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Micarea capitata, a new bryophilous lichen from Sweden

Måns SVENSSON and Göran THOR

Abstract: The diminutive species *Micarea capitata* is described from north-western Sweden. It has been found at two localities in boreal forests where it grew on the bryophyte *Hylocomium splendens*. *Micarea capitata* is distinguished by small (0·10–0·35 mm diam.) black apothecia, (0–)1-septate ascospores and a mottled, darkly pigmented hypothecium.

Key words: apothecial pigments, Europe, Fennoscandia, muscicolous, *Pilocarpaceae*

Introduction

Micarea is a genus of crustose lichenized fungi, which was earlier assigned to the family *Micareaceae* (e.g. Eriksson *et al*. 2004). Recent phylogenetic studies (Andersen & Ekman 2004, 2005) have shown that *Micarea* s. str. belongs to the *Pilocarpaceae*, while the genus as a whole is paraphyletic. However, in the absence of data showing how *Micarea* could be divided into smaller monophyletic groups, the classic generic circumscription of Coppins (1983) still remains operational. In this circumscription, the genus comprises about 90 described species (Coppins 2009), though knowledge of the genus is still lacking from many parts of the world. One of the more well researched areas is Fennoscandia (Finland, Norway, Sweden), but in spite of this, new species are continuously being added to the checklist of the region, for example *M. nowakii* Czarnota & Coppins (Svensson & Westberg 2010), *M. polycarpella* (Erichsen) Coppins & Palice (Palice 1999), *M. tomentosa* Czarnota & Coppins (Thor & Svensson 2008) and *M. viridileprosa* Coppins & v.d. Boom (Thor 2009). During fieldwork in Härjedalen in 2007, we collected an inconspicuous member of the genus which did not fit any previously published description. Hence, in the current paper we describe this entity as a new species.

M. Svensson and G Thor: Department of Ecology, Swedish University of Agricultural Sciences, P.O. Box 7044, SE 750 07 Uppsala, Sweden. Email: mans.svensson@slu.se

Material and Methods

All light microscopy measurements used for statistical calculations were made on material mounted in water using an oil-immersion lens, with a precision of 1 µm. Spore measurements are given as (the minimum value recorded−) (mean value − standard deviation)–(mean value + standard deviation) (–the maximum value recorded). The calculated values are rounded to the nearest whole number. The mean value ($\bar{x}$), the standard deviation (SD), and the total sample size (n) are given in parentheses. Only typical spores lying outside the asci were measured, obviously abnormal ascospores being excluded. The iodine coloration (Lugol's solution; iodine concentration 0·25%) was studied both with and without pretreatment with K, indicated as K/I and I, respectively. Measurements of asci, excipular hyphae and paraphyses were made on material cut into sections 12–18 µm thick using a freezing microtome (Microm cryostat HM 500 OM) and stained with lactophenol cotton blue. The photograph of the apothecial section (Fig. 2) was taken on a 16 µm thick microtome section mounted in water. HPTLC was performed using the method described by Arup *et al*. (1993).

The Species

Micarea capitata M. Svensson & G. Thor sp. nov.

MycoBank No. MB 519054

Thallus crustacea, muscicola. Apothecia multa, 0·10–0·35 mm diametro, atra. Sporae octonae, ellipsoideae, incoloratae, (0–)1-septatae, (7·5–)9–11(–12) × (2·5–)3–4(–4) µm. *Micarea hylocomii* Poelt & Döbbeler sub-

similis, sed paraphyses anastomosantes; pigmento hymenio et hypothecio differt.

Typus: Sweden, Härjedalen, Tännäs parish, the E slope of Mt. Ramundberget, above the holiday village of Kvarnbäcken, subalpine deciduous forest, on *Hylocomium splendens* on boulder, 62°41·654′N, 12°23·662′E (WGS84), alt. 730 m, 2 June 2007, *M. Svensson* 1004 (UPS—holotypus).

(Fig. 1)

Thallus crustose, forming small patches on *Hylocomium splendens* (Hedw.) Schimp., episubstratal but often very thin and then barely visible, pale grey; hyphae 1·0–1·5 µm diam. *Photobiont* 'micareoid'; cells regularly globose, 4–7 µm diam.

