

**Micarea Fr.**  
(MICAREACEAE)

After Coppins (1983, 1992), Brodo (unpubl.), and others

Rev. 5/94

Thallus immersed or superficial, effuse, uniform, composed at least in part of  $\pm$  spherical granules (goniocyts), convex to  $\pm$  globose areoles, or a rimose or scurfy crust, the areoles sometimes dissolving into soredia; when fresh often greenish and slimy;  $\pm$  ecorticate but sometimes with a colorless amorphous outer layer; prothallus indistinct. Algae green, usually "micareoid" (small, thin-walled, 4-7  $\mu$ m diam., frequently in pairs; ?Myrmecia); a few species with cephalodia containing Nostoc or Stigonema.

Apothecia mostly under 1 mm diam., epruinose, adpressed to sessile, not stipitate, whitish, yellowish, grayish, bluish, brownish or blackish, plane to convex or globose, often (but not always) without exciple; thalline exciple absent; true exciple absent to well developed, composed of branched radiating hyphae, lax in K or bound by dense pigment. Hymenium I+ blue. Hypothecium colorless or pigment. hypothecium and epihymenium variously pigmented; paraphyses mostly branched and often anastomosing, to 1.7  $\mu$ m wide, some species also with stouter unbranched paraphyses; apices not or slightly swollen, without a dark brown apical cap. Asci 8-spored, clavate to cylindrical-clavate, unitunicate?, thick-walled, I+ blue; tholus I+ blue; in K/I with blue outer layer and apical dome and unstained wall, the apical dome with an apical cushion that in some species is surrounded by a faint to distinct dark cylindrical "ring-structure". Spores colorless, smooth, without persipore, mostly narrowly ellipsoid-fusiform, to ovoid or accular, septate or not. Conidomata pycnidia, or rarely sporodochia; pycnidia immersed, sessile or stalked; conidiogenous cells enteroblastic, short-ampulliform to cylindrical, acrogenous; conidia colorless, of 3 types: (a) macroconidia, curved, thread-like or helicoid, often septate, rarely ellipsoid, (b) mesoconidia, cylindrical, ellipsoid or ovoid, simple, often biguttulate, mostly 1-2  $\mu$ m wide; (c) microconidia,  $\pm$  cylindrical, simple, eguttulate, to 1  $\mu$ m wide. No substances, or sometimes with gyrophoric acid. On wide range of acidic substrates (bark, wood, soil, rock); rarely tolerant of nutrient enrichment.

This genus is a mixture of things taken from Lecidea, Catillaria and Bacidia. The concept of the genus, like many others, is in a state of flux, and different authors have rather strongly different opinions about it.

**GROUP I. Spores ellipsoid, ovoid, oblong or fusiform,  
mainly simple to 1-(-3)-septate**

[also see Lecidea s. lato spp. and Catillaria]

**I-A. On bark, wood, soil, moss or plant debris  
(rarely on shaded sandstones)**

**1. Spores 16 per ascus, 5-11 x 4-7 um.** Thallus thin, inconspicuous. On bark of Populus, Colorado. .... (see Lecidea populina)

**1. Spores 8 per ascus.** ..... 2

**2. Upper hymenium greenish or dull brown, K+ violet.** Thallus blackish green. minutely granulose, usually C- (rarely C+ orange in M. prasina) or immersed and inconspicuous. Ascocarps mostly less than 0.4 mm in diameter, red-brown to black. .... 3

**2. Upper hymenium hyaline, green or brown, K- (rarely purple brown, K+ purple intensifying in Helocarpon crassipes), or K+ yellow-brown or K+ bright green.** ..... 8

**3. Thallus superficial, granular or verrucose; apothecial sections and thallus C-, or hymenial pigment C+ violet and thallus rarely C+ orange.** ..... 4

**3. Thallus immersed or formed of greenish gray to gray granular areoles; apothecial sections and thallus often C+ red.** ..... 5

**4. Thallus dominated by stipitate, dark brownish pycnidia. Apothecia scarce.** ..... (M. hedlundii Coppins)

**4. Thallus not dominated by pycnidia.** Thallus superficial, of minute, pale to dark greenish, scattered to densely aggregated granules. Apothecial sections C-, but hymenial pigment is C+ violet. Thallus P-, K-, KC-, C-, containing methyloxymicareic acid, micareic acid, or prasinic acid, or rarely C+ persistent orange, containing unidentified xanthone(s); sometimes with traces of gyrophoric acid (contaminant?). Apothecia 0.1-0.4 mm (to 6 mm if tuberculate), shallow-convex to subglobose or tuberculate, whitish, pale to dark gray, brownish gray or blackish. Spores 8-14(-17) x 2.3-4(-5) um, ovoid-ellipsoid to oblong, 0-1-(-3) septate. Hypothecium hyaline to dull yellowish. Pycnidia white, or grayish around ostiole, of two types: (a) emergent to sessile, not stalked, with mesoconidia, (b) usually immersed, with microconidia. Photobiont cells 4-7 um. On bark, stumps, soil or debris in rock crevices in coastal districts, rarely on shaded sandstone, usually in shaded situations. Georgia, Maryland, Massachusetts, Michigan, Wisconsin. .... M. prasina Fr.

