Thallus crustose, thin, even into the substrate, white-gray to gray-green, with *Trentepohlia*. Ap. red-brown to orange, concave, with permanent proper margin and sometimes with apparent thalloid margin. Exc. paraplecten-chymatous, interior colorless, exterior red- brown. Hym. (not however asci) commonly I-. Epihym. red-brown. Paraphyses simple, filamentous, not or scarcely thickened on the ends. Asci inverted sack-form to clavate- cylindric, I+ blue, with uniform walls, without definite tholus, commonly clearly shorter than the paraphyses. Sp. to (8)16 to 32, needle- to fusiform, cross-septate, 4- to multicellular. Pycnosp. filamentous, often curved, Ch-.

1 Sp. 15-35 x 3-5 µm, with 3-7 cross-septa, to usually 16-32 per ascus. Ap. red-brown, concave to flat, rather thick margined, numerous, -0.5 mm. Thallus very thin. Habit like *Gyalecta truncigena* **P. fagicola**

1* Sp. 35-80 x 3-5 µm, with 7-15 septa, straight to curved, to usually 8-32. Ap. red-brown to rose-brown, concave, thick margined, -0.6 mm. Thallus very thin **P. carneola**

Ecology and Distribution of the Species

Pachyphiale carneola (Ach.) Arnold (P. cornea (Wirth.) Poetsch, incl. P. arbuti (Bagl.) Arnold) Above all in submontane and montane, high precipitation oceanic sites on stems of deciduous trees (usually beech and oak), rarely on spruce, in near natural forests, above all beech- and beech-spruce forests, preferably on flat-cracked bark (above all in the cracks), climatically like the habitat where *Lobaria pulm.* (↑), resides, m.acidoph., v.hygroph., anitroph., not toxitol. – s'bor-med(mo), (oc) – rare (1); süSch, *nöSch, Rh, Ju, SFW, O, Ts,* ThW

Pachyphiale fagicola (Hepp) Zwackh
Up into the montane zone on stems of deciduous-, rarely conifer trees, in more open sites (e.g. gardens, orchards) and in forests, above all on subneutral, flat-cracked bark, e.g. on ash, walnut, elm, sycamore, subneutroph. (-m.acidoph.), r.(-v.)hygroph., a-/m.nitroph., e.g. in openings of the Physcietum adsc. – bor-mieur – rare (2); süSch, HRh, Ju, *SFW, FrJu, nöSch, nöRh,* O, Mos, ThW

Lit.: LETTAU 1937, VÈZDA 1958

PANNARIA DEL.

(Key incl. Degelia, Massalongia, Moelleropsis, Parmeliella)

Introduction

The thallus of *Pannaria* is small squamulose to foliose-rosetted, gray-blue to brown, often bordered by a dark prothallus and having as symbionts the bluegreen algae of the genus *Nostoc*. The light red-brown to blackish apothecia have an often crenate, sometimes disappearing thalloid margin, in contrast to the biatorine apothecia of *Parmeliella*, a genus extremely close to *Pannaria*.

The *Pannaria*-species live on bark, silicate rock, plant detritus, humus and naked soil in humid regions. Of the perhaps 80 species of the cosmopolitan, predominantly southern hemisphere genus six are known in Germany. *P. pezizoides* resides on naked soil and plant detritus and occurs in the Arctic, the boreal zone and in cool and cold sites of the temperate and mediterranean regions, in Central Europe predominantly in the mountains. The arctic-alpine *P. praetermissa* is limited in Central Europe in the Sudenten, the high Black Forest, the Alps and the Tatra; *P. leucophaea* which overgrows mosses on exposed habitats resides on occasionally irrigated surfaces of mineral- rich silicate rock and is distributed in humid regions of South and North Europe. *P. conoplea*, a lichen of high precipitation, mild oceanic sites, lives on mossy rock and deciduous trees in near natural forests. It occurs in the moist, oceanic sites of the entire Mediterranean region over West Europe and the central mountains of Central Europe up to Scandinavia. In the outer alpine Germany it is threatened with extinction. Also *P. pezizoides* belongs to the threatened species, especially however *P. praetermissa*, is known in the region now only from one occurrence.

Genus Characteristics and Determination

Thallus foliose, squamulose or crustose, gray-blue, gray to brown, black-brown, often with bluish to blue-black prothallus, layered, upper

side with cortex, under side without and attached to the substrate by hyphae of the medulla/prothallus. Photobionts *Nostoc*. Ap. red-brown to almost black, with thalloid margin and often apparent thin proper margin. Exc. thin, colorless to pale. Exc. thallinum exterior paraplectenchymatous, interior of loose ordered hyphae with algae packets. Paraphyses commonly unbranched. Asci with variously developed apical apparatus. Spores one-celled, ellipsoidal. Usually Ch-, rarely Pannarin.

1 Thallus like foliose lichens, ± single lobed to deeply lobed at the margin, often rosetted . **2**

1* Thallus crustose, ± granular or squamulose (-small foliose), not (or only apparently) lobed at the margin, usually not rosetted . **4**

2 Ap. extremely rare. Thallus above all with large blue-gray soredia/isidia at the lobe margin, bluish- to rarely brownish-gray, deeply incised at the margin, with elongated lobes, often somewhat up-curved at the margins. Commonly without visible dark prothallus. Habit like e.g. *Physconia* **P. conoplea**

2* With rose-red to (red-)brown ap. Without marginal soredia/isidia. Thallus blue-gray, lead-gray or slightly brownish. Extreme oceanic species **3**

3 Ap. with entire lighter (± reddish) proper margin, without thalloid margin, -1 mm. Lobes extensively merging up to the thallus margin, therefore the thallus almost placoid, longitudinally finely ribbed, with blue-blackish to blue-ray finely filamentous prothallus. Thallus -6 cm, in the center often granular-warty. Sp. 17-25 x 7-10 µm. On bark and mosses . **Degelia plumbea**

3* Ap. with thick, often granular thalloid margin, -1.5 mm. Thallus -3 cm, with definite, not merging marginal lobes with up curved light margins, in the center ± areolate. Prothallus usually not visible, blue-black. Sp. 15-19 x 9-10 µm, with perispore up to 24 x 12 µm . **P. rubiginosa**

4 Thallus on limestone, brown-black to dark brown-gray, usually with blue-black to blue-greenish prothallus, ap., if occurring, black. Not with *Nostoc.* See *Placynthium*

4* Not on limestone **5**

5 Thallus on bark and bark mosses. Ch- . **6**

5* Thallus on rock, rock- and soil-mosses, on soil **8**

6 Ap. rather rare, -1 mm, with lighter proper margin. Thallus covered with small peg-form isidia, gray to brownish, of small crenate to incised (sometimes overlapping) squamules, marginally sometimes with apparently elongated and scarcely over 1 mm large "lobules", of black, often dominating prothallus, therefore observing without a handlens the lichen upper surface often seems dark . **Parmeliella triptophylla**

6* Thallus always with ap., without isidia . **7**

7 Ap. with granular to crenate thalloid margin, commonly thick standing . **P. pezizoides (14)**

7* Ap. with (lighter) proper margin, brown-rose to dark red, thallus like *P. leucophaea*, of crenate, light- to dark gray squamules . **P. saubinetii**

8 Thallus sterile, R- . **9**

8* Thallus with ap., Ch- . **12**

9 Thallus squamules not sorediate or isidiate, flat, ± strongly crenate, thickish, 0.5-1.5 x 0.2-0.8 mm, very closely crowded to shingle- like, gray, brown, dark gray, often with black prothallus . **P. leucophaea**

9* Thallus squamules at the margin isidiate to appearing sorediate **10**

10 Thallus on conspicuous, blue-black to black prothallus, small squamulose, squamules crenate, with cylindric isidia . **Parmeliella triptophylla (6)**

10* Without blackish prothallus . **11**

11 Thallus squamules scarcely elongated, -2(3) mm long, -1.5 mm wide, shingle-like, closely crowded, often producing a thick crust, brown to brown-blackish or gray, usually whitish at the margins, crenate and often with cylindric to almost granular outgrowths, underside ± woolly. With steroids. Alpine . **P. praetermissa**

11* Squamules elongated, -6(10) mm long, -2 mm wide, producing no crust, (red)brown, under side light (± brownish-white), standing close to ± loose turf, mostly ascending-over lapping, divided narrow lobed, with strongly crenate, covered with delicate lobules to isidiate margin (isidia granular to coarse soredia-like to cylindric). Ap. rare, -2 mm, ± red-brown, narrowly sessile, flat and very thin margined, then convex marginless. Ch- . **Massalongia carnosa**

12 Ap. (at least at first) with definite thalloid margin (lecanorine) . **13**

12* Ap. without thalloid margin, often with (often lighter than the disk) proper margin (biatorin) **15**

13 Thallus coarse granular to granular-coralloid, granules -0.1 mm, coalescing into an areolate cruse, blue- to ash-gray. Ap. brown to red-brown, flat, later convex, with granular thalloid margin, -1 mm. Sp. 13-17(19) x 6-8 µm, often with one large oil droplet. On naked soil **Moelleropsis nebulosa**

13* Thallus small squamules. Squamules (sometimes rather indefinitely) flattened . **14**

14 Ap. brown to red-brown, with permanent, crenate to granular thalloid margin, flat, sunken to depressed, -1.5(2) mm. Sp. 19-25 x 8-10 µm, incl. warty epispore 25-30 x 9-12 µm. Thallus squamules -0.7 mm, crenate, very closely crowded, crustose coalescing, gray to brown, moist dark green-bluish to blackish (when moist green, dry ochre- yellowish with green algae, see *Psoroma*) **P. pezizoides**

14* Ap. dark red-brown, dark brown to black, only at first lecanorine, later biatorin, at first flat, soon convex, with disappearing margin, -1 mm. Sp. 14-18 x 5-7 µm. Thallus squamules -1.5 mm, divided to crenate, very closely crowded, gray, brown, blackish **P. leucophaea (9)**

15 Thallus finely granular, similar to *Saccomorpha icmalea*, olive to gray-brown, ephemeral on acid soil. Ap. -0.5 mm, red-brown, convex, marginless. Sp. 14-19 x 7-9.5 µm **Moelleropsis humida**

15* Thallus not finely granular, not ephemeral, with black prothallus, usually on silicate rock. Ap. -1(1.2) mm. Sp. inner wall uneven . **16**

16 Thallus with small peg-form isidia, small squamulose, dark gray, brownish, blackish-brown. Squamules crenate to lobed or incised, usually shingle-like, -1.5 mm. Ap. brown-red, with gradually disappearing proper margin. Sp. 10-17 x 5-8 µm **Parmeliella triptophylla**

16* Thallus without isidia, small squamulose robust, often producing a single cracked- areolate curse, gray, brown, blackish. Ap. dark brown to blackish, with scarcely lighter, soon disappearing thalloid margin, usually soon convex. Sp. 14-18 x 5-7 µm . **P. leucophaea (9)**

Ecology and Distribution of the Species

Pannaria conoplea (Ach.) Bory (P. pityrea auct.)
In (sub)montane and high montane, oceanic sites on mostly mossy bark of deciduous trees, like *Nephroma par.* (↑), *Lobaria ampl* (↑), also on (mossy) silicate rock, on lower sites above all on oak, e.g. with *Caloplaca herb.* or *Parmotrema chin.* (↑), Char. Lobarion pulm. – bor-atl-mieur-subatl-med-mo, oz – (v.) rare (1); süSch, *nöSch*, Vog, SJu, Al, *Sp, O, nöPf, Ts, He*, ThW

Pannaria leucophaea (Vahl) P.M.Jorg.
(P. microphylla "(SW.)" Delise)
In the foothills and montane zone on neutral and basic or often slightly soil encrusted silicate rock on sporadically (short-time) irrigated, rather sunny to shady, often relatively warm habitats, e.g. with *Collema flacc*., subneutroph. -- bor-smed(-med-mo) – rare (2); süSch, nöSch, Vog, *SFW*, HRh, *Bo, O, süRhön, Fr*, ThW, Erz, *Al*

Pannaria pezizoides (Weber)Trevisan
In subalpine and alpine, high precipitation sites, rarely in the montane zone or lower, on naked, moist, acid soil, on humus, plant detritus, soil encrusted or mossy, moist rock and at the base of mossy trees on mostly away from the sun, rather well lighted to rather poorly lighted habitats, on loser sites e.g. in old abandon rock quarries and sand pits, r.-m.acidoph., substrathygroph., hygroph., e.g. in the Solorinion – arct-bor-mieur(h'mo/alp)-alp – rare (2)/ süSch, nöSch, Vog, Sb, Av, Al, *SJu, Ju, nöPf, PfW, Ts*, Rhön, ThW

Pannaria praetermissa Nyl. (Parmeliella p. (Nyl.) P.James, Parmeliella lepidiota (Sommerf.) Vainio)
In openings in dwarf shrubby heath on/between mosses on humus, base rich, usually calcareous soils, commonly above the tree line on well lighted sites, even in fine soil filled rock fissures and ledges, subneutroph. – arct-alp – v.rare (R); süSch (2x), Al

Pannaria rubiginosa (Ach.) Bory
High oceanic lichen on climatically balanced, mild habitats, e.g. like (↑),Degelia pl. (↑) – s'bor-atl-mieur(atl)-med-mo(subatl), oz – North Alps v.rare

Pannaria saubinetii (Mont.) Nyl. (Parmeliella s. (Mont.) Zahlbr.)
In winter mild foothills sites on the base of older deciduous trees, above all oak, probably also on rock – mieur-subatl-med –*Nancy, ?Heidelberg*, ThW (Annatal)

Lit.: JORGENSEN 1978

Parmelia Ach.

(Key includes Parmotrema)

Introduction

Parmelia in recent years has been repeatedly divided into several genera. There has been a gradual stabilization of the new divisions. However *Parmotrema* is weakly differentiated in contrast to very well delimited units. Here the genus is still written in a very conservative sense. Simply *Parmotrema* is treated separately.

Parmelia in the broad sense includes deeply divided lobed foliose lichens, cortex on both sides, commonly gray-white to steel-gray, yellow-greenish or brown color. The undersides of the usually brown to black thallus are attached

to the substrate with clasping fibers. The apothecia usually have a red-brown or brown, flat to concave disk with thalloid margin and sit on the surface of the lobes. The spores are one-celled. Many species normally remain sterile and reproduce with the help of isidia or soredia, which characteristically are produced in soralia. The symbionts are coccoid green algae.

In the broad setting numbering about 1000 species (with Parmotrema 1250), world-wide distributed genus has about 40 in Germany (44 with Parmotrema), in the region about 35 (39). The Parmelias or bowl lichens grow on trees and on silicate rock; several species with broader ecological amplitude occur on both substrate types.

The yellow-green species *P. conspersa, P. somloensis* and *P. mougeotii* as well as the brown *P. loxodes, P. verruculifera* and *P. pulla* live especially on sunny silicate rocks. A few of them such as *P. conspersa, P. loxodes* and *P. verruculifera* cross over also to more strongly dunged sites. *P. omphalodes* and *P. panniformis* occur on steep surfaces of silicate rocks of mountain sites; *P. stygia* and especially *P. incurva* grow on wind exposed acid silicates and in cold boulder fields; the latter is limited to the region of the North Black Forest and is projected to become extinct there.

The bark dweller preferring in general deciduous trees, the exclusively acidophytic *P. saxatilis* is also very frequent on conifers; also *P. glabratula* is often found on conifers. The most frequent species is the ecologically truly plastic *P. sulcata.* On free-standing trees (avenue trees, field trees) one especially encounters *P. acetabulum, P. subargentifera, P. tiliacea, P. exasperata* and *P. exasperatula,* likewise *P. subrudecta, P. elegantula, P. laciniatula, P. subaurifera* and *P. flaventior,* the latter species group however more on acid bark that the former. While *P. flaventior* mainly takes the summer-warm basins and valleys, *P. submontana, P. laciniatula, P. pastillifera, P. glabra* and *P. quercina* which is threatened with extinction favor humid mostly montane sites; commonly these lichens grow on free-standing trees or tree groups, *P. pastillifera* often even in beech- and oak forests. *P. revoluta* is found especially in open oak-(beech) stands or in brook bordered woodlands, and indeed on more or less mild and oceanic sites above all limited to the Black Forest. The at one time widely distributed *P. caperata* is disappearing in many regions of Germany and even in Southwest Germany is becoming regionally rare, in the eighties they were very frequently seen to be injured by air pollution and are now clearly in regression. Even the distribution voids and "thinning out" of the populations in the case of *P. subargentifera, P. exasperata* and – apparently – even in the case of *P. tiliacea* and *P. subrudecta* are on the hole are related to emission burden. *P. revoluta* is found remarkably often also in alder thickets. The likewise belonging to the group of oceanic lichens *P. reticulata* was in the previous century known from the Heidelberg region and is with certainty extinct. Distinctly oceanic high precipitation, very humid, cool sites e.g. in beech-spruce-forests are *P. laevigata* and *P. sinuosa*; the later is probably extinct in Baden-Württemberg, but still occurring in the Allgäu, the former is immediately threatened with extinction or has already disappeared. *P. olivacea* and *P. septentrionalis* live in late frost threatened cold moors, basins and boulder fields, where they dwell especially on birch branches. Even they are to a high degree threatened.

Of interest to plant geographers in our region are the arctic-alpine, the subatlantic and the southern distributed species. One arctic-boreal area with scattered and isolated, shows toward the South to always sparsely occurring in Central Europe *P. incurva*; found in southern Central Europe in the Bohemian Forest, in the Fichtel mountain, in the Voges and very rarely in the Black Forest and in the Alps. Boreal, in addition to the southern Central Europe culminating species are also *P. olivacea* and *P. septentrionalis*. In North Europe and in the central and high mountains of the deciduous tree region as well as the high mountains of the Mediterranean region are distributed *P. stygia* and *P. omphalodes. P. disjuncta, P. exasperata* and *P. subaurifera* belong to the boreal-montane element.

The oceanic lichens *P. laevigata* and *P. sinuosa* are limited to West Europe, the oceanic sites of the alpine mountains and the central European Central Mountains. They reach Scandinavia on the outermost Southwestern Norway. *P. reticulata* in addition up to the British Isles and into western Germany the north boundary. The area of *P. submontana, P. caperata, P. subrudecta, P. revoluta, P. elegantula, P. laciniatula, P. tiliacea, P. acetabulum, P. verruculifera* and *P. mougeotii* stretches over the summer-green deciduous tree zone and part of the Mediterranean region; their north boundary passes through southern

Fennoscandia and corresponding somewhat to the area boundary of the pedunculate oak. Most of them have a western tendency and are extensively rare or lacking in East Europe, like *P. mougeotii* and *P. revoluta*. Toward the North somewhat above the boundary of oaks, *P. loxodes* is distributed out in front. *P. flaventior* is limited to Central Europe; it avoids the West European and is lacking e.g. (also) in the British Isles. The area of *P. glabra* stretches over the mountain lands of South Europe up to the alpine foothills; the northernmost collection location lies in Southwest Germany. *P. quercina* reaches even into the South of the British Isles.

The area of *P. saxatilis, P. sulcata, P. glabratula, P. exasperatula* and *P. conspersa* takes in the greater part of Europe; finally in the northern boreal zone *P. pulla, P. somloensis* and *P. subargentifera* are extensively lacking.

Genus Characteristics and Determination of Parmelia s.l.

Thallus foliose, loosely growing to closely attached, usually deeply divided, gray-white to gray, yellowish to pale yellowish-green, gray-green, light brown to black-brown, nonpruinose to pruinose, often with isidia or soralia, undersides light to black, with sparse to very numerous, simple, forked or brush-like rhizines. Both sides corticate, the cortex paraplecten-chymatous, often with pseudocyphellae, or plectenchymatous or anticlinal hyphae and with overlying epicortex with microscopic fine pores. Photobionts *Trebouxia*-like. Ap. surface standing, sessile, red-brown, brown, brown-black, flat to concave, with thalloid margin. Esc. thin, colorless. Hyp. colorless. Hym. I+ blue. Epihym. usually yellow- to red-brown. Paraph. simple to isolated branching. Asci *Lecanora*-type. sp. one-celled, ellipsoidal to spherical. Pycnosp. bacillar, hook-form, bifusiform . Ch: Gray to gray-white species with Atranorin in the cortex, yellowish-green species with Usnic acid, chemistry of the medulla very variable. An oversight of the "modern" genus division is given by ELIX (1993).

Determination hint: The specification of the color of the underside is not valid for the young parts of the margin, which is often lighter than the remaining region; in the case of the black underside the margin parts are often brown.

Oversight of the Key Parts

1 Thallus light brown to black- brown, red-brown, olive brown **PT 1 (Melanelia and Neofuscelia)**
1* Thallus not brown . **PT 2**

PT 1: Brown Species

1 Thallus of numerous very small, short, -1.5(2) mm wide, close standing, (± shingle-like) lobules growing over one another, brown, olive-brown, red- brown, dark brown. Marginal lobes usually enlarged. Medulla K-, C-, KC-. Ap. rather rare .**2**
1* Thallus not of very small, lobules growing over one another **4**
2 Medulla P+ red or orange, K- or K+ orange, cortex K± yellow. Thallus gray-brown to brown, with fine, streak-form whitish pseudocyphellae. Underside black, with numerous rhizines. On silicate rock **P. omphalodes s.l. (PT 2/13***
2* Medulla and cortex R-. Thallus without whitish pseudocyphellae . **3**
3 On silicate rock. Lobules flat to slightly convex, -1 mm wide, often arranged into rather thick almost cushion-like, with age areolate, undersides light brown to dark. Perlatolic acid, Stenosporic acid . **P. panniformis**
3* Almost exclusively on bark. Lobules ± flat, incised, -1.5 mm wide, shiny, undersides light brown. Ch- **P. laciniatula**
4 Thallus without isidia and soralia. Often with ap. Medulla P- or P+ yellow to orange-red . **5**
4* Thallus with isidia, isidia aggregated and/or soralia. Medulla P- **13**
5 On silicate rock **6**
5* On bark **10**
6 Thallus lobes convex at the margins and somewhat up-curved, above ± flat, -2 mm wide, (dark)brown to brown-black, ± shiny, cartilaginous robust, often noticeably linear (band-like), but repeatedly branching, often growing through one another, at times curved inward. Upper surface with blackish dots (Pycn.) and with small indefinite dot-like pseudocyphellae. Ap. -3(6) mm. ± flat, margin crenate. Medulla K-/K+ orange, P-/P+ orange-red, C-. Ch- or Fumarprotocetraric acid, ± protocetraric acid **P. stygia**
6* Thallus lobes ± flat, not turned up at the margins . **7**
7 Thallus lobes linear, ca. 1(1.5) mm wide, on both sides margins turned up (weakly furrowed) and covered with projecting warts (Pycn.), dark brown to brown-black. Medulla K+ yellow(-red), P+ yellow, C-. Stictic acid, Norstictic acid . ↑ **Cetraria hepatizon**
7* Thallus lobes not furrowed and covered with such pycn. warts . **8**

8 Thallus with whitish, streak-form (often reticulate) pseudocyphellae, brown-gray to brown-black, not yellowish-brown or red- brown. Medulla P+ orange or red, K+ yellow, then red or K-. With Atranorin etc **P. omphalodes (PT 2/13*)**

8* Thallus without pseudocyphellae, smooth to somewhat rugose-pitted, usually shiny, above all with age diagonally wrinkled and cracked, brown, yellow-, red- to dark brown, underside black, usually growing rosetted. Lobes usually 2-3 mm wide, rather decumbent, coalescing. Medulla P-, K-, C-/C+ rose. Ap. margin smooth. Ap. frequent. ± Gyrophoric acid (*P. pulla* s.l.) . **9**

9 Medulla KC+ red of KC-, with Divaricatic acid or Stenophoric acid *, thallus often relatively dark colored . **P. pulla** var. **pulla**

9* Medulla KC+ red or red-orange, with Glomelliferic acid, Glomellic acid, Perlatolic acid *. Thallus usually yellow-brown, lighter brown, often definitely flecked **P. pulla** var. **delisei**

10 Medulla C+ carmine red/KC+ red, K-, P-. Large lobed, robust species with mostly erect, -5(7) mm wide marginal lobes, similar to *P. acetabulum*, but dark brown, covered with many, very fine cilia (hand lens) on the young lobes and the ap. margin. Lecanoric acid **P. glabra**

10* Medulla C-/KC-, K- (if K+ red, see *P. acetabulum*). Without light cilia on young lobes and ap. margin . **11**

11 Thallus with rather regularly branched, lower, ± conical, moderate to rather close standing, on the tips deep or bored through, -0.1 mm wide warts, which arise even on the ap. margin (thereby warty), red-brown, olive-brown, (dark)brown. Lobes -3(4) mm. Ch- **P. exasperata**

11* Thallus completely without warts. Almost only on birch, or willow. With Furmarproto-cetraric acid, medulla P+ orange-red (when P-, thallus not flat, but almost cushion-like see *Cetraria sepicola*). Olive brown to dark brown, underside dark brown to black **12**

12 Thallus ± smooth, shiny, usually without pseudocyphellae, thickly covered almost to the margin with ap. Ap. margin scarcely crenate, often disappearing. Sp. 12-15 x 6-7 µm **P. septentrionalis**

12* Thallus dull to slightly shiny, upper side ± uneven, lobe ends with pseudocyphellae. Ap. usually not close standing, with crenate margin, sp. 12-15 x 7-9 µm **P. olivacea**

13 Medulla or abraded sites C- **14**

13* Medulla or abraded sites C+ rose-red or carmine red . **20**

14 Thallus on silicate rock. With soralia or large pustule-like to elongated isidia, standing together in clusters. Underside brown-black to black. With lichen substances. Medulla K-, P-, UV+ white . **15**

14* Thallus on bark and wood, only exceptionally on rock (usually under trees). Thallus purely isidiate. Isidia ± uniformly distributed, not in clusters, clavate, spatulate or cylindric. Ch- **18**

15 Thallus with large, pustule-like to elongated isidia in clusters, usually rather large, often over 4 cm, in the center commonly (cross-) furrowed to cross-cracked. Lobes as a rule 1.5-3 mm wide, yellow-brown, light- to dark- brown. Medulla KC+ red or KC- . **16**

15* Thallus with warty, basally often somewhat narrowed outgrowths, which develop into granular to isidiate, dark or whitish, capitate raised soralia. Lobes usually up to 1(1.5) mm wide, convex to (above all at the ends) flat, dark olive-brown, dark- to black-brown, not cross furrowed. Medulla KC-, rarely KC+ red. With Perlatolic acid, Stenosporic acid . **17**

16 Thallus middle-, olive- to yellow-brown, rarely dark brown (then lighter at the margin), robust. Lobes 150-340 µm thick, 1-3(5) mm wide. Isidia 0.1-0.5 mm thick, rather soft and hollow, in large groups. Medulla C- or C+ slowly yellow, KC+ red to red-orange. Glomelliferic, Glomellic acid, Perlatolic acid, ± Gyrophoric acid **P. loxodes**

16* Thallus usually (red- to) dark brown. Lobes usually about 100-150, max. -180 µm thick, 1-2(3) mm wide. Isidia 0.1-0.2 mm wide, stiff to rather soft, rarely hollow. Medulla C+/KC+ rose(red) or C-/KC-. Divaricatic acid, ±Gyrophoric acid, rarely Stenosporic acid **P. verruculifera**

17 Lobes commonly rather dull. Soralia arising on the ends of the main lobes or smaller, often erect side lobes (because of disintegration of the cortex), ± capitate, never coalescing, lobes ± linear, usually not broadened at the ends. Difficult to address, rare species ***P. sorediata**

17* Lobes shiny at the ends and usually somewhat broadened. Soralia arising at the margins and on the surface of the lobes, often basally narrowed sitting up, ± capitate, sometimes flattened above to crater-form. Often with indefinite pseudocyphellae on the lobe margins. ±Gyrophoric acid * **P. disjuncta**

18 Thallus with lower, conical, wartlets hollowed out at the tips, commonly with ap, ap. margin strongly warty. Underside of the center blackish, marginally often rather light . **P. exasperata**

18* Thallus with elongated, cylindrical to spatulate isidia. Underside commonly brown tinged whitish to light brown. Ap. commonly lacking .**19**

19 Isidia thickened, clavate thickened toward the top and flattened, strongly glossy, standing inclined to erect, interior usually hollow, usually 140-250 µm thick (p. 22). Thallus shiny, lobes often turned up at the margin, brown, red-brown, olive brown. Ap. margin not isidiate **P. exasperatula**

19* Isidia cylindric, very close standing and often branched in the center of the thallus, -1 mm high and 50-140(180) µm thick, not hollow (p. 22). Thallus usually for the most part dull, close lying, brown, olive brown. Ap. margin not isidiate .
P. elegantula

20 Thallus above all pruinose toward the margin and covered with very fine cilia (strong handlens), erupting sorediate on the surface and on the upturned margins, without isidia, light- to middle brown, yellow-brown, red-brown, rarely dark brown, mostly dull, in the center usually wrinkled. Underside dark brown to black. Medulla and soralia C+ carmine red, KC+ red, K-, P-, UV-. Lobes -3 mm wide. Lecanoric acid. Usually on bark/bark mosses
P. subargentifera

20* Thallus not or only inconspicuously pruinose, with fine cilia. Medulla P- **21**

21 Commonly on bark, very rarely on rock. Thallus with slender cylindrical isidia or fleck-form soralia. Medulla C+ carmine red/KC+ red. With Lecanoric acid **22**

21* On silicate rock. Thallus only with isidia, large isidia groups or soralia . **23**

22 Isidia thin cylindric, usually 0.07-0.12 mm thick, often branched, ± regularly ordered. thallus olive, olive-brown, fresh often greenish (shade collections) and isidia usually very delicate and relatively looser (var. *glabratula*) or brown, dark brown, then isidia mostly thick standing, from that the thallus center very dark (black-brown), like velvet (var. *fuliginosa*), underside (with exception of the margin) black. Medulla K- or K+ violet. Usually 2-4 cm. ±Rhodophyscin
* **P. glabratula**

22* Thallus with soralia or delicate isidia or usually both, olive, olive brown, brown, reddish-brown, usually wrinkled in the center. Isidia very delicate -0.25 µm long, 0.02-0.06 mm wide, rarely branching, leaving behind yellow spots after abrasion of the soredia. Soralia punctiform, arising on the surface, in the center occasionally coalescing, white to yellowish. Underside brown to black. Medulla K-. ±Subariferin
* **P. subaurifera**

23 Isidia thin, cylindric, usually 0.07-0.12 mm thick, often branching, ± uniformly distributed (not agglomerated). Thallus usually 2-4 cm wide, olive, olive-brown, moist often greenish (shade collections) and isidia usually very delicate and relatively loose (var. *glabratula*) or brown, dark brown, then isidia usually close standing, from that the thallus center very dark (black-brown), like velvet (var. *fuliginosa*). Medulla K- or K+ violet, C+ carmine red, KC+ red. Lecanoric acid, ±Rhodophyscin . **P. glabratula**

23* With soralia or clearly larger isidia (groups) or warty isidiate outgrowths. Not with Lecanoric acid, Medulla K-, UV+ white **24**

24 Arctic-alpine lichen above the tree line. Lopes with clearly light to dark pseudocyphellae on the surface, 1-3 mm wide, with punctiform to capitate, granular to isidiate, lighter to dark brown soralia, olive- brown, brown, red-brown, dark brown. Reminiscent of *P. disjuncta*, but always C+ rose and with pseudocyphellae on the surface, never with blackish soralia. gyrophoric acid + unknown substances – arct-alp – Alps
P. tominii Oxner
(*P. substygia* Räsänen)

24* Widely distributed. Lobes without pseudocyphellae or pseudocyphellae indefinite and only in the margin region. Medulla UV+ white. With Perlatolic acid or Divaricatic acid: Chemical race with Gyrophoric acid **25**

25 Lobes 0.5-1(1.5) mm wide, convex to (above all on the ends) flattened, brown, dark olive-brown, dark to black brown, commonly not cross furrowed, shiny on the ends and usually somewhat broadened. Soralia arising on the margins and on the surface of the lobes, often basally narrowed sitting up, ± capitate, sometimes flattened above to crater-form, blackish to light, often isidiate. Often with indefinite pseudocyphellae on the lobe margins. Perlatolic acid, Stenosporic acid . **P. disjuncta**

25* Lobes 1-3 mm wide, commonly furrowed to cracked toward the lobe center, usually dark brown. Isidia pustulate to elongated, not uniformly distributed, but agglomerated, 0.1-0.2 mm wide, delicate to very soft. Thallus usually rather large, often over 4 cm. Medulla K-, C+/KC+ rode(red). Divaricatic acid
P. verruculifera
(The medulla of related, usually yellow- to middle brown *P. loxodes* very rarely reacts C+ rose-red (Gyrophoric acid), see alternative 16)

PT 2: Not-Brown Species

1 Thallus with greenish to yellowish color tones (*Usnea*-green) or dusty olive-green, bluish-green. Without Atranorin (excepting the arctic *P. centrifuga* and rarely *Parmeliopsis ambigua*) **2**

1* Thallus ± gray to whitish. Cortex K+ yellow (to sometimes reddish). With Atranorin . **12**

2 Thallus dusty green, dark gray-green, bluish green, verdigris, brown-green, dark olive, moist ± green, on bark . **3**

2* Thallus yellow-green, yellowish, pale gray-green (*Usnea*-green). Usnic acid . **4**

3 Thallus delicate, thin, finely isidiate, olive-green to brown-olive. Ap. usually flat, usually lacking. Medulla C+ carmine red, K- or K+ violet, P-
P. glabratula (PT 1/23)

3* Thallus robust, broad lobed, usually 5-15 cm, without isidia, olive-green, dark green, dusty gray-green, verdigris, often pruinose, sometimes

almost bluish. Lobes -1.5 cm wide, ends up turned, broadly rounded. Underside light brown. Ap bowl form, large, up to over 1 cm. Medulla K+ red, C-, P+ orange. Norstictic acid . . **P. acetabulum**

4 Thallus without isidia and soralia, on silicate rock and poor soils . **5**

4* Thallus with isidia or soralia, on bark, rock, or mosses . **6**

5 Arctic-boreal lichens on cold sites of the Bohemian Forest, and the Harz. Thallus rosetted, closely attached, often dying in the interior, with age producing concentric rings, with narrow, 1-2 mm wide lobes, whitish yellow to yellow-green, dull, rugose. Medulla P-, K-, C-, KC+ red. Alectoronic acid, Atranorin, Usnic acid. On silicate rock, arct-bor (-mieur-alp) .**P. centrifuga** (L.) Ach.

5* Widespread. Thallus ± extensive, usually not rosetted, not dying in the interior, often light green-yellow to yellowish gray-green, lobes flat, robust, usually shiny, often irregularly growing over one another, narrow to broad, upper sides often partially with black dots (Pycn.), undersides black to brown. Ap. often lacking. Medulla P+ orange, K+ soon red, C-, KC-. Very variable. Be cautious to separate from younger *P. conspersa*. Salazinic acid, ±Lobaric acid, Usnic acid. (When medulla P+ orange-red, K- to brownish, Fumarproto-cetraric acid; Usnic acid.: **P. protomatrae** Gyelnik, e.g. Vog) **P. somloensis**

6 Thallus with cylindric, often branched isidia (sometimes sparse), light green-yellow to yellowish gray green, ± rosetted. Ap. frequent, -1 cm, (dark)brown. Underside usually blackish. Lobes usually 0.5-3 mm wide, often broader on the ends. Medulla K+ yellow (orange), P+ orange, C-. Stictic acid, ±Norstictic acid, Usnic acid. On silicate rock **P. conspersa** (when isidia not elongate, but warty to ± egg-form, medulla K+ red, Salazinic acid, Norstictic acid, Usnic acid **P. tinctina** Maheu & Gillet, e.g. MRh)

6* Thallus with lighter soralia, almost always sterile **7**

7 With whitish hemispherical soralia on the lobe ends. Lobes ± linear, -2(3) mm wide, loosely forked branching (with conspicuously rounded axils), smooth, ± shiny, whitish gray-green to gray-yellow, undersides black. Rhizines (repeatedly) forked branching, often somewhat protruding at the margin. Cortex K+ yellow, medulla/soralia K+ yellow, then red. Salazinic acid, Usnic acid, (Norstictic acid). On bark **P. sinuosa**

7* Soralia not limited to lobe ends, always on the surface protruding. Medulla K- to K+ yellow (orange). Rhizines simple. Thallus often rosetted . **8**

8 Thallus large and broad lobed (lobes usually 3-10 mm wide, coalescing with one another or overlapping), ± rugose, undersides black, with rhizine-free brown marginal zone, with soralia on the lobe margin and/or on the upper surface. Medulla K- **9**

8* Thallus narrow lobed (lobes -1(2) mm wide), scarcely over 4 cm, undersides with rhizines up to the edge. Medulla K-, K+ yellow (orange) . **10**

9 Medulla/soralia C+ carmine red, KC+ red, P-. Thallus reticulate pitted unevenly to rugose, with fleck- to streak-form (to reticulate bound) whitish pseudocyphellae above all on the rugose ridges. On the upper surface and (above all in the center) on the margins with fleck soralia, on the margins sometimes coalescing into border soralia. Lecanoric acid, Usnic acid . **P. flaventior**

9* Medulla/soralia C-, KC± red, P+ orange red. Thallus wrinkled rugose toward the center, with or without indefinite pseudocyphellae. Upper surface with punctiform, soon irregularly coalescing granular soralia. Protocetraric acid, Caperatic acid, Usnic acid . **P. caperata** (the similar south and west European *P. soredians* Nyl. reacts K+ red in the medulla)

10 Thallus closely appressed to the substrate, ± flat, with fleck soralia coalescing in the center (flat to moderately convex, -1(1.2) mm wide), medulla R-. Underside brown-black. Lobes 0.5-1(1.3) mm wide. Usually on bark and wood, rarely on shaded rock. Divaricatic acid, Usnic acid, rarely Atranorin ↑ **Parmeliopsis ambigua**

10* Thallus with other characteristics, on rock, medulla either KC+ red or P+ orange . **11**

11 Lobes convex to almost stem-like, usually 03-0.6 mm wide, even flattened on the ends and often ± curved upward, ± tuberculate, dull, with hemispherical to almost spherical projecting, usually over 1 mm soralia ± in the center of the thallus (on short lateral lobes). Underside brown. Medulla/soralia K-, KC+ red, C-, P- or P+ rust-red. Alectoronic acid, ±Protocetraric acid, ±α-Collatolic acid, Usnic acid **P. incurva**

11* Lobes ± flat, pressed to the rock, thin, usually 0.3-0.8 mm wide, radially ordered or growing through one another, with small fleck-form, flat to convex, not strongly projecting soralia. Underside black. Medulla/soralia K+ yellow (orange), KC-, C-, P+ orange, UV-. Thallus small, -2 cm wide. Stictic acid, Usnic acid **P. mougeotii**

12 Without isidia and soralia . **13**

12* With isidia or soralia . **16**

13 On bark. Medulla C+ carmine red, KC+ red, P-, K-. Thallus white to gray-white, smooth, without pseudocyphellae with flat lobes, rosetted, underside black, almost always with ap. Atranorin, Lecanoric acid . **15**

13* On silicate rock. Medulla C-, P+ orange or red. Thallus gray, brown-gray, brown-gray, even (on open habitats) brown to brown-black or blue-gray pruinose, with whitish, streak-form to reticulate bound pseudocyphellae, otherwise smooth, somewhat shiny. Lobes flat to concave. Ap. rare: **P. omphalodes** . **14**

14 Medulla K-. Lobe width relatively narrow, often convex, pseudocyphellae reticulations often relatively indefinite. Thallus usually brown. Atranorin, Protocetraric acid, Lobaric acid, ±Protolichesterinic acid, other accessory substances **ssp. discordans**

14* Medulla K+ red. Lobes narrow to wide, usually concave, pseudocyphellae well developed over the entire upper surface and on the margin, sometimes thallus even divided into small shingle like, ascending lobules. Atranorin, Salazinic acid, ±Lobaric acid, ±Protolichesterinic acid and accessory substances . **ssp. omphalodes**

15 Ap. underside margin usually with rhizines. Thallus relatively loosely attached. Axils of the branches not conspicuously round cut out. . * **P. quercina** var. **carporrhizans**

15* Ap. underside margin usually without rhizines. Thallus relatively closely attached. Axils not conspicuously round cut out * **P. quercina** var. **quercina**

16 With isidia. Ap. rather rare **17**

16* With soralia. Ap. very rare (in the case of *P. sulcata* rare) **22**

17 Thallus lobes at the margin and between/upon the isidia wit black setaceous cilia, broad (1.2 cm), above all in the interior of the thallus often with ascending, wavy-crinkled margins, isidia cylindric, on the surface and on the margins, often heaped. Undersides black, marginal zone brown, rhizine-free, curved upward. Medulla K+/P+ yellow-orange, C-. Atranorin, Stictic acid derivatives . **Parmotrema crinitum**

17* Thallus lobes and isidia without black cilia **18**

18 Thallus lobes undersides with only sparse rhizines, undersides brown to black, in the case of many forms even (partially) white, broad, on the ends and margins ± strongly ascending, often only attached at the base and ± fruticose, on the margins coraloid-isidiate and often curly, upper sides gray, bluish-gray, moist greenish, usually 0.5-1.3 cm wide. Medulla R-. Atranorin, Caperatic acid **Platismatia glauca**

18* Thallus lobes undersides up to the margin with numerous rhizines, black, brown at the margin. Medulla K+ red or C+ red . **19**

19 Upper side with ± delicate, whitish, streak- form to reticulate bound, slightly raised pseudocyphellae, thereby slightly pitted, gray, occasionally with brownish or bluish tint. Medulla C-, K+ yellow, then red, P+ orange. Isidia cylindric to coralloid or egg-form, scattered to closely crowded. Lobes often ascending at the margins. Atranorin, Salazinic acid **20**

19* Upper side smooth, without whitish pseudocyphellae, margin white to gray white, in the center darker because of thick standing gray to black isidia. Medulla C+ carmine red, K-, P-. Large, rosette growing species with ± flat lobe margins. Usually on bark, also on rock. Atranorin, Lecanoric acid . **21**

20 Thallus lobes not conspicuously elongated. Thallus often ± rosetted, with numerous cylindric isidia, above all in the thallus center. ±Lobaric acid. *, rarely Norstictic acid, Lichesterinic acid . **P. saxatilis**

20* Thallus with conspicuously elongated, often ± distorted, loosely appressed to ascending band-form lobes, not rosetted, truly similar to *P. sulcata*. Isidia short, ± egg-form, partially thick cushion-like, often erupting sorediate. Besides with punctiform soralia. Salazinic acid, ± Norstictic acid * **P. submontana**

21 Isidia black (to dark brown), at least partially broadened above ( ), knob-like flattened or cup-like deepened, in the case of breaking off very small pit-like scars are left behind. Lobes usually closely appressed, often slightly shiny. * **P. pastillifera**

21* Isidia gray to dark brown, brown sometimes blackish, on the tip not flat or pitted, in the case of breaking off as a rule no pit is left behind. Lobes dull, less closely appressed than in the case of *P. pastillifera.* * **P. tiliacea**

22 Thallus underside with rhizines up to the margin . **23**

22* Thallus underside with a ± broad rhizine-free zone at the margin. Thallus with broad, rounded, ascending lobes . **31**

23 Thallus without typical pseudocyphellae, white-gray to blue-gray . **24**

23* Thallus with whitish, point- or streak-form pseudocyphellae on the upper surface . **27**

24 Medulla R- (occasionally K+ slightly yellowish as a result of a fleeting cortex reaction). Thallus broad lobed, soon strongly ascending at the ends and margins, gray, underside brown at the margin, otherwise black, in many forms white, isidiate or sorediate bordered on the margins, often curled, very variable. Rhizines sparse **Platismatia glauca (18)**

24* Medulla C+ red or orange, K-, P-. Atranorin. Rare oceanic lichens . **25**

25 Soralia hemispherical, on the lobe ends. Lobes linear band-like, -3(5) mm. Axils between the branches conspicuously round. Medulla/soralia C+ orange, K-, P-. Barbatic/Obtusatic acid derivatives * **P. laevigata**

25* Soralia on the upper surface, usually near, rarely on the ends, irregularly erupting, soredia large, at times erupting into smaller pustules. Lobes gray, often enrolled at the ends, with mostly narrow

sinus-like axils, 2-5(7) mm broad. Rarely with single-celled marginal cilia. Medulla C+ rose-red. Gyrophoric acid. (When often even in-rolled longitudinally on the long axis, without typical soralia, but upper cortex in places exfoliating, rhizines richly dichotomously branching, Lecanoric acid and Evernic acid *: **P. taylorensis** Mitch., North Alps **26**

26 Soralia pale greenish, gray to brownish. Lobes ± dull (often shiny on the ends) . **P. revoluta** var. **revoluta**

26* Soralia becoming blackish. Lobes ± shiny, narrow, up to usually 2 mm, rock dwelling, very tightly attached to the substrate, soralia bearing segments ascending. Axils more rounded than in the case of var. *revoluta* . **P. revoluta** var. **britannica**

27 Upper side with streak form or delicately reticulate pseudocyphellae. Medulla K+ yellow, then red-orange to red, P+ orange, C-. Atranorin, Salazinic acid . **28**

27* Upper side with punctiform pseudo-cyphellae, which erupt into rounded soralia. Medulla K-, P-, C+ red. Atranorin **30**

28 "Pseudocyphellae" very delicately reticulate and narrow, only visible under the handlens. Lobes very broad (0.5-1.5cm), with half-capitate soralia on the margins, which may coalesce into border-like soralia, sparsely covered with black cilia. Dying out in Central Europe. * **P. reticulata**

28* Pseudocyphellae reticulations larger, without half-capitate soralia. Lobes usually 2-5(8) mm wide **29**

29 Thallus with elongated, often in-rolled, very loosely attached to ± up turned lobes, with punctiform soralia and ovoid, often cushion-like crowded sorediate isidia * **P. submontana (20)**

29* Thallus erupting into streak from soralia on the pseudocyphellae and often on the lobe margins, soralia mealy, not isidiate. Lobes often elongated, but scarcely in-rolled. * . **P. sulcata**

30 Thallus underside almost whitish, light to middle brown, rarely blackish, often shiny, upper side white-gray to light bluish-gray, occasionally slightly brownish overlay. Lobes marginally usually erect, with fleck- form soralia on the upper surface and occasionally with border soralia at the margin, -5(8) mm wide, overlapping one another. Medulla C+ carmine red. Lecanoric acid. * **P. subrudecta**

30* As the previous, yet underside blackish. Medulla C+ rose-red. Gyrophoric acid. * **P. borreri** (SM.) Turner

31 Upper side without pseudocyphellae. Thallus with semi-capitate soralia which may coalesce into border soralia, margin with scattered, very long black cilia, medulla C-. Atranorin **33**

31* Upper side with fine punctiform pseudocyphellae. Lobes with border soralia, without black cilia, medulla K-, P-, UV+ white. Atranorin. **Cetrelia olivetorum** s.l . **32**

32 Medulla C-, KC-/+ rose, P-. Perlatolic acid, Imbricaric acid. * **C. cetrarioides**

32! Medulla C/KC+ red. Olivetoric acid. *.**C. olivetorum**

32* Medulla C-, KC+ rose. α-Collatolic acid, Alectoronic acid. * **C. chicitae**

33 Medulla K+ yellow, then orange to red, P+/KC+ orange, UV-. Soralia usually coalescing. Salazinic acid. * **Parmotrema stuppeum**

33! Medulla K+ yellow, P+ orange, KC+ yellow-orange, UV-. Soralia usually not coalescing into border soralia, but usually ± capitate. Stictic acid, et al . ***Parmotrema chinense**

33* Medulla K-, P-, KC+ rose-red, UV+ (blue)white. Alectoronic acid, α-Collatolic acid. ***Parmotrema arnoldii**

Ecology and Distribution or the Species

(**Arctoparmelia** Hale)

Parmelia incurva (Pers.) Fr. (Arctoparmelia i. (Pers.) Hale)
In high montane (rarely in rugged montane) sites) thallus on lime-free, usually hard acid silicate stone, concentrated in cool to cold gypsum sites, on r.m.wind exposed, moderately long time snow covered rocks and in boulder fields, r.acidoph., strongly ombroph., r.photoph., a-(m.)nitroph., above all in Rhizocarpion alp. – bor(-mieur) – v.rare (1); Vog, nöSch, Fi, Erz, BayW, Rothaargeb., *WeBgl*, Hz

(**Flavoparmelia** Hale)

Parmelia caperata (L.) Ach. (Flavoparmelia c. (L.) Hale)
Up into montane sites on deciduous-, rarely conifer-trees, especially in open forests (above all oak-hornbeam forests), on forest margins and free-standing trees, preferable oak, ash, hornbeam, linden, additionally on fruit trees (above all apple), avoiding strongly eutrophied (avenue-)trees and cold sites, m.-r.acidoph., r.photoph., a-(m.)nitroph., e.g. in the Parmelietum rev., sensitive to acid and eutrophying air pollution as well as pesticides, often with damaged thalli or dying, in recent times regionally recovering – mieur(subatl)-med

– m.frequent (3) (SW-Germany); regionally becoming rare (north of the Mains) to disappearing

(**Flavopunctelia** (Krog) Hale)

Parmelia flaventior Stirton (P. kerstockii (Lynge) Zahlbr., P. andreana Müll.Arg., Flavopunctelia f. (Stirton) Hale)
In the foothills and submontane zone, rarely higher, especially in summer-warm, low precipitation to moderate precipitation regions, on stems of deciduous-, rarely conifer trees on well lighted habitats (avenues, housing estates), not in the interior of forests, usually on m.base- and m.-r.nutrient-rich substrates, more toxitolerant than *P. caperata*, in recent years clearly with a tendency to increase, (M.-)r.acidoph., mesoph.-r.xeroph., r.-v.photoph., in the Parmelietum cap., Pseudevernietum – centr – r.rare; Ne scattered, Hü, Mn, Rh, Bo, Ju, Do, Sch (low sites), otherwise rare (Mos) to lacking

(**Hypotrachyna** (Vainio) Hale

Parmelia laevigata (Sm.) Ach. (Hypotrachyna l. (Sm.) Hale)
In montane and high montane, very high precipitation sites, similar to *Parmotrema arnoldii* (↑), on v.oceanic sites, in West Europe on lower sites – mieur-atl/paralp-smed-mo, oz – v.rare (1); süSch (Feldberg), *Vog*, nöPf

Parmelia revoluta Flörke (Hypotrachyna r. (Flörke) Hale)
Foothills to montane, high precipitation winter-mild sites on deciduous-, very rarely conifer trees, especially oak, alder, ash, in open forests and brook bordered tree stands, above in hornbeam-oak-beach forests, beech (-spruce)-forest, alder-ash-stands, even on silicate rock, m.-r.acidoph., m.-r.photoph., a-(m.)nitroph., Char. Parmelietum rev., additionally in the Pertusarietum hem. (var. **Britannica** (Hawksw. & James) V.Wirth on silicate on usually somewhat substrate moistened, m.nutrient rich sites, süSch, Vog) – mieur-subatl-med – rare (3); above all west exposure of Sch, Vog, SJu, additionally Pf, Eif, O, Sp, *MRh-Ts*, Rh-Mn-T, SFW, Ne, Bo, Do, Av, Al, *Ml*

Parmelia sinuosa (Sm.) Ach. (Hypotrachyna s (Sm.) Hale
In montane and high montane, rather to very high precipitation, humid, cool-oceanic sites, on sites with frequent fog production, even occasionally cold air sites, especially in valleys nest to brooks, above all (dying) branches of spruce and fir, r.(-v.)acidoph., m.-r.photoph., v.-e.hygroph., v.ombroph., psychronph., anitroph., e.g. in the Usneion, Lobarion, very threatened species – mieur(-atl/paralp)-smed-mo – v.rare (0); *süSch (region Schramberg-Dunningen), Do (Wurzach)*, Al*(+++)*, Vog *(+++)*

(**Melanelia** Essl.)

Parmelia disjuncta Erichsen (Melanelia d. (Erichsen) Essl.)
In submontane and montane, rarely high montane sites on lime-free silicate rock on (usually steep) slop- and on rain exposed vertical surfaces, on r.-v.well lighted, often relatively warm habitats, r.acidoph., r.-m.ombroph., above all in the Umbilicarion hirs. – (arct-)bor-mieur(-smed) – r.rare; süSch, Vog, otherwise rare: nöSch, O, Pf, Eif, Erz, BayW

Parmelia elegantula (Zahlbr.) Szat. (Melanelia e. (Zahlbr.) Essl.)
Up into the montane zone on the bark (stem) of deciduous trees, almost always on free-standing trees (Streets, Parks), usually on maple, ash, linden, often in fruit orchards, in the last 10 years increasing in lower sites, often in suburban areas, a foliose lichen relatively resistant to air pollution, m.-r.acidoph., m.(-r) nitroph. – Char. Parmelietum eleg. – mieur-med – r.rare, throughout the entire region

Parmelia exasperata De Not. (Melanelia e. (De. Not.) Essl., P. aspidota (Ach.) Poetsch, P. aspera Massal.)
Similar to *Physcia aipolia* (↑), yet more strongly concentrated on branches, evidently very sensitive to eutrophication and acid air pollution, above all in the Parmelietum ac., Lecanorion subf. – bor-med, (subko) – rare (2); above all süSch, Vog, additionally e.g. Eif, Ju, Ne, Al, otherwise becoming very rare (e.g. Th) or today ± lacking

Parmelia exasperatula Nyl. (Melanelia e. (Nyl.) Essl.)
up into high montane sites, r.euryöke lichen, on deciduous- and (then mostly on twigs) conifer-

trees, above all on free standing trees on streets and around settlements, frequent on apple trees in orchards, on moderately nutrient-rich substrates, tolerating moderate to rather strong eutrophication. (subneutroph.)m.-r.acidoph., r.-v.photoph., sociologically widely comprehensive, in the Xanthorion par., Pseudevernietum – bor-med – m.-r.frequent

Parmelia glabra (Schaerer) Nyl. (Melanelia g. (Schaerer) Essl.)
In montane and high montane, high precipitation, oceanic, mild to cool sites on well lighted habitats on the bark of free-standing deciduous trees and in open near natural forests (here often in tree crowns), especially on relatively mineral rich, but not or only moderately eutrophied bark, above all ash, maple, subneutroph.-m.acidoph., above all in the Parmelietum ac., with *Ramalina fraxinea, Parmelia tiliacea* – mieur-pralp-med-mo – v.rare, in the region on the NW-boundary of the distribution (2); Ne, Ju, nöSch (each 1x), SJu, Av, Al (scattered)

Parmelia glabratula (Lamy) Nyl. (Melanelia g. (Lamy) Essl., P. laetevirens (Flotow) Resend., P. fuliginosa (Fr.) Nyl.
Up into high montane sites, generally on bark, in addition often on silicate rock and wood, going over to moss, r.euryök, usually on moderately to rather well lighted habitats, on rather rain exposed steep surfaces of rocks, on forest trees and on free-standing trees, on wooden boards, on m.-r.acid, nutrient-poor to moderately nutrient-rich substrates, epiphytic above all in the Hypogymnietea, Graphidetalia, epilithic above all in the Umbilicarion hirsutae – bor-med – frequent

Parmelia laciniatula (Flagey ex Oliv.) Zahlbr. (Melanelia l. (Flagey ex Oliv.) Essl.)
Foothills to montane sites on stems of deciduous-, very rarely conifer-trees, above all ash, maple, preferably on street trees, on rather high precipitation, rather open- and ± nutrient rich habitats (e.g. dust encrusted), above all on maple, horse chestnut, ash, m.acidoph.(-subneutroph.), r.photoph., m.-r.nitroph., often with *P. exasperatula*, Char. Parmelietum eleg. – mieur(subatl)-med-mo – r.rare (3); above all in the West of the region (Vog, Saar, Hu, Pf), rare e.g. Sch, BayW

Parmelia olivacea (L.) Ach. s.str. (Melanelia o. (L.) Essl.)
In montane and high montane, rather high precipitation sites on from time to time very cold, habitats threatened by late frost with later vegetation development, in cold air accumulating basins, in high- and transition moors, in boulder fields, on smooth, acid bark, almost only on twigs of bog birch, r.-v.acidoph., r.-v.photoph., anitroph., in forms of the Pseudevernietum – bor(-mieur-ko) – v.rare (1); süSch (Lenzkirch), Ju (Irndorf)

Parmelia panniformis (Nyl.) Vainio (Melanelia p. (Nyl.) Essl.)
Above all submontane and montane distributed, on lime-free silicate rock, especially on rather rain exposed vertical surfaces on rather well lighted habitat, r.acidoph., r.ombroph., a-/m.nitroph., usually with Pertusarias, e.g. in the Pertusarietum cor., Umbilicarion hirs. – bor-mieur-mo(-smed-mo) – rare; Sch and Vog rather rare, Saar, nöPf, Mos, Ts, Rhön, Th, Erz, BayW

Parmelia septentrionalis (Lynge) Ahti (Melanelia s. (Lynge) Essl.)
Similar to *P. olivacea* (↑); more often however on *Salix aurita* (Lecanorion subf.), (subneutroph.)m.-r.acidoph. – bor(-mieur-mo) – v.rare (1); süSch

Parmelia sorediata (Ach.) Th.Fr. (Melanelia s. (Ach.) Goward & Ahti, P. sorediosa Almb.)
In montane sites on silicate rock, on rain exposed vertical surfaces, often moistened by running water, on m.-r.well lighted habitats, r.acidoph., r.ombroph – bor-mieur-mo – v.rare; ?süSch, ?Eif, Erz

Parmelia stygia (L.) Ach (Melanelia s. (L.) Essl.)
In high montane sites and above (on larger rocks and in boulder fields occasionally lower), on usually acid silicate rock on horizontal- and sloping surfaces, on m.-v. wind exposed, r.-v.well lighted, high precipitation habitats, r.acidoph., a-/m.nitroph., Char. Umbilicarion cyl. – Arct-h'mo/alp – rare (3); süSch, Vog, v.rare also nöSch, Rhön, *Ts*, nöPf (Donnersberg), Th, ThW, additionally Erz, BayW, Hz

Parmelia subargentifera Nyl. (Melanelia s. (Nyl.) Essl., P. verruculifera auct. non Nyl.)
µp into the montane zone on mineral-rich, often through eutrification by dust encrustation, usually cracked bark, even going over to mosses, above all on older street trees (prefers linden, ash,

maple), preferably on the middle stem and at the base, subneutroph.-m.basiph., r.-v.photoph., (a-)m.(r.)nitroph., Char. Physcietum adsc., also Parmelietum ac. – s'bor-mieur(subko)-med – r.rare (3), m.frequent in the lime regions; above all Ju, SJu; in the tree-rich silicate regions as well as in West, North, and East Germany rare/v.rare and strongly regressing

Parmelia subaurifera Nyl. (Melanelia s. (Nyl.) Essl.)
In sub- to high montane sites, rarely lower, on smooth bark above all of deciduous trees on m.-r.well lighted habitats, on free-standing trees, in brook bordered stands, rarely in open forests, e.g. on willow, subneutroph.-m.acidoph., a-(m.)nitroph., Parmelietum rev., Lecanorion subf. – bor-smed – r.rare (3); above all in the mountains, rare in dry-warm regions

(**Neofuscelia** Essl.)

Parmelia loxodes Nyl. (Neofuscelia l. (Nyl.) Essl., P. isidiotyla Nyl.)
Up into the montane zone, above it rarer, on sunny sites, on m.(-r.) eutrophic silicate rock, similar to *P. conspersa* (↑), Char. Aspicilietalia gibb., above Parmelietum soml., Lasallietum, Parmelietum consp. – s'bor-med – (r.)rare; Silicate region (Sch, Eif, Hu, Pf, MRh), otherwise v.rare

Parmelia pulla Ach. (Neofuscelia p. (Ach.) Essl., P. prolixa (Ach.) Carroll)
var. **pulla**
In the foothills and submontane, rarely in montane sites on acid and basic silicate rock on sunny, often wind sheltered habitats, above all on horizontal- and sloping surfaces, preferable on mineral-rich substrate, yet avoiding strongly dunging, also on bricks and processed sandstone, subneutroph.-r.acidoph., m.-r.thermoph., Char. Parmelion consp., above all in the Parmelietum soml. – s'bor-med – r.rare; Vog, Sch, O, Pf, RhSch, ThW, Th, otherwise rare-v.rare
var. **delisei** (Duby) H.Magn. (P. delisei (Duby) Nyl., Neofuscelia d. (Duby) Essl.)
Similar to var. *pulla* (↑), -- mieur-med – rare; e.g. süSch

Parmelia verruculifera Nyl. (Neofuscelia v. (Nyl.) Essl., P. glomellifera (Nyl.) Nyl.)
From the foothills up into the montane zone on silicate rock, similar to *P. loxodes* (↑), but more frequently on processed rock (wall crowns, tombstones etc.) in housing developments, often also on rocks and boulders on warm slopes, usually lacking on bird roosting rocks, m.-r.nitroph., often synanthrop, regionally introduced and naturalized, Char. Parmelion consp., e.g. in the Lecidelletum carp. – mieur-med – r.rare; above all Sch, Vog, Ne, O, Pf, RhSch, He, Th

(**Parmelia** Ach. s.str.)

Parmelia omphalodes (L.) Ach.
ssp. **omphalodes**
In submontane to alpine sites on lime-free silicate rock, predominantly on rain exposed steep surfaces on m.-r.well lighted, wind protected to rather open to the wind habitats, especially in high precipitation regions or cool, humid valleys, preferably on rough rock upper surfaces, occasionally going over to moss or on thin humus layer, m.-v.acidoph., r.-v.ombroph., m.substrathygroph., Char. Parmelietum omph., also in d. Umbilicarietalia cyl. – arct-smed-mo/alp - r.rare; Sch and Vog scattered, additionally (Eif, Hu, MRh, Ts, Rhön, ThW, O, Sp, Al) rare
ssp. **discordans** (Nyl.) Skult
Limited to strongly exposed sites in high montane and alpine sites – rare; Sch

Parmelia saxatilis (L.) Ach.
Usually in sub- to high montane sites, sparse in the foothills zone (here probably increasing), r.euryök, on silicate rock and acid bark (deciduous- and conifer trees) and on mosses, on rain exposed surfaces, avoiding dunging, optimal on high precipitation habitats, r.v.acidoph., m.-r.photoph., r.-v.ombroph., a-/m.nitroph., in many regions, epilithic above all in the Parmelietum omph. and Pseudevernietum – arct-mieur-med-mo – Sch and Vog frequent, otherwise r.rare to rare, in the lower, low precipitation sites above all in the crown region of trees, in places v.rare (Mn, nöRh)

Parmelia submontana Nádv. ex Hale (P. contorta Bory, P. bohemica Nádv.)
In montane and high montane, high precipitation sites on deciduous trees (free standing or in forests), on bark and bark mosses, on the middle of the stem and stem bases, preferably on maple, ash, on r.well lighted, oceanic influenced, mild to cool habitats, m.acidoph., r.-v.hygroph., a-

/m.nitroph., in the Parmelietum ac., in *P. tiliacea*-rich regions, in the Pseudevernietum (Subass. *P. exasperatula*) – mieur-paralp-med-mo, (oc) – rare (3); Sch, Vog, Hu, O, SFW, Ju, Do, Bo, Al, BayW

Parmelia sulcata Taylor
Up into the high montane sites on bark above all of deciduous trees, of rather broad ecological amplitude, high point on rather well lighted, moderately nutrient rich, subneutral to m.(r.) acidic habitats, one of the most frequent and most toxitolerant epiphytic foliose lichen, in the Physcietalia adsc. and the Hypogymnietea – arct-med – frequent-v.frequent

(**Parmelina** Hale)

Parmelia pastillifera (Harm.) Schubert & Klem. (Parmelina p. (Harm.) Hale, P. scortea var. p. Harm.)
In high precipitation, rather oceanic, montane, rarely submontane sites, on bark of deciduous trees, especially beech, oak, ash, in open forests and on free-standing trees, rarely on mineral- rich silicate rock, in contrast to *P. tiliacea* on nutrient-poor substrates, avoiding dust deposits, frequently also on smooth bark, hygrometrically very demanding, m.acidoph. (-subneutroph.), r.photoph., r.(-v.)ombroph., a-/m. nitroph., in the Parmelietum rev., in montane, *P. tiliacea*-rich forms of the Parmelietum ac. – mieur-subatl(paralp)-med-mo, (0z) – r.rare (3); Sch, Vog, SJu, rare Eif, Mos, Hu, MRh, Saar, O, Ju, SFW, Bo-Av

Parmelia quercina (Willd.) Vainio (Parmelina q. (Willd.) Hale)
var. **quercina**
In submontane to high montane, high precipitation, winter-mild sites on free-standing trees and in open forests, on lower sites above all on oak, in higher above all on maple, beech, ash, preferably in the crown on thin to moderately robust branches, r.-v. photoph., subneutroph.-m.acidoph., a-(m.)nitroph., Lecanorion subf., Parmelietum ac., often with *P. pastillifera* – (s')mieur-subatl-(pralp)-med – (v.)rare (11); today only a few yet found (*süSch*, Hü, *Rh, Ne*, Bo, Do, Ju, *O, Rh-Mn-T*, Eif, Th)
var. **carporrhizans** (Taylor) V.Wirth (P. carp. Taylor, Parmelina c. (Taylor) Poelt & Vèzda)
Rather similar to *P. glabra* (↑) -- mieur-pralp-med(mo), oz – v.rare (++); süSch?, Al (r.rare)

Parmelia tiliacea (Hoffm.) Ach. (P. scortea (Ach.) Ach., Parmelina t. (Hoffm.) Hale)
From low sites up into the (high)montane zone on well lighted habitats, above all on free-standing deciduous trees (especially ash, linden, maple, apple), on higher sites often also on beech, preferably on moderately nutrient rich bark (dust deposits etc.), also on silicate rock (basic silicates, eutrophied surfaces, bird boulders), optimal and fruiting today only in higher, high precipitation regions, in lower sites (+), subneutroph.-m.(r.)acidoph., r.-s.photoph., in the Parmelietum ac., Parmelietum cap., Parmelietum rev – (s'bor-)mieur-med – (r.rare-) m.frequent; süSch, Vog, SJu and Ju r.frequent, otherwise mostly r.rare, in Middle-, East-, and North-Germany ± rare-very rare

(**Pleurosticta** Petrak)

Parmelia acetabulum (Necker) Duby (Pleurosticta a. (Necker) Elix & Lumbsch, Melanelia a. (Necker) Essl.)
Up into montane sites on subneutral to m.acid, usually cracked deciduous tree bark, especially on free-standing trees, in forests rare (tree tops), preferably on nutrient-rich substrates, r.strongly dust deposit tolerant; today in lower sites often deformed, optimal above all in rather high precipitation regions; neutroph.-m.acidoph., r.-v.photoph., m.-r.nitroph., Char. Parmelietum ac., optimal with *Ramalina frax.* (↑) – (s'bor-)-mieur-med – r.rare-m.frequent (3), rare in places (thus Sp, O, Rh148n, nöRh, Rh-Mn-T, PfW, in North-, Central- and East-Germany

(**Punctelia** Krog)

Parmelia subrudecta Nyl. (P. dubia (Wulfen) Schaerer, Punctelia s. (Nyl.) Krog)
In the foothills, rarer in the montane zone (up to ca. 1000 m), similar to *P. caperata* (↑), yet more toxitolerant and enduring stronger acidification of the substrate, Parmelietum cap., Parmelietum revol. – mieur-med, (subatl) – m.frequent (South Germany), rarer in the north

(**Rimelia** Hale & Fletcher)

Parmelia reticulata Taylor (Rimelia r. (Taylor) Hale & Fletcher, Parmotrema reticulatum (Taylor) Choisy)

On climatically very mild, relatively high precipitation or humid, foggy habitats in the foothills on the bark of deciduous trees, on mosses on silicate rocks, in open oak-beech forests, m.(-r,)acidoph., e.g. in the Parmelietum rev. – mieur-atl-med-subatl – v.rare (0); *O (Heidelberg), PfW (Bitsch)*

(**Xanthoparmelia** (Vainio) Hale)

Parmelia conspersa (Ehrh. ex Ach.) Ach. (Xanthoparmelia c. (Ehrh. ex Ach.) Hale)
Up into the high montane sites, in the Alps isolated essentially higher, on silicate rocks on sunny, usually ± nutrient rich habitats, even on moderately dunged bird roosts, above all on horizontal- and sloping surfaces, occasionally even introduced into lime regions (e.g. roof tiles, grave stones, wall crowns), subneutroph.-r.acidoph., r.-v.photoph., m.-r.nitroph., somewhat warm loving, Char. Aspicilietalia gibb. – bor-med – Sch, Vog, Eif moderately frequent, otherwise rather rare, lime region rare to very rare

Parmelia mougeotii Schaerer ex D.Dietr. (Xanthoparmelia m. (Schaerer ex D.Dietr.) Hale)
In the foothills and montane zone on hard, lime-free silicate rock, often on porphyry, granite, on rather rain exposed vertical- more rarely sloping surfaces, on r.-v.well lighted, often truly warm habitats, above all on warm hanging valleys, pioneer lichens, m.-r.acidoph., a-/m.nitroph., in the Umbilicarion hirs., Parmelion consp. – mieur-subatl-med(mo) – rare (3); Sch, Vog, Saar, Pf, Hu, Ts, Mos, Eif, O, Sp, ThW, Erz

Parmelia somloensis Gyelnik (Xanthoparmelia s. (Gyelnik) Hale, P. taractica auct, P. stenophylla auct.)
Foothills-montane, on sunny, warm, after rain rapidly drying habitats on acid and basic silicate rock, above all on horizontal surfaces and relief free, fissured substrates loosely attached, on thin humus- or scattered layer over stony subsoil and stony soils, subneutroph.-r.acidoph., xeroph., r.-v.photoph., r.thermoph., a-/m.notroph., Char. Parmelietum soml., also in the Lecanoretum argoph. – (s')bor-med, (subko) – r.rare; Sch, Vog, O, Pf, RhSch, Lahn, He (e.g. Rhön), ThW, Ries

Lit.: ANDERS 1928, ESSLINGER 1977, HALE 1975, 1976, 1987, 1990, HILLMANN 1936, KROG 1982

Parmeliella Müll.Arg.

(Determination ↑ Pannaria)

Introduction

Parmeliella resembles the genus *Pannaria* in habit and anatomically. As in the case of that one the thallus is squamulose to rosetted-foliose and often bordered by a dark prothallus; also the brown-red to blackish apothecia are reminiscent of *Pannaria*, however they have a proper margin and no thalloid margin. Both genera contain bluegreen algae as symbionts.

The predominantly tropical genus containing about 40 species is represented in Germany by one species. *P. triptophylla* is numbered with lichens of oceanic, high precipitation sites and little disturbed deciduous- and mixed forests, in the region above all on beech (-spruce)- and sycamore-mixed forests. It is distributed in the moist regions of the mediterranean zone, in the West- and Central Europe and the atlantic-subatlantic regions of North Europe. For its maintenance the establishment of forest cover is necessary.

Genus Characteristics

Thallus foliose, squamulose or crustose, gray-blue, brown, brown-black, often with darker prothallus, with *Nostoc*, with red-brown to black ap., similar to the genus P*annaria*, but ap. without thalloid margin, with thin proper margin (Exc. paraplectenchymatous).

Ecology and Distribution of the Species

Parmeliella triptophylla (Ach.) Müll.Arg. (P. corallinoides auct.)
In the montane and high montane zone in high precipitation (mostly above 1400 mm), oceanic influenced sites on m.-r.mineral-rich deciduous tree bark with higher water capacity and over bark mosses, above all at the base of the stem and on older trees of sycamore and beech, in open forests, in the case of higher precipitation even on free-standing trees, m.acidoph.-subneutroph., m.photoph., v.(-e.)hygroph., substrathygroph., anitroph., Char. Lobarion pulm. – bor-med-mo, oz – rare (2); süSch above

all over 900 m, nöSch, Vog, Al, *O+*, *Sp* (whether still ?), *Pf+*, Ba (Wutach)

LIT.: JORGENSEN 1978.

Parmeliopsis Nyl.

(Key incl. Imshaugia)

Introduction

The *Parmeliopsis*-species are rosette growing, tightly attached to the substrate foliose lichens with narrow linear lobes. The surface located, brown disked, lecanorine apothecia are only relatively rarely produced in most species; in these cases the reproduction is predominantly by soredia, which occur in round soralia.

Of the four species known, two occur in Germany. They grow on acid bark of deciduous- and conifer trees in cool and cold regions and are distributed throughout the boreal conifer belt, in Europe in addition in the mountains of Central Europe and -- more rarely – in the mountain forests of the mediterranean region. Both species are relatively weakly competitive and have their main habitat in the lower stem region of the tree, where because of unfavorably long time snow covering the prevailing ecological conditions are not tolerated by many species. In the last ten years *P. ambigua* has conspicuously increased and is today even widespread even in lower sites and is not rare. As acidophytes, the species is apparently relatively resistant to acid air pollution having the capacity to utilize the acidified habitats of more sensitive species, which are disappearing during the development of air pollution. Likewise the same is true for *P. hyperopta*, originally almost exclusively indigenous to high montane sites. Single new collections in lower sites indicate that it also is beginning to spread out.

Genus Characteristics and Determination

Thallus foliose, closely attached, with radially arranged narrow lobes, small. Underside brown-black with simple rhizines. Soralia on the surface, red- to dark brown, with thalloid margin. Paraphyses simple. Sp. 1-celled, elongate, curved. Pycn. black, sunken, on the surface. Pycnosp. needle- to peg-form, sickle- like curved to hook-form, 12-22 x 0.5-0.8 µm. Ch: Divaricatic acid, cortex Atranorin and/or Usnic acid. *Imshaugia* differs from *Parmeliopsis* by a light underside, marginal to surface standing, somewhat raised pycnidia, short straight pycnosp. thickened at the ends and ellipsoidal sp.

1 Thallus yellow-greenish (*Usnea*-green), undersides brown-black, closely attached, usually actinomorphic-rosetted, in the center with numerous, often coalescing fleck soralia, lobes narrowly linear, -1 mm, ± flat, thin. Ap. rather rare, flat, brown. Medulla R-, UV+ white. Usnic acid, Divaricatic acid, ± Atranorin . **P. ambigua**

1* Thallus gray-white, light gray, brown tinted gray **2**

2 Thallus underside brown-black (lighter at the margin), closely attached, actinomorphic-rosetted (as in *P. ambigua*), in the center with fleck soralia. Lobes narrowly linear, -1 mm wide. Ap. moderately frequent, flat, brown. Medulla R-, UV+ white, cortex K+ (weakly) yellow. Atranorin, Divaricatic acid **P. hyperopta**

2* Thallus underside light brown to whitish, moderately closely attached, rosetted, above all in the interior covered with granular to cylindric isidia, without handlens appearing sorediate. Lobes not narrowly linear, 1-3 mm wide, often somewhat curved at the margin. Ap. very rare, red-brown. Medulla K+ deep yellow, P+ yellow-orange, C-. Atranorin, Thamnolic acid . **Imshaugia aleurites**

Ecology and Distribution of the Species

Parmeliopsis ambigua (Wulfen) Nyl.
(Foraminella a. (Wulfen) F. Meyer)
Above all in montane to subalpine sites, yet rather often descending into lower sites and here (related to forestry and promoted by acid emissions) increasing on Scot's pine, larch, beech, in the mountains ecologically like *P. hyperopta* (↑), yet advancing on drier sites with *Hypocenomyce scal.* (↑) on (on beech) *Lecanora conizaeoides, L. pulicaris,* one the most resistant foliose lichens toward SO_2 - emissions, m.-v.acidoph., m.-v hygroph., r.skioph.-r.photoph., anitroph., Char. Parmeliopsidetum amb., in the Hypocenomycetum scal., Lecanoretum coniz. – bor-smed-h'mo(-med-mo) – m.frequent; above all Sch, Vog, Al, otherwise m.frequent-r.rare, in lime- and dry regions at times rare

Parmeliopsis hyperopta (Ach.) Arnold
(Foraminella h. (Ach.) F. Meyer)
In high montane and subalpine, rarely montane, high precipitation sites on cool to cold, long time snow covered habitats on acid bark at the base of trees, above all conifer trees, rarely on deciduous trees (e.g. *Sorbus*, beech), on branches of dwarf shrubs, on wood of stumps, above all in open forests, moors, on forest margins, free standing trees, m.-v.acidoph., r.skioph.-r.photoph., r.-v.hygroph., anitroph., Char. Parmeliopsidetum amb. – bor-mieur-h'mo(-smed-h'mo) – rare; Sch, Vog, BayW, al, Av, ThW, Erz, otherwise v.rare, today in association with the development of acid emissions occasionally spontaneously increasing in lower sites

LIT.: ANDERS 1928, HILLMANN 1936, MEYER 1982

Parmotrema Massal.

(Determination ↑ Parmelia)

Introduction

Parmotrema is morphologically-anatomically, ecologically and plant geographically a well characterized species group, which formerly was included in *Parmelia* and to some extent still is. It includes species with broad, rounded on the ends, often erect lobes. The underside is black, the marginal zone however is commonly brown and rhizine free. The disk of the apothecium is often perforated. The indigenous species are – as are also many exotics – as a rule sterile and reproduce by border- or capitate-soralia or isidia. Often the lobe margins bear cilia. The about 250 species number in the genus are for the most part distributed in the warm temperate and tropical as well as the oceanic regions of the earth.

The indigenous species are very widely distributed. In Europe they are limited to the West, the oceanic places of the alpine mountains and the Central European middle mountains and the Mediterranean region. They reach Scandinavia only in the extreme Southwest Norway or entirely lacking (*P. stuppeum*). In Germany they are all threatened, their biotype worthy of protection. *P. chinense*, *P. stuppeum* and *P. crinitum* are found especially in open oak-(beech-) stands of in brook bordered woods, and indeed are more or less limited to mild and oceanic sites above all of the Black Forest. Today they show frequent damage from air pollution or are in many places have already disappeared. On requiring oceanic high precipitation, very humid, cool sites e.g. in beech-spruce-forests is *P. arnoldii*; a species which is – similar also *P. crinitum* – at best outside of alpine Germany immediately threatened with extinction.

Genus Characteristics

Thallus foliose, of usually broadly rounded, relatively broad, often loosely attached to erect lobes, often with border- or capitate soralia or isidia, with blackish cilia on the margins, the European species gray-white. Undersides black, with simple, often sparse rhizines, and a brown, border without rhizines. Upper cortex of thick cemented anticlinal hyphae (palisade plectenchyma), with an epicortex with pores. Photobiont *Trebouxia*. Ap. ± stalked, with concave, often perforated brown disk and with thalloid margin. Hyp. colorless. Paraphyses branched. Asci with I+ blue wall and I+ blue tholus. sp. 1-celled, ellipsoidal, thick walled. Pycnosp. bacillar to filamentous. Ch: in the case of the indigenous species Stictic- or Norstictic acid, always Atranorin.

Ecology and Distribution of the Species

Parmotrema arnoldii (Du Rietz) Hale (Parmelia a. Du Rietz)
In submontane and montane, high precipitation sites, on cool to cold, humid, oceanic habitats, usually in a locality with frequent fog production, above all in the interior of open forests (wood rush-oak-beech-forest, spruce-fir-forests), usually on cracked bark of oak and dying branches of spruce and fir, r.acidoph., v.-e.hygroph., m.-r.photoph., anitroph., often with *Cetrelia*, *P. chinense*, mosses, also *Menegazzia*, e.g. in the Parlemietum rev. – mieur-atl/paralp(- med-mo), oz – v.rare (1); süSch, Vog, *Ju (Schörzingen)*, A

Parmotrema chinense (Osbeck) Hale & Ahti (Parmelia coniocarpa Laurer, P. perlata Ach., P. trichotera Hue)
In the foothills and submontane (rarely montane) sites in open deciduous forests, especially hornbeam brush-oak-beech-forest, on mild,

rather high precipitation, oceanic sites, preferably on warm hanging valleys on oak, m.-r.acidoph., r.photoph., m.thermoph., anitroph., Char. Parmelietum rev., also Pertusarietum hem. – mieur-subatl-med(mo/subatl) – rare (2); scattered on the west slope of the Sch and Vog, SJu; rare and mostly strongly threatened or extinct in süHü, SFW, Bo, Do, *Ju, Ne,* O, Sp, Rh, *Rh-Mn-T, Ts,* Th/ThW

Parmotrema crinitum (Ach.) Choisy (Parmelia crinita Ach.)
In submontane and montane, relatively high precipitation, climatically mild sites, on oceanic sites with frequent fog production, in open forests (e.g. hornbeam brush-oak-beech-forests) on old deciduous trees, also on mossy rock, m.-r.acidoph., r.photoph., anitroph., in the Parmelietum rev. – mieur-subatl-med-mo, oz – v.rare (1); süSch, *nöSch (Baden-Baden), O+ (Heidelb.), MRh+ (Lorch),* Eif (Ahrtal)

Parmotrema stuppeum (Taylor) Hale (Parmelia stuppea Taylor, P. maxima Hue)
Up into submontane sites in open deciduous forests above all on old trees, prefers oak, similar to *P. chinense* (↑), yet still warm loving – mieur-subatl/(paralp)-med-subatl – v.rare (2); süSch, s129Rh, Vog, Ne, *Ju, Ts*

LIT.: ANDERS 1928, HALE 1965, HILLMANN 1936.

Peccania Massal.

(Determination ↑ Polychidium)

Introduction

The *Peccania*-species are bluegreen algae species with small, thick fruticose, commonly cushion-like growing black thallus and terminal, apothecia sunken into the thallus and single-celled spores. *P. coralloides*, the single representative of the small genus in Germany, is a mediterranean lichen penetrating into southern Central Europe on sporadically irrigated limestone.

Genus Characteristics

Thallus small fruticose, with sparsely branching, ± erect branches cushion- or turf-producing, blackish, sometimes pruinose, ± unlayered, with encapsulated bluegreen algae (*Chroococcidiopsis*), whose gelatin envelops are colored brown-yellow in the thallus margin region. Ap. (almost) terminal, with thalloid margin, at first with narrow opening. Hyp. colorless. Epihym. brown. Paraphyses predominantly simple. Asci clavate, with smooth restricted, strongly thickened above, I+ blue gelatin envelop (I-coloring clearly more intense in the interior). Sp. one-celled, spherical to ellipsoidal. Pycnosp. filamentous. Ch-.

Ecology and Distribution of the Species

Peccania coralloides (Massal.) Massal.
On from time to time slightly irrigated limestone, similar to *Synalissa* (↑), and *Thyrea* (↑), in montane to alpine sites, Char. Peccanio-Thyreetum, Psorotichion schaer. – mieur-med – v.rare (R); Ju, *Ne,* additionally SJu, FrJu

LIT.: MIGULA 1929-31, MORENO & EGEA 1991*, POELT 1969

Peltigera Willd.

Introduction

The thallus of *Peltigera*-species ("Shield lichens") are generally large, broad lobed, gray to brown, dusty green when moist, dark gray to blackish (species with bluegreen algae) or bright green (species with green algae). The species with green algae symbionts have cephalodia on the thallus upper surface containing bluegreen algae. They have a cortex on the upper side, without cortex on the underside. The pale to dark colored, more or less felty underside commonly bears raised, reticulate veins and attachment organs, rarely they are uniformly felty. The red-brown to almost blackish, shield to saddle form apothecia stand on the lobe margin and are without a margin. A few species develop soralia on the surface or on the margins of the lobes or isidia-like squamules.

The genus *Peltigera* numbers perhaps 50 in part very widely distributed species, of which there are 29 in Europe and 19 have been

demonstrated in Germany. The shield lichens reside – often over mosses – on the soil, on rocks and more rarely on tree bark. They grow rapidly and are partially sufficiently competitive, to survive in turf associations. Most species are found especially on humid, shady or long time dew moistened sites, where they live on road sides, mossy boulders or at the foot of trunks of trees, often in forests. To these belong *P. praetextata, P. horizontalis, P. polydactylon, P. canina, P. hymenina* and *P. membranacea.* The two latter named prefer base-rich soils. *P. leucophlebia* lives in the region mostly on shady, somewhat moist limestone or on base- rich water flooded silicate rock. *P. rufescens* and *P. malacea* on the other hand are predominantly in open, partially strongly sunny meager turf and on stony soil, the first on basic-, often calcareous, the latter on base-poor soils. *P. neckeri* grows on base-rich substrates, usually on drier, more sunny sites that the related *P. polydactylon. P. didactyla,* a lichen with pronounced pioneer characteristics, appears rapidly on open slopes, soil impregnated rock habitats, abandon gravel pits or old fire sites and disappears again just as rapidly. *P. venosa* is likewise found on disturbed soil, it is however adapted to cold-moist climatic conditions. It is essentially boreal-montane distributed, it had however numerous relict occurrences in lower sites in Central Europe. They are almost all extinct. In Baden-Württemberg the lichen is in the last 10 years only to be found on a single site. Also only one occurrence of *P. aphthosa* is known in the region. *P. collina* is the single typical oceanic species and grows in the lung lichen association on mossy silicate rocks and deciduous trees and is dependent on relatively undisturbed habitats.

P. leucophlebia, P. malacea, P. ponojensis and *P. venosa* are distributed in the region of the boreal conifer belt and part of the width well into the arctic as well as into the corresponding higher sites in Central Europe and (with diminishing frequency) the submediterranean zone; likewise is the case of *P. degenii*, yet this one is rarer in the northern boreal zone. *P. collina* occurs especially in the oceanic influenced regions of northwest South Europe; in continental East Europe it widely lacking. *P. hymenina* and *P. membranacea* have a more or less subatlantic area and are distributed from northern Scandinavia to the Mediterranean region. Occurring in nearly all of Europe (the hygrophytic species however not in the Steppes region): *P. didactyla, P. horizontalis, P. neckeri, P. polydactylon, P. praetestata* and IP. rufescens.

Most of the shield lichens are indeed not immediately threatened, but in a broader sense they are in danger; in the region often having only individuals, at times also isolated occurrences, of *P. hymenina, P. canina, P. degenii* and *P. horizontalis*. To the most strongly threatened species belong apart from *P. venosa* because of its rarity *P. ponojensis* and because of soil enrichment of the meager turf *P. malacea.*

Genus Characteristics and Determination

Thallus foliose, often very large, ± deeply lobed with rounded ends to undivided single leaflet, gray to brown, shining green when moist or blue-green, gray-black or green- to blue tinged blackish, with smooth or finely felty upper surface, many species with fine isidia-like leaflets (Phyllidia), schidia or soralia, undersides felty, whitish, brown to dark, usually with reticulate, dark or light veins, on which arise large rhizines. Upper cortex paraplecten-chymatous. Without lower cortex. Photobionts *Nostoc* or coccoid green algae *(Coccomyxa)*, then always additional bluegreen algae *(Nostoc)* in cephalodia on the upper- or under-side. Ap. saddle form to flattened, red-brown, to black, usually sessile on erect lobes, hemiangiocarp. Asci cylindric, fissitunicate, of the *Peltigera*-type, with amyloid ring structure on the tip of the inner wall. Sp. commonly 4- to 8-celled, fusiform, colorless or brownish. Ch- or various triterpenoids and tridepsides.

In spite of the considerable size of the thallus a few of the *Peltigera*-species are difficult to determine and for the time being a certain degree of intensive study is indicated. The variability is in the case of a few species is considerable and may not be expressed in the key. Isidia occur very rarely even in normally isidia-less species on cracks. Application of diagnostic reagents is insignificant (P-, K-). T4: Hopan-7β,22-ol, T6: Hopan-6α, 7β,22.triol.

