1957

Digenetic Trematodes in Louisiana Freshwater Fishes.

Grover Cleveland Miller

Louisiana State University and Agricultural & Mechanical College

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ABSTRACT

The parasitic fauna in Louisiana fresh-water fishes is practically unknown and this fact encouraged the writer to undertake the present studies. There are two distinct groups of people who would be interested in such studies. First, the sport and commercial fishermen of the state would be interested from a recreational and economical point of view. Second, the information derived from such research would fill a considerable gap in the scientific knowledge of the fauna in the state.

This study is not a simple survey project. An attempt is made to present a comprehensive treatment of the biology and ecology of the digenetic trematodes in fresh-water fishes of the state.

The classical methods of collection and examination of fish hosts were utilized throughout this study. Most of the hosts were obtained from personnel of the Louisiana Wild Life and Fisheries Commission but many were obtained from sport and commercial fishermen. Some were directly acquired by the writer through angling and by the use of nets. All parasites were collected, recorded and preserved for study but only the digenetic trematodes are reported in this study.

A total of 625 fish, representing fourteen families, twenty genera, and thirty-one species were collected and examined during the years 1954 to 1957. The majority of these were game fishes. These
hosts were collected from twenty-six different localities which ranged throughout the state and collections were made during all months of the year.

A total of nineteen species of digenetic trematodes, representing eleven families and seventeen genera, were identified and studied. One of these has been described as a new species. New information has been presented on the biology of these worms in regard to their morphology, taxonomy, ecology and distribution.

The nineteen species of trematodes are as follows: *Phyllodistomum lacustri*, *Phyllodistomum parvulum* n. sp., *Allocreadium ictaluri*, *Homalometron armatum*, *Crepidostomum cornutum*, *Macrodercides typicus*, *Glossidium corti* n. comb., *Cryptogonimus chili*, *Caeccincola parvulus*, *Neochasmus labeosus*, *Allacanthochasmus varius*, *Allacanthochasmus artus*, *Holostephanus ictaluri* (?), *Diplostomulum* sp., *Neascus* sp., *Clinostomum marginatum*, *Pisciamphistoma stunkardi*, *Halipegus perplexus* and *Cotylogaster occidentalis*. The last named species is actually an aspidogastrid but was included in this study because of its close relationship with the digenetic flukes.

Sixteen of the nineteen species of trematodes reported in this study are recorded as new to Louisiana. The three which have previously been reported are: *Crepidostomum cornutum*, *Neochasmus labeosus* and *Cotylogaster occidentalis*.

The larval forms of *Neascus* and *Diplostomulum* are treated as generic groups but subsequent work will undoubtedly show that a number of species are involved.

It was anticipated at the beginning of this study that a number
of forms new to science would be encountered. However, this was not the case as only one new trematode was found during the entire study. This may be partially explained by the fact that nearly all of the Louisiana water-ways are either directly or indirectly connected with the Mississippi River drainage system. With this fact in mind it was not too surprising to learn that the parasitic forms found here are very similar to those found in the more northern areas drained by the Mississippi River.

The digenetic trematodes were the most commonly encountered parasites in Louisiana fishes. This included both the number of species and the number of individuals. Of the 629 fish examined, 386 or 61.3 per cent were infected with some species of digenetic trematode.
INTRODUCTION

It was brought to the writer's attention during the summer of 1951 that the parasitic fauna of Louisiana fresh-water fishes was practically unknown. At that time the Louisiana Wild Life and Fisheries Commission was greatly concerned about complaints from people who were finding parasitized fish. It seemed advisable therefore, to conduct rather extensive studies in this subject in order to define more clearly the existing problems.

It occurred to this writer that at least two distinct groups of people would be interested in such problems. First, the sport and commercial fisherman of the state would be interested from a recreational and economical point of view. Second, the information derived from such research would fill a considerable gap in the scientific knowledge of the fauna in the state. For these reasons the writer was encouraged to conduct the present studies.

This study was not intended to be a simple survey project, although this was one of the results. A study of this sort entails the collection and examination of fish hosts that marks merely the opening of the problem. Many prolonged and exacting procedures of technical preparations were required before the parasitic specimens were ready for microscopic studies leading to identification.

One of the chief aims of the study was to present a rather comprehensive treatment of the biology and ecology of the parasites of
fishes from as many areas in Louisiana as possible. As the work progressed the problems assumed larger and larger proportions. The numbers and kinds of fishes, the different forms of parasites and the many varied host habitats within the state presented such diverse problems that it was considered impractical if not impossible for one person to tackle them with any degree of accuracy. Therefore certain limitations were necessary in order to insure adequate treatment for the various parasites that were found during the study.

The limits of this particular report were confined to the study of the digenetic trematodes. Throughout the study various people were involved in the examination of more than 1200 fish hosts and all types of parasites were collected and preserved. These parasites included some protozoa, the monogenetic flukes, digenetic flukes, tapeworms, nematodes, copepods, and leeches. One linguatulid was recovered from each of two fish. The identification of such an array of parasites was not feasible, within the time limit envisioned for the study. The general trend, in survey studies which have listed all forms of parasites, has been to employ the aid of specialists for certain groups. This has not been the case in this report. All of the parasites discussed here were identified by the writer. In specific instances the writer requested the opinions of certain authorities that are discussed under the species involved but in every case the original identification was made by the writer. The identification of the other parasites in this collection has been or will be undertaken by other investigators.

Although it was mentioned that over 1200 fish were examined
during this study, only the records of 629 were used in this report. In the initial phases of the study many of the fish were only superficially examined. The original purpose of this study was to collect those parasitic forms which were obvious to the fisherman and, consequently, the intestinal parasites were not recovered. In other cases the fish hosts were identified only by the common name, or the records were incomplete. Thus not all the host records could be used, but the remaining 629 fish hosts reported here were completely examined and accurately identified.

**Literature on Fish Parasites:** The literature on fish parasites has grown extensively since the opening of the present century and this fact has been especially true for the last twenty-five years. Most of the earlier works were confined to intensive studies in systematics on one particular group of parasites. It was not until the more recent years that faunal and ecological studies of specific groups were conducted. The scattered and inaccessible condition of the literature on fish parasites has made such studies extremely difficult and this factor has continued to be a handicap.

Literature on fish parasites in Louisiana was found to be quite sparse. This was particularly true for the digenetic trematodes of the fresh-water fishes. Hopkins (1934) has recorded some work on the identity of flukes in the genus *Crepidostomum*. A few representatives of this genus from Louisiana fishes were included by him in his monographic study on the papillose allocreadiids. There were no specific records on the exact origins of these worms and no intensive studies were conducted by Hopkins on *Crepidostomum* in Louisiana. The
only other work on fish trematodes in this area which the writer encountered was the work of Sogandares-Bernal (1955). That author recorded nine species of trematodes of which only four were collected from hosts in strictly fresh-water habitats. The others were from hosts in brackish water. Sogandares-Bernal made no attempt to make a thorough study of the trematode fauna but recorded the presence of a few forms from a very few habitats. Except for the two records cited above no other work on digenetic trematodes in Louisiana fresh-water fishes has been conducted until the present report.

A number of scattered papers and monographs on fish parasites in general have proved of great value during the course of this study. Many of the smaller papers were of much help in the study of individual species but a discussion of those papers has been deferred to the sections of the thesis where it was considered more applicable. In this introductory section only the more general papers and those studies which were referred to many times have been included.

Pratt (1902) rendered a distinct service to American biologists when he presented his keys and drawings of trematodes in the American Naturalist series of Synopses of North American Invertebrates. Prior to that time there was no adequate conception of the degree of distinctness or relationship between the North American and European faunas. The very early studies near the turn of the century were patterned after the better known contributions of men such as Leidy (1851-1890) and Linton (1889-1914). Although the work of these two men was highly valued it was chiefly concerned with the records and descriptions of new forms and little emphasis was given the over-all
picture of the parasitic fauna of a given region.

The next most important single contribution was that of Ward (1918) whose chapters on parasites in Ward and Whipple's "Fresh-Water Biology," established a new era in the study of parasitology. Here was presented, for the first time, a critical analysis of the literature of the parasitic worms known to occur in fresh-water hosts. Nearly all subsequent studies have utilized Ward's work as the basis for new investigations. There were a few other outstanding contributions during this period to the literature with reference to the digenetic trematodes of fresh-water fishes. Some of the more important were those of Stafford (1900-1905), Marshall and Gilbert (1905), Osborn (1902-1919) and Cooper (1914-1920).

The period from 1920 to the present date has been characterized by an increasing number of contributors who have done much to increase our knowledge of the parasites of fish.

In more recent years the number of workers who have published on fish parasites has increased appreciably. Only a few of these have been included in this section. Pearse (1924) has contributed some excellent ecological and biological studies on fish parasites in the upper Mississippi River and in Wisconsin lakes. Simer's (1929) work on parasites from fishes in Tallahatchie River, Mississippi, was helpful during this study. The many survey studies of Bangham (1925 et seq.) were very valuable in that host and distributional records were available for many areas. Perhaps the references which proved most helpful during this study were those of Van Cleave and Mueller (1932, 1934) Mueller and Van Cleave (1932) and the excellent treatise on trematodes by Yamaguti (1953).
MATERIALS AND METHODS

The collections covered by this study were made in twenty-seven separate localities within the state of Louisiana. These collections were initiated in the summer of 1954 and continued until the spring of 1957. Many of the sampled areas were revisited on numerous occasions so that collections were made, in one locality or another, in every month of the year.

The localities from which the hosts were collected are shown on the accompanying map. Reference to this map will show that not all of the state is equally represented. Most of the fish which were examined were collected in East Baton Rouge Parish and the adjacent parishes. However, a limited number of fish were collected from many localities throughout the state. The extreme northern portions of the state were fairly well represented as were the central and mid-southern portions. The presence of brackish water in the extreme southern portion discouraged collections in this area. The southwestern and the extreme eastern parts of the state are poorly represented but it is doubtful that the parasitic fauna in those areas differs greatly from that of the rest of the state.

The various habitats from which the hosts were collected differed greatly in an ecological sense. No effort was made to study particular bodies of water. Both old and new lakes, streams, bayous, borrow pits, and isolated portions of the Mississippi River were used as
collecting areas. No restrictions were made on the localities of the hosts studied.

In the same manner, no selective methods were used in studying the fish hosts. There was random sampling from all areas although some emphasis was given to game and food fishes. It was felt that a generalised knowledge of the parasitic fauna of many fishes would be preferred to a more detailed study in some particular species of fish in a restricted area. Such detailed studies should profit considerably from the results of the present, more generalized work. The plan was to collect as many specimens of all kinds of fishes as possible in an attempt to get an over-all picture of fish parasitization in this state.

Some species of fishes are much more widespread and are more easily collected than other species. This, in part, accounts for the lack of balance in the numbers of different species examined. The kinds of fish and the number of each species examined is listed below. The identification of the fish hosts is based on Knapp's "Fishes Found in the Freshwaters of Texas."

### TABLE I

Checklist of the Host Specimens Examined During This Study

<table>
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<th>Hosts</th>
<th>Number Examined</th>
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<tr>
<td><strong>Polyodontidae</strong></td>
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<tr>
<td><em>Polyodon spathula</em> (Walbaum), Paddlefish*</td>
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</tr>
<tr>
<td><strong>Lepisosteidae</strong></td>
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</tr>
<tr>
<td><em>Lepisosteus osseus</em> (Linnaeus), Longnose Gar.*</td>
<td>4</td>
</tr>
<tr>
<td><em>Lepisosteus platostoma</em> (Ray) Shortnose Gar.*</td>
<td>6</td>
</tr>
<tr>
<td><em>Lepisosteus Boutwellii</em> Cope, Spotted Gar.*</td>
<td>2</td>
</tr>
</tbody>
</table>
**Amidae**

*Amia calva* Linnaeus, Bowfin ........................................... 6

**Anguillidae**

*Anguilla rostrata* (LeSueur), American Eel ..................... 1

**Clupeidae**

*Dorosoma cepedianum* (LeSueur) Gizzard Shad .................. 50
*Dorosoma petenense* (LeSueur) Threadfin Shad .................. 1

**Catostomidae**

*Ictiobus bubalus* (Raf.) Smallmouth Buffalo .................. 2
*Ictiobus cyprinellus* (Valenciennes) Largemouth Buffalo ...... 3

**Ameiuridae**

*Ictalurus punctatus* (Raf.) Southern Channel Catfish .......... 24
*Ictalurus furcatus* (LeSueur) Blue Catfish ...................... 12
*Ameiurus melas* (Raf.) Black Bullhead .......................... 18
*Pylodictus olivaris* (Raf.) Flathead Catfish .................. 2

**Esocidae**

*Esox niger* LeSueur, Chain Pickerel ............................. 8

**Poeciliidae**

*Mollienesia latipinna* LeSueur, Sailfish Molly ............... 10

**Cyprinodontidae**

*Gambusia affinis* (Baird and Girard), Mosquito-fish ........ 12

**Mugilidae**

*Mugil curema* Cuvier and Valenciennes, White Mullet ........ 1

**Centrarchidae**

*Micropterus salmoides* (Lacepede), Largemouth Bass ........ 62
*Micropterus punctulatus* (Raf.) Spotted Bass .................. 35
*Lepomis macrochirus* (Raf.) Bluegill ............................ 162
*Lepomis microlophus* (Gunter), Redear Sunfish ............... 20
*Lepomis megalotis* (Raf.), Longear Sunfish .................... 7
*Lepomis beliecki* (Girard), Orangespotted Sunfish ........... 1
*Lepomis cyanellus* (Raf.), Green Sunfish ...................... 1
*Chaenobryttus coronarius* (Bertram), Warmouth .............. 46
Serranidae

*Morone chrysops* (Raf.), White Bass................. 2
*Morone interrupta* Gill, Yellow Bass...................... 9
*Pomoxis nigromaculatus* (LeSueur), Black Crappie............ 69

Sciaenidae

*Aplodinotus grunniens* (Raf.), Freshwater Drum.............. 35

Total number of examinations........... 629

The total number of fresh-water species of fish in Louisiana is unknown and this fact presents an interesting research opportunity because of the many varied habitats that exist in the state. As popular as sport fishing is in the state, it seems unusual that Louisiana fishes have received so little attention.

**Collection of Hosts:** Many of the fish hosts were obtained from personnel of the Louisiana Wild Life and Fisheries Commission in the course of their studies on fish populations. Other host specimens were obtained from commercial fishermen and by angling. In a few instances the writer used nets in order to sample specific areas.

**Examination of Hosts:** All host specimens were kept under refrigeration and were examined as quickly as possible. It was found that the parasites were in very poor condition if the hosts were not examined within three days. Also, the examination of preserved material proved to be very inferior to that done on freshly caught hosts.

More than 1200 fish were examined during the course of the work but only 629 of these were examined thoroughly enough to justify an accurate report on the digenetic trematodes. There were digenetic flukes in many of the others but the incomplete examinations and
records did not permit their inclusion in this report. Therefore, the studies presented here are based on those records which were complete.

Each host was examined by the usual procedures and all parasites that were found were collected and preserved. The fish was first examined for ectoparasites and then each body organ was separated and examined. This process required a great deal of time for it has been shown that no organ in the body of the fish is immune to parasitism. The work was facilitated by using sedimentation methods. Each organ was dissected separately in dishes containing physiological saline or a seven per cent solution of sodium bicarbonate. In order to free the parasites of mucus the contents of the organs were shaken vigorously with a liberal amount of the solution. Parasites, being heavier than organic debris, rapidly sank to the bottom, whereas particles of mucus remained suspended for a long time. After a number of washings, in each of which the upper layers of fluid were decanted, the residue was examined under a dissecting microscope for the presence of parasites. By employing this method examinations were made with a small percentage of loss and a great saving of time and labor over hand picking methods.

This writer can readily agree with Van Cleave and Mueller (1934) who stated "The amount of labor involved in examining fish for parasites will be appreciated from the fact that an experienced worker can hardly handle more than four fish a day if these are examined singly."

**Killing and Preserving:** A considerable variety of parasites was collected during this study but a discussion of forms other than the
digenetic trematodes is beyond the scope of this thesis.

The flukes were removed to separate dishes of saline or soda solution, where, by their own active movements they freed themselves of mucus and other debris. The smaller worms were handled with capillary pipettes, the larger ones with needles or forceps. For each host a record was made of the parasite, its location within the host and the approximate number of each present.

The number and size of the worms found in the host determined the method of killing and preserving. In cases where many small worms occurred they were fixed as a group, without pressure in hot Bouin's fluid, A. F. A. (alcohol, formalin, acetic acid) or hot alcohol. This method not only saved time but it was preferred over the pressure flattening methods which might have distorted the specimens. In instances where few or larger forms were present they were fixed singly with or without slight pressure. After the forms were fixed they were transferred to 70 per cent alcohol for preservation.

Staining and Mounting: Nearly all of the trematode material collected during this study was stained and mounted in toto. Sections were made only in connection with special problems since the general anatomy could usually be discerned from whole mounts. With the exception of a few very abundant forms all of the collections were mounted or sectioned. It seemed desirable to stain nearly all of the material since some of the smaller worms could not be determined to species with certainty in the unstained condition. Furthermore, the presence of many well stained specimens permitted a thorough study and review of those particular species.
A number of stains were used in an attempt to find the most suitable one. Most of the specimens were stained with Delafield's haematoxylin which generally gave excellent results. Other stains that were used were Ehrlich's haematoxylin, Harris' alum haematoxylin and Semichon's carmine. All of the forms were over-stained and then destained with acid alcohol. It was necessary to use a dissectoscope while destaining the smaller forms. Also, in order to section serially the very small worms, which were half a millimeter or less in size, it was necessary to overstain the specimens and then destain after sectioning.

Most of the worms were cleared in xylol; but toluene, cedar wood oil, and beechwood creosote were also used. All forms were mounted in balsam or clarite.
TAXONOMY AND BIOLOGY OF THE DIGENETIC TREMATODES

This section contains the individual description and discussion of each digenetic trematode encountered during the study. The general form followed here is to list each species of parasite and the hosts from which they were collected. In citing the hosts, only those species actually encountered in the present study have been included. The next procedure is to describe, either briefly or fully, the parasite in question. Some of these worms have been adequately described by other workers in the field and it is necessary to include here only brief descriptions of such forms. In other cases previous descriptions were not adequate or the forms collected here have differed from those descriptions so that more detailed descriptions were required. Finally in a few instances new information resulted from the work and these findings are presented. Regardless of whether the description is brief or detailed, all such descriptions are based only on forms from this collection unless otherwise stated.

Following the description of each species a short section has been devoted to remarks or discussion on the taxonomy, biology, and ecology of the particular parasite under consideration. The more general discussion on host parasite relationships has been deferred to a later section.
Phyllodistomum lacustri (Loewen, 1929)

(Fig. 1, Plate I)

Hosts: Ictalurus punctatus
       Ambliurus melas
       Pilodictus olivarus

Description: These broad leaf-shaped distomes were collected from the urinary bladder of the hosts listed above. Adequate descriptions are already available for this species but some minor variations require that some additional description be presented here. These fairly large, yellowish worms are quite active when removed from the host and their highly muscular bodies cause considerable variations in measuring fixed material.

