

## **CHAPTER IX**

### **FREE-LIVING FLATWORMS, NEMERTEANS, NEMATODES, TARDIGRADES, AND CHAETOGNATHS**



## FREE-LIVING FLATWORMS (TURBELLARIA) OF THE GULF OF MEXICO

By L. H. HYMAN, *American Museum of Natural History, New York City*

Very little information is available concerning the free-living flatworms of the Gulf of Mexico. Nothing at all has been done with the smaller and microscopic forms so that available material is limited to the polyclads (order Polycladida), and these have been studied only for the Gulf coast of the United States. To the writer's knowledge, no study has ever been made of the turbellarian fauna of the Mexican coast of the Gulf.

The most extensive work on the littoral polyclads of the Gulf of Mexico was done by Pearse (1938) during a stay in the region of Apalachicola Bay near the Alabama border of Florida. This publication, unfortunately, contains some errors. The writer revised Pearse's work in 1940, and the names considered valid are those employed in that article.

The most common littoral polyclads of the Gulf coast, distributed from Florida to Texas, are *Stylochus frontalis* Verrill (= *Sty. inimicus* Palombi, 1931), *Stylochus ellipticus* (Girard) 1850 (= *Eustylochus meridionalis* Pearse, 1938), *Hoploplana inquilina* (Wheeler) 1894, and *Gnesioceros floridana* (Pearse) 1938 (= *Stylochoplana floridana* Pearse, 1938). Illustrations and descriptions of these species will be found in Pearse (1938) and Hyman (1939a, 1940). *Stylochus frontalis* is an oval, gray worm up to 50 mm. in length with nuchal tentacles and a band of eyes around the entire body margin. It lives in association with oysters on which it feeds and to which it may become quite destructive, hence being of some economic importance. The ecology of this polyclad has been treated at some length by Pearse and Wharton (1938). *Stylochus ellipticus* is an oval, gray, olive, cream, or brownish worm with nuchal tentacles and with marginal band of eyes extending only along the anterior part of the body. It, also, is often associated with oysters but is a general littoral species. *Hoploplana inquilina* is a small, oval, rather transparent worm that inhabits the mantle cavity

of *Busycon* and *Thais*, possibly other gastropods. Pearse (1938) attempted to separate the form living in *Thais* from that in *Busycon* as a distinct species *thaisana*, but the writer failed to find any good grounds for this distinction and considers *thaisana* to be, at best, a geographical variant. Schechter (1943) found *H. inquilina* living in *Thais floridana* at Barataria Bay, La. *Gnesioceros floridana*, a small, somewhat transparent worm of cuneate form, with nuchal tentacles but without any marginal eyes, is of common occurrence along the Gulf coast. A number of specimens of this species were sent to the writer by Joel W. Hedgpeth who collected them at Port Aransas, Tex., and many were recorded by Pearse from the west coast of Florida. In an Annotated List of the Fauna of the Grand Isle Region 1928-1941, published by the marine laboratory of Grand Isle, La., there is mentioned *Gnesioceros sargassicola lata*; this is presumably a misidentification of *Gnesioceros floridana*.

Other polyclads described by Pearse from the Apalachicola Bay, Fla., region are: *Coronadena mutabilis* (Verrill) 1873 (= *Discocelis grisea* Pearse, 1938); *Latocestus whartoni* (Pearse) 1938 (= *Oculoplana whartoni* Pearse, 1938); *Stylochus oculiferus* (Girard) 1853 (= *Stylochus floridanus* Pearse, 1938); *Zygartroplana angusta* (Verrill) 1893 (= *Stylochoplana angusta* (Verrill) Hyman, 1939); *Euplana gracilis* (Girard) 1850 (= *Conjuguterus parvus* Pearse, 1938); *Enantia pellucida* (Pearse) 1938 (= *Acerotisa pellucida* Pearse, 1938); a species of *Thysanozoon* possibly *brocchi* (Risso) 1818; *Pseudoceros maculosus* Pearse, 1938; *Oligoclado floridanus* Pearse, 1938 (= *Hymania prytherchi* Pearse and Littler, 1938); and *Prosthiostrum lobatum* Pearse, 1938. None of these species have been found in other parts of the Gulf of Mexico except Florida, but some of them extend up the Atlantic coast to the Carolinas. Descriptions and figures of these species are given in the articles by Pearse (1938), Pearse and Littler

(1938), and Hyman (1939, 1940). In addition, there should probably be mentioned *Phaenocelis purpurea* (Schmarda) 1859 (= *Comprostatum insularis* Hyman, 1944), common in the Florida Keys.

There remains to be mentioned the turbellarian fauna of the floating Sargassum. This includes acoels, rhabdocoels, and polyclads and has been discussed by the writer in a previous publication (1939b). There are two common Sargassum polyclads, *Gnesioceros sargassicola* (Mertens) 1833 and *Hoploplana grubei* (Graff) 1892. The former is very similar in appearance to *Gnesioceros floridana*, and there is some suspicion in the writer's mind that the latter may be only a littoral variant of the former. *H. grubei* is a small, oval worm with a white reticulation on a brown ground. Large numbers of both species of polyclads were taken from the Sargassum in the Gulf of Mexico by the Bingham Oceanographic Foundation at Yale University. There are no records of the occurrence of smaller Turbellaria on the Sargassum in the Gulf of Mexico, but presumably some are present there.

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# THE NEMERTEAN FAUNA OF THE GULF OF MEXICO

By WESLEY R. COE, *Professor Emeritus, Yale University*

Nemerteans are found along all the seacoasts of the world and off the shores to depths of hundreds of meters. Some of the species are circum-polar, extending southward along the Atlantic coasts as far as Madeira or South Africa on the east and to southern New England or Florida or the Gulf of Mexico on the west, and in the Pacific to California or Mexico on the east and to Japan on the west. A few species live in both the Northern and Southern Hemispheres and a few others in fresh-water streams and lakes. Some are limited to the polar seas and others to the tropics, but many have a wide geographical range and survive under a great variety of environmental conditions. Some of the bathypelagic species live at depths of 1,000 to 2,000 meters or more, and the populations may be carried for thousands of miles by the deep ocean currents, reproducing generation after generation in their endless circuits throughout the great oceans.

With the exception of the species mentioned in a few local lists of invertebrates, and two papers by Coe (1951, 1951a) no reports of the nemerteans of the Gulf have been published previously. The following account is compiled from the records of the collections sent to the writer from various localities between Apalachicola, Fla., and Port Aransas, Tex., during the past years. No information is yet available for all that portion of the Gulf coast south of the Mexican border, although there are several reports on the species found at various West Indian islands. Several of these species have been found on the Atlantic coast of southern Florida and presumably occur also on the Gulf coast (Coe 1951a).

In the area covered by this report only 17 species are at present known, presumably for the reason that only sporadic efforts have been made toward a complete survey of the littoral fauna of that region. On the Atlantic coast of North America there are 53 known species of nemerteans (Coe 1943) and on the Pacific coast 95 species

(Coe 1940). Hence, it seems probable that less than half of all the species now actually living in the Gulf can be included in this report.

Even on the Atlantic coast the nemerteans have been studied extensively only as far south as New Jersey, and our knowledge of the species living between that State and Florida is based on collections made at widely separated localities. It may therefore be assumed that some, perhaps many, additional species remain to be discovered.

## GEOGRAPHICAL DISTRIBUTION

All except two of the species known from the northern shores of the Gulf are also found on the Atlantic coast. Therefore, it may be assumed that the nemertean fauna of this part of the Gulf coast is, or has in the geologically recent past been, a continuation of that of the Atlantic coast. It seems quite possible that it is now a separate fauna which was isolated in Pleistocene times by the Florida peninsula. To determine whether the species of the two areas are at present continuous, it is essential to obtain additional collections on both sides of the southern half of that peninsula. It is already known that the species found at Pensacola, on the Gulf side, are similar to those found by the writer personally at St. Augustine, on the Atlantic side. It is also known that these two nemertean faunas are separated by an area in which other species predominate (Coe 1951, 1951a). Because of the great differences in the environmental conditions between the coasts of northern and southern Florida, however, a more or less complete separation would seem probable. In other groups of invertebrates, likewise, the species found in southern Florida are commonly identical with those of the West Indies and northern South America.

The nemerteans evidently represent a conservative group and many of the species have a wide geographical distribution. Of the 17 species at present known from the Gulf of Mexico, all except

*Paranemertes biocellata*, *Amphiporus texanus*, and *Cerebratulus ater* are widely distributed on the Atlantic coast, and 4 of them, namely, *Tubulanus pellucidus*, *Zygeupolia rubens*, *Zygonemertes virescens*, and *Amphiporus cruentatus* occur also on the Pacific coast but not in Europe; 2 others, *Carcinonemertes carcinophila* and *Tetrastemma vermiculus* are found on European coasts but not in the Pacific; *Oerstedtia dorsalis*, *Tetrastemma candidum*, and *Malacobdella grossa* are circumpolar, inhabiting European shores as well as both the Atlantic and Pacific coasts of North America, while the remaining 5 species, *Carinoma tremaphoros*, *Lineus socialis*, *Micrura leidyi*, *Cerebratulus lacteus*, and *Amphiporus ochraceus* are known only from the Atlantic and Gulf coasts. *Paranemertes biocellata* and *Cerebratulus texanus* have been found only on the northern Gulf coast, while *Cerebratulus ater* is reported from off the Cape of Florida and at Curaçao.

For comparison, it may be noted that 11 of the 53 species found on the Atlantic coast are identical with species in European waters, while 12 of the Atlantic coast species occur also on the Pacific coast, and 2 of these extend also to Japan. No less than 18 of the species found on the Pacific coast are thought to be identical with well-known European species, and others are closely similar (Coe 1943). The nemertean fauna of Bermuda resembles more closely that of Europe and Madeira than that of the American coast in spite of the proximity of the latter.

As a general rule, the invertebrates in the Gulf are much smaller when mature than are the members of the same species in more northern and colder localities. This applies likewise to the nemerteans. To anyone familiar with the species on the New England coast the representatives of the same species in the Gulf appear to be dwarfs. Species living among Bryozoa, algae, and other growths in the intertidal zone farther north are more commonly found beyond the low-tide level in the Gulf.

#### REPRODUCTION AND REGENERATION

If ripe individuals of both sexes are available, nearly all the species, but especially *Cerebratulus*

*lacteus*, are suitable for the study of embryological development. From a large ripe female of *C. lacteus* many thousand eggs may be obtained, and these usually develop rapidly into pilidium larvae after artificial insemination. Most of the species restore by regeneration the posterior end of the body after injury or removal. *Lineus socialis* provides an example of asexual reproduction by fragmentation and is unexcelled for the study of the complete regeneration of minute fragments of the body. Almost any small piece of the body, provided it contains a portion of one of the nerve cords, will regenerate into a minute replica of the original worm (Coe, 1929-34).

#### ECOLOGY

Most of the species on the Gulf coast are found burrowing in the sand or mud in the low intertidal zone and below to areas where the depth of water is 10 meters or more. Others live beneath stones or among dead shells, while many of the smaller species occur among Bryozoa, algae, and other growths in the intertidal zone and below.

#### FOOD

Nemerteans are usually carnivorous, feeding on a great variety of worms, crustaceans, mollusks, and other small, soft-bodied animals. To secure their prey they are furnished with highly specialized sense organs and most of them with a long, eversible proboscis. This organ is a formidable weapon, provided in some species with one or more acutely pointed stylets which puncture and paralyze the prey, allowing the soft parts to be sucked into the mouth. In species without stylets the proboscis, which is covered with a tenacious secretion, can be coiled about the prey, thereby holding it tightly until it can be drawn into the mouth. Only one of the species, *Malacobdella grossa* at present known from the Gulf is commensal living in the mantle cavity of clams. Another species, *Carcinonemertes carcinophila*, sucks the blood in the gills and the substance of the eggs of various species of crabs and is therefore truly parasitic.