1 Moist thallus true green. Algal layer made up of green algae. with cephalodia. Tenuiorin, Methyl-gyrophorat, ± Gyrophoric acid . **2**

1* Moist thallus not true green, but usually dark gray to almost black or deep blue-green. Algal layer made up of blue-green algae . **4**

2 Thallus small, up to ca. 2 cm, ± rounded or shell-form, one leaflet, greenish bray, in the herbarium ± brown, underside with pronounced, fan-form arranged veins. Cephalodia sessile on the underside of the veins. ap. horizontal, flat, round, dark brown to blackish, almost always occurring, Terpenoide, Phlebinic acid * **P. venosa**

2* Thallus large, lobes 2-4(5) cm broad, light gray to slightly brownish, ofte4n with wavy margin, upper sides covered with numerous small, warty, dark cephalodia. Ap. erect, not flat, rather rare **3**

3 Underside without or with few indefinite veins, therefore uniformly spongy-felty, (almost) without rhizines, marginally light, but ± consistently brown-black. Ap. undersides corticate throughout. Zeorine, Phlebinic acid * **P. aphthosa**

3* Underside with definite, marginally lighter, but dark veins and rhizines. Ap. underside only partially warty corticate. Various Triterpenes * **P. leucophlebia**

4 Thallus with soralia **5**

4* Thallus without soralia **6**

5 Thallus bordered on the wavy margins by extensive light gray to blue-gray border soralia, soredia often ± isidiate. Lobes 1-2 cm wide, ± elongated, light bray, blue-gray, rarely brownish, upper sides toward the ends often somewhat rough, undersides with lower brownish veins or almost uniformly felty (entirely without veins, undersides not felty: *Nephroma parile*). Ap. rare. Tenuiorin, Methyl-Gyrophorat, Zeorin, ± Peltidactylin, T6, et al **P. collina**

5* Thallus on the upper surface with usually rounded, later coalescing, whitish fleck soralia. Lobes rounded, often shell-form with up curved margins (later soralia disappearing and fruiting on numerous erect, elongated lobes), upper sides gray to brown (very finely felty), undersides whitish, with raised, whitish to pale brownish reticulate veins. Ch-, rarely Methyl-Gyrophorat **P. didactyla**

6 Upper side smooth, usually shiny, bald, even toward the lobe margins never flattened finely felty (handlens !) **7**

6* Upper side at least toward the lobe margin very finely felty (flattened, felty "hair" layer), therefore not shiny ( ) . **13**

7 Thallus underside even in the center cream-white, veins whitish to pale yellow-brownish. Rhizines raised, whitish to brownish, predominantly simple or sparsely branched and ± smooth. Upper side blue-gray, rarely brownish, shiny. Lobes at the margin often with isidia or lobules. Ap. round, usually on reflexed lobes. Ch- . **P. degenii**

7* Thallus undersides not whitish throughout. Isidia rare. With Tenuiorin, Methyl-Gyrophorat, ± Gyrophoric acid . **8**

8 With flat, circular, often horizontal to sloping ap. disks. Blue-gray to (gray)brown. Underside with thick network of slightly raised, broad dark veins, between them white oval flecks. Zeorin, T4 * et al . **P. horizontalis** (when undersides without veins, dark, with small white flecks, upper sides with flattened schizidia: **P. elisabethae** Gyelnik)

8* Without ap. or ap disks not flat, but ± saddle-form in curved, on narrow, mostly erect to right angled lobes **9**

9 Underside at least in a very wide marginal region light ochre colored, only in the center of the thallus darker, with wide, flat, indefinite, ochre colored veins, rhizines often sparse. Upper side dull to weakly shiny. Thallus relatively flaccid (when thick and rigid see *P. neckeri*). Lobes ascending at the ends and margins, mostly -2 cm wide, usually gray, even slightly brownish, usually dark green when moist. Ap. on short lobes, only up to 4 mm long, (light) brown, light red-brown, Peltidactylin, Dolichorrhizin, ± Zeorin * **P. hymenina**

9* Under side not ochre colored, upper side strongly shining (possibly pruinose toward the ends), gray to brown . **10**

10 Rhizines above all in the center of the thallus up to 7-10 mm long, robust, little branched, dark, Veins flat and wide, definite. Lobes 2-3 cm wide. Peltidactylin, Dolichorrhizin, Zeorin * **P. neopolydactyla**

10* Rhizines shorter, mostly under 5 mm long **11**

11 Underside with less wide dark veins and white between spaces or almost vein-less and ± felty throughout, toward the center brown-black, at the margin ± light. Upper side above all at the lobe ends often somewhat pruinose. Thallus thickish and rigid, frequently with puffy cracks. ap. dark brown to black, up to 4 mm long, sessile on rather short lobes (the related *P. hymenina* has whiter, flaccid thalli and a much lighter, often ochre colored underside). Dolichorrhizin, T4, Zeorin * **P. neckeri**

11* Underside with closed mesh network of flat brown to dark brown veins, between them ± oval white flecks. Upper side not pruinose on the lobe ends, rarely with puffy cracks .**12**

12 With (saddle-form in-curved) apothecia. Rhizines bundled. Veins almost to the margin dark, young almost coalescing. Thallus usually rigid and robust, lobes often wavy curled at the margins. Dolichorrhizin, Zeorin * **P. polydactylon**

12* Without ap.: separating of *P. horizontalis* and *P. polydactylon* difficult, only possible with the experience with well developed thalli. *P. polydactylon* (↑): veins mostly dark up to the margin, lobes often wavy-curled up turned at the margins, *P. horizontalis* (↑): underside white at the margin incl. veins, otherwise

veins dark. Margin commonly not wavy-curled

13 Thallus with shield- to flat-type isidia (= phyllidia). Ch- **14**

13* Thallus without isidia . **16**

14 Isidia granular to soredia-like, limited to the usually up turned lobe margins and these like border soralia. Lobes narrow, 1-1.5 cm .**P. collina (5)**

14* Isidia shield-form to lobule-like . **15**

15 Thallus small, usually only up to 2(3) cm, rounded-shell-form, on the surface with schield-form, decumbent isidia, thereby appearing rough, ± dark brown. Ap. very rare. Very rare species . **P. lepidophora**

15* Thallus usually substantially larger, at the margins and on cracks of the surface with horizontal to erect, flat, squamulose to divided, sometimes very thick standing isidia, gray to brown. Undersides light in a broad marginal zone with predominantly less or non branching, brown becoming rhizines and narrow, clearly raised, light to (above all toward the center) darker veins. Ap. moderately frequent **P. praetextata (21)**

16 Underside ± uniformly spongy-felty, almost without rhizines, without or rarely with less indefinitely wide veins, brown. Upper side dull (usually brown to dusty green-gray), with fine erect hair layer (handlens). Thallus robust, rigid, dark olive green to green-brown when moist, often relatively small. Lobes 1-3 cm wide, rounded, with wavy, up turned margins. Tenuiorin, Methyl-Gyrophorat, ±Gyrophoric acid, unknown Terpenoide . **P. malacea**

16* Thallus underside with definite veins. Hair covering (usually only at the margin) felt-like depressed (handlens !). Ch- (rarely Methyl-Gyrophorat in the case of *P. didactyla*) . **17**

17 Thallus small, usually only up to 3 cm, at first rounded-shell form and with soralia, with ascending margins, then soralia disappearing and fruiting on numerous ± right angled, elongated, lobes often standing over one another. Upper sides usually ash gray, finely felty, undersides whitish, with clearly raised whitish to pale brownish, reticulate veins and mostly simple rhizines . **P. didactyla**

17* Thallus commonly larger. Veins and rhizines whitish to dark **18**

18 Lobes relatively narrow and long, usually under 1.5 cm wide, outermost margins curly. Thallus brittle, rigid, pruinose or nonpruinose, commonly on base-rich soils (when nonpruinose, on acid substrate see also 21*) **19**

18* Thallus commonly over 1.5 cm wide, often erect, but on the border usually short curved downward, at the ends broadly rounded to stubby, radial to irregularly aligned. Thallus large, usually broad lobed, brittle to flaccid, gray to brown, nonpruinose, but at least in the margin region thinly to thickly fine felty. *P. canina* and *P. membranacea* approach the well known variability of *P. praetextata* **20**

19 Upper side in the center felty or bald. Underside whitish, with raised pale veins and lighter, almost unbranched rhizines. Ap. often large and flat, up to 1 cm wide . **P. ponojensis**

19* Upper side with thick depressed felt, in the center often strongly and flecked pruinose. Rhizines (except at the margin) dark, thickly branched and bushy coalescing. Lobes sometimes with proliferating small lobules. Ap. usually saddle-form in-curved, often with crenate margins, on down-curved lobes. Lichens with their high point on dry-warm habitats **P. rufescens**

20 Rhizines (5-8 mm) long and thin, simple, bottle-brush like, right angled hairy, at times even all protruding, rather uniform (in contrast to *P. canina*), relatively sparse, white, possibly somewhat darker than the veins. Underside whitish throughout, with relatively wide meshed, raised and hairy projecting veins. Upper side often with slightly convex longitudinal bulges corresponding to the spaces between the veins. Lobes usually broadly rounded, rarely elongate. Margins ± wavy, upwards curved. Commonly without isidia. Thallus relatively thin **P. membranacea**

20* Rhizines not uniformly bottle-brush like, usually up to 6 mm, light or blackish . **21**

21 Rhizines many forms, even on the same thallus very variable, relatively dense standing, but often irregularly branched, often bundled-bushy and shaggy because of right angled to oblique short branches, often (above all at the thallus margin) in a series growing with one another ("coalescing"), a few often long and thin, whitish. Upper side dull, often for the most part finely felty, often with slight elongate bulges, which correspond to the spaces between veins network on the underside. Underside always whitish. Veins usually at least in the thallus center relatively flat and smooth (sometimes however even velvety), browned in the center of the thallus, with relatively narrow spaces between, not hairy projecting. Margins wavy, curved upwards. Without isidia. Thallus relatively robust, in color and habit like *P. membranacea* . **P. canina**

21* Rhizines simple to little branched, rarely partially with sloping lateral bristles or strongly attached at the ends, sometimes velvety at the base, whitish, dark toward the thallus center. Upper side entirely smooth to scared, commonly without elongate bulges, somewhat shiny. Underside whitish in the margin region, toward the center often dark. Margin curved upwards or downwards. In the case of careful searching of the margins and cracks at least a few flat, usually

ascending isidia are to be found. In habit similar to *P. membranacea*, i.e. lobes broadly rounded, often overlapping, ascending toward the margins, but outermost edge downward curved, or relatively narrow lobed, lobes elongate, mostly radially arranged

P. praetextata

Ecology and Distribution of the Species

Peltigera aphthosa (L.) Willd.
In subalpine and alpine sites on mosses, raw humus or moist humus soils in cool dwarf shrubby heath and open forests between boulders on humid habitats, v.acidoph.-subneutroph. – (arct-)-bor-mieur-alp – v.rare (1); süSch (1 x), Alps

Peltigera canina (L.) Willd. – Dog Lichen
Up to the tree line, rarely higher, usually over moss cover or humus lager on soil, silicate- and carbonate rocks, tree trunks and stumps, commonly in forests on moderately well lighted to rather poorly lighted, m.-v.humid, cool substrate habitats, on base-rich, sandy to pure loam soils, e.g. both on [Rendzinen], and in meager turf, m.acidoph.-neutroph. – bor-smed (-med) – rare (3), e.g. Sch, Ju, Ne, Ts, Pf, Eif, *Do*

Peltigera collina (Ach.) Schrader (P. scutata (Dickson) Duby)
In montane and high montane, usually very high precipitation, oceanic sites on deciduous trees (above all beech, sycamore, ash), especially in sycamore-beech forests, rarely on mossy silicate rock, similar to *Nephroma resupin.* (↑), Char. Lobarion – bor-mieur(subatl)-med-mo, (oc) – rare (-v.rare) (2); süSch, nöSch, Vog, SJu, Ju (1x), Sb (1x), Sp+, Vgb+, Ts+, ThW, Al

Peltigera degenii Gyelnik (P. nitens (Anders) Gyelnik)
Above all in montane and high montane, high precipitation sites on cool, humus, base-rich soils in deciduous- and mixed-forests, on slopes and mossy boulders and on the base of trees on shady habitats, m.acidoph.-subneutroph., hygroph., substrathygroph. – bor-mieur-mo(-smed-mo) – rare-v.rare (3); Sch, Ju, O, Eif, ThW, Av, Al

Peltigera didactyla (With.) Laundon (P. spuria (Ach.) DC., P. erumpens (Taylor) Elenkin, P. leptoderma auct.)
Up above the tree line on well lighted habitats of sandy to loamy, often stony, humus-poor mineral soils as well as on soil encrusted or mossy silicate rocks, usually on disturbed, nutrient-rich sites, road margins, open slopes, walls, on fire sites, fruiting thallus above all on consolidated soils and on fire sites, ephemeral pioneer, often with moss associations, r.acidoph.-subneutroph., m.-v.photoph., m.-r.nitroph. – arct-med – r.rare, rare in lime regions and relief-poor regions

Peltigera horizontalis (Hudson) Baumg.
Up into high montane sites, on cool, humus, often base-rich soils, on mossy rock, mossy or decayed stumps, on the mossy base of deciduous trees, on cool substrate, shady, humid habitats, in high precipitation regions, most frequently in humid valleys, in forests and dwarf shrubby heaths, r.acidoph.-subneutroph., (m.)r.-v.hygroph., in moos-associations, often with other *Peltigera*-species – (s')bor-smed(mo)(-med-mo) – r.rare (3), in the entire region, yet above all in higher sites

Peltigera hymenina (Ach.) Delise (P. lactucifolia auct.)
On stony lime- and dolomite-soils as well as base-rich sandy to stony silicate soils, often together with mosses, even on (mossy) rocks or carbonate stone and mineral-rich silicate rock (e.g. slate), rarely on the base of trees, usually on shady, but relatively well-lighted habitats – bor-atl-smed – rare (3); Sch, SFW, Ju, Do, Lahn, Rh-Mn-T, Eif, Th, *SJu*

Peltigera lepidophora (Nyl. ex Vainio) Bitter
In high montane to alpine sites, rarely lower, on base-rich raw soils, on slopes, on basins, on soil encrusted or mossy rocks (often limestone), pioneer, subneutroph.-m.basiph. – arct-mieur(alp) – v.rare (R); Ju

Peltigera leucophlebia (Nyl.) Gyelnik (P. variolosa (Massal.) Gyelnik)
Above all from the montane zone to above the tree line, yet also (above all earlier) into the plains, commonly on cool substrates to moist shady habitats usually between or on mosses over base-rich mineral soils, on (often irrigated) rocks (silicate- and carbonate-rock), usually in basins, narrow valleys, on north facing, earlier sometimes even on paths and slopes, m.acidoph.-subneutroph., hygroph., substrathygroph.-subhydroph., r.skioph.-r.photoph., above all in moss associations. – arct-mieur(-med-mo) – rare

(2), only frequent in the Alps; earlier scattered throughout the entire region, today probably only still isolated süSch, Ba, Sb, Vog, SJu, Ju, FrJu, Pf, Eif, Th, Al

Peltigera malacea (Ach.) Funck
In (sub)montane to subalpine sites, above all in acid meager turfs and in dwarf shrubby heaths as well as on soil encrusted rocks, similar to *Cladonia cervicornis* var. *vert.* (↑), strongly in regression because of soil enrichment – arct-smed-mo – rare (2); süSch, Vog, *nöRh+ Rh-Mn-T+*, O+?, Sp+?, RhSch, ThW, Th

Peltigera membranacea (Ach.) Nyl.
Above all on shady mossy rocks and boulders usually in forests, predominantly over limestone or mineral-rich silicate rocks, subneutroph.-neutroph., r.skioph.-m.(r.) photoph. – (s'-)- bor-smed(-med) – rare (3); Ju, Sch, *Ne*, Eif

Peltigera neckeri Hepp ex Müll.Arg.
(P. polydactyloides auct.)
Similar to *P. polydactylon* .(↑) – arct-med – rare; Sch, Ju, RhSch, otherwise v.rare (e.g. SFW, Ne, Mn, Saar)

Peltigera neopolydactyla (Gyelnik) Gyelnik
In high montane sites in open forests and in rocky dwarf shrubby heath – bor-h'mo – v.rare (1); süSch, *BayW* Alps

Peltigera polydactylon (Necker) Hoffm.
Up to the tree line, rarely above, above all in high precipitation sites, scarce in the foothills zone, euryöke lichen, on naked as well as mossy, often base-rich, stony and sandy-loam soils and mossy rocks, rarely at the base of trees and on mossy tree stumps, on shady as well as on sunny and rather dry habitats, usually in dwarf shrubby heath, on road margins, slopes, boulder basins, natural stone walls, (r.)m.acidoph. -subneutroph., r.photoindiff. – arct-mieur-med-mo – r.rare (3); above all Sch, SJu-Ju, Al, RhSch, otherwise rare to (above all in relief-poor regions) lacking

Peltigera ponojensis Gyelnik
Probably similar to *P. canina* – bor-med-mo – v.rare (?); Sch, Mos, Hu, *Av*

Peltigera praetextata (Flörke ex Sommerf.) Zopf (P. subcanina Gyelnik) – Squamulose-dog lichens
Rather similar to *P. horizontalis.* (↑), above all in forests on mossy trunks of trees, on mossy boulders, rarely on soil, only in high precipitation regions on sunny habitats – bor-med – r.rare-m.frequent; widespread, but in relief-poor and intensively managed forests and acreages rare to lacking, probably only moderately toxitolerant

Peltigera rufescens (Weiss) Humb.
To far above the tree line on well lighted, usually dry-warm habitats above all on stony lime- and dolomite soils as well as base-rich silicate soils, in openings in lime-dry and semi dry turfs, on walls, stone bars, rock piles, soil encrusted or mossy scree slopes, even on somewhat disturbed habitats, subneutroph.-m.basiph., m.-s.photoph., v.xeroph.-r.hygroph., sociologically far reaching, e.g. in the Toninion sed., xero- and mesobromion, moss-associations – arct-med – m.frequent in lime regions, RhSch scattered, otherwise rare to lacking

Peltigera venosa (L.) Hoffm. – Vein lichen
On high montane to alpine sites, rarely lower, on cool, preferably sandy-loam soil, on soil cracks and slopes on cool to cold, usually radiation protected, humid habitats, earlier into the lower sites, m.acidoph.-subneutroph., r.skioph.-m.(r.)photoph., hygroph., substrathygroph., pioneer on naked soil, with mosses – arct-h'mo/alp – Alps, otherwise v.rare or widely +, earlier widespread in extra alpine Germany, in recent time only still süSch (probably +?)

LIT.: ANDERS 1928, CARLIN 1992, VITIKAINEN IN POELT & VÈZDA 1981, VITIKAINEN 1994

Peltula Nyl

Introduction

The thallus of the genus is small, gray, gray-brown to blackish and in the case of the European species squamulose-shield-form and umbilicate on rock, exotic species have even small shrubby thalli with clavate to flattened segments. They contain bluegreen algae. Many species bear soralia, as does the single species occurring in Germany. The approximately 30 species are predominantly dwellers on dry-warm habitats in the tropics, subtropics and warm temperate zones. *P. euploca* grows on warm, following short-time rainfall with base-rich

trickling water irrigated, dust impregnated silicate rock. The southern distributed lichen occurs in Central Europe only in climatically favorable valleys, above all in the xerothermic region of Bohemia and Moravia, lacking in North Germany and reaching the north boundary of its distribution with a single outpost in South Sweden and South Norway.

Genus Characteristics

Thallus squamulose-shield-form, attached to the substrate by a single umbilicus, exotic species even apparently short fruticose-cushion-like with clavate to flattened segments and attached with holdfasts, gray, brown, black, at least a tendency to layering, upper side not corticate, underside often corticate, with bluegreen algae (Chroococcales). Ap. sunken, disk red-brown to black, punctiform to wide opening. Esc. thin. Paraphyses thin, little branched, partially reticulate. Asci ± clavate, thick walled, with irregular bordering perispore, with amyloid tholus, multi-spored, as a rule with at least 32 single-celled, ellipsoidal to spherical sp. Ch-.

Ecology and Distribution of the Species

Peltula euploca (Ach.) Poelt (P. guepinii (Delise) Gyelnik, Heppia e. (Ach.) Vainio)
In the foothills and submontane sites on basic or slightly calcareous silicate rock (Schist, mineral-rich gneiss =, basalt etc.) on from time to time irrigated surfaces of contiguous rock on warm to very warm habitats, subneutroph., m.-v.photoph., subhydroph., xeroph., thermoph., Char. Peltuletum eupl. – s'mieur-med – v.rare (1); süSch (1x, earlier even *Kleinlaufenburg* +), Bo (1x), BayW

LIT.: BÜDEL 1987, EGEA 1989

Pertusaria DC.

Introduction

The genus *Pertusaria* is treated as crustose lichens with whitish, gray pale yellow or pale gray-green thalli. The thalli often reach relatively large diameters. Many species reproduce with the aid of soredia or isidia and commonly remain sterile. The remaining species regularly produce fruiting bodies, which frequently are sunken in raised warts (therefore the German name "pox lichens") and either open with a fine pore or produce wide opening disks. Very characteristic are the large single celled thick walled spores.

In the region there are 28 of the 34 species identified as indigenous in Germany (of ca. 220 world wide), two others occur in neighboring Allgäu (*P. bryontha* ands *P. wahornei*). Up on the alpine *P. bryontha* and *P. glomerata*, over crust plant detritus and soil mosses, residing also on bark and silicate rock. The bark dwellers are especially to be found on moderately acid bark, especially of beech, hornbeam and oak, thus *P. coccodes, P. coronata, P. flavida, P. hemisphaerica, P. hymenea* and *P. pertusa.* Limited to more or less smooth bark are *P. leioplaca, P. pustulata, P. trachythallina, P. constricta* and *P. alpina. P. albescens* and *P. coccodes* are frequent on relatively nutrient-rich substrate and reside often also on free-standing trees, e.g. on streets. *P. amara* has its high point often on rather acid bark and is also distributed on conifers. *P. multipuncta* and *P. omphthalmiza* and requires cool, foggy and usually high precipitation habitats in beech-fir forests. Not infrequently a few species change over to rock (usually sandstone), thus above all *P. albescens, P. amara* and *P. coccodes*, more rarely also *P. pertusa*.

The rock dwellers favor similar pH-regions as the bark lichens: commonly lime-free, but not very SiO_2-rich rock with moderate to rather acid upper surface. Distinctly mineral-rich, sometimes basic or slightly calcareous silicate rock are the typical substrate of *P. isidioides* and *P. chiodectonoides*; even *P. flavicans* and *P. pseudocorallina* show tendencies. Most of the epilithic Pertusarias grow on frequently rain-exposed steep- and vertical surfaces of rocks and boulders. While *P. flavicans, P. excludens* and *P. aspergilla* prefer habitats with mild climate, *P. lactea, P. corallina* and *P. isidioides* are more likely on cool, humid or high precipitation sites.

Most of the epiphytic species were originally truly widely distributed in Germany. Because of the development of air pollution many species are however especially in central and northern regions in strong regression; no less tolerated is eutrification and snail feeding. The rock dweller are accordingly of their acidophylic and of their

low gradient, changing over to anthropogenic habitat, limited with little exception throughout the region to contiguous silicate rocks or erratic silicate boulders.

Many of the indigenous species are distributed mainly in southern and central (temperate) Europe. *P. pustulata* penetrates toward the north merely to Westfall and Great Britain. In the case of a few terminating the area in South Scandinavia, thus is the case of *P. trachythallina*, which only reaches the south-western tip of Scandinavia, *P. hymenea, P. flavicans* and *P. multipuncta.* Infringing somewhat further toward the north are *P. flavida, P. hemisphaerica, P. pertusa, P. leioplaca, P. pupillaris* and *P. pseudocorallina.* The north boundary of the area of the pedunculate oak exceeds it not or only with truly few occurrences. Many of these (and the following) species penetrate indeed into Norway and occasionally farther toward the north. The area of *P. aspergilla, P. amara* and *P. corallina* terminates little by little in central Fennoscandia. Still more widely distributed are *P. lactea, P. chiodectonoides, P. coronata, P. coccodes* and *P. albescens.* Most of the Pertusarias have a westerly distribution tendency and become rapidly rarer in northeast Europe, e.g. *P. flavida, P. hemisphaerica, P. aspergilla* and especially *P. hymenea, P. trachythallina, P. pustulata* and *P. multipuncta,* are lichens of the western summer-green deciduous forest regions. One member of the mediterranean floral region is *P. heterochroa*; which is only known in central Europe from Kaiserstuhl.
P. bryontha and *P. glomerata* are arctic-alpine; finally having had a scattering (meanwhile disappearing) of single occurrences in the Black Forest. *P. alpina, P. sommerfeltii* and *P. ophthalmiza* belong to the boreal-montane element; which are known outside Scandinavia especially from the alpine region, in addition reaching a few central mountains. *P. constricta* is indigenous in the mountain forests of the Alps and adjacent Central Mountains as well as in the mountains of the Mediterranean region and seems strongly regressing. *P. isidioides* occurs in the higher mountains of Central Europe (Alps, High Black forest, Rhone, Bohemian Forest); in Germany only a few collection sites are known.

Genus Characteristics and Determination

Thallus crustose, often extensive, scarcely divided to cracked areolate, in the case of the wood- and bark-dwelling species even indefinite and (partially) in the substrate, usually whitish, gray, gray-greenish, yellowish, often with soralia or isidia and then commonly sterile, usually with thin cartilaginous, paraplectenchy-matous upper cortex, with coccoid green algae. Ap. either with open, ± flat disk or opening punctiform and perithecia-like sunken in ± projecting thallus warts. Exc. lacking or thin, ± colorless. Hyp. light. Epihym. light to dark (then often K+ violet). Paraphyses branched and reticulate, flaccid, loose. Asci cylindric, with tholus and broad ocular chamber, outer wall I+ or K/I+ blue, *Pertusaria*-type. Sp. 1-8, often very large, often very thick-walled, sometimes with radial wall structures. Pycn. rare. Ch: Xanthone, Depside, Depsidones and fatty-acids dispersed.

Species of other genera are also keyed, so far as they show affinity with *Pertusaria*-species habits.

1 High mountain lichens on mosses, plant detritus, soils . **2**
1* Lichens with other characteristics **10**
2 With fruiting bodies **3**
2* Sterile **6**
3 Thallus K+ yellow, then rapidly blood-red, C-, P+ yellow, gray- to yellow-white, coherent, covered with almost spherical, -1(1.5) mm wide fruiting warts, ap. perithecia-like with punctiform black disks. Sp. 50-170 x 25-60 µm, usually 4. Norstictic acid, ±Stictic acid . **P. glomerata**
3* Thallus K- or K+ yellow, at best gradually red-brown. Ap. finally with wide opening disks **.4**
4 Sp. 120-220 x 35-90 µm, one per ascus, wall usually 12-20 µm thick. ap. disk brown to brown-black, -2(2.5) mm. Thallus whitish to gray, smooth to wavy-folded, sometimes with sparse, isidia-like outgrowths, C+ red, KC+ red, K+ yellow(-ish), P+ yellowish, then orange. Gyrophoric acid, (Stictic acid) (other places even Xanthone) . **P. bryontha**
4* Sp. smaller, up to 4-8 per ascus, wall -2.5 µm thick, thallus white-gray **5**
5 Thallus thick covered with 1-3 mm long, -0.4 mm thick, easily broken off isidia, K+ yellow (finally red-brown), P+ yellow, then orange-red, C-/KC- to _ reddish. Sp. to (6-)8, 15-31 x 8-16 µm. ap. -2(2.5) mm, disk black, rarely dark brown. Epihym. K+ violet. Fumarprotocetraric acid, (Gyrophoric acid), arct-alp, Alps **P. oculata** (Dickson) Th.Fr.
5* Thallus irregularly warty, mostly coherent, without isidia, R-. Sp. to 4-8, 30-60 x 16-42 µm. Ap. -1.5 mm. Ap. disk blackish, at first

punctiform, later widening, -1 mm. Epihym. K+ brownish. Ch- **Megaspora verrucosa**

6 Thallus C-, covered with long isidia . **P. oculata (5)**

6* Thallus C+ red, KC+ red . **7**

7 Thallus with definite soralia, smooth to wavy-folded, sometimes with isolated isidia-like outgrowths, K+ yellow, P+ yellowish (to orange). Gyrophoric acid, Stictic acid **P. bryontha (4)**

7* Thallus with soralia. Without Stictic acid . **8**

8 Thallus and soralia P+ yellow-orange, K+ yellow. Thallus of ± closely crowded, hemi- to almost spherical, -0.2 mm wide warts, which finally erupt to isolated whitish to slightly ochre colored soralia. Ap. very rare, with dark red disk, sp. to 2, 22-40 x 15-20 µm. Alectorialic-SSy., ±Xanthone. On mosses, plant detritus, lichens over acid soils/silicate rock, arct-mieur-alp, Alps .**P. geminipara** (Th.Fr.) C. Knight ex Brodo

8* Thallus P- or only soralia P+ pale orange. Gyrophoric acid . **9**

9 Thallus with yellowish-green to gray-green, -2(3) mm large soralia, K- to slightly yellowish, P-, rarely soralia P+ red-brown. * ↑ **Ochrolechia androgyna**

9* Thallus erupting coarsely sorediate, diffuse warty-granular, uniformly gray-white, P+ orange. * ↑ **Ochrolechia inaequatula**

10 Thallus with isidia or soralia or irregularly erupting sorediate, almost always without ap. .**11**

10* Thallus without isidia, soralia or sorediate regions, commonly with ap **45**

11 Thallus with ± hemispherical, cylindric to spherical isidia (without handlens sometimes appearing coarse granular-sorediate), rarely sorediate in addition. Thallus slightly cracked to cracked areolate **12**

11* Thallus with soralia or laminal sorediate . **17**

12 On bark (very rarely on rock). Thallus thickly covered with small, -0.2 mm, hemispherical, egg-shaped to short cylindric isidia, coherent, but ± cracked. Isidia leaving behind small scars after falling off, so that sometimes decorticate "eroded", without handlens almost sorediate regions may develop. Occasionally (in the case of unhindered growth) with simple to zoned prothallus . **13**

12* On rock (very rarely on bark), isidia cylindric to somewhat thickened above . **15**

13 Thallus K+ yellow, then rapidly red, gray-white, light gray, more rarely light brownish-gray or greenish-gray. Isidia -0.2 mm thick and 0.5(1) mm high, hemispherical to cylindric, but in the open thallus even thickened above and dark gray to brownish. Rarely (after the isidia fall off) partially "sorediate" eroded. Norstictic acid . **P. coccodes**

13* Thallus K- or K+ yellow (sometimes gradually dirty red-brown). Isidia -0.1 mm thick . **14**

14 Thallus yellow-gray, pale yellow, pale greenish-yellow, C+/KC+ orange, K-/K+ yellowish, (medulla) P- or P+ ochre, then orange-red. Isidia of ± same color as the thallus, sometimes erupting sorediate. 3 chemical races: Thiophanic acid, ±Norstictic acid; ditto + Stictic acid. or ditto + 2'-*O*-Methylperlatolic acid, ±Confluentic acid **P. flavida**

14* Thallus light gray to light gray-greenish, also with slightly yellowish tine, C-, K+ yellow, gradually even dirty red-brown, KC+ yellow, (medulla) P+ yellow, then ± orange-red. Isidia often darker at the tip (± brownish). Coronatone, Stictic acid . **P. coronata**

15 Thallus K+ yellow, then rapidly blood-red, C-, P+ yellow. Thallus robust, white-gray, light gray, but often with slight brownish tint, usually wrinkled or warty. Isidia usually numerous, hemispherical to mostly cylindric, even branched, at least above clearly browned or brown-gray, often somewhat thickened toward the top, -0.3(0.4) mm thick, 0.8(1)mm long, sometimes grouped. Norstictic acid **P. pseudocorallina** (in certain cases difficult to distinguish from *P. coccodes* occasionally on rock; relationship unclear)

15* Thallus K- or K+ yellow (later even dirty red-brown). Thallus whitish to gray, coherent, ± cracked, smooth to usually warty-uneven. Isidia ± cylindric, sometimes branched, not clearly thickened above, without brown tone, often extensive . **16**

16 Thallus K+ yellow (even gradually dirty red-brown), C- KC+ yellow, P+ yellow, then red, often rather thick and then cracked-lumpy, usually gray-white, isidia usually thick standing and irregular, toward the top often slightly regenerating behind, 0.15-0.25 (0.3) mm thick, -0.8 (1.5) mm long. Thamnolic acid **P. corallina**

16* Thallus R-, medulla I+ rose to rose-brown, cracked to cracked areolate, white-gray to gray. Isidia moderately to densely standing, -0.4(0.6) mm thick, -0.6(1.2) mm high. Fatty acids . **P. isidioides**

17 On rock **18**

17* On bark or wood . **25**

18 Thallus white to light gray, K+ yellow, then blood-red (in the case of deep shade growing species delayed reaction), C-, P+ yellow, then yellow-orange. Norstictic acid **19**

18* Thallus K- to K+ yellow, at best gradually dirty red-brown **20**

19 Thallus thin, undivided to slightly cracked, ± even, partially irregularly laminally sorediate, gray to light gray, whitish in the sorediate parts * . **Phlyctis argena**

19* Thallus moderately thick, unevenly warty, cracked- to warty-areolate, gray, brownish-gray, with rounded white, -1.2 mm wide soralia. * **P. excludens**

20 Thallus light yellow, light yellow-gray, yellow-greenish-gray, KC+ orange, C+ yellow-orange, K+ yellowish, P+ ochre, then orange-red, thickish, usually cracked- or warty-areolate, iwht sparse to numerous, rounded to irregular, sometimes even coalescing lighter soralia. Areoles often irregular. Thiophanic acid, Stictic acid (perceptible Norstictic acid) **P. flavicans** (*P. amarescens* Nyl. is very similar, on slightly calcareous silicates: Thallus pale yellowish, thin, finely cracked to cracked areolate, areoles flat, but often somewhat chalky rough, irregular and finally erupting laminally sorediate: Alps, Vog, süSch?)

20* Thallus commonly whitish to gray, without yellow tone. Not KC+ orange, but sometimes rose-red or yellow. With delimited, rounded to irregular soralia. Without Thiophanic acid . **21**

21 Soralia KC+ violet, K- C-, P- or P+ orange-red, high convex, rounded, white, -2 mm wide, with bitter taste. Thallus thin, ± gray. Picro-licheninic acid, sometimes Protocetraric acid **P. amara**

21* Soralia not KC+ violet . **22**

22 Soralia C+ red, KC+ red, K-, P- **23**

22* Soralia and thallus C-, KC- or + yellow, later even reddish or brownish. Thallus light gray to gray, soralia white, P+ yellow or red-orange **24**

23 Thallus cracked to cracked-areolate, often rather thick, white, gray-white. Upper surface of the areoles ± smooth, flat to slightly convex, dull, (above all medulla) C+ red. Soralia usually flat to somewhat convex, -1.5 mm, white. Lecanoric acid, ±(Variolaric acid) . **P. lactea**

23* Thallus usually coherent to cracked, thin to thickish, whitish to gray, often with uneven upper surface, (above all near abrasions) C+ red. Soralia flat to convex, slightly yellowish to greenish-gray. Gyrophoric acid, ± additional substances ↑ **Ochrolechia androgyna**

24 Soralia K+ yellow, then reddish, P+ red-orange to red, at first rounded, somewhat projecting, flat to moderately convex, -1mm, later often coalescing to larger, irregularly delimited complexes, scattered to numerous. Soredia large, usually 80-200 µm. Thallus very thin, cracked to cracked areolate, sometimes with dark gray prothallus lines for whitish thallus border. Areoles usually -1.2 mm. Fumarproto-cetraric acid, (Protocetraric acid), ±Succinproto-cetraric acid **P. aspergilla**

24* Soralia K+ yellow, P+ yellow, then red, breaking up into warts, usually convex, scarcely coalescing. Similar to the former. Protocetraric acid . **P. leucosora**

25 Thallus K+ yellow, then red (delayed reactions in the case of deep shade growing thalli), C-, P+ yellow, then yellow-orange. Norstictic acid **26**

25* Thallus K- or K+ yellow to orange or brownish . **27**

26 Thallus finely isidiate, in the case of observing the upper surface and poor development the isidia seem granular-sorediate, but also sometimes partially "sorediate"-eroded after the isidia fall off. .* **P. coccodes (13)**

26* Thallus without isidia, white-gray to gray, coherent, ± even, partially erupting whitish sorediate and often coarsely laminally sorediate. * **Phlyctis argena**

27 Commonly living on wood. Thallus indefinite (mostly within the substrate), only soralia conspicuous, C- **28**

27* Commonly living on bark . **30**

28 Soralia whitish, yellow-whitish, gray-whitish, K± dirty brownish-red to K-, P+ (yellow to) red, usually flat, -1 mm. Fumarprotocetraric acid, (Protocetraric acid), rarely traces of Gyrophoric **P. pupillaris**

28* Soralia often darker. Without Fumarproto-cetraric acid **29**

29 Soralia brown, dark gray, gray-bluish, abraded whitish, K+ yellow, P+ orange, rounded to elliptical, -1mm. Thallus in the substratum. Stictic SSy., ±Norstictic acid .**Xylographa vitiligo**

29* Soralia green-gray, gray, blue-gray, gray-white, green-yellowish, greenish-white, K± orange to red-brown, P+ yellow to yellow-orange, -0.4(0.8) mm, sometimes coalescing. Thallus often also developed on the substrate. Atranorin, Norstictic acid **Buellia griseovirens**

30 Thallus yellow, yellow-gray, gray-greenish yellow, C+ orange, KC+ orange, with thick standing fine, hemispherical to cylindric isidia, which occasionally at times erupt sorediate, sometimes with ± gray prothallus **P. flavida (14)**

30* Thallus whitish to gray, pale greenish-gray **31**

31 Thallus above all soralia C+/KC+ red, K-, P- or brownish . **32**

31* Thallus/soralia C- or C+ yellowish . **35**

32 Thallus finely isidiate throughout in the center, light gray, greenish-gray to whitish. Isidia delicate, soon erupting into white- to greenish-gray soredia, spherical to mostly cylindric (to coralloid), -0.1(0.2) mm thick. Without well delimited soralia, often with whit prothallus. UV+ blue-white. Gyrophoric acid . **Ochrolechia subviridis**

32* Thallus with definite soralia **33**

33 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. Ap. very rare **Ochrolechia arborea**

33* Thallus without Lichexanthon, UV-/± white. Soralia ± flat to convex **34**

34 With Lecanoric acid, C+ (carmine)red reaction above all in the medulla/in the soralia. Soralia whitish, convex (to hemispherical), -1.3(1.8) mm wide, also coalescing. Thallus with whitish, shiny, often zoned prothallus, smooth to uneven-warty, toward the margin mostly without cracks, cracked toward the middle of the thallus, silver-gray, gray-white, gray. Very often associated with *Pertusaria coccodes* or *P. flavida*
P. hemisphaerica

34* With Gyrophoric acid, C+ (rose- to orange)red reaction in the soralia/in (less on) the cortex. Soralia somewhat yellowish, beige, greenish-white, gray-greenish, -2 mm, sometimes coalescing. Thallus without or with whitish prothallus, with flat to convex soralia (thallus thin, smooth to uneven-warty, light gray, yellowish light gray, soralia often yellowish, only with Gyrophoric acid: Type A, or thallus thick, uneven-warty to knobby, soralia colored like the thallus, gray-yellowish, gray-beige, with 2 additional fatty acids: Type B)
Ochrolechia androgyna

35 Thallus KC+ violet, gray, with usually convex to hemispherical, rarely almost flat white soralia. Prothallus very rarely zoned. Picrolicheninic acid, ±Protocetraric acid, ±Atranorin **P. amara**

35* Thallus not KC+ violet .**36**

36 Thallus/soralia K- and P- **37**

36* Thallus and/or soralia K+ yellow to orange (red-brown) or P+ yellow to red **40**

37 Thallus with sharply delimited, rounded to rarely elliptical, concave to flat, rarely convex, only isolated coalescing soralia **38**

37* Thallus at least partially with irregularly delimited, diffuse coalescing soralia, which erupt from small warts, light gray, gray-white to cream colored, wrinkled to smooth, sometimes with white prothallus. soralia whitish, cream colored, yellowish-white, greenish-white. Soredia 50-90 (120) µm. Ap. very rare. Variolaric acid. (when with fatty acids see *P. albescens*). Sometimes difficult to separate **39**

38 Montane species. Thallus cream colored, yellowish-white to gray-white, ± smooth, prothallus indefinite. Soralia -1(2) mm wide, rounded to elliptical, often surrounded by an uneven "margin", whitish, slightly yellowish, concave to flat, rarely convex. Soredia -150 µm. Ap. rather frequent, rose-brown, thickly margined, disk flat to concave, -3 mm. Variolaric acid, Lichesterinic acid
Ochrolechia alboflavescens

38* Wide spread. Thallus gray, often extensive, often with definite, (whitish-green-gray) zoned prothallus, definitely darker than the soralia. Soralia -2.5(4) mm wide, rounded, concave to (moderately) convex, margined. Soredia coarse, -200(300) µm. Sterile. Fatty acids. (always allo-Pertusaric acid.) **P. albescens** (when thallus tuberculate-uneven, with indefinitely delimited granules on the tuberculae, at times coalescing small soralia: var. **corallina**)

39 Thallus without Lichesterinic acid, with partly sharply delimited, partly diffuse coalescing soralia, rarely finally uniformly sorediate. Above all in lower and middle sites
Ochrolechia turneri

39* Thallus with Lichesterinic acid, thin, soon coarse laminal mealy to granular sorediate. Above all montane, on acid bark
Ochrolechia microstictoides

40 Thallus and/or soralia P- to P+ yellow **41**

40* Thallus and/or soralia P+ yellow-orange, orange-red to rust-red **2**

41 Thallus white to white-gray, coherent, smooth to warty, with delimited, ± round, concave to flat soralia, P-, K+ yellow. Fresh soralia light greenish-gray to cream colored, whitish in the herbarium, K+ yellow, C± yellowish, often coalescing in the thallus center. Soredia -40 µm. Ap. very rare, similar to *Lecanora allophana*. Atranorin et al. (other substance spectrum as in the case of *L. allophana*: when identical (with Atranorin, 2 Triterpenes 6/5/6, 6/3/5: *L. allophana* f. *sorediata* (Schaerer) Vainio)
Lecanora impudens

41* Thallus light gray, thin. Soralia -0.4(0.8) mm, usually flat or somewhat concave, often somewhat projecting, not rarely bordered by a ± frayed "thallus collar", greenish-white, green-yellowish, gray, green-gray, gray-blue, K+ orange to red-brown, but sometimes truly indefinite
Buellia griseovirens (44)

42 Fruiting bodies are contained within the "soralia", K+ yellow, P+ yellow, then red or K+ yellow, then reddish, P+ orange-red. See *P. trachythallina* and *P. multipuncta*

42* Soralia without fruiting body . **43**

43 Without Atranorin. Non sorediate part of the thallus commonly indefinite, ± within the substrate. Without definite prothallus. soralia whitish, slightly yellow- or gray-whitish, ± flat, K± dirty brownish-red to K-, P+ (yellow to) red, -0.7 mm. Fumarportocetraric acid., (Proto-cetraric acid), rarely (Gyrophoric acid.). UV-/weakly blue-whitish **P. pupillaris**

43* With Atranorin. Thallus/soralia K+ yellow, orange to red-brown, usually developed above the substrate **44**

44 Thallus light gray to gray, with or without dark brown to brown-black prothallus line, uneven warty or somewhat cracked, with at first small delimited (0.15-0.5 mm wide), ± concave, later larger and often coalescing pale greenish, whitish, bluish- to brownish-gray soralia, K+ yellow. Atranorin, Fumarprotocetraric acid. Thallus sometimes with irregular apothecia-like

black -0.8 mm wide structures of gelatinous consistency (= T*remella lichenicola* Diederich) .**Mycoblastus fucatus**

44* Thallus light gray, thin, also in the substrate. Soralia -0.4 (0.6) mm, usually flat or somewhat concave, often somewhat projecting, greenish-white, green-yellowish, gray, green-gray, gray-blue, K+ orange to red-brown, but sometimes truly indefinite, C-, P+ yellow to yellow-orange. Atranorin, Norstictic acid .□ **Buellia griseovirens** (similar, but with Atranorin, Placodiolic acid, K+ yellow, P± yellow: *Buellia arborea*

45 On silicate rock. K+ yellow, KC+ yellow, P+ ochre to orange-red, C- .**46**

45* On bark, sometimes over growing moss . **47**

46 Ap. warts scarcely projecting, with 1 to several ap. Disk ± widened, -0.4(0.6) mm, black, often gray pruinose, flat, often with irregular outline, similar to an *Aspicilia*. Sp. ca. 25-42 x 12-24 µm. Thallus gray, dark gray to gray-brown, cracked areolate. Stictic acid SSy. (± Norstictic acid) **P. chiodectonoides**

46* Ap. warts strongly projecting, irregularly lumpy, sometimes narrowed at the base, -2.5 mm wide, usually with several ap. with punctiform dark mouths. Sp. 140-240(300) x 40-85 µm. Thallus gray, greenish-gray, smooth to wrinkled, cracked to partially cracked-areolate, ± shiny. Stictic acid SSy, Coronaton, (± Norstictic acid) . **P. pertusa** var. **rupestris**

47 Ap. single in soralia-like rounded, -1.5 mm wide warts, with ± broad disks, at times almost *Lecanora*-like. Disk ± flat, under a sorediose film or white/gray pruinose. Thallus gray to whitish, smooth to unevenly warty, ± cracked. C- **48**

47* Ap. sunken in moderately convex to lumpy projecting thallus warts, not in soralia-like structures, not with gray pruinose disks. Thallus gray **50**

48 Thallus (medulla) and soralia-like ap. warts R-. Ap. -1(1.2) mm, to 1-2. Sp. single, (90)130-150 (170) x 50-70 µm. With 4 fatty acids . **P. ophthalmiza**

48* Thallus (medulla) and soralia-like ap. warts K+ and P+ yellow or red . **49**

49 Thallus K+ yellow, then reddish, P+ orange-red, with Physodalic acid, (Protocetraric acid). Sp. single, 90-190 x 30-70 µm. Ap. disks ca. -0.5(1) mm, blackish, rarely pale, ± pruinose . **P. multipuncta**

49! Thallus K+ yellow, then blood red, P+ yellow, with Norstictic acid. Sp. single, 70-150 µm. Ap. disks blackish. An oceanic habitat in forests. North Alps . **P. waghornei** Hulten

49* Thallus K+ yellow, then red, with Thamnolic acid. Sp. to 2, but often not developed, 50-160 x 20-55 µm. Ap. disks -2 mm, rose, pruinose . **P. trachythallina**

50 Sp. to 8, not over 130 x 50 µm. Relatively rare species **51**

50* Sp. to less than 8 . **54**

51 Ap. at first punctiform, older with clearly widened, ± puffy margined, rounded to irregular, blackish, -1(1.5) mm wide disk, to usually 1-3 in lumpy projecting, -2 mm wide warts, even almost *Lecanora*-like. Thallus yellow-gray, gray, greenish-gray, C+ yellow, KC+ strongly yellow to orange, P-, K- (reactions however sometimes failing to come), partially cracked, ± smooth. Thiophaninic acid, ±Gyrophoric acid. Sp. 60-110(130) x 25-50 µm, with multi-layered wall **P. hymenea**

51* Ap. only with punctiform dark disk, enclosed in ± convex warts. Thallus (medulla) C-, P+ ochre, then reddish, K/KC+ yellow (reaction often weak!), thin, undivided to slightly cracked, gray, greenish-gray, rarely yellowish-gray. With Coronaton, Stictic acid .**52**

52 Sp. 20-45 x 12-25 (30) µm. Epihymenium K+ violet. Ap. warts -1 mm, with mostly 1 (2-3) ap. .* **P. sommerfeltii**

52* Sp. at least in part larger, ca. 30-75 x 15-40 µm. Epihym. K- . **53**

53 Ap. warts -2.5 mm, usually moderately convex (broadened below), with 1-8 ap. * **P. alpina**

53* Ap. warts at least when old lumpy, with steep flanks to narrowed below, -2 mm, with usually 3-6 ap. . * **P. constricta**

54 Sp. to r, rarely 6, commonly 40-80(115) x 20-40 (50) µm, with smooth, -5 µm thick wall. Ap. warts -1.5(2.5) mm, with usually 1(2) punctiform opening ap., moderately convex to occasionally hemispherical, commonly not crowded. Thallus partially with lower cortex to clearly with upper cortex, but usually thin, smooth, undivided to partially somewhat cracked, gray, greenish-gray, yellowish-gray, gray-white. Thallus (medulla) P+ ochre, then reddish. (reactions only clear in the case of a well developed thallus, otherwise weak to P-), K± yellow, C-. Coronaton, Stictic acid SSy, (±Norstictic acid) . □ **P. leioplaca**

54* Sp. to 2 **55**

55 Ap. warts lumpy projecting, not widened below, with steep flanks (often narrowed), often very thick standing, often flattened above, -1.5(2.5) mm wide, with usually several (to over 10) ap. openings. Sp. 140-240(300) x 40-85 µm, wall 7-15 µm thick. Thallus upper cortex clearly developed, gray to green-gray, medulla P+ ochre, then reddish, K+ yellow, C-. Coronaton and Stictic acid SSy . □ **P. pertusa**

55* Ap. warts usually moderately convex, with flattened apex, usually with 1-2(4) ap. Thallus P+ ochre, then orange-red. Sp. up to 175 µm in size. Stictic acid SSy, ±Norstictic acid **56**

56 Thallus with Thiophanic acid, Stictic acid. *, KC+ yellow, then orange, very thin. Sp. 70-175 x 25-63 µm . **P. heterochroa**

56* Thallus with unknown Xanthone, Stictic acid. *, KC+ yellow to yellow-orange. Sp. 40-175 x 25-50 µm **P. pustulata**

Ecology and Distribution of the Species

Pertusaria albescens (Hudson) Choisy & Werner (P. discoidea (Pers.) Malme, P. globulifera (Turner) Massal.
var. **albescens**
Up into the (high)montane zone on (r.)m.acid to subneutral, not to r.eutrophic bark of deciduous-, rarely conifer trees, rarely on rock (usually anthropogenic substrate), even on moss, on free-standing trees and in open forests, above all in the Xanthorion par., Pertusarietum hem. – (s')bor-med – r.frequent
var. **corallina** auct.
Above all on eutrophic bark of deciduous trees, above all at the base of stems

Pertusaria alpina Hepp ex Ahles
In montane and high montane sites on smooth, not eutrophic bark of deciduous trees, above all on branches and young stems on very humid, m.-r. well lighted habitats, above all on beech, alder, ash, sycamore, e.g. in beech-, beech-spruce forests and in brook bordered gray alder stands, in the Lecanorion subf. –bor-med-mo – rare *(2)*; süSch, *Vog, Fi,* ThW, Al, *Obay*

Pertusaria amara (Ach.) Nyl.
Up into the high montane sites on deciduous- and conifer trees, r.euryök, preferably on m.-r. well lighted, r.acid, humid, not (to m.) eutrophic, moderately rain exposed to rather rain sheltered habitats, m.-v.acidoph., r.skioph.-r.photoph., in the Graphidion, Pseudevernietum, above all in the Pertusarietum hem., Pertusarietum amarae – (s')bor-med – r.frequent, in strongly air polluted and agricultural regions clearly in regression

Pertusaria aspergilla (Ach.) Laundon
(P. dealbescens auct., P. leucosora auct.)
Up into montane sites on lime-free silicate rock on m.-r. rain exposed steep- and vertical surfaces on mild to cool, m.-r. well lighted sites, m.-r.acidoph., m.ombroph., anitroph., Char. Pertusarietum asperg.-flav., in the Pertusarietum cor. – (s'bor-)-mieur-subatl-med-mo – rare; Sch, Vog and RhSch r.rare, Pf, O, Rhön, ThW, *Fr, BayW*

Pertusaria bryontha (Ach.) Nyl.
Over mosses and plant detritus over base-, usually calcareous soils in the alpine zone – arct-alp – rare; Al

Pertusaria chiodectonoides Bagl. ex Massal.
(P. inauinata (Ach.) Th.Fr.)
Above all in montane sites on basic and neutral, commonly lime-free silicate rock, e.g. serpentine, melaphyre, basalt, even on slightly eutrophic habitats, subneutroph., (r.skioph.-) m.-r.(v.)photoph., e.g. in the Parmelion consp. – bor-med-mo – v.rare (0); süSch, *Vog, Fr,* BayW

Pertusaria coccodes (Ach.) Nyl.
(P. phymatodes (Arch.) Erichsen)
Up into the (high) montane zone on smooth to cracked bark of deciduous trees, rarely spruce, on free-standing trees and in open forests (here above all on oak in oak-hornbeam-, beech(-spruce)-forests), (subneutroph.)m.-r.acidoph., in the Pertusarietum hem., Parmelietum rev., on avenue trees even in the Xanthorion par. – (s') bor-mieur(-subatl)-med – r.rare-m.frequent (+)

Pertusaria constricta Erichsen
In montane and high montane beech- and beech-spruce forests in high precipitation, oceanic sites, above all on smooth bark of red beech, m.acidoph., (r.-)v.hygroph., r.ombroph., m.photoph., anitroph., in the Graphidion, e.g. in montane forms of the Pertusarietum hem. – mieur-paralp-med-mo – rare (2); süSch, *nöSch*, Al

Pertusaria corallina (L.) Arnold (P. subdubia Nyl.)
From the (sub)montane to the alpine zone, high point in montane-high montane, high precipitation sites, on commonly lime-free silicate rock on humid, well lighted, cool oceanic, even on rather open to the wind habitats, usually on steep sloping and rain exposed vertical surfaces, in boulder fields sometimes in bulk stands, m.-r.acidoph., r.-v.hygroph., r.-v.ombroph., anitroph., in the Pertusarietum cor., Pert.-Ophioparmetum, Parmelietum omph. et al.; one of the most important dye lichens (Persio, Orseille) – (s') bor-mieur-mo-med-mo(alp) – r.rare; Sch, Vog, Pf, RhSch, He, ThW, Erz, BayW, rare O, Sp.

Pertusaria coronata (Ach.) Th.Fr.
Above all on m.acid bark of deciduous trees, similar to *P. flavida* (↑), also similar to *P. coccodes*, but avoiding eutrophic habitats –

s'bor(subatl)-med – r.rare (3), widespread, with the exception of strongly air polluted and deciduous forest-poor regions

Pertusaria excludens Nyl.
Similar to *P. flavicans*(↑), in location. Char. Pertusarietum asperg.-flav. – mieur(subatl)-med – v.rare (R); süSch (Zastler)

Pertusaria flavicans Lamy
Above all in submontane, mild to warm, r.oceanic sites on moderately rain exposed, rather well lighted steep- vertical surfaces on commonly lime-free, but mineral-rich silicate rock, especially on sunny, south and west exposed hanging valleys on rock interspersed oak-beech forests, m.-r.acidoph., m.-r.hygroph., m.thermoph., anitroph., Char. Pertusarietum asperg.-flav. – mieur-subatl-med – rare; süSch, Vog, Pf, Mos, Ts, MRh, v.rare *O, SFW,* ?Sb

Pertusaria flavida (DC.) Laundon
P. lutescens Hoffm.) Lamy)
Up into (high-)montane sites with the high point in the submontane and montane zones in m.-r. oceanic toned regions, on the stem of deciduous trees, rarely spruce; in relatively precipitation-poor regions in the interior of oak-hornbeam forests on cracked bark of oak, in higher, more moist sites above all on beech in ± open beech(-spruce) forests as well as on free-standing trees, m.acidoph., (m.)r.-v.hygroph., m.-r.ombroph., anitroph., Char. Pertusarietum hem. – (s'bor-) mieur-subatl-med-mo, (oc) – r.rare (3); above all Sch, Vog, PfW, O, Sp, SFW, Fr, He, ThW, rare in southeast/East (e.g. BayW)

Pertusaria glomerata (Ach.) Schaerer
In the subalpine and alpine zones on humus, base-rich soils and on dying plants, above all on long time snow covered habitats, in avalanche regions, in the Megasporetum verr., Caloplacetum niv. – arct-alp – v.rare (0); süSch (Feldberg), Al

Pertusaria hemisphaerica (Flörke) Erichsen
On deciduous trees and spruce, very much similar to *P. flavida*(↑), -- s'bor-mieur-subatl-med – r.rare (3); distributed like *P. flavida*

Pertusaria heterochroa (Müll.Arg) Erichsen
In the foothills zone in mild or warm sites on open habitats on deciduous trees with base-rich bark, found in the region on walnut trees, subneutroph. – s'mieur-med, subatl – v.rare (0); *süHü (Kaiserstuhl)*

Pertusaria hymenea (Ach.) Schaerer (P. wulfenii DC.)
In montane, high precipitation, oceanic rarely submontane sites in open, humid beech(-spruce) - and sycamore forests (Aceri-Fagetum), above all on smooth bark on stems of beech and sycamore, on mild to cool habitats, m.acidoph., (r.skioph.-)m.photoph., v.hygroph., r.ombroph., anitroph., in the Pertusarietum hem. – mieur(atl)-med-subatl – rare (2); Sch, Vog, süHü, SFW, O, Saar, He, ThW, Erz?+

Pertusaria isidioides (Schaerer) Arnold
In high montane to alpine sites usually on basic or slightly calcareous silicate rock on high precipitation, humid, usually r.well lighted, habitats away from the sun, in cool boulder fields, on rain exposed rock surfaces, m.acidoph. -subneutroph., hygroph., anitroph., e.g. in the Pertusarietum cor., Rhizocarpion alp. – mieur-h'mo/alp – v.rare (R); Rhön, Ts, süSch (Belchen), BayW, Alps

Pertusaria lactea (l.) Arnold
Above all in submontane and montane, mild to cool, often rather oceanic sites on usually lime-free silicate rock, especially on rain exposed steep- and vertical surfaces on m.-r well lighted, away from the sun, humid sites, m.-r.acidoph., m.-r.ombroph., anitroph., in the Pertusarietum cor., Pertusarietum asperg.-flav., Parmelietum omph. et al. – bor-smed-mo – r.rare; Sch, Vog, Pf, Hu, Ts, Eif, Rhön, ThW, otherwise v.rare

Pertusaria leioplaca DC. (P. leucostoma Massal.)
Up into the montane sites on smooth to flat-cracked bark of tree stems, above all on beech, hornbeam, ash in forests, pioneer together with *Graphis scripta* (↑), on young trees, disappearing on more strongly cracked bark, m.acidoph., r.-v.hygroph., m.-r.ombroph., r.skioph.-m.photoph., anitroph., Char. Graphidion, today on lower sites often algae covered and grazed by snails – s'bor-med-(mo) – m.-r. frequent

Pertusaria leucosora Nyl.
In the foothills and submontane (montane) sites on mineral-rich silicate rocks, ecologically similar to *Lecidella carp.* – mieur-med – rare (R); nöPf, Ne, Eif, probably also Pf

Pertusaria multipuncta (Turner) Nyl. (P. leptospora Nitschke ex Lahm)
In the region in montane sites, in northwest- and west Germany in the lowlands and in the foothills zones, on smooth bark of deciduous trees (commonly beech and hornbeam) in near natural forests, in the region in cool-humid beech-spruce forests, m.acidoph., ombroph., v.hygroph., r.skioph., in the Graphidion association -- mieur-(atl)-med-mo, oc - v.rare (1); süSch, NW Germany

Pertusaria ophthalmiza (Nyl.) Nyl. (P. multipuncta auct.)
In the montane and high montane zones on conifers, above all on the stem of spruce and on the branches of spruce and fir in beech-spruce and spruce-fir forests in narrow valleys, in cold air collecting depressions, in cool-moist near natural woodlands, climatic requirements similar to *Evernia divaricata* (↑), m.-r.acidoph., r.skioph.-m.photoph., v.-e.hygroph., anitroph., on branches in the Evernietum div. and in associations of *Ochrolechia szat.*, on stems e.g. in the Thelotremetum – bor-mieur, oc – v.rare (1); Sch, Al, *Ml*, BayW, Obay

Pertusaria pseudocorallina (Liljebald) Arnold
In the sub- to the high montane zone on silicate rock on sloping and rain exposed vertical surfaces, usually on relatively warm, well lighted habitats on sunny slopes in high precipitation sites, rare in cool-moist boulder fields, m.acidoph., a-/m.nitroph., localized Char. Pertusarietum asperg.-flav., also in the Lecanoretum rup., Lasallietum – mieur(subatl) - med(mo) – rare; süSch and Vog r.rare, otherwise v.rare (PfW, *O*, Rhön, *Fi*).

Notice: The differentiation from *P. coccodes* var. *phymatodes* seems problematic

Pertusaria pupillaris (Nyl.) Th.Fr.
Predominantly in montane sties on decaying wood of stumps and stems on well lighted habitats, in lower sites above all on smooth bark of deciduous trees in open forests in valley meadows, e.g. in the Xylographetum, Graphidion -–s''or-smed – r.rare; Sch, Ju, Bo, süHü, Ne

Pertusaria pustulata (Ach.) Duby
In the foothills and submontane, climatically mild to rather warm sites on smooth and flat cracked bark of deciduous trees, above all on hornbeam and beech, more rarely on oak, ash, etc., in humid oak-hornbeam- and beech forests (e.g. Stellario-Carpinetum) or Carici-Fraxinetum, above all in moist valleys, m.acidoph., r.skioph.-m.photoph., ombroph., anitroph., in the Graphidion, above all in the Graphidetum – (s')mieur(atl)-med-subatl – (r.)rare (2); Sch (up to ca. 600 m), Vog, Ne, Ju, Hü, O, Rh, HRh, Bo, *Ml*

Pertusaria sommerfeltii (Sommerf.) Fr.
High montane to alpine, on dwarf shrubs, deciduous- and conifers, above all on smooth bark, in the Alps commonly in dwarf shrubby heath on m.-r. well lighted, r.long time snow covered sites – bor-mieur-subalp/alp – v.rare *(0)*; Vog, süSch (Feldberg), Al

Pertusaria trachythallina Erichsen (P. laevigata (Nyl.) Arnold)
In the foothills and submontane, rarely montane sites in open wood rush-beech-oak forest, beech forest and oak-hornbeam forest on smooth bark of beech and oak (here above all on branches) or other trees with m.acid bark, on mild, very humid, often foggy, m.-r. well lighted habitats, m.acidoph., anitroph., in the Graphidion, e.g. Pertusarietum hem. – mieur-med, subatl, (oc) – rare (2); süSch, Ne, *nöRh, O, FrJu, Obay, Rh, Vog, Ml*

LIT.: DIBBEN 1980, ERICHSEN 1936, HANKO 1983, TONSBERG 1992

Petractis Fr.

(Determination ↑ Gyalecta)

Introduction

The thin crustose, little differentiated, whitish to rose colored thallus of the *Petractis*-species sits more or less in the interior of limestone. The apothecia sometimes look perithecia-like or have open disks. The five (in Germany two) known *Petractis*-species like shady, at times slightly moist substrate rock walls. *P. clausa* grows on calcareous rocks, *P. hypoleuca* predominantly on dolomite. Both are distributed from the Mediterranean to Central Europe. In northern Central Europe they are already rare. The north boundary of the area reaches into southern Scandinavia (Gotland). *P. hypoleuca* has its

center in the alpine mountains and has been found in Germany outside the Alps and the Jura only a few times.

Genus Characteristics

Thallus crustose, very thin, extensively endolithic, with *Trentepohlia* or bluegreen algae of the genus *Scytonema*. Ap. from the first as hemispherical, enclosed in vesicular projecting warts, at first punctiform, then later opening, with sunken, concave to flat, orange-red to rose-brown colored and sometimes deeply split. Exc. thin, light, bowl- or ring form. Hym. colorless, I+ blue, over 120 µm high. Paraphyses unbranched, colorless above, not or scarcely swollen on the ends. Asci cylindric to clavate- cylindric, thin walled when ripe, without tholus, shorter than the paraphyses, ascoplasma I+ blue, wall I+/I-. Sp. multicellular, cross septate to muriform, ellipsoidal to long fusiform, with perispore. Ch-

Ecology and Distribution of the Species

Petractis clausa (Hoffm.) Krempelh.
Up into the alpine zone on calcareous rock (usually pure lime) above all on sloping- and rain exposed vertical surfaces on shady-humid, sometimes even slightly substrate moist (dew) habitats, in lower sites especially in ravines, valleys, on north slopes, basiph., r.hygroph., a-/(m.) nitroph. – mieur-med-mo – r.rare; Sju, Ju, FrJu, Al, otherwise v.rare (süHü, Ne, ?O, Saar, *nöRh*, *Rh-Mn-T*)

Petractis hypoleuca (Ach.) Vèzda (Gyalecta h. (Ach.) Zahlbr.)
In the submontane and above all montane zones (in the Alps even higher) on rather rain protected vertical- and overhanging surfaces on carbonate rock, especially on rough or porous and somewhat spring moistened substrates, e.g. dolomite, rarely limestone, on r.(-v.)humid, r. poorly lighted habitats in gorges, forests, basiph., anitroph., Char. Petractinetum hyp. – mieur(pralp)-med-pralp – v.rare; Sju, Ju, FrJu, Ne, *Al*

Lit.: VÈZDA 1965 a.

Phaeocalicium A.Schmidt

(Determination ↑ Stenocybe)

Introduction

Phaeocalicium-species are very small nonlichenized fungi, which resemble the dust-fruiting (coniocarpic) lichens. They live saprophytically, rarely parasitically on the bark or the wood of deciduous trees. The stick-pin like fruiting bodies are very delicate, black to brown-black colored; a mazaedium lacking. *Ph. compressulum* sits on branches of the green alder (*Alnus viridis*) and occurs in the region of the alpine mountains and their environs, *Ph. populneum* lives on popular-species (*Populus* spp.) and is distributed in the boreal and temperate zone.

Genus Characteristics

Saprophytic or parasitic fungus with indefinite thallus without algae. Ap. stalked, black, brown-black, capitate egg- or lens-form or laterally strongly compressed, without mazaedium. Asci cylindric, one-layered, thickened above. Sp. 1-series in the asci. Sp. 1- to 2-celled, ellipsoidal, with rounded ends, brown. Ch-

Ecology and Distribution of the Species

Phaeocalicium compressulum (Nyl. ex Vainio) A.Schmidt (Calicium praecedens auct. medieur., non Nyl.)
In montane to subalpine sites on living and dead twigs of green alder in green alder brush and brook bordered high brush fields on usually m.-r. well lighted, often north exposed sites, m.acidoph., hygroph., anitroph., almost always without companions – mieur-pralp – v.rare *(1)*; süSch, *Do*, Al

Phaeocalicium populneum (Brond. ex Duby) A.Schmidt (Calicium p. Brond. Ex Duby)
Up into the montane sites on smooth bark, usually dead twigs, rarely on stems of popular on r.well lighted habitats in moist, cool valleys, subneutroph.-neutroph., anitroph., e.g. in openings of the initial states of the Xanthorion-society, often with *Lecania cyrt.* – bor-mieur – rare (3); SFW, Ne, Sch, *Vog*, Sju, *PfW*, *Rh*

Lit.: SCHMIDT 1970

Phaeographis Müll. Arg.

(Determination ↑ Graphis)

Introduction and Genus Characteristics

The *Phaeographis*-Species are crustose lichens with thin or endophloeic thallus and elongate to streak-form, simple to branching, ± sunken, *Graphis*-like apothecia without thalloid margin. Disk not crack-form, receptacle less strongly developed than in the case of *Graphis*, only marginally constructed, light brown to dark, or continuing under the hypothecium. Hym. I-, with crystal-like inclusions. Asci of the *Graphis*-type, K/I-. Sp. light to dark red-brown, 4-10 celled, cross septate, with lens-form compartments, I+ purple. Atlantic species, three species on deciduous tree bark in NW Germany, may be in strong remission.

Phaeophyscia Moberg

(Determination ↑ Physcia)

Introduction

The *Phaeophyscia*-species are comparatively small, narrow lobed, deeply divided gray, olive-gray to brown foliose lichens; they were formerly included in the genus *Physcia*. In contrast to *Physcia* the thallus cortex does not give a yellow color with KOH. In the imbibed condition the thallus is greenish; the underside is often blackish colored.

The species live on base-rich substrates, on subneutral to basic, frequently distinctly nutrient-rich bark of deciduous trees or on calcareous or eutrophied rock. Of the ca. 30 in part very widely distributed species twelve occur in Germany. *Ph. orbicularis* is counted as the most frequent foliose lichen and is distributed on bark and rock in almost all of Europe. *Ph. nigricans* and *Ph. sciastra* are in the region predominantly represented on walls and other anthropogenic substrates. Also they have almost all of Europe included in their area. *Ph. endococcina* lives in mountain brooks on from time to time flooded, at least spray water moistened boulders and moist silicate rocks, *Ph. strigosa* on dry-hot, calcareous or dust impregnated rocks above all in vineyard sites. The first is distributed from arctic over the boreal conifer belt up into the mountains of the mediterranean region, the latter in the mediterranean and submediterranean zone and reaches in the region the north limit of the area.

Ph. endophoenicea is found mostly in open forests and free-standing trees in mild to cool, high precipitation sites, especially on maple, Norway maple and ash. Similarly *Ph. chloantha*, is however limited to relatively warm regions; it advances from the Mediterranean region up into southern Central Europe, while *Ph. endophoenicea* is distributed up into southern Scandinavia. The area of *Ph. ciliata* is very strongly shrunken in Central Europe. The lichen growing on quaking aspen predominantly in the eastern boreal region is threatened with extinction.

Genus Characteristics

Narrow lobed, rosetted, rapidly and irregularly growing foliose lichens, rare tendency to small fruticose, light gray, greenish-gray, olive, brown, dark brown-gray, nonpruinose, underside in most taxa dark colored, rarely whitish, thickly covered with simple to little branched attachment filaments colored like the underside. Often with soredia or isidia. Upper- and lower cortex paraplectenchymatous. Photobiont *Trebouxia*-like. Ap. laminal, often with rhizines on the underside, disk brown to black, with thalloid margin. Hyp. colorless. Epihym. brown. Paraphyses often forked above, with clavate thickened ends and thinner brown cap. Asci cylindric-clavate, of the *Lecanora*-type. Sp. 2-celled, (gray-green to) brown, thick walled. Pycnidia sunken, pycnosp. ellipsoidal. Usually Ch-, always without Atranorin, sometimes with Skyrin, Zeorin. Cortex and medulla (so far as I know not orange colored) K-.

Ecology and Distribution of the Species

Phaeophyscia chloantha (Ach.) Moberg (Ph. luganensis (Mereschk.) Moberg, Physcia l. Mereschk., Ph. pragensis Nádv.)

In foothills and submontane, warm sites on deciduous trees, above all on subneutral to moderately acid, nutrient-rich bark, rarely going over to rock (e.g. walls), m.-r.photoph. – s'mieur-med – v.rare, probably also overlooked *(1)*; süRh, *Ne*, Av (Bavaria)

Phaeophyscia ciliata (Hoffm.) Moberg (Physcia c. (Hoffm.) Du Rietz)
In montane and high montane, high precipitation sites, today lacking in the lowland, on free-standing deciduous trees and in open mountain forests, preferably on smooth and flat- cracked, subneutral, non or only weakly eutrophied bark, above all on aspen, walnut, ash, (m.acidoph.-)subneutroph., a-/m.(r.)nitroph., in the Xanthorion par. – bor-med-mo – v.rare (1); Ju-Ne, earlier scattered in Ju and Ne, in addition in Hü, O, *Pf, Vog* etc.

Phaeophyscia constipata (Norrlin & Nyl.) Moberg (Physcia c. Norrlin & Nyl.)
In (sub)montane sites on open, sunny, summer-warm, winter-cold, at times rather open to the wind habitats, above all on rock crowns and projections between and over mosses and very flat soils over lime and dolomite rocks, usually with *Physconia musc., Megaspora verr.* (Megasporion verr.), neutro- to basiph., v.photoph., xeroph. – arct-bor(alp)-mieur-co.; relict - v.rare: FrJu (2)

Phaeophyscia endococcina (Körber) Moberg (Physcia e. (Körber) Th.Fr., Ph. lithotodes Nyl.)
Above all in the montane and high montane zones on silicate rock in the amphibian zone of clear mountain brooks, even on occasionally irrigated rock surfaces, on shady-humid sites even without secondary water supply, often going over to moss, subneutroph., r.skioph.-r.photoph., hygroph., a-/m.nitroph., in the Verrucarion praeterm.; Forms with orange medulla only in high montane sites and higher – arct-med-mo – r.rare (2); süSch, Vog, Al

Phaeophyscia endophoenicea (Harm.) Moberg (Physcia e. (Harm.) Santha)
In the foothills to montane, precipitation-poor to high precipitation, mild sites on deciduous trees, similar to *Bacidia rubella* (↑), also *Normandina* (↑), usually on mosses such as *Leucodon, Antitrichia, Pterigynandrum*, above all on maple species, ash, in higher sites even on old beeches, subneutroph., m.skioph.-r.photoph., r.oceanic, in the Acrocordietum gemm., Bacidio rubellae-Aleurodiscetum, Antitrichion, Lobarion p. – mieur-subatl-med-mo – r.rare (3); süSch, Vog, Ju, Sju, Ne, Bo, Al, otherwise rare (e.g. nöSch, SFW, Mn, Rh, Rh-Mn-T)

Phaeophyscia nigricans (Flörke) Moberg (Physcia n. (Flörke) Stizenb.)
Predominantly in foothills and submontane sites, but penetrating up to the tree line, high point on eutrophied, calcareous rock substrates on anthropogenic habitats, similar to *Caloplaca teich.* (↑) and *Lecanora albescens*, even on dust impregnated stem(base) of free-standing deciduous trees, in the Caloplacion dec., Physcietum adsc., neutroph.-basiph., r.-v.nitroph. – bor-med – r.frequent in lime regions and lowlands, otherwise usually r.rare, regionally introduced, Sch up to 1400 m

Phaeophyscia orbicularis (Necker) Moberg (Physcia o. (Necker) Poetsch)
Very variable, v.euryöke, very eutrophication tolerant species, one of the most tolerant foliose lichens, epiphytic especially on stem and stem base, limited in the case of lacking eutrophication on subneutral deciduous tree bark, epilithic on calcareous rock, above all on anthropogenic habitats (walls, roof tiles etc.), high point on r.well lighted, r.-v. eutrophied sites, m.acidoph.-m.basiph., epiphytic above all in the Xanthorion par., epilithic e.g. in the Caloplacion dec. – bor-med – frequent-very frequent

Phaeophyscia sciastra (Ach.) Moberg (Physcia s. (Ach.) Du Rietz)
Especially in montane and high montane sites on commonly m.-r.eutrophied substrates, on calcareous, rarely lime-free rock, on processed wood (old fences, shingles etc.) as well as on rock- and wood-dwelling mosses, on silicate rock above all on occasionally slightly irrigated, slightly lime influenced surfaces, even on spray-water moistened boulders in brooks as well as on bird roosting sites, subneutroph.-m.basiph., r.-v. photoph., m.-r.nitroph., on wood e.g. in the Lecanorion variae, Xanthorietum cand., on rock e.g. in the Xanthorietum eleg. – arct-med – r.rare, above all Ju, Sju, FrJu

Phaeophyscia strigosa (Poelt & Busch.) Golubkova (Physcia s. Poelt & Busch.)
On precipitation-poor sites on sunny rocks of dust impregnated limestone and calcareous/ mineral-rich silicate rock, above all on moderately rain exposed steep surfaces;

subneutroph.-m.basiph., r.-v.photoph., m.-r.nitroph. – s'mieur-med – v.rare (R); Ne

Lit.: FREY 1963, MOBERG 1977

Phaeorrhiza Mayrhofer & Poelt

(Determination ↑ Rinodina)

Introduction and Genus Characteristics

Crustose lichens related to *Rinodina*, with squamulose-foliose, closely coalescing, yellowish-green to usually browned thallus. Upper cortex paraplectenchymatous. Ap. cryptolecanorine, lecanorine to lecideine. Hyp. colorless to brownish. Paraphyses capitate-clavate above, brown. Asci with definite amyloid tholus and amyloid gelatinous outer layer. The arctic-alpine *Ph. nimbosa* is distributed in the Alps.

Phlyctis (Wallr.) Flotow

Introduction

The thallus of the *Phlyctis*-species are thin crustose, white to gray, sorediate or not sorediate. The apothecia are sunken and have a blackish, partially pruinose appearance, disk unmargined by the thallus. The large, muriform multicellular spores are very characteristic.

The two European representatives of the predominantly southern hemisphere genus grow above all on deciduous tree bark. Where the commonly sterile, large surface erupting sorediate *Ph. argena* shows a broad ecological amplitude, *Ph. agelaea* prefers settling in climatically mild sites on humid habitats, above all on ash and Norway maple. The area stretches from the Mediterranean region up into southern (in the case of the subatlantic *Ph. agelaea*) or central Fennoscandia (*Ph. argena*).

Genus Characteristics and Determination

Thallus crustose, decorticate, whitish to gray, with or without soralia, with coccoid green algae. Ap. sunken, rounded or with irregular outline, margined by the thallus, sometimes with soredia-like film. Paraphyses simple to sparsely branched. Asci broadly clavate, thin walled, with I+ blue outer layer, tholus I-. Sp. to 1-2(4), ellipsoidal or in the case of non European species even elongate or almost spherical, muriform multicellular, colorless or slightly brownish. Ch: in the case of the indigenous species Norstictic acid.

1 Thallus white-gray to gray, partially weakly cracked, irregularly erupting whitish (to green-whitish) mealy sorediate, finally (above all in the center) large surfaces sorediate, K+ yellow, then red (reaction in the case of shade specimens sometimes weak), C-, P+ orange-red. Ap. rare, -0.4 mm, black, white pruinose, granular-sorediate margined. Sp. single, without light points, 60-150 x 25-50 µm. Norstictic acid . **Ph. argena**

1* Thallus white to white-gray, somewhat cracked, always with ap in rounded to irregular, -1 mm wide soralia-like eruptions. Ap. -0.5 mm, sunken to deepened, dark, but covered by large whitish thallus granules. Thallus otherwise without soralia. Sp. to 2(4), 42-90(115) x 14-35(45) µm, each with one light tip, muriform-multicellular. R and Ch as the previous **Ph. agelaea**

Ecology and Distribution of the Species

Phlyctis agelaea (Ach.) Flotow
Up into submontane, rarely montane sites in winter-mild, rather summer-warm to cool oceanic regions, avoiding low precipitation and continental influenced regions, on usually flat-cracked, rather soft, base-rich, non-eutrophied bark of deciduous trees (above all ash, Norway maple) in ash(-alder) forests (Alno-Padion), brook bordered ash-fringed, cool oak-hornbeam forest as well as associations of the Tilio-Acerion on humid, mild habitats, above all in valleys, m.acidoph.-subneutroph., m.photoph., m.-4.ombroph., in the Opegraphetum ruf., Acrocordietum gemm. – mieur-subatl-med – r.rare-rare (3); süSch, Vog, PfW, süRh. Sju,. Ne,. Hü, Bo, SFW, O, Sp, Eif, Th, Al

Phlyctis argena (Sprengel) Flotow
Up into the high montane zone; euryöke species, on stem of deciduous and conifer trees, rarely on vertical surfaces of silicate rock, high point on m.-r.well lighted, not to moderately eutrophied

habitats, on free-standing trees as well in forests, m.-r.(v.)acidoph., m.ombroph.-r.anombroph., (mesoph.-)hygroph., above all in associations of the Hypogymnietea and Graphidetalia (above all Pertusarietum am.) – s'bor-med – frequent

Lit.: POELT 1969, STEIN 1879

Phylliscum Nyl.

(Key incl. Anema, Gonohymenia, Thyrea)

Introduction

Phylliscum is distinguished by a few millimeter wide becoming black, marginally clearly lobed, shield form thallus, attached at a point ("navel-like") at the lower surface. The punctiform opening apothecia are sunken in convex warts. The single European species of the small genus (6 species) grows on mineral-rich, often schistose silicate rock on occasionally irrigated surfaces. It occurs in North Europe and very rarely in the higher mountains of Central Europe (Alps, Black Forest, Voges, Sudenten). A few of the occurrences were destroyed by afforestation.

Genus Characteristics and Determination

Thallus squamulose-shield shaped, crenate to appearing lobed, attached to the substrate by an umbilicus, black, constructed of an irregular-angular network of hyphae of ± angular cells embedded in gelatin, with Chroococcaceae bluegreen algae. Ap. commonly sunken in thallus bulges, perithecia-like with narrow (in the case of exotic species even wider) opening. In the case of indigenous species exc. clearly developed, of entwined hyphae. Paraphyses lacking. Asci cylindric, thin-walled. Sp. to 8, in the case of indigenous species 16, 1-celled, ellipsoidal to almost spherical, sometimes with plasma breaks. Pycnosp. in the case of indigenous species filamentous-needle form, curved sickle-like, otherwise short bacillar, both ends pointed. Ch-.

1 Thallus foliose, lobes erect or ±rising **2**

1* Thallus squamulose, lumpy, rosette-small lobed . **4**

2 Thallus olive-brownish black, usually blue-gray pruinose. Ap. inconspicuous, sunken, with ± punctiform opening, tuberculate, pycnidia arising. Thallus -2 cm in diameter, foliose. Lobes 1-3 mm wide, usually irregularly slit, sometimes isidiate. Sp. 10-12 x 6-7 µm □ **Thyrea confusa**

2* Thallus black, nonpruinose. Ap.: part of the hymenium inlaid into the thallus, which is recognizable as a gall-like thallus swelling (thallinocarps). Hym. ± covered by algae **3**

3 Thallus -2 cm wide, often cushion-form. Thallus lobes shell- or hood-form, ± angular, ± adjacent to the thallus periphery. Ap. very rare . **Gonohymenia nigritella**

3* Thallus smaller (-10 mm diameter). Thallus lobes flat and rounded on the ends . **Gonohymenia schleicheri**

4 Ap. with punctiform opening, sunken in hemi-spherical -0.4 mm wide, perithecia-like tubercles, to 5-15 per squamule. Squamules attached umbilicus-like, with free margins, -5(8) mm, black, lobed(crenate) at the margin. Upper surface divided by furrows. Sp. to (8-)16(24), 7-10 x 4-5 µm. Pycnosp. needle-form. Thallus lying closely to the substrate. Algae large, mostly to 1-2 per gelatin envelop □ **Phylliscum demangeonii**

4* Ap. at least finally with open disk. Sp. up to 8. Pycnosp. short roll-form. Thallus umbilicate or lumpy-warty . **5**

5 Thallus lumpy-warty, ± thick, producing irregularly formed areoles, black, usually blue-gray pruinose, pressed to the substrate. Ap. sunken, at first with punctiform opening, dark red-brown, with projecting thalloid margin, -0.5 mm. Sp. 11-14 x 7-10 µm **Anema decipiens**

5* Thallus attached by an umbilicus, thereby squamules shield-form, only rarely gray pruinose . **6**

6 Thallus shield-form rosetted, clearly lobed on the margin, usually shiny black, with spherical-isidia-like upper surface structure. Asci with 4(8) spherical to almost ellipsoidal sp. Sp. 8-11 µm . **Anema tumidulum**

6* Thallus convex-rounded, scarcely lobed at the margin, dull black, cracked. Asci always 8-spored. Sp. ellipsoidal, 7-14 x 4-9 µm **Anema notarisii** (Massal.) Forss.

Ecology and Distribution of the Species

Phylliscum demangeonii (Moug. & Mont.) Nyl. In montane and high montane, very high precipitation sites on lime-free, crystalline, often feldspar-rich, even relatively basic silicate rock on sporadically irrigated, mostly sunny and relatively warm, rapidly drying, rarely only

moderately well lighted surfaces, weaker hygrophytically than most of the cyanophilic lichens of the seeping water streaks, e.g. *Ephebe*, m.acidoph.(-subneutroph.), m.-r. photoph., e.g. with (weakly developed) *Ephebe*, often using small pits and crevices in micro relief and then associated with less hygrophytic species. – bor-mieur-mo – v.rare (2); süSch (over 700 m), Vog

Lit.: HENSSEN 1963a*, 1963d, MIGULA 1929-31

Physcia (Schreber) Michaux

(Key incl. Anaptychia, Heterodermia, Hyper-Physcia, Phaeophyscia, Physconia)

Introduction

The *Physcia*-species are foliose lichens with deeply divided, frequently rosetted, whitish to gray, thallus scarcely altered when moistened. The upper cortex reacts yellow with KOH. The whitish to pale brownish, corticate underside is covered with whitish to dark colored attachment filaments. The lecanorine bordered apothecia show a brown to black, sometimes white pruinosity, the spores are two-celled and brown. Many species produce soralia. The genus includes about 50, in Europe 20, in Germany 14 species. They live, similar to the *Phaeophyscia*-species, on base-rich substrates, thus on subneutral to weakly basic bark, on calcareous or dust impregnated or otherwise eutrophied rock. Most require well lighted sites. Several are almost worldwide distributed.

Ph. caesia grows on limestone, e.g. on bird roosts, but frequent on wall habitats. Also *Ph. dubia* occurs in the region predominantly on substrates created by man. Natural habitats are bird roosts or vertical surfaces and overhangs of SiO_2-poor or calcareous rock. *Ph. wainioi* resides on smaller, slightly soil encrusted, even slightly irrigated silicate rocks or on vertical surfaces and also avoids acid silicate. *Ph. magnussonii, Ph. dimidiata* and *Ph. tribacia* reside especially on overhanging- and vertical-surfaces of intermediate or slightly calcareous silicate rock, the latter two also occur epiphytically.

The bark lichens *Ph. adscendens, Ph. tenella, Ph. aipolia, Ph. stellaris* and *Ph. vitii* grow above all on free-standing deciduous trees, e.g. on streets, in meadows and pastures. The first two frequently occur in orchards; they use the moderately acid pH-range, are relatively tolerant to toxins and a numbered with the most frequent foliose lichens. From northwestern Baden-Württemberg as from other regions of Germany *Ph. aipolia* and *Ph. stellaris* are disappearing because of air pollution. *Ph. vitii* is limited to the relatively high precipitation region of the alpine foothills and the lower sites of the Alps.

Ph. caesia and *Ph. dubia* are distributed from South Europe to the arctic, *Ph. aipolia* and *Ph. stellaris* from the mediterranean region (here however predominantly in the mountains) to the northern boreal zone. *Ph. adscendens* and *Ph. tenella* are already rare in the northern boreal zone. *Ph. magnussonii* was found in Greenland, in Scandinavia and in the alpine mountains and their environs (in Central Europe in the South Black Forest, Austrian Forest and in the Alps). *Ph. tribacia* and *Ph. dimidiata* are southern species. The area of the first stretches up to North Germany and has possibly a western tendency, that of *Ph. dimidiata* extends into southern Norway. *Ph. vitii* is known from southern Central Europe, especially from the lower sites of the Alps and their surroundings.

Genus Characteristics and Determination

Thallus narrow lobed, rosetted to rapidly growing, whitish, gray, rarely dark gray, sometimes with whitish flecks, not rarely pruinose, in the case of a few species with marginal cilia, undersides whitish, light gray to pale brownish, with light, simple to forked rhizines. Upper cortex paraplectenchymatous, lower cortex paraplectenchymatous or proso-plectenchymatous. Many species with soralia or isidia. Photobiont *Trebouxia*-like. Ap. laminal, with thalloid margin and brown to black, often pruinose, usually flat disk. Hyp. colorless. Epihym. brown. Paraphyses simple to often forked, ends clavate, with thin brown cap. Asci clavate-cylindric, *Lecanora*-type. Sp. brown, 2-celled, thick walled. Pycnidia sunken, pycnosp. short bacillar. Ch: Cortex with Atranorin; often Zeorine.

Reactions: only definite with K, C-. All *Physcia* species have Atranorin, that content not further mentioned.

1 Thallus white to light gray, scarcely changing when moistened, K+ yellow. Underside light colored (exception ↑ *Heterodermia obscurata*), Lower cortex paraplectenchymatous or prosoplectenchymatous. Atranorin **2**

1* Thallus light gray to dark gray or brown, moistened (allow one minute soak!) greenish, cortex and medulla K- (or green), rarely (on yellowish to orange sites) medulla K+ red. Underside dark or light, lower cortex paraplectenchymatous. Commonly without Atranorin (*Anaptychia cil.* occasionally with Atranorin) .**17**

2 Thallus without soralia and isidia, almost always with apothecia . **3**

2* Thallus with soralia or isidia. Ap. often lacking . **7**

3 On silicate rock. Sp. upper surface warty. Thallus thickly white pruinose, chalky white to gray-white (not white spotted), radially rosetted, lobes ± convex, often overlapping, -2.5 (3) mm wide, on the ends somewhat curved under. Ap. numerous, narrowed sessile, with margins curved inward, usually pruinose □ **Ph. magnussonii**

3* Thallus on bark, only exceptionally on rock. Sp. upper surface not warty **4**

4 Lobes on the margin and/or on the ends with single definite bristles (cilia) (not to be confused with rhizines projecting from the underside), usually ± erect, never closely appressed, -1.5(2) mm wide. Very rare species of climatically mild sites . **5**

4* Lobes without bristles on the ends, 1-2 mm wide, flat to moderately convex, whitish to gray- white. Thallus radially rosetted, ± appressed, often with black punctiform pycn **6**

5 Lobes several cm long and very narrow (1-2 mm), linear, with -1 cm long gray to blackish hairs at the margin, very loosely arranged, sparsely branched, cream-white, undersides slightly wrinkled. Medulla P+ yellow, K+ yellow, then red, C-. Sterile in the region. Zeorin, Salazinic acid. Extinct in Central Europe **Heterodermia leucomelos**

5* Lobes relatively short, rather close standing, ± white flecked, with -3 mm long light, pointed on the ends, dark bristles on the ends. Thallus similar to a *Ph. tenella* without soralia, mostly rounded rosetted. Ap. usually numerous, -3 mm, slightly pruinose. Medulla P-, K-, C- . **Ph. semipinnata**

6 Medulla K+ definitely yellow. Thallus upper sides clearly white spotted (above all easily visible when moist). Ap. usually pruinose. Zeorin **Ph. aipolia**

6* Medulla K-. Thallus upper side usually not or only indefinitely white spotted. Ap. usually non pruinose. Without Zeorin **Ph. stellaris**

7 Lobe ends with single light, on the tips commonly darker bristles (cilia), undersides with lip/helmet-soralia, usually somewhat erect. Thallus white to light gray, rosetted to irregular **8**

7* Lobes without cilia (attention: not to be confused with projecting rhizines) . **10**

8 Lobe ends helmet- or domed convex (sorediate in the dome). Thallus rosetted or turfy (-roof tile-like), lobes -1 mm wide, sometimes slightly white spotted. Ap. almost stalked, rather rare, usually nonpruinose □ **Ph. adscendens**

8* Lobe ends flat or lip-form curved . **9**

9 Medulla K-. Thallus similar to *Ph. adscendens*, but with flat to lip-form upturned ends (and lip soralia), gray-white to gray, sometimes slightly white spotted. Single thallus up to 2 cm, but often turfy coalescing. Ap. more frequent than in the case of *Ph. adscendens*. widespread . **Ph. tenella**

9* Medulla K+ yellow. Thallus larger, white to ivory colored, lobes appearing feathery branched, bristles sparse, little conspicuous, lip- or marginal soralia on the ends of short side lobes. Zeorin. Very rare lichen of high precipitation, undisturbed habitats . □ **Heterodermia speciosa** (**Heterodermia obscurata**: Thallus gray, undersides dull-felty, therefore not corticate, white to blackish toward the center, sometimes partially orange and here K+ red. Bristles blackish. North Alps)

10 Thallus with lip-soralia on the underside of the lobe ends . **11**

10* Thallus with flat- or marginal soralia or laminal isidia . **14**

11 Lower cortex paraplectenchymatous, i.e. made up of ± isodiametric (in section ± rounded to ± quadrate) cells (□). Thallus not of rosettes, not white spotted. Rare species. Medulla K-. Only Atranorin . **12**

11* Lower cortex prosoplectenchymatous, i.e. not made up rounded to quadrate cells, but of parallel lying hyphal cells, thereby clearly differentiated in the structure of the upper cortex (□). Thallus usually radial rosettes. Atranorin sometimes Zeorin **13**

12 Lobes often ± incurved tube-like, widening on the ends, erect and lip-form convex, on the higher underside with mealy, often widely extensive soralia toward the thallus center, without marginal soralia, thallus similar to *Ph. adscendens/tenella*, often turf producing, soft . **Ph. vitii**

12* Lobes usually ± appressed, -1.2(1.5) mm wide, slightly convex to flattened, crenate on the ends, relatively robust and brittle, on the margins often eroded, granular to granular-sorediate (marginal soralia), also with lip-soralia in the center of older thallus. Soralia granular . **Ph. tribacia**

13 Medulla K+ yellow. Thallus bluish-gray to gray, lighter toward the margin, white spotted. Lobes ± flat, strap-form, mostly -2 mm wide. Soralia above all on the ends of short side-lobes, lip-

form, with age even almost terminal-capitate, isolated even laminal. Zeorin. Habit separated from typical *Ph. caesia*, according to Moberg however a modification of the growth of *Ph. caesia* **Ph. wainioi**

13* Medulla K-. Thallus light gray to (dark)gray, rosetted-radial, with lobes separated of flowing over one another. Lobes usually ± convex, -1.5 (2) mm wide, spread on the ends, lip soralia terminal on the main- and side-lobes, often up-turned. Without Zeorin . □ **Ph. dubia** (Caution: *Imshaugia aleurites* which grows on acid substrates is similar. Thallus P+ strongly yellow to orange, not P-/P+ yellowish)

14 Center of the thallus usually erupting with sorediate short isidia, often becoming laminally sorediate. Thallus white to white-gray, rosetted. Lobes closely appressed, flat to slightly convex, thin, -0.6 mm wide, fan-like branching. Cortex and medulla K+ yellow. 2 Terpenoid **Ph. clementei**

14* Not erupting with sorediate laminal isidia **15**

15 Thallus with hemispherical, laminal or on the ends of small lateral lobes, white- to blue-gray, -2 mm wide soralia, white-gray to gray, even somewhat blue-tinted, white spotted, rosette-radial, lobes convex to (above all on the ends) flattened, -1(1.5) mm wide. Medulla K+ yellow. Zeorin . □ **Ph. caesia**

15* Thallus with granular-sorediate margin, without hemispherical soralia, not white spotted. Lobes -3 mm wide. Medulla K-. Without Zeorin **16**

16 Lower cortex prosoplectenchymatous (□). Thallus gray-white, thickly pruinose with very small crystals (strong lens). Lobes broad and flat to slightly concave, crenate on the ends, at the margin coarsely granular sorediate and often wavy, soralia encroaching in the center of the surface . **Ph. dimidiata**

16* Lower cortex paraplectenchymatous (□). Thallus whitish, cream-colored, gray-white, non-pruinose or finely pruinose toward the ends. Lobes slightly convex to flattened, granular sorediate at the margin and eroded, often also with lip soralia on short lateral branches **Ph. tribacia (12)**

17 Without isidia and soralia **18**

17* With isidia or soralia, ap. rare (except *Phaeoph. orbic.*) . **23**

18 Thallus on silicate rock and silicate mosses on usually projection habitats, -3 cm wide, usually rounded, closely decumbent. Lobes narrow, -0.6 mm wide, flat to convex, gray-brown to brown. Medulla white or orange-red. Underside black. Ap. frequent, -1(1.5) mm, thalloid margin crenate or small-lobed. Skyrin, Zeorin . □ **Phaeoph. endococcina**

18! Thallus on mosses and dying plant parts over base-rich soils, on soil or calcareous rock. Lobes loosely attached decumbent to rising . **19**

18* On bark or bark mosses, rarely on rock . **21**

19 Rhizines for the most part ± right angled frayed (which at the margins are in part ± simple), black. Thallus light to dark brown, often white pruinose, large, undersides (with exception of the brown ends) black. Lobes 0.5-3 mm wide, flat to concave, irregularly divided and arranged. Ap. 0-5 mm, rather rare, margin often with lobular outgrowths. Ch- .□ **Physconia muscigena**

19* Rhizines simple or forked, light to dark. Thallus gray, green-gray, gray-brown, underside light .**20**

20 Thallus robust, gray to brown-gray, often pruinose, toward the ends usually finely fringe-like hairy (handlens), of long narrow, linear branching, (0.5(1-2 mm wide lobes with long, thallus colored to dark bristles. Often with narrowly sessile ap. □ **Physconia muscigena**

20* Thallus very fragile, gray-greenish to gray-brown, nonpruinose, bald, underside light, rarely dark. Lobes -0.4 mm wide, with sparse, mainly at the margin whitish to blackish, nor frayed rhizines/bristles, repeatedly divided. Upper cortex paraplectenchymatous. Ap. very rare. Ch- **Phaeoph. constipata**

21 Thallus with long thallus colored to darker marginal bristles (cilia), underside light, without rhizines, robust, of loose lying, ± long, narrow, linear, separated but growing over one another, branching lobes, gray to brownish, toward the ends usually fringe-like haired (handlens). Lateral margin turned under, thereby underside channeled. Ap. narrowly sessile to somewhat stalked, usually pruinose, with incurved margin. ±Atranorin, (Zeorin), ±Norstictic acid □ **Anaptychia ciliaris** s.l.

