Notes RBG Edinb. 45(1): 161–169 (1988)

TWO NEW MICAREA SPECIES FROM EUROPE

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ABSTRACT. Two new saxicolous species of *Micarea* Fr. (lichen-forming fungi: Lecideaceae s. lat.) are described: *M. excipulata* Coppins from Austria and *M. marginata* Coppins & Muhr from Sweden. Both species have a well-developed excipulum.

Forty-five species of the lichens genus *Micarea* were recognized from Europe by Coppins (1983) and one additional species, *M. viridiatra*, was later described (Coppins, 1985). Material distributed as Hertel *Lecideaceae exsiccatae* no. 54 under the name *M. bauschiana* (Körber) V. Wirth & Vězda was stated not to be that species by Coppins (1983:118) but was seen too late for detailed treatment. This material is described below as *M. excipulata*. Several gatherings of a rather anomalous *Micarea* were sent to me from Sweden by Mr Lars-Erik Muhr; this species which has distinctly marginate apothecia is herein described as *M. marginata*.

Micarea excipulata Coppins, **sp. nov.** Figs. 1, 2C.

M. bauschianae (Körber) V. Wirth & Vězda similis, a qua imprimis differt excipula bene evoluta, paraphysibus monomorphis et cellulis algae grandioribus.

Typus: Austria, Kärnten, Karawanken: Am Eingang zur Trögener Klam (ca. 7km WSW Eisenkappel), 46°28′N 14°31′E, 700m, Pioniervegetation auf lose am Grunde liegenden, weich verwitternden Silikatsteinchen, 5 viii 1973, *J. Poelt*, Hertel *Lecid. Exs.* no. 54 (holo. M; iso. E, M).

Thallus effuse, pale buff, matt, very thin (mostly $<60\mu$m) and discontinuous, not forming discrete goniocysts or areolae; ecorticate, outer hyphae not pigmented. *Photobiont* cells globose and 7–15(–19)μm diam. or ellipsoid and 11–16 × 9–14μm; some divided internally into numerous (?16) aplanospores; cells deeply penetrated by haustoria.

Apothecia numerous, mostly scattered but occasionally 2–3-confluent, black but bluish grey when wet, matt, plane to slightly convex, immarginate or with a faint margin that scarcely exceeds the level of the disc, 0·2–0·35(–0·4)mm diam. *Epithecium* olive-green, K-. *Hymenium* 38–45μm tall, I+dark blue. *Paraphyses* rather scanty, irregularly flexuose, simple or sparingly branched, sometimes anastomosing, often slightly overtopping asci, c.1–1·3μm at mid-hymenium but sometimes widening to 1·7μm towards apices. *Asci* clavate, 35–41 × 9–12μm, 8-spored; with amyloid apical dome (tholus) and dark blue 'ring-structure' (Fig. 1A). *Ascospores* hyaline, ellipsoid or ovoid, simple, (6–)7–9 × 3–4(–4·5)μm (Fig. 1B). *Hypothecium* c.45–65μm tall, very dilute olivaceous (K-) with pigment confined to gel matrix; hyphae ± orientated towards the hymenium, 1–1·5μm wide but largely obscured by the numerous ascogenous hyphae with swollen cells, c.6–13 × 3–6μm. *Excipulum* well developed, c.30–40(–45)μm wide laterally, hyaline with narrow layer of olivaceous pigment along outer edge, I-; hyphae outwardly radiating and branched, 0·8–1μm wide, loosely arranged in a weak gel-matrix that disperses in K.

