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PARASITES OF FISHES IN GALVESTON BAY

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DURING THE summer of 1933 a survey of the fish fauna of certain selected localities in Galveston Bay on the Texas coast was made by A. W. Collier. A considerable number of specimens were supplied me for parasitological examination, and I examined 23 host species, the individual specimens of each varying from 1 to over 100. Some were obtained from localities in the lower part of the bay, others from near the head of the bay. In the following instances an apparently significant difference in parasite fauna in the two localities was observed: (1) The tapeworm larva *Glossocercus cyprinodontis*, new genus and species, was found in considerable numbers in *Cyprinodon variegatus* in lagoons on Galveston Island but not in the upper parts of the bay; (2) the acanthocephalan *Atactorhynchus verecundus*, new genus and species, was found commonly in *Cyprinodon variegatus* in upper parts of the bay but very sparsely in specimens from Galveston Island; (3) the acanthocephalan *Rhadinorhynchus tenuicornis* Van Cleave was found very commonly in several species of fishes in lower parts of the bay but was not met with in fishes from the upper bay. These differences are probably associated with the local distribution of an avian definitive host in the first instance and of arthropod intermediate hosts in the other instances.

There are a number of striking features in connection with the parasite fauna in general: (1) A great excess of immature over adult stages of parasites; (2) a scarcity of flukes and of adult tape-

worms; and (3) a predominance of Acanthocephala as common adult parasites. Twenty-five species of parasites were identified, but 15 of these are larval or immature stages. Of the 10 adults found, 9 are described as new, whereas of the 15 immature forms 11 are described as new, although some of them may prove to be the larvae of already described adult forms.

The flukes are conspicuous by their sparseness. Only one immature and two adult flukes were found. This is clearly correlated with the almost complete absence of gastropods in the bay; only one form, a species of *Littorina*, was found, and this in only one small portion of the bay. The immature fluke found is a gasterostome, which in all probability utilizes a bivalve as an intermediate host.

The tapeworms are represented by two adult and six larval forms. The two adults are both species of *Proteocephalus*, and both found in *Lepisosteus*. Four of the larvae (three tetra-rhynchids and one *Scolecæ*) are larval forms of fish parasites, while two (a *Glossocercus* and a cysticeroid) are probably the larvae of bird parasites.

The nematodes are represented by only three adult forms, all of which are rare, and by eight immature forms, all but two of which belong to the Anisakinae. Most of these forms were found repeatedly in certain hosts, and seemed to be fairly closely limited to these hosts, but two of them, *Rhaphidascaris anchoviellae* and *Contraecacum collieri*, were found in several different hosts. A peculiar hostal distribution was noted in the two species of *Contraecacum* found. One of these, *C. collieri*, was found commonly in *Cyprinodon variegatus*, and once each in *Sciaenops ocellatus* and *Paralichthys lethostigmus* but never in *Fundulus*; the other, *C. robustum*, was found commonly in *Mugil cephalus* and fairly frequently in *Fundulus*, but not in *Cyprinodon*.

The Acanthocephala are the commonest adult parasites of fishes in Galveston Bay. The three adult species found were all fairly common in their respective hosts; they were the only adult parasites that one could depend upon finding in repeated examinations of particular hosts. In addition to the adult forms, one immature form, which probably reaches maturity in a bird, was found.

Table 1 gives a list of the hosts examined and the parasites found.

TABLE 1.—*Hosts examined and parasites found*

Host	Part of bay ¹	Number examined	Parasites	Number infected
<i>Amphitistius sabinus</i>	L	1	.....	.....
<i>Lepisosteus osseus</i>	L	2	<i>Proteocephalus australis</i>	2
			<i>P. elongatus</i>	1
<i>Elops saurus</i>	U	1	.....	.....
<i>Brevoortia tyrannus</i>	U	6	.....	.....
<i>Dorosoma cepedianum</i>	U	2	.....	.....
<i>Anchoiella epsetus</i>	L	7	Unidentified tapeworm larva.....	1
			<i>Amphicaecum parvum</i>	1
<i>Bagre marina</i>	L	3	<i>Rhaphidascaris anchoviettae</i>	3
			L	2
<i>Galeichthys felis</i>	U	4	<i>Tentacularia lepida</i>	1
			Unidentified tetrarhynchid.....	1
			<i>Scolex pleuronectis</i>	3
			<i>Goezia minuta</i>	1
<i>Gleichthys felis</i>	L	3	<i>Tentacularia lepida</i>	1
			<i>Gymnorhynchus gigas</i>	1
			<i>Scolex pleuronectis</i>	2
			<i>Tentacularia lepida</i>	2
<i>Ictalurus furcatus</i>	U	5	<i>Gymnorhynchus gigas</i>	2
			<i>G. malleus</i>	1
			<i>Scolex pleuronectis</i>	3
			<i>Gorgorhynchus gibber</i>	2
<i>Fundulus heteroclitus</i>	U	1	<i>Agamonema vomitor</i>	1
			<i>Dichelyne diplocaecum</i>	1
<i>Cyprinodon variegatus</i>	U	20	<i>Agamonema immanis</i>	3
			<i>Contracaecum robustum</i>	5
			<i>Glossocercus cyprinodontis</i>	15
			<i>Contracaecum collicri</i>	20
<i>Mollienisia latipinna</i>	L	100	<i>Atactorhynchus verecundus</i>	2
			<i>Agamonema immanis</i>	3
			<i>Contracaecum collicri</i>	6
			<i>Atactorhynchus verecundus</i>	10
<i>Paralichthys lethostigmus</i>	U	20	<i>Scolex sp.</i>	1
			<i>Contracaecum collicri</i>	1
			<i>Arhythmorhynchus duocinctus</i>	1
			<i>Rhipidocotyle transversale</i>	2
<i>Menidia menidia</i>	U	6	Unidentified fluke.....	2
			<i>Cysticercoides menidiae</i>	2
			<i>Rhaphidascaris anchoviettae</i>	1
			<i>Contracaecum robustum</i>	16
<i>Mugil cephalus</i>	L	8	do.....	5
			L	3	Rhadinorhynchus tenuicornis.....	1
<i>Polynemus octonemus</i>	L	3	<i>Lecithochirium microstomum</i>	3
			<i>Porrocaecum trichiuri</i>	2
<i>Trichiurus lepturus</i>	L	3	<i>P. secundum</i>	1
			<i>Rhaphidascaris anchoviettae</i>	1
<i>Lagodon rhomboides</i>	L	16	.....	.....
			U	5
<i>Archosargus probatocephalus</i>	L	5	.....	.....
			L	6	Contracaecum collicri.....	1
<i>Sciaenops ocellatus</i>	U	1	<i>Dichelyne fastigatus</i>	1
			L	3	Rhadinorhynchus tenuicornis.....	2
<i>Leiostomus xanthurus</i>	U	3	.....	.....
			L	3
<i>Micropogon undulatus</i>	L	16	<i>Rhadinorhynchus tenuicornis</i>	12
			U	7	Gymnorhynchus gigas.....	1
<i>Eriscion nebulosus</i>	L	4	Unidentified tapeworm larva.....	1

¹ L, lower; U, upper.

Class TREMATODA

Family BUCEPHALIDAE Poche, 1907

RHIPIDOCOTYLE TRANSVERSALE, new species

PLATE 6, FIGURE 1

Description of immature forms encysted in Menidia.—Size 0.45 by 0.24 mm to 1.22 by 0.5 mm. Body oval with broadest region near middle. Anterior half of body covered by minute spines in transverse rows; posterior part of body with spines inconspicuous, embedded in cuticle. Anterior sucker with its forward-projecting structure cuspidor-shaped; sucker 160μ to 185μ in diameter, base of sucker 200μ to 265μ from anterior end. Very young specimens have a mass of glandular material in anterior end of body (=“cystogenous organ” of Tennent, 1906, and “penetration organ” of Woodhead, 1929). Anterior sucker develops in midst of this mass, and vitelline follicles from posterior part of it. Pharynx about two-fifths length of body from anterior end, about 90μ to 100μ in diameter, without prepharynx. Intestine egg-shaped or nearly spherical, in large specimen about 310μ in diameter. Testes round or oval, side by side or diagonally situated, somewhat posterior to center of body; size variable, up to 175μ in diameter. Cirrus pouch about 250μ to 350μ long and 70μ to 125μ in diameter, with a small seminal vesicle at its proximal end, about 50μ long. Genital atrium large, in a large specimen 180μ long and 120μ in diameter, often nearly filled by the partially everted cirrus. Ovary smaller than testes, usually oval, up to 95μ by 130μ , situated beside or diagonally in front of anterior testis. Developing uterus present in older specimens, with several twists or loops, entering genital atrium beside cirrus. Vitelline follicles 32 in number, arranged transversely, and not separated into two distinct groups but connected across median line just posterior to anterior sucker.

Host.—*Menidia menidia*.

Location.—In walls of intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39516; paratypes, no. 39517.

Remarks.—*Rhipidocotyle transversale* differs from other members of the genus in the form of the anterior sucker and its forward-projecting structure and in the arrangement of the vitellaria, which in all other forms are arranged in two lateral groups. It appears to be identical with the form figured by Linton (1901, pl. 34, figs. 367, 368) as “*Gasterostomum* sp. from *Tylosurus marinus*”, but it is not the same as the one that he recorded from this host at Beaufort,

N. C., and that Tennent (1906) erroneously referred to as *Gasterostomum gracilescens*; the Beaufort form is apparently *Bucephalopsis haimeana*.

The last-mentioned species was recorded by Tennent (1906) in a metacercarial state in washings from the stomach and intestine of *Menidia*. When viscera of infected *Menidia* were fed to carnivorous fishes, some further development of the young flukes took place. The first intermediate host of this parasite was found to be the oyster, and it is not improbable that the same is true of the species here described. The method of infection of *Menidia* is uncertain; the occurrence of the young flukes in the walls of the intestine makes it highly probable that the cercariae, liberated from sporocysts in a bivalve host, are swallowed by the *Menidia*. In the case of a related fresh-water bucephalid, *Bucephalus papillosus* (referred to the genus *Rhipidocotyle* by Eckmann, 1932), the cercariae liberated from fresh-water mussels (Unionidae) penetrated the flesh of young bass at the base of the fins and encysted there (Woodhead, 1929).

Family HEMIURIDAE Lühe, 1901

LECITHOCHIRIUM MICROSTOMUM, new species

PLATE 6, FIGURES 2, 3

Specific diagnosis.—Specimens with ripe eggs and caudal appendage retracted are 2.75 to 4.8 mm long, with maximum width of 0.875 to 1 mm. One individual with extended caudal appendage measures 3.76 by 0.63 mm; appendage about 1 mm long. Cuticle without spines or rings. Maximum width at about level of vitelline glands or behind them. Oral sucker 140 μ to 200 μ in diameter, without internal lateral protuberances. A deep sinus present on ventral surface of body between ventral sucker and genital opening, and a special small round depression, characteristic of genus, just anterior to ventral sucker. Ventral sucker 365 μ to 540 μ ; ratio between size of oral and ventral suckers, 1:2.5 to 1:2.8. Pharynx round, 70 μ to 110 μ in diameter, contiguous with oral sucker, and followed by swollen, nearly spherical esophagus about same size as pharynx. Intestinal ceca pass laterally to sides of body, at right angles to long axis of body, then turn and pass posteriorly, ending at about level of retracted appendage. Disposition of genital glands as usual, testes close together and obliquely situated. Ovary farther behind testes than testes are behind ventral sucker. Yolk glands at level of or immediately behind ovary, each with three or four lobes, which are scarcely if any longer than wide. Uterus fairly voluminous, occupying most of space around testes and between testes and ovary, and with loops extending posterior to ovary and yolk glands, on left

side in two specimens, on right in one (pl. 6, fig. 2). Uterus forms metraterm at level of ventral sucker, the two parts separated by a well-developed sphincter (pl. 6, fig. 3). Metraterm pursues fairly straight course to sinus on ventral surface of body, then bends ventrally and joins prostatic part of vas deferens to form thick-walled hermaphroditic duct. Prostatic part of vas deferens saclike, constricted into two portions and connected with large trilobed seminal vesicle by narrow duct surrounded by numerous prostate cells. Eggs 16μ by 12μ .

Host.—*Trichiurus lepturus*.

Location.—Stomach.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39518; paratype, no 39521.

