

Comments on Mertens et al. (2022): the taxonomic identity of *Miracanthodinium setiferum* (Lohmann) Deflandre (Dinophyceae incertae sedis) remains elusive, and its epitypification is not achieved

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LETTER TO THE EDITOR

Comments on Mertens et al. (2022): the taxonomic identity of *Micracanthodinium setiferum* (Lohmann) Deflandre (Dinophyceae incertae sedis) remains elusive, and its epitypification is not achieved

ABSTRACT

Micracanthodinium setiferum is a very distinctive but poorly known dinophyte with characteristically delicate, unbranched, filiform and pointed setae. A recent study by Mertens et al. (2022, *Palynology* 46: 1934908) aims to clarify the taxonomy of the species and to introduce two new formae acknowledging the presence or absence of setae in environmentally collected cells. We assert that the epitype choice of illustrations by these authors is inappropriate, but also not achieved following the rules of the *International Code of Nomenclature for algae, fungi, and plants* (ICN). Additionally, the two new formae are not described in accordance with the rules of the ICN. A more suitable epitype may therefore be chosen, once corresponding physical material from the type locality off Sicily is at hand. The taxonomic identity of *M. setiferum* meanwhile remains elusive.

KEYWORDS

Dinoflagellates; DNA sequence; epitype; microscopy; Sicily; taxonomy

Comments on Mertens et al. (2022), *Palynology* 46: 1934908

Unicellular *Micracanthodinium setiferum* (Lohmann) Deflandre is a highly distinctive but poorly known dinophyte, first described from the Mediterranean Sea off Sicily (Lohmann 1903). The most important distinguishing trait is the development of delicate, unbranched, filiform and pointed setae, a feature unique among dinophytes. The original drawing by Hans Lohmann (1863–1934), here reproduced as [Figure 1](#), shows four setae originating from the episome and five from the hyposome. Lohmann (1903) described the dinophyte as having no theca and, despite the greenish-yellow colour, he did not observe chloroplasts. *Micracanthodinium setiferum* was initially introduced as a species of *Cladopyxis* F.Stein (the original description is available at <https://ia902508.us.archive.org/21/items/wissenschaftlich71903komm/wissenschaftlich71903komm.pdf>), but was transferred to *Micracanthodinium* Deflandre based on the presence of setae and presumed absence of thecal plates (Deflandre 1937).

Using scanning electron microscopy (SEM), Dodge (1995) was the first to report a thecal tabulation pattern for *Micracanthodinium* based on field samples, but he provided no rigorous explanation for the identification of *M. setiferum*. Moreover, it seems Dodge (1995) had studied two different organisms (Gottschling et al. 2021; Mertens et al. 2022). This raises doubts over the correct taxonomic assignment of at least some of the material he investigated. In a recent SEM study of field samples, Mertens et al. (2022) documented a thecate dinophyte with a cladopyxidoid plate configuration, to which they assigned the name *M. setiferum*. These authors essentially agreed with the interpretations of Dodge (1995), but corrected and more precisely interpreted the plate labelling.

Regarding the delicate long and pointed setae diagnostic of *Micracanthodinium*, Mertens et al. (2022) reported their observations in words only and, like Dodge (1995), did not present images. Nor did they provide measurements of the delicate processes, and the number of seta was ambiguously described. As reported by Mertens et al. (2022), a seta may emerge from each thecal plate (except the cingular and sulcal plates), but they did not show or mention the characteristic number and arrangement of setae (i.e. one antapical and four pairs of pre- and postcingulars) reported by Lohmann (1903; Fig. 1), thus not meeting the description of the protologue. Mertens et al. (2022) interpreted the setae that they presented in SEM images as being broken due to preparation techniques (Dodge 1995; Mertens et al. 2022). Those short setae are reminiscent of what has been recently described for *Fensomea setacea* Tillmann & Gottschling, but Gottschling et al. (2021) found no indication from cultivated material that 2–6- μ m-long setae were incomplete; these authors did not identify longer setae in light microscopy (LM) prior to SEM preparation.