## KEY TO THE SPECIES AT PRESENT KNOWN FROM THE GULF OF MEXICO

BASED MAINLY ON EASILY RECOGNIZABLE EXTERNAL CHARACTERISTICS

1. With suction disk at posterior end of body; commensal in bivalve mollusks.....	<i>Malacobdella grossa</i>
1. Without suction disk; not commensal in bivalves.....	2
2. Mouth posterior to brain; proboscis not armed with stylets.....	3
2. Mouth anterior to brain; proboscis with central stylet and usually with two or more pouches of accessory stylets..	9
3. Head without lateral longitudinal grooves.....	4
3. Head with lateral longitudinal grooves.....	6
4. Posterior end without slender caudal cirrus.....	5
4. Posterior end with long caudal cirrus; head acutely pointed.....	<i>Zygeupolia rubens</i>
5. Body small, white; posterior end slender.....	<i>Tubulanus pellucidus</i>
5. Body when mature usually 30-150 mm. long; red or yellowish red; posterior end broad and flattened.....	<i>Carinoma tremaphoros</i>
6. Body slender, rounded; head with two to eight pairs small ocelli.....	<i>Lineus socialis</i>
6. Body flattened in intestinal region; head without ocelli.....	7
7. Lateral margins rounded in intestinal region; not adapted for swimming; color red or rosy.....	<i>Micrura leidyi</i>
7. Lateral margins in intestinal region thin; adapted for swimming; color either pale or black.....	8
8. Color whitish, pale yellow, or rosy.....	<i>Cerebratulus lacteus</i>
8. Color black.....	<i>Cerebratulus ater</i>
9. Proboscis with central stylet only and no accessory stylets; parasitic on crabs.....	<i>Carcinonemertes carcinophila</i>
9. With two or more pouches of accessory stylets; not parasitic.....	10
10. Proboscis with four or eight pouches of accessory stylets; only one pair of ocelli.....	<i>Paranemertes biocellata</i>
10. Proboscis with two pouches of accessory stylets; head with more than one pair of ocelli.....	11
11. Ocelli numerous, extending posteriorly beyond head.....	<i>Zygonemertes virescens</i>
11. Ocelli limited to head.....	12
12. More than two pairs of ocelli.....	13
12. Only two pairs of ocelli.....	15
13. Ocelli in a single row on each side of head; blood corpuscles red.....	<i>Amphiporus cruentatus</i>
13. Ocelli in several groups or irregular rows; blood nearly colorless.....	14
14. Central stylet of proboscis rounded at both ends and slightly constricted in the middle.....	<i>Amphiporus ochraceus</i>
14. Central stylet truncated at both ends; not constricted in the middle.....	<i>Amphiporus texanus</i>
15. Yellowish, without spots of dark pigment.....	<i>Tetrastemma candidum</i>
15. Body small, cylindrical; color variable; irregularly spotted with brown.....	16
16. Body short and firm; ocelli large, those of the same side not connected by band of pigment.....	<i>Oerstedia dorsalis</i>
16. Body soft, yellowish; the two ocelli of same side connected by band of dark pigment.....	<i>Tetrastemma vermiculus</i>

## SYSTEMATIC DESCRIPTION OF SPECIES

The following pages contain abbreviated descriptions of the species at present known from the Gulf, based mainly on easily recognizable external characteristics. The geographic range, as given, indicates the limits of the species insofar as at present known and should not be interpreted as implying that the species will not later be found elsewhere. Outline drawings of each of the species have been published by Coe (1951a).

## Order 1 PALEONEMERTEA

## Family TUBULANIDAE

*Tubulanus pellucidus* Coe, 1940, 1943

*Carinella pellucida* Coe, 1895.

The minute worms belonging to this species may be recognized by their slender, white bodies and by the absence of both ocelli and longitudinal

grooves on the head. Length when mature 10 to 25 mm., width 1 mm. or less.

The worms live in delicate, cellophane-like tubes among algae and other growths in the intertidal zone and below to a depth of at least 20 meters. Recorded from southern New England to northern Florida, also Pensacola, Fla., and presumably occur elsewhere along the Gulf coast. Found also from Monterey Bay to San Diego, Calif.

## Family CARINOMIDAE

*Carinoma tremaphoros* Thompson, 1900; Coe, 1943

Body pale reddish or yellowish, with broadened posterior end which is without caudal cirrus. Head broad, without ocelli or longitudinal grooves. Length when mature 30 to 150 mm., width 2 to 5 mm. The worms burrow in mud, sandy mud and clay, or live beneath stones in the intertidal zone

and below from Cape Cod to northern Florida and on the Gulf coast at least as far west as Louisiana.

## Order 2 HETERONEMERTEA

### Family LINEIDAE

#### *Zygeupolia rubens* Coe, 1905, 1940, 1943

*Valencinia rubens* Coe, 1895; *Zygeupolia litoralis* Thompson, 1900.

The worms of this species may be identified by the red or rosy color and sharply pointed head which is devoid of ocelli or longitudinal grooves, as well as by the long caudal cirrus. Length 40 to 80 mm. when mature; width 2 to 5 mm.

Found in sand or beneath stones in the intertidal zone and below from southern New England to northern Florida and on the Gulf coast westward to Copano Bay, Tex.; also from Monterey Bay, Calif., to Mexico.

#### *Lineus socialis* Verrill, 1892; Coe, 1943

*Nemertes socialis* Leidy, 1855.

Recognized by the very slender body with a row of two to eight small ocelli on each side of head and by the tendency of the worms to coil in spiral when disturbed. Length when mature 30 to 150 mm., width 1 to 3 mm. Color variable, often pale olive green, greenish brown, or reddish brown; frontal margin and lateral borders of head whitish; brain region deep red; body sometimes encircled with 6 to 20 or more narrow and inconspicuous rings of lighter color.

Lives beneath stones and among mussels and other growths in the intertidal zone from Bay of Fundy to northern Florida and on the Gulf coast westward to Texas. Locally common and often gregarious.

Differs from all other species on this coast by its capacity for asexual reproduction by fragmentation (Coe 1930). If the body is cut into many small pieces each fragment will ordinarily regenerate into a minute replica of the original worm. For complete regeneration the fragment must contain a portion of one of the nerve cords. This is excellent material for such studies, since the worms or their fragments may live for a year or more in jars of sea water with pebbles in the bottom provided the water is changed occasionally (Coe, 1929-34). A period of asexual reproduction may be followed by dioecious sexual reproduction in which the sexes mate and the eggs are deposited in a thick mucous sheath.

#### *Micrura leidy* Coe, 1943

*Meckelia rosea* Leidy, 1851; *Cerebratulus leidy* Verrill, 1892.

One of the most common of the species of ribbon worms in the Gulf and along the east coast of the United States. The body is rather slender, cylindrical in anterior portion, and much flattened in intestinal region; very fragile; head slender, without ocelli; caudal cirrus small; color deep red or purplish red, lighter anteriorly; anterior border of head and mouth region whitish; length 20 to 300 mm., width 1 to 6 mm.

Lives in sand and under stones in the intertidal zone and in shallow water from Massachusetts Bay to the coast of northern Florida and in the Gulf west to Texas. Individuals of this species are among the most fragile of all nemerteans and usually break into many pieces when lifted from the sand. The numerous eggs, which are excellent for embryological studies, are shed into the water from July to October on the coast of southern New England, but the season of reproduction in the Gulf is not at present known. The larvae can be reared to the pilidium stage without difficulty. The adult worms have the capacity for the rapid posterior regeneration of fragments from the anterior part of the body, but if the head is removed it is seldom, if ever, regenerated.

#### *Cerebratulus ater* Verrill, 1895; Coe, 1943

*Meckelia atra* Girard, 1851.

This species is known from a single specimen dredged in deep water off the Cape of Florida, together with two headless fragments which presumably belonged to the same species from near Curaçao. The body is uniformly black in color except for the pale anterior extremity.

#### *Cerebratulus lacteus* Verrill, 1892; Coe, 1943

*Meckelia lactea* Leidy, 1851; *M. ingens* Verrill, 1873.

The body is long and ribbonlike, with flattened intestinal region and thin lateral margins; well adapted for swimming. Ocelli absent; caudal cirrus slender.

Mature individuals are larger than any of the other nemerteans found on the Gulf coast, often exceeding a meter in length. Color variable; whitish, pale yellow, flesh color, pale red or salmon. Young individuals are usually translucent white, with pale yellow or brown intestinal diverticula.

This is a common species, burrowing in the mud or sand in the intertidal zone from Maine to



northern Florida and along the Gulf coast to Port Aransas, Tex.

Each large female produces each season several to many thousand translucent ova which are fertilized in the water and develop rapidly into pilidium larvae. The eggs of this species have been widely used in experimental studies and for class demonstrations. Posterior regeneration takes place readily, but anterior regeneration is limited to the head anterior to the brain, although headless fragments, which can take no food, may live for several months. With occasional changes of the sea water and low temperature, a worm of this species may live for a year or more without food, the body meanwhile being reduced to a small fraction of its original size.

### Order 3 HOPLONEMERTEA

#### Family EMPLECTONEMERTIDAE

##### *Paranemertes biocellata* Coe, 1944

This species may be recognized by the slender, pale greenish body with sharply pointed head bearing a single pair of oval, black ocelli near the tip. The proboscis is provided with a slender, cylindrical central stylet and either four or eight pouches of accessory stylets. Size when mature 60 to 120 mm. in length and 2 to 4 mm. in width.

This species is at present known only from Biloxi, Miss., where it has been found burrowing in the intertidal sand flats and in shallow water.

#### Family CARCINONEMERTIDAE

##### *Carcinonemertes carcinophila* Coe, 1902; Humes, 1941, 1942

*Nemertes carcinophilon* Kölliker, 1845; *Emplectonema carcinophila* Verrill, 1895.

This curious little nemertean is parasitic on the gills of various species of crabs when young and among the egg-masses of the host when mature. The slender body is colored in various shades of red, and there is a single pair of ocelli on the head. The proboscis is very short; it has a slender central stylet but no accessory stylets.

At the time of reproduction a male and a female place their bodies side by side and secrete a thick sheath of mucus in which a hundred or more relatively large eggs are deposited. Development is of the direct type.

Crabs of the family Portunidae, particularly the lady crab (*Ovipales ocellatus*) and the blue crab (*Callinectes sapidus*) on the American coast and *Carcinus maenas* in European waters are most frequently infested, but representatives of other families are occasional hosts (Humes 1942). With the needlelike central stylet the young worms presumably puncture the gills of the host and suck out the blood, while the adults similarly puncture the eggs of the host and suck out the contents, whether yolk or embryo. It seems probable that additional food for both young and adult is obtained from such small animals as may be encountered.

Found on the Atlantic coast from the Bay of Fundy to Florida and along the Gulf coast to Texas, as well as on European shores from Scotland to the Mediterranean. The typical species reaches a length of 20 to 70 mm., but Humes (1942) found a smaller variety (*C. carcinophila imminuta*) at Grand Isle, La., and at various localities in the West Indies, Panama, and Brazil, which differs in minor morphological details.

