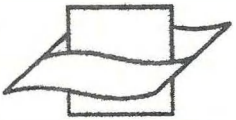
FREE-LIVING NEMATODES AND OTHER SMALL INVERTEBRATES OF PUGET SOUND BEACHES

BY WOLFGANG WIESER



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To Joy, Thomas, and Jane

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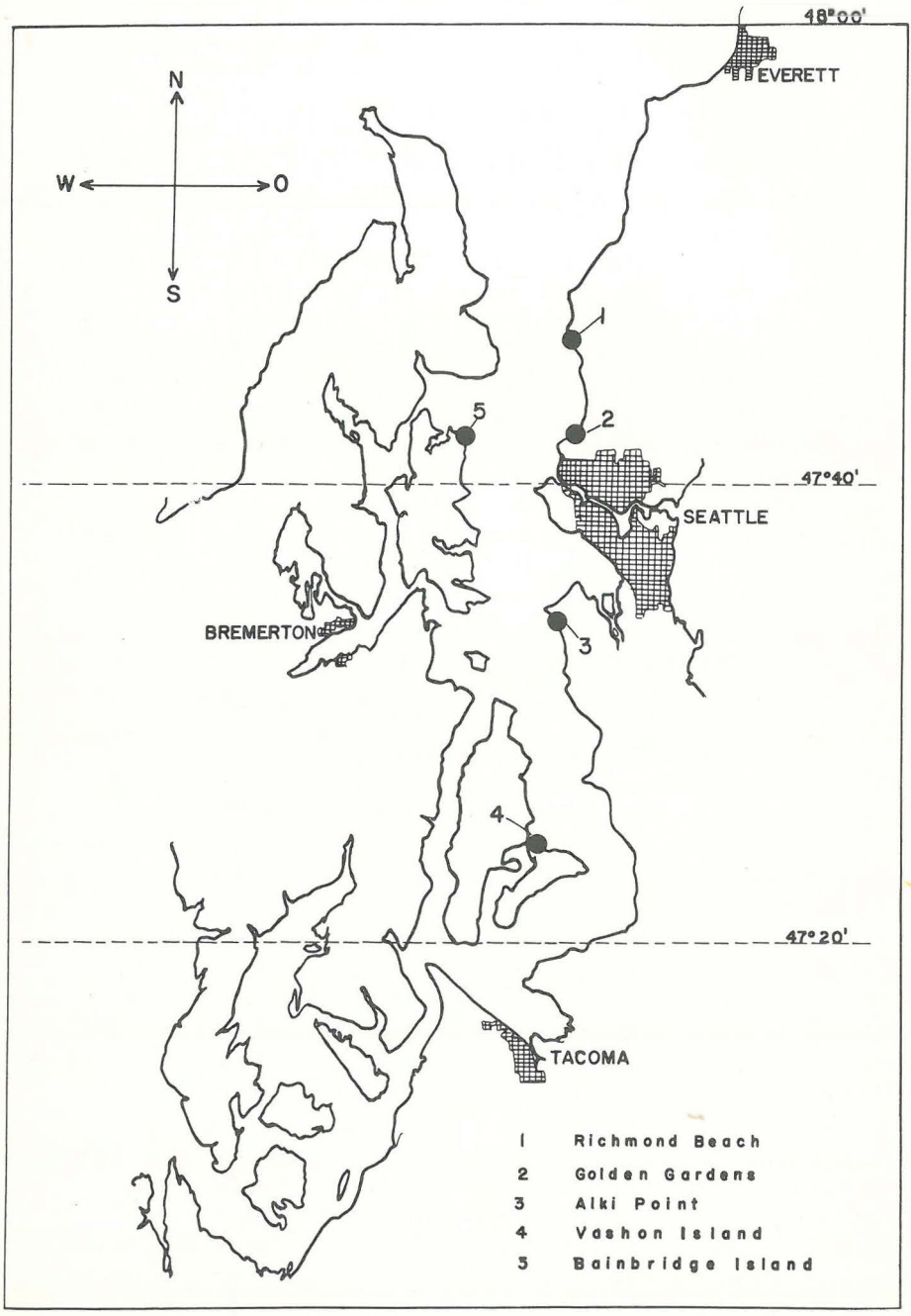

Puget Sound with localities investigated

INTRODUCTION

The sandy shores of the sea are populated by a rich and exciting fauna. Most visitors to marine beaches--be they tourists, naturalists, or fishermen--will be familiar with such conspicuous objects as sand dollars, moon snails, and basket cockles. However, the fact that side by side with these collectors' items there lives an even richer and more diversified fauna of minute invertebrates, most of them visible only through the microscope, never attracts the attention of the layman and only very rarely that of the scientist. This lack of interest belies the scientific importance of these small animals some of which belong to the most fascinating group of creatures to be found in the sea, for example, the Mystacocarida, representatives of a primitive subclass of crustaceans (Pennak and Zinn, 1943), or the macrodasyoid gastrotrichs (Remane, 1936). Moreover, the abundance both in individuals and in species of this so-called meiofauna presents a continuous challenge to the ecologist and the population geneticist, and the physiologist is likely to find problems of far-reaching consequences in the adaptations of these animals to their specialized habitats.

In Europe, Remane and his school in Kiel began to explore systematically the sand inhabiting meiofauna about thirty years ago. Smaller centers of similar research have sprung up in France (Banyuls-sur-Mer, Roscoff), in Italy (Pisa), and work on various groups of these animals has been undertaken in most other countries with access to the sea.

In the United States, with its 9,000 miles of coastline, some sporadic efforts have been made, such as the investigation of the psammobic copepods by Wilson (1932, 1935) and Pennak (1942), but in general it can be said that the study of the marine meiofauna has been neglected in this country. Gastrotrichs and archiannelids were not known from American shores until very recently. We are ignorant concerning some other small groups like psammobic hydrozoans, bryozoans, and tardigrades. A few nematodes from beaches have been described by Cobb (1920), Chitwood (1936a,b, 1937, 1951), Allgén (1947) , and Timm (1952), but it can be said with confidence that the vast store of species to be expected in this habitat has hardly been touched.

Ostracods are little known (see Tressler, 1940) and even in the larger and somewhat better known groups, like polychaetes, amphipods, and cumaceans, new findings can be expected whenever a sample of sand is taken to the laboratory and examined under the microscope. To correct this situation a deliberate effort should be made to study these animals more adequately. This would reflect not only on the status of zoology in the United States but also be of great value to marine biologists in other countries, who thus far have been unable to draw zoogeographical and more general ecological conclusions on the psammobic meiofauna because of the near absence of data from countries outside Europe.

Puget Sound seems to be ideally suited for a start in this direction. There one finds in a relatively small area and under homogeneous temperature conditions a great number of beaches with substrates ranging from very coarse to very fine sand and mud. The macrofauna is reasonably well known and extremely rich. There are excellent laboratory facilities at a small distance from the shore, notably those of the Department of Zoology of the University of Washington in Seattle and the Friday Harbor Laboratory on San Juan Island.

It was therefore with great enthusiasm that between October, 1955, and August, 1956, the author embarked on a detailed study of the meiofauna of some Puget Sound beaches while holding a fellowship of the International Cooperation Administration.

I wish to thank the whole staff of the Department of Zoology at the University of Washington, particularly the Director, Dr. A. W. Martin, and Dr. Paul Illg, for the kindness with which I was received in Seattle, the generosity with which my project was supported, and the open and warm spirit prevailing at the department which made the work there a pleasant task.

The results obtained so far justify the initial enthusiasm. Several new gastrotrichs and archiannelids could be described (Wieser, 1957a, b); the interesting hydrozoan *Protohydra leuckarti* was encountered quite frequently (Wieser, 1958a); new harpacticoid copepods were found and are to be described by Professor Chappuis from Toulouse, France. The material also contained a new species of polychaete (*Podarke* sp.) and a new amphipod (*Synchelidium* sp.), which await description.

Ecologically the relationship between grain size and the distribution of certain species could be elucidated (Wieser, 1956a, 1959. However, by far the most voluminous contribution emerging from the material collected proved to be the study of

the nematode fauna. Altogether 106 species were found, 76 of which are new, including two new genera. A taxonomic treatment of this fauna is presented in Part I of this volume. Part II is devoted to an ecological analysis of the whole fauna as far as this is possible with our incomplete knowledge of most of the species.

The help of specialists on whose data Part II also draws has already been acknowledged in Wieser (1959). I also want to thank my wife for her help, particularly in connection with the writing of the manuscript. A general account of the oceanographic features of the area under investigation can be found in Wang (1955) and University of Washington (1953b). The following remarks should suffice for the purpose of this paper:

Salinity. Puget Sound is on the average 1 to 3‰ lower in salinity than surface water in the open sea off the coast of Washington. In the central portion of the main basin, the salinity of surface waters varies from less than 27.5‰ in April and May to 30.0‰ in autumn months. Near the shore the inflow of rivers may reduce the salinity considerably. Since the salinity does not rise above 30.0‰, Puget Sound has to be considered a polyhaline area. For the discussion in part II the division of marine and brackish waters as given by Välikangas (1933) is adopted. The nomenclature used is as follows:

marine water	>30‰	
polyhaline water	≈15-30‰	
mesohaline water	3-≈15‰	} true brackish water
oligohaline water	0.5-≈3‰	

Temperature. In Puget Sound the surface waters measure about 14°C in summer and 8.5°C in winter.

Tides. As elsewhere along the Pacific Coast, the tide of Puget Sound is of the mixed type, the height difference between successive lows exceeding that between successive highs. "Within Puget Sound, the range of the tide and its characteristics vary considerably with both time and location. . . . The tides at Seattle have respectively mean and diurnal ranges of 7.6 and 11.3 feet, with the estimated highest and lowest tides (referred to mean lower low) being 14.8 and -4.5 feet, respectively. This gives an estimated range of 19.3 feet" (University of Washington, 1953b:105-6). All the indications of tidal height in the following pages are referred to mean lower low.

The Localities Investigated

Five localities were investigated: Richmond Beach, Golden

Gardens, Alki Point, Vashon Island, and Bainbridge Island (see map 1). Their position with respect to the general configuration of the shoreline and the direction and force of the currents is such that they represent a series of decreasing exposure, Richmond Beach being the most exposed, Bainbridge Island the most sheltered locality. The differences in exposure are reflected in the composition of the beach sand; Richmond Beach has, on the average, the coarsest sand, and Bainbridge Island the finest. The sand on Vashon Island and Bainbridge Island consists in large proportion of very fine, almost silty fractions, but the organic content is low. In each locality samples were taken along a transect, roughly between -2 and +8 feet. Five to nine samples were taken per locality, in most cases each sample representing a different level of intertidal height. For each sample the composition of grain sizes was determined by sieving the sand through a standard set of Tyler screens. In the following, a short characterization of the five localities and specification of each sample will be given. The average grain size is characterized by the "median diameter" (in μ), computed according to Krumbein and Pettijohn (1938).

1. *Richmond Beach*

Near the railway station. Most exposed locality. Flat, uninterrupted beach, without boulders.

Sample No.	Intertidal Height	Average Grain Size	Date
1	-2.5	200	5/13/57
2	0.5	269	4/23/57
3	3.0	294	3/17/57
4	5.0	270	6/17/57
5	6.0	254	4/7/57
6	7.5	384	5/5/57

2. *Golden Gardens*

On the northernmost edge of the public beach. Medium fine to coarse sand. Between 2 and 4 feet a belt of boulders and rocks, overgrown with *Mytilus* and barnacles. In the lower portion of the intertidal there are patches of *Zostera* in which no samples were taken. Above approximately the 3-foot level the beach is steeper than below it.

Sample No.	Intertidal Height	Average Grain Size	Date
7	-2.5	116	10/31/56
8	-1.5	147	6/22/57
9	-1.0	142	10/31/56
10	1.0	153	1/9/57
11	2.5	136	3/14/57
12	4.0	242	1/20/57
13	5.5	221	3/14/57
14	7.0	320	10/27/56
15	7.5	179	5/17/57

3. *Alki Point*

Between W. Oregon and W. Genesee streets. Medium fine to coarse sand. From 3.5 feet upward, the beach is covered with boulders and rocks, overgrown with seaweeds, barnacles, *Mytilus*, etc. In this zone the samples are derived from patches of sand between the boulders. In the lower portion of the beach there occurs the polychaet *Telepsavus costarum*, apparently an indicator of silty and fine sand. There is dense algal growth (*Nereocystis, Laminaria,* etc.) below low water.

Sample No.	Intertidal Height	Average Grain Size	Date
16	-2.5	105	5/12/57
17	0	116	4/11/57
18	2.0	117	2/10/57
19	4.0	252	6/13/57
20	5.0	210	12/20/56
21	7.0	207	6/29/57

4. *Vashon Island*

In front of the small bridge connecting the two parts of the island. Fine to medium fine sand. Boulders in the upper portion of the beach, *Zostera* and *Ulva* in patches in the lower portion. *Telepsavus costarum* reaching up to 5 feet.

Sample No.	Intertidal Height	Average Grain Size	Date
22	-1.0	93	2/22/57
23	0.5	101	5/25/57
24	3.0	109	5/25/57
25	4.5	109	2/22/57
26	7.0	144	6/29/57

5. *Bainbridge Island*

Northeast point of the island. The beach belongs to the Bainbridge Island State Park. Very fine to medium fine sand. Very coarse sand around 7-foot level. Gravel between 4.5 and 7 feet. *Telepsavus costarum* reaching up to 3-4 feet, patches of *Zostera* reaching up to zero level.

Sample No.	Intertidal Height	Average Grain Size	Date
27	-2.0	74	12/28/56
28	0	74	4/26/57
29	2.0	74	4/26/57
30	4.5	74	12/28/56
31	7.0	415	6/2/57

The taxonomic treatment of the nematodes found is patterned after my monograph of the Chilean nematodes (Wieser, 1953, 1954b, 1956b). Keys will be given only for genera that were not dealt with in the Chilean paper or for those in which important taxonomic changes have taken place since completion of that paper. All the details concerning the taxonomic and morphological terminology that were outlined in Wieser (1953, pp. 4-8) hold equally well for this study.

All species found will be mentioned here, and all but very few of the best-known cosmopolitan species will be described and figured.

PART I

THE TAXONOMY OF THE FREE-LIVING NEMATODES

Family LEPTOSOMATIDAE

Anticoma acuminata Bastian

In my material, I frequently encountered typical representatives of this cosmopolitan species. As to the synonymy of the species, see Wieser (1953).

The tail of the females measured about 7 anal diameters.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 8 to -2 feet.

Family LAURATONEMATIDAE

Lauratonema Gerlach

Of this genus, the following four species were known up to the present: *L. reductus* Gerlach 1953, *L. adriaticus* Gerlach 1953, *L. hospitum* Gerlach 1954, and *L. originale* Gerlach 1956. My material yielded two new species, *L. mentulatum* and *L. pugiunculus*, each represented by one male.

L. mentulatum n. sp. is distinguished from all other species by the shape of the buccal cavity, which is spacious, cylindroid, 1.6 times as long as wide; and by the length of the body, the long cephalic setae, the well-cuticularized spicula, and the shape of the tail.

L. pugiunculus n. sp. is distinguished from the four old species by the presence of a short, plate-shaped gubernaculum, by the shape of the tail on which there occur ventral papillae, by the shape and length of the spicula, and by the occurrence of ventral gland and excretory pore.

Lauratonema mentulatum n. sp. (fig. 18a, b)

♂♂: L = 2.44 a = 54.2 b = 7.6 c = 15.2.

Body: diameter at end of esophagus 40 μ. No cervical or somatic setae. Cuticular annulation fine, conspicuous.

Head: diameter 18 μ. Labial papillae conical. Ten cephalic

setae, 19 + 14 μ long. Shape of amphids unclear, probably pocket-shaped, in front of lateral cephalic setae.
Buccal cavity spacious, 1.6 times longer than wide.
Esophagus cylindrical. Excretory pore 120 μ behind anterior end (48 μ in front of nerve ring).
Spicula blade-shaped, straight, 26 μ long. No gubernaculum or supplement.
Tail 5.2 anal diameters long. Anal diameter 36 μ.
Occurrence: Golden Gardens; 5.5 feet.

Lauratonema pugiunculus n. sp. (fig. 3a, b)
♂♂: L = 1.80 a = 60.0 b = 6.0 c = 18.0
Body naked, fairly cylindrical. Diameter at end of esophagus 28 μ.
Head: diameter 14 μ. Labial papillae conical, well developed. Ten cephalic setae, 11 + 9 μ long.
Shape of amphids not quite clear, probably pocket-shaped.
Cuticle finely striated. Excretory pore 114 μ behind anterior end, i.e., 42 μ before nerve ring. Ventral gland just in front of end of esophagus.
Buccal cavity small, conical. In the peribuccal tissue of the esophagus, several strands of darker color can be distinguished.
Spicula slender, more or less straight but with an S-like bend, 20 μ long. Gubernaculum small, thin.
Tail 6.8 anal diameters long, cylindrical, with three or four ventral papillae and several setae. Anal diameter 22 μ.
Occurrence: Golden Gardens; 5.5 feet.

Family ENOPLIDAE

In this collection I encountered representatives of two genera that I had not seen before, viz., *Rhabdodemania* and *Trileptium*. The latter genus certainly belongs to this family, and its position will be discussed below. The position of *Rhabdodemania* has been doubtful since the structure of the buccal armature is difficult to interpret. My single specimen of *R. illgi* n. sp. was in good condition, and I consider the "cuticular projections" so far described in this genus as being homologous with the teeth of other enoplid genera, and the three pairs of longer onchia as being homologous with the mandibles. This homologization presents no serious difficulty. Consequently the genus will be referred to the Enoplidae although it occupies a somewhat isolated position there.

A new genus, *Hyalacanthion,* will be established for three species hitherto referred to *Enoploides*.

Rhabdodemania

Of all species of *Rhabdodemania*, only *R. coronata* Gerlach has cephalic setae longer than one head diameter. From this species my new species is distinguished by the length of the first circle of cephalic setae which in *R. coronata* measure 16 μ, in *R. illgi* only 7 μ. All other characters seem to agree.

Rhabdodemania illgi n. sp. (fig. 2a, b)

♀♀: L = 4.90 a = 98.0 b = 9.8 c = 32.6 Vu = 61.2 per cent

Body naked with the exception of one pair of cervical setae. Diameter at end of esophagus 48 μ.

Head: diameter (at the end of second cephalic setae) 22 μ; attenuated. The anterior end is truncate. The lips are strongly developed, cushionlike. The first cephalic setae (4) measure 7 μ, the second (6) measure 24 μ.

Buccal cavity conical, 17 μ long, provided with three pairs of curved, stilettolike, weakly cuticularized mandibles that seem to be homologous with the mandibles of other Enoplidae, and three teeth (platelike projections). Inconspicuous folds can be distinguished in the anterior portion of the buccal cavity. There is a very weakly developed cephalic capsule.

Excretory pore probably on level with second circle of cephalic setae.

Tail of female 3.3 anal diameters in length, almost cylindrical, with round, protruded spinneret. Anal width 45 μ.

Occurrence: Richmond Beach; 5-6 feet.

The species is named after Dr. Paul L. Illg of the Department of Zoology, University of Washington, Seattle.

Enoplus

The new species described below belongs to group D.2. of my key in Wieser (1953) and is very closely related to *E. behringicus* Filipjev, from which it is distinguished especially by the longer and more slender tail (3.5 anal diameters as against 2.5) and by some differences in the structure of the spicula. In *E. behringicus*, the spicula are provided with two conspicuous ventral warts that are absent in *E. velatus* n. sp. In the latter species, the spicula are also extended distally and proximally, while

they are more or less regularly attenuated in *E. behringicus*.

I also found *E. paralittoralis* Wieser, which until then was known only from Chile. The Puget Sound specimens, however, differ from the Chilean ones in having a series of cuticular ridges that ventrally occupy the posterior half of the male tail. The taxonomic significance of this character is unknown, but I do not think it suffices to establish a new species or even a new variety.

Enoplus velatus n. sp. (fig. 4a-c)

♂♂: L = 5.42 a = 36.1 b = 5.4 c = 24.7

Body: diameter at end of esophagus 114 μ. Short setae all over body, especially in the anal region of the male.

Head: diameter 58 μ; of the usual shape, not globular. Lips small, provided with papillae. Ten cephalic setae, subequal, 19.5 μ long.

Cephalic capsule well developed. Mandibles 25 μ long. Amphids just in front of the cephalic suture, 12 x 8.5 μ.

Ocellar pigments approximately 72 μ behind anterior end.

Inner layers of cuticle dotted.

Spicula 156 μ = 1.7 anal diameters long, with velum. Shortly before the distal end spicula extended. There are no teeth or plates. Gubernaculum 48 μ long, triangular, with short, caudodorsal apophysis.

Supplement tubular, 60 μ long, 168 μ in front of anus.

Immediately posterior to the anus a tubular papilla is situated on the tail, another one at a distance of 150 μ from the anus.

Tail slender, 3.5 anal diameters long in males and juveniles.

Occurrence: Bainbridge Island, Vashon Island, Alki Point; -2.5 to 3 feet.

Enoplus paralittoralis Wieser (fig. 5a-c)

♂♂: L = 4.90 a = 37.0 b = 9.8 c = 32.6

Body short. Scattered setae present. Diameter at end of esophagus 120 μ.

Head: diameter 48 μ. Labial papillae conical. Cephalic setae 15.5 + 13 μ long. Mandibles 20 μ long. The small amphid is traversed by the cephalic suture.

No eyespots, but faint esophageal pigment can be seen in the anterior cervical region.

Spicula 120 μ long (143 μ in the type specimen). Gubernaculum complicated, of exactly the shape described in Wieser (1953, p. 65, fig. 32c).

Supplement 40 μ long, 150 μ in front of anus. A row of long,

stiff bristles extends from the anus to the anterior of the supplement.

Anal diameter 84 μ. Tail stout, approximately 2 anal diameters long. In males the posterior half of the tail is characterized by a series of cuticular ridges that were not observed in the Chilean specimens. A few scattered setae.

Occurence: Golden Gardens, Richmond Beach; 5.5-8 feet.

Distribution: Chile (Strait of Magellan, upper intertidal), Puget Sound. This species, so far, is confined to the upper intertidal of cold temperate regions.

Oxyonchus

I found a new species of the genus that is distinguished from all other species by the very much elongated cephalic setae and by the unusual shape of the buccal cavity. Also, the spicular apparatus offers some distinguishing features.

The second species of *Oxyonchus* found in Puget Sound remains uncertain, since only one female was encountered.

Oxyonchus culcitatus n. sp. (fig. 6a-c)

♀♀:	L = 2.67	a = 38.1	b = 3.7	c = 10.0	Vu = 61.1 per cent
♂♂:	3.03	50.5	4.3	18.0	
juv.:	2.02	36.7	3.4	9.2	

Body: diameter at end of esophagus 70 μ. Cervical setae in the anterior cervical region. In the male some of these setae are arranged in bundles.

Head: diameter in male 30 μ, in female 42 μ. Lips with velum, altogether 12 μ high. Labial setae 18 μ long, stout. Cephalic setae in male 68 + 37 μ long; in female the paired submedian setae stick together and form one seta 90-95 μ long. In the male there is a circle of subcephalic setae up to 25 μ long. On each side, between the labial and the cephalic setae, a long, well-developed cirrus is implanted. Cephalic capsule well developed, with opening for amphid. Immediately posterior to the cephalic capsule the cuticle of the body wall forms a cushionlike thickening.

Buccal cavity spacious, consisting of an anterior portion in which the armature is situated and a posterior portion that is funnel-shaped, thick-walled, about 35 μ deep. The 2 subventral teeth are 16-20 μ long. The dorsal tooth is very small. The two subventral mandibles are broad and each contains 25-30 denticles in the field between arc and horizontal bar. The

teeth are anchored to the mandibles in a complicated manner. Spicula semicircular, 66 μ long. Apophysis caudodorsal, 28 μ long.

Supplement small, 96 μ in front of anus.

Anal diameter 48 μ. Tail 4.2 anal diameters long in the male, 6.5 in the female. A few scattered setae.

Occurrence: Bainbridge Island, Golden Gardens; 6.5-8 feet and subterranean waters.

Oxyonchus sp. (fig. 7a, b)

♀♀: L = 4.67 a = 31.1 b = 5.8 c = 17.9 Vu = 51.1 per cent

Body: diameter at end of esophagus 114 μ. Cervical setae present.

Head: diameter 41 μ, lips low, labial setae 8 μ long. Cephalic setae 25 + 22 μ long. The cephalic organ is slightly elevated and is inserted close to the lateral labial seta. Cephalic capsule 23 μ high.

Buccal cavity conical. Mandibles measuring 25 x 18 μ, with 24 denticles. Subventral teeth not quite reaching to the anterior end of the mandibles.

Tail 4 anal diameters long. Anal diameter 73 μ.

Occurrence: Richmond Beach; -2.5 feet.

Enoplolaimus

Two new species belonging to this genus were encountered in my material. *E. lenunculus* n. sp. is related to *E. propinquus, derjugini, zosterae* (see Wieser, 1953, table on p. 74), from which species it is distinguished by the shorter cephalic setae, by the large cephalic organ (not mentioned in the old species), and particularly by the shape of the spicula, which are almost semicircular in *E. lenunculus* but rectangular in all other species.

The other species, *E. paralitoralis* n. sp., is very closely related to *E. litoralis* Schulz. Both these species are characterized by the elongation of the lateral setae, which may attain twice the length of the submedian setae. *E. paralitoralis* is distinguished from *E. litoralis* by some minor characters the taxonomic significance of which is difficult to evaluate. I am, however, inclined to think that they represent true species characters. The cephalic setae are shorter (lateral setae 62-64 μ as against 83-93 μ in *litoralis* according to Gerlach, 1952a). The shorter submedian setae measure less than 1/2 the length of the longer setae in *paralitoralis* but more than 1/2 the length of those in *litoralis*. The gubernaculum has a distal process that

has not been described for *litoralis*. Furthermore, the opening of the spinneret in *paralitoralis* is of a somewhat peculiar structure.

Enoplolaimus lenunculus n. sp. (fig. 8a-e)

♀♀: L = 3.46 a = 53.0 b = 5.7 c = 21.6 Vu = 57.3 per cent
♂♂: 2.55 46.4 5.4 25.5

Body: diameter at end of esophagus 58 μ (♀). Short cervical and somatic setae present.

Head: diameter 36-38 μ in female, 30 μ in male. Labial setae 12-15 μ long. Cephalic setae 48-54+19 μ in female, 42+12 μ in male. In the male there is a circle of subcephalic setae up to 22 μ long. The cephalic organ (fig. 8c) is unusually large, forming an irregularly shaped ellipse 15 μ long. The posterior edge of the cephalic capsule consists of a dense row of fine dots.

Buccal cavity: mandibles 23 x 14 μ in female, 16 x 12 μ in male, provided with two transverse posterior projections at the point where the mandible tips are joined to the mandible arc (fig. 8b). Teeth well developed. The cuticle in the anterior head region is not always as thick as shown in fig. 8a.

Spicula 46 μ, nearly semicircularly bent. Gubernaculum small, closely fitting the distal end of the spicula, without apophysis.

Supplement 90 μ in front of anus. A few long setae in this region.

Tail club-shaped, 3.3-3.5 anal diameters long. Anal diameter 36 μ in male, 48 μ in female. The opening of the spinneret is situated at the end of a narrow tube.

Eggs 275 x 40 μ.

Occurrence: Bainbridge Island, Alki Point; 4-6.5 feet.

Enoplolaimus paralitoralis n. sp. (fig. 9a-e)

♀♀: L = 2.08 a = 46.2 b = 5.2 c = 16.0 Vu = 57.1 per cent
♂♂: 1.67 42.0 4.5 17.0

Body: diameter at end of esophagus 38-44 μ. Scattered short cervical and somatic setae present.

Head: diameter in male 19 μ, in female 22 μ. Lips 8.5 μ high. Labial setae 11-12 μ. Cephalic setae: submedian setae 38+18 μ, lateral setae 62-66 μ long, distal end truncate. Subcephalic setae in male up to 16 μ long. Cephalic capsule 13 μ high, suture faint.

Buccal cavity: mandibles 13 x 75 μ, provided with posterior projections as in the foregoing species.

Spicula 32 μ long, rectangularly bent, cephalated proximally.

Gubernaculum 10 μ long, straight, with a hook-shaped distal end.

Supplement 75 μ in front of anus. Scattered short setae in this region.

Tail club-shaped, 3.8-4.8 anal diameters long. Anal diameter 27 μ. As in the foregoing species, the opening of the spinneret is situated at the end of a narrow tube (fig. 9c).

Eggs 250 x 50 μ.

Occurrence: Bainbridge Island; 6.5 feet.

Remarks: both new species of *Enoplolaimus* are characterized by the projections on the mandibles and by the peculiar opening of the spinneret. Similar projections seem to be known from *E. propinquus*. It would be interesting to know how typical a character both the mandibular projections and the spinneret opening are within the genus *Enoplolaimus*.

Mesacanthion

Four species of this genus are represented in my material. For this reason it may be useful to emend the whole key given in Wieser (1953).

1 Posterior portion of buccal cavity almost cylindrical, with rounded pockets at base.
2 Tail blunt, conical or cylindroconical.
3 Cephalic setae 1/3 of head diameter long:
M. hawaiiensis (Allgén 1951), insufficiently described.
3' Cephalic setae 4/5 of head diameter long or more.
4 No ocelli, no supplement (in both species?):
M. infantilis (Ditlevsen 1930). Buccal cavity 1.3 head diameters deep (60 μ); tail conical, with six distal setae.
M. cricetoides n. sp. Buccal cavity not more than 1 head diameter deep (40 μ); tail cylindroconical, without distal setae.
4' With ocelli, with supplement:
M. virilis (Ditlevsen 1930).
2' Tail slender, posterior third almost filiform:
M. pacificus (Allgén 1947).
1' Buccal cavity conical, without pockets.
5 Longest cephalic setae more than twice the head diameter in length. Shorter cephalic setae measuring less than 1/10 the length of the longer ones. Labial setae measuring more than 1/2 the head diameter:
M. pali n. sp.

5' Both cephalic setae and labial setae much shorter than in the foregoing species. The short submedian cephalic setae never measuring much less than 1/2 the length of the long ones.

6 Gubernaculum close to the spicula, with small, dorsally pointing apophysis:

M. longissimesetosum Wieser 1953. Length (♂♂) = 3.76; spicula weakly curved; posterior fifth of tail cylindrical.

M. karensis Filipjev. Length (juv. ♂) = 1.75; spicula rectangularly bent; posterior half of tail cylindrical.

In Wieser (1953) I failed to stress the close resemblance of these two species. They are distinguished from the species of the following group especially by the weakly developed apophysis, but also by the somewhat longer cephalic setae.

Another species related to the two species above is *M. hirsutum* Gerlach 1952, which is distinguished by the much elongated tail and by the long somatic and cervical setae.

6' Apophysis of gubernaculum strongly developed, pointing caudodorsal.

7 Males with flaplike appendages in anterior cervical region (transformed cervical setae):

M. pannosum n. sp.: spicula 135 μ; cephalic setae 24+22 μ.

7' No such flaplike appendages known:

	Spicula	Cephalic setae
M. ditlevseni Filipjev	87-100 μ	21-26 μ+2/3
M. breviseta Filipjev	165 μ	20 μ+3/4
M. maior Filipjev	80 μ	40 μ+2/3
M. audax (Ditlevsen)	?	(longer than one head diameter)

As can be seen, *M. pannosum* is distinguished from the group of species above not only by the occurrence of the flaplike appendages, but also by differences in the dimensions of spicula and cephalic setae. There are two more species that are distinguished from all others by their long spicula that measure 8 anal diameters in *M. diplechma* (Southern) and 3 anal diameters in *M. longispiculum* Gerlach 1954.

In Wieser (1953) I also mentioned a number of species, of which only females are known, that are distinguished from all other species by various more or less well defined characters. These species are: *M. conicus* (Filipjev), *M. banalis* Filipjev, *M. lucifer* Filipjev, *M. ungulatum* Wieser. My fourth species from Puget Sound also is represented by females only. It is

quite definitely a new species, the main distinguishing features being the point of articulation and the length of the cephalic setae, the great difference in length between the long and the short submedian cephalic setae, the shape of the mandibles, and the shape of the short tail.

In *M. arcuatilis* n. sp., the cephalic setae articulate near the posterior edge of the cephalic capsule, while in all other species of *Mesacanthion* the point of articulation is either in the middle or near the anterior end of the cephalic capsule. In this respect the species occupies an intermediate position between the genera *Mesacanthion* and *Enoplolaimus*. The lips are striated, a character that is also unusual for *Mesacanthion*. Thus, without knowing the male it can be concluded that *M. arcuatilis* is a species that deviates from the typical representatives of the genus in at least two characters.

Mesacanthion pali n. sp. (fig. 10a, b)

♂♂: L = 2.16 a = 54.0 b = 3.3 c = 15.4

Body almost cylindrical. Diameter at end of esophagus 41 μ. Scarce cervical and somatic setae present. Cuticle finely striated.

Head: diameter 40 μ. Lips 9 μ high. Labial setae stout, 24 μ long. Cephalic setae 84 + 8 μ, the long ones stout, the short ones slender. Cephalic capsule regular, cylindrical, 26 μ high. Behind the cephalic capsule the cuticle is at first 6 μ thick, narrows gradually to 2.5 μ.

Buccal cavity: mandibles 25 μ long. The posterior straight portion of the teeth is very long.

Spicula 62 μ long. Gubernaculum with well developed apophysis, 26 μ long. Supplement 31 μ long, distally with three ridges, 78 μ in front of anus.

Tail club-shaped, 2.8 anal diameters long. Anal diameter 48 μ. A few scattered setae present.

Occurrence: Alki Point; subterranean water.

Mesacanthion arcuatilis n. sp. (fig. 11a, b)

♀♀: L = 3.88 a = 48.5 b = 4.6 c = 21.6 Vu = 61.5 percent

Body: diameter at end of esophagus 65 μ. Scarce cervical setae.

Head: diameter 55 μ. Lips 13 μ high, striated as in *Enoploides*. Labial setae 18 μ. Cephalic setae 72 + 25 μ long. Cephalic capsule 36 μ high. Amphid situated sublaterally.

Buccal cavity: mandibles broad, with long and curved tips, 26 μ long.

Teeth less than 1/2 the height of the mandibles. Esophagus pigmented in anterior cervical region.

Tail club-shaped, 3 anal diameters long. In juveniles the setae are more slender and the tail is longer and more slender.

Occurrence: Alki Point; 6.5 feet.

Mesacanthion pannosum n. sp. (fig. 12a-d)

♀♀: L = 4.22 a = 32.5 b = 6.0 c = 15.0 Vu = 46.7 per cent

♂♂: 4.10 41.0 6.3 13.7

Body: diameter at end of esophagus 110 μ in female, 86 μ in male. Few, scattered cervical setae in female. In male there are two circles of cervical setae and two flaps on each side of the body. The flaps are transformed cervical setae that can be paired or unpaired (fig. 12b).

Head: diameter 35 μ (at end of cephalic capsule 44 μ) in female, 30 μ in male. Lips high. Labial setae 11-12 μ, slender. Cephalic setae 24-25 + 22 μ. Cephalic capsule 17 μ high, well developed. Cephalic organ elevated (fig. 12a), sublaterally situated. Amphid just behind lateral cephalic seta.

Buccal cavity 19 μ high in female, 16 μ in male. Teeth about 1/2 the height of the mandibles.

Spicula 135 μ long, cephalated proximally. Gubernaculum strong, with powerful dorsal apophysis, 66 μ long.

Supplement 54 μ long, 180 μ anterior of anus.

Tail 3 anal diameters long in male, 4 in female, posterior 1/7-1/8 digitated. In male a few scattered setae are present. Anal diameter 63 μ in female, 90 μ in male.

Occurrence: Alki Point; -2.5 feet.

Mesacanthion cricetoides n. sp. (fig. 13a, b)

♀♀: L = 4.08 a = 31.4 b = 5.8 c = 17.7 Vu = 52.4 per cent

Body: diameter at end of esophagus 112 μ. Only 2 cervical setae behind the cephalic capsule.

Head: diameter 40 μ, conical. Lips rounded. Labial setae 10 μ long, very stout. Cephalic setae 36 + approx. 25 μ long. Cephalic capsule 22 μ high.

Buccal cavity: posterior portion cylindrical, with pockets. Mandibles 19 μ long.

Tail conicocylindrical, 3.4 anal diameters long. Anal diameter 67 μ.

Occurrence: Richmond Beach; -2.5 feet.

Hyalacanthion n. gen.

Two species of *Enoploides* are known which in the structure of the mandibles differ radically from all other species of this genus, in which the mandibles are solid. In *E. pellucidus* Saveljev and in *E. murmanicum* Saveljev, however, only the outer portions of the mandibles are solid, while the middle portion consists of a thin, transparent lamella. In my Puget Sound material, I found a third species of this type and feel justified in establishing a new genus for these three species; the type species is here designated in *H. multipapillatum* n. sp., below.

Hyalacanthion is characterized by the structure of the mandibles and by the short spicula. It is also very closely related to *Epacanthion* Wieser in which the outer portions of the mandibles are completely separated. It is not always easy to establish the presence or absence of the middle transparent lamella on the basis of data from the literature. However, *Epacanthion* is also characterized by the elongated spicula that never measure less than 2.5 anal diameters.

The key to the species reads as follows:

1 Male with 9 preanal tubular supplements:
H. multipapillatum n. sp. Type!

1' Male with 1 supplement (not mentioned in *H. murmanicus).*

2 Tips of the mandibles 3 times the width of the shaft apart. Cephalic setae 1 head diameter long. Gubernaculum reduced (Wieser, 1953):
H. pellucidus (Saveljev).

2' Tips of the mandibles twice the width of the shaft apart. Cephalic setae 1/2 the head diameter long. Gubernaculum present:
H. murmanicus (Saveljev).

Hyalacanthion multipapillatum n. sp. (fig. 14a-f)

♀♀: L=3.42 a=42.8 b=4.5 c=14.5 Vu=55.6 per cent

♂♂: 3.16 48.6 4.9 15.0

Body: diameter at end of esophagus 70 μ. Cervical setae up to 20 μ long.

Head: diameter 40 μ in females, 34 μ in males. Lips high, faintly striated. Labial setae 12 μ long. Cephalic setae 30+

21 μ. In male there are 20 subcephalic setae arranged in two circles. Cephalic capsule 16 μ high.

Buccal cavity: mandibles broad; tips twice the width of the shaft apart, 14-18 μ long; claws very strong (fig. 14c). Teeth measuring approximately 1/2 the length of the mandibles.

Esophagus pigmented in the anterior region.

Spicula 43 μ=1 anal diameter long. Proximally cephalated, distally provided with five ridges. Gubernaculum 1/2 the length of the spicula, with small dorsal apophysis.

There are 9 short, tubular supplements, an unusual feature for the family Enoplidae.

Tail 5.5 anal diameters long.

Occurrence: One of the most abundant species on the beaches of Puget Sound, Vashon Island, Alki Point, Golden Gardens, Richmond Beach; 8 to -2.5 feet.

Mesacanthoides

In Wieser (1953) I held that *Mesacanthoides* is represented by only two species, viz. *M. latignathum* (Ditlevsen) and *M. sculptilis* Wieser. I overlooked, however, that also in *Enoplolaimus caput medusae* Ditlevsen the mandibles are of the shape typical for this genus and quite different from those of *Enoplolaimus*. Thus, together with a new species described below, the genus *Mesacanthoides* comprises four species that are easily distinguished by the male genital apparatus.

Gubernaculum reduced, no supplement:
M. latignathum (Ditlevsen).

Gubernaculum plate-shaped, without apophysis; small, tubular supplement present. Head with 4 circles of cephalic setae:
M. caput medusae (Ditlevsen).

Gubernaculum S-shaped, with small apophysis; small, tubular supplement present. Head with the usual arrangement of cephalic setae (although in the male, there are 3 circles of subcephalic setae):
M. sinuosus n. sp.

Gubernaculum with long caudal apophysis: supplement solid, wrench-shaped, extremely powerful:
M. sculptilis Wieser. Type!

Besides these four species it is not impossible that *Enoplolaimus subterraneus* Gerlach 1952 also belongs to *Mesacanthoides*.