Apothecia numerous, scattered, immarginate, convex to hemispherical, constricted at the base, black, (0·10–)0·15–0·25(–0·35) mm diam. *Hymenium* blue-green in streaks or rarely hyaline, 30–40 µm tall, K−, C−, N± red, I+ blue, K/I+ blue. *Epithecium* not well delimited, pale to dark blue-green, up to 5 µm tall, K−, C−, N+ red. *Asci* clavate, 8-spored, 30–35 × 10–12 µm, *Micarea*-type. *Ascospores* ellipsoid, straight or slightly curved, rarely guttulate, hyaline, (0–)1-septate, (7·5–)9–11(–12) × (2·5–)3–4(–4) µm (length: $\bar{x}$ = 10·00, SD = 1·17, n = 32; width: $\bar{x}$ = 3·29, SD = 0·52, n = 32). *Paraphyses* numerous, branched and anastomosing, hyaline, immersed within gel-matrix that does not dissolve in K, 0·8–1·5 µm wide; apices 0·8–2·0 µm wide and sometimes with an indistinct greenish apical cap. *Hypothecium* mottled blackish green without any red or purple tinge, 40–60 µm tall, K−, C−, N+ red; composed of densely interwoven, anastomosing hyphae, 1–2 µm wide. *Excipulum* soon reflexed, composed of branched hyaline hyphae, sometimes coated with blackish green pigment, 1·5–2·5 µm wide, K−, C−, N± red.

Pycnidia not observed.

Chemistry. Thallus K−, C−, KC−, Pd−, UV−. No lichen substances detected by HPTLC. Of the insoluble pigments described in Meyer & Printzen (2000), the blue-green pigment in the apothecia is most similar to '*Cinereorufa*-green', but differs in reacting HNO_3+ red/ K+ dark brown/ HCl+ brown/ K+ dark brown, instead of shifting between blue-green and dark purple.

Etymology. The epithet '*capitata*' refers to the globose apothecia of the new species.

Ecology and distribution. *Micarea capitata* is only known from two localities in Härjedalen in north-western Sweden. Both collections were made on the bryophyte *Hylocomium splendens* on rocks in open forests. The type material was collected on a boulder in a subalpine deciduous forest dominated by *Betula pubescens* and the second specimen was collected close to a stream in an old-growth *Picea abies* forest. The species was found on one to three year old shoots of its host. These were usually yellowish (apparently dying), which indicates that the substratum for the species is short-lived. Thus, the species is probably adapted to frequent dispersal and establishment on new *Hylocomium splendens* shoots. Species with this type of life strategy are rarely restricted to small geographical areas (e.g. Döbbeler 1997). We therefore assume the species to be more common and widespread than the current findings indicate, especially since its host is such a ubiquitous species in Fennoscandia. However, we have searched unsuccessfully for *M. capitata* at several localities in northern Sweden from 2008–2010. Although the habitat requirements of the species are not fully understood, one possible explanation for this might be that its apothecia are most frequent in the spring and hence less likely to be found in the summer and autumn when most of our subsequent searches have taken place. We have also revised all the bryophilous material filed under *Micarea* in herbarium UPS without finding any additional material of the new species, although it should be noted that almost none of the available collections were collected on *Hylocomium splendens*.

Notes. *Micarea capitata* is characterized by its bryophilus habit, small, black apothecia with a constricted base, (0–)1-septate ascospores and the mottled appearance of the