#### Family PROSORHOCHMIDAE

##### *Oerstedtia dorsalis* Bürger, 1895; Coe, 1940, 1943

*Planaria dorsalis* Abildgaard, 1806; *Tetrastemma dorsale* Verrill, 1892.

Individuals of this widely distributed species may be recognized by their small, cylindrical, firm bodies often brightly colored and spotted or banded in conformity with their environment. Mature individuals seldom exceed 10 to 20 mm. in length and 1 to 2 mm. in diameter. The head bears four rather conspicuous ocelli. Proboscis relatively large; provided with slender stylet on pear-shaped basis and two pouches of accessory stylets. The colors are extremely variable with shades of red, brown, olive, whitish, or yellowish, spotted, banded or striped with more deeply colored pigment.

Locally abundant among algae, Bryozoa, and other growths on rocks and piles in the low intertidal zone and below on the coasts of Europe to Madeira, on the Atlantic coast of North America from Nova Scotia to northern Florida, on the Gulf coast westward to Texas, and on the Pacific coast from Puget Sound to Mexico. The relatively large eggs undergo the direct method of development.

## Family AMPHIPORIDAE

*Zygonemertes virescens* Montgomery, 1897; Coe, 1940, 1943

*Amphiporus virescens* Verrill, 1879, 1892; *Ophionemertes agilis* Verrill, 1873; *Amphiporus agilis* Verrill, 1892.

The slender, cylindrical, greenish worms belonging to this species differ from all others known from the region in having very numerous, minute ocelli which extend along the sides of the body far posterior to the brain. Living individuals may also be distinguished from those of other species by their restless, rapid movements. The proboscis sheath extends the entire length of the body, and the proboscis is armed with a slender central stylet with massive basis truncated posteriorly and with two lateral pouches usually containing three accessory stylets each. Length of body when mature 10 to 40 mm., width 1 to 2 mm.

The species is locally common among algae, Bryozoa, and other growths on rocks and other objects in the low intertidal zone and below. It occurs from the Bay of Fundy to northern Florida and along the Gulf coast at least as far as Pensacola, Fla. It is also found on the Pacific coast from British Columbia to Mexico.

*Amphiporus cruentatus* Verrill, 1879; Coe 1940, 1943

*Amphiporus leptacanthus* Coe, 1905.

Individuals of this species are easily recognized in life by their pale yellow color with three slender longitudinal red lines representing the longitudinal blood vessels, as well as by the single row of 5 to 10 ocelli on each side of the head. Central stylet of proboscis long and slender on long, slender basis. Length when mature 10 to 30 mm., width 1 to 4 mm. Blood corpuscles bright red.

Lives among algae, Bryozoa, and other growths on rocks and beneath stones and shells in the intertidal zone and below from New England to northern Florida and on the Gulf coast at least as far as Pensacola, Fla., as well as on the Pacific coast from Puget Sound to Mexico.

This is a good species for the study of posterior regeneration, the restoration of a lost proboscis, and the reorganization of fragments cut from the anterior portion of the body.

*Amphiporus ochraceus* Verrill, 1892; Coe 1943

*Cosmocephala ochracea* Verrill, 1873; *A. greenmani* Montgomery, 1897.

In this species the body is slender and pale yellow, whitish or grayish in color, sometimes with

tinge of orange anteriorly and occasionally with brown intestinal diverticula. The length when mature varies from 10 to 70 mm. and the width 1 to 3 mm. The head bears 6 to 14 small ocelli in irregular rows on each lateral margin, bending medially toward the brain. The proboscis has a slender central stylet and basis, with usually 2 accessory stylets in each of the 2 pouches.

Locally common beneath stones and among algae and other growths in the intertidal zone and below from Massachusetts Bay to Florida and in the Gulf westward to Port Aransas, Tex.

*Amphiporus texanus*, Coe, 1951, 1951a

This new species represents one of the larger and broader forms of this extensive genus. The type specimen was about 60 mm. in length and 6 mm. in width after preservation. The length of this specimen is therefore only 10 times the greatest width. The head is narrow, about 2 mm. in width, with subterminal mouth and transverse or oblique lateral grooves.

*Ocelli*.—There are many small ocelli on each side of the head, although the exact number and arrangement could not be determined in this specimen.

*Proboscis*.—This organ is large and extends nearly the entire length of the body. The central stylet is moderately slender and about two-thirds the length of the relatively massive basis. The latter is nearly rectangular in outline, about four times as long as its diameter, tapering but slightly toward the anterior end and is truncated posteriorly. In this type specimen the basis measured 0.135 mm. in length and from 0.027 to 0.035 mm. in diameter. One of the two accessory pouches contained two well-formed stylets and the other had three which were not yet completed. In this specimen there were 10 rather large proboscidial nerves.

*Color*.—No record is available regarding the color in life, but the specimen preserved in formalin indicated a pale, reddish brown epidermal pigmentation.

*Cerebral sense organs*.—These are comparatively larger than in most species of the genus. They are situated lateroventrally and a short distance anterior to the brain.

*Geographical distribution*.—At present known only from this type specimen which was collected by B. Earp at Port Aransas, Texas.

## Family TETRASTEMMATIDAE

*Tetastemma candidum* McIntosh, 1873, Verrill, 1892; Coe, 1940, 1943

*Fasciola candida* Müller, 1774.

These little worms may be identified by the pale green or yellowish green body without markings. Young individuals are pale yellow laterally and green medially. There are two pairs of conspicuous reddish brown ocelli anterior to the brain. The stylet basis is rounded at both ends and slightly enlarged posteriorly. Length of body when mature 10 to 20 mm., occasionally 35 mm.; width 0.5 to 1.5 mm.

Locally common among Bryozoa, algae, and other growths in the intertidal zone and below from Labrador to northern Florida and on the Gulf coast at least as far west as Louisiana. Found also on European coasts, Madeira, and South Africa, as well as on the Pacific coast from Alaska to Mexico. This is a typical circumpolar species.

*Tetastemma vermiculus* Stimpson, 1857; Verrill, 1892; Coe, 1943

*Polia vermiculus* Quatr., 1846.

This species resembles *T. candidum* in many respects but differs in having a light yellow or reddish body variously spotted with brown and in having the two ocelli of the same side connected by a band of dark pigment. Some individuals have paired lateral spots at regular intervals along the entire length of the body.

Locally common among algae and Bryozoa in the intertidal zone and below from the Bay of Fundy to northern Florida and on the Gulf coast westward to Texas. Found also on European coasts from Norway to Madeira.

## Order 4 BDELLONEMERTEA

## Family MALACOBDELLIDAE

*Malacobdella grossa* (O. F. Müller), 1776

*M. grossa* Bürger, 1895; Gering, 1911; Riepen, 1933; Coe, 1940; *M. obesa*, *M. mercenaria* Verrill, 1892.

Body short and broad, wider at posterior end which bears a comparatively large suction disk.

Length when mature 20 to 40 mm., width 8 to 15 mm. Color white, gray, pale yellow, or brownish. Ocelli and cerebral sense organs absent. Alimentary canal narrow, cylindrical, and convoluted; without diverticula. Proboscis slender with weak musculature and without stylets. Gonads

in both sexes small and numerous. Eggs that are artificially fertilized develop rapidly without metamorphosis.

Commensal in the mantle cavity of various species of bivalve mollusks; on the Atlantic and Gulf coasts more commonly in *Venus mercenaria* than in any other species. Widely distributed on European shores as far south as the Mediterranean; on the American Atlantic coast from Nova Scotia to Florida, on the Gulf coast westward to Texas, and on the Pacific coast as far south as California. It probably causes little, if any, injury to the host, since it feeds mainly on the larger particles which the clam draws into its mantle cavity but does not ingest.

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## ECHINODERIDA OF THE GULF OF MEXICO

By B. G. CHITWOOD, formerly, Department of Biology, The Catholic University of America

These are small (0.2–1.0 mm. long) worms presenting a gross similarity to crustaceans, but the body cavity corresponds to a blastocoele. The body is ventrally flattened, covered with a cuticular exoskeleton consisting of 13–14 segments. Segmentation also extends to the musculature and nervous system. The cuticle bears large, segmentally distributed, nonretractile setae and minute spines in scattered or regular arrangement. The mouth is terminal; alimentary canal straight, consisting of mouth, pharynx, esophagus, mid-gut, rectum, and terminal anus. The first segment of the body takes the form of a retractile proboscis armed with hooks and spines. The pharynx has a round lumen, cuticular lining, low cuboidal cellular layer, and external layer of circular muscles; esophagus and mid-gut are simple, non-ciliated; small salivary glands are attached to the esophagus.

The body musculature is rather complex, circular muscles being present only in the second zonite. In the remainder of the body the muscles extend from zonite to zonite through the body cavity, usually being attached only at the ends. The nervous system consists of a bilobed dorsal ganglion, paired commissures, and a double ventral nerve trunk with segmentally arranged ganglia. The body cavity is without epithelium. The excretory system consists of a single pair of simple protonephridia opening on the tenth zonite. Gonads are paired, sac-like, with paired sex openings on the thirteenth zonite. Sexes are separate.

Specialized copulatory bristles are present in the male. Development includes minor changes in external structure and at least one molt.

These organisms are found in bottom sand feeding on algae or in the slime on crabs and mollusks. Remane (1936) has given a thorough summary of our knowledge of this group.

Systematically, they present an interesting paradox since they show similarities to nematodes, gordiid larvae, gastrotrichs, and Crustacea. They are usually placed with the unsegmented worms (i. e., Subkingdom Scolecida, or Vermes Amera) on the assumption that they are pseudo-segmented. More thorough study of the embryology and post-embryonic development would appear warranted.

Only four species have been reported from North America. These include *Pycnophges frequens*, *Trachydemus mainensis*, and *Echinoderella remanei* reported by Blake (1930) from Maine and *Echinoderella steineri* reported by the writer (1951) from Aransas Bay, Texas.

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## FREE-LIVING NEMATODES OF THE GULF OF MEXICO

By B. G. CHITWOOD and R. W. TIMM, formerly, *The Catholic University of America*

### NEMATODE ANATOMY

Nematodes are unsegmented, triploblastic pseudocoelomate, dioecious organisms with a complete digestive tract. Externally they are invested with a noncellular cuticle composed of various scleroproteins; cilia are always absent both externally and internally. Immediately beneath the cuticle there is a cellular or syncytial hypodermis concentrated in dorsal, ventral, and paired lateral chords or ridges which project into the body cavity. The musculature of the body wall consists of a single layer of spindle-shaped, uninucleate muscle cells attached throughout their length to the hypodermis between the chords. Since the dorsal and ventral musculature of the body each acts as a unit, movement is whip-like or eel-like. Because of the absence of circular or diagonal muscle layers the squirming movements and transverse contractions seen in turbellarians and annelids are lacking in nematodes. The body cavity is a pseudocoelom containing scattered fixed cells of mesenchymatous origin.

The oral opening is surrounded by lips and sensory papillae or setae. Paired lateral cephalic sensory organs, the amphids, are situated at the labial or post-labial region; they are varied in shape in the different groups of marine nematodes. The mouth cavity or stoma is highly diversified and often there is a relation of stomatal structure to feeding habits. The esophagus is an elongate muscular organ lined with cuticle; it contains three or five esophageal glands the orifices of which may open into the lumen or through teeth into the mouth cavity. Grossly the esophagus may be cylindroid or may consist of several distinct regions and be terminated by a bulb with, or without, a valve. The intestine is a straight tube consisting of a single layer of cells numbering 2 to perhaps 200 in circumference. Various types of intestinal cell inclusions give characteristic

appearances to the genera or species. These may be organic or inorganic waste products, stored food materials such as glycogen, oils, and proteins, or absorption products such as plant pigments. Finally, the digestive tract ends in a rectum or cloaca lined with cuticle and opening on the ventral side of the body but never terminally.

