SOME NEW SPOROZOON PARASITES OF QUEENSLAND FRESHWATER FISH.

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With Plates XLIII–XLVII.

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THE material for this paper was collected during an investigation of the recent epidemic amongst freshwater fish in Central Queensland. We are indebted to several of the officers of the Longreach Shire Council for some of the specimens obtained. All the fish examined were taken in the Thomson River at Longreach, with the exception of one, *Sciœna australis*, which was captured in the Brisbane River in the vicinity of Ipswich. All the specimens have been kindly identified for us by Mr. J. Douglas Ogilby of the Queensland Museum. We have used the classification given by Auerbach ("Die Cnidosporidien eine monographische Studie," Leipzig, 1910).

MYXOSPORIDIA.

Family MYXIDIIDÆ.

MYXIDIUM THERAPON n. sp.

Figs. 1, 9, 12.

Hosts:—*Therapon carbo* Ogilby and McCulloch; and *Therapon hillii* Castelnau.

This parasite was found infesting the gall bladder of both these *Therapons*. Only one specimen of *T. carbo* was secured. Of thirteen examples of *T. hillii*, the common "black bream" or "grunter" of the Thomson River, nine were infected. It apparently has no harmful effect upon its host. When the gall bladder of a parasitised individual

is slit open, numerous round filmy pieces of matter float out with the bile. These are the plasmodia. They are of a pale yellowish to green colour, and vary in diameter from 3 to 12 mm. The small forms are young plasmodia and contain no mature spores, while the largest have abundance of them. In life the protoplasm can be distinguished into a clear narrow ectoplasm, about ten micra in width and a coarsely grained endoplasm. When placed in bile, diluted with normal saline, the plasmodia do not seem capable of actually changing their position, but undulations may be seen to travel round the margin of the organism. The plasmodium is very delicate and easily injured. In some cases the bile was swarming with myriads of ripe spores, in other cases of less advanced infection they were much less numerous.

The spore is spindle shaped and sharply pointed at both extremities. The polar capsules are more or less rounded structures lying one at either end of the spore. There are two medianly situated nuclei. Faint longitudinal striations are visible. The average dimensions are:—length of spore $9-10\mu$, breadth 4μ; length of polar capsule $2-3\mu$, breadth $1-2\mu$.

Auerbach[1] has recorded 11 described species of *Myxidium* from fish. They are most commonly found in the gall bladder.

Myxosoma ogilbyi n. sp.

Figs. 2, 17.

Host:—The golden perch, *Plectroplites ambiguus* Richardson.

In three out of nine specimens examined tiny white cysts were observed in the white fibrous tissue of the gill arch, usually close to the bases of the filaments. The cysts were quite small, being on the average less than a millimetre in

[1] Auerbach, "Die Cnidosporidien," pp. 170-3, 1910.

diameter; they were not at all abundant—five being the greatest number found on any single gill arch. Sections revealed the structure usually present in a myxosporidian cyst.

The spore is egg-shaped, the anterior end being pointed. There are two polar capsules situated anteriorly. The protoplasmic body contains a single nucleus. The inner margin of the envelope is indented posteriorly. The average dimensions are:—Length of spore 11 – 13μ; breadth 6 – 8μ; thickness 5μ; length of polar capsule 5 – 6μ; breadth of capsule 2μ. An iodinophilous vacuole has not been demonstrated, the lack of this characteristic placing the species in the genus *Myxosoma*. It closely resembles *Myxosoma dujardini*, a European species, from the gills of *Scardinius erythrophthalmus* and *Leuciscus rutilus*, both in shape and size, but is distinguished from it by the presence of the indentations referred to.

We have named the species as a recognition of Mr. D. Ogilby's assistance.

Family MYXOBOLIDÆ.

Myxobolus plectroplites n. sp.

Host:—Golden perch or yellow belly, *Plectroplites ambiguus* Richardson.