However, the structure of the mandibles is not quite clear in this species.

Mesacanthoides sinuosus n. sp. (fig. 15a-c)

♀♀: L = 3.87 a = 77.4 b = 5.5 c = 32.3 Vu = 57.7 per cent

♂♂: 3.40 75.6 5.7 ≈34.0

Body: diameter at end of esophagus 46 μ. Scattered cervical setae present.

Head: diameter 37-38 μ. Lips unstriated, 7 μ high. Labial setae 10-11 μ long (17 μ in one single specimen). Cephalic setae in usual arrangement, 41 + 18 μ long in male. In male there are also 3 circles of subcephalic setae, those of the first circle measuring 36 μ, of the second 13 μ, and of the third 48 μ. These setae are arranged in 8 longitudinal rows. Cephalic capsule about 20 μ high. The amphids are slightly raised.

Buccal cavity: mandibles solid, 19 μ high. There is an anterior median segment that is set off from the remainder of the mandible by 2 diagonal edges which run from the tips of the mandible to the tip of the tooth. This structure is characteristic for the whole genus. Mandibular tips with small dorsal apophyses. The mandibles are connected by a characteristic stomodaeal ring. Teeth 13 μ high.

Spicula 66 μ long, bent proximally. Gubernaculum S-shaped, tubular, with small dorsal apophysis. The distal curvature is not always as pronounced as shown in fig. 15b.

Supplement small, tubular, 85 μ in front of anus.

Tail stout, 2.8-3.6 anal diameters long, with scarce setae. Anal diameter 40-45 μ.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 4 to -2.5 feet.

Enoploides

The species described below is distinguished from the majority of other species by the length of the spicula (1.7 times the tail length) in combination with the long cephalic setae and the high lips. The same combination of characters occurs in *E. brunettii* Gerlach, which, however, is distinguished from my new species by the absence of teeth, the shorter spicula (190 μ as against 290 μ), differences in the shape of the gubernaculum, and the more slender tail.

Enoploides harpax n. sp. (fig. 16a-c)

♀♀: L=3.69 a=36.9 b=4.3 c=20.0 Vu=58.0 per cent

♂♂: 4.15 50.0 4.4 27.7

Body: diameter at end of esophagus 81 μ. Very few cervical setae.

Head: diameter 48 μ in female, 54 μ in male. Lips high, conspicuously striated. Labial setae 25 μ. Cephalic setae 62 + 28 μ in male; longest setae in female 55 μ. Cephalic capsule low, weakly developed.

Buccal cavity: mandibles with strong claws, 25 μ high; shaft 5 μ wide. Teeth well developed.

Esophagus strongly muscular in the anterior portion.

Spicula 290 μ=1.7 tail lengths, with diagonal reinforcement. The spicula glide in a complicated gubernaculum that distally is provided with 2 hooks. Supplement tubular, simple, 120 μ in front of anus.

Tail 3.5-4 anal diameters, club-shaped. Anal diameter 50 μ in male.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 6.5 to -2.5 feet.

Trileptium Cobb, 1933
= *Trilepta* Cobb, 1920

In Wieser (1953) the genus *Trileptium* was not included in my treatment of the Enoplidae. This was because of the lack of personal acquaintance with representatives of this genus. From the literature known at that time it was impossible to come to a definite conclusion as to the systematic position of the genus. In 1952 Gerlach described a new species and mentioned the relationship of *Trileptium* to *Enoplolaimus*. Gerlach did not, however, see any teeth in the buccal cavity. In 1955 the same author added another species, *T. salvadoriense*, in which teeth were seen, and thus the relationship to *Enoplolaimus* was confirmed. My Puget Sound material yielded one species, which I unhesitatingly refer to *Trileptium* although the buccal armature is still more strongly developed than in *T. salvadoriense*.

In a way, *Trileptium* is a parallel genus to *Enoplus*. These two are the only enoplid genera with low lips, and in both, one component of the buccal armature dominates to the complete or near exclusion of the other component. In *Enoplus* there are only mandibles, the teeth being completely reduced. In *Trileptium* the teeth are the main functional element, while the mandibles

are more or less reduced or, perhaps, partly transformed into the supporting frame of the teeth. The dorsal tooth was described by Cobb in *T. guttata,* but no subventral teeth were seen in this species or in *T. subterraneum* Gerlach. All three teeth were observed in *T. salvadoriense* and in my new species, also, all three teeth are clearly visible.

Apart from the differing visibility of the teeth, the four species known are separated by several other features:

1 Supplement present, tubular. Gubernaculum with caudal apophysis:
T. subterraneum Gerlach.

1' Supplement reduced or absent. Gubernaculum absent or parallel to spicula.

2 Supplement reduced to a cuticular disc. Gubernaculum absent. Spicula more than 2 anal diameters long:
T. iacobinum n. sp.

2' Supplement absent. Gubernaculum small, parallel to spicula. Spicula not more than 1.5 anal diameters long.

3 a = 200:
T. guttata Cobb.

3' a = 61-77:
T. salvadoriense Gerlach.

Trileptium iacobinum n. sp. (fig. 17a-c)

♀♀: L = 2.75 a = 54.1 b = 5.4 c = 20.8 Vu = 61.1 per cent
♂♂: 2.25 58.5 ? 26.0

Body: diameter at end of esophagus 50 μ. Cervical setae present.

Head: diameter 18-20 μ. Lips low. Labial setae 4 μ long, stout. Cephalic setae 38 + 12 μ in female; longest cephalic setae in male 30 μ. In the male there is a circle of 20 subcephalic setae, up to 15 μ long. Cephalic capsule weak, 10 μ high.

Buccal cavity: subventral teeth reaching with their tips to the anterior end of the head. Distally they are cuticularized and provided with a small cusp. The dorsal tooth is a simple cuticular projection. Mandibles weakly developed, probably partly transformed into a frame supporting the teeth.

Nerve ring at 28 per cent of the esophagus.

Spicula 66 μ long, curved. No gubernaculum. 30 μ in front of the anus there is a cuticular plate that might be a transformed tubular supplement. Between this plate and a similar but

weaker one just below the spicula there is a bundle of muscular fibrils.

Tail 3.2-3.6 anal diameters long. Anal diameter 36 μ in female, 29 μ in male.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 0 to -2 feet.

Family IRONIDAE

Dolicholaimus benepapillosus (Schulz 1935) (fig. 19a, b)

♀♀: L = 2.49 a = 35.6 b = 8.3 c = 27.7 Vu = 55.0 per cent

♂♂: 2.63 37.6 8.7 33.0

Body: diameter at end of esophagus 62 μ. Small papillae present in the anterior cervical region. Cuticle up to 7.5 μ thick.

Head: diameter 32 μ, conical, set off from the cervical region by a distinct groove. Six labial papillae near the end of the lips. The 10 cephalic papillae are conical, stout, situated at the base of the head. Amphids cup-shaped, 16 μ = 1/2 the head diameter wide.

Buccal cavity: in the anterior portion there is a field of tiny denticles. Similar fields are known from other rapacious species. No mention was made of this field in Schulz's description. The 3 teeth and apophyses are well developed, altogether measuring 60 μ in length There is a conspicuous break between the peribuccal and the esophageal tissues. The esophagus is enlarged posteriorly.

Spicula 50 μ long, very wide. Gubernaculum thin, with distal plate.

Supplement 180 μ in front of the anus in the form of a cuticular disc from which some epidermal strands reach through the cuticula. Between the supplement and the anus there are 2 papillae. More papillae are situated on the tail.

Tail conical, in male 84 μ = 1.75 anal diameters long. Anal diameter 48 μ.

Occurrence: Bainbridge Island, Richmond Beach; 5-6.5 feet.

Distribution: Baltic (Kiel), North Sea, Mediterranean, Portugal. This is a species that often occurs in subterranean waters on the beach.

Remarks: Schulz's description of this species is based on juveniles and females only. No details of the structure of the head and buccal region were given. However, my specimens agree in every respect with the little that is known of the species.

Anoplostoma viviparum (Bastian)

My specimens are typical representatives of this old European species.

♀♀: L = 1.47 a = 40.0 b = 4.6 c = 7.8 Vu = 43.4 per cent

Head: diameter 9 μ. Labial papillae conical. Longest cephalic setae 11 μ. Amphids 26 μ behind anterior end = 2 buccal lengths.

Buccal cavity 13 μ long. I saw 2 transverse rings just as I described for *A. camus* in Wieser (1953).

Spicula 55 μ long.

Tail in female 5 anal diameters long.

Occurrence: Vashon Island; 7 to -1 feet.

Oncholaimus

Four species of this genus are represented in my material, two of them, *O. campylocercoides* and *O. brachycercus*, are old European species; the other two are new. The two new species are related to the group *O. steinböcki-O. paralangrunensis* (see Wieser, 1953, table on p. 111). They are distinguished from all species of this group by the longer and more numerous circum-anal setae and by differences in the shape of the tail. There are several other characters by which either of the two species is distinguished from the rest of the group, such as the postanal papilla in *O. martini* and the structure of the demanian organ in *O. apostematus*.

Oncholaimus campylocercoides De Coninck and Stekhoven (fig. 20a-d)

= *O. campylocercus*. Filipjev 1918 nec De Man

♀♀:	L = 4.48	a = 74.6	b = 10.0	c = 34.5	Vu = 64.4 per cent
♀♀:	4.48	56.0	8.1	33.5	63.4
♂♂:	3.54	59.0	7.4	39.3	

Body: diameter at end of esophagus 66 μ. Cervical setae present.

Head: diameter 29-31 μ. Lips distinct, labial papillae conical. Cephalic setae 7-8.5 μ long. Ampids 11 μ wide = 30 per cent of head diameter.

Buccal cavity 32-36 μ long, 20-23 μ wide, walls thick.

There is a great variation in the position of the excretory pore, the distance from the anterior end ranging from 72 to 135 μ.

The following distances were found: 72 μ (♂), 78 μ (♀), 112 μ (♀), 114 μ (♀), 126 μ (♀), 135 μ (♂).

Demanian organ well developed, opening not quite clear. Eggs 100 μ long.

Spicula 36-38 μ long, almost straight. No gubernaculum. In front of the anus there is a big papilla. There are 7-9 circumanal setae. In the middle of the tail two setose papillae can be seen.

Tail first conical, then cylindrical, bent in the male, 2.8 anal diameters long in the male, 3.5-4 anal diameters in the female.

Occurrence: Vashon Island, Alki Point, Golden Gardens; 6 to -2.5 feet.

Distribution: Black Sea, Mediterranean, North Sea.

Remarks: My specimens agree in all essential points with the data given by Filipjev (1918) and by Gerlach (1951c, 1952a). Only the position of the excretory pore is subject to greater variation than has been observed previously. This great variation also renders useless the distinction between group 2a and 2b in my previous key (Wieser, 1953, p. 110).

Oncholaimus brachycercus De Man (fig. 21a-c)

♀♀: L = 3.96 a = 50.0 b = 7.9 c = 36.0 Vu = 65.0 per cent

♂♂: 3.43 57.1 7.4 43.0

Body: diameter at end of esophagus 58 μ. Scattered cervical setae present.

Head: diameter 31-33 μ. Lips and labial papillae distinct. Cephalic setae 8.5-10 μ long. Amphids in male 12 μ = 1/3 of head diameter wide.

Buccal cavity 36 x 23 μ. Longest tooth 26 μ long.

Excretory pore 55-63 μ behind anterior end.

Demanian organ present (between vulva and anus).

Spicula of varying length. Figure 21c represents the specimen with the longest (50 μ) and most slender spicula. Other specimens had spicula measuring 36, 38, and 43 μ. The length is never much more than 1 anal diameter. No gubernaculum. There are 9 long circumanal setae.

Tail stout, bent in the middle, 2-2.5 anal diameters long. Shortly before the tip there is on the ventral side a characteristic group of 2 setae. Another characteristic seta is one of medium length at the tip of the tail.

Occurrence: Richmond Beach, Golden Gardens, Alki Point, Bainbridge Island; 4-7.5 feet and subterranean water.

Distribution: Baltic, North Sea, Arctic Ocean. Known also from subterranean water.

Oncholaimus martini n. sp. (fig. 22a-c)

♀♀: L = 4.07 a = 58.1 b = 8.1 c = 34.0 Vu = 78.1

♂♂: 3.89 64.8 7.8 43.2

Body: diameter at end of esophagus 56 μ. Few cervical setae present.

Head: diameter 30 μ. Labial papillae very small. Cephalic setae 5-6 μ long. Amphids 10 μ = 30 per cent of corresponding diameter wide.

Buccal cavity 36 x 20 μ.

Excretory pore 42-48 μ behind anterior end.

Demanian organ well developed, as in *O. campylocercoides* (fig. 20d); opening between moniliform cells and vulva.

Spicula 51 μ = 1.25 anal diameters long. No gubernaculum. There are 9 circumanal setae of medium length.

The last third of the male tail is outwardly bent. At the point of inflexion there is a conical papilla on the ventral side. More setae along the tail. Anal diameter 37-40 μ. Length of tail 2.5 anal diameters in male, 3.5 anal diameters in female.

Occurrence: Golden Gardens, Richmond Beach; -2.5 to 5.5 feet.

The species is dedicated to Dr. Arthur Martin, Chairman of the Department of Zoology at the University of Washington, Seattle, Washington.

Oncholaimus apostematus n. sp. (fig. 23a-c)

♀♀: L = 3.20 a = 42.7 b = 6.7 c = 24.5 Vu = 78.1 per cent

♂♂: 2.68 40.9 ≈9.5 26.0

Body: diameter at end of esophagus 68-70 μ. Few cervical setae present.

Head: diameter in one male 29 μ, in one female 34 μ. Labial papillae small but distinct. Cephalic setae 5-6 μ long. (In fig. 23a the head is viewed obliquely; thus the cephalic setae appear implanted more posteriorly than they really are.) Amphids 10-11 μ = 27-30 per cent of corresponding diameter wide.

Buccal cavity 36 x 24 μ in one male, 40 x 24 μ in one female.

Excretory pore 68-84 μ = 1.9-2.1 stomatal lengths behind anterior end. Ampulla small.

Demanian organ present, unusual, since 190 μ in front of the

anus there is a region in which many pouchlike structures with openings to the outside can be seen (fig. 23e). These pouches are subepidermal and send their ducts through the cuticle. Both pouches and openings are partly cuticularized.

Spicula 34-41 μ long. There seems to be a very thin gubernaculum present. The 10-12 circumanal setae are fairly long. Several scattered setae can be seen on the tail, but there are no postanal, ventral papillae.

Tail 3.3-3.8 anal diameters long in males, 4 anal diameters in females; 1/2 to 2/3 of the tail is cylindrical. Anal diameter 31-36 μ.

Occurrence: Vashon Island; 3-7 feet.

Oncholaimium

This genus is mainly characterized by the big postanal papilla on the male tail.

My new species described below belongs to the group around *O. oxyuris* (see Wieser, 1953, key on p. 118), from which it is distinguished by the strong attenuation of the male tail immediately behind the anus, the position and number (only 6) of the circumanal setae, and the position of the postanal papilla, which in my species is situated in the middle of the tail but in the last third of the tail in all other species.

Oncholaimium vesicarium n. sp. (fig. 24a-d)

♀♀: L = 4.57 a = 45.7 b = 9.1 c = 64.3 Vu = 78.7 per cent

♂♂: 3.65 52.1 8.0 72.0

Body: short cervical setae present. Cuticle thick.

Head: diameter 32-39 μ. Lips and labial papillae indistinct. Cephalic setae 7.5 μ long. Amphids 8.5 μ = 20 per cent of corresponding diameter in width.

Buccal cavity in one male 32 x 22 μ, longest tooth 27 μ long. In another male the buccal cavity was 46 μ long.

Esophagus pigmented in the anterior region. Hind-gut in one specimen filled with diatoms.

Excretory pore with characteristically large ampulla, approximately 2 stomatal lengths behind anterior end (measured distances 62, 63, 90 μ).

Demanian organ indistinct.

Spicula 38 μ long. No gubernaculum. There are 6 circumanal setae. In the male the tail is strongly attenuated right behind the anus so that its greatest portion is cylindrical. In the

middle of the tail there is a large ventral papilla, and a smaller papilla can be seen near the tip. In juveniles the tail is relatively slender, 3.5-4 anal diameters long. In the female it is stout and not much more than 2 anal diameters long. Anal diameter 32 μ in female, 22 μ in male.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 7 to -2 feet. One of the most common species on the beaches of Puget Sound.

Metoncholaimus

A key to the species of this genus was given by Kreis (1934). My new species belongs to the group of species in which there are circumanal setae only, no papillae or appendages. It is distinguished from *M. antarcticus* (Linstow), *M. demani* (zur Strassen), and *M. albidus* (Bastian) by the length of the spicula, the shape of the tail, and the presence of a gubernaculum.

Metoncholaimus uvifer n. sp. (fig. 25a-d)

♀♀: L = 4.38 a = 62.6 b = 7.3 c = 33.7 Vu = 78.7 per cent

♂♂: 4.70 58.8 9.8 47.0

Body: diameter at end of esophagus 60 μ. Very few cervical setae present.

Head: diameter 34-36 μ. No labial papillae seen. Cephalic setae 7-8.5 μ long. Amphids 11-12 μ wide = 1/3 of corresponding diameter.

Buccal cavity in one female measuring 32 x 22 μ. In two males the length of the buccal cavity was 36 and 42 μ.

Excretory pore in female 50 μ behind anterior end, in two males 90 and 92 μ, respectively.

Demanian organ well developed (fig. 25d).

Spicula 287 μ long. Gubernaculum 35 μ long, plate-shaped. There are 6 pre- and 10-14 postanal setae, the latter covering 2/3 of the tail.

Tail 125-130 μ long in male, curved; in female 3 anal diameters long. Anal diameter 40 μ in male.

Occurrence: Richmond Beach; 0.5 to -2.5 feet.

Viscosia

My new species, because of the larger amphids, belongs to group B.II.b.aa.bbb. of my key in Wieser (1953, p. 123). There it is distinguished from *V. hanströmi* by the shorter buccal cav-

ity, the different shape of the tail, the greater number of circumanal setae, etc. However, apart from the different size of the amphids, the new species is most closely related to *V. langrunensis* De Man.

Viscosia tumidula n. sp. (fig. 26a-f)

♀♀:	L = 2.73	a = 54.6	b = 6.8	c = 21.0	Vu = 55.5 per cent
♀♀:	2.93	73.2	7.0	22.5	62.1
♂♂:	2.75	50.0	7.2	18.3	
♂♂:	3.97	80.0	8.3	23.5	

Body: diameter at end of esophagus 50-54 μ. Few cervical setae.

Head: diameter 24-28 μ. Lips provided with very weak labial papillae. Cephalic setae 7-8.5 μ long. Amphids in male 13 μ = 50 per cent of corresponding diameter in width, in female 8-10 μ and 38-40 per cent respectively.

Buccal cavity 25-30 x 16-17 μ. Shorter teeth reaching beyond the middle of the buccal cavity.

Excretory pore 36 μ behind nerve ring.

Spicula 34-40 μ = 1.25 anal diameters in length. There are approximately 12 circumanal setae.

Tail more or less straight; cylindrical in female and male; end swollen; length varying between 5 and 6 anal diameters. In juveniles the tail is slender, up to 8 anal diameters long. Anal diameter 26-30 μ.

Occurrence: Golden Gardens, Richmond Beach; 8 to -2 feet.

Remarks: As so often in this genus, *V. tumidula* is a species varying very much in length and thickness.

Viscosia carnleyensis (Ditlevsen)

This old Pacific species occurred in almost all samples from Bainbridge Island and Vashon Island.

Buccal cavity 24 μ long. Tooth 22 μ long. Excretory pore on a level with the nerve ring.

Spicula 36 μ long. Tail 9 anal diameters long.

Family ENCHELIDIIDAE

Eurystomina

My new species belongs to the group of species devoid of ocelli and with a conical, rounded tail (see Wieser, 1953, p. 135). It is distinguished from all other species of this group by the short

members of the submedian pairs of cephalic setae that are very short and blunt, by the enlargement of the cervical setae, and by the shape of the spicula and preanal papillae.

Eurystomina repanda n. sp. (fig. 27a, b)

♂♂: L = 5.85 a = 130.0 b = 5.7 c = 39.0

Body: diameter at end of esophagus 50 μ. There are 4 or 5 circles of cervical setae. These setae are enlarged so as to form flaplike appendages. The enlargement is not very pronounced in the first circle of setae, and it is less conspicuous in female than in male.

Head: diameter 28 μ, set off from the body by a groove. No labial papillae. Cephalic setae 17 + 5 μ long. The short members of the submedian pairs are blunt, almost papillose.

Buccal cavity 31 μ long. It is divided into 2 chambers by 1 row of rods, 2 (or 1 1/2) rows of dots, and a cuticular ring to which the long tooth is anchored. The tooth consists of a large base and a small, acute tip.

There are many cells between esophagus and epidermis.

Spicula 72 μ long, curved and recurved at the distal end, with slightly forked tip. Apophysis solid, 24 μ long. The first supplement is situated 150 μ in front of the anus, devoid of large wings. The second papilla is situated at a distance of 150 μ from the first one and provided with large, cuticularized wings.

Tail 3.5 anal diameters long, with few, short setae. Anal diameter 54 μ.

Occurrence: Vashon Island, Alki Point; 7 to -2.5 feet.

Pareurystomina

This genus is characterized by the slender tail that ends in an acute tip and by the absence of caudal glands. I consider only the three following species to be good representatives of the genus:

1 Cervical setae enlarged. Postanal papilla present in male. Buccal cavity with 2 complete and 1 incomplete row of rods: *P. pugetensis* n. sp.

1' Cervical setae normal. No postanal papilla.

2 Buccal cavity with 1 serrated ring; 2 preanal papillae, the posterior one is 1 tail length in front of anus: *P. typicum* Micoletzky.

2' Buccal cavity with 1 row of dots and 1 row of rods; 1 preanal papilla at a distance of 3 1/2 tail lengths in front of anus: *P. acuminatum* (De Man).

In all other species described the tail is slender, but in none of them was the absence of caudal glands mentioned by the authors. The figures--perhaps with the exception of those of *P. tenuissima*--seem to suggest the presence of a thin but distinct spinneret. Nowhere can I detect the needle-pointed tip of the tail that is so characteristic of the three species mentioned above. Consequently, the possibility cannot be excluded that some of the species described as *Pareurystomina* are in reality long-tailed species of *Eurystomina*. Classification is hampered, furthermore, by the fact that, with the exception of *P. tenuicauda*, of all remaining species of *Pareurystomina*, only females are known. These are the following:

P. biserialis Stekhoven 1946: buccal cavity with 2 rows of dots. Tail 10.7 anal diameters long.

P. filicaudatum Allgén 1934: buccal cavity with 1 row of rods. Tail approximately 14 anal diameters long.

P. flagellicaudata Stekhoven 1946: buccal cavity with 2 rows of dots and 1 cuticular ring. Tail 15 anal diameters long.

P. micoletzkyi Filipjev 1946: buccal cavity with 3 rows of rods. Tail 14 anal diameters long.

P. tenuissima (Filipjev 1927): buccal cavity with 1 row of rods, 1 row of dots. Tail 4.5 anal diameters long.

The only other species of which a male is known, *P. tenuicauda* Stekhoven 1950, because of the shape of the buccal cavity, particularly the absence of transverse rows of cuticular bodies, does not seem to belong to this genus at all.

Pareurystomina pugetensis n. sp. (fig. 28a-c)

♀♀: L = 5.18 a = 74.0 b = 5.5 c = 22.5 Vu = 61.5 per cent

♂♂: 4.92 98.4 6.2 29.0

Body: diameter at end of esophagus 58 μ. Cervical setae as enlarged as in *Eurystomina repanda*. Altogether, 3 or 4 circles present. No ocelli.

Head: diameter 30 μ, set off. No labial papillae. Cephalic setae 16-17 μ + ≈7 μ long, distally truncate. Amphids kidney-shaped.

Buccal cavity 25 x 20 μ, with 2 complete and 1 incomplete row of rods. Tooth 17 μ long.

Spicula 62 μ long, curved and recurved distally, with forked tip (as in *Eurystomina repanda*). Apophysis plate-shaped. First supplement 165 μ in front of anus, second supplement 102 μ in front of first one. Wings weakly developed. Near the anus there are 2 setae on each side of the body. Right behind

the anus there is a papilla or cuticular fold. Tail 5-5.5 anal diameters long, with needle-pointed tip, without glands. Anal diameter 38 μ. In the male, short setae are scattered over the tail.

Occurrence: Golden Gardens; -1.5 feet. Also under *Zostera*.

Symplocostoma

My new species described below is distinguished from all other species by the fact that in females 2 of the cuticular rings of the buccal cavity are resolved into bands of cuticular rods, and furthermore by the unequal length of the submedian pairs of cephalic setae, by the position of the excretory pore, and by the length of the excretory duct. In the male the preanal papillae and groups of setae, and the shape of the spicula, offer some more distinguishing features. I consider it possible that *S. acuta* (Cobb), of which only juveniles have been found so far, is actually the juvenile stage of some other species of *Symplocostoma*, perhaps of the one described below. In *S. acuta* the cephalic setae are arranged in 2 circles, but it is known from other species of nematodes that such a condition may occur in juveniles, with the two circles merging into one in the last molts.

Symplocostoma dissoluta n. sp. (fig. 29a-e)

	L	a	b	c
♀:	3.46	34.0	4.3	21.6
♂♂:	4.79	36.8	5.8	25.0
♂♂:	3.95	35.5	6.5	23.8

Female (♀):

Body: diameter at end of esophagus 84 μ. Many cervical setae present. Cuticle 3.5 μ thick.

Head globular, diameter 16 μ. Labial papillae minute. Cephalic setae 8+4 μ long. Amphids oval, on a level with the middle of the buccal cavity. Ocelli 24 μ behind anterior end.

Buccal cavity 22 x 10.5 μ. Altogether there are 6 cuticular rings or bands, 2 close together in the anterior portion, 2 in the middle (it is these that are dissolved into cuticular rods), and 2 in the posterior portion, the posteriormost being situated at the base of the buccal cavity. The tooth is blunt. The pharyngeal lining is cuticularized, and the lumen is fairly wide.

Excretory pore 43 μ behind anterior end, excretory duct 46 μ long.

Tail 4.1 anal diameters long.

Male(♂):

Body: diameter at end of esophagus 86-108 μ. Cervical setae approximately in the same arrangement as in the female.

Head globular, diameter 17-20 μ. Labial papillae distinct, each accompanied on either side by 2 small cuticular projections. Cephalic setae 7.5-11 μ+4-5.5 μ long. Amphids 8 μ wide. Ocelli with reddish pigment, lenses situated behind the amphids. In each lens I observed 4-5 cuticular granules.

Buccal cavity reduced. Excretory pore 37-56 μ behind anterior end, duct 45-50 μ long.

Spicula 180 μ long, proximal end bent. Gubernaculum shoe-shaped, close to spicula. Five preanal papillae are present, each accompanied by a group of setae. The first papilla is 36 μ in front of the anus; the following ones are separated by a distance of 130-145 μ.

Tail 180 μ long. Anal diameter 54 μ.

Last larval stage shows the head of the female, but the features of the male head can be seen faintly under the larval cuticle. The male genital apparatus at this stage consists of spicula and papillae (fig. 29e). No groups of setae and no gubernaculum could be discerned.

Occurrence: Bainbridge Island, Vashon Island; 0-3 feet.

Calyptronema

Of the two species of this genus represented in my material, one almost certainly is the old European *C. maxweberi* (De Man). The absence of refractive bodies and cervical setae is typical for this species. My single specimen seems to have slightly wider amphids and a slightly wider buccal cavity than the type, but I do not think too much importance can be attached to this fact.

The other species is represented by one *"Enchelidium"*-like male, which, on the basis of my discussion of the family *Enchelidiidae* (Wieser, 1953), has to be referred to *Calyptronema*. It is most closely related to *C. eberthi* (De Man) (see also Stekhoven, 1950, p. 85), from which it is distinguished by the more forward position of the excretory pore and by the greater difference in length between the 2 submedian cephalic setae.

Calyptronema maxweberi (De Man) (fig. 30a, b)

Body: diameter at end of esophagus 72 μ. No ocelli, no cervical setae.

Head: diameter 18 μ, truncate. No labial papillae. Cephalic setae 6 μ long. Amphids 6 μ wide.
Buccal cavity 18 x 10 μ. Long tooth reaching to anterior end of head. Pharyngeal lumen 5 μ wide.
Tail 6.2-8 anal diameters long, greatest portion cylindrical.
Occurrence: Alki Point, San Juan Island (False Bay); 4-8 feet.

Calyptronema pachyderma n. sp. (fig. 31a, b)
♂♂: L = 2.11 a = 42.2 b = 5.4 c = 13.2
Body: diameter at end of esophagus 48 μ. A few cervical setae present.
Head: diameter 18 μ. Labial papillae minute. Cephalic setae 9 + 2.5 μ long. Amphids with irregularly oval outline, 12 μ long.
Ocelli with well-developed reddish pigment. Lenses irregularly oblong, 28 μ behind anterior end.
Excretory pore on a level with the lenses. Excretory duct of medium length, ampulla large.
Spicula 78 μ long. Gubernaculum thin, plate-shaped. There are altogether 5 preanal papillae and 1 preanal seta, the latter just in front of the anus.
Tail 5 anal diameters long, slender.
Occurrence: Vashon Island; 4.5 feet.

Family CYATHOLAIMIDAE

Pomponema

The new species described below belongs to group B of my key given in Wieser (1954b, p. 8), since the longitudinal rows are considerably less than 1/2 the body width apart from each other. The new species is distinguished from those of group B especially by the segregation of the 10 cephalic setae into 2 circles, one comprising 4, the other 6, setae. There are, moreover, differences in the number of preanal papillae, in the shape of the spicula, shape of the tail, etc. *Longicyatholaimus lineatus* Gerlach 1952, which is closely related to *P. mirabilis* Cobb, also belongs to this genus. It can be distinguished from the latter species by the shorter labial setae and by the amphids which describe only 2.5 turns as against 5-6 in *P. mirabilis*. It should be mentioned that *Craspodema* Gerlach 1956 (=*Kraspedonema* Gerlach 1954) is closely related to the genus *Pomponema*, from which it is separated by the ornamentation of the cuticle.

Pomponema segregata n. sp. (fig. 32a-e)

♂♂: L = 0.96 a = 24.0 b = 6.0 c = 9.1

Body: diameter at end of esophagus 34 μ. Very few cervical setae present. Cuticle with horizontal and vertical differentiation all along the body. Cuticular dots very large in the anterior cervical region. Lateral differences beginning irregularly on a level with the amphids; from the mid-cervical region onwards, 2 longitudinal rows are clearly established, their distance being 6 μ in mid-body, 5 μ in the anal region. The 2 longitudinal rows reach into the second half of the tail.

Head: diameter 24 μ. There are 6 setose labial papillae, 5 μ long. First circle of 4 setae 7 μ, second circle of 6 setae 14 μ long. All the setae are relatively stout. Amphids 12 μ wide = 48 per cent of corresponding diameter, describing 4 turns.

Buccal cavity spacious, equipped with 1 big dorsal tooth, 3 or 4 smaller subventral teeth, and the usual diadema.

There is no esophageal bulb.

Spicula broad, double, 26 μ = 1 anal diameter in length. Gubernaculum plate-shaped. There are 9 preanal papillae of the usual complicated structure, each consisting of several pieces (see fig. 32d). The anteriormost papilla is situated 156 μ in front of the anus.

Tail 4.8 anal diameters long, with a row of setae on its ventral surface.

Occurrence: Bainbridge Island; 6.5 feet.

Biarmifer and *Choniolaimus*

In Wieser (1954b) I established the genus *Biarmifer* the distinctive features of which are the simple, cup- or sucker-shaped preanal papillae and the double spicula. I considered the genus *Choniolaimus* Ditlevsen to be separated from *Biarmifer* by the more complicated structure of the preanal papillae and by the simple spicula. However, my interpretation of the preanal papillae as figured in *C. papillatus* by Ditlevsen (1919) appears to have been wrong. These structures are indeed more like the papillae in *Biarmifer* than like those in *Pomponema* with which I originally compared them. Consequently, the only feature distinguishing *Biarmifer* and *Choniolaimus* is the structure of the spicula, these being double in the former genus, simple in the latter. This seems to be but a slight difference, and whether it suffices to separate the two genera may be questioned. However, for the time being I shall maintain *Biarmifer* as a valid genus.

My new species of *Biarmifer* is closely related to *B. cochleatus* Wieser by the shape of the tail, the long labial setae, and the structure of the buccal cavity. It is distinguished from this species by the relatively more elongated labial setae, by the smaller dimensions of all organs, and by the much more complicated and bigger gubernaculum.

The new species of *Choniolaimus* described below is distinguished from the other species of this genus by the strong dorsal tooth and the presence of 2 subventral teeth, by the digitiform cephalic setae, by the number of preanal papillae (7), and by some structural pecularities of the spicular apparatus.

Biarmifer gibber n. sp. (fig. 33a-f)

♀♀: L = 2.43 a = 32.2 b = 6.9 c = 11.5 Vu = 50.5 per cent

♂♂: 1.75 44.0 6.0 14.0

In this species, male and female differed considerably in the dimensions of most organs.

Body: diameter at end of esophagus in female 67 μ, in male 41 μ. Cervical and somatic setae arranged in 2 sublateral rows along the body. The somatic setae are shorter than the cervical ones. Cuticle with slight horizontal and vertical differentiation in anterior cervical region. No longitudinal rows.

Head: diameter in female 36 μ, in male 24 μ. Labial setae 12 μ and 9.5 μ, respectively. Cephalic setae 19 + 16 μ and 13 + 10.5 μ, respectively. Amphids in female 16 μ = 33 per cent of corresponding diameter in width, in male 14 μ and 50 per cent, respectively, describing 4.5-5 turns.

Buccal cavity spacious. Vestibulum in female 14.5 μ long, with well-developed diadema. Strong dorsal tooth present.

Excretory pore 120 μ behind anterior end.

Spicula double, more or less straight, 43 μ long. Gubernaculum complicated, massive, consisting of several pieces, dilated distally.

There are 4 simple, suckerlike preanal papillae. The distance between the anus and the second papilla measures 28 μ, between the second and the third 54 μ, between the third and the fourth 24 μ.

Tail 3.7 anal diameters long, posterior half cylindrical. Anal diameter 50 μ in female, 36 μ in male.

Occurrence: Vashon Island, Golden Gardens, Richmond Beach; 3 to -2 feet.

Choniolaimus macrodentatus n. sp. (fig. 34a-d)

♀♀: L=1.55 a=38.8 b=5.6 c=10.3 Vu=55.0 per cent

♂♂: 1.62 40.6 6.5 10.8

Body: diameter at end of esophagus 36 μ. Few cervical setae present. Cuticle homogeneous.

Head: diameter 22-24 μ. Labial papillae 2 μ long, conical. Cephalic setae 8.5-10 + 5-6 μ long, digitiform. Amphids in male 9.5 μ=40 per cent of corresponding diameter in width, discribing 4.3 turns.

Buccal cavity with strong dorsal tooth and 2 small subventral teeth.

Spicula 48 μ long, simple, but with velum. Gubernaculum 42 μ long, tripartite at distal end. There are 7 simple, sucker-like preanal papillae. The anteriormost papilla is 120 μ in front of the anus.

Tail slender, 4.4-6 anal diameters long, sometimes swollen at the tip. Anal diameter 30-34 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Richmond Beach; 6.5 to -2.5 feet.

Longicyatholaimus

In my material I encountered one species of *Longicyatholaimus* that, with some reservation, I identify as *L. quadriseta* Wieser. There are some minor differences from the type, particularly that the cephalic setae and the amphids are smaller in the Puget Sound specimens than in the Chilean specimens. I doubt, however, whether these differences suffice to establish a new species, the more so since they could partly be the result of the larger body width in the Puget Sound specimens.

Longicyatholaimus quadriseta Wieser (fig. 35a-c)

♀♀: L=2.00 a=33.3 b=7.7 c=10.0 Vu=46.5 per cent

♂♂: 2.23 40.5 7.4 10.0

♂♂: 1.31 26.3 6.6 7.0

Body: cervical setae few, mainly consisting of one lateral group of 4 setae. Cuticle more or less homogeneous, with irregular lateral differentiation.

Head: diameter 22-25 μ. Labial papillae distinct. Cephalic setae slightly digitiform, 6+5 μ in some specimens (fig. 35a), 7-9 + 6 μ in others. Amphids 10-10.5 μ=35-40 per cent of corresponding diameter in width, describing 5 turns.

Buccal cavity with large dorsal, and relatively well-developed subventral tooth.
Excretory pore 78 μ behind anterior end. Ventral gland around end of esophagus.
Viviparous.
Spicula 46-54 μ long. Gubernaculum with distal extension. There are 4-5 minute, setose, preanal papillae.
Tail slender, 5.5-6.5 anal diameters long. Anal diameters 38-48 μ.
Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 4.5 to -2 feet.

Metacyatholaimus (?) sp. (fig. 36a-d)

Since I found only one juvenile I refrain from establishing a new species. The long tail and the longitudinal differentiation point toward affinity with *Metacyatholaimus*, but the well-developed tooth and the absence of a bulb speak against it.

juv.: L=1.48 a=37.1 b=7.1 c=2.5
Body: diameter at end of esophagus 38 μ. Cuticular ornamentation strongly differentiated. There are 3 longitudinal rows that begin right behind the amphids. In these longitudinal rows each dot is actually the upper disc of a cuticular, dumbbell-shaped structure that consists of a basal and an upper disk, connected by thin stem. Each dumbbell is 5 μ high (fig. 36c). In the anterior cervical region these structures occur also outside the longitudinal rows. (fig. 36a), where they can be observed in lateral view. The distance of the longitudinal rows from each other is 6 μ in mid-body.
Head: diameter 21 μ. Labial papillae setose, 6 μ long. Cephalic setae 15+10 μ long. Amphids 12 μ=40 per cent of corresponding body diameter in width, describing 4.5 turns.
Buccal cavity with strong dorsal tooth. No esophageal bulb.
Tail 23 anal diameters long.
Occurrence: Golden Gardens; -2 feet.

Cyatholaimus

According to Wieser (1954b) it is the structure of the male genital apparatus that is the sole character distinguishing the genera *Cyatholaimus*, *Paracanthonchus*, *Paracyatholaimus*, *Acanthonchus*, etc. Consequently, the present species belongs to *Cyatholaimus* although it possesses a long and acute tooth. The species is related to *C. ocellatus* (see Wieser, 1955b) in so far

as the gubernaculum is shorter than the spicula, but it is distinguished from this species by the presence of the long tooth, the long cephalic setae, the structure of the genital armature, and several other characters.

Cyatholaimus dentatus n. sp. (fig. 37a, b)

♂♂: L = 1.58 a = 48.9 b = 4.9 c = 15.5

Body: diameter at end of esophagus 34 μ. Cuticular ornamentation homogeneous.

Head: diameter 24 μ. Labial setae 8 μ long. Cephalic setae 16 + 10 μ long. Amphids 7.5 μ = ≈30 per cent of corresponding diameter in width, describing 4 turns.

Buccal cavity: My only specimen was preserved with the mouth mouth wide open and the tooth protruded. Each of the 6 rods that make up the buccal diadema is provided distally with a pair of threadlike appendages. It is difficult to decide whether these appendages are genuine or artifacts.

Spicula 34 μ long. Gubernaculum of the structure typical for the genus, slightly shorter than the spicula. There are some dorsal papillae in the anal region, and on the ventral side of the tail some more minute papillae can be found.

Tail 3.8 anal diameters long, distally provided with 2 setae. Anal diameter 34 μ.

Occurrence: Alki Point; 0 feet.

Paracanthonchus
= *Harveyjohnstonia* Mawson 1953

My material contained three species of this genus, two of which belong to group C, the third one to group B, of my key in Wieser (1954b, p. 16).

P. quinquepapillatus n. sp. is distinguished from all other species of group C by the number of preanal tubuli. In other respects it is closely related to *P. micoletzkyi*, from which it is distinguished by the absence of ocelli and by some differences in the shape of the gubernaculum.