21* Without bristles. Underside black, only at the margins becoming light, with dense black rhizines. Thallus gray, gray-brown to dark brown, usually rosetted. Ch- . **22**

22 Thallus not pruinose, up to 3(4) cm, with radial, flat, usually scarcely overlapping lobes. Rhizines simple, often producing a black fringe projecting from the lobe margin. Ap. numerous, not pruinose, -2(2.5) mm, ap margin on the underside usually with a wreath of rhizine-like bristles. Sp. 20-26 x 8-12 µm . **Phaeoph. ciliata**

22* Thallus often white pruinose, gray-brown under the pruinosity, large, often over 3 cm, with radial, usually overlapping, -2 mm wide lobes. Rhizines predominantly right-angle frayed (□), sometimes producing a black fringe on the thallus margin. Ap. often pruinose, margin with out bristles, sometimes covered with small lobules, -4 mm . □ **Physconia distorta**

23 Rhizines predominantly ± right-angle frayed (on the thallus margin often only simple, black. Thallus commonly partially pruinose, robust . **24**

23 * Rhizines simple. Thallus pruinose or not . **26**

24 Lobes short, often standing roof tile-like and partially ascending, partially with gray to blue-gray lip soralia, brown, dark brown, frequently

with violet tint, above all pruinose toward the ends, underside whitish on the ends, otherwise dark. Thallus usually not rosetted, rather variable. Ch- . □ **Physconia perisidiosa**

24* Lobes usually rather long streaked, decumbent, densely branching often short and then lobes with "wavy" outline, -2.5(3) mm wide, with ± extensively covered marginal soralia, gray-brown to brown, ± whitish pruinose . **25**

25 Medulla yellowish to yellow, K+ intensively yellow. Soralia ± yellowish, rarely whitish, rarely sorediate-isidiate. Upper cortex paraplect-enchymatous (cell-like). Secalonic acid . □ **Physconia enteroxantha**

25* Medulla white, R-. Soralia whitish to gray. Upper cortex scleroplectenchymatous (of thickly marked, swollen hyphae with narrow lumina). Lobes often long streaked as in the case of *Ph. enteroxantha*. Very rare. Ch- In mountain forests (Austrian Forest, Alps), also on rock **Physconia detersa** (Nyl.) Poelt

26 Thallus fleck-like white pruinose (above all lobe ends), gray, gray-brown, robust, undersides light, reaching -6(8) cm diameter. Lobes -2.5 mm wide, at the margins, later laminally even isidiate-sorediate. Rhizines simple to forked, whitish to gray. R-, Scabrosin-4-acetate etc. . **Physconia grisea**

26* Thallus not pruinose, undersides black or light. Lobes narrow, -1.5(2) mm wide **27**

27 Thallus lobe upper sides with fleck soralia or lip soralia on the lobe ends. Thallus R-, medulla R-, only if red flecked, K+ red **29**

27* Thallus lobes without such soralia, at the margins commonly isidiate to isidiate-sorediate. Ch- **28**

28 Thallus lobes very small and very narrow, erect, sometimes almost small fruticose, slit, with granular-isidiate (to granular sorediate) margined, often growing though one another in extensive turfs, gray(brown) to brown, usually 0.1-0.3 mm wide, undersides light gray, whitish, light brownish, with sparse rhizines. On eutrophied habitats, above all on mortar, rock, rarely on the base of trees □ **Phaeoph. nigricans**

28* Thallus lobes larger, decumbent, usually radially rosetted, -0.5 mm wide, dark gray, dark gray-brown, black-brown, at the margins, later even with thick standing dark isidia on the lamina, undersides black (only lighter at the growing margin), with numerous rhizines. Thallus -4(5) cm wide. Ap. rather rare . **Phaeoph. sciastra**

29 Thallus very thin and very closely appressed to the substrate (commonly not able to remove without ruining), interior almost crustose, rounded, -1.5(2) cm wide, light to dark gray-brown to gray-greenish, with light gray to green-gray fleck soralia above all in the center, undersides light brownish to blackish, lobes narrow, -0.5 mm. Rhizines indefinite. Pycnosp. filamentous, (10)15-20 x 1 µm. Ch- □ **Hyperph. adglutinata**

29* Thallus otherwise, not crust-like closely appressed to the substrate, -2.5(3) cm. Rhizines definite. Pycnosp. under 8 µm long **30**

30 Underside and rhizines light. Thallus light greenish-gray, on the ends often even slightly brownish, in the herbarium often yellow tinted. Lobes depressed to erect (but margins curved downward), often with lip soralia. Axils between the lobes often rounded. Somewhat reminiscent of *Ph. endophoenicea*. Ch- . **Phaeoph. chloantha**

30* Underside and rhizines blackish, only light on the growing margins . **31**

31 Thallus upper side above all toward the lobe ends covered with colorless cilia, green-gray, gray to slightly brown tinted gray. Lobes flat to weakly convex, with extensive ± gray marginal soralia especially in the thallus center, 0.8-1.2(2) mm wide. Thallus -2 cm. Ch- **Phaeoph. strigosa**

31* Thallus without cilia . **32**

32 Thallus with lip-form curved up, whitish, yellowish or ± orange-colored soralia on the lobe ends (sometimes also with single laminal soralia), light gray to brown-gray, irregular to rosetted, ± decumbent. Medulla commonly partially orange. Lobes -1.5(2) mm wide. With Skyrin . □ **Phaeoph. endophoenicea**

32* Thallus with laminal to marginal whitish to dark gray (rarely yellowish), rounded, concave to capitate soralia, the laminal partially coalescing, light gray to dark gray or rarely brown, occasionally yellow tinted and with yellow-flecked medulla (then K+ red), very variable. Lobes radially rosetted or irregular, -1.2 mm wide, flat to convex. Ap. not rare. Usually without Skyrin **Phaeoph. orbicularis**

Ecology and Distribution of the Species

Physcia adscendens (Fr.) Oliv.

Above all up into montane sites, rarely up to the tree line, on well lighted and usually moderately to rather nutrient rich, eutrophied habitats, above all on free-standing deciduous trees, rather rare even on calcareous rock, thus on anthropogenic substrates (wall etc.) and on bird roosting rocks, steep surfaces of rocks, even on wood, rather tolerant to toxins, predominant species in lichen-poor regions; m.acidoph.-m.basiph., (a-)m.-v.nitroph., r.-v.photoph., Char. Physcietalia adsc., high point Xanthorion par., even in the Caloplacion dec. and other calciphytic associations -- bor-med – frequent

Physcia aipolia (Ehrh. ex Humb.) Fürnr.
Up into montane, rarer high montane sites on subneutral, mineral-rich, but often not or moderately eutrophied, smooth and flat-cracked bark of deciduous trees in open sites, above all on avenue and field margins, especially on ash, willow, popular, walnut, elder, often even on twigs, m.toxitolerant, m.acidoph.-subneutroph., r.-v.photoph., a-/m.(-r.)nitroph., Char. Xanthorion par. – bor-med(mo) – r.rare (#); Sch, Vog, Ju, Sju scattered, otherwise rare, regionally lacking today

Physcia caesia (Hoffm.) Fürnr.
Up to the alpine zone on subneutral to basic, usually nitrogen-rich substrates, especially on limestone and calcareous artificial stone, frequent on r.-v.eutrophied habitats, e.g. on walls (esp. wall crowns), roof tiles, boundary stones, even basal and strongly dust impregnat-ed avenue trees and wood (with *Ph. dubia*), on near natural habitats above all on limestone on moderately to very dunged sites (bird roosts), rare on lime-free, then strongly dunged silicate rock, sociologically uncertain dung indicator, subneutroph.-basiph., r.-v.photoph., r.xeroph., m.-v.nitroph., in the Aspicilion calc., Caloplacion dec. et al., on silicate rock e.g. in the Lecidelletum carp. or (on boulders in open waters) with *Verrucaria praetermissa* -- arct-med – moderately frequent, rarer in silicate regions

Physcia clementei (Turner) Maas Geest**.**
Similar to *Physciopsis* (↑) – mieur-atl-med-subatl – v.rare, western Vog, in the region on the east boundary of the distribution

Physcia dimidiata (Arnold) Nyl.
In foothills to montane (in the Alps even higher) sites on rather rain-protected vertical and slight overhangs on usually somewhat calcareous silicate rock (rarely limestone) as well as on old walls (e.g. castles, bridges), rarely on stems and stem bases of older deciduous trees with nutrient-rich, subneutral to moderately basic, often deep cracked bark, on warm, rather well lighted habitats, subneutroph.-m.basiph., r.xeroph., m.-r.nitroph., sociologically ↑ *Xanthoria fallax* – (s'bor-)-mieur(co)-med – rare (3); Sch (up to 1250 m), Vog, Pf, Hu, Eif, MRh, Ts, Sp (Maintal), Mn, Ne, Bo, He, Th

Physcia dubia (Hoffm.) Lettau (Ph. teretiuscula (Ach.) Lynge)
Variable, very dunging tolerant species of nutrient-rich habitats, up to alpine zone, at the most frequent on anthropogenic stone substrates, in the case of stronger eutrophication rather substrate vague and on each stone type, especially on silicate rock, concrete, roof tiles, rarer on calcareous rock, additionally on dust impregnated bases of free-standing deciduous trees (in the Xanthorietum cand.); on near natural habitats rather rare, especially on bird rocks (Candelarielletum cor., Ramalinetum cap.), additionally on less eutrophied sites on occasionally irrigated, ± rain sheltered vertical surfaces on mineral-rich, calcareous or basic silicate rock (in the Xanthorion fall., often in narrow lobed forms), high point on r.-v.well lighted, subneutral, r.-v.nitrogen-rich sites – arct-smed – m.frequent

Physcia magnussonii Frey
In sub- to high montane (subalpine) sites on slightly calcareous or dunged silicate rock on rather rain protected overhanging surfaces on mostly summer-warm, wind protected, rather well lighted rock parts, usually on splits or fissures, occasionally short-time irrigated sites, subneutroph.-m.acidoph., r.anombroph., m.-r.nitroph., loc. Char. Lecanoretum dem. – arct-alp/dealp – v.rare (3); süSch, Vog, BayW

Physcia semipinnata (J.F.Gmelin) Moberg (Ph. leptalea (Ach.) DC.
On the bark of deciduous trees in lower, mild sites, similar to *Hyperphyscia adglut.*, *Physcia adsc.* (↑), Xanthorion-species – mieur-med -- rare, overlooked?; Rh

Physcia stellaris (L.) Nyl.
Up to high montane zone on deciduous trees on moderately acid to subneutral, mostly smooth to flat-cracked bark, frequently also on branches, on well lighted habitats (usually free-standing trees and forest margins), on not to rather eutrophied substrates, m.acidoph.-subneutroph., Char. Xanthorion par. – bor-med(mo) – m.frequent (3), yet rare to lacking in relatively strongly air polluted, lime-poor regions

Physcia tenella (Scop.) DC.
Often associated with *Ph. adscendens* and similar ecologically and sociologically, yet rarer on rock, high point somewhat less eutrophied, somewhat acid habitats, somewhat tolerant to toxins – (arct-)bor-med – rather frequent, widely distributed, possibly more rare earlier

Physcia tribacia (Ach.) Nyl.
In the foothills and submontane, climatically mild to warm sites, similar to *Ph. dimidiata* (↑), but warm-loving and limited to mild-winter sites – mieur(subatl)-med – rare (1); single collections from süSch, Vog, Pf, Mos, Eif, Ts, O, Ne, Bo, süHü, *Rh*

Physcia vitii Nádv.
In montane, high precipitation, mild climatically to cool sites on moderate to rather well lighted habitats of m.acid to subneutral bark of deciduous trees, on avenue trees, forest margins, in brook bordered stands, of relatively mineral-rich, but mostly scarcely eutrophied bark – s'mieur-smed – v.rare, but probably also overlooked (2); Av, Al

Physcia wainioi Räsänen
Above all in the montane zone on basic/neutral or slightly calcareous silicate rock (e.g. on basalt), often on occasionally slightly irrigated, dust impregnated or slightly dunged surfaces by birds, yet avoiding typical bird roosting sites, almost only on natural stone, usually on rather warm habitats, subneutroph.(-m.acidoph.), r.-v.photoph., r.xeroph., m.-r.nitroph., e.g. in the Lecanoretum argoph. – rare; Sch, Vog, Pf, O, Sp, Rhön, Mos, Eif, ThW

Lit.: Frey 1963, Lynge 1935, Moberg 1977

Physconia Poelt

(Determination ↑ Physcia)

Introduction

The *Physconia*-species are robust, deeply divided, mostly rather narrow-lobed, gray to brown, corticate on both sides foliose lichens. The thallus, as also the apothecia are often more or less pruinose. In several species the reproduction is predominately by soredia or isidia. The underside is light to commonly dark colored. The older rhizines are black and right angled frayed, rarely pale and forked. The species differ from *Physcia* in spore anatomy, in addition separated by other cortex characteristics and rhizine types. Even the lichen substances are different. Thirteen species are known, 9 in Europe.

Ph. muscigena lives on mosses over base-rich soils or limestone. The arctic-alpine, partially descending into lower sites species are in extra-alpine Germany limited to the foothills of the Harz, the Franconian Jura, The Ries and the contiguous eastern-most part of the Swabian Alb. The remaining species grow mainly on weakly basic to weakly acid bark of deciduous trees on well lighted habitats, especially on avenue trees. They tolerate a considerable dust load. *Ph. perisidiosa* and *Ph. enteroxantha* appear to avoid oceanic climatic regions, *Ph. grisea* is lacking from the higher, high precipitation Central Mountain sites. *Ph. distorta* to a large extent has disappeared from the north and northwest Baden-Württemberg and the greater part of Germany; as is the case of many subneutrophic bark lichens caused by acid air pollution.

Ph. grisea occurs from South to Central Europe; the northern limit of the area passes through the southern tip of Scandinavia; only one collection is known from Finland. *Ph. distorta* ends in the atlantic North Scandinavia; besides it is almost entirely lacking in northern Sweden and Finland. *Ph. enteroxantha* and *Ph. perisidiosa* are rare in northern Scandinavia, however isolated occurrences up to the polar sea. *Ph. perisidiosa* and *Ph. grisea* especially avoid a tendency to the atlantic region of Europe.

Genus Characteristics

Rosette to irregular growing, gray to dark brown, often pruinose foliose lichens with whitish to black underside with simple, forked, right angled frayed rhizines. Many species with soralia or isidia. Upper cortex with paraplect-enchymatous or scleroplectenchymatous (lumina under 2.5 µm in size). Photobiont *Trebouxia*-like. Ap. surface-standing, brown to blackish, commonly pruinose, with thalloid margin. Hyp. colorless. Epihym. brown. Paraphyses simple or branched above, clavate above, with thin brown cap. Asci cylindric-clavate, *Lecanora*-type. Sp. 2-celled, large, broadly ellipsoidal, brown when ripe and ornamented on the upper surface. Pycnosp. short bacillar. Usually Ch-, always without Atranorin.

Ecology and Distribution of the Species

Physconia distorta (With.) Laundon

(Ph. pulverulenta auct., Physcia p. auct.)
Up into (high-)montane sites on subneutral bark usually of free-standing deciduous trees, often on nitrogen-rich substrates (wind dispersed dust), rather like *Parmelia acetabulum* (↑), above all in the Parmelietum ac. and Physcietum adsc.; distribution point in the lime regions – (s')bor-smed-med – r.rare (-m.frequent) (3), at the most frequent in Ju, Sju, FrJu; in Central and North Germany (e.g. He, Th, WeBgl) clearly rarer to extinct in places

Physconia enteroxantha (Nyl.) Poelt (Physcia e. Nyl.)
Up into (high)montane sites on free-standing deciduous trees in the stem region on mineral-rich or dust impregnated, usually cracked bark, especially on ash, linden, walnut, popular, maple, on avenue- and field trees, above all in moderately high precipitation regions, rather avoiding oceanic sites, , subneutroph.-m.acidoph., r.(-v)photoph., m.-r.nitroph., above all in the Physcietum adsc. and Parmelietum ac. – bor-med(mo) – (r.rare-) m.frequent, above all in the lime region, rare to lacking in central and northern Germany

Physconia grisea (Lam.) Poelt (Physcia g. (Lam.) Zahlbr.)
In the foothills and submontane, rel. precipitation poor, warm sites on stems of free- standing deciduous trees (avenue, field), almost always on r.-v.eutrophied bark, above all popular, linden, horse chestnut, walnut, maple and other tree species with normal m.acid to subneutral bark, most resistant to eutrophication species of the genus, widely penetrating into epiphyte-poor or urban regions (lime region), also on eutrophied rock, subneutroph., r.-v.photoph., r.v.xeroph., r.nitroph., r.toxitol., above all Physcietum adsc. – mieur-med – m.(-r.)frequent, scarcely rising over 700 m, relatively rare in silicate regions

Physconia muscigena (Ach.) Poelt (Physcia m. (Ach.) Nyl.)
In montane sites and above, on mosses, dying plant remains and on rocks, level, usually calcareous or delimed soils, in the region above all over calcareous rocks, otherwise usually in meager turfs, predominantly on very open, often rather open to the wind, subneutral to basic habitats, char. Megasporion verr. – arct-alp/dealp – v.rare (1); Vog (Rossberg), Ries, FrJu

Physconia perisidiosa (Erichsen) Moberg (Physcia farrea auct.)
Above all in montane (to high montane) sites on free-standing deciduous trees on cracked bark or over mosses, rather rarely descending into the foothills zone (here especially in orchards, above all pear trees), ± avoiding dry-warm regions, rather like *Ph. enteroxantha* (↑), but even on less eutrophied, acid bark and on moister habitats, m.(-r.)acidoph., r.photoph., m.(r.)nitroph., in the Xanthorion pur., even penetrating into the Lobarion (with *Collema nigr.*) – (arct-)bor-mieur-med(mo) – r.rare; above all Sch, Vog, Ju, Ne, Av; otherwise rare, e.g. Mn, Pf, Hü

Lit.: FREY 1963, MOBERG 1977, POELT 1966.

Placidiopsis Beltram.

(Key incl. Placopyrenium)

Introduction

The squamulose, ± brownish thallus with blackish perithecia (apices) resemble the genus *Catapyrenium. P. cartilaginea*, the single species occurring in Germany, belongs to the mediterranean element and reaches the north boundary of the distribution in southern Central Europe. As other species of the genus it resides on base-rich soils in dry turfs and on rocky slopes.

Genus Characteristics and Determination

Similar to the genus *Catapyrenium* (↑), but sp. 2-celled. Thallus squamulose to almost crustose, upper cortex paraplectenchymatous, underside attached to the substrate with rhizohyphae. Per. sunken, with blackish apex, pear-form, exc. brown. With periphyses, without paraphyses. Hym. gelatin I+ red. Asci elongate-clavate, thin walled. Sp. constantly 2-celled, ellipsoidal. Ch-.

1 Growing directly on rock . **2**
1* On soil, rarely soil- and rock mosses. Thallus olive-gray, olive-brown, brown, lighter on the margin, olive-green when moist, undersides dark brown in the center. Squamules scattered to usually crowded, even roof tile-like, at the margin free to somewhat raising, 1-2 mm in size.

Per. ± sunken, to 1-5 per squamule. Sp. (12) 15-21 x 5.5-7.5 µm . **P. cartilaginea**

2 Sp. 12-17 x 4.5-6.5 µm. Thallus light to rose brownish, ± thickly gray-white pruinose, lumpy areolate, effigurate at the margin and areoles elongate, twisted and branched, dark fringed. Per. usually to 5-10 per areole **Placopyrenium tatrense**

2* Sp. 12-20 x 4-6 µm, one-celled or with pseudoseptum. Thallus brownish-gray, slightly pruinose, squamulose. Squamules -0.7 mm, scattered or to 0.5 cm wide groups coalescing **Verrucaria botellispora**

Ecology and Distribution of the Species

Placidiopsis cartilaginea (Nyl.) Vainio (P. custnani (Massal.) Körber)
On lime-rich, rocky soil of fine earth, on loess, at times over mosses, even on lime mosses, like *Catapyrenium squamul*. and *C. cinereum* (↑), in Toninion sed. – mieur)subatl)-med – v.rare *(0)*; He (Meissner-foothills), *nöHü (Schriesheim), süRh,* Sju, *FrJu, Al*

Lit.: MIGULA 1929-31, VAINIO 1921

Placocarpus Trevisan

(Determination ↑ Verrucaria)

Introduction

P. schaereri, the single species of the genus, is distinguished by thick crustose, lumpy-areolate light gray thalli with sunken black topped perithecia. The thallus grows in youth parasitically on *Lecanora muralis*. The lichen is distributed from the mountains of the Mediterranean region up into southern Central Europe and reaches in the region the northern boundary of the area.

Genus Characteristics

Thallus very thick crustose, white-gray, lumpy areolate, appearing effigurate, the outer areoles narrowly sessile, with a "foot" attached by densely packed right angled hyphae, which draw rope-like into the medulla, the free underside with blackish paraplectenchymatous cortex. Per. with black apex. Exc. colorless, only dark around the mouth. Periphyses in the region of the ostiole, other paraphyses-like hyphae lacking in the ripe per. Asci like *Verrucaria*. Sp. one-celled, narrowly ellipsoidal. Ch-.

Ecology and Distribution of the Species

Placocarpus schaereri (Fr.) O.Breuss (Verrucaria sch. (Fr.) Nyl., Dermatocarpon monstrosum (Schaerer) Vainio)
In the foothills and warm-summer montane sites on limestone, rarely on dolomitic rocks, on sunny, relatively warm, rain exposed, nutrient-rich sloping- and horizontal surfaces of smaller rocks, on rock tops, as above all on bird roosts in the region of lime meager turfs, youth-parasite on *Lecanora muralis*, basiph., s.photoph., m.-r.nitroph., Char. Placocarpetum schaereri -- s'mieur-med – rare; Ju, Ries, FrJu, Mn, Sju, nöPf, BayW

Lit.: BREUSS 1985.

Placopsis (Nyl.) Lindsay

Introduction

Placopsis is characterized by a crustose, rosetted, clearly lobed at the margin, upper side corticate whitish to pale gray-brownish thallus, on which as a rule sit warty cephalodia. The apothecia have a rose colored to brown-black disk and a thalloid margin. Many species, as the indigenous ones, produce fleck soralia.

The genus distributed especially in the Southern Hemisphere on silicate rock, rarely on soil including about 35 species, is represented in Europe only by *P. gelida* and the closely connected *P. lambii*. Both grow on silicate rock in high precipitation oceanic sites in western and central Europe, e.g. on lower, from time to time irrigated or more often dew moistened surfaces of rocks or on stones, *P. lambii* usually on iron-shot substrates. *P. gelida* is distributed from the Arctic over the western Scandinavia up into the higher mountains of Central Europe. *P. lambii* is indigenous in atlantic and subatlantic Central Europe and occurs also in truly lower sites.

Genus Characteristics and Determination

Thallus crustose, placoid, with radial arranged marginal lobes, closely appressed to the substrate, whitish, cream-colored, rose- or brown-tinted, commonly with red-brownish cephalodia, with paraplectenchymatous upper cortex. Photobiont coccoid green algae. Ap. rose, brown, red-brown, black-brown, with thalloid margin. Exc. very thin. Hyp. colorless. Epihym. yellow-brown. Paraphyses thin, branched, reticulate, weakly cemented, above shrunken at the septa. Asci cylindric to narrowly clavate, of the *Trapelia*-type. Sp. usually single series, one-celled, ellipsoidal. Pycnosp. filamentous. Ch: Gyrophoric acid, traces of Lecanoric acid. Indigenous species C+ red, K-, P-.

1 Thallus with brown to reddish colored, definitely raised cephalodia, whitish, rarely brownish, 1-5 cm, soralia fleck-form, later concave, greenish-white, gray-white □ **P. gelida**

1* Thallus without cephalodia, usually beige, gray-rose, -2(2.5) cm. Soralia usually gray, brownish gray .□ **P. lambii**

Ecology and Distribution of the Species

Placopsis gelida (L.) Lindsay
In montane-high montane, oceanic, high precipitation sites on mineral-rich silicate rock, on smaller rocks, boulders and stones (pioneer) on rather protected, hydrostatically favorable, moderate to rather long time snow covered, long time dew moistened or habitats protected from rapid drying, above all on horizontal- and sloping surfaces; m.acidoph., substrathygroph., r.hygroph. – arct-mieur-subatl, oc – v.rare (R); süSch (e.g. Feldberg region), Vog

Placopsis lambii Hertel & V.Wirth
In montane, mild, oceanic influenced sites on stones and smaller boulders of mineral-rich (neutral), often iron containing silicate rock, e.g. schist, on m.-r open to light, long time dew moistened or sporadically irrigated, habitats protected from rapid drying, climate. Requirements like *Lecidea lithoph.* (↑), m.acidoph., substrathygroph., e.g. in the Lecideetum lith. – mieur-subatl -- rare (2); Sch, Vog, He (Rhön, Vgb, Meissner), RhSch

Lit.: HERTEL 1969*, LAMB 1947, WIRTH 1987.

Placopyrenium O.Breuss

(Determination ↑ Placidiopsis)

Introduction

The few species included in the genus are related to *Verrucaria*. The thallus is areolate to almost squamulose. *P. tatrense* grows on slightly calcareous silicate rock under overhangs and is only known from the alpine mountains of Central Europe and one find in the high Black Forest.

Genus Characteristics

Thallus crustose, areolate, areoles almost squamulose, narrowly sessile on the substrate, throughout (sub-) paraplectenchymatous. Per. sunken, without involucrellum, anatomically like *Verrucaria* (↑),. Ch-.

Ecology and Distribution of the Species

Placopyrenium tatrense (Vèzda) O.Breuss
(Placidiopsis tatrensis Vèzda)
In high montane, high precipitation sites on slightly calcareous silicate rock on (v.)sporadically (short time) irrigated, rather rain sheltered, moderately well lighted vertical surfaces and overhangs, subneutroph. – mieur-alp – v.rare (1); süSch (Belchen), Vog

Lit.: BREUSS 1987, VÈZDA 1961

Placynthium (Ach.) S.Gray

Introduction

The *Placynthium*-species are gray, black, olive-colored to brown, sometimes gray pruinose, crustose-areolate or lumpy, often rosette growing and lobed on the margin rock dwellers with bluegreen algae as symbionts. In the case of

many species the areoles are corral-like divided. Rarely are the margin "lobes" twisted filament-like. The blackish apothecia have a proper margin as a rule. Occasionally a green to blue-black prothallus is developed. About 25 species are known.

P. flabellosum, *P. asperellum* and *P. dolichoterum* given for the Allgäu are species of irrigated of from time to time flooded mineral-rich silicate rock on shady, cool habitats. The latter two are distributed in western arctic-alpine. *P. asperellum*, which grows in other places even on lime, is known in Germany only from the Feldberg region. *P. flabellosum* occurs in Fennoscandia, Great Britain and in the higher Central European mountains (in Germany only in the high Black Forest and the Bohemian Forest). *P. garovaglii, P. hungaricum* and *P. subradiatum* commonly live on short time irrigated, sunny or at least well lighted surfaces on limestone. *P. nigrum*, which is the most frequent species throughout, grows especially on rock surfaces near the soil and stones (limestone) on from time to time irrigated or long time dew moistened sites. The area of *P. nigrum* and *P. subradiatum* extends from south to north Europe, in recent years with greater voids. *P. garovaglii* has its high point in the mediterranean region, rarely penetrating up into Central Europe and is verified with one isolated occurrence in Gotland. *P. stenophyllum*, a species described from North America, is known in Europe in recent times only from Baden-Württemberg and Scandinavia. Because of the rarity of *P. asperellum, P. flabellosum* and *P. stenophyllum* the development of the populations of these species ought to be followed.

Genus Characteristics and Determination

Thallus crustose to squamulose, usually rosetted, often areolate in the center, at the margin often with elongated areoles to radial-squamulose, gray, brown, olive to black, sometimes pruinose, often isidiate, sometimes dying in the center and then thallus ring form, with or without radial-fibrous, blue-green to blue-black prothallus. Photobionts filamentous bluegreen algae (Rivulariaceae, Scytonemaceae), ± regularly branched. Ap. black to black-brown, with proper margin, rarely with thalloid margin (*P. stenophyllum*). Exc. brown, purple, green, of radial hyphae. Hyp. brown to red-brown. Hym. in the upper part ± brown violet to green, sometimes entirely greenish. Paraphyses simple to sparsely branching, septate. Asci cylindric, *Peltigera*-type. Sp. cross-septate, 2- to multi-cellular, rarely one-celled, ellipsoidal to fusiform. Pycnosp. bacillar- to dumbbell-shaped. Ch-.

1 On silicate rock . **2**

1* On limestone . **5**

2 Thallus with greenish to bluish, often filamentous or streaked prothallus, black-brown to dark brown, cracked areolate to marginally apparently squamulose, areoles at the margin crenate to finger-like divided, mostly thickly covered with granular to coraloid isidia, often with ap. **P. nigrum** coll. **(10)**

2* Thallus without that type of conspicuous prothallus. Mountain lichens **3**

3 Usually with definitely elongated/enlarged lobules at the margin. Mountain lichens, often sterile .. **4**

3* Without such elongated lobules (not effigurate). With ap. Ap. 19-35(46) x 3.5-6 µm, 4-5 celled. Thallus thickly granular-papillate, like (↑), *P. nigrum*, usually -2 cm in size. On occasionally sprayed silicate rock, arct-alp **P. dolichoterum** (Nyl.) Trevisan

4 Thallus blackish, black-brown, olive-black, thickly papillate-granular to isidiate, thick, deep cracked areolate, usually with cylindric, -0.2 mm wide marginal lobes, without prothallus . **P. asperellum**

4* Thallus light olive, light gray, beige-gray, brown, with flat, smooth, closely depressed, at the margin divided fan-like, -3 mm long and -0.5 (extreme -1) mm wide margin lobes, in the center often thickly covered with flat lobules □ **P. flabellosum**

5 Thallus with ± tubular, fine, 0.1-0.2 mm thick -3 mm long, branched, separated, loosely decumbent to raising margin lobules, mostly -2 cm wide, without prothallus, usually sterile . **6**

5* Thallus not with thin, tubular, separated margin lobules . **7**

6 Thallus undersides pale, loose lying, with radially arranged margin lobules and producing a ring or irregularly growing, with cylindric isidia, brown, blackish, occasionally pruninose **P. stenophyllum** var. **isidiatum**

6* Thallus underside dark, with definite radially arranged margin lobules, not isidiate, but often with small secondary lobules, (brown)gray to blackish. Alps, possibly Ju . .**P. filiforme** (Garov.) Choisy

7 Thallus ± pruinose, thereby bluish to white-gray . **8**

7* Thallus not or only very weakly pruinose . **10**

8 Thallus dying in the center, falling out and then circular to sickle-like . **P. subradiatum (10)**

8* Thallus not falling out in the center . **9**

9 Sp. 23-53 x 4-6 µm, with 3-7 septa. Thallus (to over 1 mm) thick, areolate, in the center ± granular-scurfy, not dying, not or only weakly effigurate, with 0.1-0.3 mm wide lobules, not papillate-coraloid. Prothallus lacking **P. garovaglii**

9* Sp. up to 25 µm long, 2-celled. Thallus usually with clearly elongated margin areoles, thickly papillate to coralloid, thick, cracked, usually without prothallus, margin lobules almost cylindric, little branched **P. hungaricum**

10 Thallus -2 cm, interior soon dying and falling out, thereby often circular to sickle- like, with 2 mm long, -0.2 mm wide, flat to convex margin lobules, dark brown, dark olive-brown, upper surface not thickly papillate-coraloid, isidia lacking or very sparse. Without prothallus. Ap. very rare **P. subradiatum**

10* Thallus to over 10 cm wide, interior not falling out, areolate to appearing squamulose, with blue-green to blue-black, often fibrous prothallus. Areoles crenate to marginally finger-like divided, because of isidia ± thickly coraloid-papillate, blackish to dark brown. Ap. -1mm, flat, margined, later convex. Epihym. brown-violet to blue- green. Sp. 8-25 x 4-6 µm, 2-4 celled □ **P. nigrum**
(differing occasionally **P. tantaleum** (Hepp) Hue with 5.5-9 µm wide, only (1-)2-celled spores, more on silicate rock)

Ecology and Distribution of the Species

Placynthium asperellum (Ach.) Trevisan
(P. aspratile (Ach.) Henssen)
In the subalpine and alpine zone on mineral- rich or slightly calcareous silicate rock, on irrigated, smaller rocks on long time snow covered, cool-shaded, high precipitation, rather oceanic habitats – arct-alp -- v.rare (R); süSch

Placynthium flabellosum (Tuck.) Zahlbr.
(P. adglutinatum (Anzi) Trevisan, Anziella adglutinata (Anzi) Gyelnik)
In high montane, oceanic sites on usually mineral-rich silicate rock on occasionally to long-time irrigated surfaces or on sporadically flooded boulders on cold brooks, subneutroph., m.photoph.-r.skioph., e.g. in the Ionaspidetum – (s')bor(atl)-mieur-h'mo – v.rare (1); süSch, Vog

Placynthium garovaglii (Massal.) Malme
(P. caesitium (Nyl.) Hue)
In sub- to high montane sites on lime-rich rock on rather rain sheltered, usually only rarely or short-time irrigated, sunny vertical surfaces and overhangs, e.g. with *Thyrea conf.* (↑), but high point on dryer sites, basiph., xeroph., (subhydroph.), r.photoph., e.g. in the Peccanio-Thyreetum, but also with *Caloplaca cirr.* (↑), -- mieur-med -- rare; Sju-Ju-FrJu, *Ne*

Placynthium hungaricum Gyelnik
On steep- and vertical surfaces of limestone, like *P. garovaglii* and *P. subradiatum* (↑), -- mieur(pralp – rare; Sju, Ju

Placynthium nigrum (Hudson) S.Gray (incl. P. tremniacum (Massal.) Jatta
Up into high montane (alpine) sites on slightly calcareous to very lime-rich rock on frequently moistened or surfaces protected from rapid drying, thus on irrigated surfaces, frequently dew moistened stones, foot surfaces of rocks, r.euryök, on sunny to rather poorly lighted, not to rather eutrophied habitats, even o lime dust encrusted pebbles, occasionally on synanthrop on walls, on mortar, concrete, basiph., subhydroph.-substrathygroph., mesoph.-r.xeroph., above all Collematetalia – bor-med – regionally rather frequent (Ju, Sju, FrJu), Ne, Mn, otherwise r.rare

Placynthium stenophyllum (Tuck.) Fink
var. **isidiatum** Henssen
In montane sites on lime-rich rock on sunny, sporadically irrigated rocks, like *Thyrea conf.* (↑), -- bor-mieur – v.rare (1); Ju

Placynthium subradiatum (Nyl.) Arnold
(Wilmsia radiosa (Anzi) Körber)
Up into the alpine zone on lime-rich rock on sunny, sporadically irrigated (sub-)vertical surfaces, basiph., m.anombroph.-ombroph., r.-v.photoph. – bor-med -- rare; Ju, Sju, FrJu, Al, süHü (Istein)

Lit.: GYELNIK 1940, HENSSEN 1964c, POELT 1969.

Platismatia W.Culb. & C.Culb

(Determination ↑ Cetraria, Parmelia)

Introduction

Platismatia includes foliose lichens with gray and blue-gray, undersides usually black, brown at the margins, rarely lighter, provided with only a few attachment organs thallus with margin standing, usually centrally perforated apothecia. The genus occurs with ca. eleven species of both hemispheres, with the taxa center in western North America. Two species are known from Europe. The single Central European consists of a deeply divided, thallus rising, thallus sorediate to isidiate at the margin. It grows on acid bark of trees, on silicate rock and mosses and is distributed from the northern boreal zone up into the cool sites of South Europe.

Genus Characteristics

Thallus foliose, lobes often rising, commonly gray, blue-gray, the two European species with isidia or soralia on the margins, undersides light to black with few scattered, simple rhizines, corticate on both sides, upper cortex ± paraplect-enchymatous. Photobionts *Trebouxia*-like. Ap. ± marginal, large, brown, with thalloid margin, disk often perforated, in the case of the European species rare. Asci of the *Lecanora*- type. Sp. one-celled, almost spherical to ellipsoidal, small. Ch: Cortex with Atranorin, the indigenous species with Caperatic acid in the medulla.

Ecology and Distribution of the Species

Platismatia glauca (L.) W.Culb. & C.Culb. (Cetraria g. (L.) Ach.)
Up to the tree line on acid bark of deciduous and conifer trees as well as on acid silicate rock, like *Pseudevernia* (↑) and *Parmelia saxatilis* (↑), Char. Hypogymnietea – bor-mieur-med-mo – m.frequent; in lower and dryer sites rare and above all in the tree crowns, in the mountains regionally v.frequent and especially on branches together with *Pseudevernia furfuracea* producing vegetation masses

Pleopsidium Körber

Introduction

The *Pleopsidium*-species are yellow, rosetted growing crustose lichens with lobed margin and a habit similar to many *Acarospora*-species, with which they even have the same high number of spores in the asci, from which they however differ in the structure of the ascus, in the structure of the thallus and in their chemistry. Both species occurring in Central Europe are arctic-alpine and reside on vertical surfaces and overhangs of silicate rocks in cold high sites. *P. chlorophanum* appears frequently on iron-rich rocks, it is not however limited to them. In Central Europe the species is indigenous in the higher central mountains (South Black Forest, Bohemian Forest, Fichtel- and Erz-mountains) as a glacial relict. *P. flavum* is to a large extent limited to the Alps and Carpathians and surrounding regions; an isolated collection location is known from the Fichtel mountains. *P. chlorophanum* occasionally appears spontaneously on lower sites. The species has been discovered often on towers and grave stones, enabling a very effective extension of area.

Genus Characteristics and Determination

Thallus crustose, rosette growing, marginally lobed (placoid), yellow, greenish-yellow, with upper cortex of ± anticlinal lying, short organized hyphae, ± prosoplectenchymatous, inspersed with large masses of Rhizocarpic acid crystals (therefore structure is difficult to recognize), with coccoid green algae. Ap. half sunken to sitting up, yellow, rarely yellow-brownish to greenish, with thalloid margin. Hyp. ± colorless. Hym, I+ intensive blue. Epihym. yellowish. Paraphyses simple, sometimes branching and bound. Asci of the *Pleopsidium*-type, with robust tholus, broad ocular chamber and amyloid gelatinous outer layer, tholus only I+ intensively blue in the lower outer region. sp. to very many, one-celled, ellipsoidal, small. Pycnosp. ellipsoidal, often somewhat narrowed on one end. Ch: Rhizocarpic acid, Acaernoic acid, Acaranoic acid, R-.

1 Ap. permanently flat and margined, half sunken. Thallus upper surface often finely wrinkled (handlens). Thallus definitely effigurate as in the case of *P. chlorophanum*, often over 2 cm in size. Sp. 4-5 x 1.7-2 µm . □ **P. flavum**

1* Ap. soon convex-marginless. The convex areoles of the upper surface ± smooth. Thallus usually -2 cm. Sp. 3-4 x 1.5-1.7 µm .□ **P. chlorophanum**

Ecology and Distribution of the Species

Pleopsidium chlorophanum (Wahlenb.) Zopf
(Acarospora chlorophana (Wahlenb.) Massal.)
In high montane to alpine, high precipitation sites on ± rain sheltered, usually away from the sun vertical- and overhanging surfaces on acid, sometimes mica- and iron-rich (rusty colored) silicate rock, usually on moderately open to the wind sites, very rarely adventitious on anthropogenic substrates and under aberrant climate. Conditions, e.g. on grave stones, lookout towers, r.-v.acidoph., m.-r.photoph., anitroph., Char. Acarosporo sin.-Pleopsidietum chloroph. – arct-alp – v.rare; süSch (Feldberg), Fi, Vgt, Erz, BayW, additionally adventitious: e.g. Ulmer Münster, Mn, He; widespread in Central Alps

Pleopsidium flavum (Bellardi) Körber
(Acarospora oxytona (Ach.) Massal.)
In alpine, usually continental valley sites on vertical and overhanging surfaces on acid, usually hard, smooth silicate rock on well lighted, but often away from the sun sites, also dealpine (e.g. with *Rhizoplaca chrysoleuca*) in xerothermic regions near sea level (e.g. Wachau), very rarely adventitious on anthropogenic substrate, Char. Pleopsidietum flavi – arct-alp/pralp, (subco) – v.rare (1); Ne (on a road marker), additionally common: Central Alps

Lit.: HAFELLNER 1993b, MAGNUSSON 1935.

Polyblastia Massal.

Introduction

Polyblastia is today consolidated in a still current version of a non uniform genus, of the crustose lichens with little differentiated, often endolithic thallus, black perithecia and muriform, colorless to dark colored spores. They are outwardly like the Verrucarias.

Except for the calcareous soil dwelling *P. philaea*, the humus- and moss dwelling alpine *P. epigaea* and *P. sendtnera* and *P. cruenta* growing on from time to time flooded silicate rocks all *Polyblastia*-species are southwestern Germany (with Allgäu) calcicolous lichens, which commonly live on away from the sun lime-, more rarely dolomite rocks. *P. theleodes* prefers lime-poor rock and goes over occasionally to SiO_2-poor silicate rock.

The species are generally and even in the region little observed and have been collected; partially they are as a whole insufficiently defined. A greater part of the Polyblastias seem to be limited in Central Europe extensively to the alpine mountains. *P. abscondita, P. deminuta, P. dermatodes, P. dominans, P. epigaea, P. helvetica* and *P. Sendtneri* are found in contiguous Allgäu. Counted with the better known species are *P. cruenta, P. cupularis* and *P. theleodes*; which are common in North Europe and the higher mountains of Central Europe.

Genus Characteristics and Determination

Thallus crustose, usually indefinite, often in the substrate, with coccoid green algae. Per. sessile to sunken, in the case of endolithic species often in rock pits, with or without involucrellum, exc. blackish, even light toward the base. With periphyses, paraphyses slimy disintegrating and disappearing. Asci with (1)2-8 sp., ventricose, thin-walled. Pycnosp. short bacillar. Ch-.

The genus is not a natural unit; they are characterized by the muriform spores and thereby only formally separated from other genera of the Verrucariaceae (*Thelidium, Verrucaria*). They are insufficiently observed, and many species are inadequately known.

Concerning the structure of the involucrellum ↑ *Verrucaria.*

1 Thallus on soil, gray, dusty-granular. Per. hemispherical projecting, 0.35-0.5 mm. Sp. 38-50 x 16-54 µm. multicellular, colorless to yellowish . **P. philaea**
1* On rock **2**
2 On silicate rock . **3**
2* On limestone **4**
3 Sp. 40-80(90) x 20-40 µm, at first colorless, then brownish to dark brown, very multicellular. Per. apex 0.5-0.8 mm, projecting hemispherical, for the most part covered by the thallus, with invol divided in half. Thallus definite, thin, smooth, ± cracked, gray-brown, olive to dark brown, clearly darker when moist, on moist silicate rock **P. cruenta**
3* Sp. 22-45(55) x 14-22(30) µm, remaining colorless to slightly yellowish. Per. apex 0.4-0.6 (0.7) mm, projecting hemispherical, invol.

divided in half, thick. Thallus thin, dull, gray, gray-brownish, very finely cracked areolate, sometimes with black prothallus, on usually dry rock (above all sandstone) . **P. cupularis**

4 Sp. small, up to ca. 20 µm long, few celled. Per. very small, -0.25 mm **5**

4* Sp. over 20 µm long . **7**

5 Parasitic on the thallus of *Protoblastenia*-species with orange colored ap., without its own thallus. Sp. 4-celled, usually cross-form divided, rarely 6-celled, at least in youth (in the ascus) with perispore, colorless, brown with age, 10-20 x 7-14 µm. Sju, Ju . **Merismatiumdiscrepans** (Lahm) Triebel (*Polyblastia d.* Lahm)

5* Not parasitic. Sp. colorless, 4-6 celled. Invol. divided in half, per. half sunken. *P. plicata* s.l. **6**

6 Thallus rather robust, coherent, wrinkled to granular, gray-white. Per. very numerous. Sp. 10-12 x 6-8 µm. Hyphae of the algae layer ± perpendicular. *Sju, FrJu* . **P. plicata** (Massal.) Lönnr.

6* Thallus thin, undifferentiated, dull, gray to reddish-gray. Sp. 9-15 x 6-9 µm. Hyphae of the algae layer not perpendicular. Usually above the tree line, arct-alp, *Al*, probably Ju? **P. singularis** (Krempelh.) Arnold (=?*P. plicata*)

7 Per. projecting hemispherical, at least at first only sunken at the base. Invol. thick, ± divided. Sp. muriform multicellular **8**

7* Per. completely sunken in a pit or only slightly with the apex projecting, after falling out a pits clearly left behind, without invol **10**

8 Sp. commonly 60-90 x (25)35-50 µm, at first colorless, soon brown. Per. 0.6-1(1.2) mm, hemispherical to almost spherical projecting. Thallus whitish, often somewhat reddish, usually relatively thick, scruffy, warty, cracked, even indefinite **P. theleodes**

8* Sp. (20)25-40(55) x (12)14-24(30) µm, colorless to yellowish. Per. -0.8 mm, hemispherical to conic projecting. Thallus thin to indefinite, usually gray-white to brownish-gray **9**

9 Per. apex 0.2-0.4 mm. Per. ± sessile. Structure similar to *P. cupularis*. Al, Sju **P. microcarpa** (Arnold) Lettau

9* Per. apex 0.4-0.7 mm. Mouth at last often wide open. Thallus sometimes with blackish prothallus lines. Rather variable .**P. cupularis (3)**

10 Young sp. (in the ascus) surrounded by a 2-5 µm thick perispore, soon olive- to dark brown, 6-9 celled, weakly muriform, 20-32 x (8)10-16 µm. Per. -0.25 mm, with ± spherical blackish exc. Thallus indefinite, white, gray, brownish, ± endolithic, upper surface often very finely "eroded" rough. On limestone, dolomite, like *Hymenelia coerulea* (↑), bor-mieur-mo, Sju, FrJu, Al, probably also Ju **P. deminuta** (Arnold)

10* Sp. without perispore, colorless to slightly yellowish . **11**

11 Sp. up to 12 celled, with single long-wall . **12**

11* Sp. at least in part with more than 12 cells, muriform-multicellular . **13**

12 Sp. with usually 3(4, rarely -5) cross walls and with altogether 0-1(2) long-walls (1 per cross-division), (2)4-7(8) celled, 25-50 x 10-18(25) µm. Per. 0.4-0.6 mm, apex ca. 0.3 mm. Thallus ± endolithic, gray-whitish to well developed and smooth to wrinkled. At this time it appears not significant, to differentiate from several other described species **P. sepulta**

12* Sp. with 3-7 cross- and 1-4(6) long walls, (3) 6-12 celled, 30-60 x 12-25 µm. Per. 0.4-0.6 mm. Thallus endolithic, gray-white **P. dermatodes** Massal.

13 Sp. to ca. 35 µm long . **14**

13* Sp. clearly longer . **16**

14 Per. (0.4)0.5-0.6 mm. Receptacle spherical to broadly egg-form, robust, black. Sp. ca. 18-32 x 12-16 µm. Thallus blue-gray, (under handlens) very finely black punctate, very thin, mealy. On limestone. *Ju* (Schaffhausen) .. . **P. cinerea** Jatta

14* Per. smaller, up to 0.4 mm, apex -0.3 mm. Receptacle black(-brown), sometime lighter in the lower part, ± spherical. Difficult to separate, a scarcely know taxa at this time **15**

15 Thallus brownish, very thin. Per. 0.2-0.3 mm wide, sp. 30-45 x 16-22 µm. Above all on limestone. *FrJu, Al* . **P. abscondita** (Nyl.) Arnold

15* Thallus whitish(gray), mealy to ± smooth or ± endolithic. Per. 0.2-0.4(0.5) mm, numerous. Sp. (21)30-52 x 12-28 µm, very multicellular . **P. albida** s.l.

16 Sp. weakly muriform, to 15 celled, the most however with clearly less cells, (30)40-60 x 12-25 µm. Per. 0.4-0.6 mm . **P. dermatodes (12)**

16* Sp. multicellular muriform, (21)30-52 x 12-28 µm. Per. 0.2-0.4(0.5) mm **P. albida** s.l. **(15)**

Ecology and Distribution of the Species

Polyblastia albida Arnold (incl. P. amota Arnold = Amphoroblastia a. (Arnold) Servit, ?P. obsoleta Arnold)

Above all from the montane to alpine zone on (hard) dolomite and limestone on shady usually slightly moist (e.g. spring moistened) rocks, usually in basins, valleys, forests, basiph., m.photoph.-v.skioph., substrathygroph.(-subhydroph.), hygroph., anitroph., usually with *Thelidium*-species or with *Petractis hyp.* (↑), but of broader ecological amplitude, Char. Thelidietalia – arct-med – Ju, Sju, FrJu, Rhön, Al

Polyblastia cruenta (Körber) P.James & Swinscow (P. henscheliana (Körber) Lönnr.)
In subalpine and alpine sites on silicate rock on long time flooded boulders in swift flowing cold brooks, like *Ionaspis odora* (↑), -- arct-mieur-alp – v.rare(2); süSch (Feldberg-region), BayW

Polyblastia cupularis Massal. (P. intercedens (Nyl.) Lönnr.)
Above all in (high) montane and alpine sites, rarely lower, usually on hard limestone, more rarely dolomite or moderately lime-rich to lime-poor rocks, on shady rocks, basiph.-subneutroph., r.skioph.-m.(r.)photoph., anitroph. – bor-med, alp/pralp – Ju, Sju (scattered), *Bo*, Al, *Ml*

Polyblastia philaea Zsch.
In the foothills zone on lime-rich loam soils and loess, pioneer, like *Thrombium epigaeum* – mieur – süHü

Polyblastia sepulta Massal. (Amphoroblastia s. (Massal.) Servit, incl. P. bavarica (Dalla Torre Y Sarnth.) Zsch. = Amphoroblastia b. (Dalla Torre Y Sarnth.) Servit, incl. P. quinqueseptata (Hepp) Zsch.)
Rather like *P. albida* (↑), often on rocks rising from the soil on long time remaining moist (e.g. dew) sites, on shaded rock walls, Thelidietalia – bor-med(alp) – Ju, Sju, FrJu, Al, *Ne*

Polyblastia theleodes (Sommerf.) Th.Fr.
In high montane and alpine sites, rarely lower, on lime-poor and basic silicate rock, lime-sandstone, sandy dolomite, on cool to cold, shady, often slightly substrate moist habitat, subneutroph.-m.basiph., hygroph., m.photoph.-r.skioph., anitroph. – arct-mieur-alp/pralp – v.rare (0); *Ju*

Lit.: POELT 1969, SWINSCOW 1971, ZSCHACKE 1933.

Polychidium (Ach.) S.Gray

(Key incl. Ephebe, Lichinella, Peccania, Spilonema, Synalissa, Thermutis)

Introduction

The blue-green algae genus *Polychidium* which in Europe is represented by on two species produces small, thickly branched, finely shrubby, brown thallus with cylindrical branches corticate on all sides and brown to red-brown apothecia with deep sitting, disk surrounded by a proper margin. The genus includes 5 species. The single Central European representative grows on mosses on from time to time irrigated, often soil impregnated silicate rocks in the arctic and boreal floral regions as well as in the mountains of the temperate and (rarely) mediter-ranean zone. The species in the region is in regression and is threatened.

Genus Characteristics and Determination

Thal lus fruticose, richly (± dichotomous) branching, brown (non-indigenous species even greenish), branches tubular, surrounding cellular cortex (one- to several layers), medulla of loosely oriented hyphae (younger branches) to a large extent paraplectenchymatous, with *Nostoc* (non-indigenous species even with *Scytonema*). Ap. usually laterally on the branches, red-brown, brown, with thick proper margin, disk concave to flat. Exc. robust, cellular. Hyp. colorless to slightly brownish. Epihym. brown. Paraphyses simple, thickened on the ends. Asci broadly cylindric, with amyloid tholus. Sp. 2-celled, fusiform (in the case of non-indigenous species even one-celled, ellipsoidal). Pycnosp. short bacillar. Ch-.

The keyed species: Ch-. Occurring on the sea coasts on from time to time splashed rocks: *Lichina confinis* (O.F.Müller) Agardh: Thallus black, thick dwarf fruticose, -3(5)mm high, with tubular branches, with *Calothrix*-algae. Ap. terminal, sunken in ± spherical swellings, with punctiform disk. Sp. 12-18 x 10-15 µm, widely distributed in Europe; **L. pygmaea** (Lightf.) Agardh: Thallus loose dwarf fruticose, -15 mm high, branches flattened, sp. 22-29 x 11-16 µm, west European coasts.

1	On limestone or over mosses on limestone .	**2**
1*	On silicate rock or on silicate mosses .	**6**
2	Sp. multicellular, brow to black-brown, ± cylindric, often radially ordered segments .	**3**
2*	Sp. 1-celled. Hyphae loose. No cortex, no paraplectenchyma developed	**4**
3	Thallus section colored blue-green at the base, center paraplectenchymatous; s'mieur-med -- Not in our region	**Placynthium filiforme** (Garov.) Choisy
3*	Thallus section not blue-green at the base, corticate, center not paraplectenchymatous. Sp. muriform	↑ **Leptogium massiliense** and **L. schraderi**

4 Thallus very finely filamentous, small black to brown-black, producing fringed filament-like cushion to cottony turf, filaments up to 12 µm thick, with a central weakly lichenized *Scytonema*-filament **Thermutis (8)**

4* Thallus of robust, crowded, branching, erect branches made up of over 150 µm thick, cushion-like, often almost coral-link, usually -8 mm high. Branch ending of equal height, tips usually about 0.2-0.4 mm thick. With 1-celled algae, single or united with one another in a gelatinous envelope (*Gloeocapsa)* **5**

5 Ap. -1.5(2) mm, soon with clearly visible disk, these at first sunken, surrounded by a thick margin, then becoming flat. Sp. ± spherical, about 8 µm. Algae in the margin region of the thallus with brown-yellow gelatin envelop. Thallus black, often blue-gray pruinose, ± coral-like of crowded, tubular to flattened, usually 0.2-1(3) mm wide branches, -8(10) mm high **Peccania coralloides**

5* Ap. -0.6(0.8) mm, sunken into the ends of the branches, disk usually ± punctiform, later also widened. Algae in the margin region of the thallus with reddish, rarely (dark) violet gelatin envelop. Sp. to 8-24, 7-12 x 6-9 µm. Thallus black, very rarely pruinose, cushion-like, of crowded, tubular to weakly clavate, cartilaginous tough, 0.15-0.4 mm (when flattened even -0.8 mm) thick branches, -5 mm high .□ **Synalissa symphorea**

6 Branch with definite cortex of polygonal cells, -130(200) µm thick, the younger points shiny. Thallus with *Nostoc* (algae often in groups, scarcely in chains). dark brown, small shrubby, thickly branched, -1.5 cm high producing a loose cushion. Ap. rather rare, red-brown, with concave to flat disk and ± protruding, lighter proper margin, -1.2(1.5) mm. Sp. 2-celled, fusiform or ellipsoidal, 15-25 x 4.5-11 µm. On mossy rock (*Nostoc*-algae have even a apparent small shrubby *Leptogium*-species ↑) □ **Polychidium muscicola**

6* Branches without definite cortex. Thallus not with *Nostoc*, not shiny brown **7**

7 Thallus filaments up to about 50 µm thick, usually only -3 mm long . **8**

7* Thallus filaments over 50 µm thick **10**

8 Thallus filaments consisting of one only to 1 cell series made up of (*Scytonema*), in whose gelatin layer the difficult to recognize hyphae lie (thereby a danger of confusing with algae, when sterile), -2.5 mm long, ± strongly branched. Thallus small, blackish, producing a felt-like fringed cushion to cottony turfs of ± erect, -12 µm thick filaments, -1 cm wide. Ap. rare, dark brown, concave, with thick proper margin, -0.5 mm. Sp. 9-15 x 5-7 µm. Epihym. brownish . **Thermutis velutina**

8* Thallus filaments of multi series ordered algae cells *(Stigonema)*, around which the hyphae produce a loose to paraplectenchymatous tissue, blackish. Ap. -0.5(1) mm, black, convex, marginless. Sp. often weakly developed, 7-9 x 2.5-3.5 µm. Hym. greenish to violet. Epihym. dark blue-green to dark violet . **9**

9 Thallus relatively loose turf-like, of ± inter-woven, low lying filaments, carpet-like, not cushion-like, filaments above all branching at the base, -4 mm long, at the base with blue-green rhizine-hyphae. Ap. moderately rare, -1 mm, sessile on the thallus upper surface. Hyp. colorless, hym. 55-60 µm . **Spilonema paradoxum**

9* Thallus producing a thick blackish cushion of erect filaments, filaments crowded, firm, -6 mm long, covered up to ¾ the length with bluegreen rhizines, therefore widely colored blue-green from above. Ap. sunken into the cushion and ± hidden, later covering the cushion center, -0.5 mm. Hyp. ± violet, hym. 45-55 µm . **Spilonema revertens**

10 Algae 1-celled, singly or incorporating into gelatin envelop (not to filaments), 5-13 x 5-11 µm in size. Thallus filaments blackish, 40-100 µm thick, branch erect repeatedly divided. Thallus very small shrubby, almost areolate, -5 mm high. Ap. rare, -0.3 mm, red-brown .**Lichinella stipatula**

10* Algae ordered into several cell series *(Stigonema)*, cells brown-green, 9-20 x 3-11 µm). Thallus usually decumbent and thick, producing a firm carpet, -4 cm in size, filaments green-black to black, at the base -200 µm thick, -1.5 cm long, rather ramified, relatively lax, ± wrinkled. Thallus often coalescing into larger surfaces. Ap. very rare, very small, almost spherical. Sp. 1-celled . □ **Ephebe lanata**

Ecology and Distribution of the Species

Polychidium muscicola (Sw.) S.Gray
Above all in montane-high montane, high precipitation sites on/between mosses on silicate rock, very rarely limestone or on sandy-loam soils, like *Massalongia* (↑), occasionally basally on old trees, Char. Polychidio-Massalongietum – (arct-)bor-med-(h)mo – rare (2); süSch, *nöSch*, Vog, *nöPf, Ts*, Eif, Erz, *BayW*

Lit.: HENSSEN 1963a, MIGULA 1929-31.

Polysporina Vèzda

(Determination ↑ Sarcogyne)

Introduction

The *Polysporina*-species – earlier judged as *Sarcogyne* – are crustose lichens with little differentiated thallus; a few parasitic on other crustose lichens. The apothecia are black, have a folded-grooved to warty disk with a lecideine proper margin. *P. simplex* grows on silicate rocks and as a rule is a pioneer, usually on dust impregnated rocks on stones. *P. lapponica* lives on crustose lichens. Both are widely distributed in Europe. The limestone dwelling *P. pusilla* and *P. urceolata* are alpine species and are known from the Allgäu.

Genus Characteristics and Determination

Thallus crustose, definitely to very indefinitely developed or living on lichens, with coccoid green algae. Ap. black, with lecideine proper margin and umbilicate-grooved disk. Exc. exterior black-brown, interior ± light, of radial lying hyphae. Hyp. colorless. Epihym. colorless to brown, in the region of the umbilicus dark brown. Hym. I+ yellowish to reddish or partially blue, K/I+ blue. Paraphyses richly branching and reticulate, colorless above or exterior brown pigmented, not thickened, of unequal height. Asci cylindric-clavate, with K/I+ blue outer layer, otherwise wall K/I-, with non amyloid tholus. Sp. to over 100, very small, 1-celled, ellipsoidal to almost spherical. Pycnosp. very small, ellipsoidal. Ch-.

Ecology and Distribution of the Species

Polysporina lapponica (Ach. ex Schaerer) Degel. (_. dubia (H.Magn.) Vèzda, Sarcogyne d. H.Magn., S. canasiacensis (Hue) H.Magn.)
Up into montane sites, rarely higher, on silicate rock, on (pioneer-)crustose lichens, especially living on *Acarospora*-species, predominantly on anthropogenic substrates (grave stones, wall crowns), here often with *Candelariella vit.* (↑), of *Buellia aethalea*, subneutroph.-m.(r.)acidoph., r.-v.photoph., in the *Candelariella vit-Lecanora muralis*-association, Lecidelletum carp., Aspicilietum cin. – bor-med – m. frequent, above all introduced

Polysporina simplex (Davies) Vèzda (Sarcogyne s. (Davies) Nyl.)
Up into montane sites, rarely higher, on lime-free silicate rock, predominantly on loose stones, rarely on natural stone walls, residing on rock surface openings (cracks), even on hewn rock, weakly competitive pioneer, on slopes, in open forests, subneutroph.-r.acidoph., m.-v.photoph., e.g. in the Aspicilietum cin., often only with very few companions – arct-med – r.rare; Sch, Vog, O, Sp, RhSch, Pf, Erz

Lit.: POELT & VÈZDA 1981, VÈZDA 1970, 1978

Porina Müll.Arg

(Key incl. Strigula)

Introduction

The fruiting bodies of the Genus *Porina* are brown, reddish to black perithecia, the thallus crustose, little differentiated and usually inconspicuous. To the characteristics are counted fusiform to cylindric, cross-septate spores in uniformly thin asci.

The genus distributed above all in the tropics includes in Germany perhaps 13, in the region nine, at this time insufficiently known species. The indigenous species require shady, rather humid localities in mild sites. *P. aenea* and *P. leptalea* crust over smooth, moderately acid bark of deciduous trees and spruce, especially in forests. *P. linearis* inhabits limestone. *P. chlorotica* is found on silicate rock, and indeed often on overhangs or on stones. *P. ahlesiana, P. grandis, P. guentheri* and *P. lectissima* sit on long-time moist silicate rocks on from time to time flooded boulders in cool, clear brooks.

P. aenea, P. guentheri and P. linearis are common from the Mediterranean region up to somewhat above the line of the area of the pedunculate oak in southern Scandinavia. *P. chlorotica* and *P. lectissima* go somewhat further toward the North; the latter is predominantly in mountain sites in Central European and – here rarely – indigenous to the Mediterranean-region. The atlantic *P. leptalea* occurs above all on the British Isles and to the facing continent and radiating into the mild regions of the western

Central Europe. *P. ahlesiana* possibly has a similar area. These species reach Fennoscandia not at all or only with outposts.

Genus Characteristics and Determination

Thallus crustose, little differentiated, often indefinite or in the substrate, with *Trentepohlia*. Per. sessile to sunken, rose, brown to black, sometimes covered by thallus tissue. Exc. colorless or brownish, reddish, greenish, violet tinted etc. colored, with or without involucrellum. Paraphyses simple, rarely forked, thin. Periphyses lacking. Asci cylindric-narrow clavate, uniformly thin walled, only very slightly thickened above, I-. Sp. 2-3 series, 1- to repeatedly (in the case of the indigenous species 3-7 fold) cross-septate (rarely with longitudinal walls, not in the case of indigenous species), fusiform. Pycn. usually similarly colored as the apothecia, often sunken in small warts. Pycnosp. (short) bacillar, in addition septate macroconidia. Ch-. The black fruiting species were recently separated out as *Pseudosagedia* (Müll. Arg) Choisy. Characteristic is a violet pigment in the per. wall.

1 On naked rock . **2**
1* On bark or mosses . **6**
2 On limestone. Thallus coherent, dull, rose, rose-gray, brown, olive-gray, ± endolithic to epilithic and cracked, in the herbarium or with age gray to brown-yellowish. Per. usually projecting hemispherical to almost spherical, -0.3 mm, invol. purple-black, violet-black, lilac-brown, brown, K+ partially bluish, even brown-orange above, K+ orange, base open, receptacle usually even basally closed by a thin brown exc. line. Sp. with 3, rarely up to 7 septa, 16-30(33) x 3.5-7 µm **P. linearis/byssophila**
2* On silicate rock . **3**
3 Per. yellow-, brown- to olive-reddish, yellow-brown to brown, at least when moist with reddish color tone, covered by a thin thallus layer, projecting hemispherical to moderately convex, (0.3)0.5-0.6 mm wide. Thallus thin, uniform to partially cracked . **4**
3* Per. black, at least in the upper part naked, half sunken to sessile (almost spherical projecting) . **5**
4 Sp. with 3 (very rarely 4-6) septa, 18-30(40) x 4-8 µm. Thallus yellow-, red- to olive brown □ **P. lectissima**
4* Sp. with (6-)7 septa, 30-50 x 6-15 µm. Thallus yellowish, pale olive, gray-green **P. ahlesiana**
5 Sp. with 3 septa, 15-25(32) x 4-6 µm. Per. -0.3 mm, numerous. Thallus olive, gray-grown, gray-green, blackish, thin to indefinite . **P. chlorotica**
5* Sp. with (5-)6(7) septa (rarely with 1 longitudinal septum), (20)30-45 x 5-6 µm. Per. -0.6(0.7) mm, scattered. Thallus olive to gray, darker when moist, coherent to finely cracked (var. *grandis*: per. -0.8 mm, sp. -10 µm wide) . **P. guentheri**
6 Per. reddish(yellow) red-brown, covered by thin thallus layer, -0.25 mm, moderately convex. Sp. with 3 septa, 15-23 x 3-6 µm. Thallus dark olive-brown, greenish-gray, gray, even indefinite, ± coherent **P. leptalea**
6* Per. black to dark gray . **7**
7 Sp. with 3 septa **8**
7* Sp. with 5-7 septa . **9**
8 Asci thickened above, interior thickening with pit. Paraphyses ± branched. Per. -0.5 mm. Sp. 15-21 x 3-5 µm. Thallus white to indefinite . **Strigula affinis**
8* Asci equally thin walled. Paraph. not or rarely branched. Per. -0.3 mm. Sp. 13-24 x 4-5 µm. Thallus red-brown, dark brown, olive or almost blackish, thin, corticate above . □ **P. aenea**
9 Sp. 20-27 x 3-5 µm, with 6-7 septa. Per. usually elliptical to elongate, -0.6 mm. Thallus very thin, whitish. Often (only) with stylospores in perithecia-like receptacle, stylospores 5-7 septate, 20-30 x 3-4.5 µm, rounded on the ends **Strigula glabra**
9* Sp. 25-35 x 5-8 µm, with (5-)7(9) septa. Per. rounded, -0.45 mm, half-sunken, often on moderately convex, at first covered with thin gray thallus layer, later black. Thallus ash-gray to light gray, thin **Strigula stigmatella**

Ecology and Distribution of the Species

Porina aenea (Wallr.) Zahlbr. (P. carpinea (Pers. ex Ach.) Zahlbr., P. chlorotica var. c. (Ach.) Keissler)
Above all foothills-submontane, rarely in mild sites of the montane zone, on smooth bark of deciduous trees (rarely spruce), at the most frequent in the lower stem region of ash and hornbeam in the interior of forests, above all in meadow forest and basin forests (e.g. Stellario-Carpinetum, Pruno-Fraxinetum, Aceri-Fraxinetum) on r.(-v.)light poor, humid, mild habitats, (Sub-neutroph.-)m.acidoph., anitroph., r.toxitol., usually in species-poor stands, in contact with or in the Pyrenuletum nit. and in other Graphidion associations. – (s'bor-)mieur (subatl)-med(mo) – r.frequent, only rarer in dry-warm regions

Porina ahlesiana (Körber) Zahlbr.
(P. septemseptata (Hepp ex Zwackh) Swinscow)
In foothills and submontane, climatically mild sites on splash water moistened or from time to time flooded silicate rock in brooks and streams on shady, humid, oceanic habitats, subneutroph., hydroph., m.photoph-r.skioph., anitroph. – mieur (atl) – v.rare (0); *nöSch (Würm)*

Porina chlorotica (Ach.) Müll.Arg.
Above all in foothills and submontane sites on silicate rock, on near the soil rock surfaces and on stones, usually in the forest interior on r.(-v.)light-poor, humid, basins, surfaces remaining moist for a long time because of rain or dew, often on slopes, even on occasionally flooded habitats, thus on brooks e.g. with *Catillaria chal.*, r.-m.acidoph., substrathygroph., -- s'bor-subatl-med-mo – r.rare; Sch, Hü, Vog, O, Sp, Ts, Pf, Mos, Eif, He, ThW, Erz

Porina guentheri (Flotow) Zahlbr.
In the montane and high montane zone on commonly lime-free silicate on long time moist or from time to time flooded rocks in brooks, like *Polyblastia cruenta* (↑) -- (s'bor-)mieur-(s)med-mo, subatl – v.rare (R); süSch (also var. **grandis** (Körber) Swinscow)

Porina lectissima (Fr.) Zahlbr.
Up into high montane sites on lime-free to slightly calcareous silicate rock on from time to time flooded sites in clear, cool brooks, on long time moist rock surfaces, on humid, r.-v.light-poor, rarely well lighted habitats, subneutroph.-m.acidoph., hydroph., anitroph., e.g. in the Porpidietum glauc., in forms of the Aspicilietum lac. – s'bor-subatl-smed-mo – r.rare (3); Sch, Vog, O, Ts, ThW, BayW

Porina leptalea (Durieu & Mont.) A.L.Sm.
In foothills and submontane sites on smooth bark deciduous trees, rarely conifers, in forests in basins, climatically mild, r.oceanic valleys, above all on hornbeam, ash, beech, rather like *P. aenea* and often associated with it, but less toxin tolerant and still more limited to mild sites, subneutroph.-m.acidoph., r.skioph., (v.)hygroph., m.ombroph., anitroph., in the Graphidion – mieur-subatl(-med) – rare; Rh, Hü, Sch, Bo, Ne, SFW, O, Eif

Porina linearis (Leighton) Zahlbr. (P. persicina (Körber) Zahlbr., ? P. byssophila (Körber ex Hepp) Zahlbr.)
Up into the alpine zone on lime-rich to lime-poor, ± hard rock, on rain exposed, usually shady sites, including the Habitat amplitude of *Acrocordia con.* (↑) and *Verrucaria parm.* (↑), in the Acrocordion -- mieur-med – rare; Sju, Ju, FrJu, Al, süHü

(*P. byssophila* is separated as a free-standing species by many Authors; used as differentiating characters a stronger developed, often cracked, gray-greenish to olive brown thallus (instead of thallus very thin rose), strongly projecting per., up to 8-celled, up to 30 - 7.5 µm spores (instead only 4-celled, usually only up to 24 x 6 µm spores), and a receptacle not colored below (in contrast to an all around enclosed, dark receptacle); however the characters of the indigenous material occurs in varying combination; by far most of the specimens "fitting" rather than to *P. byssophila*: repeatedly the spores were found to be 8-celled, over 30 µm in size)

Lit.: KEISSLER 1937, SWINSCOW 1962.

Porocyphus Körber

(Key incl. Cryptothele, Euopsis, Metamelanea, Psorotichia, Pyrenopsis, Thelygnia)

Introduction

The *Porocyphus*-species have black to dark green, granular-crustose, divided, squamulose or very small fruticose thallus with filamentous bluegreen algae as symbionts. They occur especially on from time to time irrigated rock surfaces, on long time dew moistened stones, on occasionally flooded or spray-water moistened boulders in brooks. *P. coccodes* grows on silicate rock, *P. rehmicus* on calcareous rock. Both species are common in South and Central Europe, the first even in North Europe.

Genus Characteristics and Determination

Thallus crustose, granular to areolate or appearing squamulose or coralloid-small shrubby, black, brown-black, olive-black, unlayered, without cortex, of ± gelatinous consistency, with filamentous (in the lichen association but few to 1-celled) bluegreen algae of the genus *Calothrix*. Ap. sunken or sitting up,

with brown, at first punctiform, then widening disk and thalloid margin (later even with added proper margin), sometimes developing pycnidia. Exc. colorless or brown above, in the indigenous species of loosely interwoven hyphae. Hyp. colorless to brownish. Hym. transparent, gelatin I+ yellowish, greenish-blue, wine-red. Paraphysoids richly branched and reticulate bound and/or "paraphyses" unbranched, with thickened ends and cells vacuolate. Asci ± cylindric, uniformly thin walled, without tholus, I-, spores one-celled, ellipsoidal (in the case of non indigenous species up to 16). Pycnosp. short bacillar, ellipsoidal to almost spherical. Ch-.

Note: All species in the Key Ch-.

1 Thallus brown, gray, gray-black, of small, flattened, crenate squamules, layered, with paraplectenchymatous upper cortex, closely crowded to roof tile-like, on blue-black prothallus. With *Nostoc*-algae, in at times strongly agglomerated chains or single. Ap. -1 mm, red-brown to brown-black, at first with thalloid margin, soon convex and marginless. Sp. 14-18 x 5-7.5 µm **Pannaria leucophaea**

1* Thallus granular, crustose, coralloid, appearing squamulose, but never of crenate squamules, unlayered . **2**

2 Moist thallus clearly reddish: brown-red to dark wine-red. Algal cells with reddish gelatin envelop (in the margin region of the thallus) **3**

2* Moist thallus gray-, green-, brown- to deep black, never reddish. Algal gelatin ± colorless to yellow-brown, never reddish **5**

3 Ap. -0.6(1)mm, flat to moderately convex, yellow-red to red-brown, ± shiny, with usually granular thalloid margin, sessile. Dry thallus dark wine-red to dark red-brown, areolate, areoles usually granular-fine warty rough. Sp. 11-16 x 6-7 µm. Hym. 70-80 µm, I-, ascus inner wall I+ blue, tholus I- .. **Euopsis pulvinata** (like □ **Euopsis granatina** (Sommerf.) Nyl.: Thallus with bluegreen and green algae, sp. 9-12 x 4-6 µm; on silicate rock, arct-alp, e.g. Alps)

3* Young ap with definite sunken, punctate disk, thereby at first almost perithecia-like. Dry thallus reddish- or brown-black. Hym. I+ blue- green to red-brown, tholus I+ blue **4**

4 Thallus cracked areolate to almost lumpy, reddish- or brown-black. Areoles flat, angular, with rather smooth upper surface. Ap. usually single, rarely to 2 or more, young ones sunken and with pore-like mouth, later somewhat wider opening and surrounded by a slightly raised thallus wall (pseudo angiocarp). Sp. ellipsoidal, (9)12-15(18) x (5)6-8(11) µm. Algal cells (3)5-6(11) µm . **Pyrenopsis subareolata**

4* Thallus granulate, at times of scattered or ± agglomerated reddish- or brown-black clumps, at times areolate, areoles ± rounded, with granular upper surface. Young ap. scarcely distinguished from the thallus, later with sunken brown-red disk and rather thick, granular thalloid margin. Sp. ellipsoidal, (5)7-8(11) x 5-6 µm **Pyrenopsis sanguinea**

5 Ap. with navel-like or grooved disk . **6**

5* Ap. not with navel-like or grooved disk . **7**

6 Epihym. dark green. Ap. ± 0.3 (-0.6) mm, disk sunken, at first punctate and concave, then convex,, sharply delimited by a definite narrow thalloid margin. Sp. 7-12 x 5.5-9 µm. Thallus blackish, ± shiny, lumpy, often navel-like attached, lumps -2 mm, with granular upper surface . **Thelignya lignyota**

6* Epihym. brown. Ap. -0.6 mm, blackish, sunken or depressed. Disk not sunken, thalloid margin broad (ap. becoming perithecia-like because of the broadly rounded margin in the dry condition, in the moist condition wide open). Sp. 11-13 x 8-9.5 µm. Hyp. brownish. Thallus blackish, cracked areolate, areoles ± smooth, made up of close standing, vertical segments of 12-34 µm wide, which consist of closely packed algae colonies with little fungus hyphae. Algae with brown gelatin envelop □ **Metamelanea umbonata**

7 Thallus inconspicuous, finely granular, thin, ash-gray, gray-black to black, usually clearly delimited. Ap. ± 0.1(-0.4) mm, at first perithecia-like, then with sunken dark brown, when moist ochre colored disk. Sp. 8-14 x 4-10 µm. On calcareous rock, often living on endolithic crustose lichens **Psorotichia montinii**

7* Thallus clearly developed, granular to coralloid, ± areolate . **8**

8 Sp. spherical, 10-13 µm and ellipsoidal 9-14(16) x 8-11 µm. Thallus black (even brownish- to greenish-black), granular-warty areolate, areoles 0.5-1 mm. Ap. 0.2-0.4 mm, projecting, with sunken dark brown disk, perithecia-like when young **Psorotichia frustulosa**

8* Sp. only ellipsoidal **9**

9 Paraphyses thin filamentous, branching and reticulate or simple and with capitate ends and vacuolate cells. Ap. usually strongly convex to spherical. Proper margin of the ap. clearly developed. In the hym. center – the measured height of thalloid margin in relation to the hym. height is 1:4. Epihym. brown. hym. 90-130 µm, colorless, I+ yellow, green-blue, wine-red. Sp. 11-17 x 6-13 µm. Algae filamentous (often difficult to recognize), heterocysts occurring (often first found after long searches). On moist rocks, often silicate rock (*Porocyphus*) . **10**

9* Paraph. simple to sparsely branched above, not thickened. Ap. bowl-form. In the center of the hym. the relationship of the height of the thalloid

margin thickness to the height of the hymenium is ca. 1:1.5. Without heterocysts. On lime . **11**

10 Thallus lumpy, often deeply cracked areolate, with granular to coralloid, rarely almost smooth upper surface, blackish, areoles -2.5 mm wide. Ap. -0.3 mm, first perithecia-like, then with black or dark brown margin and darker disk . **P. coccodes**

10* Thallus granular, (cracked-)areolate or appearing squamulose, with granular, rarely smooth upper surface, green-black to black, areoles -1.5 mm. Ap. -0.5 mm, with broad yellowish- to dark brown, ± shiny margin and reddish-brown disk **P. rehmicus**

11 Proper margin of the ap. narrow, widened toward the upper surface. Thallus gray-green to blackish, granular to flowing, rarely pruinose, areolate. Areoles up to ± 1 mm, often with somewhat granular upper surface. Ap. -0.7 mm, with light ochre, brown-green to blackish margin and brown flat disk, broadly setting up. Sp. 12-20 x 6-10 µm **Psorotichia schaereri**

11* Proper margin of the ap. scarcely visible . **12**

12 Thallus black to brown-black, nonpruinose, granular areolate. Areoles -0.7 mm, irregularly deformed, with finely granular rough upper surface. Ap. -0.3 mm, when young almost spherical, later ± bowl-form with dark margin, disk colored as the thallus or red-brown, weakly sunken. Ecology like *Ps. schaereri* .**Psorotichia murorum** Massal.

12* Thallus blue-black, blue-gray pruinose, areolate to cracked areolate. Areoles -0.5 mm, angular, flat lumpy. Ap. -0.4 mm, urn- to bowl-form, sitting up, margin black, with dark brown sunken disk. Sp. 11-15 x 5-8 µm **Psorotichia diffracta**

Ecology and Distribution of the Species

Porocyphus coccodes (Flotow) Körber
(P. areolatus (Flotow) Körber, P. furfurellus (Nyl..) Forss.)
In foothills up to high montane sites on lime-free to slightly calcareous silicate rock on often drying out irrigation water streaks, rarely on occasionally over flowing sites on streams, and brooks, on m.-.v.well lighted, often sunny sites, subneutroph., e.g. in the Peltuletum, in amphibious associations. – (s')bor-smed(-med) – v.rare (2); süSch, *O (Heidelb.)*, Saar

Porocyphus rehmicus (Massal.) Zahlbr.
(P. riparius (Arnold) Körber)
Up into montane sites on calcareous or lime dust impregnated silicate- and limestone, on sporadically irrigated, often drying out boulders on the banks of streams, often on nutrient rich sites, also on walls (often sandstone), subneutroph.-basiph., m.-v.photoph., m.nitroph., e.g. with *Staurothele frust.* – mieur – v.rare *(0)*; *O, Fr, FrJu*, BayW, Al

Lit.: HENSSEN 1963 a.

Porpidia Körber
(Huilia, Haplocarpon)

Introduction

The genus *Porpidia* includes crustose lichens with usually cracked or cracked areolate, white to gray, rarely ochre colored thalli and black to brown-black, sunken or sitting up apothecia with usually definite proper margin. Distinguished from the genus *Lecidea* by numerous anatomical characters, e.g. the reticulate paraphyses and the asci.

The *Porpidia*-species are rock-dwelling and predominantly distributed in the temperate zones of the earth and in the boreal region. The ca. 14 species occurring in Germany live on lime-free to rarely lime-poor silicate rock on cool, humid, shady habitats, e.g. stone, boulder and rock surfaces near the soil. This goes especially for *P. crustulata*, a pioneer on stones, *P. macrocarpa, P. tuberculosa, P. albocaerulescens, P. contraponenda* and *P. musiva*. *P. glaucophaea* covers long time irrigated rocks. *P. speirea, P. superba, P. trullisata* and *P. zeoroides*, which in Central Europe occur almost only in the Alps, e.g. in the Allgäu, are characteristic for weakly calcareous rock.

P. speirea and *P. superba* are distributed predominantly in the Arctic, the northern boreal zone and the corresponding alpine, rarely even (high-)montane sites in the Central European region. *P. cinereoatra, P. tuberculosa* and *P. musiva* occur in the boreal zone, the girdle of summer-green deciduous forests and – rarely – in the mountains of the mediterranean region. The high point for *P. glaucophaea*, which occurs up into northern Scandinavia, and *P. soredizodes* seems in Europe to lie in the summer-green deciduous forest region. *P. albocaerulescens* is limited to mild sites in Central and eastern Central Europe. The area of *P. crustulata* and *P.*

macrocarpa stretches over the greater part of Europe.

Genus Characteristics and Determination

Thallus crustose, usually definite, varnish-like to cracked areolate or warty, white, gray, rust-colored, sometimes sorediate, rarely isidiate, with coccoid green-algae. Ap. sunken to sessile, black, brown-black, sometimes pruinose, with definite proper margin. Exc. usually very robust, brown to brown-black, interior even lighter, of radially lying hyphae. Hyp. dark brown to brown-black (subhym. light). Hym. commonly over 70 µm high, I+ blue. Epihym. brown to olive, rarely blue-green. Paraphyses strongly branched and reticulate, slightly thickened above. Asci clavate to almost cylindric, *Porpidia*-type, with amyloid gelatinous outer layer and strongly amyloid, toward the top usually somewhat diverging tubular structure and often with horizontal lamellae in strongly developed tholus. Sp. one-celled, ellipsoidal, rather large, with perispore. Pycnosp. filamentous to elongate bacillar. Sp: above all Stictic acid, Norstictic acid, Confluentinic acid SSy.

Genus with many truly difficult to determine species, at times weakly delimited from one another.

1 Thallus with soralia . **2**

1* Thallus without soralia, with ap . **6**

2 Thallus at least partially rust colored to ochre overlaid, commonly extensive, coherent, cracked to finely cracked areolate, upper surface even as a rule. Soralia gray, dark gray, brown-gray. Medulla I- (when medulla I+: rare, rusty over layer formed by *P. tuberculosa* (4) **3**

2* Thallus not overlaid rusty, whitish to gray . **4**

3 Thallus partially rust-brown to ochre, above all marginally gray (bluish-gray), soralia K+ yellow, P+ orange, rounded, concave or rising over the thallus, clearly (light) margined, (white)gray to gray or brownish, -0.8(1.2) mm wide. Ap. lacking in the region. Stictic acid .□ **Hymenelia ochrolemma**

3* Thallus usually throughout, rust colored to yellow-brown, cracked to almost undivided, with smooth upper surface. Soralia commonly K-, P-, very sparse to numerous, dark gray to blackish, rising over 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 (12.5) µm. Alps. Confluentinic acid, (± Stictic acid) . **P. melinodes**

(Körber) Gowan & Ahti

4 Medulla I+ blue. Soralia usually regularly rounded, concave to somewhat rising above the thallus, -0.7 mm, gray, rarely whitish. Thallus cracked to cracked areolate, uneven, sometimes with dark prothallus. R-, very rarely medulla K+ yellow, P+ orange. Ap. often lacking, -1.5 (2.2) mm, flat to convex, black, disk often pruinose, margin little set off. Sp. (12)14-20(25) x (6.5)7-10(12) µm. Confluentinic SSy. (very rarely with Stictic acid in addition) □ **P. tuberculosa**

4* Medulla I-. With Stictic acid or Glaucophaeaic acid. Soredia usually whitish, green-whitish, gray-white. Ap. black to (at least when imbibed) brown (tinted), white pruinose or nonpruinose, with brown to dark brown hyp. Epihym. brown to olive brown . **5**

5 Thallus commonly very thin crustose, finely cracked, whitish to light gray. Soralia often hollowed out crater-form, rarely rising over the thallus upper surface, usually without differentiated margin, P+ orange, K+ yellowish, -0.5 mm. Ap. -1 mm, usually flat. Sp. 12.5-18(20) x 6.5-8(10) µm. Hym. usually about 65-100(130) µm. Stictic SSy. Sorediate parallel species of *P. crustulata* . **P. soredizodes**

5* Thallus robust, usually very extensive, white-gray to cream colored, often bordered by a dark prothallus. Soralia often erupting irregular, often sparse (especially around ap.-rich sites), whitish, P-, K-. Ap. -2(2.5) mm, not rare, flat to moderately convex, disk pruinose, margin commonly nonpruinose. Sp. 15-25 x (5)7-10 (12) µm. Hym. usually ca. 80-140 µm. Glaucophaeaic acid □ **P. glaucophaea**

6 Epihym. shining emerald green. Sp. (14)17-25 x (5.5)6-9(10) µm. Ap. -1.5(2.5) mm, flat to usually moderately convex, margined. Thallus thin crustose, dirty white-gray, cream, often rust colored to orange overlaid, usually finely cracked. Hym. 80-140 µm. Ch- **P. hydrophila**

6* Epihym. brown, black-brown, olive, rarely dirty greenish . **7**

7 Thallus very indefinite **8**

7* Thallus clearly developed . **9**

8 Ap. 1-3.8 mm (max. diameter). Max. width of the margin (aspect) 0.13-0.25 mm. Sp. (13)17-27(30) x (6)7-12(14) µm. Exc. K- up to K+ red or (also as differing from *P. nigrocruenta*) K+ blood-red solution. Hym. (70)80-130 µm .**P. macrocarpa (22)**

8* Ap. 0.55-1.6 mm (max. diameter), as a rule -1 mm, long time flat to moderately convex, with thin, raising margin, nonpruinose. Max. width of the margin 0.07-0.17 mm. Sp. (10)12-17(20) x (5)6-8(10) µm. Exc. K-, rarely K+ yellow solution. Hym. 65-90(110) µm □ **P. crustulata (22)**

9 Thallus partially or entirely rust colored to ochre . **10**

9* Thallus white, or gray **11**

10 Very rare. Arct(-alp). With Confluentinic SSy. or Ch-. Exc. hyphae (exc. margin, very thin section) 2-3 µm thick, with thin, very dark pigmented walls. Thallus entirely ochre-yellow, ocher, brown-orange to rust colored ochre, slightly cracked to cracked areolate (not cracked when moist), often slightly oily shining. Exc. K-. Ap. at first somewhat sunken, later compressed 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 .**P. flavicunda** (Ach.) Gowan (*P. flavo-caerulescens* (Hornem.) Hertel & Schwab)

10* Widespread. Ch- or rarely Stictic SSy., without Confluentinic SSy. Exc. hyphae 4.5-6.5 µm thick, with narrow (1.3-2.5 µm) lumen and colorless wall; dark pigment in the hollow space between the hyphae. Thallus commonly only partially ochre to rust-brown, otherwise gray, usually coherent to cracked, not oily shining. Exc. K+ red(flecked) or K-, rarely yellow. Ap. sessile with narrowed base, with usually non pruinose, rarely weakly pruinose disk, -2.5 (3.5) mm. Sp. (13)17-27(30) x (5.5)7-12(14) µm □ **P. macrocarpa**

11 Medulla I+ blue. Esc. soon very narrow and only developed as dark brown margin zone, K-. Thallus chalk white, dirty white (in the herbarium even yellow tinted), commonly with chalky-mealy upper surface. Ap. at first flat, then soon convex and sessile, -2(3) mm. Hyp. black-brown, without crystals. Sp. 10-17(20) x 5.5-7.5(9) µm. Epihym. dirty olive, green-brown, green-black . **12**

11* Medulla I- (very rarely weakly blue). Exc. strongly developed. Thallus white to gray. Sp. 12-18 (21) x 5.5-9(11) µm **13**

12 Ap. not or pruinose when young, -1.2(2.5) mm, ± sunken, often separated for the thallus by circular crack or surrounded by a thallus collar. Hym. ca. 70-105 µm. Thallus white, chalky, cracked areolate, finely cracked to almost smooth, usually extensive. Confluentinic SSy. On calcareous silicate rock in higher sites **P. speirea** (**P. grisea** Gowan: non sorediate parallel species of *P. tuberculosa* with Confluentinic SSy., pruinose, ± sunken ap., not chalky gray thallus, sp. 12-14 x 6-7 µm, possibly süSch)

12* Ap. usually strongly pruinose, puffy margin (margin usually less pruinose), finally strongly convex and nonpruinose, sessile with narrowed base, -1.5(3.5) mm. Hym. 85-130 µm. Thallus cracked, cracked areolate to warty areolate. Medulla in the main I+ weakly violet. Ch-. On limestone and calcareous silicate rock, mieur-alp **P. trullisata** (Krempelh.) Körber

13 Ap. at least when imbibed dark brown to dark red-brown (after moistening wait until complete swelling is reached), dry black to black-brown. Medulla K-/K+ yellow, P-/P+ orange. Stictic acid or Ch- . **14**

13* Ap. even imbibed black, but sometimes pruinose . **15**

14 Thallus with ± 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, when moist dark red-brown, 0.5-1.3(2) mm. Hyp. brown, red-brown. Sp. (16)20-28(33) x 7-12(14) µm. Epihym. yellow-brown to brown. On (calcareous) silicate rock **P. superba**

14* Thallus not chalky, thin to moderately thick, coherent to cracked areolate, whitish, gray, olive-gray. Areoles not hemispherical. Widely distributed lichen. Ap. black to dark brown. Exc. interior brown, with broad, only relatively weakly pigmented outer region (thin section!) **22**

15 Thallus chalk white, gray-white, strongly developed, with chalky rough upper surface. Alpine species of the Alps on slightly calcareous silicate rock. Ap. strongly pruinose. Exc. soon strongly reduced or strongly developed. Alps (Al) **16**

15* Thallus not chalk-white, not with chalky rough upper surface. Exc. strongly developed. Commonly on lime-free silicates . **17**

16 Exc. soon strongly reduced and narrow, brown. Sp. 10-16(20 x 5.5-7.5(9) µm. Ap. 0.5-3.5 mm. Thallus coherent to cracked. Medulla usually I+ weakly violet. Ch- (when Confluentic acid, see *P. speirea*) . **P. trullisata (12)**

16* Exc. strongly developed, interior brown, with broad, relatively weakly pigmented outer region. Sp. (16)18-26(30) x 7.5-11.5(14) µm. Thallus coherent to cracked or warty areolate, white, gray-white. Ap. black, sessile with narrowed base, at first puffy margined, later strongly convex with receding margin, -1.5(2) mm. Hym. 90-140 µm. Hyp. brown, black-brown, with crystals (Polarized). Epihym. olive tinted light brown to brown. Stictic SSy. or Ch-. mieur-alp **P. zeoroides** (Anzi) Knoph & Hertel (=*Huilia macrocarpa* var. *trullisata* (Arnold) Hertel)

17 Thallus medulla K+ yellow, P+ orange, exc. K-/K+ yellow to red, not brown-black throughout (thin layer). Stictic SSy . **18**

17* Medulla R-. Exc. commonly K- **19**

18 Ap. to a large extent sunken to closely appressed, -1.5(2.2) mm, disk thickly pruinose, flat to moderately convex. Thallus large, well developed, whitish, light gray, in the herbarium

even yellow tinged, coherent to finely cracked, sometimes slightly oily shining. Margin naked. Sp. 18-27(32) x 7-12(14) µm. Hyp. black-brown. Epihym. brown to olive brown. Exc. exterior dark brown to black, interior rather light, gray, brownish-gray, K+ yellow to red, exc. hyphae 2-4 µm thick. Hym. 80-120 µm, difficult to separate the subhym. Ascus wall I(Conc.) + blue. Medulla K+ yellow(orange), P+ orange (thallus K+ to yellowish, P- to pale orange)
*.□ **P. albocaerulescens**

18* Ap. sessile. Disk naked or (usually only slightly) pruinose. Epihym. brown to olive. Exc. interior light to dark brown or yellow-brown. Exc. hyphae 3-8 µm thick. Ascus wall I (conc.) + red-brown/brown-orange . **22**

19 Thallus with Confluentic acid or Methyl-2'-*O*-Methyl-microphyllinat, areolate, cracked areolate, cracked, not rust colored overlaid. Ap. sunken to depressed, later even sessile. Exc. dark-brown, basally frequently reduced, exc. hyphae 3-4 µm thick. Epihym. brown(olive) to olive-green. R-. Difficult group. *P. cinereoatra* s.l . **20**

19* Thallus without Confluentinic SSy. often with Stictic SSy, often thin, cracked, sometimes rust colored overlaid. Ap. usually sessile, often with narrowed base. Exc. interior light to dark brown or yellow-brown, exc. hyphae (3)4-9 µm. Epihym. brown to olive. Thallus cracked to cracked areolate or warty areolate. Ascus wall in I (conc.) + red-brown **22**

20 With Methyl-2'-*O*-Methylmicrophyllinat, 2'-*O*-Methyl-micropyllinic acid. Thallus cracked- to warty-areolate, gray-white to cream colored, smooth, often somewhat shiny. Areoles coalescing to separated. Ap. depressed to sessile, -1(1.5) mm, black, thick, but little raised margin, epihym. 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 . **P. contraponenda**

20* With Confluentinic SSy. Thallus relatively thick, cracked, cracked- to warty-areolate. Areoles coalescing. Ap. (margin) scarcely projecting over the thallus. Medulla UV- **21**

21 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+ blue to brownish-blue. .* **P. musiva**

21* 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, later even disappearing. Hym. (65)90-105 µm. Asci exterior I+ orange-brown. .* **P. cinereoatra**

22 Ap. 1-3.8 mm (max. diameter), nonpruinose or slightly pruinose, black, rarely brown-black. Max. width of the margin (top view) 0.13-0.25 mm. Sp. 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 SSy . **P. macrocarpa**

22* Ap. 0.55-1.6 mm (max. diameter), as a rule up to 1 mm, long time flat to moderately convex, with thin raised margin, nonpruinose, almost always black. Max. width of the margin 0.07- 0.17 mm. Sp. (10)12-17(20) x (5)6-8(10) µm. Thallus very thin, coherent to weakly cracked, dirty whitish to gray, commonly not rusty. Exc. interior K+ yellow, rarely K-. Medulla K-/K+ yellow, P-/P+ orange. Usually Stictic Ssy **P. crustulata**

Ecology and Distribution of the Species

Porpidia albocaerulescens (Wulfen) Hertel & Knoph (Lecidea a. (Wulfen) Ach.)
In foothills and submontane, winter-mild sites on lime-free silicate rock on shady rocks and boulders, on humid-, even slightly substrate moistened habitats, usually in deciduous forests, sheltered valleys; m.-r.acidoph., m.photoph., anitroph., Porpidion tuberc. – mieur-subatl – rare (2); Sch, Ne(Sb), SFW, O, *Sp, Ts, MRh,* Av

Porpidia cinereoatra (Ach.) Hertel & Knoph (Lecidea c. Ach.)
On smaller rocks and larger stones on cool humid or long time dew moistened habitats, above all on mineral-rich silicate rocks, e.g. in boulder scree and stone piles, e.g. like *Lecidea plana.* (↑), e.g. in the Lecideetum lith. – bor-mieur – rare; Sch, Vog, RhSch (e.g. Ts)

Porpidia contraponenda (Arnold) Knoph & Hertel
In montane and high montane sites on silicate rock on basal surface of rocks and on stones in dwarf shrubby heath, meager turfs, open forests, on pathways, usually on long time remaining dew moist, partially also long time snow covered sites, e.g. with *Trapelia moor.* – bor-mieur-mo – rare; süSch

Porpidia crustulata (Ach.) Hertel & Knoph (Lecidea c. (Ach.) Sprengel)

To above the tree line on lime-free silicate rock, predominantly on those ± sunken in the soil and on stones lying on the soil, usually on road sides, slopes, in forests, on shady or long time dew moistened or humid sites, in high precipitation sites also on sites open to the light, m.-r.(v.)acidoph., substrathygroph., r.skioph.-r.photoph., Char. Porpidietum crust. – bor-med(mo) – m.frequent, ± lacking in the lime region

Porpidia glaucophaea (Körber) Hertel & Knoph (Lecidea g. Körber)
In sub- to high montane sites on lime-free (to very weakly calcareous), usually metamorphic/ magmatic silicate rock on shady, from time to time irrigated or dropping water moistened surfaces, especially in forests, and valleys, Char. Porpidietum glauc., subneutroph., subhydroph., r.skioph.-m.photoph. – bor-mieur-rare(3); above all süSch, more rare nöSch, Vog, nöPf, Hu, Ts, We, ThW

Porpidia hydrophila (Fr.) Hertel & Schwab (Lecidea h. Fr.)
In submontane, more rarely montane sites on silicate rock on from time to time flooded boulders in clear brooks, like *Hymenelia lacustris.* (↑), but only in climatically mild sites, Char. Hymenelietum lac. – s'bor-mieur-(sub)atl – v.rare (+++); Eif.