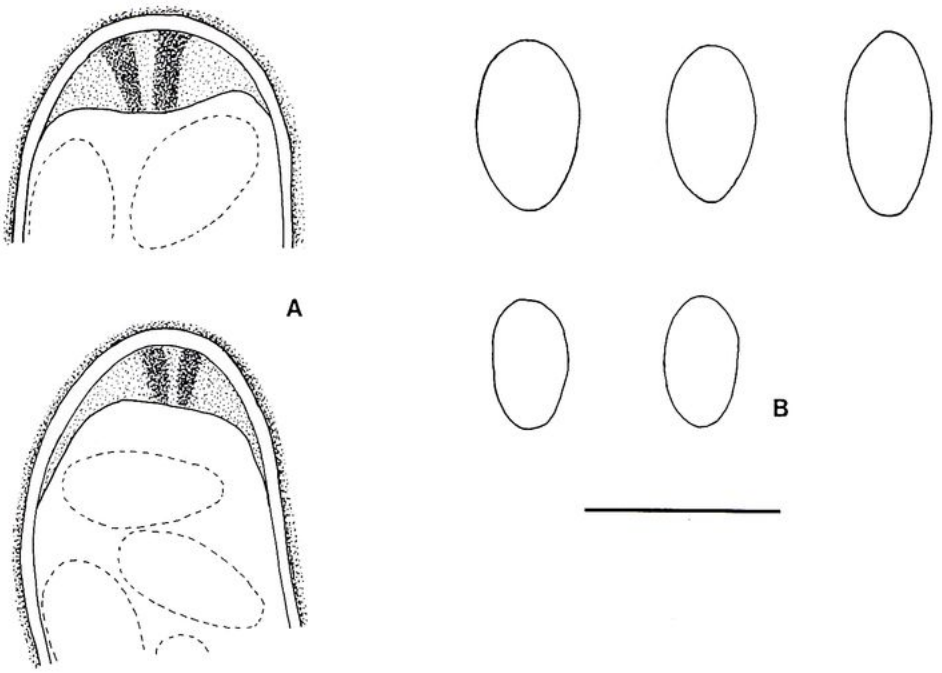

FIG. 1. *Micarea excipulata* (holotype). A, ascus tips in Lugol's Iodine after pretreatment in KOH (amyloid parts stippled), showing apical ring structure. B, ascospores. Scale = 10μm.

Pycnidia inconspicuous (and few seen), ± immersed, black, c. 30–40μm diam.; walls dark green; *conidiogenous cells* 4–7 × 1–1·5μm or with swollen base up to 3μm wide; *conidia* (microconidia) cylindrical, eguttulate, eseptate, c.3–4·8 × 0·8–1μm (few seen).

Chemistry: thallus K-, C-, KC-, PD-, I-; apothecia sections C-; no substances detected by TLC. Apothecia and pycnidia with olivaceous or green pigment, K-, HNO_3 + red (pigment A of Coppins, 1983).

M. excipulata is very similar in many respects to *M. bauschiana* but differs mainly in possessing a well-developed excipulum. The excipulum is clearly distinguished in sections mounted in Lugol's Iodine: the hymenium being blue but the excipulum remaining hyaline (Fig. 2C). In *M. bauschiana* there is no trace of an excipulum, the hymenium being reflexed to the base of the apothecium. The paraphyses of *M. excipulata* are monomorphic, whereas *M. bauschiana* has some additional paraphyses which are stout (c.1·5–2μm) and unbranched (Coppins 1983:61, fig. 34).

The pycnidia of *M. excipulata* and *M. bauschiana* are similar, although the microconidia of the latter may be slightly longer (4–6μm). Unfortunately, the few pycnidia detected and examined in the material of *M. excipulata* contained very few conidia, so the measurements given in the description above probably do not express the full variation.

A more distinctive difference between these two species is the photobiont. In *M. bauschiana* the cells are 5–12μm diam. with indistinct haustoria (in LM), but in *M. excipulata* the cells are often much larger and are distinctly, deeply penetrated by haustoria. This type of