P. mutatus n. sp. is related to *P. stateni* and *P. tyrrhenicus*. As to the latter species, it should be said that it was described as a *Paracyatholaimus* by Brunetti 1949. I referred it to a new genus, *Metacanthonchus*, and Gerlach (1952a) transferred it to *Paracanthonchus*. Undoubtedly, Gerlach is right, and my genus *Metacanthonchus* should be withdrawn. It is distinguished from the latter species by the smaller amphids with

fewer turns and by the shape of the distal end of the gubernaculum. It is distinguished from the former species particularly by the structure of the male genital armature.

P. serratus n. sp. belongs to group B. It is related to *P. elongatus* because of the serrated distal edge of the gubernaculum. It is distinguished from the latter species by the absence of labial setae, by the shorter and jointed cephalic setae, and by the number of preanal tubuli.

Paracanthonchus quinquepapillatus n. sp. (fig. 38a, b)

♂♂: L = 1.36 a = 22.8 b = 6.8 c = 13.6

Body: diameter at end of esophagus 48 μ. Cuticular ornamentation homogeneous, with anterior differentiation (see Wieser, 1953, p. 7). Pores scattered over the body.

Head: diameter 24 μ. Labial papillae conical. Cephalic setae 9.5+6 μ long. Amphids 13 μ = 40 per cent of corresponding diameter in width, describing 4.5 turns.

Buccal cavity: 1 medium-sized dorsal tooth and at least 2 small subventral teeth present.

Spicula 38 μ long. Gubernaculum thin, distally expanding into a small plate. There are 5 preanal tubuli, the anteriormost at a distance of 52 μ in front of the anus.

Tail conical, 3 anal diameters long. Anal diameter 44 μ.

Occurrence: Alki Point; subterranean water.

Paracanthonchus mutatus n. sp. (Fig. 39a-c)

♀♀: L = 1.10 a = 20.0 b = 4.8 c = 12.2 Vu = 59.1 per cent

♂♂: 0.93 23.4 4.7 11.0

Body: diameter at end of esophagus 36 μ. Cuticular ornamentation homogeneous, with anterior differentiation. One long cervical seta was seen right behind the amphids. Pores scattered over the body.

Head: diameter 21-23 μ. Labial setae 3 μ long. Cephalic setae 10+7.5 μ long. Amphids in male 10 μ = 40 per cent of corresponding diameter in width, describing approximately 5 turns; in female 9 μ and 35 per cent respectively.

Buccal cavity: 1 large dorsal tooth, 1 or 2 small subventral denticles present.

Spicula: 30 μ long, weakly cuticularized. Gubernaculum 24 μ long, strongly cuticularized, tubular, with pointed distal end. There are 5 preanal tubuli, the 2 posterior ones at close distance from each other. The anteriormost supplement is situated 64 μ in front of the anus.

Tail conical, 3.1 anal diameters long. Anal diameter 30 μ.
Occurrence: Alki Point; subterranean water.

Paracanthonchus serratus n. sp. (fig. 40a-c)

♀♀: L=3.05 a=35.1 b=8.7 c=20.3 Vu=44.3 per cent
♂♂: 2.69 33.6 8.4 19.2

Body: diameter at end of esophagus 70 μ. Few cervical setae. Cuticular ornamentation more or less homogeneous, with slight lateral differentiation on the tail. Pores scattered over the body.

Head: diameter 31-35 μ. Labial papillae indistinct. Cephalic setae 10-11 μ long, jointed. Amphids (in both sexes) 13 μ= 33 per cent of corresponding diameter in width, describing 3.5-4 turns.

Buccal cavity with 1 medium-sized dorsal tooth and at least 2 small subventral teeth.

Spicula 48 μ long. Gubernaculum 54 μ long, distally expanding into a broad plate the edge of which is serrated. 4+2 preanal tubuli. The distance between the anteriormost and the second tubuli is 48 μ, between the second and the third tubuli 23 μ.

Tail 3 anal diameters long, plump. Anal diameter 60-66 μ.
Occurrence: Golden Gardens; 2.5-5.5 feet.

Acanthonchus

A key to the species of this genus was given by me in 1955a. Ditlevsen's genus *Seuratiella* can be retained as a subgenus on the basis of the weak development of the tooth and the presence of ocelli.

Two species were found in Puget Sound, one of which belongs to the subgenus *Seuratiella*, the other to *Acanthonchus* s. str.

A. (Seuratiella) rostratus n. sp. is distinguished from *A. gracilis*, the only other species belonging to this subgenus, by the shorter cephalic setae, by the greater distance of the excretory pore from the anterior end, and by the presence of 2 small tubuli right in front of the anus.

A. (A.) duplicatus n. sp. is distinguished from its closest relative, *A. setoi*, by the smaller amphids (50 per cent as against 65 per cent, by the greater dimensions of all other organs, and by the presence of the same 2 small tubuli in front of the anus as found in *A. rostratus*. In *A. setoi* there is only one tubulus at this place.

Acanthonchus (Seuratiella) rostratus n. sp. (fig. 41a, b)

♀♀: L = 1.82 a = 28.1 b = 11.1 c = 12.2 Vu = 46 per cent

♂♂: 1.27 32.0 8.5 10.2

♂♂: 1.54 30.8 7.7 11.0

Body: diameter at end of esophagus 40 μ. A few cervical setae present. Cuticular ornamentation with some anterior and posterior differentiation.

Head: diameter 23 μ, set off from remainder of body. Minute labial papillae present. Cephalic setae approximately 3 μ long. Amphids in male 9.5 μ = 32 per cent of corresponding diameter in width, describing 2.75-3 turns. Ocelli 30 μ behind anterior end, situated subdorsally.

Buccal cavity shallow, with small dorsal tooth.

Excretory organ with characteristically cuticularized duct; pore 64 μ behind anterior end. Ventral gland 180 μ behind end of esophagus.

Intestine packed with diatoms.

Spicula 46 μ long, with proximal bend. Gubernaculum 42 μ long, dilated distally. Altogether there are 6 preanal supplements, the anteriormost being by far the biggest, measuring 34 μ. The 2 posterior tubuli are close to each other. The distance between the first (anterior) and the second supplement is 34 μ.

Tail conical, 3.6 anal diameters long. The group of setae, can be found right behind the anus. Anal diameter 42 μ.

Occurrence: Bainbridge Island, Golden Gardens; 5.5 to -2 feet.

Acanthonchus (A.) duplicatus n. sp. (fig. 42a, b)

♂♂: L = 1.94 a = 30.0 b = 6.0 c = 14.1

Body: diameter at end of esophagus 55 μ. Few cervical setae present. Cuticular ornamentation with slight horizontal and vertical spacing in anal region. Pores more or less regularly arranged in sublateral rows.

Head: diameter 30 μ. Labial papillae setose, 3.5 μ long. Cephalic setae 12 + 9 μ long. Amphids 15 μ = 48 per cent of corresponding diameter in width, describing 4 turns.

Buccal cavity shallow, with large dorsal tooth.

Spicula 48 μ long. Gubernaculum 48 μ long, expanding into a triangular plate, the distal end of which measures 15 μ in width and is provided with 2 denticles. There are 6 preanal supplements, the anteriormost measuring 54 μ. The 2 posterior tubuli are close to each other and are feebly developed.

The distance between the first and the second supplement is 42 μ.

Tail conical, 3.2 anal diameters long. Anal diameter 51 μ.

Occurrence: Vashon Island; 3 to -1 feet.

Latronema

The species described below by its two-joined cephalic setae is related to *L. piratica* Wieser from which it is distinguished by the smaller amphids, by the shape of the spicula, and by the more slender tail.

Since completion of the key in Wieser (1954b) another species, *L. botulum,* was described by Gerlach (1956b), which is characterized by the unusual, sausage-shaped amphids.

Latronema sertata n. sp. (fig. 43a-d)

♀♀: L=1.35 a=24.5 b=4.7 c=13.5 Vu=63 per cent

♂♂: 1.32 26.5 4.8 17.3

Body: diameter at end of esophagus 53-58 μ; almost cylindrical. Cuticular ornamentation consisting of transverse bars and rows of dots which alternate in mid-body. In the anterior and posterior region of the body the bars only are present. The transverse ornamentations are interrupted by about 40 to 50 longitudinal "wings," which in lateral view appear as 2 parallel rows of dots. These longitudinal rows begin right behind the amphids and run all along the body. On each body side 2 rows of cervical and somatic setae run along the body.

Head truncate; diameter 50-58 μ. The lips are deeply cut and give the impression of 12 flaplike appendages. Labial setae 8.5-10 μ long. Ten equidistant cephalic setae, 12-13 μ long, with short basal and long distal joints. Between the labial and the cephalic setae the head is longitudinally striated. Amphids (in both sexes) 7 μ=10 per cent of corresponding diameter in width, 45-48 μ behind anterior end.

Buccal cavity probably with 16 anterior mandibles, 18 μ long, each of which carries 2 teeth. Posterior apophyses weakly developed, 12 μ long.

Spicula strongly curved, 50 μ long. Gubernaculum plate-shaped. There are 20 big, suckerlike supplements.

Tail 2.2 anal diameters long. Anal diameter 42 μ. Distal third of tail devoid of setae and its cuticle darker than the cuticle of the rest of the body.

Occurrence: Alki Point; subterranean water.

In my key in Wieser (1954b, p. 28) I distinguished *Gammanema* from *Latronema* by the structure of the preanal supplements, these being insignificant, setose, or papillose in the former, and big and suckerlike in the latter genus. However, this distinction has to be based on Cobb's not very clear description of *G. ferox* and on a remark by Chitwood (1951) on that point. The question still cannot be solved since I found only a female of what I belive to be *G. ferox*.

G. conicauda Gerlach 1952 is distinguished from *G. ferox* by several characters, such as length and shape of cephalic setae and absence of "spatulate" appendages. The structure of its preanal supplements is not quite clear, but it is possible that they differ from the type described for *G. ferox* by Cobb.

G. cancellatum Gerlach 1955 apparently is related to the species above, but only one female is known. Its characteristic feature is the occurrence of a secondary cuticular ornamentation consisting of longitudinal ridges.

Gammanema ferox Cobb (fig. 44a-d)

♀♀: L=4.35 a=48.3 b=11.4 c=43.5 Vu=65.1 per cent

Another typical female measured 2.55 mm.

Body: diameter at end of esophagus 70 μ. Cuticular dots more irregularly arranged and more densely spaced in anterior cervical region than in remainder of body. Very few cervical setae present.

Head truncate, diameter 60 μ. At the anterior end there can be distinguished 12 flaplike appendages, 6 "spatulate" appendages, 6 labial setae which consist of a short and broad basal joint and a digitiform tip (fig. 44b). Of the 10 cephalic setae 6 are built exactly like the labial setae and 4 are normal setae, measuring 15 μ in one specimen, 24 μ in another. Some longitudinal striation can be observed near the anterior end. Amphids 12-14 μ wide, describing 2 turns.

Buccal cavity: anterior portion 32 μ deep, with at least 6 "mandibles" (or apophyses) which end proximally in an acute tip. Posterior portion 24 μ deep, with 3 columns.

Tail 1.5-2.2 anal diameters long; tip attenuated, but otherwise almost cylindrical. Anal diameter 60 μ.

Occurence: Richmond Beach; 7.5-3 feet.

Distribution: New Hebrides (coral sand), Puget Sound.

Family DESMODORIDAE

Subfamily CERAMONEMATINAE

Ceramonema

The new species described below is, by the position of the amphids and the structure of the cuticle, most closely related to *C. pisanum* Gerlach, from which species, however, it is distinguished by the greater proximity of the 2 circles of cephalic setae, by the absence of a labial cone, and by some differences in the dimensions.

Ceramonema carinatum n. sp. (fig. 45a-c)

♂♂: L = 0.86 a = 43.2 b = ? c = 5.8

Body: cuticle tiled. Tiles interrupted by crests that are arranged in 8 longitudinal rows along the body. The longitudinal rows extend into the head as rows of dots. Annules 7.5 μ wide in the cervical region.

Head: 36 μ long, diameter at base 22 μ, at level of second circle of cephalic setae 20 μ. Lips indistinct. Cephalic setae arranged in 2 circles of 6 and 4, each seta 12 μ long. Amphids in posterior half of head, 16 μ long, 8.5 μ wide. From the base to the anterior end of the amphids the cuticle of the head is perforated.

Spicula 24 μ long, attenuated proximally and distally, provided with a minute cusp in the distal fourth. Gubernaculum 16 μ long, plate-shaped, provided with a cusp similar to that of the spicula. In the anal region 2 cuticular annules have merged to form a single broad band.

Tail 8.5 anal diameters long; distal cone 13 μ long. Anal diameter 17 μ.

Occurrence: Alki Point; subterranean water.

Subfamily RICHTERSIINAE

Spirina

I found what seems to be the old *S. laevis*. My specimens agree with the previous descriptions except that I observed a ventral projection in the middle of the spicula which was not mentioned before. Gerlach (1950b) describes the male tail as being 1.5 anal diameters long, while Bresslau and Stekhoven

(1940) give its length as 4 anal diameters. In my male the tail measured 3 anal diameters.

Spirina laevis (Bastian) (fig. 46a-c)

♂♂: L = 4.45 a = 89.0 b = 26.1 c = 29.7

♀♀: 4.10 60.0 24.1 41.0 Vu = 58.5 per cent

Body: diameter at end of esophagus 52 μ. Cuticle finely striated. Cervical setae arranged in 8 longitudinal rows, up to 15 μ long in the anterior cervical region, then becoming progressively shorter. Somatic setae short.

Head conical. Diameter 22 μ. Six labial papillae present. Cephalic setae 14 μ long, slender. Amphids 7 μ=1/3 of corresponding diameter in width, circular in outline, but spiral-shaped in reality.

Buccal cavity narrow. Two small teeth present. Esophageal bulb round.

Spicula 54 μ long, strongly curved. Proximal end cephalated. Only the dorsal edge is heavily cuticularized, the ventral edge being more or less transparent and forming a triangular projection in the middle of the spicula. Gubernaculum short, plate-shaped distally.

Tail 3 anal diameters long in male, 1.6 anal diameters in female. Anal diameter 48 μ.

Occurrence: Alki Point, Richmond Beach; 0.5 to -2.5 feet.

Distribution: North Atlantic, North Sea, Baltic, Puget Sound.

Chromaspirina

Since completion of my key in Wieser (1954b) another species of *Chromaspirina* was described, namely, *C. pellita* Gerlach 1954, which is distinguished from all other species by its dense pilosity. The new species described below is also characterized by its dense pilosity, and, further, by the structure of the amphids and of the preanal supplements. *C. pellita* Gerlach and *C. spinulosa* n. sp. differ from each other in the structure and position of the amphids, in the length of the labial setae, and in the arrangement and thickness of the cervical and somatic setae.

Chromaspirina spinulosa n. sp. (fig. 47a, b)

♂♂: L = 1.46 a = 36.5 b = 9.1 c = 17.1

Body: diameter at end of esophagus 36 μ. Cuticle coarsely annulated. The body is densely covered with setae. There

are fairly thick setae, alternatingly long (up to 15 μ) and short, which are arranged in 8 longitudinal rows. Besides these a great number of irregularly arranged fine setae can be seen all over the body.

Head: diameter 19 μ. Six first cephalic setae and 4 second cephalic setae present, the latter approximately 7 μ long. Amphids with an inner cuticular ring, slightly oval, measuring 14 x 12 μ = 55 per cent of corresponding diameter in width. The amphids are completely surrounded by cuticular annules.

Buccal cavity: vestibulum with heavily cuticularized lining. One medium-sized dorsal tooth and 2 small subventral teeth present. Esophageal bulb roundish.

Spicula 50 μ long, curved, cephalated proximally. Gubernaculum plate-shaped. In front of the anus the cuticle is thickened over a length of about 230 μ. Shortly in front of the anus there is a small papilla, followed by 8-10 fine tubuli. Near the anterior end of the thickened portion of the cuticle 2 strongly cuticularized cushions are situated.

Tail 2.5 anal diameters long. Anal diameter 42 μ.

Occurrence: Alki Point; 4 feet.

Onyx

In Puget Sound I found a species of *Onyx* which in several points differs from all other species of this genus. The preanal supplements particularly are of an "atypical" structure, each consisting of a semi circular duct in the middle of which there is a dark body, and at the anterior end of which there is a short projection (fig. 48d). The supplements in all other species of *Onyx* are slightly S-shaped. Moreover, in my new species the head is longitudinally striated, as is the case in *Ichthyodesmodora* but in no other genus of desmodorids. The labial papillae are transformed into arrowheaded projections. However, the buccal cavity is so characteristically onyxoid that my species should be left in this genus.

Onyx rugata n. sp. (fig. 48a-d)

♂♂: L = 1.30 a = 32.5 b = 6.5 c = 13.0

♀♀: 1.73 31.5 5.7 20.5 Vu = 57.1 per cent

Body: diameter at end of esophagus 54 μ. Cuticle finely striated. In female there are few cervical setae. In male there are 8 short longitudinal rows beginning right behind the am-

phids and reaching back 20 μ, the setae becoming progressively shorter. The longest cervical setae in male measure 15 μ. Somatic setae few, short.

Head: diameter 38 μ; posterior half longitudinally striated. Six labial papillae transformed into arrowheaded projections. First cephalic setae 3.5 μ, second cephalic setae 19 μ long. Amphids 11 μ wide, situated between the longitudinal and the transverse striation of the cuticle.

Buccal cavity typical, with strong, protrusible dorsal tooth. Esophageal bulb double, with strong cuticular lining, 90 μ long.

Spicula approximately 42 μ long (in fig. 48d one of the spicula is out of line and seen ventrally). Gubernaculum plate-shaped, 22 μ long. There are 22 preanal supplements. One intersex was observed.

Tail 2-2.7 anal diameters long. Anal diameter 47 μ.

Occurrence: Golden Gardens, Richmond Beach; 7 to -2.5 feet.

Subfamily MONOPOSTHIINAE

Monoposthia and *Nudora*

The status of these two genera was discussed in Wieser (1954b, pp. 53-54). Finding representatives of both genera enables me to confirm the conclusions reached in the previous paper. Thus, *Monoposthia* is characterized by the absence of spicula and by the the proximal attenuation of the gubernaculum. *Nudora* is characterized by the presence of paired spicula and by the proximal dilation of the gubernaculum. The species of *Nudora* encountered in Puget Sound, because of the enlarged second annule, is related to *N. lineata* Cobb from which species, however, it is distinguished by the greater number of longitudinal "wings" (18-20 versus 10), by the peculiar structure of the annules in the anterior cervical region, by differences in the buccal armature, and perhaps also by differences in the shape of the spicula.

The species of *Monoposthia* that I found in my material seems to be the old *M. costata.* In my specimens the cephalic setae are slightly longer than in the type, and in the buccal cavity I saw a few more projections than are known for the European form, but these differences do not suffice to establish a new species.

Nudora armillata n. sp. (fig. 50a-c)

♂♂: L=1.90 a=35.0 b=8.0 c=11.2

Body: the second annule is enlarged and covered with a number of oblong, cuticularized plates, which are separated from one another by lighter portions of the cuticle. The amphids appear as holes in the 2 lateral plates. In the anterior portion of the cervical region each of the annules consists of a series of arcs. Where 2 arcs meet at a V-shaped angle the cuticle is light and undifferentiated. On top of each arc, however, there is situated a transversely oval, cuticularized disc that looks as if it were stuck to the underlying annule. More posteriorly these discs expand, the arcs straighten, and both components merge to take on the appearance of normal annules, interrupted only by the longitudinal rows of V's (fig. 50b). There are 18-20 longitudinal rows.

Head: diameter 23 μ, truncate. There are 6 labial and 6 cephalic papillae. Cephalic setae 19 μ long. Amphids 7 μ = 25 per cent of corresponding diameter in width.

Buccal cavity: armature consisting of 1 large dorsal tooth, 1 smaller subventral tooth, and 2 rows of denticles. Esophageal bulb barrel-shaped, double.

Spicula 38 μ long, doubly bent in proximal third. Gubernaculum shoe-shaped, 36 μ long.

Tail 3.2-3.6 anal diameters long. Anal diameter 35 μ.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 8 to -2 feet.

Monoposthia costata (Bastian) (fig. 51a-d)

♂♂: L = 1.90 a = 34.5 b = 8.6 c = 12.7

♀♀: 1.95 30.0 9.3 15.6 Vu = 89.6 per cent

Body: cuticular annules interrupted by 12-16 longitudinal rows of V-shaped structures. Short cervical and somatic setae present.

Head of different height according to state of contraction (compare figs. 51a and b). Diameter 20-25 μ. Six labial and 6 cephalic papillae present. Cephalic setae 12-15 μ long = 52-68 per cent of head diameter. Amphids 3.5-5 μ wide, situated between second and third, or between third and fourth annule.

Buccal cavity: armature consisting of 1 large dorsal tooth, 1 small subventral tooth, and 2 transverse folds.

Spicula absent (probably fused with gubernaculum). Gubernaculum 37-45 μ long, with proximal handle. The anal opening is surrounded by 2 anterior and 2 posterior cuticularized projections. Approximately 110 μ in front of the anus there

is a ventral swelling. In the anal region some of the annules may disappear and thus produce a more transparent area.
Tail 3.6 anal diameters long. Anal diameter 46 μ.
Occurrence: All localities; 8 to -2.5 feet.
Distribution: North Atlantic, Arctic Ocean, North Sea, Baltic, Mediterranean, California, Puget Sound.

Family MICROLAIMIDAE

Microlaimus

The great number of species and the few characters distinguishing them makes it more and more difficult to classify species belonging to this genus. Gerlach (1950a) bases his grouping of species on the shape and armature of the buccal cavity. There are, however, transitions between the groups. It seems that in Wieser (1954b) I misunderstood the diagnoses of Gerlach's groups A, D, and F. Thus, *M. pinguis*, *M. sensus*, *M. sicarius*, and *M. gerlachi* should be transferred from group A to group D, and *M. texianus* and *M. kaurii* should be transferred from group D to group F.

The two new species found in Puget Sound belong to group D. *M. cochleatus* n. sp. keys out with *M. honestus* but is distinguished from this species by the longer cephalic setae (70 per cent versus 35 per cent of the head diameter) and particularly by the different shape of the spicular apparatus.

M. dixiei n. sp. is related to *M. marinus*, but it has a longer and differently shaped gubernaculum, its buccal cavity is less cuticularized, and the cephalic setae are somewhat longer.

My material contained one male of another species which I identify as *M. dentatus* Allgén (see the redescription in Gerlach, 1950a), although the amphids are in a more forward position. It is possible that for this species a new subgenus will have to be created in the future.

Since completion of my key in Wieser (1954b) the following species were described: *M. compridus* Gerlach 1956, *M. crassiceps* Gerlach 1952, *M. honestoides* Meyl 1954, *M. microseta* Gerlach 1952, *M. monstrosus* Gerlach 1952, *M. oblongilaimus* Gerlach 1955, *M. pygmaeus* Meyl 1954, *M. undulatus* Gerlach 1955. None of these species is particularly closely related to the new species from Puget Sound.

Microlaimus dentatus Allgén 1935 (fig. 49a-c)

♂♂: L = 0.95 a = 24.0 b = 7.0 c = 12.6

Body: diameter at end of esophagus 36 μ. Cuticle coarsely annulated. Annules 1.5-2.5 μ wide. Hardly any setae present.

Head: diameter 26 μ. Six small, conical labial papillae present. First circle of cephalic setae measuring 3 μ, second circle 8 μ. Amphids 11 μ = 42 per cent of corresponding diameter in width, describing one turn.

Buccal cavity spacious. Armature consisting of 1 large dorsal tooth and 5 transverse rows of denticles. Peribuccal tissue swollen. Esophageal bulb oval to roundish.

Spicula approximately 30 μ long. Gubernaculum plate-shaped. There might be several preanal papillae present, but it is difficult to tell definitely.

Tail 3 anal diameters long. Anal diameter 30 μ.

Occurrence: Richmond Beach; 0.5 feet.

Distribution: Baltic, North Atlantic, Puget Sound.

Microlaimus cochleatus n. sp. (fig. 52a, b)

♂♂: L = 0.78 a = 30.0 b = 6.2 c = 7.2

♀♀: 0.69 21.3 7.2 8.8 Vu = 55.1 per cent

Body: diameter at end of esophagus 25 μ. Annulation coarse.

Head: diameter 12-13 μ. Cephalic papillae setose, short. Cephalic setae 10 μ long in male, 8 μ in female. Amphids 18-24 μ behind anterior end, measuring 5-6 μ = 30-33 per cent of corresponding diameter in width.

Buccal cavity 12 μ long. Dorsal and ventral tooth nearly equal in size.

Excretory pore 36 μ in front of end of esophagus; ampulla large.

Spicula 33 μ long, slender, cephalated proximally. Gubernaculum 18 μ long, shaped like a flat spoon, the distal end representing the handle.

Tail 4-4.5 anal diameters long. Anal diameter 22 μ.

Occurrence: Vashon Island, Alki Point, Golden Gardens; 7-2 feet.

Microlaimus dixiei n. sp. (fig. 53a-d)

♂♂: L = 1.09 a = 36.4 b = 10.1 c = 9.1

♀♀: 1.02 25.6 8.2 8.2 Vu = 50 per cent

Body: diameter at end of esophagus 30 μ. Annulation fine.

Head: diameter 10-11 μ. Cephalic papillae setose, short. Cephalic setae 6-8 μ. Amphids 14-18 μ behind anterior end, 7-8.5 μ = 50-58 per cent of corresponding diameter in width.

Buccal cavity: ventral tooth situated in a notch of the buccal wall.

Spicula 30 μ long. Gubernaculum 24 μ long.

Tail 4 to more than 5 anal diameters long. Anal diameter 30 μ in one male, 23 μ in one female.

Occurrence: Richmond Beach; 3-0.5 feet.

Paramicrolaimus

The genus was established on the basis of one female only (Wieser, 1954b, p. 64), but its status is confirmed by the find of both females and males of another species. In the male there are well-developed preanal papillae present which in this form do not occur in *Microlaimus*.

P. spirulifer n. sp. is distinguished from *P. primus* by the following characters:

	P. spirulifer	*P. primus*
Length	4.18-4.43	2.34
a	130-150	44.7
c	52-55	22.3
Length of second cephalic setae	16 μ	10 μ

Paramicrolaimus spirulifer n. sp. (fig. 54a-d)

♂♂: L = 4.43 a = 147.7 b = 22.1 c = 55.4

♀♀: 4.18 139.3 23.3 52.2 Vu = ?

Body: diameter at end of esophagus 31 μ. Short setae present all over the body.

Head: diameter 23.24 μ. Lips well developed; labial papillae not seen. Cephalic setae in 2 circles, the anterior ones 12 μ, the posterior ones 14-16 μ long. Amphids in female 13 x 11 μ, in male 14 x 13 μ = 50 per cent of corresponding diameter in width, 18-21 μ behind anterior end.

Buccal cavity long and narrow, with 1 acute, small dorsal tooth and a small ventral projection. Peribuccal tissue of esophagus swollen. Esophagus dilated posteriorly, without true bulb. Ventral gland 48 μ behind end of esophagus.

Spicula 25 μ long; broad. Gubernaculum plate-shaped. There are 6 preanal papillae, the anteriormost at a distance of 174 μ from the anus.

Tail with 4 ventral setae. Two of the 3 caudal glands seem to open dorsally, behind the tip of the tail. The structure seen

there could also be a papilla. Length 3-3.8 anal diameters. Anal diameter 30 μ in male, 24 μ in female.

Occurrence: Golden Gardens; -1.5 feet.

Family CHROMADORIDAE

Hypodontolaimus inaequalis (Bastian)

Several typical specimens of this old European species were found at Vashon Island and Alki Point, between 0.5 and 7 feet. The males are equipped with 13 preanal papillae, the spicula measure 50 μ.

Distribution: North Atlantic, Baltic, Mediterranean, Puget Sound.

Actinonema

The species I found in Puget Sound seems to be *A. longicaudata* (Steiner), but I begin to suspect that this species is not much different from *A. pachydermatum* Cobb. The only valid difference I can detect is the shorter tail in the latter species. The differences in the structure of the spicular apparatus that I mentioned in Wieser (1954b) do not seem to hold.

Actinonema longicaudata (Steiner) (fig. 55a-f)

♂♂: L=0.99 a=37.9 b=7.0 c=4.6

♀: 1.08 30.0 7.5 4.7

Body: cuticular ornamentation coarse. Lateral differentiation of varying appearance, but always prominent (fig. 55b-d). Apart from the lateral differentiation the cuticular annules are smooth.

Head: diameter 9.5-11 μ. Six minute cephalic papillae present. Cephalic setae 2 μ long. Amphids 7.2 μ=60 per cent of corresponding diameter in width, with heavily cuticularized contour.

Buccal cavity conical. One acute dorsal tooth present.

Spicula 18 μ long. Gubernaculum plate-shaped.

Tail 10-12 anal diameters long, with slightly swollen tip and long, slender spinneret. Anal diameter 20 μ.

Occurrence: Vashon Island, 0.5 feet; Alki Point, subterranean water.

Distribution: Mediterranean, west coast of Africa, Puget Sound.

Within this genus there is a highly characteristic, homogeneous group of species the outstanding features of which are their plumpness, the shape of the tail with its recurved posterior end, the strong dorsal tooth and well-developed pharyngeal bulb, and the pilosity of the body. All the species with which I am acquainted possess a dark, heterogeneous cuticle in accordance with the generic diagnosis. There are at least two more species which so far have been referred to *Chromadorita*, namely, *C. tentabunda* (De Man) and *C. crassa* Timm, which seem to belong to this group. I am fairly sure that the latter species is synonymous with the former, since the differences mentioned by Timm (1951) do not hold in the light of the redescription of *C. tentabunda* by Gerlach (1951c). I myself found specimens at Chesapeake Bay, Maryland, from where Timm has reported his *C. crassa*, which in every respect fits the description of *C. tentabunda* by Gerlach. The cuticle is dark and slightly heterogeneous, that is, there are large dots in the anterior cervical region and short rods in the remainder of the body. This feature was mentioned by Gerlach, although it is not apparent in his figures.

For *C. tentabunda* Chitwood nec De Man, I established *C. chitwoodi* nom. nov. (Wieser, 1954b). This species may be kept separate on the basis of somewhat shorter cephalic setae, a longer tail, and shorter spicula, but the distinction is not quite sharp. At any rate, this species, too, belongs to the group of *Graphonema* species as defined above.

Altogether, the following four or five species belong to this group (B. 2. a. in my key in Wieser, 1954b):

G. tentabunda (De Man). Redescription by Gerlach (1951c).
= *Chromadorita crassa* Timm
G. amokuroides (Allgén) Redescription by Wieser (1954b).
= *Spilophora pusilla* Allgén
= *Chromadora suilla* Allgén

The synonymization of my Chile specimens with Allgén's species is hypothetical, since Allgén's inexact figures and descriptions could very well fit any of the species of this group.

G. flaccida n. sp.
G. clivosa n. sp.
?G. chitwoodi (Wieser)
= *Chromadorita tentabunda* Chitwood 1951 nec(?) De Man

The best distinguishing feature between the four good species

is offered by the spicular apparatus. Otherwise the species are fairly difficult to separate.

1 Gubernaculum parallel to spicula, inconspicuous. Cephalic setae flaccid, cervical setae short:
G. flaccida n. sp.

1' Gubernaculum conspicuous, with more or less well developed dorsal apophysis. Cephalic setae stiff, cervical setae fairly long.

2 Gubernaculum with strongly hook- (almost U-) shaped apophysis. Cephalic setae not more than 1/2 the head diameter long:
G. amokuroides (Allgén)

2' Gubernaculum with weakly curved apophysis. Cephalic setae longer than 1/2 the head diameter:
G. tentabunda (De Man)
G. clivosa n. sp.

Both these species are very closely related, but the shape of the spicula is distinctly different.

Graphonema flaccida n. sp. (fig. 56a-c)

♂♂: L = 0.82 a = 20.6 b = 6.6 c = 6.6
♀♀: 0.80 17.6 6.4 8.0 Vu = 53 per cent

Body: diameter at end of esophagus 36 μ. Cuticle dark, resolvable into large dots in the cervical region, into short rods of varying thickness in the remainder of the body. Cervical and somatic setae numerous, mostly short.

Head: diameter 18-19 μ. Lips very prominent. Labial papillae minute but distinct. Cephalic setae flaccid, 8-10 μ long. Amphids oval.

Buccal cavity spacious. One strong dorsal, and a tiny subventral tooth present. The vestibulum is separated from the remainder of the buccal cavity by a cuticular ring. Pharyngeal bulb well developed. Esophageal bulb oval.

Spicula 29 μ long. Gubernaculum inconspicuous, parallel to spicula. Irregular anal setae present.

Tail 3.5-4 anal diameters long. Spinneret large. Anal diameter 32 μ.

Occurrence: Golden Gardens, Richmond Beach; 5.5 to -2.5 feet.

Graphonema clivosa n. sp. (fig. 57a-c)

♂♂: L = 0.62 a = 15.6 b = 5.0 c = 6.2

Body: diameter at end of esophagus 30 μ. Cuticular ornamentation as in the foregoing species. Dots perhaps somewhat

larger and rods slightly shorter. Cervical setae long; somatic setae shorter, arranged in 6 longitudinal rows along the body.

Head: diameter 18 μ in male, 22 μ in female. Lips prominent, labial papillae slightly longer than in *G. flaccida*. Cephalic setae stiff, 11-11.5 μ long.

Buccal cavity as in the foregoing species. Esophageal bulb round.

Spicula 33 μ long, large, strongly curved. Gubernaculum 21 μ long, with weakly curved dorsal apophysis.

Tail 4 anal diameters long, spinneret small. Anal diameter 32 μ.

Occurrence: Richmond Beach; 0.5 feet.

Neochromadora

My material contains four species of *Neochromadora,* among them what I think is *N. poecilosoma* (De Man), the type species of the genus and the most abundant species of nematodes in Puget Sound. The finding of this species makes me realize that the subgenus *Trichodorina,* as proposed in Wieser (1954b) has to be withdrawn since *N. poecilosoma* would have to be referred to it. The redescription of some of the older species by Gerlach (1951c) establishes the existence of a group of species characterized by long cephalic and somatic setae, which includes the following: *N. trichophora, N. poecilosoma, N. izhorica, N. tecta, N. lateralis,* and two new species, *N. pugilator* and *N. appiana.* A subgeneric division within the genus could be established, but in that case the above-mentioned group--since it includes the type species--would have to retain the generic name while a new name would have to be found for the remaining species of the genus. *N. pugilator* and *N. appiana* n. spp. are distinguished from *N. trichophora* by the absence of submedian somatic setae, the presence of preanal papillae, and the differently shaped spicular apparatus; from the other species of the group by the broad lateral differentiation which does not start until the end of the esophagus and which is characterized by rows of rods more heavily cuticularized than the ornamentations on the remainder of the body.

The fourth species of *Neochromadora, N. bicoronata* n. sp., belongs to the group with short cephalic setae and is characterized by the presence of 2 well-developed circles of cephalic setae, that is, the 6 cephalic papillae are setose and as long as the true cephalic setae.

Neochromadora poecilosoma (De Man) (fig. 58a-f)

♂♂: L = 1.37 a = 21.1 b = 7.2 c = 7.5

♀♀: 1.36 19.2 7.4 7.2 Vu = 47.6 per cent

Body: cuticle dark. In the cervical region the cuticular annules are covered with hexagonal bodies. Tailward these bodies change at first into large rods, then into shorter rods and elongated dots. Between the annules there are secondary cuticular elements, either rods or dots according to the region of the body. The lateral wings begin right with the cuticular annulation. In the cervical region they are 2 μ wide. In mid-body they are up to 5 μ wide, consisting of a number of heavily cuticularized dots (fig 58c). In the anal region they are very narrow, the 2 marginal dots touching each other (fig. 58d). In mid-body the wings are raised and supported by trapezoid cuticular pieces. The cervical and somatic setae follow the lateral fields closely, as is typical for this group of species. They are up to 30 μ long.

Head: diameter 19 μ. Cephalic papillae setose, short. Cephalic setae 16 μ long. Amphids oval.

Buccal cavity typical, with strong, triangular dorsal tooth. Esophageal bulb oval.

Spicula 42 μ long. Gubernaculum extended distally. There are 9 distinct, suckerlike preanal papillae.

Tail 5-58 anal diameters long.

Occurrence: One of the most abundant species in Puget Sound, occurring in all localities and on all intertidal levels.

Neochromadora pugilator n. sp. (fig. 60a-d)

♂♂: L = 1.46 a = 36.5 b = 8.3 c = 9.1

Body: diameter at end of esophagus 36 μ. The cuticular ornamentation is not so complicated as in the foregoing species. In the cervical region there are dots *between* and faint striation *on* the annules. The dots become elongated from the bulbar region onward, and the striation on the annules remains more or less distinct. The lateral wings are very broad, approximately 10 μ in mid-body, beginning at some distance behind the esophageal bulb and ending in the anal region. They are characterized by a slight bulging of the annules and by the strong cuticularization of the rods within their boundaries. They are not equally distinct in all specimens. The arrangement of cervical and somatic setae is typical. The setae are up to 20 μ long.

Head: diameter 25 μ. Cephalic papillae minute. Cephalic setae 21 μ long. Amphids oval, 11 μ wide.
Buccal cavity typical, with strong, slightly S-shaped tooth.
Excretory pore 60 μ in front of end of esophagus.
Spicula 48 μ long. Gubernaculum gradually enlarging toward distal end. There are 13 distinct preanal papillae, the anteriormost being 228 μ in front of the anus.
Tail 4.5 anal diameters long. Anal diameter 40 μ.
Occurrence: Golden Gardens, 8-5.5 feet.

Neochromadora appiana n. sp. (fig. 61a-d)
♂♂: L = 1.45 a = 20.0 b = 8.0 c = 8.3
♀♀: 1.22 24.5 7.0 7.0 Vu = 49 per cent
Body: diameter at end of esophagus 42 μ. Cuticular ornamentation exactly as in the foregoing species. Cervical setae up to 25 μ long.
Head: diameter 23 μ. Cephalic setae 18 μ long.
Buccal cavity typical, with strong, S-shaped tooth.
Spicula 51 μ long. Gubernaculum 38 μ long, with a lateral knoblike projection in the middle. There are 9-10 minute, inconspicuous preanal papillae.
Tail 4.6-5 anal diameters long. Anal diameter 46 μ.
Occurrence: Alki Point, Richmond Beach; 7.5-4 feet.
Remarks: This species is distinguished from the foregoing one mainly by the structure of the male genital armature, particularly by the shape of the gubernaculum and the number and size of the preanal papillae. The cephalic setae seem to be slightly shorter than in *N. pugilator*.

Neochromadora bicoronata n. sp. (fig. 59a-c)
♀♀: L = 1.17 a = 47.0 b = 7.3 c = 10.0 Vu = 50 per cent
Body: diameter at end of esophagus 24 μ. Cuticular ornamentation complicated, of the basketwork type. In the cervical region the annules are crenated and covered with large hexagonal bodies. Further back these bodies become more elongated and change into slender rods. In the cervical region dots can be observed between the crenated annules. In juveniles, rods or ribs are the dominant structure all over the body. The lateral wings begin in mid-cervical region and end in the anal region, never exceeding 1.5 μ in width. They are bordered by oblique bodies or ribs. Sometimes they give the impression of consisting of a longitudinal row of ovals, especially in mid-body (fig. 59b). This resembles

the condition in *N. craspedota*. There are very few cervical setae.

Head: diameter 13 μ. The 10 cephalic setae are arranged in 2 circles, each seta being 3 μ long.

Buccal cavity deep, probably armed with 2 minute teeth. Esophagus slightly enlarged posteriorly.

Tail 8 anal diameters long. Anal diameter 18 μ.

Occurrence: Alki Point; subterranean water.

Remarks: Because of the 10 cephalic setae this species should perhaps be referred to *Nygmatonchus* (see Wieser, 1954b). However, for the time being the species of the latter genus are characterized by the arrangement of the 10 cephalic setae in *one* circle.

Chromadora

The only species of *Chromadora* found in Puget Sound is a new one because of the occurrence of 11 big preanal papillae. Otherwise the species closely resembles *C. nudicapitata*.