The body of the worm consists of a long tapering anterior end and a broad discoidal posterior portion. The margin of the discoidal part is distinctly crinkled. Numerous small papillae project from the surface of the cuticula, especially around the suckers. The total body length is from 1.96 to 4.35 mm. (based on ten specimens). The width is 0.75 to 2.39 mm. as measured across the discoidal portion. A large conspicuous acetabulum separates the two body regions. It is round or nearly so and the diameter varies from 0.214 to 0.428 mm. The terminal oral sucker is slightly smaller than the acetabulum and its average diameter is 0.204 to 0.357 mm. There is no pharynx. A long esophagus extends from the oral sucker to the caeca. It is 0.163 to 0.306 mm. in length. The intestinal caeca extend back into the posterior fourth of the body. Their course is curved convexly toward the lateral margins of the posterior body and
in most instances they appear well distended.

The testes are located obliquely in the middle of the discoidal part of the body. They are irregularly and deeply lobed bodies which measure 0.183 to 0.469 mm. by 0.112 to 0.357 mm. Their long axes are not always in the same position but usually they run parallel to the main axis of the body. The vasa efferentia pass anteriad and unite just in front of the acetabulum. At this point a narrow, thin walled seminal vesicle continues forward to the genital atrium. A cirrus is absent. The genital sinus opens to the outside through the genital pore which is located about midway between the bifurcation of the esophagus and the acetabulum.

The irregularly shaped ovary may lie either on the right or left side, immediately anterior to one of the testes. It is lobed or slightly notched and measures 0.112 to 0.173 mm. by 0.102 to 0.132 mm. A shell gland is located immediately anterior to the ovary. A seminal receptacle is absent. The extensively looped uterus lies largely between the intestinal caeca but sometimes passes beyond the caeca. It passes forward beneath the seminal vesicle, to the genital sinus. The eggs appear as interrupted chains of beads within the uterus and vary considerably in size. The smaller eggs are 0.020 by 0.011 mm. and the larger ones are 0.039 by 0.023 mm.

The vitellaria consist of paired glands lying immediately behind the acetabulum. They are distinctly lobed and lie close together. Their size is rather variable but average about 0.153 by 0.051 mm.

A long slender excretory bladder extends from the posterior end of the body anteriad to near the level of the vitellaria.
Remarks: This distome was originally described by Loewen (1929) as Catoptroides lacustri and was collected from Ameiurus lacustris in Minnesota. He subsequently found it also in Ictalurus punctatus. Lewis (1935) placed the genus Catoptroides in synonymy with Phylloistomum and this is generally accepted by most workers at the present time. Thus Loewen’s species became P. lacustri. The forms in this collection were independently identified by both Dr. Loewen and the writer as P. lacustri. It is true that a number of minor differences exist between the original description and the one presented here. These differences are mainly in size and the writer agrees with Loewen (personal communication) that the differences are intraspecific and not taxonomically significant.

A total of six fishes from five localities contained this parasite and all six hosts were examined in August and September. Four I. punctatus from the Atchafalaya River and the University Lake were infected. One Pseudotus olivarus from the Ouachita River and one Ameiurus melas from Lake Bistineau were the only other infections encountered.

This appears to be the first record of P. lacustri from Louisiana and P. olivarus as a new host. The only other record of a phylloistome in Louisiana was reported by Sogandares-Bernal (1955). He recorded P. superstis Stafford, 1904 from the Croaker, Micropogon undulatus, at Lake Pontchartrain, Louisiana.
Phyllodistomum parvulum n.sp.
(Fig. 2, Plate I)

Hosts: Micropterus salmoides
Micropterus punctulatus
Leptode microlophus
Chaenobrytus coronarius

Description: Fourteen specimens of this worm were taken from the urinary bladders of the hosts listed above. All were collected during September and October from Lake Bistineau, Fordoche, and the Lower Amite River. None of the fish contained more than three worms.

This distome has the typical body divisions of the phyllodistomes. The anterior half of the body is narrow, and tapers toward the oral sucker, whereas the larger posterior body is discoidal and contains most of the body organs. The margin of the discoidal region is smooth except for one large flute. This is best demonstrated by the living worm as the flute is usually flattened after fixation. There are no papillae on the cuticula, as seen in P. lacustris, and the posterior end is not notched as in some forms. The body length of these specimens is from 0.734 to 1.86 mm. The greatest width across the discoidal portion is 0.448 to 0.765 mm. The large round acetabulum is located at the juncture of the two body portions. Its diameter varies from 0.142 to 0.193 mm, with an approximate average of 0.163 mm. The terminal oral sucker is larger than the acetabulum and measures 0.173 to 0.255 mm, with most being 0.224 mm. There is no pharynx. The esophagus varies a great deal but its length is usually slightly longer than the diameter of the oral sucker. The bifurcation of the esophagus occurs at about the middle of the anterior
body portion. The two large caeca, which are usually well distended, extend into the posterior body but stop short of the posterior fifth of the body. In most instances this point is barely beyond the testes.

The testes are located in the anterior half of the discoidal portion of the body. They are obliquely situated with either the right or the left being the most anterior. They are deeply lobed and are contiguous. They are about the same size with variable diameters because of the lobed condition. They measure 0.112 to 0.265 mm. by 0.112 to 0.211 mm. in length and width. The vasa efferentia pass forward and unite just in front of the acetabulum to form a small seminal vesicle. The seminal vesicle empties into a genital sinus and the latter opens to the outside through the genital pore. The genital pore is located midway between the bifurcation of the esophagus and the acetabulum. There is no cirrus.

The irregular ovary is located immediately in front of the testis on the right or left side. It is usually in contact with the testis of that side and is about half as large. Its length and width are 0.082 to 0.102 mm. by 0.062 to 0.091 mm. with an average diameter of 0.091 mm. A seminal receptacle is absent. The shell gland is located medially and dorsally just behind the acetabulum. The uterus passes posteriad from this point and consists of loops which are both intercecal and extracecal. However, most of the uterine loops are posterior to the ends of the caeca and extend to the posterior tip of the body. The uterus eventually passes forward and empties by way of the genital pore. The yellowish-brown,
non-operculate eggs occur sparsely as interrupted chains and vary in size according to the development of the embryo. The immature eggs are about 0.023 by 0.013 mm. and the older eggs are about 0.036 by 0.027 mm. as measured in the fixed specimens.

The vitellaria consist of two pyriform-shaped glands which are located close to each other immediately behind the acetabulum. They lie ventral to the shell gland. In a few instances the vitelline glands are slightly irregular but never as deeply lobed as the testes.

The excretory vesicle is a long slender organ extending from the posterior end to the level of the vitellaria where it divides into two anterior branches.

Remarks: Lewis (1935) made a comparative study of the genus *Phyllodistomum* Braun, 1899, listing twenty valid species. Steen (1938) added fourteen additional species which were described by various authors. Yamaguti (1953) lists a total of thirty nine species of *Phyllodistomum* which are parasitic in fishes. Thus the task of identifying members in this genus has become increasingly difficult. Any attempt to compare all of the known species is practically impossible. The writer is indebted to Dr. S. L. Loewen of Tabor College, Kansas, for his valuable suggestions concerning this group of worms and for the loan of specimens for comparative studies.

Of the described species, *P. parvulum* most nearly resembles the following: *P. fausti, P. brevicecum, P. pearsei, P. mogur-dae, P. superbum, P. carolinii*, and *P. lohrensi*. It differs from all of these species except *P. brevicecum, P. pearsei* and *P. mogur-dae* in
that the oral sucker is larger than the acetabulum. It further differs from *P. superbum* in the absence of a posterior notch. It is unlike *P. fausti* and *P. lohrensi* in the relative position of ovary and vitellaria. Also the uterus is not voluminous but contains only a few eggs and is mostly extracecal. *P. parvulum* further differs from *P. carolini* in that the testes are close together and the vitellaria are close behind the acetabulum. As far as the writer is aware, the only other species in which the oral sucker is larger than the acetabulum are *P. brevicecum, P. pearsei* and *P. mogurndae*. *P. parvulum* differs from *P. brevicecum* in having longer intestinal caeca and having the ovary posterior to the vitellaria. *P. parvulum* is unlike *P. pearsei* in having testes larger than the ovary, smaller vitelline glands, and a sparsely coiled uterus with fewer eggs. *P. parvulum* differs from *P. mogurndae* in the absence of a posterior notch, having testes which are larger than the ovary and much closer together. In addition to the differences described above, *P. parvulum* is much smaller than the closely related phyllodistomes.

This trematode was taken from four species of fishes which were collected from three localities. The large-mouth bass and the warm-mouth bass were collected at Lake Bistineau. The stump-knocker (*L. microlophus*) came from Fordoche Borrow Pit and the spotted bass was taken from the Lower Amite River. It was interesting to note that all four hosts were collected in September.
Allocreadiidae Stossich, 1903

**Allocreadium ictaluri** Pearse, 1924

(Fig. 3, Plate I)

Syn: **Allocreadium halli** Mueller and Van Cleave, 1932

Hosts: **Ictalurus furcatus**

**Ameiurus melas**

**Description**: Only three of these medium-sized digenetic trematodes were collected during the entire study. Two of these were from the intestine of one **Ameiurus melas** which was collected in September from Fordoche "Bar" Pit. The other specimen was taken from the intestine of **Ictalurus furcatus** from Old River near Morganza, Louisiana in August.

The body of this worm is elongate, with both ends rounded and sides nearly parallel. The cuticula is relatively thick and unarmed but may appear rough or even slightly papillated in areas where the cuticula is wrinkled. The average body length for the three specimens, which are similar in size, is 3.39 mm. and the average width is 0.799 mm.

The large muscular acetabulum is in the second fourth of the body length. It is round and has an average diameter of 0.496 mm. The oral sucker is subterminal, round, and slightly smaller than the acetabulum. Its average diameter is 0.377 mm. A very short pre-pharynx is present and opens almost immediately into a large pear-shaped pharynx. The latter structure averages 0.255 by 0.288 mm. A very short esophagus is present so that the alimentary tract bifurcates almost immediately into two caeca which extend to the posterior end of the body.
The two testes lie in the anterior region of the last body fourth. They are contiguous, in tandem, and have smooth surfaces. The anterior testis averages 0.269 mm., and the larger, posterior testis is 0.306 mm. A broad, ovate cirrus sac is present and overlaps the cephalic border of the acetabulum. A coiled cirrus is also present. The genital pore is on the mid-ventral surface at a point about half way between the acetabulum and the pharynx.

The vitellaria are composed of numerous small follicles which occur from the level of the pharynx to the posterior tip of the body. They are chiefly lateral in position but anterior to the acetabulum they arch over the dorsal surface and meet at the mid-line. Similarly, in the posterior part of the body, most caudal to the testes, the vitellaria arch across the ventral surface and form a continuous field. In one of the three specimens the vitellaria are absent to each side of the acetabulum for a distance of about 0.230 mm. This condition was also present in the original description of this species given by Pearse (1924). This feature is not present in the other two specimens studied here.

The spherical ovary is located in the sub-median line at the posterior border of the acetabulum. The average diameter is 0.229 mm., which is only slightly less than that of the testes. The shell gland lies dorsal to the ovary and is partly obscured by the latter organ. A large club-shaped seminal receptacle lies immediately posterior to the ovary. Seitner (1951) illustrated a Laurer's canal which this writer did not observe since all three worms found in this study were used as toto mounts and no sections were made. The uterus is confined
in the space between the anterior testis and the genital pore. It contains only a few large, yellowish, operculated eggs which measure 0.092 by 0.064 mm.

The excretory vesicle is I-shaped and extends to the anterior testis.

Remarks: Allocreadium ictaluri was originally described by Pearse (1921) from Ictalurus punctatus in Wisconsin. Mueller and Van Cleave (1932) described a new species, A. halli from Amiaurus nebulosus and noted some differences between A. halli and A. ictaluri. These differences were based mainly on Pearse's figure of A. ictaluri. Subsequently Van Cleave and Mueller (1934) examined Pearse's type specimen of A. ictaluri and reduced A. halli to synonymy with A. ictaluri. Those authors stated that Pearse's species was very poorly illustrated, which accounted for part of the confusion. The three specimens in this collection are very definitely A. ictaluri and one of them even lacks the vitellaria on each side of the acetabulum as described by Pearse.

Seitner (1951) added much needed information by describing the life history of A. ictaluri. He also affirmed the synonymy of A. halli and gave measurements of A. ictaluri that are intermediate between those of Pearse (1921) and the three specimens in the present study. Seitner demonstrated experimentally that the cercariae develop in the snail, Pleurocera acuta (Say), and the metacercariae occur in unionid bivalves. Various species of catfish become infected by ingesting the infected bivalves. This is an important contribution since it appears to be the only known life history in this large genus.
Yamaguti (1953) has thirty species listed in the genus *Allocreadium* and recognizes *A. halli* as a valid species.

This species of trematode is a relatively rare form. The number observed by Pearse (1924) is not known but from his descriptions there must have been very few. Van Cleave and Mueller (1934) found very light infestation at Oneida Lake, New York. Of the two infected *Ameiurus nebulosus* collected in June one contained but a single specimen. Seltner's (1951) work on the life history was handicapped by this rarity. He states, "Heavy infections with *A. ictaluri* were infrequent, and in an infected fish it was very unusual to find more than three or four sexually mature worms." This rarity of *A. ictaluri* is also supported by other workers who were mainly involved in survey work.

The gross morphology of three specimens of *Allocreadium ictaluri* from this area is described. This is the first report of this species from Louisiana and also the first record of *Ameiurus melas* as a host. The writer agrees with Van Cleave and Mueller (1934) in placing *A. halli* in synonymy.
Lepocreadiidae Nicoll, 1935

Homalometron armatum (MacCallum, 1895)

(Fig. 4, Plate I)

Syn: Distomum isoporum var. armatum MacC., 1895
Allocreadium armatum (MacC., 1895) Pearse, 1924
Allocrædiun armatum (MacC., 1895) Simer, 1929
Allocrædiun pearsei Hunter & Bangham, 1932

Hosts: Aplodinotus grunniens
Lepomis humilis
Lepomis microlophus

Description: The observations reported here are based on 250 specimens and on the measurements of 40. Average measurements are shown in parentheses. These distomes were collected from the intestines of the hosts listed above. These trematodes are relatively sluggish and inactive upon removal from the host and present a rather creamy, translucent appearance except in the areas of the vitellaria. The body is elongate and equally rounded on both ends. The body length is 1.7 to 3.5 mm. (2.66). The maximum breadth occurs about the middle of the body and is 0.45 - 0.9 mm. (0.71). The cuticle on the anterior two-thirds of the body is covered by rather small, stout spines which are arranged in alternate rows and decrease in size posteriorly. In some specimens the entire cuticula is spined. The relatively large acetabulum is located at the juncture of the first and middle thirds of the body. It is a highly muscular organ showing considerable variation in size and measures 0.18 - 0.51 mm. (0.36). The oral sucker is slightly subterminal, round and measures 0.15 - 0.35 mm. (0.24). The short prepharynx measures 0.04 - 0.19 mm. (0.11). The pharynx is 0.06 - 0.17 mm. (0.10) measured in an anteroposterior direction, and is of a globular shape. The esophagus is
usually very short, measuring 0.03 - 0.09 mm. (0.06), and is completely surrounded by glands which are easily recognized. The intestinal caeca bifurcate well anterior to the acetabulum and extend to the posterior end of the body.

The testes are intercecal, in tandem, and are located in the posterior half of the body. In most instances they present a smooth surface but in some forms a slight lobation is evident. They are usually wider than they are long, with the posterior one averaging a bit larger; anterior testis 0.10 - 0.42 mm. (0.30), posterior testis 0.14 - 0.47 mm. (0.35). The two vasa efferentia pass separately to about the level of the acetabulum where they join to form a very short vas deferens. The latter expands almost immediately to form a rather large seminal vesicle which lies dorsally and usually to one side of the acetabulum. The seminal vesicle is about 0.06 - 0.29 mm. in length and gradually narrows to open with the uterus into the genital atrium. The genital pore is located in the mid-line immediately anterior to the acetabulum.

The vitellaria consist of rather large follicles which extend from the level of the acetabulum to the posterior tip of the body. Behind the posterior testis they are confluent and practically fill the entire body in this area. They are drained by two vitelline ducts which empty into a small reservoir. This reservoir lies immediately posterior to the ovary. The ovary is situated about midway between the acetabulum and the anterior testis and is on the right side of the body. It is round to oval-shaped and measures 0.10 - 0.27 mm. (0.17) in length by 0.12 - 0.24 mm. (0.19) in width. A very short
oviduct arises from the ovary and almost immediately it gives off a conspicuous flask-shaped seminal receptacle and a Laurer's canal. The latter structure opens in the mid-line dorsal to the acetabulum. The oviduct receives the common vitelline duct and then passes into the rather inconspicuous ootype which lies slightly lateral to the ovary. The uterus passes forward from the ootype as a slightly looping tube to the level of the acetabulum. At this point the uterus passes dorsal to the acetabulum and directly to the genital pore. It usually contains a small number of relatively large eggs. An attempt was made to select mature eggs near the genital pore for measurement. Thusly the eggs in the uterus measured 0.071 - 0.115 mm. (0.038) long by 0.048 - 0.069 mm. (0.058) in breadth.

Remarks: MacCallum (1895) described a distome from Aplodinotus grunniens (Raf.), the fresh water drum, as Distomum isoporum var. armatum. Looss (1902) also observed this form and recognized the name given by MacCallum. In the opinion of Looss this worm could not be included in the subfamily Allocreadiinae due to a lack of a specialized cirrus sac, but no taxonomic changes were made. Wallin (1909) also records this form as Distomum isoporum var. armatum. Pearse (1924), in his work on parasites of Wisconsin fishes, retained the name armatum but chose to include it in the genus Allocreadium Looss, 1900. Simer (1929) found this form in A. grunniens from the lower Tallahatchie River in Mississippi. He cited the opinion of Looss (1902) that the Allocreadiinae was not the acceptable subfamily but he did not designate a new subfamily. Simer erected a new genus and the form became Anallocreadium armatum (MacC, 1895) Simer, 1929.
Hunter and Bangham (1932) described a new species in this genus as *Anallocreadium pearsei* from the same host, *A. grunniens* and erected a new subfamily, *Anallocreadiinae*, to contain the genus.

Manter (1936) remarked that the genus *Anallocreadium* showed affinities to the *Lepocreadiinae* through the genus *Homalometron* in that subfamily, but he stated that further evidence of relationship should be sought in life history studies. Hopkins (1937) demonstrated, at least partially, the life cycle of *Anallocreadium armatum* and gave further evidence for the familial relationships of this worm. The cercariae were found in the snail, *Amnicola peracuta*, and metacercariae were developed experimentally in the clam, *Musculium ferissi*. The writer has noted in many instances, on examining the stomach contents of the fresh water drum, the predilection of this fish for small clams. Hopkins pointed out that the cercariae resemble the trichocercous type of cercariae found in the subfamily *Lepocreadiinae* but chose to retain the *Anallocreadiinae* of Hunter and Bangham on the bases of minor differences.

From the evidence presented by life history studies and from the apparent similarity of the adult forms, Manter (1937) placed *Anallocreadium Simer, 1929* in synonymy with *Homalometron, Stafford, 1901*. He also named a new species, *H. elongatum* from *Gerris cinereus*, the grey mojarra, in Florida. Yamaguti (1953) agreed with Manter on the synonymy of *Anallocreadium*.

