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***Marchantiana asserigena* comb. nov., a possible European immigrant from Australia**

ULRIK SØCHTING and ULF ARUP

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Caloplaca asserigena is known to have a secondary compound different from other species of Teloschistaceae in the Northern Hemisphere. Studies of the secondary chemistry of the Australian Teloschistaceae have revealed the same compound to be present in *Marchantiana michelagoensis* and *Caloplaca marchantiorum*. Subsequent molecular studies based on three genes support the affinity of *C. asserigena* and *M. michelagoensis*. Accordingly, the species is tentatively included in the genus *Marchantiana*. *Marchantiana asserigena*, which was earlier regarded as extinct in Denmark, has been found to be widespread on very thin twigs of dwarf shrubs in Danish heathlands.

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Introduction

In the 19th century *Caloplaca asserigena* was regarded as a fairly common but overlooked species in central Europe (Lahm 1883, 1885). Since then it has been categorized as endangered in Austria (Türk & Hafellner 1999) and extinct in Nordrhein-Westfalen (Heibel et al. 1999) and Schleswig-Holstein, northern Germany (Jacobsen 1997).

In Denmark there are collections from the 1940ies and it was assumed to have disappeared since it grows on very thin, often dead twigs of dwarf shrubs that are particularly sensitive to air pollution.

In 1999 *C. asserigena* was found growing on *Helianthemum* twigs on the Swedish island of Öland in the Baltic Sea (Søchting & Fröberg 2003), and since then it has been found to be widespread and frequent in the British Isles, particularly in the humid western areas. A special focus on thin twigs of dwarf shrubs in heathlands has resulted in several recent reports of *C. asserigena* in Denmark and it is expected to be frequent in suitable habitats.

Caloplaca asserigena was the subject of a study of Søchting & Fröberg (2003) who concluded *C. asserigena* to be the correct name for the species, but due to a very intricate nomenclatural history, the correct authors of this species should be “(J. Lahm) DT & Sarnth”. Later results on the secondary chemistry of the Australian species *Marchantiana michelagoensis* and support from subsequent molecular studies (see below) have prompted us to transfer *C. asserigena* into the Australian genus *Marchantiana*.

Secondary Chemistry

Based on HPLC analyses by Søchting (1997), Søchting and Frøberg (2003) described the very unusual secondary chemistry of *C. asserigena*, which contained only one anthraquinone, but a compound not known from any other lichen. Later, Jack Elix in Canberra discovered an unknown anthraquinone that he called neochloroemodin from the Australian species *Caloplaca michelagoensis* Elix, S.Y. Kondr. & Kärnefelt (Kondratyuk et al. 2009). This species was subsequently transferred to the genus *Marchantiana* by Kondratyuk et al. (2014). Careful HPLC comparisons showed that neochloroemodin was identical to the unknown compound present in *C. asserigena*, thus suggesting a putative relationship between *C. asserigena* and *C. michelagoensis*. Recently, the chemistry of the lectotype of *Calloplisma asserigenum* was analysed and was shown to contain neochloroemodin. Furthermore, Kondratyuk et al. (2009) described another species, *Caloplaca marchantiorum* S.Y. Kondr. & Kärnefelt, which also contained neochloroemodin.

So far, neochloroemodin is known only from these three species. Its chemical structure remains to be determined, but as it is the only major secondary compound detected in the three species it is assumed to be responsible for the orange, K⁺ purple pigment in the apothecia.

Molecular Phylogeny

The two species, *Caloplaca asserigena* and *Marchantiana michelagoensis*, have been sequenced using the methods of Arup et al. (2013). A phylogenetic hypothesis based on three genes (nITS, nLSU and mSSU) reveals that the two taxa are closely related (data not shown). A phylogenetic hypothesis based on ITS shows *C. asserigena* to be a sister species to *M. michelagoensis* in a clade together with *M. occidentalis*, the type species of the genus *Marchantiana*.

Unfortunately the sparse material of the holotype of *Caloplaca marchantiorum* was unavailable for molecular analysis.

Morphology

The morphology and anatomy of *C. asserigena* was described by Søchting & Frøberg (2003) based on Danish and Swedish specimens.

The observed morphology (fig. 1–2) has been compared with that of the holotype of *C. marchantiorum* (fig. 3). Due to its scarcity it has not been possible to study the anatomy of the holotype of *C. marchantiorum*, but the description in Kondratyuk et al. (2009) conforms well to the characters of *C. asserigena*, even though *C. marchantiorum* seems to have a better developed, pale margin (fig. 3). Both species seems to have a fairly variable growth habit depending on the environmental conditions and they may well prove to be conspecific. However, it would require molecular data to confirm this.