The reproductive system consists of one or two tubular gonads. In the female the vulva is ventral, usually near the middle of the body. If paired, the ovaries are opposed and may be either reflexed or outstretched. Most nematodes are oviparous, but viviparous species occur in many families. In the male the testes, if paired, are usually opposed as in the female, but a common duct, the vas deferens, extends from both gonads posteriad to connect with the intestine and form a common cloaca opening ventrally. Specialized copulatory organs in the form of sclerotized spicules are present in the male. A sclerotized guiding piece, the gubernaculum, is almost always present. In addition, the male generally has copulatory sense organs varying according to the different groups.

Various glands empty externally through the cuticle. Of these, the excretory system is the most diversified. In the class Aphasmeida this system consists of a single ventral gland cell in the body cavity emptying through a duct which is usually protoplasmic rather than sclerotized. This is the condition in most aquatic nematodes. In the class Phasmidea the excretory system has a sclerotized terminal duct and one or two lateral canals situated in the lateral chords. Unicellular glands are also connected with the amphids and with similar paired lateral caudal sensory organs, the phasmids. Sublateral paired series of hypodermal glands and three caudal adhesive glands, emptying terminally at the tail, are also usually present in the Aphasmeida.

The most conspicuous element of the nervous system is the circum-esophageal commissure or nerve ring. From it six main nerves run forward and innervate the cephalic sensory organs. Four or more nerves extend posteriad from the nerve ring; of these, one is situated in the dorsal chord, a purely motor nerve; one or more pairs of sensory nerves are situated in the lateral chords; and a single or partially paired nerve is situated in the ventral chord. The latter is the chief nerve of the body, contains ganglion cells, and serves as both a motor and sensory nerve. It may also act as an associational center. Various commissures connect the longitudinal nerves. Somatic sensory organs and genital papillae are served by the lateral nerves and connect with the ventral nerve through the commissures.

A more extensive account of nematode anatomy in general and of the various groups in particular can be obtained from An Introduction to Nematology, by Chitwood and Chitwood (1950). Identification of a large number of marine forms can be had from the lengthy studies of Stekhoven (1935) and W. Schneider (1939).

## HISTORICAL RÉSUMÉ

Nematodes of the Gulf of Mexico have received only scant attention. For this reason we have included records of marine nematodes from waters adjoining the Gulf. These total 103 species representing most of the major groups of marine nematodes but probably not over 5 percent of existent forms in the Gulf area. The first report of a nematode from the Gulf was that of *Tricoma major* by Cobb (1912) from Jamaica. Thereafter, Baylis (1915) reported 2 further species from Jamaica, commensals of the land crab, *Gecarcinus ruricola*; Cobb (1920) reported 13 species from Jamaica and 29 species from the Florida coast; Chitwood (1935) reported 3 species from Puerto Rico; Allgén (1947a) reported 15 species from Tobago, British West Indies; and Chitwood (1951) reported 47 species from the Texas coast. All the species reported by Cobb were new, 33 of the 47 species from Texas were new, and 7 of the 15 species from Tobago were new. From these figures it is quite obvious that the nematode fauna of the Gulf of Mexico is quite unexplored. The following checklist is a classified summary of the species reported in the literature.

## CLASSIFIED LIST OF SPECIES REPORTED FROM THE GULF OF MEXICO AND ADJACENT WATERS

### CLASS PHASMIDEA

Phasmids present; caudal and hypodermal glands absent; lateral excretory canals present; terminal excretory duct sclerotized; amphids pore-like.

#### Order RHABDITIDA

Esophagus in three sections.

#### Suborder TYLENCHINA

Stylet present.

Superfamily TYLENCHOIDEA Chitwood and Chitwood, 1937

Dorsal gland orifice near base of stylet.

#### Family TYLENCHIDAE Filipjev, 1934

Cuticle usually thin, striation moderate to faint; stylet not greatly enlarged; esophageal metacarpus not enlarged.

1. *Halenchus mexicanus* Chitwood, 1951 (fig. 63, A).

Locality: Aransas Bay, Tex.

### CLASS APHASMIDEA

Phasimids absent; caudal and hypodermal glands usually present; lateral excretory canals absent; terminal excretory duct seldom sclerotized; amphids usually ex-

ternally modified, pocket-like, circular, spiral, ellipsoid, or vesiculate.

#### Suborder ENOPLINA

Stylet absent; cephalic sensory organs usually setose; caudal glands generally present.

#### Superfamily TRIPYLOIDEA Chitwood, 1937

Cuticle of head not duplicate. Mostly fresh water.

#### Family IRONIDAE de Man, 1876

Stoma cylindrical.

#### Subfamily *Ironinae* Micoletzky, 1922

Esophageal gland orifices at stomatal region.

2. *Trissonchulus oceanus* Cobb, 1920. Locality: Miami, Fla.

3. *Trissonchulus reversus* Chitwood, 1951 (fig. 63, F. G).  
Locality: Aransas Bay, Tex.

#### Family ENOPLIDAE Baird, 1853

Stomatal region surrounded by esophageal tissue; stomatorhabdions weakly sclerotized; no distinct stomatal capsule.

#### Subfamily *Leptosomatinae* Micoletzky, 1922

Amphids pocket-like; mandibles absent; esophagus usually cylindrical, rarely conoid; posterior part of esophagus muscular.



4. *Cophonchus ocellatus* Cobb, 1920. Locality: Kingston Harbor, Jamaica.
5. *Anticomma limalis* Bastian, 1865. Locality: Tobago, Br. W. Indies. Reported by: Allgén, 1947. Other localities: Beaufort, N. C., coasts of Holland, Belgium, France, England, Germany.
6. *Paranticomma longicaudata* Chitwood, 1951 (fig. 63, E). Locality: Aransas Bay, Tex.
7. *Leptosomatium bacillatum* (Eberth, 1863) Bastian, 1865. Locality: Tobago, Br. W. Indies. Reported by: Allgén, 1947. Other localities: Mediterranean Sea.

#### Subfamily *Oxystomininae* (Micoletzky, 1924)

Amphids usually elongate, often internally tuboid; stoma unarmed; esophagus conoid, with weak musculature; cephalic setae usually six, post-cephalic four; preanal supplement absent.

8. *Nemanema simplex* Cobb, 1920. Locality: Port Royal, Jamaica.
9. *Schistodera exilis* Cobb, 1920. Locality: Port Royal, Jamaica.
10. *Porocoma striata* Cobb, 1920. Locality: Biscayne Bay, Fla.

#### Family ONCHOLAIMIDAE Baylis and Daubney, 1926

Stoma capsuliform, only the posterior surrounded by esophageal tissue; stomatorhabdions heavily sclerotized.

#### Subfamily *Oncholaiminae* Micoletzky, 1922

Ocelli absent, diffuse pigment spots sometimes present; esophagus cylindrical, not crenate or conoid, vesiculate, or multibulbar; supplements absent or pedunculate.

11. *Anoplostoma heterurum* (Cobb, 1914) Chitwood, 1951. Locality: Ocala, Fla.
12. *Anoplostoma copano* Chitwood, 1951 (fig. 63, C, D). Locality: Copano Bay, Tex.
13. *Pontonema valviferum* Chitwood, 1951. Locality: Rockport, Tex.
14. *Oncholaimus tobagoensis* Allgén, 1947. Locality: Tobago, Br. W. Indies.
15. *Prooncholaimus aransas* Chitwood, 1951. Locality: Aransas Bay, Tex.
16. *Viscosia macramphida* Chitwood, 1951 (fig. 63, B). Locality: Aransas Bay, Tex.
17. *Viscosia papillata* Chitwood, 1951. Locality: Aransas Bay, Tex.
18. *Viscosia glabra* (Bastian, 1865) de Man, 1890. Locality: Tobago, Br. W. Indies. Reported by: Allgén, 1947. Other localities: Coasts of northern Europe and Mediterranean; very widely distributed.

#### Subfamily *Eurystomininae* (Filipjev 1934)

Ocelli, if present, with pigment and lens. Esophagus conoid to multibulbar, forepart of lumen not notably tuboid; large subventral tooth not remarkably fine; two (rarely 0 or 1) cup-like sclerotized preanal supplements.

19. *Eurystomina americana* Chitwood, 1936. Locality: Rockport, Tex. Reported by: Chitwood, 1951. Other localities: Shackleford's Banks, N. C.
20. *Eurystomina minutisculae* Chitwood, 1951 (fig. 64, E, F). Locality: Aransas Bay, Tex.

21. *Bolbella tobagoense* Allgén, 1947. Locality: Tobago, Br. W. Indies.

#### Subfamily *Enchelidiinae* (Micoletzky 1924)

Stoma absent in males; stomatal walls distinctly jointed in females; with large needle-like tooth; ocelli, if present, with pigment and lens not closely associated; esophagus conoid to multibulbar with forepart of lumen notably tuboid; well-developed supplements absent.

22. *Enchelidium tenuicolle* Eberth, 1863. Locality: Tobago, Br. W. Indies. Reported by: Allgén, 1947. Other localities: Mediterranean.
23. *Illium exile* Cobb, 1920. Locality: Jamaica.
24. *Catalaimus acuminata* Cobb, 1920. Locality: Biscayne Bay, Fla. Other localities: New Caledonia.

### Order CHROMADORIDA

Three part esophagus, commonly with bulb (rarely with pigeon-wing valve), sometimes clavate, very rarely cylindrical; amphids spiral, shepherd's crook, circular, vesiculate, transversely elliptical or very rarely pore-like (*Rhabdolaimus*, *Syringolaimus*); Ovaries outstretched or reflexed.

#### Suborder CHROMADORINA

Tri-radiate or vertically flattened esophago-intestinal valve, usually very short; stoma, if well-developed, containing a large dorsal tooth, two jaws, three jaws, or six inwardly-acting teeth; 12 stomatal rugae usually present; stoma surrounded by esophageal tissue; preanal supplementary organs usually present; tuboid, papilloid, cup-like, or stirrup-like; ovaries reflexed. Mostly marine, some fresh water forms.

#### Superfamily CHROMADOROIDEA Stekhoven and de Coninck, 1933

Amphids spiral, circular, or reniform; cuticle striated, usually punctate but not annulate; helmet absent; ambulatory and paired glandular setae absent. Marine and fresh water.

#### Family CHROMADORIDAE Filipjev, 1917

Amphids rather far forward on head: unispiral, transversely ellipsoid, or kidney-shaped; cuticle coarsely punctate; 12 labial rugae, weakly to moderately developed; stoma surrounded by esophageal tissue, teeth at anterior end; usually internal circle of 6 cephalic papillae and double external circle of 6 papillae and 4 setae; esophageal bulb usually present; esophago-intestinal valve extremely small; cup-like (i. e., chromadoroid) supplements; 2 reflexed ovaries. Marine and fresh water.

#### Subfamily *Chromadorinae* Micoletzky, 1922

Characters of family.

25. *Rhyps ornata* Cobb, 1920. Locality: Ocean Beach, Fla.
26. *Euchromadora striata* (Eberth, 1863) Filipjev, 1917. Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Atlantic coast of Europe.

