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MYXOSPORIDA FROM THE DEEP-SEA FISH, MACROURUS BERGLAX, OFF NEWFOUNDLAND AND ICELAND

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Abstract. *Auerbachia pulchra* sp.n. is described from the gall bladder of the deep-sea fish, *Macrourus berglax*, collected in the North Atlantic. Taxonomic affinities of the genus are discussed; a new genus, *Globospora* g.n., is proposed for *A. sphaerica* Evdokimova. Both genera belong to the suborder Eurysporea.

With growing interest in marine fish protozoa, more data are being collected on those parasitizing deep-sea fish. Yoshino and Noble (1973) surveyed the relevant knowledge concerning macrourid fish, which form a relatively high percentage of this fauna. They gave a preliminary description of a new *Auerbachia* species, collected earlier by Lom and Laird from Newfoundland waters. This paper finalizes the description.

MATERIAL AND METHODS

Auerbachia pulchra sp.n. was found in roughed grenadiers, *Macrourus berglax* Lacépède, 1802 caught near Newfoundland at the north eastern edge of the Grand Banks (48° North, 49° West) in depths of about 225 meters. All of the five fish examined were parasitized, the infection being rather heavy. Four of the infected hosts also harboured new species of *Nosema* in the intestinal tissue and *Eimeria* (*Goussia*) in the kidneys (illustrations published by Lom 1970). This material was studied while still alive, on board of the research vessel "A. T. Cameron". Later, in the laboratory, photographs of live spores were taken by the Zeiss compound microscope using the agar method described by Lom (1969). The descriptions and measurements are thus based on unpreserved, live spores, while for additional details some staining methods (Heidenhain's iron haematoxylin, Giemsa's and PAS) were also used.

Further material was obtained from three specimens of *M. berglax* collected in 1949, 1964 and 1970 near Hellenbank, Iceland, at a depth of about 234 meters, the fishes being preserved in alcohol and deposited in the British Museum (Natural History) London; and from three more caught off the Newfoundland coast in depths of 235 to 400 meters in April 1970. The latter material was brought to the laboratory in frozen state, measurements and drawings being made on preserved and/or stained material.

Auerbachia pulchra sp. n.

Vegetative forms were found floating freely within the bile. They were usually much less conspicuous than mature spores. Plasmodia were always very elongated and irregular, tapering into long prolongations at one end. They had a rather thin ectoplasmic layer, their surface being covered by irregularly-located, filiform projections. The endo-

plasm with developing pansporoblasts did not exhibit any distinctive features. The length of the plasmodia reached as much as 200 μ.

No pathological changes could be observed in the infected gall bladders.

The spores are slightly curved, club-like structures. They are broadly oval anteriorly, thinning out into a straight or slightly-curved caudal prolongation, the end of which swells somewhat into a bulbous, bluntly-rounded tip. The shell chamber extends into the caudal prolongation. The two unequal, asymmetrical shell valves join along a suture line. This is rather difficult to distinguish, since the borders of the valves are not markedly thickened. Only at the anterior extremity of the spore does the suture