**5. Spores (6.5-)-7-9.5 x 2.2-3(-3.7) um, ellipsoid, ovoid or oblong-ovoid, never curved, simple, rarely 1-septate.** Thallus K-, C-. Epihymenium, pycnidial walls and sometimes hypothecium with greenish pigment, which is K+ violet, C+ violet). Pycnidia of two kinds: (a) stalked, black, not tomentose, with mesoconidia, (b) ± immersed, with microconidia. Thallus immersed, rarely with pale grayish, 60-120 um diam. granular areoles. Apothecia 0.1-0.3 mm diam, black, convex to ± globose. Photobiont cells 4-7 um diam. On wood of fallen trees or stumps. Alaska, coast of Hudson's Bay, Ontario, and Newfoundland. .... M. misella (Nyl.) Hedl.

**5. Spores mostly 1- or more-septate, mostly over 9 um long, often curved; paraphyses**

numerous, 1-1.5  $\mu\text{m}$  wide. Apothecia and thallus sections usually C+ red. .... 5

**6. Spores to 11  $\mu\text{m}$  long. Thallus C-.** Epihymenial pigment closely bound to (or also in?) the apical walls of the paraphyses. Thallus  $\pm$  immersed, not evident. Epihymenium clearly delimited, dark green, K+ deep violet, C+ violet, N+ red (epihymenium purplish or bluish, K+ bright green according to ?). Thallus effuse, thin and indistinct, of scattered to  $\pm$  coherent, minute olivaceous granules (goniocytes) ca. 12-25  $\mu\text{m}$  diam., appearing  $\pm$  gelatinous when moist, C-. Apothecia numerous, convex-hemispherical, immarginate, dark gray to black, 0.1-0.24 mm diam. Hymenium 30-35  $\mu\text{m}$ , hyaline. Spores ellipsoid, ovoid, or oblong-ovoid, 0-1-septate, 7-9.7(-11) x 2.5-3.5  $\mu\text{m}$ . Pycnidia numerous but small and inconspicuous, with dark greenish (K+ violet walls), (a) 40-50  $\mu\text{m}$  diam., with mesoconidia cylindrical or ovoid-oblong, 3.3-4.5 x 1-1.3  $\mu\text{m}$ , (b) 25-40  $\mu\text{m}$  diam., with microconidia cylindrical or fusiform-cylindrical, 4-5.5 x 0.7-0.8  $\mu\text{m}$ . On conifer bark, apparently rare. .... M. melanobola (Nyl.) Coppins

**6. Spores mostly over 11  $\mu\text{m}$  long. Thallus usually C+ red.** .... 7

**7. Spores ellipsoid, mostly 1-septate, (7-)9-16(-18) x 2-3(-3.5)  $\mu\text{m}$ .** Paraphyses numerous, 1-1.5  $\mu\text{m}$  wide. Apothecial and thallus sections usually C+ red. Apothecia 0.15-0.5 mm diam., dark grey to black, pale brown in shade, convex to subglobose. Pycnidia not stalked.

Hypothecium  $\pm$  colorless. Pycnidia and conidia of three types; microconidia (4.5)5-7.5 x 0.5-1  $\mu\text{m}$ , cylindrical; macro- and meso-conidia also present. Thallus granulose, usually of greenish white to pale gray, convex areoles 60-200  $\mu\text{m}$  diam., sometimes scurfy and blackish (when parasitized), or obsolete; areoles ecorticate, the outer part  $\pm$  with greenish, K+ violet pigment. Photobiont cells 4-7  $\mu\text{m}$  diam. Usually on wood, on fallen trunks and stumps, more rarely on other substrates, including shaded sandstone rocks, dead bark and moribund mosses.

Newfoundland, Washington state, Colorado. .... M. denigrata (Fr.) Hedl.

**7. Spores bacilliform or  $\pm$  acicular, (0-)1(-3-6)-septate, 13-26 x (1.5-)2-2.5(-3)  $\mu\text{m}$ ;** microconidia 3.5-5 x 0.5-1  $\mu\text{m}$ ; macroconidia apparently absent. Otherwise similar to M. denigrata. Hymenium C+ red, K+ rose-violet or purple. Ascocarps brown to black. Thallus brownish grey, granulose, C+ red. On Abies bark, boreal Quebec. .... M. globulosella (Nyl.) Coppins

**8. Thallus light grey-green to brownish green, becoming sorediate, C+ pink or red.**

..... 9

**8. Thallus variously colored, or immersed; not sorediate; C- or rarely C+ orange (M. prasina) or C+ pink (M. melaena, but usually only when well developed).**

..... 11

**9. Ascocarps variously colored, pinkish, yellowish, reddish, or olivaceous brown, or some blackening.** Spores 11-14 x 4-6  $\mu\text{m}$ , simple. Ascocarps 0.4-1.5 mm diam. Thallus greenish grey to olivaceous, thin, membranous, or subverruculose, the verrucae fused and indistinct, C+ pink. On soil, debris, or rotten wood. .... (see Trapeliopsis granulosa)

**9. Ascocarps always black.** Hymenium olive or green. On bark or wood (not rotten). .... 10

**10. Thallus coarsely granulose to effuse sorediate, C+ pink (gyrophoric acid).**

Hymenium olivaceous, turning yellow-brown in KOH. Ascocarps 0.3-0.7 mm diam. (when single), often conglomerate, black. Spores never septate. On bark or wood. .... (see Trapeliopsis viridescens)

**10. Thallus rough, irregular to continuous, or almost disappearing; thick parts breaking into masses of granular soredia which are C+ pink. Hymenium deep green, K+ deep yellowish green. Ascocarps to 0.3 mm diameter, black, hemispherical,**