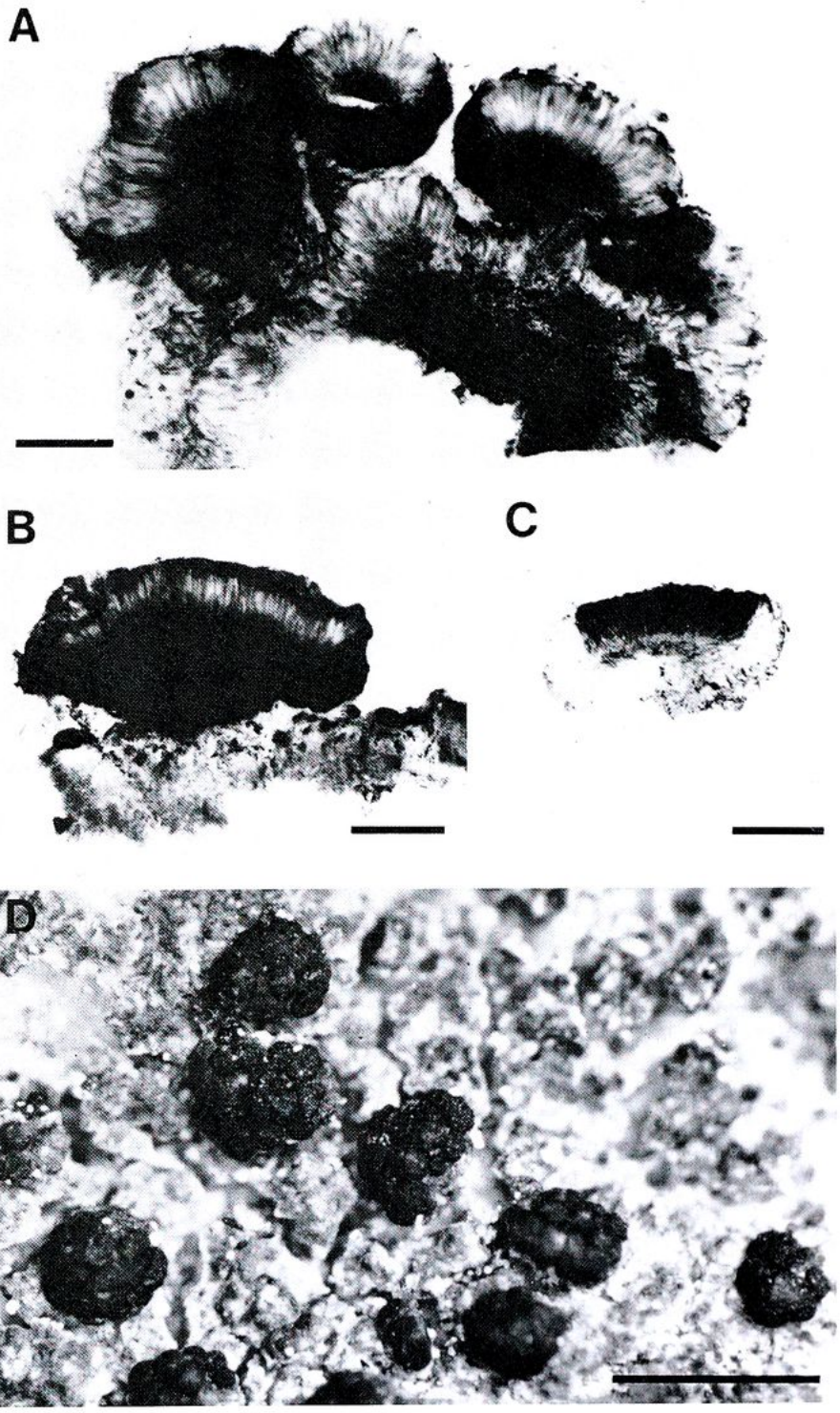

FIG. 2. A–B & D, *Micarea marginata* (A–B, holotype; D, *Muhr* 6370). C, *M. excipulata* (holotype). A, vertical section of apothecial cluster, with several small apothecia arising from a large old apothecium. B, vertical section of apothecium showing well-developed excipulum. C, vertical section of apothecium in Lugol's Iodine, showing dark amyloid hymenium surrounded by a well-developed, non-amyloid excipulum. D, apothecial clusters. Scales: A–C = 100μm; D = 1mm.

photobiont is rare in *Micarea*, but is also found in *M. intrusa* (Th. Fr) Coppins (Coppins, 1983: fig. 55).

The asci of *M. bauschiana* and *M. excipulata* show an apical 'ring-structure' in Lugol's Iodine following pretreatment in KOH (Fig. 1A), and this structure is found in several other species of the genus, e.g. *M. myriocarpa* V. Wirth & Vězda ex Coppins and *M. sylvicola* (Flotow) Vězda & V. Wirth. It is not, however, found in the type species of the genus (*M. prasina* Fr.) and other species such as *M. alabastrites* (Nyl.) Coppins (Coppins 1983: fig. 32) and *M. marginata* (Fig. 4C). The significance of this variation in ascus structure in *Micarea* requires further study.

In the key to the European species of *Micarea* (Coppins, 1983), *M. excipulata* could come out to *M. intrusa*, but the latter has 0–1(–3)-septate, larger ascospores, c.9–14 × 4·5–5·5μm, more numerous paraphyses, and stouter excipular hyphae (c.1·5–2μm wide).