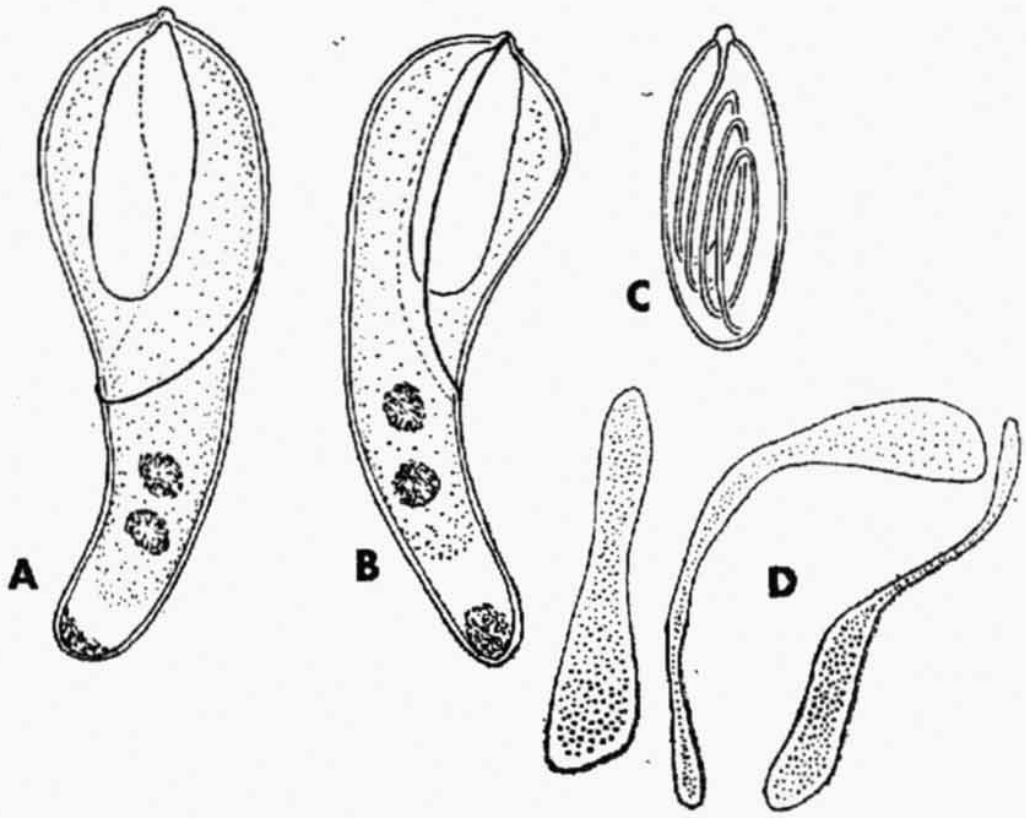


Fig. 1. A, B — two aspects of the spore; C — polar capsule with the coiled polar filament; D — shape of trophozoites.

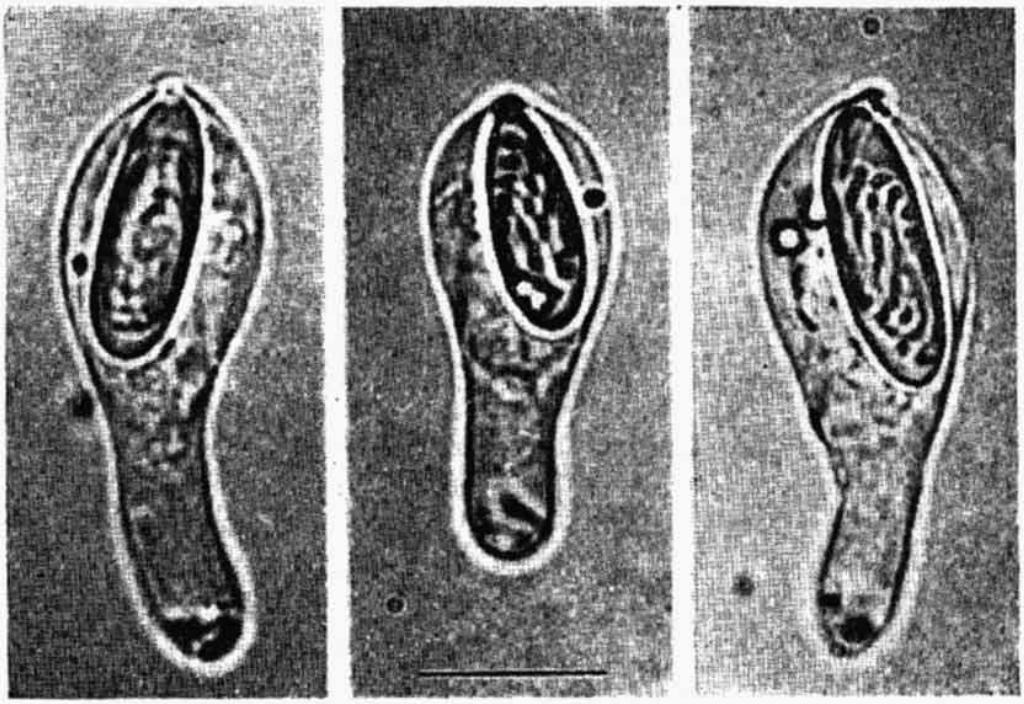
protrude to form a nipple-like structure in side view. Only the larger of the two valves forms the posterior prolongation, the smaller one not reaching beyond the end of the broadly oval anterior region.

The single, very elongated polar capsule has a thick wall protruding at the anterior apex to form a tubercle about 1 μ high. From there starts the inverted polar filament, evident as three to five very oblique, almost longitudinal coils traversing the capsule. In immature capsules, the adhering relicts of the capsulogenic cell nucleus can be seen. When exposed to concentrated urea solution (Lom 1964) the polar filament readily everts. The polar capsule wall gives a PAS-positive reaction. A heavier ring-like deposit of PAS positive material surrounds the place of filament insertion.

The sporoplasm is of irregular shape. Situated in the bulbous anterior half of the spore it reaches into the posterior prolongation but does not occupy nearly the whole space of the spore. The two oval nuclei are situated in the posterior half of the spore.

Material from Newfoundland and Iceland is morphologically comparable. However, there were some discrepancies in the dimensions. These were at least partly accounted

for by the shrinkage due to the preservation of the Iceland specimens in alcohol, the material from the Grand Banks having been measured alive. The differences are within the range of size variations known for other myxosporidan species.



Figs. 2, 3, 4. — Microphotographs of three different spores (scale = 10 μ).

DISCUSSION

To our knowledge, this is the second finding of a true *Auerbachia* species (*A. sphaerica* Evdokimova, 1973 will be discussed later) since this genus and its two species (*A. anomala* and *A. monstrosa*) were first described by Meglitsch (1968). The differing dimensions of the spores are not the main criteria for differentiation of *A. pulchra* from Meglitsch's two species (Table 1). In fact, the differences in size could well fall within the range of natural variation of a single species. There are important differential features, however. *A. anomala* has very much larger vegetative stages, its trophozoites

Table 1.