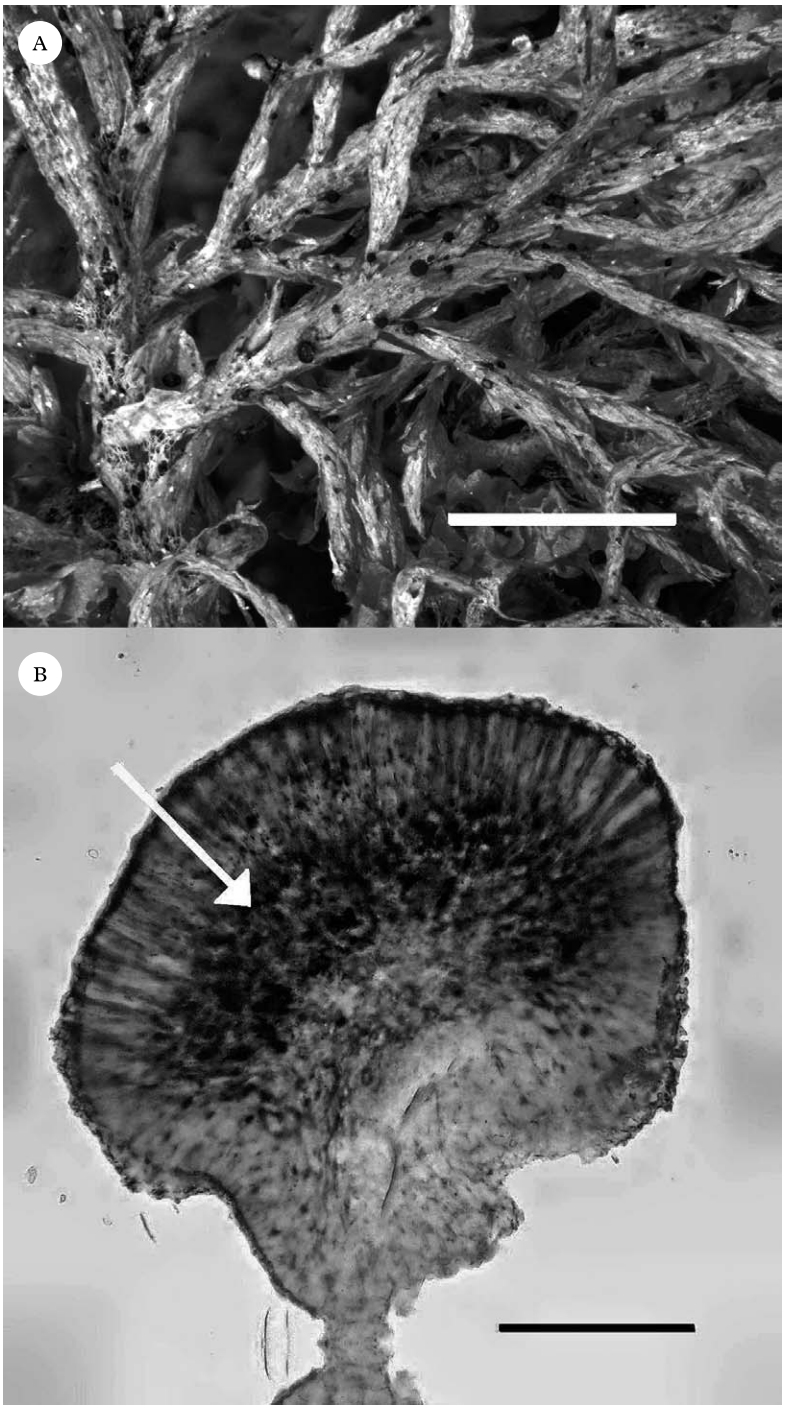

FIG. 1. *Micarea capitata* (holotype, UPS). A, habitus; B, section (16 µm thick in water) of apothecium, showing the mottled pigmentation of the hypothecium (arrow); unless K is applied and the tissues pushed apart by applying some pressure, individual paraphyses and asci are hardly discernible. Scales: A = 2 mm; B = 60 µm.

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hypothecium, which is caused by patchy distribution of pigment (Fig. 1B). This pigment appears very dark even in thin sections. It should also be noted that individual paraphyses and asci are hardly discernible unless K is applied and the tissues pushed apart by applying some pressure.

Owing to its small size, the species is easily overlooked. In the field, it can be detected as a slight discolouring of *Hylocomium splendens*, but this is likely to be missed if not actively searched for. Examined under the hand-lens, it bears some resemblance to *Arthonia muscigena* Th. Fr., which may grow on bryophytes in a similar fashion. It might also be somewhat similar to various non-lichenized fungi, which are often present on dying bryophytes in boreal forests in Sweden. Coppins (1983) divided *Micarea* into 11 infrageneric groups, some of which have received support from later molecular studies [e.g. the *Micarea sylvicola* group and the *Micarea peliocarpa* group (Andersen & Ekman 2005); the *Micarea prasina* group (Czarnota & Guzow-Krzemińska 2010)], while other groups still remain unclear. *Micarea capitata* is not easily accommodated in any of these groups because of its atypical apothecial pigment; however, it is possible that it is related to species in the 'Group H' of Coppins (1983), a group which contains other species with minute, black apothecia, 0–1 septate ascospores and a thin thallus without lichen substances.

