olive, greenish, dirty brownish. Sp. 9-13(16) x 4-6 µm. Paraph. moderately cemented. Zeorin, ± Gangaleoidin, ± α-Collatolic acid, ± Atranorin .
- **Lecanora sulphurea**
- 19*** Ap. black **20**
- 20** Ap. marginless, -1.8(2.5) mm, flat to rather convex, usually shiny black, depressed. Thallus whitish, rarely yellow-tinted, thick, K+ yellow, C-, KC+ yellow, P-. Exc. strongly reduced. Epihym. blue-green. Sp. 7.5-16 x 4.5-8.5 µm. Paraph. strongly cemented. Atranorin, Bourgeanic acid, ± Usnic acid .
- **Tephromela aglaea**
- 20*** Ap. long time margined, -1.5 mm, flat to moderately (rather) convex. Hyp. colorless or brown. Paraph. easily free under pressure, at least in K. Sp. (broadly) ellipsoidal, 5-9.5 µm, exc. K+ blue-red, thallus whitish: *Adelolecia pilati* (PT 4/4 with exceptionally well developed thallus) **21**
- 21** Hyp. colorless to weakly brownish. Exc. dark only at the margin (blue-black, green-black), interior light. Epihym. variable, blue-green, dirty reddish to brownish. Sp. 11-17 x 6-9.5 µm. Ap. -1.5 µm. Thallus variable, usually thin, usually light gray, gray, brown-gray, K-/K+ yellow, P+ yellow. Zeorin, ±Atranorin
- **Lecidella stigmatea**
- 21*** Hyp. yellow-brown. Exc. interior red-brown, exterior blue-green-black. Epihym. deep green to blue-green. Thallus KC+ yellow, P+ yellow. Atranorin, Diploicin, ±Thuringion .
- ↑ □ **Lecidella carpathica**
- 22** Ap. disk and ap. margin pure black, but sometimes pruinose, not lighter on moistening **23**
- 22*** Ap. disk and/or ap. margin at least in the moist condition not pure black . **28**
- 23** Thallus pale yellow to slightly green tinted, K- to K+ slightly yellow, thin, flat areolate, parasitic on blackish crust of *Orphniospora mosigii*. Alpine. Ap. nonpruinose. Epihym. blue-green, green, black-green. Paraph. strongly cemented. Areoles 0.3-1mm. Ap. -0.8 mm, sunken to depressed, flat, at least at first thin margined. Sp. 8-15 x 3.5-6.5 µm. Atranorin, Usnic acid, mieur-alp, Al (similar, but autotrophic: **Lecanora viridiatra** (Stenham.) Nyl. = *L. luteoatra* Nyl.)
- Carbonea distans**
- 24** Paraph. at least in K under pressure becoming rather easily free. Sp. 11-18 µm long **25**
- 24*** Paraph. rather strongly cemented . **26**
- 25** Ap. sessile, flat and margined, finally often convex and marginless, -1.2 mm. Sp. broadly ellipsoidal, (6)7-9(9.5) µm wide. Ascus clavate. Epihym. and exc. rather variably colored at the margin .
- ↑ **Lecidella stigmatea** (21)
- 25*** Ap. sunken (*Aspicilia*-like) to closely depressed, flat, thin and often indefinitely margined, -0.8(1) mm. Sp. ellipsoidal, 6-7 µm wide. Ascus subcylindrical. Epihym. emerald green to green-brown, even violet (K+ green). Exc. thin, brown. Thallus areolate, areoles flat to moderately convex, gray, dark gray, gray-brown .
- **Schaereria fuscocinerea**
- 26** Sp. 8-11(13) x 2.5-5 µm. Hym. 35-50 µm high. Epihym. intensive green to green-black. Ap. flat, definitely margined, black when moist, -1(1.5) mm. Thallus thin, coherent to cracked, gray. Planaiic acid derivatives
- **L. plana**

- 26* Sp. broader, 9-14 x 5-7 μm . 27
- 27 Ap. medulla I+ blue. Exc. exterior dark green, black-green. Epithym. black-green, blackish blue-green. Paraph. rarely branching. Thallus medulla I+ violet, but in the case of weakly developed thallus macroscopically sometimes indefinite
- L. laticida (4)**
- 27* Ap. medulla I-. Exc. greenish or brown to olive-brown, interior lighter. Epithym. olive, olive-green. Paraph. \pm branched and anastomosing. Thallus thin to rather thick, areolate, warty areolate to scattered warty, gray to dark gray or brown-gray, dull, P-, K-, C-, sometimes KC \pm weakly rose. Ap. black (moist sometimes brown-black), flat and margined or even later convex marginless, margin often somewhat lighter than the disk, -1(1.2) mm. Miriquidic acid .
- Miriquidica leucophaea var. griseoatra**
- 28 Sp. 15-25(32) x 6-11(14) μm . Ap. -2 mm, sitting up with constricted base, dark brown to black-brown, concave to flat, with lighter, puffy margin. Thallus light yellowish-gray to light ochre \uparrow \square **Trapelia mooreana**
- 28* Sp. smaller .29
- 29 Thallus \pm light yellowish to light gray-green, relatively thick, cracked to cracked areolate, P-. Ap. lead-gray, gray-green, olive, dirty brown, olive-brown to (blue) blackish, \pm pruinose, at first sunken, then sessile depressed, moderately convex, with disappearing margin, -1.5(1.8) mm. Epithym. olive, greenish, with a layer of granules soluble in K. Sp. 9-15 x 4-7 μm . Zeorin, \pm Gangaleoidin, \pm α -Collatolic acid, \pm Atranorin . \square **Lecanora sulphurea**
- 29* Thallus gray, brown-gray (only browsed or collections with abnormal algae on shady sites greenish). Ap. brown to brown-black, at most moist ones with definite brown tone. Without Zeorin . 30
- 30 Ap. margin indefinite to very thin, not raised. Exc. very narrowly developed. Sp. 7.5-10.5 x 4-7 μm . Hym. very high, difficult to separate from the hyp., base often with numerous old browned sp. Ap. -1.5(2.5) mm, sunken, soon longitudinally deformed and angular, \pm flat, brown-black, moist (black) brown, rarely even brown when dry, sometimes as slightly pruinose. Thallus gray to brown-gray, areolate, cracked- or warty-areolate, with bordering prothallus line. Epithym. light brown. Paraph. in K easily free. R-. Medulla UV+ white. Divaricatic acid . .
- \square **Fuscidea kochiana**
- 30* Ap. margin definite, exc. strongly developed. Hyp. well separated from hym 31
- 31 Sp. broadly ellipsoidal, 9-12(13) x 6.5-8.5(9) μm . Ap. -1.5(2) mm, with puffy, often strongly warty curved, usually somewhat lighter (brownish) margin, sitting up, flat, brown-black to almost black, often seeming slightly pruinose, several crowded groups and producing aggregates up to 3mm in size. Hym. -70(90) μm . Epithym. brown. Paraph. in K easily free. Thallus thin to thickish, usually uneven, gray to gray-brown. R-. Divaricatic acid only in ap \square **Fuscidea austera**
- 31* Sp. ellipsoidal 9-14(15) x 4-6(7) μm . Ap. margin not strongly puffy and wavy. Hym. 50-70 μm . Thallus R- . 32
- 32 Thallus thin, coherent to cracked, gray, often partially rusty over laid, often extensive, often with black prothallus. Ap. brown-black to black, sometimes pruinose, swollen (red) brown, \pm flat, margined, depressed sessile, young \pm sunken, -1.5(2) mm, single or in groups and flattened on the sides. Exc. exterior green- to brown-black, interior colorless to pale brownish. Epithym. brown to rarely olive. Sp. (9)10-14(15) x (4)4.5-6.5 μm . 4-O-Demethylplanic acid. or Planic acid, \pm 4-O-Demethylplanic acid
- \square **L. lithophila**
- 32* Thallus thin to moderately thick, areolate, warty areolate to scattered warty, gray-white, gray, beige, often somewhat shiny. Ap. dark gray-brown, red-brown to brown-black, flat and margined or also later convex marginless, -1(1.2) μm , margin sometimes somewhat lighter than disk. Exc. exterior brown, interior light brownish (to almost colorless), of radial lying hyphae. Epithym. brown, rarely olive-brown. Sp. 9-14.5 x 4.5-6.5 μm . Miriquidic acid **Miriquidica leucophaea var. leucophaea**
- 33 Sp. up to 5 μm thick 34
- 33* Sp. thicker . 37
- 34 Ap. soon convex and indefinitely margined, -0.8(1) mm. Hyp. red-brown to deep red, K+ intensive (violet)red. Epithym. and outer part of the exc. green-black to blackish blue-green. Exc. K-. Hym. colorless to reddish. Paraph. branching, at times reticulate, with gelatinous envelope. Sp. 8-12 x 2.7-3.8 μm . Thallus very variable, weakly to definitely developed, gray to brown. R- **L. commaculans**
- 34* Ap. \pm flat and long time margined. Hyp. dark brown to brown-black . 35
- 35 Epithym. shining emerald- to blue-green. Exc. throughout brown-black. Sp. (6.5)8.5-15 x 3.5-5.5 μm . Hym. 40-70 μm . Ap. -0.8(1.2) mm, flat, with distinctly raised margin, concave to flat. Thallus thin to (in the region mostly) definite, cracked to areolate, whitish to gray. \pm Pannarin . **Carbonea vorticosa**
- 35* Epithym. not shining emerald green. Exc. not brown-black throughout. Thallus usually coherent to cracked, dirty gray to gray-brownish 36

- 36 Ap. -1.5(2) mm, flat, with permanent, raised, often wavy margin, often closely crowded and deformed because of the lateral pressure, depressed, often pruinose. Hym. delicately violet to cherry red (to brown or almost colorless), epihym. olive. Paraph. simple to sparsely branching. Sp. 7-13 x 2.5-3.5 μ m. Exc. exterior purple-black, interior usually slightly reddish, often K+ purple-violet (color varying, no exuded solution)
- L. sarcogynoides**
- 36* Ap. -0.4(0.7) mm, long time flat, thin margined, rarely finally convex, nonpruinose. Hym. not violet to cherry red, occasionally dirty, epihym. dirty (blue)greenish, greenish-brown (blackish-brown). Sp. 6-9(10) x 2.5-4 (4) μ m. Exc. exterior bluish, not K+ purple-violet. thallus often with punctiform black pycn., pycnosp. 3-4.5 x 1.5 μ m
- Micarea erratica**
- 37 Thallus K+ yellow, P+ yellow to orange. Paraph. loose or cemented . 38
- 37* Thallus K-. Paraph. cemented . 39
- 38 Paraph. loose, at least in K, simple. Epihym. deep green to blue-green. Hyp. yellow-brown to red-brown. Exc. interior red-brown, exterior blue-greenish-black. Sp. 9-16 x 5-9 μ m, thick walled, without perispore. Ap. -1 mm. Thallus warty areolate to coarse granular, usually well developed, white to light gray, K+ yellow, KC+ yellow, P+ yellow. Atranorin, Diploicin, \pm Thuringion
- \square **Lecidella carpathica**
- 38* Paraph. strongly cemented, branching and reticulate. Hyp. dark brown to black-brown. Medulla K+ yellow, P+ orange, reaction \pm strongly diminished on the cortex "strained". Young sp. usually with recognizable perispore, at least 12 / 6 μ m. Stictic acid 48
- 39 Hym. and hyp. usually with blue-violet to blackish, K+ green granules. Exc. exterior dark red-brown, interior lighter red-brown to almost colorless, hyp. dark red-brown. Ap. -0.6(0.8) mm, red-brown to brown-black, concave to slightly convex. Sp. 11-17 x 6-7 (9) μ m. Hym. 60-80(90) μ m. thallus very thin, \pm shiny, varnish like to cracked, gray to gray-green **L. ahlesii**
- 39* Hym. and hyp. without such granules. Hyp. brown, dark brown to brown-black. Ap. black, rarely brown-black, then epihym. commonly otherwise colored 40
- 40 Sp. (6.5)8.5-15 x 3.5-5.5 μ m. Paraph. simple, cemented. Hym. 40-70 μ m. Epihym. shining emerald to blue-green. Exc. brown-black throughout. Ap. -0.8(1.2) mm, flat, with sharp, raised margin, concave to flat, black. Thallus thin to (usually in the region) definite, cracked to areolate, whitish to gray, R- or P+ red. \pm Pannarin **Carbonea vorticosa**
- 40* Sp. as a rule over 5.5 μ m wide . 41
- 41 Sp. 9-11 x 6-8 μ m, thick walled. Hyp. brown, dark brown. Exc. exterior brown-gray, green-gray, dark gray, interior light to gray-brown. Paraph. simple to rarely branching, (almost) not anastomosing. Epihym. greenish. Ap. -0.6(1) mm, flat to moderately convex, (constricted) sessile. Thallus areolate, gray, dark brown, with black prothallus. On exposed rock above the tree line – mieur-smed, alp – Schneekoppe, Alps
- Orphniospora mosigii**
(Körber) Hertel
Rambold (*Lecidea obscurissima* Nyl.)
- 41* Sp. larger, usually over 15 μ m long, often at least appearing pointed on one end, with \pm definite perispore. Hyp. dark brown to black-brown, in the brown to dark brown (in thicker sections entirely brown-black), rarely in the lighter exc. radiating. Hym. 60-150 μ m. Paraph. strongly cemented, branching and anastomosing. Ap. usually over 0.5 mm, black, rarely brown-black, sometimes pruinose. Thallus R- (rarely medulla K+ yellow, P+ orange) (*Porpidia*) . 42
- 42 Epihym. shining emerald green. Sp. (14) 17-25 x (5.5)6-9(10) μ m. Ap. -1.5(2) mm, flat to usually moderately convex, margined. Thallus thin crustose, dirty white-gray, cream, often rust colored to orange overlaid, usually finely cracked **Porpidia hydrophila**
- 42* Epihym. brown, black-brown, olive, rarely dirty greenish . 43
- 43 Ap. at least when swollen not pure black. Medulla K-/K+ yellow, P-/P+ orange. Stictic acid . 44
- 43* Ap. even when swollen black, but sometimes pruinose 45
- 44 Thallus with \pm chalky rough upper surface, usually white, rarely ochre-white, bluish-white, light gray, usually warty areolate, areoles often hemispherical to knobby, often separated, on (calcareous) silicate rock in high mountains. Ap. arising between the areoles, black to dark brown, with black margin, not (or at best when young somewhat) pruinose, moist usually dark red-brown, -2 mm. Hyp. brown, red-brown, only rarely with crystals. Sp. (16)20-28(33) x 7-12(14) μ m. Exc. very dark, without lighter outer regions. Epihym. yellow-brown to brown. * **Porpidia superba**
- 44* Thallus not chalky, whitish, gray, olive-gray, thin to moderately thick, coherent to cracked areolate. Areoles not hemispherical. Ap. black to dark brown. Exc. interior brown, with broad, only relatively weakly pigmented outer regions (thin section !). Widely distributed lichens . 53
- 45 Thallus chalk white, strongly developed, with chalky rough upper surface. Exc. soon

- strongly reduced or strongly developed. Ap. strongly pruinose. Alpine species of the Alps on slightly calcareous silicate rock . 46
- 45* Thallus not chalk white with chalky rough upper surface. Exc. strongly developed. Commonly on lime-free silicates 47
- 46 Exc. soon strongly reduced and narrow, brown. Sp. 10-16(20) x 5.5-7.5(9) μm . Ap. 0.5-3.5 mm. Hyp. black-brown. Thallus coherent to cracked. Medulla in general I+ weakly violet. Ch- (when Confluent acid, see *P. speirea*) **Porpidia trullisata**
- 46* Exc. strongly developed, interior brown, with broad, relatively weakly pigmented outer region. Sp. (16)18-26(30) x 7.5-11.5(14) μm . Ap. -1.5(2) mm. Hyp. brown, black-brown, rich with crystals (polarized). Thallus coherent to cracked or warty areolate. Epithym. olive tinted light brown to brown. Usually with Stictic acid derivatives
- Porpidia zeoroides**
- 47 Thallus medulla K+ yellow, P+ orange, exc. K-/K+ yellow to red, not brown-black throughout (thin section) 48
- 47* Medulla R- . 49
- 48 Ap. becoming sunken to closely appressed, -1.5(22) mm, disk thickly pruinose, flat to moderately convex. Thallus large, well developed, whitish, light gray, in the herbarium even yellow tinted, coherent to finely cracked, sometimes slightly oily shiny. Margin naked. Sp. 18-27(32) x 7-12(14) μm . Hyp. black-brown. Epithym. brown to olive-brown. Exc. exterior dark brown to black, interior rather light, gray, brownish-bray, K+ yellow to red, exc. hyphae 2-4 μm thick. Medulla K+ yellow(orange), P+ orange (thallus K- to yellowish, P- to pale orange). Stictic acid derivatives
- **Porpidia albocaulescens**
- 48* Ap. sessile. Disk naked or (usually only slightly) pruinose. Exc. hyphae 3-8 μm thick 53
- 49 Ap. arranged in \pm concentric rings .
- ↑ **Porpidia crustulata**
- 49! Ap. very large, over 1.6 mm .
- ↑ **Porpidia macrocarpa**
- 49* With other characteristics 50
- 50 Thallus with Confluent acid or Methyl-2'-O-Methyl[microphyllinat], warty to cracked areolate, cracked, not rust colored over layer. Ap. sunken to depressed, later even sessile. Exc. dark brown, basally frequently reduced, exc. hyphae 3-5 μm thick. Epithym. brown (olive) to olive-green. R-. Very difficult group. *Porpidia cinereoatra* s.l. 51
- 50* Thallus without Confluentinic acid, often with Stictic acid derivatives, often thin, commonly cracked, sometimes rust colored over layer. Ap. usually sessile, often with constricted base. Exc. interior light- to dark-brown or yellow brown, exc. hyphae (3)4-9 μm . Epithym. brown to olive. (ascus wall in conc. I+ red-brown) 53
- 51 With Methyl-2'-O-Methylmicrophyllinic acid. Thallus cracked- to warty-areolate, gray-white to cream colored, smooth, often somewhat shiny. Areoles coalescing to delimited. Ap. depressed to sessile, -1(1.5) mm, black, thick, but little raised margin, epithym. green-brown to olive. Sp. 14-20(25) x (5)7-9(11) μm . Hym. (80)90-115(130) μm . Asci exterior I (conc.)+ orange-brown. Medulla UV+ white
- Porpidia contraponenda**
- 51* With Confluent acid derivatives. Thallus relatively thick, cracked, cracked- to warty-areolate. Areoles coalescing. Ap.(margin) scarcely projecting over the thallus. Medulla UV- . 52
- 52 Sp. 14-20(23) x 7-10 μm . Thallus whitish, cream, light gray, cracked to warty areolate, often very thick, areoles often strongly convex. Often with black prothallus. Ap. black, rarely gray pruinose, -1.6 mm, flat to usually only moderately convex, margin rather thick. Hym. (75)90-125 μm . Asci exterior I(conc.)+ blue to brownish blue
- Porpidia musiva**
- 52* Sp. 12-17(18) x 5.5-8(9) μm . Thallus whitish light gray, often dull, cracked- to warty-areolate, areoles flat to convex. Ap. black, commonly gray because of pruinosity, -1.3 mm, flat to convex, margin usually raised. Hym. (75)90-105 μm . Asci exterior I (conc.)+ orange-brown . □ **Porpidia cinereoatra**
- 53 Ap. 1-3.8 mm (max. diameter), nonpruinose or slightly pruinose, black, rarely brown-black. Maximum width of the margin (oversight) 0.13-0.25 mm. Sp. 17-25(30) x 7-12(14) μm . Hyp. dark brown to black-brown. Thallus very variable, thin, rarely rather thick, cracked to rarely cracked-areolate, white-gray, gray, greenish-gray, often brownish to red-brown tinted. Exc. interior K- or K+ red, rarely K+ yellow. Medulla K-, P-, rarely K+ yellowish, P+ orange. Quinone substances or Ch-, rarely Stictic acid derivatives **Porpidia macrocarpa**
- 53* Ap. 0.55-1.6 mm (max. diameter), as a rule up to 1 mm, long flat to moderately convex, with thin raised margin, nonpruinose, almost always black. Maximal width of the margin 0.07-0.17 mm. Sp. 12-20 x 6-10 μm . Thallus very thin, coherent to weakly cracked, dirty whitish to gray, commonly not brownish to red-brown tinted. Exc. interior K+ yellow, rarely K-. Medulla K-/K+ yellow, P-/P+ orange. Usually Stictic acid derivatives **Porpidia crustulata**

**Lecidea PT 7: Species on Silicate rock,
Thallus brown, gray-brown, yellow-
brown, ochre, rust colored, brown-red,
rust-red**

- 1 Thallus (occasionally only partially) rust-colored, ochre, red, C-, K-, often on iron-rich rock . 2
- 1* Thallus light to dark brown, red-brown, gray-brown . 10
- 2 Sp. 5.5-8.5 x 2.5-3.5 µm. Thallus of ± isolated, small squamulose, crenate, -1.3 mm wide areoles, yellow-brown, shiny. Ap. 0.2-1.3 mm, flat, thin margined, shiny, marginally on the squamules, often crowded. Hyp. colorless, epihym. bluish-green, green. Ch-
L. variegatula
- 2* Sp. larger. Thallus ochre, rust colored, red, not shiny 3
- 3 Ap. concave to flat, margined, ± sunken, black, -0.5(0.7) mm, single or in groups. Hym. I+ orange-yellow to turquoise blue. Thallus red to red-brown, even red-blackish or ochre, thin, cracked to finely areolate, usually small. Epihym. usually greenish, hyp. dark brown, exc. carbonaceous, sp. 10-17 x 6-10 µm
□ **Tremolecia atrata**
- 3* Ap. not concave, larger. Hym. not I(conc.)+ clearly orange-yellow . 4
- 4 Sp. (13)16-30 x (6)7-15 µm. Hyp. dark to black-brown, rays in the brown to black-brown exc. Paraph. strongly cemented. Hym. over 75 µm. Ap. usually 1-2.5 (3.5) mm, black, sometimes pruinose, usually flat to moderately convex and margined (*Porpidia*) 5
- 4* Sp. 8-15 x 4.5-7 µm. Hyp. colorless to dark brown. Hym. -70 µm. Ap. usually -1.5 mm, single or in groups and laterally flattened 7
- 5 Epihym. shining emerald green
Porpidia hydrophila (PT 6/42)
- 5* Epihym. brown, olive, dark brown 6
- 6 Very rare. Arctic-alpine. With Confluent acid derivatives. Exc. hyphae (exc. margin very thin section) 2-3 µm thick, with very dark pigmented walls. Thallus entirely ochre-yellow, ochre, brown-orange to rust color ochre, slightly cracked to cracked areolate (moist not cracked), often slightly oily gleaming. Exc. K-. Ap. at first somewhat sunken, later depressed sessile, with usually blue-gray pruinose disk and black, with age often folded margin, -1.5(2.5)mm. Sp. 14-24 (26) x 6-11(12.5) µm . **Porpidia flavicunda**
- 6* Wide spread. Ch- or rarely Stictic acid derivatives , without Confluent acid derivatives. Exc. hyphae 4.5-6.5 µm thick, with constricted (1.3-2.5 µm) lumen and colorless wall; dark pigment in the space between the hyphae. Thallus commonly only

- partially ochre to rust-brown, otherwise gray, usually coherent to cracked, not oily gleaming. Exc. K+ red(flecked) or K-, rarely yellow. Ap. sessile with constricted base, with usually nonpruinose, rarely weakly pruinose disk, -2.5 (3.5) mm. Sp. (13)17-27(30) x (5.5)7-12(14) µm .
□ **Porpidia macrocarpa**
- 7 Medulla K-. Ap. in imbibed condition with red-brown tint, dry usually ± dull black, often pruinose, flat, clearly margined, depressed sessile to ± sunken, -1.5(2.0) mm. Epihym. brown, dark brown, hyp. usually ± colorless. Sp. (9)10-15 x (4)4.5-6.5 µm. Thallus usually only partially rusty, otherwise gray, thin, with black prothallus, often a broad outer thallus region with only few ap. 4-*O*-Demethylplanaic acid
□ **L. lithophila**
- 7* Medulla I+ violet. Ap. black, flat to moderately convex, margined. Epihym. intensively green, blue-green, blackish-green 8
- 8 Thallus entirely ochre to rust-red, very thick, warty areolate, dull, often slightly rough, areoles rounded, rather convex. Hyp. light- to dark brown, beyond that (delicate) verdigris to emerald green subhym. Hym. colorless to delicate greenish. Epihym. green, blue-green, green-black. Exc. with broad brown- to green-black boundary margin. Sp. 8-11 x 5-6 µm (length to width = 1.6-2), ±Stictic acid, ± Norstictic acid, ±Porphyritic acid
□ **L. silacea**
- 8* Thallus usually only partially rust colored, otherwise whitish to gray, cracked to cracked areolate. Areoles not convex. Prothallus often occurring, black. Ap. often grouped and then ± angular 9
- 9 Thallus white to light gray, rarely gray, often rusty over laid, usually thin, K± yellow (rarely red), P- or + yellowish, C- (in the case of thinner thallus reaction in the exc./ap section). Ap. permanently margined. Hyp. colorless to middle brown or delicate green, rarely darker brown. Exc. with narrow, usually greenish margin. Epihym. black-green. Sp. broadly ellipsoidal, 9-15 x 5-8.5 µm. Stictic acid derivatives or only Norstictic acid .
L. lapicida (PT 6/4)
- 9* Thallus gray to lead-gray, rarely rusty over layer, often relatively robust, R-. Ap. often strongly convex, then margin very thin to disappearing. Hyp. dark brown, dark red-brown. Exc. exterior blackish. Epihym. green, olive, brown-green, blackish. Sp. narrowly ellipsoidal to elongate, 9-13.5 x 4-6 µm. Confluent acid derivatives . □ **L. confluens**
- 10 Sp. spherical, 7-10 µm, single series in (sub) cylindrical ascus. Ap. sitting up to depressed, black, flat, permanent margined, -1.2(1.5) mm. Epihym. ± emerald green, hyp. and exc. dark brown. Paraph. usually simple, loose in K.

- Thallus rather thick, almost squamulose-areolate, areoles uneven, often easily loosened from the substrate, crenate, gray- to dark (red) brown. K-, P-, medulla C± rose. Gyrophoric acid □ **Schaereria cinereorufa**
- 10* Sp. not spherical 11
- 11 Ap. with wrinkled disk, usually with angular or folded outline, margined, flat, sunken to depressed, -0.6 mm. Hyp./exc. dark brown, K+ blood red because of crystals. Epihym. usually brownish. Sp. 10-13 x 6-8 µm. Paraph. branched, anastomosing. Thallus warty areolate, dull, gray-grown to dirty brown, medulla K+ yellow, after a short time at least partially red, P+ orange. Norstictic or Stictic acid (Ap. furrowed, but hyp./exc. K-: **Rimularia gyrizans** (Nyl.) Hertel & Rambold)
- . **L. scabridisca**
- 11* Ap. not furrowed. Hyp./exc. not K+ red because of crystals . 12
- 12 Thallus parasitic, producing islands of other crustose lichens or other thallus marginally attacking, usually small 13
- 12* Thallus not clearly parasitic 15
- 13 On or near *Lecanora rupicola*, usually rounded, small (1.5 cm, rarely larger), middle to dark brown, shiny, warty areolate, Ap. shiny black, between the areoles, -0.5 mm. Sp. 8.5-14 x 4.5-7 µm. Epihym. and hyp. dark brown. ± Gyrophoric acid .
- **Rimularia insularis**
- 13* On other crusts . 14
- 14 Epihym. dark brown, hyp. light to dark brown. Ap. dull black, depressed, definitely margined, flat to moderately convex, rare, -0.6 (0.9) mm. Sp. 10-16(20) x 5.5-8(10) µm. Thallus thick crustose, deeply cracked areolate, dark brown to black-brown, often somewhat red tinged, with fine warty-rough (granular) upper surface, parasitic, producing a usually irregular thallus on/between crustose lichens, K-/+ yellow to red, P-/+ yellow, C+ rose/-. Gyrophoric acid, ± Stictic acid, ± Norstictic acid
- **Rimularia furvella**
- 14* Epihym. emerald green, hyp. (almost) colorless. Ap. raised margin, strongly shining black, -0.6(0.8) mm. Sp. (8)10-15 x 5-8 µm. Thallus warty areolate, light to middle brown, areoles rather convex, small, often shiny, R-, usually Ch- **Carbonea assimilis**
- 15 Thallus C+ rose-red, KC+ red (often abrading the thallus is an aid for a clear reaction). Gyrophoric acid 16
- 15* Thallus or medulla C- or yellowish 18
- 16 Thallus with finely warty-rough (granular) upper surface, dark brown to black-brown, often somewhat red tinged, thick crust, deeply cracked areolate, usually producing an irregular thallus between crustose lichens.
- Almost always sterile. Ap. -0.6(0.9) mm. Sp. 10-16(20) x 5.5-8(10) µm.
- * **Rimularia furvella**(14)
- 16* Thallus not with finely warty-rough upper surface, often with ap., K-, P- 17
- 17 Paraph. cemented. Ap. -2(3) mm, dull black, even slightly gray pruinose, ± sunken to depressed sessile, flat and raised margin, later even strongly convex marginless. Hym. -60 µm. Hyp. brown-black. Epihym. dirty olive-green, olive-grown, green-black, K± olive. Thallus usually thickish, areolate, areoles concave to moderately convex, smooth to pitted-uneven, sometimes delimited, brown, light gray-brown, yellow-brown, red-brown, often shiny, imbibed often olive. Sp. 8.5-17 x 3.5-7 µm. * □ **L. fuscoatra**
- 17* Paraph. easily free under pressure. Ap. -0.8(1) mm, usually sunken *Aspicilia*-like, indefinitely margined to soon marginless, flat. Hym. over 90 µm. Hyp. light above, below ± brown, of perpendicular hyphae. Epihym. emerald green to olive, even violet, K+ green. Thallus dull, gray-brown, brown
- * ↑ □ **Schaereria fuscocinerea** (28)
- 18 Medulla I+ violet, K- to K± yellow, rarely K+ red . 19
- 18* Medulla I-, K- or K+ yellow 21
- 19 Thallus brownish gray-white, K+ blood red . ↑ **L. lapicida** var. **pantherina** (PT 6/4)
- 19* Thallus R-, ± shiny 20
- 20 Sp. 6-12 x 3-6 µm. Hym. 40-70 µm, hyp. light brownish, epihym. Green(black) to blue-green. Ap. flat to strongly convex, at least at first clearly margined, gray-black to black, -1.6(3) mm. Thallus thick, warty areolate, even almost somewhat squamulose, yellow-brown, copper brown to dark rust brown – arct-alp, Al . □ **L. atrobrunnea** (Lam. & DC.) Schaerer
- 20* Sp. 13-24 x 6.5-12 µm. Hym. 60-120 µm. Hyp. colorless, brownish below, epihym. light brown to dirty olive-green. Ap. flat, usually clearly thin margined, semi- to entirely sunken or between areoles, often angular, black, -1.2(1.8) mm. Thallus usually gray- grown, pale brown, even yellow- to dark brown, cracked areolate, areoles ± flat, even concave. Confluent acid, 2`-O-Methyl-perlatolic acid . □ **Immersaria athrocarpa**
- 21 Hyp. dark brown to black-brown, epihym. brown, olive-brown, olive-green. Hym. -60 µm .22
- 21* Hyp. colorless to light brownish .25
- 22 Thallus cracked-areolate, upper surface of the areoles very finely granular-isidiate, dark brown to brown-black **Rimularia furvella** (14)
- 22* Thallus upper surface not finely granular-isidiate . 23

- 23 Ap. flat to moderately convex, permanently raised margined, usually shiny black, usually -0.5 mm. Thallus of very small, -0.5 mm wide areoles, always nest to *Lecanora rupicola* coll., usually only up to 1.5 cm in diameter. Epihym. dark brown **Rimularia insularis (13)**
- 23* Areoles larger, ap. usually larger 24
- 24 Thallus thick, coarsely warty areolate, areoles lumpy to high convex, uneven, (red)brown to dark brown, usually somewhat shiny, often even ± delimited, relatively loosely attached to the substrate, usually small. Exc. black. Ap. soon convex, margin ± disappearing, -1(1.2) mm. Sp. 7-12 x 4-6 µm. Epihym. brown, K-Ch- . □ **L. fuliginosa**
- 24* Thallus moderately thick to thick, areolate, areoles concave to moderately convex, smooth to unevenly pitted, brown, light gray-brown, red-brown, often shiny. Exc. interior gray, exterior black, ap. flat to convex, margined at first, ± disappearing with age, dull black, -2.5 (3) mm. Sp. 8.5-17 x 3.5-7 µm. Epihym. olive-green, olive-brown, green-black, in K olive. (Gyrophoric acid, reaction sometimes indefinite) . □ **L. fuscoatra**
- 25 Sp. 5.5-8.5 x 2.5-3.5 µm. Thallus yellow-brown to brown, shiny, of ± delimited areoles. Ap. sessile on the margins of the areoles, often to several, flat, thin margined, shiny, -1 (1.3) mm. Hyp. colorless, epihym. bluish green, green **L. variegatula**
- 25* Sp. definitely broader 26
- 26 Medulla K+ yellow, P+ orange, C-. Thallus shiny yellow-brown to dark brown, thick, warty areolate to almost squamulose (areoles to high convex), without definite prothallus. Ap. brown-black to black, imbibed more brownish than black, flat and raised margined, finally strongly convex, sessile, -2(2.5) mm. Epihym. olive brown, brown, greenish. Sp. 10-18 x 4-6.5 µm. Hyp. colorless. Miriquidic acid, Stictic acid □ **Miriquidica garovaglii**
- 26* Medulla K- 27
- 27 Epihym. brown. Hyp. colorless to slightly brownish. Paraph. ± free under pressure in K. Sp. curved bean-shaped or straight. Ap. often over 0.6 mm. Thallus usually gray-brown **Fuscidea sp. (PT 6/30 + 31)**
- 27* Epihym. emerald green, blue-green, brown-green or violet, then K+ green. Ap. -0.6(0.8) mm. Thallus brown, gray-brown 28
- 28 Ap. clearly raised and sharply margined, shiny black, not sunken. Paraph. strongly cemented, branching, anastomosing. Asci clavate. Thallus light to middle brown . **Carbonea assimilis (14)**
- 28* Ap. *Aspicilia*-like sunken, ± flat, indefinite or thin margined. Paraph. easily free in K, asci subcylindrical. Sp. 11-17 x 6-7 µm. Paraph. usually simple. Thallus gray-brown to

(brownish) gray, cracked areolate, areoles flat to moderately convex. Gyrophoric acid .
□ **Schaereria fuscocinerea**

Addendum: Lichen Dwelling Species (Parasites and Parasymbionts)

- 1 Thallus developed 2
- 1* Without a thallus. Ap. black 10
- 2 Almost always sterile. Thallus brown to black-brown . 3
- 2* Commonly with ap 4
- 3 Thallus thick crustose, deeply cracked areolate, with finely warty-rough (granular) upper surface, dark brown to black-brown, often somewhat red tinged, thallus usually irregularly produced between crustose lichens. Gyrophoric acid □ **Rimularia furvella**
- 3* Thallus areolate, upper surface not finely warty. Areoles ± rounded, flat to slightly concave, (light) brown, the usually somewhat raised margin lighter (beige) and often crenate, sometimes squamulose areolate (at first made up of very small, pale margined partial areoles), sometimes even partially blackened, sessile on black “base thallus”, 0.3-1.5(2) mm. Miriquidic acid **Miriquidica intrudens**
- 4 On *Lecanora rupicola*. Thallus brown, usually small. Ap. flat to moderately convex, permanent raised margined, usually shiny black, usually -0.5 mm. Hyp. dark □ **Rimularia insularis**
- 4* On various crusts . 5
- 5 Thallus brown, warty areolate. Ap. raised margined, shiny black. Epihym. ± emerald green. Sp. 10-15 x 5-9.5 µm. Hyp. colorless **Carbonea assimilis**
- 5* Thallus not brown 6
- 6 Thallus pale yellowish to pale greenish . 7
- 6* Thallus whitish, gray, dark gray, brownish gray. Ap. black . 8
- 7 On *Tephromela*-species (*atra*, *grumosa*), ap. convex, not pure black, gray pruinose . □ **Lecanora sulphurea**
- 7* On *Orphniospora obscurissima* in alpine sites. Ap. flat, sunken to depressed, black . **Carbonea distans (PT 6/23)**
- 8 Thallus gray, dark olive-gray, brownish-gray, very variable, granular-warty, areolate or cracked. Ap. without definite margin. Sp. 1-2 celled, (7)9-14(17) x (4)4.5-5.5(6) µm. Epihym. greenish. Medulla I-. Hyp. often with orange colored granules (K+ violet) **Carbonea intrusa**
- 8* Thallus lighter, whitish, gray, cream colored. Sp. 1-celled. Medulla I+ violet . 9
- 9 Thallus whitish, small, usually only -5 mm, island-like, on *Lecidea lapicida* (rarely other *Lecidea* sp.). Hyp. light brown to brown, etc .