Porpidia macrocarpa (DC.) Hertel & Schwab (Lecidea m. (DC.) Steudel, L. nigrocruenta Anzi, L. phylliscina Nyl.)
Up over the tree line on lime-free silicate rock, above all on smaller rocks on shady, rain exposed, often even long time dew moistened surfaces, but also on sunny sites, even on iron-rich substrate, m.-r.acidoph., m.-r.photoph., anitroph., Char. Rhizocarpetalia obsc. – (s')bor-med – m.frequent in silicate regions, otherwise ± lacking

Porpidia musiva (Körber) Hertel & Knoph (Lecidea m. Körber)
Above all on long time dew moistened, rock surfaces near the soil and larger silicate stones, on commonly well lighted (rarely completely sunny) habitats, e.g. in bristle grass turfs, dwarf shrubby heaths, e.g. with *Trapelia*-species or *P. macrocarpa* in the Lecideetum lithoph., m.-r.acidoph., m.-r.photoph., -- bor-med-mo – r.rare; silicate region, e.g. Sch, O, RhSch

Porpidia speirea (Ach.) Krempelh. (Lecidea s. (Ach.) Ach.
In montane to alpine, rarely montane sites on weakly calcareous or rarely ± lime-free basic silicate rock as well as even on the upper surface of delimed carbonate rock, predominately on lime schist, hornfels, usually on shady sloping and (rain exposed) vertical surfaces on cool to cold, humid (hydrostatically/thermally moderately changeable) habitats, even on irrigated surfaces, subneutroph.-m.basiph., m.(-r)photoph., anitroph., e.g. Stenhammerelletum – arct-bor-alp (subatl) – v.rare; ?süSch, Vog, Meissner, Al (m.frequent)

Porpidia superba (Körber) Hertel & Knoph (Lecidea s. Körber, L. macrocarpa var. s. (Körber) Th. Fr.)
In high montane to alpine, high precipitation sites on very weakly calcareous to lime-free and relatively SiO_2-poor silicate rock on shady, from time to time slightly flooded surfaces, subneutroph.-neutroph., m.photoph., anitroph. – arct-alp – Al

Porpidia tuberculosa (Sm.) Hertel & Knoph (Lecidea tumida Massal., L. sorediza Nyl.)
Up to high montane sites on silicate rock on rather poorly lighted to moderately (rather) well lighted, usually away from the sun, long time dew moistened or relatively uniformly humid habitats on rain exposed surfaces near the soil, often in forests, boulder fields, and rock piles, like *Rhizoc. obsc.* . (↑), even on anthropogenic substrates, subneutroph.-r.acidoph., Char. Porpidion tub. – (arct)bor-smed – r.rare: Sch, Vog, Pf, RhSch, O, Sp, He (e.g. Rhön), ThW, otherwise rare

Lit.: GOWAN 1989, GOWAN & AHTI 1993, HERTEL 1967, 1984*, HERTEL Y KNOPH 1984, SCHWAB 1986, VAINIO 1934.

Protoblastenia (Zahlbr.) J.Steiner

(Black fruited species ↑ Lecidea PT 3)

Introduction

The genus *Protoblastenia* is recognized by thin crustose or endolithic, whitish, gray to olive

colored thallus with coccoid green algae and orange- to ochre colored, convex, outwardly marginless apothecia. The perhaps 10 species included in the calciphytic genus is represented in Germany with ca. six species. *P. calva, P. cyclospora* and *P. incrustans* live on limestone on usually well lighted sites. *P. rupestris* is rather frequent on stones and on rock surfaces near the soil and goes over repeatedly to anthropogenic habits (walls, grave borders). *P. calva, P. incrustans* and *P. rupestris* are common in Europe in geologically congenial regions. *P. siebenhaariana* which has been verified from the lime Alps is arctic-alpine (-dealpine). *P. cyclospora* is known from the alpine mountains of Central Europe, surrounding central mountains, Gotland and the British Isles.

Genus Characteristics and Determination

Thallus crustose, endolithic to clearly developed, whitish, gray, olive, light brown, with coccoid green algae. Ap. orange, red, brown, brown-olive, flat to usually convex and marginless. Exc. weakly developed, colorless. Hyp. commonly colorless to (red-)-brown. Epihym. with orange colored granules, K= red. Paraphyses rather thick, sparsely branching and reticulate, scarcely thickened above, strongly cemented. Asci cylindric-clavate, *Porpidia*-type. Sp. one-celled, ellipsoidal to spherical. pycnosp. short bacillar. Ch-, Anthraquinone in the ap.

1 Thallus squamulose, squamules light greenish-gray, light gray to olive, underside and at the margin whitish, concave to convex, usually curved, 2-5 mm wide, coalescing and overgrowing one another. Ap. ± convex, orange-brown to rust colored orange, -2 mm. Sp. 10-14 x 5-7 µm. Atranorin; Emodin, and Parietin in the ap . □ **Psora testacea**

1* Thallus egg-form crustose to indefinite and endolithic **2**

2 On wood and bark. Ap. in the region very rare, brown-red to black-red, -1 mm, strongly convex, marginless. Thallus almost completely mealy- to granular-sorediate, yellow-greenish, yellowish or almost ochre, often with black prothallus. C+/KC+ orange, K-, P-. Epihym. with granules, in K+ purple. Sp. 7-14 x 5-8 µm. Isoarthothelin, Thiophanic acid, ±Dichlo-rnorlichexanthon . **Pyrrhospora quernea**

2* On calcareous rock **3**

3 Sp. spherical, 6-9 µm. Ap. ±red, -1.5(2) mm, strongly convex. Thallus endolithic. Hyp. colorless to orange-brown .**P. cyclospora**

3* Sp. ellipsoidal. Ap. orange, red-orange, brown, olive **4**

4 Thallus epilithic, coalescing thin crustose to warty-areolate . **5**

4* Thallus endolithic, usually only apparent as lighter flecks (Caution: in observing the upper surface appear, grazed epilithic thallus may appear endolithic). Hyp. colorless to yellowish **6**

5 Thallus warty areolate, whitish, rarely ± indefinite. Ap. orange-ochre, orange, then often dirty orange, brown, olive, brown-black and strongly convex. Hyp. brown to light orange-brown. Sp. 7-10 x 3-5 µm, bor-mieur-h'mo, Alps, WeBgl **P. siebenhaariana** **(**Körber)J.Steiner

5* Thallus uniformly flowing to usually cracked (-areolate), gray-greenish, olive, yellowish-gray, sometimes grazed and indefinite or whitish. Ap. orange, orange-brown to red-orange, -1mm, ± sessile (not in pits in the rock), m.-r.convex, hyp. colorless to yellowish. Sp. 8-17 x 5-8 µm . □ **P. rupestris**

6 Ap. sessile, ± strongly projecting, soon strongly convex, orange, orange-red, brown-orange, even olive-yellow to olive-brown, brown, -1.6(2) mm. Thallus whitish to light gray, often seeming finely mealy. Sp. 8-15 x 5-8 µm **P. calva**

6* Ap. sunken into the rock, leaving a pit behind after falling out, ± flat to m.convex, usually light orange-yellow to light orange. Sp. 9-13 x 4.5-6 µm .**P. incrustans**

Ecology and Distribution of the Species

Protoblastenia calva (Dickson) Zahlbr.
Predominantly in the montane and high montane zone on usually lime-rich, compact carbonate rock, above all on shady, humid, even very slightly substrate moist sites, especially vertical surfaces, high point like *Hymenelia coer.* (↑), *Verr. dufourii* (↑), basiph., hygroph., m.photoph.-r.skioph., ombroph., anitroph., Hymenelion coer., Gyalectetum jen. etc. – bor-med(mo) – rare; Sju, Ju (r.rare), Al

Protoblastenia cyclospora (Hepp ex Körber) Poelt (P. globulificans (Nyl.) Zahlbr.)
On occasionally warm, well-lighted overhangs and steep surfaces of limestone in montane sites, e.g. with *Caloplaca flavesc., Hymenelia prev., Catillaria lent.*, basiph., r.photoph., m.nitroph. – mieur-mo – v.rare (r); Ju, Alps

Protoblastenia incrustans (DC.) J.Steiner
Above all from the montane up into the alpine zone on usually ± pure lime, on rain exposed, usually away from the sun, m.-r.well lighted surface, like *Clauzadea immersa* (↑), *Bagliettoa parmig./bald.*, Char. Protoblastenietea imm. – arct-med-mo – rare; Sju-Ju-FrJu, Al; Eif

Protoblastenia rupestris (Scop.) J.Steiner
Up into high mountains on lime-rich to lime-poor rock, above all on limestone, clay-rich lime, calcareous sandstone, rather euryök, high point on rain exposed surfaces or on shady rocks, often on slightly substrate moist, irrigated or long time dew moistened sites, frequently on stones on roadways, in residual rock piles, in vegetation openings, even on slightly earth encrusted rock, also e.g. on grave enclosures, walls and penetrating into towns on these substrates, in silicate regions as a synanthrop, basiph., r.photoindiff., ombroph., a-/r.nitroph., often with *Placynthium nigrum*, in the Collemation, *Verrucaria nigr.-Protobl. rup.*-society – bor-med – moderately frequent, frequent in the lime regions

Lit.: Ozenda & Clauzade 1970, Poelt & Vèzda 1977

Protoparmelia Choisy

(Determination ↑ Lecanora PT 2)

Introduction

The genus *Protoparmelia* includes the species which are relatives of *"Lecanora" badia*. It includes crustose lichens with gray-brown, brown to red-brown thallus and similar, often somewhat darker colored apothecia, which differ anatomically and in lichen substance content from *Lecanora*.

The ca. 15 known species of the genus reside on silicate rock. Six species occur in Germany. They usually reside on rocks open to the light, *P. badia* and *P. atriseda* commonly in the mountains, in North Germany even in the lowlands. *P. atriseda* is parasitic on crustose lichens, above all on the map lichen. *P. picea* is often found on hard, acid silicate rock, e.g. quartzite. *P. nephaea* – a northern species with few Central European occurrences – grows above all on steep surfaces.

P. badia is common on nearly all of Europe, from the arctic up into the mountains of the mediterranean region. *P. cupreobadia* is known from the central- and south European regions, also from an isolated relict occurrence in the South Black Forest. The area of *P. atriseda* includes predominantly the central European region and stretches up into central Scandinavia or into the mountains of the mediterranean region. *P. picea* has its high point in the western region of summer-green deciduous forests; it is distributed from the British Isles to central Europe, in the north up into the south atlantic Scandinavia. In Central Europe it is scattered in geologically suitable regions (Harz, Sauerland, Hunsrück, Pfälzer Forest, Vogesen, Rhön, North Black Forest) further in the East clearly rarer (e.g. Fichtel mountains, Riesen mountains, and Alps); in the Riesen mountains and the Alps the lichen reaches above the tree line.

Genus Characteristics and Determination

Thallus crustose, cracked to areolate or warty, usually brown, gray-brown, red-brown, at times on black "prothallus", with cortex of anticlinal, short-celled, hyphae brown pigmented on the ends, with coccoid green algae. Ap. lecanorine or biatorine margined, brown, red-brown, dark brown, brown-black, often shiny. Exc. with exception of the outer region colorless. Hym. I+ blue. Paraphyses simple to sparsely branching, end cells with usually brown pigment cap and lying above it a swollen gelatinous cap. Asci small, clavate, *Lecanora*-like, with non amyloid central drop, often with distinctive ocular chamber, exterior with thinner amyloid gelatin envelop. Pycnosp. filamentous to needle-form or bacillar. Sp. one-celled, (long) ellipsoidal to fusiform. Ch: often Stictic acid, Norstictic acid, Lobaric acid, without Atranorin.

Ecology and Distribution of the Species

Protoparmelia atriseda (Fr.) R.Sant. & V.Wirth
(Lecanora a. (Fr.) Nyl., L. nephaea auct.)
In montane and high montane sites on lime-free, hard silicate rock on sunny, rain exposed, often also rather open to the wind habitats, parasitic on yellow *Rhizocarpon*-species, later autotrophic, e.g. with *Umbilicaria torref., U. cylindr.,*

Rhizocarpon lecan., r.(m.)acidoph., a-(m.)nitroph., in the Umbilicarion cyl. – (s'bor-)mieur(-mieur)-med) – rare (3); Sch, Vog, Ts, Eif, Rhön, Fi, ThW

Protoparmelia badia (Hoffm.) Haf. (Lecanora b. (Hoffm.) Ach.)
In montane to alpine sites on commonly lime-free silicate rock on rain exposed, usually open to the wind, well-lighted habitats, like *Umbilicaria cylindr.* (↑), r.euryök, even on protected, rather long time snow covered sites (like *Rhizocarpon alp.*), occasionally synathropic Char. Umbilicarietalia cyl., -- arct-med-mo – (r.)rare (3); above all süSch, Vog, otherwise rare-v.rare: nöSch, O, PfW, Hu, Eif, Ts, He (Vgb, Rhön, Meissner), ThW; also BayW, Erz, Hz, Al

Protoparmelia cupreobadia (Nyl.) Poelt (Lecanora c. Nyl.)
In alpine sites, rarely lower, on usually mineral-rich silicate rock – mieur-alp(-smed-alp) – v.rare (0); süSch +?, Alps

Protoparmelia nephaea (Sommerf.) R.Sant (Lecanora n. Sommerf., non auct.)
In alpine, high precipitation sites on m.(-r.) rain sheltered overhanging- and vertical surfaces on acid, often mica- and iron sulfide-rich silicate rock, like *Pleopsidium chloroph.*, in the region glacial relicts on higher central mountain peaks, r.-v.acidoph., m.-r.photoph., anitroph., Acarosporo sin.-Pleosidietum chlorophanae, Acarosporetum sin. – arct(-alp) – v.rare (R); süSch, BayW, Alps

Protoparmelia picea auct., non (Dickson) Haf. (Lecanora p. auct.)
In montane to rarely high- or submontane, high precipitation, oceanic or at least relatively winter-mild sites on hard to very hard, lime-free silicate rocks on moderately to very open to the wind, well lighted habitats, e.g. with *Umbilicaria torrefacta* (↑), *Fuscidea koch.*, r.-v.acidoph., v.ombroph., anitroph., e.g. in the Fuscideetum koch., Pertusario-Ophioparmetum – mieur(atl)-smed-subatl – rare (R); Vog (locally frequent), PfW, Hu, Rhön, nöSch (v.rare), Fi

Lit.: FRIES 1871, POELT & LEUCKERT 1991, POELT & OBERMAYER 1990*.

Protothelenella Räsänen

(Key incl. Chromatochlamys and Thelenella)

Introduction

The thallus of *Protothelenella* in thin crustose and inconspicuous, in the fresh, imbibed condition greenish and often somewhat slimy, dry pale brownish to gray-white. Symbionts are coccoid green algae, which are surrounded by a perispore. The fruiting bodies are blackish to brown, moderately to almost entirely sunken perithecia, the spores are cross-septate multicellular to strongly muriform divided.

The *Protothelenella*-species live on acid substrates on humid- or substrate moistened sites, on silicate rock, soil, wood, mosses, lichens and other plant parts. Of the included nine (in Europe eight) known species three are verified for Germany. *P. corrosa* resides predominantly on stones near the soil or rock surfaces protected from radiation, cool and humid, often long time dew moistened sites, often in open forests, in marshy meadows near brooks. The species is distributed in North Europe and cooler regions of Central Europe (in southern Central Europe in the mountains). *P. sphinctrinoides* and *P. sphinctrinoidella* occurring in the Allgäu belong to the arctic- alpine element and are correspondingly distributed in North Europe and the high mountains of Central Europe. They grow above all on dying mosses and on moist soil on sites with longer snow covering. Outside the Alps *P. sphinctrinoides* survives in Central Europe in high Black Forest, Bohemian Forest, in the Sudenten, the Vogesen and in Sauerland, otherwise only in single isolated, relict occurrences.

Genus Characteristics and Determination

Thallus crustose, usually granular-warty or membrane-like, scarcely differentiated, with green algae with ± broad gelatin envelops (*Elliptochloris*), also not lichenized. Per. sunken, with dark brown to blackish apex. Exc. spherical to pear-form, above brown to greenish colored, below colorless. Hymenial gelatin I+ blue. Paraphysoids strongly branched and reticulate. Asci cylindric, conspicuously thick walled, fissitunicate, outer wall clearly thicker than inner wall. Ch-.

Thelenella and *Chromatochlamys* differ by non-amyloid asci without apical apparatus and non-amyloid hym.-gelatin as well as *Trebouxia*-algae; the sp. outer wall is scarcely thicker than the inner wall. In contrast to *Thelenella* the asci of *Chromatochlamys* show an indentation in the tholus, the per. are in the uppermost part filled with reticulate bound periphysoids and the per. and the thallus are not covered with a definite swollen cortex.

1 On silicate rock. Per. -0.4 mm, blackish, over half sunken into the thallus. Thallus thin, scruffy, warty-granular or cracked areolate, light gray, gray-greenish, yellowish-gray, usually bright green when moist. Sp. 16-32 x 8-15 µm □ **P. corrosa**

1* On bark or mosses . **2**

2 On bark. Per. -0.5, sunken into the thallus, wart-like projecting, as in the case of *Pertusaria leioplaca*. Sp. 25-42 x 11-17 µm, to 4-8 (muriform). Thallus indefinite to membranous or cracked, bright rose-brown, red-brown, yellowish, bleaching in the herbarium .**Thelenella modesta**

2* On (dead) bark-, rock- and soil mosses, soil, or other lichens **3**

3 Sp. to 2-4, 60-110 x (16)20-27 µm, strongly muriform, colorless, yellow-brown with age. Per. -0.5(0.6) mm, ± sunken. Thallus gray-whitish to gray-brownish, thin, membranous **Chromatochlamys muscorum**

3* Sp. to 8, smaller. Thallus in the fresh (moist) condition greenish and somewhat gelatinous, dry gray-whitish to gray-brownish, indefinite, membranous to finely granular .**4**

4 Sp. 22-33 x 7-10 µm, weakly muriform. Per. sessile, -0.3 mm . **P. sphinctrinoidella**

4* Sp. 40-50 x 10-15 µm, clearly muriform. Per. sunken, -0.6 **P. sphinctrinoides**

Ecology and Distribution of the Species

Protothelenella corrosa (Körber) Mayrhofer & Poelt (Microglaena c. (Körber) Arnold)
On smaller boulders or rock surfaces near the soil on usually away from the sun, humid, long time dew moistened sites, like *Lecidea lithophila* (↑), yet high point on still more moist sites, often on mineral-rich silicate rock, m.-r.acidoph., v.substrathygroph., (r.)v.hygroph., m.photoph.-r.skioph. Char. Porpidion tub. – bor-mieur – rare (3); Sch, Vog, Rhön, *O, FrJu*, Erz, BayW-Opf, *Hz, Westf*

Protothelenella sphinctrinoidella (Nyl.) Mayrhofer & Poelt (Microglaena s. (Nyl.) Arnold)
In subalpine and alpine, very high precipitation sites on soil dwelling, dying mosses, rarely on lichens, rarely directly on soil, often on path cracks and similar open sites on away from the sun, long time dew moistened habitats, m.r.acidoph., hygroph. – arct-mieur-alp(-smed-alp) – v.rare: Al

Protothelenella sphinctrinoides (Nyl.) Mayrhofer & Poelt (Microglaena s. (Nyl.) Lönnr.)
In alpine and subalpine, very high precipitation sites on dying mosses (above all on liverworts) over moist silicate rock and cool soil, e.g. on open road cracks and similar eroded sites, rarely directly on naked soil, on scarcely sunny, m.-r. well-lighted, often long time snow covered, very humid or long time dew moistened habitats, r.acidoph., v.substrathygroph., anitroph., in moss society – arct-mieur-alp – v.rare (2); Vog, süSch

Lit.: MAYRHOFER 1987a, MAYRHOFER & POELT 1985.

Pseudephebe Choisy

(Determination ↑ Bryoria)

Introduction

The two belonging to the genus are shiny dark brown to almost black, filamentous, repeatedly branching lichens, whose thallus lies loose to very close to the substrate. The lecanorine apothecia are colored similar to the thallus. Both species grow on silicate rock on wind exposed habitats in the high central mountain sites and in the alpine zone. *P. minuscula* is an arctic-alpine species in Germany known only from southern Black Forest (dwarf specimens) and from the Alps. The area of *P. pubescens* includes the arctic, the boreal zone and corresponding sites of the adjacent floral regions. In Germany it occurs in high central mountains (Black Forest, Bohemian Forest, Fichtel- and Erzgebirge, and Harz) and in Northwest Germany, in the neighboring Vogesen and the Sudenten. In the region the species is regressing because of afforestation and land improvement.

Genus Characteristics

Thallus filamentous, branching, loose lying to closely clinging to the substrate, brown to brown-black, without soralia and isidia. Filaments tubular to somewhat flattened, but even tubercular, attached by scattered attachment sites, cortex of periclinal lying hyphae, which produces on the upper surface a (± single series) cell-like structure layer. Photobionts coccoid green algae. Ap. with permanent to disappearing thalloid margin and dark brown to brown-black disk. Asci clavate, thick walled, amyloid, with robust tholus. Sp. one-celled, ellipsoidal, thick walled. Pycnosp. ± bacillar. Ch-.

Ecology and Distribution of the Species

Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw. (Parmelia m. (Arnold) Nyl., Alectoria m. (Arnold) Degel.)
Like *P. pubescens*, *Parmelia stygia* (↑), yet limited to extremely, strongly wind exposed places, almost only in the alpine zone, even on the upper surface of delimed limestone, subneutroph.-r.acidoph. – arct-alp – v.rare (1); süSch (uncertain dwarf form), also Al

Pseudephebe pubescens (L.) Choisy (Parmelia p. (L.) Vainio, Alectoria p. (L.) R. Howe)
In high montane to alpine, more rarely montane, high precipitation sites on r.-v. wind exposed, r.-v. well lighted, only short time snow covered sites with rather changeable moisture conditions, on lime-free, usually hard silicate rock (horizontal- and sloping surfaces), moderately dung tolerant, hygrophytically more demanding than *P. minuscula*, r.-m.acidoph., photoph., a-/m.nitroph., Char. Umbilicarion cyl., in the Parmelietum omph., even penetrating into the Ramalinetum cap. – arct-(mo)alp – rare (2); süSch, *nöSch+*, Vog, BayW, Erz, Hz, Al

Lit.: BRODO & HAWKSWORTH 1977, HAWKSWORTH 1972.

Pseudevernia Zopf

Introduction

The *Pseudevernia*-species are large gray, erect to rising, fruticose lichens attached only at the base with band-like, more or less forked branching thallus segments, whose underside commonly differs in color. The apothecia are almost stalked and have a brown, disk delimited by a thalloid margin. In the case of the indigenous *P. furfuracea*, the single European species (of a total of five, mainly North American species) reproduction is undertaken by thick standing isidia, apothecia are only exceptionally produced. This species grows on acid bark of deciduous- and conifer trees as well as on silicate rock and is distributed from the mountains of South Europe up into central Scandinavia. In the mountains of Central Europe it is together with *Hypogymnia physodes* and *Platismatia glauca* the most frequent large lichen.

Genus Characteristic**s**

Thallus band-like fruticose, with a basal attachment site, the main branch tends to an even forked branching, upper side gray, underside slightly wrinkled, whitish, rose, blue-gray to blackish, the indigenous species isidiate. Lobes dorsiventrally constructed. Photobionts *Trebouxia*-like. Ap. stalked, with brown to red-brown disk and (often in curving) thalloid margin. Asci *Lecanora*-type. Sp. one-celled, ellipsoidal. Pycnosp. slightly dumbbell shaped. Ch: Cortex Atranorin, medulla depsides or depsidones (in the case of the indigenous species: Physodic or Olivetoric acid., in the case of exotic species above all with Lecanoric acid.)

Ecology and Distribution of the Species

Pseudevernia furfuracea (L.) Zopf (Parmelia f. (L.) Ach.)
Up into the subalpine zone on acid bark of deciduous- and conifer trees on the stem and above all on the branches, on free-standing trees as well as in forests, also on wood and (in high precipitation sites) on silicate rock (like *Parmelia omphal.* ↑), optimally on rather open to the wind, precipitation and high precipitation sites and then often massive amounts on conifer trees, beech, mountain ash, and oak, on lower sites often reduced development and further limited to tree crowns in forests, avoiding strong eutrification,

but massive exposure to acid emissions tolerated and going over to primarily base-rich bark, e.g. on popular, apple trees, etc. (m.)r.-v.acidoph., m.-v.photoph., (m.)r.-v.hygroph., a-(-m.)nitroph., above all in the Pseudevernietum (Char.) with *Hypogymnia*-species, and in beard lichen society – bor-med-mo – m.frequent, in higher sites frequent, in strong air pollution and dry-warm regions rare; two chemical races: Olivetoric acid, medulla C+ red: var. **ceratea** (Ach.) D. Hawksw.: Physodic acid (C-); var. **furfuracea**

Lit.: ANDERS 1928, HALE 1968, HAWKSWORTH & CHAPMAN 1971*, HILLMANN 1936

Psilolechia Massal.

(Determination ↑ also Lecidea, sterile lichens)

Introduction

The *Psilolechia*-species are crustose lichens with uniform, mealy to finely granular thallus and convex, marginless, light to dark colored apothecia, branching and reticulate paraphyses and one-celled, clavate to cylindric spores.

The three species of the small genus known in Central Europe, reside on rain-protected vertical- and overhanging surfaces on silicate rocks in humid, shady sites and are especially distributed in the summer green deciduous tree zone, above all in the western part of Europe. *P. lucida* occurs from northern Fennoscandia to the mediterranean region. Likewise widely distributed is *P. leprosa*, which is further bound to copper- and together with base-rich substrates. *P. clavulifera* has rarely been found (Great Britain, Fennoscandia, Germany, Czechoslovakia)

Genus Characteristics and Determination

Thallus crustose, mealy to finely granular, yellow to gray-yellow or greenish to whitish, with *Trebouxia*-like photobionts or *Stichococcus*. Ap. strongly convex to almost spherical, biatorine, marginless or with white "margin" of protruding excipular hyphae. Exc. weakly developed. Hyp. colorless or pale. Hym. entirely or colored in the upper part, I+ blue, 25-35 µm high. Paraphyses simple or sparsely branching, ends not or scarcely branched. Asci cylindric-clavate, wall with K/I+ pale blue, with K/I+ intensive blue toward the top of the diverging tubular structure, *Porpidia*-like. Sp. one-celled, elongate-egg form to drop-form. Pycnosp. egg- to pear shaped. Ch- or Rhizocarpic or Gyrophoric acid.

1 Thallus yellow, green-yellow, completely yellow. Ap. deep yellow, convex marginless, -0.6(0.8) mm. Sp. 4-7 x 1.5-2(2.5) µm. Rhizocarpic acid et al. With *Trebouxia*-like algae (see *Chaenotheca furf.* with *Stichococcus*) .□ **P. lucida**

1* Thallus whitish to greenish. Ap. not yellow . **2**

2 Thallus R-, whitish to greenish, scruffy-granular to granular-areolate, granules elongate or irregular formed, 14-33 x 1-14 µm, often growing together, with *Stichococcus* (Distinguish from similar *Micarea bauschiana*!). Ap. convex to hemispherical, often with white, cobwebby margin at the base, also almost spherical, -0.3 mm, gray-black with blue tint, in shade forms pale, blue-gray, gray-brown. Hym pale greenish to blue-greenish. Sp. often drop- form, 4-7 x 1.2-2 µm. Hyp. colorless or slightly greenish/blue-greenish. Usually Ch- . **P. clavulifera**

2* Thallus C+ red, leprose, -1.5 mm thick, greenish-white, white. Granules ca. 17-30(40) µm. Photobiont-cells 6-9 µm, spherical, or 6-12 x 7-8.5 µm. Ap. convex to almost spherical, 0.1- 0.5 mm, often agglomerated, -1.6 mm, pale flesh-colored, rose, dark brown, sometimes with violet tint. Hym. colorless to yellowish. Sp. drop-form to elongate egg-form, 4-5-6.5(7) x 1.3-1.8 µm. Hyp. light. Gyrophoric acid (Lecanoric acid, Porphyrilic acid) **P. leprosa**

Ecology and Distribution of the Species

Psilolechia clavulifera (Nyl.) Coppins (Lecidea c. Nyl., Micarea c. (Nyl.) Coppins & P.James) On stones, roots, soil on/under overhangs, on overhanging flanks of stems, like *Chaenotheca furf.* and *P. lucida*, in the Psilolechietum luc. – s'bor-mieur – rare?; süSch, *O*

Psilolechia leprosa Coppins & Purvis
On ± rain protected vertical- and overhanging surfaces especially on copper-rich rocks, but even on walls – bor-med – to be expected in the region

Psilolechia lucida (Ach.) Choisy (Lecidea l. (Ach.) Ach.)

In the foothills to montane sites on rain protected sites on lime-free silicate rock (protected vertical surfaces, overhangs, niches), rarely on bark and soil in root hollows, often as a first resident on rocks, on forest paths, even on slightly spring moistened surfaces, on r.-v.humid, rather poorly lighted to moderately well lighted habitats, usually in cool (rarely cold) valleys, m.-r.acidoph., anitroph., Char. Psilolechietum luc. – (s')bor-mieur-subatl-smed (-med) – r.rare; silicate mountains in part moderately frequent up to ca. 800 m (rare higher), also synanthrop e.g. on grave stones

Lit.: COPPINS & PURVIS 1987.

Psora Hoffm.

(Determination ↑ Lecidea PT 1)

Introduction

The genus *Psora* is recognized by the squamulose thallus with sessile, convex, externally marginless black or brown apothecia with reduced biatorine excipulum, commonly unbranched paraphyses and single-celled, ellipsoidal spores. The genus is distributed worldwide, with the high point in arid and arctic-alpine regions.

Of the about 25 species , 3 occur in Germany and 2 in the region (*"Psora" lurida* can no longer remain in *Psora*). *P. decipiens* grows on calcareous, dry, often level soil, in openings in calcareous dry turfs and soil filled cracks in rock. *P. testacea* is mainly in rock fissures and on jagged calcareous rocks. The area of *P. testacea* stretches over South Europe and the southern Central Europe; dispersed northern occurrences lie in Harz foothills, on Öland and Gotland. *P. decipiens* occurs – with numerous large gaps – in the whole of Europe. In extra-alpine Germany *P. decipiens* is rare and threatened almost everywhere. The third species, *P. globifera*, is verified from the Bavarian Alps.

Genus Characteristics

Thallus squamulose, squamules isolated to coalescing (in the case of non indigenous species even like roof-tile), ± rounded, flat to concave, rarely convex, often with somewhat curved-up margins, usually light to dark brown, even rose-red, always without soralia or isidia. Thallus commonly corticate on both sides, underside attached with rhizo-hyphae or rhizine strands, upper cortex of thick walled, strongly swollen hyphae with rounded to short cylindrical lumen, appearing partially paraplectenchymatous, with overlaid thick epinecral layer. Lower cortex usually of periclinal, thickly cemented, brownish hyphae or of ± anticlinal short-celled colorless hyphae, sometimes lacking. Photobionts coccoid green algae. Ap. sessile, convex and marginless, ochre, orange-brown, brown to black, nonpruinose or pruinose. Exc. exterior colored, interior (in the case of indigenous species) ± light, of strongly swollen, radial hyphae. Hyp. colorless to light brown in the case of indigenous species, to dark brown, with oxalate crystals. Hym. (gelatin) I+ weakly blue, K/I+ deeply blue. Epihym. brown, red-brown, with Anthraquinone (crystals). Paraphyses simple or sparsely branched and reticulate, strongly cemented, end cells weakly thickened. Asci with strongly developed, I+ blue tholus with enclosed I+ strongly blue ring structure. Sp. one-celled, ellipsoidal. Pycnosp. bacillar. Usually Ch-, rarely e.g. Atranorin, Norstictic acid, (in the case of indigenous species), Anthraquinone in the ap.

Ecology and Distribution of the Species

Psora decipiens (Hedwig) Hoffm. (Lecidea d. (Hedwig) Ach.)
Up into alpine sites on calcareous soils and calciphilic mosses on sunny, quickly drying habitats, on lower sites like *Fulgensia f.* (↑), on higher sites like *Toninia sed.* (↑), Char. Toninion sed. – arct-med – rare (2); Mn, Hü, Rh, Ne, Ju, Ries, FrJu, *Lahn, Rh-Mn-T*, Saar, Bit, Eif, He, Th, Al

Psora testacea Hoffm. (Protoblastenia t. (Hoffm.) Clauz. & Rondon, Chrysopsora t. (Hoffm.) Choisy, Lecidea t. (Hoffm.) Ach.)
Up into montane sites on usually calcareous, weathered, fissured rock, e.g. along crevices, on steep- to slightly overhanging surfaces, often on occasionally somewhat irrigated sites, on well lighted sunny to half shaded habitats, basiph., m.-v.photoph., m.nitroph., Char. Squamarinetum ol., in the region often with *Synalissa, Acarospora*

macrosp., *Caloplaca flavescens* -- mieur-med – rare; Sju-Ju-FrJu

Lit.: POELT & VÈZDA 1981, SCHNEIDER 1979, TIMDAL 1984b.

Psoroma Michaux

Introduction

The genus *Psoroma* is from the southern hemisphere – above all South America and New Zealand – with a large number of species represented, in Europe only with the cosmopolitan *P. hypnorum.* In the case of the one indigenous species the thallus is greenish-gray to yellow-brown and small squamulose, in the case of the exotic species they may be foliose- lobed. Characteristic are the apothecia with strongly projecting granular to crenate thalloid margin and deep lying yellow- to red-brown disk as well as the presence of cephalodia with *Nostoc*-algae. *P. hypnorum* grows on acid soils, raw humus and mosses and is distributed arctic alpine. Outside of the alpine mountains only a few exist in Central Europe, as very threatened relict occurrences. In Germany these occurrences are extinct.

Genus Characteristics

Thallus small squamulose to (exotic species) foliose-lobed, usually greenish-gray to yellow-brown, when moist ± intensively green, with *Nostoc*-containing cephalodia (in the indigenous species like the thallus squamules in habit, pale red-brown, brown, gray-brown), underside light. Thallus layered, commonly corticate. Photobionts green algae. Ap. with strongly developed, strongly projecting, with squamulose covered to granular or crenate thalloid margin and deep lying, yellow- to red-brown disk, sometimes (thus in the case of *P. hypnorum*) the underside of the margin hairy. Paraphyses simple or branched above, end cells not thickened. Asci clavate to subcylindric, with K/I+ pale blue tholus and intensively blue central ring structure. Sp. one-celled, ellipsoidal, often with warty-ribbed epispore (thus even in the case of *P. hypnorum*). Ch- (in the case of *P. hypnorum*).

Ecology and Distribution of the Species

Psoroma hypnorum (Vahl) S.Gray
In subalpine and alpine, high precipitation sites on acid, cool to thoroughly moistened soils, on naked soil, plant detritus, mosses, peat soils, stony fine soils on long time snow covered sites, r.-e.acidoph., substrathygroph., m.-r.photoph., above all in the Lecidomatetum demissae -- arct-alp – Al, *Ts, Th*, Erz, otherwise information doubtful, such as Pf, Eif, Sch

Lit.: JORGENSEN 1978.

Psorotichia Massal.

(Determination ↑ Porocyphus)

Introduction

Psorotichia includes gray, brown-black and black crustose lichens with granular to areolate, inconspicuous thalli with one-celled colony producing bluegreen algae, punctiform to wide open apothecia and one-celled spores. The genus is inadequately studies, the species little known. They reside on calcareous rock and are found especially on short time irrigated sites. *P. schaereri* is widely distributed in Europe; *P. montinii*, *P. diffracta* and *P. frustulosa* are mediterranean-submediterranean lichens, which penetrate only sporadically into southern Central Europe. Their places of growth are worth protecting, today they are to a high degree in need of protection.

Genus Characteristics

Thallus crustose, thin to strongly developed, coherent fine granular to thick crustose areolate or coralloid, gray to black, often pruinose, e.g. with *Chroococcidiopsis*, yellow-brownish colored gelatin envelop toward the thallus margin. Ap. ± sunken, with open, flat, at times sunken in or at first perithecia-like opening red- to dark brown disk, with thalloid margin,

sometimes finally with proper margin. Exc. scarcely developed or thin, widened toward the top, colorless to brownish. Hym. usually I+ blue. Epihym. colorless, yellow- to red-brown. Paraphyses simple to sparsely branching above, ends not thickened. Asci cylindric, uniformly thin walled, I-. Sp. to (4 to) 8, one-celled, ellipsoidal to spherical. Pycnosp. short bacillar. Ch-.

Ecology and Distribution of the Species

Psorotichia diffracta (Nyl.) Forss. (Collemopsis d. Nyl.)
On limestone on well lighted, mostly sunny, occasionally irrigated rocks in Cyanolichen-society (Psorotichion schaer.), e.g. like *Thyrea conf.* (↑), *Anema decipiens* (↑) -- s'mieur-med – rare; Ju

Psorotichia frustulosa Anzi
On limestone or base-rich silicate rock on warm, sunny, occasionally irrigated rock in Cyanolichen-society (e.g. Peltuletum eupl.), r.-v.photoph., neutroph.-basiph. – (s'mieur-) smed-med – v.rare (1); Bo

Psorotichia montinii (Massal.) Forss.
On limestone, probably like *Thyrea conf.* (↑), -- s'mieur-med -- v.rare?; süHü (Istein)

Psorotichia schaereri (Massal.) Arnold
(Collemopsis sch. (Massal.) Crombie)
Up into the high montane (subalpine) sites on limestone and calcareous silicate rock (above all sandstone) on from time to time irrigated (even flooded), sunny rock surfaces, also on smaller calcareous stones on soil and on collected stone piles, even on walls (going over to mortar), in Collematetalia-society, Char. Psorotichion schaer. – bor-med – r.rare; Sju, Ju, FrJu, Ne, süHü, O, Eif

Lit.: CLAUZADE & ROUX 1985, MIGULA 1929-31, OZENDA & CLAUZADE 1970

Ptychographa Nyl.

(Determination ↑ Lithographa)

Introduction

The thallus of *Ptychographa* is weakly constructed and lives essentially in the interior of wood. The ascocarps are black, streaked to angular-rounded and in youth sit deepened crack-like, later disk even spreading flat between the puffy projecting margins of a basally closed "carbonaceous" receptacle. By habit similar wood- or bark-dwelling genera are collected e.g. because of the one-celled spores. *P. flexella*, the single Central European of the genus containing only few species, grows on dry-decayed wood in montane sites. It is known from Fennoscandia to the southern Central Europe and Rumania.

Genus Characteristics

Thallus crustose, indefinite, partially in the substrate, with coccoid green algae. Ap. black, elongate and narrow to angular-rounded, with projecting proper margin and in youth crack-form, later even flat spreading (sometimes fluted) disk. Exc. brown-black, bowl-form passing under the hymenium. Hym. K/I+ blue. Paraphyses predominantly simple, rarely branching, with brown cemented ends. Asci clavate, with gelatinous K/I+ blue outer layer, in the case of the indigenous species with narrow, I+ blue tholus. Sp. one-celled, ellipsoidal, without perispore. Ch-.

Ecology and Distribution of the Species

Ptychographa flexella (Ach.) Coppins
(Lithographa f. (Ach.) Zahlbr.)
In high montane, rarely montane high precipitation sites up to the tree line on old tough decayed wood (above all flanks of tree stumps), like *Xylographa paral.* (↑), -- bor-mieur-h'mo(-smed-h'mo) – rare (2); süSch, Vog, ThW, *Al*

Lit.: REDINGER 1938.

Pycnothelia (Ach.) Duf.

(Determination ↑ Cladonia)

Introduction

P. papillaria, the single species of the genus, has a light gray warty thallus with clavate form to elongate cylinder-like, simple to sparsely branching, usually up to 1 cm high light gray, browned above thallus stalk (pseudopodetia). It is distributed on acid soils of heath and meager turfs in the boreal and the Central European (temperate) zone (here going up to the tree line) as well as (widely less frequent) in the corresponding high places in South Europe. In the region it is rare and because of amelioration considerably threatened throughout. It is often associated with *Dibaeis baeomyces*.

Genus Characteristics

Thallus of a crustose, granular-warty light gray primary thallus and an ± vertical secondary thallus in the form of in youth almost spherical, then cylindric to clavate, simple to branching, smooth, hollow, gray to browned pseudopodetia browned on the tip, without definite cortex. Ap. rare, arising on the tip of the pseudopodetia, shield-form, dark red-brown. Asci *Cladonia*-type. Sp. 1-4 celled, cross-septate, elongate-fusiform. Pycnosp. filamentous, twisted, ± Squamatic acid.

Ecology and Distribution of the Species

Pycnothelia papillaria Duf. (Cladonia p. auct.)
Up into alpine sites on moderately nutrient rich, acid soils, on open sites in meager turf and on rocky slopes, even on road margins, like *Dibaeis baeomyces* (↑), *Cladonia cervicornis* var. *verticillata* (↑), in the Baeomycion –bor-mieur(-smed) – rare (2); süSch, *nöSch*, Vog, PfW, nöPf, nöPf, nöRh, *Rh-Mn-T*, MRh, Ts, Sp, O, süRhön, Fr, *SFW, süHü,* Sb, Av, Al, Eif

Lit.: ANDERS 1928, SANDSTEDE 1931

Pyrenopsis Nyl.

(Determined ↑ Porocyphus)

Introduction

The species of this worldwide distributed genus are blackish to red-brown crustose lichens with one-celled, colonial blue-green algae with gelatinous envelops. The more or less sunken apothecia have reddish to blackish, punctiform narrow to wide open, deepened disks. The spores are one-celled. The species are entirely insufficiently known, little collected and often overlooked. They occur mostly on sporadically irrigated, half shaded to sunny silicate rock, thus also in Europe the widely distributed *P. subareolata* and the closely related *P. sanguinea*.

Genus Characteristics

Thallus crustose, granular to areolate, blackish to dark reddish(brown), clearly rose tinted when moist, paraplectenchymous throughout, with *Gloeocapsa*, gelatin envelopes of the algae cells/-colonies reddish-brown near the thallus upper surface. Ap. at least when young perithecia-like, with pore-like opening and deepened disk, later disk even wider opened, brown, red-brown to black, with thalloid margin. Exc. very thin. Hym I+ blue-green to reddish-brown. Epihym. usually brownish. Paraphyses simple to branched, often constricted above on the septa. Asci clavate, with I+ blue tholus. Sp. to 8, in the case of non indigenous species up to 64 and more, one-celled, ellipsoidal to spherical. Pycnosp. ellipsoidal to short bacillar. Ch-.

Ecology and Distribution of the Species

Pyrenopsis sanguinea Anzi
Like *P. subareolata* – rare; süSch

Pyrenopsis subareolata Nyl.
(P. rhodosticta auct. p.p.)
Above all in montane, high precipitation sites on commonly lime-free silicate rock, on frequently or long time moistened, usually sunny, from time to time warm trickling water surfaces and on occasionally flooded boulders, somewhat more strongly hydroph. than *Ephebe*, often in the or in contact with Ephebetum, m.-r.acidoph., subhydroph., r.-v.photoph. – s'bor-med – rare (2); süSch, Vog

Pyrenula Massal.

(Key incl. Eopyrenula, Mycopyrenula)

Introduction

Characteristic for the *Pyrenula*-species are crustose, usually rather uniform, in the case of indigenous species olive colored to brown or whitish thallus with *Trentepohlia*-algae, often rather large black perithecia, in many species extensively covering the thallus, with characteristically fusiform, commonly repeatedly cross-septate brown spores with irregularly thickened walls and (in top view) elliptical to rhomboidal chambers.

The voluminous, approximately 200 species comprising the genus are distributed mainly in the tropics; in Europe there are ca. nine, in Germany there are four species represented. These reside on smooth bark of deciduous trees (almost only hornbeam, beech, and ash) in forests. They are distributed in the temperate deciduous forest region. The area stretches in the North to south Scandinavia. *P. nitida* and *P. nitidella* as well as *P. coryli*, a non lichenized, mostly hazelnut dwelling species, penetrates above all into regions with deciduous trees up into South Europe.

Genus Characteristics and Determination

Thallus crustose, usually thin and ± smooth, or extensively in the substrate, cream-white, olive, brown, many species with punctiform like pseudocyphellae, with *Trentepohlia* or rarely not lichenized. Per. almost always sunken to ± half, black, but often covered on the flanks by thallus tissue and only a small apex region visible, often rather large. Exc. light brown to brown, usually ± spherical, surrounded by an indefinite collected, close lying, dark brown to black involucrellum. Involucrellum circularly developed, rarely (*P. coryli*) open below and laterally expanding. Hym. gelatin I- to I+ green-blue. Paraphyses simple, rarely branching (in young per. instead branching-reticulate paraphysoids), periphyses in the region of the ostiole. Asci narrowly clavate-cylindric, somewhat thickened above, I-. Sp. ellipsoidal to broadly clavate, brown, with irregularly thickened walls and almost rhomboidal to rounded cell lumina, in the case of the indigenous species 4-celled. Pycnosp. filamentous, twisted. Indigenous species Ch-, occasionally Anthraquinone.

All treated species P-, C-

1 Sp. not with lens-form lumina, from the first with definite cross-walled, 4-6(8) celled, commonly one series in the asci, 16-26(32) x 6-10 µm, the two middle cells the darkest. Per. -0.35 mm. Pycnosp. 6.5-9.5 x 3-4 µm and 6-10 x 0.5-0.7 µm. Thallus wrinkled (to smooth), whitish. Ch-. **Eopyrenula leucoplaca**

1* Sp. with lens-form to rhomboidal lumina **2**

2 Brown-black receptacle open below, with laterally ± projecting involucrellum. Sp. 10-17 x 4-6 µm, often later brown. Per. -0.3 mm. "Thallus" indefinite, ± gray, without algae, with pycn., pycnosp. 20 x 0.5 µm. (Fungus) **P. coryli**

2* Brown-black receptacle circular enclosed. Involucrellum laterally at best weakly projecting . **3**

3 Receptacle K-. Thallus whitish, silver-white, without pseudocyphellae (light spots). Sp. (12) 14-26 x 7-11 µm. Per. -0.4 mm. Thallus smooth, often with pycn. between the per., K+ yellow. Pycnosp. 10 x 1 µm **P. laevigata**

3* Receptacle (and overflowing into the hym.) K+ red. Thallus olive, brown, yellow-brown, usually slightly oily shining, often with punctiform light pseudocyph., K+ dirty yellow to brown-red, C-, P-. Per. brown-black to black, but the young often still partially covered by the thallus. Sp. (15)17-23(28) x 6-9(11) µm **4**

4 Per. -1.5 mm, hemispherical projecting, at first ± covered by the thallus, later free, mouth black. Thallus oily glistening smooth, coherent, with age even cracked, olive to dull brown or yellow-brown. Sp. usually only up to 8 µm wide □ **P. nitida**

4* Per. -0.3(0.4) mm, mouth flat, often relatively light. Lichen like *P. nitida*, but per. not so strongly projecting, sharply set off from the thallus. Thallus usually remaining rather light, yellow-brown, light olive-brown, olive-greenish, usually shiny. Pseudocyph. usually more definite and regularly developed than *P. nitida* . □ **P. nitidella**

Ecology and Distribution of the Species

Pyrenula coryli Massal. (Mycopyrenula c. (Massal.) Vainio)
In the foothills and submontane sites on smooth bark or hazel stems in brush and forest margins on humid, m.(r.)well-lighted habitats, m.acidoph., in the Graphidion-society – s'bor-mieur, subatl – rare (?); *Ju, nöSch, O, Av*

Pyrenula laevigata (Pers.) Arnold
Up into montane zone preferably on smooth bark with lesser water capacity, above all hornbeam, beech, hazel, like *P. nitida* (↑), in the Graphidion, above all Pyrenuletum nit. – mieur (-subatl) – rare *(1)*; above all süHü-HRh, also süSch, Sju, Ju, *Vog*, Eif, Th, O, *Ne*, *Bo*, *SFW*, *Av*, Al.

Pyrenula nitida (Weigel) Ach.
Up in the montane zone on m.acid, smooth bark of deciduous trees, especially in the lower stem region, in lower sites predominantly on hornbeam in cool oak-hornbeam forests, in higher sites on beech in beech- and beech-spruce forests, additionally rarely on maple, very rarely on other deciduous trees and spruce, on relatively uniformly humid, rather poorly lighted sites, lacking on cold sites, (subneutroph.-) m.acidoph., r.ombroph., anitroph., Char. Pyrenuletum nit. – mieur-med-mo – m.frequent; regionally rare, thus in dry-warm sites and deciduous tree-poor regions

Pyrenula nitidella (Flörke ex Schaerer) Müll.Arg.
Above all in foothills and submontane (rarely very mild montane) sites on smooth and flat-cracked bark on the stem above all on hornbeam and ash in cool oak-hornbeam- and ash-forests. (Carici-, Pruno-Fraxinetum), in distinction to *P. nitida* much more concentrated on climatically mild habitats, more frequent also on rather base-rich bark, less concentrated on the stem bases, scarcely on beech, subneutroph.-m.acidoph., above all in the Pyrenuletum, Opegraphetum ruf. – mieur-smed(-med) -- rare (3); in lower sites throughout the entire region, in dry-warm sites and strongly air polluted regions as well as in the N and NW (Pf, RhSch, nöRh, Rh-Mn-T etc.) rare to lacking

Lit.: KEISSLER 1937, POELT & VÈZDA 1981.

Pyrrhospora Körber

(Determination ↑ Protoblastenia, Lecidea PT 2)

Introduction

The species of the genus *Pyrrhospora* are crustose lichens with red, red-brown to black apothecia with often indefinite proper margin. They were earlier predominantly placed in *Lecidea* and *Protoblastenia*, they differ however in a few anatomical characters from these genera. They reside on acid rock, acid bark and wood.

Of the ca. seven European species only *P. quernea* occurs in the region. It grows on old deciduous and conifer trees on well lighted habitats and is distributed from the Mediterranean region up into western Central Europe (Great Britain, and southern Fennoscandia); in Central Europe the species seems already to be rare.

Genus Characteristics

Thallus crustose, thin and coherent to clearly areolate, at times sorediate, with *Trebouxia*-like photobionts. Ap. red, red-brown, brown-black, or black, with same colored, often indefinite to disappearing proper margin. Exc. of radial hyphae, strongly developed to narrow and disappearing (in the case of *P. quernea*). Hym. lower (50 µm). Epihym. in the case of one part of the species (so also *P. quernea*) with brownish, K+ red crystals (Anthraquinone). Paraphyses for the most part simple with slightly clavate ends. Asci *Lecanora*-type. Sp. one-celled, ellipsoidal. Pycnosp. filamentous to long bacillar.. Ch: very variable, Depsides, Depsidones, Xanthone, Usnic acid.

Ecology and Distribution of the Species

Pyrrhospora quernea (Dickson) Körber
(Lecidea qu. (Dickson) Ach.)
In foothills to montane, winter-mild sites on the stems of older trees with not/moderately eutrophic bark, e.g. on oak, spruce, beech, elm, above all on rain protected sites at the base, m.-r.acidoph., m.-r.photoph., e.g. with *Schismatomma dec.* – mieur(atl)-med – Eif, Mos, Bit, Ne, overlooked

Lit.: HAFELLNER 1993a.

Racodium Pers.: Fr.

(Determined ↑ Cystocoleus)

Introduction

The worldwide single species of this hair lichen genus produces fine black-brown filaments, which grows together in a thick felty, dull black appearing "carpet." The filaments consist of *Trentepohlia*-algae, which are enclosed in a thick hyphal mantle. Fruiting bodies are not known.

The lichen resides on very shady, humid habitats on more or less rain protected vertical- and overhanging surfaces of silicate rocks in narrow valleys, on north slopes, on poorly lighted sites of larger rock parts, usually also on boulders in cool-moist boulder fields. They are often associated with habitually very similar *Cystocoleus ebeneus* and may cover large rock surfaces. They are above all common in Central European central mountains and in Scandinavia.

Genus Characteristics

Thallus finely filamentous. The dark brown to black filaments consist of one *Trentepohlia*-algal filament and surrounding this a close lying mantle of ± longitudinal lying, regularly parallel ordered, septate hyphae. Ap. unknown. Ch-.

Ecology and Distribution of the Species

Racodium rupestre Pers.
Up into the high montane sites on rain sheltered vertical- and overhanging surfaces of silicate rock, on cool, v.-e.humid, v.shady, wind protected habitats, like *Cystocoleus* (↑), somewhat hygrophytic, therefore in lower sites more rare, Char. Cystocoleo-Racodietum, often with *Cystocoleus* – bor-atl-s'bor-mieur – rare; above all Sch, PfW; additionally Vog, O, He (Rhön, Vgb, Meissner), Eif, Mfr, Erz

Lit.: MIGULA 1929-31, SCHADE 1932.

Ramalina Ach.

Introduction

The *Ramalina*-species are pale gray-greenish, greenish to pale green-yellowish fruticose lichens with band- to almost filament-form thallus segments, on which soralia or – as in the case of *R. fastigiata* and *R. fraxinea* – lateral- to terminal apothecia with thalloid margin and pale greenish, pale yellowish or even light brownish disks are produced. The spores are two-celled, straight or curved, thick-walled, and colorless. The thallus is attached at one site with narrowed base (attachment disk). Single species have become over 20 cm long – even today one sometimes finds such specimens (*R. fraxinea*) in the region.

Of the perhaps 200 species known world-wide, ca. 18 are in Germany. Several of these are limited to the near coastal region in North-west Germany and Schleswig-Holstein, an additional two occur only in oceanic sites of the Alps, thus also in the Allgäu (*R. elegans, R. sinensis*).

Of the eight species found in Baden-Württemberg *R. roesleri* is counted as extinct, *R. obtusata* as disappeared and *R. capitata* as well as *R. thrausta* as extremely threatened. *R. fraxinea* and *R. fastigiata* are strongly in regression.

R. capitata grows on wind exposed, sunny silicate rocks on dunged bird roosts, the species is sometimes found on roofs of old hay barns, thus e.g. in foothills of the Alps or in France, where it is strongly threatened by the existence of smelting. The other indigenous species are epiphytes. forests *R. roesleri, R. obtusata* and *R. thrausta* are bound to fog- and high precipitation habitats in higher sites, above all in gulches, narrow valleys, the vicinity of waterfalls and extensive mountain, also *R. elegans* is verified in the Bavarian Allgäu (with one collection location in Germany) and *R. sinensis*. *R. farinacea* is optimally developed on such sites, showing however a broad ecological amplitude and is even to be found on free standing trees e.g. on highways. *R. fraxinea* and *R. fastigiata* limited to the south lands are typical of well lighted habitats and nutrient-rich, subneutral reacting tree bark, above all popular, ash, Norway maple and sycamore; optimal prospering in several meters of stem height. Today precipitation poor regions seem to be avoided. *R. fraxinea* was in the previous hundred years common over all Baden-Württemberg, as known from old records and accessible vouchers. Also from Hessen and Thüringen, where it is lacking today, they were reported as frequent. The regression in Baden-

Württemberg is not only a result of the effect of air pollution, but also of the strong reduction of the number of free-standing trees and the paving of country roads (lessening dust influence); conditions for the survival of these species in the retention of older alley- and field trees, above all Norway maple and sycamore as well as ash. *R. pollinaria* resides on less strongly rain exposed flanks of older trees, occasionally even on overhangs of silicate- and dolomite rocks. *R. baltica* is known from the Spessart.

R. capitata is distributed from North Europe up into northern Germany and in the high mountains of central and southern Europe; it occurs very isolated even on lower sites, thus e.g. in the Vogesen, the Platinate, in the Bavarian-Bohemian border mountains, in the upper Platinate and Lower Austria. In southwest Germany only individual branch occurrences are known. *R. thrausta* is distributed in boreal conifer forest regions and in montane sites in southern regions, *R. obtusata* above all in central and southern Scandinavia and in cool moist mountain sites of the Alps; it prefers continental regions, while *R. baltica* occupies more atlantic regions in central European deciduous forests. *R. roesleri* occurs in northern Sweden and in moist mountain sites of the Alps and the Black Forest. The area of *R. fraxinea* and *R. fastigiata* stretches from central Fennoscandia over Central Europe up into the Mediterranean region (here preferably in mountain sites). *R. farinacea* and *R. pollinaria* have the most extensive area of these epiphytes; they include the greatest part of Europe and reach into northern Fennoscandia.

Genus Characteristics and Determination

Thallus fruticose, compact erect or decumbent to long pendent, pale gray-greenish to pale yellow-greenish with band-like flattened (to channeled) to beard-like filamentous, branching thallus segments, sometimes with pseudocyphellae, often with soralia. Structure bilateral- to almost radially symmetrical, cortex thin, plectenchymatous, over a prosoplectenchym, in which the algae of the algal layer invade. Medulla commonly very loose-"cobwebby" to lacking in the case of a hollow thallus, sometimes thick plectenchymatous. Photobionts *Trebouxia*-like. Ap. short stalked, often terminal- or almost terminal, with pale greenish, beige, pale brownish to yellowish disk and thalloid margin. Asci narrowly clavate, *Bacidia*-type. Sp. two-celled, broadly ellipsoidal or kidney-form. Pycnosp. short bacillar. Ch: all species with Usnic acid (often in small amounts), often Depside (above all Evernic acid), Depsidone, fatty acid.

1 On silicate rock, -3 cm long/high. Ap. very rare. R- . **2**

1* On bark (rarely wood) . **3**

2 Soralia terminal, almost spherical, conspicuously protruding. Thallus ± grassy, segment flattened, erect, rigid, usually little branched, 1-3 mm wide, yellowish to light gray-greenish. Without Evernic acid □ **R. capitata**

2* Soralia marginal, laminal and terminal, if the latter, then not ± spherical. Thallus spreading to pendent, thallus segment usually strongly divided. ±Evernic acid **R. pollinaria**

3 Thallus like an *Alectoria/Bryoria* loosely filamentous pendent, of fine, cylindrical, loosely to richly branching filaments, with hook-like bent back branchlets with slightly capitate thickened ends, which may erupt to punctate small, spherical soralia. Stenosporic acid (when without bent back lateral filaments, usually without soralia, with ± Alectoronic acid, Squamatic acid ↑ *Alectoria sarmentosa*) . □ **R. thrausta**

3* Thallus not of thin filaments with bent back branchlets with thickened ends **4**

4 Thallus without soralia, commonly with ap., ap. disks yellowish to beige. Sp. curved **5**

4* Thallus with soralia, commonly without ap **8**

5 On near coastal rocks (*R.. siliquosa* group . **6**

5* On other habitats, commonly on bark **7**

6 Main branch pressed flat, often with ribbed upper surface. ± Protocetraric acid, ±Salazinic acid, ±Hypoprotocetraric acid . **R. siliquosa** (Hudson) A.L.Sm.

6* Main branch usually ± cylindrical, with smooth upper surface. ±Stictic acid, ±Norstictic acid . **R. cuspidata** (Ach.) Nyl.

7 Thallus ±compact, spreading to erect, scarcely longer than broad, often of ± spherical-hemi-spherical form, richly branched, the most of the branches approximately of equal length, with terminal ap. usually sunken in inflations, thallus segments 1-6 mm wide, up to 6 cm long, ± hollow with cobwebby medulla, usually unevenly pitted, without pseudocyph. Sp. bean- form to rarely ellipsoidal. Evernic acid □ **R. fastigiata** (when in moist mountain forests in the Alps, whitish to straw yellowish, main branch only 2-3 mm wide, rigid even when moist, sp. straight to slightly curved: **R. elegans** (Bagl. & Car.) Jatta)

7* Thallus well developed longer than broad and pendent. Ap. laminal- or marginal, rarely almost

terminal. Thallus band-form, 2-2.5 mm wide, 2-20 cm long, weakly chanelled to flat, usually strongly pitted or provided with wrinkles and ridges, rigid, with (sometimes indefinite) pseudocyph. In the case of poor development only consisting of one to few relatively short segments with often tubercular upper surface. Sp. bean-form. Without Evernic acid .□ **R. fraxinea**

(when thallus segment narrow, wrinkled, with ± smooth, shiny upper surface, with or without Sekikaic acid, Sp. straight: **R. calicaris** (L.) Fr., in regions near the coast)

8 Soralia almost terminal, either punctiform small and spherical or on the underside of helmet-like convex lobe ends. In mountain forests or on free standing trees in moist sites **9**

8* Soralia marginal- and/or laminal, isolated supplementary terminal **11**

9 Soralia punctiform, small, ± spherical, predominantly on the ends of fine cylindric branches. Thallus bushy, repeatedly and finely branching. R-. Sekikaic SSy. Alps . **R. roesleri**

9* Soralia large, on the underside (often inflated) ends. Thallus segment sparsely branched, ± hollow, medulla R- **10**

10 Thallus 1-3 cm long/high, lobes delicate, narrow, pale straw yellowish (to pale gray-green), almost transparent when moist. Soralia usually helmet-form. Evernic acid. Boreal-montane . **R. obtusata**

10* Thallus 2-5 cm long/high. Lobes gray-green, robust, basally even rather broad and wedge-form to narrowed at the attachment, not transparent when moist. Soralia sometimes also marginal/laminal. Evernic acid **R. baltica**

11 Soralia almost only marginal, ± oval, ± flat. Thallus ± richly branched, segments narrow (0.4-2 mm), -6(10 cm) long. Medulla P- or P+ orange, K- or K+ yellow, then red. Soredia mealy. Protocetraric acid or Salazinic acid, ± Norstictic acid or Hypoprotocetraric acid or without additional substances. Form-rich, in air pollution regions in stalky spreading thalli . □ **R. farinacea**

11* Soralia laminal and terminal, partially even marginal. Thallus up to 4 cm, rarely longer. R- **12**

12 Thallus segment very narrow, ± cylindric, above all with punctiform spherical soralia on the ends. Thallus filamentous, richly branched. Sekikaic SSy **R. roesleri**

12* Thallus segment very variable, to several mm broad (rock dwelling forms narrow), relatively flaccid-flexible to rigid, often broadened toward the ends and strongly slit, often with numerous tubercular projections. On steep surfaces of rock often delicate, narrow lobed forms, on bark usually robust, broad-lobed forms. Soralia often close standing and coalescing (in extremely large thallus segments entirely sorediate), often even terminal and lip-form. Soredia granular to mealy. Evernic acid. Often not easily accessible □ **R. pollinaria ***

Ecology and Distribution of the Species

Ramalina baltica Lettau
In cool, (sub)montane sites on deciduous trees on humid or high precipitation habitats – mieur-subatl – v.rare (1); Sp

Ramalina capitata (Ach.) Nyl. (R. polymorpha (Lilj.) Ach. var. c. (Ach.) Clauz.)
Partly in high montane sites, partly (e.g. RhSch, Fr, Opf) essentially lower, on the crowns of strongly dunged bird roosts on silicate rock on rather to very open to the wind, very well lighted habitats, sometimes synanthrop on roof ridges of hay barns and such, m.acidoph., v.nitroph., Char. Ramalinetum cap. (in the high mountains), local Char. Candelarielletum cor. – arct-mieur(-mo/alp)-med-mo/alp – rare to v.rare (1); Vog (Kammlagen), süSch (Urberg), Eif, Mos, Rh-Mn-T*, Fr, Opf, Erz, Hz, Av, Al

Ramalina farinacea (L.) Ach.
Up to the tree line on stems and twigs of deciduous- and conifer trees; in lower (and above all dry-warm) sites predominantly on forest margins, in forests and in valleys, otherwise even on free standing trees (alley) frequent, optimal in cool, high precipitation and fog-rich sites, subneutroph.-r.acidoph., r.-v.hygroph., a-/m.nitroph., in many associations, e.g. Usneion, Graphidion, Pseudevernietum, even penetrating into Xanthorion – bor-med – m.frequent; Vog and Sch r.frequent, otherwise scattered to rare, sparse in low precipitation regions

Ramalina fastigiata (Pers.) Ach. (R. populina (Hoffm.) Vainio)
Above all in submontane and montane sites on free-standing deciduous trees, on rather base-rich, often slightly dust impregnated bark on thicker branches and in the middle and upper stem region, above all on ash, maple, on road and avenue trees with bordering green space in lightly populated regions, optimal in high precipitation habitats open to light and wind with often varying moisture conditions, in south Germany clearly regressing and rarer than *R. fraxinea*, in the North reversed, earlier even in low precipitation sites and scattered throughout the entire region, m.acidoph.-subneutroph., r.-

v.photoph., m.-r.anemoph., a-/m.nitroph., Char. Ramalinetum fastigiatae, in the Parmelietum ac. – (s'bor-)mieur-med – rare (3); Ju-B0-Do-Av, FrJu, Sju, süSch, v.rare in nöSch, SFW, nöHü, Ts, *O*

Ramalina fraxinea (L.) Ach.
On free standing deciduous trees with subneutral (to moderately acid) bark, like *R. fastigiata* (↑), but more frequent, in lower sites often only in dwarf forms – s'bor-med – r.rare (3); above all Sju-Ju-FrJu, Bo, Av, süSch, rare SFW, Ne, Do, otherwise very rare to +, widely distributed earlier

Ramalina obtusata (Arnold) Bitter
Like *R. thrausta* (↑), on twigs and stems on cool-oceanic habitats – bor-mieur-h'mo – v.rare *(0)*; in süSch, Ju, *Ne*, Bo missing, north border of the Alps rare

Ramalina pollinaria (Westr.) Ach.
Above all up into montane sites on stems of deciduous trees, especially on deep cracked bark on the middle of the stem and toward the base, on nutrient-poor to rather nutrient-rich substrates (dust film), on streets (above all linden, maple, and ash), in meadows and forest borders (here above all oak), even on vertical- and overhanging surfaces of silicate- and dolomite rocks, ecologically rather far reaching, high point on (m.-)r. well lighted, m.-r.open to the wind habitats, m.-r.acidoph., (a-)/m.nitroph., m.hygroph., m.ombroph., e.g. in the Parmelietum acet. – bor-med – r.rare (3), regionally (above all in stressed or conifer-rich regions) rare to lacking

Ramalina roesleri (Hochst. ex Schaerer) Hue
In montane and high montane sites on v.-e.humid sites, especially on twigs, like *R. thrausta* (↑), and *Evernia divaricata*, but hydrologically still more particular, on the still existing Central European collection sites (Alps) above all in the neighborhood of wild brooks and waterfalls, in the Evernietum div., Ramalinetum dil. (Alps) – bor-mieur-pralp-med – v.rare (0); *nöSch (Freudenstadt +)*, Al (Ostrachtal)

Ramalina thrausta (Ach.) Nyl. (R. crinalis (Ach.) Gyelnik)
In montane and high montane, r.-v.high precipitation sites on v.-e.humid, cool to cold habitats on conifer- and deciduous trees in spruce-fir-forests (e.g. Vaccinio-Abietetum), preferably in narrow valleys, cold air accumulating basins, at waterfalls, m.-r.acidoph., r.skioph.-r.photoph., anitroph., Char. Evernietum div., often with *E. divaricata, Usnea fulvoreagens* – bor-smed-h'mo – v.rare (1); süSch, nöSch, Vog, Ju, Ne, ThW, Al

Lit.: KROG & JAMES 1977.

Rhizocarpon Ramond ex DC.

Introduction

The *Rhizocarpon*-species are rock dwelling crustose lichens with gray-white, gray, brown, yellow to green-yellow or rarely even rust-red, commonly cracked to areolate thallus and black apothecia with indefinite to very definite proper margin. Around the thallus or between the thallus areoles a black prothallus is often developed. Characteristic are two- to four celled and cross-septate or muriform divided multicelled, colorless or gray-green to dark brown spores and a dark hypothecium. In contrast to the genus *Buellia* showing similar characters are the spores enveloped in a perispore and the occurrence of richly branched and reticulate paraphysoids. Almost all species are regularly fertile; a few species are only vegetatively reproducing and producing soralia.

The species reside almost exclusively on lime-free silicate rock, a few, such as *Rh. umbilicatum*, moderately calcareous rock to pure lime, a few others, such as *Rh. petraeum* and the alpine sites of the Alps occurring species *Rh. atroflavescens* and *Rh. caeruleoalbum*, lime-poor rock or upper surface delimed carbonate rock. Limited to heavy metal-rich, mainly iron sulfide-rich rock are *Rh. furfurosum*, *Rh. oederi* and *Rh. ridescens*; with other, ecologically similar taxa they form a floristically very characteristic heavy-metal lichen association; even *Rh. hochstetteri* tolerates relatively iron- rich substrate. Nutrient enriched natural habitats (dust impregnation, and dunging on bird roosts) as well as roof tiles and grave stones are typical for *Rh. distinctum*. *Rh. lavatum* grows on from time to time flooded sites in brooks or on long time irrigated or dew moistened rocks; also the ecologically very; plastic *Rh. germinatum* and the heavy metal-species tolerate short-time irrigated or dropping water moistened surfaces.

Rh. epispilum, Th. furax and *Rh. viridiatrum* because of their biology stand out from the other species: they live as parasites on other crustose lichens.

Most of the species in respect to climate have a truly broad habitat amplitude, avoiding however light-poor habitats. *Rh. grande, Rh. disporum, Rh. lecanorinum* and *Rh. viridiatrum* commonly occur in the region on sunny, at times warm, *Rh. alpicola, Rh. carpaticum* and *Rh. leptolepis* on cool to cold, snow-rich sites in the mountains. *Rh. cinereovirens, Rh. obscuratum, Rh. plicatile,* and *Rh. polycarpum* avoid more strongly radiation exposed sites. *Rh. badioatrum* prefers open to the light habitats of higher sites.

The cosmopolitan genus is above all distributed in the temperate to cold regions of the earth. This goes for most of the species even in Europe, whose area stretches from the Arctic up into the deciduous tree zone of Central Europe and – here partially already rare – in the mountains of South Europe, thus in the case of *Rh. geographicum, Rh. badioatrum, Rh. distinctum, Rh. grande, Rh. hochstetteri, Rh. obscuratum* and *Rh. oederi* are widely distributed in North Europe, in the Central European region however to a large extent limited to the mountains; in the Mediterranean region for the most part lacking. The South- and above all Central Europe occurring *Rh. simillimum, Rh. lecanorinum* and *Rh. viridiatrum* become rare in central to northern Scandinavia.

The area of the essentially arctic-boreal *Rh. jemtlandicum* reaches Central Europe only with relatively few relict occurrences; in Germany the species is only known from high Black Forest. *Rh. umbilicatum, Rh. caeruleoalbum, Rh. carpaticum* and *Rh. atroflavescens* are arctic-alpine distributed. *Rh. furfurosum* and *Rh. ridescens* have a distribution high point in Central Europe. *Rh. leptolepis* is indigenous in Scandinavia as well as in the higher mountains of Central Europe. Due to their rarity the last three named species, in addition to *Rh. epispilum, Rh. furax, Rh. jemtlandicum* and *Rh umbilicatum* are potentially threatened. Street and road construction or also even natural rock fall may decisively weaken the population. *Rh. epispilum,* a mediterranean population, exists in the South Black Forest as an isolated occurrence, disappearing further to the North.

According to the current point of view there are in the Republic of Germany ca. 40 species, in Baden-Württemberg till now 27 species verified; three additional were found in neighboring Bavaria. The species number depends among other things on the value of various chemical races. The *Rh. geographicum*-group is inadequately studied, on account of which the several taxa were combined under *Rh. geographicum* s.l.

Genus Characteristics and Determination

Thallus crustose, coherent-finely cracked to areolate or lumpy, yellow to green-yellow or white, gray, brown or rust-brown, on a black prothallus, that is many species is visible between the areoles. Photobionts coccoid green algae. Ap. black, without thalloid margin, with indefinite to definite proper margin, sitting up to between the areoles. Hym. usually high, I+ blue. Epihym. red-brown, brown, olive to green, hyp. brown to black-brown. Paraphysoids richly branched and reticulate. Asci fissitunicate, with definite I+ blue tholus at the tip, without ocular chamber (*Rhizocarpon*-type). Sp. mostly 8, rarely 2 or 1, 2-celled to multicellular muriform, colorless to dark brown. Pycn. rare. Ch: yellow (very rarely in others) species with Rhizocarpic acid; additionally e.g. Psoromic acid, rarely Ch-.

Notice: The content of Stictic acid in the case of non yellow species swings often strongly, corresponding drop in the various reactions. Very many species have races with and without Stictic acid. As a diagnostic characteristic this substance is therefore rather unimportant in many species. The reaction P+ red in the medulla is only to be observed macro-scopically. The reactions P+ yellow and K+ yellow in the medulla are often weak and better recognized in (squash) preparations. It ought not to be sucked off before the reaction begins. Do not add too much reagent, otherwise the reaction rapidly decreases. All yellow to yellow-green species have Rhizocarpic acid; therefore it is not further mentioned in the key.

1 Thallus yellow, citron-yellow, yellow-green, green, rarely pale yellow. Sp. soon gray-green to dark brown. Rhizocarpic acid . **2**

1* Thallus gray to brown, rust-red or whitish . **15**

2 Thallus sorediate, areolate, medulla I+ blue. Ap. rare, about 1 mm **3**

2* Thallus without soralia **4**

3 Areoles high convex, rounded, erupting sorediate in the center, strongly yellow (to greenish-yellow), scattered on a black prothallus. Medulla P+ yellow. Ap. rare. Sp. weakly muriform. Psoromic acid □ **Rh. ridescens**

3* Areoles moderately convex, erupting in the center with large fleck soralia or entirely

sorediate, gray-greenish to yellowish-green, crowded or scattered. Medulla P-/P+ yellow. Barbatic- or Psoromic acid. Ecologically like *Lecanora subaurea*, bor-mieur, Erz

Rh. sorediosum Runem.

4 Sp. 2-celled, dark brown (Sp. □ e). Medulla I-. Prothallus definite, black **5**

4* Sp. 4-celled to muriform (Sp. □ a-c, g) . **6**

5 Sp. 11-18 x 6-8 µm. Epihym. brown-black, blue-black, green-grown. Ap. -2 mm, with fine warty, usually permanent margined disk. Medulla K+ yellow, then red, P+ orange. Norstictic acid (rarely K+ yellow, P+ red: Stictic acid)

Rh. superficiale

(when thallus small, -1 cm, sp. 9-18 x 5-10 µm, parasitic on *Sporastatia testudinea*, Alps: **Rh. pusillum** Runem.)

5* Sp. 25-35 x 10-16 µm. Epihym. light to dark brown. Ap. -1.5 mm, marginless. Areoles usually very broad (-2.5 mm), coalescing, cracked undivided. Thallus usually extensive, pale green-yellow to whitish-yellow. Medulla K-, P+ yellow. Psoromic acid **Rh. alpicola**

6 Thallus medulla I- or I+ pale blue, R-. Epihym. brown-black, with ± definite black granular layer, K+ purple. Ap. usually strongly convex-marginless, -1(1.4) mm. Thallus yellow-green to green, of rounded moderately to rather convex, crowded areoles, parasitic on crustose lichens, island-form to extensive with age and ± free standing. Sp. 14-28 x 7-14 µm. ±Stictic acid

□ **Rh. viridiatrum**

6* Medulla I+ strongly blue. Epihym. brown, red-brown, without granular blackish layer . **7**

7 Prothallus whitish, blue-gray, thick. Thallus at least partially whitish-yellow and mealy pruinose. Ap. not or ± thin margined, -1(1.2) mm, epihym. red-brown, K+ red. Sp. 23-38 x 13-20 µm, few celled . **Rh. atroflavescens**

7* Prothallus scarcely recognizable or black, not whitish, thallus commonly not whitish-yellow . **8**

8 Ap. usually clearly projecting, moderately to very convex, with smooth to strongly wrinkled- warty disk and thick to thin margin, ± free standing, -0.7 mm. Sp. usually with 3 cross-walls and 1 longitudinal wall (rarely 6-7 celled), 14-23 x 8-14 µm. Thallus pale yellow, over 1 cm in size, areoles convex. Medulla K-, P+ yellow. Epihym. K- or K+ red. Psoromic acid, ±Gyrophoric acid. On vertical surfaces and overhangs in alpine sites **Rh. carpaticum**

8* Ap. slightly concave to weakly convex. Disk not wrinkled-warty **9**

9 Ripe sp. with only cross-septa or additionally with 1-2 longitudinal walls. Ap. ± sunken, -0.5 (0.8) mm. Single thallus commonly -1 cm in size, island-like (parasitic) on crustose lichens, areoles -0.6 mm. Epihym. K+ red. Medulla P+ yellow. Very rare species of higher sites . **10**

9* Ripe spores muriform. Lichen not parasitic . **11**

10 Ap. enclosed collar-like by up to half to 2/3 of the surrounding areoles. Thallus strongly yellow, areoles angular to rounded. Sp. cross-septate 4-celled, rarely with 1 longitudinal wall, 17-26 x 6.5-9.5 µm . **Rh. furax**

10* Ap. not or only little surrounded collar-like by the neighboring areoles, mostly angular. Thallus pale yellow to yellow-greenish. Sp. often cross-form divided, in top-view 2-6 celled, 14-23 x 10-16 µm **Rh. rapax**

11 Ap. for the most part surrounded by sickle-form areoles (to completely "collar-like") rounded. Epihym. brownish, olive-brown, K-/K+ greenish. Medulla P+ yellow to orange. *Rh. lecanorinum* s.l . **12**

11* Ap. not surrounded by sickle-form areoles. Epihym. K+ red or K-. Medulla P-, P+ yellow to orange **13**

12 Areoles scattered on black prothallus, high convex, yellow, medulla P+ yellow, K-. Ap. very thick margined, disk concave. Sp. 28-54 x 15-25 µm. Psoromic acid süSch

Rh. drepanodes Feuerer

12* Areoles not scattered, at least coalescing with one another into larger groups, convex, rarely flattened, yellow-green to yellow, medulla P+ orange or yellow, K+ yellow or K-. Ap. flat, without definite margin. Sp. 29-40 x 13-18 µm. Psoromic acid or Stictic acid., ± Gyrophoric acid . □ **Rh. lecanorinum**

13 Epihym. brown to olive-green, K- or K+ greenish . **Rh. geographicum (14)**

13* Epihym. ± red-brown, K+ definitely red **14**

14 Sp. 30-52 x 16-22 µm, on the average over 40 µm long, in top view over 20 cells. Ap. ± angular, -0.8 mm, flat to slightly concave. Thallus usually small, with smaller, 0.5-1.2 mm wide yellow areoles, medulla P-. (rarely Stictic acid, the P+ yellow). Al

Rh. macrosporum Räsäen

14* Sp. 24-40(45) x 11-16(20) µm, on the average clearly under 40 µm long, usually over 20 celled. Ap. angular to rounded, -0.8 mm, flat to slightly convex. Thallus small to extensive, yellow to yellow-green. Medulla P-/P+ yellow (orange), K-, C-/C± reddish. Psoromic acid or Barbatic acid, ± Gyrophoric acid. Very form-rich . □ **Rh. geographicum**

15 Thallus rust-brown to rust-red, cracked areolate. Ap. -0.6 mm, disk wrinkled or umbilicate. Epihym. green- to blue-black, olive. Sp. 12-18 x 3-7 µm, 4-celled to weakly muriform, colorless

Rh. oederi

15* Thallus not rust-colored **16**

16 Sp. 2-celled (Sp. □ e, i, l) **17**

16* Sp. with more than 2 cells, often muriform . **24**

17 Sp. colored. Thallus K- **18**

17* Sp. long time colorless (at best cast off, ± collapsing slightly colored) . **21**

18 Thallus parasitic on yellowish *Pertusaria*-species, brown, warty areolate, usually small. Ap. -0.6 mm, flat and margined, finally convex-marginless. Sp. 20-25 x 9-12 µm . **Rh. epispilum**

18* Thallus not parasitic, brown, brown-gray, gray **19**

19 Medulla I+ blue. sp. 10-16 x 5-8 µm (when sp. larger see *Rh. polycarpum*). Thallus cracked areolate, usually small, dark brown, dark gray-brown. Areoles -0.3 mm. Ap. -0.5 mm, flat, clearly margined to marginless. Epihym. brown-black to brown, K-/K+ slightly reddish. Ch- or Stictic acid . **Rh. simillimum**

19* Medulla I-. Sp. larger. Ap. -1(1.5) mm, ± flat **20**

20 Epihym. red-brown to dark brown, K+ red, without crystals. Sp. 26-36 x 13-16 µm. Thallus areolate, brown, dark brown, red- to slightly lilac-brown. Areoles high convex to flat, also separate, -1(1.8) mm. Ap. marginless, rarely thin margined. Medulla K-/P- or K+/P+ yellow. ± Stictic acid, ± Norstictic acid **Rh. badioatrum**

20* Epihym. olive-green, olive-brown, not K+ red, with crystals (polarization microscope), which dissolve in K. Sp. 21-30 x 9-15 µm. Thallus areolate, dark brown, brown, gray. Areoles flat to moderately convex. Ap. permanently margined. Medulla K+/P+ yellow. Stictic acid **Rh. jemtlandicum**

21 Medulla I+ blue. Epihym. red-brown to dark brown, commonly K+ purple-red, but also K-. Thallus (dark) brown, lilac- to red-brown, gray-brown (to light gray), cracked areolate, areoles -0.6 mm. Ap. -0.8(1) mm, usually flat and thin margined. Sp. 17-27(30) x 8-11(13) µm, with age often even 3-4 celled, rarely weakly muriform (sp. □ k). Medulla K-/P- or K+/P+ yellow. ± Stictic acid **Rh. polycarpum**

21* Medulla I-. Epihym. not K+ purple-red **22**

22 On moderately to rather calcareous rocks in high mountain. Thallus white to bluish-white, pruinose, cracked areolate to partially ± undivided. Ap. -1.8 mm, thick margined. Epihym. green, with crystals dissolving in K. Sp. 13-20 x 6-10 µm. Medulla K-/P-, K+/P+ yellow. ± Stictic acid. Alps **Rh. caeruleoalbum** (Krempelh.) Zahlbr.

22* On lime-free rock, with definite black prothallus **23**

23 Medulla K-, P-, rarely K+/P+ yellow. Thallus mostly cracked, rarely (cracked) areolate, gray-brown, red-brown, dark brown. Ap. -1(1.2) mm, flat to slightly convex, clearly margined, later convex-marginless. Epihym. greenish, gray- to red-brown. Sp. (10)15-28 x (6) 8-13 µm. ± Stictic acid . **Rh. hochstetteri**

23* Thallus/medulla K+ yellow, then red (red needles in squash preparation), thallus mostly warty, white-gray to gray, even brown tinted, usually with prothallus. Ap. -0.8(1) mm, usually flat, thin margined. Epihym. brown- to green-black, olive-green, K-/K+ greenish. Sp. 15-24 x 6-9 µm. Norstictic acid **Rh. cinereovirens**

24 Sp. colored .**25**

24* Sp. colorless (perhaps dying, breaking down slightly colored) . **28**

25 Sp. to 1-2 per ascus. Thallus gray, gray-brown, dark brown, red-brown, usually warty areolate, sometimes partially pruinose. Ap. -0.9 mm, at first flat and margined, finally convex-marginless. Epihym. red-brown to brown-black, K+ purple-red **26**

25* Sp. to 8 **27**

26 Sp. single, 48-78 x 18-33 µm. Ch, rarely Stictic acid, Norstictic acid **Rh. disporum**

26* Sp. to 2, very rarely even only single, 43-68 x 18-28 µm. Medulla K-/P- or K+/P+ yellow. Ch- or Stictic acid., ±Norstictic acid, ±Rhizocarpic acid (in varying combinations) . □ **Rh. geminatum**

27 Thallus of ± shield-form rounded, slightly concave to flat areoles with free margins, red-brown, brown, rarely blackish brown, areoles -0.8 mm, as the ap. scattered on strongly developed black prothallus. Cortex of the areoles with 20-30 µm thick epinecral layer. Medulla I-, rarely I+ pale blue, K-. Ap. -0.8 mm, usually flat, rarely convex, sitting up with a narrowed base. Epihym. brown to brown-black, K+ reddish to K-. Sp. 28-38 x 14-21 µm, very long time remaining light. With unknown lichen substances . **Rh. leptolepis**

27* Thallus warty areolate, gray to brown, rarely whitish-gray, areoles moderately to very convex, not shield-form rounded and isolated, -1.4(2) mm, coherent to at times scattered. Epinecral layer over the cortex of the areoles up to 10 µm. Medulla I+ (weakly) blue, rarely I-, K+ yellow/K-. Ap. -1.2(1.5) mm, flat to convex; usually marginless. Epihym. red-brown to brown-black, as the exc. K+ purple-red. Sp. 24-48 x 11-18 µm, soon colorless. Gyrophoric acid, (±)Stictic acid, also ±Norstictic acid **Rh. grande**

28 Sp. few-celled, with 4-8 (rarely -10) cells and at best 1 longitudinal wall per cross-section. Epihym. sometimes K+ purple-red . **29**

28* Sp. four-celled, clearly muriform, at least 1 cross-section with 2 or more longitudinal walls **32**

29 Sp. predominantly 2-celled. Epihym. red-brown to brown, mostly K+ purple-red. Medulla I+ usually blue. Hym. 60-80 µm **Rh. polycarpum (21)**

29* Sp. with more cells. Hym. 70-130 µm **30**

30 Thallus upper surface finely isidiate-granular rough, appearing sorediate on eroded places. Thallus cracked areolate, (d.)brown, brown-gray, gray. Ap. sparsely, often wrinkled on umbilicate, -1 mm. Epihym. brown to black-brown, K-. Sp.