From the study of abundant material in the writer's collection certain evidence indicated that a restudy of the genus *Homalometron* should be done. The writer's description appeared to overlap three
species within the genus. Therefore a complete study of the genus Homalometron was undertaken in order to ascertain the validity of the presently accepted species. The genotype is *H. pallidum* Stafford, 1904, from *Fundulus heteroclitus* at Woods Hole, Mass. Linton (1901) described this form as *Distomum* sp. and subsequently Stafford provided the new name without further description. In *H. pallidum* the vitellaria are shown as being both intercecal and extracecal behind the posterior testis, but they are not shown as being confluent. In *H. armatum* the vitellaria have a similar distribution but they are definitely confluent behind the posterior testis. Also, the spines on *H. pallidum* are described as being very small and easily overlooked, whereas on *H. armatum* they are quite obvious. Therefore *H. pallidum* and *H. armatum* are apparently separate species.

Hunter and Bangham (1932) had a total of twelve specimens on which they based their description of *Homalometron pearsei*. Much of their description on which the separation of *H. pearsei* and *H. armatum* is based was made from the sections of one worm. Largely the authors separated the two species on the relative size of the acetabulum in relation to other organs of the body. The characteristics on which they based their description of *H. pearsei* are shown in Table II.
Table II

Characteristics used by Hunter & Bangham (1932) to Separate *Homalometron pearsei* from *Homalometron armatum*

<table>
<thead>
<tr>
<th></th>
<th><em>H. armatum</em></th>
<th><em>H. pearsei</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>acetabulum</td>
<td>about twice the diameter of the oral sucker</td>
<td>only slightly larger than the oral sucker</td>
</tr>
<tr>
<td>pharynx</td>
<td>length 1/3 that of acetabulum</td>
<td>length 1/2 that of acetabulum</td>
</tr>
<tr>
<td>testes</td>
<td>diameter usually less than acetabulum and typically non-lobate</td>
<td>diameter usually greater than acetabulum and somewhat lobate</td>
</tr>
<tr>
<td>intestinal</td>
<td>narrower</td>
<td>wider</td>
</tr>
<tr>
<td>caeca</td>
<td></td>
<td></td>
</tr>
<tr>
<td>egg size</td>
<td>100-110μ by 60-70μ</td>
<td>85-100μ by 40-60μ</td>
</tr>
</tbody>
</table>

The description of *H. pearsei* is encompassed by the specimens of *H. armatum* in the writer's collection. The results obtained from observation based on fifteen specimens selected at random from this collection are shown below in table III.

Table III presents an analysis of the characteristics of fifteen specimens selected at random from among several hundred stained and mounted specimens. The characteristics presented in the table are those which have been used most often for distinguishing the various species assigned to the genus *Homalometron*. These characteristics relate to the acetabulum, pharynx, testes, intestinal caeca and eggs.

In the analysis of the fifteen specimens an attempt was made to determine the species through consideration of the above characteristics. It will be noted that specimen number one was very much like *H. armatum* although the egg size for this specimen was that given for
### Table III

Application of Hunter & Bangham's Criteria for Separating *H. pearsei* and *H. armatum* to Fifteen Specimens from this Collection

<table>
<thead>
<tr>
<th>No. of Specimen</th>
<th>Acetabulum</th>
<th>Pharynx</th>
<th>Testes Size</th>
<th>Testes Shape</th>
<th>Intestinal Caeca</th>
<th>Egg Size</th>
<th>Most Like</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>3</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>P</td>
</tr>
<tr>
<td>4</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
</tr>
<tr>
<td>7</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>P</td>
</tr>
<tr>
<td>8</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>P or A</td>
<td>P or A</td>
<td>?</td>
</tr>
<tr>
<td>9</td>
<td>P</td>
<td>P or A</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>P or A</td>
<td>?</td>
</tr>
<tr>
<td>10</td>
<td>P or A</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>?</td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>P or A</td>
<td>A</td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>P or A</td>
<td>?</td>
</tr>
<tr>
<td>13</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>?</td>
</tr>
<tr>
<td>14</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>P or A</td>
<td>?</td>
</tr>
<tr>
<td>15</td>
<td>P</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>P</td>
<td>P</td>
<td>?</td>
</tr>
</tbody>
</table>

A—indicates those specimens having characteristics similar to *H. armatum*

P—indicates those specimens having characteristics similar to *H. pearsei*

?—forms clearly intermediate between the two species
**H. pearsei.** All the specimens shown in the table were carefully studied and in each instance an attempt was made to assign it to either *H. armatum* or *H. pearsei*.

The writer is convinced from the analysis of these species and from observations made on the series in his collection that *H. pearsei* is synonymous with *H. armatum*. In an effort to confirm this opinion, specimens were sent to Hunter, Bangham and Manter. Hunter (personal communication) expressed the belief that the two might be separated by applying statistics to the over-all measurements. This would be especially true if two prominent peaks occurred in a statistical curve of these measurements. In other words, in any large collection there may be two well defined groups connected by a smaller number of extremes which permit an overlapping. This does not appear to be the case, for two peaks of measurements are not evident in this collection. Moreover, if such were true, the writer does not agree in the validity of this procedure. Such a method would be of little value to the worker who has few specimens to work with. Bangham, (personal communication) has many specimens in his collection and has studied many variations since describing *H. pearsei* in 1932. He states "...I have had many specimens from other locations, Wis., Tenn., and in 1951 from Cane River Lake, La. There is much variation especially in the last lot—when I have examined all of my slides I would not be certain that I could separate the two into species now."

It would appear then that *H. pearsei* is an extreme variation of *H. armatum* and in the opinion of the writer *H. pearsei* should be suppressed as a valid species.
Manter (1947) described *H. elongatum* from *Gerres cinereus* in Florida, basing his measurements on seven selected individuals. At that time he separated *H. armatum* and *H. elongatum* by stating "*H. armatum* (MacCallum 1895) is not very fully described but apparently its acetabulum is only one-half the size of the oral sucker." On the other hand, the oral sucker in *H. elongatum* was described as being slightly larger than the acetabulum. However, MacCallum says, "The acetabulum is situated about one-third the body length behind this (the oral sucker) and is of about twice its diameter." More recently, Manter (personal communication) has clarified this discrepancy in the literature by saying, "My statement that the acetabulum was one-half the size of the oral sucker is erroneous. I must have intended the reverse." In another communication, Manter described two additional characteristics for distinguishing *H. elongatum* from other members of the genus. The mouth is elongate and its border bears three papillae on each side. From the evidence presented, there is no doubt that *H. elongatum* is a valid species.

The esophageal glands of *H. armatum* that are mentioned in the present description need special consideration. The probable function of these cells is the secretion of the cuticular lining of the esophagus. This seems to be the most logical explanation due to the fact that these cells do not differ, either in size or staining reaction, from those cells which secrete the cuticular covering of the body. Their concentration in the esophageal region may be caused, to some extent, by localized contractions of the body. Whatever the reason may be, their presence is very noticeable in well-stained specimens.
The writer has seen no reference to these structures in any of the forms assigned to the genus Homalometron. Perhaps they have not been mentioned on the basis that they are of no taxonomic importance. They should be included however in a morphological description of the worm. These glands are illustrated in figures 4 and 21.

In summary, it would seem advisable to present a table of those species in the genus Homalometron that are considered valid. The writer is indebted to Dr. Manter for suggestions concerning this table.
Table IV
Comparison of the Features Exhibited by Species in the Genus Homalometron

<table>
<thead>
<tr>
<th>Features</th>
<th>H. pallidum</th>
<th>H. armatum Syn: H. pearsei</th>
<th>H. elongatum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal host</td>
<td>Fundulus heteroclitus</td>
<td>Aplodinotus grunniens</td>
<td>Gerres cinereus</td>
</tr>
<tr>
<td>Body length</td>
<td>2.72 mm.</td>
<td>1.7-1.8 mm.</td>
<td>1.9-3.1 mm.</td>
</tr>
<tr>
<td>Body width</td>
<td>0.89 mm.</td>
<td>0.45-1.5 mm.</td>
<td>0.38-0.61 mm.</td>
</tr>
<tr>
<td>Oral sucker</td>
<td>terminal</td>
<td>subterminal</td>
<td>subterminal</td>
</tr>
<tr>
<td>Sucker ratio</td>
<td>1:1</td>
<td>1:1-1:2</td>
<td>1:0.9</td>
</tr>
<tr>
<td>Anterior extent of vitellaria</td>
<td>level of ovary</td>
<td>posterior edge of acetabulum</td>
<td>level of ovary</td>
</tr>
<tr>
<td>Egg Size</td>
<td>110u X 70u</td>
<td>71-115u X 40-70u</td>
<td>71-90u X 42-54u</td>
</tr>
<tr>
<td>Glands</td>
<td>?</td>
<td>prominent esophageal glands</td>
<td>?</td>
</tr>
<tr>
<td>Major Diagnostic Characteristics</td>
<td>terminal oral sucker, sucker ratio 1:1</td>
<td>sucker ratio 1:1-1:2 vitellaria mostly extracecal except behind testes</td>
<td>oral sucker with papillae; sucker ratio 1:0.9 vitellaria between testes and between testes and ovary</td>
</tr>
<tr>
<td></td>
<td>vitellaria mostly extracecal except behind testes</td>
<td>mostly extracecal except behind testes</td>
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</tr>
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</table>
Allocreadiidae Stossich, 1903

*Crepidostomum cornutum* (Osborn, 1903)

*(Fig. 5, Plate I)*

**Syn:** *Bunodera cornutum* Osborn, 1903

**Hosts:** *Micropterus punctulatus*  
*Micropterus salmoides*  
*Chaenobryttus coronarius*  
*Morone chrysops*  
*Lepomis microlophus*

**Description:** A large number of specimens of this species are in this collection but unfortunately nearly all are immature or are very young adults. Consequently, the description given here is very brief and only the averages are given for six fully mature worms. The reader is referred to Hopkins' paper (1934) for a more detailed description.

These distomes were collected from the stomach, intestines, and caeca of the hosts listed above. They are elongate with nearly parallel sides and an entirely smooth cuticula. The anterior end is very striking in that six muscular oral papillae project from the oral sucker. These papillae are of nearly equal size with four dorsally and two ventrally located. These flukes are among the group called the "papillose allocreadiids" and their general identification is apparent because of these unique papillae.

The average body length of six specimens is 1.51 mm. and the width is 0.339 mm. The round acetabulum is located at the boundary of the first and second body thirds. Its average diameter is 0.161 mm. The oral sucker is slightly subterminal, round, and well marked by the papillae. The diameter of the oral sucker, exclusive of the papillae, is 0.205 mm. and therefore averages slightly larger than the acetabulum.
A prepharynx is present but it is extremely shortened. The muscular pharynx is nearly round and its diameter averaged 0.056 mm. The esophagus in these specimens is about the same length as the pharynx although Hopkins (1934) states that in this species the esophagus is two to four times as long as the pharynx. The intestine bifurcates immediately in front of the acetabulum and the caeca extend to the posterior end of the body.

The testes are located ventrally, in tandem in the posterior half of the body. Their shape varies from round to slightly irregular with the posterior testis averaging a little larger than the anterior testis. The diameter of the anterior testis is 0.151 mm. and that of the posterior testis is 0.171 mm. The sperm ducts enter a very large cirrus sac which is long and slender and lies dorsal to the acetabulum. The posterior two-thirds of the sac is occupied by the seminal vesicle. A simple unarmed cirrus is present but is not conspicuous and does not protrude from fixed specimens as is the case with some forms. The genital pore is located in the ventral mid-line immediately in front of the acetabulum.

The vitellaria in these specimens are rather profuse. They consist of large follicles which extend from the level of the pharynx to the posterior end of the body in the lateral body regions. In some specimens the vitellaria are contiguous behind the posterior testis.

The ovary is located between the acetabulum and the anterior testis either on the right or left side of the body. It is usually spherical in shape and has an average diameter of 0.101 mm. Located
immediately behind the ovary is the seminal receptacle which is from one-fourth to one-half the diameter of the ovary. Both a Mehlis' gland and Laurer's canal are present (Hopkins, 1931). The uterus extends back to the anterior testis and then passes forward to the genital pore. About one to fifty fairly large, yellow, operculated eggs are present in the uterus. These eggs average about 0.066 mm. in length and 0.050 mm. in width as measured in the uterus.

The excretory vesicle is I-shaped and extends forward to the front margin of the anterior testis.

Remarks: The forms in this collection were identified primarily on the basis of the sucker ratios. According to Hopkins (1931) C. cornutum has an oral sucker which is larger than the acetabulum. The most closely related species is probably C. cooperi in which the suckers are of nearly equal size or the acetabulum is slightly larger. The only apparent difference in the description of C. cornutum in this collection and that given by Hopkins (1931) is in the length of the esophagus and this is considered to be of little or no significance. It is interesting to note that although C. cornutum was found in five different hosts from eight localities in the state only those hosts examined in the months March through May yielded mature worms.

The cercaria of C. cornutum has been shown by Hopkins (1931) and others to be of the ophthalmoxiphidiocercaria type. It has been reported by Ameel (1937) in the clam, Sphaerium and by Henderson (1938) in the clam, Musculium. The metacercaria have been reported in crayfish by Osborn (1903), Stafford (1904), Hopkins (1931), Ameel,
Henderson, and others.

*Crepidostomum cornutum* is briefly described and the hosts for this species in Louisiana are listed. Hopkins (1934) has previously listed this species in Louisiana and Simer (1929) recorded it from the Tallahatchie River, Mississippi. A brief review is given concerning the life history of this species as reported by other workers.

**Plagiorchiidae Luhe, 1901**

*Macroderoides typicus* (Winfield, 1929) Van Cleave and Mueller, 1932

(Fig. 6, Plate I)

Syn: *Plesiocreadium typicum* Winfield, 1929

**Hosts:** *Amia calva, Lepisosteus osseus*

**Description:** These flukes were collected from the intestines of the two hosts shown above. The body of *Macroderoides typicus* is rather elongate, fairly slender, with both ends rounded, the posterior end tapering more than the anterior. The cuticula is densely covered with small spines which decrease posteriorly both in number and prominence. The body length is 0.765-2.55 mm. (1.48) and the breadth, which is greatest between the suckers, is 0.173-0.489 mm. (0.320).

The acetabulum is located from one-third to one-half the body length from the anterior end and is round. The diameter is 0.080-0.192 mm. (0.127). The oral sucker is subterminal and averages slightly smaller than the acetabulum. It is also usually round although occasionally it is elongated in the long body axis. The pre-pharynx is extremely short and even appears as though not present in most forms. The relatively large muscular pharynx is 0.036-0.064 mm.
(0.048) and empties into a long thin esophagus. The latter structure measures 0.030-0.306 mm. (0.169). The intestinal bifurcation occurs well anterior to the acetabulum and the caeca extend to the posterior end of the body.

The testes are located in the third fourth of the body length. They are obliquely in tandem, round, and present a smooth surface. The diameter of the anterior testis is 0.101-0.224 mm. (0.147) and the posterior testis averages slightly larger being 0.115-0.233 mm. (0.149). The sperm ducts enter a well developed cirrus sac which is located dorsal to the acetabulum. The major portion of the sac is occupied by a large bipartite seminal vesicle. A large cirrus nearly always protrudes in mounted specimens. A genital atrium is present and the genital pore is in the mid-line immediately anterior to the acetabulum.

The vitellaria are latterly distributed in the body and extend from the level of the posterior margin of the acetabulum to a short distance beyond the posterior testis. The follicles are fairly large and empty via the vitelline ducts into the vitelline reservoir which is located in front of the anterior testis.

The ovary is located immediately behind the acetabulum either on the right or left side. It is round to elliptical in shape and generally has a smooth surface. The diameter is 0.059-0.173 mm. (0.116). A Mehlis' gland is located dorsal to the ovary. No seminal receptacle is present. According to Winfield (1929) Laurer's canal is present and sperm are stored in the proximal end of the uterus. From Mehlis' gland the uterus passes posteriad between the testes to the posterior end of the body. Generally only one loop occurs but
sometimes secondary folds are present. The uterus is usually filled with oval, operculate, yellowish eggs which average 0.012 by 0.020 mm.

The excretory vesicle is I-shaped and extends to the level of the posterior testis.

Remarks: The forms in this collection compare very favorably with the description given by Winfield (1929) for this species. The only apparent difference is that forms from this locality average slightly larger than those described by Winfield from *Amia calva* at Douglas Lake, Michigan. All other features are practically identical in the two descriptions.

The genus *Macroderoides* was erected by Pearse (1924) to contain a trematode which he designated as *M. spiniferus*. It was obtained from the short-nosed gar and two species of bullhead at Lake Pepin, Wisconsin. Winfield (1929), apparently unaware of Pearse's work, created a new genus *Plesiocreadium* for his own species *P. typicum*, from *Amia* at Douglas Lake, Michigan. Van Cleave and Mueller (1932; 1934) considered *Plesiocreadium* as a synonym of *Macroderoides*. Hunter (1932) compared the two genera and dismissed the resemblances as superficial. He named an additional species, *P. parvum*, from the long-nosed gar and the bowfin at Lake Champlain, New York. Van Cleave and Mueller (1932) described *Macroderoides flavus* from the chain pickerel, *Esox niger*. Later these same authors (1934) reaffirmed their belief in the synonymy of *Plesiocreadium* and disagreed with Hunter (1932).

Four species are recognized as follows: *M. spiniferus* from *Lepisosteus* and *Amiurus*, *M. typicus* from *Amia* and *Lepisosteus*. 
(new host), *M. parvus* from *Amia* and *Lepisosteus*, and *M. flavus* from *Esox niger*. After review of the literature and study of the present material the writer agrees with Van Cleave and Mueller in placing *Plesiocreadium* Winfield, 1929 in synonymy. The writer also believes that the type specimens of all four species should be re-studied and compared for possible additional synonymy.

Van Cleave and Mueller (1934) and Yamaguti (1953) have placed the genus *Macroderoides* in the family *Allocreadiidae* on the basis of the I-shaped excretory vesicle. On the other hand McMullen (1935) placed the genus in the family *Plagiorchiidae* on the basis of adult similarity and life history studies. The writer is inclined to agree with McMullen since life history studies are more important in this determination than the shape of the excretory vesicle.

*Macroderoides typicus* was recorded by Sogandares-Bernal (1955) from four of six *Amia* at Edgard, Louisiana. The present study appears to be the second record for this species from Louisiana fishes.

To summarize briefly a description of *Macroderoides typicus* (Winfield, 1929) from Louisiana fishes is given. The writer agrees with certain previous authors that the genus *Plesiocreadium* Winfield, 1929 should be considered a synonym of *Macroderoides* Pearse, 1921. A short review of the species within the genus is presented and the genus is placed in the family *Plagiorchiidae* in agreement with McMullen (1935). A new host, *Lepisosteus osseus*, is recorded for *M. typicus* in Louisiana.
Glossidium corti (Lamont, 1921) n. comb.
(Fig. 7 & 8, Plate II)

Syn: Plagiorchis corti Lamont, 1921
Plagiorchis ameurensis McCoy, 1928
Plagiorchis geminus Mueller, 1930
Alloglossidium kenti Simer, 1929
Alloglossidium corti (Lamont, 1921) Van Cleave & Mueller, 1931
Alloglossidium geminus (Mueller, 1930) Van Cleave & Mueller, 1931

Hosts: Ameiurus melas
Ictalurus punctatus
Ictalurus furcatus

Description: There are nearly as many descriptions of this form as there are synonyms listed above. The same species from different hosts and different localities apparently presents a wide variety of variations. The writer has a large collection of these flukes from various parts of Louisiana and a detailed description may help clarify the taxonomic status of this species.