- **Cecidonia umbonella**
- 9* Thallus gray, yellow tinted light gray, usually over 1 cm, on *Aspicilia*-species. Ap. sunken to closely appressed, flat, soon marginless, -1.5 mm. Hyp. colorless to delicately light ochre. Sp. 7-10 x 4-6 µm . **L. tessellata**
- 10 On *Candelariella*-species
- **Carbonea vitellinaria**
- 10* On other lichens . **11**
- 11 On *Lecanora*-species. Hyp. yellow-brown to black-brown . **12**
- 11* On other lichens. Hyp. with or without orange colored granules (then K+ violet in solution), colorless to dark ↑ **Carbonea intrusa**
- 12 Sp. 3-4.5 µm wide, ap. usually convex, ± marginless. Hyp. dark brown
- Carbonea aggregantula**
(Müll.Arg.) Diederich & Triebel (*Lecidea a. Müll.Arg.*, *Nesolechia a. (Müll.Arg.) Rehm*)
- 12* Sp. 4-6 µm wide. Ap. usually flat, clearly margined. Hyp. colorless to dark brown .
- Carbonea supersparsa**

Ecology and Distribution of the Species

Lecidea s.str.

Lecidea confluens (Weber) Ach.

In high montane to alpine, high precipitation sites, very rarely lower, on usually lime-free silicate rock on smaller rocks/boulders on cold, humid, long time snow covered habitats, similar to *Rhizoc. alp.* (↑), but avoiding distinctly acid rock, subneutroph.-m.(r.)acidoph., (m.-)r.photoph., anitroph., Char. Rhizocarpetum alp. – arct-h'mo/alp – rare (3); süSch, Vog, Rhön, Meissner, Hz, Erz, BayW, Al

Lecidea fuscoatra (L.) Ach.

Up into montane, rarely high montane sites on lime-free silicate rock on rain exposed, usually sunny and warm, wind sheltered to m.(-r.) exposed habitats, above all on mineral rich or dust impregnated or slightly dunged substrates, even on walls, tomb stones etc., m.-r.acidoph., r.-v.photoph., xeroph., m.nitroph., above all in the Parmelion consp., Lasalletum – s'bor-med – rather rare-moderately frequent; above all silicate Central Mountains, otherwise above all synathropic; “var. *grisella* (Flörke ex Schaerer) Nyl.” Modification of lime influenced substrates, above all on walls, bricks in warmer, relatively precipitation poor sites, e.g. in the Lecidelletum carp., subneutroph.

Lecidea lapicida (Ach.) Ach.

var. **lapicida**

In (high) montane to alpine sites on lime-free (rarely delimited upper surface), usually hard rock on well lighted, moderately to very wind exposed, rapidly snow-free or rather long time snow covered habitats, r.euryök, in cool-moist basins (e.g. similar to *Rhizoc. alp.* ↑) as on exposed rocks (similar to *Umbilicaria cyl.* ↑) or as pioneer in open boulder talus slope, m.-r.acidoph., ombroph., anitroph, above all in the Umbilicarium cyl. and Rhizocarpetum alp – arct-alp – rare (3); above all süSch and Vog above 800m, Rhön, Erz, BayW

var. **pantherina** Ach. (*Lecidea lactea* Flörke ex Schaerer, *L. pantherina* (Ach.) Th.Fr., *L. swartzioidea* Nyl.)

Similar to var. *lapicida*, yet farther descending and even on nutrient rich sites – arct-h'mo/alp – rare (3); süSch, nöSch, Vog, Rhön, Ts, Eif, ThW, Erz, BayW, Al, very rarely synathropic (tomb stones)

Lecidea lithophila (Ach.) Ach.

In montane to high montane, high precipitation sites on lime-free, usually acid silicate rock on boulders and smaller rocks, on humid, protected from rapid drying out (often long time dew moistened), m.-r.light-rich habitats, above all on boulders in spring-fed marshes, swampy meadows, on brook, forest- and road-margins (here often as pioneers on freshly exposed rock surfaces), r.acidoph., r.hygroph., substrathygroph., ombroph., anitroph., Char. Lecideetum lith. – bor-mieur-mo(subatl)-smed-mo – rather rare; süSch and Vog moderately frequent, nöSch, ThW, Erz, otherwise rare: Ne, SFW, Pf, O, Sp, RhSch, He

Lecidea plana (Lahm) Nyl.

On lime-free, but occasionally basic, usually iron-rich silicate rock (e.g. basalt) on high precipitation, montane (often oceanic) sites on cool, protected from rapid drying or often dew moistened habitats, especially on horizontal- and steep surfaces of smaller rocks, in boulder fields, on mine dumps, m.-r.acidoph., (substrathygroph.), m.-r.photoph., anitroph., somewhat less hygroph. and acidoph. than *L. lithophila* (↑), Char. Lecideetum lith. – arct-mieur-mo(subatl)(-smed) – rare (3); above all Rhön, Erz, otherwise (v.)rare: Sch, Vog, O, nöPf, Ts, Eif

Lecidea sarcogynoides Körber

Foothills and submontane, winter-mild sites on usually rather warm, rather well lighted habitats on usually lime-free, but often mineral-rich silicate rock, above all on boulders, smaller rocks, m.-r.acidoph., mesoph.-(m.)xeroph. – mieur-subatl-med – (v.)rare (1); O, ?Sp, Ne, Ts, MRh, Eif, NRh

Lecidea silacea Ach.

In high montane and alpine, rarely montane sites on lime-free heavy metal rich silicate rock, on rather well lighted habitats, similar to *Acarospora sin.* (↑), Char. Acarosporion sin. – arct-mieur-mo/alp(-med-alp) – v.rare (1); süSch (1x), ?Vog, BayW, Erz, Hz, Alps

Lecidea tessellata Flörke

In the region in the montane zone on (v.)hard, usually lime-free, but often mineral-rich silicate rock (e.g. Porphyry) on sunny, occasionally moderately dunged habitats, parasitic on *Aspicilia* (usually *cinerea*), in the var. **caesia** (Anzi) Arnold in the alpine zone on rather lime-rich (marl lime) to lime-poor (calcareous slate, calcareous schist) rocks with *Lecanora marginata* and *Lecidea umbonata*; var. **tessellata**: subneutroph., ombroph., xeroph., m.nitroph., e.g. in the *Lecanoretum* rup., *Aspicilietum* cin. – arct-med(alp) – v.rare (R); süSch, Vog, Meissner (Al: var. *caesia*)

Lecidea s.l.

Lecidea ahlesii (Körber) Nyl.

Foothills and submontane sites on silicate rock on shady, humid habitats, on boulders in forests and brooks – mieur(subatl) – rare (?) O, süHü

Lecidea albolivida Lettau

On conifer bark in montane to high montane, high precipitation, oceanic sites – rare (?); süSch, Alps

Lecidea atomaria Th.Fr.

Foothills and submontane zone on silicate rock, commonly on smaller stones on long time dew moistened or sites protected from rapid drying, in forests, on road margins, in sparse meadows, similar to *Porpidia crust.* (↑), *Micarea lith.* (↑) – mieur – rare (?); O, Ne, Ml, Th

Lecidea betulicola (Kullh.) H.Magn. (*L. lignaria* (Körber) Nyl., *L. plusiospora* Th.Fr. & Hulten)

In high precipitation, high montane, rarely montane sites on deciduous- and conifer trees

with acid bark, above all on the stem base, similar to *L. pullata* (↑) and *Biatora helv.* (↑), often with their associates – s'bor-mieur-mo – v.rare(0); süSch

Lecidea botryosa (Fr.) Th.Fr.

On (even charred) wood and bark of old Scot's pine – bor-smed(-med) – Eif, Hu

Lecidea caesioatra Schaerer (*L. arctica* Sommerf.)

Above the tree line on cold, long time snow covered, well lighted, but away from the sun sites on mosses (above all *Grimmia*, *Andreaea*) on silicate rock usually near the soil, or on mosses over stony soils – arct-mieur-alp – v.rare (0); süSch (*Feldberg*, ?+), BayW

Lecidea commaculans Nyl.

In the region on long time dew moistened stones in well lighted sites on silicate rock, with *Micarea lignaria*, *Immersaria arthrooc.* or on strongly weathered rock walls, similar to *Adelolecia p.* – arct-mieur-h'mo/alp – v.rare (1); O, süSch, BayW

Lecidea erythrophaea Flörke ex Sommerf.

(*L. tenebricosa* auct., *Biatora e.* (Flörke) Fr.) Above all in montane-high montane sites on deciduous tree bark, above all on ash, but also wood and conifer bark – bor-mieur-mo – rare; süSch, nöSch, Do, Av, Vog, Pf

Lecidea exigua Chaub. (*L. decandollei* (Hepp) Jatta, *Biatora e.* (Chaub.) Fr.)

Above all on smooth bark of deciduous trees, on stem and branches, e.g. ash, hornbeam, in forests in mild sites, e.g. oak-hornbeam forests, similar to *Pertusaria leioplaca*(↑), anitroph., probably because of eutrophication strongly in regression to disappearing – mieur-smed, subatl – v.rare (0); nöRh, O, Ne, Ts

Lecidea fuliginosa Taylor (*Psora conglomerata* (Massal.) Körber)

In montane high precipitation sites on usually hard, often mineral-rich silicate rock, above all on rough substrate and in cracks, on ± sunny, wind protected to moderately exposed habitats, similar to *Parmelia disj.* (↑), *Buellia badia* (↑) – (bor-)-mieur-subatl-smed – rare (3); süSch, nöSch, Vog, nöPf, MRh, Ts, Eif, ThW

Lecidea huxariensis (Beckh. ex Lahm) Zahlbr.

On dry, tough wood, e.g. posts or railings –
mieur – rare (?); Ju, Th

Lecidea hypopta Ach. (Lecanora h. (Ach.)
Vainio)

In montane sites on wood, rarer on acid bark
(especially on conifers), above all on humid sites
– bor-mieur – Sch

Lecidea limosa Ach.

In subalpine and alpine, high precipitation sites
on naked, cool to moist soil and on plant detritus
on rather heavy snow sites, in the region similar
to *Lecidoma* (↑) – arct-alp – v.rare (1): süSch
(Feldberg), Al

Lecidea lurida Ach. (Psora l. (Ach.) DC.)

Up into alpine sites on soil encrusted or fissured
rock parts of limestone, in soil filled fissures,
similar to *Toninia cand.* (↑), additionally on
level, stony, dry calcareous soils, e.g. in openings
of sparse turfs, here like *Psora decipiens* (↑), also
going over onto calcareous silicate rock, above
all in the Toninietum cand., Toninion sed. – bor-
med – r.rare; above all Sju, Ju, FrJu, Al, Th, rare
süHü, Mn, Ne, Eif, Mos, *Rh-Mn-T*, *Lahn*, He,
Vog, süSch et al.

Lecidea nylanderii (Anzi) Th.Fr.

Foothills up to montane sites on acid, nutrient-
poor bark, above all on old Scot's pine in open
forests, additionally on fir, birch etc., rarely on
wood, r.-v.acidoph., anitroph. – s'bor-mieur –
v.rare (0); süSch, Vog

Lecidea ocelliformis Nyl. (L. atroviridis
(Arnold) Th.Fr.)

In montane and high montane sites on the bark of
deciduous- and conifer-trees, above all spruce,
very similar to *Biatora helv.* (↑) – s'bor-mieur-
mo – v.rare (0); süSch?, FrJu

Lecidea plebeja Nyl. (L. enalliza Nyl.)

Sub- to high montane, on tough decayed wood,
more rarely on conifer bark, rather similar to
Xylographa par. (↑) – s'bor-mieur-mo – süSch?,
FrJu

Lecidea pullata (Norman) Th.Fr. (Biatora p.
Norman)

In high montane (rarely montane), high
precipitation sites up to the tree line at the base
of conifer trees, more rarely deciduous trees with
usually smooth, moderately hard bark (above all
mountain ash, beech), rarely on wood, commonly

in the interior of forests and on forest margins, on
rather long time snow covered habitats, similar to
Parmeliopsis hyperopta (↑), m.-v.acidoph.,
r.skioph.-m.photoph., r.-v.hygroph.,
(substrathygroph.), anitroph., Char.

Parmeliopsidetum – bor-mieur-h'mo – rare (3);
süSch over 800 m m.frequent, nöSch, Vog, ThW,
Erz, BayW, Al

Lecidea scabridisca V.Wirth

In high montane, very high precipitation, oceanic
sites on acid, hard silicate rock on very wind
exposed, completely rain exposed habitats with
strongly varying hydrostatic conditions, e.g.
similar to *Umbilicaria probosc* (↑), *Ophioparma*
v. (↑), in the Pertusario-Ophioparmetum – mieur-
mo-med-mo – v.rare; Vog (locally not rare)

Lecidea turgidula Fr. (Biatora t. (Fr.) Nyl.)

In (high) montane to subalpine sites on bare,
tough decayed wood (above all decorticate
stems/stumps) and on bark of old deciduous tree
stems, similar to *Calicium trabinellum* (↑) --
bor-mieur(h'mo)(-med-h'mo) – rare (3); süSch,
nöSch, Vog, Pfw?+, O, Ts, ThW, BayW, Al

Lecidea variegatula Nyl. (L. microsporella
Lettau, L. lipseri Klement)

Up into montane sites on lime-free, acid to basic
silicate rock, first resident on rocks, boulders,
smaller rocks, e.g. in rock rubble, on moderately
to well lighted habitats – mieur – rare (R); O,
Saar, nöPf, Th, BayW

LIT.: FRIES 1874, HERTEL 1967, 1970, 1975, 1977, PURVIS et
al. 1992, STEIN 1879, VAINIO 1934

Lecidella Körber em. Hertel & Leuck.

Introduction

The *Lecidella*-species are like the *Lecidea*-
species crustose lichens with commonly black
apothecia with proper margin and single-celled
spores. They are however truly near related with
the genus *Lecanora*, which is distinguished – in
the case of most species – by having a thalloid
margin. The apothecia are black, the paraphyses
usually simple and less cemented, the spores
single-celled, ellipsoidal, relatively thick walled.
Several taxa have been rarely found (*L. alba*, *L.*
pulveracea). The genus at this time includes ca.

30 in part very widely distributed species, in Germany ca. 15 species.

L. elaeochroma, the most frequent bark lichen, has a broad ecological amplitude. *L. flavosorediata* lives epiphytically in high precipitation oceanic sites. The rock lichens require calcareous rock or at least intermediate silicate rock or nutrient rich sites, thus *L. stigmatea*, which predominantly occurs on limestone, as well as *L. carpathica*, *L. scabra*, *L. viridans* and *L. asema* s.l., which favor the relatively SiO₂-poor, sometimes weakly calcareous silicate rock. *L. carpathica* in the region is predominantly on anthropogenic habitats (walls, tombstones); its substrate requirements were only rarely fulfilled in the region on existing rock. *L. anomaloides* grows on vertical surfaces of usually hard, lime-free rock. In the Alps, thus in the Allgäu, *L. wulfenii* occurs living on mosses and plant detritus

L. anomaloides, *L. asema* s.l., *L. carpathica*, *L. elaeochroma* and *L. stigmatea* are very widely distributed in Europe. The area of *L. scabra* and *L. flavosorediata* reaches its north boundary in southern Sweden and central Norway. *L. viridans* reached additionally into southern central Europe and onto the British Isles which is the northern boundary; in Germany these species are very rare. *L. wulfenii* belongs to the arctic-alpine element.

Genus Characteristics and Determination

Thallus crustose, clearly developed or living in the substrate, medulla always I-. Photobionts coccoid green algae. Ap. sessile, black to rarely red-brown, with usually long time occurring proper margin. Exc. of radial lying hyphae, exterior (almost) always pigmented, interior colorless to dark colored, but not carbonaceous. Hyp. colorless to dark brown. Hym. I+ blue. Epihym. green, brown, blackish, bluish. Paraphyses simple, occasionally branching and bound, (at least in K) loose, above commonly scarcely thickened, rarely capitate. Asci of the *Lecanora*-type. Sp. 1-celled (rarely 2-celled), ellipsoidal to broadly ellipsoidal, relatively thick walled, in contrast to *Lecidea* s.str. without plasma bridge. Pycnosp. filamentous, often twisted. Ch: Atranorin, Zeorin and Xanthone are frequent.

1 On rock . 2
1! On bark 9

- 1* In alpine sites on mosses over base-rich subsoil. Thallus whitish, C+ orange, warty. Epihym. brown-black to blue-green, hyp. ± red-brown. Sp. 7-16 x 7-8 µm. Ap. -1 mm, flat, then convex. Al □ **L. wulfenii** (Hepp) Körber
- 2 Thallus sorediate, yellowish white to gray-yellow, light green-gray, cracked to cracked areolate, even granular, C+/KC+ orange-red, K+ yellow, P+ yellow, rarely K-, P-. Soralia rounded to irregular, scattered to coalescing, yellowish-white to pale yellowish-green, soredia 20-40 µm. Ap. often only few in number, sessile, flat, margined, later convex marginless, -1.6 mm. Epihym. green, blue-green, black-green, hyp. brown to reddish brown. Exc. interior brown to reddish brown. Sp. 10-15 (18) x 6-8(10) µm. Atranorin, Arthothelin, Thuringion **L. scabra**
- 2* Thallus not sorediate . 3
- 3 Hym. inspersion, i.e. ± thick filled with oil droplets and turbid 4
- 3* Hym. not inspersion 5
- 4 Exc. interior light, greenish to brownish at the margin. Sp. 11-17(19) x 6-10 µm. Ap. -1.5 (2.5) mm, shiny black, flat to moderately convex, puffy margined. Hyp. colorless to rarely weakly brownish, usually densely filled with crystals. Thallus endolithic to thick crustose, chalk white to beige, coherent to cracked, rarely areolate, K- or K+ yellow, P-/P+ yellow, C-. Hym. (above all toward the exc.) because of small oil droplets (also crystals) milky turbid. Exc. with strong crystallization, epihym. dark blue-green to gray-green. Zeorin, ±Atranorin, ±Lichexanthone. Bird perch sites as well as scarcely dunged sites, lime-rich to -poor rock – arct-alp, Al **L. patavina** (Massal.) Knoph & Leuck. (*Lecidea rolleana* Magnusson, *L. spitsbergensis* (Lyng) Hertel & Leuck.)
- 4* Exc. dark brown. Sp. 8-15 x 4-8 µm. Ap. -1(1.3) mm. Hyp. colorless, pale brown, gold- brown. Thallus rather thin, cracked, warty or areolate, whitish. Epihym. blue-black to green. K+ yellow, C-, P-. Atranorin, 2'-O-Methyl-perltolic acid **Carbonea latypizodes**
- 5 Thallus C+/KC+ orange-red 6
- 5* Thallus C- 7
- 6 Hyp. colorless, rarely in old age weakly brownish, K-. Ap. -0.4 mm, often slightly gray-green pruinose, sitting up, flat to moderately convex, narrow margined to ± marginless. Exc. not filled with crystals (epihym. with crystals). Thallus thin, areolate, with finely granular upper surface, yellowish- white to yellowish-gray, cream colored, even yellow-green, K-, P-. Epihym. gray-green, green to brown. Sp. 9-13 x 5-6.5 µm. Thiophanic acid, Arthothelin, ±Thuringion . **L. viridans**
- 6* Hyp. uniformly yellowish to reddish-brown, K+ intensely colored. Ap. 0.5-1(1.5) mm, flat and

- definitely margined, finally convex and ± marginless. Exc. often with crystallization (crystals soluble in K-. Thallus yellowish- white, cream colored, thin to thick, cracked to areolate, K-/K+ yellow, P-/P+ yellow. Epihym. black-green, bluish-green, rarely olive. Sp. 11-16(20 x 6-8(9) µm. Xanthone, always Thiophanic acid, ± Atranorin . □ **L. asema** s.l.
- 7 Exc. interior colorless, without crystals, exterior gray-brown, violet, blue-green. Epihym. black-green, blue-green, violet, olive-brown or red-brown. Ap. flat, margined, later convex and ± marginless. Sp. 11-17 x 6-9 µm. Thallus as a rule on calcareous rock, indefinitely to definitely developed, cracked to areolate or granular, whitish, gray, gray-brownish, K- or K+ yellow, P-/P+ yellow, C-. Zeorin, ±Atranorin, ±Lichexanthon . □ **L. stigmathea**
- 7* Exc. interior brown, red-brown, dark brown, without crystallization. On lime-free to slightly calcareous silicate rock 8
- 8 Thallus definitely developed, white, yellowish white, light gray, usually areolate, K+ yellow, P+ yellow, C- (very rarely orange-red). Exc. exterior usually blue-green-black, interior brown to red-brown. Hyp. yellow-brown to red-brown. Epihym. deep green to blue-green. Hym. 60-85 µm. Ap. -1(1.5) mm, margin thin, often wavy, shiny, later often disappearing. Sp. 9-16 x 5-9 µm. Diploicin, ±Atranorin, ±Thuringion . □ **L. carpathica**
- 8* Thallus indefinite, gray to greenish, R-. Exc. almost entirely or for the most part dark brown. Hyp. colorless to pale brownish, with age even red-brown. Epihym. dirty green to brown-green. Hym. 40-60 µm. Ap. -0.7(1) mm, permanent margined. Margin often wavy and shiny. Sp. 7-15 x 5-9 µm, broadly ellipsoidal to almost spherical. Atranorin, ± Zeorin . **L. anomaloides**
- 9 Thallus not sorediate, very variable, indefinite to thin and coherent to cracked or cracked areolate, smooth to granular, whitish, olive-green, gray-green to yellowish, often with black prothallus, often damaged by snail grazing. Sp. 10-16 x 6-9 µm. Ap. black to brown-black, flat and unmarginated, later convex marginless, -1.2 mm. Hyp. brownish to colorless. Epihym. and exc. exterior blue-green to green, violet, dirty reddish, red-brown, often variable. Arthothelin, ±Thuringion, ±Thiophanic acid, ±Granulosin, or Capistraton, ±Aotearon, ±Thiophanic acid, or Lichexanthon, ±Diploicin □ **L. elaeochroma**
Very variable form series. (Possible not separable: *L. elaeochroma* s.str. with usually robust, whitish, gray, yellowish thallus, C+ orange; "*L. euphorea*" with usually light gray to gray-greenish, usually thin thallus, C-; "*L. achristotera*" with interspersed hym., thallus white to yellowish, C-/C+ orange)
- (When ap. brown-red to dark brown, always slightly pruinose and thereby somewhat bluish, flat to slightly convex, -0.9 mm, thallus whitish, with granular upper surface, C-, hyp. red-brown, epihym. greenish: **L. laureri**)
- 9* Thallus sorediate . 10
- 10 Thallus entirely finely granular-sorediate disintegrated to sorediate-scruffy, whitish to slightly yellowish. Very rare, little known lichens . 11
- 10* Thallus with at least at first delimited, later even coalescing soralia . 12
- 11 Thallus yellowish-white to yellowish-gray, thin to thick, ±areolate, C± orange. Ap. rare, ± sunken, -0.5 mm, commonly occurring. Hyp. gold-brown. Hym. 80-110 µm. Sp. 8-12 x 4-5(9) µm. Unknown Xanthone 5/5/5. Very rare, on processed, ± eutrophic wood **L. pulveracea**
- 11* Thallus whitish, C-, K+ yellow. Hyp colorless. Hym. 60-70 µm. Sp. 14.5 x 10-12 µm, often poorly developed. Atranorin, Capistraton, Aotearon . **A. alba**
- 12 Soralia without Lichexanthon, C+ orange, rounded to very irregular, often coalescing, yellowish to ochre-yellowish, flat. Thallus gray-white to slightly yellowish. Non sorediate parts often scarcely developed. Ap. scattered to lacking, often soon convex. Sp. 10-14 x 6-8 µm. Epihym. often light violet. Arthothelin, ±Granulosin **L. flavosorediata**
- 12* Soralia with Lichexanthon, C- or C+ orange, delimited, rounded, flat to ± convex, 0.5-1 mm. Thallus usually thin, little divided, gray to greenish,, C+ orange. Ap. usually occurring, as in the case of the major species. Either Arthothelin, Granulosin, ±4,5-Dichlormorilichexanthon or Thiophanic acid, Capistraton **L. elaeochroma** f. *soralifera* (Erichsen) D.Hawksw.

Ecology and Distribution of the Species

Lecidella alba (Schleicher) Hertel (nomen illeg., non Lecidea a. Flörke)

On acid bark of deciduous trees – *O(-nöhü)*, *nöRh*

Lecidella anomaloides (Massal.) Hertel & Kiliias (*L. umbrosa* (Bagl. ex Massal.) Hertel, *Lecidea goniophila* auct.)

Up into the alpine zone on lime-free, often acid, hard silicate rock on moderately rain exposed to rather rain sheltered vertical surfaces and slightly overhanging, usually on outcropping rocks, rarely on natural stone dry walls, m.-r.acidoph., (r.skioph.-) m.(-r)photoph., a-/m.nitroph., usually

only with few cohorts – bor-med – rare (3); Sch, O, SFW, Saar, Hu, Eif, BayW

Lecidella asema (Nyl.) Knoph & Hertel (L. subincongrua (Nyl.) Hertel & Leuck.)
On basic or slightly calcareous silicate rock, rather like *L. carpathica*. (↑), -- rare

L. asema s.str.:

With Asemon, Ap. -1.5 mm, on relatively warm habitats, mieur-med; BayW

L. effugiens (B.Nilson) Knoph & Hertel
With Aotearon, Thiophanic acid. Thallus of very scattered, small areoles, yellowish-white, gray-white. Ap. -0.7(1.3) mm. In montane to alpine sites on silicate rock, bor-med-alp; BayW, Alps

L. elaeochromoides (Nyl.) Knoph & Hertel
With Arthothelin, ±Thuringion. Ap. -0.8(1.2) mm. Up into the alpine zone on usually mineral-rich silicate rock, mieur-med; FrJu, Al, Isar

Lecidella carpathica Körber (Lecidea c. (Körber) Szat., L. latyepa auct.)
Above all up into the montane, rarely alpine zone, on silicate rock, further limited to subneutral substrate (basic silicate, dust impregnated or very slightly calcareous rock), in the region almost exclusively synanthropic on hewn stone, predominantly sandstone, wall crowns, grave stones, bricks etc., avoiding vertical surfaces and lime-rich sites (not going over to mortar), subneutroph.-neutroph., ombroph., r.xeroph., r.-v.photoph., m.-r.nitroph., Char. Lecidelletum carp. – arct-med – m.frequent, above all Rh, Hü, Ne, Mn, Pf, rare in forested regions

Lecidella elaeochroma (Ach.) Choisy (Lecidea e. (Ach.) Ach., L. olivacea (Hoffm.) Massal., L. parasema auct., L. limitata auct., Lecidella euphorea (Flörke) Hertel, Lecidea e. (Flörke) Nyl., ?L. glomerulosa (DC.) Steudel, Lecidella achrostera (Nyl.) Hertel & Leuckert)
Up to the tree line on bark of deciduous-, rarely conifer trees and on wood, euryöke species, predominantly on smooth and flat-cracked bark, also on branches (pioneer), in shady forests (here often damaged by snail feeding and with brownish ap.) also on free-standing trees, even on dust impregnated, nutrient rich habitats, subneutroph.-r.acidoph., ombroph., hygroph.-r.xeroph., a- to r.nitroph., above all in the Graphiditalia associations, also e.g. in the Xanthorion – bor(atl)-med – rather frequent

Lecidella flavosorediata (Vèzda) Hertel & Leuck. (Lecidea f. Vèzda)

In high montane (rarely montane), high precipitation, oceanic sites on bark of deciduous trees and spruce, similar to *Caloplaca herb.* . (↑), -- s'bor-atl-mieur-subatl-med(mo), oz – rare; Al, Av, Bo

Lecidella laureri (Hepp) Körber

On well lighted habitats on subneutral, at times even eutrophic bark, in the Xanthorion – mieur-med – rare, little observed, e.g. Ju

Lecidella pulveracea (Schaerer) Sydow

On old wood and on bark of usually free-standing deciduous trees (Above all avenue trees) on ± eutrophied sites, e.g. with *Lecanora hagenii*. (↑), in the Xanthorion – mieur – rare (0); e.g. O

Lecidella scabra (Taylor) Hertel & Leuck. (Lecidea s. Taylor, L. protrusa Fr.)

On basic and neutral silicate rock, similar to *Pertusaria flavicans*. (↑), -- s'bor(subatl)-med – rare; süSch, Bo, Vog, O, Ts, MRh, Mos Eif, Meissner, FrJu, Fr, BayW

Lecidella stigmathea (Ach.) Hertel & Leuck. (Lecidea s. Ach., L. vulgata Zahlbr.)

Variable and euryöke species, up into the alpine zone on carbonate rock and on lime-free, dust impregnated or dunged or basic silicate rock, in the region mainly on anthropogenic substrates (walls etc.), especially on artificial rock, sandstone, limestone, even on occasionally flooded sites of brooks, the high point on rather to well lighted, moderately to rather dunged habitats, subneutroph.-basiph., ombroph., m.v.nitroph., e.g. in the Aspicion calc., Caloplacion dec., Lecidelletum carp. – arct-med – r.frequent

Lecidella viridans (Flotow) Körber (Lecidea v. (Flotow) Lamy)

In the foothills and submontane sites on sunny to semi shady, warm habitats on basic to neutral or slightly calcareous silicate rock, above all on vertical surfaces, subneutroph., r.xeroph., photoph., thermoph. – mieur-smed – v.rare (0); O (Heidelberg), Mos, Saar, FrJu, Al

Lit.: DIEDERICH 1989, HERTEL 1975, HERTEL & LEUCKERT 1969, KNOPH 1990, LEUCKERT, KNOPH & HERTEL 1992, POELT 1961a

Lecidoma G.Schneider & Hertel

(Determination ↑ Lecidea PT 1)

Introduction

The thallus of the monotypic genus is crustose-squamulose, often almost cushion-like, gray to reddish gray-brown. The apothecia are flat to slightly convex, dark-brown to blackish, seeming externally marginless. The spores are one celled. *L. demissum* is arctic-alpine distributed and grows on naked, cool soil on rather long time snow covered sites (e.g. in openings in sparse turf). In Central Europe it is known from the Alps, the high Black Forest, the Bohemian Forest, the Erz Mountains and the Sudenten.

Genus Characteristics

Thallus ± crustose, of coalescing, almost squamulose, areoles with the margins decumbent, with plectenchymatous upper cortex, with darker lower cortex. Photobiont coccoid green algae. Ap. sunken, flat to moderately convex, very rapidly marginless. Exc. exterior light brown, interior colorless, of thin walled, radial hyphae. Hyp. colorless. Epithym. red-brown. Hym. I+ blue. Paraphyses thin, predominantly unbranched, sparsely reticulate, cemented, above with brown cap. Asci clavate, thin-walled, with K/I+ pale blue tholus and an K/I+ dark blue tubular structure. Sp. one-celled, ellipsoidal to egg-shaped. Ch-

Ecology and Distribution of the Species

Lecidoma demissum (Rutström) G. Schneider & Hertel (*Lepidoma* d., *Lecidea demissa* (Rutström) Ach.

In subalpine and alpine, high precipitation sites on naked, cool to moist soil (sandy-loam to decomposed peat soils, stony raw soils) on long time snow covered sites, e.g. in openings of silicate sparse turfs, m.r.acidoph., r.photoph., substrathygroph., Char. Lecidomatetum dem. – arct-alp – v.rare (1); süSch (Muggenbrunn + Feldberg), Vog, Al, BayW

Lempholemma Körber**Introduction**

The *Lempholemma*-species in the moist condition are strongly swollen gelatinous lichens with bluegreen algae. The thallus is blackish and of very variable form, crustose-squamulose, shield shape, foliose lichen-like lobed or dwarf shrubby. The apothecia have a deeply sunken, usually brown-red disk with thalloid margin. In contrast to the gelatinous lichens of the genus *Leptogium* and *Collema* the spores are one-celled. The species is subneutrophytic to basiphytic and lives on soil, mosses and rock. Because of their inconspicuous nature they are often overlooked. In Germany ca. 6 species are known.

L. botryosum and *L. elveloidem* commonly live on irrigated surfaces of limestone and are distributed from the mediterranean region up to central Europe. *L. polyanthes* and *L. chalazanum* reside on moss and lime-rich soils, shade is first preference, sunny sites are least preferred. *L. myriococcum* is merely widely distributed; *L. chalazanum* occurs from the mediterranean region up to central Scandinavia.

Genus Characteristics and Determination

Thallus crustose, squamulose, foliose to small fruticose, blackish, olive when moist, gelatinous, unlayered, without cortex, with *Nostoc*. Ap. Often only easily seen in the moist condition, ± spherical with pore-like disk, later sometimes even opening wider, with thalloid margin. Exc. Commonly very narrow, of parallel hyphae. Hyp. Colorless. Hym. I+ reddish, commonly even becoming colorless above. Paraphyses simple to isolated branching, not thickened above. Asci clavate to cylindrical, without definite tholus. Sp. one-celled, ellipsoidal to spherical, colorless. Pycnosp. short bacillar to fusiform or thickened on one end to dumbbell shape Ch-

- 1 Thallus firmly attached to rock. Ap. with permanently punctiform disk or finally opening wider or sterile 2
- 1* Thallus on soil, mosses (also rock mosses), either ± granular or membrane-like, with irregular folds

- and (often warty) cracks and irregularly lobed at the margin, dark olive to blackish, -3(5) cm. Upper surface smooth to warty. Ap. at first punctiform-spherical, later opening wider, with usually urn-like deep red-brown disk, -0.3 mm
- 2 Thallus of radially aligned, -0.2 mm thick, -5 mm long cylindrical lobes, blackish, compressed shrub-like. Ap. very rare. Pycnosp. 4-5 x 1-1.5 µm, fusiform . **L. intricatum**
- 2* Thallus small foliose-squamulose, squamulose-warty or crustose 3
- 3 Thallus small foliose-squamulose or of squamulose-warty to cushion-like small areoles, firmly attached, -1 cm . 4
- 3* Thallus granular or membrane-like, with smooth to granular upper surface and lobed at the margin, often over 1 cm in size. Ap. frequent. On mortar of older walls 6
- 4 Thallus foliose, attached by a navel, depressed in the center, often gray pruinose, -1 cm wide, margin often bent under. Ap. at first punctiform, then opening wider, with urn-form sunken disk. Spores fusiform, 15-27 x 7-10 µm . **L. elveloideum**
- 4* Thallus mostly of scattered squamules or cushion-like areoles with tubercular-warty upper surface (made up of tiny crowded cylindrical lobules), 1-3(5) mm wide. Ap. rare, very small, with punctiform openings, sunken. Sp. 7-9 x 5-7 µm . **L. botryosum**
- 5 Sp. ± ellipsoidal, 20-23 x 9-13 µm. Thallus usually only -2 cm **L. chalazanum**
- 5* Sp. broadly ellipsoidal to almost spherical, 9-17 x 7-13 µm. Thallus often over 2 cm wide **L. polyanthes**

Ecology and Distribution of the Species

Lempholemma botryosum (Massal.) Zahlbr. (Physma b. (Massal.) Zahlbr.)

Up into high montane sites on limestone, on sunny rocks on commonly irrigated surfaces, even on longtime dew moistened boulders and stones, basiph., (subhydroph.), r.-v.photoph., with cyanophilic lichens, e.g. *Anema*, *Placanthium*, *Collema*, *Synalissa* (Psorotichion schaeer., *Collema fuscov.*) – s'bor-med – rare; Ju, Sju, FrJr, Al, otherwise very rare

Lempholemma chalazanum (Ach.) B. de Lesd. (Physma ch. (Ach.) Arnold)

In hilly and submontane, rarer montane, summer warm sites on lime rich fine soils, soil mosses, calcareous rock mosses, above all in openings in dry turf and in earth encrusted wall fissures and on weathered mortar, like *Toninia sed.* (↑) and *Heppia adgl.* (↑), above all in the Toninion sed. –

mieur-med – rare, easily overlooked (3); Ne, HRh, süSch (wine growing region), Ju, Sju, Saar

Lempholemma elveloideum (Ach.) Zahlbr.