Spores were first noticed in a stained smear from the kidney. Cysts were not observed with the naked eye in this or in any other of the nine specimens of perch examined, but in two other cases, however, on careful microscopic examination a few spores were found. On sectioning a piece of kidney known to be infected, a few small cysts about 60μ in diameter were discovered. In two specimens of perch, *Myxobolus*, spores were detected in the gall bladder; these proving to be extremely like those from the kidney. It was only on prolonged examination that the

infection of the gall bladder was noticed, hence the percentage infection may be much higher than it appears. This parasite was detected in four out of nine golden perch examined; in two cases in the kidney only, in one case only in the gall bladder; and one instance in both gall bladder and kidney.

In sections of the kidney the cysts are found to lie in the connective tissue of the organ. They are exceedingly small, the following being the measurements of six taken at random:—·036 mm. in diameter; ·024 × ·048 mm.; ·06 × ·04 mm.; ·076 × ·072 mm. (shewn in microphotograph); ·116 × ·084 mm.; ·144 × ·1 mm. The two latter were relatively large cysts. No definite structure could be made out. The spore is a rounded oval, and bears quite a close resemblance to *Myxobolus hylæ*, which we have recently described from the golden frog, *Hyla aurea*. It is, however, slightly shorter, the polar filaments are not so long, while the vacuole is apparently not iodinophilous. The average dimensions are:—Length of spore, 10 – 12μ; breadth of spore 7 – 8μ; length of polar capsule 5μ; breadth of polar capsule 2μ; length of polar filament 30 – 40μ.

Auerbach (pp. 39 – 44) records 28 species of *Myxobolus* from fish, three of which are undescribed. They may occur in practically any organ of the body. Some are found in a great variety of situations within the same host, e.g. *M. pfeifferi* inhabits the intestines, spleen, ovary, muscles and neurilemma (?); whilst others like *M. oculi-leucisci* from the aqueous chamber of *Leuciscus rutilus* are apparently restricted to one organ. They have been rarely recorded from the gall bladder but commonly from the kidney.

Henneguya australis n. sp.

Figs. 4, 5, 11, 14, 16.

Host:—The golden perch, *Plectroplites ambiguus* Richardson.

This parasite was found as tiny rounded white cysts on the gill filaments. In all cases observed, the infection was extremely light. It occurred in four out of nine specimens of perch examined. In sections of an infected filament the cyst was seen to lie embedded in the spongy tissue, and in many cases occupying a relatively large area of the section. The cyst exhibits the usual three well defined layers—the outermost clear ectoplasm, an inner layer of developing spores, while the whole mass of the cyst within this is filled with mature spores. The latter appear to lie in a definite manner, the long axis of the spore commonly being at right angles to the boundary of the cyst, the anterior end of the spore pointing outwards. The spores, then, seem to radiate from the central portion of the cyst.

The spore is greatly elongated, pointed somewhat anteriorly, while the posterior margin of the envelope is drawn out into a long tapering process or tail. When freshly liberated from the cyst, the tail appears single, but the two halves soon separate and usually diverge widely, giving the appearance of a double appendage. At the anterior end of the spore are two polar capsules which lie parallel and quite frequently are of different lengths, in one or two instances of a malformed spore they were seen to lie one behind the other. The posterior end of the spore is occupied by the amœbula containing two nuclei and a small vacuole. The average dimensions are:—Length of spore $11-15\mu$; breadth of spore $3-5\mu$; thickness of spore $3-4\mu$; length of polar capsule $5-6\mu$; breadth of polar capsule $1-2\mu$; length of tail process about 20μ.

HENNEGUYA GRACILIS n. sp.

Figs. 6, 8, 10.

Host:—Black bream, *Therapon hillii* Castelnau.

This parasite closely resembles the preceding one, but it makes definite narrow pear-shaped cysts in the filaments,

these cysts lying transversely, *i.e.* at right angles to the long axis of the filament. The spores are arranged with long axes parallel to that of the cyst. Infection was observed in eight out of thirteen specimens of bream, but only in one case was it at all severe.