G. corti is a parasite found in the intestines of fishes which belong primarily to the family Siluridae. Occasionally they are found in other fishes in small number. One Pomoxis nigro-maculatus from this study was found to be infected with a few worms. The following description is based on the study of 53 specimens and following the usual procedure the ranges in measurement are given and the averages are shown in parentheses.

In these distomes the body is elongate spinulate, and tapers toward the two extremities. The body length is 0.510-2.091 mm. (1.259) and the width at the middle of the body is 0.183-0.489 mm. (0.311). The acetabulum is located in the anterior body half and its diameter is 0.069-0.172 mm. (0.100). The round oral sucker is
slightly subterminal and measures 0.069-0.165 mm. (0.099). It averages about the same size as the acetabulum but in various individuals either one or the other may be larger. The elongated prepharynx is 0.032-0.142 mm. (0.072) and the globular pharynx is 0.039-0.092 mm. (0.055). The esophagus is short and measures 0.018-0.050 mm. (0.034). In some specimens the esophagus is so short that its presence is questionable. The bifurcation of the intestinal caeca occurs immediately anterior to the acetabulum and the caeca extend to the posterior end of the body.

The testes are located obliquely, in tandem, a little behind the acetabulum and are usually separated from each other by the uterus. Their size varies a great deal depending apparently upon the age of the worm. The anterior testis is 0.085-0.295 mm. (0.168) by 0.096-0.295 mm. (0.179) and the posterior testis is 0.115-0.346 mm. (0.193) by 0.108-0.346 mm. (0.209). Thus both testes are usually wider than long and the posterior testis is the larger one. The sperm ducts pass forward to a large bipartite seminal vesicle enclosed in the cirrus pouch which lies dorsal to the acetabulum. In mounted specimens this structure will appear to curve around the acetabulum on either the right or left side. The genital pore is located in the ventral mid-line immediately in front of the acetabulum.

The extent of the vitellaria is highly variable in these distomes both in location and quantity. It appears that these characteristics were the main bases for the erection of several genera and species. In the forms studied here, the vitellaria may extend from the level of the intestinal bifurcation to the anterior border of the posterior
testis or they may begin at the acetabulum and extend to the anterior or to the posterior testis. Generally speaking, the vitellaria in most of the specimens is in the area between the anterior border of the acetabulum and the anterior level of the posterior testis. Also they are mainly lateral in position. Vitelline ducts from both sides join the small vitelline reservoir immediately posterior to the ovary.

The ovary is located a little out of the median line half way between the acetabulum and the anterior testis. It may be spherical, oval or very slightly lobed. In most instances it is a smooth sphere. The diameter of the ovary is 0.069-0.193 mm. (0.110) which is slightly larger than the acetabulum in average measurement. The oviduct leaves the ovary on the dorsal surface, receives the vitelline ducts, and is joined by a seminal receptacle which is about half the size of the ovary. Laurer's canal is present and appears to open shortly in the dorsal mid-line. The uterus passes between the testes to the posterior extremity and is largely intercecal. It then passes forward without much looping to the genital pore. In fully mature worms the uterus is filled with yellow, oval eggs which measure 0.018-0.032 mm. (0.023) by 0.009-0.018 mm. (0.011).

The excretory vesicle is I-shaped or possibly Y-shaped with very short arms.

Remarks: As stated at the beginning of the description, the many morphological variations presented by this species has led to much confusion regarding the correct name. A brief resume of the synonymy is presented here with the hope that it may clarify some of the confusion. Lamont (1921) described the trematode Plagiorchis
corti, family Plagiorchiidae, as being parasitic in the intestine of Schilbeodes gyrinus in Lake Mendota, Wisconsin. McCoy (1928) found a somewhat similar form in Ameiurus natalis in Ramona Lake near St. Louis, Missouri. Because of "certain structural differences and size discrepancies," he described Plagiorchis ameiurensis as a new species. Mueller (1930) recognized the similarity of the two species mentioned and placed P. ameiurensis in synonymy. In addition, Mueller found forms in Oneida Lake, New York, that he considered sufficiently different to warrant naming as a new species, Plagiorchis geminus. He stated that P. geminus differed from P. corti in that the vitellaria extend from the anterior border of the acetabulum to the posterior testis, whereas in P. corti they extend from the pharynx to the posterior testis. Two minor differences were a larger cirrus sac and more robust form in P. geminus. Mueller stated that the distribution of the vitellaria was sharply defined and no forms with an intermediate condition were found. In all other respects the two species were similar hence the name "geminus" which means "double" or "twin."

Simer (1929) described a new species of trematode, Alloglossidium kenti from Ictalurus punctatus in the Tallahatchie River, Mississippi. He described the vitellaria as extending from the esophagus to the anterior testis. Actually his illustration shows the anterior limit to be at the level of the intestinal bifurcation. Simer's description is very brief and no comparison is made with other species so whether he knew of the work of Lamont or McCoy is not known. Simer, did however place his new genus and new species in the family, Plagiorchiidae. Also, he presented a comparison of the genera
Glossidium Looss, 1899 and Alloglossidium Simer, 1929. The differences presented by Simer have since been shown to be superficial.

Van Cleave and Mueller (1934) re-studied these forms and considered Alloglossidium kenti Simer, 1929 to be a synonym of Plagiorchis corti Lamont, 1921. Since Alloglossidium Simer, 1929, was described as a monotypic genus and the single species was subsequently placed in synonymy then it follows that the generic name, Alloglossidium, becomes invalid and should have been completely discarded. This was not the case for Van Cleave and Mueller (1934) stated that both Plagiorchis corti and P. geminus had I-shaped excretory vesicles instead of the Y-shape characteristic of the genus Plagiorchis, family Plagiorchiidae. On this basis they removed both species from Plagiorchis and remarked: "In recommending this action the present writers take the position that Simer's generic name Alloglossidium is available for P. corti and P. geminus." Thus they placed A. corti and A. geminus in the family Allocreadiidae on the basis of the bladder.

McMullen (1935), in certain life history studies, gave a new insight to the problem. He showed that within the Plagiorchiidae there is a transition in bladder form from the Y-shape of Plagiorchis to the bag-shape of Macrod eroides and stated that bladder shape should be a secondary character in the family. He showed that the life histories of A. corti and Macrod eroides typicus (Winfield, 1929) were typical of the Plagiorchiidae and returned them to this family from the Allocreadiidae. In making this transfer, however, the generic name was left unchanged. The cercariae of A. corti were
found by McCoy (1928) in the snail Planorbis tribolvis, by McMullen (1935) in the snail, Helisoma campanulatum and by Crawford (1937) in the snail Helisoma (=Planorbis) trivolvls. McCoy reported that young crayfish act as second intermediate hosts. McMullen reported mayfly and dragon fly nymphs and Crawford also reported dragon fly nymphs as second intermediate hosts.

After the work of McMullen (1935) various authors recorded both A. corti and A. geminus in parts of the United States and Canada. Bangham (1938; et seq) and Miller (1940) have recorded both species. Yamaguti (1953) chose to transfer geminus to the genus Glossidium Looss, 1899 on the basis of the distribution of the vitellaria. This author also retained A. kenti Simer, 1929 as the genotype of Alloglossidium instead of A. corti (Lamont, 1921). Whether he was unaware of the declared synonymy of A. kenti by Van Cleave and Mueller (1934) or merely disregarded it is not known by this writer. However, Yamaguti does list the paper in which the synonymy was declared.

From the study of the literature presented above and observation of forms in this collection, it appears that only one species, Glossidium corti (Lamont, 1921) n. comb., is valid at the present time. As stated previously the characters used by Simer (1929) to separate Alloglossidium from Glossidium have since been shown to be invalid. The species which Simer described and used as the basis for familial separation has since been declared synonymous with forms which definitely conform to the genus Glossidium. On this basis the writer takes the position that the genus Alloglossidium Simer, 1929 should be discarded. It may be mentioned here that the genus Glossidium has
much in common with the genus *Plagiorchis* and although no species of
*Plagiorchis* in fishes are presently known, further study may warrant
the combining of these two genera.

The writer believes that *A. geminus* (Mueller, 1930) which was
transferred to *Glossidium* by Yamaguti (1953) is also a synonym of
*Glossidium corti*. A number of factors lead to this conclusion.

Mueller (1930) separated the two species primarily on the distribution
of the vitellaria. He stated: "While it is in general unsafe to
establish a new species upon a single character, in this case at least
there seems no other way of dealing with the facts." Although, on
this basis, the forms in Oneida Lake fall into two well-defined
groups it seems significant to the writer that subsequent records
from other areas do not show this distinction so clearly. Furthermore,
even in Oneida Lake, Van Cleave and Mueller (1934) were in doubt as
to the number of species represented because they observed variable
intergrading characters. Nevertheless these two authors accepted
*A. corti* and *A. geminus*. They also stated that a further difference
in the two species included a round ovary in *A. geminus* and a lobated
or irregular ovary in *A. corti*. The forms in this collection show a
highly variable condition both in vitellaria distribution and in the
shape of the ovary. The state of development of these worms and the
manner in which they are fixed seem to be the primary influence on the
condition of the structure in question.

There are indications that some authors have separated these two
species on the basis of the host in which they are found. *A. corti*
is described as usually found in *Schilbeodes* sp., and *Ameiurus* sp.,
whereas *A. geminus* is found primarily in *Ameiurus*. Bangham (1931 et seq.) Miller (1940) and Haderlie (1953) appear to have used this method as an aid in separating the two species. Bangham's checklists have no illustrations but the drawings of both Miller and Haderlie show variations which cast doubt on the validity of two species. It should be obvious at this point that the writer does not agree with Yamaguti (1953) for that author not only considers these forms as separate species but places them in separate genera.

Through the courtesy of Professor Wilford A. Dence of the State University of New York the writer was able to study the type and co-type of *A. geminus* (Mueller, 1930). Comparison of those specimens with others in the writer's collection showed only slight variations in regard to over-all size and shape. These differences were not sufficient enough to consider them as separate species. Such differences as were present fit admirably into the various descriptions given for *A. corti*. For these reasons *A. geminus* is placed in synonymy.

A complete description and taxonomic review is given for the species *Glossidium corti* (Lamont, 1921) n. comb. A total of six species have been placed in synonymy and evidence supporting this disposition has been presented. The available evidence concerning the life history of *G. corti* is summarized and a new host, *Ictalurus furcatus*, is listed from this area.
Heterophyidae Odhnner, 1914

Cryptogonimus chilli Osborn, 1903

(Fig. 9, Plate II)

Hosts: Micropterus salmoides
Pomoxis nigro-maculatus

Description: These small flukes were found in the intestines and caeca of the hosts listed above. Due to the fact that Osborn's (1903) original description of this form has a number of errors and that subsequent corrections are scattered in the literature, a fairly detailed description is presented here. This is based on 17 specimens and average measurements are presented in parentheses.

These were the smallest adult trematodes collected in this study. They can be very easily overlooked unless the creamy chyle of the intestine is carefully examined. The body is elongated and the posterior end tapers slightly. The length of these forms is 0.632-0.836 mm. (0.697) and the greatest width is 0.102-0.173 mm. (0.134). The entire cuticula is covered with very small spines which are especially dense in the mid-ventral zone. In many cases these spines are not evident due to sloughing during recovery and fixing techniques. The small ventral sucker is located immediately anterior to the equatorial plane and measures 0.029-0.034 mm. (0.031). The terminal oral sucker is bell-shaped or funnel-shaped with the oral lips being quite flared in most specimens. In some contracted individuals this flared condition is not conspicuous. The oral sucker measures 0.071-0.085 mm. (0.076) by 0.082-0.115 mm. (0.098). The very short prepharynx is 0.023-0.039 mm. (0.034). The pharynx is slightly wider than long and measures 0.018-0.034 mm. (0.024) by
0.027-0.039 mm. (0.030). The esophagus is about twice the length of
the prepharynx and measures 0.059-0.073 mm. (0.067). The bifurcation
of the intestine occurs just anterior to the acetabulum. The caeca
do not enter the back part of the body but end at the level of the
posterior testis.

The testes are obliquely located in the third fourth of the body
length and show considerable variation in size among different
individuals. The anterior testis measures 0.085-0.128 mm. (0.102) by
0.062-0.096 mm. (0.064) and the posterior testis is 0.073-0.142 mm.
(0.111) by 0.062-0.096 mm. (0.080). Occasionally the testes are
located in tandem but this appears to be rare. Two short vasa effer-
entia enter the vas deferens which in turn immediately empties into a
very large seminal vesicle. The seminal vesicle is divided into two
or more portions by constrictions along its length. It empties via
a short duct into the genital cloaca. There is no cirrus or cirrus
pouch. Mueller (1934) states that a small prostate chamber is separa-
ted from the seminal vesicle by a constriction and that the prostatic
cells are much longer than Osborn (1910) depicts them. The genital
pore is immediately in front of the acetabulum.

This fluke was originally described by Osborn (1910) as having
"two ventral suckers." The anterior sucker of the two, has since
been shown by Mueller and Van Cleave (1932) to be a gonotyl. The
acetabulum is much more deeply set and is cup-shaped whereas the
gonotyl is more superficial, flat, and smaller. The genital pore is
enclosed by the lower rim of the gonotyl. These structures are best
seen in a side view of the fluke.
The location of the vitellaria differs from that given in previous descriptions. They are confined to a small area on each side of the seminal vesicle. The follicles are quite large and extend from a point shortly posterior to the acetabulum to the front margin of the anterior testis. The right and left vitelline ducts meet at a small reservoir which is located about mid-way between the acetabulum and the anterior testis.

The ovary consists of six to eight lobes, sometimes less, and is located ventrally just in front of the anterior testis. Due to the lobed condition it is difficult to measure but it is approximately 0.036-0.064 mm. (0.048) in diameter. The oviduct passes dorsally and is joined by a large seminal receptacle which is almost as large as the testes. According to Mueller (1934) Laurer's canal is very long and extends back to the posterior testis where it opens at the mid-dorsal surface. The oviduct receives the yolk duct shortly before passing into the ootype. The uterus passes posteriad and forms one large loop in the posterior body. Sometimes this large loop has a few minor folds in itself but usually only the single large loop is present. The uterus passes anteriad to the metraterm which empties into the genital cloaca. In mature individuals the uterus is filled with dark brown, operculated eggs which measure 0.016-0.023 mm. (0.019) by 0.009-0.011 mm. (0.011).

The excretory system is Y-shaped. The division occurs at the level of the anterior testis and the branches extend to the pharynx. All three portions are usually dilated so that the esophagus appears suspended by the dilated anterior branches.
Remarks: These forms are identified as *Cryptogonimus chili* from the combined descriptions of Osborn (1903; 1910), Van Cleave and Mueller (1934), and Mueller (1934). Although a few minor differences occur between the forms in this study and those previously described, the writer feels that these differences will not justify the description of a new species. The description of Osborn (1910) was shown by subsequent workers, notably Mueller (1934), to be incorrect in regard to the seminal receptacle, Laurer's canal, nature of the gonotyl, and certain other details. The nature of the gonotyl was not understood at the time of Osborn's work.

The two most striking differences encountered in these forms are the location and extent of the vitellaria and the structure of the gonotyl. The vitellaria are illustrated by Mueller and Van Cleave (1932) as extending from the intestinal bifurcation posterior to the front margin of the anterior testis. They are also shown as being composed of rather small follicles. The forms in this study have the vitellaria confined to a small area between the acetabulum and the anterior testis. Also, the follicles appear to be larger.

The gonotyl in these forms does not seem to be nearly as well developed as previously described for *C. chili*. It is much smaller than the acetabulum and more superficial. It does, however, appear to be enclosed in a sheath as previously described. Other minor variations occur such as size discrepancies in some of the reproductive organs. But since these variations occur to some degree within this collection they are considered unimportant.

At this point some discussion should be given to the specific
name of this form. Osborn's (1903) original description of this form uses the name *C. chili* and although the description is short and the illustrations are not too good, enough is given to adequately identify the form. Unfortunately, Osborn (1910) gave the most complete description and again described the same form as a new species and called it *C. chyli*. Undoubtedly, Osborn meant for the name to be *C. chyli* since it was taken from "the creamy chyle of the small intestine." Regardless of the author's intention, according to the law of priority, the name *C. chili* should stand. The difference in spelling may be due to the fact that the first description was published in a German journal and since the letter "y" is so rare in the German language the letter "i" was substituted. Whatever the reason, the original name stands as *C. chili*. All subsequent authors, except Yamaguti (1953), have used the name *C. chyli* and since it has been used many times, then a special ruling may be required to confirm this as the valid name. Until such time the writer must concur with Yamaguti (1953) and use the name *C. chili*.

The small number of reports for *C. chili* in various surveys in the literature indicates the form is either relatively rare or often overlooked. Van Cleave and Mueller (1934) reported that only a few worms were found in the rock-bass and small-mouth bass. Miller (1940) also reported few specimens from the same hosts in the St. Lawrence watershed. Most records are given by Bangham (1926, 1941 and 1955) and in most of these *C. chili* is not abundant. In one paper though Bangham (1926) reports that, "The adults of this species were found in the pyloric caeca and upper intestine of nearly all the small-mouth
bass, large-mouth bass, and rock-bass examined." Van Cleave and Mueller (1934) state: "The scanty records of its (C. chili) occurrence in the literature indicate that it is probably limited to the northern states and Canada." The presence of C. chili in this locality disproves the contention of those authors.

C. chili was found in one large-mouth bass taken from Lake Chicot, Louisiana and in six black crappies from University Lake at Baton Rouge, Louisiana. All specimens were collected during February and March. The writer has no explanation for the apparent rarity of this form in Louisiana unless it is of recent origin or the proper intermediate hosts are scarce. However, this rarity is in agreement with the findings of other workers in the field.

The complete life cycle of C. chili is not known but apparently it is very similar to that of Caecincola parvulus. Osborn (1910) reported a C. chili cyst in the pectoral fin of a sunfish. Cooper (1915) found the cysts in young Micropterus dolomieu in Canada and Bangham (1926) reported finding cysts in skin and muscle of young bass.

In this study C. chili is described in detail. In this description the writer has utilized the efforts of previous authors and added certain corrections and variations presented by forms from this locality. Some discussion is devoted to the validity of the specific name. C. chyli is in common usage, whereas C. chili appears to be the valid name according to priority. This is the first report of C. chili in this area and its rarity is supported by the records of other workers on fish trematodes.
Caecincola parvulus Marshall and Gilbert, 1905
(Fig. 10, Plate II)

Hosts: Micropterus salmoides
       Micropterus punctulatus
       Pomoxis nigro-maculatus

Description: These small, delicate, vase-shaped worms were
             taken from the stomach, caeca, and intestines of the hosts listed
             above. This form has been adequately described by previous authors
             and a detailed description would be superfluous in this paper. The
             scarcity of records on this species and some minor descriptive
             differences do, however, warrant a brief description. The usual
             procedure is followed in that the ranges in measurement are given.
             These are based on 32 specimens and averages are shown in parentheses.