Up into the montane sites on limestone on steep, occasionally irrigated rocks, commonly well lighted but not sunny sites – s'mieur-med – rare; Ju, Sju

Lempholemma intricatum (Arnold) Zahlbr.

On from time to time irrigated sloping and steep surfaces of weakly calcareous rock, in the region of irrigated, very slightly calcareous silicate rock on moderately well lighted, humid habitat, with *Placynthium flab.* (↑) – bor-atl-mieur – v.rare; Vog

Lempholemma polyanthes (Bernh.) Malme (L. myriococcum (Ach.) Th.Fr., L. compactum (Wallr.) Körber, ?L. fasciculare (Wulfen) Zahlbr., L. Muelleri (Hepp) Zahlbr., L. chalazanodes (Nyl.) Zahlbr.)

Up over the tree line on soil and calcareous rock mosses, on moist, calcareous soil, in rock fissures and in moist cracks and on mortar of older walls, near or on flooded habitats in brooks, on irrigated surfaces, on shady sites, subneutroph.-m.photoph., in moss associations. – bor-med – rather rare, overlooked (3); Ju, Sju, Al, HRh, süSch, Ne, Hü

LIT.: MIGULA 1929-31, POELT 1969, SCHIMAN-CZEIKA 1988.

Lepraria Ach.

(Key incl. *Lepruloma*, *Chrysothrix*)

Introduction

The *Lepraria*-species are diffuse or indefinitely delimited, always sterile, powdery-mealy (leprose) crustose lichens, which consist entirely or substantially of finely compact to cottony bordered granules. The variety and type of their lichen substances shows that in the tendency to a simple structure is not to be treated as a primitive "initial form" of lichen symbiosis, but as derived species of similar life style and anatomical adaptations. The species usually live on rain protected, but humid habitats (overhangs and bark crevices). The organization of the thallus in fine particles and the resulting higher facility of the upper surface to take up water vapor and the ability of the lichens to rapidly place themselves

in equilibrium with the water vapor pressure of the atmosphere.

In past years it was known, above thanks to the lichen chemistry, that under the leprose lichens was concealed a dissimilar variety of species. The diagnostic possibilities in the region of morphology to distinguish the species was often slight, but rarely absent. Also ecological distinction of the species was sometimes very definite.

Several *Lepraria* have a predilection for a number of different substrates, thus as well with bark as even rock or wood, sometimes even soil; thereby however it secures a definite pH-relationship. Taken in this way species belong to *L. lobificans* and the acidophytic *Lincana*, *L. rigidula*, *L. jackii*. *L. flavescens*, *L. lesdainii* and *L. nivalis* are bound to more or less rain sheltered surfaces of limestone. *L. caesioalba* and *L. neglecta* live on rain exposed surfaces of silicate rocks and silicate mosses.

Little is yet known of the distribution of the *Lepraria*. The calcareous *Lepraria* *L. flavescens*, *L. nivalis* and *L. lesdainii* occur above all in central and south Europe, the latter probably in the subatlantic region. *L. incana*, *L. lobificans* and *L. rigidula* are very widely distributed in Europe, *L. caesioalba* has a boreal-central European point of concentration.

Genus Characteristics and Determination

Thallus consisting of powdery-mealy, of fine, compact or diffusely bordered granules because of emerging hyphae, whitish, greenish-white, ; yellowish-white, cream colored, gray, greenish, diffuse or definitely bordered and sometimes appearing rosette lobed, unlayered or developing a whitish medulla under the leprose "layer." Photobiont various green algae. Ap. unknown. Ch: predominantly fatty acids, besides Depsides, Depsidones, etc.

Note: The UV-reactions are sometimes not very constant. A good measure of the UV reaction is *Lepraria incana*.

- | | | |
|----|--|---|
| 1 | Thallus sharply bordered at the margin, coherent, in the case of well developed rounded rosettes, appearing lobed or with radial folds . | 2 |
| 1* | Thallus not rounded rosetted and lobed or with radial folds . | 8 |
| 2 | On limestone | 3 |
| 2* | On silicate rock, acidophytic mosses, very rarely on bark | 5 |

- | | | |
|----|---|---------------------------------|
| 3 | Thallus (soredia) C+/KC+ deep yellow, K+ yellow, P+ yellow, UV+ violet, with Atranorin, Sorididon, (±Eugenitol), ± clearly rosette-effigurate, lobed at the margin, gray-white, green tinted white, cream colored, greenish-white, mostly -3 cm, with sorediate upper surface , soredia -200 µm . | □ L. flavescens |
| 3* | Thallus C- . | 4 |
| 4 | Thallus whitish, cream colored, gray-white, pale greenish, folded skin-like, often regularly rounded, often with radially aligned cracks, almost somewhat lobed, above all in the center often breaking up. Habit like <i>L. flavescens</i> . Atranorin, Protocetraric acid | L. nivalis |
| 4* | Thallus greenish white, blue-greenish white, thick, coherent, sometimes producing a lobed thallus, at times loosening itself and easily breaking away. Atranorin, Stictic acid, Zeorin, ± Constictic acid, (± Norstictic acid) etc., UV+ reddish violet | L. lobificans (30) |
| 5 | Thallus (at least younger collections) sharply delimited, often stuffed borders (because of up curved margin), often wavy, at least at the margin pale yellowish, spongy-pliant, of thick coalescing soredia-like, cottony to rather compact granules of mostly 70-200 µm in diameter, with age often undifferentiated leprose, P+ reddish orange, K+ yellow, C-. Pannaric acid, Roccellic acid . | □ Lepruloma membranaceum |
| 5* | Thallus relatively unclearly margined, not yellowish at the margin, not spongy-pliant, on rain exposed habitats on mosses, rarely directly on silicate rock, of relatively compact granules, without Pannaric acid | 6 |
| 6 | KC+ reddish orange, P+ citron yellow, K-/K+ yellow, C-/C+ reddish orange. Alectorialic acid., Angardianic acid. Thallus white to white-gray, often darker in the center, granular, soredia 80-200 µm | L. neglecta |
| 6* | KC- or KC+ yellow | 7 |
| 7 | With fumarprotocetraric acid, ± Atranorin, Angardianic acid or Rangiformic acid. Commonly P+ red-orange, rarely P-/P+ yellow, K-/K+ yellow, C-. Thallus white to white-gray, darker in the center, -3 cm. Soredia (50)80-200 µm | □ L. caesioalba |
| 7! | Without Fumarprotocetraric acid, with Atranorin, Porphyrilic acid, ± Fatty acids, (e.g. Roccellic acid, Angardian acid), P- or P+ citron yellow. Soredia large, 50-125 µm. In the high mountains on mosses | □ Lepruloma cacumimum |
| 7* | With Thamnic acid, Roccellic acid, K+ yellow, P+ yellow. Thallus white, light gray, well developed with gray prothallus. Soredia -300 µm . | L. nylanderiana (29) |
| 8 | Thallus bright yellow, golden yellow, or citron yellow . | 9 |
| 8* | Thallus not conspicuous yellow . | 13 |
| 9 | On trunks of trees . | 10 |
| 9* | On silicate rock, soil, mosses, or roots | 11 |

- 10 Thallus conspicuous yellow to almost golden yellow, rarely citron yellow, sterile. In the cracks of deep cracked bark or on the rain protected flanks. Hyphae of the soredia producing small conidia. Calycin or (and) Pinastrinic acid. Algae spherical (chlorococcoid) □ **Chrysothrix candelaris**
- 10* Thallus citron yellow to yellow-green (usually with stalked ap.). In cracks of deep cracked bark or basal in trunk hollows. Hyphae of the soredia producing conidia. Vulpinic acid, ± Rhizocarpic acid. With *Stichococcus* algae
□ **Chaenotheca furfuracea**
- 11 Thallus conspicuous yellow (rarely with a greenish tint on the upper surface), usually thick (over 0.3 mm), powdery, coherent to cracked-cloddy. Calycin, Vulpinic acid
□ **Chrysothrix chlorina**
- 11* Thallus citron yellow to sulfur yellow (in deep shade stronger green tinged) 12
- 12 With *Stichococcus* algae (algal cells clearly longer than thick). Vulpinic acid, ± Rhizocarpic acid . □ **Chaenotheca furfuracea**
- 12* With spherical algal cells (*Trebouxia*). Rhizocarpic acid, etc . □ **Psilolechia lucida**
- 13 Thallus with *Trentepohlia* algae, usually thick (5 mm), cushion-like, spongy-white, upper surface often with vertically placed extremely small lobules, ribbed to coral-like furrowed, gray-violet, gray-rose, violet-brown, beige, gray-brown, or gray, with Lepranic acid, Roccellic acid. UV-. On overhangs of silicate rock .
↑ **Lecanactis latebrarum**
(sorediate species with *Trentepohlia* ↑ *Lecanactis umbrina*)
- 13* Without *Trentepohlia*-algae. Thallus not cushion-like 14
- 14 On calcareous rock, calcareous earth, or calcareous mosses 15
- 14* On bark or acid soil/silicate rock . 19
- 15 Thallus intensive to dull green, bleaching in the herbarium, ± rounded, producing a spongy-powdery crust, often thick and then erupting, consisting of narrow upright lobules. Soredia up to ca. 100 µm, with numerous projecting hyphae, which extend over the thallus upper surface. UV-, K-, C-, P-. Lesdainin (A 6, B 5, C 6). V.rare
L. lesdainii
- 15* Thallus not definitely green, commonly P+ (yellow-)orange to brownish-red. Without Lesdainin . 16
- 16 With Alectorialic acid, (Barbatolic acid), Protocetraric acid. UV+ yellow to ochre or rose-violet, C-, KC+ **flecting!** Reddish (observe under the binocular, "scrape" the thallus with a preparation needle), sometimes also KC-, K-, or K+ yellow, P+ yellow to orange. Thallus producing a powdery crust, white-gray with mostly yellowish or greenish color tint, soredia -150(200) µm, unit of ca. 40 µm, with extending hyphae
L. eburnea
- 16* Without Alectorialic acid, not KC+ reddish 17
- 17 Thallus, as a rule, greenish-white, blue- greenish white, thick, coherent, sometimes producing a lobed thallus. P+ orange, UV+ reddish violet. Atranorin, Stictic acid, Zeorin, ± Constrictic acid, et al **L. lobificans (29)**
- 17* Thallus whitish-cream colored, often slightly yellowish. With 4-Oxypanaric acid.-2-methylester or Pannaric acid.-6- methylester or Sorididon or Protocetraric acid . 18
- 18 With 4-Oxypanaric acid.-2-methylester (± Pannaric acid). Thallus normally extensive, undelimited, (whitish to usually) slightly yellowish. Soredia (80)100-200 µm, very loosely spongy, diffuse bordered. P+ brownish-red, C-/C+ yellow, K-/K+ yellow or orange. On base-rich substrates, above all on fissured limestone. UV+ (usually) red-violet
Leproloma diffusum
- 18! With Pannaric acid-6-methylester, (± Pannaric acid). Thallus often clearly delimited, P+ reddish orange/P-. Soredia 80-160(200) µm, loose to rather compact. UV+ (rose-)-violet. On walls, limestone, mineral rich silicate rock .
□ **Leproloma vouauxii**
- 18* With Atranorin and either Sorididon or Protocetraric acid. Thallus commonly sharply delimited 3
- 19 Thallus with slightly yellowish color tint, greenish-yellow. Either Usnic acid or Pannaric acid, Pannaric acid.-6-methylester, Alectorialic acid or Roccellic acid . 20
- 19* Thallus without yellowish color tint 24
- 20 Thallus P-. With Usnic acid or Roccellic acid and Jackinic acid . 21
- 20* Thallus P+ (yellow)orange to reddish orange . 22
- 21 With Usnic acid, often Zeorin, KC+ yellow or orange .
Lecanora
- 21* With Jackinic acid, ± Roccellic acid, Atranorin, ± Zeorin. Thallus pale green, gray-green, yellowish-green, yellowish, rarely blue-green, K+ yellow(ish), KC-. On bark .
L. jackii
- 22 Thallus whitish-cream color, often with slight yellowish tint. At the least Pannaric acid or Pannaric acid-6-methylester occurring 23
- 22* Thallus pale gray-green, pale greenish, gray-white, yellowish-white, diffuse, irregularly delimited, entirely of soredia or appearing as a thick crust layer with a whitish medulla. Soredia -120 µm, often with short projecting hyphae. Alectorialic acid, (Barbatolic acid), Protocetraric acid .
L. eburnea
- 23 With Pannaric acid, Roccellic acid. Thallus whitish to yellowish, usually clearly delimited. P+ reddish orange. Usually on silicate rock, rarely on acid bark see *Leproloma membranaceum* (5)
- 23* With Pannaric acid-6-methylester, ± Pannaric acid etc. UV+ (rose-)violet. Soredia 80-160(200) µm, loose to rather compact. P+

- reddish orange/P-. On base rich bark, on walls, limestone, mineral rich silicate rock
- **Lepruloma vouauxii** (18)
- 24 Thallus clearly delimited, often rounded, on silicate rock and rock mosses 6
- 24* With other characteristics, commonly not rounded and at the same time on silicate rock/silicate mosses 25
- 25 With Alectoralic acid, (Barbatolic acid), Protocetraric acid. UV+ rose-violet to yellow to ochre, C-, KC+ **flecting!** Reddish (observe under binocular, "scrape" thallus with preparation needle), at times even KC-, K- or K+ yellow, P+ yellow to orange. Thallus producing a powdery crust, white-gray with usually yellowish or greenish color tint, soredia -150(200) µm, the subunit ca. 40 µm, with protruding hyphae .
- L. eburnea**
- 25* Without Alectoralic acid, KC-/± yellowish 26
- 26 UV+ intensively whitish to bluish. K- or rarely K+ yellowish, P- or P+ yellowish. With Divaricatic acid, Zeorin, rarely Gyrophoric acid, Atranorin. Thallus whitish, pale greenish (moist usually less greenish than *L. lobificans*), gray-greenish, blue tinted gray-green. Soredia compact, not spongy, scarcely with protruding hyphae, 50-125 µm, the subunit of 30-80 µm
- L. incana**
- 26* Not UV+ intensive white to bluish. Without Divaricatic acid 27
- 27 With Atranorin and fatty acids. (Nephrosteranic acid). Soredia often because of straight and radial protruding hyphae conspicuously hedgehog-like, -300 µm, or -60 µm thick subunit. UV+ rose-violet to yellow or ochre. K+ yellow, C-, P+ yellow. Thallus light gray, usually producing one thick, coherent, irregularly delimited crust
- L. regidula**
- 27* Without Nephrosteranic acid. Soredia not conspicuously hedgehog-like 28
- 28 With Jackinic acid, ± Roccellic acid, Atranorin. UV+ rose(yellowish) to ochre. Thallus pale greenish, gray-green, yellowish-green, bluish-green, diffuse, irregularly delimited, unlayered, in thick thallus with whitish medulla, K+ yellow(ish), P-, C-. Soredia -80 µm, of -50 µm thick subunit, often with short protruding hyphae .
- L. jackii**
- 28* Without Jackinic acid . 29
- 29 With Thamnolic acid, Roccellic acid, K+ yellow, P+ yellow. Thallus white, light gray, thick, even appearing lobed and with gray prothallus. Soredia -0.3 mm .
- L. nylanderiana**
- 29* Without these substances. Usually UV+ reddish violet . 30
- 30 With Atranorin, Stictic acid, Zeorin etc. UV+ reddish violet. C-, K commonly + yellow, P+ orange. Thallus pale greenish, greenish-white, whitish (moist often bluish-green), usually loose-spongy, producing a powdery crust, soredia -

100(200) µm, with projecting hyphae, a basic unit of 25-50 µm. Thallus often thickish, with white medulla. On rock, bark, soil, or mosses

L. lobificans

(TONSBERG describes *L. elobata* with identical chemistry, but with pure soredia, no layered thallus (i.e. without white medulla) and compact soredia without protruding hyphae. Soredia -100 µm)

- 30* With Pannaric acid-6-methylester. Thallus commonly thick, whitish to greenish gray, often yellow tinted, with white medulla. Soredia coarse, -150 µm, of -100 µm thick subunit .

□ **Lepruloma vouauxii**

Ecology and Distribution of the Species

Lepraria caesioalba (B.de Lesd.) Laundon

In hilly to montane sites on well lighted usually sunny sites commonly on mosses, rarely directly on rock on completely rain exposed horizontal- and sloping surfaces of silicate rock, especially on long time dew moistened, also rather long time snow covered, near the soil boulders or even on from time to time irrigated, soil impregnated rock, growing on very high precipitation sites even rather open to the wind, more warmth loving than *L. neglecta*, above all in the Lasallietum pust., Parmelietum consp., Umbilicarietum deustae – s'bor-mieur – r.rare; above all Sch and Vog, also O, RhSch, Pf, He, ThW, BayW, Fi

Lepraria elobata Tonsberg

Like *Lepraria lobificans*, but probably scarce on limestone – widespread

Lepraria flavescens Clauz. & Roux

Very like *L. nivalis* (↑) – mieur-med-mo – r.rare; Ju, süHü, Ne

Lepraria incana (L.) Ach. (*L. aeruginosa* auct. p.p.)

Up into montane sites on acid or acidified bark of deciduous and conifer trees, usually on rain-protected sites, on free-standing trees and in the forest interior, on silicate rock, on wood, on soil (slopes), mosses, v.-e.toxitol, r.photoindiff., m.-e.acidoph., anitroph.-m.nitroph. – bor-mieur-smed – frequent, especially in ± air polluted regions, rare in mountain sites

Lepraria jackii Tonsberg

Above all in montane sites on acid bark on the trunk of trees, above at the base on spruce in forests and at the forest margin, also on alder, birch etc., m.-v.acidoph., (r.)m.photoph.-r.skioph. – bor-mieur(mo) – r.rare; e.g. Do, Sch, Ju, O, Av

Lepraria lesdainii (Hue) R.Harris

In hilly to montane sites on rather poorly lighted, humid, not or scarcely rained upon habitats on rock of limestone or calcareous silicate rock, also going over to moss or soil, even wall cracks, neutroph.-basiph., r.skioph.(-m.photoph.), anombroph. – mieur-subatl-med – rare; Ju, Ne, Eif, Lux

Lepraria lobificans Nyl. (*L. aeruginosa* auct.

p.p.

Up into high montane sites on acid to subneutral bark of deciduous and conifer trees, in SW-Germany e.g. with very high uniformity on *Acer campestre*, on rained on to rain protected flanks, especially on the base of the trunk up to the middle of the stem, in the interior of the forest as well as on free standing trees, even on shaded rocks (silicate, rarely limestone), walls, wood (above all stumps), on alder (slopes), mosses, r.photoindiff. (highest concentration m.photoph.), euryion, m.-s.hygroph., r.-v.toxitol. – bor-mieur(subatl)-med – very frequent, most frequent *Lepraria*-species, yet in lower sites often rarer than *L. incana*

Lepraria neglecta (Nyl.) Lettau

In montane to alpine, high precipitation sites on silicate mosses, rarely directly on silicate rock, above all on well lighted sites on rain exposed horizontal- and sloping, rarely vertical surfaces, m.-r.acidoph., substrathygroph., m.-v.photoph., a-/m.nitroph. – bor-mieur-mo – rare; süSch

Lepraria nivalis Laundon (*L. crassissima* auct.)

Up into the alpine zone on carbonate rock, above all limestone, dolomite, on rather to very rain sheltered, but often at times moist substrate, often weathered and fissured (crevasse water) vertical surfaces and overhangs, frequent also on finely porous, light quarry water rocks on shaded, m.-v.humid habitats, basiph., m.photoph.-v.skioph., (substrathygroph.), a-/m.nitroph., above all in the Gyalectetum jen., additionally in the Verrucario-Caloplacetum xanth. –bor-med – rare; Ju, Sju, FrJu, Al

Lepraria nylanderiana Kümmerling & Leuck.

On silicate rock on warm habitats, like *Leprocaulon micr.*(↑) – rare; Bo, Lahn, Eif

Lepraria rigidula (B. de Lesd.) Tonsberg

In hilly to alpine sites on naked or mossy bark of deciduous and conifer trees (especially oak, beech, fruit trees), on wood, rarely on mossy and naked silicate rock or on soil, on rain exposed to rather rain-sheltered, rather poorly lighted to rather well lighted habitats, (subneutroph.)m.-r.(v.)acidoph., euryök – s`bor-med – moderately frequent, e.g. RhSch, Sch, O, Sp. SFW, Ju, Bo, Do, Av, Al, BayW

LIT.: KÜMMERLING & LEUCKERT 1993, KÜMMERLING, LEUCKERT & WIRTH 1991, 1993, 1995, LAUNDON 1992, TONSBURG 1992.

Leprocaulon Nyl.

Introduction

The eight *Leprocaulon*-species predominantly distributed in the southern hemisphere are distinguished by simple peg-form to shrubby branching, decorticate thallus with granular-warty to powdery erupted. Apothecia are unknown. The verdigris green *L. microscopicum*, single European species, nestles in cracks and fissures in fissured silicate rocks, usually on rather rain protected, well lighted sites. It is distributed from the mediterranean region up into central Scandinavia.

Genus Characteristics

Thallus divided into a basal, leprose, diffuse primary thallus and an erect secondary thallus with delicate, erect, branching, ± cylindrical Pseudopodetia, which are covered with leprose, cobwebby diffuse delimited granules, which in the indigenous species are verdigris green, the remainder usually white. Without cortex. Photobiont coccoid green algae. Ap. unknown. Ch: multiple, indigenous species with Usnic acid, Zeorine.

Ecology and Distribution of the Species

Leprocaulon microscopicum (Vill.) Gams
(*Stereocaulon* m. (Vill.) Frey, *S. nanum* (Ach.)
Ach., *S. quisquiliare* (Leers) Hoffm.)
Up into the montane sites in fissures, niches and
on sediments on ± rain protected sites
(overhangs) of silicate rocks and natural stone
walls, above all on dust impregnated substrate,
thin soil layers or on mosses, often on SiO₂-poor
silicate rock, on ± wind protected, rather warm,
moderately to well lighted habitats, subneutroph.-
m.(r.)acidoph., m.xeroph., e.g. in contact with the
Lecanoretum dem., *Xanthorietum* fall. – s'bor-
smed, subatl – rare (3); above all Sch, Vog,
RhSch (Eif, Mos, Hu, Ts, MRh), rare(er) Pf, O,
Sp, Lahn, He, ThW, BayW

LIT.: FREY 1932, LAMB & WARD 1974

Leproloma Nyl. Ex Crombie

(Determination ↑ *Lepraria*)

Introduction

The *Leproloma*-species are very strongly similar
to the *Lepraria*-species with their entirely
powdery to granular upper surface, ecology, and
habit. The distinctions are above all in the type
of lichen substances.

The best known *Leproloma*-species, *L.
membranaceum*, resides on vertical surfaces and
overhangs of silicate rock. *L. vouauxii* occupies a
broad spectrum on mineral-rich, subneutral to
weakly basic substrates, from base-rich bark to
wall-work. Both species are widespread over all
of Europe. Rain protected niches on limestone
are the typical habitat of *L. diffusum*, that above
all is indigenous to central and south Europe.
The arctic-alpine *L. cacuminum* lives on earth
and silicate dwelling mosses and on raw humus
on open sites near or above the tree line; in
central Europe the species occurs only on high
central mountain peaks and in the Alps.

Genus Characteristics

Thallus with powdery-leprose to granular upper
surface, usually definitely delimited, sometimes
even appearing lobed, whitish, white-gray to
usually ± yellowish. Medulla, if occurring,
white. The genus is distinguished from *Lepraria*
essentially by the content of Dibenzofuranes.

Apothecia are known from one species. Ch:
Dibenzofurane etc.

Ecology and Distribution of the Species

Leproloma cacuminum (Massal.) Laundon
(*L. angardianum* (Övstedal) Laundon)
In alpine sites on mosses over silicate rock e.g.
on bog pad, or on soil in 'curved sedge turf,' on
moderately exposed rock surfaces – arct-alp –
v.rare; süSch, also Alps

Leproloma diffusum Laundon
On fissured limestone/Dolomite in niches and
cracks, often on near earth surface, even together
with mosses/over mosses, usually on well lighted
habitats in dry turfs, on larger rocks, e.g. often
with *Cladonia pyxidata* – (bor-) mieur-med –
rare; Ju, Sju, FrJu, Bo, He

Leproloma membranaceum (Dickson) Vainio
(*Lepraria membranacea* (Dickson) Vainio,
Crocynia m. (Dickson) Zahlbr., *Psoroma*
Lanuginosum Müll.Arg.)
Up into (high)montane sites commonly on lime-
free silicate rock on moderately rain exposed to
rain protected vertical surfaces, rarer sloping
surfaces, directly on rock or on mosses, on dry as
well as from time to time slightly irrigated or
quarry water substrates, often on rich relief (e.g.
large crystalline rock) or fissured surfaces,
generally also on bark of deciduous trees, above
all in high precipitation regions, m.-r.acidoph.,
r.skioph.-r.photoph., a-/(-m.)nitroph., often
producing covering stands, e.g. also in the
Umbilicaria hirs. – bor-med – r.rare; above all
Sch, Vog, Pf, RhSch, Erz, rare(er) O, Sp, He, etc.

Leproloma vouauxii (Hue) Laundon (*Crocynia*
arctica Lynge)
Above all from lowland up into montane sites on
base-rich bark on not rained on to weakly rained
on flanks, especially on free standing trees, often
in fruit orchards on apple and pear trees, on
avenue trees (ash), usually in humid valleys or on
away from the sun overhangs, often on shady
walls, especially in mortar joints, more rarely on
rocks, sometimes on walls v.toxitol., r.skioph.-
r.photoph., aerohygroph., a-/m.nitroph. – (arct-)
bor-smed – moderately frequent

LIT.: LAUNDON 1989, LEUCKERT & KÜMMERLING 1991

Leptogium (Ach.) Gray

Introduction

The genus *Leptogium* includes gelatinous lichens with broad lobed to very narrow lobed divided or finely shrubby, solitary almost granular-crustose thallus and apothecia with red-brown to brown, concave to flat disk with proper margin and often thalloid margin. The photobionts are bluegreen algae (*Nostoc*). In the dry condition the species are light blue-gray, brown or blackish colored, when moist dark olive to black. A few species bear thick whitish hairs on the thallus underside. In contrast to the in part similar appearing *Collema*-species the *Leptogium*-species have a cortex. The spores are cross-septate to usually muriform. The small lobed to dwarf fruticose taxa are in part yet little known. Of ca. 16 species known in Germany, 14 occur in the region.

Almost all species live on base-rich substrates, on calcareous rock, such as e.g. *L. diffractum*, *L. massiliense* and also *L. schraderei*, on base rich soil, such as *L. byssinum*, *L. biatorinum* and *L. tenuissimum*, or on subneutral bark, such as *L. teretiusculum* or *L. saturninum*. Many vary there by even between bark, mosses, rock and soil. *L. lichenoides*, above all shows a very broad ecological amplitude, and grows on basic to subneutral substrates, on calcareous and mineral rich silicate rock, mosses, bark and soil. *L. gelatinosum* occurs predominantly on calcareous rock (often on walls) and calcareous mosses. *L. subtile* grows on plant detritus and old bark on foot of trees. *L. cyanescens* and *L. saturninum* is found in oceanic sites, the first residing (often on mosses) on basic or calcareous silicate rock on moist substrate-shady sites, the last predominantly on mineral rich bark, rarely on silicate rock.

L. saturninum occurs from northern Scandinavia over west Europe and the oceanic region of central Europe up into the central mountain region, *L. cyanescens* in western Europe up into western into central Scandinavia. *L. diffractum* shows a southern distribution pattern, that is distributed from the mediterranean region to central Europe (Gotland), and *L. massiliense*, that reaches only the southern central Europe and Great Britain. The most of the other species are probably widely distributed in Europe, which goes especially for *L. lichenoides*, *L. gelatinosum* and *L. tenuissimum*.

Several species are endangered to strongly threatened. Part are clearly in decline (*L. cyanescens*, *L. saturninum*, *L. teretiusculum*) part are very rare, as *L. massiliense*. A few species, and certainly *L. biatorinum*, *L. byssinum*, *L. tenuissimum* are becoming rarer, ephemeral species, exposed to unconsolidated soils, such as they occur in the case of scarcely yet longer term (e.g. always further exposed situation, but not permanently disturbed slopes, or border of gravel pits).

Genus Characteristics and Determination

Thallus broad to very finely foliose, rarely fine shrubby or granular-crustose, of \pm gelatinous structure, blue-gray to blackish, gray-brown, brown, smooth to often wrinkled, in many species with isidia, underside smooth or rarely with thick hair covering, with single band-like bulges or with small felty bushy white rhizines. Foliose thallus both sides with single layered cellular structured cortex or thallus (in the case of the smaller species) paraplectenchymatous throughout or almost throughout, with *Nostoc*. Ap. with concave to flat, brown to red-brown disk and definite raised proper- and exterior sometimes indefinite thalloid margin. Exc. Proprium lecanorine paraplectenchymatous, becoming colorless, exterior colored. Hyp. Below, colorless to yellowish, under that sometimes a paraplectenchymatous layer. Epihym. Colorless to usually yellow- to red-brown. Paraphyses simple, cemented, thickened above. Asci clavate, wall K/I+ blue, with K/I+ pale blue tholus and dark blue axial ring structure. Sp. to (4-)8, septate, usually weak to clearly muriform, ellipsoidal to fusiform, colorless. Pycnosp. short bacillar. Ch-

- 1 Thallus underside thickly covered with velvet-like with short whitish hairs, upper side black to gray-black, thickly covered with fine spherical to cylindric (coralloid) isidia (appearing as sooty), large lobed, -5(8) cm. Lobes 0.5-2 cm wide, rounded. Ap. very rare □ **L. saturninum**
- 1* Thallus underside without thick whitish hair layer **2**
- 2 Thallus often reaching several cm in diameter, with definite, visible even without handlens, (1)1.5-3(8) mm wide lobes, paraplectenchymatous cortex (section), mostly of loosely ordered hyphae in the interior **3**
- 2* Thallus small, usually reaching only a few mm in diameter, thin crustose, granular, squamulose,

- very small lobed, coralloid or finely fruticose; lobules at best 10 mm long and 0.6 mm wide, flat to ± cylindric, scarcely visible with the naked eye, thallus interior of thick hyphal tissue to paraplectenchymatous throughout (section) . 9
- 3 Lobes robust, *Collema*-like, tough, cartilaginous. Thallus with very thin (usually only up to 4 µm thick), small celled, one layered, often difficult to recognize and (above all underside) in places lacking a cortex, compressed rosetted, of very thick standing, ascending at the margin, often wavy-curly, 2-5 mm long, 1-3 mm wide lobes, often covered with miniature isidia-like warts, dark brown, olive to green-black, underside lighter, often green in places, 1-8 cm. Ap. rare, -1mm, disk concave to flat, margin at first thick, later thinner. Sp. 20-35 x 8-14 µm, muriform
□ **L. plicatile**
- 3* Lobes thin, membrane-like. Thallus with rather large cells, one layered, both sides with a cortex throughout, "cells" about 5-12 µm in diameter 4
- 4 Lobes rolled under at the margins thereby in places ± tube-like, usually blackish olive, upper side smooth, rarely wrinkled, repeatedly divided, 1-3 cm long, -5 mm wide. Ap. very rare
L. corniculatum
- 4* Lobes not ± rolled under tube-like, rare blackish olive 8
- 5 Thallus light lead-gray to blue-gray, with numerous flat to cylindric isidia on the upper surface, at the margin at most sparsely isidiate. Lobes usually 4-8 mm wide, ± flat, rounded, entire margined to sparsely indented, not wrinkled or ribbed, very thin, underside smooth, lighter, sometimes somewhat yellowish. Ap. very rare. Sp. 18-23(25) x 7-9(10) µm, weakly muriform **L. cyanescens**
- 5* Thallus lead-gray to dark brown, if isidiate, then isidia strongly concentrated on the lobe margins and cylindric, lobes 1-3(5) mm wide, ascending to erect or overlapping, usually thick standing 6
- 6 Lobules ± entire margined to sparsely divided, not isidiate or very rarely with very sparse isidia-like outgrowths . 7
- 6* Lobules frayed at the margin to repeatedly incised, with or without a thick layer of isidia . 8
- 7 Upper surface smooth to scarcely wrinkled. Lobules 1-3 mm long, -1(2) mm wide, crenate or split at the margin, often shingle-like. Ap. -0.5(0.8) mm, rather rare. Habit like a small *L. gelatinosum*. Sp. 20-32 x 9-13 µm
L. intermedium
- 7* Upper surface wrinkled to folded ribbed. Lobules clearly larger, entire margined to sparsely divided, with wrinkled to folded ribbed upper surface, ascending to almost erect, dark brown, red-brown, only rarely (in deep shade) gray. Thallus often thick lobed producing carpet/pad. Ap. frequent, -1(2mm), disk concave to flat, projecting margin. Sp. 24-48 x 8-17 µm, muriform .
□ **L. gelatinosum**
- 8 Lobes strongly divided at the margin, frayed-toothed, with simple to strongly shrubby branching, at the least in the end segments cylindric, isidia-like extensions (in the extreme case the lobe margin becoming strongly curly), blue-gray to brown, wrinkled to smooth, sometimes even with cylindric isidia on the surface, short to stretched (up to about 15 mm long), underside usually blue-gray with elongate lying ribs, often cobwebby-hairy toward the attachment point. Thallus thick lobed producing carpet/pad to very loose turf. Ap. rare, margin usually isidiate. Sp. 34-48 x 10-16 µm, muriform
□ **L. lichenoides**
- 8* Lobe margin without cylindric branching outgrowths. Lobules ± richly incised and hand-like divided to frayed (up to the entire margin), the segment however always flat, marginally never almost shrubby divided. Not always able to separate from *L. lichenoides* .
□ **L. gelatinosum (7)**
- 9 Thallus closely attached to the substrate (limestone) up to the margin, placoid, in the interior ± areolate (areoles usually -0.4 mm), toward the periphery radially lobed with elongate, ± divided, moderately convex, scarcely separated, -0.5 mm wide lobules, with cortex, up to ca. 1 cm wide, dark olive-brown to brown-black. Ap. very rare .
□ **L. diffractum** (like and sometimes formally in the case of *Leptogium* it is keyed out as *Collema parvum*: Thallus black, rarely brown-black, ± isidiate. Often with cortex-like layer, but never with clearly cellular cortex layer, marginally hyphae cells never darker colored than the underlying ones; in the case of *L. diffractum* the cortex is definite, usually brownish colored, the thallus lobes are usually wrinkled, never isidiate)
- 9* Thallus otherwise . 10
- 10 Thallus inconspicuous, thin crustose to granular, close lying, ap. ± frequent 11
- 10* Thallus definite, small lobed to fruticose . 12
- 11 Thallus granular, thin crustose, usually weakly developed (like *Moelleropsis*), of clumped or even granules lying loosely to one another, usually on soil. Granules ca. 0.2 mm, often elongate, entire or crenate to appearing lobe-like, blue-gray to gray-greenish, olive-brown to brown-black. Ap. -0.8 mm, soon flat (to moderately convex), with thalloid margin and narrow proper margin, ± sunken to compressed. Sp. 14-33 x 7-15 µm, with 0-1 longitudinal septum .
L. byssinum
- 11* Thallus granular-small squamulose to appearing lobed, brown-black, on limestone and walls. Ap. with projecting proper margin, sessile. Sq. 24-32 x 13-16 µm, with 1-2 longitudinal septa
! L. biatorinum

- 12 Thallus lobules or branches ± erect, small shrubby or coralloid **13**
- 12* Thallus lobules close lying to the substrate or ascending cylindric or finger-like **15**
- 13 Thallus lobules soon extensively covered by erect standing, shiny-smooth, cylindric, branched, coral-like, -0.8 mm long, (in the center) 40-70 µm thick, grassy close crowded branches and scarcely more visible (very narrow, flattened, branching), often shiny, mostly dark brown. Ap. very rare. Thallus usually on bark
L. teretiustum
- 13* Thallus lobules ascending to erect, wrinkled to furrowed, bushy branching. Thallus on soil or rock **14**
- 14 Lobules 3-7 mm high, ± shiny, definite cortex throughout. Ap. almost terminal, -1.5 mm. Sp. 25-33 x 10-14 µm. Segment ± cylindric, toward the ends often constricted, wrinkled to finely long streaked, often with ± spherical isidia, often forked. On soil, between mosses and on rock. Thallus on dry habitats **! L. schraderi**
(To reconcile *L. plicatile* and *L. turgidum* (Ach.) Crombie with more darkening (often broadening at the end), -1 mm thick, ascending to decumbent, often thickly granular-isidiate, concave lobes on the thallus periphery; small specimens of *L. plicatile* are distinguished by the incompletely developed interrupted cortex)
- 14* Lobules 2-5 mm high, ± dull, indefinite and noncontinuous cortex. Thallus chiefly on moist habitats **L. plicatile (3)**
- 15 Thallus of cylindric to almost filamentous, 0.1-0.2 mm thick, branched, often radially arranged, decumbent (to weakly ascending) segments, almost *Pseudophebe pub.* Like, ca. 1-4 mm high, -10 mm wide, on lime-stone. Ap. -0.4 mm, sparse. Sp. 15-27 x 7-11 µm **L. massiliense**
- 15* Thallus hand-like to horn-like divided, on soil, moss, bark. Ap. rather frequent **16**
- 16 Ap. -0.5(1) mm in diameter, with smooth margin, usually ± spherical. Thallus small, often only -2 mm, not grassy to cushion-like, gray to almost greenish. Lobes -0.3 mm wide, commonly sometimes grouped into a small rosette around one or more ap. Sp. 20-30 x 6-12 µm. Commonly on bark of older trees, old wood, of plant detritus **! L. subtile**
- 16* Ap. often over 1 mm (-4 mm), often with hairy margin, often also covered with thallus lobules. Thallus larger, lobes -1(2) mm long, but at least partially distinct strongly finger-like to horn-like repeatedly divided with very narrow linear segments (ca. 0.1-0.2 mm) up to moderately split, ± ascending to erect or ± decumbent, crowded into thick mats, commonly with groups of cylindric-coralloid isidia on the lobe margin. Sp. 24-36 x 9-14 µm **L. tenuissimum**

Ecology and Distribution of the Species

Leptogium biatorinum (Nyl.) Leighton
(*L. pusillum* Nyl.)