The spore is extremely like that of the preceding, but is slightly smaller while the tail is longer in proportion. The average dimensions are:—Length of spore $10-14\mu$; breadth of spore $2{\cdot}5-3\mu$; thickness of spore 3μ; length of polar capsule $5-6\mu$; breadth of polar capsule $1-2\mu$; length of tail process about $20-26\mu$.

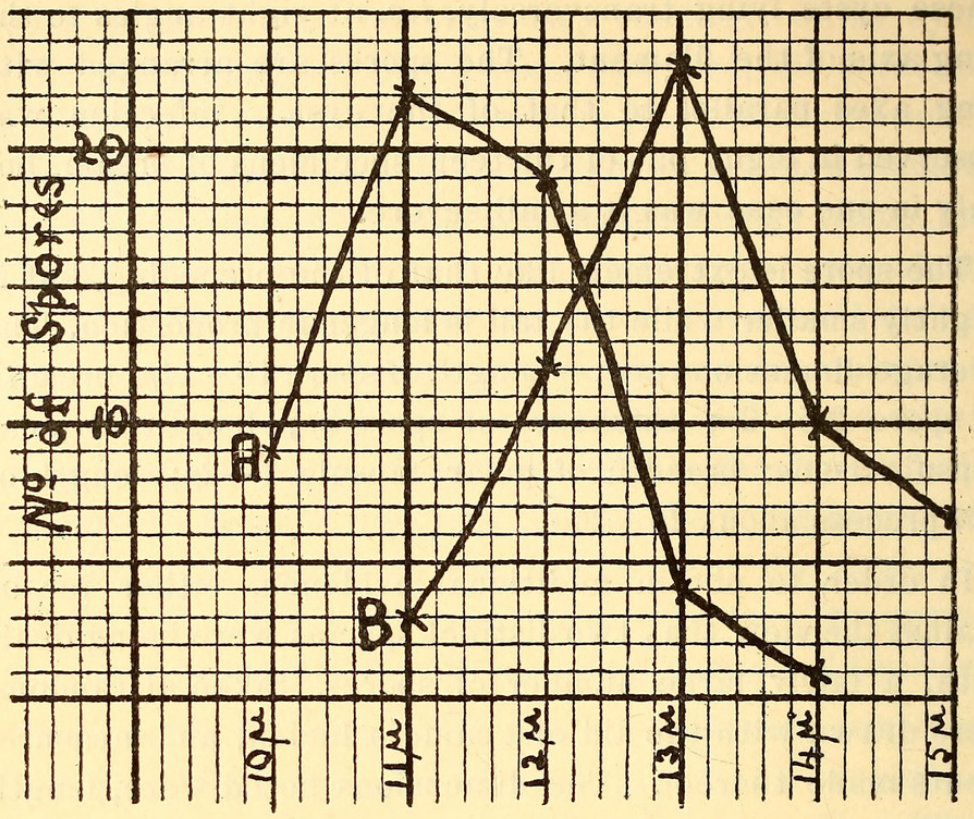
In order to obtain additional evidence, either for or against the view that two distinct species were being dealt with, a fairly large number of spores, taken at random, were drawn with the aid of a camera lucida, and measurements made thereof. The dimensions noted were, length and breadth of spore, and length of polar capsule.

The average dimensions founded on these measurements were:—

Species.	Length of spore	Breadth of spore	Length of polar capsule.
H. gracilis	$11{\cdot}38\mu$	$2{\cdot}74\mu$	$5{\cdot}22\mu$
H. australis	$13{\cdot}1\mu$	$3{\cdot}68\mu$	$5{\cdot}66\mu$

The results of plotting the lengths measured against the number of spores in each case are given below. The empirical mode in the case of *H. gracilis* will be seen to be 11, and in the case of *H. australis* 13. There was not sufficient variation in the other dimensions to render a graphical representation of any value.

Auerbach (1910, pp. 183–186) has recorded 18 species of *Henneguya*, from fish, two of which were undescribed. The various species inhabit almost every organ of the body but are rather more usually found in the ovary, gills and connective tissue.



Length of spore—A. *Henneguya gracilis;* B. *H. australis.*

HENNEGUYA sp.

