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Two new species of *Malmidea* from north-eastern Brazil

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Abstract: Two new species, *Malmidea pallidoatlantica* and *Malmidea sulphureosorediata*, are described from NE Brazil. The first is close to *M. atlantica* but differs by the hyaline or pale hypothecium. The second species is a bright golden yellow sorediate crust which is assigned to the genus *Malmidea* because it contains the same anthraquinone pigment as *M. atlantica* and *M. pallidoatlantica*. The three species together could be referred to as the *Malmidea atlantica* group. Both new species were found in Mata Atlântica fragments. *Malmidea sulphureosorediata* was found in the Serra da Jibóia, a mountain range with a maximum elevation of 800 m, in a transitional area between the Atlantic forest and Caatinga vegetation in Bahia State. *Malmidea pallidoatlantica* was found in Mata do Crasto, one of the most important Atlantic forest remnants in Sergipe. It is a well-preserved Mata Atlântica relict of *c.* 700 hectares, at sea level.

Key words: anthraquinone, lichens, *Malmideaceae*, Mata Atlântica, Mata do Crasto, Santa Luzia do Itanhy, Serra da Jibóia

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Introduction

Despite having a high diversity of species and high degree of endemism (Lagos & Muller 2007), the Atlantic rainforest in Brazil has been devastated and increasingly threatened, with over 93% of its area already destroyed (Galindo-Leal & Câmara 2005). During a floristic survey of corticolous crustose lichens in Mata Atlântica fragments in north-eastern Brazil, two undescribed species of the genus *Malmidea* from Mato do Crasto and Serra da Jibóia were found and are described below.

Mata do Crasto is one of the most important Atlantic forest remnants in Sergipe, the smallest state of Brazil. It is a well-preserved Mata Atlântica relict of *c.* 700 ha, located in the municipality of Santa Luzia do Itanhy, at the southern coast of Sergipe at sea level. The Serra da Jibóia is a mountain range with a maximum elevation of 800 m, located in Bahia State, in a transitional area between the Atlantic forest and Caatinga vegetation, which is a drier and more open forest type.

The genus *Malmidea* in the separate family *Malmideaceae* was only recently described and is still incompletely known, with 41 accepted species worldwide (Lücking 2008; Kalb *et al.* 2011, 2012; Cáceres *et al.* 2012; Schumm & Aptroot 2012); however, many additional species, already described in this group are still hidden under *Lecidea* and new species are now described quite regularly.

Material and Methods

Identification and descriptive work was carried out in Itabaiana, Universidade Federal de Sergipe, using a Leica EZ4 stereomicroscope and a Leica DM500 compound microscope, and also in Soest using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections were mounted in tap water, in which all measurements were taken. The specimens from this study are preserved in ISE. The chemistry of the type specimen was investigated by thin-layer chromatography (TLC), using solvent A, and by observing extract recrystallization in acetone with a compound microscope (Orange *et al.* 2001).

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Chemical reactions were applied directly on the thallus and medulla and on acetone extracts on filter paper.

The Species

Malmidea pallidoatlantica M. Cáceres & Aptroot sp. nov.

MycoBank No.: MB 801122

Similar to *Malmidea atlantica* (M. Cáceres & Lücking), M. Cáceres & Kalb, but with a hyaline to pale hypothecium.

Type: Brazil, Sergipe, Santa Luzia do Itanhy, Mata do Crasto, on bark of tree, *c.* 10 m alt., 17 April 2010, *M. E. S. Cáceres & V. M. dos Santos* 7017 (ISE—holotype).

(Fig. 1A–D)

Thallus thin, dull, grey, with numerous corticate grey warts *c.* 0·2 mm diam., in which the medulla is bright yellow, without prothallus. Warts hemispherical, sometimes abraded at the top, but not developing into soralia. *Algae* green, *c.* 7 × 5 µm.