On naked, clay to sandy, base rich soils as a short lived pioneer (like *L. byssinum* ↑), also on walls and limestone – (bor)mieur-smed – rare (0); *Rh, Ju*

Leptogium byssinum (Hoffm.) Zwackh ex Nyl.
On naked, sandy to clay, usually calcareous soils on open slopes, road-, forest- meadow- and field-margin soil heaps, also on flat stony soils, on fine soil islands, rarely on limestone (stone) on ± moist sites, subneutroph.-m.basiph., substrathygroph., short lived pioneer lichen transient habitat – bor-smed – very rarely found, yet easily to overlook (0); *Ju, O, FrJu*

Leptogium corniculatum (Hoffm.) Minks (*L. palmatum* (Hudson) Mont.)
Up into the montane zone in oceanic, mild winter sites on mossy silicate rock on usually shady, cool substrate habitats, subneutroph. –mieur-med, atl – v.rare; *Eif, Vog. Hessen (Giessen)*

Leptogium cyanescens (Rabenh.) Körber
In sub- to high montane, high precipitation, oceanic sites on cool substrates to moist, shaded habitats, above all on mossy or naked (often neutral to basic) silicate rocks, over and between mosses toward the trunk bases of old trees, rarely on mossy limestone, like *Collema flacc.* (↑), yet more strongly bound to mild winter sites, subneutroph., often with *Homalothecium sericeum* *Isothecium myurum* – (s')bor-subatlm(ed)(mo), (oc) – rare (1); *Sch, Sju, Ts, O, NRH*

Leptogium diffractum Krempelh. ex Körber (*L. placodiellum* Nyl.)
Above all in montane sites on naked, hard limestone, on stones in stone-collection-heaps, calcareous dry walls, and on rocks, on well lighted, rain exposed, even short time irrigated habitats (e.g. like *Collema fuscov.* ↑), basiph., m.-s.photoph., anitroph. – mieur-med – rare (3); *Ju, Ne, Sju, FrJu*

Leptogium gelatinosum (With.) Laundon
(*L. sinuatum* (Hudson) Massal., *L. scotinum* (Ach.) Fr.)
Up over the tree line over and between mosses on carbonate-, rarely weak calcareous or basic silicate rock (irrigated surfaces), above all on soil

impregnated sites, often on old walls of castle ruins etc. (even on mortar), rarely even on stony soils, usually on moderately to rather well lighted, cool substrate or sporadically irrigated habitats, subneutroph.-m.basiph. – bor-med-mo – rare; süSch, Vog, Ne, SFW, Ju, Sju, Bo, O, Mn, MRh, Ts, Saar, Eif, Th, Al

Leptogium intermedium (Arnold) Arnold
(*L. minutissimum* auct.)

Like *L. tenuissimum* (↑), on calcareous soils, limestone (usually on stones), on mosses and on bark of older trees, subneutroph. – bor-med – rare (2); Hü-süSch, Ju, O, SFW, Sju-HRh, MI

Leptogium lichenoides (L.) Zahlbr. (*L. lacerum* (Reitz.) S.Gray)

Up over the tree line, euryöke species, var. *lichenoides* on more shaded, humid sites on and between mosses on carbonate rocks and walls as well as on trunks of older mossy deciduous trees, rarer on mossy (basic or slightly calcareous) silicate rock, perhaps including the amplitude of *Collema flaccidum* (↑) and *C. auriforme* (↑), above all in moss-rich associations. (e.g. Antitrichion, Neckero-Anomodontetum), var. *pulvinatum* (Hoffm.) Zahlbr. above all on naked or soil encrusted as well as mossy rock, on calcareous soil (dry turfs); subneutroph.-m.basiph., r.skioph.-s.photoph., substrathygroph. – arct-med – r.rare to m.frequent; especially calcareous region, otherwise (r.)rare

Leptogium massiliense Nyl.

Naked limestone, on stones and rocks, rather like *L. diffractum* – s'mieur-med – rare (R); Ju (Schörzingen)

Leptogium plicatile (Ach.) Leighton (?L. turgidum (Ach.) Crombie

Up into the high montane zone on naked or mossy limestone, also on basic silicate rock, on sporadically irrigated sites on rocks as well as on walls, rarely on lime-rich, level soils, basiph.-subneutroph., m.-r.photoph., substrathygroph. – s'bor-med – (r.)rare (e); süHü, Sju, HRh, Bo, Ju, Ne, Mn, süSch, O, Sp, Ts, Eif, He, Th

Leptogium saturninum (Dickson) Nyl.

(*Mallotium tomentosum* (Dickson) S.Gray)
Like *Collema nigr.* (↑) – bor-subatl-mieur-subatl-med(mo), (oc) – rare (1); süSch, nöSch ?+, Vog, HRh+, Ju, Bo, Al, O+, TS+, Vgb+, Rhön, Eif+

Leptogium schraderi (Bernh.) Nyl.

Above all pioneer on rock and stone heaps, and rubble stone dumps, on from time to time dew moistened sites, also on mossy rocks and over mosses on calcareous earth – mieur-med – rare (the most of the data unsafe); süHü, Ne, Ju, Sju, Mn, FrJu, Mos, Eif, Bit

Leptogium subtile (Schrader) Torss.

On subneutral bark above all on the base of older deciduous trees, usually on dead or dying trunks, even on old wood, especially on walnut, willow, rarely on soil, or plant detritus – bor-mieur – rare; uncertain find: süSch, Ju, Ne, Th, MI

Leptogium tenuissimum (Dickson) Körber

Up into the high montane zone on cool to moist, naked to sparsely mossy, sandy-loam, usually relatively nutrient-poor, but base-rich soils, above all on open slopes, road- and forest-margin, rare on the base of deciduous trees on cracked, subneutral (even mossy) bark of higher water capacity (e.g. poplar, walnut), rare on limestone (above all lower, long time dew moist rocks and stones), pioneer lichen, subneutroph.(-m.basiph.), (r.)m.skioph.-r.photoph., substrathygroph. – bor-med(mo) – rare (2); süSch, O, Mn, Ne, Ju, Sju, Saar

Leptogium teretiusculum (Wallr.) Arnold
(*L. microscopicum* Nyl.)

Up into montane sites, above all on old deciduous tree trunks on cracked, subneutral, even mossy bark of higher water capacity, v.rare on base rich soils (↑ *L. tenuissimum*) – bor-med – rare (2); Ne, süHü, süSch, Ju, Sju, FrJu, Fr, Al, Eif

LIT.: JORGENSEN 1994, PURVIS et al. 1992, SIERK 1964

Leptorhaphis Körber

Introduction

The *Leptorhaphis*-species are not or not definitely lichenized, bark living fungi with black perithecia and needle-form to narrow fusiform spores. The species were traditionally treated along with the known lichens, but scarcely observed. *L. epidermidis* is widely distributed.

Genus Characteristics and Determination

Thallus lacking or very indefinite, without algae or algae loosely associated. Per. with blackish apex. Involucrellum dark brown to green-black, laterally broadened and integrating the tree bark. Exc. above all developed under the involucrellum, paraplectenchymatous, colorless to pale brown, basally not or scarcely developed. Pseudoparaphyses branched and reticulate. Asci ± clavate, fissitunicate. Sp. to 8 (rarely 16), needle-form to narrowly fusiform, cross-septate.

Leptorhaphis: Asci with two functionally different (separated from one another) layers. Pseudoparaph. permanent. With hemispherical to moderately convex, often basally horizontally lying involucrellum, exc. colorless.

Cresporhaphis Aguirre: Asci with only one functional uniform layer, thin walled. Paraph. permanent. No involucrellum. Exc. of two different colored layers

- 1 Sp. 1-celled, slightly curved, appearing sickle-like. With chlorococcoid algae associated
(Cresporhaphis) 2
- 1* Sp. 2-4 celled 3
- 2 Per. commonly coalescing, black, dull, irregular in outline, -1 mm long, if single, then 0.3-0.4 mm, irrupting out of the bark. Hym. gelatin I+ bluish-amber. Exc. exterior dark brown to black. Sp. 25-30 x 2-3.5 µm. Thallus gray-white. On sycamore. E.g. Sch
C. muelleri
(Duby Aguirre
(Leptorh. aggregatus Eitner)
- 2* Per. commonly single, black, shiny, 0.15-0.3 mm. Hym. gelatin I+ blue-green. Exc. exterior dark brown. Sp. (20)25-30(35) x 3-3.5 µm, interior with several particles. Thallus indefinite. On cracked bark of *Salix, Quercus, Robinia*
C. wienkampii
(Lahm ex Hazsl.) Aguirre
(Leptorh. w. Lahm ex Hazsl.)
- 3 Per. (at least partially definite) ± elliptical, surrounded by a dark halo. Sp. narrowly fusiform, 2-celled . 4
- 3* Per. rounded, without halo . 6
- 4 Per. 0.18-0.3 mm. Exc. not developed. Invol. green-black. Hym. gelatin I+ blue. Sp. (25)30-38 x 3-4.5 µm, fusiform, somewhat curved. On almond bushes .
L. amygdali
- 4* Per commonly at the least 0.3 mm. Exc. developed . 5
- 5 On birch. Per. 0.3-0.45 mm, round to ± ellipsoidal. Hym. gelatin I+ orange-amber colored. Sp. 24-36 x 2-3.5 µm, curved, ripe 2-celled. Invol. dark brown. Exc. thin

L. epidermidis

- 5* On *Prunus*. Per. 0.28-0.37 mm, ellipsoidal, shiny. Hym. gelatin I+ blue. Sp. 30-45 x 3-4 µm, curved to S-form. Invol. green-black
L. paramecia
- 6 At least a few spores when ripe 4-celled . 7
- 6* Sp. 1 or 2-celled 10
- 7 Sp. 50-85 x 3-4.5 µm. Hym. gelatin I-. Per. 0.25-0.3 mm, black, dull. Exc. dark brown. Thallus mealy, whitish. On cracked bark of oak along the cracks – e.g. Ju .
Cresporhaphis macrospora
(Eitner) Aguirre
- 7* Sp. clearly smaller. Hym. gelatin I+ blue, blue-green, or yellowish 8
- 8 Hym. gelatin I+ yellowish. Sp. (25)30-45 x 1.5-2.5 µm, filamentous, curved to S-form, ± pointed. Thallus indefinite. On hazel and young oak bark. Per. dark brown to black, shiny, 0.15-0.3 mm. Invol. dark brown to green-black
L. maggiana
- 8* Hym. gelatin I+ blue or blue-green . 9
- 9 Per. -0.15-0.3 mm, black, shiny. Sp. (20)25-30(35) x 3-3.5 µm, completing outnumbering 1-celled, interior with several particles. Thallus indefinite. On cracked bark of *Salix, Quercus, Robinia*
Cresporhaphis wienkampii (2)
- 9* Per. -0.15(0.2) mm, black, dull. Sp. (20)25- 32 x 2-3.5 µm, curved, ± more or less rounded on the ends. Hym. gelatin I+ blue. Thallus white-gray. On *Populus, Fraxinus, ?Salix*. After disappearance of the per. a narrow ring remains behind. Invol. green- brown .
L. atomaria
- 10 Sp. predominantly 1-celled, a few 2-celled, (20)25-30(35) x 3-3.5 µm, to 8 per ascus. Hym. gelatin I+ blue-green. Per. 0.15-0.3 mm, black, shiny
Cresporhaphis wienkampii (2)
- 10* Ripe sp. 2-celled, 13-25.5 x 3-4.5 µm, 8-16 per ascus. Hym. gelatin I- or amber colored. Per. 0.14-0.25 mm, black, dull, with invol. On branches of *Populus*-species, not lichenized. E.g. *FrJu*
L. tremulae Körber

Ecology and Distribution of the Species

Leptorhaphis amygdali (Massal.) Zwackh
On hazel bushes – s'mieur-med – O

Leptorhaphis epidermidis (Ach.) Th.Fr.
On stem of popular-species and ash, very easily facultatively lichenized, subneutroph., in the Xanthorion – bor-smed – Westf

Leptorhaphis epidermidis (Ach.) Th.Fr.
On birch, probably saprophytic, photoph., anitroph. – bor-mieur – moderately frequent; e.g. Rh, Ne, Ju, Sch, O

Leptorhaphis maggiana (Massal.) Körber

On smooth bark of hazel and young oak, saprophytic. – mieur – e.g. *Do*

Leptorhaphis parameca (Massal.) Körber
On *Prunus*-species (cherry, plum), saprophytic – mieur e.g. *Do*

LIT.: AGUIRRE-HUDSON 1991

Letharia (Th.Fr.) Zahlbr

Introduction

The *Letharia*-species are shining yellow to greenish-yellow fruticose lichens, which occur on conifer trees and wood above all near the tree line. Only a one species occurs in Europe, the wolf lichen *L. vulpina*. Its name refers to the earlier use of the thallus for poisoning wolf bait. In Germany it occurs in the Alps as well as Allgäu, commonly it is found also in the lowlands on old barns and boards (e.g. Vogtland). It is distributed in the boreal conifer forest belt surrounding the northern hemisphere.

Genus Characteristics

Yellow to green-yellow, ± richly branching fruticose lichen, the indigenous species with isidia. Thallus segment flattened, in section bilaterally symmetrical, to rounded and cortex all around. Cortex of anticlinal hyphae, medulla loose, of several longitudinal long hyphal strands. Photobiont *Trebouxia*. Ap. dark brown, with thalloid margin. Asci clavate. Sp. 1-celled, almost spherical. Pycnosp. needle-like. Ch: Vulpinic acid.

LIT.: ANDERS 1928, KEISSLER 1948, POELT 1969

Lichenothelia D. Hawksw.

Introduction

The thallus of the *Lichenothelia*-species consist of scattered black single areoles or thin areolate crusts of paraplectenchymatous structures. These organisms are fungi, which are often associated with bluegreen or green algae, however probably no true lichens are produced. The genus includes

at this time ca. 25 species, which occur as pioneers on rock, usually silicate rock. Little is known of their distribution. The best known species is *L. scopularia*; it grows on silicate rock, often in drip zone of deciduous trees. The taxon is distributed predominantly in central Europe, occurring however also in northern Scandinavia.

Genus Characteristics

Thallus crustose, dark brown to black, of isolated, at times “cushion form” areoles to cracked crusts, paraplectenchymatous structured, without algae, by algae associated. Living relationship yet unclear. Fruiting bodies are apothecia- or perithecia-like or near gall-like, “cushion-form” structures. Exc. and hyp. similar in structure to the thallus. Hym. I- to I+ blue. Pseudoparaphyses branched and reticulate or lacking and replaced by a paraplectenchymatous tissue between the asci. Asci clavate to almost cylindrical, thick-walled, fissitunicate, I-, outer layer I+ blue. Sp. brown, 2- to 4-celled or weakly muriform, thick-walled, often with perispore. Pycnosp. short bacillar, macroconidia 4-celled, almost spherical, brown, warty. Ch-

Outside of *L. scopularia* other species likely exist in the region. *L. convexa* Henssen is known from Hessen and the Eifel: Thallus of scattered to crowded, -0.4 mm convex areoles, black, ap. convex, -0.2 mm. Sp. 11-14.5 x 5.5-7.5 µm. (2)3-4 celled, warty, brown. Macroconidia ± spherical, multicellular, brown.

Ecology and Distribution of the Species

Lichenothelia scopularia (Nyl.) D. Hawksw. (Microthelia aterrima (Krempelsh. ex Anzi) Zahlbr.)

In submontane to alpine sites on very hard, mineral-rich silicate rock or on secondarily mineral rich silicates because of the natural acids through the drip from the leaf of overhanging trees (e.g. sycamore), or rocks and above all on rock piles, pioneer on smooth, rapidly drying after a rain, subneutroph., r.xeroph., m.-v.photoph., e.g. in the Aspicilietum cin. – bor-mieur – rare; süSch, O, Vog

LIT.: HAWKSWORTH 1981, HENSSSEN 1987

Lichinella Nyl.

(Determination ↑ Polychidium)

Introduction

The *Lichinella*-species (in Europe 2) are small, fruticose, dark greenish to blackish bluegreen algae lichens, which grow on sporadically irrigated rock surfaces. *L. stipatula* is distributed in south Europe and reaches with a outpost into the central European floral region (in Germany Lahntal, south Black Forest, Hegau). The species is to a high degree threatened in Germany.

Genus Characteristics

Thallus small fruticose, dark greenish to blackish with tubular to somewhat flattened, acute-angled, on the ends pointed crowded branches, with bluegreen algae or the order Pleurocapsales. Ap. terminal, gall-like developing from a widened thallus part (Thallinocarp). Hym. is part covered with algae. Paraphysoids branched, with thickened ends. Asci thin walled, cylindric, often tapered toward the ends. Sp. commonly to 24-48, elongate to spherical. Pycnosp. short bacillar. Ch-.

Ecology and Distribution of the Species

Lichinella stipatula Nyl.

On basic silicate rock on sunny, sporadically lightly irrigated rock in warm sites, e.g. like *Peltula euploca* (↑) – s'mieur-med – v.rare (1); Bo, süSch, Lahn

LIT.: HENSSEN 1963a, MORENO & EGEE 1991*, 1992a

Lithographa Nyl.

(Key incl. Ptychographa)

Introduction

The genus *Lithographa* includes crustose lichens (ca. 3 species) with oval to elongate (sometimes branched) black ascocarps with crack-form disk

and carbonaceous receptacle. In distinction to the habit of similar lichens with such kind of fruiting bodies the spores are one celled and the photobionts coccoid green algae, not *Trentepohlia*.

The single species discovered in Germany resides on SiO₂-poor (intermediate and basic) or slightly calcareous silicate rock and lives on moist rock on cool, shaded habitats. It occurs in northwestern Europe and in montane oceanic central Europe. In Germany it is a rare lichen as yet known from the Rhön, the Harz, the Meissner and the Alps.

Genus Characteristics and Determination

Thallus crustose, areolate, with coccoid green algae. Ap. with crack-form disk (lirella-form), oval to elongate, even branched, black. Exc./hyp. dark brown (subhym. light). Hym. I+ blue. Paraphyses branched and reticulate bound, disappearing. Asci clavate, of the *Rimularia*-type. Sp. one celled, ellipsoidal. Ch: indigenous species with Norstictic acid.

- 1 On silicate rock. Thallus strongly developed, areolate, gray-white to light brownish-gray, often with black prothallus, K+ yellow, then red, P+ orange, C-. Ap. robust, elongate, -1.2(1.5) mm long, -0.4 mm wide, straight or curved. Disk narrow crack-form, margin thick. Sp. 9-12(15) x 5-8 µm. Hyp. black-brown, over that colorless subhym. Norstictic acid **L. tesserata**
- 1* On wood. Thallus indefinite, of tiny scattered brown granules. Ap. -0.8 x 0.4 mm, at first elongate, then ± rounded to angular, with at first crack-form, the broadened out or furrowed disk, with definite, sharp, often in-curved margin, sp. 5-8 x 3-4 µm. Hyp. dark brown. Ch- **Ptychographa flexella**

Ecology and Distribution of the Species

Lithographa tesserata (DC.) Nyl.

In montane to subalpine (alpine), high precipitation, oceanic influenced sites on basic and neutral, sometimes slightly calcareous silicate rock, e.g. basalt, or feldspar-rich granite (substrate requirement like *Lecanactis dill.* ↑), on long time dew moistened or irrigated, nutrient poor surfaces on cool, regularly very humid, less sunny habitats (often north facing), often in boulder fields, subneutroph., anitroph., in the Porpidion tub. – bor-atl-s'bor-mieur-mo (-smed-

mo), (subatl) – v. rare (R); süSch (2x), Rhön, Hz, Meissner, Al

LIT.: HERTEL. & RAMBOLD 1990, REDINGER 1937

Lobaria (Schreber) Hoffm.

Introduction

The Lobarias belong to the largest foliose lichens and reach diameters of several decimeters. The thallus is truly diversely colored, in the case of the indigenous species, light gray, yellow-greenish, light brown to olive brown or gray-brownish (in the dry condition). The species contains either only bluegreen algae or predominantly green algae and in addition bluegreen algae in cephalodia; in the moist condition the thallus color turns correspondingly more or less into dark gray or greenish. The thallus underside is at least partially thick short haired. The apothecia have usually a brown-red disk with a thalloid margin, however in the case of sorediate species they are only rarely developed. The spores are cross-septate, two or more celled, fusiform or needle-like.

The perhaps 60 species included in the genus, occurring worldwide in moist, above all warm- and cool temperate regions, is represented in central Europe by five species. *L. virens*, an indigenous species in oceanic west Europe (western north Norway to the montane mediterranean region), in western central Europe only a few tokens, thus species found in the Hessian Odenwald, Taunus and Habichtswald, are extinct – they were exterminated by collectors. Likewise only *L. amplissima* and *L. scrobiculata* growing in high precipitation, mild-to cool-oceanic sites are immediately threatened by extinction. They live in near natural forests on old deciduous trees (likewise on “willow bushes”), especially *L. scrobiculata* also on mossy silicate rocks. They need undisturbed habitats. Normal forestry practices lead to the disappearance of these lichens. A high sensitivity toward acid air pollution has in recent years led to further diminution of the stand. Perhaps *L. pulmonaria*, the lung lichen, is less sensitive. But even it is in strong regression; many occurrences are exceptionally poor individuals and are characteristically injured

thalli, thus in the Swabian Alp, in northern Black Forest, and in the Swabian Forest. Earlier frequent encountered luxurious, large, fruiting specimens are no more to be found. Survival of *L. scrobiculata* and *L. amplissima* in the region is questionable.

L. amplissima is distributed strictly westward in northern Europe (Scandinavia), occurring in west Europe, reaching in oceanic influenced mountains even to eastern central Europe and is found in the mountain forests of the mediterranean region. *L. scrobiculata* is distributed somewhat more widely and less strictly oceanic. This is even more true for *L. pulmonaria*, whose area in Europe stretches from high precipitation regions of the mediterranean up into the northern boreal zone; otherwise lacking in the continental regions. *L. linata*, an arctic alpine lichen of the dwarf shrubby heath, should be found in the cold north Black Forest

Genus Characteristics and Determination

Thallus foliose, broad lobed, with rounded to complex ends, usually light brown to brown, olive, gray-yellowish, whitish, smooth, wrinkled or pitted, often with soralia or isidia, underside whitish to pale brownish, short hairy, often with bald spots, but without pseudocyphellae and cyphellae, with sparse rhizines, both sides with paraplectenchymatous cortex, with green algae (*Trebouxia*, or *Myrmecia*) or bluegreen algae (*Nostoc*, or *Scytonema*), often with internal, many species with external, cephalodia. Ap. in the case of the indigenous species rather to very rare, with brown to red-brown disks and thalloid margin. Paraphyses usually simple. Asci of the *Peltigera*-type. Sp. cross-septate 2- to 8-celled, fusiform to elongate, colorless to slightly brownish. Pycnosp. bacillar, usually slightly thickened on the ends. Ch: Depsides, Depsidones.

- 1 Thallus pale yellowish, gray-yellowish, pale yellow-greenish gray, moist lead-gray (with bluegreen algae), upper side dull, surface pitted, at the margin above all on the “ribs” with rounded gray soralia, underside ± felty to thickly short-hair carpeted, with large, raised, bald light spots. Lobed broadly rounded, 1-3 cm. Medulla P+ orange, K+ yellow, C-. Ap. very rare. Usnic acid, Scrobiculin, ± Norstictic acid

□ ***L. scrobiculata***

- 1* Thallus without pale yellowish tint, not gray when moist, but greenish, olive or little changed, main algae a green alga **2**
- 2 Thallus pitted-reticulate ribbed, marginally or on the raised reticulate ribs with yellowish-white soralia or usually squamulose isidia, olive to brown, shade forms even light (yellow) brown, green to olive when moist, often ± shiny, deeply divided, underside light- to black-brown, felty-short hairy to almost bald, felt-free places often whitish. Medulla P+ red, K+ yellow-orange, C-. Ap. today usually very rare, -4 mm, red-brown (when shiny black: then galls of the fungus *Lichenomyces lichenum*). Lobes 1-3 cm wide, ends somewhat complex. Up to over 20 cm large lichen, yet today often only in dwarf forms. Norstictic acid, Stictic acid
- **L. pulmonaria**
- 2* Thallus without soralia, without isidia. **3**
- 3 Thallus lobe upper side clearly pitted-net ribbed, reminiscent of *L. pulmonaria*, olive to brown, in deep shade even gray, often shiny, underside light to black-brown, short hairy, with whitish felt-free spots. Medulla P-, K± yellow, C-. Ap. rare, -3.5 mm. On soil, mosses, commonly above the tree line. Tenuiorin **L. linita**
- 3* Thallus lobe upper side smooth to transversely wrinkled, whitish or gray-brownish to gray-olive, rounded on the ends, underside thickly short hairy, light brown to brownish-white, (almost) without bald spots. Often with ap. or black shrubby outgrowths. Often with black pycn. Medulla P-, K+ yellow/K-, C-. ± Scrobiculin. **4**
- 4 Thallus robust, thick, leathery, gray-whitish (in the herbarium slightly brown tinted), greenish when moist, often over 10 cm in size, in the center often with large black, thick shrubby branching, ± dome shaped outgrowths (Cephalodia). Pycn. in projecting warts. Lobes up to ca. 1(1.5) cm wide, toward the thallus center growing over one another and ± fusing. Ap. rather rare, (red)brown **L. amplissima**
- 4* Thallus thin, decumbent, gray-brownish, gray-olive, green when moist, often smooth and ± shiny, -10 cm, without blackish outgrowths, always with ap. Ap. -3 mm, rose- to orange-red. Lobes 3-10 mm wide. **L. virens**

Ecology and Distribution of the Species

Lobaria amplissima (Scop.) Forss.

(*Dendriscoaulon umhausense* (Auersw.) Degel. = Blaualgen-Photosymbiodem)

In the montane and high montane zone in high precipitation, mild to cool oceanic sites (rainfall usually over 1500 mm), on old deciduous trees above all sycamore and beech, in the interior of undisturbed, near natural or natural forests

(beech-spruce forests, *Aceri-Fagetum*), especially on thick branches in the crown region, also in well lighted open to the wind, foggy sites on the trunk of older trees in the region of thin turf, avoiding poorly lighted sites, predominantly on sites with rather often changing moisture conditions, often over mosses, very sensitive to forest exploitation and other habitat alterations, strongly diminished in the last 20 years, inventory in the most critical stage, m.acidoph.-subneutroph., m.-r.photoph., substrathygroph., v.ombroph., s.hygroph., a-/m.nitroph., Char. Lobarion p. -bor-atl-mieur-subatl-med-mo, oz - v.rare (1); süSch, Vog; +: nöSch, PFW (*Bitsch*), O, Sp, Rhön, Eif, WeBgl

Lobaria linata (Ach.) Rabenh.

Commonly above the tree line in dwarf shrub heath on cool, acid-humus soils and over mosses or between silicate boulders, very rarely on the base of mossy trees, m.-r.(v.)acidoph., hygroph., substrathygroph., m.-r.photoph., e.g. in the *Cladonietum stell.* -arct-mieur-alp - v.rare (0); nöSch (*Kaltenbronn 1823*), WeBgl, *Rothargeb.*, Obay, Al

Lobaria pulmonaria (L.) Hoffm., Lung lichens

Above all in montane and high montane, high precipitation, mild to cool (rarely cold) sites, rare in the submontane, formerly even in the foothills zone, on bark above all of deciduous trees and on silicate rock, often over mosses, on very to extremely humid, in lower sites rather poorly lighted, in higher sites even on rather well lighted habitats, often on substrates with higher water capacity (but not on poorly lighted, very humid sites), predominantly in undisturbed forests, in lower sites in narrow valleys (Talsohle, Hangfuss) above all on ash, oak, sycamore in ash-, oak-beech, linden-maple forests (*Carici-*, *Aceri-Fraxinetum*, *Luzulo-Fagetum*), in higher sites especially on beech and hornbeam in beech-spruce forests, *Aceri-Fagetum* as well as on older free standing trees in thin turf; formerly used in Homeopathy for coughs etc.; strongly threatened because of forestry practices and air pollution, subneutroph.-r.acidoph., v.(-e)hygroph., substrathygroph., a-(m.)nitroph., Char. Lobarion p. - bor-med-mo - rare (2); süSch, Vog and Al over 800 m, rarely lower, Ju, BayW, otherwise v.rare and mostly distorted (nöSch, Ba, SFW, O+, Sp, Rhön (+?), Eif, Mos); formerly widely distributed, today in N-, NW-, central Germany + (except Schlesw.-Holst.)

Lobaria scrobiculata (Scop.) DC. (*L. verrucosa* (Hudson) Hoffm.)

In montane and high montane, high precipitation and foggy, oceanic, mild to cool (to cold) sites, like *L. pulmonaria* (↑), but in lower sites much rarer or lacking and even in higher sites scarcely on free-standing trees, above all on trunk and trunk base of older deciduous trees (beech, sycamore), in lower sites above all on silicate rocks (steep, vertical surfaces), above all in open beech-spruce forests, oak forests, very sensitive to forestry exploitation; m.-r.acidoph., (r.skioph.-)m.-r.photoph., v.-e.hygroph., substrathygroph., anitroph., Char. Lobarion p. – bor-med-mo – v.rare (1); süSch, nöSch (whether yet?), Vog, Saar+, O+, Sp+, Ts+, He (e.g. Rhön+, *Meissner*), *WeBgl*, Obay

Lobaria virens (With.) Laundon (*L. latetevirens* Zahlbr.)

In mild oceanic sites on very to extremely humid, shady sites on old deciduous (ash, linden, oak) or on (usually over moss cover) silicate rock, m.acidoph., substrathygroph., Char. Lobarion p. – s'bor-atl-med-subatl, oz – v.rare, in D +; *O* (*Tromm*, *Waldmichelbach*), *nöPf*, *He* (*Habichtswald*)

LIT.: ANDERS 1928, PURVIS et al. 1992

Lobothallia (Clauz & Roux) Haf.

(Determination ↑ *Aspicilia*, *Lecanora*)

Introduction

In the genus *Lobothallia* is the formerly generically independent *Aspicilia radiosa* group, rosette growing crustose lichens with definite marginal lobes and ± sunken red-brown to brown-black apothecia. In southwest Germany it is only represented by *L. radiosa*, which is distributed in mediterranean, submediterranean and central European floral regions on calcareous rocks. Moreover, *L. alphoplaca*, a species of sunny silicate, was collected from Germany.

Genus Characteristics

Thallus crustose, usually rosetted, placoid, with elongated lobes at the margin to almost foliose, gray, gray-brown, gray-black, with coccoid green algae. Ap. sunken to sessile, with brown-black to red-brown disk and thalloid margin. Hyp. colorless, paraphyses flaccid, predominately simple. Sp. 1-celled, ellipsoidal. Pycnosp. short bacillar. Ch: e.g. Norstictic acid.

Ecology and Distribution of the Species

Lobothallia radiosa (Hoffm.) Haf. (*Aspicilia* r. (Hoffm.) Poelt & Leuckert, *Lecanora* r. (Hoffm.) Schaerer, *L. subcircinata* Nyl.)

Commonly up into the montane sites on calcareous rock, above all pure lime, preferably on full sun, dry-warm habitats, e.g. in dry turf, on eutrophic rock caps, slightly dust impregnated surfaces near the soil, wall crowns, commonly on calcareous artificial stone (Terrazzo), rarely on concrete and mortar, basiph., xeroph., r.-v.photoph., r.nitroph., above all in Placocarpetum schaeer. – (s'bor-)mieur-med – moderately frequent in the lime regions (above all Sju, Ju, FrJu, Ne, Th), otherwise rare and synathrop

LIT.: BUSCHARDT 1976, CLAUZADE & ROUX 1984, HERMANN et al. 1973*

Lopadium Körber

Introduction

The genus *Lopadium* includes crustose lichens with basally strongly constricted black, clearly margined lecideine apothecia and large, one per ascus muriform colorless spores. Of the till now four species (two in Germany) two species are distributed arctic alpine and grow over mosses and plant detritus, thus also *L. pezizoideum*, that resides in the Alps, has been authenticated, e.g. in Allgäu. *L. disciforme* resides above all on bark of trees in cool, high precipitation sites in the boreal zone and rarely in the corresponding mountain sites in central Europe (Black Forest, Thüringer Forest, and the Alps).

Genus Characteristics

Thallus crustose, granular to very small squamulose, with coccoid green algae. Ap. sessile with strongly constricted base, black to black-brown, short top-shape, with concave to flat disk and strongly projecting proper margin. Exc. radiating-threadlike, dark red-brown. Hyp. brown-black. Hym. gelatin I-. Paraphyses simple to branched, rather thick, strongly swollen above, with thick dark brown pigmented cap. Asci broadly clavate to almost cylindrical, thick walled, outer wall I+ blue, without tholus, with thinner K/I+ blue "case" on the inner side of the ascus tip. Sp. single, strongly muriform, colorless to light yellow-brownish. Ch: Atranorin.

Ecology and Distribution of the Species

Lopadium disciforme (Flotow) Kullhem (L. pezizoideum (Ach.) Körber p. p.)
In the montane and high montane zone in near natural forests on (usually older) deciduous and conifer trees on the central stem and stem base, directly on bark and over mosses, rather like *Menegazzia* (↑), e.g. in the Lobarion p., Thelotrema lep. – bor-mieur-mo – rare (2); süSch (over 800 m), nöSch, Vog, O+, ThW, Al

LIT.: HAFELLNER 1984*, POELT & VEZDA 1981.

Loxospora Massal.

(Determination ↑ *Haematomma*)

Introduction

The species of the genus have crustose, yellow-whitish to gray, coherent or coarse surface sorediate thallus, red-brown nonpruinose or whitish pruinose apothecia with thalloid margin and needle- to worm-form, cross-septate, colorless spores. The two species known in Europe are epiphytes. *L. cismonica* are at home in very moist oceanic mountain forests of the Alps, Carpathians and the foothills of the central mountains; they live almost exclusively on spruce, especially in old spruce- and spruce-beech forests. *L. elatina* grows in conifer forests in the boreal zone and the central European mountains and is concerning moisture conditions

less exacting than *L. cismonica*, which is to a high degree threatened with extinction.

Genus Characteristics

Thallus crustose, with or without soredia, whitish, light gray, greenish-gray, with coccoid green algae. Ap. ± red-brown (in contrast to *Haematomma* not K+ purple), ± pruinose, flat, with thalloid margin. Epihym. yellow-brown to reddish. Hyp. colorless to pale brownish. Hym. I+ blue. Paraphyses simple to isolated branching, rather loose. Asci clavate to narrowly clavate. Sp. lying spirally in the ascus, needle-form to worm-like, cross septate. Pycnosp. short bacillar. Ch: Thamnic acid, Elatinic acid.