14-22 x 8-12 µm, 4-8 celled. Medulla K+/P+ yellow. Stictic acid or Norstictic acid . **Rh. furfurosum**

30* Thallus upper surface not finely isidiate rough to sorediate **31**

31 Epihym. olive, green-gray, olive-brown, brown, not K+ purple-red. Sp. few-celled only when young, 20-33 x 9-15 µm. Thallus gray, gray-brown, dark brown, medulla K-/K+ yellow, P-/P+ yellow . **Rh. obscuratum (37)**

31* Epihym. brown-black, (like exc.) usually K+ red. Sp. usually 4-8 celled, 16-27 x 8-13 µm. Thallus gray to brown and reddish-brown, areolate to cracked areolate, areoles -0.6 mm, flat to moderately convex. ap. usually flat to moderately convex, marginless, rarely margined, -0.6 mm. Medulla K+/P+ yellow. Stictic acid, ±Norstictic acid □ **Rh. distinctum**

32 On calcareous rock or basic silicate rock. Thallus white, bluish-white or light gray, cracked areolate, medulla commonly K+/P+ yellow. Ap. margin often pruinose. Exc. with exception of the uppermost margin region colorless, sometimes with algae. Epihym. green-gray, olive, brown or greenish black, with crystals soluble in K. Stictic acid **33**

32* On lime-free rock. Thallus commonly gray to brown, rarely light gray. Epihym. commonly without crystals **34**

33 Sp. 18-28 x 10-16 µm. Ap. little to clearly rising above the thallus upper surface, -2 mm wide, thick margined, margin often pruinose, rarely also the disk. Thallus chalk-white, rarely light gray to bluish gray. On pure lime, rarely on weakly calcareous rock * **Rh. umbilicatum**

33* Sp. 20-50 x 13-24 µm. Ap. usually not rising above the thallus upper surface, -0.9 mm, black, usually with permanent margin, scattered or often in concentric rings. Margin weakly pruinose or nonpruinose. Thallus white, rarely light gray to gray. On weakly calcareous to moderately lime-rich rocks, on basic silicate rock .* **Rh. petraeum**

34 Thallus upper surface finely isidiate rough to sorediate, brown . ↑ **Rh. furfurosum (3)**

34* Thallus smooth, cracked to warty areolate **35**

35 Asci with 1-2(4) sp., sp. 25-50(60) x 13-28 µm, colorless, with age weakly greenish. Epihym. olive-green to brown. Thallus areolate. Areoles scattered to standing together, flat, rounded, brown, on black prothallus. Ap. ± round, flat to moderately convex, permanently margined. Ch- . **Rh. subgeminatum**

35* Asci with 8 sp. Epihym. olive, brown, gray, dark brown. Ap. round, disk weakly concave to moderately convex, often with umbilicus . **36**

36 Thallus, at least medulla K+ yellow, then red, P+ yellow. Thallus warty areolate, white-gray to pale brownish. Ap. -0.8 mm, flat to slightly convex, round. Epihym. brown, K-. Sp. 24-32 x 10-14 µm. Norstictic acid . **Rh. plicatile**

36* Medulla not K+ red **37**

37 Sp. 30-42 x 14-18 µm. Hym. 120-200 µm. Exc. near the hym. over (40)50 µm thick. Thallus cracked (to cracked areolate), with relatively smooth upper surface, brown, red-brown, gray-brown, gray, sometimes even ochre. Medulla R-. Ap. 0.8-1.6 µm wide, clearly rising above the thallus, flat, rarely convex, round, with usually thick (sometimes differing in color) margin. Disk smooth. Ch- .□ **Rh. lavatum**

37* Sp. 20-33 x 9-15 µm. Hym. 70-130 µm. Exc. usually narrow to lacking, on the average over 20 µm thick, but even -80 µm. Thallus cracked areolate to warty areolate, gray, brown-gray, brown, red-brown, medulla K- or K+ yellow. Ap. -0.8(1) mm, usually depressed sessile and not projecting above the thallus, concave to flat, rarely convex, thin margined. Disk rough. ±Stictic acid, rarely additionally Norstictic acid . **Rh. obscuratum**

Ecology and Distribution of the Species

Rhizocarpon alpicola (Anzi) Rabenh.
In high montane to alpine, very high precipitation sites on lime-free silicate rocks, on small boulders or foot surfaces of rocks on cold, rather long time snow covered (over 2 months) and frequently dew moistened, moderately to rather open to the wind habitats with frequently changing moisture conditions, usually on horizontal- and sloping surfaces, often in boulder fields, m.-r.acidoph., m.-r.photoph., anitroph., Char. Rhizocarpetum alp. – bor-mieur-alp – rare(R)*; Vog (over 1100 m scattered), Sch (v.rare), BayW, ThW, Erz, Hz

Rhizocarpon atroflavescens Lynge (Rh. pulverulentum (Schaerer) Räsänen)
In subalpine and alpine sites on moderately lime-rich to lime-poor rocks, above all siliceous limestone, calcareous shale, or chalky sand-stone, even on almost lime-free basic silicates, e.g. hornfels, usually on moderately to rather well lighted, moderately rain exposed vertical surfaces, (sub)neutroph.-m.basiph., in the region with *Pertusaria flavic.* – arct-alp – v.rare; Vog, Al.

Rhizocarpon badioatrum (Flörke ex Sprengel) Th.Fr.
In montane to alpine sites on lime-free silicate rocks, on cool-moist, moderately well lighted

habitats, here e.g. on sporadically irrigated or dunged sites, like *Umbilicaria deusta* (↑), commonly on smaller rocks, m.-r.acidoph., a-/m.notroph., in the Lasallietum, Umbilicarietum deustae, Rhizocarpetum alp. et al. – arct-bor-mo/alp – rare; Sch, Vog, *Ts*, Rhön, Meissner, Al

Rhizocarpon carpaticum Runem.
In subalpine and alpine sites on ± rain protected overhangs on lime-free silicate rocks on cold, foggy sites, m.acidoph., anombroph., usually in species-poor stands, also in Fuscideetum koch. or with *Pleopsidium flavum, Dimelaena* – (arct-) mieur-alp-med-alp – v.rare; süSch, BayW

Rhizocarpon cinereovirens (Müll.Arg.) Vainio
In montane sites on long-time dew moistened boulders, e.g. in boulder fields, or on near the soil rock surfaces on cool-moist habitats, e.g. like *Lecidea lithoph.* (↑), *Rh. hochstetteri* -- bor-mieur – (s.)rare*(0)*; Sch, ThW, Th, Fi

Rhizocarpon disporum (Naeg. ex Hepp) Müll.Arg.
In the foothills (and submontane), warm, usually rather low precipitation sites on neutral and basic, lime-free to slightly calcareous silicate rocks (e.g. shale, serpentine, basalt) on rapidly drying horizontal- to moderately rain exposed vertical surfaces, often on slightly dust impregnated, moderately nutrient rich, sunny sites, subneutroph.-neutroph., r.-v.photoph., thermoph., r.-v.xeroph., above all in the Lecanoretum argoph. and Lecanoretum dem. – (bor-)mieur-med – rare (R); Eif, Mos, MRh, Bo

Rhizocarpon distinctum Th.Fr.
Up into the subalpine zone on silicate rock, r.euryök, preferably on r.-v.well lighted habitats, on usually m.-r.nutrient-rich (dust impregnated or dunged) sites or on mineral-rich silicate rock, frequently going over on anthropogenic substrate (e.g. natural stone wall crowns, grave stones, roof tiles), often with *Lecanora rupicola, Candelariella vitellina,* on natural habitats often with *Candelariella cor.*, subneutroph.-m.(r.)acidoph., a/r.nitroph., Char. Aspicilietalia gibb., above all in the Parmelion conspersae, Candelarielletum vit. – bor-smed(-med-mo) – r.rare-m.frequent, in the lime regions ± rare and snyanthrop, occurrences on anthropogenic substrates on the wane

Rhizocarpon epispilum (Nyl.) Zahlbr.
Parasitic on *Pertusaria flavicans* (↑) on silicate rock on rather rain protected, sunny, warm vertical surfaces in the Pertusarietum asperg.-flav., m.(-r)acidoph., thermoph., a-(m)nitroph. – smed-med – r.rare(R); süSch (Höllental), very isolated, further occurrences toward the North disappearing

Rhizocarpon furax Poelt & V.Wirth
In subalpine and alpine, very high precipitation sites on silicate rock on rain exposed, open to the light and wind steep surfaces, e.g. with *Schaereria fusc., Ophioparma vent.* (↑), r.acidoph., anitroph. – mieur-alp – v.rare (R); süSch

Rhizocarpon furfurosum H.Magn. & Poelt
On heavy metal containing rocks, like *Acarospora sin.* (↑) -- mieur(-med) – v.rare (R); süSch, Erz, Hz

Rhizocarpon geminatum Körber (Rh. disporum auct.)
Up above the tree line on commonly mineral-rich or slightly calcareous silicate rocks (above all magmatite and metamorphite), above all on m.-r.warm, r.sunny vertical surfaces, often on sporadically slightly irrigated as well as somewhat dust impregnated sites, even on boulder talus as pioneer, rarely on anthropogenic substrates, on less warm sites as *Rh. disporum*, up into cool, very high precipitation sites, subneutroph.-m.acidoph., m.-v.-photoph., a-/m.nitroph. – arct-med – rare (3); süSch, Vog, nöPf, Eif, *Ts*, Rhön, Th, Bo as well as synanthropic occurrences

Rhizocarpon geographicum (L.) DC. (Rh. riparium Räs.) map lichen
Up into the alpine zone on silicate rock, relatively rare on lower sites, euryök, preferably on acid silicates on r.-v.well lighted rain exposed habitats; on r.-v.shady sites, on rain sheltered as well as periodically irrigated and on nutrient rich surfaces ± lacking, sparse on basic silicates, avoiding soft porous rock; also synathrop on older roof tiles and processed rock (e.g. wall crowns, old grave stones), m.-v.acidoph., ombroph., a-/m.nitroph., Char. Rhizocarpetea geogr. – arct-med -- moderately frequent; frequent in rocky silicate regions to lichen masses here and there, rare apophyte (++) in lime regions

Rhizocarpon grande (Flörke) Arnold

In submontane and montane sites on silicate rock, like *Rh. viridiatgrum* (↑), and *Rh. lecanorinum* (↑) on well lighted, mostly warm, rapidly drying out silicate rocks, e.g. in the Lasallietum -- (arct-)-bor-med -- rare; süSch, O, *FrJu*

Rhizocarpon hochstetteri (Körber) Vainio
Especially in sub- to high montane, high precipitation sites on silicate rock, usually on iron-rich metamorphite and magmatite, commonly on from time to time dropping water- or running water moistened rock surfaces or long time dew moistened boulders on away from the sun, m.well lighted, cool, usually r.-v.humid habitats, e.g. even in boulder fields, like *Porpidia glauc.* (↑), or *Lecidea lith.* (↑), (subneutroph.-)m.-r.acidoph., (r.)m.photoph. (-r.skioph.), a-(m)nitroph. – arct-smed-mo(-med-mo) – rare; süSch, Vog, Opf, BayW

Rhizocarpon jemtlandicum (Malme) Malme
In montane sites on vertical surfaces of silicate rock (above all mineral-rich rock) on r.well lighted habitats -- arct-mieur(alp) -- v.rare (R); süSch (1x)

Rhizocarpon lavatum (Fr.) Hazsl.
In montane to alpine sites on silicate rock on flooded surfaces of rocks (like *Porpidia glauc.* (↑), and *Dermatoc. lur.* (↑), and (± amphibious) in brooks, even in cool-humid boulder fields, often even (above all in alpine sites) on away from the sun near the earth, long time dew moistened, long time snow covered surfaces, on stones, in the Hymenelietea lac. –arct-mieur-mo/alp(-smed-mo/alp) -- rare; Sch, Vog, Eif, Rhön, Meissner, Erz, Alps

Rhizocarpon lecanorinum Anders
Especially in sub- to high montane sites on acid to basic silicate rocks, r.euryök, on warm as well as (more rarely) on rather cool, usually r.-v.well lighted, rain exposed habitats, even on sporadically slightly irrigated surfaces and iron containing substrates, on nutrient-poor as well as above all on moderately nutrient rich sites, m.-r.acidoph., r.xeroph.-mesoph., in numerous associations of the Rhizocarpetea, remarkable often in the Umbilicarietum deustae – (s')bor-med-mo -- r.rare; above all Sch, Vog, nöPf, Eif, Ts, Lahn, He, ThW, Erz, rarely synanthrop

Rhizocarpon leptolepis Anzi
In alpine-subalpine Sites on hard SiO_2-rich to lime influenced silicate rock, commonly on trickling or dropping water moistened steep surfaces on shady, cool-moist habitats, subneutroph.-m.acidoph., hygroph., anitroph. – bor-mieur-subalp – v.rare (1); süSch (Belchen), BayW, Erz

Rhizocarpon obscuratum (Ach.) Massal.
Above all up into high montane zone on silicate rock, especially on humid habitats on near the soil and shaded rock surfaces, bounders and stones, even on the shaded side of natural rock walls and grave stones, like *Porpidia tub.* (↑), *Lecidea lithophila* (↑), subneutroph.-r.(v.)acidoph., above all in the Porpidion tub. – (arct-)bor-med-mo – r.rare; in silicate regions rather rare to moderately frequent, in lime regions extensively lacking or synathropic

Rhizocarpon oederi (Weber) Körber
On heavy metal-rich silicate rocks, like *Acarospora sin.* (↑), but stronger hygroph., therefore usually on often long time dew moistened or rather humid as well as sporadically weakly irrigated sites, Char. Acarosporion sin. – bor-mieur – rare-v.rare (2); süSch, Vog, Eif, BayW, Erz, Hz

Rhizocarpon petraeum (Wulfen) Massal. (Rh. concentricum auct.)
From the lowlands up into alpine sites on moderately calcareous rocks to (almost) lime-free basic silicate rocks, often on slightly calcareous sandstone (red marl), on hornfels, siliceous limestone etc., (above all earlier) even on roof tiles, preferably on smaller rocks and stones (over basic or calcareous soils even on acid silicate), subneutroph., m.-r.photoph., a-/m.nitroph., e.g. in the Lecidelletum carp. – bor-med(mo) -- rare (2); e.g. Ne, Bo, Sch, *Rh*, *Hü*, Eif, *Ts*, *MRh*, *Lahn*, Th, Erz, *Do*, Al

Rhizocarpon plicatile (Leighton) A.L.Sm. (Rh. rubescens Th.Fr.)
In montane sites on silicate rock on usually m.-r.well lighted, away from the sun, humid habitats, like *Rh. obscuratum* (↑), *Rh. hochstetteri* (↑), but scarcely on irrigated surfaces – s'bor-mieur-subatl(-smed) – rare; Sch, Vog, *O*, *Ts*, *Opf*, *BayW*

Rhizocarpon polycarpum (Hepp) Th.Fr.
Above all in montane-high montane sites (up into the alpine zone) on silicate rock, preferably on

shady-humid sites, usually on vertical surfaces or as a pioneer on stones and boulders (here like e.g. *Lecidea lith.* and *Rh. obscuratum* ↑), relatively rare on anthropogenic substrate, subneutroph.-r.(v.)acidoph., v.skioph.-r.photoph., hygroph., in the Porpidion tub., even in the Parmelion consp. – arct-med-mo – r.rare; above all Sch & Vog, rare RhSch, He, ThW, O, *Ju*, Al

Rhizocarpon rapax V.Wirth & Poelt
In subalpine and alpine, very high precipitation sites on lime-free silicate rocks, parasitic on *Lecidea*-species, in the region on *L. scabridisca* (↑), -- Alp – v.rare; Vog, Alps

Rhizocarpon ridescens (Nyl.) Zahlbr.
In montane to alpine sites on heavy metal-rich silicate rocks, like *Lecanora epanora* (↑), *Lecidea silacea*, Char. Acarosporion sin. – mieur-alp/pralp – v.rare (1); süSch, Alps

Rhizocarpon simillimum (Anzi) Lettau
In submontane and montane sites on silicate rock on vertical surfaces -- s'bor-mieur-med-mo – rare, even overlooked (?); süSch (Höllental), BayW, Erz

Rhizocarpon subgeminatum Eitner
In montane sites on acid silicate rock on well lighted habitats, on sporadically slightly irrigated, rather nutrient rich surfaces – mieur – v.rare (R); nöSch, Erz, *Vog*

Rhizocarpon superficiale (Schaerer) Malme
Commonly in the alpine zone, in the region on very open to the wind, for the high places (800 m) climatically very rough localities, on steep surfaces on phonolite -- arct-alp – v.rare; Rhön (Milseburg*), Alps

Rhizocarpon umbilicatum (Ram.) Flagey (Rh. pseudospeireum (Th.Fr.) Lynge)
In alpine and subalpine, high precipitation sites on v.-m.lime-rich, rarely lime-poor rocks, especially on cold, shady steep- and vertical surfaces, rarely on boulders and stones, rather like *Porpidia speirea* (↑), e.g. in the Stenhammarelletum, basiph., m.-r.photoph., anitroph. – arct-alp – Al, Sju, v.rare süSch (R) and *Do* (dealpine)

Rhizocarpon viridiatrum (Wulfen) Körber
In submontane and montane sites on lime-free silicate rocks parasitic on *Aspicilia*- rarely other species, on ± sunny, relatively warm and usually not wind exposed habitats on rain exposed surfaces, on stones, in boulder talus, on rocks, m.-r. acidoph., r.xeroph., r.-v.photoph., a-(m.) nitroph., in the Aspicilietea gibb., especially foliose lichen poor stands – (bor-)mieur-med – rare; Sch, Vog, Bo, Pf, *O*, Sp, HeBgl, RhSch

Lit.: FEUERER 1978, 1991, TIMDAL & HOLTAN-HARTWIG 1988.

Rimularia Nyl.

Introduction

Rimularia-species (in Europe ca. 11) which earlier were accommodated in *Mosigia* and *Lecidea* have crustose, often parasitic thalli, black sessile apothecia with lecideine proper margin, branching and reticulate paraphyses, one-celled, spores sometimes colored brown with age.

R. gibbosa occurs on rain exposed or dropping water moistened vertical and overhanging surfaces on usually mineral-rich silicate rock in the mountains. *R. intercedens* seems to prefer steep surfaces of harder silicate rock on well lighted habitats. *R. furvella* and *R. insularis* live parasitically on crustose lichens on well lighted silicate rocks, the latter is limited to the *Lecanora rupicola*-group.

R. gibbosa and *R. intercedens* are lichens of the summer-green deciduous forest region. Their area reaches mainly over Central Europe, toward the North up into southern Scandinavia. The first is known in Germany in several of the central mountains, the latter is significantly rarer and is known only from the Black Forest and Erz mountain. *R. insularis* is distributed in South and Central Europe and fades away gradually in central Fennoscandia. *R. furvella* is indigenous in the boreal zone and the mountains of the deciduous forest zone.

Genus Characteristics and Determination

Thallus crustose, mostly areolate, often gray-grown, brown, red-brown, dark brown, sometimes sorediate or isidiate, at times para-plectenchymatous, with *Trebouxia*-like green

algae. Ap. usually sitting up, with black disk and proper-, sometimes with thalloid margin, in outline (in contrast to the related genus *Lithographa*) rounded. Disk often umbilicate to wrinkled. Exc. in the margin region brown to brown-black, interior brownish to colorless. Hyp. pale brown to dark brown. Epihym. brown. Hym. divided in many species by a carbonized partition. Paraphyses branched and reticulate bound. Asci broadly clavate, tholus with non-amyloid central region, an amyloid cap and amyloid lateral regions (*Rimularia*-type). Sp. one-celled, ellipsoidal, colorless to browned with age. Pycnosp. short bacillar. Ch: usually Gyrophoric acid, additionally Stictic acid, Norstictic acid.

1 Thallus parasitic on other lichens. With Gyrophoric acid . **2**

1* Thallus not parasitic **3**

2 On *Lecanora rupicola* and closely related species, shiny brown, dark brown, rarely yellow-brown, warty areolate, upper surface smooth. Ap. -0.6 mm, round to angular, clearly narrow margined, black. Hym. 50-70 µm, sp. 8-14 x 4.5-7 µm . □ **R. insularis**

2* On various crustose lichens, areolate, with rough, granular (almost isidiate) upper surface, dark brown, black-brown, dark red-brown. Ap. rare, -1.2 mm. Hym. 40-75 µm. Sp. 10-20 x 5-10 µm □ **R. furvella**

3 Thallus with isidia-like, peg-form to hemi-spherical outgrowths, often even with whitish, delimiting soralia on or instead of the outgrowth. C+ red (Gyrophoric acid). Ap. with thalloid margin and at first punctiform, later broader, often warty uneven disk. Sp. 11-30 x 7-14 µm .**4**

3* Thallus without isidia-like outgrowths, without delimiting soralia (occasionally upper surface partially granular sorediate). Usually C+ red (±Gyrophoric acid) . **5**

4 Thallus areolate, areoles convex, rarely flat, coalescing or ± separated on a black prothallus, (cocoa)brown, rose-brown, gray-brown, yellow-brown, isidia-like outgrowths 0.15-0.25 mm wide, -0.5 mm high, usually lighter on the tip, on the place of these outgrowths often with -0.5 mm wide soralia. Ap. -1.2 mm, puffy margined. Sp. 15-25(30) x 10-13(14) µm □ **R. gibbosa**

4* Thallus cracked areolate, brown, gray-brown, thin crustose, usually without conspicuous prothallus between the areoles. Isidia-like outgrowths 0.05-0.15 mm, up to 0.2 mm high, peg-form to hemispherical. Ap. very rare, like *R. badioatra* . **R. intercedens**

5 Ap. with thalloid margin, sunken, folded-wrinkled, -0.25(0.4) mm, black. Sp. 11-22 x 7-13 µm. Thallus cracked areolate, brown, gray-brown, thin crustose, usually without conspicuous prothallus between the areoles, somewhat of the habit of *Buellia aethalea*. Rarely with additional Norstictic acid **R. badioatra**

5* Ap. without thalloid margin, lecideine. Upper surface of the thallus finely granular-isidiate (to sorediate), brown, dark brown, black-brown, usually C+ red (Gyrophoric acid, ±Norstictic acid) . **R. furvella (2)**

Ecology and Distribution of the Species

Rimularia badioatra (Hepp ex Krempelh.) Hertel & Rambold (Aspicilia b. Hepp ex Krempelh. Lecidea corrugatula Arnold)
In submontane to high montane sites above all on hard, often basic, neutral or weakly calcareous, silicate rocks, e.g. basalt, mineral- rich gneiss, on m.-r.well lighted habitats, often on vertical surfaces, subneutroph.-m.acidoph., anitroph. – mieur – v.rare; süSch?, *O, Al, Solling*

Rimularia furvella (Nyl. ex Mudd) Hertel & Rambold (Lecidea f. Nyl. ex Mudd)
In montane to alpine sites on lime-free silicate rock parasitic on crustose lichens, above all *Rhizocarpon geogr*., on well lighted, wind exposed, rain exposed habitats, like *Schaereria fuscocin.* (↑), *Umbilicaria polyph.* and *U. deusta*, high point in the Umbilicarion cyl. – bor-mieur-h'mo(-smed-h'mo) – rare (3); süSch & Vog, otherwise v.rare (nöSch, Rhön, Eif, Ju, Erz)

Rimularia gibbosa (Ach.) Coppins, Hertel & Rambold (Mosigia g. (Ach.) Fr. ex Massal., Lecanora bockii (Fr.) Rabenh.)
In montane and high montane, high precipitation, oceanic sites on lime-free, but usually mineral-rich to basic silicate rocks on steep sloping- and relatively strongly rain exposed vertical surfaces, even on dripping water moistened sites under overhangs, on (m.-)r.(v.)well lighted, frequently water absorbing thoroughly worked sites, m.(-r)acidoph., r.hygroph., anitroph., in the Pertusarietum cor., Pert. -Ophioparmetum – mieur-mo, subatl – rare (3); Sch, Vog, Rhön?, Erz, BayW, Th

Rimularia insularis (Nyl.) Rambold & Hertel (Lecidea i. Nyl., L. intumescens (Flörke ex Flotow) Nyl.)
Above all in montane and high montane, high precipitation sites on lime-free, mineral rich or

slightly dunged, usually crystalline silicate rock on well lighted habitats, parasitic on *Lecanora rupicola* (↑), not including the entire habitat amplitude of the host, avoiding more strongly dunged and precipitation poor habitats, scarcely synanthropic, Char. Lecanoretum rup. – (s')bor-mieur-subatl-med – rare (3); süSch, Vog, v.rare Ts, Rhön, Eif

Rimularia intercedens (H.Magn.) Coppins
(Mosigia i. (H.Magn.) R.Sant.)
In montane sites on ± rain exposed, r.well lighted steep surfaces of rocks of hard silicate stones, m.r.acidoph., anitroph. – mieur – v.rare (R); Sch, Erz

Lit.: FRIES 1874, HERTEL & RAMBOLD 1990, MAGNUSSON 1930.

Rinodina (Ach.) S.Gray

(Key incl. Dimelaena, Phaeorrhiza, Rinodinella)

Introduction

The *Rinodina*-species are crustose lichens with usually gray to brown, in the case of calcareous living sometimes even indefinite, in rock dwelling thallus and dark brown to black apothecia. The margin of the apothecia usually contain algae and are colored like the disk or the thallus, but even in the latter case often in color less set off from the disk. The spores are in the ripe condition brown to green-brown, mostly two-celled and in most cases provided with characteristic wall thickening.

The majority of the European species are noticeable rare. Of the several species known there are only very few occurrences in Germany. This possibly depends with in many cases very specific, rarely fulfilled habitat-"demands." Consequently many species are threatened. Furthermore the epiphytic species are in regression throughout, especially *R. polyspora, R. colobina, r. albana, R. sophodes,* and even the formerly truly frequent *R. pyrina.* As in many cases precautions for their preservation may be taken, by planting and preserving free- standing (avenue trees) with subneutral bark (Norway maple, hawthorn, ash, poplar). Of the ca. 48 species known in Federal Republic of Germany, perhaps 31 are to be found in Baden-Württemberg, which underlines the rarity and dispersion of the occurrence of the Rinodinas. Five additional species are known from the neighboring Allgäu, one in the Pfälzer Forest (*R. interpolata*) and one in a nearby region (*R. trachytica*).

R. conradii overgrows mosses on old trees, on rocks or even on the soil. Earlier even occurring in the lowlands, the lichen today is only to be found in mountain sites. *R. olivaceobrunnea* and in southwest Germany only occurring in the Allgäu *R. mniaraea, R. roscida* and *R. turfacea* live in the alpine zone on mosses, remains of higher plants and humus soil. The remaining species are bark and rock dwellers.

Calcareous rock requiring *R. bischoffii* and *R. immersa,* as well as *R. calcarea, R. lecanorina, R. luridata* and *R. dubyana,* which often soon go over to small stones as pioneers. They live on well lighted places, e.g. in calcareous meager turfs, on rock caps in forest openings. *R. calcarea* and *R. lecanorina* prefer rather nutrient-rich sites. Many silicate dwellers of the genus are typical of the more rarely suited weakly calcareous or SiO_2-poor, so called neutral and basic silicate rock, which yield weakly acid to slightly basic reacting substrate. To these belong *R. milvina, R. oxydata, R. confragosa, R. venostana* and *R. trachytica. R. gennarii* and the rare to very rare *R. teichophila* and *R. tephraspis,* also reside on subneutral to weakly basic, in addition to nutrient-rich layers often from dust impregnation or organic dunging, which in our case are to be found only on habitats produced by man, like e.g. walls and grave stones. Even the two single vouchers of *R. venostana* and *R. zwackhiana* stem from wall habitats. *R. atrocinerea, R. aspersa, R. interpolata* and *R. occulta* occur on lime-free silicate rocks in sheltered valleys. Most of the rock dwellers show a preference for climatically mild to warm habitats. *r. fimbriata* lives on from time to time flooded silicate boulders in clear brooks.

Like the rock dwellers also the bark- and wood-dwellers avoid acid substrates. Subneutral conditions are especially required by *R. colobina, R. pyrina* and *R. polyspora,* which typically are on nutrient-rich bark (occasionally even wood), in addition *R. albana, R. sophodes* (especially on smooth periderm of beech, mountain ash, or hawthorn) and *R. archaea. R. pyrina* and *R. sophodes* frequently reside on thin branches. Whereas *R. colobina* occurs especially in summer-warm regions, *R. sophodes, R.*

archaea and *R. capensis*, which grows also on conifers, and *R. orculata* on high precipitation, seem to require cooler sites.

Many *Rinodina*-species are in Central Europe and are otherwise rare and show no contiguous distribution region, corresponding to the rarity of the edaphic constraints, which are underlying. A greater part has a more southern area; which is the case of the rock lichens *R. calcarea, R. dubyana, R. lecanorina* and *R. luridata*, which in Europe are distributed from the Mediterranean to South Germany and even show isolated occurrences in southern Scandinavia (above all Öland, and Gotland), in addition *R. colobina, R. aspersa, R. oxydata, R. teichophila, R. immersa, R. occulta, R. atrocinerea* and *R. gennarii*, which occur somewhat to the boundary of the summer-green deciduous forest region (or the pedunculate oak); the latter three have possibly subatlantic characteristics. *R. sophodes* and *R. efflorescens* penetrate even somewhat further toward the North. *R. venostana* is known from warm dry valleys of the Alps (especially South Tyrol) and one isolated collection site in southwestern Baden. *R. capensis* and *R. albana* are distributed in the mountains of southern Central Europe and the mountain lands of the Mediterranean region. *R. bischoffii* and *R. confragosa* are indigenous to nearly the whole of Europe. *R. castanomelodes, R. milvina, R. mniaraea, R. roscida, R. turfacea* and *R. olivaceobrunnea* belong to the arctic-alpine element and show the corresponding disjunction. Between the North European part of the area and each of the high mountains of Central- and partially even South Europe lie only a very few isolated occurrences in the high central mountains (*R. olivaceobrunnea* in the South Black Forest and *R. turfacea* in the Sudenten).

Genus Characteristics and Determination

Thallus crustose, strongly developed to indefinite and living in the substrate, usually gray to brown, rarely with soralia or isidia. Photobionts of *Trebouxia*-type. Ap. commonly occurring, commonly lecanorine, margin colored like the thallus or like the disk, with age sometimes receding. Disk brown, dark brown to black. Exc. proprium weakly to clearly developed, colorless to slightly browned, exceptionally (in the case of non indigenous species) brown. Epihym. usually brown colored, rarely blue-green to blue-black. Hyp. colorless. Paraphyses unbranched to occasionally forked, thickened above and with a brown cap. Asci clavate, of the *Lecanora*-type. Sp. according to the stage of development greenish, light- to dark brown, 2-, rarely 4-celled, ellipsoidal, structurally complicated, usually recognizable by the characteristic wall thickening. Pycnosp. bacillar. Often Ch-, not rarely Atranorin, additionally e.g. Zeorin, Gyrophoric acid.

Keying advice: The spore structure is considerably altered during spore development. For judging the spore character one must consider relatively young, not yet completely colored spores. In the case of fresh specimens one must treat the spores with K, thereby clarifying the structures.
Disk of the ap. in moist condition often lighter.

1 Thallus on mosses, plant detritus, soil, humus . **2**
1! Thallus on wood or bark . **10**
1* Thallus on rock **23**
2 Sp. 4-celled with very unequally thickened wall, 25-35 x 10-15 µm. Ap. -1 mm, dark brown to brown-black, depressed to sitting up, flat to convex, with gray-brown thalloid margin. thallus indefinite to definite, than light gray-white to brown, areolate to squamulose (very variable). Ch- **R. conradii**
2* Sp. 2-celled. Arct.-alpine species . **3**
3 Thallus lobed-foliose, underside attached with dark brown rhizohyphae, brown, on shady sites pale yellowish to ochre, occasionally pruinose. Ap. at first sunken, cryptolecanorine, then sitting up, lecanorine. Sp. 18-22 x 8-10 µm, with rather uniformly thin walls. Variolaric acid, Triterpene . **Phaeorrhiza nimbosa** (Fr.) Mayrhofer & Poelt
3* Thallus not lobed-foliose, without brown rhizo-hyphae **4**
4 Ap. margin with definite cortex . **5**
4* Ap. margin without definite cortex **6**
5 Sp. 16-24 x 7-10 µm. Ap. 0.2-0.7 mm, flat to slightly convex, dark brown to dark gray-brown. Ap. cortex I-, rarely I+ gray to blue-gray. ±Zeorine, ±Pannarin .**R. olivaceobrunnea**
5* Sp. 24-34 x 9-14 µm. Ap. 1-17 mm, concave to flat, black. Ap. cortex I+ lilac to blue-gray, rarely only gray. Sphaerophorin, ±Variolaric acid .**R. turfacea** (Wahlenb.) Körber
6 Hyp. at best 60 µm deep **7**
6* Hyp. at least 80 µm deep **8**
7 Sp. 16-24 x 7-10 µm. Medulla without Oxalate crystals see **R. olivaceobrunnea (5)**
7* sp. 25-36 x 8-13 µm. Medulla (especially outer region) with oxalate crystals. Ap. 0.5-1(3) mm, pruinose, with age sometimes nonpruinose and

blackish, concave to flat. Thallus whitish. ±Variolaric acid, ±Zeorine . **R. roscida** (Sommerf.) Arnold

8 Thallus K-. Medulla without crystals. Ap. 0.4-1.5 mm, soon convex . **9**

8* Thallus K+ yellow. Medulla with crystals soluble in K. Thallus whitish, light brown to brown. Ap. dark brown, black-brown, 0.4-1.5 mm. Atranorin, ±Variolaric acid **R. mniaraea** var. **mniaraeiza** (Nyl.) H.Magn.

9 Medulla uniformly hyaline. Sp. 20-34 x 10-15 µm. Thallus light brown, gray-brown, brown to red-brown. Ap. dark brown. Variolaric acid **R. mniaraea** (Ach.) Körber var. **Mniaraea**

9* Medulla in the lowermost region orange (K+ violet-red). Sp. 21-34 x 10-15 µm. Thallus brown to red-brown. Ap. dark brown, cinnamon brown, red-brown. Unknown Anthraquinone, ±Variolaric acid .**R. mniaraea** var. **Cinnamomea** Th.Fr.

10 Thallus with fleck soralia. Soredia 15-40 µm. Ap. rare **11**

10* Thallus without delimited soralia **12**

11 Thallus of scattered, rarely coalescing areoles, brown-gray, brown-white, areoles flat to slightly convex, 0.1-0.5 mm, almost minutely squamulose. Soralia -0.4 mm, scattered, sometimes coalescing, convex, whitish, pale greenish, greenish-yellow. K-, C-, KC-, P+ orange, UV+ orange. Ap. -0.4 mm, dark brown. Sp. 15-30 x 7-10 µm, of the Physcia-type (sp. □ a). Pannarin, unknown substance **R. efflorescens**

11* Thallus areolate, of brown, prothallus visible around the areoles, pale greenish, light gray, gray-brownish, areoles -0.2 mm, rounded, flat to convex, finally becoming entirely sorediate. Soralia numerous, blue-gray, ± convex. K+ yellow, C-, KC-, P+ yellowish. Ap. brown. Sp. 20-30 x 12-18 µm, of the Pachysporaria-type (Sp. □ e). Atranorin, Zeorin, Terpenoid . **R. griseosoralifera**

12 Epihym. blue-green, blue-gray, gray, K+ violet. Ap. -0.7 mm, with permanent, thick thalloid margin, usually sparse and scattered, ± flat, black. Sp. 15-22 x 7-10 µm, young of the Pachysporaria-type and ripe of the Mischoblastia-type, yellowish brown, torus lacking, septum as a rule not visible. Thallus gray, dark gray, bluish-black to black, cracked- lumpy, granular, warty, blastidiate. Ch- **R. colobina** (very similar is **R. pityrea** Ropin & Mayrhofer, sp. clearly fine warty, with perispore; almost always sterile, often on rock, e.g. concrete, e.g. Ne)

12* Epihym. yellowish brown, brown, red-brown, gray-brown **13**

13 Sp. to 16 per ascus, 12-16 x 6-8 µm, of the Physcia-type. Ap. -0.4 mm, red-brown, flat to convex. Thallus very thin, whitish-gray to light gray, cracked areolate. Ch- **R. polyspora**

13* Sp. to 8 per ascus . **14**

14 Sp. 4-celled, with very irregularly thickened wall, 25-35 x 10-15 µm . see **R. conradii (2)**

14* Sp. 2-celled, smaller . **15**

15 Thallus K+ yellow, C-, KC-. With Atranorin. Sp. of the Physcia-type (Sp. □ a). Ap. commonly black, with thallus colored margin **16**

15* Thallus K- . **17**

16 Ap. cortex clearly developed (take a median section!), I+ light blue. Ap. -0.7 mm, sessile, with definite thalloid margin. Sp. 18-24 x 8-12 µm, thallus white, dirty yellowish-white to beige, K+ yellow, P+ yellow. Chloratranorin, (Zeorin) * **R. capensis**

16* Ap. cortex indefinite, I-. Ap. -0.5(0.7) mm, sunken to compressed, with soon receding thalloid margin. Sp. 15-21 x 7-9 µm. Thallus white to dirty white, frequently black punctate, K+ yellowish, P+ yellowish * □ **R. exigua**

17 Ap. cortex clearly developed and of large lumen, ± spherical, made up of thin-walled cells (5-9 µm in diameter) (take a median section!), I-. Ap. -0.7 mm, dark brown to black, sp. 18-22 x 9-11 µm, of the Physcia-type with transition to the Physconia-type, with definite ornamentation (400x). Thallus light gray, brownish gray to gray, cracked areolate, areoles with tubercular-granular upper surface. Ch- . **R. albana**

17* Ap. cortex indefinite or otherwise **18**

18 Ripe spores uniformly thin-walled, only slightly thickened in the region of the dividing wall, 12-17 x 5-7 µm, usually slightly curved. Ap. -0.5 mm, dark brown to black, flat to convex, depressed to sessile, epihym. dark brown, ap. cortex indefinite, I-. Thallus thin, light gray, gray to blackish, finely granular, warty to indefinite. Ch- **R. pyrina**

18* Sp. wall irregularly strongly thickened (above all in the region of the dividing wall, usually also apically, e.g. like Physcia-type) **19**

19 Ripe spores slightly narrowed in the center and only with weak, irregular thickening, 15-18 x 7-9 µm, of the Physconia-type. Ap. -0.5 mm, dark brown to black, ± sunken to depressed, flat, usually aggregated and closely crowded in the thallus center, ap. cortex clearly developed, I+ light blue, epihym. red-brown. Thallus light gray, red-brown to dark brown, with definite, black-brown prothallus. Ch- . **R. sophodes**

19* Sp. not narrowed in the center **20**

20 Sp. of the Physcia-type **21**

20* Sp. of the Physconia-type, but in certain development stages Physcia-like. Thallus R- . **22**

21 Thallus with Atranorin. Atranorin crystals visible in the ap. margin in polarizing light see **R. exigua (16)**

21* Without Atranorin. No Atranorin crystals visible in polarizing light. Ap. -0.5 mm, dark brown to

black, with thallus colored, non corticate margin, sunken to sitting up, epihym. yellow- to red-brown, sp. 17-21 x 7-8 µm. Thallus dirty white, gray, gray-brown to brown, cracked areolate. Ch- **R. glauca** Ropin [When on *Rhododendron* and green elder in high mountain, thallus brown, yellow-brown, gray-brown, gray-green, blastidiate sp. 16-19 x 7-9 µm: **R. malangica** (Norman) Arnold (= *R. rhododendri* Hepp ex H.Magn.)]

22 Sp. 17-22 x 8-11 µm. Ap. -0.5 mm, dark brown to black, flat, convex or concave, sessile, with definite thalloid margin, ap. cortex weakly developed, I- or I+ light blue. Epihym. rod-brown. Thallus light brown, reddish-brown to dark brown, usually not coherent, clumped, knobby, or tuberculate. Zeorin **R. archaea**

22* Sp. 12-16 x 6-8 µm. Ap. -0.4 mm, dark brown to black, flat to convex, sessile, with definite, later receding thalloid margin, ap. cortex weakly developed, I+ light blue, red-brown to gray-brown, usually not coherent or reduced of few areoles between the ap. ±Zeorin **R. orculata**

23 Thallus on silicate rock . **24**

23* Thallus on lime-rich rock as well as concrete, or mortar . **38**

24 Thallus pale yellow-green to yellowish-white, interior areolate, at the margin with enlarged areoles, thereby clearly rosetted-radiate effigurate, areoles flat, angular. Ap. 0.4-1.2 mm, black, sunken to depressed. Sp. 9-13(15) x 5-7.5 µm, uniformly thin-walled. In the region Usnic acid, Fumarprotocetraric acid, ±Protocetraric acid., (Medulla P+ orange-red, C-), (Hz: Usnic acid, Gyrophoric.) . □ **Dimelaena oreina**

24* Thallus not so colored, margin not rosetted-radially effigurate **25**

25 Thallus with green-whitish (to yellow-whitish), -0.5 mm wide fleck soralia, gray to greenish-gray, warty-areolate, areoles on black prothallus. Thallus K+ yellow, soralia C+ red. Ap. rare, -1 mm, sessile, with black, when moist brown disk and projecting thalloid margin. Sp. 15-20 x 10-13 µm, with very thick walls and angular, irregular inner space (Pachysporaria-type, Sp. □ e). Atranorin, Gyrophoric acid **R. aspersa**

25* Thallus without soralia **26**

26 Ap. margin clearly colored other than the thallus, colored like the disk (lecideine, *Buellia*-like, or looking biatorine, with isolated algae in the exc.). Thallus K+ yellow (sometimes only weakly), C-,P+ yellowish. Atranorin . **27**

26* Ap. margin colored like the thallus (lecanorine)**28**

27 Sp. 11-16 x 5.5-9 µm, like the Physcia-type, with apically less strongly thickened wall. Ap. -0.3 mm, brown-black to black, soon convex, sessile, with permanent to disappearing, rarely with apparent thallus colored margin when young. Hym. 50-80 µm. Thallus white-gray, gray, ochre, areolate, usually on black prothallus. . * **R. occulta**

27* Sp. 19-25 x 9-14 µm, with very strongly thickened walls and ±heart-form lumina (Mischoblastia-type, Sp. □ f). Ap. -0.8 mm, black-brown to black, usually flat, ± sunken to projecting, biatorine to lecideine (*Buellia*-like), rarely (above all when young) with thallus colored margin. Hym. 70-115 µm. Thallus whitish, gray, brown, ochre, usually thin, continuous to cracked or even flat warty, often with black prothallus * **R. oxydata**

28 Thallus K+ yellow, P+ yellow. Atranorin . **29**

28* Thallus K- . **32**

29 Sp. of the Physcia-type (Sp.□ a). Thallus C-. Ap. -1.5 mm, black, broadly to narrowly sitting up, with projecting margin. Sp. 17-27 x 8-13 µm. Thallus white to light gray, in the herbarium slightly yellowish, cracked- to warty areolate (to sometimes squamulose), often on black prothallus. ±Chloratranorin, ±Zeorin . *□ **R. confragosa**

29* Sp. otherwise .**30**

30 Thallus C+ red (often rapidly changing!). Sp. with small ± rounded lumina (Pachysporaria-type, Sp.□ e), 15-21 x 8.5-13 µm. Ap. -1 mm, ± sunken to later broadly sitting up, dark brown to black-brown. Hym. 74-140 µm. Thallus light gray, gray, brown-gray, areolate, with black, often even prothallus visible between the areoles. Gyrophoric acid * **R. atrocinerea**

30* Thallus C- or C+ weakly yellow . **31**

31 Sp. with very strongly thickened walls and ±heart-form lumina (Mischoblastia-type), 19-25 x 9-14 µm. Thallus C- .***R. oxydata (27)**

31* Sp. to begin with heart-form inner space, apically strongly thickened (Mischoblastia-type, Sp.□ f), later going over to the Pachysporaria-type, 15-21 x 7.5-11.5 µm. Ap. -0.6 mm, sunken (cryptolecanorine) to slightly projecting, dark brown to black. Hym. 70-100 µm. Thallus light gray, gray to gray-brown, areolate, sometimes on black prothallus, K+ yellow, C+ (weakly) yellow, P+ yellow. Confluentinic-SSy., ±(unknown p-Depside of the Orcin type) * **R. trachytica**

32 Sp. of the Pachysporaria- (Sp.□ e) or Mischoblastia-type (Sp.□ f) or intermediate **33**

32* Sp. otherwise **35**

33 Sp. of the Mischoblastia-type (Sp.□ f), 22-31 x 11-17 µm. Ap. -0.8 mm, sunken to little projecting, brown-black, flat. Hym. 90-120 µm. Thallus light gray, light brown, gray-brown, areolate, on broad fringed prothallus. On watered, from time to time flooded. Ch- . **R. fimbriata**

33* Sp. midway between the Mischoblastia- and Pachysporaria-type. Not occurring on from time to time flooded habitats **34**

34 Sp. midway between the Mischoblastia- and Pachysporaria-type, torus lacking, in K somewhat swelling in the region of the septa, 20-32 x 11-19

µm. Ap. -1mm, somewhat sunken to depressed, with entire, partially slightly crenate thalloid margin, dark brown to brown-black, flat to slightly convex. Hym. 90-130 µm. Thallus dark gray, ochre, brown to dark brown, crustose to slightly squamulose, cracked-areolate t warty, with granular to warty upper surface. Ch- **R. teichophila**

34* Sp. of the Pachysporaria-type (the young with Physcia-type thickening), with definite torus, in K not swelling in the region of the septa, 17-24 x 8-14 µm. Ap. -0.9 mm, broadly sitting up, with puffy thalloid margin, dark brown to black, flat to convex. Hym. 90-120 µm. Thallus light gray, gray-brown to brown, warty to warty-areolate. K-, C+ pale red, KC+ pale red, P-. Zeorin, ±5-O-Methylhiascinic acid, ±Lecanoric acid **R. tephraspis**

35 Ripe sp. slightly narrowed in the middle, of the Milvina-type (Sp.□ b), 16-22 x 8-12 µm. Ap. -1 mm, sunken to sitting up. often thick standing and laterally flattened, black. Thallus thickish, gray, brown to dark brown, areolate. Ch- . **R. milvina**

35* Ripe sp. not narrowed in the middle, apical thickening of the Physcia-type Sp.□ a) corresponding or with relatively weaker apical thickening (midway between Physcia- and Physconia-type) **36**

36 Sp. in K somewhat swollen in the region of the septa, torus lacking, of the Dirinaria-type (Sp.□ d), 11-17 x 6-9 µm. Ap. -0.8 mm, ± sunken to broadly sitting up. flat to convex, brown, dark brown to black-brown, with permanent to receding thalloid margin. Thallus thin, whitish, light gray, light brown, to olive, cracked areolate. Ch- . **R. gennarii**

36* Sp. in K not swelling in the region of the septa, torus clearly developed, of the Physcia-type (Sp.□ a) or midway between the Physcia- and the Physconia-type. Ap. -0.5 mm . **37**

37 Sp. of the Physcia-type, 15-20 x 7.5-10.5 µm. Ap. slightly sunken to broadly sitting up, flat, black. Thallus light gray to gray, warty to cracked areolate. Ch-. Lichens of dry-warm habitats **R. venostana**

37* Sp. midway between the Physcia- and the Physconia-type, 13-18 x 6-9 µm. Ap. broadly to narrowly sitting up, with entire to pushed back thalloid margin, flat to convex, dark brown to black. Thallus light brown to dark brown, cracked to cracked areolate, ± Zeorin. Atlantic lichen **R. interpolata**

38 Sp. narrowly ellipsoidal to cylindric, 12-18 x 4.5-7 µm, for a long time colorless, later light brown, with uniformly thin wall (wall ca. 0.5 µm). Ch- **39**

38* Sp. broadly ellipsoidal, soon definitely colored **40**

39 Thallus clearly epilithic, gray-brown to dark brown, areolate, often weakly effigurate at the margin. Ap. -1 mm, sunken to broadly sitting up, lecanorine, dark brown **Rinodinella controversa** (Massal.) Mayrhofer & Poelt

39* Thallus endolithic to thinly epilithic, then whitish to light gray, ap. -0.5 mm, appearing biatorine, yet usually with single algae groups in the exc., brown **Rinodinella dubyanoides**

40 Hym. turbid because of fine oil droplets (inspersed) . **41**

40* Hym. clear, without oil droplets **42**

41 Epihym. gray-brown, K+ purple to violet. Sp. without wall thickening, of the Buellia-type (Sp.□ k), 15-19 x 8-11 µm. Ap. -0.7 mm, scattered, sessile, flat, black-brown. Thallus gray to brown, extensive, of rounded to angular squamules. Ch- . **R. zwackhiana**

41* Epihym. red-brown to brown, not K+ purple to violet. Sp. with conspicuously dark cross-band of the height of the septa, of the Bischoffii-type (Sp.□ h), 15-21 x 9-13 µm. Ap. -1 mm, with (later often pushed back) thalloid margin and definite proper margin, flat to convex, dark brown to black. Thallus indefinite to thin, whitish, gray, gray-brown. Ch- □ **R. bischoffii** (when thallus definitely epilithic, thick, gray-brown to dark brown. Ap. with puffy thalloid margin, concave to flat, black. Epihym. dark brown. Alpine sites: . **R. castanomelodes** Mayrhofer & Poelt)

42 Sp. with dark cross-band of the height of the septum (as in the case of *R. bischoffii*, but often less definite), of the Bischoffii-type (Sp.□ h), 15-20 x 9-13 µm. Ap. -0.7(1) mm, sunken in small pits of the (lime-) substrate, without (or with very early pushed back) thalloid margin. Thallus endolithic to indefinite, whitish to light gray. Ch- **R. immersa**

42* Sp. otherwise. Ap. not or only little sunken into the (lime-) substrate **43**

43 Ap. without or with very early pushed back thalloid margin, with blackish proper margin (sometimes single algae groups penetrating into the exc.), -0.6 mm, ± flat, sessile, brown to black-brown. Thallus endolithic, rarely thinly epilithic, then whitish to light gray. Ch- . **R. dubyana**

43* Ap. with definite thalloid margin. Thallus epilithic . **44**

44 Sp. during a short development phase with a dark cross band in the center of each cell, of the Bicincta-type (Sp.□ i) . **45**

44* Sp. without dark cross-band . **46**

45 Sp. 11-13-15 x 6.5-9-11 µm. Hyp. 70-90 µm. Ap. 0.3-0.6 µm, depressed, disk often pruinose, black, slightly concave to flat. Thallus thin, small, ochre, areolate. Zeorin **R. luridata**

45* Sp. 12-16-20 x 7.5-10-12 µm. Hym. 80-150 µm. Hyp. 80-150 µm. Ap. 0.5-1 mm, sunken to

depressed, disk nonpruinose, black, flat. Thallus thick, extensive, strongly developed, gray, dark gray, rarely brown, areolate. Zeorin .
□ **R. lecanorina**
(when hym. is inspersed, thallus thick, dark brown to black-brown, ap. -1 mm, concave to flat, depressed with projecting thalloid margin and definite proper margin, mieur-alp: .
R. castanomela
(Nyl.) Arnold)

46 Sp. 11-17 x 6-9 µm, of the Dirinaria-type (Sp.□ d, like Physcia-type, but the septum-region swelling in K). Usually on anthropogenic substrate (mortar, or concrete)
. see **R. gennarii (36)**

46* Sp. larger and not of the Dirinaria-type **47**

47 Sp. midway between the Mischoblastia- and Pachysporaria-type, 20-32 x 11-19 µm. On slightly calcareous substrate
see **R. teichophila (34)**

47* Sp. of the Tunicata-type (Sp.□ g, outer wall and thick outer gelatinous layer in the middle of the impression of an additional thick wall around the "actual" spore, not clearly visible in each developmental stage of the cell), 16-25 x 10-16 µm. Ap. -1 mm, sunken to sitting up, often rather sparse, black-brown to black, ± flat, with permanent, often somewhat warty thalloid margin. Thallus strongly developed, gray to gray-brown, cracked areolate, areoles often irregularly warty. Ch- **R. calcarea**

Ecology and Distribution of the Species

Rinodina albana (Massal.) Massal.
In montane and high montane, high precipitation sites on the smooth and flat cracked bark of deciduous trees, on branches and on the stem, in open mountain forests and on free-standing trees, like *R. sophodes*, neutroph.-subneutroph. – mieur-med – v.rare (1); süSch, Alps

Rinodina archaea (Ach.) Arnold (R. trevisanii (Hepp) Körber
Especially in montane and high montane, high precipitation sites on the bark of deciduous trees (above all sycamore, and mountain ash), preferably on the stem and at the stem base, often on somewhat nutrient-rich sites, (esp. in the case of eutrification) even on conifers and on wood (e.g. fences), subneutroph.-r.acidoph., photoph., m.-r.hygroph., m.-r.nitroph., e.g. with *Caloplaca cerina, Lecidella elaeochr.* (Lecanorion subf., Physcietum adsc.) – bor-mieur(?-med) – rare (3); süSch, Lux. *Vog*, Ne, *SFW*, ThW, *Av*, Al

Rinodina aspersa (Borrer) Laundon (R. fatiscens (Th.Fr.) Vainio)
In the foothills and submontane, wither-mild regions of lime-free, hard silicate rock on m.-r.well lighted, usually away from the sun, foggy, very humid, cool-oceanic habitats, commonly in boulder scree and on stones, m.-r.acidoph., anitroph. – mieur-smed -- (v.)rare (3); süSch, *O, Ts, Opf*, ThW

Rinodina atrocinerea (Hooker) Körber
In foothills-submontane, more rarely montane, winter-mild, moderately to very high precipitation sites on lime-free, rather hard silicate rock (usually granite, or porphyry) on sloping and vertical surfaces on well lighted, cool to rather warm habitats, like *Rhizocarpon virid.*, *Parmelia mougeotii* (↑), e.g. in the Umbilicarion hirs. – s'bor-atl-mieur-subatl-med-subatl -- rare; Sch, Vog, nöPf, O, *Rh-Mn- T*, Eif

Rinodina bischoffii (Hepp) Massal**.**
Up into alpine sites on carbonate rock, especially on limestone and dolomite, above all as a pioneer on stones and smaller rocks, even on walls, roof tiles etc., on rain exposed surfaces, basiph., xeroph., photoph., (a-)m.nitroph., sociologically far reaching – arct-med – m.frequent; lime region (above all Ju, Sju, FrJu, Mn, Ne, Th) and regions with calcareous alluvium, otherwise very rare

Rinodina calcarea (Arnold) Arnold
On limestone, like *Placocarpus schaer.* (↑), *Buellia venusta* (↑), e.g. in the Placocarpetum schaer. – mieur-med – r.rare; Sju-Ju-FrJu, süHü, HRh, Ne, Mn

Rinodina capensis Hampe (R. corticola (Arnold) Arnold
In montane and high montane, high precipitation sites on the smooth bark of deciduous and conifer trees (above all spruce, and beech), especially on twigs, above all on cool-moist, oceanic habitats in open spruce-beech forests in valley meadows with brook bordered stands (e.g. gray elder), subneutroph.-m.acidoph., v.hygroph., m.-r.photoph., anitroph., e.g. like *Caloplaca herbidella* (↑), in the *R. corticola-Caloplaca herbidella-* society – mieur-mo-med-mo, (oc) -- v.rare *(0)*; süSch, nöSch, *Fr*, ThW, Al

Rinodina colobina (Ach.) Th.Fr.
In the foothills to montane, usually high precipitation to moderately high precipitation,

relatively warm sites on dust impregnated, subneutral bark at the base of stems of free-standing deciduous trees (avenue trees), especially on poplar and walnut, e.g. with *Phaeophyscia nigr.*, *Xanthoria fallax* (↑), in the Xanthorion, above all Physcietum adsc. xanthorietosum fall. -- s'bor-med -- rare-v.rare (2); Ne, SFW, Ju, süRh, *nöRh*, süSch, Vog, *O, Rh-Mn-T* Th, *Av, Al*

Rinodina confragosa (Ach.) Körber (R. caesiella (Flörke ex Sprengel) Körber, R. crassescens (Nyl.) Arnold)
Up into high montane sites on lime-free to weakly calcareous silicate rock, avoiding acid silicates, above all on m.-r.rain protected, often relatively warm vertical- and overhanging surfaces, subneutroph.-m.acidoph., r.photoph., (a-)m.nitroph., e.g. with *Lecanora swartzii, L. demissa* or *Ramalina poll.* – bor-med-mo -- rare (3); Sch, Vog, Saar, Pr, Eif, *Ts, O, Fr, Opf,* ThW, BayW, *Al*

Rinodina conradii Körber
In montane to alpine, usually high precipitation sites, above all earlier even lower, over mosses at the base of older open stands of deciduous trees, usually beech, like *Chromatochlamys musc.* (↑), but even on wood or on plant detritus, then like *R. olivaceobr.*, Char. Rinodinetum conr. – bor-mieur – rare (1); süSch (above 600 m), Vog, Sju, otherwise v.rare (*Ju, nöRh,* Mos, *We)*

Rinodina dubyana (Hepp.) J.Steiner (Buellia d. (Hepp) Rabenh.)
Up into montane sites on calcareous carbonate rock, e.g. like *Caloplaca cirrochroa* (↑), above all on relatively warm, ± nutrient rich sloping- to m.rain exposed vertical surfaces, scarcely on stones, often with *Bagliettoa parmigera* -- (s')mieur-med – rare; Sju-Ju-FrJu, Th, süHü, *Ml*

Rinodina efflorescens Malme (R. hueiana (Harm.) Migula)
In the foothills and montane sites on deciduous trees (stem and branches) in open forests, on forest margins, e.g. in moist valleys, above all on oak, also on epiphytic Parmelias, m.-r.acidoph., m.photoph., anitroph., e.g. with *Parmelia sulcata* – bor-mieur-subatl-smed – rare; Ne, Sch, Ju, Lux, overlooked

Rinodina exigua (Ach.) S.Gray
Above all in the foothills and montane, rarely high montane sites on the bark of ± free-standing deciduous-, rarely conifer trees and on wood, especially on dust impregnated or nutrient rich substrates (avenue trees), often on the nature of acid bark, above all on stems of linden, or oak, m.-r.acidoph., r.xeroph., r.photoph., m.(-r.)nitroph., in the Xanthorion par., e.g. Xanthorietum cand. – bor-med – rare-r.rare (3); over the entire region

Rinodina fimbriata Körber
In the foothills and montane sites on from time to time flooded silicate boulders on brooks with clear water, subneutroph., r.photoph., hydroph. – (s'bor-)mieur-subatl-smed – v.rare *(0)*; Eif, süSch, *HeBgl (Höxter)*

Rinodina gennarii Bagl. (R. subexigua (Nyl.) Oliv., R. salina Degel., R. demissa auct.)
Predominantly up into submontane, rarely up into montane sites on lime-poor artificial stone, roof tiles, lime influenced or dunged or neutral/ basic silicate rock, high point on anthropogenic substrates (walls, grave structures), like e.g. *Lecidella carp.* (↑), subneutroph.-neutroph., in the Lecidelletum carp., Lecanoretum disp. – s'bor-med – r.rare-m.frequent

Rinodina griseosoralifera Coppins
Up into montane sites on nutrient-rich, at least subneutral bark of deciduous trees on open habitats, e.g. like *Anaptychia ciliaris, Physconia dist., Candelariella refl.* – mieur(?-smed) – rare?; Bo, Ju

Rinodina immersa (Körber) Zahlbr.
Up into alpine sites on limestone and dolomite on well lighted, half shaded to completely sunny, not (massively) eutrophied, rain exposed sites, on steep- and vertical surfaces, even on small stones in gathered stone piles/-bars (e.g. like *R. bischoffii* ↑), basiph., r.photoph., Char. Rinodinion imm. – s'bor-med – r.rare; Sju-Ju-FrJu, süHü, Th, rare Ne, Mn, HRh, Saar (shell limestone region)

Rinodina interpolata (Stirton) Sheard
In foothills, winter-mild sites on lime-free silicate rock, on m.rain exposed to r.rain sheltered vertical surfaces on overhangs, in the region like *Lecanora gang.* (↑), and in assoc. with *Lecanora swartzii, Ramalina. poll.* – bor-sub-atl-mieur-subatl – v.rare PfW

Rinodina lecanorina Massal.) Massal. (R. ocellata (Hoffm.) Arnold)
Up into montane sites on lime-rich rock, like *Buellia venusta* (↑),, Char. Placocarpetum schaer. – mieur-med – rare (3); Sju-Ju-FrJu scattered, Ne, ThW, Lahn

Rinodina luridata (Körber) Mayrhofer, Scheideg. & Sheard (Buellia l. Körber)
In montane to alpine sites on lime-rich rock on open habitats, like *Aspicilia calc.* (↑), -- mieur-med – rare *(0)*; *Ju-FrJu*, Th, *Westf*, Alps

Rinodina milvina (Wahlenb.) Th.Fr.
Above all in subalpine and alpine sites on usually neutral or basic or weakly calcareous hard silicate rock (e.g. calcareous slate, or hornfels), especially on smaller rocks, on nutrient rich surfaces or trickle or flooded sites in mountain brooks, subneutroph., photoph., a-/ m.nitroph. – arct-med-alp/h'mo – Alps, ?süSch

Rinodina occulta (Körber) Sheard (Buellia o. Körber)
In foothills and submontane, more rarely montane climatically mild sites on hard, lime-free usually acid silicate rock on rather rain sheltered vertical- and overhanging surfaces on humid, moderately well lighted habitats, r.acidoph., r.hygroph., anitroph., e.g. in the Lecanoretum orosth. – mieur-subatl-med – rare; süSch, *nöSch, O, Ts, PfW*

Rinodina olivaceobrunnea Dodge & Baker (R. archaeoides H.Magn.)
In alpine and subalpine sites over weakly vigorous mosses (e.g. *Grimmia*) usually on silicate rocks, like *Caloplaca tirol.* (↑), -- arct-alp – v.rare (1); süSch (Belchen)

Rinodina orculata Poelt & M.Steiner (R. trevisanii auct.)
In high montane and subalpine sites on conifer trees with acid bark or on wood, r.acidoph. – mieur(subco) – v.rare (?); süSch, Al

Rinodina oxydata (Massal.) Massal. (R. discolor (Hepp) Arnold)
In sub- to high montane sites on silicate rock, usually on hard, smooth, subneutral to m.acid, even occasionally irrigated or rarely flooded substrates (highest amphibian zone on the brook), often on sites with enriched nutrients, subneutroph.-m.acidoph., m.-r.photoph., m.subhydroph., a-/m.nitroph. – (s'bor-) mieur-smed -- rare (3); Sch, *Vog*, süHü (Kaiserst.), HRh, Bo, O, Saar, Eif, *MRh*, *Ts*, Hu, ThW

Rinodina polyspora Th.Fr.
Up into (high) montane sites on smooth, subneutral deciduous tree bark (ash, *Sorbus*, of hornbeam), above all on stems of younger trees and on branches, in open forests and shrubbery, e.g. like *R. sophodes* (↑) -- mieur – rare *(0)*; *Ju, FrJu, Fr, O, Do*

Rinodina pyrina (Ach.) Arnold
Up into high montane sites on smooth and flat cracked bark of deciduous trees, more rarely on wood, preferably on ash, elder or aspen, above all on branches, (m.acidoph.-)subneutroph., r.photoph., in the Lecanorion subf., like *Lecania cyrtella* (↑), -- (bor-)s'bor-mieur(subco)-med-mo -- r.rare, lacking in air pollution regions (3); e.g. Sch, Vog, Ne, Ju, süHü, Eif

Rinodina sophodes (Ach.) Massal.
Above all in montane-high montane, high precipitation sites on smooth, non eutrophied (but relatively mineral rich) bark of deciduous trees, pioneer, almost only on branches and young stems, above on *Sorbus*, ash, wild cherry, beech, on free- or open standing trees or in the crowns, subneutroph.-m.acidoph., photoph., a-(m.)nitroph., Char. *Rinodina sophodes-Parmelia exasperata*-society – s'bor-med-mo - r.rare-rare (2); above all süSch, Vog, Sju, Al, otherwise rare (süHü, Ju, *O, Ts*, Mos, *FrJu*, ThW)

Rinodina teichophila (Nyl.) Arnold R. arenaria (Hepp) Arnold)
In the foothills and submontane sites on weakly calcareous or lime- or dust impregnated, ± eutrophied silicate rock (above all sandstone, e.g. clay coal- and reed-sandstone), usually on wall crowns etc., like *Caloplaca teichol.* (↑), but scarcely on mortar and other artificial stone – mieur-subatl-med – rare (3); SFW, Ne, Hü, HRh, O, Eif, nöPf, *Rh-Mn-T, Fr, Av, Westf*

Rinodina tephraspis (Tuck.) Herre (R. badiella (Nyl.) Th.Fr.)
On from time to time moisten silicate rock or near the soil on boulders on humid habitats, occasionally even on anthropogenic substrates (walls), often with bluegreen algae lichens, subneutroph., m.-r.photoph. – bor-mieur – v.rare (1); süSch, *SFW*, o, *Ne, FrJu*

Rinodina trachytica (Massal.) Bagl. & Carestia
On basic and neutral silicate rocks, e.g. Magmatite, on warm habitats – s'mieur-med – v.rare; *nöPf*

Rinodina venostana Busch. & Mayrhofer
In the foothills, high precipitation sites on weakly calcareous or basic and neutral silicate rocks on warm, sunny, often dust impregnated rock surfaces, even on anthropogenic habitats (wall crowns) -- s'mieur-med – v.rare *(0);* süHü

Rinodina zwackhiana (Krempelh.) Körber
In foothills and submontane sites on warm, rather rain protected steep surfaces of limestone and on the flanks of walls, basiph., photoph., thermoph., nitroph. – s'mieur-smed – v.rare *(0); O*

Lit.: HECKLAU et al. 1981**, LEUCKERT & MAYRHOFER 1984**, MAGNUSSON 1947, MAYRHOFER 1984, MAYRHOFER & LEUCKERT 1985**, MAYRHOFER & POELT 1979, ROPIN & MAYRHOFER 1993

Rinodinella Mayrhofer & Poelt

(Determined ↑ Rinodina)

Introduction

The Genus *Rinodinella* related to *Rinodina* differs essentially through equally thin walled less strongly colored spores. In Germany only one or two described species occur. They reside on limestone in dry-warm climate regions, from the Mediterranean up into southern Central Europe (Swiss Jura, South Baden, one isolated occurrence in Belgium).

Genus Characteristics

Like *Rinodina* in very many characters, but sp. very thin walled, without other thickenings. Thallus endo- to epilithic, ± brown or (in the case of the indigenous species) whitish. Ap. dark brown to brown, with brown to blackish margin. Exc. lecanorine to (in the case of *R. dubyanoides*) ± biatorine. Paraphyses branching above and capitate thickened, with brown pigment cap. Epihym. brown, hyp. colorless. Asci *Lecanora*-type. Pycnosp. (short) bacillar. Ch-.

Ecology and Distribution of the Species

Rinodinella dubyanoides (Hepp) Mayrhofer & Poelt (Buellia d. (Hepp) Müll.Arg., Rinodina d. (Hepp) Arnold)
Up into submontane sites on rather hard, compact, calcareous rocks on dry-warm, rain exposed sloping- and vertical surfaces, like *Verrucaria marm.* (↑), basiph., v.photoph., a-/m. nitroph., Char. Rinodinion imm. – s'mieur-med -- v.rare; süHü, süRh, Sju

Lit.: MAYRHOFER 1984, MAYRHOFER & POELT 1978.

Ropalospora Massal.

(Determined ↑ Fuscidea)

Introduction

The *Ropalospora*-species are crustose lichens on bark and silicate rock, which in many characteristics resemble the *Fuscidea*-species, but have cross-septate spores. The single indigenous species lives on acid bark, sorediate *R. viridis*, which is rather resistant to air pollution and earlier must have been more rare. It is distributed above all in the western part of the Central European deciduous forest region (up into the southern boreal zone).

Genus Characteristics

In all important characteristics like *Fuscidea*, yet sp. repeatedly cross-septate, ± needle-form. Hyphae in the exc. narrow, equally thick (in the case of *Fuscidea* unequally thick, with ellipsoidal to rectangular lumina), Asci clavate (in the case of *Fuscidea* often slightly ampoule- like rejuvenated toward the tips). The indigenous species greenish-gray and sorediate.

Ecology and Distribution of the Species

Ropalospora viridis Tonsberg) (Fuscidea v. (Tonsberg) Tonsberg)
Up into montane sites on ± smooth bark of deciduous trees (above all hornbeam, oak) and spruce in forests and in brook bordered tree stands, above all on high precipitation and cool-moist habitats, in humid sites clearly expanding, like *Mycoblastus fucatus* (↑), but more strongly hygrophytic, m.-r.acidoph., m.photoph.-r.skioph., in the Graphidion -- s'bor-mieur-subatl – r.rare; above all Sch, Vog, SFW, O, Sp. PfW, RhSch, Av

Lit.: EKMAN 1993

Saccomorpha Elenkin

(Placynthiella Elenkin)

(Determined ↑ as well as Lecidea PT1/2)

Introduction

The *Saccomorpha*-species are crustose lichens with fine granular to warty or coralloid, light brown to brown-black thallus, sitting up light brown to almost black apothecia with biatorine proper margin and one-celled spores.

Of the at present four known species three occur in Germany. They grow on nutrient-poor, acid, humus to humus-poor sandy and loam soils, over raw humus and peat, *S. icmalea* frequently also on old wood, escaping to branches or even on to the base of trees and on rough porous silicate rock. They live mostly on well lighted sites, *S. uliginosa* often in the high moors, *S. oligotropha* and *S. icmalea* on roadside, slopes and level soils over rocks, the latter frequently in open forests and on cut-over forests. The species is very widespread in Europe, with the high point in the zone of the boreal conifer forests and the summer-green deciduous forests; *S. icmalea* has possibly a western tendency.

Genus Characteristics and Determination

Thallus crustose, finely granular, fine granular-isidiate to warty areolate, brown, dark brown, brown-green, areoles/granular paraplect-enchymatous cortex. Photobionts coccoid green algae. Ap. brown to brown-black, with (later even disappearing) proper margin. Epihym. and hym. brown, paraph. ± branching, capitate above, dark brown, hym. gelatinous I+ green-blue. Exc. paraplectenchymatous, brown. Asci of the *Trapelia*-type. Sp. commonly one-celled, ellipsoidal. Ch- or Gyrophoric acid.

1 Thallus very fine granular, fine granular-isidiate to finely coralloid or indefinite and appearing gelatinous, dark brown to black-brown, red-brown, rarely olive, brown when moist, blackish or pale greenish, granules usually under 100 µm thick **2**

1* Thallus small warty to coarsely granular, reddish yellow-brown, when moist with definite yellowish tine, granules 100-300 µm thick, R-. Ap. flat, later convex, thin and long time margined, brown-black, -0.6 mm. Sp. 10-14 x 4.5-6 µm. Ch- . □ **S. oligotropha**

2 Thallus isidiate-fine granular, i.e. of fine spherical to usually elongate or coralloid granules, granules 25-140(200) x 25-50 µm thick, light brown to dark brown or greenish, P-, K-, on abraded places, at least however in squash preparations C+/KC+ red. Ap. when occurring, usually 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, ± 5-*O*-Methylhiascinic acid . □ **S. icmalea**

2* Thallus of rounded (never definitely elongated) granules (diameter 25-100 µm), dry often very finely wrinkled (50 fold magnification), dark brown, rarely dark green, slightly gelatinous when moist, R-. Ap. numerous, -0.3 (0.4) mm, often coalescing, rose-brown to red-brown (to black-brown), soon convex marginless. Sp. 9-14 (16.5) x (4)5-6(7) µm. Ch- . **S. uliginosa**

Ecology and Distribution of the Species

Saccomorpha icmalea (Ach.) Clauz. & Roux (Placynthiella i. (Ach.) Coppins & P.James, Lecidea uliginosa (Schrader) Ach. s.l.)
Above all up into the montane zone on acid, usually nutrient-poor, sandy to loamy, humus to humus-poor soils, above all on roadsides, open slopes, rocky openings, on peat and raw humus, on old, moderately to very decayed wood of stumps etc., often on cross-sections of posts and wood of fences (here almost always with *Trapel. flexuosa*, occasionally on acid/very acid bark of trees or on rough, porous silicate rock (m.)r.-v. acidoph., r.skioph. -v.photoph., a-(m.)nitroph. – bor-med -- frequent

Saccomorpha oligotropha (Laundon) Clauz. & Roux (Placynthiella o. (Laundon) Choppins & P. James, Lecidea o. Laundon)
Up into high montane sites on nutrient-poor, acid, cool soils, e.g. on sandy, humus loam soils on road slopes, in openings of silicate meager turf, additionally on peat soils (on drained high moors), on spongy raw humus- and decomposed surface of silicate rock, r.-e.acidoph., substrathygroph., m.-v.photoph., anitroph., e.g. in the Lecidetum uliginosae -- bor-mieur – rare; in the distribution region of metamorphic and magmatic silicate rock, of the bunt sandstone and red marl, moors – bor-mieur – r.rare-rare; Sch, SFW, O, Rh, RhSch, He, BayW, et al.

Saccomorpha uliginosa (Schrader) Haf. (Placynthiella u. (Schrader) Coppins & P. James, Lecidea u. (Schrader) Ach.)
Up to above the tree line on very acid soils, raw humus, peat, on pathways, slopes, in the high moors, in openings of silicate meager turfs and dwarf shrubby heath, rarely on strongly decayed wood, usually on humid sites, r.-e.acidoph., m.-v.photoph., anitroph. – arct-med-mo -- r.rare; above all Sch. Vog, Bo, Av, Al

Lit.: COPPINS & JAMES 1984, VAINIO 1934

Sagiolechia Massal.

(Determination ↑ Gyalecta)

Introduction

The *Sagiolechia*-species have simple thin crustose thallus with *Trentepohlia*-algae, black apothecia with black or pale, deeply crenate projecting margin and often umbilicate to grooved disk and four-celled cross-septate spores. Of the two species of the genus, one is represented in Germany. It grows on shady, humid habitats on limestone. It is distributed in North Europe and mountains of Central and South Europe.

Genus Characteristics

Thallus crustose, thin or endolithic, light orange to slightly violet tinted, in the herbarium gray-greenish to gray-white, with *Trentepohlia*. Ap. black, without thalloid margin, with black to pale, crenate proper margin and sometimes umbilicate to grooved disk. Hym. sometimes divided below by conical sterile exc. tissue, brownish to colorless, I+ blue. Exc. exterior black-brown, toward the interior yellow-brown to colorless and cartilaginous. Epihym. dark brown, paraphyses simple to sparsely branched, isolated bound. Hyp. colorless to dark. Asci clavate-cylindric, wall I+ blue, tholus K/I-. Sp. 4-celled, ± fusiform. Ch-.

Ecology and Distribution of the Species

Sagiolechia protuberans (Ach.) Massal.
From the montane up into the alpine zone, rarely lower, on calcareous rock on shady moist sites, on vertical surfaces like *Petractis hypoleuca* (↑), and *Acrocordia conoidea* (↑) -- arct-med-mo – rare, probably usually sterile and overlooked; Sju-Ju-FrJu, Al

Lit.: VĚZDA 1967

Sarcogyne Flotow

(Key incl. Polysporina)

Introduction

The *Sarcogyne*-species are rock dwellers and depicted by a simple crustose, often scarcely visible (even endolithic) thallus, apothecia sitting up or sunken with black proper margin and dark red to black, sometimes pruinose disk, and very small, one-celled, spherical to ellipsoidal colorless spores, which lie in the ascus in great number. They differ from the species represented in the genus *Polysporina* by habit because of the smaller black apothecia with grooved disk, and anatomically because of other paraphyses and asci.

Of the eight species known in Germany only three occur in Baden-Württemberg. *S. regularis* grows on limestone and goes over frequently to anthropogenic substrate; it is found above all on competition-poor, thinly populated silicate rocks

and stones. It is distributed throughout Europe. *S. clavus* resides on silicate rock and prefers cracks on vertical surfaces. *S. privigna* occurs mainly on slightly calcareous rocks. The area of this species stretches from parts of South Europe over Central Europe up to southern Fennoscandia. *S. algoviae*, *S. cretacea* and *S. fallax*, lichens of calcareous rocks, are known in higher places of the North Alps, e.g. in the Allgäu.

Genus Characteristics and Determination

Thallus crustose, definitely to indefinitely developed, even endolithic, with coccoid green algae, e.g. *Myrmecia*. Ap. sunken to sitting up, reddish-black to black, pruinose to nonpruinose, without thalloid margin, with (with age even disappearing) proper margin. Exc. interior light, exterior black-brown, of radial hyphae. Hyp. colorless to brown. Paraphyses simple, capitate thickened above, clearly septate. Epihym. yellow-brown, red-brown, dark brown. Asci of the *Acarospora*-type, clavate to swollen in the lower part, strongly thickened above, a thin outer layer I+ blue, tholus K/I-. Sp. very numerous in the ascus, one-celled, narrowly ellipsoidal. Pycnosp. ellipsoidal to almost spherical. Ch-.

All included species Ch-.
Polysporina: upper surface of the hymenium and outer layers of the exc. carbonaceous hard, paraph. branched, reticulate, not thickened above, indefinitely septate. Disk umbilicate, warty to wrinkled – Sarcogyne: upper surface of the hym. not carbonaceous hard.

1 On limestone. Hym. red-brown to dark brown above. Paraph. commonly not or only isolated branching. Ap. pruinose or nonpruinose, disk not umbilicate, not grooved **2**
1* On (commonly lime-free) silicate rock. Disk not umbilicate or umbilicate-grooved . **5**
2 Sp. predominantly at least twice as long as wide, elongate (-ellipsoidal) to cylindrical, 3-6 x 1.5-2 µm. Ap. red-brown to blackish, usually bluish-white pruinose, when moist red-brown to dark red, rarely remaining black, sessile to sunken into the rock, flat, -1(1.8) mm, rather variable. Thallus usually indefinite □ **S. regularis**
2* Sp. predominantly less than twice as long as wide, spherical to broadly ellipsoidal, 3.5-5 x 2-3.5 µm. In higher places. Alps . **3**
3 Ap. usually deeply concave, black, entirely sunken, often angular, -0.8 mm. Thallus thick, chalky white **S. cretacea** Poelt
3* Ap. not deeply concave, thick bluish-white pruinose, -1 mm **4**
4 Lacking epilithic thallus **S. fallax** H.Magn
4* Thallus definite, chalk-white **S. distinguenda** Th.Fr.
5 Ap. (even moist) entirely black, carbonaceous-hard, 0.3-0.6(1) mm, disk uneven, grooved, umbilicate in the center, margin often puffy, curved and crenate. Hym. above (in the region of the navel) dark brown, black-brown, paraph. branched and reticulate **6**
5* Ap. dark red-brown to red-black, moist dark red, with black raised margin, usually over 0.5 mm, not rarely even compressed angular at the sides. Disk not warty or grooved, only occasionally umbilicate. Hym. above yellow- to red-brown, paraph. predominantly simple. Sp. 3-5-6 x 1-1.5 µm. Thallus indefinite . **7**
6 Ap. on parasitising foreign thallus or brown true thallus, weakly to clearly margined. Sp. 4-5.5 x 2-3 µm. Foreign thallus usually cracked areolate or squamulose, C- or C+ red. ±Gyrophoric acid **Polysporina lapponica**
6* Thallus indefinite or very thin and scruffy, gray, lichen not parasitic. Ap. often puffy margined. Sp. 3-5 x 1.5 µm **Polysporina simplex**
7 Ap. 1-3 mm, with thick, projecting, irregular cracked to coarsely warty, finally thin margin, singly or to 2-6 crowded and flattening themselves, otherwise very scattered, round to often irregularly angular to wrinkled, sometimes with navel, narrowly sessile, 0.3-0.7(1) mm high, often sessile along fine cracks. Hym. 85-115 µm. Carbonaceous exc. laterally 35-75 µm thick (central section). Hyp. usually brownish . □ **S. clavus**
7* Ap. 0.5-1 mm, with entire smooth, often curved margin, singly, numerous to scattered, -0.3 mm thick. Disk flat to moderately convex, not umbilicate. Hym. 60-95 µm. Carbonaceous exc. laterally 18-30(45) µm thick. Hyp. ± colorless to pale brownish . **S. privigna**

Ecology and Distribution of the Species

Sarcogyne clavus (DC.) Krempelh.
Up into high montane sites on usually mineral-rich silicate rock, especially on granite and metamorphite, often even on weakly eutrophic sites, in cracks with occasionally out flowing irrigating water, especially on vertical surfaces, even under overhangs, sometimes on dressed stone (dry walls), subneutroph.-m.acidoph., xeroph., m.-r.photoph., a-/m.nitroph., pioneer, often without neighbors, even in the Umbilicarietum hirs., Lecanoretum dem. – s'bor-med -- rare; Sch (up to 1200 m), O, Ts

Sarcogyne privigna (Ach.) Massal.
Up into montane sites on lime-free, but usually mineral-rich or slightly dust impregnated, or on slightly calcareous silicate rock, above all on porous or rough rocks, e.g. sandstone, granite, even delimed dolomite, above all on vertical surfaces, often on dressed stone (dry walls), pioneer, e.g. with *Lecidella stigmatea, Lecanora mur.*, subneutroph., r.xeroph., m.-v.photoph., m.nitroph. – s'bor-smed-mo(-med-mo) – rare (3); Ne, SFW, Sch, O, Sp, Mn, Ts, Mos, Eif

Sarcogyne regularis Körber (S. pruinosa auct.)
Up into the alpine sites on lime-poor to above all on lime-rich rock, on small stones as well as on cliffs and on walls, even on mortar, artificial stone, loess as well as dust impregnated silicate rock (e.g. sandstone walls), r.euryök, but moderately strong competitor, pioneer, above all on well lighted, dry (but rain exposed) habitats, basiph., sociologically. rather vague – arct-med – m. frequent, introduced in the silicate region

Lit.: FRIES 1874, MAGNUSSON 1935, VÈZDA 1987

Sarcopyrenia Nyl.

Introduction

The *Sarcopyrenia*-species grow on other lichens; at least partially destroying the foreign thallus. Its own thallus is not visible. The black perithecia are almost spherical, hemispherical to deformed, sitting on the foreign thallus or half sunken; their mouth is often projecting.

The genus includes four, in Germany two species. The species verified in Baden-Württemberg, *S. gibba*, grows on nutrient-rich habitats on calcareous rocks (e.g. on bird roosts) and going over frequently onto artificial substrates. It spreads out centrifugally over other crusts and leaves circular dying regions. It is distributed from the Mediterranean up into Central Europe.

Genus Characteristics

Lichenologically, without its own definite thallus. Per. black, with thick paraplect-enchymatous, outer black receptacle of polygonal-isodiametric "cells." Hym. colorless, I-. Paraphyses simple, gradually dissolving. Periphyses thin, above all in the region of the ostiole. Asci cylindric-clavate, fissitunicate, *Verrucaria*-type. Sp. one-celled to septate, bacillar, worm-form, filamentous or approaching dumbbell form.

Ecology and Distribution of the Species

Sarcopyrenia gibba (Nyl.) Nyl.
Up into submontane, rarely montane sites on m.-v. lime-rich rock, lichens infected and dying, especially on anthropogenic, ± nutrient-rich habitats, above all walls, often on artificial rock (concrete, and mortar), like *Caloplaca teich.* (↑), rarely on natural habitats, here like *Candelariella med.* (↑), on bird roosts, basiph., r.-v.photoph., xeroph., m.-r.(v.)nitroph., in the Caloplacion dec. – mieur(subatl)-med – r.rare; in the entire region

Next to *S. gibba* with 25-44 x 2.5-5 µm, sp. clavate thickened on the ends, found in Germany (Westf.) is **S. beckhausiana** (Lahm) Aguirre, Nar.-Ros. & Hladun (Leptorhaphis b. Lahm) with 45 x 1-1.5 µm, filamentous sp.

Lit.: MIGULA 1929-31, NARARRO-ROSINES & HLADUN 1990.

Sarcosagium Massal.

(Determination ↑ Biatorella)

Introduction

The till now single species is recognized by a thin crustose thallus, puffy margined, rose to brown-red apothecium and multispored ascus, belonging therefore to the formerly compound genus *Biatorella*. Anatomical characteristics justify the independent status. *S. campestre* lives – usually only as previous founder – on base-rich soils, dying mosses and other plant remains, even on old fire sites. The lichen is widely distributed in Europe, but rare. In Baden-Württemberg it is missing, possibly only overlooked.

Genus Characteristics

Thallus thin crustose, gray to greenish, with coccoid green algae. Ap. rose to brown-red, with puffy proper margin. Exc. exterior paraplectenchymatous, interior of entwined hyphae. Paraphyses simple to sparsely branched, thickened above, asci uniformly thin walled, without tholus, K/I+ blue. Sp. very numerous in the ascus, one-celled, very small, cylindric. Ch-.

Ecology and Distribution of the Species

Sarcosagium campestre (Fr.) Poetsch & Schiederm. (Biatorella campestris (Fr.) Almq.)
Up into alpine sites on usually calcareous, sandy, stony to pure loam soils, on loess, over dying mosses and plant detritus, decayed wood, on old fire sites, on slopes, in openings of dry turf, usually on ephemeral habitats, m.basiph.-subneutroph., r.skioph.-r.photoph., social. less specific, often only with few lichens – bor-smed – v.rare-rare, probably even overlooked *(O); Ju,* Lux, He (Meissner-foothills)

Lit.: POELT & VÈZDA 1977

Sarea Fr.

(Determination ↑ Biatorella)

Introduction and Genus Characteristics

The two species of the genus are on resin of conifer trees living as saprophytic fungi with yellow-red, red-brown to black apothecia with biatorine proper margin and multispored asci with very small spherical, one-celled spores. *S. resinae* prefers relatively fresh resin of larch and Scot's pine, *S. difformis* older resin of fir. Both are distributed in the boreal zone and corresponding sites in Central Europe.

Ecology and Distribution of the Species

Sarea difformis (Fr.) Fr. (Biatorella d. (Fr.) Vainio, Tromera d. (Fr.) Rehm)
Above all in montane and high montane sites in the interior of spruce-beech- and spruce-fir forests on old, weathered resin of stems especially on fir and spruce – bor-mieur-mo – r.rare; Ju, Sch, *Ne (Trillfingen)*

Sarea resinae (Fr.: Fr.) Kuntze (Biatorella r. (Fr.) Th.Fr., Tromera r. (Fr.) Körber)
Up into high montane sites on not to older, upper surface solidified and ± weathered, interior often still viscous resin on stems of conifer trees, especially Scot's pine and larch, usually in Scot's pine rich (spruce-)fir- and moor forests – bor-smed-mo – rare; Sch, O, Sp, Saar, PfW, Ts, Eif, *We*

Lit.: MAGNUSSON 1935.

Schaereria Körber

(Determination ↑ Lecidea)

Introduction

The genus *Schaereria* includes lichens with crustose or lumpy-squamulose, gray to brown thallus, sessile to sunken black apothecia without thalloid margin. The two representa-tives occurring in Germany of the at this time ca. five species numbered in the genus live on (often mineral-rich) silicate rock on well lighted ledges in montane to alpine sites. They occur predominantly in the boreal zone and the mountains of the deciduous forest region, in Central Europe in the Alps and the silicate central mountains; *S. cinereorufa*, the more important rarer of the two, is known from the extra-alpine Central Europe only from the Sudenten, the Bohemian Forest, The Vogesen, the Eifel and the Black Forest. This species is framework of the consolidation of arable land in considerable regression. As in the case of many other species numerous occurrences are being destroyed by the "removing stones" from meager turf.

Genus Characteristics

Thallus crustose, areolate to squamulose-lumpy, gray to brown. Photobiont *Trebouxia*. Ap. sunken to sitting up, black, with definite to indefinite proper margin. Exc. dark brown. Hyp. brown, above even light. Paraphyses

unbranched to sparsely branched above, loose (at least in K). Epihym. blue-green, green to violet. Asci uniformly thin-walled, cylindric to rarely clavate, without tholus, wall I-, gelatinous outer layer I+ weakly blue. Sp. one-celled, globose to ellipsoidal. Ch: Gyrophoric acid.

Ecology and Distribution of the Species

Schaereria cinereorufa (Schaerer) Th.Fr. (Lecidea c. Schaerer)
In (high) montane to subalpine, high precipitation sites on mineral-rich silicate rock, above all gneiss, slate, commonly on rough, rain exposed sloping- and vertical surfaces, usually on boulders or near the soil, sometimes also sporadically slightly irrigated cliff surfaces, on well lighted, but often less sunny, hydrostatically, favorable habitats, m.acidoph., hygroph., (substrathygroph.), (m.-)r.photoph., anitroph., Char. Pertusarietum cor., in the Pert.-Ophioparmetum – bor-mieur-mo – rare (3); süSch, Vog, Rhön, BayW, Eif

Schaereria fuscocinerea (Nyl.) Clauz. & Roux (Sch. tenebrosa (Flotow) Hertel & Poelt, Lecidea t. Flotow)
In high montane and subalpine, rarely alpine or montane, high precipitation sites on hard lime-free silicate rock on r.-v.wind exposed, well lighted habitats, like *Umbilicaria polyph.* (↑), *Ophioparma* (↑), m.-r.acidoph., r.-v.photoph., a-(m.)nitroph., Char. Umbilicarion cyl. – (arct-) bor-h'mo/alp – rare (3); süSch and Vog over 900 m r.rare, nöSch, Rhön, Saar, Hu, Ts, Eif, ThW, Erz, BayW, Hz, WeBgl, Rothaargeb., Al

Lit.: FRIES 1874, HAFELLNER 1984*, POELT & VÈZDA 1977, STEIN 1879, VAINIO 1934.

Schismatomma Flotow & Körber ex Massal.

Introduction

The *Schismatomma*-species are crustose lichens with simple structured thallus with *Trentepohlia*-algae. The apothecia are blackish, sometimes white pruinose, marginless or nor sharply walled off from the thallus. They have cross-septate four-celled, fusiform to needle-form colorless spores. In the narrow sense the genus numbers only eight from the North Hemisphere and New Zealand.

The three representatives of the species occurring in Germany reside predominantly on acid bark on rain protected sites. *S. pericleum* is found on conifer trees in near natural mountain forests, rarely on deciduous trees and is distributed in the southern boreal zone and in Central Europe. *S. decolorans* prefers old oaks in open forests and on forest margins. Both species are in regression. Their area stretches from the Mediterranean region up into the deciduous forest region of southern Sweden. The third *S. graphidioides,* appears very endangered, occurring mostly on smooth bark of deciduous trees in the mild atlantic-subatlantic region.

Genus Characteristics and Determination

Thallus crustose, clearly developed to living in the substrate (bark), unlayered, white, white-gray, brownish gray, sometimes sorediate, with *Trentepohlia*. Ap. rounded to elongate, blackish, but usually pruinose, with commonly weakly developed, in old ap. disappearing decorticate thalloid margin. Exc. reduced, brown. Hyp. dark brown, rarely light. Paraphysoids simple to sparsely branched, reticulate. Epihym. brown. Asci clavate, thickened above, with I+ blue ring in the tholus, fissitunicate. Sp. 4-celled, fusiform to fusiform- needle like. Pycnosp. as a rule bacillar or rarely filamentous, curved. Ch: Rocellic acid. Thallus R-.

1 Thallus on silicate rock, (chocolate) brown, with ± sorediate upper surface and therefore often ochre colored (eroded ± whitish), in the herbarium soon ochre-yellow, R-, UV+ yellowish (fresh ice-blue), often extensive, up to 1 mm thick, dull, somewhat spongy soft. Prothallus dark brown to black. Ap. rare, black-brown, -1.5 mm, round to lobed in outline, with ± well developed wavy thalloid margin, sitting up, nonpruinose. Epihym. brown, sp. fusiform, 4-celled, slightly curved, 19-25 x 3-5 µm. Schizopeltic acid et al **Lecanactis umbrina** (see also *Opegrapha gyrocarpa*)

1* Thallus on bark. Roccellic acid **2**

2 Thallus sterile, light brownish-gray, rose-gray, lilac-gray, with -0.8 mm wide, at times coalescing soralia, ± cracked, R-, UV-. Rarely Atranorin. On old deciduous trees

.**Sch. decolorans**

2* Thallus with -0.8 mm ap. Sp. fusiform (-needle form). Closely related species . **3**

3 Ap. rounded to shortly elliptic, flat, nonpruinose to slightly pruinose when young, thalloid margin the height of the disk or somewhat puffy, thick, with age often disappearing. Sp. 4-celled, 25-42 x 2.5-4 µm. Fresh thallus rose-whitish, in the herbarium gray-white, thin to in places very thick, even partially leprose-sorediate . **Sch. pericleum**

3* Ap. elliptical to long streaked with crack-form disk and pointed ends, simple, branched or star-form, sunken. Sp. 4-celled, 24-36 x 3-3.5 µm. Thallus thin, not sorediate-leprose **Sch. graphidioides**

Ecology and Distribution of the Species

Schismatomma decolorans (Turner & Borrer ex Sm.) Clauz. & Vèzda (Arthonia d. (Turner & Borrer ex Sm.) Erichsen)
In foothills-submontane, relatively winter-mild regions almost only on old oak stems, above all at the stem base, like *Lecanactis am*. and *Arthonia byssacea*, but clearly tolerant of eutrification, often in contact with *Ramalina poll.* (↑), m.acidoph., m.photoph.-r.skioph., a-/m.notroph., Char. Arthonietum pruin. – mieur-subatl-med – rare (3); Ne, Hü, Rh, Bo, Do, Ju, SFW, Sp, Mos, Lux, Th

Schismatomma graphidioides (Leighton) Zahlbr. (Enterographa rimata (Nyl.) Zwackh)
In foothills and submontane winter-mild sites in humid deciduous forests (e.g. oak-hornbeam forests) on smooth to flat cracked, subneutral to m.acid bark, above all on *Fagus, Sorbus auc.*, rarely *Fraxinus*; m.photoph.-r.skioph., v.hygroph., anitroph. – mieur-atl-med-subatl – v.rare (0); *O, Sch*

Schismatomma pericleum (Ach.) Branth & Rostrup (Sch. abietinum (Humb.) Almq.)
In montane and high montane, usually high precipitation sites on the bark of fir and spruce in fir- and fir-spruce forests, in lower sites on oak, on rain sheltered stem surfaces on very humid, often from time to time relatively dry, cool to cold habitats, like *Calicium vir.* (↑), but stenök, r.-v.acidoph., r.skioph., anitroph., above all in the Calicietum vir. – bor-mieur-mo (-smed-mo) -- rare (2); Sch, Sb, Ju(-*Ne*), *SFW, nöRh, O,* ThW, *Al*

Lit.: TEHLER 1993

Sclerophora Chevall.