- irregular. Spores 8-8.5 x 3.5-4 um. On bark or wood. Michigan. .... M.?  
sp.
- 11. Apothecia pale, without distinct pigmentation in section.** ..... (M. prasina)
- 11. Apothecia black or colored, with obvious pigmentation in section.** Hypothecium brownish, greenish or purplish. .... 12
- 12. Hypothecium hyaline or pale dull yellowish.** Thallus superficial, effuse, consisting of dispersed to continuous, convex to subglobose areoles; areoles 0.08-0.16(-0.25) mm diam., greenish white or whitish gray, sometimes tinged gray-brown or olivaceous, occasionally dark brown (when on burnt lignum), matt, sometimes  $\pm$  white prinosse. Photobiont 4-7 um. Apothecia usually numerous, immarginate, convex to  $\pm$  globose, dark brown to brown-black, matt, (0.08-)0.12-0.3 mm diam., often becoming tuberculate, to 0.8 mm diam.; hymenium 30-40 um; epihymenium dark fuscous brown, K- (to faint violet when young), N-, not dissolving. Spores fusiform, oblong-fusiform or ovoid-oblong, often slightly curved, 0-1(-2-3)-septate, slightly constricted at septum, (9-)11-15(-19) x 2-3.5 um. Hypothecium 60-150 um tall, pale, tinged dilute yellowish brown, K-, N-. Pycnidia usually present and numerous. Thallus without substances. Usually on wood of decorticate trunks or large stumps, rarely on rock. .... M. elachista (Körber) Coppins & R. Sant. in Coppins
- 12. Hypothecium  $\pm$  distinctly pigmented.** Thallus usually superficial and clearly evident. .... 13
- 13. Hypothecium mottled reddish brown, K-, N- or N+ orange-brown.** ..... 14
- 13. Hypothecium with distinct purple or green tinges, N+ purple-red.** ..... 15
- 14. Apothecia 0.3-0.8(-1) mm diam., sometimes forming irregular tuberculate clusters to 1.2 mm diam. Thallus dull gray-white, or gray-brown to dark gray, usually with cephalodia.** Thallus composed of confluent, convex-verrucose areoles, usually intermixed with cephalodia; areoles matt, 0.08-0.3 mm diam. Photobiont 4-7 um. Cephalodia irregularly globose, brown, 0.2-0.6 mm diam., usually hidden among the areoles. Apothecia numerous, immarginate, convex,  $\pm$  adnate and often immersed by surrounding areoles, black, matt, hymenium 45-50 um; epihymenium dark aeruginose or olive, K-, N+ red, lower part pale greenish or hyaline. Spores ellipsoid, oblong-ellipsoid, oblong-ovoid or oblong-fusiform, 0-1(-2)-septate, (10-)12-17 x 4-4.8 um. Hypothecium 150-400 um tall, dark red-brown, K-, N+ bright orange-brown. Pycnidia rare. Thallus without substances. On bryophytes, plant debris or sandy soil. Arctic-alpine. Colorado; Queen Charlotte Islands. .... M. incrassata Hedl.
- 14. Apothecia 0.15-0.3(-0.4) mm diam. Thallus blackish gray or brown-black (dull gray-green in shade), minutely granular or scurfy, thin, without cephalodia.** Spores (10-)12-25 x (3.5-)4-5(-6) um, elongate ellipsoid to fusiform, sometimes slightly curved, some becoming 1-3-septate. Ascocarps abundant, hemispherical, C- in section. Pycnidia immersed. Thallus K-, C-, without substances. Thallus thin, often appearing gelatinous when wet, not forming definite areolae or granules; outer hyphae N+ red. Apothecia convex to  $\pm$  globose, black, dull or slightly glossy, rarely brown in shade; exciple reflexed but distinct, red-brown and darker than hypothecium; hypothecium mottled reddish brown, K-, - or turning orange-brown but with no purplish tinge; epihymenium dirty green, turning red with N, K-; hymenium 35-50 um, middle part bluish or olivaceous, lower part pale reddish brown and merging with hypothecium; paraphyses 1-1.5 um, branched and anastomosing, tips 1.5-3 um and greenish; asci clavate. Conidia

3.5-4.7 x 1 um. Thallus and apothecia K-, C-, P-. On acid peat or exposed turf, usually on bryophytes; arctic-alpine to boreal. Alaska; Queen Charlotte Islands; Greenland. ....  
M. turfosa (Mass.) Du Rietz

**15. Apothecia marginate at least when young, markedly constricted below, appearing turbinate or short-stalked.** On mosses over rocks. Alaska, New York. .... Helocarpon crassipes Th. Fr. [treated by Coppins, 1992 as Micarea crassipes (Th. Fr.) Coppins]

**15. Apothecia immarginate and convex to subglobose from the beginning, sessile or partly immersed.** Photobiont cells 4-8 um diam. Hypothecium purplish brown in water, K+ purple intensifying or K± green, N+ purple-red in upper part. Pycnidia ± immersed in thallus or absent. Spores mostly > 9 um long, 0-1(-3)-septate. .... 16