Ecology and Distribution of the Species

Loxospora cismonica (Beltr.) Haf. (*Haematomma cismonicum* Beltr.)
In high montane, very high precipitation, or very to extremely high humidity, foggy sites, definitely preferring spruce in near natural spruce forests, on usually rather poorly lighted brook side habitats, in cold accumulating depressions, like *Stenocybe major*, m.-r.acidoph., r.skioph.-m.photoph., anitroph., oceanic, above all in the Thelotrema and related associations. – mieur-h'mo – v.rare (1); Vog, süSch, BayW, Al, MI

Loxospora elatina (Ach.) Massal. (*Haematomma elatinum* (Ach.) Massal.)
In high montane, more rarely montane, high precipitation sites on conifer, very rarely deciduous trees, predominantly on spruce in spruce forests and spruce-fir forests, especially near natural, but also strongly forestry altered stands, on humid, rather poorly lighted to moderately to well lighted, cool habitats, on far less strongly changing moisture habitats than *L. cismonica*, r.-v.acidoph., anitroph., in high montane forms of the Pseudevernetum – s'bor-mieur-h'mo, (oc) – rare; Sch, Vog, SFW, ThW, BayW, also Al

LIT.: POELT & VEZDA 1977, TONSBORG 1992.

Macentina Vězda

Introduction and Genus Characteristics

The predominantly tropically distributed genus is recognized by light brown perithecia and septate to muriform spores. The thallus is purely crustose or, as is the case of the indigenous species *M. stigonemoides*, made up of tiny, spread out on the substrate, coraloid structures. *M. stigonemoides* grows only on base-rich, often mossy bark, above all of elder. The species is distributed subatlantic, in western Europe.

Thallus purely crustose or of tiny branching, coraloid structures, with coccoid green algae. Per. pale brown. Exc. light, made up of elongated cells, without involucrellum. Paraphyses lacking, with paraphyses, hymenial gelatin I+ red. Asci clavate-cylindric, fissitunicate, I-. Sp. 4- to 6-celled, in the case of exotic species even 2-celled or weakly muriform. Ch-.

Ecology and Distribution of the Species

Macentina stigonemoides A. Orange

On very base-rich bark, mostly in contact with mossy parts, mainly on black elder, rarely on maple, on humid, mostly shady habitats, in forests, brook bordered woods, subneutroph.-neutroph., m.photoph. – mieur-subatl-smed -- r.rare; e.g. Sch, Ne, SFW

LIT.: PURVIS et al. 1992

Maronea Massal.

Introduction

The *Maronea*-species are mostly gray thallus crustose lichens with black to brown-black apothecia with thalloid margin and very small single celled, ellipsoidal, colorless spores, which are produced in large numbers in the thallus. The species numbering 13, mainly tropically distributed genus is represented in Europe only by *M. constans*. Their area includes south Europe and central Europe and reaches up to the southern tip of Scandinavia, where they have died out; in western Europe they seem to be lacking. They grow on smooth bark of deciduous

trees and spruce in open forests and in the open. In central Europe the species is in danger of extinction; in Baden-Württemberg it has now disappeared.

Genus Characteristics

Thallus crustose, usually gray to brownish-gray, with dark prothallus, with coccoid green algae. Ap. sessile with constricted base, with black-brown to black disk and thalloid margin. Epihym. often with brown granules. Hyp. light. Paraphyses simple to little branching, with brown ends. Asci clavate to pear-shaped narrowing above, with interior and exterior K/I+ blue cap, additionally with a K/I+ pale blue gelatinous cap. Sp. many per ascus, ellipsoidal to almost spherical, small.

Ecology and Distribution of the Species

Maronea constans (Nyl.) Hepp

In foothills and submontane, mostly winter mind and rather summer warm sites on stem and branches of free or open standing deciduous trees and spruce, also in orchards, on trees along country roads, in very open forests, above all on m.-r.mineral-rich, smooth or flat cracked bark of cherry, oak, alder, beech, m.(-r)acidoph., r.photoph. – mieur(subatl)-smed – v.rare (0); süSch, Ju, Sju, nöSch, Vog, PFW, nöRh, O, SFW-Ne

LIT.: HAFELLNER 1984*, MAGNUSSON 1935

Massalongia Körber

Introduction

Massalongia produces a small foliose turf to looser squamulose brown thallus with lighter underside, with (in the case of the indigenous species) brown, biatorine bordered apothecia and two- to four-celled, ellipsoidal to fusiform spores. Phycobiont is the bluegreen alga *Nostoc*. Of the two species of the genus in Europe only *M. carnos* is native. They grow on mossy, from time to time moist, usually shady, but well lighted silicate rocks in the boreal zone and in cooler mountain sites of central- very rarely southern Europe. In Germany the species is

clearly in regression. They number in the region among the more strongly threatened species.

Genus Characteristics

Thallus small, small-foliose turf, with elongated lobules, brown to red-brown, ± isidiate on the margins of the lobes, undersides whitish to brownish, with sparse rhizines. Upper cortex paraplectenchymatous, underside without cortex, of sinuous longitudinally oriented hyphae. Photobiont is *Nostoc*, in balls. Ap. hemiangiocarp, brown, red-brown (non indigenous species even blackish), with often lighter proper margin. Exc. of rounded cells. Hyp. ± colorless. Hym. often brownish above, hym. gelatin I+ blue. Paraphyses simple to generally branched, thickened on the ends. Asci cylindrical, apically thickened, I+ blue. Sp. cross-septate 2- (up to 4) celled, ellipsoidal to fusiform. Pycnosp. short bacillar or dumbbell shaped. Ch-

Ecology and Distribution of the Species

Massalongia carnosa (Dickson) Körber
From the submontane zone to above the tree line on outcropping silicate rocks, commonly on sporadically irrigated, often soil encrusted sloping- and vertical surfaces, avoiding singularly acid silicate rocks, above all on surfaces which border base-rich soils, often in regions of dwarf shrubby heath and thin turfs on sunny to (above all in the lower sites) shady sites, m.acidoph., m.nitroph., Char. Polychidio-Massalongietum, often even in pure moss associations –arct-mieur-mo(-med-mo) – rare (2); süSch, nöSch, Bo, Vog, nöPf+, Ts+, O+, BayW, Rothargeb.

LIT.: GYELNIK 1940, HENSSEN 1963b.

Megalaria Haf.

(Determination ↑ Catillaria)

Introduction

The *Megalaria*-species are crustose lichens with black apothecia with a proper margin,

moderately to rather thick walled two-celled spores and *Trentepohlia*-algae. The indigenous species *M. grossa*, *M. laureri* and *M. pulvereae* grow on deciduous trees with non eutrophic bark and are found only on mild climate to cool oceanic, humid, protected, usually rather high precipitation habitats in near natural forests. They are indigenous in western Europe on mild Scandinavian sites to the mediterranean region; in central Europe they occur overall to the eastern distribution boundary, only in mild oceanic sites. All are strongly endangered, *M. grossa* and *M. laureri* to a high degree are threatened with extinction.

Genus Characteristics

Thallus crustose, thin film-like, cracked or thickish, even soresiate, usually with *Trentepohlia*. Ap. black, with definite proper margin, sessile. Exc. interior colorless, exterior as well as the epihym. blue- to green-black. Hyp. blue- to green-black or even red-black. Hym. I+ pale blue. Paraphyses simple to sparsely branching, clavate above. Asci narrowly clavate, like *Lecanora*-type, with broader, non amyloid central axial mass and lower, broader, often indefinite ocular chamber. Sp. to (2-)8, 2-celled, ellipsoidal, thick walled, with smooth upper surface. Pycnosp. ellipsoidal to elongate. Ch- or diverse substances.

Ecology and Distribution of the Species

Megalaria grossa (Pers. ex Nyl.) Haf. (Catinaria g. (Pers. ex Nyl.) Vainio, Catillaria leucoplaca auct.)

In the foothills to montane, oceanic sites on smooth to flat-cracked, r.mineral-rich bark of deciduous trees, climatic conditions similar to the case of *Degelia plumbea* (↑), *Nephroma laev.* (↑), rarely also on spruce, e.g. in the *Nephrometum laev.* – s'bor-atl-med – v.rare (1); Vog, Ba (Wutach), HRh (Lörrach, +), O (Heidelb. +), MRh (Lorch +), Eif

Megalaria laureri (Hepp ex Th.Fr.) Haf. (Catinaria l. (Hepp ex Th.Fr.) Degel., Catillaria l. Hepp ex Th.Fr.)

Up into the montane sites in near natural humid, open forests on stems of older beech and oak,

like *Megalania grossa* (↑) – mieu-subatl-med-mo, oz - v.rare (0); süSch, Pfw (*Bitsch*), Lux

Megalania pulverea (Borrer) Haf. & Schreiner (Catinaria p. (Borrer) Vězda & Poelt, Catillaria p. (Borrer) Lettau)

In montane, high precipitation sites on cool oceanic habitats on the bark of deciduous trees, rarely spruce, in near natural forests. In the climatic demands similar to *Lobaria pulm.* (↑), m.acidoph., v.(e.)hygroph., m.photoph.(-r.skioph.), anitroph. – mieu-subatl-med-mo, oz – v.rare (2); Al, Vog, Sch, SFW, O+

LIT.: HAFELLNER 1984, SCHREINER & HAFELLNER 1992

Megalospora Meyen

Introduction

The mainly tropically distributed genus includes crustose lichens with sessile, relatively large brown to black apothecia with thick proper margin, large colorless, one- to several cross-septate spores. *M. pachycarpa* lives on the stem of older deciduous trees and spruce in near natural beech-spruce forests in very humid mountain sites. They are distributed in subatlantic-mediterranean and reach central Europe only in oceanic, very high precipitation regions. They occurred in the region, where the older spruce- “virgin forest” in south Black Forest occurred, probably became extinct as a result of forest utilization.

Genus Characteristics

Thallus crustose, yellowish-, greenish-, white-gray, with coccoid green algae. Ap. brown to black, concave to flat, with projecting proper margin, sessile. Exc. interior of radiating hyphae, looser arachnoid in the center, exterior of thick baked hyphae. Hyp. light. Hym. often with oil droplets, I-/I+ blue. Epihym. usually orange-brown, rarely e.g. olive-green, olive-brown, sometimes (as in the case of indigenous species) granular. Paraphyses sparsely branching, sparsely reticulate bound, slightly thickened above. Asci subcylindric-clavate, with thick, I+ blue tholus and I+ blue gelatinous outer

layer, egg-shaped. Sp. to 1-8, one- to multi-cross septate, ellipsoidal to elongate (in the case of the indigenous species sp. single, 6-12 celled).

Pycnosp. short bacillar. Ch: Zeorin, ± Usnic acid, ± Pannarin, ± Lichexanthon.

Ecology and Distribution of the Species

Megalospora pachycarpa (Del. ex Duby) Oliv. (Bombyliospora p. (Del.) De Not., B. incana A.L.Sm.)

In montane and high montane, very high precipitation sites on the stem of usually older deciduous trees (predominantly beech) and on spruce, usually on thick, smooth to flat-cracked bark, commonly on bark mosses, in old, near natural beech-spruce forest on very humid, distinctly oceanic, moderately well lighted habitats, m.acidoph., anitroph., very sensitive to forestry habitat alteration, in the Lobarion, Thelotremetum – mieu-subatl-med-mo, oc – v.rare (0); süSch (Gersbach, +?), Vog +?, Al, MI

LIT.: SCHREINER & HAFELLNER 1992, SIPMAN 1983.

Megaspora (Clauz. & Roux) Haf. & V.Wirth

Introduction

M. verrucosa, till now a single species in the genus, is somewhat reminiscent of *Pertusaria*-species. The blackish, sometimes whitish pruinose apothecia are sunken into warts of the whitish, crustose thallus. The single celled spores are large and very thick walled. *M. verrucosa* lives commonly on plant detritus and on mosses in openings in turf associations over base-rich soils in the alpine zone, commonly also deep below the tree line in calcareous thin turfs on long time forest free habitats, rarely also on stems of deciduous trees with subneutral bark. It is distributed from the arctic to the mediterranean region, in central- and south Europe predominantly in the higher mountains.

Genus Characteristics

Thallus crustose, ± granular-warty, with coccoid green algae. Ap. sunken in thallus warts, with black, coarse, pore-like to wide opening disk and definite, inner blackened thalloid margin. Exc. thin, colorless to yellowish. Hyp. colorless. Hym. I+ blue. Epihym. olive. Paraphyses branching and reticulate, not thickened above, cemented. Asci clavate to almost cylindric, thin walled, with K/I+ pale blue tholus above. Sp. 1-celled, large, ellipsoidal to almost spherical, thick walled. Ch-.

Ecology and Distribution of the Species
Megaspora verrucosa (Ach.) Haf. & V. Wirth
 (Aspicilia v. (Ach.) Körber, A. mutabilis (Ach.) Körber)

Above all above the tree line in openings in dwarf shrubby heath, bent sedge turfs, snow glen associations etc. on dead and living plant remains above all on calcareous soils, tolerating long time snow cover, regarding the climatic factors euryök, optimal probably on rather well lighted sites; rarely descending into the montane or foothills zones and then in fissures in calcareous rocks and in openings of calcareous dry turfs, on the base and on the middle stem of older deciduous trees (e.g. walnut, ash, or oak) on cracked, even decaying, also dust impregnated bark, neutroph.-subneutroph., photoph., Char. Megasporion verr., in lower sites in the Toninion sed. – arct-mieur(alp)-med.alp – rare (2); Ju, Sju, FrJu, Al, süSch, süHü, Vog, nöPf, Bit, Eif, O, Rh-Mn-T, MRh, Mn, He, Th

LIT.: CLAUZADE & ROUX 1984, FRIES 1871, PURVIS et al. 1992

Melaspilea Nyl.

Introduction

The crustose thallus of *Melaspilea* is little differentiated or only developed in the substrate; it contains *Trentepohlia*-algae, in many species the algae are probably only associated. The apothecia are rounded, elliptical or long streaked and black colored. They consist of crack-form to wide opening disks and two-celled, colorless, later brown spores.

The, at this time, taxonomically heterogeneous contents of the genus are mainly tropically distributed. The indigenous species (in Germany ca. 6) are little known and often overlooked. *M. gibberulosa* and *M. proximella*

are fungi on tree bark; *M. granitophila* which is distributed in the boreal and temperate zone grows on shaded silicate rock.

Genus Characteristics and Determination

Thallus crustose, thin or living in the substrate, usually with *Trentepohlia*. Ap. black, ± rounded to elongate or streak form, with crack-form to wide opening disk and indefinite to definite proper margin, sessile or sunken. Exc. weak to strongly developed, usually prosoplectenchymatous and continuous under the hym., dark brown to black. Hyp. colorless to brown. Hym. colorless to brown streaked, I-/I+ blue.

Paraphyses simple to sparsely branched and bound. Asci clavate, above with tholus and ocular chamber, commonly I-. Sp. 2-celled, ellipsoidal to “slipper shaped”, colorless, when ripe usually brown, with smooth to warty upper surface. Commonly ch-

- 1 On silicate rock. Ap. -0.3(0.4)mm, rounded to elliptical, flat, ± margined. Hyp. brown, hym. pale brown. Sp. 11-15 x 4.5-5.5 µm, colorless, later pale brown and warty, elongate to sole-form. Thallus scarcely developed, mostly fine granular. Ch- **M. granitophila**
- 1* On bark. Saprophytic fungi, even with algae associated. Ch- **2**
- 2 Ap. rounded to elliptical, -0.5 mm, usually heaped up to (-2 mm wide) groups of 8-12. Hyp. yellow-brown. Sp. with 2 unequal sized cells, long time colorless, 10-17 x 5-7 µm. Thallus white-gray **M. gibberulosa**
- 2* Ap. round, single, -0.2 mm, rarely in groups. Hyp. colorless to dark brown. Sp. with usually somewhat unequal cells, colorless to brownish, 14-22 x 7-9 µm. Thallus indefinite **M. proximella**

Ecology and Distribution of the Species

Melaspilea gibberulosa (Ach.) Zwackh
 Up into the montane (rarely high montane) zone on stem of deciduous trees and spruce, usually on oak, rarely ash, beech, or hornbeam, usually in humid oak-hornbeam forest, m.-r. acidoph., r. anombroph.-m. ombroph., hygroph., r. skioph., anitroph. – mieur-smed – rare (3); süHü, HRh, nöSch, Ju, O, Sp, Ts, Rh-Mn-T

Melaspilea granitophila (Th.Fr.) Choppins
 (Arthonia g. Th.Fr. M. subarenacea J. Nowak & Kiszka

In montane and high montane sites on lime-free silicate rock on steep surfaces and overhangs, like *Micarea lutulata* (↑) – (s')bor-mieur-mo – rare (R); süSch, Vog

Melaspilea proximella (Nyl. ex Norrlin

Up to tree line on the bark of deciduous and conifer trees, r.euryök, overlooked – bor-med – rare (?); süSch, Hü, Sp

LIT.: REDINGER 1937-38.

Menegazzia Massal.

(Determination ↑ Hypogymnia)

Introduction

The entire genus predominantly distributed in the temperate regions of the southern hemisphere includes about 50 species of deeply divided, gray foliose lichens with hollow, underside without rhizines, lobes, which are bored through on the upper side with characteristic small holes. In the case of many species – thus also in the case of the indigenous – soralia are produced; the brown disked apothecia are then rare.

The single European species, *M. terebrata*, grows on acid bark in cool, high precipitation sties, above all in fully managed spruce-beech and beech forests, commonly even on mossy silicate rocks. The population has clearly declined. The lichen is distributed from atlantic Norway over southern Sweden, the oceanic central Europe up into the mountains of the submediterranean region.

Genus Characteristics

Thallus crustose, deeply divided usually radially arranged lobes, usually rosetted and decumbent, upper sides commonly light gray to gray (exotic species even light green-yellowish to brownish), with round perforations and collar soralia, undersides blackish, without rhizines, without perforations. Lobes hollow, both sides with cortex. Ap. flat, dish-shaped, with brown to red-brown disk and thin thalloid margin. Hyp. colorless. Hym. I+ blue. Epihym. brown. Paraphyses richly branched and bound, not thickened above (or thickened). Asci with 2 sp.

(in the case of exotic species up to 8). Sp. bacillar. Ch very variable, usually Atranorin, in the case of the indigenous species also Stictic acid derivatives.

Ecology and Distribution of the Species

Menegazzia terebrata (Hoffm.) Massal. (*M. pertusa* (Schrank) B.Stein, *Parmelia p.* (Schrank) Schaer)

In montane and high montane (rarely submontane), high precipitation sites in near natural beech-, beech-spruce and spruce-fir forests on stems usually older beech and spruce, rarely also on oak, sycamore, etc. above all on smooth bark on cool oceanic, very to extremely humid, foggy, wind sheltered sites, in lower sites usually in oak-beech forests, m.-r.acidoph., m.(-r.)ombroph., m.photoph.(-r.skioph.), anitroph., above all in the Thelotremetum, Parmelietum rev., in montane forms of the Pertusarietum am. – s'bor-atl-mieur-subatl-smed-mo, (oc) – rare (3); above all süSch, nöSch, Vog, Al (above all over 800 m), BayW, otherwise very rare and (1-2): PFW, O, Sp, SFW, Ju, Do-Av, Bo, Ne, nöRh+

LIT.: ANDERS 1928, HILLMANN 1936

Metamelanea Henssen

(Determination ↑ Porocyphus)

Introduction

Of the, at the present, 3 species included in the genus one occurs, *Metamelanea umbonata*, at Feldberg in the Black Forest. The high montane-alpine distributed species, living on mineral rich silicate rock is otherwise known only from the type location in the Bernese Oberland.

Genus Characteristics

Thallus crustose, blackish, cracked areolate, of closely packed truly lichenized colonies of a single-celled bluegreen alga, erupting into vertical “lobules.” Photobiont belonging to Chroococcales with a brown epispor. Ap. sunken, in the case of the indigenous species later depressed, blackish, disk umbilicate to

furrowed (otherwise even flat and multiply divided), one species surrounded by a thalloid margin. Asci cylindrical and thickened below. Sp. 1-celled, ellipsoidal. Pycnosp. short bacillar. Ch-

Metamelanea umbonata Henssen

In high montane to alpine sites on calcareous or basic silicate rock on sometimes slightly irrigated surfaces, like *Koerberiella w.* (†) – mieur-alp – v.rare (R); süSch (Feldberg)

LIT.: HENSSEN 1990

Micarea Fr.

Introduction

The thallus of *Micarea*-species is crustose, usually greenish to gray colored. The pale to black apothecia are moderately to strongly convex, marginless or very rarely margined. The excipulum is usually strongly reduced. The paraphyses are strongly branched and reticulate, the spores one-celled to multiply cross septate, ellipsoidal to fusiform, colorless.

In Europe *Micarea* includes over 40 species, in Germany perhaps 27 (excluding the *Lecidea assimilatata*-group). The species live predominantly on shaded, humid habitats on acid substrates and distinguished often by an uncommonly low substrate specificity. Many are found on bark, on rock, on humus, and on decaying wood, as *M. lignaria*, *M. melaena*, *M. peliocarpa* and *M. prasina*. A high point of the occurrence of bark-dwelling species is fir-spruce or beech-spruce forests, where *M. adnata*, *M. cinerea*, *M. melaena*, *M. myriocarpa*, *M. peliocarpa*, *M. prasina* may occur, especially on spruce. *M. nitschkeana* grows predominantly on branches of most variable tree species. The rarer *M. hedlundii*, *M. elachista*, *M. misella* and the boreal *M. anterior* reside on wood, whereby species specific distinction of degree of decay are typical. The more frequent *M. denigrata* occurs almost only on still tough wood of decorticate poles, posts and boards. *M. adnata* frequently lives on decayed (oak-) stumps and on the base of spruce, *M. leprosula* above all on silicate mosses, *M. lithinella* and *M. erratica* “favors” small stones. *M. sylvicola*, *M. bauschiana*, *M.*

lutulata, *M. botryoides* and *M. tuberculata* similar ecologically and reside on scarcely rain exposed, shaded vertical and overhanging acid silicate rock on humid sites. *M. subnigrata* lives on high precipitation sites on fully rain exposed surfaces on silicate rock.

Many species have in their area a western tendency and avoidance of continental sites. To the western most distributed species in Europe belong *M. denigrata*, *M. lignaria*, *M. melaena*, *M. misella* and *M. prasina*. They occur from northern to southern Europe, in the mediterranean region as a rule mainly in the mountains; *M. misella* and *M. prasina* are however already rare in the northern boreal zone. *M. melaena*, *M. lignaria*, *M. erratica*, *M. tuberculata* and *M. sylvicola* are predominantly distributed in the central European and boreal region and at least by tendency boreal-montane taxa. A western subatlantic, western European area has *M. adnata*, *M. botryoides*, *M. subnigrata*, *M. myriocarpa* and characteristic *M. cinerea*, *M. lutulata*, *M. lithinella* and *M. bauschiana*. *M. adnata* widespread over the British Isles, south Sweden and the lower winter mild sites of central Europe as well as in the western mediterranean region, *M. subnigrata*, *M. cinerea* and *M. myriocarpa* over the British Isles, the atlantic region of Scandinavia and oceanic mountains of central Europe (*M. myriocarpa* up to the present only in the Black Forest, *M. subnigrata* in the Black Forest and in the Vogesen, *M. cinerea* in several central mountains and the Alps). *M. bauschiana*, *M. lithinella* and *M. lutulata* are dispersed above all in the summer green deciduous forests. The area of *M. nitschkeana* appears reach wider toward the north and east, that of *M. leprosula* and *M. elachista* stretches over central Europe up into central Fennoscandia. *M. hedlundii* is distributed in moist sites of the central European mountains and in the south boreal zone.

Above all *M. cinerea*, *M. hedlundii* and *M. myriocarpa* characteristically seem to be dependent upon old forests with high precipitation, oceanic climate, furthermore (it is the) basis of the rarity of *M. subnigrata* and *M. anterior*.

Genus Characteristics and Determination

Thallus crustose, usually scruffy to warty (areolate), sometimes with spherical granules (goniocysts), rarely indefinite and in the

substrate. Photobionts green algae, usually micareoid (4-7 μm in size, often in pairs). Ap. commonly moderately to very convex and without margin, nonpruinose, whitish, gran, bluish, violet tinted, brown, black, rarely with margin. Exc. usually lacking to weak, rarely strongly developed, of radiating, branched, paraphyses-like hyphae. Hyp. colorless to very dark. Hym. I+ blue. Epihym. colorless to strongly colored. Paraphyses sparse to plentiful, as a rule branched, not thickened above to only weakly thickened, without pigmented cap. Asci clavate to narrowly clavate-cylindric, with K/I+ blue tholus with non amyloid central drop (axial mass). Sp. 1-celled to cross-septate, ellipsoidal, egg-fusiform to needle-like. Pycn. very variable, sunken to stalked. Pycnosp. of 3 types: macroconidia, curved, filamentous or twisted, often septate, large; mesoconidia bacillar, ellipsoidal or egg-shaped, single celled, 1-2 μm thick; microconidia short bacillar, up to 1 μm thick. Usually ch-, isolated Gyrophoric acid, Argospsin, etc.

- 1 Lichens with conspicuous, stalked pycnidia (\pm cylindric outgrowths), often sterile . 2
- 1* Lichens without stalked pycnidia 6
- 2 Pycnidia (bearing) brown, rose-brown, gray-brown, very finely thick hairy (strong lens), 0.1-1.0 mm high, 0.07-0.14 mm thick, cylindric, unbranched. Pycnosp. 4-6 x 1.3- 1.7 μm . Thallus olive-green, finely granular (granules 20-40 μm in diameter). Thallus granules in the center with yellow-brown to orange-brown pigment in K+ purple-violet (squash preparation). Ap. usually sparse, pale to gray-brown (brown), -0.5 mm. Epihym. (when colored) K+ violet. Sp. 1-, rarely 2-celled, 6.5-12 x 2.5-4 μm . R-, Ch- or unidentified substance .

M. hedlundii

- 2* Pycnidia (bearing) not finely hairy, thallus not bearing that type of pigmented granules . 3
- 3 Pycnidia (bearing) pale translucent to reddish-brown (often flecked), up to 250 μm high, simple or branched. Pycnosp. 3.5-4.5 x 1.2-1.6 μm , often with 2 droplets, slightly constricted in the center. Ap. red-brown, orange brown, convex, -0.3 (0.35) mm, sometimes tuberculate. Hym. red-brown above, K-. Sp. 1-celled, 9-15 x 2.5-4(4.5) μm . Thallus indefinite, ch-

M. anterior

- 3* Pycnidia (bearing) black or gray . 4
- 4 With long cylindric, at least at times branched, 50-400 μ high, 40-90 μm thick pycn. Pycn. wall (squash preparation) K- or greenish. Thallus diffuse, scruffy to fine granular, pale greenish to dark green or blackish. Pycnosp. 3.5-5 x 1.5 μm .

Ap. rare, hemispherical to \pm spherical, black. Sp. 1-2(4) celled, 8-13 x 2.3-3.7 μm . Hyp. dark red-brown. Ch-

M. botryoides

- 4* Pycn.(bearing) unbranched. Wall K+ violet. Hym. greenish above, K+ violet C+ violet . 5
- 5 Thallus generally well developed, light to dark gray, greenish-gray. Pycn. black or gray, -0.15 mm wide, sunken into the thallus to clearly protruding, often crowned with a conspicuous protruding cylindric whitish droplet (pycnosp. mass). Pycnosp. 4-celled, 12-24 x 1 μm or 1-celled, 3-5 x 1.2-1.8 μm or 5-7 x 0.7-0.8 μm . Section through thallus C+ rose or orange-red, K-, P-. Gyrophoric acid . □ **M. denigrata**
- 5* Thallus commonly in the substrate (wood), thereby indefinite, R-. Pycn. black, sessile or usually clearly stalked, 0.07-0.32 mm high. Pycnosp. 3.5-5 x 1-1.5 or 3.8-6 x 0.6-0.8 μm

M. misella

- 6 Lichens sterile, conspicuously granular to granular-isidiate or with pycn. or pycn.-like structures . 7
- 6* Lichens with apothecia . 12
- 7 Lichens with pycnosp. producing structures of apothecia-like to bowl-shaped form or with black to gray pycn 9
- 7* Lichens without such structures/Pycn. Thallus fine or coarse granules. Algal cells micareoid, 4-7 μm thick . 8
- 8 Thallus of fine light to dark green granules of 12-40 (60) μm diameter crowded, thallus presenting a finely isidiate habit or producing a thick granular crust, \pm gelatinous when moist, R- (but the outer hyphae covered with granules often with K+ violet substance, microscopic)

↑ **M. prasina**

- 8* Thallus gray, of 100-400 μm thick crowded granules, often producing a thick, cracked erupting crust, erupting irregular sorediate, C+ red, P+ red, K-, Gyrophoric acid, Argospsin . □ **M. leprosula**
- 9 Pycn. gray to black, sunken to clearly projecting, often crowned by white drops (pycnosp mass), at best 0.16 mm wide. Usually on decayed wood

M. denigrata (5)

- 9* Pycn. or pycn.-like structure growing into light greenish apothecia-like convex or sunken in the center bowl-like, -0.3 mm wide. Thallus gray-green to pale greenish or lead-gray 10
- 10 Pycnosp. 6.5-9.5 x 2.3-3 μm . Pycnosp. producing a convex apothecia-like structure, not sunken in the center, cream-colored, light ochre. Thallus gray-green. Ch- ↑ **M. adnata**
- 10* Pycnosp. over 20 μm long. Pycn. \pm sunken, with pal to light greenish, broad, usually bowl-form, deepened orifice region. Thallus, when well developed, and pycn. C+ red, K-, P-. Gyrophoric acid, Hiassic acid 11
- 11 Pycnosp. 50-110 x 1 μm , 10-18 celled

□ **M. cinerea**

- 11* Pycnosp. 20-50 x 1-1.5 μm , often indefinite. 2-6 celled, strongly curved to S-form twisted
M. peliocarpa
- 12 Sp. 1- or 2-celled . 13
12* Sp. 4- or more celled . 30
13 Hyp. dark red-brown, dark olive-brown, dark blue-green to almost black 14
13* Hyp. light, colorless to light brownish or light greenish 17
14 Ap. definitely margined, 0.2-0.5(0.7) mm, flat, later even \pm convex-marginless, black. Exc. definitely developed, exterior blue-black. Hyp. dark brown to black-brown. Sp. 6-9 x 3-4 μm , 1-celled. Thallus thin, \pm smooth, finely cracked or warty, frequently with numerous black pycn. Pycnosp. 3-4.5 x 1.5 μm , \pm cylindric, often somewhat curved. R-
M. erratica
- 14* Ap. without visible margin. Exc. lacking. Ch -15
15 Hyp. dark red-brown, K- or K+ strongly reddish. Hym. colorless to slightly greenish or blue-green, -40 μm . Ap. gray-brown, brown, dark brown to blackish, blackish when moist, -0.4, balled -0.8 mm. Sp. 6-9 x 2-3(3.5) μm , 1-celled. Thallus thin to moderately thick, gray-green, green-gray, sometimes rust colored, smooth to scruffy-granular
M. lutulata
- 15* Hyp. with greenish color tint above, K- to K+ green . 16
16 Sp. 7-10 x (2.5)3-4.5 μm , \pm ellipsoidal. 1-celled (very rarely 2-celled). Hym 40-60 μm , \pm blue-green. Hyp. dark blue-green or olive-black, K- to K+ green, below \pm dark purple-brown (K+ darker purple). Ap. -0.5 mm, balled -1.2 mm, black, bluish-black. Thallus thin to moderately thick, scruffy-smooth to cracked areolate or rarely granular to warty, gray, blue-gray
M. sylvicola
- 16* Sp. 5.5-8 x 1.5-2.5 μm , 1-2 celled, \pm elongate-egg form to elongate ellipsoidal. Hym. up to 40 μm . Hyp. blue-green, black to olive-black, K+ intensively blue-green. Hym. pale green to blue-green. Ap. black, blue-black, -0.3 mm (balled -0.5 mm). Thallus pale yellow-brown to greenish (white), usually scruffy-granular **M. tuberculata**
- 17 Epihym. greenish to olive, K+ violet. On wood or bark, exceptionally on rock . 18
17* Hym. not K+ violet (very rarely hyp. with orange colored flecks, which react in K) . 20
18 Ap. waxy white to lead-gray, lilac-gray, brownish-gray, rarely blackish. Sp. 1-2 (4) celled, 8-15 x 2.5-4.5 μm . Thallus pale green to dark green, fine granular-fine isidiate or thick granular, \pm gelatinous when moist, thallus R- (but outer hyphae of the granule layered with greenish, K+ and C+ violet pigment, microscopic). Predominantly on bark, decayed wood, peat
M. prasina
- 18* Ap. black to gray. Thallus light to dark gray or in the substrate (endoxyl), thallus section (in good development) C+ orange-red, K- P-. Almost always on wood 19
19 Thallus usually within the substrate. Pycn. sunken or stalked, black, pycnosp. 3.5-5 x 1.1-1.5 μm or 3.8-6 x 0.6-0.8 μm . Sp. 6.5-9.5 x 2.3(3.5) μm , 1-, rarely 2-celled. Ap. black, -0.3 mm. Hym. above (greenish pigment) C+ violet .
M. misella
- 19* Thallus light to dark, rarely endoxyl, often with conspicuous, sunken to projecting pycn. with often protruding whitish pycnosp. droplets. Pycnosp. 5-7.5 x 0.7-0.8 μm . Sp. usually 2-celled, often curved, 7-16 x 2.3.5 μm . Ap. black to dark gray, rarely lighter, -0.5 mm, section above (greenish pigment) C+ violet, hym. usually C+ orange-red. Gyrophoric acid
M. denigrata
- 20 Sp. all 1-celled . 21
20* Sp. at least in part 2-celled . 24
21 Sp. very small and narrow, 4-7 x 1.2 μm , drop-form to elongate egg-shaped. Ap. blue-gray to dark brown or blackish, sometimes whitish margined, -0.3 mm, \pm hemispherical. Hym. -35 μm , pale yellowish-green to blue-green. Hyp. colorless to pale greenish. Thallus whitish to pale greenish, granular to scruffy. R-, Ch- .
Psilolechia clavulifera
- 21* Sp. over 6 x 2 μm in size . 22
22 Thallus commonly green, olive-green, gray-green, when moist fresh-green, of fine granules, sometimes becoming very finely isidiate, or even crustose-scruffy, when moist becoming \pm gelatinous. Ap. waxy white to lead gray, rose-gray, or brownish-gray to rarely blackish, 0.1-0.4 mm. Sp. 8-15 x 2.5-4.5 μm . Above all on bark, decayed wood, or peat, on \pm rain exposed sites. R-, various chemotypes .
M. prasina
- 22* Thallus not so. Sp. 6.5-10 x 2.5-4 μm . On rock, rarely going over on roots or hard soil crusts. Ap. in part over 0.3 mm. Ch- 23
23 Hym. colorless to usually straw-yellow above, hyp. straw-yellow to light orange-brown. Ap. -0.4 mm, never balled, pale to strongly yellow-orange, red-brown. Algal cells 4-7 μm thick (micareoid). Thallus often indefinite, rarely of separated areoles, whitish .
M. lithinella
- 23* Hym. pale green, olive, blue-green or colorless, hyp. colorless or pale green above. Ap. -0.3 mm, if grouped -0.7 mm, hemispherical to almost spherical, bluish- gray to black, in shade forms (mixed color) brown. Algal cells 5-12 μm thick, not micareoid. Thallus thin and cracked to scruffy-granular, gray-green to gray-brown or rust colored .
M. bauschiana
- 24 Sp. very narrow, 6-8.5 x 1.5-2.5 μm , usually 2-celled. Ap. -0.25 mm, light to dark red-brown, hemispherical to almost spherical. Hyp. (pale) orange-brown. Hym. often with brown streaks, -35 μm . Thallus pale green to ochre-green, scruffy-mealy to scruffy-granular. Ch-

