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RESTUDY OF A 19TH-CENTURY DINOFLAGELLATE CYST HOLOTYPE FROM THE POLISH UPPER JURASSIC

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Results are presented of a re-examination of the holotype of *Xanthidium penicillatum*, a species of dinoflagellate cyst first reported by Ehrenberg (1843) from the Corallian of Poland and validly published by him in 1854. It is shown to correspond exactly in morphology with *Systematophora fasciculigera* (Klement, 1960), from the Upper Jurassic of Germany. The new combination *Systematophora penicillata* (Ehrenberg, 1854) is proposed and *S. fasciculigera* is rejected as a subjective junior synonym.

K e y w o r d s: Dinoflagellata, taxonomy, Upper Jurassic, Poland.

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INTRODUCTION

In 1843, the Polish stratigrapher Ludwik Zejszner (also known as Ludwig Zeuschner; 1805—1871) sent a specimen of chert from the Polish Upper Jurassic for examination by the great German microscopist Christian Gottfried Ehrenberg (1795—1876). In his accompanying letter, Professor Zejszner noted: "Ich habe die Ehre eine Schachtel mit Feuersteinen aus dem Coralrag von Podgorze zu senden; alle stammen von einem Bruche". (I have the honour to send a box with flints from the Coral Rag of Podgórze; all come from one quarry).

Ehrenberg published a first report of his study of these cherts in 1843, naming two new species of microfossils he had observed in thin flakes he had prepared. He considered that the microfossils were the silicified zygospores of desmids, treating them as new species of an existing genus and naming them *Xanthidium pilosum* and *Xanthidium penicillatum.* Neither was illustrated, nor was any account given of them; both were thus *nomina nuda.* However, the report of them is of great interest, since it constitutes the first published record, not of desmids, but of dinoflagellate cysts from the Jurassic.

In his massive work *Mikrogeologie* (1854), Ehrenberg published illustrations of both taxa; no description was given, but under Article 44 of the *International Code of Botanical Nomenclature*, the publication of the names accompanied by an illustration showing the essential characters was sufficient to constitute valid publication. These are thus the two earliest Jurassic species of dinoflagellate cysts to be erected.

In 1904 H. Lohmann, correctly concluding that the micro-organisms were not desmids, compared them instead to microscopic planktonic eggs encountered during his studies of the plankton of the Humboldt Current; accordingly he renamed them respectively *Ovum hispidum pilosum* and *Ovum hispidum penicillatum*. The trinomen form he adopted contravened the provisions of the *International Code of Botanical Nomenclature* governing specific names and was thus invalid. Subsequently Otto Wetzel (1933) during a study of microfossils from German Upper Cretaceous cherts, transferred both species to his *incertae sedis* genus *Hystrichosphaera*. The subsequent nomenclatural history of the species *pilosa* is treated at length elsewhere (see Erkmen and Sarjeant 1979). It was Wetzel who gave the first description of the species *penicillata*, as follows (1933: 41): "Shell spherical. Processes broadened at their free ends in fan-, tuft- or brushlike fashion or flaring apart and unravelled (7—12 tufts).

The thin terminal bristles of the various processes may in part be linked together by thin shreds. Processes at the bases sometimes already markedly broad or grown together, thereby producing small round spaces ("basal windows"), separate from one another ("crown or tower-top forms"). A proportion of the separate processes are often simply thin, merely developed into hooklets or knobs at their tips. Appearance of the processes all together sometimes strikingly rhizopod-like. Colour brownish" (Transl.).

Wetzel then proposed three new names for the different morphological variations that he recognized in his Cretaceous assemblages; formae *coronata*, *rhizopodiphora* and *medusettiformis*, forma *coronata* being cited as the "Typical form".

The French microscopist Georges Deflandre, in his work on the microfossils of Upper Cretaceous flints from the Paris region, commented as follows (1937: 27):

"It is truly difficult to obtain an exact idea of the morphology of Ehrenberg's species (*penicillatum*), above all nowadays when one knows many others whose representation, a little simplified, would correspond quite well with the original drawing ... O. Wetzel has distinguished three forms, f. *coronata*, f. *rhizopodiphora*, f. *medusettiformis*, which would appear to me rather to belong to different types. I have not encountered them yet in my materials, or, at least, I have not known that I have recognised them". (Transl.) The species, with its constituent forms, was

nevertheless transferred by Deflandre to his new genus *Hystrichosphaeridium*.

