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A STUDY OF MICROSCOPIC FAUNA
OF SOME WATERS OF THE DOUGLAS LAKE AREA

By

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A report submitted in fulfillment of a requirement in the course, "Zoology 369 - Investigations in the Natural History of Invertebrates", under the direction of Dr. F. E. Eggleton at the University of Michigan Biological Station.

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Introduction

The studies described in this report were undertaken with the primary objective of acquiring information on the techniques of collecting and observing microscopic invertebrates. It is the intention of the writer to apply such information in a series of studies in the Mesilla Valley of the middle Rio Grande basin in southern New Mexico. No studies of this nature have been reported from that area, and there is no literature available on the microscopic fauna of the region. For this reason, the present study was conducted on the assumption that the Douglas Lake area is as much a "virgin" territory as is the Mesilla Valley. The extensive literature originating from studies at the University of Michigan Biological Station were purposely ignored, with the exception of the work of Brunson on the Gastrotricha, and only very general text-books and keys were used.

Eight different types of aquatic habitats were selected. Notes were made on the location, general characteristics, and physical environmental factors at the time of study in each of the habitats. Samples of the water, vegetation, and decaying organic matter were collected from each and brought to the laboratory for study. Since the methods of collection and study varied from one habitat to another, description of the methods is deferred to the ensuing summary of each of the areas.

It should be noted that the collections made in each of the habitats included

greater numbers of species than are dealt with in this report. Because of the limited time available for the study, it was necessary to select only a few for detailed observation, and to give no further attention than the recognition of the presence of a Class in the case of all others. It is probable that in a series of studies such as is proposed above, a similar procedure will be followed, considering a single group in each of the parts of the entire series. In this study somewhat more time was spent on the members of the Phylum Gastrotricha than on other groups, and the observations on the members of this phylum are recorded in a separate section of this report.

Section I. General surveys.

Habitat # 1.

Douglas Lake, "Blissville" beach; T37N-R3W-S33. Cultures designated DLB.

Collection made 22 June 1949, 8:30 AM. Sky clear; wind slight, NNW; air temperature 19.5° C.; water temperature 22° C. The lake water is generally clear, there is little coloration, and good circulation. The beach is exposed and there is no water vegetation.

Water, some sand, Ephyminidae, leaves, and other debris were collected from within 50 cm. of the shore line. This collection constituted a culture which was kept in the laboratory until 26 July 1949, and examined several times in the meantime. Specimens observed were as follows:

6/22/49 - One Chaetogaster sp. (Annelida: Chaetopoda)

Several genera of the order Holotricha (Protozoa: Ciliata). There was an average of six of these animals per low power field of the compound microscope.

6/29/49 - Three different species of Holotricha.

Rotifera, various species. An average of two or three per drop.

7/1/49 - Actinophrys sol Ehrenburg (Protozoa: Heliozoa)

7/26/49 - No life remaining; culture discarded.

Habitat # 2.

Douglas Lake, Grapevine Point beach pool; T37N-R3W-S28.

Collection made 22 June 1949, 10:00 AM. Sky clear; wind slight NNW; air temperature 20.5° C.; mud temperature 20.5° C. This pool is almost completely overgrown with fern and other plants. Water was standing in only a few small areas. When a bottle was dipped into these pools, more mud than water was collected.

A few ciliates (Protozoa) of the families Colepidae and Spirostomidae were found, and there were many Nematodes (Nemathelminthes) similar to the genus Dorylaimus. A culture from this collection contained no animal life when next examined.

Habitat # 3.

Douglas Lake, Grapevine Point Cove; T37N-R3W-S28.

Collection made 22 June 1949, 10:30 AM. Sky clear; wind slight NNW; air temperature 20.5° C.; water temperature 22.5° C. The bottom is sandy and there are scattered water plants close to the shore line. The area is protected from strong wave action.

Collection was made with a Birge Cone net. The samples were kept in the laboratory and examined at intervals.

6/22/49 - A few ciliates (Protozoa).

Rotifers of the genus Cephalodella were the most numerous types.

7/15/49 - Culture heavy with members of family Colepidae, genus Coleps.

One Oligochaeta (Annelida) of the genus Chaetogaster. (Since this genus is always parasitic or commensal in its habits, this

specimen was probably associated with one of the copepods in the culture.)