M. excipulata is known only from the type gathering from Austria but, fortunately, the ample material is in good condition. The species occurred in a pioneer community on loose stones of a shattered siliceous rock lying on the ground. Associated species included *Baeomyces rufus, Porpidia crustulata* and *Micarea lithinella*. Prof J. Poelt (pers. comm.) informs me that the habitat is a sheltered situation, the Trögener Klam being a deep gorge with very steep sides of dolomitic rocks. This locality is well known for the occurrence there, at low altitudes, of several alpine phanerogams.

Micarea marginata Coppins & Muhr, **sp. nov.** Figs 2A–B, D; 3; 4A–C.

Thallus effusus, viridi-fulvus, griseus vel fumosus, ex areolis convexis confluentibus c.0·1–0·3mm diam. reversa compositus, sed saepe rimosescens et areolis primis indistinctis. Algae cellulis c.4·5–8μm diam.

Apothecia atra, primum plana tenuiter marginata 0·1–0·35mm diam., postea convexa vel tuberculata ad 0·8mm diam. *Hymenium* 35–45μm altum, hyalinum vel in dimidio inferior dilute viridulum; saepe epithecio fuligineo K olivaceo. *Ascosporae* ellipsoidae, ovoideo-ellipsoideae vel oblongo-ellipsoideae, rectae vel interdum parum curvae, 0–1(–3)-septatae, 9·5–14(–16) × (2·5–)3·5–4(–4·8)μm. *Paraphyses* numerosae, simplices vel parce ramosae et anastomosantes, plerumque 1·2–1·5μm latae, versus apices interdum leviter incrassatae ad 2μm latae. *Hypothecium* fuscovinosum vel fuscopurpureum K purpureum augens, sed in parte superna persaepe olivaceum vel sordide aeruginosum K viride augens *Excipulum* in apotheciis junioribus bene evolutum et distinctum, atropurpureum, K atrovirens vel interius K purpureum augens.

Pycnidia ± immersa, atra, parietibus brunneolis vel viridi-brunneis K viridulis augentibus. *Mesoconidia* oblongo-ellipsoidea, 3·5–5(–5·7) × 1–1·5μm. *Macroconidia* filiformia, arcuata vel sigmoidea, c.24–32 × 1μm. Thallus K-, C-, PD-; sine materia chemica (pigmentis exceptis).

Typus: Suecia, Wermelandia, par. Norra Finnskoga, c.400m ad austro-orientum e Brännknölen, secus rivulum Fiskhusbäcken, [60°57′N 14°41′E], alt. 500m, ad saxa in rivulo, in situ umbroso, 1 iv 1984, *L.-E. Muhr* 7014 (holo. E; iso. UPS, hb Muhr). Topotypi: 1983–84, *Muhr* 6367, 6370 (E), 7010, 7011, 7012 (E), 7013 (BM), 7014, 7015 (omnes in hb Muhr).

Thallus effuse, pale greenish buff to grey or brownish grey (sometimes appearing olive green and subgelatinous due to covering of non-lichenized algae), composed of confluent, convex areolae c.0·1–0·3mm across. Thallus often becoming secondarily rimose and primary areolae losing their individual identity. In section c.50–120μm thick, without well-defined cortex, but sometimes with hyaline covering (c.7–15μm thick) of necrotic hyphae and algae cells. *Photobiont* 'micareoid'; cells c.4·5–8μm diam.

Apothecia numerous, black, matt, at first plane and thinly marginate and 0·1–0·4mm diam., later becoming convex and up to 0·6mm diam.; often proliferating from an old apothecium to form blackberry-like clusters 0·5–0.9mm diam. (Fig. 2A, D). *Hymenium* 35–40(–45)μm tall, mostly hyaline or dilute greenish, especially in lower half, sometimes with a few brownish (K + olivaceous) vertical streaks; surface with a thin (c.5μm) dark brown (K + olivaceous) layer ('epithecium') which may be $\pm$ absent in old apothecia. *Paraphyses* numerous, lax in K and without individual gel coats, simple or sparingly branched, occasionally anastomosed, often curved above and overtopping asci, c.(1–)1·2–1·6μm thick at mid-hymenium, not or slightly incrassate above (to 2μm), not pigmented but apices often surrounded by the pigmented matrix of the epithecium. Sometimes also present are small fascicles of stouter paraphyses (c.2–3μm) surrounded by pigment (cf. 'vertical streaks'). *Asci* clavate, 31–40 × 11–13μm, 8-spored; with an amyloid apical dome penetrated by a non-amyloid apical cushion, but no dark 'ring-structure' present (Fig. 4C). *Ascospores* hyaline, variable in shape (Fig. 3) but mostly ellipsoid to oblong ellipsoid, 0–1-septate, but old spores sometimes 2- or 3-septate, 9·5–14(–16) × (2·5–)3·5–4(–4·8)μm. *Hypothecium* c.45–70μm tall in plane apothecia, or up to 200μm tall in tuberculate apothecia, dark purplish- or vinose brown (K + purple intensifying) but in uppermost part usually dark