Chromadora undecimpapillata n. sp. (fig. 62a-c)

♂♂: L = 0.90 a = 22.6 b = 6.7 c = 8.7

Body: diameter at end of esophagus 30 μ. Cuticular ornamentation typical. Outer longitudinal rows 5.5-6 μ apart. Dots slightly elongated. Weak ocellar pigment and the usual group of cervical setae present.

Head: diameter 13 μ. Papillae indistinct. Cephalic setae 8 μ long.

Buccal cavity typical. Esophageal bulb 28 μ long.

Spicula 30 μ long. Gubernaculum with lateral plates. There are 11 big preanal papillae, the anteriormost at a distance of 144 μ in front of the anus.

Tail 4 anal diameters long. In the middle and near the tip there are the 2 minute ventral papillae that also occur in *C. nudicapitata*. Spinneret 4 μ long. Anal diameter 26 μ.

Occurrence: Vashon Island; -1 foot.

Chromadorina germanica (Buetschli)

Typical representatives of this species were found in all localities from 7 to -2 feet.

This species has been known from coasts of northern Europe and from the Mediterranean.

Spilophorella paradoxa (De Man)

♀♀: L = 0.66 a = 16.6 b = 4.4 c = 6.0 Vu = 50 per cent

Body: diameter at end of esophagus 37 μ. Cuticular ornamentation typical; longitudinal rows 3-3.6 μ apart.

Head: diameter 16 μ. Cephalic setae 7 μ long.

Excretory pore 50 μ behind anterior end. Esophageal bulb 48 x 30 μ.

Spicula 48 μ long. Gubernaculum typical, with lateral plates and projections.

Tail 4 anal diameters long in male, 5.5 in female. Spinneret 28-30 μ long, with 2 setae near its middle. Anal diameter 22 μ in female.

Occurrence: Bainbridge Island, Vashon Island, Alki Point; 2 to -1 feet.

Remarks: My specimens seem to be typical representatives of this cosmopolitan species except that the tail is somewhat shorter than usual.

Prochromadorella

I found one species of this genus that so closely resembles *P. antarctica* that I am still not quite sure whether it is justifiable to describe it as new. There are, however, some differences. The cuticular ornamentation is less heterogeneous, and the oval bodies are less densely arranged in *P. triangularis* n. sp. than in *P. antarctica*. The contour of the annules is never crenate, as was described for the latter species by Cobb (1914), and the rods are never as elongated and thin as figured by Allgén (1929). The spicula are larger and more pronouncedly cephalated in the new species than in *P. antarctica* and there are 12, as against 9-10, preanal papillae.

Since completion of my key for *Prochromadorella* in Wieser (1954b), the following species were described:

P. chitwoodi Timm 1952. This species, however, is synonymous with *P. paramucrodonta* in which the occurrence of lateral differentiation has been noted before.

P. subterranea Gerlach 1952

P. tenuicaudata Gerlach 1954

Both these species belong to group B. 4. of my key in Wieser (1954b).

Prochromadorella triangularis n. sp. (fig. 64a-c)

♂♂: L = 0.85 a = 21.3 b = 6.8 c = 7.7

♀♀: 0.71 17.8 7.1 6.5 Vu = 46.5 per cent

Body: diameter at end of esophagus 30 μ. Cuticular ornamentation consisting of fairly widely spaced elongated dots in cervical and anal region and short rods in mid-body. No basketwork structures. Several groups of cervical setae present.

Head: diameter 15-16 μ. Labial and cephalic papillae distinct. Cephalic setae 8.5 μ long.

Buccal cavity: the teeth are triangular and weakly cuticularized. In this respect they are not quite typical for the genus *Prochromadorella* but assume an intermediate position between this genus and *Chromadorita* or *Graphonema*. Some additional minute denticles are present on the level of the teeth. Esophageal bulb roundish-oval.

Spicula 30 μ long, arcuate, proximally cephalated. Gubernaculum with lateral plates. There are 12 big preanal papillae, the anteriormost of which is 130 μ in front of the anus.

Tail 4 anal diameters long in male, 5 in female.

Occurrence: Alki Point; subterranean water.

Chromadorella

Two species belonging to this genus were found in Puget Sound. *C. galeata* n. sp., with its 2 longitudinal rows of dots that are 20 per cent of the corresponding diameter apart in the anterior cervical region, and with its heavy sclerotization of the anterior annules, belongs to group I. A. of my key in Wieser (1954b, p. 110). Because of its short cephalic setae it is related to *C. mytilicola,* but it is much more slender (a = 42.5 versus 14.0), and the longitudinal rows are even further apart from each other than in the latter species.

The second species, *C. edmondsoni* n. sp., is characterized by the lateral differentiation of the cuticle into a number of *irregular* longitudinal rows, and by the great number of preanal papillae in the male.

Chromadorella galeata n. sp. (fig. 65a-c)

♂♂: L = 1.70 a = 42.5 b = 8.1 c = 11.3

Body: diameter at end of esophagus 39 μ. Cuticular ornamentation complicated. Annules in anterior cervical region solid, with crenate contour. Further back the annules are resolvable into rods, and also between the annules there are somewhat thinner and lighter rods. In the posterior portion

of the body only dots can be seen on the annules. The two longitudinal rows are represented by large dots in the anterior cervical region, by smaller dots in the remainder of the body. Their distance from each other is 7 μ in the anterior cervical region, 4.5-5 μ in the remainder of the body. They are accompanied on both sides by cervical and somatic setae.

Head: diameter 25 μ, height 12 μ. Cuticular plates form a sort of helmet. Cephalic setae frail, probably 8 μ long.

Buccal cavity with 3 solid teeth. Esophagus gradually enlarging posteriorly.

Spicula 52 μ long, cephalated proximally. Gubernaculum plate-shaped. There are 12 preanal papillae.

Tail 5 anal diameters long. Anal diameter 36 μ. Spinneret curved dorsally.

Occurrence: Alki Point; 2 feet.

Chromadorella edmondsoni n. sp. (fig. 67a-d)

♂♂: L = 1.47 a = 29.5 b = 7.4 c = 11.8

Body: diameter at end of esophagus 38 μ. Cuticular ornamentation complicated. Annules in anterior cervical region covered by large, irregularly shaped cuticular bodies which further back change into a zigzag pattern (fig. 67c). The pattern is further resolved into rods in mid-body and into dots in the anal region. Lateral differentiation consisting of several irregular longitudinal rows (or irregularly spaced dots). A few cervical setae present.

Head: diameter 22 μ. Lips very prominent. Cephalic papillae setose, 1.5 μ long. Cephalic setae 9 μ long.

Buccal cavity with 3 large, solid teeth (each approximately 5 μ long). Esophagus gradually enlarging posteriorly, with 2 weak plasmatic breaks.

Spicula arcuate, 43 μ long, cephalated proximally. Gubernaculum plate-shaped. There are 12 large preanal papillae, the anteriormost of which is 170 μ in front of the anus.

Tail 4.5 anal diameters long. Anal diameter 36 μ. Spinneret curved dorsally.

Occurrence: Bainbridge Island; 2 feet.

Atrochromadora n. gen.
= *Chromadoropsis* Wieser nec Filipjev

Since *Chromadoropsis* Wieser 1954 is preoccupied by *Chro-*

madoropsis Filipjev 1918 a new name had to be found for the genus with the type species *C. parva*. Some of the problems concerning this genus have been mentioned in Wieser (1954b), but more have arisen. The distinguishing characters of this genus I held to be the circularly spiral but indistinct amphids (text figure 1) and the dark but homogeneous cuticle. These characters hold for the type, *C. parva*, but for the other species I suspect the amphids to be more of the type found in *Chromadora* and *Chromadorina*, that is, oval- or loop-shaped (text figure 2).

Text figure 1 Text figure 2

If this is true still another genus should be established for these species, distinguished from *Chromadora* and *Chromadorina* by the dark cuticle (this is a good character although it is difficult to represent in figures) and by the lateral differentiation that is either irregular or consists of 2 (not 4) longitudinal rows. In Wieser (1954b, pp. 112, 114), I erroneously held that in *A. microlaima* there are 4 longitudinal rows.

A key to the three species belonging to this group reads as follows:

1 Lateral differentiation regular, consisting of 2 longitudinal rows; 10-15 preanal papillae.
2 Cephalic setae 75 per cent of the head diameter long; 12-15 papillae:
A. microlaima (De Man)
2' Cephalic setae 40 per cent of the head diameter long; 10 papillae:
A. obscura n. sp.
1' Lateral differentiation irregular; 8 preanal papillae:
A. dissoluta (Wieser)

For the time being I shall keep these three species in the genus *Atrochromadora*. Besides them only the type, *A. parva*, with spiral though indistinct amphids and without papillae belongs to this genus.

Atrochromadora obscura n. sp. (fig. 66a-c)

♂♂: L = 0.88 a = 21.1 b = 6.7 c = 7.2

Body: diameter at end of esophagus 30 μ. Cuticle dark, re-

solvable into short rods throughout the body, the rods forming the 2 lateral rows being larger and darker than the rest. The 2 longitudinal rows are 4.8 μ apart in the anterior cervical region, 4 μ in the remainder of the body. Few cervical setae present.

Head: diameter 13 μ. Lips prominent, papillae distinct. Cephalic setae 4.5-5 μ long. Amphids oval, loop-shaped.

Buccal cavity with 3 solid teeth, the dorsal one the biggest. Esophageal bulb oval, 28 μ long.

Spicula 26 μ long. Gubernaculum bent distally, with weak lateral plates. There are 10 preanal papillae, the anteriormost being 102 μ in front of the anus.

Tail 5 anal diameters long. Anal diameter 24 μ.

Occurrence: Vashon Island; -1 foot.

Family COMESOMATIDAE

Sabatiera

All four species found in my material are already known. The following species were not included in my key in Wieser (1954b):

S. paravulgaris Filipjev 1946 (only female known)

S. americana Timm 1952 (see below)

S. supplicans Gerlach 1956

Sabatiera jubata (Cobb)

Head: diameter 19-21 μ. Cephalic setae 13-16 μ. 17-21 cervical setae in each of the 4 longitudinal rows. Amphids 11 μ = > 50 per cent of corresponsing diameter in width, 3 turns.

Spicula 74 μ long, apophysis of gubernaculum 36 μ.

Tail 5 anal diameters long. Anal diameter 54 μ. Terminal setae 16 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 4.5 to -2.5 feet.

Distribution: Australia, Chile, Puget Sound.

Sabatiera clavicauda (Filipjev) (fig. 68a, b)

= *S. punctata* Kreis; Timm 1952

♂♂: L = 2.32 a = 38.8 b = 11.6 c = 15.5

Body: diameter at end of esophagus 50 μ. Cuticular ornamentation consisting of fine dots, without noticeable lateral differentiation. A few cervical setae present.

Head: diameter 17 μ. Cephalic setae 6 μ. Amphids 11 μ = 60

per cent of corresponding diameter in width, 2.75-3 turns (in male).

Excretory pore situated behind nerve ring.

Spicula 50 μ long, with an incomplete longitudinal reinforcement. Apophysis of gubernaculum 18 μ long. There are 7 preanal papillae.

Tail 3.5 anal diameters long, distal fourth cylindrical; tip swollen. Anal diameter 50 μ.

Occurrence: Bainbridge Island, Alki Point, Golden Gardens; 2 to - 2.5 feet.

Distribution: North Sea, Baltic, Black Sea, Chesapeake Bay, Puget Sound.

Remarks: My specimens agree completely with the descriptions of *S. punctata* by Kreis; Timm; and Gerlach (1953c). There can hardly be any doubt that this species is identical with *S. clavicauda* Filipjev, although in the latter species the cephalic setae seem to be slightly longer. Because of the variability in the length of the cephalic setae, the species of group B.2.b.bb.I., from 4(1) to 8(5), in my key in Wieser (1954b, p. 123) are not too well separated.

Sabatiera americana Timm 1952 (fig. 69a, b)

♂♂: L=1.97 a=39.4 b=10.0 c=11.6

♀♀: 2.01 30.8 9.0 13.0 Vu=51.2 per cent

Body: diameter at end of esophagus 43 μ. Lateral differentiation of cuticle consisting of larger and irregularly arranged dots, restricted to posterior cervical and to anal region. A few cervical setae present.

Head: diameter 17 μ. Cephalic setae measuring 9 μ in male, 8 μ in female. Amphids 10 μ=55-60 per cent of corresponding diameter in width, describing 3 turns.

Spicula 66 μ long, cephalated proximally. Apophysis of gubernaculum 34 μ long. There are 10 preanal papillae and 1 seta immediately in front of the anus.

Tail 4-4.3 anal diameters long, less than 25 per cent cylindrical. Anal diameter 34-36 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point; 4.5 to 0 feet.

Distribution: Chesapeake Bay, Puget Sound.

Remarks: My specimens agree with the type, but for the somewhat longer spicula and the occurrence of 10, instead of 7, papillae. The next relatives are *S. vulgaris*, which has smaller amphids and differently shaped spicula, and *S. an-*

cudiana, which has 16 papillae and a differently shaped genital armature.

Sabatiera cupida Bresslau

Typical representatives of this cosmopolitan species (North Sea, Mediterranean, Brazil, Chile) were encountered on Vashon Island and Alki Point, between 7 and -2 feet.

Body: lateral differentiation of cuticle conspicuous.

Head: diameter 17 μ. Cephalic setae 10.5 μ long. Amphids 13 μ = 74 per cent of corresponding diameter in width, 2.5 turns.

Spicula 48 μ long. Apophysis of gubernaculum bent. Thirteen preanal papillae.

Family AXONOLAIMIDAE

Subfamily AXONOLAIMINAE

Parascolaimus n. gen.

This new genus is separated from other genera of this family by the occurrence of 6 labial "claws," which probably represent modified labial papillae, and by the peculiar structure of the gubernaculum. The latter is divided into 2 parts, a dorsal one that carries the caudodorsal apophysis, and a ventral one that is paired, tubular, and situated lateral to the distal end of the spicula (figs. 70b, 71b). The amphids describe a circular loop, a feature that this genus has in common with *Ascolaimus*. The buccal cavity is shaped as in *Axonolaimus* and *Ascolaimus*. The pilosity of the body is very well developed. The ovaries are paired. The type species is here described as *Parascolaimus tau* n. sp., below.

The labial "claws" represent, as already mentioned, modified labial papillae, that is, they are not homologous to the "teeth" in the genus *Odontophora*, which are a formation of the vestibular wall. Two species are known.

Parascolaimus tau n. sp. Amphids 60-75 per cent of corresponding diameter in width. Preanal tubuli present in male. Type!

Parascolaimus ungulatus n. sp. Amphids 25 per cent of corresponding diameter in width. No preanal tubuli present.

Parascolaimus tau n. sp. (fig. 70a-d)

♂♂: L = 2.54 a = 63.2 b = 12.7 c = 18.1

♀♀: 2.82 56.4 13.4 23.5 Vu = 62.1 per cent

Body: annulation coarse. Cervical setae arranged in 2 sublateral longitudinal rows on each side of the body.

Head: diameter 16-19 μ. Six labial "claws" and 6 large cephalic papillae present. The "claws" can be extruded. Cephalic setae 36-47 μ long. Amphids mostly circular in outline, loop-shaped, 12 x 12 μ = 75 per cent of corresponding diameter in width, sometimes more oval (12 x 8 μ in one specimen).

Buccal cavity unarmed, 24 + 7 μ long.

Excretory pore 60 μ behind anterior end. Ventral gland 130 μ behind end of esophagus.

Spicula 51 μ long, large, cephalated proximally. Gubernaculum consisting of 2 parts, a dorsal, and a ventral, tubular one. The latter is paired and lies lateral of the spicula. Apophysis of dorsal part 18 μ long. The preanal armature of the male consists of 10 arcuate tubuli and a papilla at a distance of 480 μ in front of the anus. Over a distance of 620 μ the ventral cuticle is divided into fields by approximately 35 constrictions.

Tail 3-4 anal diameters long, setose. Anal diameter 40-42 μ.

Occurrence: Bainbridge Island, Alki Point, Golden Gardens, Richmond Beach; almost exclusively in the upper intertidal zone.

Remarks: I also found specimens that conformed with the above description in every respect except that the dimensions of most of the organs (except amphids) were smaller. Also since the preanal constrictions of the male were absent I suspect that these specimens represented the last larval stage.

Parascolaimus ungulatus n. sp. (fig. 71a-c)

♂♂: L = 3.65 a = 91.2 b = 15.8 c = 36.5

♀♀: 3.85 63.4 15.2 24.6 Vu = 63.2 per cent

Body: diameter at end of esophagus 48 μ. Cuticular striation indistinct. Cervical and somatic setae in 4 sublateral longitudinal rows, the former up to 18 μ long, the latter considerably shorter.

Head: diameter 15-18 μ. Six labial "claws" and 6 cephalic papillae present. Cephalic setae in one female 40 μ, in one male 26 μ long. Amphids circular, loop-shaped, 5 μ = 25 per cent of corresponding diameter in width.

Buccal cavity 19-22 μ long, unarmed.

Excretory pore 42 μ behind anterior end; ampulla large.

Spicula 44 μ long. Apophysis 18 μ long. There might be 2 minute preanal papillae present.

Tail 3-3.4 anal diameters long. Anal diameter 39 μ in male, 52 μ in female.

Occurrence: Vashon Island, Golden Gardens, Richmond Beach; 7 to -2 feet.

Axonolaimus

A group key to the species of this genus reads as follows:

1 Amphids as long as (or longer than) the posterior portion of the buccal cavity, its 2 arms being straight and lying parallel to each other so that there is no trace of a loop left. (This group might represent a new subgenus. An analogous division is to be found in the genus *Odontophora*):
A. antarcticus Cobb 1930
A. arcuatus Stekhoven 1950
A. setosus Filipjev 1918 nec Skwarra
A. spinosus (Buetschli 1874)
Doubtful species that might belong to this group are:
A. longisetosus Allgén 1947, *A. diegoensis, A. tenuicollis*' Allgén 1947

1' Amphids mostly shorter than the posterior portion of the buccal cavity, always forming a distinct loop shaped like a shepherd's crook.

2 Cephalic setae not longer than 1 head diameter:
A. demani Stekhoven and De Coninck 1933
A. filiformis De Man 1899 (doubtful species)
A. filipjevi Timm 1952
A. odontophoroides Chitwood 1936
A. paraspinosus Stekhoven and Adam 1931
A. ponticus Filipjev 1918
A. subsimilis Chitwood 1936 (cephalic setae perhaps slightly longer than 1 head diameter)
A. typicus De Man 1922

2' Cephalic setae 1.75 to 2 head diameters long.

3 The posterior end of the amphids reaches to, or surpasses, the posterior end of the buccal cavity.

4 Excretory pore 4-5 head diameters behind anterior end:
A. villosus Skwarra 1922
A. tyrrhenicus Brunetti 1941 (see also Gerlach, 1952b). This species is probably synonymous with *A. villosus*.

4' Excretory pore 2 head diameters behind anterior end:
A. schuurmans-stekhoveni Allgén 1935. Amphids just reach-

ing to posterior end of buccal cavity. No posterior cervical and somatic setae. Tail narrow-conical.

A. interrogativus n. sp. Amphids reaching far beyond posterior end of buccal cavity. Four longitudinal rows of setae all along the body. Tail plump-conical.

3 The posterior end of the amphids does not reach to the posterior end of the buccal cavity:

A. steineri Timm 1952

Doubtful species: *A. leptosoma* Allgén 1951, *A. limalis* Saveljev 1912.

Axonolaimus interrogativus n. sp. (fig. 72a, b)

♀♀: L = 2.27 a = 57.0 b = 11.4 c = 22.7

Body: diameter at end of esophagus 36 μ. Finely striated. Cervical and somatic setae in 4 dense longitudinal rows all over the body, the former up to 17 μ long.

Head: diameter 17 μ. Six conspicuous conical papillae. Cephalic setae 40 μ long. Amphids 20 x 11 μ, shepherd's crook.

Buccal cavity 24 μ long.

Excretory pore 32 μ behind anterior end.

Tail 4 anal diameters long, plump-conical, setose. Anal diameter 36 μ. Spinneret truncate.

Occurrence: Richmond Beach; 4 feet.

Odontophora

In my material I encountered four closely related species of this genus that all belong to group B. 2. b. bb. of my key in Wieser (1956b, pp. 4-5). However, in the characterization of group B. 2., the sentence "terminal setae--if present--much shorter than one anal diameter" has to be deleted since in three out of the four species from Puget Sound the terminal (rather, "subterminal") setae are very well developed. One of the four species I identify as *O. peritricha* Wieser, although there are some minor differences from the type. The three other species are new.

An emended key to group B. 2. b. reads as follows:

b. Amphids just behind cephalic setae, loop-shaped, oval in outline.

aa. 4 subcephalic setae; first circle of cervical setae behind buccal cavity longer than 1 head diameter; preanal papillae in the male:

O. longisetosa (Allgén)

bb. 10-12 subcephalic setae; first circle of cervical setae be-

hind buccal cavity shorter than 1 head diameter; no papillae in the male.

The four species belonging to this group are difficult to separate but careful comparison of the figure and descriptions shows convincingly that they all are good species.

O. mercurialis n. sp. is characterized by the peculiar structure of the male genital apparatus (fig. 75c), *O. mucronata* n. sp. by the trapezoid shape of the teeth and by the shape of the gubernaculum. Both these species are also distinguished from the remaining two by the well-developed labial and cephalic papillae.

O. peritricha Wieser and *O. lituifera* n. sp. are separated from each other by the following features: the amphids are larger, and the cephalic papillae are more indistinct in *O. lituifera*. The specula are cephalated and recurved proximally in *O. peritricha*.

Since completion of my key in Wieser (1956b) two more species, namely, *O. setosoides* and *O. axonolaimoides* Timm 1952, were described; the latter species belonging to group A, the former to group B.3.

Odontophora lituifera n. sp. (fig. 73a, b)

Body: diameter at end of esophagus 34 μ. striation distinct. Cervical setae in 4 longitudinal rows.

Head: diameter 18 μ. Labial and cephalic papillae indistinct. Cephalic setae 32 μ long. Eight long subcephalic setae present. Amphids 11-12 μ long, 7-10 μ wide.

Buccal cavity: posterior portion 18 μ deep.

Excretory pore shortly behind cephalic setae.

Spicula 24-25 μ long, not cephalated proximally. Long pre- and postanal setae present.

Tail 3.4 anal diameters long, setose; near the tip there are 2 dorsal setae in the male that are somewhat longer than the other setae. Anal diameter 34 μ.

Occurrence: Alki Point, Golden Gardens; 0 to -2 feet.

Odontophora peritricha Wieser (fig. 74a-c)

♂♂: L = 2.76 a = 55.2 b = 22.1 c = 25.0

♀♀: 2.25 45.0 16.7 22.5 Vu = 58.9 per cent

Body: diameter at end of esophagus 43 μ. Striation fine. Cervical setae in 4 longitudinal rows, up to 12 μ long.

Head: diameter 15-18 μ. Labial and cephalic papillae distinct, small. Cephalic setae 24-30 μ long. Eight sub-

cephalic setae, 21 μ long. Amphids 10 μ long, 7 μ wide. Buccal cavity 6-8 + 18 μ deep. The cuticular teeth forming the anterior portion of the buccal cavity are surrounded at their base by a cuticular ring. Near the tips of the teeth there is a circle of small plates (which actually are cuticularized portions of the external layer of the body cuticle). Excretory pore between cephalic and subcephalic setae. Ventral gland 44-66 μ behind end of esophagus. Nerve ring at 81 per cent of esophagus. Spicula 26-30 μ long, recurved and cephalated proximally. Apophysis of gubernaculum 13 μ. Tail 4 anal diameters long, setose. In the male the 2 subterminal setae measure about 3/4 of the anal diameter. Anal diameter 31-38 μ. Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 4.5 to -2.5 feet. Distribution: Chile, Puget Sound. Remarks: In my Chile specimens I did not observe the long subterminal setae of the male, the spicula were shorter (16 as against 26-30 μ), and the esophagus was longer. I feel, however, that these differences can be explained by individual variation. The subterminal setae, for example, cannot be observed in all male specimens.

Odontophora mercurialis n. sp. (fig. 75a-c)

♂♂: L=3.37 a=56.1 b≈24.1 c=28.1

Body: diameter at end of esophagus 37 μ. Cervical and somatic setae in 4 longitudinal rows all along the body, the former up to 18 μ long, the latter short. Head: diameter 17 μ. Labial and cephalic papillae very well developed, conical. Cephalic setae 25 μ long. Eight subcephalic setae, 26 μ long. Between cephalic and subcephalic setae there are on each side of the body 2 very short setae. Amphids 9.5 μ long. Buccal cavity 7+22 μ. Cuticular ring at base of teeth present, cuticular plates near tips of teeth strongly developed. Excretory pore shortly behind cephalic setae. Spicula 30 μ long, with unusual curvature and beaklike distal end. Apophysis of gubernaculum slender, approximately 16 μ long. Tail setose, 4 anal diameters long. Subterminal setae 43 μ long. Anal diameter 42 μ. Occurrence: Vashon Island, Richmond Beach; 0.5 to -2.5 feet

Odontophora mucronata n. sp. (fig. 76a, b)

♂♂: L = 2.91 a = 64.6 b = 23.3 c = 26.5

♀♀: 3.00 60.0 20.0 30.0 Vu = 49.1 per cent

Body: diameter at end of esophagus 36 μ. Cervical setae numerous, scattered.

Head: diameter 18 μ. Labial and cephalic papillae very well developed, conical. Cephalic setae 21 μ long. Eight long subcephalic setae present. Between cephalic and subcephalic setae there are on each side of the body 2 short, stiff setae. Amphids 10 μ long, 6 μ wide.

Buccal cavity 8 + 20 μ. Teeth trapezoid. Cuticular ring and plates well developed.

Nerve ring at 70 per cent of esophagus.

Spicula 28 μ long. Apophysis of gubernaculum large, blunt.

Tail 3-3.7 anal diameters long, setose. Subterminal setae approximately 20 μ long. Anal diameter 36 μ.

Occurrence: Vashon Island; 7 feet.

Subfamily CYLINDROLAIMINAE

Araeolaimus

One species was found in Puget Sound which, because of the position of the excretory pore, is closely related to *A. laqueifer* (see Wieser, 1956b, p. 12), but distinguished from this species by the pilosity of the cervical region (which is very much like that of *A. elegans*), by the length and shape of the spicula, and by the occurrence of stiff circumanal setae and postanal papillae.

Araeolaimus boomerangifer n. sp. (fig. 77a-c)

♀: L = 0.92 a = 37.0 b = 6.5 c = 9.3

Body: diameter at end of esophagus 25 μ. Cuticle finely striated. Cervical setae in characteristic arrangement, roughly as in *A. elegans*. Ocelli 36-42 μ behind anterior end; excretory pore on the same level, ampulla about 12 μ further back.

Head: diameter 8.5 μ. Six minute papillae present. Cephalic setae 6 μ long. Amphids 4.8 μ wide, 9.5 μ behind anterior end.

Buccal cavity indistinct; postocellar swelling of esophagus distinct.

Spicula 29 μ long, regularly curved, slightly cephalated proximally. Apophysis of gubernaculum 12 μ long, slender.

There is a group of 10-12 stiff circumanal and postanal setae.

Tail in male 3.5, in female 4.5, anal diameters long, setose in male, with 3 postanal, ventral papillae.
Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens, Richmond Beach; 7 to 0 feet.

Araeolaimoides

Although I found only one female belonging to this genus I am establishing a new species for it since it is quite distinctly separated from all other species.

A. botulus n. sp. belongs to group B. of my key (Wieser, 1956b, p. 15). It is distinguished from the other two species of this group by longer cephalic setae, absence of cervical setae, and particularly by the position of the excretory pore, which is situated 126 μ behind the anterior end.

Araeolaimoides botulus n. sp. (fig. 78a, b)
♀♀: L=1.66 a=55.5 b=8.3 c=15.0 Vu≈57.5 per cent
Body: diameter at end of esophagus 25 μ. Coarse cuticular annulation.
Head: diameter 14 μ. No papillae. Cephalic setae 17 μ. Amphids sausage-shaped, oval in outline, 23 μ long.
Buccal cavity indistinct. Excretory pore 126 μ behind anterior end, ampulla large.
No ocelli. Ovary symmetrical.
Tail 6.8 anal diameters long. Anal diameter 22 μ.
Occurrence: Alki Point; -2.5 feet.

Family TRIPYLOIDIDAE

Bathylaimus

My material contained three species of this genus, one of which is *B. australis* while the other two are new. Both new species belong to group B.2.b.bb. §§. of my key in Wieser (1956b, p. 32).

B. bicoronatus n. sp. is separated from the other species belonging to this group by the extreme elongation of the labial setae and of the long members of the cephalic setae.

B. tarsioides n. sp. is characterized by the stoutness of labial and cephalic setae and by the fact that the longer cephalic setae are jointed. The distal joint of the cephalic setae is club-shaped and notched.

Bathylaimus bicoronatus n. sp. (fig. 79a, b)

♀♀: L = 2.67 a = 33.4 b = 4.0 c = 22.3 Vu = 60 per cent

Body: diameter at end of esophagus 72 μ. Very few short cervical setae.

Head: diameter 36 μ. Labial setae 22 μ, cephalic setae 60 + 12 μ long. Amphids 10 μ = 22 per cent of corresponding diameter in width, 48 μ behind anterior end.

Buccal cavity spacious, anterior portion 36 μ, posterior portion approximately 15 μ deep.

Nerve ring at 20 per cent of esophagus.

Tail 2.5 anal diameters long, finger-shaped. Anal diameter 50 μ.

Occurrence: Richmond Beach; 5 feet.

Bathylaimus tarsioides n. sp. (fig. 80a-c)

♂♂: L = 1.62 a = 33.6 b = 7.3 c = 28.0

♀♀: 1.91 31.8 7.0 22.5 Vu = 40 per cent

Body: diameter at end of esophagus 45 μ. Scarce, short cervical and somatic setae. Cuticle finely striated.

Head: diameter 24 μ. Two minute elevations were seen near the apex of the lips. It is unclear whether these elevations represent another circle of labial papillae. Labial setae extremely stout at the base, attenuated at the tip, 7 μ long. Longer members of cephalic setae 30 μ long, jointed, with the distal joint club-shaped and notched; shorter members 10 μ, unjointed, stiff. Amphids 25 μ behind anterior end, 20 per cent of corresponding diameter in width, slightly oval.

Buccal cavity 30 μ deep, with several projections and at least 1 tooth near the base.

Spicula 36 μ long, cephalated proximally. Gubernaculum rostrate, distal end cuticularized, pointed. There are 4 subventral preanal setae.

Tail 3 anal diameters long, setose. Anal diameter 32 μ.

Occurrence: Bainbridge Island; 6.5 feet.

Bathylaimus australis Cobb

Head: cephalic setae 20 + 8 μ long, truncate. Amphids 6 μ wide, slightly more forward than in my Chilean specimens.

Buccal cavity 37 μ deep.

Occurrence: Vashon Island; 7 feet.

Distribution: Australia, Chile; Puget Sound.

One of the two species found in Puget Sound is *T. gracilis*. (In Wieser, 1956b, I erroneously listed this species under the name *septentrionalis* although *gracilis* has priority.) The other species is new, being, with exception of the shape of the tail and the occurrence of pre- and postanal papillae in the male, an exact, larger copy of the former species.

Tripyloides imitans n. sp. (fig. 81a, b)

♂♂: L = 2.62 a = 52.5 b = 7.5 c = 21.0

Body: diameter at end of esophagus 46 μ. Cervical setae in 6 longitudinal rows.

Head: diameter 23-24 μ. Labial papillae short, cephalic setae stout, 9-12 + 7.5-9 μ long. Amphids 7.5 μ = 23 per cent of corresponding diameter in width, 35 μ behind anterior end.

Buccal cavity as in *T. gracilis*, anterior portion about 13 μ long, with projections at base.

Spicula and gubernaculum 30 μ long, shape as in *T. gracilis*. There are 5 preanal papillae.

Tail 3.8 anal diameters long, plump, in male with 6 ventral papillae. Scattered setae. Anal diameter 36 μ.

Occurrence: Vashon Island, Richmond Beach; 7 to -1 feet.

Tripyloides gracilis (Ditlevsen) (fig. 82a-c)

♂♂: L = 1.40 a = 31.1 b = 7.0 c = 11.2

♀♀: 1.44 28.8 6.4 13.1 Vu = 50 per cent

Body: diameter at end of esophagus 36 μ. Two groups of cervical setae.

Head: diameter 17 μ. Cephalic setae 6-7 μ, the longer ones with truncate tip. Amphids 7 μ = 30 per cent of corresponding diameter in width, 18-28 μ behind anterior end.

Spicula 28 μ long.

Tail 4.5-4.7 anal diameters long. Anal diameter 30 μ.

Occurrence: Vashon Island, Alki Point; 7 - 3 feet.

Distribution: Baltic, North Sea, Chile, Puget Sound.

Family LINHOMOEIDAE

Metalinhomoeus setosus Chitwood (fig. 83a-d)

♂♂: L = 2.28 a = 65.0 b = 17.6 c = 17.8
♀: 2.11 53.0 16.9 13.0

Body: diameter at end of esophagus 30-34 μ. Cuticle finely striated.

Head: diameter 17-18 μ. Four cephalic setae, 16-18 μ, 2 subcephalic (median) setae, 14-15 μ long. Amphids 9.5-10 μ = 40 per cent of corresponding diameter in width, 15-16 μ behind anterior end.

Excretory pore 50 μ anterior to end of esophagus. Cardia 42 μ long. Intestine filled with yellow-orange inclusions.

Spicula 30 μ, apophysis of gubernaculum 18-23 μ long.

Tail in female 5.5, in male 4.5 anal diameters long, posterior sixth to eight cylindrical.

Occurrence: Vashon Island, Golden Gardens; 3 to -2 feet.

Distribution: Texas (Port Aransas), Puget Sound.

Remarks: Except for some differences in the dimensions, my specimens agree very well with Chitwood's description.

Desmolaimus

In my material I encountered typical representatives of an old brackish water species, namely *D. fennicus*.

A key to the good species of this genus reads as follows:

1 Tail conical, not swollen distally:
D. zeelandicus De Man 1884
D. zeelandicus var. *americanus* Chitwood 1936
D. zosterae Allgén 1933

1' Tail conical or elongated, swollen distally

2 Tail elongated, posterior half cylindrical, filiform:
D. longicaudatus Kreis 1929

2' Tail conical:
D. fennicus G. Schneider 1926
= *D. elongatus* Allgén 1935

The characters supposed to distinguish these two species are quite insignificant. That *D. fennicus* and *D. elongatus* are synonymous is also shown by the specimens from Puget Sound, which in several respects are intermediate between the extremes as they have been known from the literature so far.

Desmolaimus fennicus G. Schneider (fig. 84a-c)

♂♂: L = 1.98 a = 49.5 b = 12.0 c = 12.8
♀: 1.43 57.4 9.5 10.6

Body: diameter at end of esophagus 36 μ.

Head: diameter 17 μ (on level of subcephalic setae 21 μ). Four cephalic setae, 6-6.5 μ, 2 (median) subcephalic setae 7.5 μ long. Amphids 6-7 μ = 26-30 per cent of corresponding diameter in width, 15 μ behind anterior end.

Buccal cavity typical, base cuticularized, with 2 transverse rings. Esophageal bulb with 3 cuticular thickenings at the posterior end of which there are 3 hemispherical, more strongly cuticularized bodies (already seen by G. Schneider). This cuticular apparatus might be homologous with the valvular apparatus as known in plectids and rhabditids. It probably has masticatory function. Cardia 36 μ long. Excretory pore 60 μ in front of end of esophagus.

Spicula 36 μ long, cephalated distally, apophysis of gubernaculum 22 μ long.

Tail in male 4.2, in a juvenile female 6 anal diameters long, swollen distally. Anal diameter 35 μ.

Occurrence: Bainbridge Island; 2 feet.

Distribution: Baltic, Öre Sound, Puget Sound.

Eleutherolaimus

My material contained two old species of this genus, namely, *E. stenosoma* and *E. obtusicaudatus*.

Eleutherolaimus stenosoma (De Man) (fig. 85a-c)

♂♂: L = 1.66 a = 66.4 b = 8.3 c = 12.3

♀♀: 1.67 56.0 9.6 13.4 Vu = 52.4 per cent

Body: diameter at end of esophagus 28 μ. Very few cervical setae, up to 6 μ long.

Head: diameter 10 μ. Six minute labial papillae. Eight cephalic setae in 2 circles, measuring 3.8 and 4.2 μ, respectively. Amphids 5-6 x 6-7 μ = 40-50 per cent of corresponding diameter in width.

Buccal cavity: vestibulum 3.5 μ, posterior portion 5 μ deep, with cuticular ring between the 2 compartments. Excretory pore 74-100 μ behind anterior end. Ventral gland on level of, or slightly behind, end of esophagus.

Spicula 24 μ, apophysis of gubernaculum 11 μ long.

Tail in female 8, in male 5, anal diameters long. Anal diameter 18-25 μ.

Occurrence: Bainbridge Island, Alki Point; 6.5 to -2 feet.

Distribution: Baltic, North Sea, Chesapeake Bay, California, Chile, Puget Sound.

Remarks: the relative length of the 2 circles of cephalic setae seems to vary somewhat. In the type specimen and in the Puget Sound specimens the 2 circles are almost equal in length, whereas in the specimens from Chesapeake Bay (Timm, 1952) and from Chile (Wieser 1956b) the second circle is considerably longer than the first.

Eleutherolaimus obtusicaudatus Allgén (fig. 86a-c)

♂♂: L = 4.40 a = 88.0 b = 17.6 c = 29.3

Body: diameter at end of esophagus 42 μ. Scattered cervical setae. Cuticle finely striated.

Head: diameter 17 μ. Six minute labial papillae. Cephalic setae 5 and 6 μ long. Amphids 6.5 μ = 33 per cent of corresponding diameter in width, 10 μ behind anterior end.

Buccal cavity 8.5 μ deep, with 2 cuticular rings, the second one feeble. Excretory pore 132-256 μ behind anterior end. Ventral gland shortly behind end of esophagus.

Spicula 42 μ; apophysis of gubernaculum 24 μ long.

Tail in male 3.4, in female 3.5-4.7, anal diameters long, in the former with ventral setae. Anal diameter 40-52 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Richmond Beach; 5 to 0.5 feet.

Eumorpholaimus

This genus is characterized by the long, cylindrical buccal cavity and by the occurrence of 10 cephalic setae arranged in 1 or 2 circles. However, several species were described that quite definitely do not show this arrangement of cephalic setae, whereas others are so inadequately described that it is impossible to decide whether 10, 8, or only 4 setae are present.

Species that possess the typical buccal cavity but are equipped with 2 circles of cephalic setae each consisting of 4 setae (as in *Eleutherolaimus*) should be referred to the genus *Filipjevinema* (see below).

Of the remaining species only two, namely, *E. sabulicolus* Schulz 1932 (type) and *E. chesapeakensis* Timm 1952, quite definitely have 10 cephalic setae.

Three more species may possess 10 cephalic setae, but decision on that point is difficult because of inadequate description. These species are: *E. parasabulicolus* Allgén 1935 (only 8 cephalic setae figured), and *E. longisetosus* Allgén 1935 (the first of the figured 2 circles of cephalic setae may in fact be the cir-

cle of the labial setae. If that is so, the species possesses only 4 cephalic setae and should be transferred to *Tubolaimus*).

E. digiticaudatus Stekhoven 1946 (the author speaks of "two circles of cephalic setae" but it is impossible to decide whether these circles consist of 4+4 or 4+6 setae).

Filipjevinema Allgén 1953

This genus has in common with *Eumorpholaimus* the shape of the buccal cavity, which is longer than wide, cylindrical, well cuticularized, and with *Eleutherolaimus* the arrangement of the cephalic setae which is in 2 circles of 4 setae each. The type species, *F. latilaimus* (Allgén 1929, is insufficiently described, but from the figure, there can hardly be any doubt that the cephalic setae are arranged four+four (although in the text Allgén [1929] states: *"Kopfborsten sehr kurz, 2 laterale und 4 submediane"*). I have, however, reason to doubt this statement. First, if Allgén speaks of lateral setae why does he not figure them? Second, an arrangement of 6 cephalic setae in 1 circle is unknown in the whole family Linhomoeidae, and Allgén's figure certainly does not bear out his description. Third, he has previously confused the terms lateral, sublateral, median, and submedian).