7/18/49 - Coleps few in number.

7/26/49 - No life remaining; culture discarded.

Habitat # 4.

Carp Creek Bridge; T36N-R3W-S4.

Collection made 22 June 1949, 1:30 PM. Sky clear; wind slight NNW; air temperature 21° C.; water temperature 14° C. The water was clear; bottom sand and rocks; current rapid, forming riffles. Vegetation grows to the banks of the stream and tall trees shade the water most of the day. Aquatic vegetation is not abundant.

Collection was made with a Birge Cone net and a culture prepared from the materials obtained.

6/22/49 - Arcella sp., Difflugia sp., and Amoeba sp. were present in limited numbers.

7/1/49 - Arcella sp. and Difflugia sp. still present. No increase in numbers was noted.

7/12/49 - No new forms have appeared.

Habitat # 5.

Nigger Creek; T36N-R2W-S8 & 17.

Collection made 1 July 1949, 8:45 AM. Sky cloudy; air temperature 20° C.; water temperature 22° C. Bank and aquatic vegetation abundant. Water flow was sluggish and the water was highly colored. ~C

Collections were made with a dip-net variation of a Birge Cone net. Three cultures were set up in the laboratory, designated as NC-1, NC-2, and NC-3.

NO-1 was placed in a large baking dish with bottom debris and sand to a depth of one-half inch, two lily pads and stems, and several pieces of rotting wood.

NO-2 and NO-3 were prepared in finger bowls with fine black settlings and green water plants, with a few amphipods and empty Sphaerium shells.

During the observation period (7/1/49 - 8/5/49) the numbers and varieties of microscopic animals seen were very great. A list of the Classes represented follows.

| | |
|--|------------------------------------|
| Phylum Protozoa, Class Mastigophora | Phylum Trochelminthes |
| Phylum Protozoa, Class Sarcodina | Phylum Annelida, Class Chaetopoda |
| Phylum Protozoa, Class Ciliata | Phylum Arthropoda, Class Crustacea |
| Phylum Nemathelminthes, Class Nematoda | Phylum Tardigrada |
| Phylum Gastrotricha | |

A few of these forms were studied in some detail. Notes on the observations of these follow, except that the Gastrotricha are treated in Section II of this report.

Paramecium caudatum in NO-1.

7/1/49 - None were noted.

7/5/49 - The first identified. Each drop of water yielded two or three Paramecia per low power field. One-fourth of those counted were undergoing fission.

7/12/49 - The culture was too thick to count. Many individuals were undergoing fission. Conjugation was noted.

7/15/49 - Paramecia thick at the top of the culture. Fission and conjugation stages were hard to find. Other species are present in increasing numbers.

7/20/49 - P. caudatum dominant in surface scum only. Many large Oxytrichidae

and a smaller species of Paramecium were present below the surface.

7/27/49 - P. caudatum few. Acoelosoma sp. numerous in surface scum.

8/2/49 - No P. caudatum present.

Nematoda in NC-3.

Eight female Nematodes were taken from the culture. They were all identified as belonging to the genus Menonchus. In 1915 Cobb reported that the only North American species was M. simile. He gave no account of distribution records. The specimens were probably all immature, as no uterus or ovary could be found, and only the faintest trace of a vulva, with no elevation present, was observed. The averages of the measurements of the eight specimens were:

Length - 1.183 mm. Width at vulva - 0.05 mm.

The specimens were extremely small and delicate, and none of the attempts to prepare permanent mounts were successful. Drawings showing the diagnostic features were made from the living specimens (Plate I).

Tardigrada in NC-3.

On 5 July 1949, two individuals of the Phylum Tardigrada were found. These were of the genus Echiniscus, and both were apparently of the same species.

Habitat # 6.

Nichols Bog; T36N-R3W-S2

Collection made 1 July 1949, 8:00 AM. Sky overcast; air temperature 21.5° C; water temperature 22° C. The bog is in an open meadow. There are shrub-like plants around the south edge of the open water. Collecting was done on the northern edge where only grass grows to the edge of the water. The water covers a deep black muck. Aquatic vegetation is abundant.