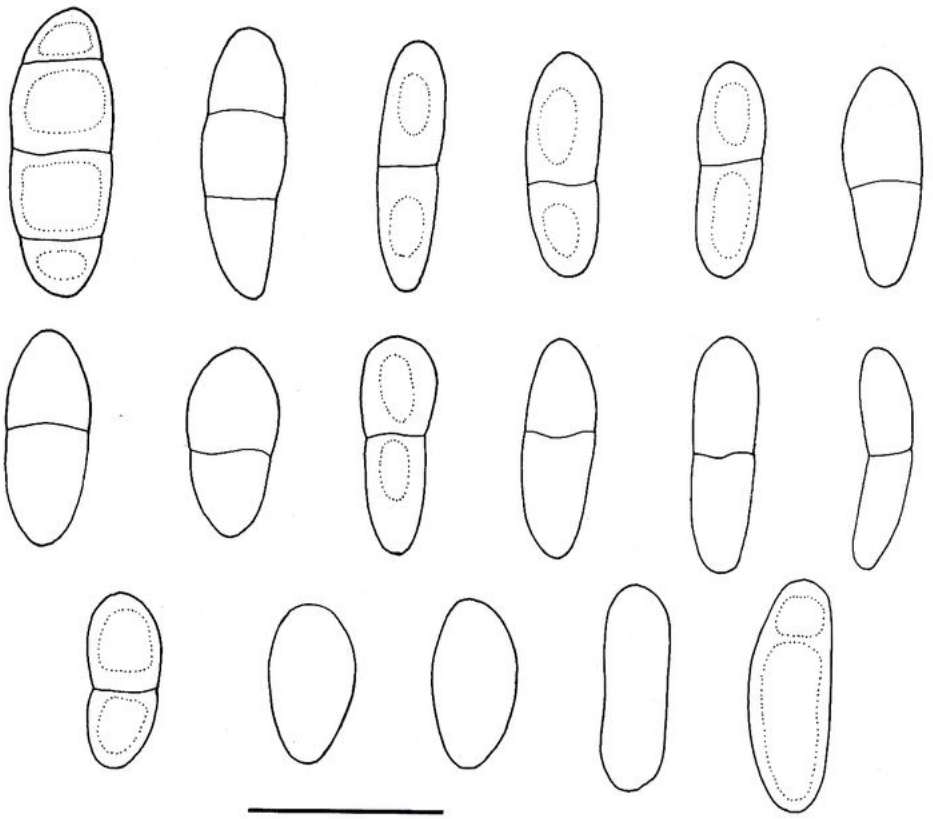

FIG. 3. *Micarea marginata* (holotype). Ascospores. Scale = 10μm.