	Auerbachia anomala (data of Meglitsch 1968, on live spores)	*A. monstrosa* (data of Meglitsch 1968, on live spores)	*A. pulchra*	
			live spores from Grand Banks locality	preserved spores from Iceland locality
length of spore	22 (20–24) μ	25 (21–28) μ	30 (26–34) μ	22 (17–18) μ
width of spore	13 (11–14) μ	9 (9–10) μ	11 (11–12) μ	8 (7–10) μ
length of capsule	9 (8–10) μ	11.2 (9.8–13.2) μ	12 (9–14) μ	10.1 (7.5–13.5) μ
width of capsule	3 (2.8–3.4) μ	4.3 (3.9–4.9) μ	4 (3.5–5) μ	3.9 (3–5.5) μ

reaching up to 4×2 mm (vegetative stages are unknown in *A. monstrosa*). Both species have spores considerably more curved and with a much narrower caudal prolongation than *A. pulchra*. Moreover, the polar filament of *A. monstrosa* has coils of distinctly diminishing diameter. These characters warrant the independent specific status of *A. pulchra*, the host and locality of which are different from Meglitsch's, too.

Meglitsch's diagnosis of the genus *Auerbachia* must now be emended, in view of the existence of two shell valves, as follows:

Myxosporida with a single, elongated polar capsule containing an almost longitudinaly coiled polar filament and with two unequal shell valves, joined by a delicate suture. The discharge pore of the capsule is located in the apex close to the suture line. The posterior part of the spore is extended as a hollow prolongation, its cavity being continuous with the spore cavity. No iodinophile vacuole. Coelozoic in marine fishes.

Evdokimova (1973) described as *A. sphaerica* a species from the gall bladder of *Austroatherina incisa* collected off the Argentinian coast. However, this species lacks three characters essential to the above generic diagnosis: it has a regularly sphaerical shape and a pear-like, much shorter polar capsule discharging quite apart from the suture line. Thus there is no reason to associate this species with *Auerbachia* and her species has to be included in another genus. Since, however, there is no genus with characters complying with the features of "*A.*" *sphaerica*, we propose to establish for it a new genus, *Globospora* g. n. The diagnosis is as follows:

Myxosporida of an almost globular shape, with a single, pear-like polar capsule with an obliquely-coiled polar filament. The discharge pore is located some distance from the suture line of the two shell valves, which are slightly unequal. Coelozoic in marine fishes.

Globospora g. n. can be placed in the family Sphaerosporidae; thus there is no necessity to create a special new family Auerbachiidae, to accomodate both *Auerbachia* and *Globospora*, as Evdokimova (1973) proposed.

Taxonomic affinities of *Auerbachia*. Myxosporidan genera with a single polar capsule—*Thelohanellus*, *Unicapsula*, *Coccomyxa*, *Phlogospora*, *Auerbachia*, and the recently described genera *Pileispora* and *Parapileispora* (Naidenova and Zaika 1970) have little in common. They may well be products of several independent evolutionary lineages sharing just the simplifying trend to preserve but one capsule per spore. In *Thelohanellus*, there is a clear relation to *Myxobolus; Pileispora* and *Parapileispora* belong to the Multivalvulea. The remaining genera, however, defy reliable tracing of their phylogenetic relationship within the framework of myxosporidan taxonomy, which is based upon the spores and to a considerable extent artificial. Thus *Coccomyxa*, *Unicapsula* and *Phlogospora* were alloted quite different positions in the taxonomic schemes of Kudo (1933, 1970), Meglitsch (1960, 1973) and Shulman (1966).

Auerbachia somewhat resembles *Unicapsula*, in which the polar capsule is also elongated and the valves asymmetrical; here all resemblance stops. The extended cavity of one spore valve reminds one of the prolongations in the valves of *Ceratomyxa*. It also resembles a similar asymmetrical prolongation of only one spore valve in *Parvicapsula unicornis* (Kabata 1962). In the absence of more substantial criteria, the best solution seems to assign *Auerbachia* among the thin-walled, coelozoic genera like the two just mentioned parasites of marine fishes, i.e. in the suborder Eurysporea in Shulman's (1966) wider conception.

MYXOSPORIDA ОТ ГЛУБОКОВОДНОЙ РЫБЫ *MACROURUS BERGLAX* НЕПОДАЛЕКУ ОТ НЬЮФАУНДЛЕНДА И ИСЛАНДИИ

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Резюме. Дано описание нового вида миксоспоридии *Auerbachia pulchra* sp. n. из желчного пузыря глубоководной рыбы *Macrourus berglax*, добытой в Северном Атлантике. Обсуждается таксономическая принадлежность данного рода; для *A. sphaerica* Evdokimova представлен новый род *Globospora* g.n. Оба рода относятся к подотряду Eurysporea.

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