27. *Euchromadora vulgaris* (Bastian, 1865) de Man, 1886. Locality: Tobago, Br. W. Indies. Reported by: Allgén, 1947. Other localities: Atlantic coast of Europe.
28. *Paraeuchromadora longicaudata* Chitwood, 1951. Locality: Aransas Bay, Tex.
29. *Actinonema pachydermata* Cobb, 1920. Locality: Key West, Fla.
30. *Spilophorella paradoxa* (de Man, 1888) Filipjev, 1918 (fig. 63, I). Localities: Tobago, Br. W. Indies and Aransas Bay, Tex. Reported by Allgén, 1947; Chitwood, 1951. Other localities: Atlantic coast of Europe and North America.
31. *Chromadora quadrilineoides* Chitwood, 1951 (fig. 63, H). Locality: Aransas Bay, Tex.
32. *Chromadorella macrolaimoides* (Steiner, 1915). Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Sumatra.
33. *Chromadora paramacrolaimoides* Allgén, 1947. Locality: Tobago, Br. W. Indies.
34. *Chromadorella filiformoides* Chitwood, 1951. Locality: Cedar Bayou, Tex.
35. *Chromadorita tentabunda* (de Man, 1880) Filipjev, 1930. Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Atlantic coast of Europe.
36. *Prochromadorella micoletzkyi* Chitwood, 1951. Locality: Copano Bay, Tex.
37. *Prochromadorella bipapillata* Chitwood, 1951. Locality: Port Bay, Tex.
38. *Spilophora antillensis* Allgén, 1947. Locality: Tobago, Br. W. Indies.
39. *Spilophora mortenseni* Allgén, 1947. Locality: Tobago, Br. W. Indies.

**Family MICROLAIMIDAE Stekhoven and de Coninck, 1933**

Amphids post-labial, circular to 1-2 spiral; cuticle finely to coarsely punctate; weakly developed labial rugae; stoma cylindroid, surrounded by esophageal tissue, teeth at anterior or mid-stomatal; 6 cephalic papillae and 10 setae or 6 papillae and 4 setae; esophageal bulb usually present; papilloid to chromadorid supplements; gubernaculum not highly developed; reflexed or outstretched ovaries. Marine and fresh water.

**Subfamily Microlaiminae Micoletzky, 1922**

Cuticle weakly punctate; teeth mid-stomatal; esophago-intestinal elongate; papilloid preanal supplements, if present; outstretched ovaries. Marine and brackish.

40. *Microlaimus texianus* Chitwood, 1951. Locality: Aransas Bay, Tex.

**Family CYATHOLAIMIDAE Stekhoven and de Coninck, 1933**

Amphids multispiral; cuticle coarsely punctate; hypodermal glands often prominent; usually 12 prominent labial rugae; stoma usually cyathiform (i. e., two-part funnel-shaped); teeth, if present, at junction of two parts; esophagus clavate to cylindroid; commonly double gubernaculum, often dentate or denticulate; tuboid, chromadorid, or setose supplements; reflexed ovaries. Marine.

**Subfamily Cyatholaiminae Micoletzky, 1922**

Stoma funnel-shaped or shallow, without ribs to the base or jaws; dorsal tooth or onchium usually present.

41. *Cyatholaimus sunesoni* Allgén, 1947. Locality: Tobago, Br. W. Indies.
42. *Nannolaimus guttatus* Cobb, 1920. Locality: Biscayne Bay, Fla.
43. *Acanthonchus cobbi* Chitwood, 1951 (fig. 64, B, C). Locality: Rockport Harbor, Tex.
44. *Paracanthonchus truncatus* (Cobb, 1914) Chitwood, 1951. Locality: Silver Springs, Fla. Reported by: Cobb, 1914.

**Subfamily Choanolaiminae Filipjev, 1934**

Stoma deep cyathiform, with 6 or 12 ribs; jaws and dorsal tooth absent.

45. *Halichoanolaimus quatuordecimpapillatus* Chitwood, 1951 (fig. 64, A). Locality: Aransas Bay, Tex.
46. *Synonchium obtusum* Cobb, 1920. Locality: Miami, Fla.

**Superfamily DESMODOROIDEA Steiner, 1927**

Cephalic capsule or helmet usually present; amphids various, not vesiculate; cuticle annulate, not punctate; glandular tube setae present or absent. Mostly marine.

**Family DESMODORIDAE Micoletzky, 1924**

Body not epsilonoid; ambulatory bristles and glandular setae absent.

**Subfamily Desmodorinae Micoletzky, 1924**

Amphids circular or spiral; helmet present; cuticle not tiled; dorsal tooth usually present.

47. *Desmodora dubia* Allgén, 1947. Locality: Tobago, Br. W. Indies.
48. *Xennella cephalata* Cobb, 1920. Locality: Key West, Fla.
49. *Ichthyodesmodora chandleri* Chitwood, 1951. Locality: Copano Bay, Tex.
50. *Bolbonema brevicolle* Cobb, 1920. Locality: Kingston Harbor, Jamaica.
51. *Croconema cinctum* Cobb, 1920. Locality: Port Royal, Jamaica.
52. *Leptonemella cincta* Cobb, 1920. Locality: Miami, Fla.
53. *Laxonema majum* Cobb, 1920. Locality: Kingston Harbor, Jamaica.
54. *Stilbonema brevicolle* Cobb, 1920. Locality: Kingston Harbor, Jamaica.

**Superfamily DESMOSCOLECOIDEA Stekhoven, 1935**

Amphids vesiculate; helmet present; cuticle coarsely striated, without punctations; ocelli common; non-sclerotized stoma; four short cephalic setae; tubular gland setae present; esophagus not clearly divided, glands often free; supplements absent; reflexed ovaries. Marine.

**Family DESMOSCOLECIDAE Southern, 1914**

Coarsely annulate cuticle, not usually hirsute.

55. *Desmoscolex americanus* Chitwood, 1936. Locality: Aransas Bay, Tex. Reported by Chitwood, 1951. Other localities: Bogue Sound, N. C.

56. *Desmoscolex nudus* Chitwood, 1951 (fig. 64, D). Locality: Rockport, Tex.
57. *Eudesmoscolex luteocola* Chitwood, 1951. Locality: Rockport, Tex.
58. *Tricoma major* Cobb, 1912. Locality: Jamaica.
59. *Tricoma spinosoides* Chitwood, 1951. Locality: Aransas Bay, Tex.
60. *Tricoma flipjevi* Chitwood, 1951. Locality: Aransas Bay, Tex.
61. *Tricoma spinosa* Chitwood, 1936. Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Bogue Sound, N. C.

#### Family GREEFFIELLIDAE (Filipjev 1929)

Cuticle not coarsely annulate, usually hirsute.

62. *Greeffiella dasyura* Cobb, 1922. Locality: Biscayne Bay, Fla.

#### Suborder MONHYSTERINA

Esophago-intestinal valve dorsoventrally flattened, never vertically flattened, usually elongate; stoma, if well-developed, unarmed or without prominent teeth, surrounded or not by esophageal tissue; stomatal rugae absent; papilloid or tuboid supplements, may be minute depressions; outstretched or reflexed ovaries. Marine or fresh water.

#### Superfamily PLECTOIDEA Chitwood, 1937

Amphids 1-2 spiral or almost circular; punctation, if present, weak; ends of esophageal radii tuboid; reflexed ovaries.

#### Family LEPTOLAIMIDAE Oerley, 1880

Esophageal bulbar region muscular but without valve; stoma narrow, cylindrical, or presumably absent; cuticle somewhat coarsely striated. Mostly marine.

63. *Leptolaimus plectoides* Chitwood, 1951. Locality: Aransas Bay, Tex.

#### Subfamily Rhabdolaiminae Chitwood, 1951

Amphids pore-like, minute; stoma cylindrical, very narrow. Marine or fresh water.

64. *Syringolaimus smaragdus* Cobb, 1928 (fig. 65, A). Locality: Rockport, Tex. Reported by: Chitwood, 1951. Other localities: Woods Hole, Mass.

#### Family CAMACOLAIMIDAE Stekhoven and de Coninck, 1933

Amphids basically unispiral; terminal excretory duct never sclerotized; stoma tiny or absent, often armed with dorsal tooth; four cephalic setae; posterior region of esophagus glandular.

#### Subfamily Camacolaiminae Micoletzky, 1924

Amphids anterior to cephalic setae. Marine.

65. *Neurella simplex* Cobb, 1920. Locality: Key West, Fla.
66. *Onchium ocellatum* Cobb, 1920. Localities: Mass. and Key West, Fla.
67. *Onchulella ocellata* Cobb, 1920. Locality: Biscayne Bay, Fla.

68. *Nemella ocellata* Cobb, 1920. Locality: Biscayne Bay, Fla.

69. *Camacolaimus tardus* de Man, 1889. Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Coasts of Holland.

70. *Digitonchus cylindricaudatus* Chitwood, 1951. Locality: Rockport, Tex.

#### Subfamily Aphanolaiminae Chitwood, 1935

Amphids posterior to cephalic setae. Fresh water or marine.

71. *Alaimella cincta* Cobb, 1920 (fig. 65, B). Localities: Biscayne Bay, Fla., and Aransas Bay, Tex.

#### Superfamily AXONOLAIMOIDEA Chitwood, 1937

Amphids spiral or variants, rarely circular; cuticle not punctate; stoma, if well-developed, cylindroid to conoid; teeth, if present, as three or six eversible prorhabdions; esophagus three part without valve to clavate; ends of esophageal radii tuboid; outstretched ovaries (reflexed in a few comesomes). Mostly marine.

#### Family AXONOLAIMIDAE Stekhoven and de Coninck, 1933

Amphids unispiral to shepherd's crook, seldom a broken circle; cuticle usually smooth, punctation absent or minute; supplements papilloid or absent; gubernaculum usually with posterior apophyses; outstretched ovaries.

#### Subfamily Axonolaiminae Micoletzky, 1924

Amphids unispiral, circular to shepherd's crook; stoma conoid with well-developed rhabdions. Marine.

72. *Odontophora angustilaimoides* Chitwood, 1951 (fig. 65, E, F). Locality: Aransas Bay, Tex.

#### Subfamily Diplopeltinae Rautner, 1930

Amphids unispiral, on a sclerotized plaque; stoma weak, walls not sclerotized.

73. *Didelta maculata* Cobb, 1920. Locality: Key West, Fla.

74. *Araeolaimus punctatus* (Cobb, 1920) Chitwood, 1951. Localities: Key West and Biscayne Bay, Fla. Reported by: Cobb, 1920.

75. *Araeolaimus texianus* Chitwood, 1951 (fig. 65, M). Locality: Rockport Harbor, Tex.

76. *Pseudaraeolaimus perplexus* Chitwood, 1951 (fig. 65, L). Locality: Aransas Bay, Tex.

#### Family COMESOMATIDAE Stekhoven and de Coninck, 1933

Amphids multispiral; cuticle often punctate; stoma cylindroid with three sclerotized points at anterior or reduced; supplements papilloid or absent; gubernaculum with or without posterior apophyses; ovaries usually outstretched. Marine.

77. *Mesonchium poriferum* Cobb, 1920. Locality: Key West, Fla.

78. *Pepsonema pellucidum* Cobb, 1920. Locality: Kingston Harbor, Jamaica.

79. *Laimella longicauda* Cobb, 1920. Localities: Biscayne Bay and Key West, Fla.

80. *Cynura uniformis* Cobb, 1920. Locality: Miami, Fla.

81. *Sabatieria hilarula* de Man, 1922 (fig. 65, G, H).  
Locality: Aransas Bay, Tex. Reported by: Chitwood, 1951. Other localities: Coasts of Holland, Germany, Norway, France, and North Carolina.