Remarks.—Only one other species of this genus as restricted by Looss (1907) has hitherto been described from American fishes with sufficient accuracy to be specifically recognizable, namely, *L. synodi* Manter (1931), although some of the forms referred by Linton (1898, 1901, 1905) to *Distomum monticellii* may be species of *Lecithochirium* and may even be identical with the form here described. *L. microstomum* differs from *L. synodi* in the greater relative difference in size of the suckers, in the presence of a bladder in the prostatic part of the vas deferens just behind the hermaphroditic duct, and in the larger size of the eggs. These flukes were found in small numbers in two out of three specimens of *Trichiurus lepturus*.

UNIDENTIFIED DISTOME

PLATE 6, FIGURE 4

A few specimens of an unidentified distome, which may be identical with Linton's "*Distomum* sp. from *Menidia notata*" (1901, pl. 32, figs. 357, 358), were found in *Menidia menidia* along with *Rhipidocotyle transversale*. The specimens were extremely fragile, with a tendency to stick to glass during the process of preparation, and were so densely crowded with eggs that no organs except the suckers and pharynx could be identified. The flukes are about 0.48 to 0.7 mm long, with greatest transverse measurement from dorsal to ventral side through ventral sucker. Ventral sucker in large specimen (0.7 mm long) 140μ , oral sucker 70μ , pharynx 50μ . Eggs about 22μ by 12μ .

Class CESTODA

Family TETRARHYNCHIDAE Cobbold, 1864

TENTACULARIA LEPIDA, new species

PLATE 7

Specific diagnosis.—Head and neck very long and slender, with an annular constriction immediately behind contractile bulbs where neck joins tail-like blastocyst. Two lateral heart-shaped bothria, emarginate behind, about 550μ long, and 450μ to 550μ wide at posterior end. Head and neck anterior to bulbs (pars vaginalis) 2.5 to 3 mm long. Just behind bothria neck only about 135μ to 170μ broad in lateral view; neck flares a little in bulbar region, reaching diameter of 320μ to 540μ at postbulbar constriction. Tail-like blastocyst 1.5 to 2.5 mm long, nearly cylindrical, with diameter of 300μ to 350μ . Contractile bulbs about 400μ to 500μ long and about 120μ broad, very close together, and collectively forming pear-shaped body. Each bulb with dense mass of fibers on inner wall; thickness of these muscular masses increases to a maximum at a point about two-thirds distance from anterior to posterior end, and then decreases again. A few fibers cross through central area between bulbs, holding latter together in a compact manner. Appearance and structure of bulbs as in plate 7, figures 1, 2, 5, and 6. Slender proboscis retractors attached anteriorly on inner wall of bulbs. Proboscides estimated to be between 1.5 and 2 mm long, cylindrical, with diameter of about 45μ to 50μ , armed with hooks of various kinds, form and arrangement of which are shown in plate 7, figure 4. Largest hooks in each spiral arranged in two groups of five hooks each, three elongate and only moderately curved, and two shaped somewhat like a cat's claw and sheath. At point where claw joins sheath these hooks very broad dorsoventrally and very thick. On side of proboscis opposite these two sets of hooks a single row of small round plates, in a continuous series, two plates to each whorl of hooks. On either side of this row of plates a close group of three slender spines, and between these and the three slender hooks of each group of five a single very slender spine. Maximum length attained by any hooks about 20μ . Little difference in size or arrangement of hooks on different parts of proboscides. Proboscis sheaths coiled in characteristic manner throughout length of neck. Numerous granular bodies in neck about 20μ in diameter; these begin about one-fourth length of neck behind bothria and continue to anterior ends of contractile bulbs, being somewhat more numerous posteriorly; granular bodies for most part apparently round and sessile (pl. 7, fig. 3) but actually attached to walls of neck by slender stalks, and closely similar to granular bodies

figured by Southwell (1930, fig. 57, B), on bulbs of his *Gymnorhynchus malleus*. Similar granular bodies are described and figured by Linton (1897) in the neck of his *Rhynchobothrium speciosum* (= *Tentacularia speciosa*).

Type host.—*Galeichthys felis*.

Location.—Attached to mesenteries.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39519; paratypes, no. 39520.

Remarks.—Only the encysted larvae of this form have been found; these occur in moderate numbers attached to the mesenteries of two species of catfish, *Galeichthys felis* and *Bagre marina*. The scolex and tail-like postbulbar portion appear to be free in the cysts, since when the cysts are broken and pressure is applied, the enclosed larva emerges entirely unattached. The cysts are usually pear-shaped and 2 to 4 mm long.

Tentacularia lepida is closely related to *T. speciosa* (Linton, 1897) and to *T. spiracornuta* (Linton, 1907). *T. speciosa* has recently been transferred to a new genus, *Lintoniella*, by Yamaguti (1934), but the reasons for its establishment seem to me inadequate. If, however, this genus is accepted, both *spiracornuta* and *lepida* should be placed in it. The armature of the proboscides of *lepida* is strikingly similar to that of *spiracornuta* as figured by Southwell (1930) and that of *speciosa* as figured by Yamaguti (1934), but *lepida* is much smaller than either of these, with differences in the proboscis hooks, proboscis sheaths, and contractile bulbs that clearly indicate specific distinctness.

GYMNORHYNCHUS GIGAS (Cuvier, 1817)

PLATE 8, FIGURES 1-4

Southwell (1930) has shown that this is the correct name for a tetrarhynchid that has hitherto been known as *Synbothrium fragile* Diesing, 1850, or *Syndesmobothrium fragile* Diesing, 1855. Linton (1897) described a second species of *Synbothrium* (*S. filicolle*) that he obtained in the larval state from a considerable number of fishes. In 1908 he briefly described an adult tetrarhynchid from a sting ray and assigned it to the same species. This adult, however, was probably incorrectly identified, for the dimensions given for the head, contractile bulbs, and other parts do not correspond with those of the larvae. Southwell believes that Linton's *S. filicolle* and Diesing's *S. fragile*, as well as *S. hemuloni* MacCallum, 1921, are all the same species, and with this I agree. Southwell, however, also considers *Tetrarhynchus platycephalus* Shipley and Hornell, 1906, to be the adult of the same species. This, I believe, is a mistake, for the characters of the head of this worm are strikingly different from

those of *Gymnorhynchus gigas*. Further remarks on *Tetrarhynchus platycephalus* will be found in the discussion of *Gymnorhynchus malleus*.

Three specimens of larval tetrarhynchids (U.S.N.M. no. 39522) from Galveston Bay fishes have been assigned to this species; two were found encysted on the mesenteries of *Galeichthys felis*, a single one in each of two hosts, while the third was found encysted in the body cavity of a croaker (*Micropogon undulatus*). When the cysts were burst the very characteristic larvae were freed; these larvae consist of a head and neck, followed by a nearly spherical vesicle into which the head and neck may be withdrawn, and then a long tail-like portion. Such larvae, probably all belonging to the same species, have been figured under the names *Gymnorhynchus reptans* and *Anthocephalus macrourus* by Bremser (1824); under the name *Pterobothrium heteracanthum* by Diesing (1855); as a "*Tetrabothrium* larva" by Linton (1887); as a *Syndesmobothrium filicolle* by Linton (1889); and as *Gymnorhynchus gigas* by Southwell (1930). The larvae reported by Southwell that lack a vesicle in the neck should not, I think, be referred to this species. Dollfus (1929b) considers *Pterobothrium* Diesing, 1850 (later renamed *Synbothrium* and still later *Syndesmobothrium*) as a valid genus distinct from *Gymnorhynchus*, but his reasons for doing so are not clear.

Since there is so much confusion with respect to this species it seems desirable to describe some of the details of the specimens found in Galveston Bay fishes, and then to point out the features actually characterizing the species.

The vesicle in which the scolex lies measures, in my specimens, 2.5 to 3.5 mm in length and is about three-fourths as wide as long. The relations of scolex, vesicle, and "tail" are precisely as described by Linton in 1887. The tail is several centimeters in length and about 0.75 mm in breadth. The four bothria are mobile, spreading from the front of the head, each with a sucking disk; they measure about 300 μ in an anteroposterior direction, while the width of the head across the bothria is about 450 μ to 470 μ . The neck anterior to the contractile bulbs (pars vaginalis of Pintner, 1913) is 2.4 mm long and about 200 μ broad, widening out in the bulbar region to about 400 μ (pl. 8, fig. 1). The neck is slightly dilated just anterior to the bulbs, where the proboscis sheaths are coiled. The postbulbar region is shorter than the pars vaginalis but varies in my specimens from about 0.5 to 1.5 mm, according to the state of contraction. The bulbs are elongate and of nearly uniform width, measuring about 1 to 1.3 mm in length by about 135 μ in width. The total length of the proboscides, judged by the extent of the inverted spines, is about 3 mm; the diameter, exclusive of the spines, is about 60 μ . The proboscis sheaths are straight in the

greater part of the neck, becoming thrown into coils just anterior to the bulbs. The spines on the proboscides, as far as observable in the everted part, are arranged in two groups of five each. Near the base of the proboscis one set of five spines in each whorl consists of recurved clawlike spines, tending to become straight and elongate, at first one or two in a set, in more distal whorls all of them. Many of the spines near the base have more or less well-developed prongs (pl. 8, fig. 4). After the first six or eight whorls all the spines tend to become elongate, only slightly curved, and to have their prongs flattened out (pl. 8, fig. 3). Near the base these elongate spines are about 50μ to 60μ long, but they gradually grow larger until they reach a length of about 110μ . At about 900μ from the base the spines in one series of five change rather suddenly, in the space of two or three whorls, to very stout, strongly curved, clawlike spines with stout bases, the spines in the other series remaining broad, flat, elongate, and slightly sinuous (pl. 8, fig. 2). Examination of the inverted part of the proboscis shows that at least some clawlike spines continue nearly to the tip, but the form and arrangement of the spines in this part of the proboscis could not be made out clearly.

Following are the characters that I think should be possessed by a specimen before it can be correctly assigned to this species: Larvae with "blastocyst" divided into an anterior oval or spherical vesicle containing the head (unless pressed out) and an elongate, posterior tail-like portion. Head when pressed out of vesicle remains attached to it unless broken. Bothria four, spreading out anteriorly and each with a sucking disk directed forward. Head and neck 3 or more mm in length, and about 200μ broad in narrowest region; contractile bulbs about 1 mm or more in length and about one-tenth to one-eighth as wide as long. Proboscis sheaths nearly straight in anterior half or two-thirds of length of neck, but thrown into coils just anterior to bulbs. Retractable muscles of proboscides attached near anterior end of bulbs. Proboscides about 3 mm in length. Spines on proboscides arranged in two groups of five. On basal portion of proboscides, except first six or eight rows, spines slightly curved and bladeliike, frequently notched at tip, and reaching maximum length of about 110μ . About 1 mm from base, spines in one set of five change to a stout clawlike form, which is maintained in at least one set of spines to tips of proboscides.

GYMNORHYNCHUS MALLEUS (Linton, 1924)

PLATE 8, FIGURES 5, 6

The larvae of this species were described and figured by Linton (1897) as *Tetrarhynchus erinaceus*. These larvae were transferred by Linton in 1905 to the genus *Synbothrium*, and in 1924 were as-

signed to the species *S. malleum*, the adult of which he described in that year, parasitic in the ray *Dasybatis centrura*. The larvae were found in a number of salt-water fishes, including *Galeichthys milberti*. Southwell (1930) referred to this species some adult specimens, which he found in rays in Ceylon. Two specimens (U.S.N.M. no. 39523), which I have assigned to this species, were obtained from the mesenteries of *Galeichthys felis*.

My specimens seem to agree fairly closely with Linton's description and figures of this species except for the smaller size. Unfortunately the proboscides are only slightly exerted, so a full comparison of their armature with that described and figured by Linton is not possible. So far as can be seen, however, my specimens agree with Linton's.

The cysts have an enlarged egg-shaped anterior end measuring about 4 to 5 mm in length and 2.5 mm in breadth. Behind this anterior portion there is a long tail-like appendage. The scolex and neck, and a bulblike expansion of the body behind the neck, are contained in the enlarged anterior portion of the cyst. The tail consists of a slender prolongation of the body covered by a loose thin sheath, which is a part of the cyst wall. The tail in one specimen is about 17 mm long and in the other about 50 mm. The bothria spread out at right angles to the long axis, giving the hammerlike appearance that has been described and figured by Linton. The breadth of the head across the bothria is about 850μ , and the length of the bothridial portion of the head only about 350μ . A proboscis emerges from near the outer extremity of each bothrium, but none of the proboscides are exerted far enough to show more than one or two basal rows of hooks. The visible hooks consist of very stout thorn-shaped hooks, slender recurved hooks, and numerous minute spines. The proboscides are about 2 mm in length, with a diameter at the base of about 40μ . The short thick neck is about 560μ in diameter. The contractile bulbs are about 1.2 mm long and 270μ abroad.