**16. Thallus of whitish, warted areoles 0.1-0.4 mm diam., often with brownish cephalodia.** Apothecia numerous, immarginate, convex to subglobose, matt or subnitid, usually prominent, black, 0.3-0.8 mm diam., sometimes forming tuberculate clusters to 1.5 mm diam. Hypothecium 150-400 um, dark purple brown, K+ purple intensifying or (especially in upper part) K+ dark green, all parts N+ purple red. Hymenium 45-50 um; epihymenium dark blue-green, olive or brownish green, K-, N+ red; lower hymenium dilute greenish and K- or dilute purplish and K+ purple intensifying or K+ sordid green. Spores oblong-ellipsoid to oblong-fusiform, (10-)12-16(-19) x 3-5 um, 0(-1)-septate. Pycnidia rare. Photobiont cells 4-7 um. Thallus K-, C-, KC-, P-; no substances in TLC. On soil of heaths, decaying bryophytes and plant detritus on the ground or on soil accumulations in arctic or montane situations. .... M. assimilata (Nyl.) Coppins

**16. Thallus scurfy or granular areolate; the granules mostly < 0.2 mm diam.; cephalodia absent.** Spores simple. Paraphyses numerous, monomorphic, < 1 um wide. Microconidia 4.5-7 x 0.5-1 um. .... (immature forms of M. melaena)

**I-B Spores ellipsoid, ovoid, oblong or fusiform,  
mainly simple to 1-(-3)-septate.  
On rock (usually shaded),  
sometimes on roots or consolidated soil.  
Thallus C-, without substances.**

**1. Hypothecium hyaline or pale.** Apothecia convex-hemispherical from the beginning, if tuberculate then clusters less than 0.7 mm diam., and apothecia black. Sporodochia absent. Upper hymenium K-. Photobiont cells 5-12 µm, or sometimes 4-8 µm diam. True exciple absent (sections). ..... 2

**1 Hypothecium dark, with distinct purple or green tinges, N+ purple-red.** Photobiont cells 5-12 µm diam., or ellipsoid, < 15 x 10 µm. Apothecia convex to subglobose from the beginning, sessile or partly immersed, pale to distinctly colored but usually not black. .... 5

**2. Apothecia whitish to pale reddish brown or slightly greenish, without distinct pigmentation in section.** ..... 3

**2. Apothecia colored, with obvious pigmentation in section.** ..... 4

**3. Hymenium hyaline below, K-.** Spores (6.5-)9-13 x (2.5-)3.3-4.3 µm, simple.

**Hypothecium colorless to pale greenish in upper part. Photobiont cells 5-12 µm diam., or ellipsoid, < 15 x 10 µm.** Epithecium and upper hymenium greenish (sometimes very pale), K+ blue-green (K- according to Coppins). Thallus grey-green, (to ochraceous, or rusty?), rimose-areolate becoming granulose. Apothecia pale to distinctly colored, with or without distinct pigmentation in section. In dry but humid situations, especially underhangs, on rock, stones, roots and consolidated soil, tolerant of iron and copper rich rocks. Mixed deciduous forest, in Quebec. .... M. bauschiana (Körber) V. Wirth & Vezda

**3. Hymenium K+ violet (after a minute on thin vertical sections. Spores ovoid, 5.5-8 x 2.5-3.5 µm, often partly one-septate. Hypothecium colorless to pale orange-brown. Photobiont cells 4-8 µm diam.** Apothecia pale, dull yellow-orange to reddish brown, without distinct pigmentation in section, 0.15-0.4 mm diam., convex. Thallus thin, often indistinct, sometimes with whitish convex areoles 40-100 µm. On shaded stones, often with Trapelia species, on the ground. .... M. lithinella (Nyl.) Hedl.

**4. Spores simple, (6.5-)9-13 x (2.5-)3.3-4.3 µm.** ..... (see M. bauschiana)

**4. Spores (0-)1-septate, 8-12 x 4-5 µm (to 7 µm wide according to Herre).** Thallus indeterminate, purplish black to dark brown, of scattered to confluent, convex areoles or squamules 0.8-4.5 mm diam., imbricate, lobed and crenulate, rugulose, K-, C-. Photobiont cells 4-7 µm diam. Apothecia sessile, 0.2-0.6 mm diam., or tuberculate to 1 mm; disc flat, dark brown to black, finely papillate, becoming markedly convex; margin pale brown, reflexed, at first thick, but becoming partly or wholly obsolete; hymenium 35-38 µm thick (68 according to Herre), pale purplish gray, paling downward, I+ blue; epihymenium brown, K-, N- paraphyses numerous, branched (1-)1.5-2 µm wide, subcoherent, the tips to 2.5 µm, clavate; hypothecium colorless; asci 33-35 x 10-14 µm; spores ellipsoid. Pycnidia frequent, immersed, (a) 80-200 µm, the macroconidia 7-10 x 5-6 µm, helicoid; (b) 40-100 µm diam., the microconidia 4.5-6 x 0.5-1 µm, bacilliform. No substances. On ± exposed hard siliceous rocks. [Reported from California by Herre under Catillaria; not mentioned by Egan or Esslinger under that genus nor under Micarea; according to Coppins the species is known only from Britain and Scandinavia]. ....