Collection was made with a dip net. Protozoa, Ostracods, Copepods, and Rotifers were abundant. Arcella sp. and Diffugia sp. were more abundant in this collection than in those from any of the other habitats studied. They persisted until the cultures were discarded but all other forms had disappeared. The culture was discarded on 5 August 1949.

Habitat # 7.

Smith Bog; T36N-R3W-S35.

Collection made 13 July 1949, 8:30 AM. Sky clear; air temperature 22° C.; water temperature 23.5° C. The bog is in an open meadow. The grass is thick and at least 18 inches high. Water is shallow, stagnant, and highly colored. The bottom is deep black muck. The fauna was similar to that of Nichol's Bog. In one culture, designated SB, one gastrotrich, Polymerurus magnafurca, was found.

Habitat # 8.

Douglas Lake, Camp beach west of boat-house to edge of rocky beach to the northwest; T37N-R3W-S33. Cultures designated DLB.

On 13 July 1949 a study of organisms found in the sand and interstitial water was begun. Two samples of 10 cc. each were taken on each of the following days: 13 July, 15 July, 19 July, 22 July, 29 July, and 2 August. The samples were taken about two feet apart, 10 to 15 cm. beachward from the water line. Small pits varying from 3 - 5 cm. in depth were dug in the sand, and water allowed to seep into them. The water was drawn from the pits with a medicine dropper. No quantitative analysis was made of the fauna present. The entire sample was examined to determine the genera of Nematoda and Gastrotricha present. Ciliates and Rotifers were present in all samples. A few Arcella sp. were seen. One individual of the genus Chaetonotus was found and lost before further identification was made. Five females of the genus Tripla (Nematoda) were found and mounted on slides.

One female, probably of the genus Alaimus (Nematoda) was found. The permanent mount of this specimen was not successful.

Section II. Notes on Gastrotricha.

The first Gastrotrich of this study was found upon preliminary examination of the material collected from Nigger Creek on 1 July 1949. It was tentatively identified from the keys in Ward and Whipple, Fresh Water Biology, as of the genus Chaetonotus. A second like the first was found, and the two observed for several hours. Thereafter a systematic search for gastrotrichs was made of all culture dishes. The following is a record of the findings.

| Genus | Species | No. found | Culture Dish | Date | Drawings. |
|--------------------|-------------------|-----------|--------------|--------------------|------------------|
| <u>Chaetonotus</u> | <u>sp.</u> | 2 | NC-3 | 7/1/49 | -- |
| <u>Chaetonotus</u> | <u>sp.</u> | 2 | NC-3 | 7/13/49 | -- |
| <u>Chaetonotus</u> | <u>sp.</u> | 3 | DLB | 7/13/49 | -- |
| <u>Chaetonotus</u> | <u>sp.</u> | 1 | NC-3 | 7/15/49 | -- |
| <u>Polymerurus</u> | <u>magnafurca</u> | 1 | SB | 7/20/49 | Pl. II, Fig. 1. |
| <u>Chaetonotus</u> | <u>formosus</u> | 5 | NC-3 | 7/22/49 | Pl. II, Fig. 2. |
| <u>Chaetonotus</u> | <u>vulgaris</u> | 3 | NC-3 | 7/22/49 7/27/49 | Pl. II, Fig. 3. |
| <u>Lepidoderma</u> | <u>squamatum</u> | 1 | NC-3 | 7/27/49 | Pl. III, Fig. 1. |

Many attempts were made to isolate a single animal on a depression slide, of which only a few were successful. The first was Chaetonotus formosus. The following notes were taken after the animal was first isolated.

The specimen swims with a graceful smooth gliding motion by the beating of cilia on its ventral surface. As it progresses forward the head moves from side to side, its ciliary processes held at right angles to the long axis of the head. When travelling in a straight line the body is held straight. When turning or

travelling slowly, the body undulates from side to side. Minute bits of debris catch on the body spines and are shaken off by slight twitches. Sensory structures are probably present in the spines. It investigates all clumps of debris larger than itself and frequently makes its way through an entire mass, presumably in search of food. The dorsal spines remain fairly rigid when the animal is moving. Their only purpose seems to be protection. It may travel with dorsal, ventral, or lateral side upward, but the more rapid motion is with the dorsal side up. It tends to travel in a circle when a lateral side is up, and the motions appear to be exploratory when the ventral side is up. In contrast with a few ciliates which it superficially resembles, it seems to possess a "sense" of orientation. The caudal processes are extensions of the body proper and seem to play no part in forward swimming. They act as a brake and rudder when the animal stops and turns in the opposite direction. They adhere to debris or the substratum when it bends about in an exploratory manner.