Ecology and Distribution

In Denmark Christiansen (1946) reported *C. asserigena* to be common on *Calluna* twigs, particularly in the clefts of old stems, thin *Juniperus* twigs and on *Picea*. He mentioned collections from East and West Jutland and Zealand. Later Degelius (1986) reported it from the island Anholt, based on material collected by M. S. Christiansen in 1941. Søchting & Frøberg (2003) described it from thin twigs of *Helianthemum oelandicum* on Öland in the Baltic Sea. After an intensive search,



Figure 1. *Marchantia asserigena*. Thy. Hanstholm Reservatet. US 12.238 (C). Scale: 500 μ m.

it has since been found on thin, dead twigs of dwarf bushes like *Calluna*, *Empetrum* and *Vaccinium* in heathlands both in Jutland and Zealand.

In Coppins (2004) *C. asserigena* was presented as new to the British Isles and a number of records listed. Since then it has been found to be fairly common, particularly in western areas (GBIF). There are still relatively few reports of this species from other parts of Europe.

Biogeography

The genus *Marchantia* originally included five species from the Southern Hemisphere (Kondratyuk et al. 2014), where it is particularly well represented in Australia. As no other species of *Marchantia* have been identified from the Northern Hemisphere, it seems most probable that the genus diversified in the south, and that colonization of the north took place at a later time.

If molecular studies confirm the conspecificity of *C. asserigena* and *C. marchantiorum* this would provide an additional example of fairly recent migration between the two Hemispheres. Similar cases are known among Teloschistaceae where migrations have taken place so recently that northern and southern populations have not diversified to species level. For example, *Austroplaca soropelta* is so far the only species of this genus known to have migrated to the Northern Hemisphere (Søchting & Castello 2012).

If *C. asserigena* is not conspecific with any Southern Hemisphere species, it would probably have been in the Northern Hemisphere for sufficient time to speciate, or for its ancestor from the south to become extinct.



Figure 2. *Marchantiana asserigena*. Lectotype. Scale: 500 µm.

Nomenclature

***Marchantiana asserigena* (J. Lahm) Søchting & Arup, comb. nov.**

MycoBank: MB825549

Basionym: *Callopisma asserigenum* J. Lahm, Zusammenst. Westfal. Flech.: 107 (1883). Lectotype (here selected): **Deutschland**. *Nordrhein-Westphalen*: An Bretterzäunen zu Welbergen. August 1862. Lahm (M-0289846!). ≡ *Caloplaca asserigena* (J. Lahm) DT & Sarnth., Die Flechten von Tirol, Voralberg und Lichtenstein: 196 (1902).

Note: The name *Callopisma asserigenum* is here lectotypified with a specimen in the Arnold Herbarium (M) (fig. 2) mentioned in the paper of Lahm (1883).

Material studied: *Marchantiorum asserigena*: **Denmark**. *Jutland*: Agri Sg., Femmøller, 1945-08-15, M.S. Christiansen 12.801 (C); Thy, Hanstholm Naturreservat, dead *Salix* twigs, 2016-07-30, U. Søchting 12.238 (C); dead *Vaccinium uliginosum* twigs, 2016-08-02, L.S. Espersen (C); Thy, Nørre Vorupør, 2016-05-03, U. Søchting (C); Thy, Lodbjerg Klitplantage, dead *Salix* twig, 2016-06-14, L.S. Espersen (C); Thy ; ANHOLT, Ørkenen, on *Calluna*, 1941-07-10, M.S. Christiansen 6552,b (C); *Sjælland*: Melby Overdrev, on *Calluna*, 2015-11-16, U. Søchting 12.490 (C); 2016-09-21, U. Søchting 12.525 (C). **Germany**. *Bayern*., zwischen Baierbrunn und Eberhausen, 1888-08-25. F. Arnold (M); **Sweden**. *Öland*: Ås sn., Näsby, S of Parboängsvägen, 1999-06-18. Fröberg (LD), 2015 Arup L15635 (LD); **Switzerland**. *Uri*: Altdorff, alten planken, A. Gisler (ZT).



Figure 3. *Caloplaca marchantiorum*. Holotype. Scale: 500 μ m.

Caloplaca marchantiorum: **Australia.** *New South Wales*: North Western Slopes, between Delungra and Warialda, along the Gwydir Highway, *Eucalyptus* woodland, on bark, 2004-01-17, S. Kondratyuk 20458 (CANB, holotype) (fig. 3).

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