[*Micarea subnigrata* (syn.: *Catillaria subnigrata*)]

**5. Hypothecium reddish brown to dark brown.** ..... 6

**5. Hypothecium greenish or greenish black.** Discs convex; exciple low, soon excluded. .... 8

**6. Upper hymenium greenish, K+ violet.** *Stigonema* clusters usually present between areoles. Hypothecium dark purple-brown. Spores 9-16(-17) x 4-5  $\mu$ m. Pycnidia unknown. On small stones in turf around late snow-beds. Similar to *M. assimilata* but on rock. Alpine. Queen Charlotte Islands, British Columbia. .... *M. subviolascens* (Magnusson) Coppins

**6. Upper hymenium colorless, green or brown.** ..... 7

**7. Discs convex.** Hypothecium medium to strong reddish brown; epithecium hyaline to pale olivaceous, colored parts K+ bluish green. Apothecia black to olive black, convex, sometimes becoming somewhat tuberculate. Spores predominantly simple (occasionally 1-septate), 6-9 x 2-3(-4)  $\mu$ m, ellipsoid or ovoid. Thallus smooth or cracked, or scruffy granular, lacking discrete areoles or granules, pale, gray, greenish or buff, sometimes ferruginous. Photobiont cells 5-12(-15)  $\mu$ m diam. Apothecia 0.2-0.4 mm diam., or tuberculate, to 0.8 mm, convex to  $\pm$  globose, gray-brown to black; true exciple absent; hymenium 30-40  $\mu$ m tall, colorless, pale brown olivaceous to blue-green, the pigment often vertically streaked; hypothecium dark fuscous or reddish brown, K- or + red intensifying (not purplish or greenish), N-. Paraphyses rather sparse, dimorphic: mostly 0.5-1(-1.5)  $\mu$ m wide, often branched; some 1.5-2  $\mu$ m wide, unbranched and often in fascicles. Asci 30-40 x 7-10  $\mu$ m. Pycnidia 80-200  $\mu$ m diam., immersed, black; conidia (3.5-)4-5(-5.5) x 1-1.  $\mu$ m, bacilliform. No substances. On rocks and roots in dry but humid underhangs in woods and small valleys. New Brunswick. .... *M. lutulata* (Nyl.) Coppins in D. Hawksw., James & Coppins

**7. Discs concave to  $\pm$  flat, rarely somewhat convex;** true exciple persistent, raised, rarely finally excluded. Hypothecium dark brown. Thallus gray, continuous or of scurfy scattered fragments, or if on wood  $\pm$  immersed, hardly discoloring weathered gray wood; medulla I-; prothallus often predominant, fimbriate and black. Apothecia (0.15-)0.2-0.4(-0.7) mm diam., sessile, constricted at base, black; exciple blue-black at outer edge, pale brownish (K+ purplish) within; epithecium dark greenish blue to greenish brown, K+ green intensifying, N+ purple-red; hymenium 35-50  $\mu$ m tall; paraphyses 1.5-2.5(-3)  $\mu$ m wide, sparsely branched and anastomosed, not strongly swollen or capitate at tips; asci 25-30 x 7-10  $\mu$ m, with K/I+ blue apical dome penetrated by a darker tube-like structure. Spores (6-)7-9(-10) x (-2)3-4(-5)  $\mu$ m, mostly simple, narrowly ellipsoid, rather abruptly truncated at the ends. Pycnidia 80-150  $\mu$ m diam., often abundant, sometimes only those present, black, scattered on the prothallus or partly immersed in the thallus; conidia 3-5 x 1.5  $\mu$ m,  $\pm$  cylindrical. Thallus P-, K-, C-, KC-. On pebbles, rarely also on wood. .... *M. erratica* (Körber) Hertel, Rambold & Pietschmann in Rambold

**8. Spores (5-)5.5-8(-9) x 1.5-2.5  $\mu$ m, O- to 1-septate, oblong-ovoid or oblong-ovoid.**

**Hypothecium blue-green to blue-green-black, K+ completely blue-green.** Hymenium and subhymenium bluish to blue-green or emerald green, upper hymenium  $\pm$  colorless. Ascocarps 0.1-0.3 mm diam., to 0.55 mm if tuberculate. convex, tuberculate, internally gelatinized. Conidia 3-4.5 x 1-1.5  $\mu$ m. Thallus white to greenish grey, continuous, verruculose-uneven. On siliceous rocks, stones and roots in dry underhangs, subalpine, streamside, in Colorado. .... *M. tuberculata* (Sommerf.) R. Anderson

**8. Spores (6-)7-10 x (2.5-)3-4.5  $\mu$ m, 0(-1)-septate. Hypothecium  $\pm$  olive-black, K-. Apothecia 0.2-0.5 mm diam., to 1.2 mm if tuberculate. Conidia 3.5-6(-6.5) x 1-2  $\mu$ m.**

Hymenium hyaline (to blue-green toward base). Thallus dark ashy, continuous to diffract-areolate. Usually in dry but humid situations, especially underhangs, on rock, stones, roots and consolidated soil, tolerant of iron and copper rich rocks; rarely on old wooden fence posts. New York, Newfoundland. .... M. sylvicola (Flotow) Vezda & V. Wirth

**GROUP II. Spores acicular, or 3- or more septate.**

**Mostly on organic substrates**

**(except M. ternaria, sometimes M. peliocarpa, and rarely others)**

**(also see Bacidia spp.)**

**1. Hypothecium dark, often purple-brown. .... 2**

**1. Hypothecium colorless, pale or mottled brown or greenish.** (If spores ovoid-ellipsoid to oblong and mostly 1-septate, see M. prasina). .... 4

**2. Spores 3-5 septate, 22-35 x 2.5-4 um.** Thallus thin and inconspicuous, greenish grey. Ascocarps brown-black to black, soon strongly convex. On holly, Massachusetts. .... M. endocyanea (Tuck. ex Willey) R. C. Harris in Egan

**2. Spores 1(-3) septate. .... 3**

**3. Spores 11-19(-24) x 4-5(-6) um, acicular, 1(-3) septate.** Thallus dark green to greenish black, smooth to verruculose or leprose-granulose, or obsolete. Ascocarps pitch black, 0.2-0.5 mm wide, subglobose. Hypothecium dark purple-brown, K+ purple-black. Paraphyses numerous, monomorphic, often anastomosing, to 1-1.25 um thick. Microconidia 4.5-7 x 0.5-1 um. Usually on wood of stumps, fallen trees and decaying timberwork, but also on acid bark and peaty turf, rarely on rock in woodlands. Eastern Canada and northeastern U.S. .... M. melaena (Nyl.) Hedl.