On 27 July one gravid Lepidoderma squamatum was found in NC-3, placed on a depression slide, and the mount was sealed. Also present were three rotifers of two species and numerous very small ciliates. At 1:20 PM on the following day, an egg in a 2-cell stage of cleavage was found. This preparation was kept under close observation until the specimens died. Following are the notes made on these observations.

7/28/49 - 2:00 PM - Second cleavage complete to 4-cell stage.

2:45 PM - Two more cleavages were complete—16 cell stage.

3:10 PM - Development beyond 32 cell stage (Plate III, fig. 5).

7/29/49 - 8:30 AM - Embryo active within the shell (Plate III, fig. 6).

4:00 PM - Drawing made of state of development (Plate III, fig. 7).

7/30/49 - 8:00 AM - Egg case empty. Young found and noted to be smaller than parent. Another egg present in advanced stage of development.

7/31/49 - 8:10 AM - Another empty egg case found. A new egg in the 1-cell stage present.

8:20 Nuclear membrane has disappeared.

8:30 Constriction of cytoplasm taking place.

8:35 Division complete, 2 nuclei re-formed. (Plate III, fig. 2).

8:50 Nuclear membranes disintegrating.

8:52 No trace of nuclear membranes.

(These observations interrupted while baby was watched eating-- feeds on abundant bacterial growth)

9:00 Cytoplasmic division taking place.

9:05 Complete to 4-cell stage. (Plate III, fig. 3).

9:15 Four nuclei present.

9:28 Nuclear membranes disappearing.

9:35 Cytoplasmic division taking place.

10:45 16-cell stage. (Plate III, fig. 5).

11:30 The total population of the slide was checked and found to be as follows:

6 Lepidoderma squamatum

2 Developing eggs of L. squamatum

17 Rotifers of one species

2 Rotifers of another species

Many very small ciliates

Many rotifer eggs.

9:00 PM - All dead.

Summary

1. The microscopic fauna of eight types of aquatic habitats in the Douglas Lake region of northern Michigan have been studied to an extent equivalent to a preliminary survey of such habitats in a new area.
2. Members of the phylum Gastrotricha found in the survey were observed and reported upon in some detail.
3. The embryonic development of a gastrotrich, Lepidoderma squamatum was observed and compared with these processes as described by Brunson. The need for observation of such processes under natural conditions is suggested.

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EXPLANATION OF PLATES

Plate I. One of eight specimens of Mononchus sp. (Nematoda) found in culture NO-3.

Fig. 1 - Entire worm (female)

Fig. 2 - Anterior end, showing sensory papillae on lips.

Plate II. Gastrotricha.

Fig. 1 - Polymerurus magnafurca.

Fig. 2.- Chaetonotus formosus.

Fig. 3. - Chaetonotus vulgaris.

Plate III. Lepidoderma squamatum (Gastrotricha).

Fig. 1 - Outline of adult.

Fig. 2 - 2-cell stage in embryonic development.

Fig. 3 - 4-cell stage.

Fig. 4 - 16-cell stage.

Fig. 5 - Late cleavage stage.

Fig. 6 - Active larva within egg-case.

Fig. 7 - Older larva within egg-case.

Fig. 8 - Egg-case after hatching of larva.



Fig. 2

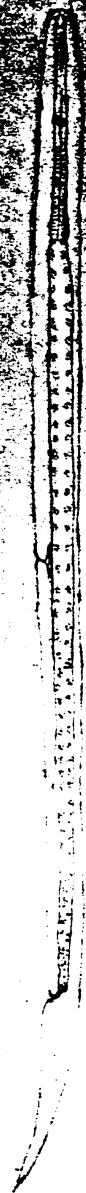


Fig. 1.

Mononchus

NC. 3 #1.