             This is the second smallest worm encountered in this study. It
             is noticeable in the partially digested food of the fish as a small
             black speck. The dark brown or black eggs cause this appearance.
             The entire cuticula is covered with small spines which are slightly
             more dense on the ventral surface. Scattered pigments of the eyespots
             are evident on each side of the pharynx. The total length is 0.438-
             1.09 mm. (0.745) and the greatest width which is at the acetabular
             level is 0.140-0.290 mm. (0.187). The acetabulum is approximately
             one-third of the body length from the anterior end and measures
             0.036-0.062 mm. (0.044). The oral sucker is terminal, cup-shaped and
             much larger than the acetabulum. It measures 0.069-0.163 mm. (0.112)
             by 0.128-0.224 mm. (0.142). A short prepharynx and esophagus are
             present and average 0.031 mm. and 0.034 mm. respectively. The pharynx
             is about the size of the acetabulum and averages 0.047 mm. The
esophagus bifurcates anterior to acetabulum. The caeca are widely divergent and stop short of the middle of the body.

The testes are located immediately behind the middle of the body. They are usually oblique, sometimes lateral, and are generally somewhat longer than wide. The anterior testis measures 0.098-0.183 mm. (0.125) by 0.055-0.149 mm. (0.089) and the posterior testis is 0.096-0.180 mm. (0.134) by 0.052-0.172 mm. (0.098). A large seminal vesicle constricted into several parts is located behind the acetabulum and empties into the common duct immediately anterior to the acetabulum. There is no cirrus or cirrus sac. The common duct empties through the genital pore which is located directly in front of the acetabulum and is partially recessed with it.

The ovary is usually tri-lobate and is located ventrally immediately in front of the testes. Its greatest diameter measures 0.046-0.085 mm. (0.067) but the diameter is highly variable due to the lobed condition of the ovary. The oviduct is joined by a large, round seminal receptacle which is located just anterior to the ovary or either dorsally or to one side of the ovary. Laurer's canal passes posteriad and opens at the dorsal mid-line between the testes. Mueller (1934) has described the area in detail in regard to the ovarian complex. The vitellaria consist of two groups of follicles located in the anterior one-fourth of the body on either side of the pharynx. Other writers speak of this as the neck region. The follicles of either side approach each other dorsally but are not confluent. The two vitelline ducts pass posteriad to a small reservoir just behind the ovary. The uterus passes posteriad from the ovary and practically
fills the posterior body with one large loop which is coiled many times. It passes forward to the acetabulum where the metraterm empties into the common genital duct and then outside through the genital pore. A gonotyl is absent. The uterus is heavily filled with dark brown operculated eggs. The anopercular end is drawn out to one side into a small papilla as described by Mueller (1934). The eggs as measured in the uterus, are 0.018-0.025 mm. (0.020) by 0.009-0.013 mm. (0.011).

The excretory system is Y-shaped with all three arms being dilated. The division occurs at the level of the anterior testis and the branches reach the level of the pharynx.

Remarks: The description presented here agrees in all essential details to that given by Marshall and Gilbert (1905) as amended by Mueller and Van Cleave (1932), Van Cleave and Mueller (1934) and Mueller (1934). Due to the fact that no single reference includes a thorough description utilizing measurements of internal organs, the writer has repeated much of the known description and added some concerned mainly with organ measurements.

Mueller (1934) stated that, "The surface of the worm is covered with spines, but these are so small that they appear as mere dots under the oil immersion lens." The forms in this collection have spines which are easily recognised and quite pronounced under the high dry lens. It is true that they are not as evident as those seen in Cryptogonimus chilli but nevertheless more evident than previously stated. Also, the measurements presented in this study indicate that the forms from this locality average a little larger
than those previously reported.

**Caecincola parvulus** shows a marked resemblance to **Cryptogonimus chilli**. In fact *C. parvulus* was placed in the family Heterophyidae and subfamily Heterophyinae due to this close similarity. Mueller and Van Cleave (1932) have done an excellent study of the taxonomic relationships of this form and the writer concurs with their opinions, so further discussion is considered unwarranted here. Since the two species are similar a comparison is presented. Both forms are alike in general size and position of body organs. The genital systems of both forms are remarkably similar. In this study, both species have been found in the same localities, utilizing the same type of hosts. Strangely enough though, they were never found in common in the same fish. The two species differ in the position of the vitellaria and the absence of a gonotyl in **Caecincola**. Thus while the two are alike in many respects, the differences are as striking as the similarities.

The life history of **Caecincola parvulus** was adequately studied by Lundahl (1939; 1941). He stated that the primary hosts for this worm are Huro (*Micropterus*) salmoides and *Micropterus dolomieu* but that other centrarchid fish might serve as facultative hosts. The first intermediate host is the snail, *Amnicola (Marstonia) lustrica* Pilsbry. The cercariae are of the Pleurolophocerca Group and encyst in the fins and skin of various centrarchids and cyprinids which serve as second intermediate hosts. In his paper Lundahl (1941) gives an excellent discussion of relationships and chooses to place **Caecincola** in the family Cryptogonimidae Ciurea (1933). The writer is inclined to agree with Yamaguti (1953) and Mueller and Van Cleave.
(1934) and retain the family Heterophyidae. Lundahl (1941) also gives detailed measurements for the adults as presented in this study but his forms are much smaller.

*C. parvulus* was originally described from the large-mouth bass, *Micropterus salmoides* by Marshall and Gilbert (1905). Pearse (1924) recorded *Micropterus dolomieu* and *Ambloplites rupestris* as hosts in Wisconsin lakes. Van Cleave and Mueller (1934) found *Caecincola* only in *M. salmoides* in Oneida Lake, New York. Bangham (1942) recorded *Caecincola* from *M. salmoides* and *Pomoxis annularis*, the white crappie, at Reelfoot Lake, Tennessee. Bangham (1955) also reported *M. salmoides* as a host in Lake Huron.

In addition to *M. salmoides*, two new hosts are reported for *Caecincola* in this area. *Micropterus punctulatus*, the spotted bass, was found to harbor this fluke in fairly large numbers in several localities. *Pomoxis nigro-maculatus*, the black crappie, was found infected in one instance. This fish was collected at Lake Chicot near Ville Platte, Louisiana. Thus the black crappie may be merely a facultative host as Lundahl (1941) suggests but the spotted bass appears to serve as well as the large-mouth bass as a normal host.

To summarize briefly, *Caecincola parvulus* is reported for the first time from this general area. Additional description, dealing mainly with the size of internal organs, is presented. The measurements of these forms show them to be slightly larger than those previously described. Two new hosts, *Micropterus punctulatus* and *Pomoxis nigro-maculatus*, are listed for *Caecincola*, and as far as the writer is aware this is the most southern locality reported for this distome.
Neochasmus labeosus Bernett, 1935
(Figs. 11 & 12, Plate II)

Syn: Neochasmus ictaluri Sogandares-Bernal, 1955

Hosts: Ictalurus punctatus
Polidictus olivaris
Polyodon spathula
Lepisosteus caseus

Description: These rather small distomes were taken from the intestines of the hosts listed above. In addition, there was one small immature worm, presumably N. labeosus, collected from Aplodinotus grunniens. The study is based on 15 specimens and the average measurements are shown in parentheses. The body of this species is sub-cylindrical and measures 0.663-1.530 mm. (0.394) in length by 0.224-0.510 mm. (0.354) in width. The cuticle is spined but in many instances these spines are absent on the posterior one fourth of the body. The spines are very small and during fixation they are easily lost. The rather small acetabulum is located at the junction of the first and second body thirds and measures 0.059-0.087 mm. (0.069). The terminal oral sucker is 0.087-0.153 mm. (0.126) in diameter. It is surrounded by a single continuous circle of spines each of which measure 0.019-0.024 mm. (0.020) in length. A fairly conspicuous, thickened dorsal lip is also noticeable. The oral spines vary in number from 22 to 35 with the average being 29. The oral sucker opens into a short prepharynx measuring 0.013-0.059 mm. (0.033) in length. The globular shaped pharynx is 0.041 by 0.048 mm. The esophagus averages slightly longer than prepharynx measuring 0.018-0.069 mm. (0.042) in length. The intestinal bifurcation occurs a short distance anterior to the acetabulum. The caeca do not extend to the
posterior end but stop short of the last quarter of the body length.

The two ovoid testes are located laterally and usually just behind the middle of the body. Often they are obscured by the uterus if the latter is heavily filled with eggs. They are situated obliquely in the dorsal half of the body and present a smooth outline. The right testis averages 0.109 by 0.079 mm, and the left testis is 0.123 by 0.082 mm. The vasa efferentia pass forward and enter separately into a large seminal vesicle. The posterior extremity of the seminal vesicle is about mid-way between the acetabulum and the testes. It coils forward dorsal to the acetabulum and enters a short ejaculatory duct which in turn empties into a small chamber just anterior to the acetabulum. This chamber is surrounded by small gland cells. A genital sinus connects this chamber to the genital pore which is located immediately anterior to the acetabulum. The anterior border of the acetabulum and the genital sinus are bounded by a conspicuous gonotyl. This gonotyl consists of two lateral folds in the body wall and is most evident in contracted specimens which are slightly flattened.

The ovary consists of an irregular series of follicles which are transversely arranged across the ventral region of the body just behind the acetabulum. In many instances it is difficult to separate the ovary from the vitelline follicles. Mehlis' gland lies dorsal to the ovary and a small seminal receptacle, approximately the size of the pharynx, lies anterior to Mehlis' gland. Laurer's canal is present and appears to open in the mid-line dorsal to the acetabulum. The uterus, when filled with eggs, practically fills the entire
posterior third of the body. A short metraterm enters the genital sinus just posterior to the entrance of the male duct. The eg.s are 0.020-0.032 mm. by 0.011-0.013 mm. (0.024 by 0.013) as measured in the uterus.

The vitellaria consist of large scattered follicles which are irregularly placed in the lateral regions of the body. They extend from the level of the anterior border of the acetabulum to the posterior border of the testes. They are extracecal except in the region of the acetabulum where they approach the mid-line but do not touch. Two common vitelline ducts approach the mid-line just posterior to the acetabulum and empty into a small vitelline reservoir. The latter is located immediately behind Mehlis' gland.

The excretory vesicle is the typical heterophyid type i. e. the bladder divides just posterior to the testes and two lateral rami extend to the level of the pharynx.

Remarks: Through the courtesy of the U. S. National Museum and the Parasite Branch of Bureau of Animal Industry the writer was able to study all the species in the genus Neochasmus except N. microvatus (Tubangui, 1928) Tubangui and Masilingan, 1944. From the study of these type and cotype slides certain new facts became evident.

The forms in this collection are obviously the same as those described as Neochasmus labeosus Bennett, 1935. Bennett (1935) described N. labeosus from a water snake, Natrix rhombifera, from this area and a few minor differences occur between his description and that given above. But these differences do not warrant a separate species. Bennett (personal communication) has compared these forms
and concurs with this opinion.

Although a water snake was described as the host for *N. labeosus* it is apparent, even in this study, that *Neochasmus* is able to utilize a wide variety of hosts. Therefore this diversity of hosts seems negligible in comparison to the apparent similarity of the specimens.

The cuticula of *N. labeosus* was described as being smooth except for the oral spines. Bennett (personal communication) states that this is probably an error caused by a sloughing of the spines during fixing and staining. Indeed, this seems to be the case for in one small area around the acetabulum in one of his cotypes a few spines can be seen. Most of the forms in this collection have also lost their spines. As further evidence, all other forms in this genus and even all of the related genera have been described as having a spiny cuticula.

The number of oral spines on *N. labeosus* was described as being 34. However, the writer recounted these spines on the type and a cotype and found 34 spines on the type specimen and 29 on the cotype. Van Cleave and Mueller (1932) described *N. umbellus* as having 27 spines. Re-study of seven cotypes of this species showed the following totals in regard to the number of oral spines: 29, 30 or 31, 30, 31, 28, 31 (? definitely more than 27), and 27. Only one of the cotypes had 27 oral spines so there must be a range in number instead of the 27 as reported in the description of the species. Sogandares-Bernal (1955) reported 22 spines for *N. ictaluri* and, although the writer has the type and a cotype of this species, it was impossible to accurately count the oral spines due to the extreme
contraction in both specimens. But it is reasonable to assume that there is also a variation here. Moreover, in the two closest related species to the forms in question, variations in oral spine count were noted in the original descriptions. For *Allacanthochasmus varius* Van Cleave, 1922 part of the description states: "... usually 2½ spines in the oral circle though in some instances a smaller number has been observed and in one individual 28 were present." Also in *Allacanthochasmus artus* Mueller and Van Cleave, 1932 the authors described 26-29 spines in the oral circle. Both of the latter species are in the writer's collection and are discussed separately.

It appears then that the number of oral spines in any of the species in *Neochasmus* is variable and not a fixed total as described in the literature for some species. This explanation would clarify the apparent discrepancy between the 3½ spines reported for *N. labeosus* and the variable number given by the writer for his specimens.

There is one other difference that might be mentioned here between *N. labeosus* as described by Bennett (1935) and the forms in this collection. Bennett (1935) gives the measurement of the acetabulum in his forms as being 0.11 by 0.14 mm. whereas this writer gives 0.059-0.087 mm. (0.069) as the diameter. Re-examination of all slides show this to be the only real difference between Bennett's two specimens (type and cotype) and those in this collection. This is not a significant difference, considering the highly variable muscular acetabulum. This difference, however might be explained on the basis that Bennett's specimens were taken from a water snake whereas all of the writer's specimens were taken from fishes. Moreover,
there is a greater acetabular difference between the forms taken from
Polidictis olivaris and those from other fishes than there is between
Bennett's forms from the snake and those in this collection from
fishes.

With the evidence presented above and comparison of the writer's
description with that of Bennett (1935) it is obvious that his
specimens from a snake and those taken by the writer from fishes are
the same species, Neochasmus labeosus Bennett, 1935.

Sogandares-Bernal (1955) described a new species, Neochasmus
ictaluri, from the catfish, Ictalurus furcatus. He separated N.
ictaluri from all other species in the genus on the basis that it
contained 22 oral spines. It has already been shown, by the writer
and others, that the number of oral spines is highly variable and is
not a good criterion for separation of species. Although the type and
cotype of N. ictaluri were made available to the writer it was impossi-
bile to count the oral spines. However, since all 17 specimens were
taken from the same species of fish then it is possible that each of
the worms had 22 oral spines. But this appears questionable to the
writer since variable oral spine counts were noticed in worms from the
same fish in this collection.

Sogandares-Bernal (1955) also stated that N. ictaluri differed
from N. labeosus in that the mid-acetabulum lies in the first fourth
rather than the first third of the body. This slight difference may
be explained on the basis that all of the specimens of N. ictaluri
were taken from preserved fish (Sogandares-Bernal, personal communica-
tion) whereas those described by Bennett (1935) and those in the
writer's collection were alive when removed from their hosts. Forms from preserved hosts are highly contracted and show a different acetabular location. This fact is quite evident on both the type and cotype of *N. ictaluri*. In the writer's opinion the acetabular position is obviously due to a state of contraction and is not indicative of separate species in this case.

One other factor is used by Sogandares-Bernal to separate *N. ictaluri* from *N. labeosus*. He states the sucker ratio is 1: 1.13 for *N. ictaluri* and 1: 0.71 for *N. labeosus*. The ratio 1: 1.13 for *N. ictaluri* is evident from that author's descriptive figures. However, from Bennett's figures the ratio 1: 0.71 could not be obtained except by dividing the length of the acetabulum by the width of the oral sucker which is in error for proper comparison. Bennett (1935) gives the width of both the oral sucker and the acetabulum as 0.14 mm. which is a 1:1 ratio. This compares favorably with the 1: 1.13 given for *N. ictaluri*.

From the evidence presented above it is the writer's opinion that *Neochasmus ictaluri* Sogandares-Bernal, 1955 is in synonymy with *Neochasmus labeosus* Bennett, 1935.

*Neochasmus umbellus* Van Cleave and Mueller 1932 is easily separated from *N. labeosus*. The very conspicuous gonotyl in *N. labeosus* is not present on *N. umbellus* and a vestigial gonotyl is present which appears as a series of concentric rings. Superficially these rings closely resemble a thumb print. The oral spine count of 27 given for *N. umbellus*, is in error as was stated above. The number varies at least between 27 and 31 spines.
Neochasmus microvatus (Tubangui, 1928) was not observed by the writer but apparently it is sufficiently different to prevent any confusion with the other species. The acetabulum (0.03-0.05 mm.) is much smaller than the oral sucker (0.10-0.14 mm.) and a conspicuous gonotyl is also apparently absent. Tubangui and Masilungan (1924) reported 7 oral spines in one specimen and 16 in another so the number of oral spines is quite different. Furthermore, *N. microvatus* was taken from *Glossogobius giurus* and other fishes at Luzon, Philippines which is some distance from any of the localities of the other members of the genus. The latter of course is not a distinguishing characteristic in itself but with other criteria it becomes useful.

The three species in the genus *Neochasmus* which are considered valid by the writer are summarized below in tabular form. As far as the writer is aware, the life history is not known in any of these forms.
Table V

Comparison of the Features Exhibited by Species in the Genus Neochasmus

Species

<table>
<thead>
<tr>
<th>Features</th>
<th>N. umbellus</th>
<th>N. labeosus</th>
<th>N. microvatus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle host</td>
<td>Micropterus</td>
<td>Ameiuridae</td>
<td>Glossogobius</td>
</tr>
<tr>
<td></td>
<td>salmoides</td>
<td></td>
<td>giurus</td>
</tr>
<tr>
<td>Body length</td>
<td>0.85 mm.</td>
<td>0.89 mm.</td>
<td>0.70 mm.</td>
</tr>
<tr>
<td>Body width</td>
<td>0.39 mm.</td>
<td>0.35 mm.</td>
<td>0.32 mm.</td>
</tr>
<tr>
<td>No. of oral spines</td>
<td>27-31</td>
<td>22-35</td>
<td>7;16</td>
</tr>
<tr>
<td>Gonotyl</td>
<td>vestigial;</td>
<td>two large lateral lips by genital atrium</td>
<td>vestigial (?)</td>
</tr>
<tr>
<td></td>
<td>concentric rings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetabular position</td>
<td>junction of first &amp; second body fourths</td>
<td>junction of first &amp; second body thirds</td>
<td>junction of first &amp; second body thirds</td>
</tr>
<tr>
<td>Egg size</td>
<td>0.022 X 0.011-0.032 X 0.015 mm.</td>
<td>0.020 X 0.011-0.032 X 0.013 mm.</td>
<td>0.018 X 0.011-0.022 X 0.012 mm.</td>
</tr>
</tbody>
</table>

Allacanthochasmus varius Van Cleave, 1922
(Figs. 13 & 14, Plate III)

Hosts: Morone chrysops
       Morone interrupta

Description: These small spiny distomes were found in the intestines of the hosts mentioned above. A complete description of A. varius is not given here since Van Cleave (1922), Van Cleave and Mueller (1932; 1934) and Mueller (1934) have already adequately described it. (See remarks below). Due to the fact that a few variations do occur, especially in size, the measurements and ranges are given for 28 specimens in this collection. As usual the averages
are given in parentheses. The total length of these worms is 1.17-1.92 mm. (1.65) and the width is 0.38-0.65 mm. (0.54). The small acetabulum measures 0.08-0.12 mm. (0.11) by 0.09-0.11 mm. (0.11) and is located in the center of the body. The terminal oral sucker measures 0.12-0.21 mm. (0.18) by 0.19-0.24 mm. (0.22) and is surrounded by a single circle of spines which vary in number from 24 to 30. A short prepharynx is present and measures 0.02-0.07 mm. (0.05). The pharynx is somewhat longer than wide and measures 0.07-0.12 mm. (0.11) by 0.06-0.09 mm. (0.08). The esophagus is also quite short measuring 0.03-0.05 mm. (0.04). The testes, which are approximately equal in size, show a tendency for being slightly longer than wide and measuring 0.188-0.230 mm. (0.204) by 0.133-0.161 mm. (0.151). In many instances they are covered by the heavily filled uterus and are difficult to measure. The ova, as measured in the uterus, are 0.020-0.023 mm. (0.022) by 0.011-0.016 mm. (0.013).