- M. myriocarpa**
- 24* Sp. larger . 25
- 25 Ap. in section (epihym., hym., and hyp.) colorless 26
- 25* Ap. in section colored in places . 27
- 26 Thallus finely isidiate or of spherical, -50 µm granules. Ap. without margin, 0.1-0.4 mm .
↑ **M. prasina**
- 26* Thallus thin, smooth to scruffy-granular, gray-green, of waxy appearance. Ap. yellow-brown to pale (red)brown, at first nearly flat and often with whitish margin, depressed, 0.2-0.5 mm, later moderately convex and coalescing to -2 mm complexes. Sp. ellipsoidal, egg-shape to elongate, (1-)2 celled, 9-16 x 3-5 µm. Thallus often with convex, lighter, apothecia-like structures (sporodochia), -0.25 mm, with macroconidia, 6-10 x 2-3 µm. Ch-
□ **M. adnata**
- 27 Ap. lead-gray, brown-gray, waxy whitish, rarely dark brown to black (then epihym clearly K+ violet), -0.4 mm. Thallus usually gray-green, olive-green, usually finely granular, gelatinous when moist, green. Sp. 8-15 x 2.4-4.5 µm. Usually on bark, decayed wood, or peat
↑ **M. prasina**
- 27* Ap. dark brown to black. Ch- 28
- 28 On wood and bark. Sp. 10-15(19) x 2-3.5 µm, 1-2(4)celled. Thallus greenish-white to white-gray. Hym. brown above, brown pigment on the hym. dissolves in K. Ap. dark brown to brown-black, strongly convex to ± spherical, -0.3 mm, agglomerated -0.8 mm **M. elachista**
- 28* On rock. Ap. black. Sp. 1-2 celled. Exc. clearly developed, but ap. without raised margin . 29
- 29 Epihym. brown. Sp. 8-12 x 4-5 µm. Thallus dark gray-brown, warty areolate. Ap. moderate, later strongly convex, -0.6 mm, agglomerated -1 mm. Exc. well developed. Hyp. colorless. Hym. 35-40 µm. Paraph. somewhat thickened above. Algae micareoid (4-7 µm thick) **M. subnigrata**
- 29* Epihym. greenish. Sp. (7)9-14-14(17) x 4-6 µm. Thallus dark olive-gray to dark brownish-gray, very variable (granular-areolate, cracked), usually producing a small thallus upon/between other lichens. Exc. moderately developed. Hyp. colorless to brownish, sometimes with orange flecks (K+ purple-red). Algae not micareoid, cells 7-21 µm in diameter. Hym. 40-50 µm. Paraph. not thickened above. Like *Scoliciosporum umbrinum* **Carbonea intrusa**
- 30 Hym. above all in upper part K+ violet. Hyp. colorless. On bark . 31
- 30* Hym. not K+ violet 33
- 31 Ap. -0.5 mm wide. Algal cells 4-7 µm thick. Ap. section and/or thallus C+ orange-red (Gyrophoric acid). Epihym. without granules. Thallus K-, P- 32
- 31* Ap. commonly 0.5-1 mm wide, gray to black, often pruinose, when moist often somewhat blue tinted. Algal cells 8-14 µm. Epihym. greenish, often with granules soluble in K, C+ violet for a short time, then usually ± red-brown. Thallus usually thin, whitish, gray, greenish or scarcely visible, R-. Sp. 4-8 celled, 17-26 x 1.5-2.5 µm, bacillar . **Bacidia beckhausii**
- 32 Sp. fusiform, often curved, 10-17 x 2.5-3 µm, (2-)4(5) celled. Ap. gray-black to black, only shade forms lighter, often coalescing, the young sometimes with indefinite margin, -0.3 mm. Thallus thin, usually warty, gray-green to greenish white **M. nitschkeana**
- 32* Sp. bacillar- to almost needle-form, 13-26 x 1.5-2.5 µm, 1-4(7) celled. Ap. gray to brownish-black, shade forms lighter. Thallus of convex areoles, whitish to gray . **M. globulosella**
- 33 Sp. strongly spirally curved . ↑ **Scoliciosporum**
- 33* Sp. otherwise . 34
- 34 Hyp. dark, usually dark purple-brown, K+ green or intensively purple. Hym. gray- to green-blue. Sp. (2-)4(6) celled, 12-21 x 4-5.5 µm, with stumpy ends. Ap. black, -0.4 mm, convex to almost spherical. Thallus yellow-brown, greenish to dark gray-green, C-/C+ red, K-, P-. ± Gyrophoric acid **M. melaena**
- 34* Hyp. colorless to slightly greenish or brownish . 35
- 35 Ap. true black (rarely brown-black) 36
- 35* Ap. not true black 37
- 36 Thallus C+ red, P+ red, K-, almost always sterile, ash-gray, blue-gray, ± granular, often rather thick, in places sorediate erupting and becoming shabby. Sp. (2-)4 celled, 14-26 x 4-5.5 µm. Gyrophoric acid, Argopsin **M. leprosula (8)**
- 36* Thallus C-, P+ red, K-, light gray to green- gray, not disintegrating sorediate, granular or of convex to spherical areoles, even indefinite. Ap. almost spherical, often agglomerated, sometimes short stalked (*f. gomphillacea* (Nyl.) Hedl.), -0.6 (0.9) mm. Hym. (above) usually greenish. Ap. 4-8 celled, 16-36 x 4-6(7) µm, fusiform. Argopsin □ **M. lignaria** var. **lignaria** (when thallus C+ red, P=, whitish with slight yellowish tint: **M. lignaria** var. **endoleuca** (Leighton) Coppins)
- 37 Ap. brown, red-brown, red-black, brown- black, -0.3 mm. Sp. (4-)8 celled, 20-40 x 3-5 µm. Thallus R-, gray-green, green, granular .
↑ **Scoliciosporum**
- 37* Ap. pale lead-gray to gray-black (shade forms almost whitish), often with apparent pale raised margin. Ap. section C+ red. Thallus in the case of good development C+ red, K-, P-, greenish-white, gray-white, blue-gray, green-gray, often of (moderately) convex areoles. Pycn. relatively conspicuous, -0.3 mm, sunken into the thallus, with often wide opening (crater-like) mouth, whitish or greenish. Gyrophoric acid, Hiassicinic acid 38

- 38 Sp. predominantly 4-, rarely up to 6 celled, 15-23 x 3-5 µm, often somewhat curved. Macroconidia 21-45 x 1-1.5 µm, curved to s-shaped. Hym. 40-55 µm, commonly olive- to blue-green. Thallus sometimes scarcely developed * **M. peliocarpa**
- 38* Sp. (4)6-8 celled, 23-34 x 4-6 µm. Macroconidia 50-110 x 1 µm, not conspicuously curved or strongly twisted. Hym. 55-70 µm, colorless to olive to blue-green above. * □ **M. cinerea**

Ecology and Distribution of the Species

Micarea adnata Coppins

In the foothills to montane sites in ± shady forests on rather to very rotted tree stumps (above all oak) and on the rain exposed base above all of conifers on spongy bark, predominantly in winter mild or in oceanic sites, rarer toward the East, e.g. with *M. prasina* (Micareetum prasinae), r.acidoph., ombroph., r.skioph. – mieur-subatl-med – r.rare; Sch (above all nöSch), Pf, Rh, Ne, Ju

Micarea anterior (Nyl.) Hedl.

In high montane sites in fir forests and in fir stands disintegrating at the tree line on decaying wood on well lighted to rather light poor habitats, e.g. with *Parmeliopsis hyp.* (↑), in the *Parmeliopsidetum amb.* – s'bor(-mieur-h'mo) – v.rare (1); süSch

Micarea bauschiana Körber) V.Wirth & Vèzda

In the foothills to montane sites on silicate rock, rarely on roots or going over to soil, above all on the rocks ± sunken into the soil (especially on slopes), on overhangs and vertical surfaces of rocks, preferably on sandstone, usually in forests, on forest paths, either on cool substrate, porous substrate or on humid habitats, often without associates or with *Psilolechia lucida*, m.-r.acidoph., aérohygroph., m.photoph.-v.skioph., ombroph.-anombroph. – mieur(-subatl) – rare; O, Sp. nöHü, Ne (Keuper- sandstone-region), Sch, Vog, Saar

Micarea botryoides (Nyl.) Coppins

In the foothills up to (sub)montane sites on dead and dying mosses, on stones, rocks, roots, tree bases, consolidated soils, commonly on steep surfaces and on/under overhangs, on humid sites, on rocks in the *Psiolechetum luc.* and *Micareetum sylvic.*, m.-v.acidoph., aérohygroph., m.photoph.-v.skioph. – (s'bor-)mieur-subatl –

rare; Sch, O, PfW, Lux, RhSch, Rothaargeb., Hz etc.

Micarea cinerea (Schaerer) Hedl.

Above all in the montane and high montane zone on acid bark, rarely on wood, especially on rain exposed sites at the foot of conifers in cool-moist, near natural mixed and conifer forests, even on near the soil silicate boulders, r.-e.acidoph., r.-v.skioph., r.ombroph., anitroph. – s'bor-atl-mieur-subatl, (oc) – rare (2); Sch (above all nöSch), O, ThW

Micarea denigrata (Fr.) Hedl. (*M. hemipoliella* (Nyl.) Vèzda

Up to the tree line on old, tough decayed, upper surface still hard wood on decorticate stems and tree stumps, predominantly secondarily on wood posts, fence boards and shingles, rarely also on acid bark (especially conifers), anthropogenic strongly assisted, e.g. associated with *Lecanora saligna*, *L. varia*, *Strangospora pinicola* or *L. conizaeoides*, above all on well lighted habitats, r.-v.acidoph., r.photoindiff., xeroph.-m.hygroph., anitroph.-m.nitroph., in the *Lecanorion variae* – bor-med – moderately frequent, throughout the region, rarer in dry- warm sites.

Micarea elachista (Körber) Choppins & R.Sant. (*M. golmerella* (Nyl.) Hedl., *Catillaria g.* (Nyl.) Th.Fr.)

In the foothills and submontane sites on wood (rarely bark) decorticated stems and stumps of older trees, especially of *Castanea*, rarer e.g. Scots pine, or oak, on moderately to rather well lighted habitats, r.v.acidoph., xeroph.-m.hygroph., anitroph., in the *Chaenothecetum ferr.*, also e.g. with *Parmeliopsis* and *Imshaugia* – s'bor-med – v.rare (?); O, süHü-süSch, Obay

Micarea erratica (Körber) Hertel, Ramb. & Pietschm. (*Lecidea e.* Körber)

Up into montane sites on lime-free, often hard silicate rock, especially on stones sunken into the soil, rarely on smooth, cool free standing rock surfaces, usually shaded, longer dew moistened sites, on road margins, in gravel pits, on slopes, rock piles, rubble, rather like *Porpidia crust.*, m.-r.acidoph., in the *Porpidietum crustul.* – (bor-)s'bor-mieur-subatl – rare, frequently overlooked; süHü, süSch, süRh, O, Ne, Ts, Eif, ThW, Th, Erz

Micarea globulosella (Nyl.) Coppins (*Lecidea g.* Nyl.)

In montane-high montane cool, high precipitation sites in near natural forests predominantly on the bark of conifers, m.-v.acidoph., hygroph., anitroph. – s'bor-mieur(centr-mo)-smed – v.rare; Al

Micarea hedlundii Coppins

In montane sites in the interior moist, shady forests, e.g. in ravines, on the flanks of spongy-decayed stumps of trees, especially in near natural forests, e.g. spruce forests, beech-spruce forests, m.-r.acidoph., r.(-v.)skioph., s.hygroph., anitroph., e.g. with *Tetraphis pellucida* – s'bor-mieur, (oc) – v.rare (1); SFW, also Alps

Micarea leprosula (Th.Fr.) Coppins & A.Fletcher (Bacidia l. (Th.Fr.) Lettau)

In sub- to high montane, high precipitation sites on dying mosses (*Andreaea*, *Rhacomitrium*, *Gymnomitrium*) over silicate rock, rarely on fine humus soil, on moderate to rather well lighted often dew moistened habitats, on smaller rocks, rock terraces, in boulder fields, m.-v.acidoph., r.photoph., in moss associations. (↑ *M. lignaria*) – s'bor-mieur-mo – rare (3); Sch, Vog, O, Lahn, Rhön, Meissner, Eif

Micarea lignaria (Ach.) Hedl. (Bacidia l. (Ach.) Lettau, Lecidea milliaria Fr., *Micarea gomphillacea* (Nyl.) Vèzda)

Above all in submontane to alpine, moderate to very high precipitation sites on mosses (above all rock mosses, e.g. *Rhacomitrium*, *Andreaea*), plant detritus, nutrient poor mineral soils, humus, on rather to very decayed, moisture holding wood, rarely directly on lime-free, mostly porous silicate rock (above all sandstone), then usually on shady and moist substrate habitats, often on boulder slopes, on shaded rock walls, r.s.acidoph., r.substrat-hygroph., anitroph., in moss associations, e.g. *Gymnomitrietum*, *Rhacomitrio-Andreaetum*, *Andreaetum rothii* – bor-med-mo – r.rare; Sch, Vog, Rhön, PFW, Al, RhSch, rare to v.rare in ThW, Vgb, Ts, O, SFW, Sb, He

Micarea lithinella (Nyl.) Hedl.

In the foothills to submontane zone on lime-free silicate rock, especially sandstone, above all on stones sunken in soil in deciduous forests on climatically mild humid habitats, m.-r.acidoph., hygroph., m.photoph.-r.skioph., in the *Porpidietum crust.* – mieur(centr) -v.rare; süHü-süSch, O

Micarea lutulata (Nyl.) Coppins (*M. umbrosa* Vèzda & V.Wirth)

Like *M. sylvicola*, yet more limited to overhangs like *Psilolechia lucida* (↑), often on plate weathered or even on iron rich rocks, commonly on contiguous rocks, in *Psilolechietum luc.*, *Micareetum sylv.* – s'bor-mieur – rare; Sch, Eif

Micarea melaena (Nyl.) Hedl. (Bacidia m. (Nyl.) Zahlbr.)

Favors montane to subalpine, humid or high precipitation sites above all on old, very decayed spongy wood of deciduous stumps, on peat, raw humus and at the base of older trees, frequent in the moors, r.-e.acidoph., substrathygroph., anitroph., r.photoindiff. bor-mieur(-med-mo) – rare (3); Sch, Vog, Av, Al, otherwise v.rare, e.g. ThW

Micarea misella (Nyl.) Hedl. (Lecidea asserculorum sensu Th.Fr, L. globularis (Nyl.) Lamy)

Predominantly in sub- to high montane sites on wood, above all on decorticate (even spongy decayed) wood stumps in open forests, at the forest margin and on fallen trees, very rarely on mosses, [Porlingen], lichens, r.-v.acidoph., anitroph., e.g. in the *Xylographetum*, in openings of moss-algae associations – bor-smed-mo(-med-mo) – r.rare (3); Sch, Hü, Ne, Ju, O, Mn, Saar, RhSch, ThW, Ju, Al

Micarea myriocarpa V.Wirth & Vèzda ex Coppins

In montane sites on free lying roots under overhanging trees and on rain sheltered sites on the flanks of stumps and old trees (conifers), other sites even on stones and on mosses, anombroph., v.hygroph., r.-v.skioph. – mieur-subatl – v.rare (1); nöSch

Micarea nitschkeana (Lahm ex Rabenh.) Harm.

Up into the montane zone on acid bark of conifer and deciduous trees, above all on Scots pine and fir, often on thinner branches, in forest interior, even in forests strongly influenced by cultural practices (spruce culture), also on the stems of dwarf shrubs, e.g. *Calluna*, m.-v.acidoph., r.skioph.-r.photoph., in the *Lecanorion varia*, *Lecanoretum conizaeoidis*, *Pleurococcetum* – (s'bor-)-mieur(-smed-mo) – rare (2); Sch, Vog, Eif, O, Ju, Rh, Th, Erz.

Micarea peliocarpa (Anzi) Coppins & R.Sant.
(*M. violacea* (Nyl.) Hedl.)

Up into the montane zone, substrate indeterminate species, on bark, above all base of trees (like *M. cinerea* ↑), on rather to very decayed wood, on (usually granular-porous or long time dew moistened) silicate rock (sandstone), above all on stones sunken in the soil, also over mosses and plant detritus or going over to soil, usually in the interior of the forest, r.v.acidoph., r.-v.hygroph., ombroph., anitroph. – s'bor(atl)-med-mo, subatl – rare; Sch, Vog, O, Sp, RhSch, Sb, SFW, Do, BayW, Hz, Al

Micarea prasina Fr. (Catillaria p. (Fr.) Th.Fr.,
C. sordidescens (Nyl.) Vainio, *C. micrococca*
(Körber) Th.Fr.)

Up into the montane, more rarely high montane zone, usually in forests, on bark on the stem and above all on the stem base of deciduous and conifer trees, often in bark cracks or on decaying places, often on decayed tree stumps, even as a pioneer on young fir stems in thick forests, occasionally on sandstone, relative euryök, above all on humid and/or cool substrates, moderately well lighted to very poorly lighted wind protected habitats in forests, ± ombroph., ± substrathygroph., m.photoph.-v.skioph., e.g. often with *Dimerella in.*, *Cladonia coniocraea* in contact with Graphidetalia association. – bor-med(-mo) – rather frequent, rare in dry-warm regions

Micarea subnigrata (Nyl.) Coppins & Kilius
In high precipitation montane sites on silicate rock on moderate to rather well lighted, away from the sun, rain exposed habitats, e.g. on smaller, long time dew moistened rocks, m.-r.acidoph., ombroph., e.g. in the Porpidion tub. – mieur(atl) – v.rare (R); süSch, Vog

Micarea sylvicola (Flotow) Vězda & V.Wirth
(*Lecidea s.* Flotow)

Predominantly in montane and high montane, high precipitation sites on lime-free (often mineral-rich metamorphic or magmatic) silicate rocks on shady, rather to very humid habitats, on smaller stones on the soil or on contiguous rocks especially on vertical and overhanging surfaces, commonly in the forest interior or in ravines and narrow valleys, rather weakly competitive pioneer, m.-r.acidoph., r.-v.skioph., anitroph., Char. Micareetum sylv., in the *Psilolechietum lucidae*, also in the Porpidion tub. – bor-mieur(-

mo) – rare; Sch, Vog, O, Hu, Eif, ThW, Erz, BayW

Micarea tuberculata (Sommerf.) R.Anderson
(*Lecidea t.* Sommerf.)

On vertical- and overhanging surfaces on silicate rocks, ecologically like *M. sylvicola* and *M. bauschiana*, Char. Micareetum sylv., in the Porpidion tub. – bor-mieur-mo – v.rare; süSch, Eif

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Microcalicium Vainio em. Tibell

(Determination ↑ Calicium, Cyphelium)

Introduction

The *Microcalicium*-Species are saprophytic or living on lichens and algal film, at times parasitic on fungi. The black ascocarps, with or without short stalks, bear a black to black-green appearing spore mass (mazaedium). The spores are cross septate and greenish colored.

Of the four species two occur in central Europe. *M. disseminatum* is distributed in the boreal zone and corresponding central European sites and live above all in old conifer forests on spruce and fir, often in association with other dust fruiting species; they are endangered as are other lichens of older trees. *M. arenarium* occurs mainly in mild and cool sites of the western and central Europe and in the southern boreal zone. It attacks *Psilolechia lucida* and other leprose crustose lichens and resides on rain protected silicate rocks.

Genus Characteristics

On lichens and algal films or saprophytically living fungi, thallus indefinite, covered by green-black sp. mass (Mazaedium). Exc. clearly developed, dark. Paraphyses sparse. Asci broadly ellipsoidal, disintegrating when ripe. Sp. cross septate 2- to 4(8) celled, greenish, broadly ellipsoidal to bacillar, ornamented with spiral ribs.

Ecology and Distribution of the Species

Microcalicium arenarium (Hampe ex Massal.) Tibell (Calicium a. (Massal.) Hampe ex Körber, Coniocybopsis arenaria (Massal.) Vainio) Parasitic on *Psilolechia lucida* (↑) and ecologically similarly behaved leprose crustose and algal films, especially on strongly shaded habitats of these lichens, Char. *Psilolechietum luc.* – s'bor-mieur(-med-mo) - rare; Sch u. Vog scattered; süHü-HRh, O, Sp, Ts, Eif, Th, Erz, Hz

Microcalicium disseminatum (Ach.) Vainio (*M. subpedicellatum* (Schaerer) Tibell) In high montane and montane sites on rain protected sites on the stem of older fir and spruce, like *Chaenotheca subroscida* (↑), on green algae crusts or on *Calicium*- and *Chaenotheca*- species, e.g. *Calicium viride*, *Chaenotheca chrysocephala* (↑) – bor-mieur-mo – v.rare (3); Sch, SFW, Ju, Sb, O

LIT.: TIBELL 1978b, 1980a, 1984*.

Miriquidica Hertel & Rambold

(↑ also Key Lecidea s.l.)

Introduction

The *Miriquidica*-species are silicate rock dwelling crustose lichens with brown to black apothecia with generally biatorine margin and one-celled spores and were accordingly earlier placed in the genus *Lecidea*. Typical is among others the presence of Miriquidic acid in almost all species and the ascus structure.

M. atrofulva resides on heavy metal-rich silicate rock in mountain sites. *M. leucophaea*, *M. garovaglii*, *M. nigroleprosa* and *M. intrudens*, living parasitically on the land map lichen, are silicate lichens of higher humidity sites. The area of *M. atroflava*, *M. garovaglii* and *M. nigroleprosa* are in the basic arctic-alpine zone; commonly these species are also in the boreal zone or rarely occurring in high montane sites in central Europe. *M. atrofulva* is known in extra alpine central Europe only from the Black Forest and from the Vogesen, *M. garovaglii* and *M. nigroleprosa* from a few central mountains. *M. leucophaea* is mainly boreal-montane, *M.*

intrudens is distributed in the temperate zone of central Europe. *M. deusta* known from western Europe from north Scandinavia into the mediterranean region is found in the Rhine schist mountains.

Genus Characteristics and Determination

Thallus crustose, mostly areolate, medulla I-, with coccoid green algae. Ap. brown to black, with definite (sometimes lighter) or – when ap. sunken – indefinite to lacking proper margin, rarely with thalloid margin. Exc. greenish to brownish at the margin, of radiating hyphae, sometimes penetrating under the algae. Hyp. colorless, in case of the non indigenous species even dark violet-brown. Hym. I+ blue. Epihym. greenish, brownish to red-brown. Paraphyses branched and ± bound, commonly thickened and pigmented above. Asci like the *Lecanora*-type, but non amyloid central region (Axial mass) weakly set off or lacking, without ocular chamber. Sp. 1-celled, rarely with plasma break or old 2-celled, ellipsoidal to elongate-ellipsoidal. Pycnosp. filamentous twisted. Ch: often Miriquidic acid, in addition e.g. Stictic acid, Lobaric acid et al.

- 1 Thallus with dark gray to blackish soralia . . . 2
- 1* Thallus without soralia. With Miriquidic acid . 3
- 2 Thallus ochre colored to rust brown, with dark gray soralia, areolate. Areoles often ± scattered, K+ yellow, P± yellow, C-. Stictic acid, ± Norstictic acid . **M. atrofulva**
- 2* Thallus gray, coarsely cracked areolate to areolate, areoles flat to moderately convex, at times erupting into irregular, flat to moderately convex, blackish soralia. Medulla K-, P-/P+ yellow, C-. Miriquidic acid, ± Psoromic acid. In exposed mountain sites **M. nigroleprosa**
- 3 Thallus middle brown to black-brown . 4
- 3* Thallus gray, beige, gray-white, Medulla K- or K+ yellow (Stictic acid), hyp. colorless, epihym. olive to olive-green. Ap. -1(1.2) mm, sitting up to depressed 6
- 4 Thallus parasitic on crustose lichen, areolate. Areoles ± rounded, slightly concave, brown, the usually somewhat raised margin lighter and often crenate, sometimes squamulose-areolate, at times even partially blackened, sessile on a black “base thallus”, 0.3-1.5 mm, ap. rare (hyp. colorless, epihym. brown). * **M. intrudens**
- 4* Thallus not parasitic, brown, often ± shiny. Hyp. colorless . 5
- 5 Medulla K+ yellow, P+ orange, C-, thallus thick, light to dark brown. Ap. -2.5 mm, sitting up, flat

to convex, margined, brown-black to black.
Ephym. olive-brown to greenish. Sp. 10-18 x
4.5-6.5 µm. Stictic acid derivatives

* □ **M. garovaglii**

- 5* Medulla R-, thallus (dark) brown to black- brown,
rather thick, with weakly concave to weakly
convex areoles. Ap. -0.7 mm, margined, ±
sunken to depressed, flat, black. Ephym.
blackish, brown, olive. Sp. 10-15 x 5-6 µm.

* **M. deusta**

- 6 Thallus gray-white, gray, beige, thin to
moderately thick, areolate, areoles flat to convex,
scattered to coalescing, often shiny. Ap. dark
gray-brown, red-brown to brown-black, flat and
margined or even later convex marginless, -1(1.2)
mm, margin sometimes somewhat lighter than the
disk, with lecanorine tendencies. Exc. exterior
brown to olive-brown, interior colorless to
delicate brownish. Sp. 9-14 x 4.5-6.5 µm. Hym.
50-70 µm.

* **M. leucophaea** var. **l.**

- 6* Thallus (beige-gray) gray to dark gray, dull, thin
to rather thick, areolate, warty areolate to
scattered warty. Ap. black or almost black, flat
and margined or even later convex marginless, -
1(1.2) mm, margin rarely somewhat lighter than
disk. Exc. exterior brown to olive-brown,
interior colorless to delicately brownish.
Ephym. olive, olive-green. Sp. 9-14 x 5-7 µm.
Hym. 60-75 µm.

* **M. leucophaea** var. **griseoatra**

Ecology and Distribution of the Species

Miriquidica atrofulva (Sommerf.) Schwab &
Rambold (Lecidea a. Sommerf.)

On lime-free, heavy metal rich silicate rock in
montane to alpine sites, like *Rhizocarpon oed.*
(↑) – arct-mieur-mo/alp – v.rare (R); süSch, Vog,
Alps

Miriquidica deusta (Stenh.) Hertel & Rambold
(Lecidea deustata Zahlbr.)

In the foothills and submontane sites on open
silicate rocks, like e.g. *Rhizocarpon virid.*, in the
Parmelion consp. – (s')bor-med – rare; MRh-Ts,
Eif

Miriquidica garovaglii (Schaerer) Hertel &
Rambold (Lecidea G. Schaerer, Lecidea aenea
(Fr.) Nyl.)

In high montane and alpine, high precipitation
sites on mineral-rich silicate rock on suitable
wind exposed habitats, even on slightly
calcareous rocks, subneutroph.-m.acidoph.,
ombroph., r.-v.photoph., anitroph, e.g. in the
Umbilicarion cyl. – arct-mieur0h'mo/alp-smed-

alp – v.rare (1); süSch, Vog Rhön*, Al, BayW,
Erz

Miriquidica intrudens (H.Magn.) Hertel &
Rambold (Lecanora i. H.Magn.)

In alpine and high montane, rarely montane sites
on lime-free silicate rocks, parasitic on crustose
lichens, above all yellow *Rhizocarpon*-species,
on well lighted, mostly sunny, rain exposed
surfaces, like *Protoparmelia badia* (↑), in the
Umbilicarion cyl. and Rhizocarpon alp. – mieur-
h'mo/alp – rare (3); süSch, Vog, RhSch, Rhön

Miriquidica leucophaea (Flörke ex Rabenh.)
Hertel & Rambold (Lecidea l. (Flörke ex
Rabenh.) Nyl.)

var. **leucophaea**

In montane to alpine sites on lime-free silicate
rocks, above all on cool-moist (even long time
dew moistened), shaded, wind protected to
moderately open to the wind, before more rapid
drying protected habitats, rather long snow cover
tolerated, r.acidoph., r.hygroph., ombroph., m.-
r.photoph., anitroph., above all in the
Rhizocarpon alp. – bor-mieur-h'mo – rare(3);
süSch, Vog, Eif, Rhön, ThW, Erz, Fi, BayW
var. **griseoatra** (Flotow) V.Wirth (*Miriquidica* g.
(Flotow) Hertel & Rambold, *Lecidea* g. (Flotow)
Schaerer)

In high montane-alpine sites on wind- and light-
open habitats, like *M. nigroleprosa* (↑), in the
Umbilicarion cyl. – bor-mieur-h'mo – süSch,
Vog, BayW

Miriquidica nigroleprosa (Vainio) Hertel &
Rambold (Lecidea n. (Vainio) H.Magn.)

In high montane and alpine, very high
precipitation sites on lime-free silicate rock on
r.(-v) wind- and open to the light, fully rain
exposed surfaces, in the region on rocks near the
summit, on ridges, e.g. like *Ophioparma vent.*
(↑), *Pseudephebe pub.* (↑), amplitude
overlapping *Rhizocarpon alp.*, but shunning sites
with long snow cover, in the Umbilicarion cyl.,
Rhizocarpetum alp. – arct-mieur-alp(-med-alp) –
rare (3); Vog, süSch, v.rare nöSch, Rhön, BayW,
Fi, Hz

LIT.: FRIES 1874, HERTEL & RAMBOLD 1987, MAGNUSSON
1942, VAINIO 1934.

Moelleropsis Gyelnik

(Determination ↑ Pannaria)↑

Introduction

Moelleropsis is recognized by a gray, olive like to gray-brown granular thallus with bluegreen symbiont (*Nostoc*), red-brown biatorin to lecanorine apothecia and one-celled ellipsoidal spores.

M. nebulosa grows on naked loam- and sandy soils on open slopes and similar habitats. Distinctly acid subsoils are avoided. The lichens were distributed from the mediterranean region over Western and Central Europe up into the southernmost part of Scandinavian peninsula, today however it has disappeared from significant parts. In Southwestern Germany it is missing. This likewise goes for *M. humida*, which is similarly distributed, but probably on less base-rich soils, also occurring on peat soils; it is to be found in Oberschwaben. Actual occurrences of *N. nebulosa* exist in Vogelsberg and in Marburg, of *M. humida* in North Germany.

Genus Characteristics

Thallus crustose, granular, with *Nostoc*. Ap. brown to red-brown, without margin or with proper and granular thalloid margin. Exc. paraplectenchymatous, of radial hyphae or reduced. Hyp. pale brown. Hym. K/I+ blue-green. Paraphyses simple to branching, brown above, scarcely thickened. Asci cylindric to clavate, thin walled, with I+ blue tholus. Sp. one-celled, ellipsoidal, with smooth upper surface. Ch-

Ecology and Distribution of the Species

Moelleropsis humida (Kullhem) Choppins & P.M.Jorg. (Lecidea h. (Kullhem) Th.Fr.)
Like *M. nebulosa* (↑) – mieur – rare, yet easily overlooked: Do

Moelleropsis nebulosa (Hoffm.) Gyelnik (Pannaria n. (Hoffm.) Nyl.)
In hilly and submontane, rarely montane sites on base-rich sand- and sandy loam soils, above all on open road sides, pit margins, old sand- and

gravel pits, in rock fissures, rarely on forest soils, pioneer on naked earth, usually on cool, shaded, long time open sites, subneutroph.-m.acidoph., substrathygroph., above all with mosses – mieur-med – v. rare (0) süHü(-süSch), He, Ne, Ju, vot, PfW, Ts, Rh-Mn-T, sürh148n, Fr

LIT.: GYELNIK 1940, JORGENSEN 1978, VAINIO 1934

Multiclavula R.H.Petersen

Introduction

Multiclavula is one of the few European genera of the higher fungi (Basidiomycetes), which have produced lichen symbioses. The fruiting bodies are stalked to club-form, thin, simple, rarely branched, transparent whitish to cream colored and becoming up to 2 cm high. The thallus consists of thick stratified small, dark green globules. Three lichenized species are known; they occur on decayed wood and, like *M. vernalis*, on acid soils and on peat walls. The distribution region of *M. vernalis* stretches over the North- and cool region of Central Europe.

Genus Characteristics

Thallus crustose, of crowded dark green globules. The globules of hyphae penetrated *Coccomyxa*-groups with surrounding hyphal envelope. Fruiting body (basidiocarp) erect, -2 cm high, -2 mm thick, thin rod-form to club-form, simple or branched, whitish when fresh (± yellowish to slightly orange when dry), the club-like part consisting of basidia. Sp. egg-form to ellipsoidal.

Ecology and Distribution of the Species

Multiclavula vernalis (Schwein.) R.H.Petersen
On peat and acid soils, in the region on peat cutting walls, v.acidoph., r.photoph., substrathygroph., anitroph. – bor-mieur – v.rare (1); Do

LIT.: POELT 1969

Mycobilimbia Rehm

(Determination ↑ Bacidia, Lecidea PT ½, Biatora)

Introduction

The *Mycobilimbia*-species are crustose lichens with gray to greenish, usually soil and moss dwelling thallus with coccoid green algae, perched, almost whitish or yellowish, rose-brown to black, biatorin margined, in old age often strongly convex and externally marginless appearing apothecia and one-celled to multiply cross-septate, long ellipsoidal to bacillar colorless spores. They are separated from *Bacidia*- and *Biatora*-species through development layer characteristics and anatomical fine structure. Definition and characterization of the genus are yet insufficiently clarified.

M. accedens, *M. sabuletorum*, *M. hypnorum* grow predominantly on mosses and plant detritus over base-rich soils and (rarely) rock, *M. carnealbida*, *M. fusca*, *M. sanguineoatra* and *M. sphaeroides* more often over mosses or directly on mineral-rich bark at the foot of trees; several of these species vary from the named substrate. *M. lobulata*, *M. microcarpa* and *M. berengeriana* spread over various mosses and plant detritus over lime- and dolomite rocks and base-rich soils or sit on naked soil; *M. berengeriana* seems to be more concentrated on cool substrates and sites away from the sun.

M. sabuletorum, most frequent species of the genus, *M. fusca*, *M. accedens*, *M. microcarpa* and *M. hypnorum* are widely distributed over Europe, in South Europe predominantly in the mountains. *M. sphaeroides* is distributed in the summer green deciduous forest region, *M. carnealbida* predominantly boreal-montane. *M. lobulata* and *M. berengeriana* are arctic-alpine species, also occurring frequently in the boreal zone; whereas *M. lobulata* in Central Europe often descends into lower sites and in the region – like *Physconia muscigena* – has survived in the East Alp, *M. berengeriana* is known in Germany only from the Bohemian Forest, the foothills of the Alps and in the Allgäu. *M. lobulata* occurs in the region on a few rock crowns and is strongly threatened. A definite regression has been registered for *M. sanguineoatra*, *M. sphaeroides* and *M. carnealbida* – the latter two are threatened by extinction; *M. fusca* is endangered. *M.*

sabuletorum is able to colonize anthropogenic habitats, above all mossy walls.

Genus Characteristics

Thallus crustose, usually granular to warty or very thin to living in the substrate, with coccoid green algae. Ap. sessile, with at first usually definite, later often disappearing biatorin proper margin, very light to dark colored, usually soon moderately to rather convex. Exc. at least at first clearly developed, of radial hyphae with often clavate swollen end cells, usually cartilaginous (chondroid). Hyp. colorless to colored above, usually chondroid. Hym. I+ blue. Paraphyses simple to isolated branching, rarely bound. Ends often thickened. Asci with I+ blue tholus and therein embedded I+ darker tubular structures or with inserted from below non amyloid axial plug, which is surrounded by an I+ dark blue zone, outside with a thinner amyloid gelatinous coating. Sp. one-celled to multiple cross-septate, ellipsoidal, elongate, fusiform. Usually Ch-.

The limits of the genus *Mycobilimbia* is still in flux. Provisionally a few species not yet combined with *Mycobilimbia* are presented here.