(Determination ↑ Chaenotheca)

Introduction

The *Sclerophora*-species have a thallus living in the interior of the wood with *Trentepohlia*-algae and a delicate stalked fruiting body, like those frequently occurring in the "dust fruiting" lichens. The stalks are whitish, yellowish or red-brown. The spherical to conical capitula are pruinose and covered by a pale spore mass.

The genus is widely distributed in both hemispheres. There are five known species, three in Europe. They sit in rain sheltered cracks of subneutral to weakly acid bark of old deciduous trees, *S. nivea* and *S. farinacea* especially on well lighted sites, *s. peronella* more on moist shady sites. Their area stretches over Central European deciduous forest region (with the north boundary in south Scandinavia).

Genus Characteristics

Thallus crustose, in the substrate, with *Trentepohlia.* Ap. stalked, with spherical to conic capitula and pale, usually light brown mazaedium. Stalk yellow, pale brown, red-brown. Exc. well developed, fastening at the base of the stalk. Sp. one-celled, pale, spherical, very finely warty ornamented. Ch-.

Ecology and Distribution of the Species

Sclerophora farinacea (Chevall.) Chevall. (Coniocybe f. (Chevall.) Nyl.)
Like *S. nivea* (↑), -- mieur – v.rare (0); *Ba*

Sclerophora nivea (Hoffm.) Tibell (Coniocybe n. (Hoffm.) Arnold, C. pallida (Pers.) Fr.)
In the foothills and submontane, rarely montane sites on deep cracked, mineral-rich, yet scarcely decayed bark of old deciduous trees, almost only on elm, ash, maple, summer linden, especially in linden-maple forests, ash stands, in parks, on single trees, on climatically mild, usually m.(-r.)

well lighted sites, subneutroph., (r.)anombroph., hygroph., usually with or without few neighbors, often with *Opegr. varia* – (s'bor-)mieur-med-mo – rare (2); above all Ju, otherwise v.rare: Ne, süSch, Sju, Bo, *nöRh, O, Rh-Mn-T*, Th

Sclerophora peronella (Ach.) Tibell (Coniocybe p. (Ach.) Tibell, C. hyalinella Nyl.) Above all in montane (to high montane), often oceanic, high precipitation sites on cracked, often already decayed bark of old deciduous trees (rarely spruce), even on decorticate stems in the region of old near natural forests, m.acidoph., v.hygroph., anombroph., m.photoph.-r.skioph., anitroph., usually without companions -- (s'bor-)mieur(-med-mo) -- v.rare (1); süSch, *SFW*, ThW

Lit.: TIBELL 1973, 1978a, 1984*, VAINIO 1927

Scoliciosporum Massal.

Introduction

The *Scoliciosporum*-species are lichens with crustose, finely granular, gray to greenish thallus, small sessile, soon convex and marginless, pale to black apothecia and needle- form, curved to spiral wound or long fusiform cross-septate spores.

Of till now about eight described *Scoliciosporum*-species six are indigenous to Germany. *S. chlorococcum* grows mainly on bark, *S. umbrinum* on rock. It behaves as uncommonly tolerant to toxins, eutrification, high heavy metal burden and effects of acid emissions enduring species, which in the last ten years has become more frequent and evidently even has extended its area. *S. sarothamni* lives on bark, rarely rock; the taxon is insufficiently known. *S. umbrinum* is distributed over all of Europe, *S. chlorococcum* mainly in the boreal region and in the deciduous forest region, the bark dwelling *S. pruinosum* atlantic distributed.

Genus Characteristics and Determination

Thallus crustose, granular-scruffy to mealy, thin, rarely diffuse sorediate, unlayered, with coccoid green algae. Ap. soon convex and marginless, sitting up with narrowed base, whitish to black. Exc. of paraphyses-like, radial, branched hyphae embedded in gelatin, light. Hyp. colorless to pale. Hym. I+ blue, epihym. colorless to colored. Paraphyses branched and reticulate. Asci bulbous to narrow clavate-cylindric, with thick tholus, *Lecanora*-type. Sp. 4- to multicellular, needle-form with one narrowed end, septa often indefinite. Pycnosp. small, curved, macroconidia cylindric to slightly curved. Usually Ch-.

1 Ap. whitish to brownish, thickly white pruinose, 0.1-0.4 mm, with rapidly disappearing margin. Sp. filamentous, spirally twisted in the ascus, when free S-form wound to rarely ± straight, 4-6 celled, cross-walls scarcely recognizable, 21-32 x 1-1.5 µm. Exc. clearly developed. Epihym. with granular, ± yellow-brown layer. Pycn. frequent, black, -0.1 mm. Thallus whitish-green, granular . □ **S. pruinosum**

1* Ap. dark, red-brown to black **2**

2 Sp. almost straight or slightly curved, 20-38 x 3-5 µm, usually 8-celled, long fusiform. Epihym. red-brown, brown, sometimes olive (brown). Ap. -0.4 mm, dark brown-red, dark brown to black, often shiny, ± strongly convex, single or in small groups. Thallus thin to thick, finely granular, sometimes becoming almost sorediate, of goniocysts, gray- to dark green, similar to an epiphytic algae layer □ **S. chlorococcum**

2* Sp. at least in part strongly curved to S-form **3**

3 Thallus gray-yellowish, gray-greenish, brown-greenish, partially erupting to (coalescing) irregular fleck soralia, soredia (green) yellowish, KC± weakly red (squash preparation). Sp. and ap. as in the case of *S. umbrinum*. (Gyrophoric acid) . **S. sarothamni** (when sorediate throughout, ap. light to dark brown, flat to slightly convex, -0.3 mm, sp. fusiform to slightly curved, -4celled, 12-22 x 2.5-3.5 µm: **S. gallurae** Vèzda & Poelt)

3* Thallus not erupting yellowish sorediate **4**

4 Epihym. and exc. reddish, red-brown, K+ purple. Paraph. simple to forked, cemented. Ap. -0.5 mm, black, flat, finally even convex, with thin, permanent to finally disappearing margin. Sp. 25-43 x 2-3.5 µm, 4-6(8) celled. Thallus whitish. On deciduous tree bark. SüSch .**Bacidia hegetschweileri** (Hepp) Vainio

4* Epihym. blue-green, olive to brown-yellowish. Paraph. strongly branched and reticulate bound **5**

5 Ap. -0.3 mm, flat, margined, later hemispherical marginless, black.. Sp. (4)6-8 celled, curved to slightly twisted, 15-40 x 1.5-3 µm. Thallus gray-greenish to greenish. On bark. Doubtful in the region . **S. perpusillum** Lahm ex Körber

5* Ap. 0.3-0.5(0.8) mm, moderately to very convex, (almost) marginless, sessile, brown-red, brown-black (to black), often shiny. Sp. 4(8) celled, S-form, at least in the ascus spirally twisted, (15) 20-40 x 1.5-3 µm. Thallus unevenly warty to granular or areolate, dark gray to dark gray-green. On rock, wood, or bark **S. umbrinum**

Ecology and Distribution of the Species

Scoliciosporum chlorococcum (Graewe ex Stenh.) Vèzda (Bacidia chlorococca (Stenh.) Lettau)
Up to the tree line on acid bark, on stems and frequently even on branches, in forests (above all on beech) as well as on free standing trees (above all on field trees, in orchards), remarkably frequent in air polluted regions, yet even on sites with strongly diminished lichen flora, very tolerant to toxins (often single species beside *Lecanora coniz.*), relatively strongly tolerating eutrophication (affected by dung), as one of the few species simultaneously surviving strong acidification and eutrophication of bark, commonly together with coccoid green algae layers, m.-e.acidoph., (r.skioph.) m.-r.(v.)photoph., a- to r.nitroph., Char. Pleurococcetum, even in the Lecanoretum coniz. – bor-med – frequent, spreading

Scoliciosporum pruinosum (P.James) Vèzda
In mild sites in deciduous forests, e.g. hornbeam, m.acidoph., r.skioph. – mieur-subatl-med -- rare; Sch, Rh

Scoliciosporum sarothamni (Vainio) Vèzda (Bacidia s. Vainio)
Up into high montane sites on acid bark of trees, bushes and dwarf shrubs, rather like *S. chloroc.* (↑), avoiding strongly eutrophic habitats – (s'bor-)mieur -- rare; e.g. süSch, Ju, Ne

Scoliciosporum umbrinum (Ach.) Arnold (Bacidia umbrina (Ach.) Bausch, B. turgida (Körber) Hellbom)
Up into subalpine sites, on silicate rock, bark, wood, on very acid to subneutral substrate, very euryök, but rather weakly competitive, therefore on corresponding ecological niches, pioneer lichens on cool, hard cliff surfaces, on heavy metal containing rocks, on overhangs, synanthrop on grave stones, wall crowns etc., into the interior of cities, even on occasionally flooded sites in brooks, relatively rarely on bark (above all in strongly air polluted regions), on board fences, posts, rather photo indifferent, very tolerant to toxins, in numerous associations, above all Candelarielletum vit. – bor-med – rather frequent, commonly synanthrop

Lit.: POELT & VÈZDA 1981, PURVIS et al. 1992, VÈZDA 1978.

Solenopsora Massal.

Introduction

The indigenous and numerous other *Solenopsora*- species with their crustose thallus lobed at the margin and the lecanorine apothecia resemble the lobed *Lecanora*-species or *Squamarina*- species, differing however by two-celled spores. They live on rock and on soils in mild or dry- warm regions. *S. candicans* prefers calcareous to above all dolomitic rock in the Mediterranean region and atlantic-subatlantic regions of Central Europe to Germany and Great Britain.

Genus Characteristics

Thallus crustose, placoid, in the case of non indigenous species even squamulose, white to white-gray, in the case o f non indigenous species even gray, olive, or brown. Upper side corticate. Photobionts coccoid green algae. Ap. with thalloid margin, disk in the case of *S. candicans* gray-black to brown-black, often weakly pruinose. Hyp. colorless to intensively colored. Hym. colorless to brown, I+ blue (in the case of *S. candicans* hyp. light, hym. colorless, epihym. ± yellow-brown). Paraphyses simple, thickened above. Asci clavate, usually like *Catillaria*-type. Sp. 2-celled, ellipsoidal to fusiform. Ch variable, indigenous species with Pannarin, Zeorin.

Ecology and Distribution of the Species

Solenopsora candicans (Dickson) J.Steiner
In the foothills and submontane, summer-warm sites on carbonate rock, above all on granular-rough substrates, like dolomite, calcareous sandstone, on sunny, warm rock caps and smaller rocks in (semi-) dry turfs, m.basiph., r.-

v.photoph., r.xeroph., m.nitroph., in the Aspicilion calc. – mieur-subatl-med – v.rare; Mos, Bit, Saar, Eif, Mn?, FrJu, He

Lit.: POELT 1969

Solorina Ach.

Introduction

The *Solorina*-species are foliose lichens with large leaflets to fragmented thallus only collar like around the apothecia with green algae and bluegreen algae in internal cephalodia or in rather extensive bluegreen thalli. The laminal, unmargined, dark brown to almost black apothecia are sunken or sessile in pits.

The European species of the perhaps 10 species comprising the genus are distributed essentially arctic-alpine, while the area of *S. saccata* is especially questionable it includes the boreal zone and the corresponding montane sites. The species grows on the soil and in fissures of rocks. *S. saccata* occurs on calcareous soils and on limestone on shaded sites. Three other species are in the Bavarian Alps, also verified in the Allgäu.

Genus Characteristics and Determination

Foliose lichens, from time to time with thallus reduced to a collar around the ap., gray to green-gray, upper side paraplectenchymatous of anticlinal hyphal cortex, underside (with exception of the region under the ap.) decorticate, ± felty, with scattered bundles of rhizines, one species with orange-red underside. Photobionts green algae of the genus *Coccomyxa*. Upper side or the interior with cephalodia with *Nostoc*; external cephalodia producing a gray-brownish, warty-squamulose thallus. Ap. laminal, sunken and over the entire thallus upper surface or sunken in pits, large, dark red-brown to almost black, marginless. Exc. lacking. Hyp. colorless to pale. Epihym. yellow- to red-brown. Paraphyses simple, cemented, not or scarcely thickened on the ends. Asci clavate *Peltigera*-type. Sp. to 1-8, 2-, rarely to 6-celled, brown, ellipsoidal to fusiform, with ornamented upper surface. Almost always Ch-.

1 Thallus underside orange-red, veined, K+ purple. Upper surface gray- to brown-olive, R-. Ap. 2-10 mm, ± round, sunken, but nor deeply sessile, dark brown. Soloriniac acid. High mountain lichen, in avalanche tracks, arct-alp, Al . □ **S. crocea** (L.) Ach.

1* Thallus underside whitish to brownish, upper side light gray (to slightly brownish-gray), moist pure green, smooth, underside felty, not or indefinitely veined, usually about 2-5 cm in size. Ap. deeply sunken, dark brown to almost black, 2-6 mm. Sp. to 4, 30-60 x 18-28 µm. Ch- □ **S. saccata** (when gray thallus only around the ap. (collar-like) normally developed, otherwise squamulose- to coralloid-warty and spongy, gray-black: **S. spongiosa** (Ach.) Anzi; if sp. to 2 or 1 per ascus, thallus often ring-like reduced: **S. bispora** Nyl.; both arct-alp. Al)

Ecology and Distribution of the Species

Solorina saccata (L.) Ach.
Up into alpine sites on calcareous, humus, nutrient-rich soil and on soil dwelling mosses, usually in the region of cliff parts, often in rock fissures, sometimes on porous or going over to weathered carbonate rock, on loess, rarely on old walls (e.g. castles), usually on shady, cool substrate habitats, subneutroph.-m.basiph., m.photoph.(-r.skioph.), substrathygroph., in moss society – arct-smed-mo(-med-mo) – rare; Sju-Ju-FrJu and Al scattered, otherwise (v.)rare; Av, Ne, HRh, süHü, Bo, *PfW, Rh-Mn-T, Lahn, Rhön, We*, He, Th, Eif; synanthrop: süSch, *nöSch+*, nöRh+, Sp

Lit.: MIGULA 1929-31, POELT 1969.

Solorinella Anzi

Introduction

S. astericus, the single European representative of the still in South America with a second species of the indigenous genus, is recognized by the star-form apothecia with deeply sitting brown-black disk and three angled appendage. The actual thallus is thin.

S. asteriscus lives on loess and calcareous soils on slopes, soil ridges and in dry turfs on

well lighted summer-warm habitats and is indigenous in the southern and southeastern Central Europe, and indeed for the most part in three larger parts of the area: in the Upper Rhine region (Kaiserstuhl and foothill zone of the Black Forest and the Odenwald), in the continental sites of the central Alps and in the West Pannonian floral region of the Central Danube area (Lower Austria, South Moravia, and Hungary), with isolated occurrences e.g. in Banat, in the Meissner foothills, on the Saale in the case of the Halle and in South Norway. Additional occurring in Central Asia. *Solorinella* is as a result of field improvement, especially for vineyard improvement and replenishment of loess hollows clearly in regression and seems to a high degree threatened.

Genus Characteristics

"Thallus" strongly reduced, of small, often triangular, the ap. ± star-form consisting of accessory lobules. Ap. disk sunken, black-brown. Esc. light, of radially ordered, septate hyphae, which produce the star-form thallus lobes. Hyp. light, underlain by an algae layer, with coccoid green algae. Paraphyses very delicate, unbranched, thickened on the ends, ± loose. Asci narrowly clavate, multispored, with tholus, wall I-. Sp. 2-celled, ellipsoidal. Ch-.

Ecology and Distribution of the Species

Solorinella asteriscus Anzi
In the foothills, warm, low precipitation sites (wine region) on loess and loess soils, rarely on loess free, calcareous fine soil, in vegetation openings of dry turfs, on vineyard terraces, pioneer on the upper surfaces solidified soil ridges, on very warm, try, often rather nutrient-rich habitats; basiph., xeroph., v.photoph., in ephemeral moss assoc. and in the Toninion sed. with *Endocarpon pus.* – mieur-co(-smed) – v.rare (1); süHü (Kaiserstuhl, *Lahr* +), nöHü, *O-nöHü+*, Meissner-foothills

Lit.: BUSCHARDT 1979, MIGULA 1929-31, POELT & VÈZDA 1969*

Sphaerophorus Pers.

Introduction

The *Sphaerophorus*-species have richly branching, shrubby (extra European species even almost foliose), erect to decumbent, usually light gray to browned thallus. The branches of the indigenous species are cylindrical to somewhat flattened. The fruiting bodies arise at or near the ends of the branch, sitting in a spherical swelling of the thallus and bear a black spore mass (mazaedium). The above all distributed in temperate oceanic climatic zones of both hemispheres genus includes approximately 21 species. The high point lies in Australasia; in Europe three species are known. They occur on silicate rock, *S. globosus* and *S. melanocarpus* even on old deciduous and conifer trees in near natural mountain forests and are dependent on high precipitation, very humid habitat. While these species grow more on protected sites, *S. fragilis* often sits on rather wind exposed cliffs.

S. fragilis is distributed arctic-alpine, *S. globosus* from western North Europe over West Europe and the oceanic part of Central Europe up into moist sites of the mediterranean region. *S. melanocarpus* is of the atlantic region, hot West Europe from the Mediterranean region up to South Norway, limited and reaching Central Europe only with a few isolated populations in oceanic toned regions (a single collection in Vogesen, Harz, Westphalia , Saxon Switzerland, Fichtel- and Erz mountains, Bohemian Forest, Upper Bavaria, Adersbacher sandstone mountains in the Sudenten, North Bohemia). The single occurrences of the species in Southwest Germany lie in a climatically mild of the upper Kinaigtales in Central Black Forest. The latter example in the Black Forest, together with possibly the last in Germany, are not to be destroyed because of the end of forest road construction in the seventies. *S. fragilis* is known from two collections in the region, in South Germany also from the Bohemian Forest, from Fichtel mountains and from the Rhön (earlier also from Taunus). *S. globosus* has become strongly regressed because of the reduction of the careful management of beech- spruce and spruce forests as well as recent development of acid emissions. Fruiting specimens have not been observed in recent years.

Genus Characteristics and Determination

Thallus shrubby, richly branched, erect to decumbent, corticate, layered, with radial- to bilateral- symmetrical segments, in the case of non indigenous even foliose, fan-like branched and dorsiventral. Cortex cartilaginous, of anticlinal hyphae. Medulla of longitudinally oriented thick-walled hyphae. Photobionts *Trebouxia*-like. Ap. commonly terminal to almost terminal, -9 mm wide, covered by a black mazaedium, with thalloid margin. Exc. reduced. Hyp. black-brown. Asci clavate to cylindric, *Calicium*-type. Ap. one-celled, brown, spherical, upper surface irregularly ornamented. Pycn. sunken, pycnosp. short bacillar. Ch diverse, all species with Sphaerophorin (but sometimes changed).

1 Thallus segment flattened, above all toward the ends, white-gray to gray-greenish, "underside" whitish. Thallus loosely branched, with ±continuous main stems and weaker branches, usually up to about 5 cm high, feathery branched toward 2 sides. Medulla I-, K+ yellow, P+ orange, C-. Sphaerophorin, Stictic acid . **S. melanocarpus**

1* Thallus segments cylindric to slightly flattened **2**

2 Medulla I+ blue (sometimes weakly), thallus usually richly and loosely fruticose branched, with ± continuous main stems and weaker branches, up to about 5(7) cm high, white-gray to light brownish, tips often lighter, blunt. Medulla P-/K- or ± yellowish, C-. Sphaerophorin, Squamatic acid, ±Thamnolic acid, ±Hypothamnolic acid □ **S. globosus**

2* Medulla I-. Thallus branches very thick standing, ± producing thick cushion, ± forked branched, without definite main stems (branch not clearly thinner), white-gray to brownish, usually -3 cm high. Medulla R-. Sphaerophorin, ±Squamatic acid, ±Hypothamnolic acid □ **S. fragilis**

Ecology and Distribution of the Species

Sphaerophorus fragilis (L.) Pers.
In high montane to alpine, usually very high precipitation sites on silicate rock on complete rain exposed surfaces, usually on rather exposed cliff faces, e.g. like *Cornicularia norm.* (↑), but even on wind protected, moist habitats on steep surfaces with *Parmelia omph*. (habitats overlapping with *S. globosus*), rare in the montane zone (e.g. in cool-moist boulder fields), subneutroph.-r.acidoph., r.-v.photoph., a-/m. nitroph., Char. Umbilicarion cyl., in the Parmelietum omph. – arct-alp – v.rare (2); Vog, süSch, *Ts*, Rhön, BayW, ThW, Erz, *Rothaargeb.*, *WeBgl*, Hz

Sphaerophorus globosus (Hudson) Vainio
(S. coralloides Pers.)
In montane and high montane, oceanic, usually very high precipitation, at least foggy sites on cliffs and silicate rock, usually on completely rain exposed sloping and vertical surfaces together with foliose lichens and mosses (e.g. like *Parmelia omph.* (↑), and *Bryoria bicolor* (↑), additionally on stems of old deciduous and conifer trees, especially beech and spruce in natural beech-spruce and spruce-fir forests (like *Bryoria bicolor*), on cook, but not distinctly cold air collecting or winter-cold habitats, m.-v.acidoph., (r.)m.photoph.-r.skioph., v.-e.hygroph., anitroph., e.g. in the Parmelietum omph., in the Thelotremetum lep. (with *Menegazzia*) -- (arct-atl-)bor-subatl-mieur-subatl-med-mo, oc – rare (2); Sch, Vog, PfW, Hu, Eif, *Ts*+, Rhön, ThW, Erz, Hz, *WeBgl*, Al

Sphaerophorus melanocarpus (Sw.) DC.
(S. compressus Ach.)
In montane, high precipitation sites on cool, extremely humid, rather winter-mild, oceanic habitats on richly mossy, cool substrate (often mountain moist) surfaces on lime-free silicate rock (sandstone) in spruce forests, e.g. associated with *Sphenolobus minutus*, r.-v.acidoph., r.skioph.-m.photoph., v.-e.hygroph., substrathygroph., anitroph. – mieur-atl-med-mo, oc – v.rare (0); nöSch (*Alpirsbach*, Reinerzau), *Vog*, PfW, Lux, *WeBgl*, *Hz*, Saxon Switzerland

Lit.: ANDERS 1928, KEISSLER 1938, OHLSSON 1974, POELT 1969, TIBELL 1980a, 1984*

Sphinctrina Fr.

Introduction

The *Sphinctrina*-species live as parasites or parasymbionts on the thalli of (at least) epiphytic *Pertusaria*-species. The black ascocarps are approximately egg-form, sitting up with narrowed base or are stalked and bear a dust-like spore mass (mazaedium).

In Germany are four, in the region three rare and threatened species throughout of the five species known for the genus. *S. tubiformis* and *S. turbinata* reside especially on deciduous trees, usually on hornbeam and beech, the former on *Pertusaria leioplaca*, the latter of *Pertusaria pertusa*. *S. anglica* grows mainly on conifer trees. The area of these species and of *S. turbinata* stretches over Central Europe up into the southern boreal zone, that of *S. tubiformis* over the summer-green deciduous tree region.

Genus Characteristics and Determination

Parasites and parasymbionts, without their own thallus. Ap. sessile to stalked, black, capilitia approximately egg-form, with black mazaedium, ± margined. Exc. well developed, dark brown, red-brown, of ± periclinal twisted hyphae. Stalk exterior dark brown to reddish, interior light. Asci cylindric, I-. Sp. 1- to 2-celled, dark brown, spherical to ellipsoidal. Ch-.

1 Sp. ellipsoidal, pointed, 10.5-15 x 6.5-8.5 µm. Ap. -0.4 mm high, often ± sunken. Capitula -0.35 mm wide, blackish to dark brown. Stalk short to lacking . **S. tubiformis**
1* Sp. (almost) spherical to angular **2**
2 Sp. clearly warty, spherical, ripe 7.5-9.5 x 6.5-8.5 µm. Ap. -0.4 mm high, capitula -0.25 mm wide, shinny black. Stalk definite, short. Exc. K- . □ **S. anglica**
2* Sp. indefinitely warty, ripe 5.5-7.5 x 4.5-6.5 µm. Ap. -0.4 high, capitula -0.4 mm wide, black to dark brown. Stalk short or lacking. Exc. (section) K+ red . □ **S. turbinata**

Ecology and Distribution of the Species

Sphinctrina anglica Nyl. (S. microcephala (Sm.) Körber, S. pinicola Körber
On conifer bark (above all Scot's pine) and wood, rarely oak, questionable whether lichenized and with a true thallus or lichenicolus -- s'bor-mieur -- rare (1); Sch, *O, SFW, Ml*

Sphinctrina tubiformis Massal. (S. microcephala Nyl.)
Not lichenized, parasitic/parasymbiont on bark dwelling Pertusarias, above all on *P. leioplaca* (↑), also like *S. turbinata* (↑), especially in little disturbed, non eutrophic forests, anitroph. – mieur-subatl-med-mo -- rare *(0)*; *Sch*, Hü, *O, Sp, Th-Mn-T*

Sphinctrina turbinata (Pers.: Fr.) De Not.
(S. gelasinata (Wirth.) Zahlbr.)
Not lichenized, parasitic/parasymbiont. above all on *Pertusaria pertusa* (↑), rarely other *Pertusaria*-species of the Pertusarietum hem., up into montane sites, above all on old beech, oaks, hornbeam; very sensitive to eutrification -- s'bor-med-mo -- rare (2); *O*, Sp. *nöRh*, Sb, *Bo, Sju*, süHü-HRh, *SFW*, Mos

Lit.: LÖFGREN & TIBELL 1979

Spilonema Bornet

(Determination ↑ Polychidium)

Introduction

Spilonema produces dwarf shrubby brown to blackish turfs with fine thallus filaments, the filaments are built up of fungus hyphae surrounding bluegreen algae. The black apothecia are convex.

Of four described species two closely related occur very rarely in Germany. *S. paradoxum* is only known from one collection (high Black forest), *S. revertens* from the Bavarian-Bohemian Forest, Hegau and Fichtel mountain. Both live on from time to time irrigated surfaces of silicate rock and are widely distributed in Europe but rare.

Genus Characteristics

Thallus fine filamentous, small fruticose, loose turf to cushion-like, olive colored to blackish. Filaments in the case of the indigenous species attached with bluegreen rhizines, consisting of hyphae surrounding algal filaments. Photobiont filamentous, bluegreen algae of the genera *Stigonema* and *Hyphomorpha*. Ap. sitting up, convex, without thalloid margin, brown to black, proper margin indefinite (not raised). Exc. ± clearly developed, of radial cell series. Hym. slightly violet to greenish, strongly gelatinous. Paraphyses thick, branched, cellular, end cells, apically thickened, I+ blue. Sp. one-celled,

colorless, narrowly ellipsoidal. Pycn. sessile, black. Pycnosp. laterally and terminally produced, short bacillar. Ch-.

Ecology and Distribution of the Species

Spilonema paradoxum Bornet
On silicate rock on sunny, from time to time irrigated surfaces, m.acidoph.-subneutroph., photoph., m.nitroph. – bor-med – v.rare, possibly süSch

Spilonema revertens Nyl.
On neutral and basic or slightly calcareous silicate rock, e.g. on basalt, on well lighted, from time to time irrigated surfaces, in the region like *Peltula* (↑), also in the neighborhood of brooks, in alpine sites also on small long time dew moistened stones -- subneutroph., photoph., subhydroph., m. nitroph. – bor-smed -- v.rare (1); Bo, *Fi*, BayW

Lit.: HENSSEN 1963a

Sporastatia Massal.

Introduction

The North Hemisphere distributed genus occurring on silicate rocks includes the two arctic-alpine species *S. cinerea* and *S. testudinea*, both of which occur in Germany. They have been named from the Sudenten, the Alps, first also from the Bohemian forest. They are considered as areolate, marginally often appearing radially lobed crustose lichens with sunken black apothecia, multispored asci with small spherical to almost spherical spores.

Genus Characteristics and Determination

Thallus crustose, areolate, gray to brown, margin areoles sometimes enlarged, on a black prothallus, with coccoid green algae. Ap. sunken, black, flat to slightly convex, with thin proper margin. Exc. narrow, exterior or throughout brown. Hyp. colorless to pale brownish. Hym. I+ blue. Paraphyses usually simple, on the ends ± thickened. Asci clavate, with K/I + blue tholus. Sp. to over 100, one-celled, almost spherical to spherical. Pycnosp. short bacillar. Ch: Gyrophoric acid.

1 Thallus yellow-brown, brown (to blackish), often with somewhat elongated marginal areoles, often shiny, on black prothallus. Ap. unevenly-grooved .**S. testudinea** (Ach.) Massal.
1* Thallus light gray, bluish-gray, toward the margin even yellowish-gray, usually without elongated marginal areoles, prothallus definite or indefinite **S. polyspora** (Nyl) Grumm. (*S. cinerea* (Schaerer) Körber)

Squamarina Poelt

Introduction

The *Squamarina*-species have thick squamulose to crustose-rosetted and marginally lobed, gray- to yellow-greenish or olive colored, often white pruinose thallus with yellow- to red-brown apothecia, which at least at first show a thalloid margin. They are dwellers on base-rich soils and calcareous rock, rarely on lime-free basic silicate rock in dry, summer-warm or alpine regions. Of the ca. 20 species mostly occurring in climatically continental regions of the North Hemisphere, four are verified in Germany. *S. cartilaginea* resides above all on faulted, weathered limestone and stony soils, *S. lentigera* on calcareous soils in dry turfs and on loess walls. The latter belonging to the Bunt soil lichen association, is threatened with extinction in Germany as a result of air pollution. Both species are southerly distributed and occur from the Mediterranean region up into the warmer regions of Central Europe (up to south Scandinavia); *S. lentigera* penetrates toward the North into atlantic Norway. *S. gypsacea* is known in the Allgäu Alps.

Genus Characteristics and Determination

Thallus squamulose to squamulose-lobed, sometimes rosette-placoid, thick, pale gray-green, yellow-green, brown-greenish, with thick, sharply delimited cortex and thick medulla, becoming chalky. Photobionts coccoid green algae. Ap. with (with age often regressing) thalloid margin, rarely with proper margin,

yellow-brown, brown- red-brown. Hym. with granular upper layer. Paraphyses simple to sparsely branched. Asci of the *Bacidia*-type. Sp. one-celled, ellipsoidal. Pycnosp. filamentous, ± curved. Ch: Usnic acid, often Psoromic acid.

1 Thallus clearly rosetted, clearly lobed at the margin, in the interior areolate-squamulose, lobes with turned up margins, whitish, greenish- white, pale brownish-green, lower side white. Medulla/thallus P-, K-, C-. Ap. -1.5(2.5) mm, usually light brown, ± flat, with white, finally disappearing margin. Sp. 9-12 x 4-5 µm. Usnic acid . **S. lentigera**

1* Thallus at best when young rosetted. Medulla P- or P+ yellow. Ap. commonly larger **2**

2 Ap. -10 mm, usually ocher-yellow, concave to flat, often only indefinitely margined. Thallus squamulose. Squamules 1-5 mm in size, (1mm) thick, concave, rigid, whitish-green to ocher-olive, white margined, finally depressed. Sp. 11.5-18.5 x 5.7 µm. Medulla P+ yellow, K-, C-. Psoromic acid, Isousnic acid **S. gypsacea**

2* Ap. -4 mm, brown to red-brown, flat to convex, with finally disappearing margin. Thallus squamulose, squamules -0.5 mm thick, convex to concave or irregular, greenish to green-white, pruinose or nonpruinose, usually irregular to standing roof tile-like, at the thallus margin often enlarged. Sp. 10-15 x 4-6 µm. Thallus P-, K-, C-, medulla P- or P+ yellow. Usnic acid, ±Psoromic acid .□ **S. cartilaginea**

Ecology and Distribution of the Species

Squamarina cartilaginea (With.) P.James (S. crassa (Hudson) Poelt, Lecanora c. (Hudson) Ach.)
In summer-warm, usually low precipitation, foothills to montane sites on weathered to strongly faulted calcareous rock, rarely on calcareous stony soils and level stony to sandy, humus loam soils, then usually in openings of dry turfs (here habitat amplitude overlapping with *S. lentigera*), on warm, sunny, dry habitats, basiph., (r.)v.photoph., (a-)m.nitroph., e.g. in the Toninion sed., Toninietum cand. et al. -–mieur-subatl-med – rare (3); Ju, Sju, FrJu, Mn, v.rare süHü, Bo, Saar, nöPf, Eif, *Rh+, nöHü, Lahn, He* (e.g. Meissner-Vorland)

Squamarina gypsacea (Sm.) Poelt (Lecanora g. (Sm.) Th.Fr.
In alpine sites, rarely lower, on ± weathered, calcareous rock, in rock fissures on well lighted, but usually away from the sun habitats, often with *Lecidea lurida* – mieur-med, alp/pralp – Al, Sju, ?Ju

Squamarina lentigera (Weber) Poelt (Lecanora l. (Weber) Ach.)
In foothills and submontane, summer-warm, low precipitation sites on calcareous fine soil, on gypsum soils, even going over to moss, in openings of dry turf, like *Fulgensia fulgens* (↑), Char. Toninion sed. – (arct-atl-)mieur-med -- rare (1); Mn, otherwise v.rare: süHü, nöHü, HRh, süRh, *Ne, Ju, FrJu, nöRh+, Rh-Mn-T, Lahn*, He, Bit, Eif, Th, *Do*

Lit.: POELT 1958

Staurothele Norman

Introduction

The *Staurothele*-species are crustose lichens with usually brown or gray, strongly developed to endolithic thallus. The fruiting bodies are black, frequently of thallus tissue surrounded perithecia, which in the case of lime dwellers are often sunken in pits in the stone. A peculiar characteristic of the genus still to be found in the case of *Endocarpon* is very small green algae in the hymenium of the fruiting body. The spores are commonly muriform multicellular, colorless to colored.

The species live exclusively on rock. Of ca. 35 species verified approximately 15 are in Germany, at this time few are known. *S. fissa* lives amphibiously in clear brooks are resides on silicate rock. The remaining indigenous species grow on calcareous substrates, some of them even on weakly calcareous rocks, such as *S. hymenogonia* and *S. rugulosa. S. bacilligera, S. caesia, S. guestphalica, S. rufa* and *S. rugulosa* are southern species, region of distribution reaches from the Mediterranean region into Central Europe. *S. frustulenta, S. fissa and S. hymenogonia* are widely distributed in Europe. The arctic-alpine *S. areolata* as well as *S. rupifraga* and *S. succedens* occur in the Alps, e.g. in the Allgäu.

Genus Characteristics and Determination

Thallus crustose, clearly developed or more frequently indefinite and in the rock, with green algae of the genus *Stichococcus*. Per. almost sessile to sunken (into the thallus or rock), black, but often partially covered by thallus tissue. Involucrellum occurring or lacking. Exc. dark or basally light. Hym. with spherical- polyhedral to cylindric hymenial algae. Only periphyses occurring. sp. to 1-8, muriform, large, colorless to brown. Pycnosp. short bacillar. Ch-.

Hymenial algae 1-2 celled, about (3)4-8(12 x 2-4 µm or spherical-multiangular, about 2-4(5) µm.

1 On lime-free silicate rock. Sp. to 2 per ascus **2**

1* On limestone. Sp. to 1-8 per ascus **4**

2 Hym. algae elongate to bacillar, 5-12 x 2-4 µm. Lichen of high places. See *S. areolata* (6)

2* Hym. algae ± spherical (-blunt angled), 2-4(5) µm . **3**

3 Per. sunken in hemispherical, 0.3-0.6 mm wide thallus warts. Thallus dark (red)brown, black-brown, dark green-brown, usually thin-continuous, ± finely cracked, otherwise smooth, often shiny. Sp. 30-50 x 13-22 µm, finally brown . **S. fissa**

3* Per. warts -0.3 mm. Thallus warty areolate, thickish, gray-brown, chestnut brown to (rarely) dark brown, dull, often light gray dusty, very variable, fruiting areoles clearly larger than sterile. Sp. 33-48 x 12-22 µm, upper spores broader and often longer than lower, finally light brown **S. frustulenta**

4 Sp. to 1, 2 or 4 per ascus, colorless to dark brown . **5**

4* Sp. to 6-8 per ascus, permanently colorless or finally brown-yellowish to (gold) reddish **9**

5 Thallus robust, cracked, cracked areolate, warty areolate, even almost lumpy areolate. Per. about 0.3 mm, to a large extent sunken into ± hemispherical thallus warts/areoles, with the tip projecting, sometimes walled from the thallus as though margined. Sp. to 2, 30-50 x 12-24 µm, finally usually brown. Exc. colorless to light brown. Invol. weakly developed, dark brown to black **6**

5* Thallus indefinite, very thin to endolithic. Hym. algae ± spherical(-polyhedral), 2-5 µm . **7**

6 Hym. algae elongate-bacillar, 5-12(18) x (2)3-4 (5) µm. Thallus uneven, (dark)brown to black-brown, in the herbarium sometimes light gray pruinose. Calcareous rock on dunged sites in higher places; bor-alp, e.g. Al **S. areolata** (Ach.) Lettau (*S. clopima* auct.)

6* Hym. algae ± spherical(-polyhedral), 2-5 µm. Thallus gray- to chestnut brown, rarely dark brown, usually light gray pruinose **S. frustulenta (3)**

7 Per. hemispherical to counter sunken projecting, after falling out leaving behind no deep pits in the rock, about 0.5 mm wide, with definite invol. Sp. to 2, 30-50 x 12-24 µm, finally brown. Thallus scruffy-dusty, gray, brownish-gray . **S. rufa**

7* Per. sunken into the rock, not or slightly projecting, after falling out leaving behind definite pits, -0.4 mm, without invol **8**

8 Sp. colorless, finally pale brownish to reddish, single, rarely to 2, 55-88 x 18-28 µm (when to 2, then also smaller, up to 40 x 15 µm or less). Exc. (brown) black □ **S. guestphalica**

8* Sp. soon dark brown, to 2 or 4, 30-52 x 15-25 µm. Per -0.2(0.4) mm, numerous, extensively covered by thallus. Exc. interior light, exterior dark brown to black. Thallus gray-white to brownish, endolithic or as a thin mealy layer; bor-mieur-h'mo, Sju, Alps, Th, ?Ju **S. rupifraga** (Massal.) Arnold

9 Per. sunken into the rock, after falling out definitely leaving behind pits, without invol. Thallus indefinite, usually bluish-gray to light gray, ± endolithic. Sp. 25-50 x 12-24 µm, colorless to yellowish or slightly reddish/ brownish. Closely related taxa . **10**

9* Per. hemispherical projecting, after falling out no definite or only surface pits remaining, with invol. Sp. colorless to pale reddish or yellowish. Closely related taxa. Separation problematic **11**

10 Hym. algae elongate (4-6 x 1-2 µm). Per. -0.35 mm. Sp. 25-40 x 12-20 µm, colorless, then yellowish to brown **! S. bacilligera**

10* Hym. algae spherical(-polyhedral), 2.5-5 µm. Per. (0.3-)0.5(0.7) mm. Sp. (25)30-40(48) x 15-23(25) µm, colorless, then often reddish or brownish . **! S. caesia**

11 Thallus epilithic, commonly strongly developed, areolate to small granular, brown-yellow to dark brown, greenish-gray, areoles wrinkled. Per. half to sunken into the thallus (scarcely into the substrate), -0.5(0.6) mm, mouth usually appearing brown. Hym. algae commonly elongate, 2-7 x 1.5-3 µm, but occasionally even ± spherical. Sp. up 8:4-parted (up to y cross walls and, pro cross "storey", up to 3 longitudinal walls), about 22-38 x 12-20 µm **! S. rugulosa**

11* Thallus thin, indefinite to finely granular. Hym. algae spherical(-polyhedral), often even elongate intermixed **12**

12 Thallus whitish-gray, scruffy, or indefinite. Per. 0.5-1 mm, often very rough, sometimes ± pruinose, half sunken and ± surface pits left

behind. Mouth usually not appearing brown. Sp. up to 8:4-parted, (20)28-47 x 14-22 µm .

! S. hymenogonia

12* Thallus blackish, finely wrinkled or fine granular. Per -0.5 mm, ± sitting up, nonpruinose. Sp. up to 10:5-parted, (30)35-45 x 15-22 µm

! S. succedens

Ecology and Distribution of the Species

Staurothele bacilligera (Arnold) Arnold
In montane and alpine sites on carbonate rock (above all limestone, dolomite) on open habitats -- mieur -- Sju, Ju, *FrJu*

Staurothele caesia (Arnold) Arnold
Above all in submontane and montane sites on calcareous rocks (limestone, Dolomite) on open sites, basiph., photoph., xeroph., e.g. in the Aspicilion calc. – mieur -- Ju, süHü, Sju, *FrJu*, Eif

Staurothele fissa (Taylor) Zwackh (S. hazslinszkyi (Körber) Blomb. & Forss.)
In montane to alpine, usually high precipitation sites on commonly lime-free silicate rocks on often flooded or long time spray water moistened sites on clear brooks, like *Hymenelia lac.* (↑), probably on the average somewhat longer moistened habitats than these, even on shady, irrigated cliffs, subneutroph., Char. Hymenelietum lac. – (arct-)bor-smed-mo (-med-mo) -- rare (3); süSch, Vog, Eif, *O+*

Staurothele frustulenta Vainio (S. catalepta auct., non (Ach.) Blomb. & Forss., ? S. ambrosiana (Massal.) Zsch., ? S. clopima auct.)
Up into alpine sites on carbonate rocks as well as on slightly calcareous (or lime dust impregnated) silicate rocks on usually nutrient- rich, dunged, dust impregnated habitats, above all on anthropogenic substrates (mortar of walls etc.), here like *Candelariella medians* (↑), *Calopl. sax.*, even on occasionally flooded sites on streams, basiph.-neutroph., photoph., r.-v. nitroph., usually in the Caloplacion dec. – bor-smed – r.rare throughout the region

Staurothele guestphalica (Lahm ex Körber) Arnold
In the foothills and montane zones on calcareous rocks (limestone, lime marl), e.g. on stones and smaller boulders in semi dry turfs, collected stone piles – (s'bor-)mieur -- Sju, Ju, *FrJu*, Eif, Th

Staurothele hymenogonia (Nyl.) Th.Fr. (S. ventosa (Massal.) Sydow)
Up into the alpine sites on limestone, often on porous, granular, even only moderately calcareous substrate, such as calcareous sandstone, sandy dolomite, even on mortar, m.-r.photoph., basiph. – (bor-)mieur(-med) -- Ne, Saar, Al, Sju

Staurothele rufa (Massal.) Zsch.
Up over the tree line on calcareous rocks, on cliffs, stones, even on walls -- mieur-med, alp/pralp -- süHü-HRh, Ju

Staurothele rugulosa (Massal.) Arnold
Up into montane sites on carbonate rock, often on substrates with granular-rough upper surface, on weakly calcareous sandstone as well as on limestone and dolomite, often on anthropogenic substrates as well as walls (even on mortar, brick), neutroph.-basiph., m.-v.photoph. – mieur-med -- rare (3); *süHü, Rh,* O, nöHü, nöPf, Ne, Al

Staurothele succedens (Rehm ex Arnold) Arnold
Montane-high montane, on weekly calcareous to calcareous rocks on long time irrigated, long time dew moistened or flooded surfaces, at least however on very humid sites, often on brooks, in gulches, subneutroph.-basiph., r.skioph.-m.photoph. – bor-mieur – Sju, Eif, Al

Lit.: SWINSCOW 1963, ZSCHACKE 1934.

Steinia Körber

(Determination ↑ Lecidea PT 1)

Introduction and Genus Characteristics

The single species of the genus is a possibly truly short-lived, inconspicuous lichen with thin film-like thallus and a strongly convex, marginless dark brown apothecia. It grows on moist soil, decayed wood, plant detritus, small stones and is distributed in the boreal zone and the Central European deciduous forest region.

Thallus very thin, film-like to scruffy, in the moist condition somewhat slimy, with coccoid green algae with ellipsoidal cells. Ap. brown-black, strongly convex marginless. Exc. strongly reduced. Hyp. light to dark brown. Hym. brownish, I+ blue, with sparse, imbedded in gelatin, simple paraphyses, I+ blue. Asci clavate-cylindric, thin-walled, without tholus, opening through apical K/I+ blue pores. Sp. to 16, one-celled, spherical. Pycnosp. ellipsoidal. Ch-.

Ecology and Distribution of the Species

Steinia geophana (Nyl.) B.Stein (Lecidea g. Nyl.)
Up into montane sites on cool, sandy, lime-poor or upper surface delimed loam- and sandy soils, on roadways, on cool soil ridges, in vegetation openings, on disturbed or ephemeral habitats, rarely on decayed tree stumps or on small stones, m.acidoph.-subneutroph., substrathygroph., m.-r.photoph. – bor-mieur – rare; Ne, ThW

Lit.: POELT & VÈZDA 1977, STEIN 1879, VAINIO 1934.

Stenhammarella Hertel

(Determination ↑ Lecidea)

Introduction and Genus Characteristics

Crustose lichen with chalky white thallus and black apothecia with gray pruinose proper margin, the young are sunken and have a punctiform small, conspicuous flat and thick margined disk. Exc. carbonaceous black, hyp. (light)brown. Sp. very large. On rocks with low lime content in alpine sites, in the alpine mountains; Allgäu Alps.

Stenocybe (Nyl.) Körber

(Key incl. Phaeocalicium)

Introduction

The *Stenocybe*-species are parasitic or saprophytic fungi with millimeter size, stalked black fruiting bodies, which resemble the stick-needle fruiting bodies of various dust fruited (coniocarpic) lichens. The approximately egg-form capilitia develop no mazaedium. The spores are cross-septate, four- to eight-celled and dark brown.

The *Stenocybe*-species live on the bark of trees, rarely on mosses. Of the ca. 11 species three are in Germany, two are verified in Baden-Württemberg. *S. pullatula* sits on twigs of black- and green alder in Central- and North Europe, the becoming very rare and threatened *S. major* grows on old spruce in cool-moist, near natural spruce forests of Central Europe.

Genus Characteristics and Distribution

Parasitic or saprophytic, without thallus, without algae. Ap. stalked, black, rarely olive-brown, with ± egg-form, narrowly clavate to narrowly cup-form capilitia without mazaedium. Stalk dark brown, of periclinally arranged hyphae. Exc. clearly developed, dark brown. Asci cylindric, uniformly thickened above, until only ripe spores remaining. Sp. one series in the asci, (1)2- to 4(8) celled, light- to dark brown- gray, ellipsoidal to fusiform. Ch-

Phaeocalicium: without thallus, not lichenized. Asci cylindric, strongly and uniformly thickened. Sp. (dark)brown, one series in the ascus. 1- to 2-celled. Exc. well developed.

1 Ripe sp. r-celled, commonly over 13 µm long. Ap. capilitia cup-form to clavate in outline **2**

1* Sp. 1-2 celled, up to 13 µm long, (dark)brown. Ap. capilitia (spherical-) top-form . **3**

2 On the stem of spruce, often with *Loxospora*-species and (apparently) growing on these. Ap. 0.8-1.6 mm high. Stalk -0.1 mm, capilitia 0.4 (0.5) mm. sp. 20-32 x 7-10 µm, dark brown . **S. major**

2* On alder twigs (*Alnus*). Ap. -0.6(0.8) mm high. Stalk -0.07 mm. Capilitia -0.15 mm, young spherical. Sp. (10)14-21 x (3.5)4-5(6) µm, pale gray-brown, long time 1-2 celled, later 4 celled . □ **S. pullatula**

3 Popular (*Populus*). Ap. -0.6 mm high, capilitia not compressed, top- to lens form, black. Ripe sp. 2-celled, with often very thin septa, often even one-celled, 10-13 x 4-6 µm. Stalk black- to olive brown □ **Phaeocalicium populneum**

3* On alder **4**

4 On green alder branches (*Alnus viridis*), without its own thallus. Ap. -0.5 mm high, capilitia ± conic, but compressed when ripe. Ripe spores one-celled, 9-14 x 4-5.5 µm
Phaeocalicium compressulum

4* On black alder or green alder. Capilitia in outline narrowly cup-form to clavate, not compressed. Sp. 10-15 x 3.4-6 µm
□ **S. pullatula**

Ecology and Distribution of the Species

Stenocybe major Nyl. ex Körber (S. euspora (Nyl.) Anzi)
In montane and high montane, very high precipitation sites in near natural spruce-beech and spruce-fir forests on the stems of old spruce, often on/near *Loxospora elat.* (↑), on cool to cold (cold air barrier), v.-e.humid, wind sheltered sites, r.-v.anombroph., in forms of the Pseudevernietum, Thelotremetum – centr-mo – v.rare (2); Sch, Vog, BayW, Al, over 900 m

Stenocybe pullatula (Ach.) B.Stein (S. byssacea (Fr.) Körber)
Up into the montane zone on thin, usually dying and dead twigs of alder (in the region almost only on black alder) in brook bordered alder- and alder-ash stands, usually on bank trees in contact with meadows in cool-humid valleys, scarcely occurring in strongly used agricultural regions, avoiding eutrification (dust layers) (competitive to green algae), r.acidoph., mesoph.-v.hygroph., r.photoindiff., anitroph. – bor-mieur(smed) – r.rare; common with the exception of air polluted and strongly utilized agricultural regions, high point, O, Sp. SFW, Do-Av

Lit.: SCHMIDT 1970, STEIN 1879, TIBELL 1984*, VAINIO 1927.

Stereocaulon Hoffm.

Introduction

The *Stereocaulon*-Species or "coral lichens" are fruticose lichens with simple column-form to richly branched, ascending to erect, stout, often almost woody thallus stalk (pseudopodetia) and an in the case of most species rapidly transient granular to squamulose, decumbent basal thallus; very rarely existing as only that. The thallus stalk resembles somewhat that of the *Cladonia*-species, however in contrast to almost all Cladonias the interior is not hollow. They are commonly densely covered with squamule- like, coralloid or elongate outgrowths (phyllocladia). Terminal- or laterally developed brown to black, flat to strongly convex apothecia. A few species produce soralia for vegetative reproduction.

Of the 125 species occurring mainly in cool and cold regions of both hemispheres 12 are in Germany, 10 are verified in Baden-Württemberg. *S. alpinum, S. condensatum, S. paschale* and *S. tomentosum* dwell on acid mineral soils in meager turf and on eroded of long time open sites. Of these species only *S. alpinum* is still known to actually occur in Baden-Württemberg, the last collection of *S. tomentosum* was about 20 years ago. Both species are strongly threatened. The causes of the regression are on the one hand amelioration of meager turfs, on the other possibly a natural decrease of the in any case usually small populations of these mainly conifer tree zone distributed, in Central Europe only disjunct species. *S. dactylophyllum, S. evolutum, S. leucophaeopsis* (also on soil), *S. nanodes, S. pileatum* and *S. vesuvianum* grow on silicate rock, especially on cool, high precipitation sites, on semi shady cliff surfaces, in boulder fields, on long time dew moistened stones. *S. nanodes* and *S. pileatum*, live mainly on near the soil surfaces and stones, have spread to gravel and bricks; especially *S. nanodes* is extremely tolerant to toxins and has been able to reside on very heavy metal rich substrate. Heavy metal-, especially copper-rich is the habitat also of *S. leucophaeopsis*, that colonizes the mine dumps. Such dumps were also overgrown by other *Stereocaulon*-species, e.g. S. tomentosum.

S. dactylophyllus, S. pileatum and *S. nanodes* are distributed in North- and Central Europe, the subatlantic *S. evolutum* is from western North Europe to the western mediterranean region. The area of *S. vesuvianum* stretches – with great openings – over all of Europe. *S. leucophaeopsis* is a rarely western lichen verified in Scandinavia, on the British Isles, Jan Mayen and with one occurrence in the South Black Forest. Except for the soil dwellers, all of which are threatened to a high degree in extra alpine Germany, *S. evolutum, S. leucophaeopsis* and *S. vesuvianum* are endangered in the region.

Genus Characteristics and Determination

Thallus two parted, but the primary thallus usually soon disappearing. Primary thallus basal, granular, warty or squamulose, whitish to gray. Secondary thallus shrubby, ascending to erect, richly branched. Photobionts of the *Trebouxia*-type, *Nostoc*, *Scytonema*, or *Stigonema* in the cephalodia. Branches compact, tough, more of less thickly covered with very variously formed, warty, coralloid, shield-like to squamulose phyllocladia, sometimes dorsiventral because of one sided distribution of the phyllocladia, with tougher cartilaginous central axis and relatively looser medulla (with algae), corticate or decorticate, often with cephalodia, which however are often inconspicuous and hidden, variously formed, brown, brown-blackish, or greenish. Ap. terminal, flat to convex, light brown to brown-black, with at first often definite, later regressing proper margin. Exc. interior light, margin colored. Hyp. usually colorless. Paraphyses simple, clavate-capitate above, with brown cap. Asci clavate to cylindric, thick walled, with thick amyloid tholus, *Porpidia*-like. Sp. to 6-8, cross-septate, (2)3-14 celled, needle-form to fusiform. Pycnosp. filamentous to cylindric, straight to curved. Ch: all species Atranorin (K+ yellow), often Lobaric acid or Stictic acid.

Note: Reactions of the phyllocladia carried out with P often relatively weak.

1 Basal thallus (primary thallus) remaining, squamulose, warty-granular or areolate. Podetia small often lacking **2**

1* Basal thallus disappearing. Podetia conspicuous **5**

2 Thallus areolate, on rock. Areoles close lying, with darker (± olive) center and slightly raised wavy margin. Without cephalodia. Between the areoles usually blackish bluegreen algae. Without podetia. Ap. black, sessile, margined, -1.5 mm. Sp. 4-6 celled, 25-40 x 6-7 µm. P± yellow. Lobaric acid . **S. leucophaeopsis**

2* Basal thallus otherwise, not with areoles with darker center. Podetia occurring or not developed . **3**

3 Basal thallus of ascending to erect, shell-form or broadened at the free end, sorediate on the under side, -1(2) mm squamules, which finally may also branch regularly. Podetia up to 10(15) mm, often weakly branched, occasionally shorter or lacking, with the under side sorediate, -2 mm squamules. P± yellowish. Lobaric acid .□ **S. Nanodes**

3* Basal thallus not sorediate on the undersides, ascending squamules . **4**

4 Attached to rocks. Podetia with terminal spherical soralia, peg-like, commonly unbranched, ca. 3-5 µm high, ± scattered, with sparse warty to cylindric phyllocladia. Primary thallus warty (phyllocladia 3 mm). P± yellowish. Lobaric acid □ **S. pileatum**

4* On sandy to gravely soils. Podetia not with terminal spherical soralia, commonly lacking, simple to sparse branching, -1(1.5) cm, ± warty. Primary thallus warty-granular to crustose, rarely of short cylindric phyllocladia, between hemi-spherical, red-brown to blackish, 0.5-1 mm wide cephalodia. Ap. terminal on the podetia or sitting up on the thallus. P± yellowish, ±Lobaric acid . □ **S. condensatum**

5 Phyllocladia P+ orange. Stictic acid, ±Norstictic acid. Ap. terminal on short side branches . **6**

5* Phyllocladia P± yellow. Without Stictic acid **8**

6 Podetia on small stems (above all upper side) clearly spongy-felty, decumbent to erect, with differentiated upper- and lower side. Phyllocladia warty to usually flattened and squamulose, rounded, ± close standing, often overlapping one another. Ap. small, -0.6 mm. Felt gray. Cephalodia indefinite, hidden in the felt, with *Nostoc*. On soil and rock * **S. tomentosum**

6* Podetia without definite felt, attached to rock, erect or decumbent-ascending. Cephalodia rare, rough to warty, with *Stigonema* **7**

7 Phyllocladia at least in part rounded-shield form and darker in the center (gray-olive) than gray-white, ± raised margin, at times even warty. Podetia very variable, usually 15-40 mm high, branched or unbranched, producing compact cushions or looser turf, ± thickly squamulose to warty clothed, above all in the tip region of the podetia sometimes erupting sorediate. In the region ap. often lacking, -1 mm * **S. vesuvianum**

7* Phyllocladia not shield-like round, but finger-like divided to cylindric or coral-like branched or flattened and strongly crenate. Without soralia. Ap. frequent, brown-black to red-brown, at first flat and lighter margined, later convex-marginless, -1.3(2) mm. * .□ **S. dactylophyllum**

8 With terminal spherical soralia on -5 mm high, usually unbranched, peg-form podetia . **S. pileatum (4)**

8* Podetia otherwise, commonly not sorediate **9**

9 Podetia branchlets without clearly differentiated upper and lower side, branching to all sides, felty. Phyllocladia warty-granular . **10**

9* Podetia branchlets with clearly differentiated upper and lower side, decumbent to erect. Phyllocladia for the greater part squamulose-flattened or finger-like divided or crenate. Ap. rare, terminal. Lobaric acid **11**

10 Cephalodia definite, numerous, brown-blackish, rough, with *Stigonema*-algae. Podetia erect to decumbent, thickly granular-warty, granules grape-like aggregated. Ap. rare, -2 mm. Lobaric acid (rarely only Atranorin). Extinct **S. paschale**

10* Cephalodia small, sparse, gray-green to brown, clearly spherical, with *Nostoc*. Podetia erect, -3 cm high. Ap. terminal, usually 1-2 mm wide. Felt gray, ± coherent-spongy. Phyllocladia, small warty, scattered, half hidden in the felt, -0.2 mm in diameter. ±Lobaric acid **S. incrustatum**

11 Podetia undersides nor or very weakly felty. Cephalodia indefinite, rare, with *Stigonema* **12**

11* Podetia branchlets undersides clearly felty . **13**

12 Podetia branchlets slender, delicate, undersides not or very weakly felty, mostly richly branching from the base. Phyllocladia flattened, finger-like divided, whitish to ash-gray, often crowded at the branch tips. Thallus thickly cushion like- convex to loosely turf-like. Usually loosely attached to cliffs * **S. evolutum**

12* Podetia compact, on the young branches undersides gray-felty, older branchlets bald, in the central part of the thallus undersides blackened. Thallus usually conspicuously flat cushion-like * **S. saxatile (13)**

13 Felt whitish, cream-colored, rose to gray. Phyllocladia gray-white, at first warty, later lumpy to squamulose, crenate at the margin to finger-form divided. Podetia decumbent and producing a flat cushion-like thallus to rarely erect, branchlets usually whitish. Cephalodia sparse, small, inconspicuous, blue-greenish, with *Nostoc*, hidden in the felt. On gravely, stony soils * □ **S. alpinum**

13* Felt ash-gray, usually only occurring on young branches. Phyllocladia usually gray, thickly crustose crowded on the branches, flat to convex, deeply crenate to finger-like (coral-like) divided. Thallus flat, at times extensive, undersides in the center to a large extent producing a blackened cushion. Cephalodia rare, with *Stigonema*. On bedrock and gravely soils * **S. saxatile**

Ecology and Distribution of the Species

Stereocaulon alpinum Laurer
In subalpine and alpine sites, rarely lower (long time open soils, e.g. on mine dumps), commonly on moor soils and alluvium on long time snow covered sites, in the region like *S. tomentosum*; in the region in *S. alpinum-Rhacomitrium elong*.-society – arct-mieur-alp – v.rare (1); *nöSch (Bulach, +)*; süSch (1 x)

Stereocaulon condensatum Hoffm.
Above all in lower sites on acid, permeable, open, very nutrient-poor, humus-poor, sandy, detrital material and gravely soils, on sand dunes, on level-rocky sites, often on disturbed, consolidated sites, e.g. mine dumps, in heath land, pioneer lichens on sterile soils, e.g. like *Dibaeis baeomyces* (↑), e.g. in the Lecideetum ul. in contact with reindeer lichen society – bor-mieur – v.rare *(0)*; süSch, Pf, *Rh-Mn-T, Ts, Vgb, We,* Eif, *Mfr,* Erz, *BayW*

Stereocaulon dactylophyllum Flörke
(S. coralloides Fr.)
In montane and high montane sites on lime-free silicate rock, like *Lecidea lith.* (↑), however without strongly marked pioneer character, in the Porpidion tub. – bor-mieur – rare (3); süSch and Vog r.rare, otherwise (v.)rare: nöSch, O, PfW, *Sp,* Ts, We, Eif, He (Vgb, Rhön, Meissner), ThW, Erz, BayW, Al

Stereocaulon evolutum Graewe
In high montane to alpine, high precipitation sites, rarely in the montane zone, on lime-free silicate rocks, above on shady, also soil encrusted and mossy surfaces, like *Cladonia macrophylla* (↑), commonly with mosses such as *Andreaea*, r.acidoph., m.-r.(v.) photoph. – bor- atl-mieur(atl) -- v.rare (R); süSch, nöSch, Vog

Stereocaulon incrustatum Flörke
On meager sand- and gravel soils, like *S. tomentosum* (↑), -- bor-mieur, co -- v.rare; Rhön, Pf, *Ts*, süSch?, Fi

Stereocaulon leucophaeopsis (Nyl.) P.James & Purvis (Toninia l. (Nyl.) Th.Fr.)
On heavy metal rich, above all nickel-rich silicate rocks, especially on small boulders and stones, e.g. in the region of ore mines; in the region only one from the main area wide remotely occurring on nickel-rich waste stones on often dew moistened stones; r.acidoph., substrathygroph., extremely heavy metal resistant -- bor-alt/subatl(-mieur-mo) – v.rare (1); süSch

Stereocaulon nanodes Tuck. (S. tyroliense (Nyl.) Lettau)
Up into alpine sites on lime-free, usually hard, iron-rich rocks, often on mineral-rich or basic silicate rock, often on extreme habitats (higher heavy metal content, ore slag, overburden, iron ballast, on long time snow covered sites etc.), climatically less specific, yet frequently on long time dew-moistened sites, pioneer, synanthrop. subneutroph.-v.acidoph., m.-v.photoph., extremely heavy metal resistant, e.g. in the

Porpidion tub., Acarosporion sin. – bor-mieur – rare, but increasing and overlooked; e.g. Sch, O, Rh, Rhön, Eif, BayW

Stereocaulon paschale (L.) Hoffm.
In the Region probably like *S. tomentosum* (↑), -- bor(mieur) – earlier rare, today +; from süSch, Pf, Sp, Rh-Mn-T, Vgb, Rhön Eif, Erz, Av named; the most of the names are false

Stereocaulon pileatum Ach. (S. saxonicum Bachm.)
Predominantly in the montane zone on lime-free, but mostly mineral-rich or basic, even iron- rich silicate rocks, on larger stones, near the soil, usually only moderately sloping, frequently dew moistened and weakly irrigated bedrock surfaces, also on slag and overburden of ore mines, additionally on roof tiles, usually on radiation exposed sites, a toxin tolerant pioneer, subneutroph.-v.acidoph., r.-v.photoph., above all in the Lecideetum lith., Ephebetum -- (s')bor-mieur – rare; süSch, Vog, Eif, Rhön, Pf, O, Sp, Ne, SFW, ThW, Erz, BayW, widely distributed and increasing on roof tiles

Stereocaulon saxatile H.Magn
Like *S. vesuvianum* (↑), often with these as associates – bor-mieur, subatl –v.rare; Rhön

Stereocaulon tomentosum Fr.
Up into montane sites, rarely higher, on acid usually humus- and nutrient-poor sand- and stony soils as well as on sandy loam soils, on fine soil rich scree surfaces, usually attached to stones or gravel, above all on level and little sloping areas, in the region often very weakly competitive toward higher plants, commonly on earlier disturbed, slowly consolidated habitats, as well as formerly ore mines, gravel pits, on open sites in heaths, on pathways, r.v.acidoph., r.-v.photoph., in the Baeomycion rosei -- bor-mieur – rare (1), today almost extinct overall; süSch, *nöSch*, Vog, *Pf, Ts*, Eif, *Rh-Mn-T, Sp, Ne, Ju, Do, Bo, Fr*, ThW, Erz, *BayW, Av*

Stereocaulon vesuvianum Pers. (S. denudatum Flörke)
In the montane and high montane zone in usually high precipitation sites above all on basic silicate rocks (above all basalt) in boulder fields on cool to cold, long time dew moistened, but also from time to time sunny and very warm sites, locally sometimes very numerous, m.acidoph.-subneutroph., extremely heavy metal resistant, m.-v.photoph., a-(m.)nitroph., e.g. in forms of the Pertusarietum cor. – arct-med-mo – rare, above all in the Hercynian region, (R); above all Rhön; Vog (rare), *Ts*, süSch (v.rare), Meissner, ThW, Opf, BayW, Fi, Erz

Lit.: LAMB 1977, 1978.

Sticta (Schreber) Ach.

Introduction

The *Sticta*-species are relatively large, commonly brown or gray colored foliose lichens with bluegreen algae or rarely green algae. Sunken in the thick short hairy underside are sharply delimited pits (cyphellae). Many species of plants reproduce by isidia or soredia, thus even in both hemispheres.

The genus is distributed mainly in oceanic regions of the tropics and in warm temperate zones. Of the approximately 200 species seven occur in the oceanic region of Europe, four of these in Central Europe. *S. limbata* which was verified for the Weser mountains and *S. wrightii* named for Bertesgaden area are extinct. Also the two other *Sticta* species are very strongly in regression and to a high degree are threatened by extinction. They grow commonly on mossy silicate bedrock and old deciduous trees in near natural, carefully managed forests in high precipitation sites or on sites with frequent fogs. Refugia of these species were also the immense bushes of the extensive meadows of the high Black Forest. Today existing in Germany are only a few remnant occurrences in the South Black Forest, in the North Alps and (*S. sylvatica*) in the Bohemian Forest. In the region the thallus often shows, especially toward winter, emission caused necrosis.

Genus Characteristics and Determination

Foliose lichens with partially rather large, loosely attached, little to clearly divided thallus. Both sides of the thallus with paraplecten-chymatous cortex, underside with thick short hairs or – in the case of non indigenous species – bald, always with scattered, sharply bordered pits (cyphellae). Often with soralia or isidia. Photobionts coccoid

green algae or *Nostoc* bluegreen algae. Ap. with thalloid margin. Paraphyses simple. Asci of *Peltigera*-type. Sp. almost always 2-4 celled, cross-septate, colorless to slightly brownish, fusiform. Pycn. punctiform or hemispherical. Pycnosp. short bacillar to ampoule-like. Ch-.

1 Thallus with gray-blue margin- and upper surface soralia, gray-brown **S. limbata**

1* Thallus without soralia, with laminal isidia, brown to dark brown, sometimes difficult to distinguish . **2**

2 Thallus dull or slightly shiny, without ledge-like ridges or with slightly, reticulate "ledges", isidia commonly over the entire surface, numerous, often rather large. Thallus broad lobed, lobes scarcely divided, usually broadly rounded. Ap. v.rare □ **S. fuliginosa**

2* Thallus upper side ± shiny, isidia very small, clearly concentrated on raised ledges, reticulate "ledges". Thallus rather richly divided, usually more extensive than in the case of *S. fuliginosa*. Lobes ± rising. Ap. unknown . □ **S. sylvatica**

Ecology and Distribution of the Species

Sticta fuliginosa (Hoffm.) Ach.
Like *S. sylvatica*, but more on rock, even more frequently going over on conifer trees (e.g. twigs), in lower sites pronounced substrat-hygroph. (over mosses or on shady-irrigated surfaces) -- mieur-med-mo, subatl, oc -- v.rare (1); süSch, Vog, Eif, otherwise +: *nöSch, PfW, Mrh-Ts*, süHü, *Ju, O, Sp, He* etc.

Sticta limbata (Sm.) Ach
Like *Nephroma laev.* (↑); commonly together with mosses of over mosses, Char. Nephrometum laev. – mieur-med, atl – v.rare, +?; Vog, *WeBgl*

Sticta sylvatica (Hudson) Ach.
In high precipitation, oceanic sites on bark and silicate rock on cool-moist, foggy habitats, usually on stems of older deciduous trees on thicker bark with higher water capacity, often on mosses, on extremely humid, shady sites even on conifer trees (and then often on thin twigs) going over, in lower sites to mossy often somewhat moist rock, somewhat stronger (substrat-/aero-) hygroph. than *Lobaria pulm.* (↑), Char. Lobarion -- mieur-med(mo), subatl, oc – rare (1); süSch, Vog, Al (v.rare), Sju, otherwise +: HRh, *Ju, nöSch, O, Sp, Vgb, He (e.g. Rhön, Meissner), süRhön, Rh-Mn-T, Pf, Ts, ThW*

Lit.: DEGELIUS 1935, PURVIS et al. 1992.

Strangospora Körber

(Determination ↑ Biatorella)

Introduction

The *Strangospora*-species have crustose, inconspicuous thallus, yellow, brown to black, usually convex and marginless apothecia with multispored asci and small spherical spores. Distinguished from the genera *Biatorella* and *Biatoridium* by the structure of the ascus.

Of at this time seven species, five are verified in Germany. *S. pinicola* and the closely related *S. moriformis* occur on hard wood and on acid bark, e.g. of Scot's pine, commonly on well lighted habitats. *S. pinicola* is mainly distributed in Central European deciduous forest region, *S. moriformis* also in the boreal zone. *S. ochrophora* lives on subneutral bark and is widely distributed in western Europe.

Genus Characteristics

Thallus crustose, warty to indefinite and living in the substrate, with coccoid green algae. Ap. convex, usually marginless, with commonly very reduced or without excipulum. Hyp. colorless or pale. Paraphyses branched and reticulate, not thickened above, not bent over. Asci multispored, broadly clavate, thick walled, strongly thickened above, without gelatinous outer layer, wall and strongly developed tholus I+ blue, resembling the *Lecanora*-type. Sp. 1-celled, small, spherical. Commonly Ch-.

Ecology and Distribution of the Species

Strangospora deplanta (Almq.) Clauz. & Roux
(Biatorella d. Almq.)
In the foothills and submontane sites on deciduous tree bark, above all on *Populus tremula*, subneutroph. – s'bor-mieur(-smed) -- v.rare (?); *Fr*, Mos, *Ml*

Strangospora moriformis (Ach.) B.Stein
(Biatorella m. (Ach.) Th.Fr.)

Up into the high montane zone above all on tough decayed, hard, usually processed wood, like *S. pinicola* -- bor-mieur – rare; Ju, Ne, O, Mos, Saar-Pf, Eif, Erz

Strangospora ochrophora (Nyl.) R.Anderson (Biatorella o. (Nyl.) Arnold)
In the foothills and (sub)montane sites on subneutral bark, above all on elder, popular, willow, in open forests and bushes, subneutroph. – bor-med – rare (?); nöRh, O

Strangospora pinicola (Massal.) Körber (Biatorella p. (Massal.) Anzi)
Above all in the foothills and submontane, rarely montane sites on tough, hard wood, on boards, posts etc., frequently also on usually acid bark of free standing deciduous- (above all popular) and rarely conifer trees (Scot's pine), often in the proximity of settlements, on streets, usually on slightly eutrophic (dust) substrate, m.(-r.)acidoph., r.-v.photoph., m.(-r.)nitroph., r.toxitol., often only with few cohorts (e.g. *Lecanora varia, L. conizaeoides, L. pulicaris*), above all in the Buellietum punct., Lecanorion variae -- mieur – m.frequent-r.rare; throughout the entire region, in pure air regions rarer than in moderately contaminated

Lit.: POELT & VÈZDA 1977, PURVIS et al. 1992.

Strigula Fr.

(Determination ↑ Porina)

Introduction

The *Strigula*-species are mainly tropically distributed, leaf dwelling lichens with black, in the case of many species perithecia partly covered by the thallus, thin crustose thallus and cross-septate multi-cellular spores. The genus is represented in Germany with ca. four species. *S. glabra* and *S. affinis* reside on smooth barked trees in mild sites, *S. stigmatella* grows on mosses at the base of trees, mainly in oceanic toned regions. All three species are south and west distributed in Europe and penetrate up into the mild regions of Central Europe; whereas *S. stigmatella* reaches even to western Scandinavia, the area of *S. affinis* and *S. glabra* ends already in northern Central Europe.

Genus Characteristics

Thallus crustose, thin, with green algae (*Trentepohlia*, in the case of exotic species *Cephaleuros*) Per. with black, in the case of many species even the apex covered by the thallus. Exc. ± spherical, even ± pear shaped, dark brown or (above all toward the base) light. Involucrellum black-brown, usually present. Hym. gelatin I+ blue. Paraphysoides usually simple and occasionally bound, thin. Asci cylindric to cylindric-clavate, fissitunicate, I-, tholus definite, with short ocular chamber. Sp. multicellular, cross-septate, ellipsoidal to fusiform. Two types of pycnosp.: Macroconidia elongate to fusiform, one- to repeatedly septate, often curved on one end, subterminally attached. Microconidia one-celled, ellipsoidal, small. Ch-.

Ecology and Distribution of the Species

Strigula affinis (Massal.) R.Harris (Porina a. (Massal.) Zahlbr., Arthopyrenia a. (Massal.) Boistel)
In foothills-submontane, relatively warm sites on smooth barked deciduous trees, above all walnut, on rather dry-warm, well lighted sites, subneutroph. – mieur-med -- rare *(0);* Hü, süRh, O, Eif, Th

Strigula glabra (Massal.) V.Wirth (Arthopyrenia g. (Massal.) J.Nowak & Tobol., Porina g. (Massal.) Zahlbr.)
Up into montane sites on smooth barked deciduous trees in shady, cool forests (moist oak-hornbeam forests, canyon forests) in moist mild to cool valleys, above all on hornbeam, ash, Norway maple, beech, m.acidoph.(-sub-neutroph.), r.skioph., anitroph., Char. Graphidion, e.g. with *Porina aenea* – mieur-smed -- (?); süHü. süSch, Sju, Av, probably even Ne, Ju

Strigula stigmatella (Ach.) R.Harris (Porina faginea (Schaerer) Arnold)
Above all in montane and high montane sites in the interior of near natural forests on mosses or directly on bark at the base up to the middle of the stem of older deciduous trees, above all

beech, sycamore, even on mossy silicate rock, m.acidoph., v.hygroph., r.skioph., substrathygroph., e.g. in the Antitrichion (e.g. on *Pterigynandrum filif.*) -- mieur-smed-mo, (oc) – rare (2); süSch, Vog, Ju, Sju, Ts, Th, *O, Bo, Av*, Al, BayW

Strigula sychnogonoides (Nitschke) R.Harris (Geisleria s. Nitschke)
In lower sites on naked, humus-free sandy-loam to loamy soils, pioneer lichen on open, abandon surfaces in clay pits and similar habitats (e.g. slopes), like *Thrombium ep.*, even going over on peat walls, on wood and silicate rock (gravel), often with S*accomorpha ulig.*, m.acidoph.-subneutroph., photoph. – mieur -- v.rare; North Germany, *Ml, Do*

Lit.: COPPINS 1988*, ERNST 1993, POELT & VÈZDA 1977, SANTESSON 1952*, SWINSCOW 1962

Synalissa Fr.

(Determination ↑ Polychidium)

Introduction

The *Synalissa*-species are small shrubby blackish gelatinous lichens with thick, ± cushion-like, erect-branched thallus with one celled bluegreen algae. The apothecia are sunken into the points of thallus branches and to begin with only punctiform, then often wide open and surrounded by a thalloid margin. *S. symphorea* is the single European representative of the approximately five species included in the genus; which grows on weakly irrigated, after rain rapidly drying surfaces and in fissures of limestone in South- and Central Europe and isolated in North Europe (up into Central Sweden and North Norway).

Genus Characteristics

Thallus dwarf shrubby cushion-like, of ascending to ± erect, tubular branches, black, decorticate, made up of loose hyphal net with angular cells, with *Gloeocapsa* (in the case of *S. symphorea* gelatin envelope in the neighborhood of the thallus margin reddish colored). Central part of the branch without algae. Ap. sunken into the tips of the somewhat swollen thallus branch, with thalloid margin and pore-like to later wide open disk. Hym. I-. Paraphyses thin. Asci cylindric to clavate, thin walled, without gelatin envelope, I-. Sp. to 8 to 24, one-celled, broadly ellipsoidal to spherical. Pycnosp. cylindric to needle-form. Ch-.

Ecology and Distribution of the Species

Synalissa symphorea (Ach.) Nyl. (S. ramulosa auct.)
Up into subalpine sites on carbonate rock, usually limestone, rarely on calcareous silicate rock, on from to time irrigated, sunny to semi-shadowed, rather warm, usually steep, often fissured sloping and vertical surfaces, soil encrusted sites, often on *Lecidea lurida* (↑), like *Collema crist.* (↑), basiph., photoph., subhydroph., m.(r.)nitroph., Char. Collemation fusc. – (s'bor-)mieur-med-mo – r.rare; above all Sju, Ju, FrJu, Th, otherwise (v.)rare; süHü, süSch, HRh+, Ne, Saar, Eif; Al

Lit.: MIGULA 1929-31, MORENO & EGEA 1991*.

Teloschistes Norman

Introduction

The genus *Teloschistes* related to *Xanthoria* includes yellow and orange colored, rarely gray fruticose lichens with ascending to erect or pendent branches. The perhaps 30 species numbered in the genus is predominantly represented in the tropics and subtropics. The single species verified from Central Europe, *T. chrysophthalmus*, has small shrubby-cushion like thallus ciliate on the ends of the lobes and ciliate apothecia margins. It grows on subneutral bark of deciduous trees, especially popular, and formerly was distributed in the Central European region and West Europe up into the south of the British Isles with extending into warm regions of southwestern Central Europe (above all Upper Rhine valley and nearby valleys). In the British Isles and in Central Europe is extinct for a long time. In Germany it reaches the east boundary of the distribution; the northern most occurrence site is in the Wetterau and in the Rheinland.

Genus Characteristics

Thallus fruticose, thallus segment tubular and radially constructed or (in the case of indigenous species) flattened and dorsiventral, richly branched, commonly yellow to orange, often with cilia, many non indigenous species thickly shot haired, with hold fasts. Cortex of periclinal hyphae. Photobionts *Trebouxia*-like. Ap. with thalloid margin, these sometimes with cilia, disk yellow to orange. Hyp. colorless. Hym. above with gold-yellow granular layer. Paraph. clearly cellular, ± branched, capitate above. Asci elongate-clavate, thickened above, with I+ amyloid cap (*Teloschistes*-type). Sp. almost always polar 2-celled (as in the case of *Xanthoria*). Pycn. in orange-red to dark brown warts, pycnosp. short cylindric. All yellow to orange-red colored thallus parts reacting on account of the Anthraquinone content reacting deep red with KOH.

Ecology and Distribution of the Species

Teloschistes chrysophthalmus (L.) Th.Fr.
In the foothills, (r.)warm, low precipitation to moderate precipitation sites on shrubs and deciduous trees (often on branches) on well lighted habitats, e.g. in orchards, sloe bushes, above all on *Prunus*, apple trees, walnut, popular, even on wood, on subneutral, often slightly lime-dust impregnated substrate, strong dunging, application of pesticides, and acid air pollution not tolerated, already dying out toward the end of the 19th century, subneutroph., r.xeroph., a-/m.nitroph., in the Xanthorion – mieur-atl(subatl)-med – v.rare (0); above all *nöRh, Rh-Mn-T* (to *Randgeb. Sp*); *nöHü, süHü, HRh, Ne, Pf, Eif*

Lit.: KÄRNEFELT 1989*, MIGULA 1939-31, POELT 1969.

Tephromela Chiosy

Introduction

The *Tephromela*-species commonly have whitish to yellowish, crustose thallus and black apothecia with or without thalloid margin and in habit resemble *Lecanora*- or *Lecidea*-species, with they have in common with them single- celled spores. The genus include today perhaps 13 species, five are in Germany, four are verified for the region.

The Tephromelas reside as a rule on mineral-rich, not to acid silicate rock, rarely even on limestone with the upper surface delimed (*T. atra*). Preferably well lighted habitats. *T. pertusarioides* and the arctic-alpine *T. aglaea* and *T. armeniaca* are limited to a large extent on cool, high precipitation mountain sites. *T. atra* has a broad habitat amplitude; it lives even (in the region meantime extremely rare) epiphytically and is distributed from the North to South Europe. *T. grumosa* prefers vertical surfaces in mild and warm sites; its area stretches from Central Fennoscandia to the mediterranean region. *T. pertusarioides* is known from atlantic South Sweden and from high precipitation sites from all the mountains of Central and South Europe.

Genus Characteristics and Determination

Thallus crustose, warty to cracked areolate, whitish, gray, yellowish, with coccoid green algae. Apothecia sunken to sessile, black, with thalloid margin or without thalloid margin, then externally as a rule unmargined. Esc. reduced, thin, only colored at the margin. Hyp. colorless to (below) ochre colored. Hym. above greenish or purple throughout. Paraphyses simple to isolated branched, thick (> 3 µm), often with pigment cap, with gelatinous outer layer. Asci clavate, *Bacidia*-type. Sp. 1-celled, ellipsoidal. Pycnosp. elongate-ellipsoidal to narrowly or broadly cylindric. Ch: often Atranorin, additionally Psoromic acid, Stictic acid, Usnic acid, Alectorialic-SSy.

1 Thallus sorediate, whitish to gray, often sterile. Ap. lecanorine, rare. Hym. almost shiny red-violet **2**

1* Thallus not sorediate, commonly fertile. Disk ± shiny black .. **3**

2 Medulla KC+ red, thallus cracked areolate to warty areolate, not sorediate at the margin, not sorediate, in the center large surfaces sorediate, K+ yellow, P-. Soredia whitish to blue-gray. Atranorin, α-Collatolic acid, Alectoronic acid. soredia white to here and there gray, mostly 80-200 µm **T. pertusarioides**

2* Medulla KC-. Thallus often granular sorediate at the margin, K± yellow, P-. Soredia blue-gray, 50-100 µm. Atranorin, Protolichesterinic acid, (α-Collatolic acid) . **T. grumosa**

3 Ap. with puffy raised thalloid margin, -2 (2.5) mm, flat (to concave). Thallus warty areolate, rather thick, with black prothallus K+ yellow, C-, P-. Areoles often uneven- wrinkled. Hym. shiny colored, ± reed-brown to purple-violet, in the lower part often more ochre-brown. sp. 10-15 x 5-8 µm. Atranorin, ±α-Collatolic acid, ±Alectoronic acid . **T. atra**

3* Ap. without thalloid margin, without proper margin. Only epihym colored, not purple. Esc. reduced. Hyp. ± colorless, below slightly ochre/brownish. Thallus areolate, areoles -2 mm **4**

4 Thallus whitish, often somewhat yellow tinted, in the herbarium darkening, gray yellow, thick, K+ yellow, C-, KC+ yellow, P-. Areoles flat to convex. Ap. depressed to sunken, flat to rather convex, -1.8(2.5) mm. Esc. strongly reduced. Epihym. blue-green to black-green. Sp. 7.5-16 x 4.5-8.5 µm. Paraph. strongly cemented. Atranorin, ±Usnic acid, Bourgeanic acid . **T. aglaea**

4* Thallus yellowish, yellowish-green, gray-greenish, in the herbarium ochre to red-brown, dull or shiny, with definite black prothallus, K± yellow to orange, P+ yellow, C-, KC+ red. Ap. ± sunken, flat, later convex and projecting, -2(4) mm. Epihym. blue-green to blackish-green, even partially brownish. Sp. 8-12 x 3-5 µm. Alectorialic acid, ±Protocetraric acid .**T. armeniaca**

Ecology and Distribution of the Species

Tephromela aglaea (Sommerf.) Hertel & Rambold (Lecidea a. Sommerf.)
In the high montane to alpine, high precipitation sites (over 900 m) on lime-free, usually hard silicate rocks on habitats which are rather well lighted, and insuring frequent and moderately to very long lasting soaking of the thallus, above all on strongly rain exposed sloping- and vertical surfaces of boulders and cliffs, like *Umbilicaria torref.* (↑), *U. polyph.* (↑), tolerating moderate to long time snow covering, m.-r.acidoph., r.(-v.)photoph., anitroph., in the Rhizocarpion alp., Umbilicarion cyl. – arct-mieur-h'mo/alp-smed-alp – rare (2); süSch, Vog, Rhön BayW, Hz, *Rothaargeb.*

Tephromela armeniaca (DC.) Hertel & Rambold (Lecidea a. (DC.) Fr.)
In alpine, very high precipitation sites on very wind exposed sites on silicate rock, m.-r.acidoph., anitroph., in the Umbilicarion cyl. – arct-alp – v.rare; Vog, BayW

Tephromela atra (Hudson) Haf. (Lecanora a. (Hudson) Ach.)
Up into the alpine zone on silicate rock, rarely even on upper surface delimed carbonate rocks, even on silicate rock walls and other anthropogenic substrates (e.g. grave stones), isolated (earlier more frequent) also on smooth and flat cracked bark of deciduous trees, r.euryök, optimally on well lighted, moderately nutrient-rich habitats, preferring subvertical- and vertical surfaces, avoiding decidedly acid silicate, subneutroph.-m.acidoph., ombroph., m.-v.photoph., (a-)m.nitroph., Char. Rhizocarpetea geogr., above all in the Lecanoretum rup. – arct-med – r.rare (3); Sch and Vog m.frequent, otherwise rare, e.g. Eif, Hu, Pf, Rhön, O, Sp, SFW, Ne

Tephromela grumosa (Pers.) Haf. & Roux (Lecanora g. (Pers.) Du Rietz)
On silicate rock, above all on vertical surfaces, like *Lecanora sulph.* (↑), but more frequently on anthropogenic substrates (above all grave stones), above all in the Lecanoretum rup. – s'bor-med -- r.rare; Sch, Vog, Pf, Ts, MRh, Lahn, Eif, Rhön, O, Sp. SFW, Ne

Tephromela pertusarioides (Degel.) Haf. & Roux (Lecanora p. Degel.)
Rather like *Ophioparma vent.* (↑), yet avoiding their extreme light- and wind-open habitat, also like *Fuscidea koch.* (↑),, in the Pertusario-Ophioparmetum, Fuscideetum koch. – mieur-smed-alp – v.rare (R); Vog, süSch

Lit.: FRIES 1871-74, HERTEL & RAMBOLD 1985*, MAGNUSSON 1931, PURVIS et al. 1992

Thamnolia Ach. ex Schaerer

Introduction and Genus Characteristics

Arctic-alpine fruticose lichen with worm-form, unbranched to little branched, pointed, decumbent to ascending whitish thallus. Known

only as sterile. Alps, high central mountains, e.g. Harz, Bohemian forest, formerly Rhön

Thallus either lying a long time with rose colored tint, K+ yellow, P+ orange, UV-, with Thamnolic acid (var. *vermicularis*, e.g. Al) or thallus in the herbarium not slightly rose, K+ light yellow, P+ deep yellow, UV+, with Baeomycesic acid, Squamatic acid (var. *subuliformis* (Ehrh.) Schaerer)

Ecology and Distribution of the Species

Thamnolia vermicularis (Sw.) Schaerer
Like *Alectoria ochr.* (↑), in alpine wind heath, very rarely on exposed central mountain peaks on cliffs and in boulder fields on silicate rocks -- arct-alp – v.rare; Rhön + (Milseburg), BayW*, Hz (all var. *subul.*), Al (var. *vermic.*)

Lit.: KEISSLER 1960, POELT 1969.

Thelenella Nyl.

(Determination ↑ Protothelenella)

Introduction

The *Thelenella*-species are inconspicuous thin crustose lichens, living on tree bark and rock, with perithecia sunken in the thallus or thallus warts and muriform multicellular spores. Of the 17 species included (occurring above all in the tropics and subtropics) four and verified in Europe and only *Th. modesta* has been known in Germany. It grows on smooth, subneutral to weakly acid bark and was distributed from the mediterranean region over the western and central Europe up into southern Fennoscandia. It has disappeared from many parts of the former region in the last century, thus from Central Europe, where the it was found on stems in winter-mild, summer-warm regions (Westphalia, Upper Rhine, southern French Alp).

Genus Characteristics

Thallus thin crustose, gray-whitish to light brownish, even living in the substrate, with swollen cortex, with coccoid green algae. Per. sunken in the thallus or thallus warts, covered by the thallus cortex. Exc. brown above, usually colorless below, without, in the case of exotic species also with involucrellum. Paraphysoids richly branched and remaining reticulate bound. Asci cylindric, fissitunicate, wall uniformly thick, with apical indentation, I-. Sp. colorless to brownish, weakly to strongly muriform divided. Ch-.

Ecology and Distribution of the Species

Thelenella modesta (Nyl.) Nyl. (Microglaena m. (Nyl.) A.L.Sm.
In foothills to submontane, winter-mild and rather summer-warm sites on subneutral to moderately acid, usually smooth bark, above all on walnut, popular, or ash, on rather well lighted habitats, possibly very sensitive to air pollution – (s'bor-atl-)mieur-subatl-med -- v.rare (0); süHü, *FrJu, Westf.*

Lit.: MAYRHOFER 1987b, MAYRHOFER & POELT 1985.

Thelidium Massal.

Introduction

The genus includes almost exclusively rock dwelling lichens with endolithic, rarely thin crustose epilithic thallus and black perithecia and strongly similar habit and ecology to the *Verrucaria*-species, from which they differ by the cross-septate spores.

Th. zwackhii as a pioneer lichen covers open moist sites, sandy-loam mineral soils. *Th. rehmii* resides on moist silicate rock. *Th. aeneovinosum*, an arctic-alpine taxon, and *Th. submethorium* lives amphibiously on silicate rock in mountain brooks or on long time wet cliffs. The other species are lichens on calcareous rocks and live usually on rocks away from the sun, thus *Th. decipiens*, *Th. pyrenophorum*, *Th. papulare* and *Th. incavatum*. These species are widely distributed in Europe. Many of the lime- dwellers have a thallus living in the rock (↑ *Verrucaria*).

Genus Characteristics and Determination

Thallus crustose, usually thin or (in the case of lime-dwellers) endolithic, whitish, gray, olive, brown, with coccoid green algae. Per. with black apex, usually ± sunken into the thallus or in pits in the limestone. Exc. dark brown to black-brown or light in the lower half, with or without involucrellum. Involucrellum red-brown, dark brown, black-brown, usually only developed in the apical part to the center of the per. Hym. I+ red. With periphyses in the region of the ostiole. Pseudoparaphyses-like hyphae turning to slime early. Young asci thickened above, I-, fissitunicate. Sp. ellipsoidal to elongate-ellipsoidal, 2- to 4-, rarely multi-cellular, cross-septate, few small spores with longitudinal walls. Ch-.

The genus and its species are entirely insufficiently known, the boundaries of several taxa are still unclear. They are correspondingly rarely collected.