Shiple and Hornell (1906) described and figured under the name *Tetrarhynchus platycephalus* an adult tetrarhynchid that had the head shaped strikingly like *G. malleus*, but in which the hooks as described are like those of *G. gigas*. In Shiple and Hornell's worm, however, the short proboscides are nearly straight within the head and posteriorly pass to the posterior extremity of the contractile bulbs, in which they lie coiled. In my specimens no such condition exists; the retractor muscles of the proboscides are attached to the anterior ends of the bulbs. It seems certain, therefore, that *T. platycephalus* is identical with neither *G. gigas* nor *G. malleus*, but should be recognized as a third species of *Gymnorhynchus*, *G. platycephalus*.

Superfamily PHYLLOBOTHRIOIDEA Southwell, 1930

SCOLEX PLEURONECTIS Müller, 1788 (S. POLYMORPHUS Rudolphi, 1819, of many writers)

Larval cestodes of this species have been found in a great number of different marine fishes and show a considerable variation in size and form, but the variation among the individuals in a single host and changes that are thought to take place with age make it extremely difficult, and at present impossible, to separate different species with any degree of accuracy. These worms have been considered to be the larval forms of various tetraphyllidean worms by different authors; among the supposed parent worms are species of *Acanthobothrium*, *Calliobothrium*, *Onchobothrium*, *Echeneibothrium*, and *Phoreiobothrium*. Experimental feedings of the larvae to elasmobranch hosts have been made by Monticelli (1888) and Curtis (1911). Monticelli, feeding larvae from a flounder (*Arnoglossus*) near Naples to a species of *Torpedo*, obtained young specimens of *Calliobothrium filicolle*, which he believed to have developed from the larvae fed. Curtis, on the other hand, fed larvae obtained from *Cynoscion regalis* at Woods Hole, Mass., to *Carcharias littoralis* and obtained young specimens of *Phoreiobothrium triloculatum*, which he believed to have been derived from the experimental feeding. Southwell (1925) sums up the situation as follows: "There can, I think, be little doubt that the name *Scolex polymorphus* does not indicate a definite species; it is a group name which includes a number of different species in the final host."

Linton in his various papers has noted the occurrence of these larval cestodes, which he lists under the name *Scolex polymorphus*, in over 60 widely diversified species of fish. In some hosts (e. g., *Cynoscion regalis* in New England) they were found in almost every specimen examined and in enormous numbers, either in the cystic duct and gall bladder or in the intestine, or in both. The forms described from various fish hosts are by no means all alike. They differ in size, in the form of the sucker, or "myzorhynchus", at the anterior end between the bothria, in the size and shape of the bothria, in the presence or absence of cross partitions, or "costae", on the bothria (one to four in number when present), and in the presence or absence of red pigment patches. Linton (1905) records this parasite from *Galeichthys milberti* at Beaufort, N. C. Twelve specimens were obtained from the cystic duct near its junction with the intestine. Of these Linton says: "The specimens contracted freely between 4 and 8 mm in length. At rest, with bothria retracted, the length was about 1.2 mm. There was no indication of costae on the bothria nor of the red pigment patches often noted in these larval cestodes." Similar specimens were found in the intestine of another host of the same species.

My specimens were found in three of five specimens of *Galeichthys felis* taken at Evergreen Beach in Galveston Bay and in two of three specimens taken in the Gulf of Mexico near Bolivar Point, Galveston. Similar larvae were found in several specimens of *Bagre marina*. In most instances the parasites were present in moderate numbers, from 8 or 10 to 30 or 40, attached to the cystic duct, free in the gall bladder, or free in the chyle of the intestine. While living they were extremely active, extending to a length of 6 to 8 mm and becoming as slender as a thread, with a slight enlargement just behind the head, and contracting down to less than 1 mm in length. There was a very marked tendency, when the worms contracted slightly from a fully extended condition, for the body to bulge conspicuously just behind the head. After fixation the worms contracted to a length of 2 to 4.5 mm, with a maximum diameter behind the head varying from 0.1 to 0.6 mm. Across the widest region of the bothria the head measures 0.4 to 0.65 mm. The bothria are 0.23 to 0.3 mm long and about half as wide. The apical sucker, or "myzorhynchus", is flat anteriorly and rounded posteriorly, about as long as wide, and about 0.07 mm in diameter.

Family PROTEOCEPHALIDAE La Rue, 1911

PROTEOCEPHALUS AUSTRALIS, new species

PLATE 9, FIGURES 3-6

Specific diagnosis.—Total length 20 to 38 cm, with maximum diameter of about 1 mm when relaxed, but up to 1.8 mm in contracted regions. Head not clearly demarcated from strobila; maximum diameter, shortly behind suckers, about 780μ (pl. 9, fig. 6). Suckers face anterolaterally and are about 285μ in diameter without deep grooves between them. Anterior end with vestigial sucker. Segmentation begins immediately behind scolex. Narrowest part of neck about 665μ broad. Proglottids in various regions of strobila with measurements in millimeters as follows:

	<i>Length</i>	<i>Breadth</i>
5 mm from anterior end.....	0.045	0.75
10 mm from anterior end.....	0.1	0.77
25 mm from anterior end.....	0.3	1
50 mm from anterior end.....	0.7	1.33
75 mm from anterior end.....	1.2	1.8
100 mm from anterior end.....	2	0.75
Longest proglottid.....	2.65	1

In relaxed condition all proglottids over 100 mm from anterior end longer than broad. Posterior segments split on mid-ventral line, and with tendency to pull apart at junctions, remaining attached only at lateral margins, leaving fenestrae between them. Calcareous granules very numerous, angular in outline, and about 5μ in diameter.

Genital pore marginal, at bottom of well-developed sinus, irregularly alternating, one-fourth or less of length of proglottid from anterior end. Testes 90 to 100, about 50μ to 70μ in diameter, occupying greater part of proglottid between vitellaria, except space occupied by other organs. Vas deferens forms dense mass of coils lying median and slightly posterior to cirrus pouch (pl. 9, fig. 3).

Cirrus pouch large, 450μ to 530μ long and 240μ to 265μ broad, of variable shape. After entering pouch vas deferens makes about three loops, then rather suddenly enlarges to form cirrus. Retracted cirrus extends almost to proximal end of pouch and then twists forward and distally to junction with vas deferens; wall thick and thrown into conspicuous corrugations. Exserted cirrus extremely long, up to 1.5 mm when fully exserted, about 100μ in diameter at base, tapering to diameter of 40μ at truncated tip (pl. 9, fig. 5). Vagina, opening just anterior to cirrus, forms crescentic curve with convex side forward, about 300μ long (pl. 9, figs. 3, 5). Distal 40μ or 50μ of duct with moderately thick walls, rest of curve surrounded by powerful sphincter muscle, thickest on middle of convex side of curve; maximum diameter of vagina through sphincter about 90μ to 110μ with narrow lumen, not more than 5μ or 6μ in diameter when open. At end of curved sphincter region vagina opens into expanded thin-walled tube with lumen usually about 80μ to 90μ in diameter at junction with sphincter, sometimes bulged to diameter of 120μ . This tube passes toward median line of segment, curving posteriorly, and then passes back to ovary, its direction frequently interrupted by kinky folds. When empty, diameter of this portion of vagina only about 20μ to 25μ but frequently expanded to a diameter of 40μ or 50μ . Coils not noticeably more numerous just anterior to ovary. Behind ovary oviduct and vagina thrown into several transverse loops, which could not be successfully followed. Ovary bilobed, usually of rather characteristic shape (pl. 9, figs. 3, 4), its posterior border almost straight, extending to vitellaria on each side; anterior border a deep-swinging curve, each end not quite reaching vitellaria, having lateral borders nearly straight and at right angles to posterior border but with anterior tips bent inward. Greatest anteroposterior diameter of ovary, from tips of anterior curve to posterior border, about 400μ to 450μ . Vitellaria extend from near anterior border of segment to near posterior border of ovary on aporal side, and from posterior side of cirrus pouch to posterior border of ovary on poral side, only rarely any follicles present anterior to cirrus pouch. Uterus spreads laterally, maintaining almost straight lateral borders; about 15 to 20 incomplete septa on each side tend to divide uterus into lobes (pl. 9, fig. 4).

Type host.—*Lepisosteus osseus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39525.

Remarks.—This species comes strikingly near to *P. ambloplitis* Leidy as described and figured by Benedict (1900), although it looks much different from specimens examined by me taken from *Microp-terus dolomieu* in Douglas Lake, Mich., and referred to that species by LaRue. No other member of the genus *Proteocephalus* except *P. ambloplitis* as described by Benedict has a vaginal sphincter even approaching that of the species here described (LaRue, 1914).

P. australis differs from *P. ambloplitis* as described by Benedict in the following particulars: In *P. ambloplitis* all the segments, except sometimes a few square posterior ones, are broader than long; in *P. australis* all proglottids beyond 75μ to 100μ from head are longer than broad, some over two and one-half times longer. In *P. ambloplitis* the scolex is sharply set off from the neck, which in Benedict's figures appears to be only 300μ to 400μ broad, and the suckers are separated by deep sulci; in *P. australis* the scolex is hardly broader than the neck, and there are no sulci between the suckers. In *P. ambloplitis* the inner longitudinal muscles are arranged in 50 to 60 distinct bundles; in *P. australis* these muscles are not distinctly segregated into bundles. In *P. ambloplitis* the vas deferens is intricately coiled in the cirrus pouch, and the protruded cirrus measures about 500μ to 700μ in length; in *P. australis* the vas deferens has only about three loops inside the cirrus pouch, and the protruded cirrus has a length of 1.5 mm. In *P. ambloplitis* the vitellaria are described and figured as extending anterior to the cirrus pouch on the poral side; in *P. australis* they rarely do this. In *P. ambloplitis* the ovaries are described as retort-shaped and figured as narrow anteroposteriorly; in *P. australis* each lobe laterally is about as broad anteroposteriorly as it is transversely. So far *P. ambloplitis* has been recorded from various species of bass and from the bowfin (*Amia calva*) in fresh-water lakes and streams while *P. australis* was found in a gar in the highly brackish water of Galveston Bay. Two specimens were found in one of three host specimens examined.

PROTEOCEPHALUS ELONGATUS, new species

PLATE 8, FIGURES 7, 8; PLATE 9, FIGURES 1, 2

Specific diagnosis.—Total length about 560 mm. Head 675μ to 765μ in diameter with an apical prominence, very prominent suckers and deep sulci between suckers extending back on neck to a point about 800μ to 900μ from anterior end (pl. 8, fig. 7). Suckers about

320 μ in diameter. Head sharply constricted behind suckers. Neck long, segmentation beginning to show faintly at 5 to 9 mm from anterior end, with minimum width of 360 μ to 450 μ . Proglottids at first much broader than long, but relative length rapidly increasing until, at a distance of 4 cm from head, they may be approximately square if in an uncontracted state. Even mature segments 10 or 12 cm from head vary greatly in measurements according to state of contraction, some being broader than long (1.8 mm broad by 1.2 mm long), others longer than broad (1.2 mm broad by 2.1 mm long). Ripe segments longer than broad, varying in breadth from about 1.2 to 1.5 mm and in length from 2.8 to 4.7 mm.

Genital pores marginal, without papillae, irregularly alternating, about one-fifth to two-ninths length of segment from anterior end. Testes very numerous, about 200 to 225 or more, 60 μ in diameter, arranged almost all in one plane, and filling in greater part of space between vitellaria anterior to ovary, although soon crowded out of middle portion of segment posterior to cirrus by developing uterus (pl. 9, fig. 1). Vas deferens forms dense mass of coils lying between cirrus pouch and median line of proglottid. Cirrus pouch roughly three-eighths width of segment, measuring about 480 μ to 580 μ in length by 260 μ to 325 μ in diameter. Retracted cirrus bent upon itself in pouch; ejaculatory duct capable of great distention, which makes the walls appear thin instead of thick and muscular (pl. 8, fig. 8, A). Everted cirrus about 600 μ to 650 μ long, with bulblike enlargement of proximal half; diameter through bulb about 180 μ (pl. 8, fig. 8, B).