1 Cephalic setae very short, not longer than 1/3 the head diameter:
F. latilaimus (Allgén 1929)
= *Chromagaster latilaima* Allgén 1929
= *Pandolaimus sabulicola* Allgén 1929
F. longicaudatus (Allgén 1935)
= *Eumorpholaimus longicaudatus* Allgén 1935
F. cylindricaudatus Stekhoven 1946

2 Second circle of cephalic setae longer than 1 head diameter. (In the two species belonging to this group, 2 long median subcephalic setae shortly behind the second circle of cephalic setae give the impression that it consists of 6, instead of 4, setae. That this is not so is shown by the median position of the 2 subcephalic setae. Such a position never occurs in cephalic setae, but it is common in cervical setae, that is, the 2 subcephalic setae are, in reality, cervical setae. This interpretation of the cephalic pilosity is derived from *F. doliolum* n. sp. but I am fairly sure that it applies to *F. norvegicus* as well. *F. doliolum* n. sp. is separated from *F. norvegicus* Allgén 1947 by the definitely shorter second cephalic setae (14 μ as against 25 μ), the smaller

amphids (8 μ as against 10 μ), and the longer buccal cavity which, moreover, is provided with 4 fine transverse rings.

Filipjevinema doliolum n. sp. (fig. 87a-c)

♀♀: L = 1.85 a = 74.0 b = (?)3.4 c = 14.8 Vu = ?

Body: diameter at end of esophagus 24 μ. There is 1 characteristic cervical seta just behind the amphids. Besides that, only a few short cervical setae are present.

Head: diameter 12 μ. Six distinct labial papillae. First circle of cephalic setae 4 μ, second circle 14 μ, long. Two median subcephalic setae shortly behind the second cephalic setae and about as long as the latter. Amphids 7-8 μ = 55-60 per cent of corresponding diameter in width, posterior to buccal cavity.

Buccal cavity 10 x 6 μ, with 4 fine transverse rings.

Excretory pore 130 μ behind anterior end, ampulla large.

Tail 7 anal diameters long. Anal diameter 20 μ.

Occurrence: Alki Point, Richmond Beach; 3 to -2.5 feet.

Linhomoeus

One of the two species found in Puget Sound is new and closely related to *L. brevisetosus,* from which it is distinguished by longer cephalic setae and by the different shape of tail and spicula.

The other species I identify as *L. buculentus* of which so far only one juvenile had been known (Wieser 1956b, p. 54).

Linhomoeus undulatus n. sp. (fig. 88a-c)

♂♂: L = 2.33 a = 46.6 b = 10.6 c = 17.8

Body: diameter at end of esophagus 70 μ. Few short cervical setae.

Head: diameter 30 μ. Ten cephalic setae, 7.5 + 3 μ long, plus an additional circle of 6 short subcephalic setae. Amphids 11 μ = 25 per cent of corresponding diameter in width, 19 μ behind anterior end, with heavily sclerotized outer rim.

Buccal cavity with transverse ring between vestibulum and posterior portion. Base strongly cuticularized, with plates and denticles.

Excretory pore 100 μ behind anterior end. Ventral gland on level with end of esophagus. Unpigmented portion of intestine ("cardia") 50 μ long.

Spicula 52 μ, apophysis of gubernaculum 14-18 μ long (in one

specimen the apophysis was larger and plumper than the one shown in fig. 88c). Preanally the cuticle is undulated.

Tail 2.2 anal diameters long, with 7 ventral papillae, each with a minute seta. Spinneret not seen. Anal diameter 60 μ.

Occurrence: Bainbridge Island, Vashon Island; 4.5 to -1 feet.

Linhomoeus buculentus Wieser 1956 (fig. 89a-c)

♂♂: L = 3.13 a = 78.2 b = 15.7 c = 11.2

♀♀: 2.32 66.4 14.0 13.0 Vu = 53 - 2 per cent

Body: diameter at end of esophagus 30 μ. Cuticle coarsely annulated.

Head: diameter 20.5 μ in female, 24 μ in male. Cephalic setae 10 + 4 μ and 12 + 5 μ, respectively. Amphids in female 7 μ = 30 per cent of corresponding diameter in width, 16 μ behind anterior end, in male 10.5 μ and 33 per cent, respectively, 24 μ behind anterior end.

Buccal cavity with broad cuticular ring between vestibulum and posterior portion, base with cuticular plates. Esophagus enlarged posteriorly; cardia 40 μ long.

Spicula 37 μ long, Gubernaculum with strong apophysis.

Tail in female 8, in male 5.3, anal diameters long. Anal diameter 38 μ in male.

Occurrence: Vashon Island, Golden Gardens; 4.5 to -1 feet.

Distribution: Chile, Puget Sound.

Remarks: my specimens agree well with the type except that the female tail seems to be more slender and the cuticular annulation is coarser. However, since the type specimen from Chile is a juvenile, these differences do not count much.

Family SPHAEROLAIMIDAE

Sphaerolaimus

The only species of this genus encountered in Puget Sound fits the description of *S. penicillus* Gerlach 1956 exactly but for the greater length of the spicula (262 μ as against 165 μ) and the presence of a preanal papilla. Therefore, I feel justified in establishing a new variety.

Sphaerolaimus penicillus var. *pugetensis* nov. var. (fig. 90a-c)

♂♂: L = 2.09 a = 23.2 b = 6.0 c = 8.8

♀♀: 2.13 21.3 5.3 9.0 Vu = 54.8 per cent

Body: diameter at end of esophagus 85 μ. Cervical setae numerous, up to 28 μ long. Cuticle finely striated.

Head: diameter 28 μ (on level with amphids 45 μ). Lip region conical, labial papillae indistinct. Cephalic setae 6+3 μ. Subcephalic setae in eight groups of 2-5 setae, the longest setae measuring 42 μ. In front of the amphids there are 2 characteristic setae. Amphids in male 12 μ = 27 per cent of corresponding diameter in width.

Buccal cavity spacious, wall consisting of thick cuticular columns. Vestibulum 8.5 μ, sculptured portion 18 μ, posterior end 13 μ deep.

Excretory pore 205 μ behind anterior end.

Spicula 262 μ long, gubernaculum 24 μ. 80 μ in front of the anus there is a ventral swelling of the cuticle, probably a papilla.

Tail 250 μ long, setose, posterior seventh cylindrical.

Occurrence: Bainbridge Island, Vashon Island; 4.5 to -1 feet.

Distribution of the species: Brazil (Pernambuco), Puget Sound.

Family MONHYSTERIDAE

Cobbia

The finding of two new species induces me to revise the grouping of the species belonging to this genus (compare Wieser, 1956b, p. 65).

1 Buccal cavity with 1 big dorsal onchium and either 2 small subventral projections or no subventral armature at all.

2 Cephalic setae much shorter than 1 head diameter:
C. mawsoni Cobb 1930

2' Cephalic setae measuring 1 head diameter or more.

3 Tail cylindroconical, without flagellum:
C. dentata Gerlach 1952

3' Tail elongated, with flagellum:
C. trefusiaeformis De Man 1907. Labial papillae elongated but conical and stout; cephalic setae measuring 1 head diameter, the 2 submedian ones very unequal in length; amphids 1.5-2 head diameters behind anterior end.
C. urinator n. sp.: Labial papillae setose, slender, 6 μ long; cephalic setae measuring 1.3 head diameters, the 2 submedian ones almost equal in length; amphids 1.3 head diameters behind anterior end.

1' Buccal cavity with 3 equal-sized teeth.

4 Amphids 2 head diameters behind anterior end, 1/5 of corresponding diameter in width:
C. triodonta Filipjev 1918

4' Amphids not much more than 1 head diameter behind anterior end, at least 1/3 of corresponding diameter in width.

5 Cephalic setae measuring 1/3 of head diameter:
C. scutata Wieser 1956

5' Cephalic setae measuring 1 head diameter:
C. truncata n. sp.

Cobbia truncata n. sp. (fig. 91a-d)

♂♂: L=1.45 a=32.3 b=4.9 c=7.1

♀♀: 1.59 26.3 4.5 6.6 Vu=?

Body: diameter at end of esophagus 46-48 μ. Cervical setae numerous, up to 36 μ long, somatic setae in 4 rows, up to 42 μ long. Cuticular annulation coarse.

Head: diameter 20 μ in male, 25 μ in female. Lips conspicuous, labial papillae elongated (3.6-6 μ long), conical. Twelve cephalic setae, 20+15 μ in male, 25+18 μ in female. Amphids in male 18 μ long, 25 μ behind anterior end; in female 14 μ=33 per cent of corresponding diameter in width, 27 μ behind anterior end.

Buccal cavity spacious, with 3 equal-sized teeth. Buccal ring feeble.

Spicula 41 μ=1 anal diameter long. Gubernaculum strong, apophysis of varying shape, blunt in one specimen (fig. 91d), slender in another.

Tail 5.8 anal diameters in male, 7 anal diameters in female, with long cylindrical portion and with truncate tip.

Occurrence: Golden Gardens, Richmond Beach; 5.5 to -2.5 feet.

Cobbia urinator n. sp. (fig. 92a-c)

♂♂: L=1.59 a=40.0 b=8.0 c=4.4

Body: diameter at end of esophagus 32 μ. Cuticular annulation coarse, beginning at some distance behind cephalic setae. Cervical and somatic setae fairly numerous, up to 16 μ long.

Head: diameter 19 μ. Lips well developed, labial papillae setose, slender, 6 μ long. Longest cephalic setae 25 μ. Amphids 8.5 μ=33 per cent of corresponding diameter in width, 25 μ behind anterior end.

Buccal cavity with 1 big dorsal onchium and 2 subventral projections.
Spicula 36 μ long. Gubernaculum short, denticulate distally.
Tail 11.5 anal diameters long, posterior two-thirds flagellate. Anal diameter 34 μ.
Occurrence: Vashon Island; 4.5 feet.

Paramonhystera

The subgenus *Leptogastrella*, which according to Wieser (1956b) includes three species, is an extremely difficult group. Most of the taxonomically important characters vary so much that delimitation of the species becomes a somewhat haphazard task.

The amphids in *P. elliptica* and *P. paranormandica* seem to be of about equal width. Stekhoven (1950) gives the size of a female amphid in *P. elliptica* as 80 per cent, but in Filipjev's *"P. setosa"* (1918, fig. 60a) the female amphid measures about 62 per cent, which is also the size of the amphid in Micoletzky's figure (1924) of a female *P. paranormandica*. Thus, as far as the amphids are concerned, *P. elliptica* and *P. paranormandica* represent one group as opposed to *P. pellucida*, in which these organs--according to Cobb and to Wieser (1956b)--measure only 50 per cent of the corresponding diameter or less. Micoletzky separates *P. paranormandica* from *P. elliptica* mainly on the strength of the arrangement of the cephalic setae. In the former species there are 16-20 setae arranged in the usual 6 groups; in the latter there are only 10 setae plus a distinct subdorsal group of 2 short setae on each side of the head. *P. pellucida* shows an arrangement of cephalic setae similar to that in *P. paranormandica*. The latter species is also shorter (1.1-1.4 mm. as against 2.4-2.6 mm.) than *P. elliptica*, and the tail is said to be longer (c = 7.7-8.8 as against 12).

My material contains a fair number of specimens that in most characters correspond to the description of *P. elliptica*. The amphids are of exactly the shape and size as figured by Filipjev; the shape and length of the tail is typical; and there occurs, above all, the distinct subdorsal group of 2 cephalic setae. On the other hand, the number of true cephalic setae in my specimens varies from 10 to 16. However, the number of cephalic setae is the feature most strongly subject to variation in all species of this subgenus (see also the description of *P. pellucida* in Wieser, 1956b),

and for this reason it cannot serve as a character of specific value as Micoletzky has assumed.

Summing up, I consider my specimens to be representatives of *P. elliptica.*

Paramonhystera (Leptogastrella) elliptica Filipjev 1918 (fig. 93a-e)

= *P. setosa* Filipjev

♂♂: L = 1.56 a = 24.0 b = 4.3 c = 14.2

♀♀: 1.90 21.1 3.8 12.7 Vu = 4 per cent

Body: diameter at end of esophagus 60 μ. Cuticular annulation very fine. Cervical setae numerous. Just behind the amphids there is a circle of long cervical setae, consisting of 8 groups, the longest setae measuring 27 μ.

Head: diameter 30-36 μ. Six short, setose labial papillae. Cephalic setae up to 14 μ long, varying in number from 10 to 16. In most specimens (only females ?) there is a distinct subdorsal group of 2 short setae just in front of the regular circle of cephalic setae (fig. 93b). Between the cephalic setae and amphids there are 2 short setae on each side of the body. Amphids in male 30 μ = almost 100 per cent, in female 23 μ = 66 per cent, of corresponding body diameter in width.

Buccal cavity spacious, buccal ring feebly developed.

Spicula 56 μ long. Gubernaculum tubular, with distal, plate-like extension. 240 μ in front of the anus the testis is interrupted by a group of glandular cells (fig. 93e), as was also described in *P. pellucida* (Wieser, 1956b, fig. 227e).

Tail clavate, setose, 3.1-3.5 anal diameters long. Anal diameter 30-36 μ.

Occurrence: Vashon Island, Alki Point; 7-3 feet.

Distribution: Black Sea, Mediterranean, North Sea, Puget Sound.

Steineria

Of the two species found in Puget Sound, one, *S. gerlachi* n. sp., displays a cuticle the annulation of which is resolvable into dots. Among all Monhysteridae, *S. gerlachi* n. sp. has this character in common solely with *S. punctata* Gerlach 1955, from which it is separated by the occurrence of 12, instead of 8, groups of subcephalic setae, by the different shape of spicular apparatus and tail, and by the smaller and more posteriorly situated amphids, etc. The second species, *S. phimifera* n. sp.,

is closely related to *S. polychaeta*, from which it is distinguished by the still longer and more numerous subcephalic setae, by the absence of the 2 pairs of long cervical setae just in front of the amphids, by the stouter, shorter, and differently shaped spicula, and by its greater length.

It appears to me that *S. scopae* Gerlach 1956 belongs to *Theristus*, subgenus *Pseudosteineria* (since the long cervical setae are situated *between* cephalic setae and amphids and not on a level with the cephalic setae). *S. paramirabilis* Gerlach 1955 belongs to *Theristus*, subgenus *Trichotheristus*.

Steineria phimifera n. sp. (fig. 94a-c)

♀: L = 1.50 a = 20.0 b = 5.7 c = 7.6

Body: diameter at end of esophagus 62 μ. Apart from many scattered setae the cervical and somatic setae are arranged in 4 longitudinal rows in which long and short setae alternate. Longest cervical setae 30 μ. Cuticle finely striated.

Head: diameter 24-27 μ. Six minute labial papillae. Ten cephalic setae, 15 μ long. Subcephalic setae on a level with cephalic setae, in 8 groups of 4-5 setae (the sublateral groups consisting of 5 setae), the longest setae measuring 62-72 μ. Amphids in male 9.5 μ = 30 per cent of corresponding diameter in width, in female 7 μ and 23 per cent, respectively, 25 μ behind anterior end.

Excretory pore 132 μ behind anterior end.

Spicula 36 μ long. Gubernaculum with small dorsal apophysis.

Tail 4.1-4.5 anal diameters long. Terminal setae 70-72 μ. Anal diameter 42 μ.

Occurrence: Vashon Island, Alki Point, Golden Gardens; 3 to -1 feet.

Steineria gerlachi n. sp. (fig. 95a-d)

♂♂: L = 0.91 a = 23.0 b = 5.2 c = 10.7

♀♀: 0.96 24.0 5.2 8.7 Vu = 64.2 per cent

Body: cervical and somatic setae arranged in 6 longitudinal rows. Cuticular annulation resolvable into dots.

Head: diameter 22-24 μ. Six minute labial papillae. Probably 10 cephalic setae, up to 12 μ long. Subcephalic setae in 12 (!) groups (this increase in number is due to the splitting up of the 4 sublateral groups), each group consisting of 3 or 4 setae, the longest setae measuring 36-41 μ. Amphids in male 7.5 μ = 25 per cent of corresponding diameter in width, 25 μ

behind anterior end; in female 6 μ and 22 per cent, respectively, 30 μ behind anterior end.

Spicula 26 μ, weakly arcuate. Gubernaculum 10 μ long.

Tail clavate to conical, 3.5 anal diameters long. Terminal setae measuring 21 μ. Anal diameter 30-34 μ.

Occurrence: Golden Gardens, subterranean water.

Theristus

As usual, this genus presents the greatest taxonomic difficulties. Since completion of my key in Wieser (1956b) no less than nineteen new species have been described, and my material from Puget Sound contains altogether 11 species, 7 of which are new.

I shall treat separately the various subgenera established in Wieser, 1956b.

Subgenus *Theristus* s. str.

Within this subgenus there is a group the species of which are characterized by the 2 spicula being of different size and shape.

1 Amphids 4-5 head diameters behind anterior end:
T. problematica (Allgén 1927)

1' Amphids not much more than 2 head diameters behind anterior end.

2 12 cephalic setae, 2/3 of head diameter long:
T. diversispiculum Gerlach 1953

2' 6 cephalic setae, not longer than 1/2 head diameter.

3 Apophysis of gubernaculum dorsally directed:
T. heterospiculum (Allgén 1932). According to the redescription by Gerlach (1952), this species belongs to *Theristus* s. str. and not to *Penzancia* as assumed in Wieser (1956b).

3' Apophysis of gubernaculum caudally directed:
T. heterospiculoides Gerlach 1952
T. wimmeri n. sp.

These two species are very closely related, but in *T. wimmeri*, it is the right and not the left spiculum that is the longer of the two, the shape of the longer spiculum is different, the cervical setae are longer and more numerous, and the amphids occupy probably a more forward position.

Of the species with symmetrical spicula, two are represented in my material, namely, *T. modicus* and *T. acer*. As to the latter, my specimens show some minor differences from the type (cf. Gerlach, 1951a), but since this species is known to be

quite variable I refrain from establishing a new variety or new species.

Subgenus *Daptonema*

One of the two species from Puget Sound belongs to group A of my key in Wieser (1956b, p. 86). A key to the species of this group reads as follows:

1 Amphids just behind buccal cavity; cephalic setae 1/2 head diameter long:
T. filispiculum (Allgén 1932)

1' Amphids at some distance behind buccal cavity; cephalic setae about 1 head diameter long.

2 Spicula 2 tail lengths.
T. trichospiculum (Allgén 1933)

2' Spicula less than 2 tail lengths.

3 Spicula 125 μ long = 1 tail length; amphids 6 μ = 40 per cent of corresponding diameter in width:
T. trichinus Gerlach 1956

3' Spicula 234 μ long = 1.3 tail lengths; amphids 10 μ = 40 per cent of corresponding diameter in width:
T. uncinatus n. sp.

The second species, *T. sinuosus* n. sp., belongs to group B. 2. a. of my key in Wieser (1956b). It is distinguished from the other species by the long cephalic setae of 1 head diameter and by the large amphids which in the male measure 66 per cent of the corresponding diameter.

To this subgenus also belongs *T. curvatus* Gerlach 1956.

Subgenus *Pseudosteineria*

I refound *T. anticipans* Wieser 1956. To group A of this subgenus (Wieser 1956b, p. 88) also belongs *T. scopae* (Gerlach 1956) = *Steineria scopae*; to group B, *T. metacoronatus* nom. nov. for *T. coronatus* Gerlach 1955 nec (Stekhoven 1950).

Subgenus *Mesotheristus*

My material contained one new species, *T. circumscriptus* n. sp., which is distinguished from the other species of this subgenus by the absence of the apophysis of the gubernaculum

and by the fact that the long body setae are confined to the anterior half of the cervical region and to the male tail.

Subgenus *Cylindrotheristus*

In Puget Sound I encountered one species which belongs to group B of this subgenus (Wieser, 1956b, p. 95), that is, to the species with a conspicuous, rectangular, backward-pointing apophysis of the gubernaculum. *T. ecphygmaticus* n. sp. is characterized by the unique shape of the spicula (fig. 104d) and by the occurrence on the male tail of three pairs of conical, elongated papillae. To this group also belongs *T. curvispiculum* Gerlach 1952.

The last three species of *Theristus* from Puget Sound belong to group A. 2. b. of this subgenus. This group presents extreme taxonomic difficulties, the species belonging to it being separated only by very slight differences, especially in the shape of the spicular apparatus. Further divisions in the mode of a key are not very reliable, and classifications should be made by comparing the original figures, particularly of the genital armatures.

Despite these difficulties concerning grouping, I shall tentatively distinguish between species in which the gubernaculum lies absolutely parallel to the spicula and those in which the gubernaculum possesses a small dorsal apophysis or--differently expressed--is slightly bent in its proximal portion.

1. Gubernaculum absolutely parallel to spicula, no apophysis:
   T. tenuispiculum (Ditlevsen 1919)
   T. longicaudatus Filipjev 1922
   T. naviculivorus Cobb 1930
   T. kornöensis (Allgén 1929)
   T. oxycerca (De Man 1888)
   T. oxyuroïdes (Stekhoven 1931)
   T. alternus Wieser 1956
   T. dentatus Wieser 1956
   T. gyrophorus Wieser 1956
   T. aversivulva (Gerlach 1952)= *Metadesmolaimus a.*

My material contains one species which in all details conforms with the description of *T. kornöensis*.

2. Gubernaculum with a small dorsal apophysis:
   T. normandicus (De Man 1890)
   = *paranormandicus* Timm 1952
   T. marylandicus Timm 1952 is a doubtful species but is said to be closely related to *T. normandicus*

T. calceolatus De Coninck and Stekhoven 1933
T. elaboratus Chitwood 1951
T. paraelaboratus Timm 1952
T. resimus n. sp.
T. trecuspidatus n. sp.

T. resimus n. sp. is distinguished from all other species of this group by the shape of the gubernaculum (fig. 103b, c) and by the large amphids.

T. trecuspidatus n. sp. is very closely related to *T. normandicus*, from which it is, however, separated by several minor characters, namely: the tail is devoid of setae (only in the male were 2 terminal setae seen), the spicula are provided distally with 3 small cusps, the gubernaculum is of a slightly different shape since the portion anterior to the spicula is fairly well developed, the cervical setae are differently arranged, and the setae seem in general to be more slender.

Of the following subgenera no species were represented in my material, but new species have been reported in the literature since completion of my key in Wieser (1956b).

Subgenus *Pseudotheristus*

T. microspiculum Gerlach 1952

Subgenus *Penzancia*

T. parambronensis Timm 1952
T. biarcospiculum Timm 1952
T. parvulus Timm 1952
T. inermis Gerlach 1952
T. macroflevensis Gerlach 1953
T. monstrosus Gerlach 1954
T. metaflevensis Gerlach 1955
T. maior Gerlach 1956
T. hamatus Gerlach 1956

Theristus (T.) wimmeri n. sp. (fig. 96a-d)

♂♂: L = 0.67 a = 20.0 b = 4.1 c = 8.0
♀♀: 0.74 16.4 3.7 7.4 Vu = 60 per cent

Body slender in first half of cervical region, then suddenly enlarged. Diameter at end of esophagus 34 μ. Many cervical and somatic setae, up to 8 μ long. Cuticular annulation coarse.

Head: diameter 12 μ. Six (!) cephalic setae, 4.5-5.5 μ long.

Amphids thin-walled, indistinct, seen only in one female, situated 15 μ behind the anterior end.

Spicula asymmetrical, the right one 25 μ long, with pointed tip, the left one 22 μ long, broader than the right one, with opening at the tip. Apophysis of gubernaculum caudally directed, plate-shaped.

Tail conical, setose, 4 anal diameters long.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 6.5 to -2.5 feet.

This species is dedicated to Miss M. Wimmer of the Zoological Institute, University of Vienna.

Theristus (T.) modicus Wieser 1956 (fig. 97a-d)

♂♂: L=1.16 a=29.0 b=6.7 c=10.5

♀♀: 1.11 37.0 5.5 7.0 Vu=?

Body: diameter at end of esophagus 26 μ. Cuticular annulation coarse. Cervical setae scarce, in male up to 18 μ long, in female shorter.

Head: diameter 13-14 μ. Labial papillae setose, short. Ten to twelve cephalic setae, in male 11-12 μ, in female 8 μ, long. Amphids in male 7.5 μ, in female 6 μ, that is, 42 per cent and 33 per cent, respectively, of corresponding diameters in width, 15-22 μ behind anterior end.

Spicula 23 μ long, apophysis of gubernaculum plate-shaped, slightly varying in outline (fig. 97b, c), 10 μ long.

Tail conical, 6-8 anal diameters long. Anal diameter 24-26 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point, Golden Gardens; 6.5-0.5 feet and subterranean waters.

Distribution: Chile, Puget Sound.

Theristus (T.) acer Bastian 1865 (fig. 98a-e)

♂♂: L=2.22 a=44.5 b=8.6 c=12.7

♀♀: 2.20 36.7 7.3 8.8 Vu=72.7 per cent

Body: diameter at end of esophagus 40-42 μ. Cuticular annulation weak. Cervical and somatic setae scattered, up to 10 μ long.

Head: diameter 22-25 μ. Labial papillae setose, very short. Cephalic setae 11-12 μ long; laterally there may be just 1 seta, or 2-3 setae (see also Gerlach 1951a). Amphids in male 7.5 μ=30 per cent, in female 7 μ=25 per cent, of corresponding diameter in width, 19 μ behind anterior end.

Spicula 25 μ long. Gubernaculum plate-shaped, 23 μ long.

Tail conical, setose, 5.5 anal diameters in male, 8 anal diameters in female. Anal diameter 34-36 μ.

Occurrence: Bainbridge Island, Alki Point; 2 to -2.5 feet.
Distribution: North Atlantic, Barents Sea, Mediterranean, Puget Sound.

Theristus (Daptonema) sinuosus n. sp. (fig. 99a-c)
♂♂: L = 0.78 a = 26.0 b = 4.1 c = 6.5
Body: diameter at end of esophagus 29 μ. Very few and short cervical setae. Cuticular annulation coarse.
Head: diameter 13 μ. Cephalic setae 13 + 10 μ long. Amphids 10 μ = 66 per cent of corresponding diameter in width (male !).
Spicula 67 μ long. Gubernaculum 24 μ, tubular, distally with lateral projection. There are 2 preanal setae.
Tail 5 anal diameters long, terminal setae 15 μ. Anal diameter 24 μ.
Occurrence: Bainbridge Island; 0 to -2 feet.

Theristus (Daptonema) uncinatus n. sp. (fig. 100a-d)
♂♂: L = 1.21 a = 18.8 b = 5.4 c = 6.6
♀♀: 1.53 20.5 6.0 6.5 Vu = 63 per cent
Body: diameter at end of esophagus 51-60 μ. Cuticular annulation medium coarse. Very few short cervical setae.
Head: diameter 18-23 μ. Labial papillae setose, short. Ten to twelve cephalic setae, 16-19 μ long. Amphids in male 10 μ = 40 per cent, in female 9 μ = 33 per cent, of corresponding diameter in width, 23-28 μ behind amphids.
Spicula 234 μ = 1.3 tail lengths, with hooked distal end. Gubernaculum tubular, with lateral tooth, 26 μ long.
Tail in male 5, in female 6.5, anal diameters long. Anal diameter 41-56 μ.
Occurrence: Alki Point, Golden Gardens; 2.5 to -2.5.

Theristus (Pseudosteineria) anticipans Wieser 1956 (fig. 101a-d)
♂♂: L = 1.08 a = 27.1 b = 5.4 c = 6.8
♀♀: 1.40 23.3 4.4 7.0 Vu = 67.8 per cent
Body: diameter at end of esophagus 56 μ. On a level with the amphids there are 8 groups of long cervical setae. The sublateral groups consist of 4 setae, the longest measuring 72 μ; the submedian groups consist of 3 setae, the longest measuring 60 μ (in a female). In addition there are scattered short cervical and somatic setae.
Head: diameter 16-17 μ. Labial papillae setose, very short. Cephalic setae jointed, 15 μ long. Amphids (in female)

7 μ = 30 per cent of corresponding diameter in width, 16 μ behind anterior end.

Spicula probably of unequal length, the left one measuring 50 μ, the right one 44 μ; cephalated proximally. Gubernaculum 30 μ long, strongly developed.

Tail 5-5.5 anal diameters long, setose. Terminal setae 36-40 μ long. Anal diameter 36-38 μ.

Occurrence: Bainbridge Island, Vashon Island, Alki Point; 2 to -2 feet.

Distribution: Chile, Puget Sound.

Remarks: despite some smaller dimensions the Puget Sound specimens are typical representatives of this species.

Theristus (Mesotheristus) circumscriptus n. sp. (fig. 102a-d)

♂♂: L = 2.11 a = 26.4 b = 4.7 c = 7.4

♀♀: 2.30 21.0 4.6 7.2 Vu = 67.4 per cent

Body: diameter at end of esophagus 120 μ. Cuticular annules double. Long cervical setae confined to anterior 2/5 of the cervical region, arranged in 8 longitudinal rows, the setae measuring up to 54 μ = 70 per cent of the corresponding body diameter in a female, up to 115 μ = 1 body diameter in a male. These cervical setae are absent in juveniles.

Head: diameter 32-33 μ. Labial papillae conical. Twelve cephalic setae, jointed, 42 + 22 μ long. Amphids 9.5-10 μ = 22-25 per cent of corresponding diameter in width, 30-36 μ behind anterior end.

Spicula 64 μ long. Gubernaculum tubular, with lateral projection distally and a short, narrow tubulus anterior to the spicula (fig. 102c).

Tail 4.3-5.2 anal diameters long, in male strongly setose, but the setae confined to the ventral and ventrolateral aspect. Anal diameter 62 μ.

Occurrence: Bainbridge Island, Golden Gardens; -1 to -2 feet.

Theristus (Cylindrotheristus) ecphygmaticus n. sp. (fig. 104a-d)

♂♂: L = 1.35 a = 20.7 b = 4.5 c = 9.0

♀♀: 1.62 20.3 4.6 8.1 Vu = 70 per cent

Body: diameter at end of esophagus 50 μ. Short, scattered cervical and somatic setae. Cuticular annulation coarse.

Head: diameter 18 μ in one male, 25 μ in one female. Labial papillae setose, short. Ten to twelve cephalic setae, 14 μ

in male, 18 μ in female. Amphids 7.5-8 μ = 30 per cent of corresponding diameter in width, 24-25 μ behind anterior end.

Spicula 40 μ long, with an unusual proximal apophysis. Gubernaculum strongly developed and cuticularized, with caudal apophysis, 12 μ long.

Tail 4 anal diameters long. In the middle of the tail of some males, there are 3 pairs of elongated, conical papillae, 1 pair ventral, 2 pairs subventral. Terminal setae 25 μ long. Anal diameter 40 μ.

Occurrence: Vashon Island, Alki Point, Golden Gardens; 7-4 feet.

Theristus (Cylindrotheristus) resimus n. sp. (fig. 103a-e)

♂♂: L = 1.22 a = 24.4 b = 4.1 c = 7.2

♀♀: 1.05 16.1 4.5 5.0 Vu = 61.8 per cent

Body: diameter at end of esophagus 38 μ in one male, 54 μ in one female. Short setae all over the body.

Head: diameter in three specimens 14.5, 18, and 22 μ. Labial papillae conical. Ten to twelve cephalic setae 13-16 μ long, very slender. Amphids in one male 8.5 μ, in another male 9.5 μ, and in a third one 11 μ = 40-50 per cent of corresponding diameter in width, in female 6.5 μ = 27 per cent, respectively, 16-24 μ behind anterior end.

Spicula 36 μ long, slender, cephalated proximally. Gubernaculum 25 μ long, tubular, with dilated distal portion and a small caudodorsal apophysis.

Tail 6 anal diameters long. Anal diameter 31 μ.

Occurrence: Vashon Island, Alki Point, Golden Gardens, Richmond Beach; 6-2.5 feet.

Remarks: females and juveniles of this species could not be distinguished from those of the foregoing species.

Theristus (Cylindrotheristus) trecuspidatus n. sp. (fig. 105a-d)

♂♂: L = 1.12 a = 37.5 b = 5.6 c = 9.0

♀: 1.19 34.0 5.9 7.2

Body: diameter at end of esophagus 30 μ. Cervical setae in one male 10 μ long, in another shorter, absent in females. Cuticular annulation coarse.

Head: diameter 15-18 μ. Labial papillae indistinct. Ten cephalic setae 8.5-10 μ long, slender. Amphids 7-8 μ = 30-35 per cent of corresponding diameter in width, 15-17 μ behind anterior end. Buccal ring strongly developed.

Spicula 32 μ, cephalated proximally, distally provided with 3 cusps. Gubernaculum surrounding the distal arm of the spicula, provided with a minute dorsal apophysis.

Tail in male 6, in female 7.5, anal diameters long. In another male the cylindrical portion was longer than that of the specimen represented in fig. 105b. The tail is almost naked. Only in the male were 2 terminal setae seen. Anal diameter 24-25 μ.

Occurrence: Alki Point, Golden Gardens, Richmond Beach; 7 to -2 feet.

Theristus (Cylindrotheristus) kornöensis (Allgén 1929) (fig. 106a, b)

= *Sphaerolaimus k.*

♂♂: L = 1.52 a = 26.8 b = 5.9 c = 6.6

♀♀: 1.46 22.5 5.0 6.8 Vu = 63.8 per cent

Allgén's male:

L = 1.25 a = 25 b = 5 c = 7.8

Body: diameter at end of esophagus 54-60 μ. Cuticular annulation indistinct anterior to amphids. Few short cervical setae.

Head: diameter 22-24 μ. Labial papillae stout, well developed. Ten to twelve cephalic setae 17-19 μ long. Amphids in male 10.5 μ = 40 per cent, in female 9.5 μ = 33 per cent, of corresponding diameter in width, 24-25 μ behind anterior end. (In Allgén's specimen the amphids measure 7.5 μ.)

Spicula 38 μ long, cephalated proximally. Gubernaculum 18 μ long, tubular, distally with 2 lateral projections.

Tail 6 anal diameters long. Anal diameter 41 μ.

Occurrence: Vashon Island, Alki Point, Golden Gardens; 0.5 to -2.5 feet.

Distribution: West Coast of Sweden, Puget Sound.

Monhystera

In 1951 I established a var. *britannica* of the species *M. refringens* on the basis of the shorter distance of the amphids from the anterior end and the longer cephalic setae. The same "variety" was refound in Chile and given species rank (Wieser, 1956b, p. 103). In my Puget Sound material I encountered one male which in the two distinguishing characters, distance of amphids from anterior end and length of cephalic setae, is intermediate between *M. refringens* and *M. britannica*. From this I

conclude that the range of variability of the former species is greater than suspected and that *M. britannica* Wieser should be considered a synonym of *M. refringens* Bresslau.

I found another species of *Monhystera* which I reluctantly refer to *M. disjuncta* Bastian. In my specimens the cephalic setae are considerably shorter than in the specimens figured by Gerlach (1953a) and Osche (1955). However, since only females were present I refrain from establishing a new variety or new species.

Monhystera refringens Bresslau and Stekhoven 1940 (fig. 107) = *M. britannica* Wieser

♂♂: L = 0.59 a = 23.6 b = 5.9 c = 5.1

Head: diameter 13 μ. Cephalic setae 4.8 μ long. Amphids 8.5 μ behind anterior end. Ocelli not seen.

Excretory pore 21 μ behind anterior end.

Spicular apparatus typical. Spicula 40 μ long. Preanal papilla 54 μ in front of anus, postanal papillae 54 μ and 76 μ posterior to anus, respectively.

Occurrence: Golden Gardens; -2 feet.

Distribution: North Sea, Chile, Puget Sound.

Monhystera disjuncta Bastian 1865 aff. (fig. 108a, b)

♀♀: L = 0.92 a = 23.1 b = 7.4 c = 10.3 Vu = 87.5 per cent

Body naked; diameter at end of esophagus 27 μ.

Head: diameter 11 μ. Lips conspicuous. Six cephalic setae, 1 μ long. Amphids 4 μ = 25 per cent of corresponding diameter in width, 15 μ behind anterior end. Buccal cavity double, without armature.

Excretory pore probably 30 μ anterior to end of esophagus; ventral gland 108 μ behind end of esophagus.

Tail 4.6 anal diameters long. Anal diameter 22 μ.

Occurrence: Golden Gardens; 4 feet.

Distribution: North Atlantic, Baltic, Mediterranean, Campbell Islands, Chile, Puget Sound.

I found some specimens of this species also in empty egg capsules of crabs which were kept in aquaria at the Department of Oceanography at the University of Washington. This is of some interest since *M. disjuncta* is already known to associate with amphipods (Kinne and Gerlach, 1953; Osche, 1955).

Rhynchonema cinctum Cobb

At Richmond Beach (3 feet) I found one female which in every respect conforms with the description of this species by Gerlach (1955).

PART II
DISTRIBUTION OF THE SPECIES, WITH ECOLOGICAL REMARKS

The five localities investigated differ from each other mainly in the mechanical composition of the substratum. If all the samples taken are arranged with respect to the median diameter of their particular sand mixture (fig. 109) it is evident that at Richmond Beach no sample possesses a median diameter smaller than 200 μ, at Vashon Island the median diameter never exceeds 150 μ, and at Bainbridge Island all the sand mixtures with median diameters between 75 μ and 400 μ are absent. Thus, on theoretical grounds it could be argued that if a species were dependent on substrata with a median diameter around 100 μ it would be absent from Richmond Beach, or, conversely, if a species preferred substrata with a median diameter between 100 and 400 μ it would be absent from Bainbridge Island.

In a previous paper (Wieser, 1959) it was shown that the distribution of certain species of animals indeed is correlated to the distribution of certain grades of sand. Thus it does not seem unreasonable to assume that differences between the five localities as to the distribution of animals are to a great extent due to differences in substratum, which, in turn, depend on the position of each locality in relation to currents in Puget Sound.

The main factor of uncertainty which enters the whole argument is that the "median diameter" of a given substratum as used in figure 109 does not represent in an unequivocal manner *all* the mechanical qualities of this substratum that are of importance to the animals. It can, however, be assumed that, if the sorting is good, it represents enough of the mechanical qualities of a substratum to be of ecological use.

The five localities are also distinguished by the different development of algal zones in the littoral and upper sublittoral. Hardly any algae were present at Richmond Beach, but in the other four localities algae occurred to a varying degree. At Alki Point the sublittoral algal belt was particularly well developed.

Relatively speaking, Richmond Beach and Bainbridge Island are extremely localities, the former consisting of coarse, and the latter, almost entirely (with exception of the uppermost

sample) of very fine material. This situation is perhaps reflected in the somewhat poorer microfauna of these two localities:

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Number of species found	60	83	78	89	60

In the following section a short account of the intertidal and the horizontal* distribution of the whole microfauna will be given, together with an ecological analysis--as far as this is possible--of the better-known species.

HYDROZOA

The hydrozoan *Protohydra leuckarti* occurred quite frequently at Vashon Island and Golden Gardens. According to Remane (1940) and Ekman (1953), it is a typical brackish-water species. However, I was recently informed by Professor Remane that he had found the species in the North Sea in polyhaline water (28‰). *P. leuckarti* is a species occurring mainly in muddy sand and in sand rich in organic debris (cf. Remane, 1940, p. 153). In Puget Sound it showed preference for substrata with a median diameter finer than 200 μ (Wieser, 1959).

NEMATODA

The horizontal and the intertidal distribution of all nematodes is shown in tables 1 and 2 (except for species represented by not more than two specimens). To these and all following tables the criticism expressed in Wieser (1959) applies. This is that in pooling the data from different localities and from different intertidal levels, the actual pattern of distribution of each species is neglected, only the extreme limits of distribution being considered. By keeping apart the intertidal distribution for the

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*The term horizontal is here used to designate the distribution *along* the coast, that is, covering the area as defined by the five localities investigated. Pennak's use of "horizontal" (Pennak, 1942, 1950) is synonymous with intertidal, that is, it designates distribution *at right angles* to the coastline.