In Fennoscandia, most lichen species overgrowing bryophytes grow on dead specimens of their hosts and although adequate data are missing for many species, they generally seem to exhibit low host specificity. A few of these species might eventually prove to be host specific (e.g. some of the species growing on *Andreaea* spp. in alpine situations), but many of them also grow on other substrata. The only well-documented bryophilous lichen in Fennoscandia is *Puttea margaritella* (Hulting) S. Stenroos & Huhtinen, which grows exclusively on the liverwort *Ptilidium pulcherrimum* (G. Web.) Hampe, where it is viewed as a necrotrophic parasite or a colonizer of damaged parts of its host (Stenroos *et al*. 2009). Although the available data on *M. capitata* are insufficient for any firm conclusion, its presence on seemingly still living specimens of its host suggests a parasitic life strategy similar to that of *P. margaritella*.

Among lichenized species, *M. capitata* is probably most likely to be confused with *M. hylocomii* Poelt & Döbbeler, a rarely collected species which has only been reported from the Alps and Norway (Poelt & Döbbeler 1975; Poelt & Buschart 1978). Although superficially similar in habit and pigmentation, this species is clearly different from *M. capitata* in having smaller (0·05–0·15 mm) ± adnate apothecia without a clearly constricted base and simple or rarely sparingly branched paraphyses, which have apices (–3 µm diam.) with a dark brown or a black pigment hood (Poelt & Döbbeler 1975). The ascospores of *M. hylocomii* (holotype, GZU!) were originally given as 2 µm wide; our own measurements range between 1·5–3 µm, which is on average thinner than the ascospores of *M. capitata*, although there is an overlap. Further, the blue-green apothecial pigment in *M. hylocomii*, although also reacting K− and N+ red, seems different from the one found in *M. capitata*, since it dissolves rapidly in C (M. Svensson & G. Thor, personal observations). Overall, the position of *M. hylocomii* in *Micarea* is doubtful (Poelt & Döbbeler 1975; Coppins 1983).

Micarea botryoides (Nyl.) Coppins is similar to *M. capitata* in having apothecia that are constricted at the base and in the size and septation of the ascospores, but differs in having a reddish brown hypothecium, two types of paraphyses and numerous stalked pycnidia (Coppins 1983). *Micarea melaena* (Nyl.) Hedl. has apothecia of similar shape and although this species is chiefly corticolous or lignicolous, it might occasionally grow on bryophytes. It differs from *M. capitata* in having a hypothecium that usually has a dark purple pigment, reacting K+ green, larger (12–21 × 4–5·5 µm), mostly three-septate ascospores and a better developed thallus, reacting C+ red due to presence of gyrophoric acid (Coppins 1983; Czarnota 2007). *Micarea prasinella* (Jatta) I. M. Lamb may also grow on bryophytes and likewise has predominately 1-septate ascospores and

black apothecia that are clearly constricted at the base, but differs in having more distinctly stalked apothecia, a purple-brown, K+ purple or K+ green pigment in the apothecia and a better developed thallus that contains gyrophoric acid (Coppins 2009). The bryophilous *M. turfosa* (A. Massal.) Du Rietz differs in having a black thallus, a mottled reddish brown hypothecium and larger (10–25 × 3·5–5 µm) ascospores (Coppins 1983). A species that may be found growing over bryophytes in subalpine habitats similar to the one *M. capitata* was found in, is *Helocarpon crassipes* Th. Fr., which, however, has a more well-developed thallus, a much more developed excipulum and contains a purple-brown pigment in the apothecia (Coppins 1983).

Additional specimen examined. **Sweden:** *Härjedalen*: Tännäs parish, 900 m SSE of Svalåvallen, by stream in old-growth mixed coniferous forest, 62°37·161′N, 12°25·193′E (WGS84), alt. 700 m, on *Hylocomium splendens* on vertical side of boulder, 4 vi 2007, *G. Thor* 21842 (UPS).

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