Vagina opens anterior to cirrus and lies close along anterior wall of latter. It is provided with an elongated muscular sphincter, somewhat reminiscent of that of *P. ambloplitis*, extending from genital pore to about half length of cirrus pouch. Musculature not nearly so thick as in *P. ambloplitis*, thickest near middle of its length and gradually disappearing instead of ending abruptly as in *ambloplitis* (pl. 8, fig. 8; pl. 9, fig. 1). Whole vagina, including part with muscular wall, may be greatly distended, although the sphincter causes a slight constriction in it (pl. 8, fig. 8, A). In young mature segments vagina, after reaching middle of proglottid, passes almost straight posteriorly to ovary, although in older proglottids it has a few kinks (pl. 9, fig. 1). Over bridge of ovary vagina has slight club-shaped enlargement from which lower vagina emerges and after one or two loops enters oviduct near middle of its length (pl. 9, fig. 2). Oviduct originates in oocapt attached to bridge of ovary. Just before entering ootype oviduct is joined by a common vitelline duct, which has a reservoirlike enlargement before it branches to go to opposite sides of segment. Shell gland surrounding ootype an

irregularly shaped mass of cells. Vitellaria arranged in two narrow lateral bands extending throughout length of proglottid on both sides. Uterus grows out from midline in form of numerous pouches separated only by wall-like partitions; pouches 20 to 30 on each side extending laterally in ripe proglottids to vitellaria.

Type host.—*Lepisosteus osseus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39526.

Remarks.—This worm differs from all other members of the genus except *P. ambloplitis* and *P. australis* in the size and extent of the vaginal sphincter, but the musculature of this organ is very much thinner than in either of these species. It differs further from both these species in having a slender unsegmented neck several millimeters long.

Three specimens of this worm were found in a specimen of *Lepisosteus osseus*, along with two specimens of *P. australis*. In one worm some interesting abnormalities occurred. In a group of six mature segments, three abnormalities were found. One segment had a genital pore, cirrus pouch, and transverse portion of the vagina duplicated on opposite sides of the segment. In this case the mass of coils of the vas deferens was also duplicated, but the two transverse vaginas met to form a single tube in the middle of the segment. In another segment two cirrus pouches, each with its accompanying coil of the vas deferens, lie one immediately behind the other on the same side of the segment, but only a single vagina, anterior to the first cirrus pouch, is present. In another segment the vagina opens posterior to the cirrus instead of anterior, as is the case in every other instance.

Family DILEPIDIDAE (?) Railliet and Henry, 1909

GLOSSOCERCUS, new collective group of tapeworm larvae

Definition.—Larval tapeworms consisting of two parts separated merely by a constriction: (1) Head and neck and (2) long, slender, tonguelike tail. Head provided with four suckers and armed rostellum. Posterior part of neck with an oval cavity with a ductlike extension passing into tail, where it continues as an ill-defined central cavity partially filled with loose parenchyma. A pair of excretory tubes become conspicuous in posterior part of neck and pass through whole length of tail, usually becoming markedly wider just behind neck. Scolex retractile into anterior part of neck. Strong muscle fibers pass from neck back into tail. Found free in body cavity of small fish. Probably larvae of tapeworms of family Dilepididae, parasitic in fish-eating birds.

GLOSSOCERCUS CYPRINODONTIS, new species

PLATE 10, FIGURES 1-5

Specific diagnosis.—Length of head and neck about 4 to 7 mm, according to state of contraction; of body 9.5 to 12.5 mm. Maximum diameter of scolex (pl. 10, fig. 4) about 630μ , of neck (when relaxed) about 280μ to 300μ , and of tail about 0.8 to 1.2 mm. Suckers oval, about 175μ long and 155μ wide. Rostellum very muscular, when retracted shaped like cone with rounded sides, about 175μ wide and about the same in depth. Hooks (pl. 10, fig. 5) in two rows of 10 hooks each, the larger ones 180μ long, with blade 100μ long; guard (or ventral root) 55μ measured from dorsal contour of hook to base, and with breadth of about 25μ across base; root shorter than blade with expanded proximal end about 20μ broad. Smaller hooks 130μ long, with more curvature than long hooks; guard 42μ from dorsal contour of hook to base, and with transverse breadth of about 30μ across base; root expanded at proximal end to transverse width of about 20μ . Oval cavity in posterior part of neck (pl. 10, fig. 3, A) about 500μ long and 200μ wide. Longitudinal muscles in well-defined bundles (pl. 10, fig. 3, B). Tail shaped like an elongated willow leaf, its broadest point shortly behind junction with neck, thence tapering to a rounded point at posterior end (pl. 10, fig. 1). Excretory tubes in tail are very conspicuous and may be over 100μ broad.

Type host.—*Cyprinodon variegatus*.

Location.—Body cavity.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39527; paratypes, no. 39528.

Remarks.—These worms, up to two or three in a host, were found in about 30 percent of a dense swarm of top minnows (*Cyprinodon variegatus*) in a pool on Galveston Island. No specimens were found in individuals of the same species taken in the upper part of Galveston Bay, but one young specimen was found in a *Fundulus heteroclitus* in the upper bay. The worms were found free in the body cavity of the fish, although in a few instances they were seen coiled up in a delicate membranous cyst, which burst as soon as touched. The worms are extremely active, and capable of contracting and stretching to a remarkable extent. So far as I have been able to find, no larvae in any way resembling this one have hitherto been described, although the *Gryporhynchus* larvae come nearest to them. The nature of the scolex suggests the probability of the adult belonging to a member of the Dilepididae, but no form with a scolex conforming with that of this species in details of structure has so far been described in fish-eating birds. The nearest approach is

Dilepis kempfi Southwell, 1921, from a cormorant in Assam. In this the hooks are similar, but the scolex and suckers are markedly smaller.

CYSTICERCOIDES MENIDIAE, new species

Specific diagnosis.—Small oval cysticercoids 200μ to 300μ long and 150μ to 185μ broad. Evaginated scolex about 155μ broad and 135μ long, with poorly defined suckers but provided with 20 (or 18?) hooks in a double row, the short hooks 50μ long, the long ones about 70μ .

Host.—*Menidia menidia*.

Location.—Intestinal wall and mesenteries.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39530.

Remarks.—A few of these small tapeworm cysts were obtained from a silversides along with specimens of the gasterostome *Rhipidocotyle transversale*. It is probably the larvae of an avian parasite of the family Dilepididae, but I have not been able to identify the hooks with those of any North American species.

Class NEMATODA

Family ASCARIDAE Cobbold, 1864

Subfamily ANISAKINAE Railliet and Henry, 1912 (emend. Baylis, 1920)

CONTRACAECUM COLLIERI, new species (= *C. MICROPAPILLATUM*?)

PLATE 10, FIGURES 6-8

Specific diagnosis.—Body reddish, robust, bluntly rounded at head end, conical at caudal end. Length 18 to 26 mm, with maximum diameter of 600μ to 750μ . Head without distinct lips, but truncated and with pair of slight liplike elevations, one of which bears boring tooth, which is not pointed but resembles a knoblike papilla. Shortly behind head body conspicuously annulated for distance of about 200μ , beyond which annulations (pl. 10, fig. 7) become indistinct. Diameter through posterior part of striated region about 240μ to 250μ . Esophagus 2 to 3 mm long with diameter of about 75μ , followed by appendix about 450μ to 590μ long. Anterior diverticulum of intestine 1.45 to 1.9 mm long. Anus 180μ to 200μ from posterior end of body.

Type host.—*Cyprinodon variegatus*.

Location.—Body cavity.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39531.

Remarks.—These relatively large worms are fairly common in *Cyprinodon variegatus* in Galveston Bay. Usually one but sometimes two specimens occur in a single host, and in one instance two of these and one of the huge *Agamoumena inananis* described below were found in a single *Cyprinodon* not over 3 inches in length. Four specimens were found in the body cavity of one of two *Paralichthys lethostigmae* examined. Ten specimens freshly removed from infested *Cyprinodon* were fed to each of three domestic mallard ducks. When no eggs were found in the feces by the end of three weeks the ducks were killed and examined, but no trace of worms of the genus *Contracaecum* was found.

CONTRACAECCUM ROBUSTUM, new species (=C. MICROCEPHALUM?)

PLATE 19, FIGURES 9, 10

Specific diagnosis.—Body blood-red, robust, tapering in anterior fourth, bluntly conical at posterior end. Length 20 to 26 mm, with maximum diameter of 1 mm. Head without distinct lips, but with conspicuous pointed boring tooth about 30μ in length. Just behind head cuticle conspicuously marked with annulations, which are very close together and end rather abruptly after about 135μ to 150μ . Diameter through posterior part of striated region about 325μ to 350μ . Esophagus about 3.5 mm long with diameter of about 160μ , followed by appendix about 1.12 to 1.15 mm long. Anterior diverticulum of intestine 2.6 to 2.9 mm long. Anus 135μ to 150μ from posterior tip. Caudal end of body indistinctly annulated and terminated by demarcated conical lobe.

Type host.—*Mugil cephalus*.

Location.—Embedded in kidneys.

Locality.—Galveston Bay, Tex.

Type specimens.—U.S.N.M. Helm. Coll. no. 39533.

Remarks.—This worm is common in mullets during the summer months and accounts for the popular reputation of mullets being "wormy." It is also fairly common in *Fundulus heteroclitus* in summer. It is a much stouter worm than *C. colliceri*, more tapering anteriorly, is much less distinctly striated posteriorly, and has a different boring tooth, a longer and broader esophagus, a longer esophageal appendix, and a differently shaped tail.

Fourteen specimens freshly removed from infected mullets were fed to each of two domestic mallard ducks. The feces of the ducks were then examined for ova every other day for three weeks, with negative results. The ducks were then killed and examined, but no trace of worms of the genus *Contracaecum* was found.

The relation of these two species of *Contracaecum* to the adult species known from American fish-eating birds is uncertain until

successful infection experiments have been performed. I can find no reference in descriptions of *C. spiculigerum* to the deep striations in the neck region, which is a conspicuous feature of both the species described above, but these striations are mentioned by Cram (1927) in *C. microcephalum* of ducks and ciconiiform birds and in *C. micropapillatum* of pelicans, as well as in *C. multipapillatum* of South American ciconiiform birds and in *C. tricuspe* of similar birds in Asia and Africa. Cram considers *C. quadricuspe* Walton a synonym of *C. microcephalum*. In his description of *C. quadricuspe*, Walton (1923) mentions that the tail ends abruptly in a terminal spine, which is also a character of *C. tricuspe*, but it is neither mentioned nor figured by Gedoelst (1916) in his description of *Kathleena arcuata*, a species that Baylis and Daubney (1922) found to be identical with Rudolphi's *microcephalum*. *C. robustum* has a terminal papillalike structure such as Walton figures for his *C. quadricuspe*, but the esophageal appendix is longer than in Walton's *quadricuspe* and similar to the dimensions given for *microcephalum*. *C. collieri*, on the other hand, has no papilla at the end of the tail and has a much slenderer esophagus, shorter appendix, and shorter cecum, in which respects it suggests the possibility of its being the young of *C. micropapillatum*. As noted above, however, both species were fed to domestic mallard ducks without resulting infection.

AMPHICAECUM PARVUM, new species

PLATE 11, FIGURE 1

Specific diagnosis.—Body small and slender, 6.7 mm long, with maximum diameter of 230 μ . Diameter fairly uniform for most of length of body, tapering in anterior fourth and more abruptly at tail end. No striations on cuticle. Head truncated, 60 μ across at anterior end. No larval boring spine, but mouth flanked on each side by bladderlike structure, which may be forerunner of a lip. Esophagus about 830 μ long, followed by a more or less spherical bulb about 15 μ in diameter and a large hollow appendix 1.06 mm in length. Diameter of esophagus about 56 μ , of appendix about 80 μ . Intestinal cecum about 300 μ long and 60 μ in diameter. Anus 135 μ from posterior end. Tail conical, ending in truncated papilla-like structure about 10 μ in diameter.

Type host.—*Dorosoma cepedianum*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39535; paratype, no. 39536.

Remarks.—In the possession of a posterior esophageal bulb instead of a ventricle and of a large hollow esophageal appendix, this

form obviously belongs to the genus *Amphicaecum*, which Walton erected in 1927 for some larval forms obtained by Leidy from the weakfish (*Cynoscion regalis*). Walton presents no measurements but gives a diagram of the digestive system of a 15 mm specimen. In this it is clear that the intestinal cecum and esophageal appendix are smaller relative to the esophagus than in my specimens, and the two are therefore believed to be specifically distinct.