**Superfamily MONHYSTEROIDEA Stekhoven and de Coninck, 1933**

Amphids circular; stoma very diverse; cephalic setae 4 (?), 6, 10, 12, 16, 18, or more; ends of esophageal radii convergent; esophago-intestinal valve usually spheroid to cylindrical; outstretched ovaries. Marine or fresh water.

**Family MONHYSTERIDAE Oerley, 1880**

Stoma not styletiform; radial muscles of esophagus diffuse, without cuticular attachment points; esophagus cylindrical, without bulb.

**Subfamily Monhysterinae Micoletzky, 1922**

Cuticle not ridged; stoma not sclerotized, usually conoid; three low lips; papiloid sensory organs of internal circle; usually one anterior outstretched ovary. Marine or fresh water.

82. *Diplolaimella ocellata* Chitwood, 1951. Locality: Aransas Bay, Tex.  
83. *Cytolaimium exile* Cobb, 1920. Locality: Biscayne Bay, Fla.  
84. *Monhyстера parva* Bastian, 1865. Locality: Cedar Bayou, Tex. Reported by: Chitwood, 1951. Other localities: Northern coast of Europe, Mediterranean and Red Seas.  
85. *Monhyстера socialis* Bütschli, 1874 (fig. 65, C, D). Locality: Cedar Bayou, Tex. Reported by: Chitwood, 1951. Other localities: Northern coast of Europe.  
86. *Monhyстера tobagoensis* Allgén, 1947. Locality: Tobago, Br. W. Indies.  
87. *Theristus bütschlioides* Chitwood, 1951. Locality: Aransas Bay, Tex.  
88. *Theristus elaboratus* Chitwood, 1951 (fig. 65, I-K). Locality: Copano Bay, Tex.

**Subfamily Xyalinae Chitwood, 1951**

Cuticle coarsely striated; stoma sometimes sclerotized; cephalic setae 6 plus 12; 6 or 3 (?) lips. Marine.

89. *Xenolaimus striatus* Cobb, 1920. Locality: Biscayne Bay, Fla.

**Family LINHOMOEIDAE Filipjev, 1929**

Stoma not styletiform; esophageal radial muscles centered, often with cuticular attachment points; esophagus usually with distinct bulb. Esophago-intestinal valve usually very large; one or two outstretched ovaries. Usually marine.

**Subfamily Linhomoeinae Filipjev, 1929**

Cuticle almost smooth; stoma short with weak to moderate sclerotization. Marine.

90. *Catanema exile* Cobb, 1920. Locality: Port Royal, Jamaica.  
91. *Anticyathus tenuicaudatus* Cobb, 1920. Locality: Miami, Fla.  
92. *Terschellingia longicaudata* de Man, 1907. Locality: Copano Bay, Tex. Reported by: Chitwood, 1951. Other localities: Northern coast of Europe.

93. *Monhystrum wilsoni* (Baylis, 1915) Cobb, 1920. Locality: Jamaica and Puerto Rico on gills of *Gecarcinus ruricola* and *G. lateralis*. Reported by: Baylis, 1915; Cobb, 1920; and Chitwood, 1935.

94. *Monhystrum transitans* Cobb, 1920. Locality: Jamaica and Puerto Rico, on gills of *Gecarcinus ruricola* and *G. lateralis*. Reported by: Cobb, 1920 and Chitwood, 1935.

95. *Halinema spinosum* Cobb, 1920. Locality: Biscayne Bay, Fla.

96. *Metalinhomoeus setosus* Chitwood, 1951. Locality: Aransas Bay, Tex.

97. *Synonemoides ochra* Chitwood, 1951. Locality: Rockport Harbor, Tex.

98. *Anticyclus exilis* Cobb, 1920. Locality: Bath Tub Springs, Jamaica.

99. *Crystallonema fuscacephalum* Cobb, 1920. Locality: Miami, Fla.

100. *Linhomoella exilis* Cobb, 1920. Locality: Biscayne Bay, Fla.

**Subfamily Sphaerolaiminae Filipjev, 1924**

Stoma cylindrical to globoid, heavily sclerotized.

101. *Tripylum carcinicolum* (Baylis, 1915) Cobb, 1920. Locality: Jamaica, on gills of *Gecarcinus ruricola* and *Cardisoma guanhumi*. Reported by: Baylis, 1915 and Cobb, 1920.

102. *Tripylum carcinicolum* var. *calkinsi* Chitwood, 1935. Locality: Puerto Rico, gills of *Gecarcinus lateralis*.

103. *Halanonchus macrurus* Cobb, 1920. Locality: Biscayne Bay, Fla.

**GEOGRAPHIC DISTRIBUTION**

Very few of the species thus far described from the Gulf and adjoining areas have been encountered by more than one worker so that discussions of geographic distribution are liable to considerable error. *Spilophorella paradoxa* has been reported from numerous localities on the coast of northern Europe, the North American Atlantic coast from Massachusetts to North Carolina, as well as from Tobago, British West Indies, and Aransas Bay, Texas. *Syringolaimus smaragdus* has been reported from Massachusetts and Texas. Both feed on algae, and it may be that their distribution is governed by the movement of the algae in oceanic currents. *Onchium ocellatum* was reported from Massachusetts and Florida, and *Alaimella cincta* was reported from Florida and Texas. Two species were reported as associates of land crabs in Jamaica and Puerto Rico, though the species of hosts appear to differ in the two localities. Two species were reported from North Carolina and Texas, seven species from Europe and Texas and seven species from Europe and Tobago, British West Indies. A

single species was reported from Sumatra and Texas.

Due to the scarcity of qualified American workers the fauna of the European coasts is far better known than the Gulf fauna, and this probably explains the predominance of European forms among species recorded from more than one locality. Allgén (1947b) reported numerous species from the western coast of North America, and these differ from the eastern fauna, as would be expected.

### ECOLOGY AND LIFE HABITS

Most marine nematodes are bottom dwellers or live in association with algae, sponges, colonial hydroids, bryozoa, mollusks, decapods, ascidians, and others. Because of their inability to swim freely for long periods of time, they are never typically planktonic (i. e. holoplanktonic). A few nematodes appear capable of directed movement; monhysterids in particular exhibit a very rapid vibratory motion in which the body may appear as an ellipse with two processes at each end, but the worms cannot sustain these swimming movements for more than several seconds. Most nematodes have a slow serpentine motion which is rather ineffective in locomotion without the aid of a substrate for leverage. In their true habitat, however, locomotion is quite efficient (e. g., oncholaims can move rapidly among filamentous algae). Bottom dwellers are usually confined to a sharply restricted local area.

Many European workers, notably Micoletzky and Stekhoven, have paid considerable attention to ecological considerations, e. g., the association of certain species with certain types of bottoms, the frequency of species in a certain habitat, etc. The largest nematode population is to be found in mud rich in organic debris. Stekhoven has estimated that 500-600 nematodes per cubic centimeter may be found in such a bottom. Saprophagous species, carnivores, and algivorous and diatomivorous species abound here. In highly aerated regions such as breakwaters or surf-beaten rocks there is a rich fauna of algivorous species.

There are numerous references in the literature to the food of nematodes among the genera reported from the Gulf of Mexico. Monhysterids and chromadorids in general feed on algae and diatoms; *Monhystera* and *Euchromadora* feed

especially on algae—unicellular and filamentous; and *Theristus* on diatoms. The diatoms may be almost half the diameter of the body. In the anterior of the intestine they are filled with bright green pigment, but when the shells are rejected through the anus they usually contain only a small amount of unabsorbed brownish yellow pigment, proving that the diatoms are actually being utilized as food. Chitwood (1951) presumes that *Paranticoma longicaudata* feeds on algae because of elongate, irregular, greenish masses in the lumen and similarly colored cell inclusions. *Halichoanolaimus* has been reported several times as predatory on other nematodes. The genus *Halenchus* belongs to a group primarily parasites of terrestrial angiosperms, but the species *H. fucicola*, first described by de Man (1892), is a parasite of the brown alga, *Fucus*. Such nematodes have a strictly liquid diet, inserting their hollow oral stylet into plant cells and predigesting the contents to some extent. It would be interesting to ascertain the host plant for *H. mexicanus* described from the Gulf of Mexico (Chitwood 1951).

Herbivorous species may usually be recognized as such by the pigments present either in the intestinal lumen or as cell inclusions. Timm (1951) has reinvestigated such cell inclusions in *Syringolaimus smaragdus* which Cobb (1928) first found associated with the common mud snail, *Nassa obsoleta*. Cobb had reported that *Syringolaimus* was feeding on an encrusting orange alga of the genus *Ralfsia* growing on the shell of the snail, but Timm showed by chemical tests of the cell inclusions and contents of the lumen that this worm feeds rather on the filamentous green alga which forms a thick felt mat on the shell of *Nassa*. The junior author has likewise observed the feeding of *Chromadora quadrilineoides* obtained in the living state from Chesapeake Bay off Solomons Island, Maryland. This nematode was found in great abundance in association with the bright red sponge, *Microciona prolifera*. Some worms were apparently feeding off the epidermal substance of the sponge through the action of their three, fine teeth, because bright red, finely divided particles were observed in the intestinal lumen. After 2 months in an unaerated aquarium the sponges had died, but the chromadorids were still thriving on small algae trapped by the coarse skeleton of the sponge.

As a general rule, four molts occur in the development of the parasitic and terrestrial free-living nematodes thus far observed, but there has been no formal study on the life cycle of any of the marine nematodes. Neither has the embryology of any marine nematode been worked out. We have recently observed the first three cleavages of *Euchromadora vulgaris* collected at Woods Hole, Massachusetts. In this species the first two cleavages appear to be equal, while the third cleavage is quite unequal in the derivatives of one of the first two blastomeres. The few published illustrations of nemic embryos in aphasmeids would appear to indicate differences from the established pattern in the Phasmidea. This should be an interesting field of investigation. Most species produce relatively few eggs; 1 or 2 fully formed eggs per uterus is the rule in small forms such as *Monhystera* and *Chromadora*, but some of the larger forms such as *Oncholaimus* may contain up to 20 mature eggs per uterus. The number of eggs is characteristic of the species. Eggs may be deposited in the one cell condition or in various stages of development, and a few viviparous marine nematodes have been reported.

Saline content of the water in which the marine nematodes live must be an important factor in their life, since there is practically no overlapping between marine and fresh-water inhabitants. Attempts to acclimate marine nematodes to fresh water, and vice versa, have been unsuccessful. *Rhabditis marina* has recently been found on decaying seaweed along the beach at Woods Hole, Massachusetts. This form has been cultured with bacteria on nutrient agar made up with either sea water or tap water. Specimens taken from either substrate may be transferred directly to tap water or sea water. Both rhabditids and tylenchids are usually soil or fresh-water inhabitants. Study of their osmotic relations should prove interesting. In the Nematoda, as in the Protozoa and Turbellaria, the excretory system is best developed in fresh-water and soil groups (Phasmidea) and less well developed in the marine groups (Aphasmeida). A study of estuarine forms would probably be very helpful in determining the conditions of transition from a marine to a fresh-water biotope.

On the other hand, the influence of oxygen tension is probably not so important as has been surmised. Chitwood and Chitwood (1938) concluded that *Chromadora quadrilineoides* and *Oncho-*

*laimium oxyure* var. *domesticum* were highly oxygen loving, since they were found in abundance on an aquarium aerator. However, we have cultured the former species for 2 months and the latter for an entire year in small unaerated aquaria. Probably they are able to help satisfy their oxygen requirements from the green algae on which they feed. Few appear to be adapted to anaerobic life.