TABLE 1
DISTRIBUTION OF NEMATODES ON THE BEACHES OF PUGET SOUND*

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Metoncholaimus wifer	+				
Gammanema ferox	+				
Microlaimus dixiei	+				
Graphonema clivosa	+				
Bathylaimus bicoronatus	+				
Oncholaimus martini	+	+			
Viscosia tumidula	+	+			
Onyx rugata	+	+			
Graphonema flaccida	+	+			
Cobbia truncata	+	+			
Enoploides harpax	+	+	+		
Mesacanthoides sinuosus	+	+	+		
Trileptium iacobinum	+	+	+		
Spirina laevis	+	+	+		
Nudora armillata	+	+	+		
Neochromadora appiana	+		+		
Filipjevinema doliolum	+		+		
Theristus wimmeri	+	+	+		
Theristus trecuspidatus	+	+	+		
Hyalacanthion multipapillatum	+	+	+	+	
Biarmifer gibber	+	+		+	
Parascolaimus ungulatus	+	+		+	
Theristus vesimus	+	+	+	+	
Odontophora mercurialis	+			+	
Tripyloides imitans	+			+	
Oncholaimus brachycercus	+	+	+		+
Chromolaimus macrodentatus	+		+	+	+
Monoposthia costata	+	+	+	+	+
Neochromadora poecilosoma	+	+	+	+	+
Chromadorina germanica	+	+	+	+	+
Enoplolaimus paralitoralis	+	+			+
Parascolaimus tau	+	+	+		+
Araeolaimus boomerangifer	+	+	+	+	+
Eleutherolaimus obtusicaudatus	+		+	+	+
Dolicholaimus benepapillosus	+				+
Paracanthonchus serratus		+			
Neochromadora pugilator		+			
Odontophora lituifera		+	+		
Theristus uncinatus		+	+		
Oncholaimus campylocercoides		+	+	+	
Pareurystomina pugetensis		+		+	
Microlaimus cochleatus		+	+	+	
Metalinhomoeus setosus		+		+	
Linhomoeus buculentus		+		+	
Steineria phimifera		+	+	+	
Theristus ecphygmaticus		+	+	+	
Theristus hornõensis		+	+	+	
Anticoma acuminata		+	+	+	+
Oncholaimium vesicarium		+	+	+	+
Longicyatholaimus quadriseta		+	+	+	+
Sabatiera clavicauda		+	+		+
Sabatiera jubata		+	+	+	+
Odontophora peritricha		+	+	+	+
Theristus modicus		+	+	+	+
Oxyonchus culcitatus		+			+
Acanthonchus rostratus		+			+
Theristus circumscriptus		+			+
Mesacanthion parnosum			+		
Calyptronema maxweberi			+		
Eurystomina repanda			+	+	
Hypodontolaimus inaequalis			+	+	
Sabatiera cupida			+	+	
Tripyloides gracilis			+	+	
Paramonhystera elliptica			+	+	
Enoplus velatus			+	+	+
Spilophorella paradoxa			+	+	+
Sabatiera americana			+	+	+
Eleutherolaimus stenosoma			+		+
Theristus anticipans			+	+	+
Enoplolaimus lenunculus			+		+
Theristus acer			+		+
Anoplostoma viviparum				+	
Oncholaimus apostematus				+	
Acanthonchus duplicatus				+	
Odontophora mucronata				+	
Cobbia urinator				+	
Viscosia carnleyensis				+	+
Symplocostoma dissoluta				+	+
Linhomoeus undulatus				+	+
Sphaerolaimus penicillus var. *pugetensis*				+	+
Bathylaimus tarsioides					+
Desmolaimus fennicus					+
Theristus sinuosus					+

*Average grain size of substratum decreasing from Richmond Beach to Bainbridge Island.

TABLE 2
INTERTIDAL DISTRIBUTION OF NEMATODES ON THE BEACHES OF PUGET SOUND

	Intertidal Height in Feet				
	8-6.5	6-4.5	3-2	1-0	-1-2.5
Enoplolaimus paralitoralis	+				
Oxyonchus culcitatus	+				
Odontophora mucronata	+				
Bathylaimus tarsioides	+				
Enoplus paralitoralis	+	+			
Enoplolaimus lenunculus	+	+			
Dolicholaimus benepapillosus	+	+			
Oncholaimus brachycercus	+	+			
Neochromadora appiana	+	+			
Neochromadora pugilator	+	+			
Parascolaimus tau	+	+			
Theristus ecphygmaticus	+	+			
Oncholaimus apostematus	+		+		
Gammanema ferox	+		+		
Microlaimus cochleatus	+	+	+		
Tripyloides gracilis	+	+	+		
Paramonhystera elliptica	+	+	+		
Theristus resimus	+	+	+		
Hypodontolaimus inaequalis	+	+	+	+	
Araeolaimus boomerangifer	+	+	+	+	
Theristus modicus	+	+		+	
Anticoma acuminata	+	+	+	+	+
Hyalacanthion multipapillatum	+	+	+	+	+
Mesacanthoides sinuosus	+	+		+	+
Enoploides harpax	+	+	+	+	+
Oncholaimus campylocercoides	+	+	+	+	+
Oncholaimium vesicarium	+	+	+	+	+
Viscosia tumidula	+	+	+	+	+
Viscosia carnleyensis	+	+	+	+	+
Anoplostoma viviparum	+	+	+	+	+
Eurystomina repanda	+		+		+
Chromolaimus macrodentatus	+		+	+	+
Onyx rugata	+	+	+	+	+
Nudora armillata	+	+	+	+	+
Monoposthia costata	+	+	+	+	+
Neochromadora poecilosoma	+	+	+	+	+
Chromadorina germanica	+	+	+	+	+
Sabatiera cupida	+			+	+
Parascolaimus ungulatus	+	+	+	+	+
Tripyloides imitans	+	+	+		+
Eleutherolaimus stenosoma	+		+		+
Theristus wimmeri	+		+	+	+
Theristus trecuspidatus	+	+	+	+	+
Pareurystomina pugetensis	+				+
Calyptronema maxweberi		+			
Bathylaimus bicoronatus		+			
Cobbia urinator		+			
Paracanthonchus serratus		+	+		
Oncholaimus martini		+	+		+
Longicyatholaimus quadriseta		+	+	+	+
Acanthonchus rostratus		+	+	+	+
Graphonema flaccida		+	+		+
Sabatiera jubata		+	+	+	+
Sabatiera americana		+	+	+	
Odontophora peritricha		+	+		+
Eleutherolaimus obtusicaudatus		+	+	+	
Linhomoeus undulatus		+	+	+	+
Linhomoeus buculentus		+			+
Sphaerolaimus penicillus var. *pugetensis*		+		+	+
Cobbia truncata		+		+	+
Desmolaimus fennicus			+		
Enoplus velatus			+	+	+
Microlaimus dixiei			+	+	
Symplocostoma dissoluta			+	+	+
Biarmifer gibber			+		+
Acanthonchus duplicatus			+	+	+
Spilophorella paradoxa			+	+	+
Sabatiera clavicauda			+		+
Metalinhomoeus setosus			+	+	+
Filipjevinema doliolum			+		+
Steineria phimifera			+	+	+
Theristus anticipans			+	+	+
Theristus acer			+	+	+
Theristus uncinatus			+		+
Graphonema clivosa				+	
Trileptium iacobinum				+	+
Metoncholaimus uvifer				+	+
Spirina laevis				+	+
Odontophora lituifera				+	+
Odontophora mercurialis				+	+
Theristus sinuosus				+	+
Theristus kornöensis				+	+
Mesacanthion pannosum					+
Theristus circumscriptus					+

five localities it was possible, in the paper mentioned above, to show for several abundant species a relatively close dependence on certain grades of sand. The tables in the present paper cannot indicate such relationships, but they give a general idea of the distribution of the whole fauna.

As was to be expected there are more species that occur on all tidal levels than species that occur in all localities.

An ecological characterization of the nematode fauna is impossible since two-thirds of the species are new. Among the known species the greater number seem to be eurytopic, for example, *Anticoma acuminata*, *Viscosia carnleyensis*, *Longicyatholaimus quadriseta*, *Monoposthia costata*, *Chromadorina germanica*, *Hypodontolaimus inaequalis*, *Spilophorella paradoxa*, *Odontophora peritricha*, *Tripyloides gracilis*, *Eleutherolaimus* spp., *Theristus acer*, *Monhystera disjuncta*. Most of these species are eurytopic also in Puget Sound, that is, they occur in most localities and on most intertidal levels. This does not hold, however, for *Viscosia carnleyensis*, which is a species confined to a relatively fine substratum.

Species more or less typical for sandy habitats are: *Dolicholaimus benepapillosus*, *Oncholaimus brachycercus*, *Oncholaimus campylocercoides*, *Gammanema ferox*, *Spirina laevis* (?), *Theristus anticipans*, *Rhynchonema cinctum*. To these could perhaps be added new representatives of genera that are psammophilic in general, such as *Onyx*, *Mesacanthoides*, *Trileptium*, *Enoplolaimus*. The majority of these species also occur in the subterranean water.

Characteristic for soft bottom and very fine sand are probably the species of *Sabatiera* and perhaps *Anoplostoma viviparum*. No representative of *Sabatiera* occurs in the locality with the coarsest substratum, Richmond Beach.

Of the known species, practically all the more abundant ones have been found before in meso- or polyhaline waters, mostly in the Baltic (cf. Gerlach, 1954c). Species with probable marine-polyhaline distribution are: *Anticoma acuminata*, *Oncholaimus brachycercus*, *Viscosia carnleyensis*, *Calyptronema maxweberi*, *Chromadorina germanica*, *Spilophorella paradoxa* (center of distribution perhaps marine), *Paramonhystera elliptica*.

Species with probable marine-mesohaline distribution are: *Dolicholaimus benepapillosus*, *Eleutherolaimus stenosoma*, *Theristus acer*, *Monhystera disjuncta*.

Brackish-water species--which may also occur in polyhaline water--are: *Anoplostoma viviparum* (found at 2.5‰ in the Baltic;

cf. Gerlach, 1954c), *Sabatiera americana* (found at 11.9‰ in Chesepeake Bay; cf. Timm, 1952), *Tripyloides gracilis, Desmolaimus fennicus, Theristus kornöensis*.

Species with predominantly marine distribution are: *Oncholaimus campylocercoides, Gammanema ferox, Spirina laevis* (sometimes also polyhaline ?), *Monoposthia costata, Actinonema longicaudata, Hypodontolaimus inaequalis*.

GASTROTRICHA and ARCHIANNELIDA

These two groups can be treated together, since ecologically they behave very much in the same way. Their horizontal distribution is shown in table 3 (and can also be inferred from figure 7 in Wieser, 1959).

TABLE 3
HORIZONTAL DISTRIBUTION OF
ARCHIANNELIDS AND GASTROTRICHS

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Archiannelida					
Trilobodrilus nipponicus	+				
Protodrilus chaetifer	+				
Protodrilus flabelliger	+		+		
Nerilla antennata	+		+		
Gastrotricha					
Turbanella cornuta	+	+	+		
Macrodasys cunctatus	+	+	+	+	
Turbanella mustela		+			
Paraturbanella intermedia		+	+		
Tetranchyroderma pugetensis					+

Both gastrotrichs and archiannelids are to a large extent sand forms, a fact that is also reflected in their distribution in Puget Sound. Archiannelids occurred only in the upper reaches of Alki Point and Richmond Beach. Gastrotrichs were absent from Bainbridge Island, with the exception of the uppermost sample of coarse sand. At Vashon Island only one sample contained few

specimens of *Macrodasys cunctatus*, the largest and most widespread of the gastrotrichs in Puget Sound. On the other hand, in the three localities possessing substrata with a median diameter larger than 200 μ, gastrotrichs occurred abundantly (cf. Wieser, 1959).

Of the gastrotrichs only *Turbanella cornuta* is a previously known species. It has been called a species typical for fine sand by Remane (1943), Wilke (1954), and Swedmark (1956). According to Karling (1954), the grain size of its habitat may vary. In Puget Sound the substratum inhabited by *T. cornuta* has to be called coarse to medium fine. From the point of view of salinity tolerance, the distribution of *T. cornuta* is marine-mesohaline or almost holeuryhaline.

Of the archiannelids, *Nerilla antennata* is eurytopic, occurring in seaweeds and on sand. *Protodrilus chaetifer* seems to be restricted to coarse sand (Remane, 1940). Of *Trilobodrilus nipponicus* nothing is known except that it occurs on sand. *N. antennata* is marine-mesohaline. The other two species seem to have been found so far in marine water only, but this is not very significant on account of the paucity of these finds.

POLYCHAETA

The horizontal and the intertidal distribution of the species found is given in tables 4 and 5. Three species which were represented by one or two specimens, and which could be identified as to genus only, have been omitted.

Members of the family Spionidae dominated quantitatively the polychaete microfauna of the beaches investigated (only small polychaetes are taken into consideration). The two most common species, *Rhynchospio* (cf. *arenincola*) and *Boccardia* sp., belong to this family, and, in addition, spionid larvae were found at Bainbridge Island and Alki Point.

Of the identified species, *Dorvillea gracilis* has been found so far only in coarse sand (Hartman 1938, 1955), and in Puget Sound it was also restricted to a coarse sand sample from Richmond Beach. *Rhynchospio arenincola*, *Glycinde picta*, and *Scoloplos armiger* are all inhabitants of various types of sand, muddy sand, and mud. *Sphaerodorum minutum* is known from algae (Laminaria holdfasts), sand, shell, and mud.

The distribution of these species seems to be mainly marine (although too few finds are known to make a definite statement), with the exception of *Scoloplos armiger*, which occurs also in mesohaline water (down to about 10‰; information from Dr. Banse, Kiel).

TABLE 4
HORIZONTAL DISTRIBUTION OF POLYCHAETA

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Dorvillea gracilis	+				
Eteone sp.	+		+	+	
Nephthys sp.	+			+	
Boccardia sp.	+		+	+	+
Rhynchospio (cf. *arenincola*)	+	+		+	+
Podarke n. sp.		+			
Sphaerodorum minutum		+			
Glycinde picta		+	+	+	
Scoloplos armiger			+		
Spionid larvae			+		+
Owenia sp.				+	+

TABLE 5
INTERTIDAL DISTRIBUTION OF POLYCHAETA

	Intertidal Height in Feet				
	8-6.5	6-4.5	3-2	1-0	-1-(-2.5)
Boccardia sp.	+	+	+	+	+
Spionid larvae	+		+	+	+
Dorvillea gracilis		+			
Eteone sp.		+	+	+	+
Rhynchospio (cf. *arenincola*)			+	+	+
Nephthys sp.			+		+
Glycinde picta				+	
Sphaerodorum minutum				+	
Scoloplos armiger				+	
Podarke n. sp.				+	+

COPEPODA

The horizontal and the intertidal distribution of the copepods is given in tables 6 and 7. A few species represented by only one specimen were omitted.

Of the thirty-nine species found in Puget Sound, twenty-seven, or 69 per cent, are confined to one locality (in comparison, the percentage of nematode species confined to one locality is 37 per cent), which is in keeping with the patchiness of the distribution of copepods as known from other habitats (for example, from algae; cf. Colman, 1940; Wieser, 1952).

By far the most abundant species is *Huntemannia jadensis*, which occurs in all localities except Richmond Beach. Species with the widest range of occurrence are *Dactylopodia glacialis*, *Heterolaophonte strömi* and *Enhydrosoma* n. sp. Most of the species of *Ectinosoma* (including the rare ones) are restricted to the localities with very fine substratum, that is, Bainbridge Island and Vashon Island.

As to the ecological preferences of the known species, Lang (1948) and Noodt (1956) supply the following data (in this survey the rare species omitted in tables 6 and 7 are also included):

True eurytopic species are *Ectinosoma gothiceps*, *Heterolaophonte minuta*, and probably *Amphiascella debilis*.

Species occurring in algae and also on algal debris ("phytaleuryök" according to Lang) are *Ameira longipes*, *Dactylopodia tisboides*, *Ectinosoma melaniceps*, *E. normani*, *Harpacticus* spp., *Heterolaophonte littoralis*, *H. strömi*, *Laophonte cornuta*, and *Thalestris rufoviolascens*, to which probably can be added *Zaus sarsi*, *Dactylopodia glacialis*, *Paralaophonte macera*, *P. hyperborea*, *Ameiropsis brevicornis*, *Heterolaophonte sigmoides*.

Species occurring on various types of muddy sand are *Bulbamphiascus imus*, *Ectinosoma propinquum*, *Acrenhydrosoma perplexum*, *Rhizotrix curvata*, *Huntemannia jadensis*, and probably *Pseudobradya robusta* and *Enhydrosoma* n. sp. In Puget Sound, *Huntemannia jadensis* definitely extends its range into fairly clean and medium fine sand (up to an average diameter of 250 μ).

Species confined to sand are the two species of *Arenosetella*, *Pararenosetella gracilis*, and most probably the new species of *Leptastacus*, *Paraleptastacus* and *Paraleptocaris*, since these genera as a whole are arenicolous. All these species are confined to the upper intertidal zones on the Puget Sound beaches.

Marine-polyhaline species are *Dactylopodia tisboides*, *Hete-*

TABLE 6
HORIZONTAL DISTRIBUTION OF COPEPODS*

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Paraleptastacus n. sp.	+				
Paraleptocaris n. sp.	+				
Arenosetella fissilis	+				
Nitocra platypus	+				
Leptastacus n. sp.	+	+	+		
Heterolaophonte littoralis	+		+		
Enhydrosoma n. sp.	+			+	+
Heterolaophonte strömi	+			+	+
Dactylopodia glacialis	+		+	+	+
Pararenosetella gracilis		+			
Amphiascella debilis		+			
Ameira longipes		+			
Thalestris rufoviolascens		+			
Heterolaophonte discophora		+		+	
Robertsonia propinqua		+			+
Huntemannia jadensis		+	+	+	+
Ameiropsis brevicornis			+		
Rhizotrix curvata			+		
Paralaophonte hyperborea			+	+	
Ectinosoma finmarchicum			+		+
Ectinosoma normani				+	
Pseudobradya robusta				+	
Laophonte n. sp.				+	
Acrenhydrosoma perplexum				+	
Paralaophonte macera				+	
Ectinosoma melaniceps				+	+
Ectinosoma gothiceps				+	+
Arenostella germanica					+

*Average grain size of substratum decreasing from Richmond Beach to Bainbridge Island.

TABLE 7
INTERTIDAL DISTRIBUTION OF COPEPODS
ON THE BEACHES OF PUGET SOUND

	Intertidal Height in Feet				
	8-6.5	6-4.5	3-2	1-0	-1-(-2.5)
Arenosetella germanica	+				
Pararenosetella gracilis	+				
Paraleptastacus n. sp.	+				
Nitocra platypus	+	+	+		
Leptastacus n. sp.	+		+	+	+
Huntemannia jadensis	+	+	+	+	+
Heterolaophonte discophora	+				+
Pseudobradya robusta		+			
Ameiropsis brevicornis		+			
Paraleptocaris n. sp.		+			
Arenosetella fissilis		+			
Ectinosoma gothiceps		+	+	+	
Heterolaophonte littoralis		+	+	+	
Dactylopodia glacialis		+	+	+	+
Heterolaophonte strömi		+	+	+	+
Enhydrosoma n. sp.		+	+	+	+
Ectinosoma finmarchicum		+			+
Amphiascella debilis			+		
Laophonte n. sp.			+	+	
Robertsonia propinqua			+	+	
Paralaophonte hyperborea			+		+
Thalestris rufoviolascens				+	
Rhizotrix curvata				+	
Ectinosoma melaniceps					+
Ectinosoma normani					+
Paralaophonte macera					+
Ameira longipes					+
Acrenhydrosoma perplexum					+

rolaophonte littoralis, *Laophonte cornuta*, *Ameira longipes*, *Ectinosoma propinquum*, *Ectinosoma gothiceps*, *Arenosetella germanica*, *Huntemannia jadensis* (predominantly in brackish water, but according to Noodt also marine).

A typically brackish-water species is *Nitocra platypus*, which is able to penetrate into fresh water. In Puget Sound it occurred in the upper intertidal of Richmond Beach.

Heterolaophonte strömi is a holeuryhaline species.

True marine species are absent with the exception perhaps of *Ameiropsis brevicornis* and *Thalestris rufoviolascens*, of which species, however, only single specimens were encountered in my material.

OSTRACODA

The horizontal distribution of the seven ostracod species found is given in table 8.

TABLE 8
HORIZONTAL DISTRIBUTION OF OSTRACODS

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Cytheridea papillosa			+	+	
Leptocythere tenera			+	+	+
Cytherura gibba			+		+
Cytherois vitrea				+	
Paradoxostoma pulchellum				+	
Cypridina squamosa					+
Xestolebris rara aff.					+

The most striking feature is that all species were restricted to Bainbridge Island, Vashon Island, and Alki Point, that is, to the localities having substrata that are mostly finer and richer in debris than those of the other two localities. The preference of ostracods in general for fine and muddy material has been noted by Klie (1929). The occurrence of the ostracods at Alki Point but not at Golden Gardens, the substrata of which are of similar mechanical composition, is probably due to the particularly well-developed algal zone in the infralittoral fringe of Alki Point.

As to the intertidal distribution of the species, it has been remarked in Wieser (1959) that most of the finds were made below the 3-foot level, only *Cytheridea papillosa* and *Xestolebris* (cf. *rara*) occurring infrequently between 6 and 4.5 feet at Vashon Island and Bainbridge Island.

According to W. L. Tressler, all the ostracods are known European species. This is perhaps somewhat surprising.

Of the relationship of the species to certain types of substrata the following is known (cf. Elofson, 1941): *Cytherura gibba* lives exclusively between algae and on sand rich in organic debris in very shallow water. *Cytheridea papillosa* occurs on muddy sand, rich in organic debris. *Cytherois vitrea* occurs on algae and debris. *Paradoxostoma pulchellum*, like all species of this genus, lives on algae, the juices of which serve as its food.

From these data it can be concluded that the ostracod fauna of the beaches investigated is largely dependent on the presence of algae, the latter occurring either in the intertidal on boulders or in the sublittoral. The ostracods live either directly on algae (*Paradoxostoma*) or in the algal debris that accumulates in the upper layer of the sand.

Cytherura gibba is a true brackish-water species, preferring mesohaline water. *Cytheridea papillosa*, the most common species, is marine-mesohaline, occurring in waters ranging from 10 to 35 ‰. *Cytherois vitrea* is marine-polyhaline. *Leptocythere tenera* and *Paradoxostoma pulchellum* are euryhaline.

CUMACEA

The horizontal and intertidal distribution of the three species found can be inferred from figure 9 in Wieser (1959). All three species were well established at Bainbridge Island, Vashon Island, Alki Point, and Golden Gardens. At Richmond Beach only *Lamprops krasheninikova* occurred in the lowest sample, and single males of *Cumella vulgaris* were found in one sample. The males of this species are excellent swimmers and make long excursions beyond their dwelling places, while the females are more bound to the substratum. Thus the finding of males but no females in a sample usually means that the substratum from which the sample was taken does not represent the genuine habitat of the species. *Diastylopsis tenuis* was absent from Richmond Beach. Altogether the three species exhibit a similar preference for fine substratum.

Very little is known as to the ecology of the three species. *C.*

vulgaris has been found in Alaska and in the Vancouver region, and is probably euryhaline to some degree. I found it in great numbers in False Bay on San Juan Island, Washington Sound, particularly in tide pools where during low tide the salinity rises considerably. All three species occur in clean sand and in various types of muddy sand. *C. vulgaris* is most abundant in muddy areas (Carl, in litt.)

AMPHIPODA, CHELIFERA, and ISOPODA

The horizontal and the intertidal distribution of the remaining peracarids is given in tables 9 and 10.

Since many forms could not be identified as to species, little of value can be said about the general ecology of the amphipod fauna. However, a number of genera are ecologically homogeneous, for which reason the unidentified representatives in my material may be assumed to have the same relationship to substrata as the known species.

TABLE 9
HORIZONTAL DISTRIBUTION OF AMPHIPODS, CHELIFERA, AND ISOPODS

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Pontharpinia sp.	+	+	+		
Exosphaeroma oregonensis	+	+	+	+	
Westwoodilla caecula		+			
Monoculodes (cf. *zernovi*)		+			
Hyale sp.		+			
Photis californica		+			
Ischyrocerus sp.		+	+		
Anisogammarus sp.		+		+	
Leptochelia dubia		+		+	+
Synchelidium n. sp.		+	+		+
Photis sp.			+	+	+
Corophium salmonis				+	
Hyale pugetensis				+	
Calliopius laeviusculus				+	
Ampelisca venetiensis					+

TABLE 10
INTERTIDAL DISTRIBUTION OF AMPHIPODS, CHELIFERA, AND ISOPODS

	Intertidal Height in Feet				
	8-6.5	6-4.5	3-2	1-0	-1-(-2.5)
Exosphaeroma oregonensis	+	+	+		
Corophium salmonis	+	+	+		
Hyale sp.		+	+		
Anisogammarus sp.		+	+	+	+
Ampelisca venetiensis			+		
Pontharpinia sp.			+	+	
Leptochelia dubia			+	+	+
Synchelidium n. sp.			+	+	+
Monoculodes (cf. *zernovi*)				+	
Photis californica				+	+
Photis sp.					+
Westwoodilla caecula					+
Calliopius laeviusculus					+
Ischyrocerus sp.					+

The genera *Hyale* and *Ischyrocerus* are fairly consistently related to seaweeds and algal debris.

Species of *Anisogammarus* occur on mud flats, associated with eelgrass and seaweeds. They are more common in brackish water than in oceanic salinity and might even occur in fresh water (Barnard, 1954).

Species of *Photis* build mud tables attached to some firm object. *Photis californica* has been found in algal debris, on algae, and on kelp (Stout, 1913; Barnard, 1954).

Representatives of the genera *Synchelidium* and *Pontharpinia* nearly always occur in mud, on muddy sand, or on fine sand.

Of the identified species, *Ampelisca venetiensis, Corophium salmonis* and *Westwoodilla caecula* are restricted to mud and muddy sand. *Monoculodes zernovi* is probably a true sand form. I found this species at Mukkaw Bay, on the ocean coast of Washington, in clean sand. *Calliopius laeviusculus* is eurytopic. It occurs in seaweeds (cf. Dahl, 1948) but also on fine deposits (the members of this genus, according to Enequist, 1949, are typical deposit feeders).

Exosphaeroma oregonensis, according to Hatch (1947) occurs under stones and in mud. It is said to penetrate even into fresh

water. *Leptochelia dubia* is a tube builder and occurs in mud, particularly in the vicinity of algae where the substratum is rich in debris. It was also recorded from algae and hydroids (cf. Hatch 1947).

In the foregoing discussion the known species have been divided into three ecological groups: (1) true sand forms; (2) species occurring in various types of sand, muddy sand, and mud; (3) phytal and eurytopic species (for the term "phytal" see Remane, 1933). These groups are represented in the five localities investigated as follows:

	Richmond Beach	Golden Gardens	Alki Point	Vashon Island	Bainbridge Island
Sand forms	15	10	9	3	5
Sand-mud forms	6	11	14	17	11
Phytal and eurytopic forms	8	16	21	27	19

Since only the better known species could be taken into consideration this table gives but an incomplete picture of the ecological situation at the five localities. The number of sand forms is significantly higher at Alki Point, Golden Gardens, and particularly Richmond Beach, reflecting the coarser substratum in these localities. The number of phytal and eurytopic species is significantly lower at Richmond Beach, reflecting the scarcity of algae in the littoral and upper sublittoral of this locality.

All in all, the meiofauna of the area has to be considered a sand/sand-mud fauna with strong influence from the phytal.

The effect of algae on the sand fauna lies not only in their contributing typical algal species to the inhabitants of the beach, but also in the production of algal debris which through water movements is deposited on the shore. The admixture of large quantities of debris to fine sand produces a soft substratum to which mud-loving animals are attracted. This is well illustrated by the occurrence of *Leptochelia dubia* or by the pattern of distribution of the ostracods in the area. The ecological importance of algae near a sandy beach thus lies not solely in their nutritive value but also in the fact that--through the formation of debris--they change the texture of the substratum.

Relationship between fauna and salinity

As was mentioned in the introduction to this volume, Puget Sound is a polyhaline area. In the intertidal, however, the variations of salinity most probably exceed the limits of polyhaline waters. Animals living in the intertidal must therefore be of considerable euryhalinity.

An analysis of the tolerance limits of the more important species of the area would be of some interest, particularly in the light of the controversy between Remane (1940) and Dahl (1956) as to the character of the polyhaline fauna. According to Remane the polyhaline waters are inhabited by euryhaline marine animals. According to Dahl this zone is "positively characterized by the presence of brackish water species and negatively by the absence of the majority of marine forms."

The problem touched by these two controversial opinions cannot be solved on the basis of intertidal investigations alone because of the greater fluctuations of salinity in this zone. But even the intertidal fauna of a polyhaline area ought to tell us something about the importance of the marine element there.

In Part II of this volume the species were divided into the following groups as far as their relationship to salinity is concerned:

marine: generally in waters above 30‰
marine-polyhaline: generally in waters above 15‰
marine-mesohaline: generally in waters above 2-3 or 10‰
brackish: generally in waters below 15‰, but sometimes also between 15‰ and 30‰
holeuryhaline: without apparent restriction to any degree of salinity.

The better known species in my material can be allotted to these groups as set out below:

	No. of species
marine	14
marine-polyhaline	16
marine-mesohaline	17 (18)
brackish	9 (8)
holeuryhaline	2

This table is, of course, preliminary since the distribution of species is so little known that nothing definite can be said as

to their true relationship to salinity. However, the little that is known shows that the number of species that also occur in marine water by far exceeds the number of brackish water species. The number of the latter is most likely to decrease even more since the distribution of the five brackish water nematodes is particularly little known and an extension of the range of salinity in which these species occur is quite probable.

Two species that had been referred to in the literature as typical brackish water species, i.e., *Huntemannis jadensis* and *Protohydra leuckarti* (both quite abundant in Puget Sound), have been found recently in polyhaline or marine water (Remane, Noodt, verbal information). Only *Cytherura gibba* and *Nitocra platypus* had not been reported in water above 15‰ before they were found in Puget Sound.

If one ventures to generalize on these data, it can be said that the beaches of Puget Sound are inhabited by a meiofauna that consists predominantly of euryhaline marine animals. This would support Remane's view.

However, it might turn out that Remane's and Dahl's points of view are not irreconcilable after all. For even Dahl had to allow that polyhaline species might penetrate into sea water of more than 30‰ salinity. Thus polyhaline waters are inhabited, according to Remane, by marine species that can also tolerate waters of reduced salinity, and according to Dahl by brackish water species that can also tolerate waters of oceanic (30-35‰) salinity. These two definitions have a very similar meaning. Now, Dahl thinks that "the essential difference between a polyhaline brackish water species and a euryhaline marine species is that *the brackish water species seems unable to establish itself successfully in a stable marine environment* . . . even if its salinity tolerance *per se* would not prevent it from doing so" [italics mine]. That is, the whole controversy revolves about the question whether the inhabitants of the polyhaline waters are also established *successfully* or *unsuccessfully* in a stable marine environment--a question whose resolution requires a great amount of data. There is no doubt that for the small animals on the beaches we are still far from possessing these data. In short, the controversy between Remane and Dahl cannot be settled because we do not yet know whether it is a true controversy at all, that is, whether it is not based on incomplete data.

Finally, attention should be drawn to the fact that the salinity tolerance of a species is not an absolute quantity but is subject to variation under the influence of temperature. The range of

distribution of a species in *one* body of water is therefore not necessarily identical with that in another body of water of a greatly different temperature. In cold water the minimum, optimum, and maximum salinity of a species will be higher than in warm water (Broekema, 1941). This holds particularly for larval stages (Smith, 1955).

PLATES

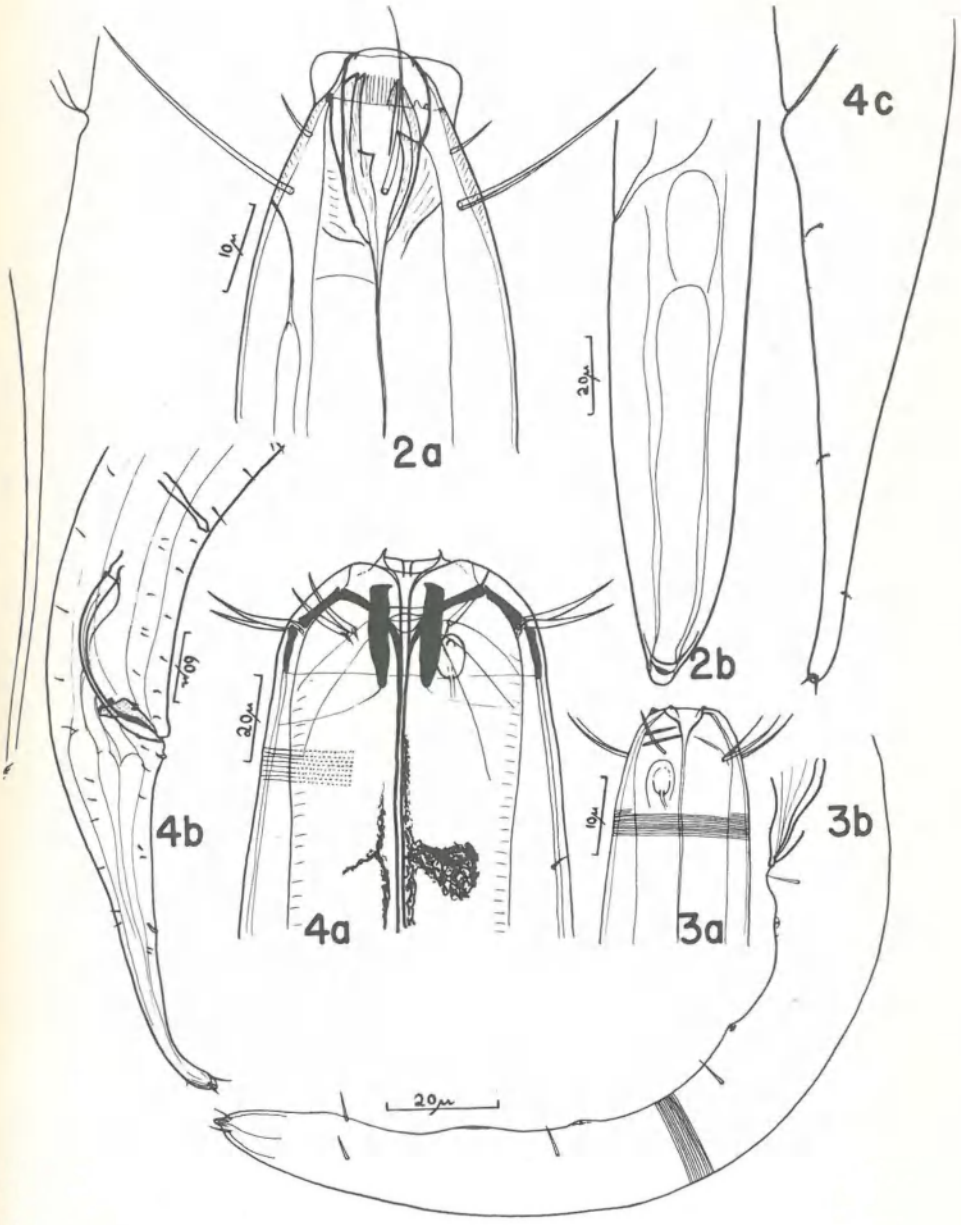

PLATE I. Fig. 1. *Anticoma acuminata.* Tail of female. Fig. 2. *Rhabdodemania illgi.* a, anterior end of female; b, tail of female. Fig. 3. *Lauratonema pugiunculus.* a, anterior end of male; b, tail of male. Fig. 4. *Enoplus velatus.* a, anterior end of male; b, tail of male; c, tail of female

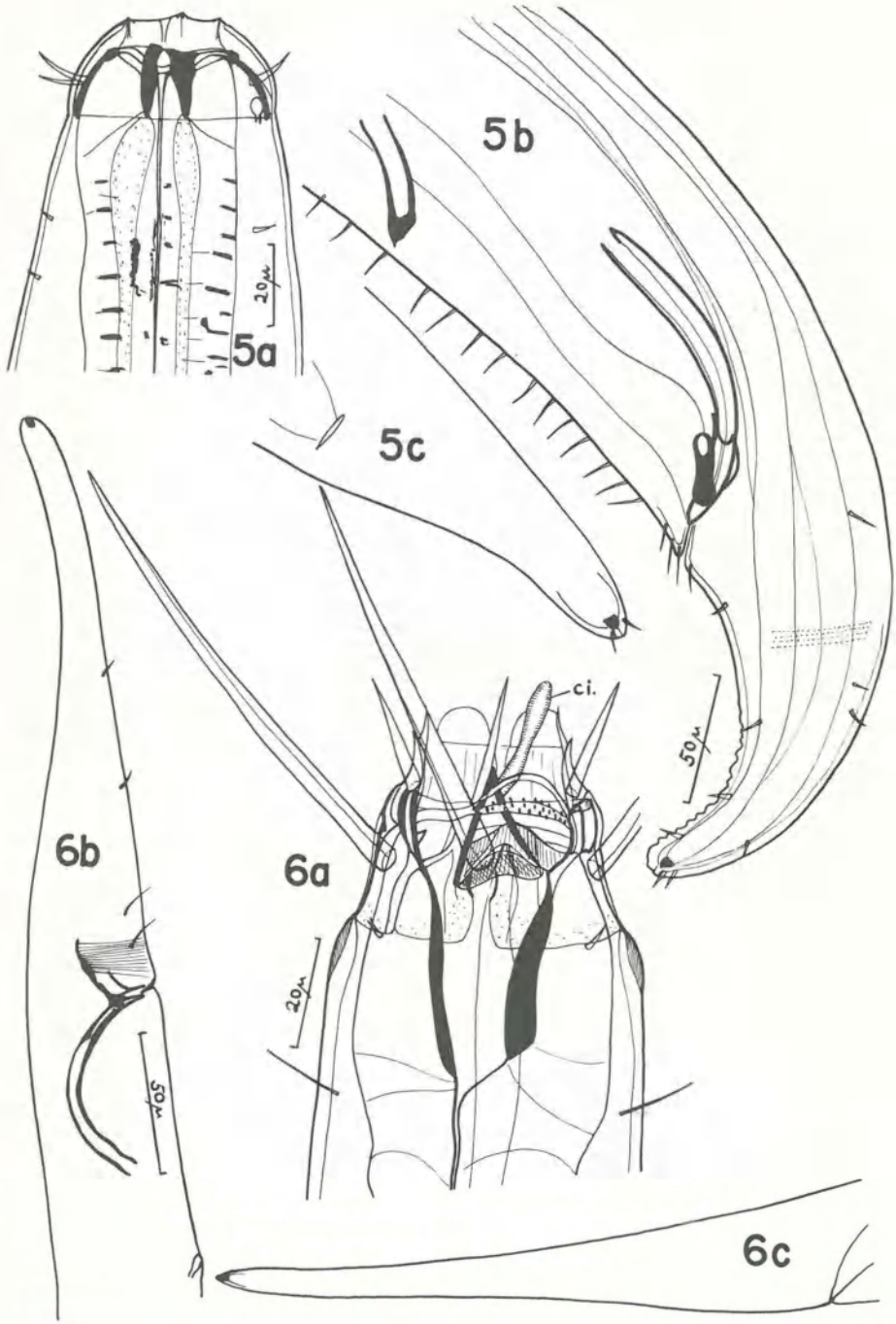

PLATE II. Fig. 5. *Enoplus paralittoralis*. a, anterior end of male; b, tail of male; c, tail of juvenile. Fig. 6. *Oxyonchus culcitatus*. a, anterior end of female; b, tail of male; c, tail of juvenile; ci = "cirrus"