RHAPHIDASCARIS ANCHOVIELLA, new species

Specific diagnosis.—Females 4 to 6 mm long, with maximum diameter of 160μ to 250μ . Head truncated, 60μ to 72μ in diameter. Esophagus, in specimens 5 to 6 mm long, about 600μ to 750μ long and 90μ to 100μ broad, with a small bulblike posterior ventriculus from which springs a posterior flattened appendix 310μ to 420μ long and about 25μ in diameter dorsoventrally and about 60μ in diameter from side to side. Ventriculus about 30μ to 50μ long and 90μ broad. Vulva 1.2 to 1.5 mm from anterior end. Ovejector directed posteriorly, dividing into two posteriorly directed uteri about 630μ from vulva. Uteri loop forward, but not anterior to vulva, and then pursue a wavy course backward, ending near anus. Anus about 240μ to 300μ from posterior end. Tail bluntly conical, terminating in a spine.

Males about 4 to 5.8 mm long with diameter of about 165μ to 235μ . Esophagus 410μ to 500μ long and 65μ in diameter, with ventriculus 30μ long and 50μ broad, and posterior appendix 240μ to 280μ long. Reproductive tube extends anteriorly to about 350μ behind end of esophagus and pursues a wavy course posteriorly to cloaca, which is 90μ to 120μ from posterior end. Tail abruptly conical at tip and terminated by a spine.

Specimens in anchovy immature with reproductive tubes present, but without adult lips and without spicules in males.

Host.—*Anchoviella epsetus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39537; paratypes, no. 39538.

Remarks.—These immature worms correspond in the structure of the alimentary canal with members of the genus *Rhaphidascaris*. Their specific identity is uncertain, since they are immature, but until the adult stage can be obtained by infection experiments it seems advisable to designate this species by a new name, even though it may subsequently fall into synonymy.

A few specimens of a larval form probably identical with this species from the anchovy were found in *Menidia menidia*, and also in a

specimen of *Trichiurus lepturus*, along with the two forms of larval *Porrocaecum* described below. The specimens from *Trichiurus* are slightly larger than the *Rhaphidascaris* in the anchovy, with relatively shorter and stouter esophagus, but this might easily be accounted for by a slightly greater age. The specimens from *Trichiurus* (all females) are 6.4 to 7.2 mm long, with a maximum diameter of 230μ to 255μ . The esophagus is 700μ to 735μ long, with a diameter of 110μ to 115μ ; and the diverticulum is 350μ to 375μ long. The anus is about 265μ from the tip of the tail.

PORROCAECUM TRICHIURI, new species

Specific diagnosis.—Length 6.85 to 8.4 mm, with maximum diameter of 135μ to 180μ . Head 65μ in diameter; diameter at anus 65μ . Tail 105μ to 130μ long, conical, rounded at tip, and conspicuously striated, the striations about 4μ apart. Esophagus anterior to ventriculus 875μ to 910μ long with a maximum diameter of 60μ to 65μ ; ventriculus 340μ to 415μ long and 90μ in diameter. Intestinal diverticulum 530μ to 680μ long, with diameter of 50μ to 60μ at base, tapering to rounded point at distal end. Only larval forms found, with boring tooth present and no development of reproductive system. Enclosed in delicate sheaths.

Type host.—*Trichiurus lepturus*.

Location.—Mesenteries.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39539; paratypes, no. 39540.

PORROCAECUM SECUNDUM, new species

Specific diagnosis.—Length 8 mm, with maximum diameter of 160μ . Head 65μ in diameter; diameter at anus 65μ . Tail 130μ long, conical, rounded at tip, and conspicuously striated, the striations about 4μ apart. Esophagus anterior to ventriculus 910μ long, with maximum diameter of 85μ ; ventriculus 820μ long and 110μ in diameter. Intestinal diverticulum 900μ long, more bluntly rounded distally than in *P. trichiuri*. Only a single larva found, with boring tooth present and no development of reproductive system.

Type host.—*Trichiurus lepturus*.

Location.—Mesenteries.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39541.

Remarks.—This worm differs from the larval *P. trichiuri* in the greater length of the ventriculus (which in this species is nine-tenths the length of the anterior part of the esophagus, while in all of five specimens of *P. trichiuri* it is only about two-fifths as long) and in the larger size of the intestinal diverticulum.

GOEZIA MINUTA, new species

PLATE 11, FIGURES 2-4

Specific diagnosis.—Body 3.1 mm long, nearly cylindrical, bluntly rounded at head end, bluntly conical at caudal end, and slightly narrower at end of anterior third of length than either before or behind this region (pl. 11, fig. 2). Maximum diameter 280μ . Cuticle provided with rows of spines for entire length. Spines largest and rows farthest apart in second fourth of body length, where they are spaced as much as 22μ apart. Just behind head annulations only 6μ apart; in the middle esophageal region and again in third fourth of body length, about 15μ apart; much closer in posterior region. In anal region the spines minute and directed forward instead of backward. Lips provided with prominent lateral papillae. Diameter across lips 110μ . Body constricted behind lips to diameter of 85μ . Caudal appendage bluntly rounded, about 28μ long and 13μ broad (pl. 11, fig. 4). Esophagus 360μ long, cylindrical, about 65μ in diameter for two-thirds its length, then widening out to diameter of about 90μ . Esophageal appendix a long, narrow tube about 850μ in length (pl. 11, fig. 3). Anterior cecum of intestine about 180μ long and 115μ broad. Spicules approximately equal, about 345μ long. Cloaca about 45μ from posterior end, exclusive of caudal appendage.

Host.—*Bagre marina*.

Location.—Stomach.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39542.

Remarks.—Only a single specimen, a male, has been found. Four of the five species of *Goezia* hitherto described were described in the early days of parasitology, and the descriptions are entirely inadequate from a modern point of view. The only well-described species is *G. gaviolidis* Maplestone, 1930, and only a single female of this form was found. It is by no means certain that the form here described is not identical with some of the earlier species, but it would not be possible to identify it with any one of them at present. It seems best for the present, therefore, even though the name may eventually fall into synonymy, to consider it a distinct species.

Family CUCULLANIDAE Barreto, 1916

DICHELYNE FASTIGATUS, new species

PLATE 11, FIGURES 5-7

Specific diagnosis.—Small, fairly stout nematodes, with body tapering fairly evenly in both sexes from esophageal region to tail. Cuticle in cephalic region thickened to about 30μ . Female 4.6 mm

long, with maximum diameter, at posterior end of esophagus, of 390μ . Esophagus 720μ long, anterior portion about 320μ long. Diameter 180μ across expanded anterior end, 78μ at narrow neck, where anterior and posterior parts join, 135μ across bulb. Lips 170μ broad, with finely fluted rather than serrated margins, and three papillae. Intestinal diverticulum reaches to about junction of two parts of esophagus. Vulva situated 58 percent of body length from anterior end. Anus about 180μ from tip of tail. Tail conical, about 56μ broad at anus, terminated by spine, which, as pointed out by Van Cleave and Mueller in the case of *D. robusta*, apparently has the structure of a sensory papilla. About in middle of postanal region a pair of conspicuous lateral papillae. Male 5.75 mm long, with diameter of about 380μ . Esophagus 675μ long, 136μ broad at expanded anterior end, 70μ broad at neck, and 100μ broad through bulb. Cloaca 135μ from tip of tail, with conspicuous lips. Caudal papillae arranged much as in *D. cotylophora*. Four pairs of papillae postanal, three pairs adanal, and four pairs preanal. Most posterior pair of postanal papillae ventral near tip of tail, next pair dorsal, next pair lateral, and next pair ventral. Two pairs of adanal papillae large and ventral, situated on sides of genital prominence immediately in front of and behind cloacal passage; third pair small and situated laterally. First pair of preanal papillae situated close to anterior pair of adanal papillae, other three pairs spaced out roughly 150μ , 400μ , and 700μ from cloaca. Ventral sucker practically absent, although its position is faintly indicated by slight flattening in curvature of body. Spicules about 1 mm long, tubular, 30μ broad near base, and about 10μ broad near tip. Tip beveled off like tip of a hypodermic needle. A well-developed troughlike gubernaculum present, about 120μ in length.

Type host.—*Sciacnops ocellatus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. 39543.

Remarks.—Only two individuals of this species were found, a male and a young female. The species closely resembles *D. cotylophora* (Ward and Magath, 1916) but differs in the absence of the ventral sucker, in the somewhat longer spicules, in the slightly different arrangement of the caudal papillae in the male, and in the considerably greater diameter of the body relative to the length. In the thickness of the body and absence of a sucker it resembles *D. robusta* (Van Cleave and Mueller, 1932), but differs from that form in the length of the spicules and arrangement of caudal papillae in the male. It differs from *D. fossor* Jagerskiöld, 1902, in its smaller size, shape of esophagus, presence of cloacal lips, form and

arrangement of papillae, and length of spicules. From *D. mauritanicus* (Gendre, 1927) it differs in body form and in the thickness of the cuticle. (For description see Törnquist, 1931.) Linton (1901) figured and briefly described a female cucullanid from *Paralichthys dentatus*, which is clearly a *Dichelyne*. In 1905 he reported parasites that he considered similar from *Sciaenops ocellatus*, *Paralichthys albiguttus*, *Leiostomus xanthurus*, and *Lophopsetta maculata*, and in 1907 from *Haemulon carbonarium* and *Neomaenis griseus*. In 1901 he described a male from *Fundulus heteroclitus* and figured the posterior end, which is provided with a sucker. Barreto (1922) put all these records and figures together and called the collection *Cucullanus lintoni*. Törnquist (1931) called attention to the improbability of a single species of cucullanid occurring in such a wide range of hosts. As remarked above, Linton's form from *Paralichthys dentatus* is clearly a *Dichelyne*, but there is no positive evidence that the other forms are, since no mention is made of the presence or absence of an intestinal diverticulum.

The measurements given by Linton for the form from *Sciaenops ocellatus* correspond fairly well with those of the species here described, and it is not unlikely that Linton actually had this species. His *Dichelyne* from the flounder is, however, distinctly different in shape of head and tail, position of vulva, and other details. His form from *Leiostomus xanthurus* differs in having the vulva anterior to the middle of the body but agrees in this respect with the form from *Haemulon carbonarium*. The figure of a female from *Neomaenis griseus*, on the other hand, shows the vulva well posterior, and the shape of the body shows this form to be distinctly different from the form from *Paralichthys* figured in 1901.

It seems evident to me that Linton's various records do not apply to a single species but probably to several. Barreto's "*Cucullanus lintoni*", therefore, must either be discarded as a *nomen nudum* or limited to some one of Linton's forms. Barreto reproduces the figures of the forms from *Haemulon* and *Neomaenis* from Linton's plates 2 and 3 (1907). Of these figures, Linton's figures 11 and 11a of plate 2 (Barreto's pl. 36, figs. 1, 3) show characters that are of taxonomic value and that would probably serve to identify the species. If Barreto's name "*lintoni*" is retained, therefore, it is suggested that it be limited to the form from *Neomaenis* represented in Linton's figures 11 and 11a and that forms from other hosts be ascribed to that species only when a restudy of Linton's specimens, or additional material, shows them to be conspecific. For Linton's form from *Paralichthys dentatus*, represented on his plate 7, figures 57-61 (1901) and referred to by him as "*Ascaris* (?) sp." on p. 481, the name *Dichelyne cylindricus* is suggested.

DICHELYNE DIPLOCAECUM, new species

Specific diagnosis.—Body short and thick, its widest point about one-third of body length from anterior end; head end bluntly rounded, posterior end tapering to pointed tail. Length of young female 4 mm, maximum diameter 525μ . Vulva posterior to middle of body length, dividing body about 11:9. Anus 175μ from posterior end. Tail conical, terminated by short conical spine, 105μ in diameter at anus. Cuticle finely striated, 50μ thick in middle esophageal region, 35μ thick throughout most of body. Nerve ring 360μ from anterior end. Excretory pore 665μ from anterior end. Esophagus 800μ long, 145μ broad just behind mouth, narrowing to 75μ about 350μ from anterior end, then club-shaped, with maximum diameter about 120μ . Intestine ribbon-shaped, with transverse axis much bent and folded, and with two flat folded anterior diverticula, one dorsal and one ventral, the former somewhat the larger, reaching nearly to nerve ring.

Type host.—*Ictalurus furcatus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39544.