Subsequently the Belgian micropalaeontologist Maria Lejeune-Carpentier elevated two of Wetzel's three Cretaceous forms to specific status and placed them into a third new genus, as *Areoligera coronata* and *A. medusettiformis*: forma *rhizopodiphora* was tentatively synonymised with the latter. Concerning the Jurassic holotype of Ehrenberg's species, she commented (1938: B170):

"The original drawing ... is quite rough. It would be difficult to do better, the type specimen which we have succeeded in locating in the Ehrenberg collection (R L111, no. 3) being, in fact, quite shattered! The shell is not only incomplete, but severely corroded; the flint flake is too thick and opaque. We cannot think of using it and prefer not to reproduce the drawing here. We will state nevertheless, from having discovered in the vicinity of the type several other specimens belonging to the same species, that *penicillatum* is also to be integrated into our genus *Areoligera*". (Transl.).

However, no formal taxonomic transfer of the species to *Areoligera* was made, then or subsequently: and the species *penicillatum* has remained to this day in the genus *Hystrichosphaeridium*, in disuse. When, through the courtesy of Dr. S. Locker (Museum für Naturkunde, Humboldt University, Berlin), I was given the privilege of undertaking a re-examination of Ehrenberg's Jurassic type material, the restudy of the holotype of *penicillatum* was a matter of prime interest. The use of more sophisticated microscopic equipment than was available to the earlier microscopists shows Lejeune-Carpentier's comments and conclusions to be alike unfounded. Though indeed at depth in a rather opaque flint, the holotype of *Xanthidium penicillatum* is a good and well-preserved specimen, in a slightly oblique orientation but with a discernible apical archaeopyle. The species is here generically reallocated and a revised diagnosis is formulated.

SYSTEMATIC DESCRIPTION

Class **Dinophyceae** Pascher
Order **Peridiniales** Haeckel
Suborder **Gonyaulacystineae** Norris, 1978
Family **Systematophoraceae** Sarjeant and Downie, 1974

Genus *Systematophora* Klement, 1960, emend. Stover and Evitt, 1978

Remarks. — The "modified diagnosis" of this genus presented by Stover and Evitt (1978) includes a number of new features. Though it is not presented by those authors as a formal emendation, it appears to deserve citation as such (see International Code of Botanical Nomenclature, Rec. 47A).

Systematophora penicillata (Ehrenberg, 1854), comb. nov., emend.
(pl. 37)

1843. *Xanthidium penicillatum*; Ehrenberg: 61, *nomen nudum*.
1854. *Xanthidium penicillatum*; Ehrenberg: pl. 37, no. 8, fig. 3.
1904. *Ovum hispidum (Xanthidium) penicillatum* (Ehrbg.); Lohmann: 21.
1933. *Hystrichosphaera penicillata* (Ehrbg.); O. Wetzel: 41.
1937. *Hystrichosphaeridium penicillatum* (Ehrbg.); Deflandre: 27.
1938. *Hystrichosphaera penicillata* (Ehrbg.); Lejeune-Carpentier: B169—B170.
1960. *Systematophora fasciculigera* Klement: 65—66, pl. 9: 11, 12; pl. 10: 8.
1964. *Systematophora fasciculigera* Klem.; Sarjeant: tab. 3.
1964. *Hystrichosphaeridium penicillatum* (Ehrbg.); Downie and Sarjeant: 121.
Systematophora fasciculigera Klem.; Downie and Sarjeant: 146.
1967. *Systematophora fasciculigera* Klem.; Sarjeant: tab. VII.
1971. *Systematophora fasciculigera* Klem.; Davey and Verdier: 35, pl. 6: 10—11.
1971. *Systematophora fasciculigera* Klem.; Eisenack and Kjellström: 1003.
1972. *Systematophora fasciculigera* Klem.; Riley and Sarjeant: tab. 2.
1972. *Systematophora fasciculigera* Klem.; Habib: 368, pl. 8: 2
1973. *Hystrichosphaeridium penicillatum* (Ehrbg.); Lentin and Williams: 78.
Systematophora fasciculigera Klem.; Lentin and Williams: 133.
1974. *Systematophora fasciculifera* (*sic*) Klem.; Williams, Jansa, Clark and Ascoli: 11.
1976. *Systematophora fasciculigera* Klem.: Ioannides, Stavrinos and Downie: 461, pl 4: 14—15.
1977. *Hystrichosphaeridium penicillatum* (Ehrbg.); Lentin and Williams: 84.
Systematophora fasciculigera Klem.; Lentin and Williams: 159.
1978. *Systematophora fasciculigera* Klem.; Sarjeant: 25, fig. 9.
1978. *Hystrichosphaeridium penicillatum* (Ehrbg.); Stover and Evitt: 56.
Systematophora fasciculigera Klem.; Stover and Evitt: 84.
1979. *Systematophora fasciculigera* Klem.; Barss and Williams: 16, 19, 21, 34, 53, 59, 61, 62.
?1979. *Systematophora* cf. *S. fasciculigera* Klem.; Barss, Bujak and Williams: 62.