**3b Spores 18-29 x 1.3-2.2 um, 1(-3) septate.** Hypothecium dark. Thallus of minute, smooth granules, greenish to ashy. Ascocarps lead-colored to black, convex. [need to check on spore shape; if spores not acicular this species should go in group 1]. .... M. chlorosticta

**4. Upper hymenium dull greenish or brownish, K+ violet. Spores under 4 um wide. .... 5**

**4. Upper hymenium colorless, greenish or brownish, K-. Spores fusiform, [often] 4-6 um wide.** Pycnidia ± immersed or absent. .... 7

**5. Spores 3-7 septate, to 18-28 x 2 um.** Apothecia often thinly pruinose. .... Bacidia beckhausii (syn.: M. miniuscula)

**5. Spores mostly 3-septate.** Ascocarps minute, less than 0.5 mm diameter. Apothecial sections C+ red, the K+ violet pigment also C+ violet. .... 6

**6. Spores elongate-oblong or spindle-shaped, 10-17(-19) x 2.5-3(-3.5) um, 3-septate,** Thallus effuse, usually forming small patches but sometimes widespreading, sometimes partly endoxylic but usually superficial, developed as crowded, often contiguous, convex to subglobose areoles, especially around apothecia; areoles 0.04-0.2 mm diam., dull greenish white to green-gray or dark green, matt, ecorticate. Photobiont 4-7 um diam. Ascocarps usually numerous, often contiguous or confluent, adnate, plane to convex-hemispherical, 0.1-0.3(-4) mm diam., sometimes becoming tuberculate, immarginate or occasionally indistinctly marginate when young, usually gray-black to black (paler in shade forms and sometimes near margin), matt. Hypothecium hyaline. Hymenium 30-40 um; epihymenium pale olivae to olive, K+ violet, N+ red, C+ violet, also C+ orange-red throughout due to gyrophoric acid; olive pigment mostly confined to the gel matrix. Pycnidia usually present but inconspicuous. Thallus K-, P-. On spruce twigs or pine bark (also reported from many other types of bark), Newfoundland; on old fenceposts, near San Francisco, California. .... M. nitschkeana (J. Lahm ex Rabenh.) Harm.

6. **Spores bacilliform or  $\pm$  acicular, curved, 0- to 3(-6)-septate, 13-26 x (1.5-)2-2.5(-3)  $\mu$ m; microconidia shorter, 3.5-5 x 0.5-1  $\mu$ m; macroconidia apparently absent. On bark or wood. .... (*M. globulosella*)**
7. **Apothecial sections C+ red.** Ascocarps pale or soon black. Thallus P+ or P-. Spores various. .... 8
7. **Apothecial sections C-.** Ascocarps soon black. Thallus P+ red. Spores 3-7(9) septate, 16-34 x 4-6  $\mu$ m. Hypothecium hyaline to greenish or brownish, K-.  
..... 10
8. **Thallus in part leprose-chinky, of fragile granules, blue-gray, more rarely gray-brown, P+ red, C+ red (ch.: argopsin and gyrophoric acid);** granules scattered to usually coalescing, convex to globose, 100-400  $\mu$ m diam., often proliferating to form a thick crust, matt, eroding to form sorediate patches, the soredia 20-50  $\mu$ m diam.; outer hyphae greenish, K-, N+ red. Photobiont cells 4-7  $\mu$ m. Ascocarps rare, similar to those of *M. peliocarpa*, depressed-convex, soon black. Spores 3-7(9) septate, 16-34 x 4-6  $\mu$ m. Hymenium K-. Pycnidia unknown. On dying bryophytes on acid rocks, rarely bark or wood. N. America? (not mentioned by Esslinger). .... [*M. leprosula* (Th. Fr.) Coppins & A. Fletcher]
8. **Thallus of firm areoles or granules, P-.** Ascocarps  $\pm$  pale, at least in part, buff pale gray or black (rarely whitish in extreme shade), flat to hemispherical, not stalked. Thallus greenish or brownish grey, minutely verrucose to granulose. .... 9
9. **Spores 3(-5)-septate, (8)12-17.5 x (2)3-5  $\mu$ m. Macroconidia 20-50 x 1  $\mu$ m, fusiform-cylindrical. Apothecia 0.14-0.4(-0.6) mm diam., to 1 mm if tuberculate, Hymenium 40-55  $\mu$ m, usually greenish to blue-green (K-, N+ red) in upper part.** Apothecia whitish (shade) or blue-gray to black; true exciple well developed, hyaline. Hypothecium  $\pm$  colorless. Pycnidia frequent, of two types; macroconidia 21-40(-50) x 1-1.5  $\mu$ m, curved or sigmoid. Thallus of scattered to confluent,  $\pm$  globose areoles 40-200  $\mu$ m, usually  $\pm$  matt. On a wide range of acid substrata, decayed wood, bark, plant debris or rock (especially sandstone). Eastern Canada and northeastern U.S. .... *M. peliocarpa* (Anzi) Coppins & R. Sant. in Coppins & P. James
9. **Spores (3-)5-7-septate, elongate-elliptical, (16-)23-34(-40) x 4-6  $\mu$ m, macroconidia 50-110 x 1  $\mu$ m, flexuose, apothecia 0.2-0.7 mm diam., to 1.3 mm when tuberculate, and hymenium 55-70  $\mu$ m.** Otherwise similar to *M. peliocarpa*. On trunks (often over bryophytes), especially *Betula* and *Quercus*, in woodlands, rarely on rocks, occasionally on exposed turf in the mountains and then mostly sterile with only the macroconidial anamorph (*Hastifera tenuispora*), which has pycnidia with widely gaping ostioles. .... *M. cinerea* (Schaerer) Hedl.
10. **Thallus of firm, yellowish white granular areoles (or sometimes immersed when in wood [or dark green and verruculose?]), P+ red, C- or P-, C+ persistent orange. Spores 3-7-septate, 16-36(-38) x 4-6(-7)  $\mu$ m. Hypothecium pale blue-green or olivaceous, but central part often  $\pm$  colorless or pale brownish.** Ascocarps 0.15-0.6(-0.9) mm, black or blue-black, soon highly convex, almost spherical, rarely with stalk to 1 mm tall. True exciple  $\pm$  distinct in section when young, but soon reflexed. On soil, mosses, plant debris, and wood, on acidic substrata. Boreal to arctic. New Hampshire; Queen Charlotte Islands; etc. .... *M. lignaria* (Ach.) Hedl.
10. **Thallus blackish or inconspicuous, C-, P-.** Spores (0-)3-septate, 13-22(-24) x 3.5-5  $\mu$ m. Hypothecium hyaline, to pale greenish or brownish in upper 1/3-1/2.