Remarks.—Only two young females were found. This species differs from all other known members of the family Cucullanidae in having two intestinal diverticula. Törnquist (1931) erected a new genus *Cucullanellus* for a group of small spindle-shaped cucullanids, which differ from typical members of the genus *Dichelyne* in having a ventral instead of a dorsal diverticulum. The present species, with both a dorsal and a ventral diverticulum and a body form intermediate between that typical of *Dichelyne* and *Cucullanellus*, respectively, makes it appear unjustifiable to separate these two genera, and *Cucullanellus* is, therefore, reduced to the rank of a subgenus of *Dichelyne*.

INCERTAE SEDIS

AGAMONEMA IMMANIS, new species

PLATE 11, FIGURES 11-13

Specific diagnosis.—Very long, cylindrical, and blood-red except in esophageal region, which is whitish and clearly differentiated. Length 110 to 155 mm, with maximum diameter of about 900μ . Anterior end bluntly rounded, with no distinct lips, but with minute boring tooth. Vestibule about 200μ long. Esophagus 20 mm long, about 200μ broad at anterior end, gradually widening to nearly 600μ , where it almost fills space inside of body. Posterior end with chitinous rectum about 1 mm long, 200μ wide where it joins intestine, and about 40μ wide at anus, which is terminal (pl. 11, fig. 13).

Type host.—*Fundulus heteroclitus*.

Location.—Peritoneal cavity.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39545.

Remarks.—These relatively huge immature nematodes are fairly common, coiled up in the body cavities of both *Cyprinodon variegatus* and *Fundulus heteroclitus*, some of which are only about half as long as the worms. Usually one but occasionally two specimens occur in a single host.

AGAMONEMA VOMITOR, new species

PLATE 12, FIGURES 1-4

Specific diagnosis.—Length 7.3 to 9.6 mm, with diameter of 165μ to 250μ , uniform for most of length. Cuticle finely striated except on dorsal side of tail, where there are coarse corrugations. Head 90μ to 110μ in diameter, capable of partial retraction so that cuticle may form a slight collarette. Two lateral lips, each with a prominent median papilla (pl. 12, figs. 1, 2); breadth of lips 32μ to 38μ . Anus 135μ to 175μ from posterior end, the tail with minute knob-like termination (pl. 12, fig. 4), actually longer in small specimens, presumably males; esophagus 1.5 to 2.2 mm long, with diameter of 65μ to 95μ , not divided into two regions; entire membranous lining of esophagus peculiar in being torn loose and turned inside out, remaining attached to mouth, when living specimen is cleared in carbolic acid and exposed to pressure under cover glass (pl. 12, fig. 3); esophageal lining when so everted has diameter of 45μ in bulblike anterior expansion, then narrows to 22μ , and then gradually widens to about 50μ . Nerve ring 160μ to 200μ from anterior end. Excretory pore about 100μ to 120μ behind nerve ring. No trace of reproductive tubes present.

Host.—*Ictalurus furcatus*.

Location.—Stomach.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39547; paratypes, no. 39548.

Remarks.—Several dozens of these immature nematodes were found in the stomach of a specimen of *Ictalurus furcatus*, a catfish ordinarily found in fresh water. The relationships of the worm are doubtful, but the lips and general appearance suggest affinity with the Physolopteridae.

Class ACANTHOCEPHALA

Family NEOECHINORHYNCHIDAE Travassos, 1917

ATACTORHYNCHUS, new genus

Generic diagnosis.—Body small, stout, ventrally curved, with greatest diameter behind middle. Proboscis very small, armed with about eight diagonally transverse rows of hooks, about eight in number in anterior rows, about twice as many and half as large in posterior rows, the arrangement strikingly irregular. Hooks U-shaped, with large rod-shaped roots and slender spines, only tips of which project through cuticle. Proboscis sac about twice as long as proboscis. Retractor muscles of proboscis sac attached behind middle of body. Lemnisci very long and large, extending about to middle of body, one containing one nucleus, the other two. Testes large, subglobular, contiguous; syncytial cement gland in contact with testes. Well-developed cement reservoir and seminal vesicle, the latter with two ducts.

Type species.—*Atactorhynchus verecundus*, new species.

Remarks.—The only other genera in the family Neoechinorhynchidae with more than four horizontal rows of hooks on the proboscis are *Tanaorhamphus* Ward, 1918, and *Pandosentis* Van Cleave, 1920. *Tanaorhamphus* has a large, elongate proboscis with 20 or more transverse rows of large hooks, and a body that is cylindrical or enlarged anteriorly, while *Pandosentis* has a short cylindrical proboscis with hooks that are not U-shaped but bent at right angles, remarkably short lemnisci, and short retractor muscles.

ATACTORHYNCHUS VERECUNDUS, new species

PLATE 12. FIGURES 5-7

Specific diagnosis.—Body robust, bluntly rounded posteriorly, tapering to small proboscis anteriorly, and with maximum diameter behind middle of body. Females up to 6.5 mm in length, with maximum diameter about 0.63 mm. Males up to 4.5 long, usually smaller, with maximum diameter of 0.6 mm or less. Proboscis very small, nearly cylindrical, but slightly expanded distally, about 0.15 mm long and 0.06 mm in diameter. Hooks arranged irregularly in about eight diagonally transverse rows, the first four or five of which, occupying anterior two-thirds of proboscis, with about eight hooks each; last two or three rows smaller and with more hooks, last row having about 16, which are about half the size of anterior hooks. Hooks U-shaped, with broad, bluntly rounded roots and slender sharp points, only tips of which project through cuticle.

Measured from top of bend both points and roots about 18μ to 19μ long in hooks at anterior end of proboscis and only 9μ to 10μ long in hooks of posterior row. Proboscis sac about twice length of proboscis. Retractor muscles of sac long and slender, attached posterior to middle of body, so anterior end of body can be, and frequently is, retracted. Lemnisci long, about half length of body, in males terminating at about anterior margin of anterior testis. Testes in posterior half of body, contiguous, 300μ to 400μ long and about two-thirds as wide. Syncytial cement gland just behind testes, sometimes smaller, sometimes larger, in size; number of nuclei not determined. Cement reservoir bag-shaped, just behind cement gland. Seminal vesicle rounded, dorsal to anterior end of cement reservoir, and connected with genital aperture by two ducts. Eggs in uterus of female 27μ to 30μ long and 12μ to 13μ broad.

Host.—*Cyprinodon variegatus*.

Location.—Intestine.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39549; paratypes, no. 39550.

Remarks.—This parasite was found in about 30 to 40 percent of the specimens of *Cyprinodon variegatus* taken in the upper parts of Galveston Bay in August and was present in fairly large numbers in some hosts. Eighteen specimens of this fish taken on Galveston Island early in March yielded only two female worms, one in each of two hosts.

Family CENTRORHYNCHIDAE Van Cleave, 1916

ARHYTHMORHYNCHUS DUOCINCTUS, new species

PLATE 12, FIGURES 8, 9

Specific diagnosis.—Salmon colored when living, body spindle-shaped, quite abruptly narrowed posteriorly, 3.2 to 4.2 mm in length, with maximum diameter of 0.77 to 1.05 mm. Proboscis spindle-shaped, 685μ to 900μ long, 160μ to 200μ in diameter anteriorly, 285μ to 310μ through bulged region, 200μ to 240μ at base. Proboscis hooks arranged in 18 or 19 longitudinal rows of 15 or 16 hooks each. Anterior hooks moderately slender, sharply bent at base, blade nearly straight, 53μ long and 13μ to 15μ in diameter; hooks on bulged area shorter and heavier, more evenly curved, 47μ long and 19μ in diameter; posterior hooks slenderer, gently curved, 50μ long and 8μ to 10μ in diameter. Neck unarmed, in form of truncated cone, 360μ to 400μ long. Anterior part of body with two bands or girdles with fine transverse striations, and armed with spines in fairly regular quincunxial arrangement; anterior band shortly behind neck, with

about five or seven transverse rows of 50 to 60 spines each; posterior band of 10 to 13 transverse rows of 80 to 90 spines each. Spines all about 20μ long. Anterior band 150μ to 200μ broad, posterior band 180μ to 300μ broad, separated by distance of about 75μ to 150μ . Proboscis sac very large, 1.45 to 1.75 mm long, with diameter of 250μ to 300μ . Lemnisci not recognizable. Testes just behind proboscis sac in posterior part of broad region of body, close together or separated by less than 75μ , with diameter of 135μ to 145μ . Cement glands four, long and slender, extending from testes to near posterior end of body (about 1 mm).

Host.—*Paralichthys lethostigmus*.

Location.—Body cavity.

Locality.—Galveston Bay, Tex.

Type specimen.—U.S.N.M. Helm. Coll. no. 39551; paratypes, no. 39552.

Remarks.—One of two specimens of *Paralichthys lethostigmus* examined contained eight immature specimens of this worm, attached to the mesenteries. The worms are in all probability the young of a species that matures in a fish-eating bird. Another form of strikingly similar general appearance, *A. hispidus*, was described by Van Cleave (1925) from a Japanese frog; it has been suggested by Fukui (1929) that *A. fuscus* Harada, 1929, obtained from Japanese night herons, may be the adult of this form. More recently Dollfus (1929a) has described an *Arhythmorhynchus* (*A. siluricola*) from two African catfishes, but I have not had access to this paper. Witenberg (1932) has erected a new genus, *Southwellina*, with Van Cleave's *A. hispidus* as type. This genus is differentiated from *Arhythmorhynchus* by the spindle-shaped instead of cylindrical body and by having four instead of two cement glands. Since Van Cleave omits any reference to the cement glands in *A. hispidus*, Witenberg must either have re-examined Van Cleave's material or have accepted *A. fuscus* as a synonym of it. However, *A. fuscus* has the typical *Arhythmorhynchus* body form. I have seen no reference in the literature to the number of cement glands in members of the genus *Arhythmorhynchus* other than in *A. fuscus*, which has four. Lühe (1911) merely describes the cement glands as "auserordentlich lang und dünn, fadenförmig", but his figure of *A. frassoni* suggests more than two glands. Van Cleave (1916) in a revision of the genus in which he describes two new species, repeatedly refers to the cement glands as long and slender but makes no mention of their number.

In my opinion the genus *Southwellina* cannot be considered valid in the present state of our knowledge of these forms; therefore the species here described, which would fit that genus perfectly, is

placed in the genus *Arhythmorhynchus*. It seems probable that the immature forms of *Arhythmorhynchus* found in the body cavities of their second intermediate hosts, frogs or fishes, differ from the adults in the relatively undeveloped condition of the posterior part of the body, which presumably elongates after the parasites have reached the intestines of their definitive hosts. The four cement glands of these young forms may possibly fuse into two when they elongate in the adults, but it is more probable that in the adult worms the attenuated glands, closely applied to each other, have not had their number accurately determined except in the case of *A. fuscus*. A similar error has been made in the case of *Gorgorhynchus medius* (see Chandler, 1934), and it would seem advisable to reinvestigate the number of the cement glands in the genera *Centrorhynchus* and *Prosthorhynchus*.

GORGORHYNCHUS GIBBER Chandler, 1934

This species was found for the first time in two of three specimens of the marine catfish (*Galeichthys felis*) at Bolivar Point near the entrance from the Gulf of Mexico into Galveston Bay. It is a form close to *Echinorhynchus medius* Linton, 1907, adults of which were found only in *Mycteroperca apua*, although encapsulated immature specimens were found among the viscera of a number of spiny-rayed fishes. Linton's species was transferred by me (1934) to a new genus *Gorgorhynchus*, of which the present species, *G. gibber*, was made the type.

RHADINORHYNCHUS TENUICORNIS Van Cleave, 1918

This species, which Linton has recorded from a large number of species of marine fishes, was found in about 75 percent of the croakers (*Micropogon undulatus*), in two of three "spots" (*Leiostomus xanthurus*), and in one thread-fin (*Polynemus octonemus*) taken in Dickinson Lake in the lower part of Galveston Bay, but it was not found in any of seven croakers or three spots taken in the upper reaches of the bay. I have published elsewhere (Chandler, 1934) a more complete description of this parasite than has hitherto been available.