9-211 ♀

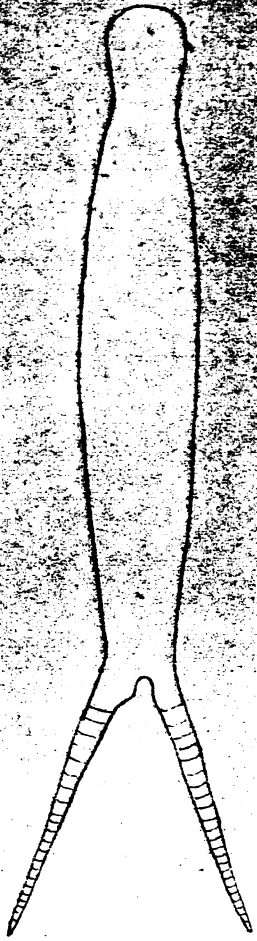


Fig. 1.

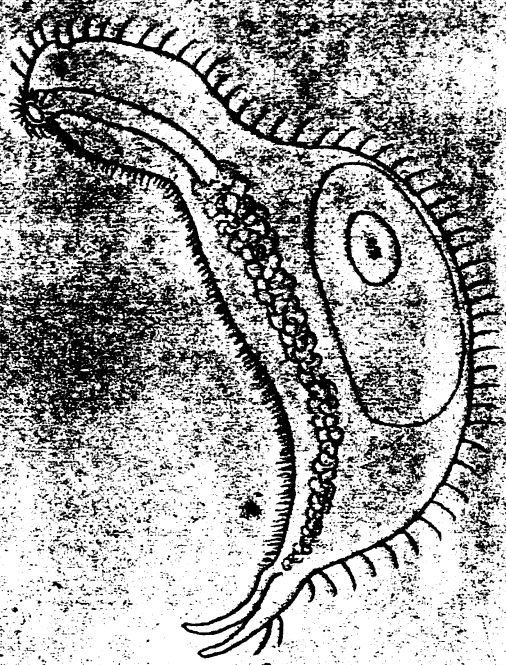


Fig. 2.

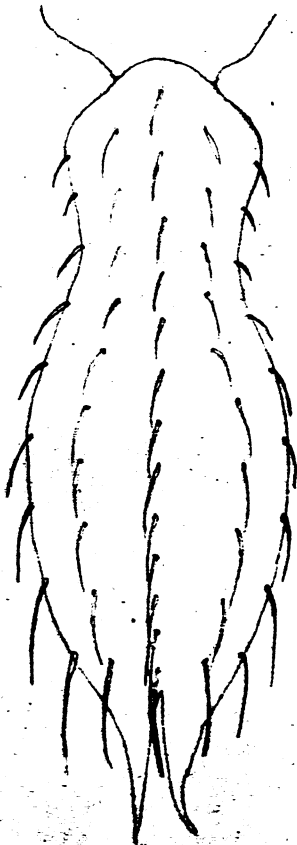


Fig. 3.



Fig. 1.

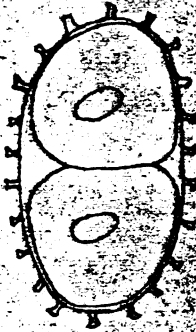


Fig. 2.

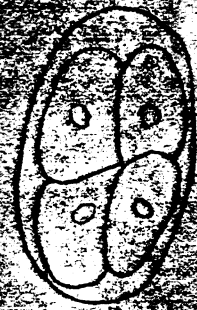


Fig. 3.

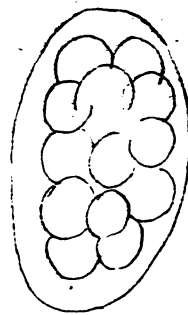


Fig. 4.

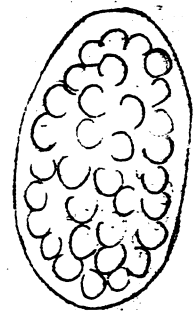


Fig. 5.

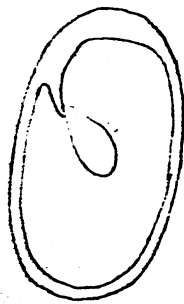


Fig. 6.



Fig. 7.

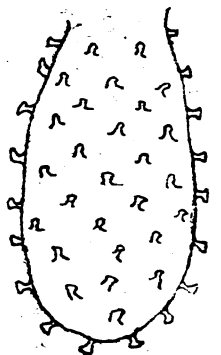


Fig. 8.