Apothecia sessile, 0·2–0·9 mm diam.; *disc* flat, smooth, pinkish brown, margins rough, *c.* 0·2 mm wide, pale pinkish, often partly with the bright yellow medulla exposed. *Hymenium* hyaline, 45–65 µm high; *epihymenium* hyaline to very pale brownish, 4·0–6·5 µm high; *hypothecium* hyaline to yellowish brown, 35–50 µm thick; *excipulum* not corticate, mostly filled with bright yellow crystals, at least sideways and at the lower part of the excipulum underneath the apothecium, 85–125 µm thick, lumina elongated, outer cells 5·0–7·5 × 10·0–14·5 µm. *Paraphyses* unbranched, not thickened at the tips, *c.* 1 µm wide. *Asci* cylindrical, 45–60 × 10·0–13·5 µm. *Ascospores* hyaline, IKI−, simple, ellipsoid, 9·5–10·5 × 5·0–5·5 µm, ends somewhat pointed but not thickened.

Pycnidia not observed.

Chemistry. Thallus UV−, C−, K−, KC−, P−. Medulla K+ blood red, UV+ orange. Acetone extract deep yellow, KOH+ violet, not recrystallizing but pigment present in small droplets. TLC: anthraquinone, probably emodin.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This species is close to *M. atlantica* (M. Cáceres & Lücking) M. Cáceres & Kalb (Cáceres 2007), which mainly differs by the black hypothecium. They share the bright yellow pigment in the medulla. Both species grow together in the Mata do Crasto. The same pigment is present in the sterile *M. sulphureosorediata* (see below), which forms large soralia. These three species are probably closely related and known only from NE Brazil, which is one of the centres of speciation of the genus. The three species together could be referred to as the *Malmidea atlantica* group. Anthraquinones are generally not identifiable with certainty by TLC alone, and the identification is tentative. However, two additional characters of the substance are given: the KOH-reaction of the acetone extract and the shape as observed under a compound microscope. These characters are easily observed and may serve to distinguish the pigment in the *Malmidea atlantica* group from other pigments, irrespective of the identification of the compound. For instance, the most common anthraquinone that is similar in colour (dark yellow) and KOH-reaction (blood red on thallus, extract violet), physcion (= parietin), recrystallizes immediately in acetone extract, forming short, needle-like crystals in mostly star-like agglomerates.

Malmidea sulphureosorediata M. Cáceres, D. A. Mota & Aptroot sp. nov.

MycoBank No.: MB 801123

Malmidea with confluent pulverulent bright golden yellow soralia.

Type: Brazil, Bahia, Santa Teresinha, Serra da Jobóia, on bark of tree, *c.* 700 m alt., September 2010, *M. E. S. Cáceres* 7645 (ISE—holotype).

(Fig. 1E & F)

Thallus thin, dull, grey, with numerous corticate grey dots *c.* 0·1 mm diam., of which the medulla is bright yellow, surrounded by a hyphal prothallus line *c.* 0·1 mm thick. Medullary tissue soon developing into pulverulent soralia which are confluent to form soralia covering several cm^2, forming a crust 0·3–0·8 mm thick. *Soredia* farinose, bright golden yellow, remaining mixed with