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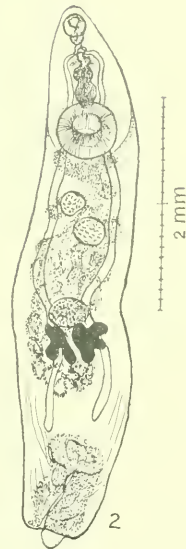
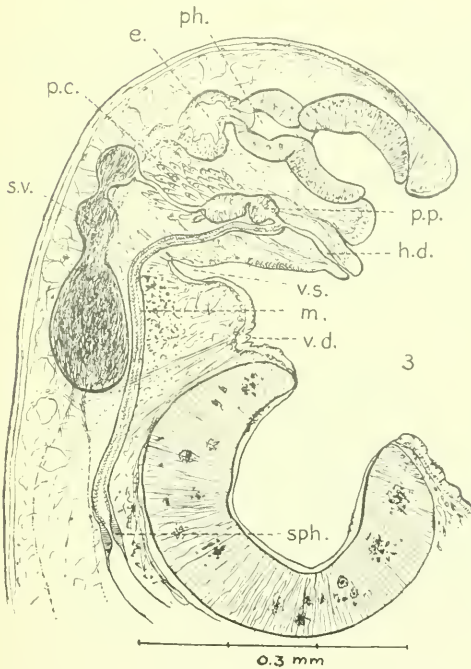
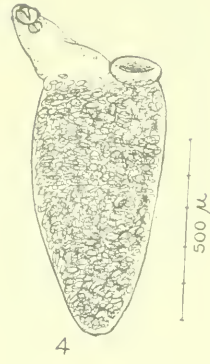
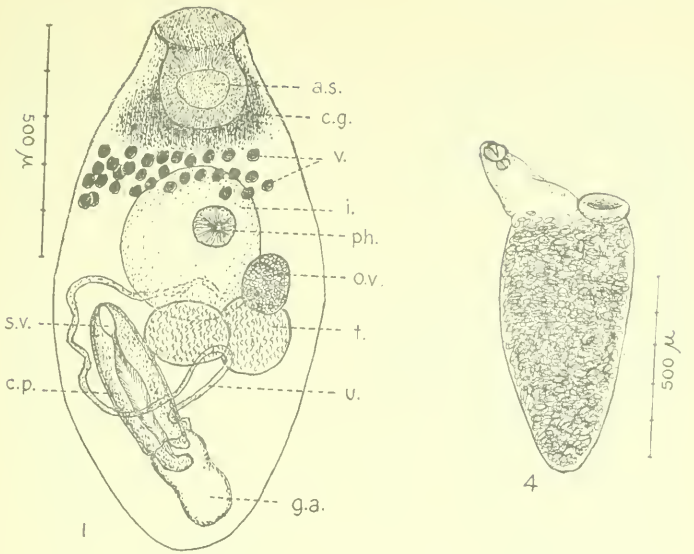
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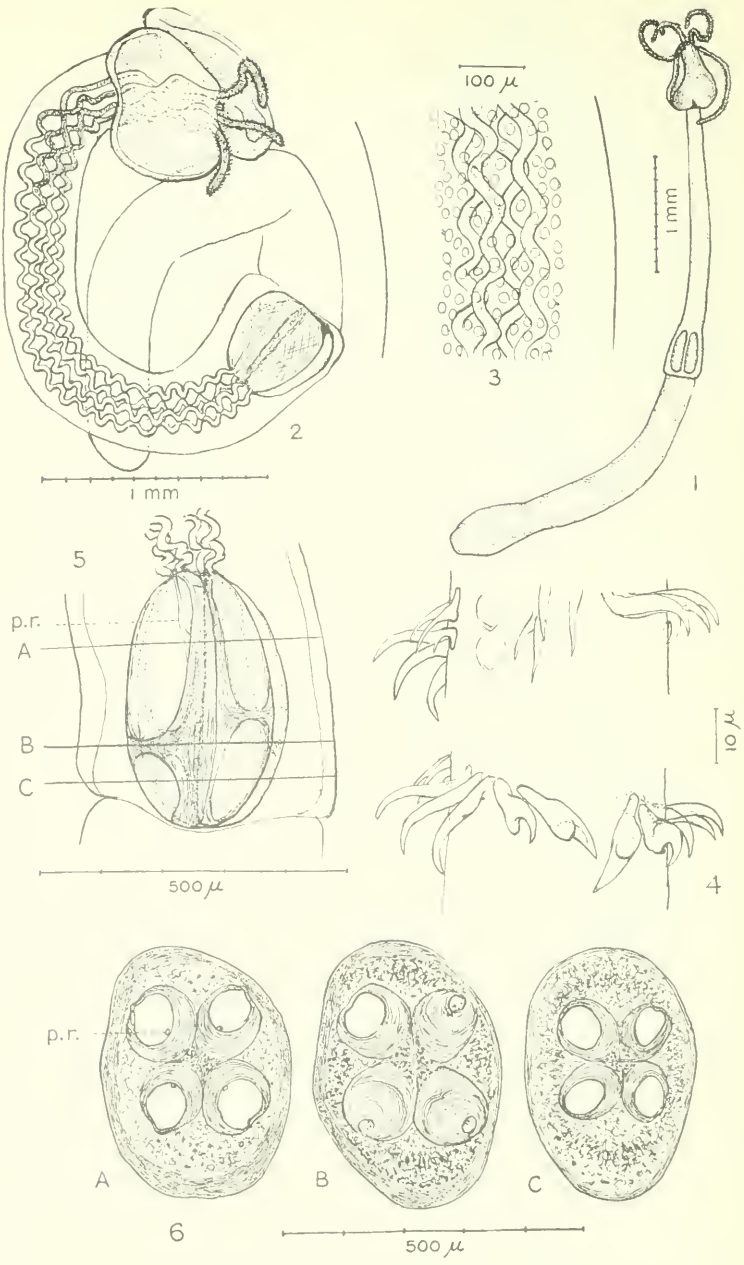
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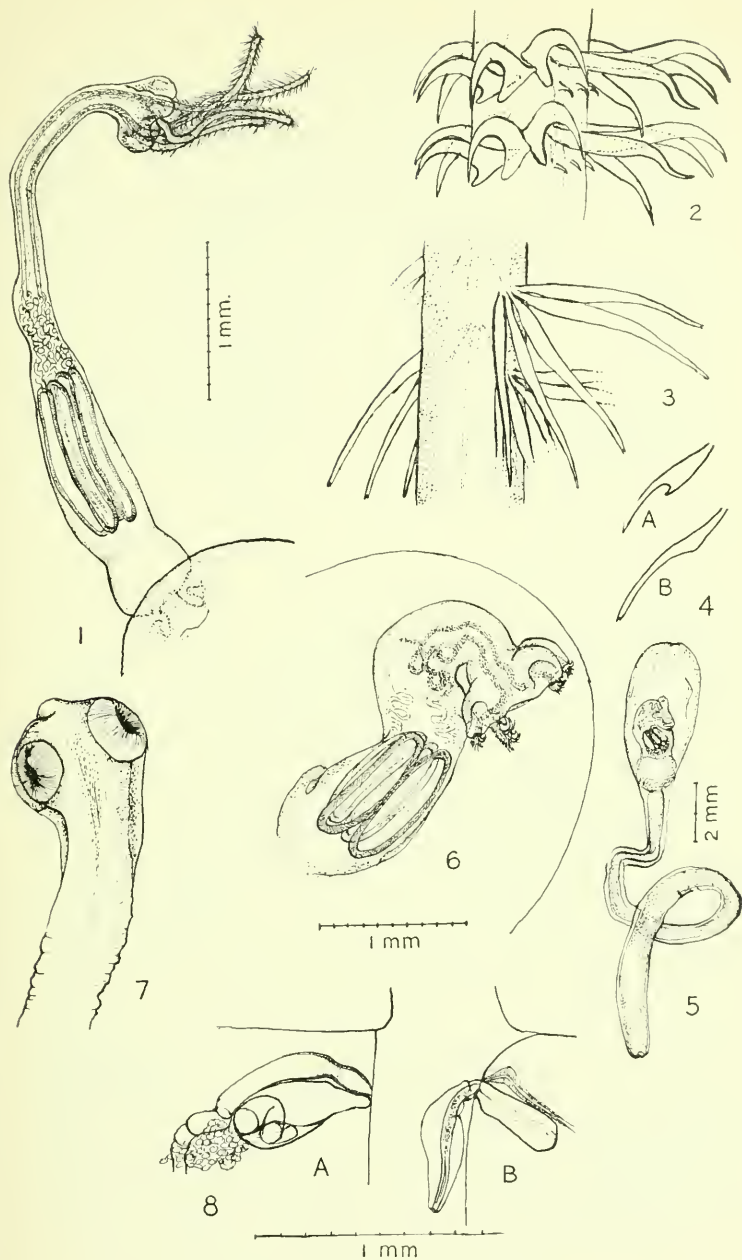
PARASITES OF GALVESTON BAY FISHES.

1. *Rhipidocotyle transversale*. (a. s., Anterior sucker; e. g., cystogenous glands; g. a., genital atrium; i, intestinal sac; ov., ovary; ph., pharynx; t., testis; u., developing uterus; r., vitellaria; s. r., seminal vesicle; c. p., cirrus pouch.)
- 2, 3. *Lecithochirium microstomum*: 2, Ventral view; 3, median longitudinal section through anterior end (e, esophagus; h. d., hermaproditic duct; m., metraterm; p. c., prostate cells; ph., pharynx; p. p., prostatic part of vas deferens; sph., sphincter of metraterm; s. v., seminal vesicle; v. d., ventral depression; v. s., ventral sinus).
4. Unidentified distome from *Menidia menidia*.



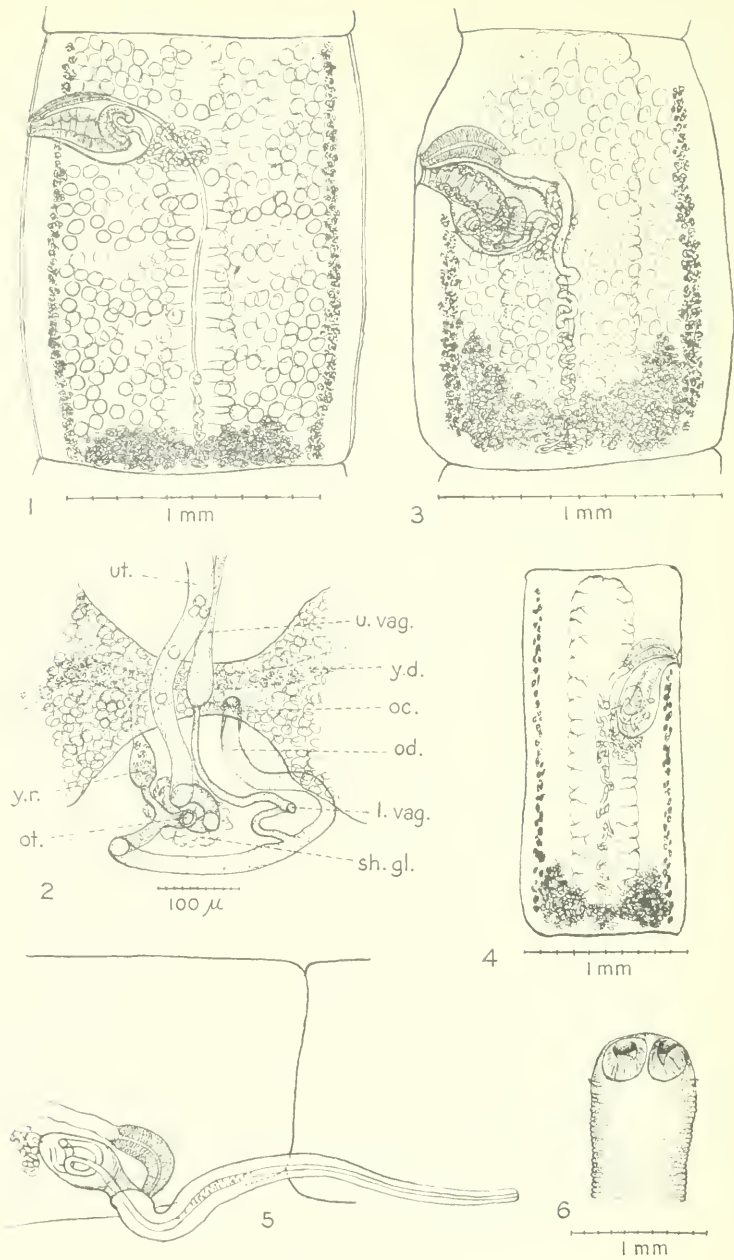
PARASITES OF GALVESTON BAY FISHES.