Ecology and Distribution of the Species

Mycobilimbia accedens (Arnold) V. Wirth & Haf. ex Haf. (Bacidia a. (Arnold) Lettau)
Above all in higher sites, usually above the tree line, however even in dryer turfs of the hilly zone, like *M. sabuletorum*, but ± avoiding anthropogenic substrates, m.nitroph. – rare (?); Ne, Th

Mycobilimbia berengeriana (Massal.) Haf. & V. Wirth (Lecidea b. (Massal.) Nyl.)
In high montane and alpine sites on mosses on limestone on shady, humid habitats, basiph., m.photoph. – arct-alp – Al

Mycobilimbia carnealbida (Müll.Arg.) (Biatora c. (Müll.Arg.) Coppins, Bacidia c. (Müll.Arg.) Coppins, B. sphaeroides auct.)
In (high) montane, very high precipitation, oceanic sites on old deciduous trees (above all sycamore and beech), on cracked, often spongy,

decaying bark and on mosses in the lower and middle trunk region, especially on cool humid habitats in old, near natural forests, e.g. beech-spruce forests, sycamore stands, subneutroph.-m.acidoph., substrathygroph., m.ombroph., v.hygroph., anitroph.(-m.nitroph.), Antitrichion curtip., Gyalectetum ulmi – mieur-med – v.rare (1); süSch, BayW

Mycobilimbia epixanthoides (Nyl.) (Biatora e. (Nyl.) Diederich, Bacidia e. (Nyl.) Lettau)

In montane and high montane sites on mosses on trunk of deciduous trees and spruce in forests, above all beech- and spruce-forests as well as in brook-side ash stands, m.acidoph., m.photoph.-r.skioph., m.ombroph., anitroph. – s'bor-mieur – rare-r.rare (3); e.g. Sch, Ju

Mycobilimbia fusca (Massal) Haf. & V.Wirth (M. tetramera (De Not.) Clauz., Diederich & Roux, Bacidia f. (Massal.) Du Rietz, M. obscurata (Sommerf.) Rehm)

In high montane to subalpine, rarely montane sites, mostly in very high precipitation regions in near natural forests at the base of older trees on mosses, even directly on cracked bark, on plant detritus (e.g. dying cushion plants and dwarf shrubs), on mosses over soil or rocks, also on rotting wood, subneutroph.-r.acidoph., m.-r.photoph., a-(m.)nitroph., in moss associations. – bor-mieur-mo-smed-mo – rare (2); süSch, Sju, Al

Mycobilimbia hypnorum (Libert) Kalb & Haf. (Lecidea h. Libert, ?Lecidea atrofusca (Hepp) Mudd)

In montane to alpine sites on mosses and plant detritus on limestone and over base rich soils, rarely on mosses on the base of the trunk of trees, subneutroph.-m.basiph., m.-v.photoph. – arct-mieur-mo/alp-med-mo/alp – v.rare (2); süSch, Vog, SFW, Sju, Ju, FrJu, Westf, Alps

Mycobilimbia lobulata (Sommerf.) Haf. (Toninia l. (Sommerf.) Lyngé, T. syncomista (Flörke) Th.Fr.)

In high montane and alpine, rarely montane sites on calcareous, level or stony soils or on mosses over lime-rich substrates – arct-alp/pralp – v.rare (1); Ju (East Alp 2x), Th (1x), Al

Mycobilimbia microcarpa (Th.Fr.) Brunnbauer (Bacidia m. (Th.Fr.) Lettau)

Mostly in high montane to alpine sites on dying mosses and plant detritus over ± lime-rich soils or on limestone dwelling mosses, in openings in semi-dry and dry turfs sporadically descending into lower sites, m.basiph., r.photoph., in the Megasporion verr., Toninion sed. – bor-mieur-smed(alp) – rare, likely above all Al, Ju, Sju, FrJu, single collection süHü, Eif, He, Th

Mycobilimbia sabuletorum (Schreber) Haf. (Bacidia s. (Schreber) Lettau, B. hypnophila (Turner ex Ach.) Zahlbr.)

Up into the alpine zone, almost always on mosses and moss remains, rarely on other plant detritus, as a rule over lime-rich, level soils, in fissures of limestone, also on mossy trunk bases of trees and over lime-poor substrates, often a synanthrop, above all over mortar of walls, usually on nutrient rich, often dust influenced sites, subneutroph.-m.basiph., r.photoindiff., m.-r.nitroph., sociologically mature (moss associations) – bor-med – in the limestone region moderately frequent-r.rare, otherwise (r.)rare

Mycobilimbia sanguineoatra ad int. (Lecidea s. auct.)

In montane and high montane, high precipitation sites in open mountain forests basal on mossy old deciduous trees, above all beech, sycamore, also going over to cracked bark, more rarely on mossy rock or on detritus over or directly on earth, subneutroph., m.-r.photoph., anitroph., e.g. in contact to (or in) Lobarion pulm.-association – rare (2); Sch, ThW, Al

Mycobilimbia sphaeroides (Dickson) (Biatora sph. (Dickson) Körber, B. pilularis (Körber) Hepp. Catillaria sph. (Massal.) Schuler)

In submontane and montane, rare (formerly) in hilly sites, on old deciduous trees, on cracked often spongy, decaying bark and on mosses in the lower and middle trunk region (above all ash), especially on cool-humid or high precipitation, rather oceanic habitats in open forests, e.g. beech-spruce forests, also on mossy lime- and silicate rocks, subneutroph.-m.acidoph., r. substrathygroph., m.ombroph., v.hygroph., anitroph.(-m.nitroph.), Antitrichion curtip. – bor-smed-mo – v.rare (1); süSch, SFW, O, He

LIT.: FRIES 1874, HAFELLNER 1984*, VAINIO 1934, WIRTH 1987*.

Mycoblastus Norman

Introduction

The *Mycoblastus*-species are gray crustose lichens with black, convex, more or less marginless apothecia with vestigial excipulum and large to very large, thick walled single celled spores. Of the perhaps 10 species of the genus, four occur in Germany. *M. sanguinarius* and the rare and strongly threatened *M. affinis* and *M. alpinus* live on acid bark above all of conifers in the boreal floral region and the correspondingly cool mountain sites in Central Europe, in the region above all in beech-spruce and spruce-fir forests in high precipitation and high fog sites. *M. fucatus* is widespread on smooth acid bark. The area of these in relation to rather acid air-pollution resistant taxa stretches according to present knowledge mainly over Central, Western and Northwestern Europe.

Genus Characteristics and Determination

Thallus crustose, granular to thick warty, light gray to gray, often sorediate, with coccoid green algae. Ap. black, usually convex, marginless (or with rapidly disappearing proper margin). Exc. with age often reduced. Hyp. colorless, brown or red. Hym. colorless or because of pigment granules bluish-black, violet, brownish, I+ blue. Epithym. usually ± blue-black. Paraphyses branched and bound. Asci clavate, thick walled, with strongly I+ blue tholus, definite ocular chamber with delimiting non amyloid border, and definite amyloid gelatin cap over the ascus tip. Sp. 1-2(3), one-celled, elongate to ellipsoidal, with layered thick wall. Pycnosp. short bacillar. Ch: Atranorin, Fatty acids, Fumarprotocetraric acid, et al.

- | | | |
|----|---|---|
| 1 | Sterile, sorediate | 2 |
| 1* | As a rule with ap., rarely sorediate . | 3 |
| 2 | Soralia whitish, greenish, greenish-, bluish- to brownish-gray, concave to convex, later coalescing. Soralia/thallus P+ red, K+ yellow, C-/+ yellowish. Crust whitish to light gray, warty areolate to unevenly warty and cracked, with | |

blackish prothallus. Atranorin, Fumarprotocetraric acid, (Protocetraric acid). Often the upper surface with a gelatinous fungus (*Tremella lichenicola*) reminiscent of an ap. fruiting body .

- | | | |
|----|--|------------------------|
| | | M. fucatus |
| 2* | Soralia light yellow to light yellow-green, later often large and coalescing, soralia/thallus P-, K± yellow, C-/+ yellowish. Crust flat-warty to film-like, gray, often extensive, with gray to black prothallus. Atranorin, Planaic acid, soralia: Usnic acid | M. alpinus |
| 3 | Sp. to 2 (rarely 1 or 3) per ascus, 25-70 (100) x 15-42 µm. Hyp. colorless to light brown. Epithym. blue-black. Ap. -1.5 mm, strongly convex. Thallus thin, uneven, light gray, rarely sorediate, K-/+ yellowish, P-, C-. ± Atranorin, Planaic acid . | M. sanguinarius |
| 3* | Sp. single (rarely to 3), 65-100 x 32-50 µm. Hyp. and ap. medulla blue-red (to be seen even with hand lens in the case of scratches on the thallus). Ap. -2 mm. Thallus rather thick, irregularly warty, gray, greenish-gray, sometimes partially (yellowish-gray) sorediate, K+ (dirty) yellow, P+ yellow/P-, C-. Atranorin, Caperatic acid . | M. sanguinarius |

Ecology and Distribution of the Species

Mycoblastus affinis (Schaerer) Schauer
In high montane sites on old conifers and birch under similar climatic conditions as bark dwelling *Sphaerophorus globosus* (↑) and *Arthonia leucop.* (↑), but more ombroph. that later – bor-mieur-h' mo, (oc) – v.rare (2); süSch, BayW

Mycoblastus alpinus (Fr.) Th.Fr. ex Hellbom
In (high) montane spruce and fir forests on the bark of older conifers, on humid habitats, like *M. sanguinarius* (↑) – bor-mieur-h' mo (oc) – (2); nöSch

Mycoblastus fucatus (Striton) Zahlbr. (M. sterilis Coppins & James
Above all in sub- to high montane, humid sites, especially on smooth bark deciduous trees such as beech, hornbeam, in beech-, oak-hornbeam-, beech-spruce forests, brook side alder stands etc., for twenty years strong increasing and spreading, in most regions probably vegetatively apophytic, promoted by massive acidification of the bark, often with *Ropalospora viridis*, e.g. in the Graphidion association, r.toxitol., r.v.acidoph., m.photoph. – bor-mieur – regionally moderately frequent, in dry-warm regions rare; above all in the central mountains

Mycoblastus sanguinarius (L.) Norman
 In high montane, rarely montane, high precipitation sites, in climatic demands like *Thelotrema* (↑), and *Loxospora el.* (↑), commonly on the trunk of older fir and spruce, rarely on wood, r.v.acidoph., s.hygroph., m.ombroph., anitroph., in the Pseudevernetium – bor-mieur-mo/h'mo - rare (3); Sch, Vog, BayW, otherwise v.rare (Rhön 1x), Hu, ThW, Erz, Pf+, Sp+ Ts+, Rh-Mn-T+, Eif?+

LIT.: POELT & VÈZDA 1977, SCHAUER 1964, TONSBURG 1992.

Mycocalicium Vainio

(Key ↑ Chaenothecopsis)

Introduction

The *Mycocalicium*-species are small lichens, which were as a result of their similarity with dust fruiting lichens traditionally treated with them in lichen study. They live saprophytically on wood or bark of trees. The capitula on a short, delicate pin-like fruiting body is lens- to egg-form. A mazaedium is lacking in contrast to the habit of similar *Calicium*-species. The spores are one-celled, broadly fusiform, dark brown. The genus contains perhaps 10 species. The single indigenous taxon grows on tough decayed wood, rarely on bark. It is distributed in the boreal floral region and in the corresponding boreal-montane sites.

Genus Characteristics

Without a thallus, without algae. ap. stalked, with inverted egg- to lens-form capitula, black. Stalk of dark brown to bluish-green, parallel ordered hyphae. Exc. ± clearly developed, dark-brown, paraplectenchymatous or of radial hyphae. Paraphyses simple to sparsely branching, with their ends producing a layer over the hym. Asci cylindrical, with tholus. Sp. one row in the asci, one-celled, dark brown.

Ecology and Distribution of the Species

Mycocalicium subtile (Pers.) Szat. (M. parietinum (Ach. ex Schaerer) D.Hawksw.)
 High montane-montane, on old, tough decayed to rather decayed wood of decorticate stumps and trunks, rarely on bark of older trees, above all conifers, r.v.acidoph., hygroph., (r.)anombroph., r.photoindiff., anitroph., usually without companions —bor-med – rare (3); Sch, Vog, Ne, SFW, Ju, Do, Al, ThW

LIT.: TIBELL 1990*, VAINIO 1927

Mycomicrothelia Keissler

The evidence for bark-dwelling *Microthelia*-species, today *Mycomicrothelia*- and *Peridiothelia*-species, is very doubtful and to be studied. *Microthelia atomaria* auct. -- = *Mycomicrothelia melanospora* (Hepp) D.Hawksw. grows on *Mespilus germanica*; one collection secured from Baden-Württemberg was not seen; the evidence shows that it is probably another species. *Microthelia micula* auct. = *Peridiothelia fuliguneta* (Norman) D.Hawksw. characterized by -0.3 mm wide per., 16-24 x 7.5-11 µm, sp. somewhat constricted at the septum with ± equal or somewhat unequal cells, cellular organized, branching and anastomosing, permanent, 2-3 µm thick paraph. *Mycomicrothelia wallrothii* (Hepp) D.Hawksw. is distinguished by 12-18(20) x 6-8.5 µm, sp. median not constricted, 1-2 µm thick paraph. and occurring on *Betula*, very rarely *Populus*. Per. surrounded by an elliptical halo.

To **Peridiothelia** D.Hawksw.:

Peridiothelia fuliguneta (Norman) D.Hawksw. (*Microthelia micula* auct.)

Up into (high)montane sites on trunk and especially the base of older deciduous trees, often on somewhat decayed bark, above all on linden, oak, cherry, usually on free standing trees in parks, on streets, r.acidoph., r.xeroph.-mesoph., m.nitroph., toxitol., in the Buellietum punct., Pleurococetum – s'bor-smed(-med) – r.rare, but often overlooked, throughout the entire region

LIT.: HAWKSWORTH 1985

Mycoporum Flotow ex Nyl.

Introduction

The thallus of *Mycoporum* is simple crustose and algae containing or indefinite and algae free. The black, rounded to very irregular fruiting bodies usually contain several perithecia-like structures, which at times have one pore toward the outside. The receptacle is in part thick and carbonaceous, in part thin. The spores are cross-septate to muriform multicellular, colorless to weakly yellow.

M. elabens is found on foggy, cool places on acid bark of conifer and deciduous trees, commonly in swamp bordered forests and boulder fields. *M. fuscocinereum* grows on smooth bark (especially branches) of oak. Both are Central European species and are or were limited to mild, lower sites. *M. elabens* has a very small distribution area; it stretches originally from the North Alps and their foothills with isolated single occurrences up to the Vogesen and the Odenwald. The species is threatened by extinction and is missing in the region.

Genus Characteristics and Determination

Genus probably non uniform. Thallus indefinite, without algae, or \pm indefinite, with *Trentepohlia*. ascomata rounded to irregular in outline, with usually several perithecia-like chambers, blackish. Receptacle in part very thick, \pm carbonaceous, at times thin and covered by a dark brown shield-like involucre. Hym. gelatin I+ orange(red). Pseudoparaphyses branched and bound, in time disappearing. Asci broadly ellipsoidal to bulging. Sp. cross-septate to weakly muriform, colorless. Ch-

- 1 Sp. 12-18 x 4.5-8 μ m, with 3-5 cross-walls, 1-4 cross-cells with always 1 longitudinal wall. Fruiting body with (1)2-5 chambers, which each open with a pore or crack, irregular to short streak-form, -0.4 x 0.2 mm. Thallus indefinite

M. quercus

- 1* Sp. larger
- 2 Fruiting body almost circular, -1.2 mm, with several chambers (p. 81), which open finally with small pores. Sp. 22-40 x 8-12 μ m, finally

with 8 cross-walls and 1 transverse longitudinal wall. Thallus definite, granular-scruffy, yellow-white, with *Trentepohlia*

M. elabens

- 2* Fruiting body round to fleck-form, -0.3(0.7) mm. Sp. 27-38 x 11-14 μ m, with 6-8 cross- and numerous longitudinal walls side by side. Thallus indefinite

M. fuscocinereum

Ecology and Distribution of the Species

Mycoporum elabens Flotow ex Nyl. (Dermatina e. (Flotow ex Nyl.) Zahlbr.)

In montane, rarely submontane, high precipitation sites on climatically mild to rather cold, often foggy habitats with favorable, but often variable moisture conditions, on rather to (very) acid bark of deciduous (mostly birch, alder) and conifer (usually *Pinus*) in open forests, e.g. swamp margin forests, birch-mountain ash stands in boulder fields etc., r.acidoph., m.photoph.-r.skioph., anitroph. – mieur-paralp – v.rare (0); *O* (Heidelb.), *Vog* (*Docelles*), *PfW* (*Bitsch*), *Av-Do* (*Wurzach*, *Eisenharz*), *Ml*, Obay

Mycoporum fuscocinereum (Körber) Nyl.

(Dermatina fuscocinerea (Körber) Zahlbr.)

In foothills and submontane sites in beech- and oak-hornbeam forests on smooth bark of beech and hornbeam, possibly m.acidoph., m.photoph.-r.skioph., r.-v.hygroph., anitroph. – mieur – v.rare (0); *O* (Heidelb.)

Mycoporum quercus (Massal.) Müll.Arg.

(Dermatina q. (Massal.) Zahlbr.)

In the foothills, rarely submontane sites on smooth bark of branches and young stems of oak as well as rarely on hazel, usually on forest margins and in bushes as well as free standing trees, pioneer, usually without cohorts, m.acidoph., r.photoph., anitroph., -- mieur-smed – possibly rare (2); e.g. süHü-HRh, süSch, O, ThW, \pm lacking in intensively cultivated as well as air polluted regions

Lit.: KEISSLER 1937, MIGULA 1929-31, POELT 1969.

Nephroma Ach.

Introduction

The genus *Nephroma* includes brown to gray, to one small part – especially in the Arctic and Antarctic floral region – even light yellow-green foliose lichens with relatively large lobed, partially erect thallus with bluegreen algae, rarely green algae as symbionts. Especially characteristic is the location of the brown to red-brown, disk-form apothecia; they stand on the underside of lobe ends, which bend back toward the top. The spores are four-celled, fusiform and brown. Many species produce soralia, many isidia.

Of the perhaps 35 species existing on earth 10 live in Europe and six in Germany. They are limited to high precipitation or humid sites and grow – often over mosses – above all on deciduous trees, commonly also on rock, like the most frequent species, *N. parile*. A few are assigned to distinctly oceanic influenced habitats, thus *N. bellum* and *N. laevigatum*. *N. helveticum* lives on cool to cold, very foggy sites. All species are on long time undisturbed habitats, on not or very carefully managed near natural forests and strongly diminished in the last decade. *N. helveticum*, that occurred in the eastern central Black Forest, is probably extinct, the remainder are, with the possible exception of *N. parile*, threatened with extinction. Responsibility for the maintenance of the stands needs to be with the Forestry Superintendent's Office.

N. bellum, *N. resupinatum* and *N. parile* are distributed from the Mediterranean region over Western and Central Europe up into Northern Fennoscandia. The area of *N. laevigatum* stretches over the Mediterranean region, West Europe (toward the East into the Schwäbischen Forest and Schleswig-Holstein) as well as over the Atlantic Scandinavia to Central Sweden and North Norway. *N. helveticum* is indigenous in Northeast Europe and the mountains of Central Europe.

Genus Characteristics and Determination

Thallus foliose, in the case of the indigenous species up to 10 cm in diameter, loosely attached, rather short lobed, with usually ascending lobe ends, gray to brown (in the case on one non indigenous species light yellowish-green), smooth, sometimes with soralia or with delicate isidia-like lobules, underside light to black-brown, bald to appearing hairy or thickly velvet-like short hairy. Lobes usually 3-10(15)

mm broad. Upper- and lower-side with large-celled paraplectenchymatous cortex. Photobionts bluegreen algae of the genus *Nostoc* (greenish species with green algae of the genus *Coccomyxa* and internal cephalodia with *Nostoc*). Ap. rounded to kidney-form, standing on the underside at the lobe ends, light brown, red-brown, brown-black, with thin thalloid margin, hemiangiocarpic. Asci similar to *Peltigera*-type. Sp. cross-septate, 4-celled, fusiform, pale brown, in the case of the indigenous species 17-27 x 4-8 µm. Ch: depside, Triterpenoids: P1: Peltidactylin, P2: Dolichorrhizin, P4: Hopan-7β,22diol, P5: Hopan-15α,22-diol, P6: Hopan-6α,7β,22-triol.

- 1 Thallus on the upper surface and above all at the margins with blue-gray, rounded, often border-like to coalescing soralia, brown to brown-gray, underside bald or partially sparsely short hairy. Ap. very rare. Medulla K-/K+ yellowish. P2, Zeorin, P5 **N. parile**
- 1* Thallus not sorediate, but sometimes with flattened isidia or very small lobules on cracks or at the lobe margins, dark brown, brown-gray (even almost gray), undersides pale ochre to dark brown. Ap. often occurring **2**
- 2 Medulla yellowish, K+ rose to red. Thallus underside commonly bald. Anthraquinone, P6 **N. laevigatum**
- 2* Medulla whitish, K- or K+ yellow **3**
- 3 Underside bald, rarely very weakly hairy. Thallus without isidia, rarely with regeneration lobules along cracks. Margin not toothed. P2, Zeorin, P5 **N. bellum**
- 3* Underside loosely to thickly short hairy-velvet. Thallus often with isidia or clearly toothed at the margin. Ap. back side rugose or pitted-reticulate ribbed. Medulla R- **4**
- 4 Underside without papillae, loosely to thickly hairy. Ap margin and often also the margin of the lobes toothed. Back side of the ap. bald. Thallus usually only -4 cm. ± P1, P4 **N. helveticum**
- 4* Underside with scattered whitish papillae, thickly short hairy. Thallus very robust, often with flattened isidia at the margin. Ap. margin not toothed. Back side of ap. commonly with fine light hairs (handlens). Ch- **N. resupinatum**

Ecology and Distribution of the Species

Nephroma bellum (Sprengel) Tuck. (*N. laevigatum* auct.)
In montane and high montane, oceanic mild to cool, (rather) very high precipitation, very to

extremely humid sites on deciduous trees with usually rather mineral rich bark, above all on sycamore, beech, ash, willow, especially on mossy stem parts in forests (ravine forests, beech-spruce forests, *Aceri-Fagetum*), in very humid sites also rather open to light, very sensitive to forestry disruptions, subneutroph.-r.acidoph., r.skioph.-r.photoph., substrathygroph., r.-v.ombroph., anitroph., Char. Lobarion p. – bor(-subatl)-mieur-subatl- med-mo – v.rare (1); süSch, Vog, *nöSch+*, *O+*, *Ju+*, ThW, Al

***Nephroma helveticum* Ach.**

In high montane and montane, high precipitation sites on extremely humid, foggy, cool to cold sites in near natural spruce-fir and beech-fir forests, in the region above all on thin twigs of spruce, m.-r.acidoph., m.photoph.-r.skioph., anitroph., in the Lobarion p., Usneion, e.g. with *Sticta* s. (↑) - bor(subko)-mieur-mo – v.rare (0); *nöSch* (Alpirsbach)

***Nephroma laevigatum* Ach. (non auct.)**

(*N. lusitanicum* Schaerer)

In the region like *N. bellum* (↑), commonly with *Lobaria pulm.*, in comparison to these it is limited to mild-oceanic habitats, in higher sites lime *Lobaria ampl.* (↑), at the east boundary of its distribution, Char. Nephrometum laev. – (s')bor-atl-mieur-atl-med(subatl), oz – v.rare (1'); süSch, *nöSch-Ne*, HRh, Vog, Ba, Ne, Ju, SFW, additionally *H_z+*, NW-Dtschl. +

***Nephroma parile* (Ach.) Ach.**

In montane and high montane, isolated submontane, high precipitation sites on deciduous, rarely conifer trees and on silicate rock, like *Peltigera coll.* (↑), Char. Lobarion p. – bor-med-mo, (oc) – rare (2); süSch and Vog over 600 m r.rare, Al, SJu, otherwise v.rare (*nöSch*, SFW, *süHü+* HRh, ThW+, *O+*, *Sp+*, *Rhön+*, *Rh-Mn-T+*, *Ts-MRh+*, *Pf+*)

***Nephroma resupinatum* (L.) Ach.**

In montane and above all high montane, (rather) very high precipitation, oceanic sites on the bark of usually older deciduous trees, above all beech, sycamore, usually over and between mosses in the lower trunk region, on bark of higher water capacity, on very humid sites even on branches,

preferably in open near natural beech-(spruce) forests, in very high precipitation high sites even on free standing trees (↑ *Lobaria ampl.*), sensitive to forestry management, m.acidoph., s.hygroph., r.ombroph., substrathygroph., a-/m.nitroph., Char. Lobarion p. – bor-med-mo, (oc) – rare (2); süSch and Vog r.rare over 800 m, Al, otherwise very rare (*nöSch*, *Ne+*; *Ju+*, *Pf+*, *Sp+*, *Vgb+*, *Rhön+*, *Ts-MRh+*, *Eif+*, ThW+)

Lit.: ANDERS 1928, JAMES & WHITE 1987

Normandina Nyl.

(Determination ↑ *Omphalina*)

Introduction

Normandina pulchella is distributed worldwide in temperate zones and corresponding sites of the tropics. The thallus consists of small gray, rounded squamules with circular for the most part curved up, partially sorediate erupting margins. The lichen is only known as sterile, but possibly belonging to the few basidiolichens. They grow predominantly on weakly acid bark of deciduous trees on mild climate habitats, in open forests as well as on free standing trees (above all scattered orchards). Commonly they sit upon snugly pressed against the bark leafy mosses and liverworts. *Normandina* is distributed from the Mediterranean region over Central and Western Europe up into atlantic Scandinavia.

Genus Characteristics

Thallus squamulose, ear/shell form, with raised margins, gray, blue-gray, greenish-gray, margin often sorediate, underside whitish, layered, with paraplectenchymatous to indefinite upper cortex, with out lower cortex. Photobiont *Trebouxia*. Ap. unknown. Ch-.

Ecology and Distribution of the Species

***Normandina pulchella* (Borrer) Nyl.**

Up into the high montane zone with the high point in submontane to montane, moderate to

very high precipitation, mild sites, above all over mosses (e.g. *Frullania*) on the bark of deciduous trees, often also directly on the bark, rarely on silicate rock, usually on rather well lighted, rather humid habitats, but also in rather low precipitation regions (under 800 mm); in lower sites on completely rain exposed tree flanks (slanting stems), above all in orchards on apple trees, in open wood rush-oak-beech forests, slightly mixed forest, ash forest, moist oak-hornbeam forest, usually on oak and ash, in higher sites above all in beech-(spruce-) forest on beech, sycamore; continental influenced regions clearly avoided, even yet in a lichen rather poor region; subneutroph.-m.acidoph., substrathygroph., r.ombroph., a-(m.)nitroph., m.toxitol., in the Lobarion, Acrocordietum gemm., Parmelietum rev., in *Normand.-Candelariella reflexa*- association etc. – s'bor-med, subatl, (oc) – r.rare; distributed outside the dry-warm sites in Baden-Württemberg (the species has possibly increased in this century), above all Sch, SFW, Ne, rare in PFW, RhSch

Lit.: PURVIS et al. 1992

Ochrolechia Massal.

Introduction

Ochrolechia is recognized by usually gray-white, gray or cream colored, crustose, often rapidly growing thallus and relatively large sitting up apothecia with rose-brown to ochre colored disk and bulging thalloid margin. Many species produce soredia and commonly produce no fruiting bodies.

The indigenous species (in Germany ca. 12 of the total of ca. 40) are predominantly bark- and silicate dwellers. *O. upsaliensis* occurring in the Alps, also in Allgäu, overgrows plant detritus and soil dwelling mosses. *O. androgyna*, *O. microstictoides* and *O. alboflavescens* reside preferably on acid bark, above all on conifers in cool forests; *O. microstictoides* goes over also into far from natural conifer forests. *O. szatalaensis* requires foggy, cool sites and is found especially on spruce branches. *O. pallescens* occurs for the most part on beech and sycamore in near natural forests (today almost only in mountain forests) in mild to cool, high

precipitation, oceanic influenced sites, isolated also on the older bushes in regions or willow. *O. arborea* and above all *O. turneri* reside on free or open standing trees, especially of late on somewhat nutrient-rich habitats. *O. turneri* is distributed in the region at the region at the western border of the genus. The remaining tree dwellers are mostly concentrated in the highland, with the exception of *O. subviridis*; which grows on acid bark (especially oak) in open forests in climatically relatively mild regions. The silicate lichen *O. parella*, which only occurs in lower sites, and *O. tartarea*, which in the region is known only from the southern Black Forest and here is strongly threatened, are rare in Germany also beyond the region.

O. androgyna is widely distributed in the boreal conifer forests and corresponding sites in Central and Southern Europe, even almost as widely as *O. microstictoides*. *O. turneri*, *O. arborea* and *O. alboflavescens* which in South Germany is limited to higher sites, are extensively lacking in northern Scandinavia. *O. subviridis*, *O. parella* and *O. pallescens* are atlantic-subatlantic species, which in Central Europe are found almost only in the West; first occurred from South Europe up into the north boundary of the summer-green deciduous forests, later reaching even to the northern Scandinavia. *O. pallescens* is a typical oceanic species, which penetrates into corresponding mild-moist mountain sites farther to the east. *O. tartarea* occurs from boreal Scandinavia up into the mountains of the western mediterranean region; in Central Europe it is extensively limited to the high precipitation oceanic mountains.

Genus Characteristics and Determination

Thallus crustose, commonly coalescing, uneven to warty, rarely areolate, whitish, gray, cream-colored, sometimes yellow- or brown tinted, often sorediate, with coccoid green algae. Ap. large, with rose-brown to yellowish, sometimes pruinose, concave to flat disk and thick projecting thalloid margin, sometimes additionally with an apparent proper margin. Exc. commonly developed, but narrow. Hyp. colorless. Hym. very high, I+ blue. Epihym. colorless to brownish, sometimes granular. Paraphyses thin, richly branched and reticulate, above the bound with one another. Asci thick walled, *Pertusaria*-like. Sp. 2 to 8, 1-celled,

large, ellipsoidal, thick walled. Pycnosp. ± bacillar. Ch: often Gyrophoric acid, Variolaric acid.

- 1 Thallus sorediate or with fine, sorediate erupting isidia 2
- 1* Thallus not sorediate or finely isidiate, almost always with ap . 7
- 2 Thallus/soralia C- to C+ yellowish, KC-, K-, P-, with Variolaric acid (in ap. even Gyrophoric acid), with sharply delimited soralia or diffusely sorediate. On bark 3
- 2* Thallus/soralia C+/KC+ red, K- (or unclearly yellowish), with Gyrophoric acid, without Variolaric acid . 5
- 3 Thallus with sharply delimited, regularly rounded, -1 mm wide, concave to flat, rarely convex soralia, cream-colored, yellowish-white, yellowish-gray, gray-white, ± flat to rugose. Ap. rather frequent, rose-brown, thick margined, disk flat to concave, -3 mm. Lichesterinic acid *. Montane species **O. alboflavescens**
- 3* Thallus at least partially with irregularly delimited, diffuse coalescing soralia, which erupt from small warts, light gray, gray-white to cream colored, rugose to smooth, sometimes with whitish prothallus. soralia whitish, cream colored, yellowish-white, greenish-white. Ap. very rare. Sometimes difficult to separate . 4
- 4 Thallus without Lichesterinic acid, with in part sharply delimited, in part diffusely coalescing soralia, rarely finally uniformly sorediate. Above all in lower to central sites. * **O. turneri**
- 4* Thallus with Lichesterinic acid, thin, soon large surface mealy to granular sorediate. Above all montane, on acid bark * **O. microstictoides**
- 5 Thallus in the center fine sorediate throughout, light gray, greenish-gray to whitish, P-. Isidia delicate, soon erupting into white- to greenish-gray soredia, spherical to usually cylindric (to coralloid), -0.1(0.2) mm thick. Without well delimited soralia, often with lighter prothallus. UV+ blue-white. . * **O. subviridis**
- 5* Thallus with definite soralia 6
- 6 Thallus with Lichexanthon, thin, smooth, whitish. Soralia UV+ orange, flat to slightly concave, rounded, whitish, cream colored to slightly greenish, 0.3-0.7 mm wide, soredia -70 µm, P-. Ap. very rare. * **O. arborea**
- 6* Thallus without Lichexanthon, UV-/+ white, thin to thickish, unevenly warty, whitish to gray or slightly greenish, very variable. Soralia usually convex and over 0.6 mm, rounded to irregular, usually somewhat yellowish, even beige, P-, rarely P+ brown-red. soredia up to 100 µm. Ap. brown-rose, with thick, often sorediate margin and ± flat disk, rather often lacking or poorly developed. Sp. 30-45 x 13-22 µm (two chemical

racas: A: Gyrophoric acid, (Lecanoric acid); B: additionally 3 substances "Androgyna-unknowns"

- O. androgyna**
- (in the high mountains in exposed sites over mosses and plant detritus, diffuse warty-granular to granular sorediate, uniformly gray- to yellowish-white, without delimited, yellowish soralia, soredia P+ soon orange-red, ap. 2-4 mm, * **O. inaequatula** (Nyl.) Zahlbr.)
- 7 Thallus over mosses and plant detritus in alpine sites, whitish, C± yellowish, K-, P-, with Variolaric and Murolic acids. Ap. thickly white pruinose. Sp. 45-75 x 30-50 µm . **O. upsaliensis**
 - 7* Thallus on bark or silicate rock, K- (or ± yellowish), P- . 8
 - 8 Thallus on bark, C-/C+ yellowish, KC-, with Variolaric acid, whitish to light gray, usually rather smooth . 9
 - 8* Thallus on silicate rock and rock-/soil mosses. Ap. disk C+/KC+ red . 10
 - 9 Ap. disk not C+/KC+ red, ap. without gyrophoric acid. (sometimes with Aleatoronic acid.), usually not closely crowded and numerous, -2 mm. Sp. 40-70 x 28-38 µm **O. szatalaensis**
 - 9* Ap. disk C+/KC+ red, with Gyrophoric acid. Ap. usually numerous and closely crowded, -3(4) mm. Sp. 40-70 x 25-30 µm **O. pallescens**
 - 10 Thallus/medulla C-/C+ yellowish, KC- K-, moderately thick, whitish to (light)gray. Ap. close standing, -2(3) mm. Disk gray to ochre, rarely rose, white pruinose. Sp. 45-70 x 25-38 µm. Variolaric acid, Gyrophoric acid only in ap **O. parella**
 - 10* Thallus/medulla C+/KC+ red, K± yellowish, usually very thick (several mm), often partially loosened from the substrate plate-like, unevenly rugose-warty. Ap. isolated or in groups, -7 mm. Disk rose-brown, nonpruinose or rarely slightly pruinose. Sp. 35-70 x 20-40 µm. Without Variolaric acid, Gyrophoric acid even in the thallus **O. tartarea**

Ecology and Distribution of the Species

Ochrolechia alboflavescens (Wulfen) Zahlbr. In high montane-subalpine, rarely montane sites on conifers, especially fir, rarely Scot's pine, very rarely on deciduous trees, above all in open forests in the neighborhood of the tree line on cold, high precipitation, often moderate to rather open to the wind habitats, r.-v.acidoph., hygroph., r.-m.photoph., anitroph., in the Pseudevernetium – s'bor-h'mo, (subko) – rare (3); Sch, Av, Al

Ochrolechia androgyna (Hoffm.) Arnold

Above all in montane and high montane, high precipitation sites on acid bark of deciduous- and conifer trees, usually in forests, additionally on rain exposed (vertical-) surfaces of silicate rock (often on mosses, above all in the Parmelietum omph.), on rather light poor to rather light-rich sites, optimally in very humid, cool to cold fir(-spruce)-forests and beech-spruce forests above all on fir, spruce, beech (in the Pseudevernetium, Thelotremetum, Pertusarietum hem.), m.-v.acidoph., hygroph., anitroph. – bor-med-mo – r.rare (+); Sch, Vog and Al over 800 m r.frequent, otherwise r.-v.rare (e.g. PF, RhSch, O, Sp, He, ThW, SFW, Ju, Ne, Bo). Chemical taxon A in foothills and submontane sites, chemical taxon B in foothills up to high montane sites. Related to the assay evidence (38): A:30% (Ne, Ju, SFW, süHü, Sch; B: 70% (O, Sch, SFW)

Ochrolechia arborea (Kreyer) Almborn

Above all in montane and submontane, moderate to very high precipitation sites on smooth to cracked rather to moderately mineral rich bark of deciduous trees on well lighted habitats, e.g. on free standing trees on roadways, in fruit orchards, in brook bordered stands, in the region above all on mountain ash, cherry, pear, strongly avoiding eutrophication, m.-r.acidoph., a-/m.nitroph., above all in the Pseudevernetium, Parmelietum cap. – s'bor-med – r.rare; scattered, above all in the region Sch-Ju-Av-Al

Ochrolechia microstictoides Räsänen

In montane and high montane sites on trunks of conifers, rarely deciduous trees with acid bark, usually in forests, also in relatively species poor fir forests, like *Pseudevernia* (↑), but not on twigs, even on decorticate trunks, on moderately rain exposed to very rain sheltered sites, r.v.acidoph., r.-v.hygroph., r.skioph.-m.photoph., anitroph., in the Pseudevernetium -- bor-smed-mo(-med-mo) – r.rare; Sch (over 700m r.frequent), Vog, SFW, O, Al, Av, Do, Ju, PfW, Hu, Mos, Eif, He

Ochrolechia pallescens (L.) Massal.

In montane and rarely high montane, high precipitation, oceanic sites, rarely lower, on moderately to rather base rich bark of older trees (above all beech, sycamore) in open mountain forests (beech-spruce forests, Aceri-Fagetum,

beech-linden mountain forests), in very humid regions even on free standing trees (willow bushes), avoiding cold sites, like *Parmelia past.* (↑), sensitive to forest utilization, m.acidoph., r.ombroph., e.g. in the Parmelietum rev., in *Parmelia tiliacea*-stands, montane forms of the Pertusarietum hem. – bor-subatl-med(mo), oz – rare (2); süSch (scarce under 800m), Vog, Al, otherwise v.rare (1), Eif, Ju, *nöSch* (?+), süRh+, Bo+, Do+, O+, Sp+, Ts+, ThW

Ochrolechia parella (L.) Massal.