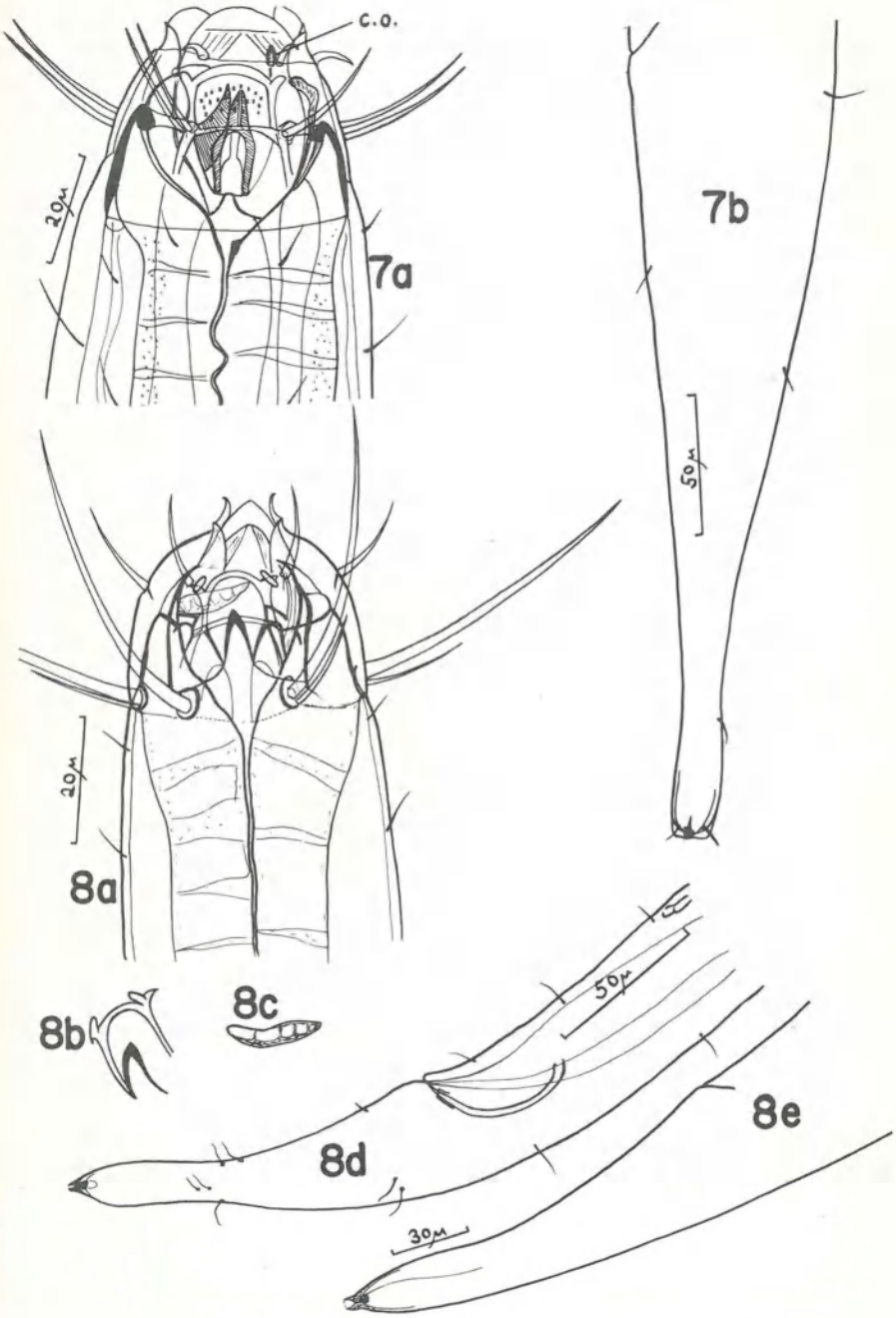

PLATE III. Fig. 7. *Oxyonchus* sp. a, anterior end of female; b, tail of female; c.o. =.cephalic organ. Fig. 8. *Enoplolaimus lenunculus*. a, anterior end of female; b, mandible; c, cephalic organ; d, tail of male; e, tail of female

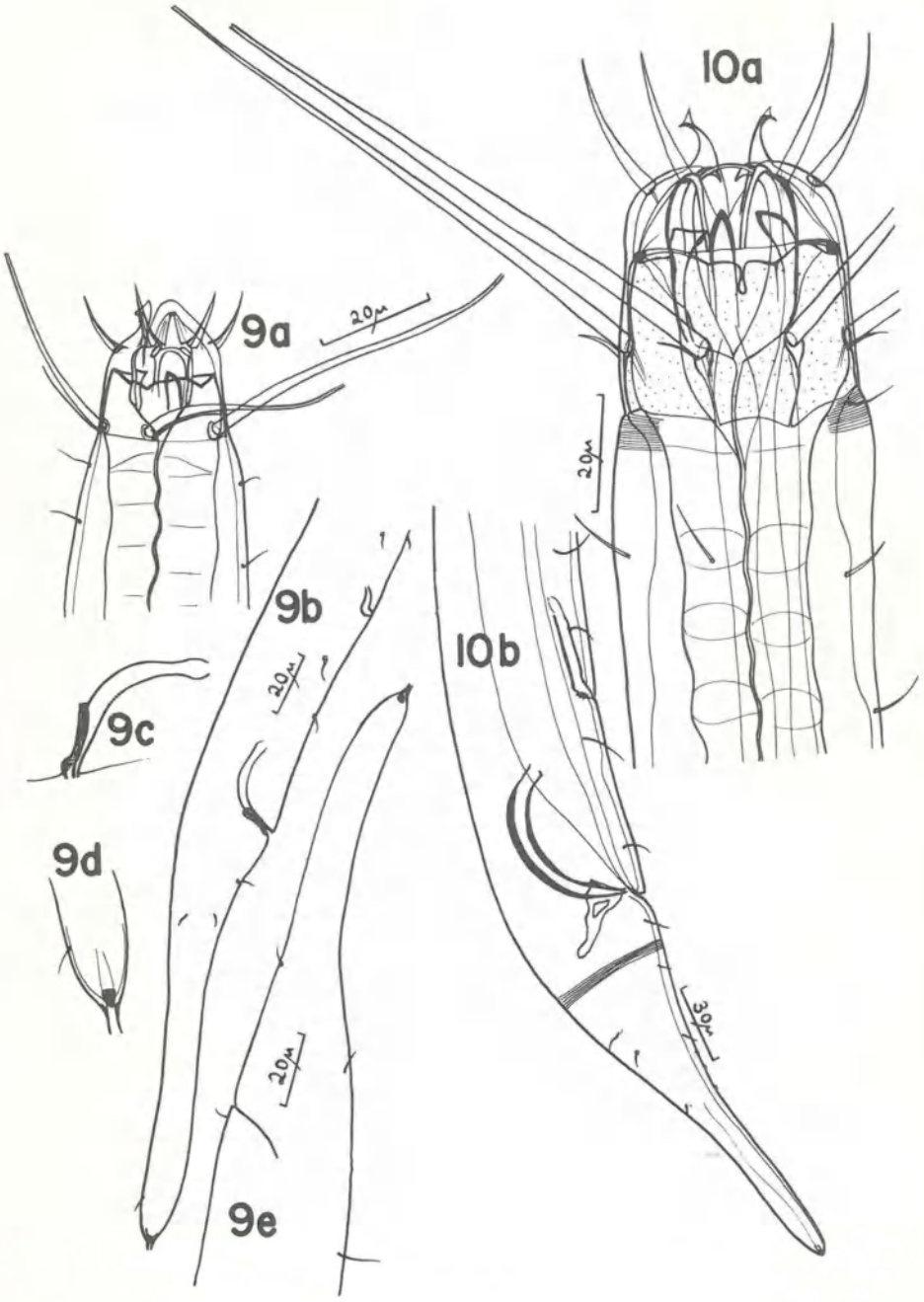

PLATE IV. Fig. 9. *Enoplolaimus paralitoralis*. a, anterior end of female; b, tail of male; c, spiculum and gubernaculum; d, tip of tail with spinneret; e, tail of female. Fig. 10. *Mesacanthion pali*. a, anterior end of male; b, tail of male

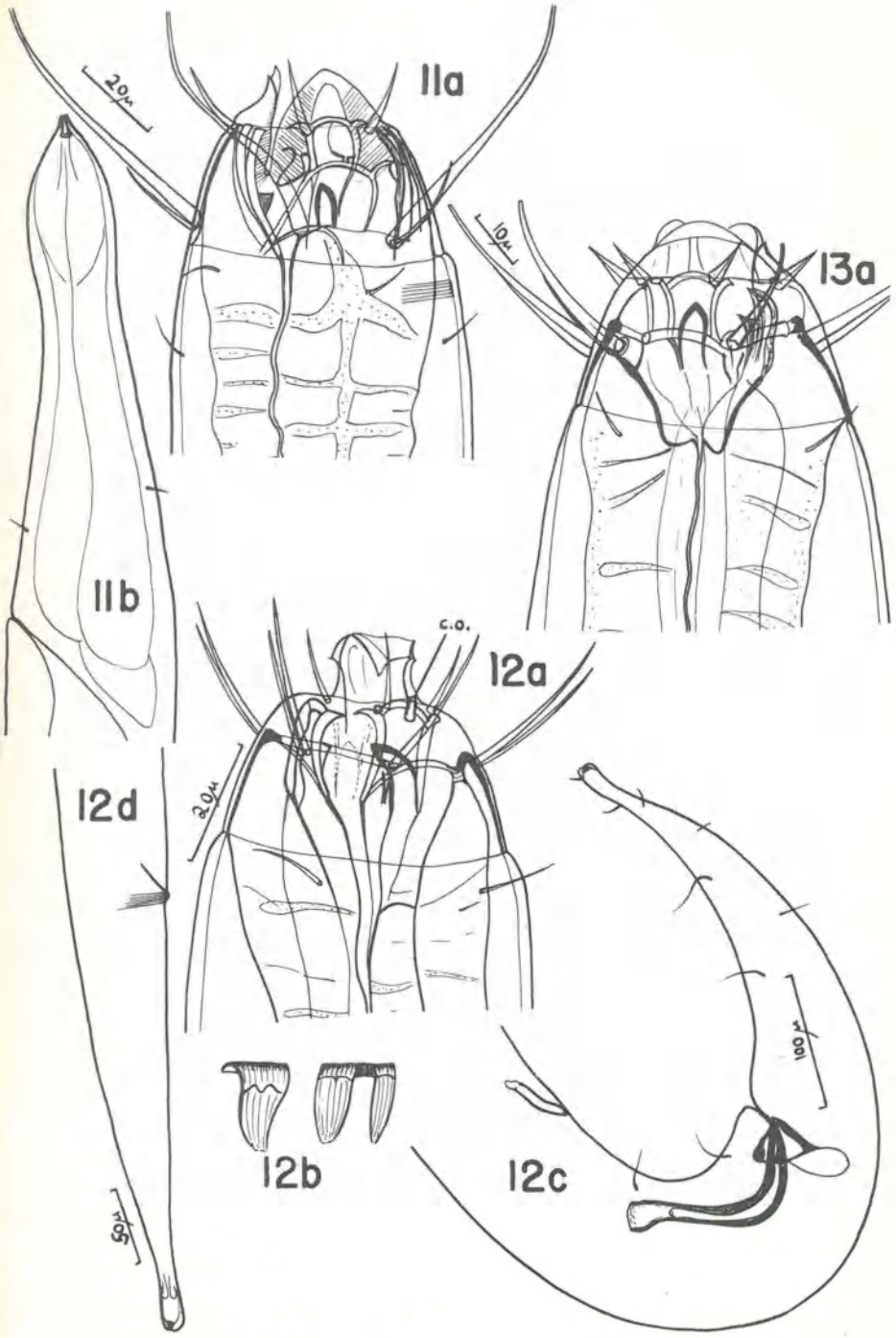

PLATE V. Fig. 11. *Mesacanthion arcuatilis*. a, anterior end of female; b, tail of female. Fig. 12. *Mesacanthion pannosum*. a, anterior end of female; b, enlarged cervical setae; c, tail of male; d, tail of female; c.o. = cephalic organ. Fig. 13. *Mesacanthion cricetoides*. a, anterior end of female

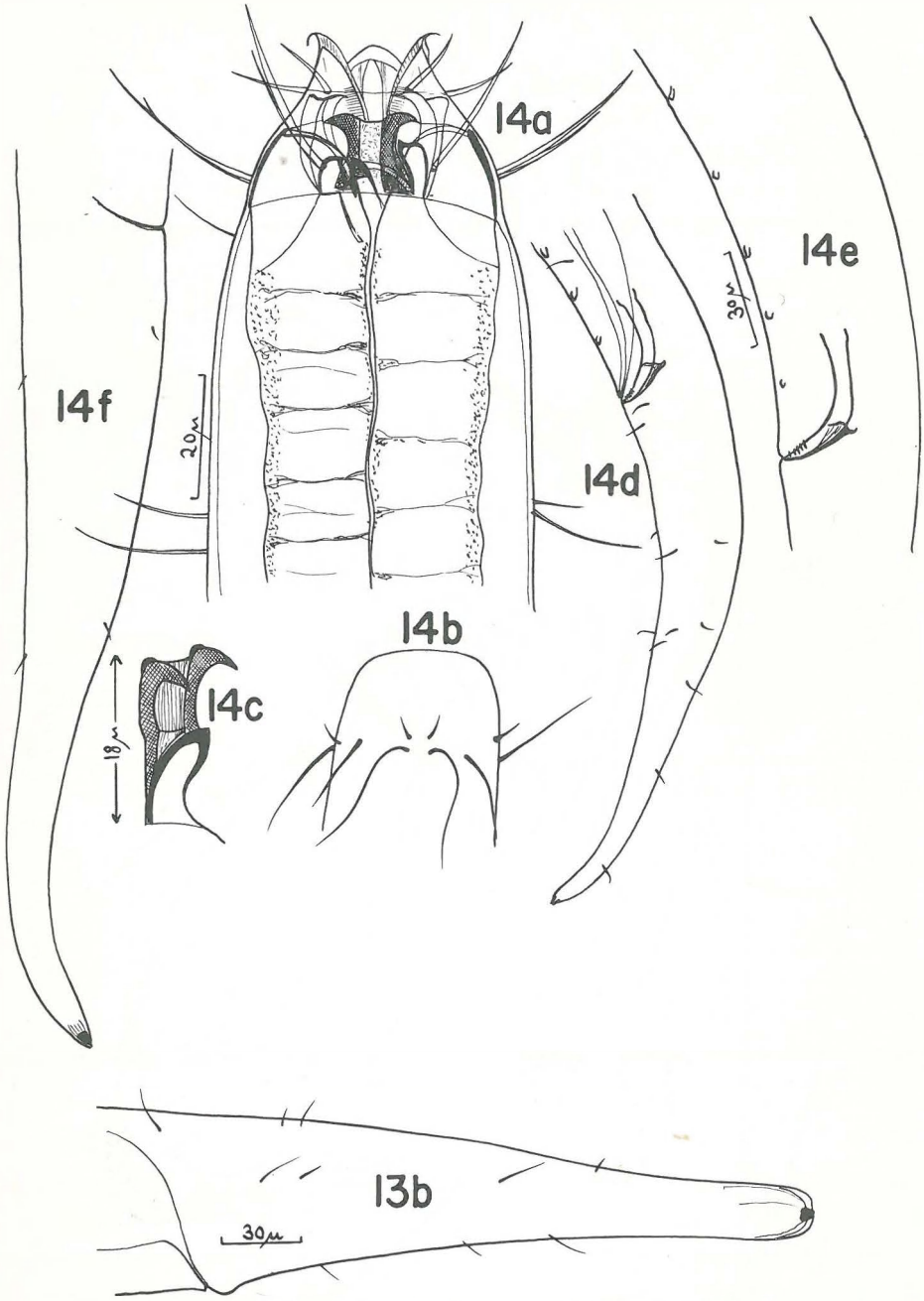

PLATE VI. Fig. 13. *Mesacanthion cricetoides*. b, tail of female. Fig. 14. *Hyalacanthion multipapillatum*. a, anterior end of female; b, outline of head of male to show subcephalic setae; c, mandible; d, tail of male; e, genital armature; f, tail of female

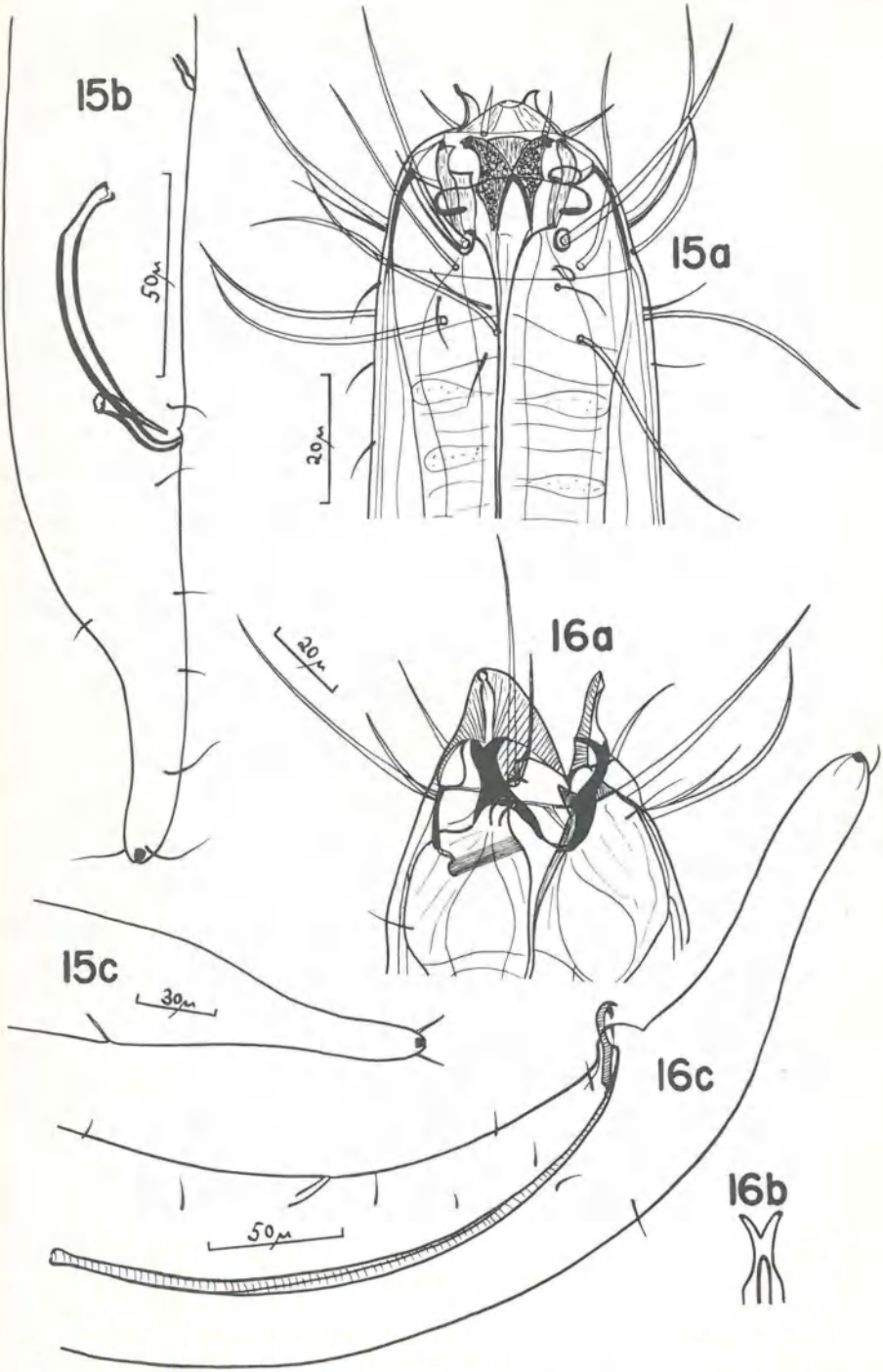

PLATE VII. Fig. 15. *Mesacanthoides sinuosus*. a, anterior end of male; b, tail of male; c, tail of female. Fig. 16. *Enoploides harpax*. a, anterior end of male; b, mandible; c, tail of male

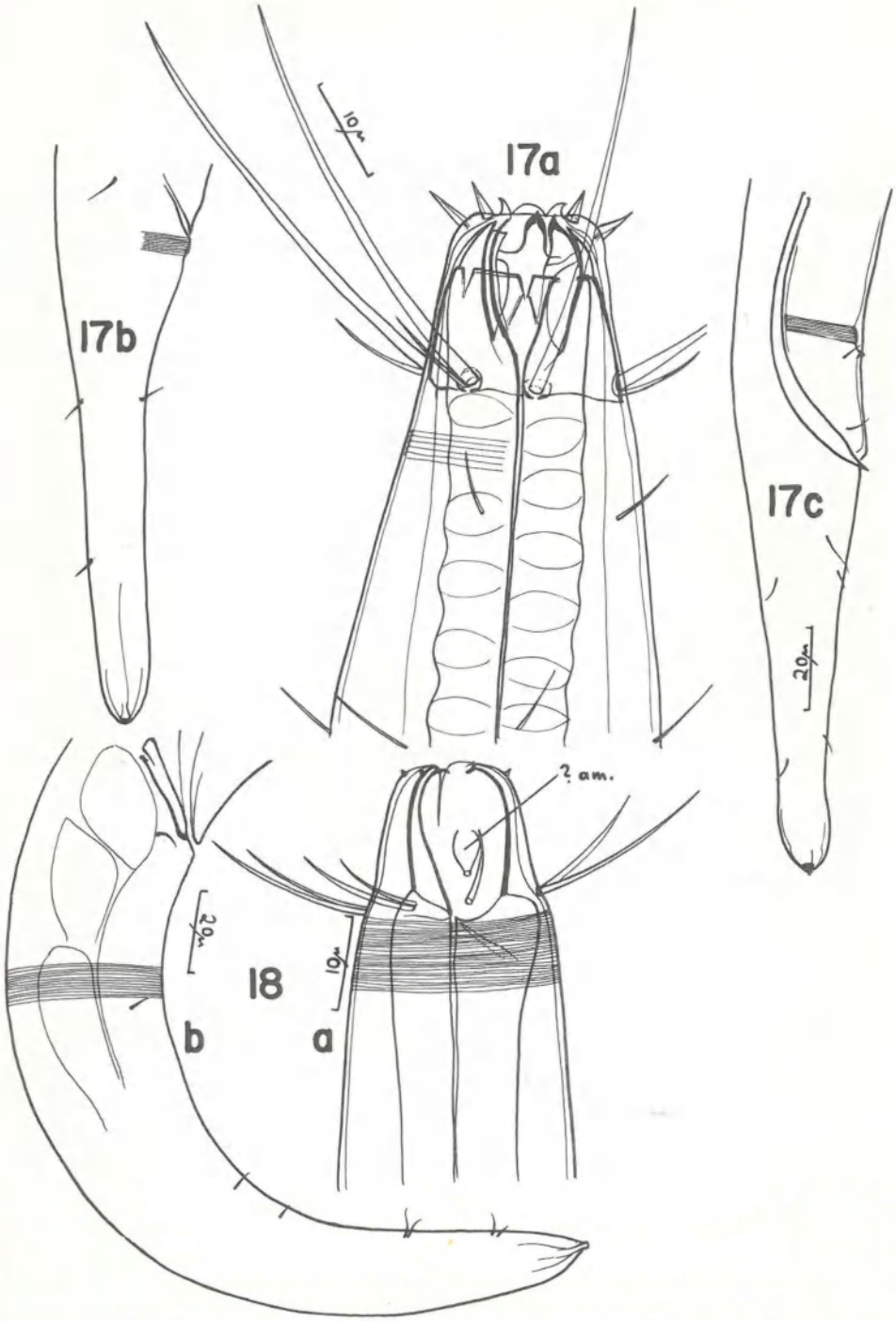

PLATE VIII. Fig. 17. *Trileptium iacobinum*. a, anterior end of female; b, tail of female; c, tail of male. Fig. 18. *Lauratonema mentulatum*. a, anterior end of male; b, tail of male; ?am. = amphid?

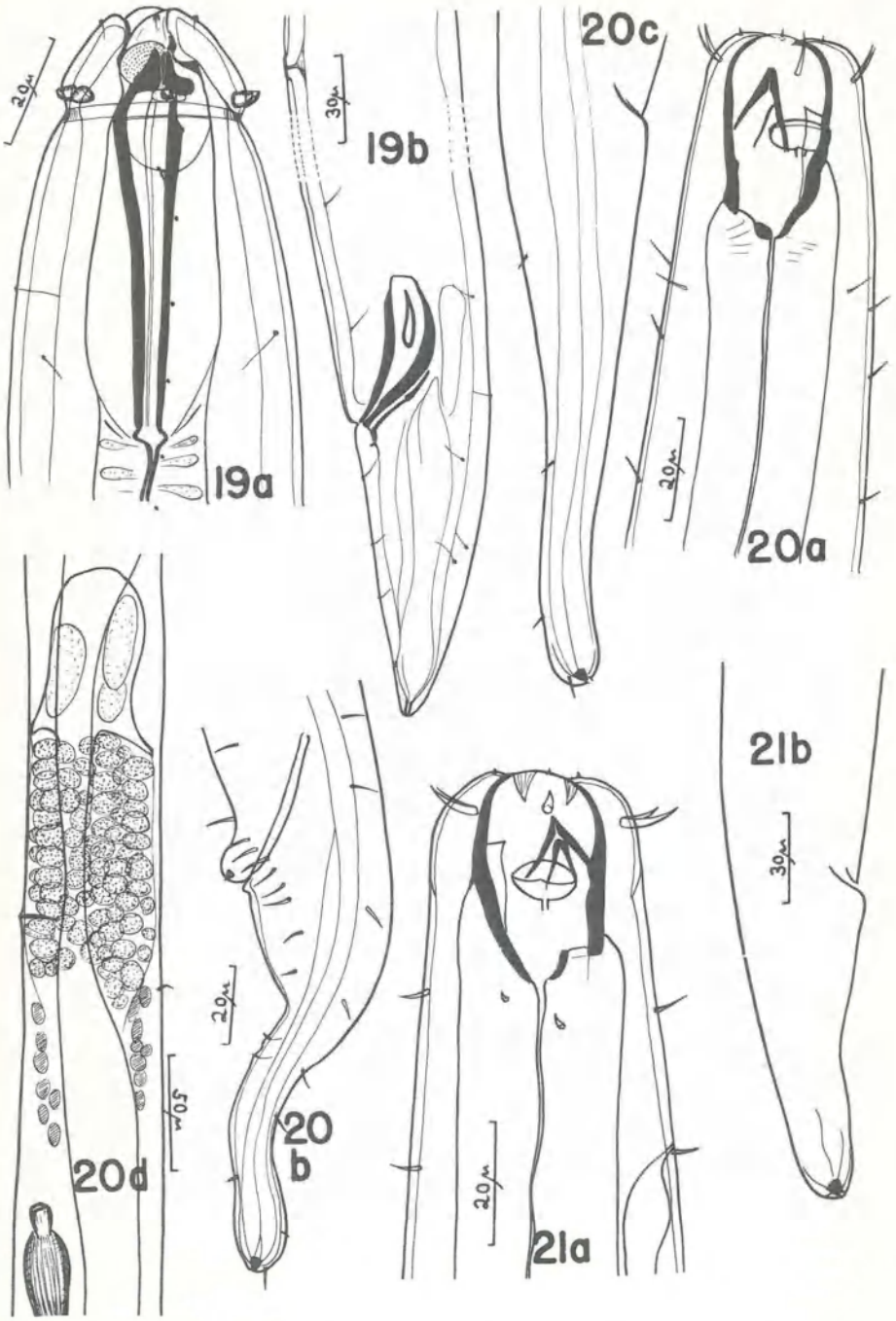

PLATE IX. Fig. 19. *Dolicholaimus benepapillosus*. a, anterior end of male; b, tail of male. Fig. 20. *Oncholaimus campylocercoides*. a, anterior end of male; b, tail of male; c, tail of female; d, demanian organ. Fig. 21. *Oncholaimus brachycercus*. a, anterior end of male; b, tail of female

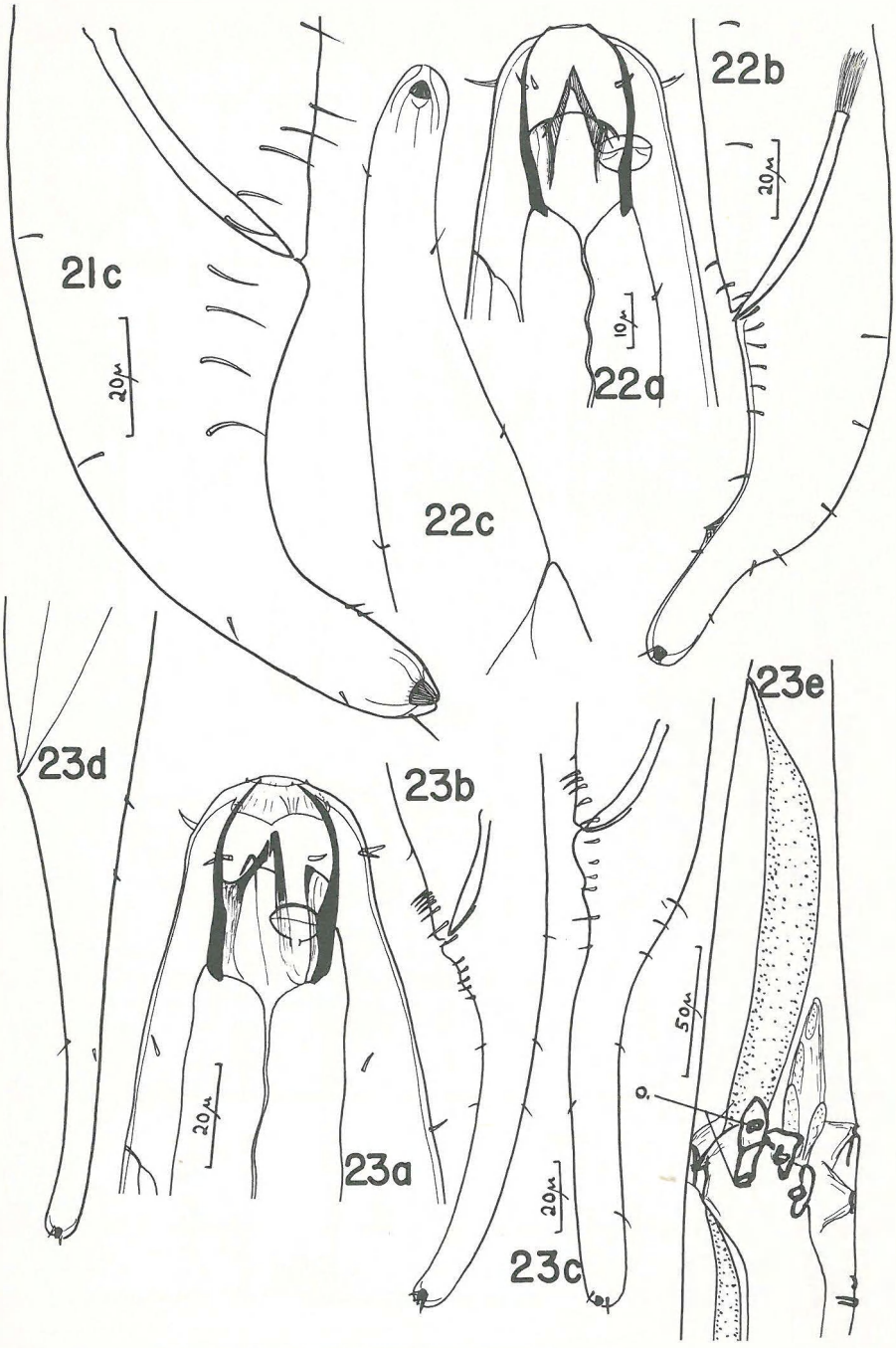

PLATE X. Fig. 21. *Oncholaimus brachycercus*. c, tail of male. Fig. 22. *Oncholaimus martini*. a, anterior end of male; b, tail of male; c, tail of female. Fig. 23. *Oncholaimus apostematus*. a, anterior end of male; b, tail of male; c, tail of another male; d, tail of female; e, demanian organ; o = openings of demanian organ

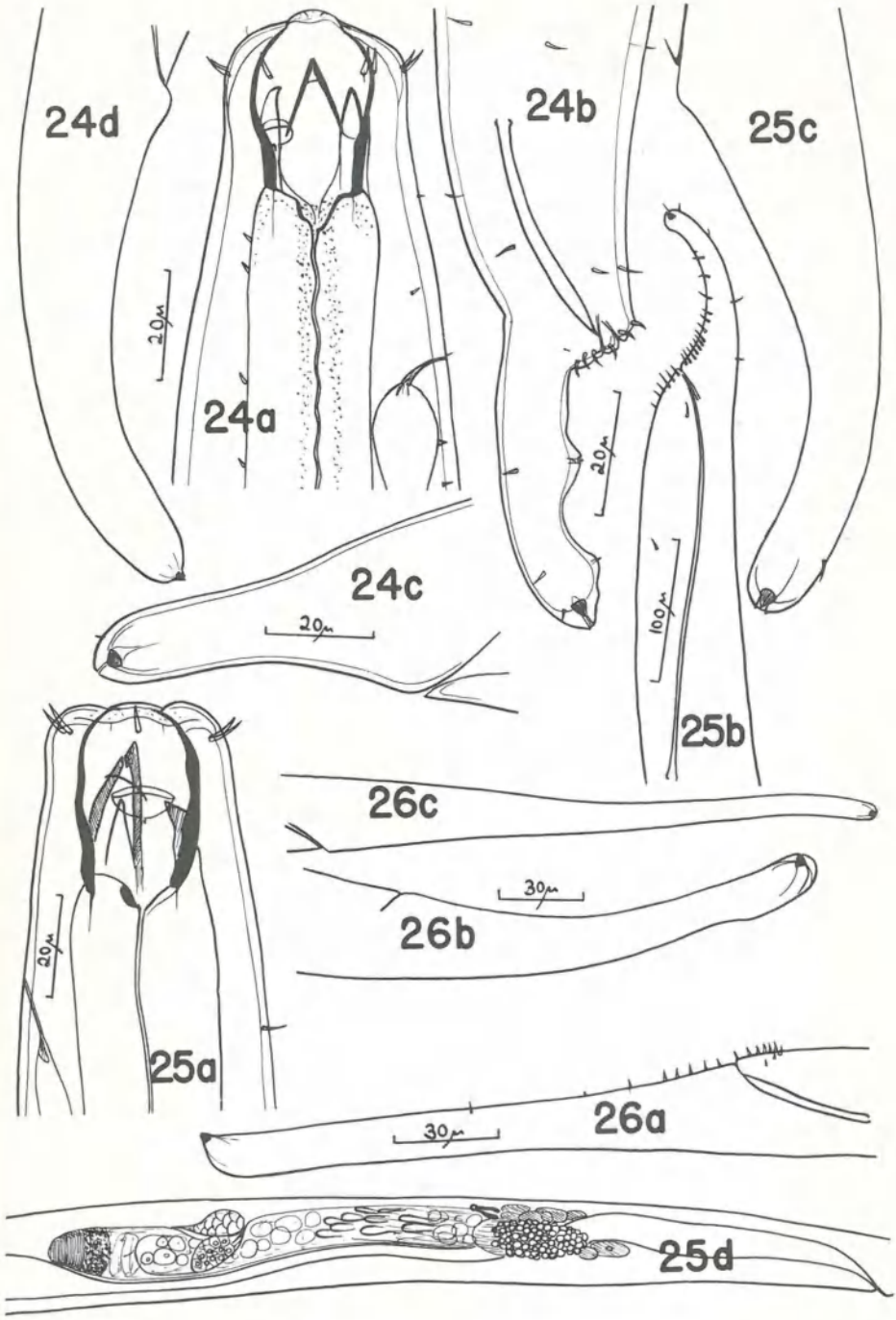

PLATE XI. Fig. 24. *Oncholaimium vesicarium*. a, anterior end of male; b, tail of male; c, tail of female; d, tail of juvenile. Fig. 25. *Metoncholaimus uvifer*. a, anterior end of female; b, tail of male; c, tail of female; d, demanian organ. Fig. 26. *Viscosia tumidula*. a, tail of male; b, tail of female; c, tail of juvenile

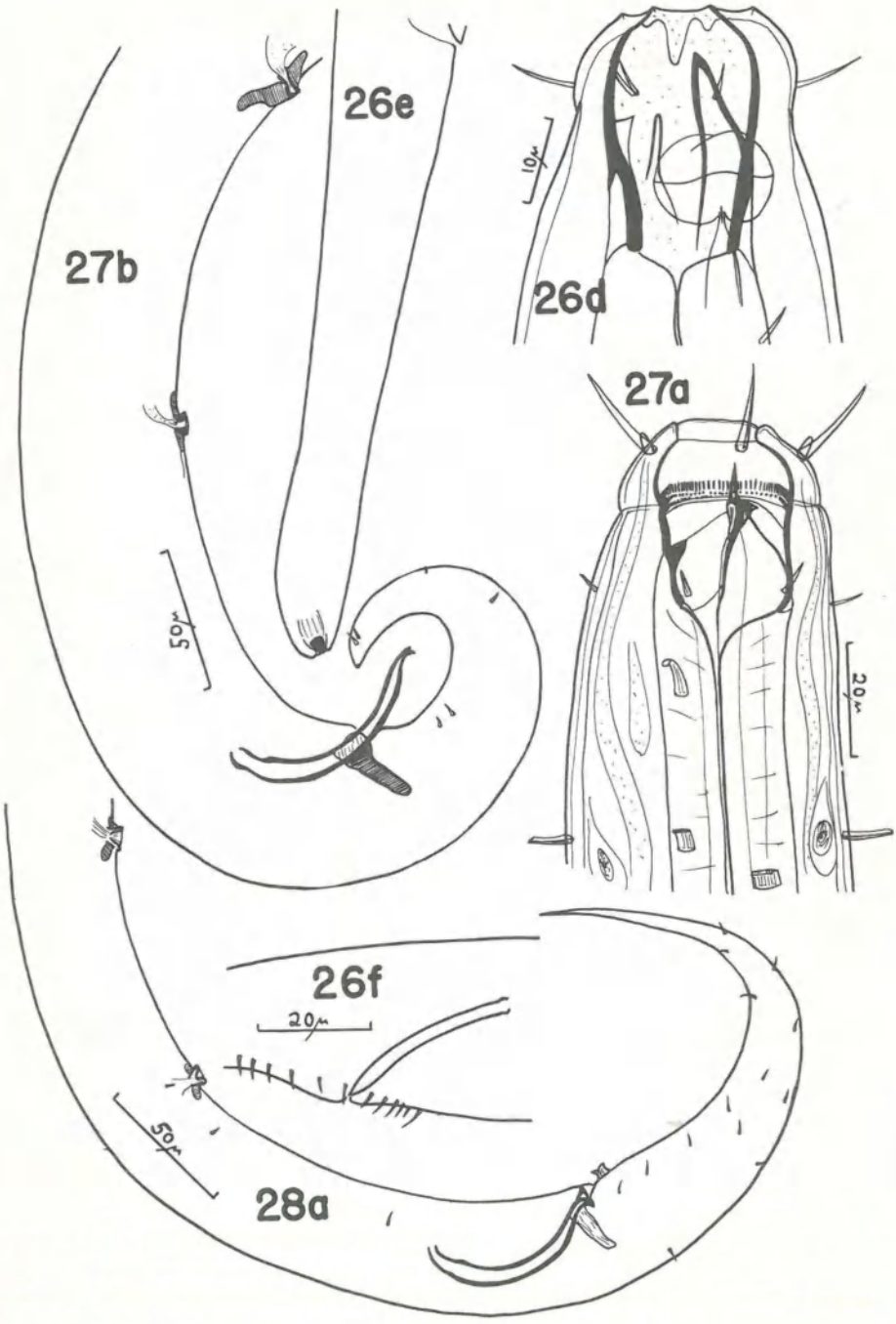

PLATE XII. Fig. 26. *Viscosia tumidula*. d, anterior end of male; e, tail of female; f, genital armature. Fig. 27. *Eurystomina repanda*. a, anterior end of male; b, tail of male. Fig. 28. *Pareurystomina pugetensis*. a, tail of male