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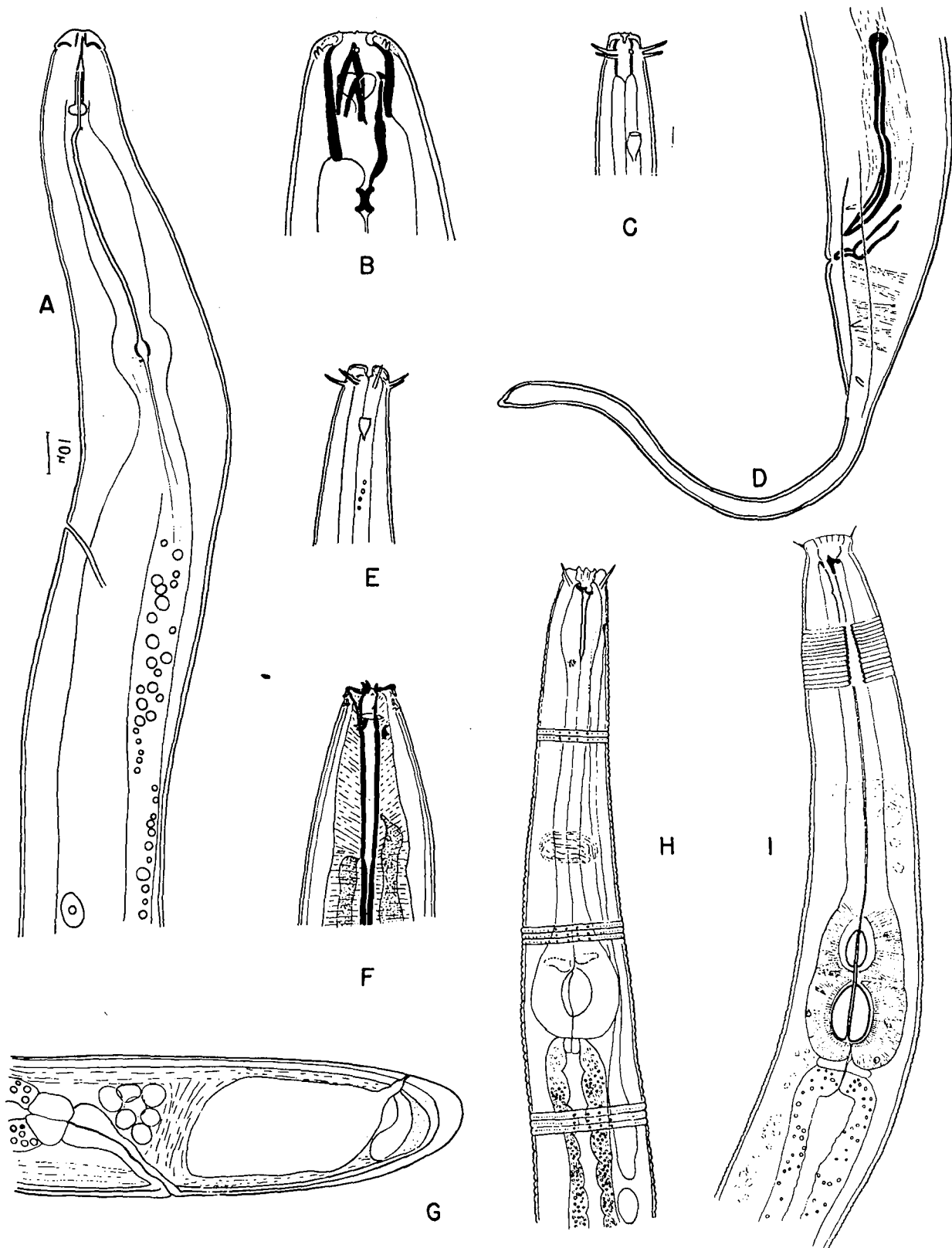


FIGURE 63.—A. *Halenchus mexicanus*. Esophageal region. B. *Viscosia macramphida*. Head. C–D. *Anaplostoma copano*. C. Head. D. Tail of male. E. *Paranticoma longicaudata*. Head. F–G. *Trissonchulus reversus*. F. Head. G. Tail. H. *Chromadora quadrelinoidea*. Esophageal region. I. *Spilophorella paradoxa*. Esophageal region.

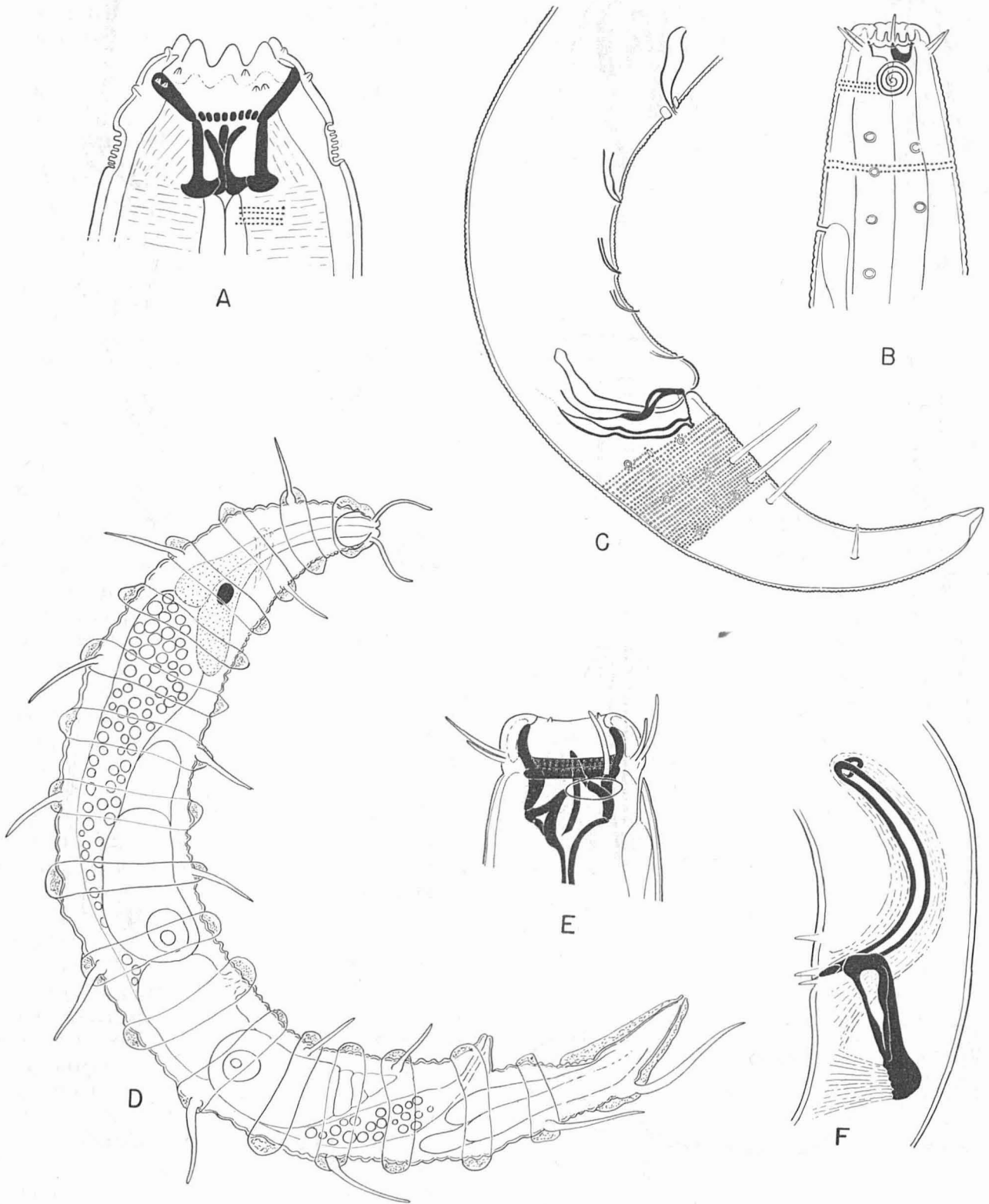


FIGURE 64.—A. *Halichoanolaimus quatuordecimpapillatus*. Head. B-C. *Acanthoichthys cobbi*. B. Head. C. Male tail. D. *Desmoscolex nudus*. E-F. *Eurystomina minutisculae*. E. Head. F. Male cloacal region.



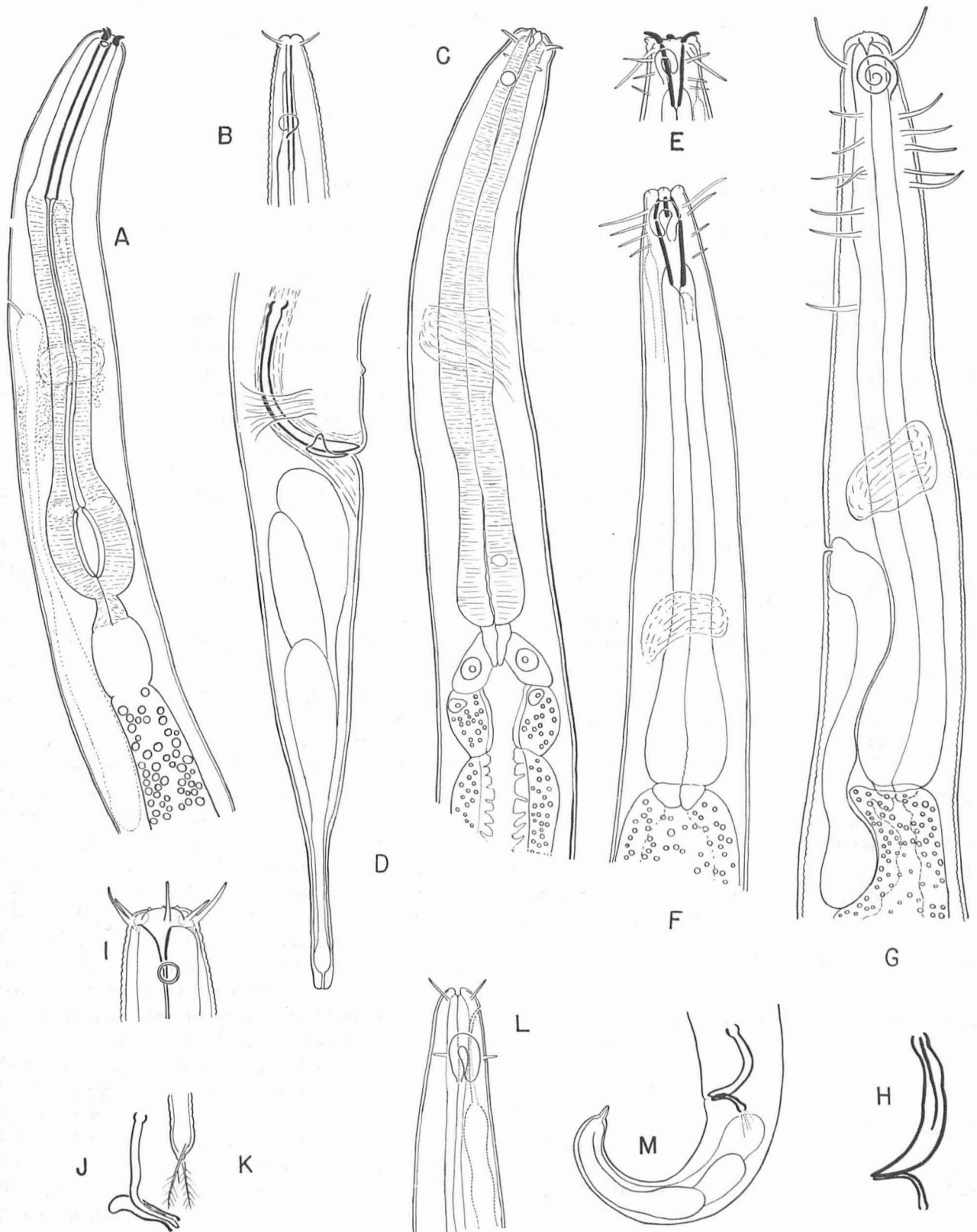


FIGURE 65.—A. *Syringolaimus smarigdus*. Esophageal region. B. *Alaimella cincta*. Head. C–D. *Monhystera socialis*. C. Esophageal region. D. Male tail. E–F. *Odontophora angustilaimoides*. E. Head. F. Esophageal region. G–H. *Sabatieria hilarula*. G. Esophageal region. H. Spicules and gubernaculum. I–K. *Theristus elaboratus*. I. Head. J. Spicules and gubernaculum. K. Tip of tail. L. *Pseudaraeolaimus perplexus*. Head. M. *Araeolaimus texianus*. Tail of male.