In the foothills to montane, climatically warm to mild sites on mineral rich (or slightly eutrophic), even slightly calcareous silicate rock (above all basalt, lava, slate, sandstone) on well lighted habitats, lacking in continental influenced climatic regions, subneutroph.-m.acidoph., mesoph., ombroph., m.-r.(v.)photoph., (a-)m.nitroph., e.g. in the Lecanoretum rup. – bor-atl-mieur-subatl-med – rare (1)*; above all RhSch, Pf, additionally He (e.g. VGB, Rhön), Sp, O, Vog, v.rare Ne

Ochrolechia subviridis (Hoeg) Erichsen (*O. gallica* Verseghy)

In winter mild, foothills to submontane, moderately to rather high precipitation sites on non eutrophic deciduous tree bark, above all on older oak in open oak(-beech) forests, predominantly of deep cracked bark, climatically like *Parmelia rev.* (↑), m.-r.acidoph., m.ombroph., anitroph., in the Pertusarietum hem. – mieur-subatl-med-mo, oz) – rare (2); O, Sch, Rh, SFW, Vog, Bit-Mos, Eif, Th

Ochrolechia szatalaensis Vers.

In the montane and high montane zones on mostly smooth bark, often on branches, usually on spruce, beech, oak (and fir branches) in beech(-spruce)-, fir-spruce forests and *Quercus petraea*- stands on foggy cool habitats, e.g. in narrow valleys, climatic requirements like *Evernia div.* (↑), m.-r.acidoph., m.(r)photoph., ombroph., anitroph., in the Evernietum divaric. – bor-mieur-paralp-med-mo – v.rare (1); süSch, Al

Ochrolechia tartarea (L.) Massal., Tartar lichen

In very high precipitation, oceanic, high montane sites on lime-free silicate rock, often over thin humus layers, on well-lighted, but often shaded,

frequently intensively moistening of the thallus guaranteed habitats, e.g. on relatively exposed sites exposed rocks, r.-v.acidoph., v.ombroph., hygroph., (m.)r.photoph., above all in the Parmelietum omph. Earlier used to manufacture dye substances (orchil, and litmus). – bor-subatlmieur-subatl(-smed), oz – v.rare (R); Bog, süSch (1 actual occurrence), nöSch+, Hz, Alps

Ochrolechia turneri (Sm.) Hasselrot (Pertusaria leprarioides auct.)

Up into the montane zone above all on cracked bark of deciduous trees on rather light-rich habitats, e.g. on forest margins, on field- and avenue trees, above all on linden, oak, often on m.(r)eutrophic habitats, r.-m.acidoph., mesoph., r.photoph., in the Buellietum punct., Parmelietum cap., in contact with Xanthorion-association., also in the Pertusarietum hem. – s'bor-smed – r.rare (-m.frequent), in low precipitation and rarer in ± air polluted regions

Ochrolechia upsaliensis (L.) Massal.

In alpine windy moors over calcareous soils, like *Megaspora verr.* (↑), Char. Megasporion verr. – arct-alp – v.rare; Vog (*Hohneck*), Al

Lit.: HANKO, LEUCKERT & AHTI 1985, TONSBORG 1992

Omphalina Quélet

(Key incl. Normandina)

Introduction

Omphalina is one of the few genera of standard fungi (Basidiomycetes), whose species sometimes enter into a symbiosis with algae and produce lichens. The up to about 3 cm high fruiting bodies contain no algae; they consist of a tubular stalk and a cap provided with pendent continuous lamellae. The lichenized part, the thallus consists of closely crowded deep green spheroids or leek-green, up to ca. 5 mm, rounded shell-like squamules with up curved white margins.

The *Omphalina*-species grow on acid soils, especially on raw humus and peat as well as on decayed wood and are distributed in the boreal

conifer forest zone (to some extent in the Arctic) as well as cool sites in Central Europe. *O. umbellifera* occurs in the region in the high precipitation regions scattered on acid substrates, predominantly in conifer forests and moors. *O. hudsoniana* is reliant upon cool and cold habitats in the moors, mossy boulder fields and on moist rocks and in Germany is limited to the Alps, high central mountains and the North German low plains.

Genus Characteristics and Determination

Thallus of small green spheroids (*Botrydina*) or leed- to gray-green, ± shell-form squamules, curved up on the margins (*Coriscium*), with *Coccomyxa*-symbionts. Spheroids of algae groups with surrounding paraplectenchymatous hyphal mantel, cortex on both sides, hyphae enveloped algae groups. Basidiocarps: cap fungus with lamellae on the underside, with flat to convex cap, the indigenous species light brown, yellow-brown, orange-yellow, cream colored. Stalk slender, without collar. Ch-

- 1 Thallus of crowded dark green spheroids (“*Botrydina*”) in their midst up to 2 cm high cap fungus fruiting body, cap -1.5 cm wide, cream colored to light brownish. Lamellae subtended. Sp. 7-11 x 5-8 µm **O. umbellifera** (when cap vivid yellow to orange, sp. only 3.5-4.5 µm wide: *O. alpina* (Britzelm.) Bresinsky & Stangl, Al)
- 1* Thallus of rounded to shell-form, flat to marginally up turned squamules **2**
- 2 On bark, bark-mosses, rarely rock-mosses. Squamules rounded to kidney-form, light gray to blue-gray, above all sorediate erupting at the margin, rolled upward at the margin, lighter than the raised border, on the surface sometimes slightly concentrically wrinkled, 1-2 mm, scattered to crowded. **Normandina pulchella**
- 2* Above all on peat, raw humus, mossy rocks. Squamules rounded to kidney-form or foliose coalescing, moist deeply leek-green, dry pale green-gray, not sorediate, -3(5 mm). On the squamules sometimes cap-fungus fruiting bodies, -3 cm high, stalk at first lightly lilac, then whitish, cap cream-colored to slightly brownish-yellow, -1.5 cm wide, lamellae scarcely subtended. Sp. 6-7.5 x 3-3.5 µ

O. hudsoniana

Ecology and Distribution of the Species

Omphalina hudsoniana (Jenn.) Bigelow (*O. luteolilacina* (Favre) Henderson, *Coriscium viride* (Ach.) Vainio)

In high montane and alpine, r.-v.high precipitation sites on almost permanently moist mosses or detritus over silicate rock or peat soils or directly on moist peat, raw humus or moist decayed wood on shady, humid, cool habitats, above all on rocky, long time snow covered north slopes and in high moors, r.-e.acidoph., substrathygroph., (r.skioph.)m.-r.photoph., anitroph. – arct-mieur-h' mo/alp – v.rare; süSch, nöSch, Av, Vog, BayW, Rhön, Erz, Hz, Al

Omphalina umbellifera (L.;Fr.) Quélet *ericetorum* (Fr.) M.Lange ex Bigelow, *Botrydina vulgaris* Bréb.)

Above all in sub- to high montane, high precipitation sites on cool-moist habitats on almost continuously moist mosses and (above all moss-)detritus over sandy, sandy-loam or peaty soils as well as moss cover over silicate rock, above all in boulder fields, on moist rocks, in dwarf shrubby heath, peat cutting, drained high moors, r.-e.acidoph., substrathygroph., r.-v.hygroph., r.skioph.-r.photoph., anitroph. – bor-smed-mo – rare(3); Sch, Vog, SFW, Rhön, Eif, Hu, Pfw, RhSch, O, Av, Al, otherwise v.rare

Lit.: PURVIS et al. 1992

Opegrapha Ach.

(Key incl. Enterographa)

Introduction

The thallus of *Opegrapha*-species is little differentiated, crustose and thin or indefinite and contained in the substrate, whitish, gray or brown; the algae belong to *Trentepohlia*. The black, irregular rounded to usually elongated and often branching fruiting bodies commonly have bulging margins and crack-form hollowed out disk, a carbonaceous receptacle and cross-septate, usually fusiform spores. The species boundary is in a few cases contested.

The genus is very species rich and distributed mainly in the warmer regions of the earth. In the case of a broad species

interpretation there are about 14 lichenized species occurring in Germany and in Baden-Württemberg. Many of them are rare. *O. demutata*, *O. varia* var. *herbarum* and *O. variaeformis* are to be found in the area exclusively in the climatically mild region around Heidelberg. They are the subatlantic or atlantic taxa, which occur in western Europe. They reside on calcareous rock, e.g. even on walls, or epiphytically (*O. varia* var. *herbarum*). In the region are those missing. *O. variaeformis* was known in Germany only from the Heidelberg region; which formerly occurred mainly in North Germany plains.

O. dolomitica, *O. varia* (“*mougeotii*”) and *O. calcarea* grow on limestone on shady sites, in forests, in gulches and on north slopes. Their area stretches from the mediterranean region up to Sweden, in the case of *O. dolomitica* in the north to the Scandinavian peninsula. *O. rupestris* lives on lime crustose lichens and in not lichenized. *O. gyrocarpa* and *O. lithyrga* overlay more or less rain protected vertical- and overhanging surfaces on silicate rock on shady, very humid habitats. They are distributed mainly in the Western, Northwestern and Central Europe.

The epiphytic species live in the first line in forests on moderately acid and subneutral bark of deciduous trees and spruce; many were displaced, when the trees age and the smooth bark between the bark cracks disappears, they “favor” therefore the smooth or flat cracked bark of hornbeam, beech or ash, thus above all *O. atra*, *O. viridis*, *O. rufescens* and *O. vulgata*. *O. vermicellifera* and *O. ochrocheila* are found in warm to mild valley sites in pasture- and ravine-forests, foremost mainly on ash and pedunculate oak.

Genus Characteristics and Determination

Thallus crustose, usually thin and smooth to cracked, even sessile in the substrate, whitish, gray, brown, olive, rose, often with a black prothallus line, rarely sorediate, commonly with *Trentepohlia*, sometimes lichen dwelling and without algae. ap. black, sometimes pruinose, with raised proper margin and ± crack-form disk (lireliae-form), elongate, simple to branched (to star-form grouped), rarely rounded. Exc. strongly developed, almost always continuous under the hym. (bowl-form), commonly dark

brown to black-brown. Subhym. colorless to slightly colored. Hym. I+ blue, I+ orange-red of I-. Epithym. colorless, light brown to brown, rarely olive. Paraphysoids branched and reticulate. Asci almost cylindrical to clavate or bulging, I- (young in the upper part often with thin amyloid inner layer), above with intimation of I+ blue ring structure, fissitunicate. Sp. repeatedly cross-septate, clavate, fusiform to almost needle-form, often with perispore, overripe sometimes brownish and warty. Pycnosp. variable. Usually Ch-.

Determination remark: The ap. size is often indicated in length and width; example 2 x 0.3 mm. Spore measures incl. perispore, so far as it occurs. The determination of the calciphilic species is at present still difficult and problematic.

- | | | |
|----|--|----|
| 1 | On rock . | 2 |
| 1* | On bark, wood, very rarely on plant detritus | 14 |
| 2 | On silicate rock | 3 |
| 2* | On limestone, mortar | 8 |
| 3 | Ap. disk mostly gray to bluish pruinose. Ap. rounded, rarely elliptical, sessile, flat, margined. Exc. clearly developed, dark brown. Hyp. dark brown. Thallus C+ red or P+ yellow orange . | |
| | ↑ Lecanactis | |
| 3* | Ap. disk nonpruinose, if pruinose, then ap. elongate streaked | 4 |
| 4 | Sp. 4-celled, broadly fusiform, 17-26 x 4-6 µm. Ap. 0.7-1.6 mm, rounded to angular, sitting up, shrunken below. Disk folded-furrowed. In the ap. section usually 3-5 hym. parts visible (). Ap. receptacle (exc.) strongly developed, carbonaceous, above all basally thick. Hym. I+ orange-red, subhym. I+ blue. Fresh thallus red-brown to almost brick red, in the herbarium usually yellow-brown to brown, scruffy to mealy upper surface, partially sorediate; sorediate parts orange to reddish, in the herbarium gray-white to yellowish, UV+ light yellow to white. Gyrophoric acid or Schizopeltic acid or | |
| | O. gyrocarpa | |
| | (when sterile, C+ red: Lecanoric acid, Erythrin, see <i>Lecanactis</i> and <i>Dirina</i>) | |
| 4* | Sp. (4)6-9 celled. Thallus R- | 5 |
| 5 | Thallus wither delimited rounded, -0.5 mm large, gray-white fleck soralia, thallus brown to dark brown, in the herbarium not bleaching out, usually with definite black prothallus (often larger surfaces taken in and prothallus "map-like" reticulate). Ap. rounded, almost perithecia-like, with at first punctiform deep disks, disk sometimes umbilicate in the center. Exc. only laterally black, basally open, light (). Sp. usually (5)-6(8) celled, fusiform, 24-36 x 3.5-5.5 µm. especially sterile frequently with delimited lighter soralia. Confluent acid | |

Enterographa zonata

- | | | |
|----|--|---|
| 5* | Thallus without soralia. Ap. at least partially clearly streaked, simple, rarely branched | 6 |
| 6 | Exc. reduced, brownish, not carbonaceous, open below. Thallus brown, gray-brown (in the herbarium even somewhat yellow-tinted), finely cracked, with rather smooth upper surface, with black prothallus. Ap. up to 1.0 x 0.15 mm. Sp. 6-9(10) celled, 22-30 x 4-5 µm. Confluent acid . | |
| | Enterographa hutchinsiae | |
| 6* | Exc. strongly developed, carbonaceous, basally closed. Hym./subhym. I+ orange-red. Ch- . | 7 |
| 7 | Ap. usually long streaked and narrow, up to 1.0(2.0) x 0.2 mm, often wavy curved, with narrow crack-form disk, sometimes branched. Exc. section K± greenish. Sp. 20-35 x 2.5-4 µm, middle cells ± equal sized. Thallus usually very thin and indefinite, film-like | |
| | O. lithyrga | |
| 7* | Ap. more robust, up to 2(2.4) x 0.25-0.5 mm, with disk-like spreading flat disk, sometimes bluish to greenish pruinose. Exc. section K-. Sp. (16)20-37 x (4.5)5.5-6.5(8) µm, with somewhat enlarged middle cells. Thallus usually little developed, granular, very variable | |

O. varia

- | | | |
|----|--|----|
| 8 | Sp. 5-7 celled, with enlarged middle cells, rarely 4-celled. Hym. I+ orange-red. Ch- | 9 |
| 8* | Sp. 4-, rarely isolated 5-celled | 10 |
| 9 | Ap. up to 1 x 0.5 mm, rounded to elliptical, with flat, gray pruinose or blacker, delicate bordered disk, sometimes to several crowded. Sp. 17-25 x 5-7 µm, 5-6(7) celled. Thallus chalk white, often poorly developed . | |
| | O. variaeformis | |
| 9* | Ap. up to 1.5(2.4) x 0.4(0.5) mm, robust, usually long streaked, rarely branched, with at first crack-form, later flatter, sometimes whitish, bluish or yellow-greenish pruinose disk. Sp. 20-37 x 5-8.5 µm, 5-7(9) celled. Thallus usually scarcely developed . | |
| | O. varia (mougeotii) | |
| | (it is at this time unclear, whether <i>O. mougeotii</i> of <i>O. varia</i> can be conclusively separated) | |
| 10 | Thallus C+ red, K-, P-. Lecanoric acid, Erythrin | |

↑ **Lecanactis**

- | | | |
|-----|--|----|
| 10* | Thallus C- | 11 |
| 11 | Hym. and subhym. I+ orange-red. ap. rounded to streaked or angular, even irregularly nodular-folded, rarely appearing branched, with narrow disk, 0.5-1(1.5) x 0.4-0.6 mm, often with 2 hym. Hym. 90-120 µm. Exc. K-, epithym. brown, K-. sp. 16-27(33) x 4-7(8) µm, clearly narrowed to one end, with perispore. Fresh thallus often ± orange, rose or indefinite, bleached in the herbarium. Ch- . | |
| | O. dolomitica | |
| 11* | Hym. entirely or only in the upper part I+ blue. Sp. usually asymmetrical (clavate) . | 12 |
| 12 | Hym. entirely I+ blue. Exc. basally closed and also here carbonaceous-black, basally often strongly developed. Ap. long streaked, (0.4)0.8-1.5(2.5) x 0.15-0.3 mm, simple to short branched or star-form. Exc. K+ olive-green. Epithym. | |

- brown, K+ greenish. Sp. (11)14-21 x (3)4-5(6) μm . Perispore usually indefinite. Thallus usually whitish to indefinite (fresh even rose), I+ blue. Ch- . **O. calcarea**
- 12* Hym. I+ blue above, basally orange-red, subhym. I+ blue **13**
- 13 Exc. basally closed (brown-black to brown) or open (\pm colorless), K- or K+ brown-red. Ap. up to 0.6 x 0.3 mm, usually elliptical, straight or twisted, simple to branched, even rounded, often producing groups of several "star-form", often parasitic on endolithic *Verrucaria*-species, without its own thallus or thallus indefinite. Sp. 13-25 x 4.5-6.5 μm , perispore often very definite and thick, with age \pm brownish and finely warty. Pycnosp. 3.5-5 x 0.8-1.2 μm . Ch- **O. rupestris**
- 13* Exc. basally closed, K+ red solution. Ap. streaked, up to 1.2(1.6) x 0.25-0.4 mm, simple, rarely branched, ap. margin often brown-orange pruinose, pruinosity K+ red. Thallus whitish, gray, brownish, not parasitic. sp. 13-18 x 3-4.5 μm , perispore indefinite. Sp. not pigmented. Pycnosp. 12-23 x 0.8-1.5 μm , sometimes septate (if ap. white pruinose, K-, exc. K-, pycnosp. nonseptate, ap. -0.7(1) x 0.2 mm: *O. demutata*)
 \uparrow **O. ochrocheila**
- 14 Ap. definitely pruinose . **15**
- 14* Ap. nonpruinose **18**
- 15 Pruinosity green-yellow. Ap. elliptical to elongate . **O. varia (25)**
- 15! Pruinosity brown, K+ red
 \uparrow **O. ochrocheila (22)**
- 15* Pruinosity white. Thallus R- . **16**
- 16 Sp. (7)8-10(12) celled, 21-35 x 3.5-4.5 μm . Ap. rounded to broadly elliptical (at times even elongate), unbranched, with flat, broad, bluish-white pruinose disk, 0.5-1.5 x 0.3-0.6 mm. Thallus yellowish-white, clearly developed, smooth, medulla UV+ yellow- greenish-bluish .
Lecanactis lyncea
- 16* Sp. up to 7-celled **17**
- 17 Ap. elliptical to elongate, 0.7-2.5 x 0.2-0.5 mm, only occasionally pruinose. Sp. (4)5-7 celled, (16)20-37 x (4.5)5.5-6.5(8) μm , with somewhat enlarged middle cell, in the older ones even slightly brownish. Ch- . **O. varia**
- 17* Ap. round, -0.5 mm, \pm sunken, numerous, disk always pruinose, margin pruinose or non-pruinose. Sp. 4(-7) celled, 15-28 x 2.5-3.5 μm . Thallus, white, without pycn. (when with pycn. see *Arthonia byssacea*, *cinereopruinosa*, *pruinata*, ap. however not margined), UV+ blue-white. Confluent acid, 2'-*O*-Methylmethylphyllic acid **Lecanactis amylacea**
- 18 Exc. reduced, brown, not carbonaceous, open below. Without Confluent acid
Enterographa hutchinsiae (6)
- 18* Esc. definitely developed, closed below, therefore in section producing a \pm U-form receptacle. Without Confluent acid . **19**
- 19 Sp. usually up to 7 celled . **20**
- 19* Sp. 9-16 celled, rarely with only 7-8 cells, with very definitely thicker perispore, incl. perispore 25-60 x 6-9 μm . Ap. short elliptical to elongate, simple to rarely three-branched, with very narrow, crack-like disk, -1 x 0.3 mm, sunken to sessile. Thallus brown, brown- red, brick-red, ochre, olive (to brown-gray), in the herbarium bleaching gray to yellowish. Ch- **O. viridis**
- 20 Sp. 4 celled **21**
- 20* Sp. 5-7(8) celled. Hym. I+ red. Ch- **25**
- 21 Ap. 1.5 x 0.5-1 mm, very robust, elliptical to narrowly elliptical, \pm strongly convex, with usually crack-like disk, margin often long streaked, receptacle carbonaceous. Sp. brownish, 18-32 x 5-10 μm . Fungus, without thallus, on deciduous tree bark, e.g. old oaks
Species of the Genus **Hysterium**
- 21* Ap. very delicate and narrower . **22**
- 22 Pycnosp. 12-23 x 0.8-1.5 μm , \pm straight, sometimes 2-4 celled. Hym. I+ blue above, otherwise I+ red (subhym. I+ bluish). Ap. streaked, -2 x 0.3 mm, unbranched to branched, sp. 13-20 x 3.5-5.5 μm . Thallus gray, whitish, very thin or indefinite, K-/K+ purple
O. ochrocheila
- 22* Pycnosp. shorter. Ch- **23**
- 23 Thallus brown, gray-brown, red-brown, in the herbarium even bleached, often with spot-like lighter flecks, sometimes with black prothallus. Ap. \pm sunken to depressed, usually short elliptical to elongate, simple to branched, not bound, up to 1(1.3) x 0.3 mm. sp. 15-23(27) x 3-4(5) μm , often somewhat curved. Hym. I+ red (only subhym I+ bluish). Pycnosp. straight to twisted, 4-8 x 1.2 μm . **O. rufescens**
- 23* Thallus whitish, smooth. Spores 3.5-6 μm wide . **24**
- 24 Sp. 16-26 x (4)5-7(8) μm , usually with thinner, definite perispore, 4(-5) celled. Ap. disk at first narrow, then widening. Ap. usually simple, up to 1 x 0.3 mm. Exc. K-. Epihym. brown, K-/K+ red-brown. Hym. I+ red. In the region on thin stalked herbaceous plants, commonly on bark. Thallus I-. Pycnosp 4-6 x 0.5-1 μm .
O. varia var. herbarum
- 24* Sp. 13-18(21) x 3.5-4.5(5.5) μm , narrowly ellipsoidal to clavate, perispore usually indefinite and very thin. Ap. simple to branched and star-form (-reticulate), depressed sessile, with narrow, black to black-brown disk. Esc. K+ greenish, epihym. brown to olive, K+ greenish. Hym. I+ light blue. Thallus I \pm blue. Pycnosp. 4-6 x 1 μm
O. atra
- 25 Sp. ca. (16.5)18-26(30) x (4.5)5-6(8) μm , with rounded ends and often definitely enlarged middle cells, often apparently clavate. Ap. disk crack-form to widening, sometimes green-yellow or gray pruinose, ap. often sessile, elliptic to elongate, up to 1.5(2.5) x 0.4(0.5) mm, simple,

- rarely forked. Pycnosp. 4-6 x 0.5-1.5 µm.
Thallus gray-brown, gray, whitish, ochre, olive or scarcely visible . **O. varia** s.l.
- 25* Sp. narrower, 2.5-3.5(4) µm wide, ap. disk remaining crack-form. Esc. K+ red-brown (*O. vulgata*-group) . 26
- 26 Thallus whitish to light gray, clearly developed, usually rich with projecting, hemi-spherical to short cylindrical, white pruinose, -0.25 mm wide pycn. warts. Pycnosp. 4-7 x 1.1.5 µm, straight to slightly twisted. Ap. in the case of richer pycn. development usually sparse to lacking, usually forked to multiple branched or star-form, up to 2 x 0.3 mm. Sp. 15-32 x 2.5-3.5(4) µm. Hym. I± yellowish **O. vermicellifera**
- 26* Thallus without definitely projecting pycn. warts, pycn. brown to black, usually in the margin region of the thallus, sometimes lacking, -0.2 mm. Pycnosp. clearly twisted or straight. Ap. up to 2 x 0.25 mm, numerous. Sp. 1-30 x 2.5-3 µm. Hym. I+ red. Thallus gray, gray-brown, whitish, rarely rose, thin . 27
- 27 Pycnosp. 3-7 x 1.5 µm or 6-8.5 x 0.7-1.0 µm, clearly twisted. Sp. (5)6-8(9) celled, 20-30 x 2.5-4 µm. Ap. usually simple and single, rarely branched to star-form, up to 1.5 x 0.2 mm, with crack-form, with age even somewhat broadened disk. Exc. K± greenish . **O. vulgata**
var. **subsiderella**
- 27* Pycnosp. (4)6-20 x 0.6-1.5 µm, clearly twisted, often developing fascicles, or straight, 3-5 x 1-1.5 µm. ap. simple to forked, single to reticulate, up to 2 x 0.25 mm, usually with permanent crack-form disk. Sp. 5-8(9) celled, (16)18-34 x 2.5-4 µm. Exc. K- **O. vulgata**
var. **vulgata**

Ecology and Distribution of the Species

Opegrapha atra Pers.

Up into the montane zone (rarely higher), especially on smooth and flat cracked bark of deciduous trees (above all ash, beech, hornbeam), very rarely on spruce, commonly in the interior of forests (above all Carpionion), like *Pertus. leiopl.* (†), avoiding cold sites, m.acidoph., r.skioph.-m.photoph., ombroph., r.-v.hygroph., anitroph. – Char. Graphidion – s'bor-med, (subatl) – m.-r.frequent. rel. rare in forest-poor and dryer regions

Opegrapha calcarea Sm. (non auct.)

(*O. chevallierii* Leighton ?*O. trifurcata* Hepp)
In the foothills, winter-mild sites on shady, humid habitats on lime-rich to lime-poor rock (above all vertical faces), even on anthropogenic

substrates, above all on mortar, bricks and walled in silicate rock on walls and old construction (churches, cemeteries), subneutroph.-m.basiph., skioph. – mieur-atl-med – v.rare; Ju, *O Heidelberg*)

Opegrapha demutata Nyl. (to *O. ochrocheila*)

In the foothills, winter-mild sites on old shady, mortared walls of silicate rock/bricks, subneutroph.-neutroph – mieur-atl – v.rare (0); O

Opegrapha dolomitica (Arnold) Körber

Above all on sandy-rough, somewhat [berg] moistened dolomite rock on rather rain protected vertical- and overhanging surfaces, rarely on lime-rich rock, like *Petractis hyp.* (†), Char. Acrocordion con. – bor-med-mo – v.rare; SJu, Ju, FrJu, Al

Opegrapha gyrocarpa Flotow

In montane and high montane, high precipitation sites on lime-free silicate rock, like *Enterogr. zonata* (†), yet with somewhat more narrow habitat amplitude (still distinctly limited to very humid and cool habitats), also on [berg] moistened surfaces, Char. Enterographetum zon. – bor-mieur-subatl(-med-mo), (oc) – rare; Sch, Vog, O, Rhön, Meissner, BayW, Fi

Opegrapha lithyrga Ach. (to *O. vulgata* var. *vulgata*)

Like *Enterogr. zonata* (†), yet more often on short time slightly substrate moist sites (e.g. fissure-, water drops), Char. Enterographetum zon. – mieur-sub—atl-med – rare; Sch and Vog rare, otherwise v.rare: *Bo, O, MRh, Ts, Eif, Mos*

Opegrapha ochrocheila Nyl. (*O. rubescens* Sandst., really *O. demutata* Nyl.)

In mild hilly sites on humid habitats on base-rich lime influenced rock (e.g. walls), subneutroph.-neutroph., m.photoph., anitroph. – mieur-smed, subatl – v.rare (2); süHü, Ne, O

Opegrapha rufescens Pers. (*O. herpetica* (Ach.) Ach.)

Up into the montane zone on usually smooth or surface cracked base-rich deciduous tree bark, above all ash, hornbeam, maple, rarely even on spruce, above all in cool oak-hornbeam forests, *Aceri-Fraxinetum, Pruno-Fraxinetum*, corresponding to the high point of the habitat of *Arthonia cinnabarina* (†), but also even on

poorly lighted habitats, ± lacking in continental climate regions, subneutroph.-m.acidoph.,-r.skioph.-m.photoph., m.-r.ombroph., r.-v.hygroph., Char. Opegraphetum ruf., additionally in other Graphidion-associations. – s'bor-mieur-subatl-smed-mo(-med-mo) – r.rare (3); scattered, but ± lacking in air polluted, dry and deciduous forest poor regions, sensitive to eutrophication

Opegrapha rupestris Pers. (*O. centrifuga* Massal., *Leciographa c.* (Massal.) Rehm, *O. persoonii* (Ach.) Ach., *O. parasitica* (Massal.) Oliv., *O. saxatilis* DC.)

Up into the alpine zone on Carbonate rocks, usually limestone, r. euryök, on sunny, dry-warm such as shady moist habitats, frequently parasitic on endolithic *Verrucaria*-species, *Verrucaria nigresc.* and (rarely) other crusts – mieur-med – r.rare; Lime regions, above all SJu-Ju-FrJu, Ne, also Th, He

Opegrapha varia Pers. (*O. lichenoides* Pers. ?*O. mougeotii* Massal.)

var. **varia**

On subneutral to m.acid, often relatively soft bark of deciduous trees (rarely spruce), above all in forests on maple, linden, ash,, on moderately light rich to rather light poor, moderately rain exposed to rather rain protected, humid habitats, above all in oak-hornbeam forests, Aceri-Fraxinetum, Aceri-Tilietum, also in old orchards on apple trees, often with *Bacidia rubella*, even in contact with Opegraphetum verm., more rarely ("*O. mougeotii*") on carbonate rock, on dust impregnated or calcareous silicate rock (often sandstone), on mortar and roof tile, on rock and walls, subneutroph.-m.acidoph., m.(r.)photoph., a-/m.nitroph., above all in the Acrocordietum gemm. – (s'bor-)mieur-med – r.rare (+), throughout the entire region, but rarer in hilly sites and in the West

var. **herbarum** (Mont.) Källsten ined. (*Opegrapha h.* Mont.)

In hilly, wither-mild sites on oceanic influenced habitats, commonly on wood and bark, found in the region on dying plant stalks – mieur-atl(-med) – v.rare; *O* (*Heidelb.*)

Opegrapha variaeformis Anzi

In hilly, winter mild sites on limestone and on lime impregnated silicate rock (e.g. on walls) – (s'mieur-)smed-med – v.rare (*O*); *nöRh*, *O*

Opegrapha vermicellifera (Kunze) Laundon (*O. fuscilla* (Fr.) Almb., *O. hapaleoides* Nyl.)

In foothills and submontane, very rarely montane, low precipitation to high precipitation, usually rather warm summer sites on deciduous trees, above all toward the stem base on rain protected flanks, often on soft, even somewhat spongy (decayed) bark, above all on ash, pedunculate oak, maple, elm, hornbeam, commonly in valleys and gulches in pasture-forests, gulch-forests, [Kleeb] forests (cool Stellario-Carpinetum, Pruno-Fraxinetum, Carici-Fraxinetum, Aceri-Fraxinetum, Aceri-Tilietum), on shady, moderately warm (to cool, never endangered by late frosts), humid habitats, subneutroph.-m.acidoph., r.-v.hygroph., r.anombroph.-m.ombroph., r.skioph., anitroph.(-m.nitroph.), Char. Opegraphetum verm. – mieur-subatl-med – r.rare-m.frequent, above all in the larger river valleys and adjacent valleys

Opegrapha viridis (Pers. ex Ach.) Behlen & Desberger

Up into the montane zone on usually smooth to flat-cracked bark of deciduous trees and spruce on moderately rain exposed surfaces of the middle stem and stem base, in shady deciduous and mixed forests, combining the habitat amplitude of *Arthonia cinn.* and *Porina aenea*, but less toxitolerant than the latter, above all on hornbeam, ash, sycamore, rarely on oak, beech, etc., Char. Graphidion, subneutr.-m.acidoph., m.-r.skioph., anitroph., m.toxitol. – mieur-subatl-med(-mo) – m.frequent, rare in low precipitation regions, outside South Germany strongly regressing

Opegrapha vulgata Ach.

var. **vulgata** (*O. cinerea* Chev.)

In oceanic, high precipitation sites above all on spruce, and on ± smooth, acid, rarely subneutral bark of deciduous trees, in cool, humid beech-spruce forests, r.acidoph., r.skioph., v.hygroph., anitroph. – s/bor-subatl-med – r.rare; above all Sch, süHü-süRh, HRh, O, Eif

var. **subsiderella** Nyl. (*O. niveoatra* (Borrer)

Laundon, *O. subsiderella* (Nyl.) Arnold)

Up into the high montane zone, in moderately to very high precipitation sites on base-rich, moderately acid to subneutral, not to moderately eutrophic bark of deciduous trees, even on spruce, in shady, ± temperate humid forests, oak-hornbeam forests, gulch forests (here often on sycamore), beech-spruce forests; m.-v.acidoph.,

v.skioph.-m.photoph., (r.-)v.hygroph.,
anombroph.-m.ombroph., usually in species poor
associations. – mieur-subatl-med – r.rare; above
all Sch, Vog, SFW, Ne, HRh, RhSch

Lit.: KÄLLSTEN 1993, PURVIS et al. 1992, REDINGER 1937,
TORRENTE & EGEE 1989.

Ophioparma Norman

(Determination ↑ Haematomma)

Introduction

The two known *Ophioparma*-species have
crustose, yellowish-green to yellowish-gray,
thallus and blue-red apothecia frequently with
pressed back thalloid margin and then projecting
proper margin. The apothecial pigment turns
blue with KOH. *O. ventosa* the single
representative of the above all arctic- boreal
genus in Germany, is distributed from the Arctic
over North Europe, the Central European
mountains up into the high mountains of South
Europe and grows on rather exposed silicate rock
in high precipitation sites, thus in the Black
Forest, the Bohemian Forest, Fichtel- and Erz
mountains, Harz, in the Voges and the Alps.

Genus Characteristics

Thallus crustose, yellowish-green to yellowish-
gray, with cortex, not sorediate, with *Trebouxia*-
like photobionts. Ap. with red to brown-red disk
and thick proper margin, thalloid margin clearly
developed to lacking. Hym. and exc. ± orange
flecked, K+ blue, then rose-red to orange-red.
Epihym. orange-red to red, K+ blue, then violet-
blue. Hyp. colorless above, below rose to
yellow-brown. Paraphyses simple to rarely
branched or bound. Asci clavate, with smaller,
uniformly I+ blue tholus, without non-amyloid
axial mass, without ocular chamber. Sp. thick
needle-form, screw-like twisted in the ascus, 3-7
fold cross-septate. Pycnosp. bacillar to elongate
fusiform. Ch: Divaricatic acid, Thamnolic acid,
± Usnic acid.

Ecology and Distribution of the Species

Ophioparma ventosa (L.) Norman
(*Haematomma ventosum* (L.) Massal.)

In the high montane to alpine, high precipitation
sites on calcareous silicate rock (above all
metamorphic and magmatic) on habitats with
frequent and strongly varying moisture
conditions, on completely rain exposed steep and
vertical surfaces on rather to very wind exposed
rocks, on larger rock groups and in well lighted
boulder heaps, widely descending into valleys
(500m), likely with *Umbilicaria cyl.*, in
montane/high montane sites usually with
Pertusaria cor., m.-r.acidoph., r.-v.photoph.,
a-(m.)nitroph., Char. Umbilicarion cyl. –
arct/bor-mieur-h'mo/alp-med-alp – rare (3); Sch,
Vog, Rhön, ThW, Erz, BayW, Hz, Al

Lit.: ROGERS & HAFELLNER 1988.

Orphniospora Körber

Brown-blackish crustose lichens with areolate
thallus, black, lecideine ap., dark brown
excipulum and hypothecium, colorless to dark
brown, single-celled or apparent two-celled
spores. On silicate rock in alpine sites. *O.*
mosigii and *O. moriopsis* in the Alps, so in the
Allgäu.

Lit.: HAFELLNER et al. 1979, HERTEL & RAMBOLD 1988,
POELT 1969

Pachyphiale Lönnr.

Introduction

The species of *Pachyphiale* have a thin crustose
thallus, partially even in the interior of the tree
bark, with *Trentepohlia*-algae and brown-red
apothecia with proper margin and asci with 16 to
48 elongate fusiform to filamentous, multicellular
cross-septate spores. Of the five known species,
two occur in Germany. They live on bark of
deciduous-, rarely conifer trees in forests. *P.*
carneola is distributed from the Mediterranean
up into central Scandinavia, *P. fagicola* up to
North Scandinavia.

Genus Characteristics