18.—NOTICE OF THE OCCURRENCE OF PROTOZOAN PARASITES (PSOROSPERMS) ON CYPRINOID FISHES IN OHIO.

BY EDWIN LINTON.

(With Pl. cxx.)

Three small Cyprinoids, *Notropis megalops*,* Pl. cxx, Fig. 1, each with several more or less spherical cysts on the exterior of the body, were submitted to me for examination in September, 1890, by the U. S. Fish Commission. The fish were taken in Black River, Lorain County, Ohio, by Mr. L. M. McCormick, of Oberlin College, Ohio, September 1, 1890. In a letter accompanying the specimens, and dated September 10, 1890, the following data are given:

> The fish were taken about 6 miles from the lake (Erie) just above an old mill-dam. The water was very shallow and quite warm, the bottom gravelly with a thin layer of mud. Besides the Cyprinoids there were taken in the same locality *Noturus miurus*, *Catostomus teres*, and *Moxostoma macrolepidotum*, and in the rapid water, just below the dam, *Ictalurus* and *Roccus*. The Cyprinoids appear to be the only fish affected by this parasite.

The parasitized fishes are 47, 56, and 57 millimetres in length respectively, exclusive of the tail fin.

No. 1 has two small globular masses 2½ millimetres in diameter on the nose in front of the nasal pores, one on the under side of the head below the right eye, one at the base of the dorsal fin on the right side, and one at the base of the caudal fin on the left side near the ventral edge of the fin. These are all about the same size, and have the appearance of small globular cysts lying beneath the cuticle. Their color is white, with minute patches of black pigment belonging to the skin of the host.

In No. 2 there is a botryoidal cluster made up of about six subspherical cysts at the base of the tail fin on the left side and extending from the dorsal to the ventral edge of the fin. This mass is about 7 millimetres long and 3 millimetres wide. The shorter diameter is in the direction of the anteroposterior axis of the host. On the right side there is another mass similarly situated, and composed of five cysts and a sixth placed a little below the others. The component cysts are from 2 to 3 millimetres in diameter.

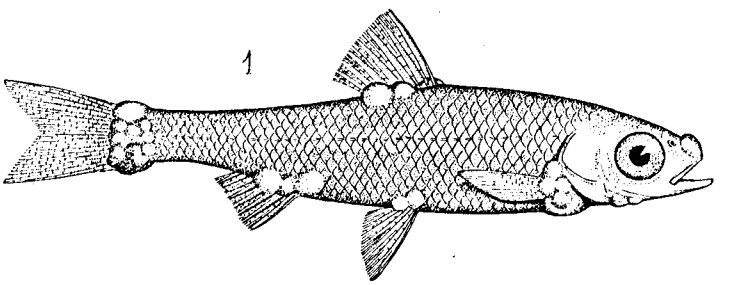
A view of the right side of No. 3 is given in Pl. cxx, Fig. 1. This is the most seriously parasitized fish of the lot. There are the following cysts and clusters of cysts: A cyst on the tip of the nose, a cluster of three cysts on the under side of the head

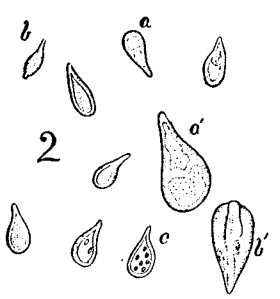
* I am indebted to Dr. D. S. Jordan for the identification of this minnow.

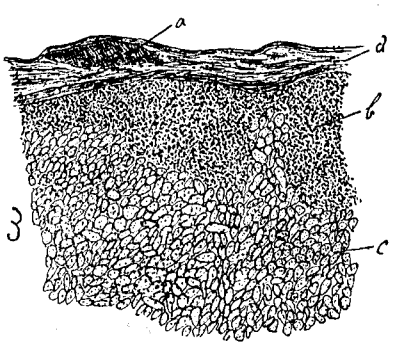
beneath the eye, a cluster of five cysts in front and at the base of the right pectoral fin, two at the base and in front of the left pectoral fin, one on the back at the posterior edge of the base of the dorsal on the right side, and another smaller one a little in front of this one, one on the left side near the anterior edge of the base of the dorsal, two at the base of the right ventral, a cluster of five at the base of the anal fin mainly on the right side, a corrugated mass made up of several cysts on the right side at the base of the caudal fin. This mass is 5 by 7 millimetres in its two diameters and the epidermis over its lower half is dark-colored. On the left side there is a smaller mass at the base of the caudal fin. It is more deeply immersed in the tissues of the host than the other. The epidermis of this fish is marked in several places with dark purplish blotches.