Tentaculairia lepidi: 1. Removed from cyst; 2, enlarged to show course of proboscis sheaths; 3, portion of pars vaginalis, much enlarged to show granular bodies; 4, opposite views of one whorl of hooks on proboscis; 5, contractile bulbs (p. r., proboscis retractors); 6, cross sections through contractile bulbs at levels indicated by A, B, and C in figure 5.



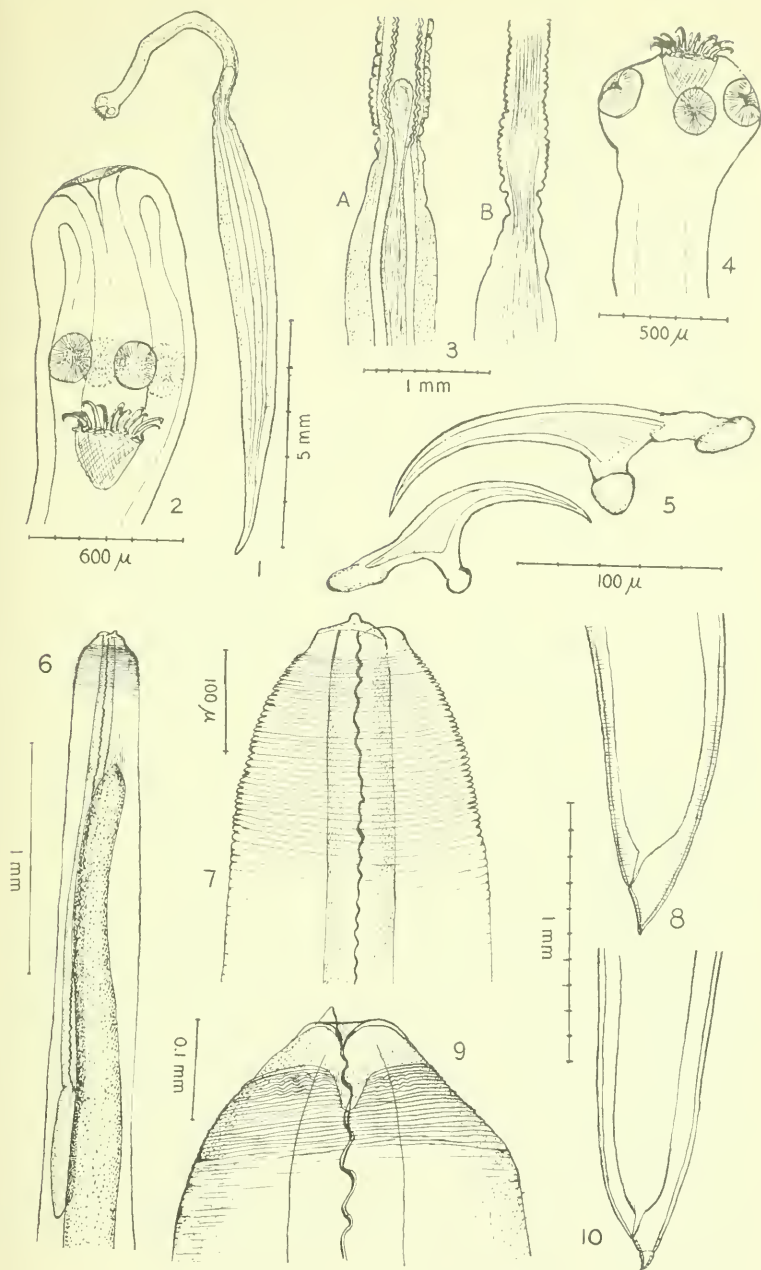
PARASITES OF GALVESTON BAY FISHES.

- 1-4. *Gymnorhynchus gigas*: 1, Head and neck, showing attachment to spherical vesicle of blastocyst; 2, portion of proboscis about 1 mm from base, showing two whorls of spines; 3, portion of proboscis about 0.75 mm from base, showing parts of two whorls of spines; 4, spines from near base of proboscis, A, two or three rows proximal to B.
- 5, 6. *G. malleus*: 5, Entire larva in cyst; 6, head and neck.
- 7, 8. *Proteocephalus elongatus*: 7, Scolex; 8, A, vagina and cirrus pouch with cirrus retracted and vagina distended, and B, same with cirrus exerted and vagina not distended.



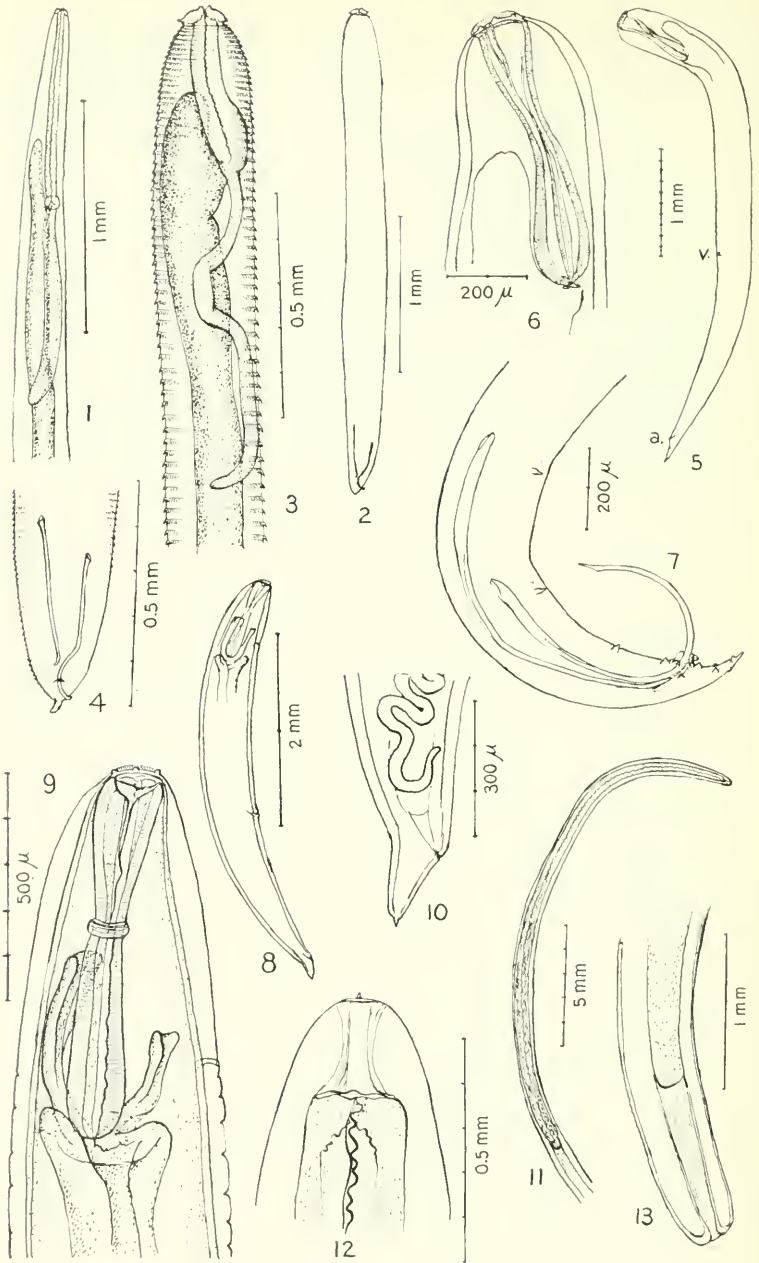
PARASITES OF GALVESTON BAY FISHES.

- 1, 2 *Proteocephalus elongatus*: 1, Proglottid slightly past maturity; 2, female genital organs in posterior part of proglottid (l. vag., lower vagina; oc., oocypit; od., oviduct; of., ootype; sh. gl., shell gland; ut., uterus; u. vag., upper vagina; y. d., yolk duct; y. r., yolk reservoir).
- 3, 4, 5, 6. *P. australis*: 3, Proglottid well past maturity; 4, ripe proglottid; 5, vagina and cirrus pouch, with cirrus exerted; 6, scolex.



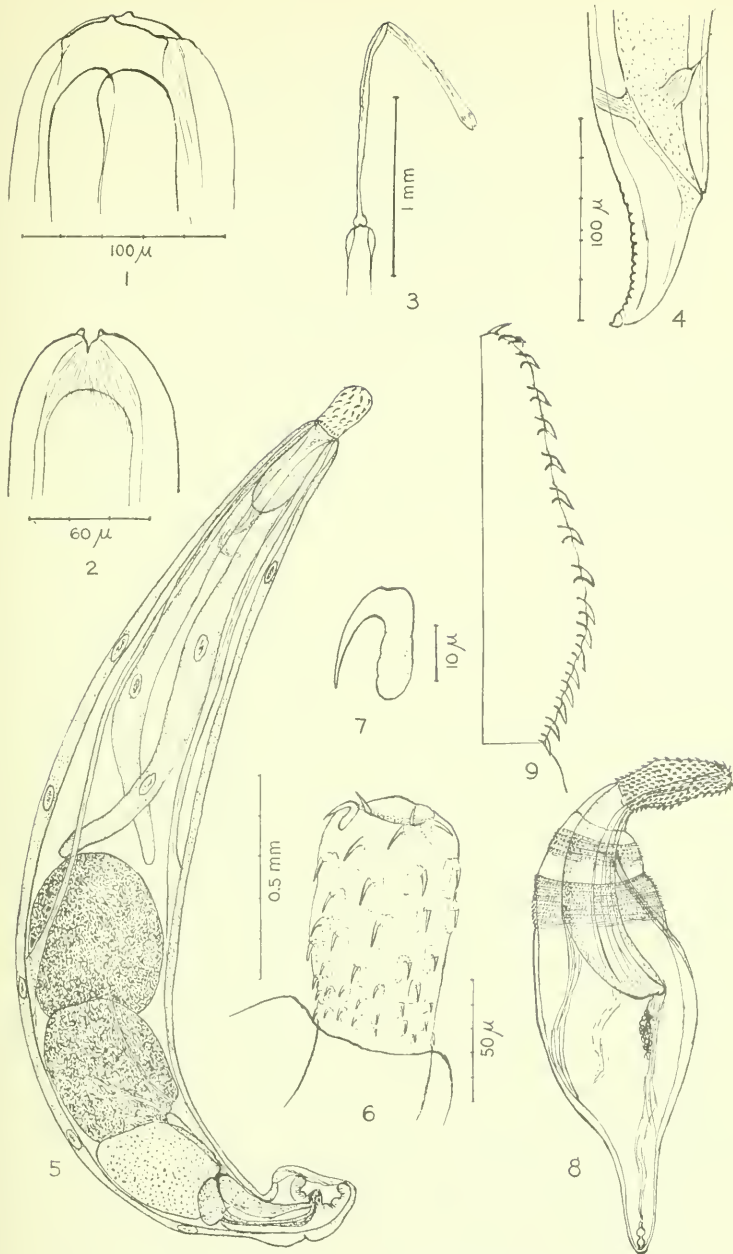
PARASITES OF GALVESTON BAY FISHES.

- 1-5. *Glossocercus cyprinodontis*: 1, Entire specimen; 2, anterior end with scolex inverted; 3, neck region (A, median longitudinal section, showing cavity in neck and conspicuous excretory tubes; B, lateral longitudinal section, showing bands of muscle fibers); 4, scolex; 5, large and small hooks.
 6-8. *Contracacum collieri*: 6, Anterior end of body; 7, head; 8, posterior end of body.
 9, 10. *C. robustum*: 9, Head; 10, posterior end of body.



PARASITES OF GALVESTON BAY FISHES.

1. *Amphicacum parvum*: Anterior end.
 2-4. *Gozia minota*: 2, Male; 3, male, anterior end; 4, male, posterior end.
 5-7. *Dichelyle fastigatus*: 5, Female; 6, anterior end of male; 7, posterior end of male.
 8-10. *D. diplocacum*: 8, Young female; 9, anterior end; 10, posterior end of female.
 11-13. *Agamonema immanis*: 11, Anterior end; 12, head; 13, posterior end.



PARASITES OF GALVESTON BAY FISHES.

- 1-4. *Agamonea vomitor*: 1, Head, dorsal view; 2, head, lateral view; 3, head, showing cuticular lining of esophagus ejected from mouth; 4, posterior end.
 5-7. *Atactorhynchus rerecundus*: 5, Male; 6, proboscis; 7, hook from anterior end of proboscis.
 8, 9. *Arhythmorhynchus duocinctus*: 8, Immature female; 9, profile of proboscis.