Ascocarps numerous, black, matt or slightly glossy, 0.15-1.0 mm diam., at first  $\pm$  globose or turbinate, later expanding to become broadly convex and  $\pm$  adnate, sometimes faintly marginate. Hypothecium to 380  $\mu$ m; hymenium 60-70  $\mu$ m; epihymenium dark blue-green, K-, N+ purple-red. Spores fusiform, sometimes slightly curved. Thallus (when muscicolous) composed of scattered to confluent, convex to irregularly subglobose areoles 0.08-0.3 mm diam., cream-white to ashy gray, or (when saxicolous) blackish or inconspicuous. Thallus C-, P- (no substances). Pycnidia rather numerous, 100-140(-200)  $\mu$ m diam.; mesoconidia 4.6-6.3 x 1.2-1.7  $\mu$ m. Photobiont 4-7  $\mu$ m diam. True exciple distinct and well defined in section. On moss, coastal Alaska; also reported from hard, siliceous rocks. .... M. ternaria (Nyl.) Vezda (syn. Bacidia suballinita)

**Group III. Apothecia absent; pycnidia or sporodochia dominant.**

**1. With stalked or sessile pycnidia containing mesoconidia (smaller,  $\pm$  immersed pycnidia containing microconidia sometimes present); without curved or flexuose macroconidia (except in *M. clavopycnidiata*). .... 2**

**1. Pycnidia innate sometimes becoming emergent with gaping ostioles, or with small, sessile, apothecia-like sporodochia; pycnidia sometimes containing curved or flexuose macroconidia.** Sporodochia absent; thallus and/or pycnidia C+ red (gyrophoric acid) or C- ("prasina unknowns"). .... 4

**2. With curved or flexuous macroconidia.** Pycnidial stalks 0.04-0.07 mm thick, unbranched, with a black spatulate head comprising ca. half the length of the entire structure (i.e. 0.2-0.3 mm long and 0.01-0.15 mm broad); macroconidia 75-118 x 2-2.5  $\mu$ m, 9-16-septate, filiform, tapering slightly at tips. Thallus clearly visible, thin, granulose, grayish yellow green, grayish greenish yellow, or olivaceous brown; edge definite. Soredia and isidia absent; granules sometimes resembling soredia, rounded, 40-70  $\mu$ m diam.; prothallus present and usually visible, blue-gray, very thin, making a border almost 1 mm wide around each thallus patch. Filaments of cyanobacteria sometimes mixed with micareoid green algae. Apothecia absent. Pycnidia abundant and conspicuous, raised on short pale to dark gray stalks, 0.4-0.6 mm high in total; conidia often oozing out of the tip of the pycnidium as a colorless thread-like mass, then coating the surface of the pycnidial expansion with a whitish slime; wall of pycnidial stalk composed of longitudinally oriented hyphae in center and loosely organized hyphae on the surface, medium yellowish brown grading into strong green; wall of pycnidium composed of dark brown-black to greenish black elongated, interlocking cells 3.0-3.8  $\mu$ m diam.; tissues of pycnidial stalk and wall unchanged in K and turning strong to dark red in N. Thallus P-, K-, C-, KC-, I-, UV- (no substances). On bark of *Alnus*, *Picea*, and *Pinus*, British Columbia and Washington. .... *M. clavopycnidiata* Brodo & Tonsberg