1 On soil, or moist wood. Per. sitting up and almost spherical projecting to half sunken, -0.25 mm. Per. wall simple, without invol., blackish, brown to almost colorless at the base. Sp. 4-celled, 26-36 x 10-14 µm. Thallus thin, gray-greenish to brown . **Th. zwackhii**

1* On rock . **2**

2 On silicate rock **3**

2* On limestone **6**

3 Sp. 4-celled, 26-36 x 10-14 µm **Th. zwackhii (1)**

3* Sp. 2-celled. On (usually moist) silicate rock. Per. hemispherical projecting, invol. usually clearly developed . **4**

4 Per. apex 0.4-0.7 mm, partly covered by the thallus. Invol. robust, -100 µm thick, ± halved. Sp. 24-46 x 13-21 µm. Thallus definite, brown, gray- to blackish-brown, gray, coherent or finely cracked . **Th. aeneovinosum**

4* Per. smaller. Sp. up to 30 x 14 µm **5**

5 Per. -0.4 mm. Per. constructed as in the former. Sp. 20-30 x 11-14 µm. Thallus thin, smooth, olive- to gray-brownish **Th. submethorium**

5* Per. -0.3 mm. Esc. brown-black, below lighter to almost colorless. Sp. 20-28 x 9-11 µm. Thallus thin, olive-brown . **Th. rehmii**

6 Per. for the most part sunken into the rock, at first only punctiform visible, later apex somewhat strongly uncovered, leaving behind pits after falling out. Invol. not or scarcely developed, exc. for the most part dark brown (black), below even lighter. Thallus usually rather indefinite . **7**

6* Per. projecting, only the base sunken, no definite or only flat pits left behind . **9**

7 Sp. 4(-6) celled (very rarely with one longitudinal wall), 30-50(60) x 12-18 (20) µm, with age often crumpled. Per. 0.3-0.6 mm, apex -0.3 mm, separated from the thallus by a circular fissure. Thallus gray-whitish, gray-greenish or indefinite, endolithic to semi endolithic . **Th. incavatum**

7* Sp. usually 2-, rarely 4-celled. Thallus usually semi endolithic. Closely related taxa, separation at times very difficult and unclear (*Th. decipiens* s.l.) . **8**

8 Per. 0.5-0.6 mm, apex -0.3 mm, frequently sunken in projecting thallus ridges. Thallus usually epilithic, oily shining .**Th. dionantense (11)**

8* Per. 0.2-0.4(0.5) mm, completely sunken to the apex somewhat projecting, not in definite projecting thallus warts, 0.4-0.5 mm high, apex -0.25 mm, usually separated from the rock by a fine circular fissure. Sp. (15)20-36(42) x (7) 10-17 µm. Thallus thin to indefinite, usually semi endolithic, dirty yellowish-white, light gray, gray greenish, brownish, smooth to very finely cracked, with or without dark prothallus. . **Th. decipiens**

9 Sp. (30)35-50(65) x (12)14-20(22) µm, (2-)4(6) celled. Per. 0.3-0.6(0.8) mm, with invol. only developed above (apical) to only half, very thick (the exc. enclosed), base sunken in the rock, apex -0.5 mm, ± strongly convex, upper part flattened, mouth often in a depression, flanks sometimes even pruinose. Thallus thin, indefinite or whitish, gray, yellowish, rarely brownish, smooth to very finely cracked or finely roughened, often delimited or separated by black prothallus lines . **Th. papulare**

9* Sp. up to 36 x 15 µm . **10**

10 Per. 0.5-1 mm, clearly (± hemispherical) projecting, apex ca. 0.3-0.6 mm. Sp. 2-celled **11**

10* Per. smaller, -0.4 mm, apex -0.25 mm . **12**

11 Per. -0.7(1) mm, with apical up to ± reaching to half the per., invol. very thick (somewhat protruding below), apex -0.6 mm. Sp. 19-32 x 9-14 µm. Thallus thin, inconspicuous, granular to almost mealy or crustose coherent, whitish, gray, brownish-gray . **Th. pyrenophorum**

11* Per. -0.6 mm, without invol., ± sunken into the thallus and partially the rock, often in projecting warts. Apex ca. 0.3 mm. Sp. 22-36 x 11-15 µm. Thallus for the most part epilithic, oily shining, wrinkled, light gray-greenish to whitish, often studded by fine black punctae. SJu . **Th. dionantense** (Hue) Zsch.

12 Sp. (2-)4 celled, 26-36 x 10-14 µm. Per. -0.25 mm, without invol. Thallus inconspicuous, gray-greenish to brown . **Th. zwackhii (1)**

12* Sp. commonly up to 26 µm long . **13**

13 Per. -0.4 mm, with up to only the center and lower reaching the invol., hemispherical projecting, apex ca. 0.2 mm, ± clearly covered by the thallus. Sp. 2 celled (rarely a few 4 celled),

16-22(34) x 7-12(14) µm. Thallus dirty brown-olive, moist olive-blackish, thin, somewhat cracked . **Th. olivaceum**

13* Per. not with ± halved invol., -0.25 mm. Differentiation of the taxa still to be clarified. *Th. minutulum* s.l . **14**

14 Per. hemispherical to almost spherical sitting up, naked or ± clearly covered by the thallus. Sp. 2 celled, 15-26(29) x 6-10(12) µm. Receptacle above from over the center olive-black, pale below. Thallus brownish-gray, brown, gray-green, thin, epilithic, sometimes cracked . **Th. minutulum**

14* Per. projecting hemispherical, not covered by the thallus. Sp. 2(4) celled, 22-30 x 6-10 µm. Thallus gray-greenish, thin to very unclearly developed **Th. parvulum**

Ecology and Distribution of the Species

Thelidium aeneovinosum (Anzi) Arnold
(Involucrothele aeneovinosa (Anzi) Servit)
On silicate rocks in subalpine and alpine sites, exceptionally in the high montane zone, on from time to time flooded or long time splash water moistened surfaces on boulders in cold, clear brooks, on usually shady habitats, subneutroph. /m.acidoph., hydroph., m.-r.photoph., anitroph., Char. Ionaspidetum -- arct-h'mo/alp -- v.rare (3); süSch

Thelidium decipiens (Nyl.) Krempelh. (Th. absconditum (Hepp) Rabenh., Th. immersum (Leighton) Mudd, Th. amylaceum auct.)
Above all in montane to alpine, cool sites on carbonate rocks, above all lime, dolomite, of rather wide habitat amplitude, on stones as well as exposed cliffs, in forests and on rather open to the light sites, usually on rather light-poor to well lighted, shaded, nutrient-poor, sometimes even somewhat moistened sloping- and vertical surfaces, basiph., m.-r.hygroph., a-(m.)nitroph., e.g. in the Hymenelion coer., Char. Thelidietalia dec. – bor-med, mo/alp – rare; SJu-Ju-FrJu (scattered), Th, süHü, Ne, HRh, Al, Rhön, Eif, *Lahn*

Thelidium incavatum Mudd (Amphoroblastia i. (Mudd) Servit)
In submontane to alpine sites on carbonate rocks (e.g. lime, dolomite, calcareous sandstone), often on stones protruding from the soil, habitat regions strongly overlapping with that of *Th. decipiens* (↑) -- bor-med -- SJu, Ju, FrJu, Th, s129Hü, *Mos*, Eif, He

Thelidium minutulum Körber (Th. Mesotropum (Nyl.) A.L.Sm., Th. hospitum Arnold, ?Th. acrotellum Arnold)
On carbonate rocks up into the alpine zone, usually on shady, humid habitats, e.g. on small stones on the soil, even on bricks and basic silicate rocks – mieur-smed -- SJu-Ju-FrJu, süHü, *Rh-Mn-T*, Al

Thelidium olivaceum (Fr.) Körber
Up to over the tree line, on calcareous rocks – mieur-med-mo -- *SJu, Ju, FrJu*, süHü

Thelidium papulare (Fr.) Arnold (Polyblastia p. (Fr.) Servit)
Above all in montane to alpine sites, rarely into the foothills zone, on calcareous rocks and dolomite, rarely on calcareous sandstone or slate or basic silicates, above all on steep sloping- and vertical surfaces on usually shady, sometimes slightly substrate moistened habitats, basiph., r.skioph.-r.photoph., m.-r.hygroph., a-/m. nitroph., e.g. in the Acrocordion con. – arct-med-mo -- r.rare; SJu, Ju, FrJu, Ne, Rhön, *Mos, Lahn*, Eif, Al

Thelidium parvulum Arnold
On weakly calcareous to lime-rich, usually granular rocks (sandy dolomite, calcareous sandstone etc.) – *FrJu, ?Ju,* Th

Thelidium pyrenophorum (Ach.) Mudd (Involucrothele p. (Ach.) Servit, Th. auruntii (Massal.) Krempelh.)
In montane to alpine sites, rarely lower, on carbonate rocks, above all lime and dolomite and calcareous sandstones, above on m.-r. well lighted, usually shaded cliff walls in humid sites, basiph., m.-r.hygroph., anitroph. – bor-smed, mo/alp -- *SJu, Ju*, Th, Al

Thelidium rehmii Zsch. (Involucrothele r. (Zsch.) Servit)
Up into montane sites on moist, porous sandstone on shady, r.humid habitats, m.acidoph. – (bor-)mieur – süSch, O, *Fr*

Thelidium submethorium (Vainio) Zsch.
On montane sites on silicate rock, on long time or continually flooded stones and boulders in cool brooks, like *Verrucaria kernst.* (↑) -- süSch

Thelidium zwackhii (Hepp) Massal.
(Th. fueistingii auct.)

Up into montane sites on moist, sandy-loam to loam soils on soil ridges, pathways, slopes (like *Thrombium epig.* ↑), on decayed stumps as well as on small stones, above all on limestone and calcareous sandstone, even on silicate stones on base rich soils; pioneer, (m.acidoph.) subneutroph. -m.basiph., substrathygroph., a-/m .nitroph. – (s'bor-)mieur -- süHü, Ne, O, Eif, Al

Lit.: ZSCHACKE 1934.

Thelignya Massal.

(Determination ↑ Porocyphus)

Introduction

The species of *Thelignya* which earlier were placed in *Porocyphus* have blackish, squamulose thallus consisting of closely packed granules with bluegreen algae of the genus *Calothrix*. The apothecia are entirely sunken into the thallus, the disk is punctiform small and pit- form deepened.

The two known species are dwellers on moist silicate. *Th. lignyota* is arctic-alpine distributed and known in Germany only from the Black Forest; in addition the species is to be found very rarely in Fennoscandia and Greenland. It occurs on cool-shady, irrigated, long time snow covered cliffs at Feldberg in the Black forest.

Genus Characteristics

Like *Porocyphus.* Epihym. black-green above (in the case of *Th. lignyota*) or red-brown, ap. sunken. Lichenization of the thallus poor, the algae (*Calothrix*) are often to be seen as threads with basal heterocysts, hyphae in loose arrangement. Thallus squamulose, blackish. Asci 8- (*Th. lignyota*) up to 16 spored, 1-celled, ellipsoidal to almost spherical.

Ecology and Distribution of the Species

Thelignya lignyota (Wahlenb.) P.M.Jorg. & Henssen (Psorotichia ocellata (Th.Fr.) Forss., Porocyphus ocellatus (Th.Fr.) Henssen, P. dispersus E.Dahl)

In cold, acid substance rich mountain brooks on frequently flooded boulders/cliffs of (mineral-rich) silicate rock, like *Ionaspis odora* and *Placynthium fab.*. (↑) -- arct-alp – v.rare (R); süSch

Lit.: HENSSEN 1963a, HENSSEN & JORGENSEN 1990

Thelocarpon Nyl. ex Hue

Introduction

The *Thelocarpon*-species are lichenized or unlichenized saprophytic and parasitic fungi. An actual thallus is not developed. The very small ascocarps usually have only a punctiform narrow opening and resemble a perithecium, rarely are they apothecia-like. They are green- yellow to light yellow colored. The ascus has a large number of spores.

Th. laureri, the most frequent species, is like the most of the others very substrate vague and grows on SiO_2-poor silicate rock, old processed wood, stumps or on soil. *Th. epibolum, Th. lichenicola* and *Th. superellum* are found on peat soils, humus sandy soils, rotted wood and even on other lichens. *Th. coccosporum* is only known from the South Black Forest and was only found once on old bricks. *Th. laureri, Th. lichenicola* and *Th. superellum* are distributed in the Central European deciduous tree zone; *Th. epibolum* occurs in the boreal region and corresponding high sites in Central Europe.

Genus Characteristics and Determination

Crustose lichens of lichen dwelling fungus. As well as lichenized with coccoid green algae, which are limited to one algae layer in the outer region of the ap. warts, otherwise thallus lacking. Ap. spherical to egg-form, with perithecia-like narrow opening, yellow. Periphyses in the region of the ostiole and on the side walls. Paraphyses simple, branched or reticulate. Asci flask-form, with 50 to ca. 200 sp., thin walled, not or slightly thickened above, I- or with I+ blue tholus. Sp. small, 1-celled or with apparent septum, spherical, ellipsoidal to almost cylindric. Ch: Pulvinic acid-derivative.

Note: a;; species R-.

1 Paraph. lacking. Ap. (almost) spherical, -0.2 mm, ± sitting up. Hymenial gelatin I+ yellow to reddish **2**

1* Paraph. occurring. Ap. spherical, egg or lens-form **3**

2 Asci I+ pale blue. Sp. 3-4(5) x 1-1.5 µm. On soil, silicate, or wood, mieur (Lux) . **Th. intermediellum** Nyl.

2* Asci I-. Ap. -0.2 mm, sp. spherical, 3.5-5 µm **Th. coccosporum**

3 Paraph. unbranched or rarely branched. Ap. egg-form-conic to spherical. Receptacle without algae **4**

3* Paraph. branching. Ap. lens-form to spherical. At least ascus tips I+ pale blue . **5**

4 Ap. -0.3(0.4) mm thick, -0.4(0.5) mm high. Sp. 6-13 x 2.5-6 µm, commonly appearing 2-celled. Asci I+ blue, hym. gelatin I- **Th. superellum**

4* Ap. -0.15 mm thick, -0.2 mm high. Sp. 4-6 x 1.7-2 µm (in the case of one alpine variety up to 12 x 3 µm). Asci I-, hym. gelatin I+ red **Th. epibolum**

5 Ap. lens-form to spherical, disk soon wide opening, concave. Receptacle without algae, light citron yellow, -0.35 mm. Sp. 4-6(7) x 1.5-2 µm. On *Baeomyces rufus* or wood . **Th. lichenicola**

5* Ap. spherical, with punctiform opening. Receptacle with algae, citron-yellow to greenish-yellow, -0.4 mm thick, -0.25 mm high. Sp. 2-4 (6) x 1.2-2 µm . **Th. laureri**

Ecology and Distribution of the Species

Thelocarpon epibolum Nyl.
In sub- to high montane sites on dying lichen thalli (e.g. *Peltigera*), rotted spongy wood, dying mosses, algae layers, peat, commonly on cool substrates, e.g. frequently dew moistened substrates or on humid and high precipitation sites, ephemeral species, acidoph., r.skioph.-r.photoph., anitroph. – bor-mieur – rare; e.g. Sch, Ju, Ne

Thelocarpon laureri (Flotow) Nyl.
(Th. prasinellum Nyl., Th. epilithellum (Nyl.)
In the foothills to montane sites on m.-r.well lighted, often hydrostatically favorable (humid, long time dew moistened), near the soil, often ephemeral habitats, very substrate vague, on soil (e.g. cool loam soils), on neutral and basic silicate rock, above all basalt (usually on stones and boulders), additionally on bricks, old processed wood, tree stumps, even mosses, often on rather nutrient-rich sites, subneutroph.-m.acidoph., r.hygroph., pioneer, in crustose lichen initial stages -- (s'bor-)mieur – r.rare; e.g. süSch, Rhön, Sp, O, süHü, Ne, Rh-Mn-T, RhSch, BayW

Thelocarpon lichenicola (Fuckel) Poelt & Haf.
(Ahlesia l. Fuckel)
On *Baeomyces rufus* in cool-moist sites, e.g. on cool road slopes on longer dew moistened sites – (s'bor-)mieur – v.rare; O

Thelocarpon superellum Nyl. (Th. herteri Lahm)
In submontane and montane sites on peat soils, humus-rich sand- and sandy loam soils, on rotted wood, r.-e.acidoph., m.-r.substrathygroph. – s'bor-mieur(pralp) – rare (0); *Do*

Lit.: POELT & HAFELLNER 1975*, POELT & VÈZDA 1977, SALISBURY 1966.

Thelomma Massal.

(Determination ↑ sterile Crustose Lichens)

Introduction

The genus *Thelomma* is related to *Cyphelium*. The species have crustose, warty or areolate, gray, yellowish or brown-gray thallus and fruiting bodies sunken in thallus warts, with a black mazaedium. The genus includes seven, partially silicate-, partly wood dwelling species. A distribution high point lies in California.

The single species existing in Germany of the three species in Europe included in the genus grow on tough wood, especially on conifers. In the region they were found only on processed wood, thus on wood posts of pasture fences or on boards of old barns. They prefer eutrophied habitats and are distributed in the south boreal zone toward the North- and central Germany as well as in the montane to alpine sites of Central Europe, above all in the Alps, the near Alps region, in the Riesengebirge and in the Carpathians. In the region the black sorediate crustose lichens are only sterile.

Genus Characteristics

Thallus crustose, usually warty, with *Trebouxia*. Ap. sunken in thallus warts, black, covered by a mazaedium, in the case of many species slightly greenish pruinose. Esc. basally very thick, dark brown to black, laterally thin, almost colorless. Asci commonly cylindric, with single series spores, very soon falling apart. sp. dark brown, one-celled and spherical or 2-celled and ellipsoidal. Various lichen substances in mazaedium/hymenium and thallus. Depside, Depsidone. *Th. ocellatum* ±Usnic acid, in the mazaedium with Rhizocarpic acid, Epanorin.

Ecology and Distribution of the Species

Thelomma ocellatum (Körber) Tibell
(Cyphelium o. (Körber) Trevisan)
Above all in high montane and subalpine sites, but even descending into the submontane zone, on tough decayed conifer wood, usually on posts, railings, shingles, often synanthrop, especially in the region of pastures, acidoph., ombroph., r.-v.photoph., m.nitroph., in the Lecanorion variae – s'bor-mieur-subalp/praealp – rare (3); al, Av, Ju, Do, SFW, Sch, O, Rhön et al.

Lit.: TIBELL 1976

Thelopsis Nyl.

Introduction

The thallus of the *Thelopsis*-species are crustose, in the fresh condition light gray to at most light rose colored and containing algae of the genus *Trentepohlia*. The fruiting bodies are at the apex light to black colored perithecia.

Th. rubella, the single species occurring in the region of six of six numbered in the genus, three are in Germany, living on stems of older deciduous trees in forests not or carefully managed in humid, oceanic sites. The species is strongly threatened. The area stretches over the region of summer-green deciduous forests in West and Central Europe, in the North up into the South of the Scandinavian peninsula and Scotland, in the East into the Balkans and the Ukraine. *Th. melanthelia* crusts over living and dying mosses on base-rich soils in alpine sites; the nearest occurrence of this arctic-alpine species lies in the Allgäu. The third species, *Th. flaveola*, is very rare in the Bavarian mountain forests and is to be found on dwarf shrubs above the tree line.

Genus Characteristics

Thallus crustose, decorticate, usually thin, with *Trentepohlia*. Per. pale red-brown to black, ± sunken to sessile. Hym. colorless, I+ blue, later red-brown, with simple, straight, permanent paraphyses. Asci cylindric to elongate, uniformly thin walled, without tholus, wall strongly cemented to neighboring paraphyses, multi-spored. Sp. ellipsoidal to short clavate, 1-celled to cross-septate 4-celled (exotic species even weakly muriform). Ch-.

Ecology and Distribution of the Species

Thelopsis rubella Nyl.
In montane to high montane, high precipitation sites on stems of older deciduous trees, especially at the stem base on cracked bark with higher water capacity, above all on beech, oak, in open near natural mountain forests (beech-spruce forests) on very humid, m.well lighted, away from the sun habitats, subneutroph.-m.acidoph., e.g. with *Bacidia phacodes, Gyalecta flot.* – mieur-med, subatl, (oc) – v.rare (2); *nöRh+* (*Karlsruhe*), O (Heidelb.), *SFW+*, süSch, Ju, BayW

Thelotrema Ach.

Introduction

The simply constructed crustose thallus of *Thelotrema*-species contain green algae of the genus *Trentepohlia*. The apothecial disks sit deep in the thallus or in thallus warts and are surrounded by a mostly above the disk convex thalloid margin; they have often a narrow opening and become then almost perithecia-like.

The single Central European species of the mainly occurring in the tropics and the moist temperate regions of the earth, ca. 100 (in Europe

5 ± atlantic) species making up the genus which is to be found in near natural beech- and beech-spruce forests on old trees on cool-oceanic, very humid habitats. They are distributed in the mediterranean region, in West- and Central Europe up into southern Scandinavia. In the region the species is regressing.

Genus Characteristics

Thallus crustose, usually gray, cream colored, brownish, with *Trentepohlia*. Ap. with deep sitting disk, often sunken in thallus warts, with narrow opening. Disk black, sometimes pruinose, surrounded by usually in-curving thalloid margin. Proper receptacle at first closed over the disk, spitting later and producing a set off from the convex thalloid margin, in-curving proper margin. Hyp. colorless. Hym. colorless, I-. Paraphyses simple, embedded in gelatin. Asci almost cylindric, I-. Sp. to 1 to 8, cross-septate or muriform multicellular, colorless to brownish. Ch- or with very various lichen substances.

Ecology and Distribution of the Species

Thelotrema lepadinum (Ach.) Ach.
In montane and high montane, high precipitation sites in near natural spruce-beech- and spruce-fir forests on stems of usually older beech and spruce, rarely on other deciduous trees, on cool-oceanic to cold (cold air basins), very humid, foggy, sheltered from the wind habitats; in rather to moderate high precipitation sites always in narrow valleys near brooks; m.-r.acidoph., r.anombroph.-m.(r.)ombroph., r.skioph., anitroph., Char. Thelotremetum lep. (often with *Menegazzia*), even in the Lecanactidetum ab. et al. – s'bor-subatl-med-mo, (oc) – rare (3); Sch, Vog and Al over 900 m scattered, otherwise v.rare, oft (+++): Lux, *Ts+*, *PfW*, O, Sp. SFW, Ju, ThW, Erz, Av

Lit.: HALE 1974*, LETTAU 1932, MIGULA 1929-31, POELT & VÈZDA 1981.

Thermutis Fr.

(Determination ↑ Polychidium)

Introduction

The thallus of *Th. velutina*, the single species of the bluegreen algae lichen genus, consists of fine brown-black filaments, producing the cottony small turf to flat cushion. The lichen occurs on sporadically irrigated rock surfaces if limestone and SiO_2-poor silicates. It is distributed in the boreal and temperate zone, but rare.

Genus Characteristics

Thallus of finely branching, brown-black, ± erect filaments, producing directly attached to the substrate, flat cushion to cottony small turfs. Thallus filaments of *Scytonema*-filaments, in whose gelatin sheath the hyphae of the fungus partners lie. Ap. without thalloid margin, with proper margin, red-brown, laterally sessile. Exc. of loosely interwoven hyphae. Hyp. colorless. Hym. colorless or brownish above, I+ blue. Paraphyses simple, with thickened ends. Asci cylindric, thin walled, with tholus, I+ blue. Sp. one-celled, ellipsoidal. Pycnosp. spherical. Ch-.

Ecology and Distribution of the Species

Thermutis velutina (Ach.) Flotow
Up into subalpine sites on basic or purely mineral-rich silicate rock or calcareous rock on usually sunny, warm, sporadically irrigated, rapidly drying surfaces, m.basiph.-subneutroph., usually in associations of bluegreen algae – bormieur – v.rare (1); süSch, *Lahn*, *Eif*

Lit.: HENSSEN 1963 a

Thrombium Wallr.

Introduction

T. epigaeum, possibly the single species of the genus, grows on open sites on clay and loam soils, above all on slopes and road sides. The thallus of black perithecia developing lichen is very inconspicuous and only clearly to be seen in

moist weather. The species is common in nearly all of Europe.

Genus Characteristics

Thallus crustose, membrane-like thin, somewhat gelatinous when moist, with green algae of the genus *Leptosira*. Perithecia entirely sunken, with blackish apex. Esc. brown-black, without involucrellum. Paraphyses simple, thin, permanent, periphyses lacking. Asci cylindric to narrowly clavate, thin-walled, with definite K/I+ blue cap and K?I+ blue tholus, with narrow cylindric axial mass. Sp. 1-celled, ellipsoidal, without perispore.

Ecology and Distribution of the Species

Thrombium epigaeum (Pers.) Wallr.
Up into alpine sites on commonly calcareous, cool sandy-loamy to loam, usually humus-poor soils, on loess, on open (disturbed) sites on road margins, slopes, pits, in dry turf etc., lichens of ephemeral habitats, m.basiph.-subneutroph., in Moss-Lichen-pioneer associations, e.g. Lecideetum ulig. – bor-med – rare, overlooked (3); süHü, Ne, Sch (loam region), Hu, He, Erz, *Vog, Rh, O, Ju, Rh-Mn-T, Lahn, Al*

Lit.: SWINSCOW 1964.

Thyrea Massal.

(Determination ↑ Phylliscum)

Introduction

The *Thyrea*-species are gelatin lichens with black, sometimes bluish pruinose, foliose, attached at one site by an umbilicus-like attachment, rarely even almost crustose-areolate thallus. The apothecia are at least at first only point-like opening.

The (ca. 20) species dwell predominantly on warm, short-time irrigated limestone. This goes also for the single taxon known in Germany; it occurs from the Mediterranean region up into southern Central Europe; a single "outpost" exists in South Sweden.

Genus Characteristics

Thallus foliose, attached with an umbilicus, blackish, olive-black, nonpruinose or pruinose, of gelatinous consistency, with Chroococcales- of Pleurocapsales- bluegreen algae, unlayered to layered and algae concentrated in the outer region of the thallus segment, hyphae often longitudinally oriented in the center of the lobe, producing a network at the margin to predominantly anticlinal orientation. Ap. ± sunken, with thalloid margin, at first perithecia-like closed, later usually ± open, of projecting pycnidia (pycnoascocarp). Hym. I+ blue to red. Asci clavate to cylindric, thin-walled, with very thick above, with I interior more intensively colored than the exterior of the gelatin envelope. Sp. 1-celled, broadly ellipsoidal to spherical. Pycnosp. short bacillar to fusiform. Ch-.

Ecology and Distribution of the Species

Thyrea confusa Henssen (Th. pulvinata auct.)
In the foothills to submontane, low precipitation to moderately high precipitation sites on carbonate rock, rarely on calcareous silicate (here like *Peltula*), on sporadically irrigated, sunny, warm, rain exposed to rather rain sheltered sloping surfaces and under overhangs, basiph., r.xeroph., subhydroph., r.-v.photoph., thermoph., like *Anema decipiens*, Char. Peccanio-Thyreetum – mieur-med – rare (3); Ju r.rare, SJu, FrJu, otherwise v.rare and probably +: süHü, *Ne, HRh*

Lit.: HENSSEN & JORGENSEN 1990, MIGULA 1929-31, MORENO & EGEA 1991*

Tomasiella Massal.

Introduction

The *Tomasiella*-species are fungi, which probably are not lichenized. The species have been little observed mycologically and lichenologically. Their thallus is very inconspicuous. The black fruiting bodies are rounded in aspect, elliptical or irregularly

constructed, containing several to many perithecia-like chambers. The spores are two- to four celled, colorless to brown. The species grow on the smooth bark of branches and young stems of trees and on shrubs.

Genus Characteristics and Determination

"Thallus" inconspicuous, in the substrate, without algae. Ascocarps round in outline, elliptical or irregular, black, ± flattened, with perithecia-like chambers, each of which open out (often protruding) to an ostiole. Hymenium of branching pseudoparaphyses. Asci pear-form narrowing above, I-. sp. clavate to slipper-form, colorless to brown, finely warty. Pycnosp. bacillar. Ch-.

1 Sp. 2-celled, 18-27 x 5-7 µm, dark brown, often with perispore (thicker in K). Cells rounded to oval. "Per.-"warts round to ellipsoidal, with 2-12 chambers, -1mm. Thallus indefinite **T. diffusa**

1* Sp. 4-celled, 18-27 x (5)7-10 µm, colorless (at best old single-celled sp. brownish), without perispore. "Per.-"warts ± round, with 10-50 chambers, -1 mm. Thallus indefinite **T. gelatinosa**

Ecology and Distribution of the Species

Tomasiella diffusa (Leighton) Lahn
In the foothills and submontane, winter-mild, relatively oceanic sites on smooth bark of deciduous trees, above all alder -- mieur-atl-smed – v.rare, probably +; Eif (Nuremberg)

Tomasiella gelatinosa (Chev.) Zahlbr.
Up into montane sites on the smooth bark of hazel stems (rarely alder, quaking aspen) on cool-moist habitats, in open forests, in brook borders, m.-r.acidoph. – mieur-med – (v.) rare (also overlooked); O, Vog, Eif

Lit.: KEISSLER 1937, PURVIS et al. 1992.

Toninia Massal.

Introduction

The *Toninia*-species have a purely crustose thallus to one mostly composed of flat to high convex squamules, black, sometimes pruinose apothecia with at least at first projecting proper margin and cross-septate spores.

The genus includes ca. 50 species. Most of the indigenous species (in Germany 18, exclusively of the genus with the exception of *T. tumidula*) growing on limestone on well lighted habitats, thus *T. alutacea, T. candida, t. taurica, T. verrucarioides, T. toniniana, T.tristis* and *T .tumidula*, which occurs on fissured rock parts and in cliff fissures, additionally *T. athallina* and *T. philippea*; *T. pennina* is especially to be found on dolomite. *T. sedifolia* and *T. physaroides* reside on base-rich soils, above all in openings in vegetation or dry turf and pioneer associations, but even on fissured calcareous rock and basiphytic mosses. *T. aromatica* occurs in cliff fissures, on walls and on soil and mosses, *T. squalida* on soil impregnated, usually sporadically irrigated silicate rock, directly on sandy, humus soils or on mosses, in the region mainly in the area of extensive winged broom meadows and bristle-grass turfs.

Several *Toninia*-species are widely distributed in Europe, if also – geologically conditioned – in part with large openings in the area, thus the basiphytic *T. aromatica, T. sedifolia, T. verrucarioides* and *T. candida.* Also the area of *T. squalida* stretches over the greater part of Europe; the species are found in Central- and South Europe mainly in the mountains. *T. alutacea* and *T. rosulata* which live in limestone fissures, on lime-mosses and calcareous soils (in SW-Germany only in Allgäu) are arctic-alpine distributed. Many species have southern distribution high points and occur in South- and Central Europe, thus *T. toniniana* and the southern Scandinavian – today only with isolated exclaves – including *T. tumidula, T. taurica, T. tristis* var. *tristis, t. physaroides, T. opuntioides, T. pennina, T. philippea.* Also *T. anthallina* has its distribution high point in South- and in southern Central Europe, isolated occurrences are to be found however into North Norway.

Genus Characteristics and Determination

Thallus squamulose, with flat to bloated-high convex, at the margin sometimes elongated squamules, which in many species are bound to the substrate with long compact <<rhizine

strands>>, rarely crustose and epilithic, rarely endolithic, usually white, gray, olive, brown, pruinose of nonpruinose, in the case of the squamulose species usually with upper and lower cortex. With coccoid green algae. Ap. without thalloid margin, at least when young with definite proper margin, black, often pruinose. Esc. interior lighter brown to colorless, exterior dark and usually very similarly colored as the epihym. Hyp. dark red-brown to colorless. Epihym. usually gray, olive, green, brown, red-brown. Paraphyses simple or little branching, straight, weakly cemented, thickened above and usually with gelatinous pigmented cap. Asci clavate, wall I-, exterior with I+ or K/I+ blue gelatinous layer, with I+ blue tholus with intensive blue colored tubular structure and definite ocular chamber. Sp. cross-septate, 2- to 8(10) celled, rarely 1-celled, ellipsoidal, elongate, fusiform, needle-form or bacillar. Pycnosp. filamentous, curved. Usually Ch-, sometimes Terpenoide, indigenous species R- (except sometimes *T. tumidula*).

Many *Toninia*-species live as juveniles on bluegreen algae lichens, e.g. *Toninia candida, taurica, toniniana.*

1 On wood, bark, Thallus usually sterile, of olive-gray, gray-green to brown, convex to unevenly deformed, partially flattened squamules. Ap. finally with wavy margin. Sp. 2-, rarely 4-celled, 6.5-14 x 2-4 µm **Hypocenomyce caradocensis**

1* On rock, soil, mosses **2**

2 Sp. only 2-, rarely also 1-celled . **3**

2* Ripe sp. at least 4-celled . **17**

3 On silicate rock in alpine zone. Thallus squamules ash-gray, convex, united into thick cushions. Ap. -1.5 mm, finally convex-marginless, usually aggregated, epihym. dark green, hyp. light, sp. 9-17 x 3.5-6 µm. Vertical- and overhanging surfaces – arct-alp – Alps, BayW **Psorinia conglomerata** (Ach.) G. Schneider (*Toninia c.* (Ach.) Boistel*)*

3* On limestone, calcareous soil, calciphytic mosses . **4**

4 Thallus crustose, areolate to appearing squamulose of endolithic. Sp. 2-celled. Almost always Ch- . **5**

4* Thallus definitely squamulose. Squamules flat to convex or vasicular swollen to almost cylindric. Sp. 1-2 celled . **7**

5 Hyp. colorless to slightly yellowish. Epihym. gray, gray-brown to violet, K+ violet. Ap. -0.8 mm. Thallus crustose, areolate to scruffy, at best appearing squamulose, often crusted over by blackish bluegreen algae, dark brown, moist red-brown. Hym. 50-55 µm. Sp. 8-12(16) x 3-5 µm. Ch- **T. pennina**

5* Hyp. red-brown to brown-violet (rarely even brown-black to greenish). Epihym. olive-brown to dark green, K- **6**

6 Thallus commonly endolithic, rarely thin crustose. Ap. 0.3-0.5(0.8) mm, flat and margined, later convex and ± marginless. Sp. 10.5-13.5 x 3.5-7 µm. Ch- . **T. athallina**

6* Thallus usually clearly developed, cracked to lumpy areolate or warty areolate, areoles flat to convex or uneven, (yellowish)gray to gray-green, brown, rust-brown. Ap. 0.2-0.8 mm, flat to moderately convex, indefinitely margined. Sp. 11-16.5 x 4-7 µm. Hym. 50-75 µm. Ch- or ±(Terpenoide) . **T. philippea**

7 Epihym. brown, olive, green, K- . **8**

7* Epihym. gray, gray-brown, K+ violet. Squamules convex to vesicular or flat . **10**

8 Thallus pale rose, squamulose, ± rosetted, squamules flat to convex, irregularly finely cracked, thereby finely warty. Ap. -1.5 mm, ± flat and margined, ± thickly pruinose. Hyp. brown. Sp. 9.5-17 x 3.5-5 µm. Ch- . **T. toniniana**

8* Thallus not pale rose **9**

9 Squamules dark to chestnut brown, nonpruinose, mostly flat, vesicular-high convex, usually closely coalescing. Ap. up to ca. 1.5 mm, flat to moderately convex, nonpruinose. Hyp. pale brown to middle brown. Sp. 1-2 celled, 12.5-20 x 3.5-5.5 µm, epihym. brown, olive-brown (or 1-celled, 10-15.5 x 4.5- 6.5 µm, epihym. green), ellipsoidal to fusiform. Terpenoide . **T. tristis**

9* Squamules whitish, convex to flat, often delimited, with dull, finely cracked, areolate upper surface, K-/K± yellow. Ap. -1.5 mm, nonpruinose, squamules standing at the margin, flat to convex. Hyp. ± brown, epihym. brown to olive. Sp. mostly 1-celled, elongate egg-form, 10-18 x 3.2-5.0 µm. Atranorin **T. tumidula**

10 Squamules with small punctiform to short streak-form pseudocyphellae, dark greenish-gray to dark brown, mostly slightly pruinose, strongly convex to vesicular and column-form. Ap. rather rare, -5 mm, flat to slightly convex, with age often marginless, mostly nonpruinose. Hyp. light brown to colorless. Sp. 11.5-18.5 x 3.5-5 µm, broadly fusiform. Ch-, rarely (fatty acids) **T. physaroides**

10* Thallus without pseudocyphellae. Ap. ± flat . **11**

11 Thallus entirely nonpruinose (yet ap. often pruinose). Ch-, rarely one Depside **12**

11* Thallus partially of entirely pruinose . **13**

12 Hyp. pale brown to colorless. Thallus squamules dark olive brown (moist clearly greenish), shiny, cracked on the upper surface, to coherent to shingle-like, moderately convex to high convex or sometimes even flattened, producing cushions.

Ap. -3 mm, pruinose (rarely nonpruinose), margined, margin nonpruinose. Sp. 16.5-24.5 x 3-4.5 µm **T. taurica**

12* Hyp. brown to dark red-brown. Thallus squamules dark olive-green to dark brown, dull to weakly shining, without cracks, flat, weakly to strongly convex and vesicular, scattered to coherent and shingle-like. Ap. -3 mm, nonpruinose, margined, later marginless . ↑ **Toninia sedifolia** (see also nonpruinose forms of *T. opuntioides*)

13 Hyp. light brown to colorless. Squamules -6 mm, convex to vesicular, later flattened, thick white pruinose, often becoming an irregularly rosetted thallus. Pruinosity granular. Ap. -4 mm, permanently margined. Ch-, rarely (Terpenoide). Alpine . **T. rosulata** (Anzi) Oliv. (if with pseudocyphellae, usually weakly pruinose: *T. physaroides*)

13* Hyp. brown to dark red-brown . **14**

14 Upper side of squamules pruinose throughout. Sp. fusiform, 15-26 x 3-4(4.5) µm. (*T. candida* s.l.) **15**

14* Upper side of squamules partially nonpruinose (underside pale brown to white. Hyp. middle- to dark red-brown. Sp. fusiform) **16**

15 Thallus rosetted, i.e. squamules coherent and enlarged and elongated at the thallus margin. Pruinosity relatively fine, mealy. Ap. -2 mm, margined, thickly pruinose. Ch- or fatty acids **T. candida**

15* Thallus of scattered to coherent, more or less rounded to rounded-angular, not elongated squamules (at best appearing rosetted). Pruinosity relatively coarse, granular. Ap. -1.5 mm, slightly to thickly pruinose. Ch- or with Terpenoides **T. diffracta**

16 Squamules vesicular swollen, -4 mm, usually partially erect, flat and ± roof tile-like, mostly with surface cracks, dark olive-brown to dark red- brown, mostly weakly to moderately pruinose, above all on the margin. Ap. -4 mm, nonpruinose to moderately pruinose. Sp. 16-24 x 3.5-4 µm. Terpenoide (Rf 5/1/5) **T. opuntioides**

16* Squamules weakly convex to vesicular swollen, commonly not erect, -3 mm, scattered to coalescing or irregularly roof tile-like, olive-green to dark brown, weakly to thickly pruinose, usually smooth. Ap. -3 mm, margined, old often marginless, nonpruinose to thickly pruinose. Sp. 12-24 x 3-5 µm. Ch- or Depside (Rf 3-4/5-6/6), rarely Fat-Sn . **T. sedifolia**

17 Without its own thallus. Ap. sessile on crustose lichens, nonpruinose, flat to weakly convex, margined, -0.6 mm. Epihym. olive-green to dark green, K-, hyp. red-brown. Sp. 2-4 celled, 9.5-16 x 4.4.5 µm **T. subfuscae**

17* With its own thallus **18**

18 On heavy metal containing (Cu, Ni) silicate rock, thereby occurring regions. Thallus areolate to appearing small squamulose, areoles whitish, in the center ± olive and usually depressed, -1 mm, occasionally sorediate. Ap. flat, margined, -1.5 mm. Hyp. dark brown. Sp. 4-6 celled, 25-40 x 6-7 µm. Atranorin and Lobaric acid **Stereocaulon leucophaeopsis**

18* On mosses, soil, limestone. Atranorin and Lobaric acid lacking **19**

19 On acidophilic soil- and rock mosses and acid soils. Thallus squamulose, squamules often closely coalescing, weakly concave to weakly convex, middle- to dark brown, dull. Ap. -1.5 mm, soon convex and ± marginless. Hyp. colorless to pale brown, epihym. olive-green to green. Sp. needle-form, 23-42 x 2.5-4.5 µm, 4-8 celled. Ch- . **T. squalida**

19* On lime cliffs, calcareous rock (even walls), lime-rich soils. Sp. up to 4-celled . **20**

20 Epihym. gray to brownish, K+ violet. Hyp. colorless to pale brown . **21**

20* Epihym. brown, olive, green, green-black, K-. Hyp. dark brown to red-brown (purple) . **22**

21 Thallus crustose, areolate to lumpy, at best appearing squamulose, dark brown, often over crusted by bluegreen algae, nonpruinose. Ap. -0.8 mm. Sp. 8-12(16) x 3.5 µm, 2-4 celled **T. pennina (5)**

21* Thallus squamulose, rosetted, thickly white (granular) pruinose. Margin squamules ± flat, central squamules convex to vesicular. Ap. -2 mm, ± flat, margined, moderately to thickly pruinose. Sp. 23.5-33 x 3.4 µm, narrowly fusiform (Terpenoide) . **T. alutacea**

22 Paraph. scarcely thickened above (2.5 µm), without pigmented gelatinous cap, cemented. Sp. 15-26(30) x 3.5(6) µm. Epihym. olive, green, green-gray. Thallus thick small squamulose (to coarse granular), rather thick. Squamules 0.2-1 mm, gray-white to blue-gray or brownish, with lighter margins, crustose coalescing, crenate. Ap. -0.6(0.8) mm, soon convex, often crowded. Zeorin **Mycobilimbia lobulata**

22* Paraph. clearly thickened above, with pigmented gelatinous cap, moderately cemented. Thallus squamules or areoles often not coalescing, larger. Ch- **23**

23 Epihym. dark olive green to green. Squamules -4 mm, light gray to dark brown, often green tinted, often with irregularly lighter flecks, nonpruinose to pruinose, young parasitic on crustose lichens. Ap. -1.5 mm, ± flat, margined, even weakly pruinose. Sp. bacillar, rarely ellipsoidal, 12-23 s 4-5.5 µm **T. aromatica**

23* Epihym. dark brown, sometimes green tinted. Squamules -2 mm, flat to weakly convex, dark brown to dark gray, sometimes partially pruinose, without flecks, parasitic on bluegreen algae lichens, above all *Placynthium (nigrum).* Ap. -1

mm, flat, margined, sometimes weakly pruinose. Sp. ellipsoidal to bacillar, 10.5-19 x 3.5-5 µm
T. verrucarioides

Ecology and Distribution of the Species

Toninia alutacea (Anzi) Jatta (T. intermedia (Massal. ex Arnold) Oliv.)
Like *T. candida*, yet more in higher sites -- arct-alp – v.rare (0): *Ju (Lemberg)*, Al

Toninia aromatica (Wm.) Massal. s.l. (T. fusispora (Hepp ex Körber) Th.Fr.)
Up into montane sites on m.-r.well lighted habitats on calcareous substrates, above all on old mortar on walls, on rock dwelling mosses, on lime cliffs on slightly earth encrusted or dust impregnated sites, often on m.-r.nutrient-rich sites, even on calcareous sandy soils, basiph., m.-r.photoph. – (arct-)bor-med – rare (3); Single collection in süSch, Ne, Rh, Mos, He, Th, *Ju, O, Mn, Bo*

Toninia athallina (Hepp) Timdal (Catillaria a. (Hepp) Hellbom, Kiliasia a. (Hepp) Haf.)
Up into the alpine zone on lime-rich rocks, like *Rinodina imm.* (↑), .usually on sloping- and vertical surfaces of cliffs, pioneer on stones, Char. Rinodinion imm., basiph., r.photoph. – (bor-)- mieur-med – r.rare; SJu, Ju, FrJu, süHü, Eif, Al

Toninia candida (Weber) Th.Fr.
Up into alpine sites on lime-rich to weakly calcareous rocks, especially in fissures, depressions, on weathered sites, usually on steep- and vertical surfaces, often on occasionally slightly irrigated substrates (with bluegreen algae lichens), Char. Toninietum cand., basiph., r.-v.photoph., r.xeroph., (subhydroph.) – mieur-med-mo – rare; SJu, Ju, FrJu, Th, Al scattered, otherwise (v.)rare (Mn, Ne, Bo, süHü, Vog, Eif)

Toninia diffracta (Massal.) Zahlbr.
Up into alpine sites on sloping- and steep surfaces of limestone, above all on fissured sites (like *T. candida*), even on lime-rich soils (like *T. sedif.*), basiph., r.-v.photoph. – mieur-med – rare; Ju, SJu, FrJu

Toninia opuntioides (Vill.) Timdal
Up into alpine sites on fissured lime cliff walls (like *T. candida*), rarer on stony raw lime soils or base-rich loam soils and loess, often together with mosses, when young associated with bluegreen algae, on well lighted to semi shaded habitats, neutroph.-basiph., r.-v.photoph., e.g. in the Toninion cand. – (s'bor)s'mieur-med – rare (3); Ju, Mn

Toninia pennina (Schaerer) Gyelnik (Catillaria scotina (Körber) Hertel & Kilias)
In submontane and montane sites above all on dolomite, predominantly on steep- and vertical surfaces on well lighted habitats – mieur-med (co) – v.rare (R); Ne, *FrJu, Ml*

Toninia philippea (Mont.) Timdal (Catillaria ph. (Mont.) Massal., Kiliasia ph. (Mont.) Haf., Kiliasia riparia (Müll.Arg.) Haf.)
Up into alpine sites on usually m.-very lime-rich rocks, on well lighted habitats, e.g. in semi- dry turfs -- (bor-)mieur-med – v.rare (2); *süHü, Ne*, Ju, Eif, *Mn, Fr*, Th, Al

Toninia physaroides (Opiz.) Zahlbr.
From foothills sites to above the tree line on fine soil of stony raw lime soils, usually between and on mosses, rarely on soil encrusted cliffs, on sunny habitats, when young associated with bluegreen lichens, basiph., photoph., like *Toninia sedif.*, in the Toninion sed. – mieur-med – r.rare (3); Hü, Ju, Mn

Toninia sedifolia (Scop.) Timdal
(T. caeruleonigricans auct.)
In the region above all on foothills and montane sites, but penetrating up into the alpine zone, on calcareous soils and earth filled fissures of lime cliffs, above all in openings of lime dry meager turfs (Bromion) on level, stony soils, even on loess, repeatedly on calciphilic soil mosses, rarely in fissures of calcareous silicate rocks, even as a pioneer on road margins, on r.-v.well lighted, often warm habitats, basiph., r.xeroph., Char Toninion sed., above all in the Ton.-Psoretum (Bunt soil lichen society) – (arct-)bor-med – r.rare (3); SJu, Ju, FrJu, Mn (2) scattered., Al, otherwise rare and (2); Hü, süRh, Bo, Do, *Av*, Ne, *O*, Pf, Vog, *Rh-Mn-T*, Mos, Bit, Eif, He, Th

Toninia squalida (Ach. Massal.
In montane and high montane (-alpine) sites on acid-humus, sandy or stony soils, in the region level meager turfs (Nardo-Callunetea) as well as on soil encrusted silicate rock on occasionally irrigated, of ± nutrient-rich, now and then even somewhat calcareous flooded surfaces, on r.-v.well lighted habitats, m.acidoph. -subneutroph.,

m.nitroph., Char Polychidio-Massalongietum, usually with *Bryum argenteum, Cephaloziella starkei, Massalongia, Polychidium* – bor-mieur-mo/ap-med-mo/alp -- rare (2); süSch, Vog, ThW, BayW

Toninia subfuscae (Arnold) Timdal (Celidium s. Arnold)
Living on stone dwelling subneutrophytic to basiphytic crustose lichens on well lighted habitats – bor-med – V.rare *(0)*; *O (Heidelb.*, on walls)

Toninia taurica (Szat.) Oxner (T. clemes H.Baumg. ined.)
In the region in montane sites on steep surfaces of fissured limestone, like *Toninia candida* (↑) -- (s')mieur-med – rare (3); Ju, SJu

Toninia toniniana (Massal.) Zahlbr.
In the foothills and submontane (montane) sites on lime-rich rocks, above all on steep surfaces in fissures and splits, basiph., r.-v.photoph., r.thermoph., r.xeroph., m.ombroph., anitroph. – s'mieur-med – v.rare (3); süHü (Kaiserstuhl: 1x) Ju, FrJu

Toninia tristis (Th.Fr.) Th.Fr. (T. tabacina auct.)
From the foothills up into the alpine zone on lime-rich, fissured lime cliffs and on lime-rich stones, level soils on r-.v.well lighted, sunny habitats, basiph., in the region e.g. with *Toninia candida, T. sedifolia* – (bor-)mieur-med -- v.rare (1); Ju (Überkingen), *Ne*, Th

Toninia tumidula (Sm.) Zahlbr
In the submontane and montane sites, on calcareous rock on vertical- and sloping surfaces in fissures, like *Psora testacea* (↑), Char. Squamarinetum oleosae – s'mieur-med – rare (3); Ju

Toninia verrucarioides (Nyl.) Timdal (T. kolax Poelt)
Above all in montane to alpine sites on calcareous rock parasitic on bluegreen lichens, above all *Placynthium*-species (above all *P. nigrum* (↑), in the Placynthietum nigri and in the *Plac. filif.-subradiatum*- society – (arct-)bor-med – rare (3); Ju, FrJu, Al, süRhön

Lit.: TIMDAL 1991.

Trapelia Choisy

(Determination and Introduction incl. Trapeliopsis)

Introduction

The Trapelias have crustose, sometimes appearing marginally lobed or squamulose thallus with rose, brown or blackish colored apothecia with biatorine proper margin, occasionally with thalloid margin in addition. Many plants reproduce predominantly with soredia. They are dwellers on acid substrate, mainly soil and rock; many have pioneer characteristics. *Trapelia* contains in Europe ca. 7, in Germany 6 species, *Trapeliopsis* ca. 10 and 8 species. The breadth of modification of many taxa is considerable and insufficiently clarified, thus in the *T. coarctata*-group.

Trapeliopsis wallrothii, T. gelatinosa, T. pseudogranulosa and *Trapelia geochroa* are found mainly on sandy to sandy-loam mineral soils; the later occurring only on cool substrate, long time snow covered sites in higher sites of the Central European mountains. *Trapeliopsis pseudogranulosa* is a common pioneer of open road slopes, above all in forests. *T. granulosa* and the rarer *T. percrenata* have their optimum on humus soils, raw humus and peat, *T. viridescens* and *T. flexuosa* on wood, the latter going over occasionally on to bark. *Trapelia coarctata, T. involuta, T. placodioides, T. mooreana* and *T. obtegens* reside on lime-free silicate rock, preferably on long time dew moistened stones, bounders and cliff surfaces near the soil. *T. placodioides* seems with respect the moisture condition requirements to be especially fastidious and is found on boulders in brooks. *T. mooreana* is known from very high precipitation oceanic sites. *T. involuta* repeatedly goes over to walls and other anthropogenic habitats.

T. coarctata, T. involuta, T. placodioides, T. granulosa, T. flexuosa and *T. pseudogranu-losa* are widely distributed in Europe and only in the Arctic rare of not occurring. The area of *T. wallrothii* stretches over the mild regions of Scandinavia to the Mediterranean. *T. mooreana* is extensive limited to West Europe (Great Britain, western Scandinavia) and high precipitation oceanic region of central middle Europe (Alps, Vogesen, Black Forest, Riesengebirge, Carpathians). *T. viridescens* and

T. gelatinosa occurs mainly in the summer-green deciduous forest region. *T. percrenata*, one of only a few lichens known to be only from Central Europe. It is known from a single collection in the region and in Germany has not been further found. *T. viridescens* and possibly *T. gelatinosa* are in regression. *T. geochroa* is on the basis of its rarity and the scarcity on their collection sites are potentially strongly threatened.

Genus Characteristics and Determination

Thallus crustose to appearing squamulose, usually whitish, beige, gray, gray-green, with coccoid green algae, in the case of a great many species sorediate. Ap. rose, brown, yellow-brown, red-brown to black, with or without thalloid margin, usually with proper margin, Exc. light, strongly developed to very thin. Hyp. colorless. Paraphyses branched and reticulate bound, very thin. Asci narrowly clavate-cylindric, thin walled. Tholus I- or weakly I+ blue. sp. one celled, ellipsoidal, colorless or very slightly colored. Pycnosp. cylindric to filamentous. Ch: very often Gyrophoric acid.

1 Thallus C+/KC+ red, P-. Gyrophoric acid . **2**
1* Thallus C-/KC- **12**
2 Thallus partially sorediate . **3**
2* Thallus not sorediate, on rock or soil . **10**
3 Thallus partially orange, there K+ red, otherwise pale greenish, light gray, greenish-gray, K-, extensive, coarsely granular, with greenish white, partially even orange colored, at first convex, then fleck-wise coalescing soralia, P-. Soredia fine, -25 µm. Ap. rare, depressed, flat, wavy margined, green-gray to gray-black, -1 (1.6) mm. Epihym. greenish. Sp. 10-12 x 3.5-6 µm. Anthraquinone
* . **Trapeliopsis pseudogranulosa**
3* Thallus not fleck-wise orange. K-/K+ slightly yellowish **4**
4 Thallus whitish to mostly slightly rose-white, clearly thick and coherent, with numerous small yellowish-white to pale greenish soralia above all on the cracks or areole margins. Ap. very rare (like *T. involuta*). On rock
* **T. placodioides**
4* Thallus not weakly effigurate, not flat and coherent, but warty areolate to granular **5**
5 Thallus on rock . **6**
5* Thallus on wood, bark, or soil . **7**
6 Thallus inconspicuous, of ± scattered, ± ochre tinted, pale greenish, mostly convex, -0.3(0.4) mm areoles. Soralia -0.4 mm, concave to convex. Ap. not rare, -0.5 mm, rose to red-brown, with somewhat lighter proper margin. Sp. ca. 11-14 x 5-6.5 µm * **T. obtegens**
6* Thallus usually extensive, often on sandstone, of granular-warty small areoles. Ap. rose to black, often over 0.5 mm wide . **9**
7 Ap. marginless, black to green-black, mostly convex, -0.6 mm or aggregated, -1 mm. Thallus coherent finely granular (granules -0.1 mm), greenish (at least when moist) to light gray, usually large surfaces pale green sorediate. Esc. ± lacking. Sp. 9-12 x 4-5 µm. On decayed wood
* **Trapeliopsis viridescens**
7* Thallus with other characteristics, not large surfaces uniformly sorediate. Ap. lacking or lone time flat, at least when young clearly margined, pale to dull black **8**
8 Thallus of inconspicuous, ± scattered, greenish to brownish, -0.15 mm wide areoles with punctiform, convex, pale brownish to green-brownish, soralia. Ap. very rare, -0.2 mm, rose-brown, pale margined. Sp. 11-14 x 5-6.5 µm
* **T. corticola** Coppins & P.James
8* Thallus ± extensive and coherent, of over 0.1 mm, warty to granular-warty areoles. Ap. not rare, essentially larger **9**
9 Ap. gray-rose to brick-red, red-brown, olive-brownish, green-gray to almost dull black, even in the same thallus often variable, 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 in the case of *T. flexuosa*, whitish, yellowish to rarely gray-greenish. On soil, humus, or rock. * .**Trapeliopsis granulosa**
9* Ap. dark greenish-gray to (green)black, rarely pale colored in deep shade, flat to weakly convex, -0.7 mm. 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), granules often enlarged and flattened (0.4mm) at the margin. Soralia at first delimited, -0.4 mm, later often coalescing, mealy to finely granular, gray-green to dark green (bluish-green). Usually on wood, more rarely bark, rarely rock.
***Trapeliopsis flexuosa**
10 Thallus entirely crustose, ± cracked, not squamulose, not effigurate at the margin, commonly thin, whitish, light gray, greenish-gray, rose-white. Ap. -0.8 mm, rose to red-brown, dark to blackish-brown (moist usually clearly reddish), flat to convex, only the younger stages with apparent proper margin, at first surrounded by a fine white, often irregularly toothed thalloid margin, flat to convex. Sp. 14-26 x 7-13 µm. . * **T. coarctata**
10* Thallus apparently to clearly squamulose or of crenate to apparently lobed, scattered to partially overlapping areoles **11**

11 Commonly on soil and raw humus. Thallus squamulose. Squamules flat to uneven, crenate, appearing lobed at the margin of the thallus and there often even convex, whitish to light gray, -1.6 mm, often with groups of irregular, isidia-like outgrowths, which after falling out leave round concave scars. Ap. 1-2 mm, often lacking, rose-brown to greenish-gray or almost blackish, often slightly pruinose. Sp. 8-14 x 4-5 µm. Epihym. and hyp. pale to yellow-brownish.
* **Trapeliopsis wallrothii**

11* Commonly on rock, rarely on soil over stony soils. Thallus areolate. Areoles separated to overlapping, often crenate to appearing lobed at the margin, flat to convex, without isidia, beige, slightly brown- or gray tinted whitish, at the thallus margin often larger, -0.4 mm. Ap. -0.8 mm, rather frequent, rose to red-brown, with thallus colored or often lighter proper margin, sometimes at first with thin thalloid margin. Sp. 15-25 x 7-13 µm. Epihym. light to dark brown.
* **T. involuta**

12 Sp. 15-32 x 6-14 µm. Ap. large, up to over 2 mm, disk dark brown to black-brown, concave to flat, margin puffy, often curved, mostly lighter colored. Thallus crustose, warty. Ap. in section and pycn. C+ rose (Gyrophoric acid). On rock and naked soil . **13**

12* Sp. smaller. All parts C-. On raw humus, decayed wood, or soil . **14**

13 Thallus on rock, beige, light yellowish to light ocher. Ap. -1.5(2) mm, sitting up on strongly narrowed base **T. mooreana**

13* Thallus on soil, whitish, of vesicular-hemispherical, ± high, erupting, closely crowded areoles. Ap. -3 mm, narrowed at the base. Uncertainly differentiated from *T. mooreana* . **T. geochroa**

14 Thallus squamulose. Squamules light gray-greenish, olive-gray, C-, K-, P-, with lobed, ascending, sorediate erupting margins, -3 mm, soralia lip-form to capitate. Ap. brown to dark gray with often lighter margin, finally convex-marginless, 1-2.4 mm. Epihym. and hyp. pale to yellow-brownish. Sp. 8-11 x 3.5-5.5 µm **Trapeliopsis percrenata**

14* Thallus membrane-like thin to very finely granular, gelatinous when moist, dark green-brown, green-gray, loam colored, often with pale greenish, soon irregular and coalescing soralia. Ap. -1(1.5) mm, depressed, marginless or pale and not raised margin, gray-black, gray, greenish-gray. Epihym. green, K± brown. Sp. 8-14 x 4.5-6 µm **Trapeliopsis gelatinosa**

Ecology and Distribution of the Species

Trapelia coarctata (Sm.) Choisy (Lecidea c. (Sm.) Nyl., Lecanora c. (Sm.) Ach.)
Predominantly from the foothills up into the montane zone on lime-free silicate rock, almost always on stones and near the soil cliff surfaces, on long time dew moistened or radiation protected sites, like *Porpidia crustulata* (↑), Char. Porpidietum crust. – bor-med-mo – moderately frequent, locally rather frequent, above all in the region Green Mountains, Keupers and Bunt sandstones, in the lime regions rare (synanthrop) to lacking

Trapelia geochroa (Körber) Hertel (Biatora g. Körber)
In subalpine and alpine, very high precipitation sites on cool to moist, naked soil on sites with very long snow covering (snowdrifts and avalanche tracks), e.g. in openings in meager trufs, secondarily even on road sides, m.-v.acidoph., substrathygroph., r.photoph., in the Solorinion croceae -- mieur-h'mo – v.rare (1); süSch (Feldberg-region)

Trapelia involuta (Taylor) Hertel (Lecidea ornata (Sommerf.) Hue)
Up into high montane sites on lime-free, often mineral-rich silicate rock, often on somewhat more strongly weathered, rough substrates, on stones and near the soil, frequently dew-moistened or even sporadically irrigated cliff surfaces, even on somewhat dust impregnated sites, even on wall crowns of natural stone, roof tiles, pioneer character not as pronounced as in the case of *T. coarctata*, more frequently even on well lighted, often even on sunny and warm habitats, subneutroph.-r.acidoph., (substrat-hygroph.), m.-v.photoph., e.g. in the Lasallietum and Lecideetum lithoph. – (bor-) s'bor-med, subatl – r.rare; Sch, Vog, PfW, O scattered; SFW, Sp, He (e.g. Rhön), RhSch etc. as well as synanthrop

Trapelia mooreana (Carroll) P.James (T. torellii (Anzi) Hertel, Lecidea lopadioides (Th.Fr.) Grumm., L. brujeriana (Schaerer ex D.Dietr.) Leighton)
In montane to subalpine, very high precipitation sites on lime-free, usually more strongly weathered, mica-rich silicate rock, on stones or near the soil cliff surfaces on moist soils or long time dew moistened, moderately to rather to very well lighted sites, usually on moist slopes and road sides, pioneer, r.acidoph., substrat-hygroph.,

in the Porpidion tub. – mieur-subatl, oc; (v.)rare (2); süSch (over 1200 m), nöSch, Vog

Trapelia obtegens (Th.Fr.) Hertel (Lecidea o. (Th.Fr.) Vainio)
Above all on small silicate stones, like *T. coarctata* and *T. involuta* -- (s'bor-)mieur-smed -- r.rare; e.g. Sch, Vog, HRh, O

Trapelia placoidioides Coppins & P.James (T. obtegens auct.)
Above all on silicate stones, like *T. coarctata*, but larger stones and boulders on humid and dew moistened sites, even on brooks, like *Lecidea lithophila* (↑), even syanthropic (walls, roof tiles), on m.-r.well lighted, usually rather away from the sun sites, above all Porpidion tub. – s'bor-mieur – r.rare, above all Green Mountains, Keuperland, Bunt Sandstone region (Sch, O, Sp, SFW, Eif, Pf), otherwise isolated

Lit.: COPPINS & JAMES 1984, FRIES 1874, HERTEL 1969*, STEIN 1879.

Trapeliopsis Hertel & T. Schneider

(Introduction and Determination ↑ Trapelia)

Genus Characteristics

Very like the genus *Trapelia*. The difference between *Trapelia* and *Trapeliopsis* lies e.g. in the structure of the excipulum and the paraphyses as well as in the character of the development layers.

Ecology and Distribution of the Species

Trapeliopsis flexuosa (Fr.) Coppins & P.James (Lecidea aeruginosa Borrer)
Up to the tree line on wood, on posts, boards, or stumps, above all on cross-sections, on acid bark (above all conifers), usually on m.-v.well lighted, humid to dry sites, very frequently with *Saccomorpha icmalea*, r.-v.acidoph., Cladonion coniocr., *Trapeliospsi flex.-Saccomorpha icm.*-Society – bor-med – m.-r.frequent

Trapeliopsis gelatinosa (Flörke) Coppins & P.James (Lecidea g. Flörke)
Up into (high)montane sites on naked sandy-loamy, usually humus-poor soils on shady habitats, above all in forests, e.g. on road sides, on animal structures, even on roots, pioneer lichen of little competitive strength, m.-v.acidoph., substrathygroph., m.photoph.-r.skioph. – s'bor-mieur – rare (3); Sch, *Vog*, Saar, Pf, O, *Sp*, SFW, RhSch

Trapeliopsis granulosa (Hoffm.) Lumbsch (Lecidea g. (Hoffm.) Ach.)
Up over the tree line on naked acid, sandy to loamy soils, on plant detritus and soil mosses, raw humus, peat, as well as rarely on r.-v.decayed, broken open wood (stumps) or on sunny cliff surfaces (above all sandstone), usually in openings of dwarf shrubby heath, in high moors (peat pits), in open forests, on craggy boulders and in boulder fields, r.-e.acidoph., r.photoindiff., substrathygroph., anitroph., Char. Baeomycion rosei, Lecideetum ulig. – arct-smed-mo(-med-mo) – r.rare, above all Sch, Vog, RhSch, otherwise rare, Lime region ± lacking

Trapeliopsis percrenata (Nyl.) G.Schneider (Lecidea p. Nyl.)
In montane, cool sites over raw humus and straw on cool, very nutrient-poor, v.acid sand- or on peat soils as well as on the base very decayed tree stumps, e.g. in open Scot's pine-fir forests, v.-e.acidoph., substrathygroph., e.g. with leafy mosses and liverworts – central – v.rare (0); süSch; Sutzbach in Schramberg

Trapeliopsis pseudogranulosa Coppins & P.James
On sterile, nutrient-poor, acid soils, on plant detritus, dying mosses, very decayed stumps and stems in usually high precipitation sites on sheltered sites, especially in forests, frequent on sloped, mossy boulders, rarely even on porous rock, r.-e.acidoph., r.skioph.-m-photoph., substrathygroph., anitroph. – bor-smed – r.rare, in silicate regions regionally moderately frequent; above all Sch, Vog, O, Sp, RhSch

Trapeliospsi viridescens (Schrader) Coppins & P.James (Lecidea v. (Schrader) Ach.)
In montane, rarely high montane, often high precipitation sites on strongly decayed, spongy, strongly water storing wood, on stumps and downed stems, exceptionally on detritus, usually in the interior of forests, not syanthropic, r.-v.acidoph., hygroph., substrathygroph., r.skioph.-m.photoph., anitroph., usually with mosses --

mieur-smed – rare (2); süSch, *nöSch, Vog,* SFW, O, Do, *Av, Al*

Trapeliopsis wallrothii (Flörke) Hertel & G.Schneider (Lecidea w. Flörke ex Sprengel)
In the foothills and submontane, moderately high precipitation to rather precipitation-poor, warm, winter-mild sites on nutrient-poor, lime-poor, but often rather base-rich, stones or gravely soils, often between or on weathered cliffs of mineral-rich silicate rock, going over to moss (e.g. *Hedwigia*), on well lighted, warm, rather dry habitats, m.-r.acidoph. – mieur-subatl-med – v.rare *(0)*; O (Schriesheim),* MRh-Ts, nöPf, Vog

Lit.: COPPINS & JAMES 1984, FRIES 1874, HERTEL 1969*, STEIN 1879

Tremolecia Choisy

(Determination ↑ Lecidea)

Introduction

The single species of the genus has a crustose red thallus and sunken to sitting up black apothecium with puffy projecting lecideine proper margin. It grows on (often with iron inclusions) silicate rock in cool and cold regions of the earth and is widely distributed in North Europe and the mountains of Central and South Europe.

Genus Characteristics

Thallus crustose, areolate, with black prothallus. Photobiont of *Trebouxia*-type. Ap. sunken, black, usually concave, without thalloid margin, with definitely developed proper margin. Exc. very strongly developed, carbonaceous-black. Hyp. dark brown, narrow. Paraph. branched and bound, strongly cemented, scarcely thickened above. Epihym. greenish. Asci clavate, with thin, I+ blue gelatinous outer layer and with definite (I- or I+ weakly amyloid) tholus. Sp. 1-celled, ellipsoidal. Pycnosp. short bacillar. Ch: unidentified red pigment, thallus R-.

Ecology and Distribution of the Species

Tremolecia atrata (Ach.) Hertel (Lecidea a. (Ach.) Wahlenb., L. dicksonii auct)
In montane and alpine sites on lime-free, usually hard, magmatic and metamorphic above all iron-rich silicate rocks, on smaller rocks and boulders, stones, often on frequently dew moistened or rather humid, r.-v.well lighted habitats, in very high precipitation sites even on wind exposed sites, pioneer, (m.)r.-v.acidoph., in the Rhizocarpion alp., in Acarosporetum sin. – arct-mieur-mo-alp-med-alp -- rare; Vog and süSch scattered, Rhön, Erz, BayW, Al

Lit.: FRIES 1874, HERTEL 1977, POELT & VĚZDA 1981, VAINIO 1934.

Umbilicaria Hoffm.

(Key incl. Lasallia)

Introduction

The genus *Umbilicaria* is recognized by the usually rounded, little separated, more rarely strongly incised, then "multi-foliose", gray, brown or almost black foliose lichens, which are bound to the substrate by an umbilicus. The underside is balk or warty or thickly covered with filaments, which often take on only a small part of the attachment function. The disks of the black lecideine apothecia are often sulcate.

Of the ca. 50 without exception silicate rock dwelling species 16 are known in Germany and 14 in the region. The most indigenous species are distributed in North Europe and in the mountains of Central and (often with decreasing frequency) South Europe, belonging also to the arctic-alpine or boreal-high montane element. Especially deviating from this type is *U. grisea*, a species indigenous in western Europe and in the Mediterreanean region. It is limited to winter-mile lower sites; having few eastern outposts the species reaches its east boundary of its area in the region. *U. suglabra* is distributed in the mountains of the central and southern Europe. *U. polyrrhiza* has a western area and occurs from central Fennoscandia into the Mediterreanean region; in contrast *U. grisea* which is western shows an oceanic movement (in the climatological sense) and avoids lower sites in the region; by comparison it is found near the sea in Northwest Germany in the plains zone. Most

of the high montane (-alpine) distributed species live on high precipitation habitats open to light and wind. *U. crustulosa* and *U. vellea* occur in the high montane zone especially on fissured, sometimes weakly irrigated cliffs. *U. duesta* lives on near the soil, long time snow covered or sporadically irrigated surfaces, *U. torrefacta* often in cooler boulder fields. *U. hirsuta* descends from middle to higher mountain sites occasionally into the lowland and resides mainly on nutrient-rich, less exposed steep surfaces.

The most of the umbilicate lichens are in some way threatened and deserve protection. Many species are in regression because of afforestation for meadows and removal of boulders ("destoning"). Extremely rare and known only in Germany from the South Black Forest are *U. cinereorufescens* and *U. leiocarpa* (only few specimens) as well as *U. polyrrhiza* and *U. crustulosa* (in Germany only yet in the Bohemian Forest and very rare in the Alps). Also rare and threatened are *U. torrefacta, U. nylanderiana, U. subglabra* (known in Germany only still from the Hessian Mountains), *U. vellea and U. grisea. U. proboscidea* to died out in the region.

Genus Characteristics and Determination

Thallus single foliose and undivided-rounded to divided and multi-foliose, with one umbilicus attached to rock, when dry often rigid and fragile. Upper side commonly gray to brown, smooth to warty or ribbed, rarely with isidia or sorediate on the margins, undersides light brown (rose) to black, smooth, warty, areolate or with ± radial lying "girders", with or without rhizines. On the underside of many species are one- to several-celled black vegetative diaspores (thallospores) separated off from the lower cortex or the rhizines. Photobionts: coccoid green algae. Ap. without thalloid margin, black, with smooth to umbilicate and ribbed disk. Hym. sometimes only made up of sterile tissue. Asci thick walled with I+ amyloid tholus, elongate- clavate. Sp. one-celled to muriform, colorless or slightly brownish. Pycnosp. bacillar. Ch: frequently Gyrophoric acid.

Determination note: The Gyrophoric acid content is very variable, the corresponding C+/KC+ red- reaction as a result is sometimes weak.

1 Thallus covered with many oval, vesicular pustules, then on the underside corresponding deepened pits, gray to brown, spatially with aggregated, blackish, coralloid isidia, underside blackish. Ap. very rare. Usually 2-10 cm. Gyrophoric acid **Lasallia pustulata**

1* Thallus without conspicuous pustules . **2**

2 Thallus thickly covered with fine, cylindric to flat isidia (thereby appearing flaky-sooty strewn), marginally mostly somewhat curved under, dark brown, underside brown-black, bald, slightly uneven, -3 cm, usually in thick stands. Ap. v.rare. Gyrophoric . **U. duesta**

2* Thallus not isidiate . **3**

3 Thallus at the margin thickly to sparsely covered with usually flattened black bristles, underside light brownish to white-rose; upper sides ± gray, rather robust, in the center at times puffy-folded. Ap. frequent, at first sitting up, later almost stalked, with furrowed disk . **U. cylindrica** (when underside black-brown to gray, ± pruinose see *U. proboscidea)*

3* Thallus without black bristles at the margin . **4**

4 Thallus often with fine perforations at the margin, undersides with rigid, fragile, often becoming broken off, radially aligned, reticulate "ridges" or "small beams", between them coarse warty to granular, beige, light rose-brown to brown, upper sides separated by narrow furrows (areolate), otherwise smooth. Ap. frequent, furrowed, sunken to depressed. Stictic acid or Gyrophoric acid **U. torrefacta**

4* Thallus not finely sieve-like perforated at the margin, underside without that kind of ridges, upper side areolate by narrow furrows . **5**

5 Rhizines lacking or spares on the thallus underside. Thallus -3(5) cm **6**

5* Rhizines numerous **14**

6 Thallus at least in the center light to dark gray. **7**

6* Thallus middle brown, dark brown, brown-black. Gyrophoric acid **12**

7 Thallus underside regularly small warty areolate, dark gray to blackish, rarely brownish, without or more rarely with very sparse rhizines, upper side regularly light gray, in the center often undulated, toward the edge often ± mealy-sorediate and curved under, single foliate. Ap. very rare, disk with concentric or irregular furrows. Gyrophoric acid . **U. grisea**

7* Thallus undersides smooth to uneven or warty around the umbilicus, not regularly warty areolate, upper side not sorediate at the edge **8**

8 Ap. frequent, with conspicuously furrowed disk **9**

8* Ap. almost always lacking, when occurring, then disk even or with one central umbilicus, thallus usually -5 cm . **10**

9 Thallus undersides pale rose, pale brownish, upper side ± gray, unevenly puffy to smooth, often with isolated bristles at the margin, ap. sessile, later strongly narrowed to almost stalked

at the base, with furrowed disk. Medulla C/KC-. ± Norstictic acid . **U. cylindrica (3)**

9* Thallus thin, fragile, undersides black-brown to dark gray, ± light gray pruinose, often light (brown) around the navel, rhizines sparse to lacking; upper side dark gray-brown to blackish, in the center white-gray and bloated and with wavy, reticulate, ribs becoming indefinite toward the outside, marginally often frayed, without bristles, ap. closely sitting up. Medulla C/KC+ red. Gyrophoric acid, ±Norstictic acid **U. proboscidea**

10 Underside light, rose, pale brownish, not blackened, without brood bodies see **U. cylindrica (3)**

10* Underside partially, usually around the navel, (sooty) black, with 1-2(3) celled brood bodies **11**

11 Thallus upper side cracked areolate, in the center coarsely cracked areolate, underside part (around the navel) sooty black (with 1-2 celled black brood bodies), part (especially toward the margin) brown or gray, robust, usually to 5 cm. Norstictic acid **U. leiocarpa** (if upper side divided by strongly projecting reticulate ribs, ap. disk with navel, Alps: **U. decussata** (Vill.) Zahlbr.)

11* Thallus upper side not clearly (i.e. visible with the naked eye) cracked areolate, then ± radially cracked and ± radially folded, at the margin often slit to strongly divided, at times black bordered, undersides for the most part sooty black (with 1-2 celled brood bodies). Gyrophoric acid . **U. subglabra**

12 Thallus one foliose, dark brown, copper brown, gray-brown, thin, often wrinkled-folded or warty, undersides smooth to frequently with flat indentations, light- to dark gray(-brown). Ap. frequent, furrowed, sunken to depressed. Rhizines lacking or very sparse. Gyrophoric acid **U. hyperborea**

12* Thallus one- to multi-foliose, slit from the margin, undersides for the most part sooty black, even, not pitted. Ap. very rare. Gyrophoric acid . **13**

13 Thallus upper side smooth, brown. * .**U. polyphylla**

13* Thallus upper side above all in the center wrinkled-folded to pitted ribbed, often gray-brown and dull * **U. nylanderiana**

14 Thallus margin with rigid blackish cilia. Underside light, rose (whitish) to light brownish. Ap. frequent, furrowed. Medulla C-/KC-. Without Gyrophoric acid **U. cylindrica (3)**

14* Thallus otherwise. Medulla C+/KC+ red. Gyrophoric acid **15**

15 Thallus upper side toward the edge sorediate to slightly mealy, white-gray, often brown tinged, paper-like to flaccid leather, underside light to middle brown, more rarely dark brown, with ± numerous lighter to dark, often branched rhizines. Usually up to 4, rarely over 5 cm. Ap. commonly lacking. * **U. hirsuta**

15* Thallus otherwise, cortex not mealy disintegrating at the margin . **16**

16 Thallus underside light rose-brownish to middle brown, with lighter to dark rhizines, upper side white-gray, usually with brownish or violet tint (above all toward the margin), usually slightly curved upward at the margin, usually 3-8 cm wide. Ap. commonly occurring, when young sunken and umbilicate. 8 **U. crustulosa**

16* Thallus underside black to brown-black . **17**

17 Thallus white-bray to gray, often violet-reddish to brownish overlaid, large, 4-14 cm, thick leathery, rigid, underside appearing black to black-brown because of brood bodies, rhizines likewise colored, numerous, filamentous. Ap. Furrowed * **U. vellea**

17* Thallus brown, dark gray-brown, violet-brown, upper side smooth, underside black, warty areolate, with blackish rhizines **18**

18 Thallus dark brown to copper-colored, dull shiny, at the margin usually wavy-wrinkled. Rhizines filamentous, thick-standing, at the thallus margin and at cracks visible from above. Ap. rather rare, depressed, without proper margin, with age crowded, radial ledges * **U. polyrrhiza**

18* Thallus dark gray(brown) to violet tinted dark brown, undersides above all with irregular, elongated, rough papillae, scarcely with typical filamentous rhizines. Ap. rather rare, with age strongly furrowed. . . * **U. cinereorufescens**

Ecology and Distribution of the Species

Umbilicaria cinereorufescens (Schaerer) Frey
In the subalpine and alpine zone on vertical surfaces r.(-v.)well lighted, r.-v. wind exposed cliffs on lime-free, hard silicate rock, on localities with higher precipitation and frequent fogs, m.-r.acidoph., a-/m.nitroph., r.ombroph., Char. Umbilicarietum cinereoruf., also in the Parmelietum omph. – bor(mo/alp)-alp – v.rare (R); süSch

Umbilicaria crustulosa (Ach.) Frey
In high montane to alpine sites on sloping and vertical surfaces commonly lime-free silicate rock, on m.-r.well lighted, moderately wind exposed to wind protected habitats, commonly on sporadically irrigated and thereby (m.) nutrient-rich substrates, e.g. in the Umbilicarietum hirs., Umbilicarion cyl. – arct-alp/pralp -- rare-v.rare (1); süSch, Vog, BayW

Umbilicaria cylindrica (L.) Del. ex Duby

In high precipitation montane to above all alpine sites on r.-v.wind exposed, r.-v.well lighted, not or moderately dunged habitats with strongly variable thermal-hydrostatic conditions, above all on only short time snow covered horizontal- and sloping surfaces of cliffs and bounders of usually lime-free silicate rock, r.acidoph., a-/m.(.r)nitroph., Char. Umbilicarietalia cyl., high point in the Umbilicarietum cyl. – arct-mieur-mo/alp-med-alp --r.rare (3); scattered in süSch, Rhön; v.rare *Eif+, Ts*, Erz, BayW, Al (on grave stones; Ju, Bo)

Umbilicaria deusta (l.) Baumg.
In montane to alpine sites on usually only m. wind exposed, often sheltered, m.-v.well lighted habitats, preferably on smaller boulders on near the soil, rough, remaining relatively moist long after the rain or dew fall, even sporadically irrigated, often long time (several months) snow covered surfaces, on exposed cliffs usually on water streaks, because of trickling water or dust traces (m.)nutrient-rich, above all on boulders in heath, meager turf (Nardion), (r.)m.acidoph., ± substrathygroph., Char. Umbilicarietum deustae – (arct-)bor-mieur-mo/alp-med-alp -- r.rare (3); süSch, Rhön, Ts, Eif-Lux, ThW, Fi, Erz, BayW, Al

Umbilicaria grisea Hoffm. (U. murina (Ach.) DC.)
In mild to warm, foothills to submontane sites above all on m.rain exposed vertical surfaces of cliffs of lime-free silicate rock on m.-r.well lighted habitats; substrate at times irrigated or moderately dunged (dust impregnated, dunged by birds); m.(-r.)acidoph., m.-r.thermoph., in the Umbilicarion hirs., nor rarely associated with *U. hirsuta* -- mieur-subatl-med-mo -- rare (R); nöSch (above all Baden-Baden), Vog, Pf, O, Ts, MRh, Mos, Eif

Umbilicaria hirsuta (Sw. ex Westr.) Hoffm.
In the foothills to subalpine, more rarely alpine sites on lime-free silicate rock, above all on vertical- and steep surfaces on m.-v.well lighted, often m.-r.rain sheltered habitats, preferably on slightly dust impregnated, fissured, occasionally irrigated, even on r.dunged substrate (bird roosts), preferring wind sheltered and rather warm surfaces, r.acidoph.-subneutroph., penetrating into corresponding nutrient-rich associations, often stand producing, Char. Umbilicarion hirs., additionally in bird-boulder associations – arct-med-mo – r.rare; Sch, Vog, rarer in O, Pf, Saar, Hu, Ts-MRh, Rhön, Eif, Erz

Umbilicaria hyperborea (Ach.) Hoffm.
Like *U. torref.*, only in high precipitation, climatically rough, high montane to alpine sites, above all on horizontal- and sloping surfaces, Char. Umbilicarietum cyl. – arct-mieur-mo/alp -- v.rare; Vog, additionally Fi, Erz, BayW, Hz

Umbilicaria leiocarpa Dc.
Commonly above the tree line on rain exposed vertical surfaces on lime-free silicate rock, on r.-v.well lighted, r.-v wind exposed, snow-free habitats, r.acidoph., in the Umbilicarietum cyl. – bor-alp -- v.rare (1); süSch

Umbilicaria nylanderiana (Zahlbr.) H.Magn.
Commonly in alpine, v.rarely in high montane sites on usually v.well lighted, m.r.dunged horizontal- and sloping surfaces on lime-free silicate rock, especially lower half of the caps of bird roots, even avoiding the strongly dunged sites and the true bird-boulder associations, r.m.acidoph., in the Umbilicarion cyl., more rarely in the Dimelaenion – bor-alp – v.rare (2); süSch, BayW, Erz

Umbilicaria polyphylla (L.) Baumg.
From the montane to subalpine, more rarely alpine sites on commonly acid silicate rock, on completely rain exposed surfaces, in lower sites more on protected, rather humid, m.-r.well lighted habitats, in higher, high precipitation sites more on light- and wind open sited, descending lower and more hygrophytic than *U. cylindrica*, m.-v.acidoph., a-(m.)nitroph., m.-v.photoph., above all in the Pertusarietum cor., Pert.-Ophioparmetum, additionally in the Umbilicarion cyl., Rhizocarpion alp., Parmelietum omph. – bor-mieur-mo-alp -- r.rare (3); Sch, Vog, Pf, otherwise rare: Saar, Hu, MRh-Ts, Eif, O, Rhön, ThW, Erz, BayW (rarely apophyte: Do, Ju)

Umbilicaria polyrrhiza (L.) Fr.
In montane and high montane, commonly oceanic, high precipitation sites on sloping- and completely rain exposed vertical surfaces on lime-free silicate rock, on wind protected to (in the case of higher precipitation) r.wind exposed, m.-v.well lighted habitats, r.-m.acidoph., a-(m.) nitroph., in the Umbilicarion cyl., Parmelietum omph., often with *U. polyphylla* – (bor-atl-) s'bor- med-mo, subatl, (oc) – v.rare (2); nöSch,

süSch, Vog, east PfW, Eif (Monschau) *WeBgl, Hz*

Umbilicaria proboscidea (L.) Schrader
In the high montane and alpine zone on very high precipitation localities on lime-free silicate rock, above all with *U. cylindrica*, of narrower ecological amplitude than it, only on climatically rough sites, Char. Umbilicarietum cyl. – arct-bor-mieur-alp(-smed-alp) -- v.rare (0); s*üSch? (Belchen, +?), nöSch (Kniebis +)*, Vog (Tanneck, Gazon du Faing), BayW, Hz

Umbilicaria subglabra (Nyl.) Harm.
From the montane to only subalpine, more rarely alpine zone on lime-free silicate rock, rather like *U. polyphylla*, r.-m.acidoph., m.(-r) nitroph., above all in the Umbilicarietum cyl. – mieur-mo/alp-med-alp – rare (2); süSch, Vog, Ts, Rhön (Milseburg*)

Umbilicaria torrefacta (Lightf.) Schrader (U. erosa (Weber) Hoffm.)
Predominantly in high montane, high precipitation sites on lime-free silicate rock on r. well lighted and r.open to the wind, nutrient poor, completely rain exposed habitats, frequently in cool boulder fields with strongly variable moisture conditions, more hydrostatically fastidious than *U. cylindrica*, tolerating moderately long time snow covering, on larger cliffs predominantly on steep surfaces, r.acidoph., in the Pert.-Ophioparmetum, in the Rhizocarpetum alp., in the Umbilicarietum cyl., -- bor-mieur-mo/h'mo-med-alp – rare (2); süSch, nöSch, Vog, Ts, Rhön (Milseburg*), ThW, Erz, Bay, Hz

Umbilicaria vellea (l.) Hoffm.
Of (high) montane to alpine sites on usually r.well lighted, often r.wind sheltered habitats on ± mineral-rich substrates, usually on sporadically irrigated or falling water moistened vertical- and steep surfaces outcropping silicate rocks, avoiding snow covering, r.-m.acidoph., usually with *U. hirsuta* – arct-bor-med-alp -- rare (2); süSch, Vog, Eif (Monschau), Rhön (Milseburg), Fi, *Rothaargeb*.

Lit.: FREY 1933, LLANO 1950, POELT & VÈZDA 1981, SCHADE 1955.

Usnea Dill. ex Adanson

Introduction

The *Usnea*-species are gray- to yellow-greenish beard lichens with usually richly branched, bushy erect to long pendent, only attached at one place thallus of thin filamentous sections, which are penetrated by a very much stronger central strand. The branches usually bear numerous short side branches and are often covered with wart-like outgrowths (papillae). the apothecia are relatively large, thin disk-like and pale colored, the spores one-celled. Many species remain sterile and reproduce by soredia or isidia. The species concept of this genus, for a long time very difficult and controversial, has gradually consolidated. Numerous taxa described as species have been shown to be modifications of better known species or are shown to be such. The number of indigenous *Usnea*-species lies, in the case of broader species conception, perhaps 18 to 21.

The beard lichens are optimally developed in high precipitation, cool mountain sites with frequent fogs. They are to be found locally even in lower sites on very humid places, thus in narrow valleys, cold air accumulating basins and extensive forests. They reside above all n acid, non eutrophic bark of deciduous and conifer trees, especially on well lighted sites (tree crowns, open, dying trees, forest margins, sterile hangers). *U. lapponica* and probably also *U. wasmuthii* grow especially on cool to cold, late frost threatened sites, e.g. cold air accumulating valleys. Milder, cool-oceanic sites are preferred by *U. florida, U. rigida, U. subfloridana, U. fulvoreagens, U. madeirensis* and *U. ceratina*, which especially reside in the crowns of oak, mountain ash, sycamore and beech in valleys and hanging valleys. Similar, but especially mild habitats have *U. rubicunda*. *U. longissima* is dependent upon very humid sites in long time undisturbed forests; possibly tolerating only drying. In contrast to this is *U. hirta* the least hygrophytically fastidious species; which is able to grow even on rather open, moderately high precipitation sites. *U. cornuta* and *U. diplotypus* live as a rule on silicate rock.

All beard lichens are in regression. *U. filipendula* and *U. hirta* are still relatively common in Southwest Germany, the former is however rare outside of the Black Forest; their area seems even today still not strongly shrunken.

Nevertheless the diminution of the populations of *U. filipendula* have reached desperate dimensions. The present developmental conditions of beard lichen vegetation is in comparison to earlier extra-ordinarily wretched. The production of an "fairy forest" with lichen hung trees and gray- greenish aspect of the entire forest belongs to the past. Within a quarter of a century many such forests will have lost their beard lichen growths. Many other species are still stronger affected by regression than *U. filipendula*. The from the beginning of time very rare *U. rubicunda* and *U. cavernosa*, only a few once known in the region are extinct in Germany. This is true – with the exception of the Alps, where possibly there are yet remnant populations to be found – also for *U. longissima*, a species which reacts with a high sensitivity to alteration of the climatic condition, producing several meters long garlands. Threatened by extinction are *U. ceratina* and *U. cornuta*. Others to be found in regression are *U. florida, U. rigida, U. fulvoreagens, U. lapponica* and *U. subfloridana.* The causes of the regression are today first in line the especial sensitivity of the outer-surface rich beard lichens toward emissions and possibly the moistening with strong acidification, in recent time to be seen even eutrophying precipitation. Besides the diminution of the stand may due to forestry utilization methods (clear-cutting);sometimes special beard lichen rich stands were cut or cleaned because of the higher snow breaking danger. Nevertheless the beard lichen vegetation may be, at least for the less sensitive taxa, earlier always recurring from the deforestation by again colonizing from neighboring forests, where today it is obviously scarcely still possible. The beard lichen vegetation can be promoted through particular forestry measures, especially the leaving of dead trees.

U. ceratina, U. florida, U. fulvoreagens and *U. glabrata* are common above all in European deciduous forests regions. They reach the northern area boundary in southern Scandinavia; at least partially occurring even in mountain forests or near atlantic regions of South Europe. *U. rubicunda* and *U. madeirensis* are indigenous in oceanic sites of the Mediterranean region and West Europe. Branches push up into south and northwestern Germany. *U. cornuta* is a subatlantic species, which is very rare in Central Europe. *U. diplotypus* occurs in southern Fennoscandia and in the mountains of the Central European region. *U. filipendula, U. lapponica, U. subfloridana* and *U. hirta* are distributed in the boreal zone and corresponding regions of Central and South Europe. *U. longissima*, one of the most spectacular lichen species, is lacking in nearly all of West Europe. The altogether continental, disjunct, cool- to cold-oceanic sites occupying area includes the southern and central Fennoscandia (with exception of the atlantic West) and montane sites of the central and eastern temperate regions, especially part of the Alps and Carpathians, the Caucuses and the Urals. The west boundary lies throughout the western Central Europe (Vogesen).

Genus Characteristics and Determination

Erect bushy to long pendent beard-form, usually richly branching gray-greenish, greenish, or greenish yellow fruticose lichens with tubular to angular branches and often an blackened attachment site. Branch sometimes separated by circular cracks, frequently with ± perpendicular standing thin short branches ("fibrils"), often with papillae, in many species with isidia and soralia, radially symmetrical: outer cortex, interior of a compact, cartilaginous central strand of longitudinal lying hyphae, between them a loose to compact structured medulla. Photobionts: green algae of the *Trebouxia*-type. Ap. terminal- or lateral, with flat to concave disk and narrow thalloid margin, supplied with radially ordered fibrils, rare in many species. Sp. 1-celled, ellipsoidal. Ch: Usnic acid in the cortex (in almost all species, in all indigenous species), various Depsides, Depsidones, Fatty acids in the medulla.

Note: Many species groups are still unclear, sometimes chemical investigation is inevitable. Young plants often scarcely to be addressed. Primary branch: branch of the first order, the main shoot going from the attached base. Secondary branch: going from the primary branches. Main branch: primary and secondary branches.