The writer has studied both whole mounts and serial sections of this form and feels that any further description would be superfluous since Mueller and Van Cleave (loc. cit.) have done an excellent job in the detailed description of this distome.

Remarks: Van Cleave (1922) discovered some unusual trematodes from the white bass, Roccus (= Morone) chrysops, from the Mississippi River and some of its tributary streams and lakes. Collections of the host were made in Iowa, Illinois, and Minnesota. These distomes resembled certain members of the genus Acanthochasmus Looss (1899) but their internal organization differed so much that Van Cleave erected a new genus Allacanthochasmus. The forms that he took from
the white bass were so variable that he gave them the name of "varius."
Van Cleave realized the close similarity of the fishes *M. chrysops* and *M. interrupta* and made special efforts to compare their trematode fauna. But he stated that, "... not a single specimen of *A. varius* was encountered in *M. interrupta* even in regions where *R. chrysops* was heavily and generally infected by this trematode."

Mueller and Van Cleave (1932) also found *Allacanthochaomus* sp. in fishes from Oneida Lake, New York but they "... never found members of this genus reaching full sexual maturity in any host other than the white bass." Therefore the presence of *A. varius* in *M. interrupta* in Louisiana constitutes a new host and a new locality record.

As far as the writer is aware this species of trematode has been recorded very few times. The reason for this may be two-fold. First, the worm appears to be highly specific for the genus *Morone* and consequently is not seen in many surveys and, secondly, even the sexually mature forms are quite small and may escape detection. In addition to the records of Mueller and Van Cleave there is a record of *A. varius* in *M. chrysops* given by Bangham (1955) from Lake Huron, Ontario, Canada. Though the records of distribution of *A. varius* are few, it appears that wherever the genus of fishes, *Morone* occurs, one will also find the genus of trematodes, *Allacanthochaomus*.

There is one other point that needs mention here. Van Cleave (1922) described and illustrated the genus *Allacanthochaomus* as having no prepharynx and no esophagus. This statement should be deleted and the sentence: "A short prepharynx and a short esophagus
are present," should be substituted. In one of their illustrations, Mueller and Van Cleave (1932) had these structures present but there was no description. However, these same two authors corrected other errors in the original description especially concerning the ventro-genital complex.

A new host and locality record is given for Allacanthochasmus varius Van Cleave, 1922. It is believed that the distribution of A. varius is limited only by the distribution of fishes in the genus Morone. A minor correction is recommended in the original description of Allacanthochasmus concerning the prepharynx and esophagus.

Allacanthochasmus artus Mueller and Van Cleave, 1932
(Figs. 15 & 16, Plate III)

Hosts: Morone chrysops
Morone interrupta

Description: These small elongated distomes were taken from the intestines of the above mentioned hosts. The hosts were collected from Old River at Morganza, Louisiana and the Ouachita River at Monroe, Louisiana. Again the writer feels that a detailed description of the form is not justified due to the fact that Mueller and Van Cleave (1932) and Mueller (1934) have given excellent descriptions. From the study of whole mounts and serial sections in this collection, it is evident that these forms agree in almost every detail with the description given by Mueller and Van Cleave.

This species is described as A. varius in that only the measurements of body structure are given. Some of these measurements were not given in the original description and this should add to our knowledge of the species. The figures given here are for 33 specimens and the averages are in parentheses. A. artus is a much more
elongated form than A. varius and this is shown in the illustrations. The total length of A. artus is 1.11-2.59 mm. (1.43) and the width, at the level of the intestinal bifurcation, which is usually the widest part, is 0.09-0.35 mm. (0.21). The funnel-shaped oral sucker measures 0.12-0.21 mm. (0.14) by 0.09-0.19 mm. (0.13) and is surrounded by a single row of 18-26 oral spines. These oral spines each measure approximately 0.038 by 0.013 mm. and have a slightly different shape than those of A. varius. The acetabulum is very small and measures 0.05-0.09 mm. (0.06) in diameter. The most striking feature of this form, excluding perhaps the oral spines, is the conspicuous gonotyl, which is immediately anterior to the acetabulum. It consists of a naked, muscular stalk-like organ which is permanently exserted and its apex bears five root-like processes. This is best seen in the side view of a whole mount. This structure was aptly described by the original authors.

A short prepharynx and esophagus are both present. The prepharynx measures 0.04-0.11 mm. (0.08) and the esophagus, 0.03-0.09 mm. (0.04). The caeca do not extend the full length of the body but stop shortly beyond the testes. The anterior testis measures 0.06-0.15 mm. (0.09) by 0.05-0.12 mm. (0.07) and the posterior testis, 0.07-0.19 mm. (0.11) by 0.05-0.12 mm. (0.08). The ova, as measured in the uterus, are 0.018-0.023 mm. (0.020) by 0.011-0.013 mm. (0.011).

These measurements compare very favorably with those given by Mueller and Van Cleave (1932) for this species even though their specimens were collected in New York and the writer's forms from Louisiana.
Remarks: A close study of both whole mounts and serial sections of these forms shows little difference from the description given by Mueller and Van Cleave (1932) for specimens from Oneida Lake, New York. In the original description those authors reported the number of oral spines to be 26-29. Of the 28 specimens observed here the range for oral spines is 13-26 with an average of 20. The writer has shown elsewhere in this study that too much emphasis should not be placed on the total number of oral spines. Van Cleave (1922) has stated, "The presence of conspicuous spines around the oral orifice, though a conspicuous character, is in itself of little or no phylogenetic significance." Looss (1899) exemplified this by pointing out the essential differences in the three genera Acanthostomum, Stephanostomum, and Echinostomum all of which are quite different and each of which displays a prominent crown of oral spines. Mueller and Van Cleave (1932) in discussing fish heterophyids, have arranged a number of genera in phylogenetic sequence although in some (Vietosoma, Acetodextra, Cryptogonimus, Caecincola and Centrovarium) the spines are absent, whereas in others (Neochasmus and Allacanthochasmus) the spines are present.

It is interesting to note that *A. artus* was found in common with *A. varius* in those fish which were infected except in two instances. *A. varius* occurred alone in one *M. chrysops* and one *M. interrupta*. The latter fish host then is also a new record for *A. artus*. In all previous reports *A. artus* has been found only in *M. chrysops*.

At this time it seems desirable for those who may utilize this
report, to state the differences between *A. artus* and *A. varius*. *A. artus* differs from *A. varius*, its only congeneric relative, in (1) form of body (slender in *A. artus*, robust in *A. varius*); (2) form of gonotyl (cylindrical with five root-like processes at apex in *A. artus*, a simple crescentric prominence without lobes in *A. varius*); (3) extent of uterus (transverse loops filling posterior third of body in *A. varius* are lacking in *A. artus*); (4) coiled seminal vesicle is anterior to acetabulum in *A. varius*, posterior in *A. artus*. Mueller & Van Cleave (1932) also state that there is a difference in the shape of the oral spines. Although this appears to be so, it is very difficult to observe except in superbly stained specimens. These same authors also separate the two species on the basis of development of prepharynx and esophagus "... very short or wanting in *A. varius*, fairly well developed in *A. artus." The writer has shown that this is no longer a valid criterion even though both structures usually appear longer in *A. artus*.

The development of *A. artus* and *A. varius* is unknown. Mueller (1934) reported that the encysted young of Allacanthochasmus have been found in the tissues of fishes which never serve as normal hosts of the adult flukes. This corroborates the supposition that the definitive fish host acquired its heterophyids through the agency of an alternative fish host, as in the avian and mammalian representatives of the Heterophyidae.

To summarize briefly, *A. artus* is reported for the first time from this section of the country and also for the first time from the host, *M. interrupta*. A detailed description of *A. artus* is
omitted due to the fact that excellent descriptions have already been
given by other authors. The oral spine count in these forms is 18-26,
whereas, the original description gave 26-29. The life history of
A. artus is unknown but certain evidence indicates that the metacer-
carial stage occurs in other fishes.

Cyathocotylidae Poche, 1926

Holostephanus Szidat, 1936

(Fig. 17, Plate III)

Hosts: Ictalurus punctatus
        Pomoxis nigro-maculatus

The cyathocotylids are typically parasites of birds although a
few forms have been described from poikilothermalic animals. According
to Dawes (1946) these worms combine the form of a distome with the
structure of a strigeid. Indeed they are closely allied with the
strigeids in most systems of classification.

There are only a few small immature specimens in this collection
so that species identification with any certainty is practically
impossible. There are indications that the species may be H. ictaluri
Cable and Vernberg, 1949 but the scanty material does not permit
positive identification. A total of nine worms were taken from two
P. nigro-maculatus from University Lake at Baton Rouge. These worms
were encysted in the flesh of minnows which the crappie had eaten
and should therefore be considered ectopic parasites. There is no
reason to assume that the worms would have remained in the intestine
of the crappie. Also one catfish, I. punctatus, from University Lake
yielded a total of eleven worms. Unlike the crappie though, the worms
were free in the intestine and in various stages of development. All,
however, were immature. One *P. punctatus* from Lake Verret contained one worm which was fairly mature but no eggs were present.

The very brief description given here is based mainly on the one worm from Lake Verret. The body is almost round being 0.850 mm. in length and 0.732 mm. in width. The entire cuticula is covered with very small spines. The terminal oral sucker is round with a diameter of 0.080 mm. very closely followed by a pharynx which measures 0.064 by 0.052 mm. An esophagus is practically absent and the caeca extend nearly to the posterior end of the body. The small acetabulum occurs a short distance behind the pharynx and is approximately the same size as the oral sucker, 0.080. A large adhesive structure called the tribocytic organ practically covers the ventral surface of the worm. Its anterior border is just behind the acetabulum. The testes are located obliquely dorsal to the tribocytic organ. They are slightly irregular with the right one a little anterior to the left. The anterior testis is 0.184 by 0.142 mm. and the larger posterior testis is 0.190 by 0.152 mm. A well developed cirrus sac is located between the testes and measures 0.161 by 0.069 mm. The ovary is seen only as a developing organ in front of the left testis, and about opposite the right anterior testis. No eggs are present. The vitelline follicles are large and arranged in a circle around the tribocytic organ but not meeting in front.

These forms appear very similar to *Holostephanus ictaluri* as described and illustrated by Vernberg (1952). The only real difference is in size. Vernberg gives the length as averaging 1.42 mm. and the width 1.34 mm. The largest form here is 0.850 by 0.732 mm. All
of the other measurements given by Vernberg are correspondingly larger. However her specimens were mature ones with eggs which might explain this size discrepancy. All other descriptions and organ ratios are very similar. Also Vernberg's specimens were collected at Lafayette, Indiana from *Ictalurus punctatus* which is the principal host for the specimens in this collection.

From the evidence available this writer is inclined to believe that these worms are not normally parasites of fishes. As stated previously the forms collected from *P. nigro-maculatus* are definitely ectopic parasites since they were dissected from small minnows which the fish had eaten. Only two of thirty-two catfish were infected with one of the two having only one worm. This seems to indicate that at most the catfish is merely a facultative host. The fact that all of these specimens were immature may indicate that they were ingested shortly before the fish were captured. Thus the ability of the worms to reach maturity in the catfish is seriously questioned. Even if the forms here are *H. ictaluri*, as postulated above, there is still doubt concerning the definitive host. Vernberg (1952) reported that of 114 catfish examined only five were infected with a total of nine specimens. From these numbers it appears that the catfish may be only an incidental host for *H. ictaluri*. It seems likely that the normal definitive host of this distome is a fish eating bird although fishes cannot be ruled out completely.

In this study a small number of worms belonging to the genus *Holostephanus*, possibly *H. ictaluri*, were collected from the catfish, *I. punctatus*, and as ectopic parasites in the crappie, *P. nigro-
The infections were so small and so infrequent that it is believed that fishes are not the definitive host for this parasite. This is strengthened by the fact that none of the forms taken from fishes during this study contained eggs. One very young adult is described and compared with *H. ictaluri* and all of the specimens in this collection are tentatively identified as *H. ictaluri*. Some discussion is given in regard to the normal definitive host of this parasite and it is postulated that birds, not fishes, are usual hosts for these distomes.

**Strigeidae Railliet, 1919**

The strigeids, or holostomes as they are sometimes called, are digenetic trematodes which reach maturity chiefly in birds and mammals. The adult worm is very much unlike the metacercaria and for that reason when the larval stages are found it is almost impossible to assign them to their respective genera. Consequently parasitologists have followed a custom of classifying the metacercariae and giving names to what appear to be closely related forms. These names are considered as equivalent to generic groups, but as the life histories of individual species are determined, the species within these groups of convenience are reassigned to their respective genera. Various species of fishes act as the second intermediate hosts for these larval strigeids. Many infections with these metacercariae were encountered in this study.

The two common types of metacercariae found here belong to the groups *Diplostomulum* and *Neascus*. Each of these groups have fairly well defined locations within the host. *Diplostomulum* is usually
found in the eye and this was always so in this study. They may be in either chamber of the eye or in the lens itself. The worm is found free in the eye humors and never surrounded by a cyst. Neascus has an oval, thin cyst and is found throughout the viscera, mesenteries, and often in the pericardium.

Most species of holostomes which have been described are named from the larval stages and there are obviously many more which at the present time are unrecognized. The problem is complicated by the fact that morphologically similar larval forms are not always identical. La Rue (1927), for example, has shown that Diplostomulum huronense from the trout perch is morphologically indistinguishable from the Diplostomulum from the perch eye and yet the two are different species. He found that Diplostomulum huronense is a parasite of the herring gull, Larus argentatus whereas the similar larva from the eyes of the other perch failed to develop when fed to gulls. The latter must therefore be the metacercaria of a different species.

It is obvious from the statements above that any attempt to specifically identify members of this group is extremely unwise. Nolf (1956, personal communication) who has had considerable experience with this group, advised this writer to identify the forms only to their larval groups. He believes that positive identification for many of the forms can only be based on life history work. Any attempt at the present time to attach specific names to these forms may lead to confusion in later work. It is the intention of this writer therefore, to restrict the discussion of these forms to their
major groups. However, some indications of relationships are mentioned.

Larval group *Neascus* Hughes, 1927

(Fig. 19, Plate III)

Hosts: Lepomis macrochirus Micropterus punctulatus
      Micropterus salmoides Ictalurus punctatus
      Chaenobrytus coronarius Lepomis humilis
      Pomoxis nigro-maculatus Lepomis microlophus

Hughes (1927) defines the larval group *Neascus* as follows:

"Strigeid metacercariae with both fore and hindbodies well developed and distinctly set apart by a constriction; no lateral sucking cups; forebody leaf-like; holdfast organ well developed; reserve bladder highly developed, the smaller branches of which are usually anastomoses; calcareous granules mostly free in the circumambient fluid; encysted."

All members of this group occur as encysted metacercariae. At least seven species have been recorded in North America but studies on some of these indicate that not all of the described species are valid. Some forms occur in pigmented cysts on the integument of fishes while others occupy non-pigmented cysts within the internal organs of the host. All of the *Neascus* in this collection are from the internal organs of fishes even though the integuments of the fishes were examined.

This was the most common parasite encountered in this study. Members of the centrarchid family, especially the sunfish group, were almost 100 per cent infected from nearly every locality sampled within the state. Infections also appeared throughout the year although they seemed more heavily concentrated during the summer
months.

There is a great deal of resemblance between the forms collected here and the metacercariae known as *Neascus vancleavel* (Agersborg, 1926). The latter was shown by Miller (1954) to be the larval form of *Posthodiplostomum minimum* (MacC., 1921) which is an adult strigeid living in herons and egrets. There is no experimental evidence in this study to confirm the identity of the present forms as *N. vancleavel*, but the similarity is striking.

A great many of these metacercariae were dissected from their cysts, some while still alive, preserved at once, and later stained and mounted for study. The overwhelming number of individuals encountered discouraged such treatment for each worm. Mounted specimens are 0.370 to 1.70 mm. in length by 0.312 to 0.622 mm. in width. They are found in white, thin-walled, loose-fitting cysts in which the worms are slightly bent. Within the cysts they are surrounded by a granular fluid. The shape is very variable but most of the mounted specimens show a broad, ellipsoidal forebody and a slightly smaller and narrower hindbody. A small acetabulum is in the posterior region of the forebody, separated by a short distance from a larger holdfast organ. Holdfast glands are closely associated with the latter structure. The oral sucker is closely followed by a small pharynx and a short esophagus is present. The caeca extend the length of the body. The hindbody contains rudiments of the reproductive organs and is sometimes greatly enlarged by a swollen excretory vesicle.

The larval genus *Neascus* is abundantly represented in Louisiana fishes. This fact might be anticipated since large numbers of egrets,
herons, and other water birds, which act as definitive hosts for Neascus occur very commonly within the state. Eight species of fishes, principally centrarchids, were found infected with Neascus during this study. Of this group the brim sunfish Lepomis macrochirus, appeared to be the most common host.

Larval Group Diplostomum Brandes, 1892
(Fig. 18, Plate III)

Hosts: Dorosoma cepedianum
Aplodinotus grunniens
Aplodinotus grunniens
Ictalurus punctatus
Micropterus salmoides

These are small, flattened, elongate metacercariae found in the eyes of fishes. They are usually free in the eye humors without a cyst or capsule. In many cases they can be detected without any dissection by merely looking into the eye of the fish. These forms were found in only three localities during this study but it is suspected that they are more prevalent in the state. The three localities are Lake Verret, Lake Chicot, and the Coliseum Lake at Louisiana State University. The latter yielded the highest incidence of infection. One gizzard shad, D. cepedianum, harbored forty worms. Most of the other species had from one to five worms per fish.

The body of this worm is not clearly divided into two regions although a small caudal lobe is present. The body length is 0.382 to 0.612 mm. and the width is about one third the length. A small acetabulum is some distance behind the mid-point, followed by a large adhesive or holdfast organ. At the posterior edge of the holdfast organ is a transverse structure called the holdfast gland.
The small oral sucker is followed immediately by a smaller pharynx. A longer esophagus divides into two caeca which extend the length of the body. On each side of the oral sucker in the "shoulder" region there is a thickening of the body wall to form an additional sucker. These structures vary in size according to the state of contraction. Immediately behind the large adhesive organ are the primordia of the gonads. The excretory bladder is located in the caudal lobe and is divided by a median longitudinal septum. Branches from the bladder extend anteriorly and ramify throughout the body.

Van Haitsma (1931) has shown experimentally that Diplostomulum larvae are not specific but will penetrate almost any species of fish. A check of the host list in this study would tend to confirm this observation.

The life cycles of some of these Diplostomulum larvae have been demonstrated, (LaRue, 1927 and Van Haitsma, 1931). However, the forms in this study are identified only as members of the larval group Diplostomulum. Any effort to relate them to known species would be more conjecture than fact and consequently they are discussed no further.