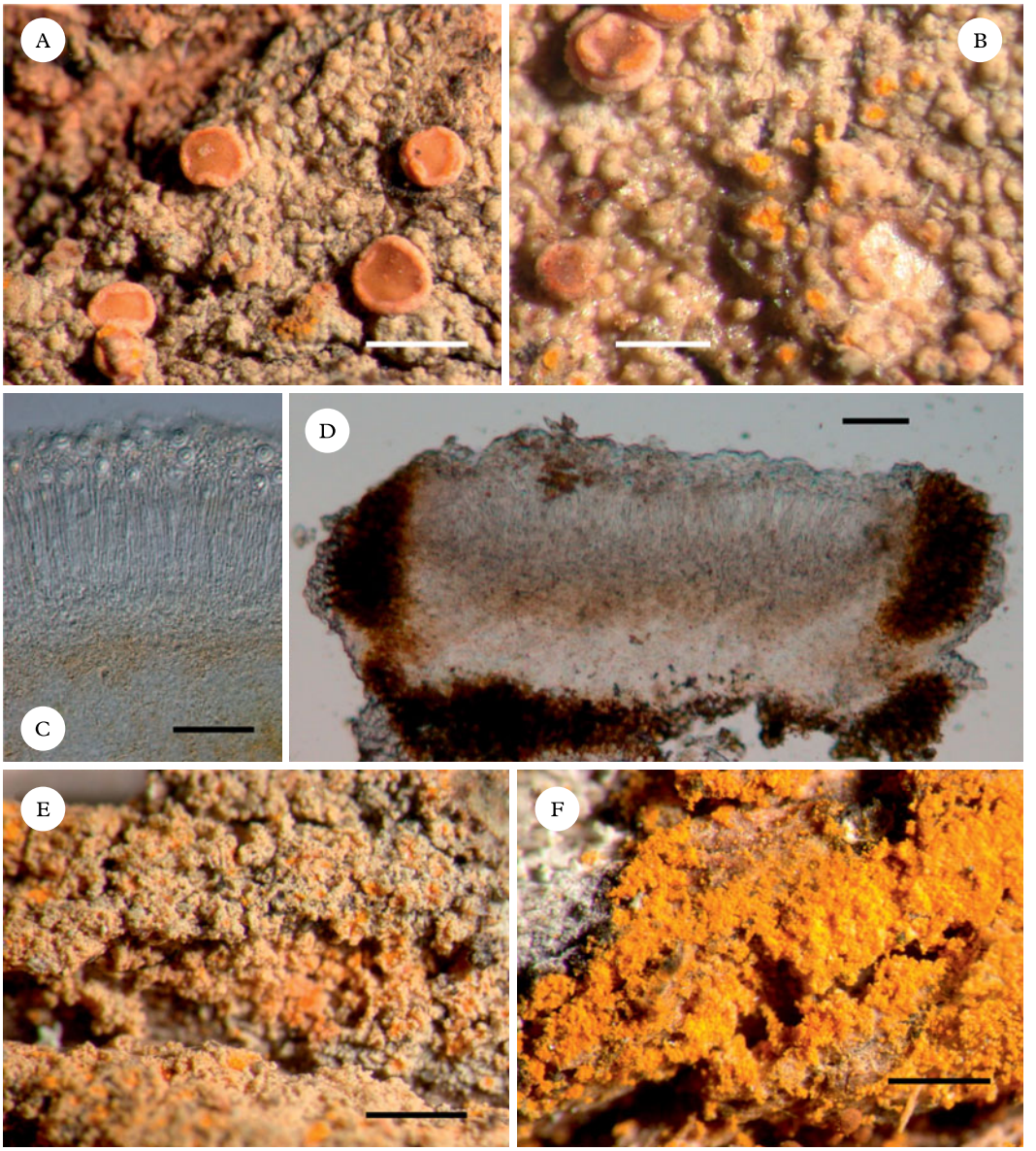

FIG. 1. A–D, *Malmidea pallidoatlantica* (holotype); A, habitus; B, thallus showing medulla; C, section through hymenium showing pale hypothecium (the band above the letter C; underneath is the excipulum); D, section through apothecium margin showing the distribution of yellow crystals in the excipulum (dark on the picture). E & F, *Malmidea sulphureosorediata* (holotype), habitus; grey thallus parts dominate the aspect in E, yellow soralia in F. Scales: A, E & F = 1 mm; B = 0·5 mm; C & D = 50 μm.

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grey cortical granules that particularly dominate some marginal or sheltered thallus parts. *Algae* green, *c.* 7 × 5 µm.

Apothecia and *pycnidia* unknown.

Chemistry. Thallus UV−, C−, K−, KC−, P−. Medulla and soredia K+ blood red, UV+ orange. Acetone extract deep yellow, KOH+ violet, not recrystallizing but pigment present in small droplets. TLC: anthraquinone, probably emodin.

Ecology and distribution. On smooth bark of trees in primary forest. Known only from Brazil.

Discussion. This is a sterile but very characteristic bright golden yellow sorediate lichen species. No distinct thallus warts are formed, but the soralia start as very tiny dots surrounded by a grey corticated thallus, reminiscent of some *Malmidea* species. Therefore, it was co-chromatographed with, and proved to be chemically identical to, the non-sorediate *Malmidea pallidoatlantica* (see above), a species close to *M. atlantica* (Cáceres 2007) which mainly differs by the black hypothecium. These three species seem to be chemically identical.

Additional specimen seen. **Brazil:** same locality as the type, *M. E. S. Cáceres* 7659 (ISE).

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