Type specimen. — Ehrenberg Collection, box 53, book 5, slide LXXIII, flake bb1 (second flake, with blue ring).

Type locality and horizon. — "Corallian" (Upper Oxfordian), Podgórze, Cracow, Poland.

Derivation of name. — Latin, *penicillus*, painter's brush, tuft.

Emended diagnosis. — Cyst subspherical, with an apical archaeopyle, and with surface smooth to faintly ornamented. No parasutural features, but a tabulation indicated by penitabular process groups, according to the formula ?3—4′, 6″, 5—6c, 1p, 1‴′, ?Os. The paracingular processes are paired, arising from the two ends of more or less rectilinear ridges; they bifurcate, trifurcate or ramify distally. Sulcal processes were not observed, but may be present on some individual cysts. All other plates are indicated by well-spaced annulate process complexes of moderate size. The processes arise from a basal ridge and show a variable degree of proximal fusion; they may also be linked to adjacent processes in their distal sections by short trabeculae, but no distal ring-trabecula is developed. Instead, the tips of the processes are free; they may be bifurcate, with bifurcations of equal or unequal length that sometimes connect with those of adjacent process, or they may ramify in antlerlike fashion. The process complexes thus resemble very ragged and torn tubes, frayed at their ends. The total length of the processes is typically less than one-half of the cyst diameter.

Dimensions. — Lectotype: overall length 58 μm, breadth 50 μm, maximum length of processes c. 24 μm. Other specimens in Ehrenberg's flakes too poorly presented for

measurement. German specimens (Klement 1960): length 58 μm, breadth 43—58 μm, length of processes 17—29 μm. (Note: though Klement noted having seen "more than 200" specimens, only the measurements of three specimens were quoted). English specimens (Ioannides, Stavrinos and Downie 1976): length 40—70 μm, breadth 40—65 μm, length of processes up to 25 μm.

Remarks. — In all major morphological aspects, Ehrenberg's specimens of *Xanthidium penicillatum* corresponds with the diagnosis, description and figures of the species *Systematophora fasciculigera* Klement, 1960. The latter is thus a subjective junior synonym of Ehrenberg's species. Since Klement's species has only rarely been reported, the rejection of the name he proposed involves no great problems for palynologists, certainly not sufficient to justify its conservation under Article 14 of the *International Code of Botanical Nomenclature*; instead, the name *fasciculigera* must be rejected, under Article 63 of that Code.

Systematophora penicillata (Ehrenberg) differs from the type species, *S. areolata* Klement, 1960, and from *S. valensii* (Sarjeant, 1960) in that its processes show a higher degree of anastomosis and more elaborate distal branching. It differs from *S. orbifera* Klement, 1960 in having markedly smaller annulate process complexes; and from the only other Jurassic species, *S. ovata* Gitmez and Sarjeant, 1972, in being more distinctly spherical and having processes of markedly greater length.

This species has been recorded from the "Corallian" (Upper Oxfordian) of Poland (Ehrenberg 1843); the Upper Jurassic (Malm Upper Alpha — Lower Delta) of Germany (Klement 1960); the Kimmeridge Clay (Wheatleyensis Zone) of England; the Upper Jurassic of the Scotian Shelf Grand Banks, offshore eastern Canada (Williams *et al.* 1974; Barss *et al.* 1979) and the late Jurassic of an Atlantic deep-sea core (Habib 1972). The forms from the Albian of Paris attributed to this species by Davey and Verdier (1971) were considered by those authors to be reworked from Jurassic strata; the single Berriasian specimen reported by Barss *et al.* (1979: 19) also may well have been reworked. The probable range for the species is thus late Oxfordian to middle Kimmeridgian.

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ZBADANIE HOLOTYPU DINOFLAGELLATA OPISANEGO W XIX W. Z GÓRNEJ JURY POLSKI

Streszczenie

Zbadano na nowo holotyp *Xanthidium penicillum*, gatunku cysty Dinoflagellata notowanego przez Ehrenberga (1843) z oksfordu Polski i opisanego przez tego autora w 1854 roku. Morfologicznie odpowiada on *Systematophora fasciculigera* Klement, 1960 z górnej jury niemieckiej. Zaproponowano nową kombinację *Systematophora penicillata* (Ehrenberg, 1854), a nazwę *S. fasciculigera* odrzucono, jako młodszy synonim.

EXPLANATION OF THE PLATE 37

Systematophora penicillata (Ehrenberg, 1854) comb. nov., emend. The holotype. Upper: photomicrograph of the upper (ventral) surface of the specimen, set obliquely so that the apical archaeopyle is not in view. Lower: drawing to show the character and distribution of the process complexes.