Each of the three fishes is in fair condition. When a cyst was broken open a milky fluid escaped and the wall of the cyst collapsed. A small quantity of the fluid contents when subjected to microscopic examination revealed the presence of myriads of psorosperms. These are somewhat top-shaped, one end broadly rounded and slightly flattened, the other tapering to a point. Their dimensions are about as follows: Length 0.017 millimetre, breadth 0.01 millimetre, thickness 0.006 millimetre. The outline presented by the edge differs from a side view only in being a little narrower. There is, however, a low ridge on the margin, which may be seen when an individual is turned on its edge, but which is not visible as such in a side view. A cross section of one at its thickest part would be a broad ellipse. They are transparent, or nearly so. The walls are thick and strong, and resist the action of both sulphuric acid and caustic potash for a long time. They do not exhibit any tendency to change their shape or capacity with either of the above reagents or with glycerine or acetic acid. The protoplasmic contents of these thick-walled cells appear, in most cases, to be evenly and finely granular. I was unable to distinguish anything corresponding to the twinned vesicles or polar capsules characteristic of these problematical organisms, although the specimens when placed in caustic potash or sulphuric acid become quite transparent and the thick walls are sharply defined. Specimens which were left for several days in dilute sulphuric acid showed no sign of disintegration. The protoplasmic contents, however, had disappeared or were represented by a few granular bodies. What appeared to be a median transverse partition was made out in many individuals in lateral view. An ill-defined mass near the smaller end was present in many (made visible when treated with caustic potash) which may be the beginning of the polar vesicle. No evidence of protractile threads was found.

A cyst was stained with Beal's ammonia carmine, mounted in paraffine, and cut into sections. The cyst was allowed to remain in the staining fluid for several days. The walls of the cyst and a granular protoplasmic material within were deeply stained. The psorosperms were not in the least affected by the staining material. The wall of the cyst is composed of connective tissue, is rather thin, and indistinguishable from the deeper layers of the dermis. All the cysts lay immediately beneath the skin. Scales appeared to be absent from the surface of the cyst in most cases, although a few were observed quite loosely attached on one of the larger clusters. Numerous pigment patches are scattered over the surface of the cysts. The sections showed the cyst to be packed with psorosperms and with granular protoplasm, the latter for the most part lying near the wall of the cyst. There is no apparent order of arrangement







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of the psorosperms. In the sections they are evidently undisturbed and lie as they did in the cyst. They appear to lie in all positions. Edge, side, and end views are presented by individuals lying side by side.

These cysts differ from those found on the short minnow (*Cyprinodon variegatus*) in the absence of connective tissue and calcareous bodies in their substance. They agree closely with those described by Zschokke from *Coregonus fera* of Europe. The psorosperms, however, appear to be different. I am unable to determine from the material at hand whether the absence of polar vesicles is to be interpreted as a specific character or simply due to the immature condition of the psorosperms. The real nature of these peculiar forms is as yet little understood and their life history is not known.

A list of the more important contributions on the psorosperms is given in an article by the author entitled "On certain Wart-like Excrescences occurring on the Short Minnow, *Cyprinodon variegatus*, due to Psorosperms." Bulletin U. S. Fish Commission, 1889, p. 99.

EXPLANATION OF THE FIGURES.

Fig. 1. Cyprinoid (*Notropis megalops*) with dermal cysts caused by psorosperms. × 1½.

Fig. 2. Psorosperms liberated from cysts and highly magnified. *a*, side view of specimen in caustic potash; *a'*, same more highly magnified; *b*, view of edge; *b'*, same more highly magnified; *c*, specimen treated with sulphuric acid.

Fig. 3. Portion of thin section of cyst. *a*, pigment spot; *b*, granular protoplasm; *c*, psorosperms; *d*, wall of cyst and dermis. × about 150 diameters.