In SEM, the length of the setae, and their undisturbed arrangement, probably cannot be determined for *Micracanthodinium*. Therefore, it is advisable to show such cells under natural conditions (i.e. of a field sample) in LM and then to document them in SEM after isolation of the cells. Although relevant for their conclusions, Mertens et al. (2022) did not cite Gottschling et al. (2021), but we remaining authors of the latter article continue to assert that still no published study exists that reliably shows the filiform setae of true *Micracanthodinium* in combination with a dinophyte plate pattern. Thus, the taxonomic identity of *Micracanthodinium*, and its relationship to cladopyxidoid (Loeblich 1982; Dodge 1984) or other dinophytes, remains

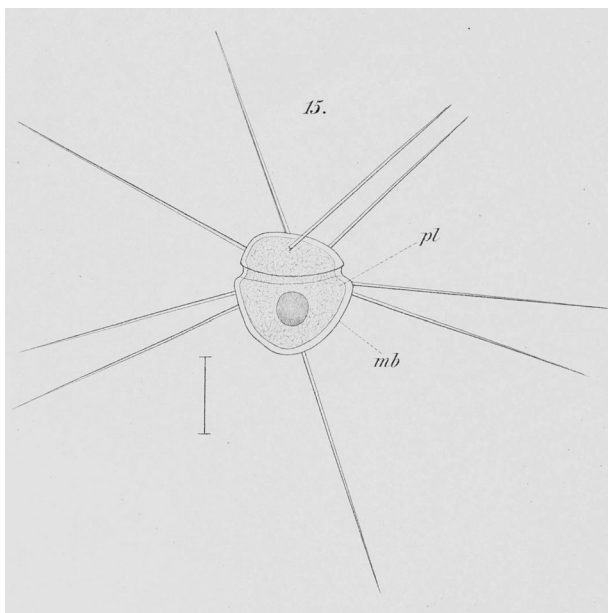


Figure 1. Hans Lohmann's original material of *Cladopyxis setifera* (excerpt of pl. I: 15). Note the characteristic number and arrangement of setae, with 1 unpaired element at the antapical pole and 4 pairs of pre- and postcingular setae. Abbreviations: mb, membrane; pl, plasma. Scale bar: 11.3 μ m.

elusive and conjectural. Gottschling et al. (2021) noted that *Micracanthodinium* might not even possess cellulosic thecal plates (an absence explicitly stated by Lohmann 1903). We therefore consider the identity of the studied material as *Micracanthodinium* to remain disputable. This taxonomic uncertainty is especially pertinent to mention given the decision to designate an epitype for *M. setiferum* (Mertens et al. 2022).

Any scientific name of (at least extant) protists described prior to the present millennium will have some taxonomic uncertainty owing to an absence of DNA sequence information (Boenigk et al. 2012; De Clerck et al. 2013; Romeikat et al. 2019). The taxonomic tool of epitypification has been developed to overcome taxonomic ambiguity and works well in the microscope domain, using contemporary material linked to DNA sequence information (Zinßmeister et al. 2011; Kretschmann et al. 2018; Tillmann et al. 2021). Mertens et al. (2022) used illustrations of field samples for their epitypification of *M. setiferum*. This approach is unfortunate since designation of an epitype would make their interpretation taxonomically irreversible but still fails to provide DNA sequence information.

Mertens et al. (2022) did not fulfil all requirements of the *International Code of Nomenclature for algae, fungi, and plants* (ICN; Turland et al. 2018) when designating the epitype. Namely, ICN Art. 7.11 ['... designation of a type is achieved only... if the typification statement includes the phrase "designated here" (hic designatus) or an equivalent'] and ICN Art. 9.9 ('An epitype is a specimen or illustration ...' – note the singular) are not adhering to *the Code*. The two illustrations designated as epitype show different specimens originating from different Indian Ocean localities. Moreover, they refer to one of their new forms (having no setae), and not to the original material of *Cladopyxis setifera* Lohmann (having distinct setae: Lohmann 1903), here not adhering to ICN Art.

9.9 ('An epitype is ... selected to serve as an interpretative type') and to ICN Art. 9.20 Note 8 ('An epitype supports only the type to which it is linked'). Thus, the epitypification of *M. setiferum* is not achieved. This way is clear for the designation of a more suitable epitype, once corresponding physical material from the type locality off Sicily is available. We emphasise that any approach should provide DNA sequence information in order to settle taxonomic uncertainties.

In five printed lines, Mertens et al. (2022) additionally proposed two new taxa under *M. setiferum* at the rank of forma to account for determination of specimens with and without setae, respectively. The descriptions consist of only two words each ('with setae' and 'without setae') that the conformity with ICN Art. 38.1 is at least questionable. A delimitation (which would be a true diagnosis and not a description as they present it) of the spiny form from the autonym (having the same type as *C. setifera*, see ICN Art. 26) was lacking as well. Most importantly, they designated no type (contravening ICN Arts 7.11, 40.1) and consequently, the two new taxa are not validly published. We urge that greater care must be taken in future taxonomic work of cladopyxidoid and other dinophytes, especially regarding the rules of taxonomy and nomenclature.

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No potential competing interest was reported by the authors.

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