The strigeid larval group known as Diplostomulum is reported from five species of fishes from three localities in the state. Since the definitive host, for those in which the life cycle is known, is a gull, it is suspected that these metacercariae are more widely distributed in the state than this study indicates.
Clinostomatidae Luhe, 1901

Clinostomum marginatum (Rudolphi, 1819)

(Fig. 20, Plate IV)

Hosts: Aplodinotus grunniens
Micropterus salmoides
Chaenobryttus coronarius
Ictalurus punctatus

The metacercaria of this worm is found encysted in the muscles and under the skin of various fishes. The adult form lives in the mouth and in the throat and esophagus of fish-eating birds such as herons, bitterns and egrets. The few forms in this collection are 3.0 to 5.0 mm. in length and about 2.0 mm. in width. The living worms when removed from the cysts are very active. The body is flattened with the sides more or less parallel and has an opaque white color. The acetabulum is in the anterior half of the body and quite large. The oral sucker is small and leads to an even smaller pharynx. There is no esophagus. The two caeca are quite large, very rugose, and extend the length of the body. They are usually filled with a yellowish substance from the cyst so that they are well distended. The future gonads are located in the third body-fourth and in these metacercaria they consist mainly of two lobated structures, one behind the other, which are primordia of the testes. In the older forms the primordium of the ovary can be seen between the testes.

In most instances during this study these larval worms were found under the skin of the mouth cavity or on the gills. In some cases they were encysted at the bases of the fins or in the body musculature. Only four species of fishes from five localities were found infected. This is surprising for one would suspect this form to
be much more common due to the many birds in the state. Also very few of the fishes had more than three or four worms per fish and in most instances only one worm per fish. One fresh water drum, A. grunniens, collected from Fordoche "Borrow" Pit in September had the heaviest infection. This fish harbored fifteen worms which is light compared to the numbers reported by other workers.

These worms are of considerable economic importance, for in many regions fish carry such a heavy infestation of these "yellow grubs" that they are rejected as human food. Although there is no danger of human infection, there is naturally a repugnance against eating such parasitized fish.

Van Cleave and Mueller (1934) report that, "Clinostomum leaves the fish at the end of summer, so that fish caught in the winter are free of the grubs. In Oneida Lake the infestation reaches its height during the month of August, and after this period subsides." This writer observed fishes in February which were infected with well developed larvae. These hosts were collected from University Lake at Baton Rouge. The infection was light but it appears the grub can overwinter in this area.

The metacercaria of Clinostomum marginatum is reported from four species of fish in this area. The apparent lack of host specificity indicates that other species of fish may also be infected. Enough description is presented to permit the identification of the worm. The economic importance of the worm is mentioned and the possibility of the "grub" overwintering here is discussed.
Paramphistomidae Fischoeder, 1901

Pisciamphistome stunkardi (Holl, 1929) Yamaguti, 1953

(Fig. 22, Plate IV)

Hosts: Micropterus salmoides
       Micropterus punctulatus
       Lepomis macrochirus
       Pomoxis nigro-maculatus
       Chaenobryttus coronarius

Description: These amphistomes were collected from the distal portion of the large intestine of each host listed above. Only one worm was immature and the description below is based on nine fully mature, well stained specimens. Only the average measurements are given due to the small number of specimens observed.

These trematodes are very active when removed from their hosts and have a semi-transparent appearance except in the areas where the vitellaria is concentrated. In order to obtain good toto mounts it was necessary to fix all of the specimens under slight cover glass pressure. The results appear to be very good for none of the specimens are distorted and none are excessively contracted.

The average body length of these forms is 2.29 mm. and the width at the middle of the body is 0.786 mm. The body cuticula is fairly thick but unarmed and a considerable amount of pigment is present. On each side of the body just behind the oral sucker are highly pigmented areas. These diffused areas are apparently the results of former eyespots for in the one immature form they are much more highly concentrated in two areas.

The very large acetabulum which is ventroterminal at the posterior end of the body is a highly muscular organ. The opening of
the acetabulum is triangular in shape with the apex directed posteriorly. The average length of the acetabulum is 0.547 mm. and the width is 0.44 mm.

The oral sucker is terminal and ranges from ovoid to nearly spherical in shape. Its posterior cavity is larger than the oral opening. The average measurements for the oral sucker are 0.333 mm. by 0.251 mm. This structure is considered homologous to the pharynx in other distomes by some writers. The esophagus extends from the oral sucker as a narrow, thin tube in its anterior portion. The posterior part of the tube is characterized by an enlarged esophageal bulb which is formed from the walls of the esophagus. The entire length of the esophagus is about equal to the length of the oral sucker. The average length of the bulb is 0.148 mm. The alimentary tract bifurcates at the caudal end of the esophageal bulb and the caeca extend almost to the anterior margin of the acetabulum. They may be either smooth or rather rugose and vary considerably in width.

The ovoid testes may be smooth or slightly irregular and are located obliquely in the anterior half of the body. The anterior testis is 0.212 mm. by 0.187 mm. and the posterior testis is 0.234 mm. by 0.190 mm. It appears that it is the right testis which is most anterior but in at least one worm they are symmetrical in position. The sperm ducts enter a seminal vesicle which lies very near the anterior testis. The genital pore is on the mid-ventral surface just posterior to the division of the alimentary tract.

The small round ovary lies in the median line, in the posterior half of the body. Its average diameter is 0.139 mm. Mehlis' gland
lies dorsal to the ovary and a Laurer's canal opens on the dorsal body surface above the ovary. There is no seminal receptacle. The uterus is fairly short with one loop barely extending posterior to the ovary and then coiling forward to the genital pore. In mature worms it is filled with a few large operculated eggs which average 0.149 mm. by 0.083 mm.

The vitellaria of *P. stunkardi* consist of rather large follicles which extend from the level of the esophageal bulb to the cephalic margin of the acetabulum. They are quite extensive and occur both lateral and median to the intestinal rami.

The excretory pore is in the mid-line on the dorsal surface just anterior to the acetabulum. A large excretory vesicle lies anterior to the acetabulum but the anterior extent of the system can not be seen in these specimens.

**Remarks:** *Pisciamphistoma stunkardi* was originally described by Holl (1929) as *Paramphistomum stunkardi* and was collected from the intestines of the pumpkinseed sunfish and the warmouth bass near Durham, North Carolina. The original description is apparently based on eight worms which varied in length from 1.4 to 1.8 mm. Holl (1929) stated, "The shortest worm, 1.4 mm. in length, has been taken as the type since it was the only one which contained eggs." This is unfortunate because it may be inferred that Holl's specimens were immature and that his type specimen (from which his measurements were taken) is not typical. The measurements of the one immature specimen in this collection most nearly fit those given by Holl. This would explain the large differences in measurements given by Holl and those
reported here. Rather than contrast each of these differences it seems only necessary to say that Holl's measurements are considerably smaller than those reported here. Otherwise the forms are morphologically similar.

A cirrus sac was reported in *P. stunkardi* by Holl although he did not illustrate it in his figure. This writer was unable to identify such a structure in observing thirteen whole mounts and Yamaguti (1953) also questions its presence. The question is probably concerned with the interpretation or identity of the organ which is considered in this report as a seminal vesicle.

Yamaguti (1953) erected the genus *Pisciamphistoma* to contain Holl's *Paramphistomum stunkardi*. He stated, "*Pisciamphistoma* differs distinctly from *Paramphistomum* parasitic in mammals in the possession of a muscular esophageal bulb." This writer agrees with Yamaguti in forming a new genus for this amphistome in fishes.

*P. stunkardi* is widely distributed and apparently has little host specificity although never commonly found in large numbers. Holl (1929) described it from North Carolina. Bangham (1938) reported that 30 of 143 warmouth bass from southern Florida were infected. The same author (1941) reported a total of ten species of fishes from four different families in Florida contained this parasite. Bangham and Venard (1942) reported *P. stunkardi* from a number of fishes at Reelfoot Lake Tennessee. Sparks (1951) recorded it in largemouth bass in Texas and Haderlie (1953) found it in California. As far as the writer is aware the present report is the first record of this parasite from Louisiana fishes.
Pisciamphistoma stunkardi (Holl, 1929) is briefly redescribed and certain corrections and additions are added to supplement the original description. The writer concurs with Yamaguti (1953) in transferring this parasite to a new genus on the bases of morphology and general host differences. The widespread distribution and the apparent lack of host specificity among fishes is noted for this parasite. This appears to be the first record of P. stunkardi from Louisiana fishes.

Hemiuridae Luhe, 1901

Halipogus perplexus Simer, 1929

(Fig. 23, Plate IV)

Hosts: Morone interrupta

Micropterus salmoides

Description: These diatomes were taken from the intestine of the above mentioned hosts. Both hosts were collected at Old River at Morganza, Louisiana. The average measurements of three mature specimens are given and no ranges will be considered due to the small number of specimens. These medium-sized, yellowish-brown worms average 3.37 mm in length and 1.32 mm in width. The body is approximately of uniform width from end to end and has a thick, smooth cuticula. The large acetabulum is barely post equatorial and measures 0.88 mm by 0.89 mm. It is highly muscular and the posterior lip is slightly more muscular than the anterior lip. The oral sucker is subterminal and measures 0.39 mm by 0.42 mm. So the sucker ratio is about 1:2.12. There is no prepharynx. The bulbous pharynx is 0.19 mm by 0.17 mm and leads into a short, crooked, esophagus. The caeca are thick and very rugose. They extend in the dorsal part of the body to the posterior end.
The testes lie ventral to the caeca in the posterior one-fourth of the body. They are either symmetrical or very slightly sub-equal in position and are about the same size. No lobation is evident. The right testis measures 0.38 mm. by 0.31 mm. and the left, 0.38 mm. by a 0.35 mm. The two vasa efferentia pass forward and unite into a vas deferens just anterior to the acetabulum. The short vas deferens empties into a flask-shaped seminal vesicle which is immediately posterior to the intestinal bifurcation and about the same size as the pharynx. The neck of the seminal vesicle is surrounded by prostate glands near the genital pore. The male duct joins the terminal end of the uterus to form a short ductus hermaphroditicus which, in turn, opens into the genital atrium. The genital pore is located at the posterior border of the oral sucker in the ventral mid-line.

The vitellaria consist of two groups of deeply incised bodies lying in the very posterior end of the body. There are five to eight finger-like projections in each group and the number does not appear to be constant for either side. These projections cause the vitellaria to appear rosette-shaped. From each of the two groups a short right and left vitelline duct passes to the mid-line where they join to form the common vitelline duct. At this point, a slight enlargement of the duct results in a small vitelline reservoir. The short common duct passes dorsally to join the oviduct.

The nearly round ovary has a smooth outline and lies in the mid-line dorsal to the testes. It is somewhat smaller than the testes, measuring 0.253 mm. by 0.255 mm. and tends to be obscured by the
heavily filled uterus which lies ventral to it. The oviduct gives off a sinuous Laurer's canal shortly after leaving the ovary. The canal opens on the mid-dorsal surface. A slight enlargement of the proximal portion of Laurer's canal may function as a seminal receptacle but no definite structure was seen which might be considered comparable to the seminal receptacle in other trematodes. (Fig. 25, Plate IV). Just before the origin of Laurer's canal the oviduct is joined by the vitelline duct and continues to the ootype. This latter structure is surrounded by a well developed Mehlis' gland. From this point the uterus continues forward in many S-shaped coils which are mostly intercecal. The uterus is heavily filled with eggs and occupies all the available space between the ootype and the genital pore. The distal portion of the uterus is thickened into a vagina shortly before it is joined by the male duct. The eggs are yellow, elongate-oval with the broad end being operculate and the opposite end having a filament which is at least longer than the egg. (Fig. 26 Plate IV). Since the eggs were measured in the uterus, the entire extent of the filament could not be ascertained. The measurement of fifteen eggs averaged 0.044 mm. long and 0.020 mm. wide. They are well embryonated when laid.

Remarks: The forms described here, though few in number, are obviously the same as those described by Simer (1929). He collected three immature forms from Polyodon spathula, the spoonbill catfish, taken from the Tallahatchie River, Mississippi. The immature forms in the writer's collection, (Fig. 24, Plate IV) compare most favorably with the description and illustrations given by Simer. Since
the writer was fortunate enough to obtain some adults with the immature worms, the complete description of the adults was made possible. Simer's description is very brief and based entirely on the three immature specimens. The writer agrees with Simer that the occurrence of *H. perplexus* in such small numbers in fishes is probably a case of accidental parasitism and it is likely that this species, as is true of most species in this genus, is normally a parasite of amphibians. This is substantiated by the fact that of the more than 600 fishes examined in this study, only two were found infected with this trematode.

In an attempt to determine the validity of *H. perplexus*, it seemed advisable to examine all members of the genus *Halipegus*, including those in amphibian hosts. This task proved to be much greater than anticipated and in many instances it was discouraging or even futile due to the taxonomic status, not only of the many species, but of the genus itself. Moreover, much of the literature is scattered in obscure journals throughout the world. The entire group needs re-study but since so few specimens are present in this collection, and these apparently incidental, then a complete study of this group by the writer does not seem justified.

In comparing the different species of *Halipegus* Looss, 1899, it was found that specific identification is based on highly variable characters and on very few specimens. According to Rankin (1944) the characters considered for identification are: position of testes, ovary, and genital pore; presence of or absence of esophagus; location of the coils of the uterus; position of the acetabulum; solid or
follicular vitellaria; union of excretory horns; size of ova and length of filaments; condition of the caeca; life cycle; and type of host. Chandler (1923), Beaver (1937), Rankin (1938) and others have shown these characters to be subject to much variation. Since in some instances adult specimens appear morphologically similar, whereas the intermediate stages are quite different, Krull (1935) and Thomas (1939) are correct in holding that data from life history studies should be used in identification when possible. But in the meantime what are we to do with few specimens in a collection which are identified on these variable characters? They must be identified as accurately as the literature will permit and await life history studies for change or confirmation as the case may be.

In comparing H. perplexus with other members in the genus, the example of other workers in this group is followed. Only the closest related species are discussed in the comparison. As far as the writer is aware this is only the fourth record of Halipegus sp. taken from fishes. Simer (1929) described H. perplexus from Polyodon spathula. Travassos, Artigas, and Pereira (1928) found three new species in fishes in South America. These authors placed the three species in a new genus Genarchella and it was Manter (1934) who transferred them to the genus Halipegus. These three species are H. dubius (Trav., Art., and Per., 1928) in esophagus of Salminus maxillosus; H. genarchellus (Trav., Art., and Per., 1928) in Acostorhamphus sp. and H. parvus (Trav., Art., and Per., 1928) also in Acostorhamphus sp. The third record is of H. tropicus (Manter, 1936) which Manter described from two specimens taken from the fish, Rhamidia guatemalensis in Yucatan.
That author tentatively placed the fluke in the genus *Derogenes* Luhe, 1900 but Sogandares-Bernal (1955) in collaboration with Manter, realized the close similarity of *H. genarchellus* and *Derogenes tropicus* and placed the latter species in the genus *Halipegus*.

*H. perplexus* differs from *H. dubius* in that the testes are ventral to the caeca and not extracecal as in *H. dubius*. It differs from *H. genarchellus* in that the seminal vesicle is not elongated diagonally in the body. It differs from *H. parvus* in that the acetabulum is almost twice the size of the oral sucker rather than of equal ratio. It differs from *H. tropicus* in that an esophagus is present.

It was mentioned above that the true definitive host of *H. perplexus* is probably some amphibian. If this is the case then those forms parasitizing amphibia should also be compared with *H. perplexus* in an effort to establish the latter's position. Of the species considered valid by Rankin (1944) the closest related forms to *H. perplexus* are *Halipegus occidualis* Stafford, 1905 and *Halipegus ovocaudatus* (Vulpian, 1860). Both of these species are morphologically similar as adults but Krull (1935) has shown by life history studies, that their larval stages are quite different. *H. perplexus* differs from both species in that the testes are smaller and are symmetrically located immediately behind the acetabulum. The vitellaria in *H. perplexus* are more rosette-shaped and both the ovary and the eggs are smaller than in the other two species.

This re-description of *Halipegus perplexus* Simer, 1929 should establish the validity of the species. Consequently, it should no
longer be considered a species inquirenda. Further work in life history studies may prove that the form differs morphologically in other hosts even to the degree of synonymity with forms already described. However, at present it seems advisable to consider *H. perplexus* a valid species.

Aspidogastrea Faust and Tang, 1936

Aspidogastriae Faust and Tang, 1907

*Cotylogaster occidentalis* Nickerson, 1900

(Fig. 27, Plate IV)

Host: *Aplodinotus grunniens*

Note: The writer realized that this trematode is not a digenetic trematode but a member of the order, Aspidogastrea. This was the only such form encountered and the remainder of the study deals exclusively with species belonging to the order Digenesa.

Description: A total of twenty-nine specimens of this species was taken from the intestines of fresh-water drums, *Aplodinotus grunniens*. All of the forms were dead when collected and only twelve specimens were stained well enough to permit a general description.

These forms are very conspicuous and easily recognized due to unique morphological features. The body is divided into two parts with the anterior part being a long slender proboscis containing the mouth and the posterior part containing most of the body organs and a compound ventral sucker. The measurements presented here are only the averages for twelve individuals. The average body length is 4.60 mm. Due to the slightly coiled condition, which is apparently characteristic of this species, all mounted specimens lie on their sides. Consequently, the depth of the body instead of the width is
measured. The average depth at the anterior level of the compound ventral sucker is 0.469 mm.

The ventral surface of practically the entire body, excluding the proboscis, is covered by the compound sucker. This structure is composed of 132-141 acetabula of which 31-34 form a median longitudinal row of transversely elongated grooves. The remaining 100-110 are in a single row surrounding the median series. According to Nickerson (1900) marginal sense organs and glands are present in these outer acetabula. The average measurement for this compound sucker is 3.37 mm, which indicates that it is quite extensive on a total body length of 1.60 mm.

The long slender anterior body portion is terminated by a five lobed disc surrounding the mouth. These lobes are symmetrical and the average diameter across the crown of the disc is 0.791 mm. A very long slender prepharynx is present and averages 0.591 mm. The pharynx is rectangular shaped and measures 0.177 mm in length. The esophagus is about the same length of the prepharynx and is dilated at the distal end. The extent of the caeca is very difficult to ascertain from these twelve specimens but there appears to be two thin branches extending to the posterior end of the body as Nickerson has depicted them.

There are two testes of about equal size arranged in tandem in the posterior body fourth. They are round to slightly oval and have smooth surfaces. The anterior testis averages 0.145 mm, and the posterior testis 0.150 mm in diameter. The sperm ducts are not identified but a very conspicuous coiling seminal vesicle is located
at the level of the anterior one-fourth of the compound ventral sucker. The seminal vesicle passes forward to the genital pore which is located in the mid-ventral line immediately anterior to the sucker. A cirrus is not present.

The vitellaria consist of a pair of elongated cords of tissue which are laterally placed in the posterior fourth of the body. The follicles are rather large and close together.

A single ovary lies anterior to the testes in the middle of the body. It is also round to oval-shaped and has a smooth surface. It is smaller than the testes and averages 0.13\text{mm} in diameter. A rather diffuse shell gland lies dorsal and a little anterior to the ovary. Laurer's canal is not visible but is reported for this species.

The uterus loops a number of times in the body before passing to the genital pore. The eggs are numerous and of different sizes but they average about 0.064 by 0.033 mm. The embryo is fully formed when discharged and has a large posterior sucker. Some of these embryos can be seen within the worm and the posterior sucker is evident. A few of these embryos average 0.112 by 0.062 mm.

At the posterior end of the body on the dorsal surface there is a broad conical elevation. The excretory pore is located between the base of this cone and the posterior margin of the compound sucker.