A number of spores of a *Henneguya* were detected in scrapings of the gill of one out of four specimens of the slender bony bream, *Nematalosa elongata* Macleay. The slide having become mislaid, we are unable to give further particulars.

MICROSPORIDIA.

PLEISTOPHORA SCIÆNÆ n. sp.

Figs. 7, 13.

The ovary of a single specimen of *Scicena australis* Gunther,[1] the so-called perch of the Brisbane River, examined by us, was found to contain small white cysts. Each cyst was seen to be filled with myriads of tiny spores. When sections of the infected portion were examined, it was obvious that the parasite had originally taken up its

[1] Syn. *S. canina* de Vis. See Ogilby Mem. Qld. Mus. 6, 1918, p. 75.

position in the connective tissue covering the ovary, but as growth proceeded, the cyst had come to press down among the developing ova, though it was still surrounded by a hypertrophied layer of this tissue.

The spore is a tiny pyriform structure with a mass of more deeply staining material at the narrower end. The average length is $3-5\mu$, while the breadth is $2-3\mu$. Its morphological characteristics and the formation of an indefinite number of spores relegate this organism to the genus *Pleistophora*.

Host.	Parasite.
Nematalosa elongata	*Henneguya sp.*
Plectroplites ambiguus	*Myxosoma ogilbyi* J. and B.
	Myxobolus plectroplites J. and B.
	Henneguya australis J. and B.
Scicena australis	*Pleistophora sciœnæ* J. and B.
Therapon carbo	*Myxidium therapon* J. and B.
Therapon hillii	*Myxidium therapon* J. and B.
	Henneguya gracilis J. and B.

All figures (1 – 9) on Plates XLIII and XLIV have been drawn to the same magnification, (see scale beside fig. 1). The photo-micrographs have not been retouched in any way. References to lettering:—*c*, cyst; *c.t.*, connective tissue surrounding cyst; *d.s.*, developing spores; *ect.*, ectoplasm; *end.*, endoplasm; *g.t.*, gill tissue; *k.t.*, kidney tissue; *ov.*, ovum; *s.*, spores; *s.f.*, skeleton of gill filament.

EXPLANATION OF PLATES.

Plate XLIII.

Fig. 1. Group of spores of *Myxidium therapon.* × 1250.
„ 2. *Myxosoma ogilbyi.* × 1250.
„ 3. *Myxobolus plectroplites.* × 1250.
„ 4. *Henneguya australis.* × 1250.
„ 5. „ „ abnormal spores. × 1250.
„ 6. „ *gracilis.* × 1250.

Plate XLIV.

Fig. 7. Portion of transverse section ovary of *Sciœna* with spores of *Pleistophora sciœnœ*. × 1250.

„ 8. Transverse section, gill filament of *Therapon hillii*; with cyst of *Henneguya gracilis*. × 1250.

„ 9. Edge of plasmodium of *Myxidium therapon*. × 1250.

Plate XLV.

„ 10. Portion of gill filament of *Therapon hillii* (stained with hæmatoxylin) showing six pyriform cysts of *Henneguya gracilis*. × 34.

„ 11. Portion of gill filament of *Plectroplites ambiguus* (unstained) showing cyst of *Henneguya australis*. × 35.

„ 12. Portion of plasmodium of *Myxidium therapon*. × 75.

Plate XLVI.

„ 13. Transverse section of ovary of *Sciœna* with cyst of *Pleistophora*. × 72.

„ 14. Transverse section of gill filament *Plectroplites ambiguus*, showing portion of cyst of *Henneguya australis*. × 312.

„ 15. Transverse section of kidney of *Plectroplites ambiguus* with cyst of *Myobolus plectroplites*. × 434.

Plate XLVII.

„ 16. Transverse section of two gill filaments of *Plectroplites ambiguus*, one showing section of cyst of *Henneguya australis*. × 90. No radiating arrangement of spores.

„ 17. Transverse section of portion of gill arch of *P. ambiguus* at base of several filaments—showing two cysts of *Myxosoma ogilbyi*. × 74.