**2. Macroconidia, if present, not curved or flexuous. .... 3**

**3. Pycnidia black, the wall olivaceous brown, K+ violet; mesoconidia 3.5-5 x 1-1.5(-1.7)  $\mu$ m. .... (*M. misella*)**

**3. Pycnidia whitish to reddish brown, never black.** Thallus of pale to dark green goniocysts 12-40  $\mu$ m diam.; goniocysts containing purple, oily substance in K; pycnidia brown with white tomentum; mesoconidia (4-)4.5(-6) x 1.3-1.7  $\mu$ m. Pycnidial stalks 0.07-0.14 mm diam., often branched, with up to 5 pycnidia; mesoconidia oblong-ellipsoid or oblong-ovoid. Thallus dominated by stipitate, dark brownish conidiomata. Apothecia scarce. Apothecial tissues hyaline, completely K-, or hymenium only in part faintly K+ purplish. Spores 6.5-10(-12) x 2.5-4  $\mu$ m, 0(-1)-septate. Thallus pale to dark, grayish green, olive or blackish, effuse, granular to verruculose. Pseudothecia 0.2-0.4 mm broad, round, dark grayish brown to black (occasionally grading to medium or even light grayish brown). Thallus C-. Pycnidia numerous, stalked, brown, thinly white-tomentose, 0.1-1 mm tall. The goniocysts often contain a yellowish K+ purple-violet pigment (as oily droplets). On old or rotting wood. Chem.:  $\pm$  traces of micareic acid (contaminant?). New Brunswick. .... *M. hedlundii* Coppins

**4. Thallus of pale to dark green (sometimes K+ violet) goniocysts 12-60  $\mu$ m;**

pycnidia, if present, 30-80  $\mu\text{m}$  diam., containing either (5-)5.5-8 x 0.7-1  $\mu\text{m}$  microconidia, or (3.5-)4-6 x 1.2-1.7  $\mu\text{m}$  mesoconidia; all parts C- ("prasina unknowns). ..... (M. prasina)

4. Thallus areolate, or scurfy (invaded by dermatiaceous hyphae and foreign algae), or  $\pm$  endoxyllic; sometimes with curved or flexuose macroconidia; thallus and/or pycnidia usually C+ red (gyrophoric acid). ..... 5

5. With numerous pycnidia containing mesoconidia 3.5-4.5 x 1.3-2  $\mu\text{m}$ , often extruded as conspicuous white blobs; in addition, pycnidia containing microconidia (4-)4.5-6(-6.5) x 0.7-1  $\mu\text{m}$ , or curved macroconidia 12-21 x 1  $\mu\text{m}$ , sometimes present; pycnidial walls with pale olivaceous pigment, K+ violet; usually on wood, commonly on worked timber. .... (M. denigrata)

5. Pycnidia usually with longer, curved or flexuose macroconidia; smaller pycnidia with microconidia sometimes present; mesoconidia unknown; pycnidial walls colorless or greenish, K-; on various substrata, rarely on worked timber. .... 6

6. Macroconidia curved or hamate, 21-40 x 1-1.5  $\mu\text{m}$ ; microconidia (5-)6-7(-7.7) x 0.4-0.7  $\mu\text{m}$ ; on bark of old trees (especially Quercus) in old woodlands. .... (M. peliocarpa)

6. Macroconidia flexuose, 50-110 x 1  $\mu\text{m}$ ; microconidia (3.8-)4.5 x 0.5-0.7  $\mu\text{m}$ ; on shaded wood in woodlands. .... (M. cinerea)

ADD:

Massachusetts; California? On dead stump. .... M. rhabdogena (Norm.) Hedl. (syn. Lecidea punctella)

Thallus continuous to membranous. Apothecia discs black to charcoal-colored, margin rarely seen; epihymenium and hymenium deep green; hypothecium with two layers; spores 10-12 x 5-6 um. With microconidia. On submerged rocks in stream. Queen Charlotte Islands, British Columbia. See Coppins' monograph for more info. .... M. vulpinaris (Nyl.) Muhr (syn. M. muhri Coppins)

Thallus scurfy farinose-granular, pale greenish or buff. Photobiont cells 4-7 um diam. Apothecia 0.1-0.15 mm, or tuberculate to 0.25 mm diam., immarginate, convex to globose, pale to dark reddish brown; true exciple absent; hymenium 25-25 um tall, colorless or brownish streaked; hypothecium reddish- or orange-brown, K-, N-. Paraphyses rather sparse, of two types: mostly 0.5-1 um wide, often branched; some 2-3 um wide, unbranched, usually in brown fascicles. Asci 21-25 x 5-7 um. Ascospores 5.5-8.5 x 1.5-2.5 um, 0- to 1-septate, oblong or oblong-ovoid. Pycnidia 25-30 um diam.,  $\pm$  sessile, doliiiform; conidia 2.5-3 x 1-1.5 um, shortly bacilliform. No substances. In dry underhangs on rock, stones, roots, bryophytes, etc. Washington state. .... M. myriocarpa V. Wirth & Vezda ex Coppins

ADD:

Close to M. rhabdogena, but spores wider, 6.7-9.8 x 2.5-4.0 um. Differs from M. misella in having a brown epihymenium and shorter microconidia (4.0-4.5 x 0.8 um). Louisiana. On dead wood. .... M. perparvula (Nyl.) Coppins & Printzen (Syn.: Lecidea perparvula Nyl., Flora 64: 532 (1881).

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