Remarks: A total of twenty-nine specimens of *Cotylogaster occidentalis* were collected from five fresh-water drums. All were dead when recovered and there were never more than eight worms in any one fish. A total of thirty-one drums from various parts of the state were examined but only the five fish from four localities yielded
this species of trematode. These facts are in agreement with other workers in the field who report that *Cotylogaster occidentalis* is a rare form. It is interesting to note also that all twenty-nine worms were collected in the month of August.

This writer is inclined to believe that *C. occidentalis* is primarily a parasite of clams. Throughout this study it was shown that one of the main foods of fresh-water drums is clams. This was evident from the examination of stomach contents. Thus the worms may have been acquired by the fish only shortly before the fish were caught. This theory is strengthened by the fact that all of the worms were dead when recovered from the fish and that only a few were present. Moreover, it is well known that most aspidogastrids are parasites of mollusks.

This parasite has been reported from the fresh-water drum from the Great Lakes region by Nickerson (1900; 1902) and Dickerman (1918) and in Mississippi by Siner (1929). Sogandares-Bernal (1955) reported finding it in three of five drums from Lake Pontchartrain, Louisiana. The latter author stated that *A. grunniens* may have acquired *C. occidentalis* in fresh water before entering the brackish environment of Lake Pontchartrain. Dickerman (1918) reported that mature and immature *C. occidentalis* from snails of the genus *Goniobasis* were capable of infecting *A. grunniens*. Kelly (1927) reported *C. occidentalis* from unionid clams, *Lampsilis luteola*.

*Cotylogaster occidentalis* Nickerson, 1900 is briefly redescribed. This is the second record of this aspidogastrid trematode from *Aplodinotus grunniens* in Louisiana and the first in a strictly fresh-
water environment. Evidence from the literature and from this study indicates that *C. occidentalis* is primarily a parasite of clams but that the fresh-water drum, *A. grunniens* may be secondarily infected by eating the parasitized clams.
GENERAL DISCUSSION OF HOST-PARASITE RELATIONSHIPS

This section was not intended to be a detailed discussion of individual species of parasites but rather to give some consideration to the more generalized aspects of the problem. An effort was made in the previous section to discuss individual flukes in more detail.

The digenetic trematodes were the most abundant parasites of all the forms found in the fishes. This included both the number of species and the number of individuals. There were two distinct biological groups: (1) those which attained sexual maturity in the body of the fish; and (2) those which were immature in the fish and reach maturity only in some fish-eating animal. This final host is usually a bird or mammal but in some instances another fish may serve this function.

There are two very general methods by which trematodes are able to infest the fish host. The first of these is a passive action on the part of the parasite. Passive entrance to the host occurs when the parasites are taken in with food or otherwise accidentally ingested. Most of the flukes belong to this group. The second method is an active entrance of the parasites. The larval worm actually seeks out the host or in some way comes into contact with it. After contact is made the parasite enters the body and generally encysts as a metacercarial stage. Members of the family Stregeidae are examples of this active method.
Regardless of the method of establishing contact, the food habits of a fish and the conditions of its environment influence the number and nature of the parasites present. Ward (1910) stated, "The parasitic record reflects clearly the manner of life led by any host," and also, "The parasitic fauna of any animal is primarily a function of its habitat." This fact is clearly illustrated in this study. The suckers and shad, which feed primarily on vegetation, contained very few trematodes, whereas the carnivorous fishes such as the large-mouth bass, usually contained large numbers of worms.

There are but few scattered records concerning the effect of worm parasites on their fish hosts. This is especially true concerning the digenetic trematodes. The damage to the host by this group is very difficult to measure and various contrasting opinions are held by different authorities in the field. Pratt (1919) in remarking in general on fish parasites stated that they occasionally cause disastrous epidemics in which thousands of fishes die. There are others who favorably entertain the contrasting opinion. For example Pearse (1924) states, "Most fish parasites do little harm to their host." In general, the writer agrees with Pearse but Meyer (1954) seems more correct in stating that all kinds of parasites, whether occurring singly or in great numbers, have some harmful effect upon the host. Even a single parasite withdraws from its host enough food for its own sustenance.

The data presented here are not intended to be conclusive regarding the intensity of parasitism by digenetic flukes in Louisiana fresh-water fishes. Rather the writer has merely scratched the
surface of a very fertile, almost untouched, area of research. Also, it is felt that this study might form the initial groundwork for future investigations on Louisiana fish trematodes. Undoubtedly questions will arise as a result of this study and there are enough ecological, taxonomic, and life history studies remaining to consume the average working lifetime of one or more persons.

The data also reveal the fact that the numbers of different fishes examined were very unequal. It is natural that when a large number of hosts are examined the list of parasite species encountered will be greater than if only a few hosts are examined. Also it should be remembered that not every body of water in Louisiana is represented but the sampled localities give an indication of the forms present. These basic facts should be considered before attempting to interpret the lists of hosts and their parasites which are presented in this section.

One of the important questions in a study of this nature is what trematodes occur in a particular host species and are the parasites abundant or rare. The following list presents this information in tabular form and is patterned after authoritative workers in the field in that the frequency of occurrence of the parasites is given in the order: Abundant, Common, Occasional and Rare. It should be remembered that only the digenetic flukes are given although in many cases other types of parasites occurred in varying intensities of kinds and numbers.
Table VI
Digenean Trematodes of Louisiana
Fresh-Water Fishes, listed by Hosts

(An asterisk (*) indicates the parasite does not attain maturity in host cited).

<table>
<thead>
<tr>
<th>Host</th>
<th>Number examined</th>
<th>Number infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyodon spathula</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Rare: *Neochasmus labeosus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepisosteus osseus</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Rare: *Neochasmus labeosus, Macroderoides typicus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepisosteus platostomus</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Rare: *Neochasmus labeosus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepisosteus productus</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Amia calva</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Common: Macroderoides typicus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anguilla rostrata</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Dorosoma cepedianum</td>
<td>50</td>
<td>19</td>
</tr>
<tr>
<td>Common: *Diplostomulum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dorosoma retinensis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ictiobus bubalus</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Ictiobus cyprinellus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Carpoides carpio</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Ictalurus punctatus</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Common: *Neochasmus labeosus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rare: *Neascus sp. Holostephanus sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish Species</td>
<td>Number Examined</td>
<td>Number Infected</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><em>Ictalurus furcatus</em></td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Occasional:</td>
<td><em>Glossidium corti</em></td>
<td></td>
</tr>
<tr>
<td><em>Ameiurus melas</em></td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Abundant:</td>
<td><em>Glossidium corti</em></td>
<td></td>
</tr>
<tr>
<td>Occasional:</td>
<td><em>Phyllodistomum lacustri</em></td>
<td></td>
</tr>
<tr>
<td><em>Pilodictus olivaris</em></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Occasional:</td>
<td><em>Neochasmus labeosus, Phyllodistomum lacustri</em></td>
<td></td>
</tr>
<tr>
<td><em>Esox niger</em></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><em>Gambusia affinis</em></td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td><em>Mollefinia latipinna</em></td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td><em>Mugil curema</em></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><em>Micropterus salmoides</em></td>
<td>62</td>
<td>53</td>
</tr>
<tr>
<td>Abundant:</td>
<td><em>Neascus sp., Caecincola parvulus</em></td>
<td></td>
</tr>
<tr>
<td>Common:</td>
<td><em>Crepodistomum cornutum</em></td>
<td></td>
</tr>
<tr>
<td>Occasional:</td>
<td><em>Fissiaphistoma stunkardi, Clinostomum marginatum, Phyllodistomum parvulum</em></td>
<td></td>
</tr>
<tr>
<td>Rare:</td>
<td><em>Diplostomulum sp., Halipegus perplexus</em></td>
<td></td>
</tr>
<tr>
<td><em>Micropterus punctulatus</em></td>
<td>35</td>
<td>32</td>
</tr>
<tr>
<td>Abundant:</td>
<td><em>Neascus sp., Caecincola parvulus, Crepidostomum cornutum</em></td>
<td></td>
</tr>
<tr>
<td>Occasional:</td>
<td><em>Fissiaphistoma stunkardi</em></td>
<td></td>
</tr>
<tr>
<td>Rare:</td>
<td><em>Phyllodistomum parvulum</em></td>
<td></td>
</tr>
<tr>
<td><em>Lepomis macrochirus</em></td>
<td>162</td>
<td>123</td>
</tr>
<tr>
<td>Abundant:</td>
<td><em>Neascus sp.</em></td>
<td></td>
</tr>
<tr>
<td><em>Lepomis megalotus</em></td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Common:</td>
<td><em>Neascus sp.</em></td>
<td></td>
</tr>
<tr>
<td><em>Lepomis microlophus</em></td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Abundant:</td>
<td><em>Neascus sp.</em></td>
<td></td>
</tr>
<tr>
<td>Common:</td>
<td><em>Homalometron armatus</em></td>
<td></td>
</tr>
<tr>
<td>Rare:</td>
<td><em>Phyllodistomum parvulum, Crepidostomum cornutum</em></td>
<td></td>
</tr>
</tbody>
</table>
Lepomis humilis
Number examined: 4  Number infected: 2
Common: *Neascus sp.*
Rare: Homalometron armatum

Lepomis cyanellus
Number examined: 4  Number infected: 0

Chaenobryttus coronarius
Number examined: 16  Number infected: 38
Abundant: *Neascus sp.*
Common: Crepidostomum cornutum
Occasional: Pisciaristoma stunkardi
Rare: Phyllobothrium parvulum

Morone chrysops
Number examined: 2  Number infected: 2
Common: *Allacanthochasmus varius*
Occasional: *Allacanthochasmus artus*

Morone interrumpa
Number examined: 9  Number infected: 5
Common: *Allacanthochasmus varius*, *Allacanthochasmus artus*
Rare: Halipegus perplexus

Pomoxis nigro-maculatus
Number examined: 69  Number infected: 25
Abundant: *Neascus sp.*
Common: Cryptogonimus chili
Rare: Pisciaristoma stunkardi, Holostephanus sp., Caecincola parvulua

Aplodinotus grunniens
Number examined: 35  Number infected: 28
Abundant: Homalometron armatum
Occasional: *Clinostomum marginatum*, *Diplostomum sp.*
Rare: Ctyloraster occidentalis, Neochasmus labecus
Table VII

Checklist of the Digenetic Trematodes in Louisiana Fresh-Water Fishes

(An asterisk (*) indicates forms found only in larval stages)

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Species Fish Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phyllodistomum lacustri</td>
<td>3</td>
</tr>
<tr>
<td>Phyllodistomum parvulum</td>
<td>4</td>
</tr>
<tr>
<td>Allocreadium ictaluri</td>
<td>2</td>
</tr>
<tr>
<td>Homalometron armatum</td>
<td>3</td>
</tr>
<tr>
<td>Crepidostomum cornutum</td>
<td>5</td>
</tr>
<tr>
<td>Macroderoides typicus</td>
<td>2</td>
</tr>
<tr>
<td>Glossidium corti</td>
<td>3</td>
</tr>
<tr>
<td>Cryptogonimus chili</td>
<td>2</td>
</tr>
<tr>
<td>Caecincola parvulus</td>
<td>3</td>
</tr>
<tr>
<td>Neochasmus labeosus</td>
<td>4</td>
</tr>
<tr>
<td>Allacanthochaemus varius</td>
<td>2</td>
</tr>
<tr>
<td>Allacanthochaemus artus</td>
<td>2</td>
</tr>
<tr>
<td>Holostephanus ictaluri (?)</td>
<td>2</td>
</tr>
<tr>
<td>*Diplostomulum sp.</td>
<td>5</td>
</tr>
<tr>
<td>*Neascus sp.</td>
<td>8</td>
</tr>
<tr>
<td>*Clinostomum marginatum</td>
<td>4</td>
</tr>
<tr>
<td>Pisciamphistome stunkardi</td>
<td>5</td>
</tr>
<tr>
<td>Halipegus perplexus</td>
<td>2</td>
</tr>
<tr>
<td>(1) Cotylogaster occidentalis</td>
<td>1</td>
</tr>
</tbody>
</table>

(1) This form is actually a member of the Aspidogastrea but is included here due to its close relationship with the Digenea.
At the beginning of this study it seemed only natural to suspect that a number of new forms would be encountered. This was anticipated due to the almost nonexistence of literature on fish trematodes in Louisiana. However, such was not the case and this study has revealed only one new trematode. This may be partially explained by the fact that nearly all of the Louisiana water-ways are either directly or indirectly connected with the great drainage system of the Mississippi. With this fact in mind it was not too surprising to learn that the parasitic forms here were similar to those found in the more northern areas drained by the Mississippi River. A great deal of work has been done in those areas by various workers.

In some instances the forms encountered differed considerably with original descriptions. Wherever these differences occurred, the writer endeavored to obtain the type and cotype specimens for comparison. In nearly every instance these differences were considered to be intra-specific and the description of a new species was unwarranted. Indeed, there appeared to be more names in the literature than there were forms available and certain detailed studies by this writer have been attempted in order to correct the situation.
SUMMARY

Detailed studies have been presented on the digenetic trematodes of Louisiana fresh-water fishes. A total of 629 fishes, representing fourteen families, twenty genera, and thirty-one species, were collected and examined from 1954 to 1957. The majority of these fish hosts were game fishes commonly encountered within the state although a few so-called "rough fish" were also examined.

The hosts were collected from twenty-six different localities which ranged throughout the state. The largest numbers however, were collected at Baton Rouge and adjacent areas.

A total of nineteen species of digenetic trematodes, representing eleven families and seventeen genera, have been identified and studied. One of these has been described as a new species. New information has been presented on the biology of these worms in regard to their morphology, taxonomy, ecology, and distribution. Some of the more important results have been discussed below in relation to the species involved.

**Phyllodistomum parvulum** n. sp.—This fluke was found in the urinary bladders of certain centrarchid fishes. It was the only new species encountered during the study.

**Homalometron armatum**—A detailed study on the entire genus *Homalometron* revealed that *H. pearsei* should be placed in synonymy with *H. armatum*. 
Glossidium corti n. comb.—Examination of type material of Alloglossidium corti and Alloglossidium geminus has shown that their differences should be considered merely intra-specific variations. Furthermore, certain evidence showed that the genus Alloglossidium was no longer tenable in the light of recent knowledge. Consequently, the specific name of the species involved is a new combination and becomes Glossidium corti according to the law of priority.

Cryptogonimus chill—Although the specific name of this species is usually written "chili" in most of the literature, a search of the records revealed that "chili" has priority. Correspondence with authorities in the field supported this contention.

Caecincola parvulus—Minor variations in this species as compared to those of other localities were presented and complete measurements were presented for the first time.

Neochasmus labeosus—A study of type and cotype materials has shown that Neochasmus ictaluri is a synonym of N. labeosus. Corrections were made on the original description of N. labeosus and its host range was extended to include fishes.

Pisciamphistoma stunkardi—Corrections and additional description were given for this species. Also some discussion was devoted to its taxonomic status and its lack of host specificity.

Halipegus perplexus—The first description of the adult worm was given and the validity of the species was established. These studies have shown that this form should no longer be considered a species inquirendi.

Cotylogaster occidentalis—This species is actually a member of
the Aspidogastrea but was included in these studies due to its close relationship to the Digenea. This is the second record of this trematode in Louisiana and the first in a strictly fresh-water environment in the state.

In addition to the results listed above, a number of minor observations were made on the other species encountered. These included morphological variations, some minor taxonomic considerations, and the citation of new host records. These facts were summarized with the individual species.

Sixteen of the nineteen species of trematodes reported in this study are recorded as new to Louisiana. The three which have previously been reported are: Cotylogaster occidentalis, Crepidostomum cornutum, and Neochasmus labecus.

The larval forms of Neascus and Diplostomulum were treated as generic groups but subsequent work will undoubtedly show that a number of species are involved.

A short section was devoted to the discussion of host-parasite relationships. In this section certain ecological aspects were mentioned and the parasites were listed according to their hosts. Also, a checklist of the parasites was presented and the number of species of fishes infected by each parasite was given.

The digenetic trematodes were the most commonly encountered parasites during the course of this study. This included both the number of species and the number of individuals. Of the 629 fish examined in this study, 386 or 61.3 per cent were infected with some species of digenetic trematode.
EXPLANATION OF PLATES

All figures were made with the aid of a camera lucida with the exception of Fig. 25 which is a graphic reconstruction.

Abbreviations Used

ac.......acetabulum
    c.........cirrus
    cb.......copulatory bursa
    cvd.......common vitelline duct
    eb.......esophageal bulb
    eg.......egg
    egl.......esophageal glands
    es.......eye spot
    esop.......esophagus
    ex.......excretory vesicle
    g.......gonotyl
    gp.......genital pore
    ho.......holdfast organ
    is.......intestinal caeca
    lc.......Laurer's canal
    ls.......lateral sucker
    m.........mouth
    mg.......Mehlis' gland
    op.......oral papilla
    os.......oral sucker
    osp.......oral spine
    ov.......ovary
    ph.......pharynx
    rg.......rudimentary gonads
    sr.......seminal receptacle
    sv.......seminal vesicle
    t.......testis
    to.......tribocytic organ
    ut.......uterus
    vi.......vitellaria
PLATE I

Fig. 1. *P.* lacustri
Fig. 2. *P.* parvulum
Fig. 3. *A.* ictaluri
Fig. 4. *H.* armatum
Fig. 5. *C.* cornutum
Fig. 6. *M.* typicus
Fig. 7. *G. corti* from *Ictalurus furcatus*

Fig. 8. *G. corti* from *Ameiurus melas*

Fig. 9. *C. chili*

Fig. 10. *C. parvulus*

Fig. 11. *N. labesus*

Fig. 12. *N. labesus* contracted and flattened
PLATE III

Fig. 13. *A. varius*

Fig. 14. *A. varius* side view of gonotyl

Fig. 15. *A. artus*

Fig. 16. *A. artus* side view of gonotyl

Fig. 17. *Holostephanus* sp.

Fig. 18. *Diplostomulum* sp.

Fig. 19. *Neascus* sp.
PLATE IV

Fig. 20. C. marginatum
Fig. 21. H. armatum, cross section through esophagus showing esophageal glands.
Fig. 22. P. stunkardi
Fig. 23. H. perplexus
Fig. 24. H. perplexus, immature worm
Fig. 25. H. perplexus, graphic reproduction of the female genital complex.
Fig. 26. H. perplexus showing egg with filament
Fig. 27. C. occidentalis
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BIOGRAPHY

Grover Cleveland Miller was born January 23, 1927 at Jackson, Kentucky. Shortly after the death of his parents he was entered into the Masonic Widows and Orphans Home at Louisville, Kentucky where he completed grammar school and junior high school. In 1944 he was graduated from Berea Academy and completed one year of college at Berea College, Kentucky before being called into the armed forces. He served two years in the 70th Tank Batallion, U. S. Army and returned to Berea College where he was graduated with the Bachelor of Arts degree in June 1950. He attended graduate school at the University of Kentucky from 1950 to 1952 where he served as a graduate assistant and received the Master of Science degree in Zoology in June, 1952. From 1952 to 1957 he was a graduate student in the Department of Zoology, Physiology and Entomology at Louisiana State University and served until 1956 as a graduate assistant. In June 1956 he accepted a position as Research Associate in the Department of Veterinary Science, Louisiana State University and is presently employed in that position. He is now a candidate for the degree of Doctor of Philosophy in the Zoology, Physiology, and Entomology Department.
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Title of Thesis: The Digenetic Trematodes of the Fresh Water Fishes of Louisiana

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