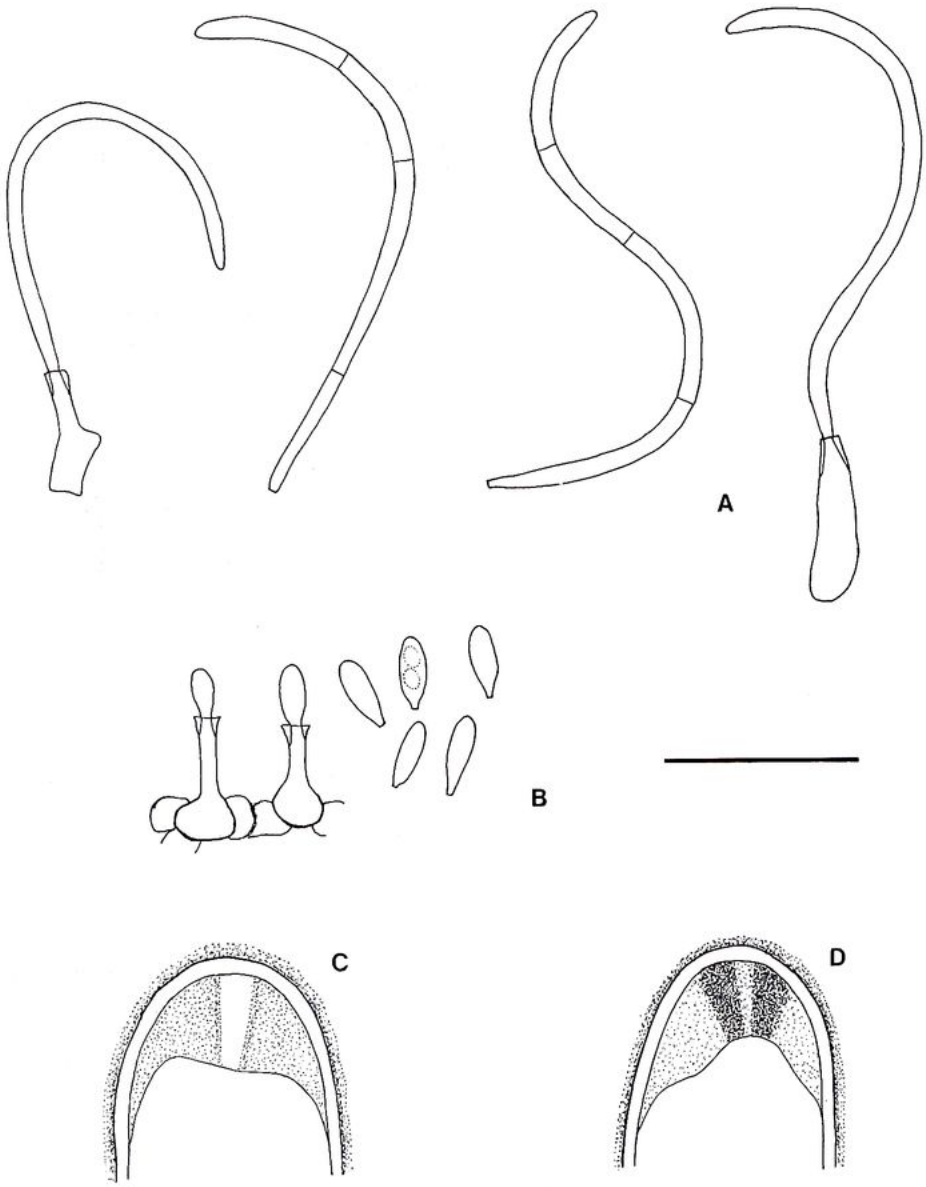

FIG. 4. A–C, *Micarea marginata* (holotype). D, *M. crassipes* (*Coppins* 11045, E). A, macroconidia; two still attached to conidiogenous cell. B, mesoconidia and conidiogenous cells. C–D, ascus tips in Lugol's Iodine following pretreatment in KOH (amyloid parts stippled; developing ascospores omitted). Scale = 10μm.

olivaceous or sordid aeruginose (K+green intensifying); hyphae ± interwoven or ± vertically orientated towards the hymenium, c.1·2–1·5μm wide, embedded in densely pigmented gel-matrix, also with short-celled ascogenous hyphae c.2–4μm wide. *Excipulum* well-developed and distinct in plane apothecia, c.15–21μm wide laterally, purple-black (K+green-black or K+purple intensifying in inner part), of richly branched, outwardly radiating hyphae, 1–1·5μm wide, but heavily coated with pigment and appearing to be c.3μm wide; excipulum reflexed and inconspicuous in old, convex apothecia.

Pycnidia immersed or up to $\frac{1}{5}$-emergent, black; walls dull brown or greenish brown (K+ green intensifying); of two types: (a) c.100–200μm diam.; *conidia* (*macroconidia*) curved, hamate or sigmoid, sometimes thinly 1–3-septate, c.24–32 × 1–1·3μm (Fig. 4A); (b) c.60–80μm diam.; *conidia* (*mesoconidia*) oblong-ellipsoid, often narrowing to a truncate apex at proximal end, sometimes biguttulate, 3·5–5(–5·7) × 1–1·5μm (Fig. 4B).