# TARDIGRADES OF THE GULF OF MEXICO

By B. G. CHITWOOD, formerly, Department of Biology, The Catholic University of America

Tardigrades are small, segmented organisms (usually under 1 mm. in length) showing some similarities to arthropods and annelids. They have four pairs of parapodia and a varied number of sensory appendages. The body is covered with a cuticle of uncertain composition; this layer is molted during development. The musculature is apparently smooth, though it presents many similarities to striated muscle. The mesoderm arises as four pairs of gut pockets, and the body cavity is a haemocoel containing a colorless liquid with numerous cells in suspension. A circulatory system is absent. Respiration is through the cuticle. These organisms are very sensitive to lack of oxygen. The nervous system consists of a large, lobed dorsal and lateral ganglion, paired commissures, and a paired ventral nerve with four segmentally paired ganglia.

The digestive tract consists of an ectodermal buccal tube, bulb and esophagus, a mesenteron, and ventral anus. Opening on each side into the buccal tube there is a protrusible stylet. Salivary glands also open into the buccal cavity. The bulb acts as a pump. These forms usually feed on the contents of chlorophyll cells punctured by the stylets; digestion in the mesenteron is intracellular. Posteriorly, there are a group of unicellular to multicellular rectal glands or malpighian tubules at the junction of mesenteron and rectum in the fresh-water forms (Eutardigrada), while such are absent in the marine forms (Heterotardigrada). This is an interesting feature relative to osmoregulation and excretion. We have similar lack of development of rectal glands and lateral excretory canals in the marine nematodes; the protonephridial system of marine Turbellaria is less developed than in fresh-water forms; and the contractile vacuoles of Protozoa are only developed in fresh-water forms.

Sexes are separate, there being a single tuboid gonad suspended dorsal to the intestine. In the male two deferent tubes encircle the intestine to

open in a single ventral gonopore anterior to the anus. In the female the single oviduct opens anterior to the anus in the Heterotardigrada and into the rectum in the Eutardigrada. The eggs are usually ornate. Cleavage is total, equal with the formation of a blastula.

Tardigrades usually inhabit algae and mosses. Fresh-water forms are known to be able to resist extensive drying and extremely low temperatures in a state of anabiosis. The two most comprehensive reference articles on the group are those by Marcus (1929) and Cuenot (1932).

The group has been placed with the Acarina, Onychophora, Annelida, and Nematoda. Most of the characters are similar to those of arthropods, but the musculature, digestive tract, and absence of circulatory system present difficulties. For the present, it appears best to place these organisms as a phylum under the Subkingdom Annulosa but to recognize similarities to the Subkingdom Scolecida.

A single species *Bathyechiniscus tetronyx* Steiner, 1926, has been reported from sargassum in the vicinity of Aransas Bay, Texas (Chitwood 1951). This species has also been reported from the South Polar regions (Steiner 1926) and in *Dictyota* washings on the California coast.

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# NOTES ON THE CHAETOGNATHA OF THE GULF OF MEXICO

By E. LOWE PIERCE, *Department of Biology, University of Florida*

The chaetognaths are elongate, transparent, marine animals. They range in length, when mature, from one-half to several centimeters. One or two pairs of lateral fins and a caudal fin are present. A group of hooks, or seizing jaws, are arranged on either side of the head by means of which they catch their prey. The body is divided into head, trunk, and tail regions. They are hermaphroditic with the ovaries in the trunk and the testes in the tail segment.

Because of their distinctive features the "arrow-worms" are usually set apart from the other worms into a separate phylum. At present about 9 genera and 38 species are recognized. The genus *Sagitta* is by far the largest both in number of species and in number of individuals.

Few published records exist concerning chaetognaths in the Gulf of Mexico. Ritter-Zahony (1910) described specimens taken from the region of the Dry Tortugas, Florida. Conant (1895, 1896) published records of specimens from the West Indies and Beaufort, North Carolina. Davis (1949) and King (1949) briefly mentioned chaetognaths in their studies of plankton of the Gulf coast of Florida. Inasmuch as many of the species in the Gulf have a wide and in some instances an almost cosmopolitan distribution in the warm oceanic waters, many references to such species collected in other bodies of water may be found in the literature.

A recent study (Pierce 1951) of the Chaetognatha of the Gulf coast of Florida revealed two genera and five species present in the inshore waters. These are: *Sagitta hispidata* Conant, *Sagitta helenae* Ritter-Zahony, *Sagitta tenuis* Conant, *Sagitta enflata* Grassi, and *Krohnitta pacifica* (Aida).

Two samples collected by the *Atlantis* from the offshore waters of the northern portion of the Gulf of Mexico were obtained through the courtesy of the Woods Hole Oceanographic Institution and

Dr. H. B. Moore of the Marine Laboratory, University of Miami. The data and the list of species for each sample are given below:

First sample: *Atlantis*. Location: 27°15' N., 90°09' W. Date: January 18, 1947. Depth of tow: 495-749 meters.

Species	Relative abundance
<i>S. bipunctata</i> Quoy and Gaimard	Common.
<i>S. enflata</i> Grassi	Common.
<i>S. serratodentata</i> Krohn	Common.
<i>S. hexaptera</i> d'Orbigny	Scarce.
<i>S. lyra</i> Krohn	Scarce.
<i>S. macrocephala</i> Fowler	Scarce.
<i>Eukrohnia hamata</i> (Mobius)	Common.
<i>Pterosagitta draco</i> (Krohn)	Scarce.
<i>Krohnitta subtilis</i> (Grassi)	Scarce.

Second sample: *Atlantis*. Location: 26°24' N., 87°15' W. Date: 1947.

Note: No further data available from sample.

Species	Relative abundance
<i>S. bipunctata</i>	Scarce.
<i>S. enflata</i>	Common.
<i>S. serratodentata</i>	Common.
<i>S. hexaptera</i>	Common.
<i>S. macrocephala</i>	Scarce.
<i>Pterosagitta draco</i>	Common.
<i>Krohnitta subtilis</i>	Common.

A comparison of the chaetognaths taken from the Gulf coast of Florida and the above two samples from the offshore waters in the Gulf reveals an almost totally different fauna. In fact, out of a total of 14 species only 1 (*S. enflata*) was common to both inshore and offshore waters. It would be well to keep in mind, however, that the depth at which the samples were collected was quite different for the first *Atlantis* sample, and probably for the second as well, from that of the coastal samples where the water was never over 20 meters deep. This difference in collecting depth between the two areas would undoubtedly accentuate the faunal differences; however, the appearance of only one species in common is certainly noteworthy.

## NOTES ON THE RANGE OF SPECIES COLLECTED IN THE GULF OF MEXICO

*S. hispida* was collected regularly from the diluted inshore waters along the Gulf coast of Florida. In the Fort Myers and Sarasota region it was not usually taken more than 10 miles offshore. This species has also been collected from the Cedar Keys region, off Cape Sable, the Florida Keys, and 12 miles north of Key West.

Because Conant (1895) failed fully to describe this species which he obtained from Beaufort Harbor, North Carolina, a certain amount of confusion has resulted in later attempts at identification. A comparison of my specimens with the material deposited by Conant in the United States National Museum leaves little doubt about their identity.

*S. helenae* was a very common species along the Gulf coast of Florida. It was not usually found in the diluted inshore belt of water as was *S. hispida* but was most abundant 5 miles or more offshore where water of approximately normal salinity was encountered.

This species was collected about 40 miles west of Sarasota and probably is to be found much farther offshore in the Gulf. A sample collected by the *Albatross* on March 3, 1885, about 50 miles southeast of the mouth of the Mississippi River contained specimens of *S. helenae*. Ritter-Zahony (1910) obtained it from the Dry Tortugas area and suggests that it is a definitely neritic species.

*S. tenuis* is also a common form along the west coast of Florida. This small chaetognath, maturing occasionally at 5 millimeters, was taken in water whose salinity varied from 24 to 35 parts per thousand. It was described by Conant in 1896 from specimens obtained in Kingston Harbor, Jamaica. This species was not recognized by Ritter-Zahony (1910) who, not having access to Conant's material in the United States National Museum, failed to consider it a valid species. No references have been found concerning the distribution of *S. tenuis* in the Gulf of Mexico.

*S. enflata*, by way of contrast, is a true cosmopolitan form and is taken in abundance in the warm waters of all oceans both over the continental shelf and in the open ocean as well. Moreover, it may be collected from the surface to a depth of

several hundred meters. Common along the west coast of Florida, in the Florida Current, and in the offshore samples taken by the *Atlantis* in the Gulf, this species is almost certainly very abundant and widely distributed in the Gulf of Mexico.

Little is known about the distribution of *S. bipunctata*, *S. serratodentata*, *S. hexaptera*, *S. lyra*, and *S. macrocephala* in the Gulf of Mexico. Ritter-Zahony (1910) records the first two species from the Dry Tortugas area but apparently did not find the latter three in the collections he examined which, incidentally, were all taken near the surface. These species are all found in the tropic and temperate regions of the Atlantic, Pacific, and Indian Oceans. *S. lyra* and *S. macrocephala* are not typically epipelagic forms but are found most abundantly 100 meters or more beneath the surface. As indicated earlier, none of the above were taken in the waters of the west coast of Florida. They are essentially open-water chaetognaths.

*Krohnitta pacifica* was collected occasionally from the west coast of Florida. It was never very abundant. This species has also been recorded from Australian and Japanese waters. Past errors in its taxonomic status cast some doubt on the extent of its distribution.

*Krohnitta subtilis* was found in each of the *Atlantis* samples from the Gulf and was never taken close to shore. It is also common to the waters of Australia and Japan.

*Eukrohnia hamata* was present in one of the *Atlantis* samples. It was never found along the west coast of Florida. This species has been taken in the Atlantic, Indian, and Pacific Oceans.

In order that we may extend our very meager knowledge of the occurrence of the chaetognaths in the Gulf of Mexico added samples are needed from the northern and western portions and especially from the surface and deep waters in the central portion of the Gulf. Studies of such samples will not only add to our information of the distribution of the Chaetognatha but will increase our knowledge of the effects of water movement on the Gulf plankton generally.

## SUMMARY

Fourteen valid species of chaetognaths have been collected from the Gulf of Mexico. Five of

these were from the waters of the west coast of Florida. Only one, *S. enflata*, was common to the inshore and offshore samples. The distribution of some of the neritic species are in certain cases well defined and decidedly limited in their offshore range.

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