1 Thallus very long thread-like hanging down, commonly 50-200 cm long, not or only in larger stands branching, with numerous fibrils. Cortex of the main threads flaking off. Medulla I+ blue. Only still in the Alps **U. longissima**

1* Thallus essentially shorter, not consisting of one (almost) unbranched filament. Main strand corticate. Medulla usually I- **2**

2 Thallus at least in the older parts of the thallus reddish-brown colored (red pigment in the

cortex), the younger parts often gray-yellowish (Caution: dying, long time lying on the soil specimens of other species may be partially reddish colored). Thallus (short) pendent to erect, with numerous fibrils and warts erupting to soralia, with papillae on the main branches. Medulla P+ orange, K+ yellow (to red), C-. Stictic SSy., ± Norstictic acid **U. rubicunda**

2* Thallus without reddish colored parts . **3**

3 Medulla and central strand pale rose (sometimes scarcely colored), C+ yellow-orange, CK(!)+ yellow-orange. Thallus greenish-gray to bluish gray-green, rigid and sturdy, the main strand equally thick almost to the ends (2mm), somewhat furrowed , often angular, cartilaginous cortex, covered with numerous, -0.5 mm wide, whitish (decorticate) warts, -15 cm (earlier -30 cm) long. Fibrils filamentous, usually sparse. Ap. rare. Medulla K-, P-. Diffractaic acid, (Barbatic acid) . **U. ceratina**

3* Medulla and central strand not rose, C- **4**

4 Thallus without warts, papillae, soralia, isidia, (almost) without fibrils, smooth cortex, but conspicuously articulated or angular and pitted. Very rare, extinct species in the region **5**

4* Thallus otherwise, always with warts, papillae, soralia or fibrils . **6**

5 Older parts of the thallus conspicuously divided into ± swollen segments and broad notches, in which the central strand becomes visible, almost without fibrils, long beard-form, basally scarcely branched, the main branch 2-4 mm thick, with isolated pits and pseudocyphellae, otherwise smooth. Medulla very loose, K-, P+ red. Fumarprotocetraric acid, ± protocetraric acid **U. articulata**

5* Thallus not conspicuously articulated, clearly angular and pitted, but otherwise completely smooth cortex, without fibrils, very soft and lax, beard-form pendent. Medulla loose . **U. cavernosa**

6 Thallus erect, upright bushy or short pendent, usually scarcely longer than wide, main branch diverging . **7**

6* Thallus pendent, often beard-form, main branch ± parallel, commonly clearly longer than wide (in the case of young specimens and the more poorly developed not easily recognizable) **22**

7 Thallus without soralia and isidia, commonly with numerous ap. **8**

7* Thallus with soralia or isidia **9**

8 Ap. disk P+ yellow (ap. margin: P+ red), KC+ rose (these reactions only reliable on if tested on several ap.). Branch regularly cylindric, gradually reducing, without pit-like depressions. Papillae low, warty, numerous. Fibrils numerous, straight to curved. Thallus -5 (10) cm, thick bushy, blackened at the base and never clearly narrowed. Cortex ca. (7)9-12(17)% of the branch thickness (measure on the thickest part of the primary branch). Ap. frequent, on the ends of the thicker branch, concave to flat. sp. 8.5-11 x 5.5-7 µm. K+ yellow, P+ yellow-orange, or K-, P-. Thamnolic acid, ± Squamatic acid, ±Diffractaic acid, ±Bourgeanic acid, or Squamatic acid alone. In ap. Alectorialic acid. Young thalli scarcely separable from *U. subfloridana* **U. florida**

8* Ap. disk P- (Ap. margin often P+ red), KC-. Branches irregularly cylindric, almost the same diameter over the entire length. Thallus without or with pits, sometimes clearly narrowed at the base. Papillae warty to cylindric. Cortex ca. (2)5-7(9)% the thickness of the branch. Sp. 7-8.5 x 5-6.5 µm. ± Salazinic acid, ± Protocetraric acid . **U. rigida s.l.**

9 Medulla and soralia P+ rust-red, K-. With Fumarprotocetraric acid, ±Protocetraric acid. Base not blackened. Soralia conspicuous, young projecting-hemi-spherical, later sunken, often broader than the branch, not isidiate. Main branches at times narrowed at the attachment. Fibrils numerous. Thallus small, -3 cm, ± erect, gushy, pale gray-yellow, in the herbarium dark brown, shiny, without definite papillae and isidia. Cortex thin (5-8%), medulla very loose, central strand thin **U. glabrata**

9* Medulla not reacting in this combination with P and K. Not with Fumarprotocetraric acid . **10**

10 Ripe soralia punctiform, smaller than the half diameter of the thickest branch with soralia, numerous, usually isidiate (at least when young) . **11**

10* Ripe soralia rather large, larger than the half diameter of the thickest branch with soralia, often not conspicuously numerous, isidiate or not isidiate **15**

11 Main branches (primary and secondary branch) blunt edged at times even deformed, with pits in the cortex, upper surface with ledge-like prominences. Base not blackened. Without true papillae. Single branch often thick with short thick thorn-like isidia. Fibrils sparse or lacking. Soralia commonly thickly covered with isidia (appearing thorny), above all on the branch ends. Thallus -5 cm, rarely longer, erect, gray-green to green-yellow, very flaccid when moist. Medulla rather ax, K- P- (± Fatty acids) or K+ red, P+ orange (± fatty acid and Norstictic acid) **U. hirta**

11* Main branches tubular (cylindric), not pitted or with ledges. Base blackened or not blackened. With papillae . **12**

12 Main branches clearly narrowed to clavate narrowed and/or branch segment swollen at the base. Branching anisotomic-dichotomous. Soralia, at least when young, ± thickly covered with isidia, never pitted, never ring-form surrounding the branch, usually on the branch ends and accumulating on the fibrils, very small

(0.2 mm), but often coalescing and becoming like one large soralium. Cortex shiny. Medulla ca. 1/3 diameter, central strand ¼. Thallus erect, with scattered to numerous usually curved side branches, gray-green (in the herbarium dark brown), base rarely blackened. Medulla K+ yellow, then blood red or K+ yellow to red-orange, P+ yellow- orange to orange-red (Stictic SSy., Norstictic acid, ± Salazinic acid). Very rare . **U. cornuta**

12* Main branches not clearly smaller or narrowed at the base. Branch segments cylindric, never swollen. Branching isotomic-dichotomous. Soralia projecting to pitted, with or without isidia. Thallus -6 cm, ± shiny **13**

13 Soralia only isidiate in the young condition, when ripe commonly without isidia, flat to slightly tuberculate, or slightly concave, regularly rounded. Basal part commonly with longitudinal cracks. Fibrils sparse, on the basal parts. Norstictic acid, ±Salazinic acid or Stictic SSy., Norstictic acid . **U. glabrescens (20)**

13* The most of the soralia (young or ripe) thickly isidiate. Basal part without longitudinal cracks. Never with Norstictic acid or Stictic SSy **14**

14 End branches usually anisotomic-dichotomous branching, elongate, not gradually decreasing, but almost the same thickness over the entire length, curved and sometimes "crossing" other branches, of filamentous-distorted aspect. Papillae warty to cylindric. Base blackened or light. Medulla K+ red, P+ orange, C- (Salazinic acid, ± Barbatic acid.) or K+ yellow, P+ yellow, C/KC+ red (Alectorialic acid) **U. diplotypus**

14* End branches usually isotomic-dichotomous, gradually narrowed, not curved, all somewhat ending at the same height, not filamentous-distorted. Papillae warty (hemispherical), never cylindric. Base clearly blackened. Main branch thickly papillose, end branch smooth with sparse papillae and with partially isidiate soralia. Fibrils ± numerous. Thallus -8(12) cm, erect to ascending or short pendent, thickly bushy. Medulla K+ yellow, P+ yellow-orange, C- UV- (Thamnolic acid) or R-, UV+ white (Squamatic acid) **U. subfloridana**

15 Main branches clearly shrunken to clavate narrowed at the base and/or branch segments swollen. Soralia, at least the young, ± thickly covered with isidia, never pitted, never ring- form surrounding the branch. Cortex shiny. Papillae numerous, regularly ordered. Soralia never aggregated, but scattered, rarely coalescing, round, flat to concave, large in the ripe condition. Thallus short pendent or erect, relatively flaccid, very pale gray to green, moist often ± transparent, basally blackened, -5 cm. Medulla K+ yellow to red, P+ red (Stictic acid, ±Norstictic acid.). West Europe. Whether in the region ?

U. fragilescens

Hav. ex Lynge

15* Main branches not constricted to clavate narrowed at the base . **16**

16 Soralia commonly at least partially covered with isidia ("thorn-like" appearance of the soralia, isidia of older herbarium specimens however often fallen off), even ± tuberculate, small to middle sized. Papillae commonly numerous . **17**

16* Soralia never developing isidia, even to clearly pitted, when ripe, coarse and conspicuous . **20**

17 Medulla K+ yellow, P+ yellow-orange, C-, UV- (Thamnolic acid) or very rarely R-, UV+ white (Squamatic acid). End branch usually isotomic-dichotomous, gradually narrowing, all ending somewhat at the height. Main branch thickly papillose, end branch smooth with sparse papillae and with wart-like, partially isidiate soralia. Papillae warty, never cylindric. Fibrils ± numerous. Thallus -8(12) cm, erect to ascending or short pendent, thickly bushy .

U. subfloridana

17* Medulla K- or K+ yellow, then orange-red or red. Not with Thamnolic acid or Squamatic acid . **18**

18 With Norstictic acid or Psoromic acid. Soralia regularly formed, ripe rounded, young sometimes with isidia. Basal segment with fine longitudinal cracks (50 fold enlargement !)

U. glabrescens (20)

18* Without these lichen substances. With Salazinic acid or Barbatic SSy. Soralia irregularly formed, not clearly round. Basal segment without or with fine longitudinal cracks **19**

19 Basal segment with fine but clearly longitudinal cracks (50 x), with fewer ring cracks (2 to 5 cracks per 5 mm). Ripe soralia commonly streaked in the long direction. Barbatic SSy, ±Salazinic acid, ±Protocetraric acid or Salazinic acid. – Cortex: ± Atranorin **U. wasmuthii**

19* Basal segment without longitudinal cracks, with numerous ring cracks (6-9 per 5 mm). Ripe soralia not clearly streaked in the long direction. Branch gradually narrowing. Papillae and fibrils sparse. Soralia above all on the ends, finally somewhat warty projecting, then the same height as the upper surface, flat to slightly concave, finally broader than the half the branch thickness. Isidia occurring on young soralia. Medulla compact, thin, cortex thick. Thallus erect bushy to short pendent, -10 cm, richly branching, conspicuously rigid, pale greenish, yellow- to green-gray (olive brown in the herbarium), main stem blackened below, with numerous ring cracks. Salazinic acid **U. madeirensis**

20 Ripe soralia deeply pitted, concave, often coalescing, the cortex irregularly lacerated and reaching to the central strand and these uncovering it (at the ends of fine branches), at times thicker than the branch, consisting of lower warts. Fibrils commonly numerous on the whole

thallus. Basal part without longitudinal cracks (50 fold !). Thallus -10 cm **21**

20* Soralia not deeply pitted, flat to slightly tuberculate, or slightly concave, regularly rounded, the cortex not irregularly lacerated, not reaching to the central axis, scattered. Fibrils sparse, on the basal parts. Branch ends almost without fibrils, smooth, without papillae. Main branch thickly papillose, with fibrils, -1.5 mm, secondary branches often "elongated", ± pendent. Thallus -12 cm, gray-green, yellow-green. Salazinic acid and Norstictic acid or Stictic SSy., Norstictic acid **U. glabrescens**

21 Branching isotomic-dichotomous. Medulla thin, 13-22%. Fibrils usually regularly divided, fishbone-like. Stictic SSy., Norstictic acid, ±Diffractaic acid or only Diffractaic acid . **U. fulvoreagens**

21* Branching clearly anisotomic-dichotomous. Medulla thicker (21-30%). Fibrils irregularly divided. Salazinic acid or Caperatic acid or Psoromic acid . **U. lapponica**

22 Medulla at the least on a few places slightly rose, CK!+ yellow-orange. Thallus with broad and large, partially decorticate soralia-like warts on rather thick, cartilaginous corticate branches, green-gray, gray-green **U. ceratina (3)**

22* Medulla white, not CK+ yellow-orange. Not with such decorticate warts **23**

23 With Alectorialic acid, Barbatic acid (medulla P+ yellow, K+ yellow, C+ red, KC+ red). End branches elongated, filamentous, over the entire length approximately equally thick, deformed and crossing one another, usually anisotomic-dichotomous branching, without or with sparse fibrils and papillae. Main branch thickly papillose, at times with decorticate warts. Soralia isidiate. Papillae warty or cylindric. Base light or blackened . **U. diplotypus** agg.

23* Not with Alectorialic acid, medulla C- **24**

24 Without soralia or isidiate soralia. Often with ap. **25**

24* With soralia, isidiate soralia or isidia groups **28**

25 Commonly almost each main branch with ap., ap. (almost) terminal, disk P- (ap. margin often P+ red). Papillae wart-like to cylindric. Fibrils sparse or loosely distributed. Thallus rather rigid and robust, without or with pits, sometimes clearly narrowed at the base. Cortex ca. (2)5-7.5(9)% of the branch thickness. Sp. 7-8.5 x 5-6.5 µm. ±Salazinic acid, ±protocetraric acid **U. rigida** s.l.

25* Commonly not almost each main branch with ap. Ap. lateral to almost terminal **26**

26 Fibrils numerous, regularly distributed over the entire length of the main branch (fishbone-like), often isidiate. Medulla K+ orange to red, P+ orange. Main branch in the case of older specimens parallel. Salazinic acid . **U. filipendula** s.l.

26* Fibrils lacking to very sparse . **27**

27 Thallus smooth or with single pits, without papillae or with very sparse papillae, rather flaccid. Branch gradually decreasing, thallus ring cracked in the region of the base . **U. barbata** (L.) Weber ex Wigg. s.l.

27* Thallus furrowed-rough, main branches very thickly papillose to coarse warty, papillae and warts gradually erupting-eroding. Branch at times somewhat angular. Fibrils lacking or sparse, short. Thallus yellow-green to green, in the herbarium often brownish-yellow, dull, robust. Ap. rare, not terminal. ± Salazinic acid . **! Y, scabrata**-group

28 Fibrils numerous, regularly distributed over the entire length of the main branch (fishbone like). Medulla K+ orange to red, P+ orange. Soralia arising from warts, finely isidiate to coarse thorn-like or granular-mealy. Thallus -20(30) cm (but in less humid sites often only a few cm), rather flaccid, usually narrow beard-form with few long main branches, above all the ± parallel secondary branches with numerous, -1 cm long perpendicular fibrils, gray-green. Main branches usually thickly papillose, often ring cracked, sometimes richly isidiate. Salazinic acid . **U. filipendula** s.l.

28* Fibrils sparse to lacking . **29**

29 Branches provided over the entire length with large warts, which frequently become isidiate, without typical soralia. Main branches conspicuously parallel, with very many papillae/warts. Upper surface very rough. ±Salazinic acid **U. scabrata-group**

29* Branches without such large warts, main branches not conspicuously parallel **30**

30 Soralia punctiform, smaller than half the diameter of the thickest branches with soralia, numerous, even when ripe richly isidiate. End branched elongated, filamentous, approximately equal thickness over the entire length, deformed and crossing one another, mostly anisotomic-dichotomous branching, without or with sparse fibrils and papillae. Main branches thickly papillose, at times with decorticate warts. Papillae warty or cylindric. Bases light or blackened. Medulla K+ red, P+ orange, C- (Salazinic acid, ±Barbatic acid) **U. diplotypus** agg.

30* Ripe soralia rather coarse, larger than the half diameter of the thickest branches with soralia, rape flat or slightly concave, rape never isidiate (only very young soralia sometimes isidiate). Main branches with numerous long lateral branches, thickly papillose, with fibrils, end branches smooth, largely without fibrils. Central strand not exposed by soralia. With Norstictic or Psoromic acid **U. glabrescens (20)**

Ecology and Distribution of the Species

Usnea articulata (L.) Hoffm.
In the foothills and submontane, winter-mild, relatively summer-cool, oceanic sites, predominantly on twigs of old deciduous trees (above all beech) in very humid open forests, very sensitive to habitat alteration, m.acidoph. – s'mieur-alt-med-subatl, oc – v.rare (0); *Westfalen*, further indications questionable (e.g. *Wetterau, Sp)*

Usnea cavernosa Tuck.
In high montane, very high precipitation or very foggy sites, like *Evernia div.* (↑), on conifer trees, above all fir, in near natural fir spruce forests, Char Evernietum div. – bor-mieur-mo-smed-mo – v.rare (0); süSch, Al

Usnea ceratina Ach.
In montane, usually rather to very high precipitation sites, more rarely even in the submontane zone, on cool-oceanic, very to extremely humid, foggy habitats, in lower sites in cold accumulating valleys, above all on twigs of spruce and beech in beech-spruce forests, often with lichens of the *U. florida*-group, even with *Alectoria sarm.* or *Ramalina thrausta*, m.-r.acidoph., m.-r(s.)photoph., anitroph., in the Usneion-Society – mieur-subatl-med-mo – v.rare (1); süSch, nöSch, Vog, Ju, HRh, *Do*, SFW, Sb, PfW, O+, Sp, Ts+, Eif, additionally Al

Usnea cornuta Körber (U. inflata (Duby) Motyka)
In foothills-submontane, wither mild sites on acid silicate rock, above all sandstone, on m.-r.well lighted, rather humid habitats – mieur-subatl – v.rare (1); PfW, nöSch

Usnea diplotypus Vainio
In montane sites on deciduous and conifer trees in forests, even on silicate rock, on m.-r.well lighted, rather humid habitats – mieur-subatl – v.rare (1); PfW, nöSch

Usnea filipendula Striton s.str. (U. dasypoga (ach.) Shirley, U. flagellata Mot. as well as possibly numerous other described "species", see below)
Optimally in high montane and montane, high precipitation sites, on cool-moist sites descending into the foothills zone (narrow valleys, cold air accumulating sites, extensive forests), on rather to very acid bark of deciduous and conifer trees, above all in enclosing forests, especially in high precipitation regions even on free standing trees, most frequently, ecologically one of the strongest increasing species of the genus, especially luxuriantly developing in near natural spruce-fir and fir forests, on stems and (frequently) in the crown region, on moderately cool to cold, wind protected to rather wind exposed, foggy sites, in regression because of forestry management, (m.)r.-v.acidoph., (r.skioph.)m.-v.(v.)photoph., (r.)v.-e.hygroph., anitroph., Char Usneion – bor-med-mo – v.rare, locally frequent (3); Sch, Vog and Al over 900 m r.frequent, even today in places still producing vegetation masses; SFW, Ju, Av, Bo r.rare; Ne, O, Sp, Pf, Hu rare (usually only small specimens); otherwise v.rare
To the *U. filipendula*-complex probably even *U. capillaris* Mot., *U. meylanii* Mot., *U. muricata* Mot., *U. sublaxa* Vainio, *U. fbrillosa* Mot., *U. subscabrara* (Vainio) Mot.

Usnea florida (L.) Weber ex. Wigg.
Above all in montane and submontane (rarely high montane), moderately to very high precipitation sites, in low precipitation regions on relatively foggy places, especially on m.-r.acid bark in the crown of deciduous (preferring mountain ash, oak, sycamore, even beech), rarely conifer trees (above all spruce, larch), predominantly on ± horizontal even decaying branches, on r.-v.well lighted habitats, in lower sites predominantly on oak in oak-beech forests (Luzulo-Fagetum) in valleys, in higher sites often on free standing trees, on forest margins, in open spruce-beech forests, on m.-r wind exposed habitats with frequently varying moisture conditions, m.-r.acidoph., (r.-)v.hygroph., anitroph., Char. Usneetum flor.-negl. – mieur-smed-mo – r.rare-rare (3); süSch and Vog scattered.; nöSch (Valleys), Eif, Al, Av-Bo, otherwise rare-v.rare (e.g. O, PfW, Ju, Sb, upper Ne); Rh, Mn, Rh-Mn-T (almost) lacking

Usnea fulvoreagens (Räsänen) Räsänen
In (sub-)montane and high montane, m.-v. high precipitation, commonly ± continental influenced sites, on cool to cold, late frost threatened, foggy, v.-e.humid, r.-m.well lighted, rather wind protected habitats above all on branches of spruce and fir, more rarely on deciduous trees (above all beech, birch), on forest margins and in

forests (spruce-fir forests), prefering cold accumulating valleys in the depressions and in the lower hang region, m.-v.acidoph., anitroph., usually with *Evernia div*, Char. Evernietum div. – bor-smed(-med-mo) – r.rare (2); Sch over 500 m, above all in the East and Southeast and bordering regions of Ne (above all Ba), Ju rare, Vog v.rare, O, Av, Do

Usnea glabrata (Ach.) Vainio
Like *Lobaria pulmonaria*, *Usnea glabrescens* – mieur-med-mo – rare; Sch, SFW, Ju, Do, *Ne*

Usnea glabrescens (Nyl. ex Vainio) Vainio (U. compacta (Räsänen) Mot., U. laricina Vainio)
In montane and high montane(-subalpine), ± continental influenced sites, e.g. in cold accumulating basins, above all on free-standing conifer trees, on wood posts etc., opposite *U. fulvoreagens* on wind exposed habitats, r.-v.acidoph., anitroph., in society of Usneion – bor-mieur-mo – rare; Sch, Ju, Ne, Av, additionally Al

Usnea hirta (L.) Weber ex Wigg. (U. glaucescens Vainio, U. foveata Vainio)
From the foothills up into the high montane (sub alpine) zone on (m.-)r.(-v.)well lighted, m.-r. wind exposed, often drying out habitats, preferably in winter-cold, avoiding climatically continental influenced regions with later vegetation development, oceanic regions, on conifer trees and deciduous trees with acid bark (e.g. birch, mountain ash, oak) and on hard wood, on free-standing trees (often even on stems) as well as forest trees (above all on twigs), on at the least high precipitation or humid habitats dependent upon indigenous species of the genus, thus even in low precipitation sites, relatively less sensitive toward environmental variations; r.-v.acidoph., r.-v.(e.)hygroph., a- (-m.)nitroph., above all in the Bryorio-Usneetum filip., Evernietum div., Pseudevernietum – or-mieur(-med-mo) – r.rare (3); almost through the entire region, especially East-Sch, Ju, Av, in dry-warm areas ± lacking

Usnea lapponica Vainio (U. arnoldii Mot., U. laricina auct., U. monstruosa Mot., U. sorediferа sensu Mot.)
In montane and high montane sites on cool to cold, late frost threatened, foggy, r.-m.well lighted habitats above all on branches of spruce and fir, like *U. fulvoreagens*, on somewhat continental influenced habitats – bor-smed(-med-mo) – whether in the region

Usnea longissima Ach.
In montane and high montane, r.-v. high precipitation sites in large surface enclosed natural (and very near natural) spruce-fir and spruce-beech forests with old trees, on twigs of fir, spruce, beech, on cool-oceanic to cold, very foggy, extremely humid, protected from direct sun habitats, a species reacting extremely sensitively to habitat alteration, rather like E*vernia div.* (↑), in the Evernietum div., also in the Usneetum cap. – bor-mieur-mo-med-mo, subco – earlier rare, today 0; süSch, nöSch, Vog, Al

Usnea madeirensis Motyka
In mild to cool oceanic, high precipitation montane sites on foggy habitats in spruce(-beech) forests – mieur(atl)-med-subatl, oc – v.rare *(0)*; Sch

Usnea rigida s.l. (incl. U. glauca Mot.)

U. faginea Mot.
Like *U. florida* (↑), yet in submontane sites ± lacking, more frequent up into the high montane zone, here like e.g. *U. subfloridana* especially on beech – mieur – rare (2); süSch over 700 m scattered, nöSch rare, Ju, Do, Vog, Al

U. rigida (Ach.) Mot. (U. neglecta Mot., incl. U. hapalotera (Harm.) Mot., U. protea Mot., U. montana Mot.)
Rather like *U. florida*, yet scarcely in the submontane zone, more often on conifer frees, preferably on beech-spruce forests, in the Usneetum flor.-negl. – mieur(subatl)(-med) – rare (2); Sch and Vog over 700 m, O, Ts, Ju, Ne, Do

Usnea rubicunda Stirton (U. rubiginea (Michx.) Massal.)
In the foothills and submontane, winter mild, rather summer warm, oceanic influences sites on humid, mild habitats on deciduous trees and spruce, e.g. in beech- and beech-spruce forests – mieur-atl-med – v.rare (0); HRh (Dossenbach), Vog

Usnea scabrata Nyl. (U. sylvatica Mot.)
In high montane, rarely montane, high precipitation sites above all in near natural, open

fir and fir-spruce forests, rarely spruce-beech forests, above all on branches of fir, on cool to cold, rather foggy habitats, in lower sites on cold accumulating localities, r.(-v.)acidoph., r.photoph., anitroph., above all in Bryorio-Usneetum filip. –bor-mieur-mo – rare (2); Sch, Vog, Ju (v.rare), *O+*

Usnea subfloridana Stirton (U. comosa auct.)
In sub- to high montane, high precipitation, above all foggy sites, in cool-moist valleys or extensive forests occasionally descending into the foothills zone, in forests and on free-standing trees, above all in the crown region of deciduous trees, avoiding distinctly cold sites and v.acid bark, above all in the Usneetum flor.-neglectae, even in the Bryorio-Usneetum filip., m.acidoph.-subneutroph., (m.)r.-v.photoph., anitroph. – (s')bor-mieur(-med-mo) – v.rare (3); Sch, Vog, otherwise rare (e.g. PfW, Eif, Ju, Ne, Bo)

Usnea wasmuthii Räsänen
above all in the crown region of deciduous trees, like *U. subfloridana*, but probably scarce in high montane sites – mieur-smed-mo(-med-mo), (oc) – rare (2); Ju, Ne, O, Sch

Lit.: CLERC 1984, 1987a ,1987b, 1992, MOTYKA 1936-38, 1947, TALLIS 1959.

Verrucaria Schrader

(with Bagliettoa, Key incl. Placocarpus)

Introduction

The genus includes numerous, almost without exception rock dwelling species.. The thallus is in the case of one series of robust developed species, corticate, mostly gray to brown colored, in the case of others weakly constructed or in the case o several taxa outwardly scarcely perceptible, thus in the case of several limestone dwellers. The fruiting bodies are small (rarely over 0.6 mm wide) perithecia, which commonly are more or less sunken into the thallus or - in the case of endolithic construction of the thallus – into the stone and only the black apex is visible. The genus is only formally distinguished from related or similar genera (like *Thelidium*) by the one-celled spores. Scarcely one other lichen genus is today so insufficiently known as *Verrucaria* and contains so many unclear species or as species showing modification.

Most of the Verrucarias are typical lime lichens. In the case of part of them – the endolithic species – there was development of amazing adaptation to the hostile living conditions of naked limestone. In these species the thallus – a loose hyphal tissue and algal layer – is produced in the interior of the rock and outwardly at best recognizable as a discoloration of the rock; finally the apex of the perithecia are visible "resting" in the stone. The constantly rain exposed weathering of the upper surface of the limestone as a result of solution effect and with it the difficulty of attachment, in establishing an epilithic thallus, was avoided by these species. In the old ones the perithecia of these endolithic species fall out each species leaves behind more or less deep pits. The rock upper surface appears for a time after the death of the thallus studded with small pits. In spite of the inconspicuous nature of the endolithic species they play an important role in the chemical-physical weathering of the rock, all the more, since they are almost always occurring on the larger limestone and these frequently almost covering the surface area.

The ecological amplitude is frequently broad. Well lighted habitats were preferred e.g. by *V. calciseda, V. marmorea, V. nigrescens, V. macrostoma, V. lecideoides* and *V. foveolata,* semi-shaded (to shady) but *V. caerulea, V. cyanea* and the *Bagliettoa*-species. *V. amylacea* resides on drier overhangs.

Only a few *Verrucaria*-species occur on silicate rock, excepting lichens, which live amphibiously or submerged, also on more or less frequently flooded habitats, above all in brooks. To these hydro- or water Verrucarias are numbered *V. aethiobola, V. aquatilis, V. funckii, V. hydrela, V. margacea, V. praetennissa, V. rheitrophila* and *V. scabra.* These water-lichens are arranged, each according to the flooding duration, in various bands over or under the normal water level; *V. funckii* tolerates on short time emerging, whereas e.g. *V. praetermissa* only occasionally becomes normally flooded. *V. elaeomelaena* occupies limestone lying under water for longer times. Dryer, i.e. not frequently moist or flooded habitat on silicate rock were colonized by Verrucarias almost only in the case of the presence of lime traces. Very few species occur on naked soil, thus the widely overlooked pioneer species *V. bryoctona* , also on wood.

V. marmorea, V. amylacea, V. lecideoides, Bagliettoa sphinctrina and *B. parmigerella* are southern species, which penetrate into southern and central Middle Europe. The area of *Bagliettoa baldensis, B. steineri, B. parmigera, V. fuscula, V. macrostoma, reach up into southern Scandinavia,* further toward the North those of *V. calciseda, V. muralis, V. fuscella.* The species *V. aquatilis, V. praetermissa,* and *V. rheitrophila* possibly have their high point in the Central European deciduous forest region, however occurring partially even yet in the boreal zone. *V. funckii* and *V. hydrela* are indigenous in the boreal and temperate zones. Very widespread are *V. foveolata* and *V. nigrescens.*

Genus Characteristics and Determination

Thallus crustose, endolithic to clearly developed, unarticulated-"poured" to areolate, in the case of definite structural hyphae against the upper surface often perpendicularly arranged, also the algae often in ± perpendicular series, above all in the case of amphibious species with a black basal layer (hypothallus), which is conic or in ribs reaching up to the thallus upper surface and is visible as points or lines: green algae of various genera, e.g. *Myrmecia*. Perithecia ± spherical to pear-form, ± sunken into the rock or the thallus, rarely ± sessile. Exc. black, brown or becoming colorless, often because of a dark brown to blackish outer receptacle (involucrellum) strengthened or overlaid; this may surround the exc. or only be superimposed in the upper part, overlaid or standing above shield-like. Periphyses in the region of the ostiole; pseudoparaphyses slimy disintegrating and not visible in the ripe fruit. Asci broadly clavate-bulging to elongated ellipsoidal, two layered. Sp. commonly one-celled, ellipsoidal, colorless, escaping in an entire slime packet. Ch-. Species with shield- or lid-form sitting off from the exc., exterior of the involucrellum frequently provided with radial furrows – thus even here – separated from the genus *Bagliettoa*.

The listed species illustrate only one selection of the taxa indicated for the region. For the individual species to be the basis of material from the region seems sometimes heterogeneous, on the other hand in many cases it does not suffice to distinguish between the material from other species. One submission of a spread of species for many species seems under the given circumstances not sensible, especially since most in the region till now have not been sufficiently observed and collected.

Determination hints:
The genus *Verrucaria* is rated as one of the most difficult of all the lichen genera. Insufficient field studies and a quantitatively entirely inadequate studied material – many descriptions are based on the analysis of one or few pieces and thus give only a small segment of the breadth of variation – have lead to describing a large number of species, from which numerous not deserved species ranks. In the case of careful descriptions and determinations the breadth of variation of the taxa and corresponding careful analyses of the specimens then the determination becomes even in the genus *Verrucaria* not essentially a greater problem than in many other crustose lichen genera, possibly many species are even character poor. Faced with the unsatisfactory preparation and knowledge many species must often remain of questionable determination. Some scarcely known and collected species remain here unconsidered.

The crustose thallus may be developed over the rock (epilithic), penetrating however in the case of the most of the lime-dwelling species more or less further in the substrate, with parts of the medulla or even the algae layer (thallus hemi-endolithic), or the thallus may be found completely in the rock (endolithic). In the case of the epilithic thallus the cortex and algal layer are often constructed more or less paraplectenchymatous. Over the cortex often is fund a definite, colorless, amorphous covering layer. In a few species, above all in the case of the water lichens, the *V. fuscella*- and *V. nigrescens-groups*, a brownish black basal layer is developed under the algal layer, which partially, often in the form of a ledge- or support-form layer, which goes over the algal layer, sometimes penetrating the upper surface. It produces a puncturing of the thallus (in the case of many of the water lichens) or the blackish flecking or surrounding of the thallus areoles (*V. fuscella*-group). The basal layer may even partially exposed by snail grazing (has lead to stronger "variability" in the appearance of lichens). In the case of numerous species the algae cells lie in irregular to regularly perpendicular series.

The endolithic development of the algae- and cortex-layer the ± continuous plectenchymatous coherence is lost. Then only small parts of the developed region (mostly over the algae-clumps or small nests in the cortex layer) are "cellular." The algae are aggregated in groups. The perithecia are in the case of endolithic thallus construction more or less sunken into the rock and leave behind after dying and falling out definite pits.

The perithecia construction plays a large role in the determination. The part of the perithecium visible from above is known as the apex; the apex is from the penetrated perithecium mouth. The receptacle or the wall of the perithecium may be simply constructed, i.e. structurally uniform or be gradually altered envelope (excipulum, "inner receptacle"). The excipulum is above these, in the region of the apex, commonly dark colored, basally often pale, sometimes circular dark; around the mouth it is often somewhat thickened. The excipulum is frequently exterior/above a second, structurally differing, commonly dark brown to blackish envelop, lying outside the involucrellum ("outer receptacle"). The involucrellum is only above developed around the mouth or reaching more or less widely under it, up to half or deeper, or it is completely constructed around it. It lies close to or stands away from it laterally. In the case of a few species it stands horizontal to the tip of the perithecium and produces a type of deck (genus *Baglietoa*).

The relationships are to be seen clearly only in the case of thin sections, often reached however even in a crude procedure, in which one studies the lichen (in situ) halving the perithecium longitudinally under the binocular by reflected light.
Exc. ∅ means ∅ exc. incl. core.

Oversight of the Parts of the Key:

PT 1: On flooded or long time moist habitats
PT 2: Not on such Habitats

Verrucaria PT 1: on flooded or long time moist Habitats

Almost all species are silicate dwellers. The algal layer is often paraplectenchymatous (only in the case of weaker thallus development is this characteristic weakly pronounced). In the case of many species the thallus in the moist condition is greenish to green-blackish and sub-gelatinous (it lays film-like in a thin layer scaling off in large pieces and is slightly transparent; in the case of other species the thallus breaks off as scales in smaller pieces). Many specimens may not at this time be clearly ordered.

1 On limestone. Thallus gray-greenish, brown-green, brownish, moist green to black-green, not cracked to partially cracked, smooth. Per. -0.3 (0.4) mm, sunken in 0.3-0.7 mm wide warts, with 0.1-0.2 mm wide, naked apex. Receptacle dark in the upper region. Sometimes developing a black basal layer. Algae in perpendicular rows. Algal layer sometimes interrupted by the black basal layer. Sp. 20-30 x 11-13(16) µm, content often coarsely granular . **V. elaeomelaena**

1* On silicate rock **2**

2 Sp. small, up to 14 µm long, broadly ellipsoidal to almost spherical. Species living almost constantly submerged. Thallus at least when moist dark green to blackish, sub-gelatinous, coherent of partially finely cracked, smooth or with very fine papillae (20-40 µm wide, handlens !), thereby sometimes seem finely punctate. Algae in regularly perpendicular series **3**

2* Sp. larger. Usually not living constantly submerged. Thallus without fine papillae, algae usually only in irregular series . **5**

3 Sp. 6-9(11) x (4)5-7 µm. Thallus black, dark olive, green, thin, not cracked, smooth, without papillae. Per. 0.2-0.3 mm, sunken, thallus for the most part covered, only the mouth region visible. Involl. only reaching half under the per., mostly lateral **V. aquatilis**

3* Sp. 9-14 x 5-9 µm. No lateral development of the lower involucre **4**

4 Thallus black to green-black, often extensive and robust, with numerous tiny papillae (handlens!). Per. scattered, sunken into very flat convex, usually 0.5-0.7 mm wide thallus warts. Receptacle circular blackish, proceeding below in the continuous black basal layer. Basal layer columnar breaking through the algal layer (papillae). Sp. 12-14 x 7-9 µm . **V. scabra**

4* Thallus green, gray-green, moist almost black-green (in the herbarium ± brown), usually with tiny black punctae (ca. 30 µm), usually small. Per. very numerous, -0.2 mm, apex 0.05-0.15 mm, not/scarcely projecting. Receptacle thickened above and blackish, below brown to light. In the collective thallus there are distributed blackish, irregular clumps/columns (punctae on the upper surface), lacking or thin continuous black basal layer. Sp. 9-12(14) x 5-8 (10) µm . **V. rheitrophila**

5 Thallus definitely cracked to cracked areolate, moist not green, not sub-gelatinous. Involl. thick, not definitely lateral and growing into the thallus. Lichens of the upper amphibious, not long time flooded zone **6**

5* Thallus film-like coherent or usually only partially finely cracked, moist often greenish or green-blackish. Usually lower amphibious, long time flooded zone or on shady-moist habitats . **7**

6 Thallus light, brownish-white, beige, rose-beige, slightly rose-brownish, gray-whitish, light brown, often extensive, usually cracked, upper surface smooth. Areoles 0.3-0.6 mm, with 1-3 per. Per. 0.25-0.3(0.4) mm, apex 0.1-0.25 mm. Involl. reaching to half under the per., dark brown to black. Sp. 20-27 x 7-11 µm. Algae cells at times

very large, 6-25 x 6-15 µm. Black basal layer developed . **V. praetermissa**

6* Thallus brown, dark brown, red-brown, black-brown, brown-gray, gray, cracked to almost areolate. Areoles -0.4 mm. Per. -0.3(0.4) mm, covered laterally by the thallus, naked apex -0.15 mm. Invol. up to perhaps reaching half or further. Sp. 18-25(30) x 8-12(15) µm. Black basal layer developed or lacking . **V. aethiobola**

7 Sp. ca. 24-38 x 10-20 µm. Per. incl. invol. 0.4-0.6 mm, sunken in slightly raised to hemispherical thallus warts, only region around the ostiole free. Invol. reaching to half under the per, clearly standing off below. Esc. -0.3 mm ∅. Thallus thin, smooth, not or scarcely cracked, dark brown to dark gray, sometimes green tinted, with or without black basal layer, (in section) without black ribs/columns, algal layer ± paraplectenchymatous . **V. margacea**

7* Sp. in the center up to 25 µm long, 11 µm wide **8**

8 Invol. spreading from the exc. and extending laterally into the thallus, strongly developed. Thallus greenish to black-green, usually not cracked. Per. sunken into the surface thallus warts, 0.3-0.6 mm. Exc. colorless to pale brownish; between exc. and invol. sometimes a brown paraplectenchymatous tissue developed. Sp. 18-25 x 7-10 µm. Often with clearly developed blackish basal layer, this easily visible in a slanting section of the thallus, also with isolated black regions in the thallus and even externally visible . **V. hydrela***

8* Invol. not clearly extending laterally into the thallus . **9**

9 Thallus light, brownish-white, gray-white, weakly rose, beige, as a rule little altered when moist. Invol. thick . **V. praetermissa (6)**

9* Thallus olive-gray, greenish-brown, light gray-brown, light brown to brown, sometimes with black flecks, often with lighter fringe on the thallus margin, even with black prothallus, moist green, olive, green-black, often extensive, smooth to almost shiny. Per. sunken into ± flat convex thallus warts and with only the tip (mouth) visible, when young entirely sunken and not projecting. Algae frequently regularly ordered in rows. Per. receptacle dark throughout, usually merging into the black basal layer, invol. and exc. indefinitely separated. Sp. narrowly ellipsoidal, 18-25(29) x 7-10(12) µm **V. funckii**

Verrucaria PT 2: Not on long time moist or at times flooded Rock

1 Thallus on soil, gray-greenish, finely granular (-finely warty), made up of goniocysts. Per. -0.3 mm, half sunken, interior region I+ red. Exc. dark brown to reddish, basally often lighter, without invol. Sp. 19-27(29) x 5-7(8) µm, sometimes with smaller gelatinous projections, overripe even 1(-3)-septate **V. bryoctona**

1* Not on soil . **2**

2 Thallus clearly cracked to areolate, to a large extent epilithic, never very thin or indefinite or coherent-unarticulated **3**

2* Thallus not clearly cracked to areolate, but thin and coherent-unarticulated or completely in the interior of the rock . **21**

3 Thallus parasitic on crustose lichens . **4**

3* Thallus not parasitic . **5**

4 Thallus on *Caloplaca*-species, as a rule on *C. granulosa*, cracked to areolate or appearing small squamulose, gray, greenish-gray, gray-brown. Per. almost completely sunken; invol. lacking. Esc. up to 0.2 mm wide, colorless. Sp. 12-17(21) x 5-7.5 µm . **V. granulosaria**

4! Thallus on *Verrucaria nigrescens*, regularly areolate, areoles small, 0.15-0.5 mm, angular, flat, sharply angular, black fringed, light gray, brown-gray. Per. apex 0.1-0.25 mm, flattened. Invol. well developed, reaching to the base of the per. Exc. -0.22 mm, black, core I+ red. Sp. 10-20 x 4-9 µm **V. fuscella** (often ↑ *V. subfuscella* also grows on *V. nigrescens*)

4* Thallus on various crusts, squamulose, like an *Acarospora*-species, -2 cm wide, dark brown to brown-black. Sp. (9)11-18 x 6-9(11) µm see **V. compacta (10)**

5 Per. almost all sitting definitely at the margin of areoles **6**

5* Per. predominantly in the center of areoles (when marginal, then thallus brown) **7**

6 Per. with clearly projecting, conic, apex flattened above, usually 1-2 per areole. Thallus robust, deep cracked areolate to areolate. Areoles as a rule not black bordered, angular, flat to moderately convex, -0.8(1) mm, light gray, gray, gray-brown, brown, sometimes even darker, with or without dark prothallus. Black basal layer occurring. Upper surface wrinkled. Apex 0.2-0.3 mm. Receptacle soon almost circular dark. Sp. 14-20 x 5-9 µm. Algae 5-20 µm **V. lecideoides** (!**V. beltraminiana** (Massal.) Trevisan has smaller, -05 mm wide, in general lighter areoles. Without prothallus. without black basal layer. e.g. Ne, Hü, often on natural stone walls of limestone)

6* Per. completely sunken, with the apex not projecting, usually to 1-2 per areole. Areoles black fringed, -0.5 mm wide, not conspicuously wrinkled . **V. fuscella (4)**

7 areoles black fringed, often run through by delicate dark lines, often as checked, gray-white to dark gray, gray-brown, olive-gray, partially irregularly angular, -1(2) mm, with uneven margins, in section usually for the greater part blackish (because of the black basal layer, the

cone- and ledge-like projecting into the algal layer and partially into the upper surface, in the case of horizontal and near upper surface sections appearing as flecks and lines). Thallus areolate to almost squamulose, thick. With dark prothallus. Per. completely sunken, with the apex not projecting, usually to 2-5 per areole, at least surrounded below by the black basal layer, above scarcely separated from the algae layer. Apex ca. -0.2 mm. Receptacle dark surrounded. Sp. 10-18(23) x 4-7(8) µm **V. subfuscella** (Attention! Forms whose areoles because of delicate dark lines – often reticulate – are subdivided or checked, are often snail-frass forms of *V. nigrescens*; when areoles smaller, margin not uneven, surface never checked by run through lines, with well developed invol: *V. fuscella*)

7* Areoles uniformly colored, not black fringed or black flecked or with dark lines **8**

8 Thallus brown, yellow-, red-, dark brown to (brown) black . **9**

8* Thallus colored otherwise **14**

9 Thallus areoles sorediate at the margin, yellow-brown, rarely darker brown, like *V. macrostoma*: **V. macrostoma** f. **furfuracea** B.de Lesd. (similar is **V. tectorum**: Areoles in small 0.05 - 0.3 mm size undivided lower areoles, on whose borders soralia erupt; soralia yellowish, -0.2 mm long, 0.05 mm wide; thallus thick, in section with 2-3 algal layers, which are separated by brown plectenchyma; rarely *V. nigrescens* also has sorediate erupting areole margins, this taxon distinguished by black prothallus and smaller areoles)

9* Thallus not sorediate . **10**

10 Sp. (9)11-18 x 6-9(11) µm. Thallus areolate to usually almost squamulose and then almost like an *Acarospora*, -2 cm wide. Areoles 0.6-3 mm, dark brown to brown-black, with uneven upper surface, separated by 0.1-0.3 mm wide cracks, easily falling out. Without black basal layer. Per. sunken, -0.4 mm wide, apex scarcely visible. Invol. only developed at the apex. Core I+ red . **V. compacta**

10* Sp. in the center over 18 µm. Thallus not squamulose **11**

11 Per. simply structured, without definite invol. Exc. dark brown to black **12**

11* Per with invol. **13**

12 Sp. (20)23-35(40) x (10)13-17(22) µm. Per. ½ to almost completely sunken, apex large, 0.3-0.6 (0.8) mm, flat to slightly convex. Core -0.6 (0.7) mm, usually somewhat elongated to pear-form. Thallus greenish-gray, brown-gray, light brown to rarely dark brown, foist ± green, cracked to areolate, even granular to scruffy. Areoles 0.2 - 1 mm, angular, smooth to uneven **V. viridula**

12* Sp. 18-23 x 8-12(14) µm. Per. completely sunken, apex -0.3 mm, convex, brown to black. Core 0.3-0.4 mm, spherical. Thallus pale yellow-brown, gray, gray-brown, brown, areolate. Areoles 0.3-1.2 mm, flat to convex, rounded to angular **V. ochrostoma** (Leighton) Trevisan

13 Thallus dark brown to blackish, more rarely middle brown, often with black prothallus, even visible between the areoles (in areole section often with black basal layer), rather thin to moderately thick, -0.4 mm, rarely thicker, finely cracked, cracked areolate or warty, areoles 0.2-1 mm, flat to weakly areolate. Per. usually predominantly covered by the thallus, m.-r. projecting, apex -0.2 mm. Receptacle/invol. dark, merging into blackish basal layer. Invol. -0.4 mm. Core -0.25 mm. Sp. 17-27 x 9-13 µm. Very form rich . **V. nigrescens***

13* Thallus yellow-brown, brown, hazelnut brown, dirty loam-brown, without black prothallus (in section without definite black basal layer), often over 0.4 mm thick. Areoles 0.4-1.5(2) mm, flat to slightly convex, smooth to slightly unevenly wrinkled, often somewhat shiny, at the margins sometimes (in the case of eutrification) somewhat granular, separated by relatively broad cracks, most of the areoles sterile. Per. usually to 1-2 per areole, for the most part sunken, with convex 0.25-0.4(0.5) mm wide projecting apex, -0.6 mm, in the upper half with robust, at times even reaching deeper Invol. Core ± spherical, unbroken to a conic mouth, -0.4 mm. Sp. usually (17)22-32(36) x (10)12-17(20) µm. Algae in ± perpendicular rows **V. macrostoma**

14 Areoles very thick (1.5 mm), very large, 2-7 mm wide, gray-white to light blue-gray, thickly pruinose, flat, sharp angled, somewhat narrowly sessile, the free part of the underside paraplect-enchymatous corticate. Thallus deeply cracked areolate to lumpy, young parasitic on *Lecanora muralis*, therefore almost always on or near these lichens. Per. to a large extent sunken, apex -0.2 mm. Exc. only dark above otherwise ± colorless. Sp. 15-25(30) x 7-10 µm, often weakly developed **Placocarpus schaereri**

14* Areoles not so thick and large, not on *L. muralis* . **15**

15 Sp. under 23 µm in the middle. Exc. ± spherical . **16**

15* Sp. larger . **19**

16 Thallus brownish-gray, lightly pruinose, squamulose. Squamules -0.7 mm, scattered or to 0.5 cm wide coalescing groups. Sp. 12-20 x 4-6 µm, 1-celled or with pseudoseptum . **V. botellispora**

16* Thallus not squamulose **17**

17 Receptacle mostly pale below, dark all the way around. Per half to ¾ sunken, after falling out leaving pits behind, apex 0.2-0.4(0.5) mm, ±

hemispherical projecting, gray-black to black. Involl. reaching to half and clearly deeper, robust (around the per. center up to ca. 40 µm thick). Core ± spherical. Thallus gray-whitish, gray-brownish, dirty gray, even with slight reddish tint, thin, coherent, also cracked or cracked areolate, sometimes indefinite. Sp. ca. (15) 19-25(30) x (8)10-13(16) µm **V. muralis**

17* Receptacle dark all around. Per. entirely sunken. Thallus very clearly developed, conspicuous. Sp. commonly up to 23 µm. Core ± spherical **18**

18 Sp. 14-20(22) x (4)5-8 µm. Thallus very finely cracked (to very fine cracked areolate), bluish- to lead gray, even slightly brownish-gray, always definite, often moderately thick and abruptly delimited at the thallus margin, not gradually thinner, often with black prothallus. Upper surface very finely rough, dull, even. Per. somewhat projecting to completely sunken, -0.3 mm, apex 0.15-0.2 mm. Exc. dark all around (at least with age), rarely basally light, -0.2 (0.25) mm ∅. Involl. deeply reaching down, close lying, very thick around the mouth . **V. caerulea**

18* Sp. broader, 18-23 x 8-12(14) µm. Thallus cracked areolate, not very finely cracked, pale yellow-brown, gray, gray-brown, brown, areolate. Areoles 0.3-1.2 mm, flat to convex, rounded to angular. Per. completely sunken, -0.4 mm. Apex -0.3 mm, convex, brown to black. Exc. black to dark brown all around, without involl., -0.4 mm ∅ . **V. ochrostoma**

19 Core ± spherical. Receptacle mostly pale below, sometimes dark all around. Sp. ca. (15)19-25 (33) x (8)10-13(18) µm. Involl. up to half and definitely reaching deeper, robust (around the per. center up to ca. 50 µm thick). Per half to ¾ sunken, after falling out leaving pits behind, apex 0.2-0.4(0.5) mm, ± hemispherical, gray- black to black. Thallus gray-whitish, gray-brownish, dirty gray, even with slight reddish tint, thin, coherent, also cracked or cracked areolate, sometimes indefinite **V. muralis**

19* Core/exc. pear-form, i.e. per higher than wide. Involl. only developed around the ostiole or receptacle thickened above and no involl. distinguishable **20**

20 Exc. light at least in the lower half. Thallus gray, gray-white, thin. Per. almost completely sunken, 0.2-0.4 mm. Involl. only developed around the ostiole. Algae layer not completely paraplectenchymatous. Sp. 23-30 x 13-18 µm **! V. ruderum***

20* Exc. dark all around. Thallus greenish-gray, brown-gray, gray, light brown, moist ± green, cracked to areolate, even granular to scruffy. Per.1/3 to almost completely sunken. -0.5 (0.6) mm, usually somewhat elongated to pear-form. Involl. only developed around the mouth or in the upper third or receptacle only strongly thickened in this region. Areoles 0.2-1.2(1.5) mm, angular, smooth to uneven. Cortex and algal layer paraplectenchymatous. Sp. (20)23-30(40) x (10)13-17(22) µm . **V. viridula**

21 Thallus conspicuous rose- to wine-red (sometimes only in the direct influence of the per.), endolithic. Per. apex -0.3 mm, often with a few radial groves, receptacle -0.4 mm, only dark around the apex, without involl., after falling out leaving pits behind in the stone. Sp. (15)20-30 x 10-15 µm, often weakly developed . **V. marmorea**

21* Thallus not red (*B. parmigera* may sometimes have a very slightly rose tinting) . **22**

22 Sp. large, usually 23-35 x 13-20 µm. Core I+ red **23**

22* Sp. usually smaller, up to 25 x 13 µm. Core I+ blue(green) or red . **25**

23 Per. receptacle latterly thickened by robust involl. reaching to the middle or deeper, pale below to rarely dark. Per. hemispherical projecting, naked or with thallus covering, or almost entirely sunken, leaving pits behind in the rock or pits lacking. Apex 0.2-0.4 mm. Sp. up to 28 x 15 µm **V. muralis (19)**

23* Per. receptacle blackish all around, ± uniformly thick, only thickened around the mouth, without definite involl. Per. after falling out definitely leaving pits behind. Thallus with fine rough, porous to almost mealy upper surface, even seeming like fine punctae; closely related (*V. hochstetteri* s.l.) . **24**

24 Per. entirely sunken, often sunken into the thallus (rock) puffy surrounding wall or in wart- like elevations, apex ca. 0.2-0.4 mm, not raised above the thallus/substrate. Receptacle/exc. mostly ± pear-form, 0.5-0.8 µm. Sp. 21-38 (40) x 13-21(24) µm. Thallus whitish to white-gray, even slightly reddish, slightly brownish-gray, slightly whitish, ± endolithic . **V. hochstetteri**

24* Per. ca. ¾ to ½ sunken with apex projecting above the substrate, covered by the thallus on the side, 0.25-0.35 mm wide, convex. Receptacle ± spherical to pear-form, -0.5 mm. Sp. 21-36 x 12-18(20) µm. Thallus gray, gray- brownish, -violet, -whitish, even slightly reddish . **V. foveolata**

25 Per. (in most cases) completely sunken, with not or only slightly projecting apex, -0.3 mm, leaving deep pits behind after falling out. Involl. forming a deck over the sitting up or lacking per. Apex with or without radial groves. Hym. I+ blue-(green), or at first blue, then red. Sp. (12) 15-23(28) x 6-13 µm. Only on lime-rich rock, not on concrete or mortar . **26**

25* Per. not completely sunken, with the apex clearly rising above the substrate, definite to small pits left behind. Involl. never deck-form. Apex without radial groves. Hym. I+ red **31**

26 Per. receptacle above without deck-form involl., simple, black all around, -0.4 mm wide, wall

somewhat thickened above. Apex without groves, somewhat convex and sometimes somewhat projecting, 0.25-0.3 mm. Thallus white, upper surface smooth (not rough), often with fine, straight cracks, the radius of the per merging (and sometimes several of them bound), often with black prothallus. Core ± spherical, I+ blue, at times even red. Sp. 13-28 x 7-15 µm .**V. calciseda**

26* Per. receptacle with deck-form invol above. Per.-apex in aspect often with radial groves. In the thallus no cracks merging with the per. Core I+ blue to blue-green **27**

27 Thallus bluish-green, greenish, mouse gray, often somewhat shiny or oily shining, often like very finely hammered, but also bleached whitish and dull. Receptacle (exc.) only blackish above, otherwise brownish to almost colorless, spherical, flask-form when ripe. Apex (invol.) well constructed with radial groves, -0.2 mm, narrower than exc. ∅ (0.3 mm), flat or convex. Often without sp. or sp. poorly developed (15-27 x 7-12 µm) **Bagliettoa parmigerella**

27* Thallus white (gray-white, slightly greenish-white), unarticulated, smooth, sometimes delimited by ± colorless furrow or blackish prothallus. Apex (invol.) in the case of per. in aspect with4-5 radial groves, in case of falling out often leaving a blackish ring behind, flat or slightly convex and margin often weakly curved under. Exc. 0.2-0.3 mm ∅, sp. often not developed **28**

28 Per. apex (invol.) large, 0.3-0.4 mm, flat to slightly curved upward at the margin, never curved downward, in the center slightly convex and ± towering above the thallus upper surface, with definite groves, commonly broader than the exc. Esc. -0.35 mm ∅, light to dark. Thallus white to light gray. So. 17-20(35) x 10-13 µm, 1- to rarely 2-celled **Bagliettoa limborioides**

28* Per. apex (invol.) smaller, 0.15-0.3 mm, flat to convex, not rarely even margin curved under, not towering over the thallus . **29**

29 Per. receptacle (almost) lacking, completely colorless, only invol. dark. Sp. (10)13-26 x (5) 8-15 µm **Bagliettoa steineri**

30 Per. receptacle (exc.) toward the base light to dark brown, above dark, -0.4 mm, spherical to pear-form or fig-form. Invol. at best as broad as the receptacle, often slightly convex. Sp. 14-21 x 6-10 µm **Bagliettoa baldensis**

30* Per. receptacle (exc.) black all around, often irregularly crowded, e.g. fig-form. Invol. broader that the receptacle. Sp. 10-25 x 5-14 µm **Bagliettoa parmigera**

31 Thallus brown. Sp. (12)14-19(22) x 6-9(10) µm. Receptacle with invol. reaching to half of deeper **32**

31* Thallus whitish, gray, gray-greenish to -brownish . **34**

32 On silicate rock. Per. hemispherical projecting, 0.2-0.3 mm, ± naked, see *V. nigrescens* s.l., *V. dolosa*

32* On limestone, thallus usually small, fleck-form. Per. very small, apex -0.2 mm . **33**

33 Per. very numerous and crowded, ½ to $^1/_3$ sunken, apex pushed in around the mouth or ragged. Core ± spherical. Invol. robust, black, reaching to perhaps half o the per, exc. colorless to brown. Thallus light brown, chestnut brown, olive brown, often slightly shiny, smooth, cartilaginous, not cracked to fine cracked . **V. pinguicula**

33* Per. moderately numerous, hemispherical projecting, apex not pushed in around the mouth. Thallus black-brown, dark brown to olive brown, thin, rather smooth to rough, coherent, rarely cracked areolate .**! V. maculiformis***

34 Per. large (apex ca. 0.3-0.5(0.6) mm), after falling out leaving pits behind. Invol. robust, reaching to half and deeper **35**

34* Per. small (apex ca 0.2-0.3 mm), pits left behind after falling out or not . **36**

35 Sp. predominantly ca. (15)19-25(30) x (8)10-13 (16) µm. Apex ca. 0.3-0.4 mm, rarely larger, moderately ragged. Invol. at half the height of the per. ca. 50 µm thick **V. muralis (19)**

35* Sp. narrower in the center, (12)14-20(25) x 5-9 (10) µm. Per. apex ca. 0.4-0.6 mm, often strongly ragged to weakly crater-like. Invol. reaching to almost the base, at half the height over 100(-200) µm thick. Exc. colorless to pale brown, only 0.2-0.35 mm. Thallus ± endolithic, white- to bluish-gray, dirty light gray, with very many tiny, brownish fleck, rough to porous, often with black prothallus or delimited by a grove. Sp. sometimes 2-celled . **V. dufourii**

36 Thallus merging and intersected by dark brown, relatively broad lines (usually double lines!), coherent, color clearly varying from the rock substrate, whitish-gray, light brownish-gray, dull, with very fin rough upper surface, with countless extremely small (100 µm) flecks. Per. leaving behind pits after falling out, apex 0.2-0.3 mm. Invol. reaching up to only half the per., exc. colorless to light brown. Sp. 12-20 x 6-9 µm . **V. cyanea**

36* Thallus not of merging dark brown double lines, but sometimes with simple black prothallus lines . **37**

37 Sp. mostly ca. 8-13(16) µm wide, 15-25(30) µm long. Per. apex 0.2-0.4 mm, invol. robust. Receptacle pale to brown below **V. muralis (19)**

37* Sp. narrower in the middle **38**

38 Per. sessile to half sunken, hemispherical projecting, leaving behind small pits after falling out. Apex ca. 0.2 mm. Invol. only half reaching under (at the base), black, exc. colorless to pale brown. Thallus very thin, gray-green to whitish

or gray-brownish, moist green, smooth to almost lacking, even granular, on silicate- and limestone. Sp. (13)15-19(22) x 5-8(10) µm **V. dolosa***

38* Per. usually ± half sunken. Pits after per. falling out occurring or not. Esc. ∅ -0.2 mm. Thallus moist not green. On limestone **39**

39 Thallus endolithic to very thin epilithic, pale gray, gray to gray- or olive-brownish, smooth to weakly cracked. Per. very small, rather numerous. Apex 0.15-2 mm, for the greatest part ragged. Invol. reaching to the base. Esc. black, indefinitely separated from the invol. Sp. 16-23 x 6-9 µm **V. murina**

39* Thallus thin, ± endolithic, partially even somewhat cracked, gray-white to gray-brownish. Per. rather numerous. Apex 0.2-0.3 mm, hemispherical. Invol. reaching up to half. Exc. colorless to brown. Sp. 18-21(23) x 7-8(10) µm, sometimes with several cross-septa **V. anceps**

Ecology and Distribution of the Species

Bagliettoa Massal.

Bagliettoa baldensis (Massal.) Vèzda (Verrucaria b. Massal.)
Commonly up into montane sites on lime-rich rock, above all thick limestone, on nutrient- poor shady to semi-shaded (rarely sunny) ± rain exposed habitats, but avoiding eutrophic sites, perhaps combining the ecological amplitude of *Protoblastenia incrustans* and *Acrocordia con*; Char. Verrucarietalia parm. – mieur-med – SJu-JU-FrJu, Rhön, certainly widely distributed

Bagliettoa limborioides (Massal. (B./Verrucaria sphinctrina auct.)
In montane and high montane sites on compact limestone on steep surfaces away from the sun – s'mieur-med – rare; Ju

Bagliettoa parmigera (J.Steiner) Vèzda & Poelt (Verrucaria p. J.Steiner, Protobagliettoa p. (J.Steiner) Servit)
Commonly up into montane sites on lime-rich rock, above all thick limestone, on nutrient poor shady to semi-shaded (rarely sunny), ± rain exposed, even slightly substrate moist habitats, avoiding eutrophic sites, perhaps combining the ecological amplitudes of *V. marmorea* and *Acrocordia con.* (↑); basiph., xeroph.-r.hygroph., Char. Verrucarietalia parm. – mieur-med – r.rare; SJu-Ju-FrJu, süHü, Mn

Bagliettoa parmigerella (Zahlbr.) Vèzda & Poelt (Verrucaria sphinctrinella Zsch., V. pinguis J.Steiner)
Up into montane sites on lime-rich rock, above all limestone, dolomite, on m.-r.well lighted, shady, rain exposed, nutrient-poor habitats, above all on steep- and vertical surfaces, basiph., mesoph.-r.hygroph., a.(m.)nitroph., in the Verrucarion sph., Acrocordion con. – s'mieur-med – Sju-Ju-FrJu, süHü

Bagliettoa steineri (Kusan) Vèzda (Verrucaria st. Kusan, Protobagliettoa st. (Kusan) Servit))
Ecologically like *B. baldensis* (↑) -- mieur-med – r.rare, lime region partially m.frequent; Ju, SJu, FrJu

Verrucaria Schrader

Verrucaria aethiobola Wahlenb. (V. cataleptoides (Nyl.) Nyl., V. laevata Ach., non Körber, non auct.)
In the montane and high montane zones on commonly hard, smooth silicate rock on clear, cold, acid substance rich brooks amphibious on surfaces from time to time only flooded in case of high water, subneutroph., r.hydroph., m.-r.photoph., anitroph., in the Hymenelietum lac., Ionaspidetum -- arct-mieur-smed-mo – rare; süSch, Vog, Eif

Verrucaria amylacea Massal.
On limestone, dolomite, probably rather like *Dirina stenh.* (↑) and *Caloplaca cirr.* (↑) -- mieur-smed – rare; Ju, FrJu

Verrucaria anceps Krempelh. (Polyblastia a. (Krempelh.) Servit)
On limestone and Dolomite, probably above all on shady sites -- Al, FrJu, Ml

Verrucaria aquatilis Mudd
Like *V. rheitrophila* (↑), predominantly in the foothills up into the montane sites -- mieur-subatl(-med) – rare; süSch, O, Rhön, Vgb, Ts Eif

Verrucaria botellispora Breuss (Placidiopsis muelleri Servit)
On ± neutral silicate rock on shady vertical surfaces in warm sites, subneutroph.-m.acidoph. – mieur – v.rare; Eif

Verrucaria bryoctona (Th.Fr.) A.Orange (V. psammophila Erichsen)

On base rich sand- and sandy loam soils in ephemeral pioneer associations together with mosses, on cool slopes, roadways etc., like *Thrombium* (↑) – bor-mieur-subatl – rare; Ne

Verrucaria caerulea DC. (V. plumbea Ach.)
In montane to alpine sites, rarely lower, on lime-rich rock, above all limestone, rarely dolomitic rocks, above all on rain exposed vertical and sloping surfaces on m.-r.well lighted, commonly shady, non eutrophic habitats with moderately varying hydric/thermic condition, basiph., mesoph.9r.hygroph.), a-(m.)nitroph., Char. Thelidietalia dec. – (bor-)-mieur-mo-med-mo – rare; Sju-Ju-FrJu (at times m.frequent), süHü, Ne, Eif, Al

Verrucaria calciseda DC. (Amphoridium calcisedum (DC.) Servit)
Up into montane sites, rarely higher, above all on well lighted, commonly sunny habitats on lime-rich, soft to hard rocks, above all on limestone, rarely dolomite, on cliffs and stones on sites with very strongly varying hydric/thermic conditions, avoiding stronger dunging, in the region e.g. like *Aspicilia calc.*, basiph., ombroph., xeroph., r.-v.photoph., thermoph., a-/m.nitroph., above all in the Aspicilion calc. – s'bor-med – in the lime regions m.-v.frequent, above all SJu-Ju-FrJu, Ne, Mn

Verrucaria compacta (Massal.) Jatta (Dermatocarpon compactum (Massal.) Blomb. & Forss.)
Up into alpine sites on limestone on usually sunny, m.-r.(v.)nutrient-rich habitats, on horizontal- to vertical surfaces, often on other lichens, like *Lecidea lurida* (↑), even on walls (like *Caloplaca teich.* ↑), basiph., xeroph., r.-v.photoph., e.g. in the Caloplacion dec. – mieur(mo)-med(mo) – rare; Nm, Th, Ju, FrJu, nöHü (Nahe)

Verrucaria cyanea Massal. (V. limitata Krempelh.)
On steep surfaces of cliffs, usually on very lime-rich limestone, like *Acrocordia con.* (↑), Char. Acrocordion con. – bor-med-mo -- (r.)rare; SJu-Ju-FrJu, Eif, Al

Verrucaria dolosa Hepp (?V. floerkeana Dalla Torre & Sarnth.)
Above all on small stones and boulders of lime- and silicate rock (in the latter case often on stones over base-rich soils), e.g. in gravel pits, roads, above all on shady-moist sites, thus in forests, basiph.-subneutroph., pioneer lichens – (bor-)-mieur-med – r.rare; Ju, SJu, Ne, süHü, süSch, HRh, Rh, O, Eif

Verrucaria dufourii Dc.
Montane to alpine, rarely lower, on relatively hard lime-rich rocks, like *Hymenelia coer. Farnoldia jur.* (↑), Char. Hymenelietum coer. – bor-med-mo/alp – rare; SJu, Ju, FrJu, Al, Eif, Lahn, ?süHü

Verrucaria elaeomelaena (Massal.) Arnold
Up into the alpine zone on limestone submerged in moderately cool to cold brooks and streams, only very short time emerging or amphibious on very shady sites, basiph., r.photoindiff., a-(m.) nitroph., Char Verrucarietum elaeom. – bor-med – rare (2); SJu, Ju, FrJu, Ne, SFW, O, HRh, Al

Verrucaria foveolata (Flörke) Massal. (V. dolomitica (Massal.) Krempelh., Amphoridium dolomiticum Massal., V. veronensis Massal.)
Up into the alpine zone on lime-rich rock, often on dolomite, r.euryöke species, on nutrient-poor, poorly lighted to well lighted sites, on small stones (pioneer) as well as large cliffs, almost the entire habitat amplitude of *V. calciseda* and *V. hochstetteri* combined, basiph. – bor-med-mo – r.rare; Ju, FrJu, süHü, Ne, O, Av, Al

Verrucaria funckii (Sprengel) Zahlbr. (V. silicea Servit, V. denudata auct. p.p.)
Rather like *V. rheitrophila* (↑), -- bor-mieur – (r.)rare; Sch, Vog, O, Sp, Ts, Vgb, Rhön, Eif

Verrucaria fuscella (Turner) Winch. (V. polysticta Borrer, V. nigricans Nyl.)
Up to the tree line on limestone, above all on steep and vertical surfaces, rarely even on weakly calcareous silicate rock (on old walls), frequently parasitic on *V. nigrescens* (above all in the Aspicilion calc.), on well lighted, not to moderately eutrophic habitats; basiph.-neutroph., r.photoindiff., xeroph.-mesoph. – bor-med – r.rare(-m.frequent), above all lime region, e.g. Ju, FrJu, Ne, Eif, Vog, Sch

Verrucaria granulosaria Clauz. & Zehetl.
Parasitic on *Caloplaca granulosa* (↑) -- mieur-med -- rare (R); Ju

Verrucaria hochstetteri Fr. (? V. foveolata, ? incl. V. mastoidea (Massal.) Trevis., V. arnoldii Steiner, ? V. hiascens (Ach.) Hepp)

From the montane to alpine zone, but even lower, on not eutrophic lime-rich rocks, additionally often on dolomite, predominantly on shady, humid, even mountain moist habitats, including the ecological amplitude of *V. dufourii, V. caeruleai* and *Thelidium dec.* (↑), Char. Thelidietalia dec., e.g. Hymenelietum coer. – bor-med-mo/alp – r.rare; Sju-Ju-FrJu, Al, süHü, Eif

Verrucaria hydrela Ach. (Verrucaria laevata auct., V. denudata auct. p.p.)
Predominantly in the sub- to high montane zone on silicate rock on shady, humid habitats, on stones remaining moist for a long time and boulders (e.g. on forest paths), on moist cliffs in forest shaded or amphibious on boulders in brooks, subneutroph.-m.acidoph., subhydroph.-r.hydroph., r.skioph.-m.(r.)photoph., anitroph., Char. Verrucarietum hydr. – bor-mieur(-med) – rare (3); Sch, O, Sp, Ts, Vgb, Rhön, Eif, FrJu

Verrucaria lecideoides Trevisan (? V. beltraminiana (Massal.) Trevisan)
Like *Placocarpus schaereri* (↑), but ecological amplitude broader, even going over on nutrient-poor sites – s'mieur-med – rare; SJu-Ju-FrJu, Mn

Verrucaria macrostoma Dufour ex DC.
(? V. apatela (Massal.) Trevisan)
Above all on dust impregnated walls (like *Caloplaca teich.*), even on limestone cliffs, above all on rather rain protected vertical- and overhanging surfaces and on bird roosting sites, e.g. like *Caloplaca cirr.* and *Caloplaca decipiens* (↑), Char. Caloplacion dec., in the Dirinetum – mieur-med – r.rare (-m.frequent); above all Ne, Hü, Mn, Ju, Al

Verrucaria maculiformis Krempelh.
Like *Clauzadea metzleri* (↑), above all on stones, gravel, preferably under bushes, basiph., often with *V. muralis* and *V. nigrescens* -- mieur-smed -- e.g. süHü, Rh, Ne, FrJu, Al

Verrucaria margacea (Wahlenb.) Wahlenb.
(V. applanata Zwackh)
In montane to alpine sites on silicate rock submerged or in the lower (long time flooded) amphibious zone in rapidly flowing, clear, cold brooks, subneutroph.-m.acidoph., anitroph., in the Ionaspidetum -- bor-mieur-h'mo/alp -- v.rare; süSch, Vog

Verrucaria marmorea (Scop.) Arnold
In the hilly and submontane sites on ± hard, ± compact, clean, lime-rich limestone, scarcely on granular-rough stones (e.g. many dolomites), on relatively warm, semi-shaded to rather (never completely) sunny sites, often on steep surfaced, basiph., r.xeroph., r.photoph., anitroph., Char. Verrucarietum marm. – s'mieur-med – rare; Sju, Ju, O

Verrucaria muralis Ach. (V. rupestris Scrader, non (Scop.) Wigg., V. submuralis Nyl., V. confluens Massal.)
Up into the alpine zone on limestone of all types, additionally on lime impregnated silicate rock, especially sandstone, even on mortar, bricks, concrete, loess, on walls, on projecting cliffs as well as on small stones as pioneer (roads, gravel pits; over base rich soils even on lime-free silicate), on climatically very variable, rain exposed habitats, basiph.-(sub)neutroph., m.-v.-photoph., a-/r.nitroph., in numerous assoc. – (arct-)-bor-med – r.frequent, predominantly synanthropic in silicate regions

Verrucaria murina Leighton (V. myriocarpa Hepp ex Lönnr.)
On limestone, dolomite, up into alpine sites – mieur-smed – e.g. SJu, FrJu, Al

Verrucaria nigrescens Pers.
Very euryöke species, on carbonate rocks, rather oceanic or winter-mild sites on (mineral-rich) silicate rock on from time to time flooded of frequently splash water moistened, often somewhat nutrient-rich sites (bird roosts) above all on brooks, subneutroph., hydroph., (m.)r.-v.photoph., a-/m.(r.)nitroph., Char. Hymenelietum lac., even with *Lecanora muralis* and *Physcia caesia* -- mieur-subatl – rare (2); süSch, *nöSch*, Vog, O, Eif

Verrucaria rheitrophila Zsch. (V. kernstockii Zsch., V. minutipuncta Erichsen)
Up into high montane sites on silicate rock submerged in cool and cold brooks, above all in small, rather rapidly flowing water, in deep shade as well as on sunny sites, at best short time emerging (or amphibious on very shady sites), subneutroph.-m.acidoph., anitroph., Char
Verrucarietum funckii -- mieur-subatl – rare (3); süSch, Vog, Ts, Vgb, Eif

Verrucaria ruderum DD. (Amphoridium r. (DC.) Servit
On limestone, concrete, mortar – s'mieur-med – nöHü(-O), Eif

Verrucaria scabra Vèzda
On silicate rock in rapidly flowing, cool, clear mountain brooks submerged or on permanently splash water moistened sites, subneutroph., m.-r.photoph., anitroph. – mieur-mo -- v.rare (1); süSch

Verrucaria subfuscella Nyl. (V. glaucina auct. p.p.)
Up into alpine sites on calcareous rocks, euryöke lichens m.-r.nutrient-rich habitats, predominantly on sites away from the sun on limestone (e.g. in the Acrocordion con.), rarely on lime influenced or basic silicate rock (here like *Dermatocarpon min.* and *Caloplaca obliterans* ↑), also on mortar and bricks (e.g. in the Caloplacion dec.), in numerous assoc.

Verrucaria tectorum (Massal.) Körber
Like *V. macrostoma*, but almost only on steep- and vertical surfaces on eutrophic habitats, on limestone and mortar, often on walls, cavities -- mieur-med – r.rare; Hü, Ne, Ju, Sch etc.

Verrucaria viridula (Schrader) Ach. (Amphoridium viridulum (Schrader) Servit, Verrucaria griseorubens Migula, V. obductilis (Nyl.) Zsch.)
Above all in the foothills and submontane sites, euryöke species on limestone, mortar, silicate rock (above all dust impregnated sandstone), on walls, bricks (here rather like *Caloplaca teich.* ↑), on stones and cliffs, often even as a pioneer -- mieur-med – widespread, above all Ne, Rh, Hü, FrJu, Eif

Lit.: CLAUZADE & ROUX 1985, FRÖBERG 1989, NOWAK & TOBOLEWSKI 1975, POELT & VÈZDA 1981, PURVIS et al. 1992, SERVIT 1954, ZSCHACKE 1933-34.

Vezdaea Tsch.-Woess & Poelt

Introduction

The species which according to the Czechoslovakian lichenologist Antonin Vèzda belong to the genus are short lived lichens with rapidly transitory apothecia. They live on mosses, plant detritus, dying lichens, soil, or rock. The apothecia are simply constructed, lacking an excipulum. They are often gray, rose to red-brown and appear sometimes as velvety haired. The spores are single-celled to cross septate.

With the very unobtrusive, predominantly to be found in the winter species there have been verified till now in Baden-Württemberg *V. aestivalis* and *V. retigera*; the first found especially on mosses on deciduous trees, the latter on dying mosses and *Peltigera*-species. Both are above all distributed in mild sites of the zone of the summer green forests.

Genus Characteristics and Distribution

Thallus crustose, delicate, of greenish granules, which develop often within the moss leaves and under the cortex of lichens, with *Leptosira*-algae. Apothecia rounded to fleck-form, marginless, gray to rose or red-brown, often with velvety seeming upper surface. Exc. and hyp. lacking. Hym. of branched, sometimes the paraphyses entwining the asci, without hym. gelatin. Asci ± cylindric, thick walled, with thick I+ blue apex. Sp. 1-celled to repeatedly septate, ellipsoidal, fusiform to needle-form. Ch-.

1 Sp. needle-form, 8-12 celled, 60-85 x 2-2.5 µm. Ap. -0.4 mm, gray-white to rose-brown, dull, hairy. On soil. North Germany **V. acicularis** Coppins
1* Sp. essentially shorter, not needle-form . **2**
2 Sp. 15-19 x 5-7 µm, 2(4)celled, when full ripe often finely warty. Ap. 0.3-1 mm, depressed sessile, gray, brown, red-brown, convex, young short finely hairy. Paraph. anastomosing, the asci clasped. Thallus granular to granular sorediate, granules with short conic projections. In habit reminiscent of *Mycobilimbia sabuletorum* **V. aestivalis**
2* Sp. 15-22 x 7-11 µm, 1-celled, smooth. Ap. hemispherical, -0.35 mm. Paraph. anastomosing, the clasped. Granules with short spinose projection (when sp. somewhat larger, warty: **V. rheocarpa** Poelt & Döbbeler) **V. retigera**

Ecology and Distribution of the Species

Vezdaea aestivalis (Ohl.) Tsch.-Woess & Poelt (Pachyascus byssaceus (Vèzda) Vèzda)

On mosses on deciduous trees with basic bark (above all ash), on mosses and plant detritus on limestone, old walls and on basic soils (in ditches, quarries), on shady, humid habitats, above all in narrow valleys; subneutroph., substrathygroph., r.-v.hygroph. – mieur – rare; SFW, Isar-Inn, Alps

Vezdaea retigera Poelt & Döbbeler
On mosses, (dying) lichens (above all *Peltigera*) and plant detritus, on old walls, on stony soils, decayed wood, on shady humid habitats – mieur – rare; Ne, Av, Alps

Lit.: COPPINS 1987, GIRALT et al. 1933, POELT & VĚZDA 1977, TSCHERMAK-WOESS & POELT 1976*.

Vulpicida Mattson & Lai

(Determination ↑ Cetraria)

Introduction

The deep yellow species of the genus *Cetraria* were placed in the independent genus *Vulpicida*. They differ in the lichen substance content, the pycnidia and the asci from the other *Cetraria*-groups. Of the six species of the genus only *V. pinastri*, an above all species growing at the base of trees and on stumps in mountain sites, is indigenous; its main distribution region lies in the boreal conifer forests. In the Alps *V. tubulosus* occurs, an arctic-alpine species, which is very typical for the windswept lime heaths above the tree line.

Genus Characteristics

Thallus foliose to fruticose erect, yellow, underside pale yellow, toward the center even blackish, rhizines ± sparse, pseudocyphellae lacking, with coccoid green algae. Ap. almost marginal- to laminal, with brown disk and thalloid margin, very rare in the case of sorediate species. Asci broadly clavate, with strong amyloid-reaction in the tholus, with broad ocular chamber and definite axial mass. Sp. ellipsoidal to almost spherical, one-celled. Pycnidia black, on outgrowths, pycnosp. lemon- form to bacillar with slight sub-terminal swelling. Ch: Usnic acid (cortex), Pinastrinic and Vulpinic acid (medulla).

Ecology and Distribution of the Species

Vulpicida pinastri (Scop.) Mattson & Lai
(Cetraria p. (Scop.) S.F.Gray)
On conifer, rarely deciduous trees with acid bark, mainly at the stem base, additionally on wood, especially on stumps, like *Parmeliopsis hyp.* (↑), almost always associated with *Parmeliopsis amb.*, Char. Parmeliopsidetum -- bor-smed-mo(-med-mo) – rare (e); Vog, süSch and Al over 900 m m.frequent, nöSch, Al, Sju, otherwise v.rare: Eif, Rhön, Ts, Sp, O, Ju, Av, *Vgb*, in lower sites isolated in spontaneously appearing depauperate specimens.

Lit.: MATTSON 1993, MATTSON & LAI 1993.

Xanthoria (Fr.) Th.Fr.

Introduction

The genus includes yellow to orange-red, corticate on both sides foliose lichens with yellow to red apothecia surrounded by a thalloid margin. The underside is usually whitish and is provided with short attachment organs or rarely sparse filamentous rhizines. The spores are ellipsoidal and polar-two celled or polarlocular, i.e. the two “cells” are separated by a thick dividing wall penetrated by a canal. All yellow to red colored parts on the basis of anthra-quinone-content, react deep red. A part of the plants of the species reproduce by soredia.

Of the perhaps 15 of the partly very widely distributed species contained in the genus with nine represented in Germany, with eight species in the region. They live on nutrient-rich or base-rich, well lighted habitats. *X. parietina*, one of our most frequent nuetrophytic foliose lichens, as well as *X. fallax* and *X. candelaria* grow on bark, wood, and rock, *X. calcicola* and *X. elegans* almost only or rock. *X. ulophyllodes*, *X. fulva* and *X. polycarpa* are bark dwellers, where subneutral, dust impregnated substrate – as for many Xanthorias – is typical; the latter is to be found most frequently on branches. *X. candelaria* resides especially on nitrogen-rich

sites, such as bird roosts, wound discharge of trees, and dust impregnated bark. *X. calcicola* and *X. elegans* are found frequently on walls, roof tiles and other anthropogenic substrates; they are more frequent on such habitats than on natural habitats. The occurrences of *X. calcicola* are concentrated in summer warm sites.

X. elegans and *X. candelaria* are distributed throughout Europe (up into the Arctic). *X. fallax, X. fulva, X. polycarpa* and *X. parietina* occur from the Mediterranean up into the boreal zone; in northern Fennoscandia they are for the most part rare or lacking. The area of *X. calcicola* reaches from the mediterranean up into the warm and mild regions of Central Europe; t reaches the boundary of the area in southern most Sweden. *X. ulophyllodes* is distributed possibly mainly in the nemoral zone. The arctic-alpine *X. sorediata* a widespread species, is known in Germany from the lime Alps and the Franconian Alp.

Genus Characteristics and Determination

Thallus foliose to appearing dwarf fruticose. Lobes wide to narrow, appressed to ascending, yellow to orange, in the shade even yellow-gray, underside whitish to slightly browned, with (sometimes very sparse) rhizines or with little differentiated holdfasts, in contrast to *Caloplaca* even the underside corticate. Commonly either with ap. or with soralia or isidia, in many species with blastidia. Photobionts *Trebouxia*-species. Ap. orange, with usually concave to flat disks and definite, often somewhat incurved thalloid margin. Hyp. colorless. Asci clavate, *Teloschistes*-type. Sp. polar diblastic, i.e. with two cells separated by a dividing wall with a central opening, ellipsoidal. Pycnosp. ellipsoidal to sub-cylindrical. Ch: Anthraquinone, above all Physcione, all yellow to orange colored parts K+ deep red/violet red.

1 Thallus with soredia or soredia-like structures (blastidia), usually without apothecia . **2**

1* Thallus without soredia, usually with ap. . **5**

2 Lobules without rhizines, attached directly by the base or with all short holdfasts, ascending, pointed or blunt, the lower segment dorsiventral and cutting off blastidia from the corticate underside. End segments often crenate-toothed, partially in structure and coloring radial, cutting off blastidia on all sides. Thallus almost small fruticose. Ap. sunken in the level of the final branches. Pycnosp. ellipsoidal, almost always occurring, 2.3-3 x 1-1.3 µm . □ **X. candelaria**

2* Lobule undersides covered with – sometimes only few – rhizines, always dorsiventrally constructed, ascending at least near the base. Pycnosp. ± bacillar . **3**

3 Rhizines lacking or only sparsely occurring on the base of the usually soon (± lip form) ascending lobes. Thallus usually strong red-orange to brown-red. Lobes ca.2 mm long and 0.7(1) mm wide, for the greater part, excepting a few marginally, of ± appressed basis steeply ascending, cutting off fine blastidia on the large surface of the underside. On older lobes underside bare. Sp. broadly ellipsoidal, with broadly rounded ends and thick septa, 13.5-17.5 x 8-10.5 µm, septum 4-6.5 µm . **X. fulva**

3* Rhizines numerous over the entire underside, even on the ascending lobes. Lobes appressed to ascending, scarcely erect. Sp. two sided ± narrowed, 10.5-15(16) x 6-7(8) µm. Septum usually 3.5-5 µm **4**

4 Marginal lobes usually clearly elongated and to a large extent appressed, on the tips often somewhat curved under, up to ca. 7 mm long, 1.5 mm wide. There are produced at first on the margin shorter, ascending to strongly curved lateral lobes, which are usually shell-like arched to funnel-like curled, undersides sub-apical short time blastidia, later were long time produced from the (often fissure like openings) medulla sulfur- to greenish-yellow, various soredia the color of the thallus. Margin of older ap. sometimes erupting to corticate soralia. Under- and upper cortex remaining intact. Thallus yellow-orange □ **X. fallax**

4* Marginal lobes loosely appressed, up to 5 mm long and 1-1.5 mm wide, at most the outermost tips curved down. Side lobes and central lobes ± arched (like *Physcia tenella*) ascending, above all sub-marginal (in the neighborhood of the margin) provided with thick blastidia-borders, without soredia **X. ulophyllodes**

5 Growing on rock **6**

5* On bark, wood . **8**

6 Thallus lobes narrow and long stretched, ± equally broad throughout (-1 mm), convex to almost tubular, only flattened at the ends, long stretched, radially-rosette ordered. Thallus usually 1-3 cm, deeply divided, commonly regularly rounded, usually orange to red □ **X. elegans**

6* Thallus lobes broader, ± flat or irregularly wrinkled, ± overlapping one another. Only the young under 2 cm wide **7**

7 Thallus usually red-, brown- to yellow-orange, in the center with warty-lumpy to capitate, even flattened outgrowths to vesicular inflations, often without ap., if fruiting, then ap. sparse □ **X. calcicola**

7* Thallus usually light yellow to orange-yellow, usually very richly covered with ap. Lobes ± flat to concave, without warty, lumpy outgrowths . □ **X. parietina**

8 Only the young thallus under 1.5 cm wide. Lobes on the ends in a broad zone free of ap., flat to concave, usually 1.5 mm wide, light yellow, orange-yellow, yellow-orange. Ap. -4 mm, disk yellow-orange to brown-orange . □ **X. parietina**

8* Thallus -1.5(2) cm, thickly (almost) to the margin covered with ap., rounded, in age cushion-like. Lobes -1 mm wide, on the ends divided-crenate, yellow, gray-yellow, ap. -2 mm, disk deep orange, grown-orange □ **X. polycarpa** (Confusion is possible with the very rare *Caloplaca lobulata* with scarcely developed thallus of tiny lobules, in contrast to *X. polycarpa* undersides decorticate and without rhizines, ap. flat, not concave as in the case of *X. polycarpa*, thallus even in old age not cushion-like)

Ecology and Distribution of the Species

Xanthoria calcicola Oxner (X. aureola auct.)
In the foothills and submontane, usually low precipitation, warm sites above all on weakly calcareous to moderately lime-rich rock on dust impregnated or ± dunged sites (in the case of stronger dunging going over even on lime-free substrate), above all on artificial substrates (bricks, concrete, and mortar), on roofs, walls, on dry-warm habitats, subneutroph.-m.basiph., v.photoph., m.-r.nitroph., often with *X. parietina*, *Lecanora muralis*, Char. Xanthorietum calc. – mieur-subatl-med – r.rare; above all Rh, HRh, Hü, Ne, Ju, Mn, Eif

Xanthoria candelaria (L.) Th.Fr.
Up into the alpine sites on nitrogen rich, r.-v.eutrophied substrates, commonly on deciduous, more rarely conifer trees and wood, above all at the base to the middle stem of street trees, in the region on wound discharge (lower half of branch perforation, or scar), additionally on bird roosts on silicate rock (with *Ramalina cap.* ↑) and dolomite, (r.)m.acidoph.-subneutroph., r.-v.photoph., r.-v.nitroph.(ammonoph.), Char. Xanthorietum cand., in the Candelarielletum cor. – arct-med -m.frequent

Xanthoria elegans (Link) Th.Fr. (Caloplaca e. (Link) Th.Fr.)
Up into alpine sites on weak calcareous to lime-rich rock as well as on basic silicate rock, mainly on anthropogenic habitats on concrete, brick, mortar, asbestos cement, terrazzo, frequently on walls, on near natural habitats above all on bird roosts and scarcely rain exposed steep- and overhanging surfaces, neutroph.-basiph., r.-v.photoph., m.-r.nitroph., in the Caloplacion dec. – arct-med – m.frequent, in silicate regions relatively rare

Xanthoria fallax (Hepp) Arnold (X. substellaris (Ach.) Vainio)
In the foothills and submontane, summer-warm sites on well lighted, moderately rain exposed habitats on subneutral, often somewhat dust impregnated bark, above all on walnut, linden, Norway maple, at the stem base and middle stem or on steep surfaces of weakly calcareous or lime-free, basic silicate rock (e.g. basalt, phonolite), rarely on carbonate rock, subneutroph., r.photoph., m.ombroph.-r.anombroph., Char. Xanthorietum fallacis, in the Physcietum adsc. – mieur-med – rare; e.g. Hü, Ne, Ju, Mn, Pf, Eif, Mos, MRh, O, Sp, Sch, Bo

Xanthoria fulva (Hoffm.) Poelt & Petutschnig
On free standing deciduous trees (above all street trees), mainly on sycamore, m.acidoph.-subneutroph. – bor-med -- r.rare; Sch, Ju, Bo, Av, Do

Xanthoria parietina (L.) Th. Fr.
Up into the high montane sites on subneutral, ± nutrient-rich bark on well lighted habitats, like *Parmelia acet.* (↑), but resistant toward acid air pollution, additionally on calcareous, usually dust impregnated or dunged rock, above all on anthropogenic substrates on walls, roofs, concrete washing platform etc., subneutroph.-m.basiph., r.-v.-photoph., (a-)m.-v.nitroph., r.toxitol., Char. Xanthorion par., in the Caloplacion dec. – bor-med – r.frequent

Xanthoria polycarpa (Hoffm.) Rieber
Up into high montane sites, on subneutral to m.acid bark of deciduous trees and shrubs, especially on thin branches (above all elder, sloe, ash, hawthorn, *Sorbus*) and then on ± mineral-rich, but often not eutrophic bark, rarer on dust impregnated stems and wood, on r.-v.well lighted, often open to the wind habitats, subneutroph.(-m.acidoph.), (a-)m.nitroph., in the Xanthorion par. (often with *Physcia stell.*), more rarely Lecanorion subf. (with *Rinodina soph.*) --

mieur -- r.rare(-m.frequent), through the entire region, above all Ju, Ne, Mn

Xanthoria ulophyllodes Räsänen
On free standing deciduous trees on subneutral often slightly dust impregnated bark, above all on street trees, subneutral, r.photoph., a-/m.niroph., in the Xanthorion par. – mieur-smed, (paralp) – rare (3); Av

Lit.: LYNGE 1935, POELT 1969, POELT & PETUTSCHNIG 1992a, 1992b, PURVIS et al, 1992

Xylographa (Fr.) Fr.

Introduction

The *Xylographa*-species are inconspicuous crustose lichens with thin, often sessile in the substrate thallus and rounded to usually elongated or branched, red-brown to black ascocarps, which often originate in direction of the wood grain; in contrast to other script lichens such as *Opegrapha* the spores are one- celled. Of the ca. eight distributed in the temperate zones, three species are indigenous to Germany. *X. minutula* grows on bark at the base of conifer trees in montane sites of Central Europe (up to Scotland). *X. vitiligo* and *X. parallela* live on wood, as well as on decorticate tree stems also on stumps and processed wood; they are distributed in the boreal floral zone and in mountain sites of Central- and South Europe.

Genus Characteristics and Determination

Thallus thin or for the most part developed in the substrate, with coccoid green algae. Ap. rounded to usually elongate, with narrow disk (lirelliform), rarely branching, brown to black-brown, without thalloid margin, with thin to indefinite proper margin. Exc. brown to light brown. Hyp. colorless. Hym. colorless, I+ blue; paraphyses simple to sparsely branching and reticulate, brown on the ends, epihym. brown. Asci clavate-cylindric, with definite tholus, like *Trapelia*-type. Sp. one-celled, colorless, at best brownish over aged. Ch: e.g. Stictic acid, Norstictic acid.

1 Thallus with numerous rounded, -0.8 mm wide, whitish, gray, brownish to green-bluish, K+ yellow soralia, otherwise indefinite, like *Buellia griseovirens*. Ap. lacking to numerous, reddish-brown, ± concave, narrow margined, -1 mm long, -0.25 mm wide. Sp. 8-12 x 4-6 µm. Stictic acid **X. vitiligo**

1* Thallus without soralia. Ap. always occurring, marginless, flat to weakly convex . **2**

2 On bark. Thallus upper cortex very thin, whitish to gray. Ap. rounded to elongate, black, -1 mm long, -0.25 mm wide. Sp. 10-15 x 7-8 µm, (broadly) ellipsoidal **X. minutula**

2* On wood. Thallus indefinite, in the wood interior. Ap. ± rounded, elongate to star-form, -2 x 0.3 mm. brown to brown-black. Sp. 11-17 x 5-7 µm, ellipsoidal to narrowly ellipsoidal. Stictic SSy., Norstictic acid . □ **X. parallela**

Ecology and Distribution of the Species

Xylographa minutula Körber
In high montane sites, rarely lower, on bark at the base of conifer trees (above all fir), often on roots, on moderately rain exposed, in the winter ± long time snow covered habitats, r.-v.acidoph., probably in the Parmeliopsidetum -- bor-mieur – v.rare (?over looked); süSch, *Al*

Xylographa parallela (Ach.) Behlen & Desb.
(X. abietina (Pers.) Zahlbr.)
In montane to subalpine sites on tough decayed, rather hard wood, above all on the flanks of conifer tree stumps, on moderately to rather rain exposed, usually moderately to rather well lighted, in the winter rather long time snow covered to snow free habitats, r.-v.acidoph., mesoph.-r.hygroph., anitroph., in the Xylographetum vit., Parmeliopsidetum -- bor-smed-h'mo – rare; Sch and Vog over 800 m m.frequent, *Do*, Av, Al Ju, *SWF*, Eif

Xylographa vitiligo (Ach.) Laundon
(X. spilomatica (Anzi) Th.Fr)
Above all in high montane sites on tough decayed, rather hard wood, like *X. parallela*, but limited more on humid, very long time snow covered, r.hygroph., Char. Xylographetum vit. – bor-smed-h'mo – rare; süSch, Vog, Al

Lit.: REDINGER 1938.

In the past 25 years very many lichens have largely disappeared. This decimation of the lichen flora is due above all to farmland clearing, the intensification of agriculture and the influence of air pollution, but also to forestry management measures and to the destruction of avenue and dispersed fruit tree stands. To conserve the remaining occurrences of the rarer species in these parts we must severely limit the collection of these species. This work ought for those, who have an interest in the indigenous flora and vegetation and their preservation, convey knowledge about the way of life, occurrence and endangerment of lichens and thereby the conditions for creating protection measures for these threatened organisms. It will be fatal, if this knowledge were to lead to further decimation of the threatened species by collecting for Herbaria.

Thanks to the Baden-Württemberg Forestry Authority, which through the designation of numerous managed and protected forests, have successfully decelerated the withdrawal of the forest dwelling species, thanks also to the District Office for Nature Conservation, which increasingly considers also lichen occurrence as criterion for the identification of Nature Conservation Regions and Nature Monuments.