Chemistry: thallus K-, C-, KC-, PD-, I-; no substances by TLC. Apothecia with pigments A, B and C; pycnidial walls with pigment A (see below).

Micarea marginata is characterized by its plane, thinly marginate young apothecia, well-developed excipulum, dark, ± purplish hypothecium, sparingly branched paraphyses, mostly oblong-ellipsoid, 0–1(–3)-septate ascospores, and curved, filiform macroconidia. The well-developed excipulum does not immediately suggest a *Micarea*, but when cleared of pigment (e.g. with bleach) it is seen to be of a simple construction (thin, branched, radiating hyphae) as found in apothecia of, for example, *M. nitschkeana* and *M. peliocarpa*. A similar, densely pigmented, though sooner reflexed, excipulum is also found in *M. melaenida* and *M. subviridescens* (Coppins, 1983). The nature of its paraphyses, asci, spores, pigmentation, conidial states and 'micareoid' photobiont, all confirm the placement of this new species in *Micarea*.

Following Coppins (1983) the three pigments present in the apothecia of *M. marginata* can be simply characterized thus: pigment A (green, K± intensifying); pigment B (purple, K+ green); pigment C (purple, K+ intensifying); all three are HNO_3+ purple-red). The combination of these three pigments occurs together in varying proportions (even within the same specimen) in several other *Micarea* spp., e.g. *M. assimilata, M. crassipes, M. melaena* and *M. sylvicola*, and the pigments are probably closely related chemically.

Mesoconidia-containing pycnidia were found in all the specimens of *M. marginata*; those containing macroconidia were much less frequent, but are present in at least three of the specimens (*Muhr* 6370, 7012, 7014). Similar macroconidia are known also in *M. alabastrites, M. denigrata, M. lignaria, M. melaena, M. nitschkeana* and *M. peliocarpa* (Coppins, 1983).

An interesting feature of *M. marginata* is that it often has blackberry-like clusters of tiny apothecia. These clusters are formed by the proliferation of numerous apothecia from a single old apothecium (Fig. 2A, D). This curious development is occasionally seen in other members of the Lecideaceae s. lat., such as *Fuscidea austera* (Nyl.) P. James and *Lecidella subincongrua* (Nyl.) Hertel & Leuckert, and is a more consistent

FIG. 5 The stream at Fiskhusbäcken, Sweden—type locality of *Micarea marginata*.

feature of others such as *Lecidea botryosa* (Fr.) Th. Fr. and *L. pycnocarpa* (Körber) Ohl.

By virtue of the saxicolous habitat, thallus appearance and densely pigmented apothecial tissues, *M. marginata* could be confused with *M. sylvicola*, but that species has completely immarginate apothecia, scanty paraphyses, smaller, predominantly simple spores, and a larger-celled photobiont. A conspicuous, deeply pigmented excipulum is found in *M. crassipes*, but it can be distinguished by its small ± globose or isidia-like areolae, larger, turbinate or short-stalked apothecia, asci with dark amyloid apical 'ring- structure' (Fig. 4D), and habitat of mosses or plant debris. Saxicolous forms of *M. melaena* with immature spores differ from *M. marginata* in having much narrower (0·8–1μm wide) and more richly branched paraphyses, and an inconspicuous, reflexed excipulum. Outside

Micarea, M. marginata could be mistaken for other saxicolous taxa with small, black, thinly marginate apothecia, e.g. *Catillaria chalybeia*. The latter can be found in similar habitats, but is easily distinguished by its dark brown, capitate paraphysis apices (see Kilias, 1981).

Micarea marginata is known only from the type locality in Sweden, where it grows on boulders of a coarse-grained igneous rock in and alongside a small stream (Fig. 5). The lichen is probably inundated on occasions when the stream is in spate. Associated species include *Lecidea lithophila, Porpidia glaucophaea, Rhizocarpon hochstetteri, R. lavatum*, and the mosses *Andraea rupestris* and *Racomitrium heterostichum*. The stream at Fiskhusbäken runs down an east-facing slope covered in a thick and humid spruce forest, mixed with a few deciduous trees of *Betula pubescens, Populus tremula* and, along the stream, *Alnus incana*.

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