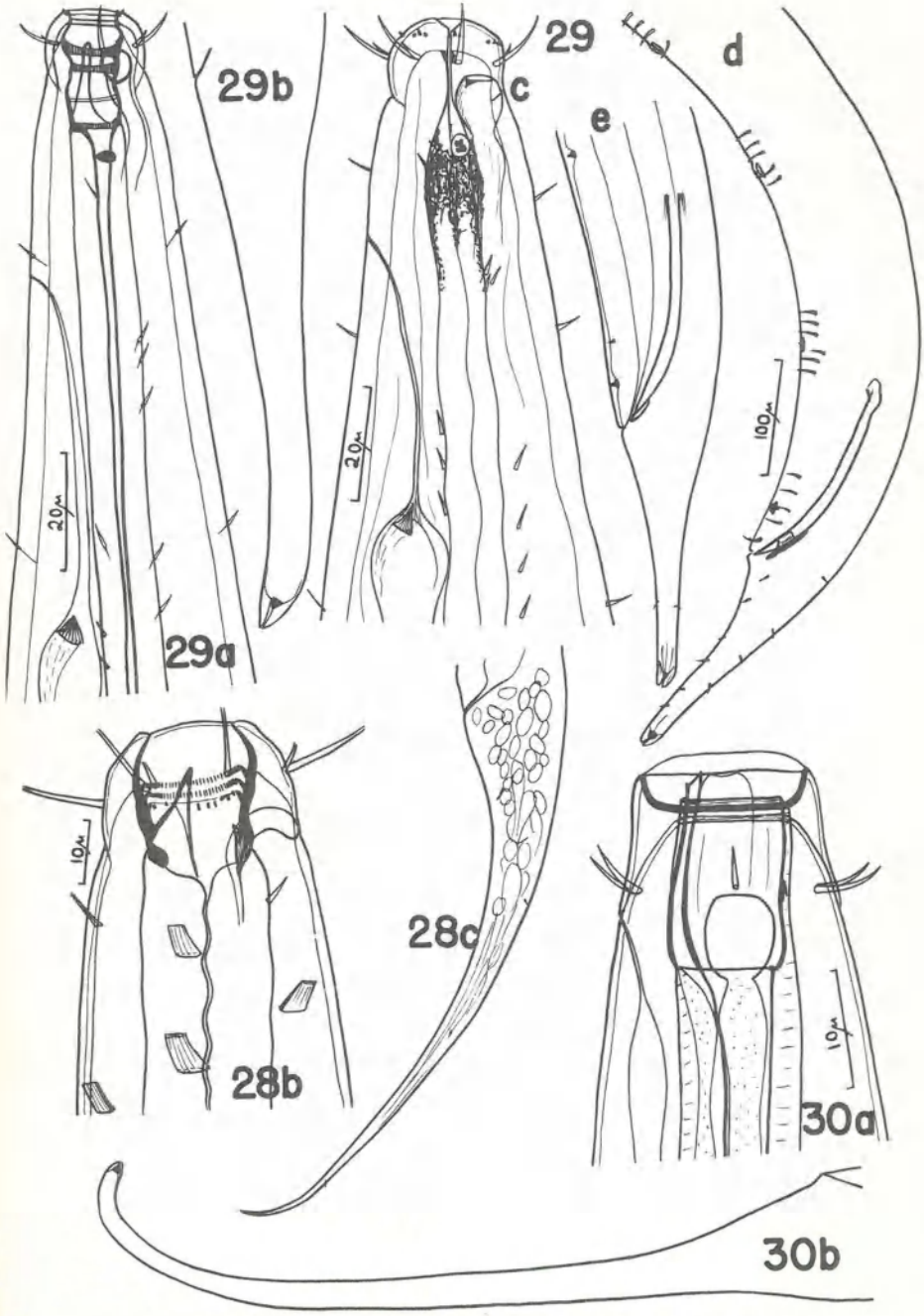

PLATE XIII. Fig. 28. *Pareurystomina pugetensis*. b, anterior end of female; c, tail of female. Fig. 29. *Symplocostoma dissoluta*. a, anterior end of juvenile; b, tail of juvenile; c, anterior end of male; d, tail of male; e, tail of last larval stage of male. Fig. 30. *Calyptronema maxweberi*. a, anterior end of female; b, tail of female

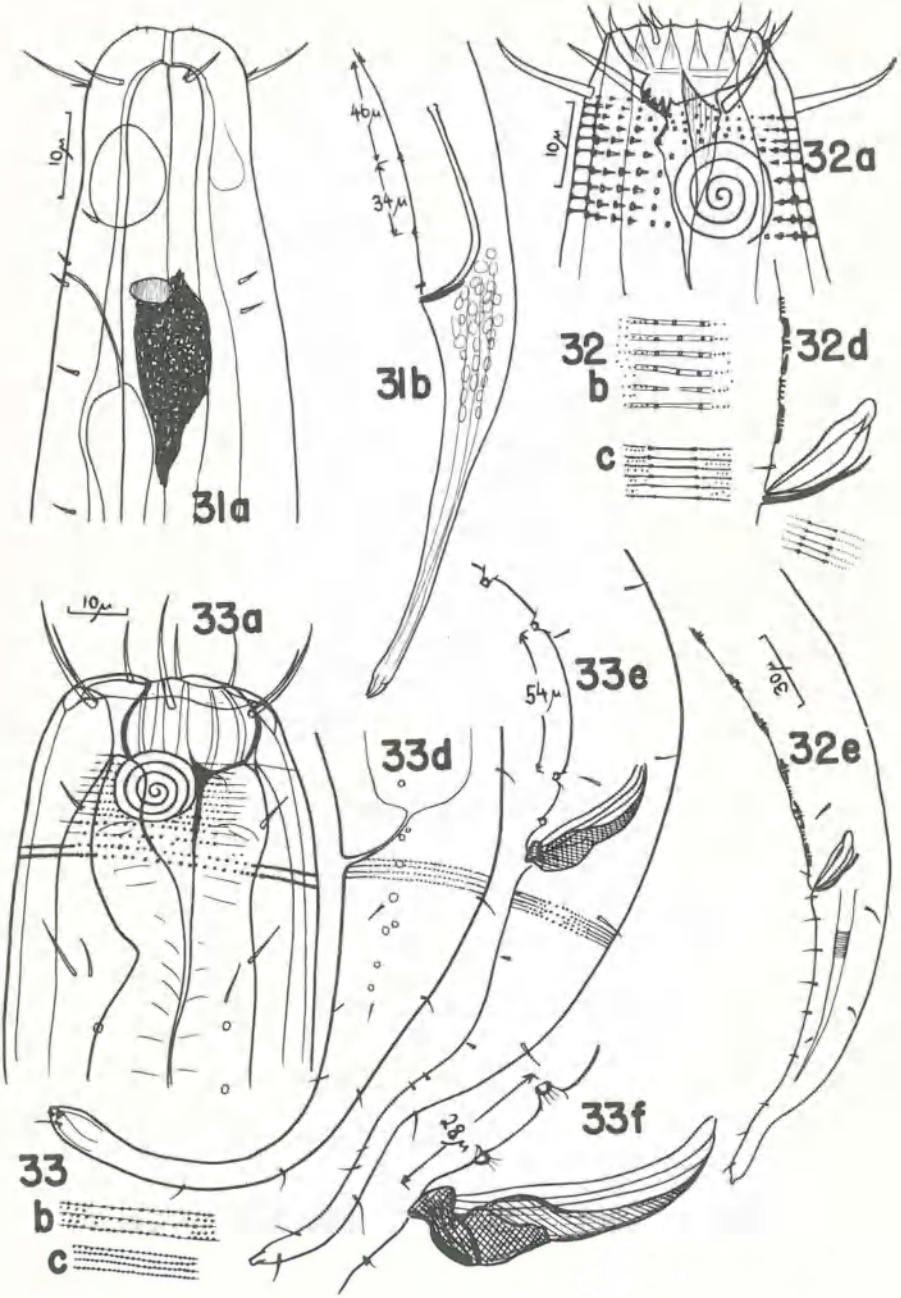

PLATE XIV. Fig. 31. *Calyptronema pachyderma.* a, anterior end of male; b, tail of male. Fig. 32. *Pomponema segregata.* a, anterior end of male; b, lateral cuticular differentiation in mid-cervical region; c, the same in mid-body; d, genital armature; e, tail of male. Fig. 33. *Biarmifer gibber.* a, anterior end of female; b, lateral cuticular striation in mid-cervical region; c, the same in mid-body; d, tail of female; e, genital armature; f, tail of male

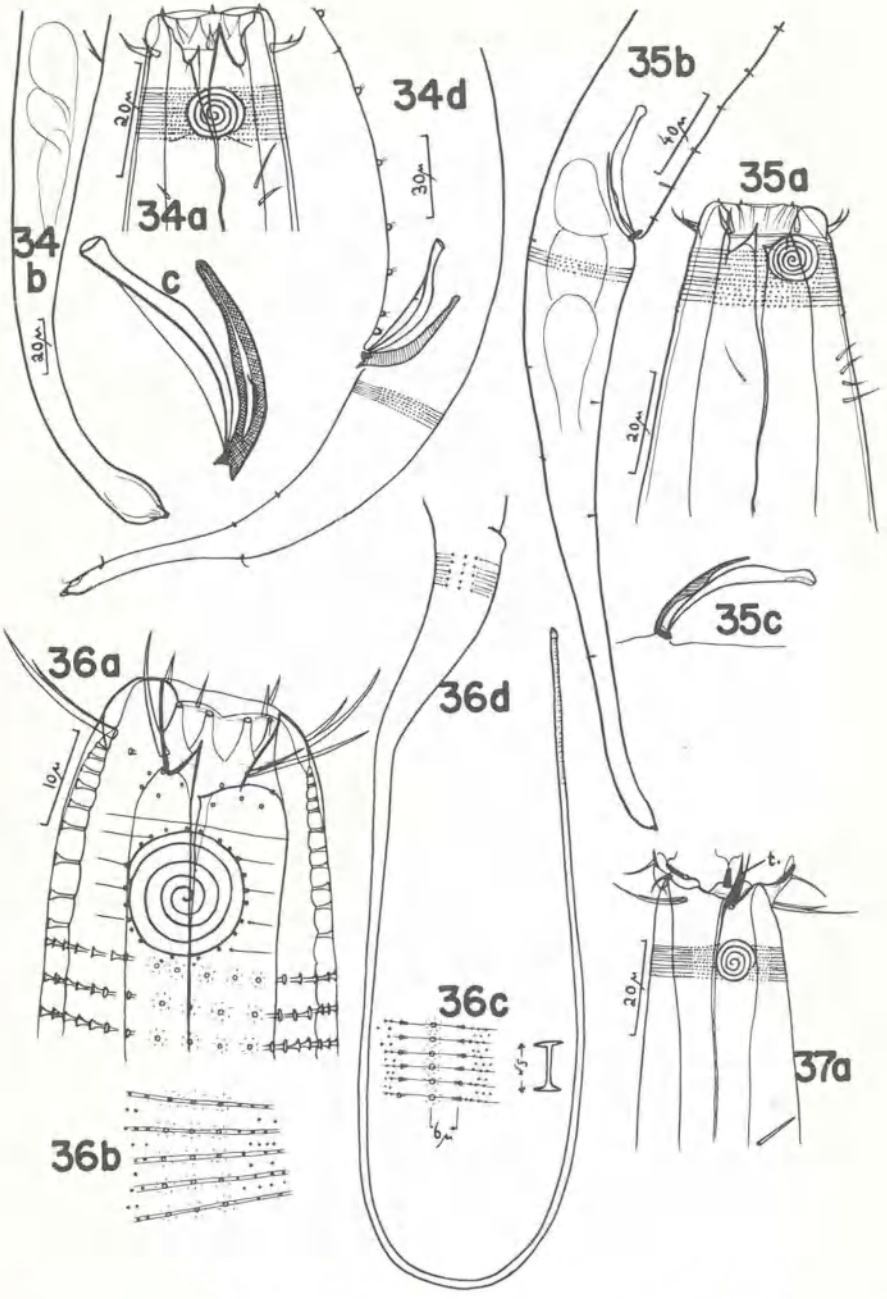

PLATE XV. Fig. 34. *Choniolaimus macrodentatus*. a, anterior end of male; b, tail of female; c, spicular apparatus; d, tail of male. Fig. 35. *Longicyatholaimus quadriseta*. a, anterior end of male; b, tail of male; c, spicular apparatus. Fig. 36. *Metacyatholaimus* (?) sp. a, anterior end of juvenile; b, lateral cuticular differentiation in mid-cervical region; c, the same in mid-body, and lateral view of dumbbell-shaped structure; d, tail of juvenile. Fig. 37. *Cyatholaimus dentatus*. a, anterior end of male

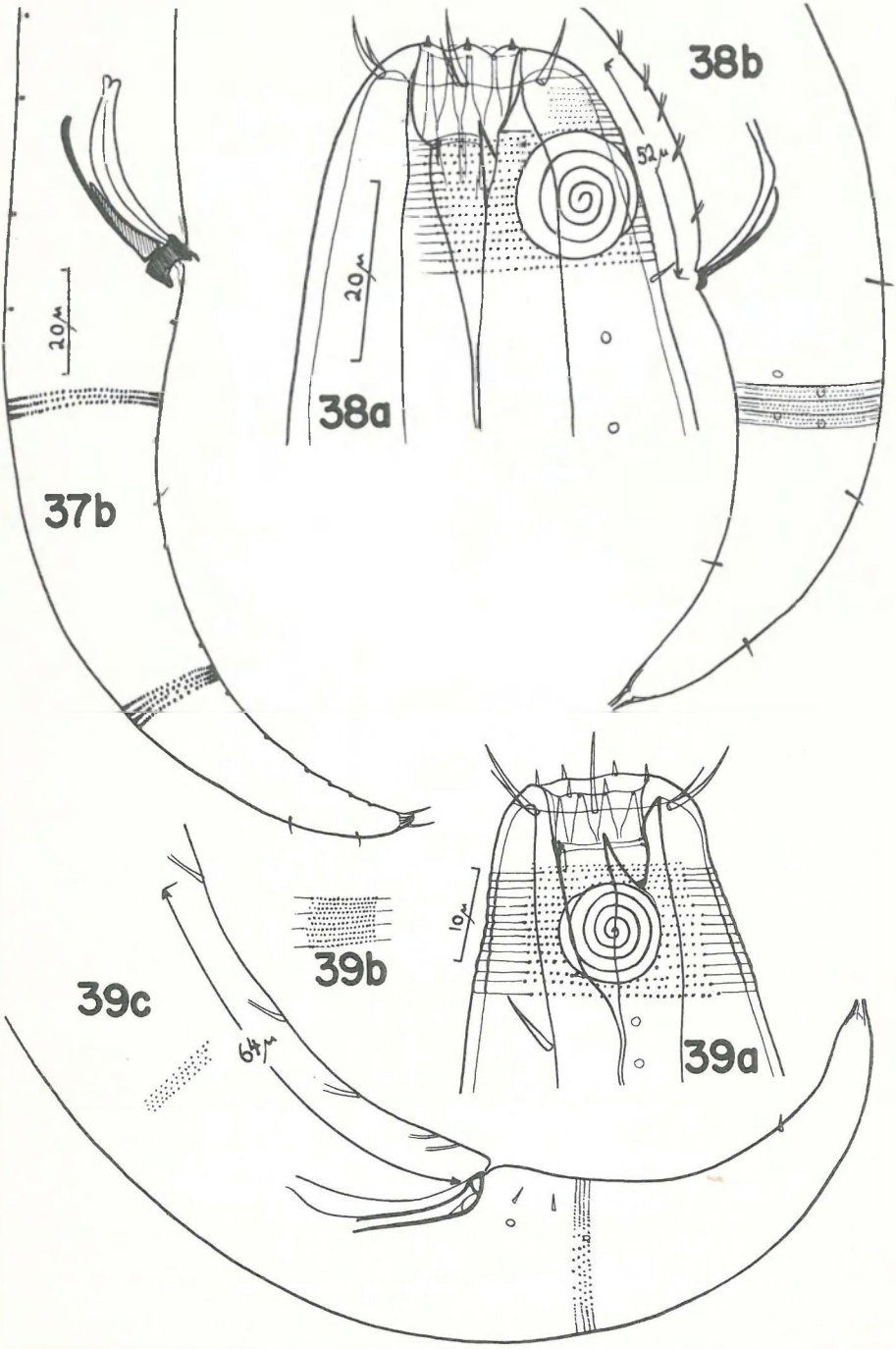

PLATE XVI. Fig. 37. *Cyatholaimus dentatus*. b, tail of male; t=tooth. Fig. 38. *Paracanthonchus quinquepapillatus*. a, anterior end of male; b, tail of male. Fig. 39. *Paracanthonchus mutatus*. a, anterior end of male; b, lateral cuticular striation in mid-body; c, tail of male

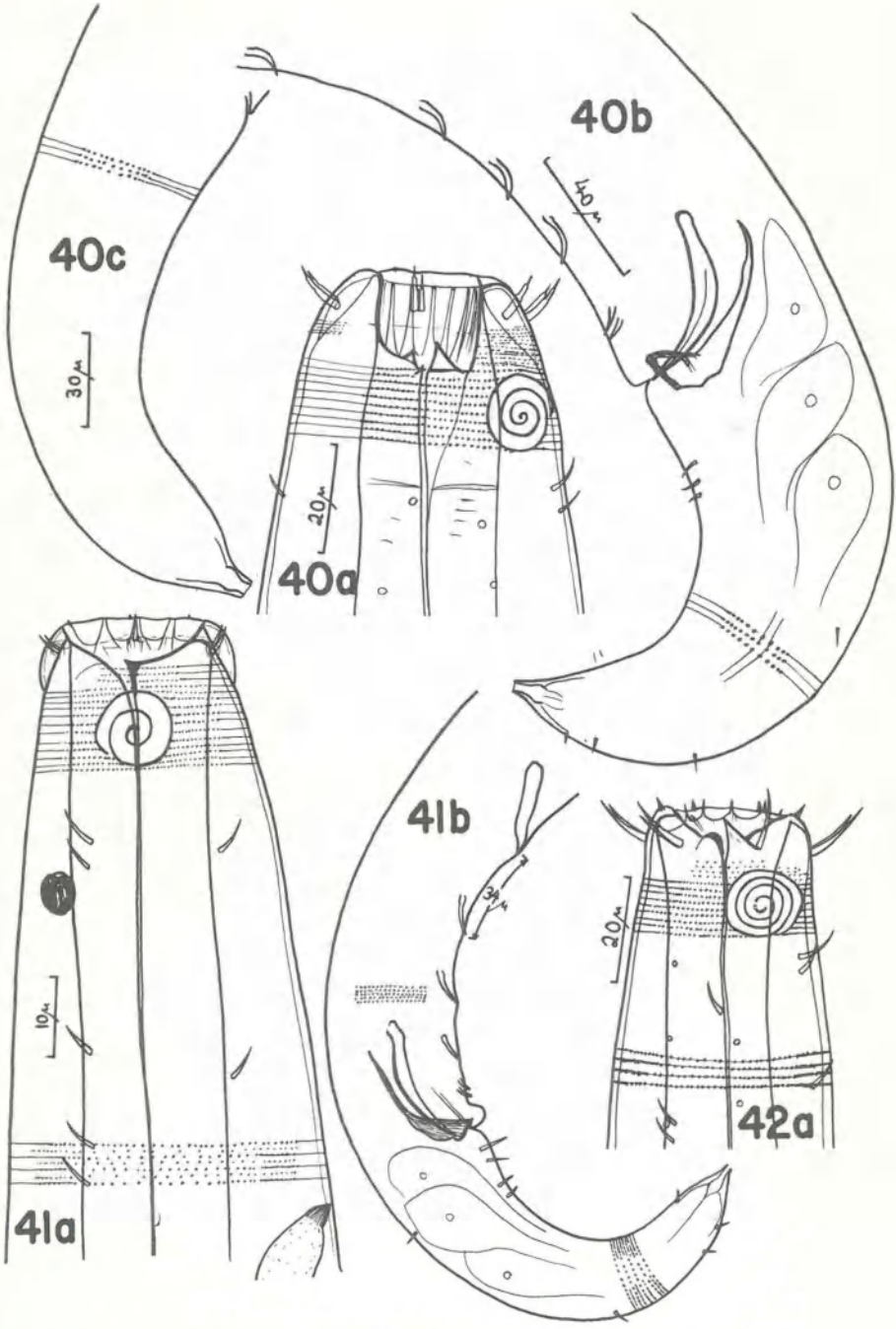

PLATE XVII. Fig. 40. *Paracanthonchus serratus*. a, anterior end of male; b, tail of male; c, tail of female. Fig. 41. *Acanthonchus rostratus*. a, anterior end of male; b, tail of male. Fig. 42. *Acanthonchus duplicatus*. a, anterior end of male

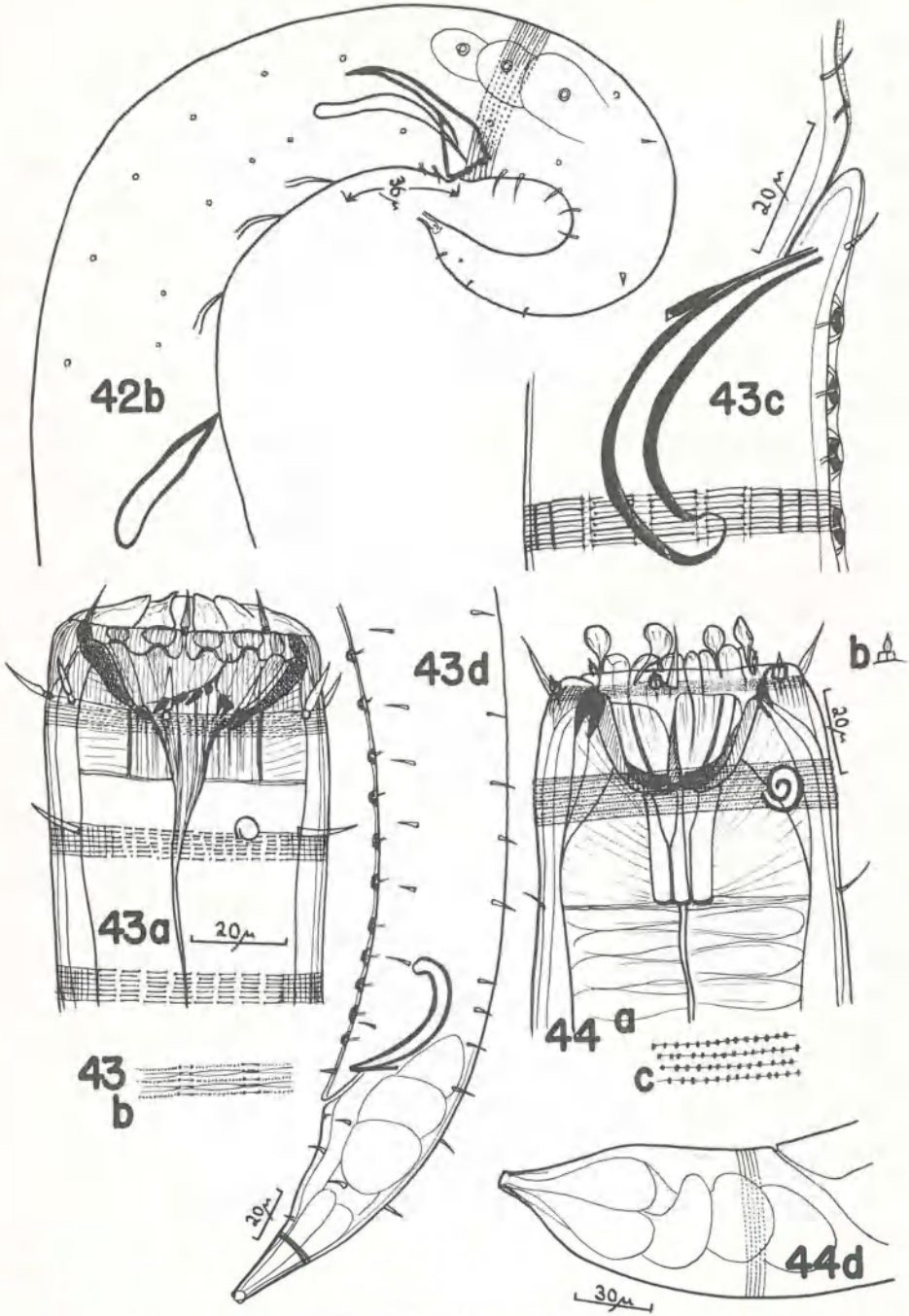

PLATE XVIII. Fig. 42. *Acanthonchus duplicatus*. b, tail of male. Fig. 43. *Latronema sertata*. a, anterior end of female; b, lateral cuticular differentiation in mid-body; c, anal region of male; d, posterior end of male. Fig. 44. *Gammanema ferox*. a, anterior end of female; b, labial seta; c, lateral cuticular striation in posterior cervical region; d, tail of female

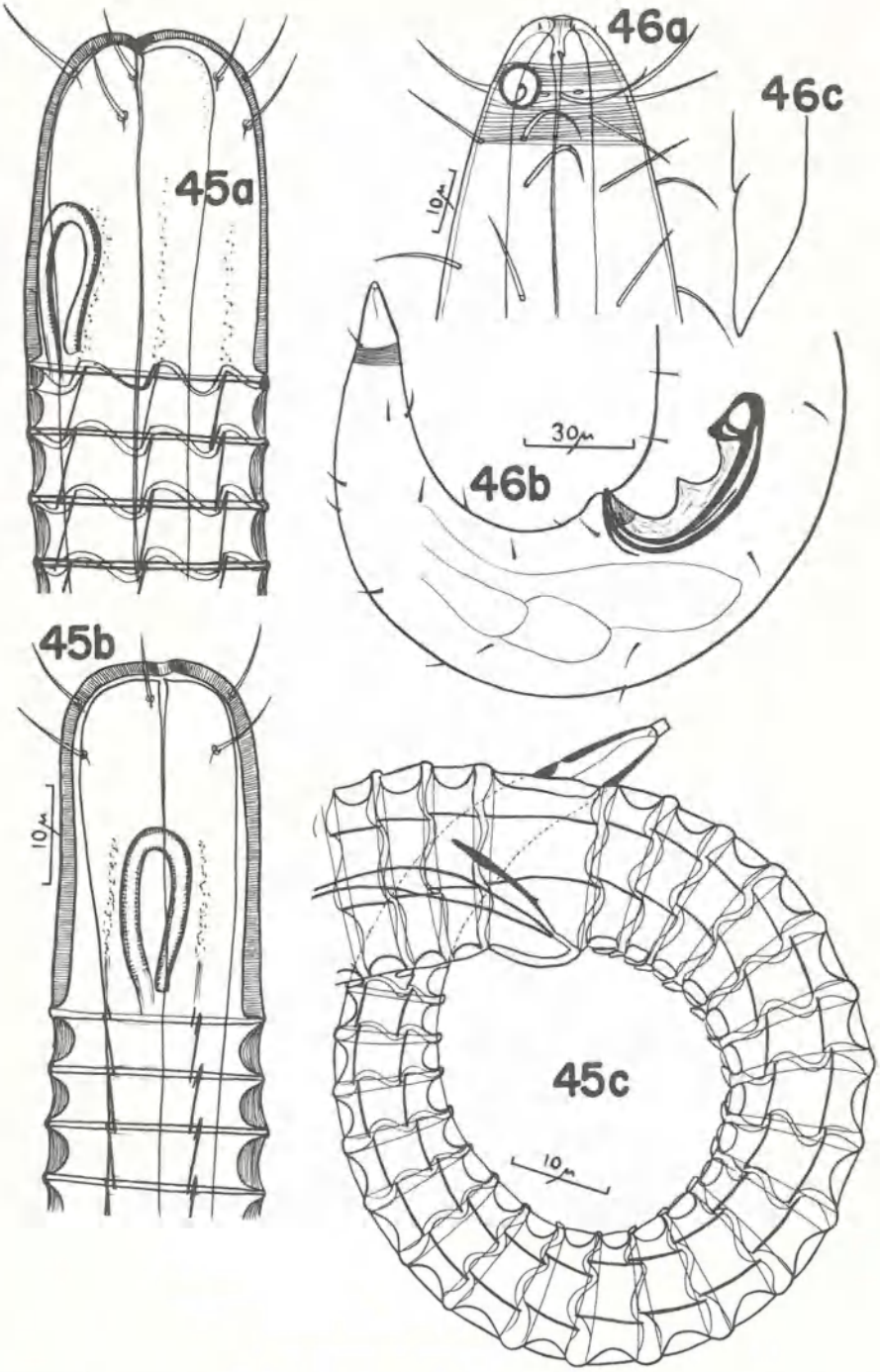

PLATE XIX. Fig. 45. *Ceramonema carinatum*. a, b, anterior ends of two males; c, tail of male. Fig. 46. *Spirina laevis*. a, anterior end of male; b, tail of male; c, tail of female

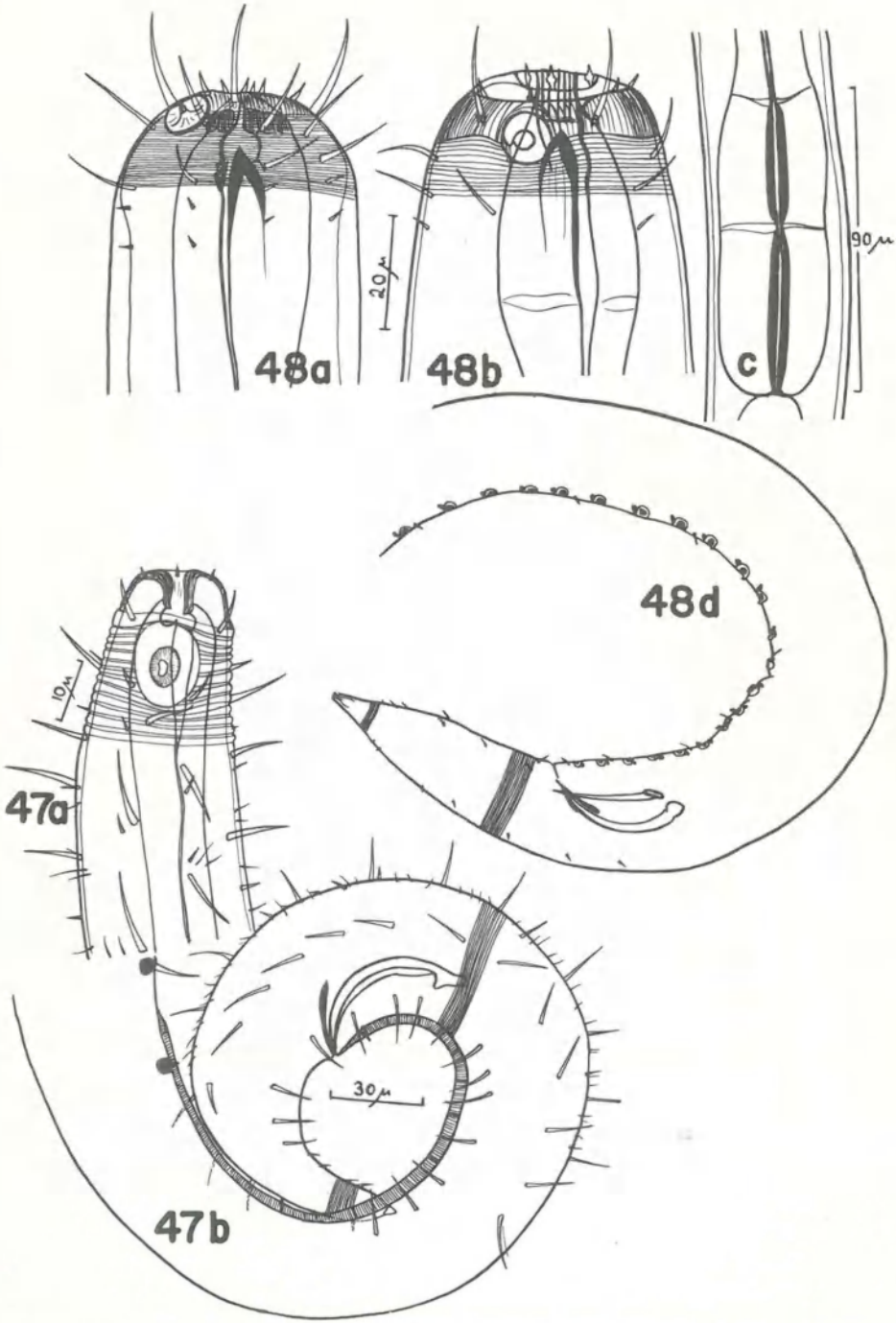

PLATE XX. Fig. 47. *Chromaspirina spinulosa.* a, anterior end of male; b, tail of male. Fig. 48. *Onyx rugata.* a, anterior end of male; b, anterior end of female; c, esophageal bulb; d, tail of male

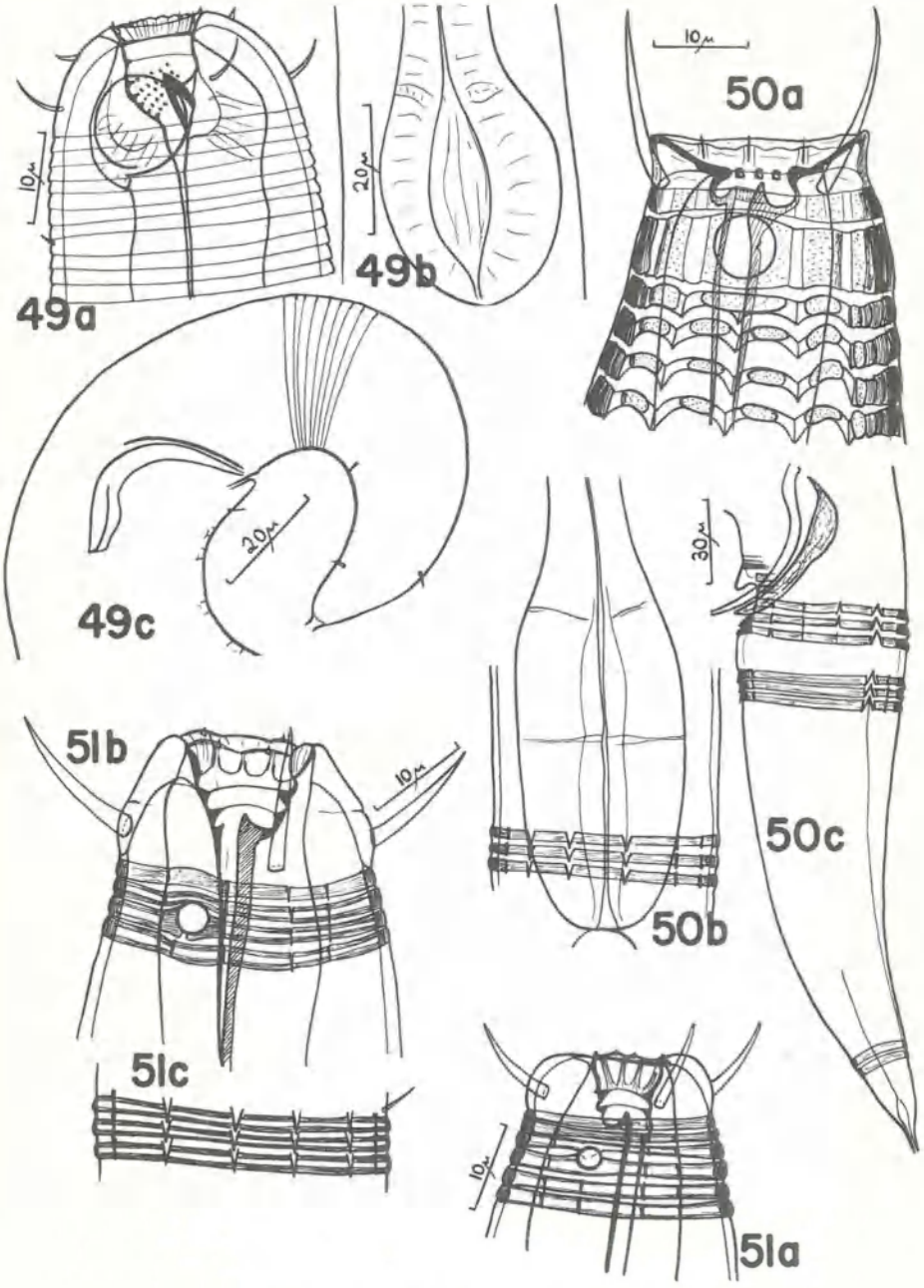

PLATE XXI. Fig. 49. *Microlaimus dentatus*. a, anterior end of male; b, esophageal bulb; c, tail of male. Fig. 50. *Nudora armillata*. a, anterior end of male; b, esophageal bulb; c, tail of male. Fig. 51. *Monoposthia costata*. a, anterior end of male (head contracted); b, anterior end of another male (head extended); c, cuticular annulation in bulb region

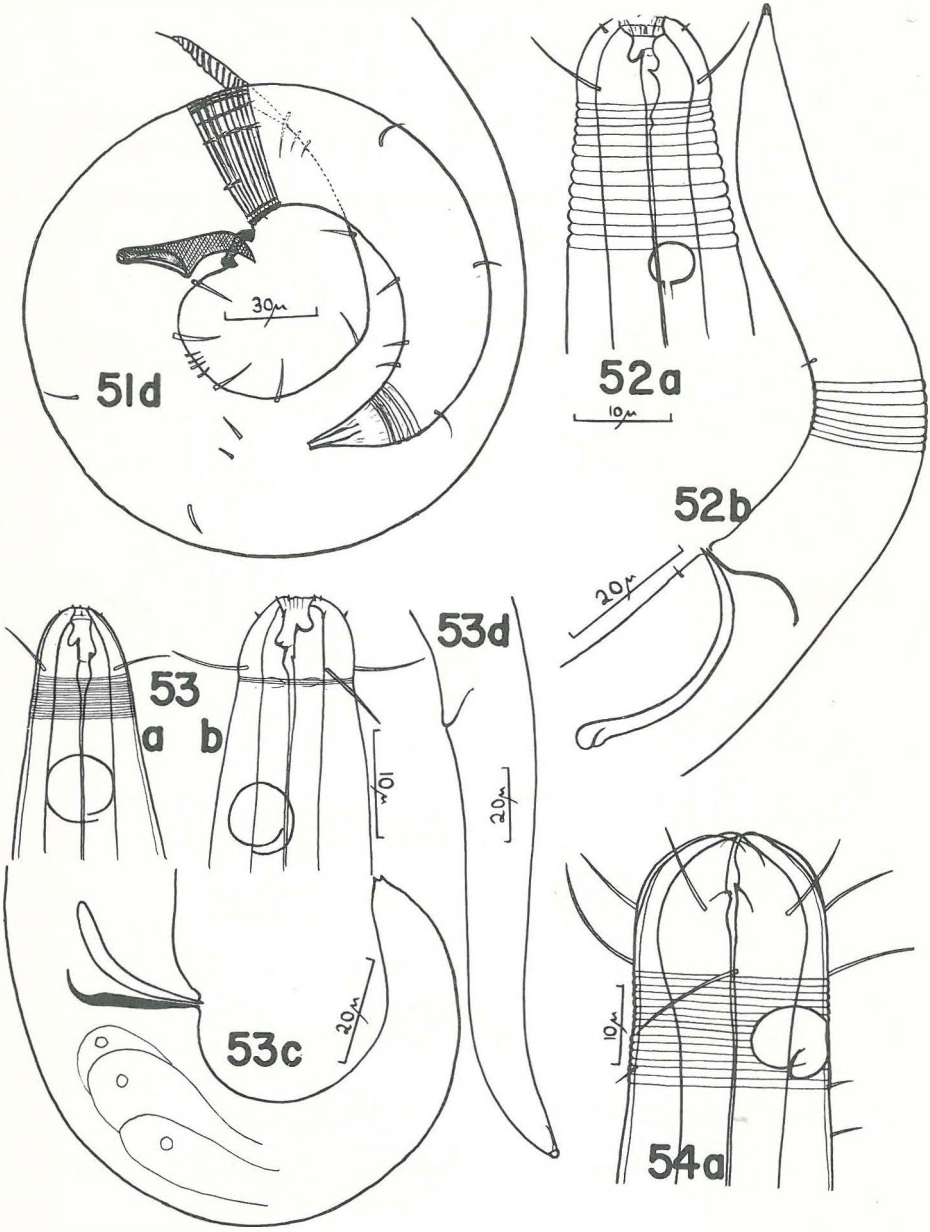

PLATE XXII. Fig. 51. *Monoposthia costata*. d, tail of male. Fig. 52. *Microlaimus cochleatus*. a, anterior end of male; b, tail of male. Fig. 53. *Microlaimus dixiei*. a, anterior end of male; b, anterior end of female; c, tail of male; d, tail of female. Fig. 54. *Paramicrolaimus spirulifer*. a, anterior end of female

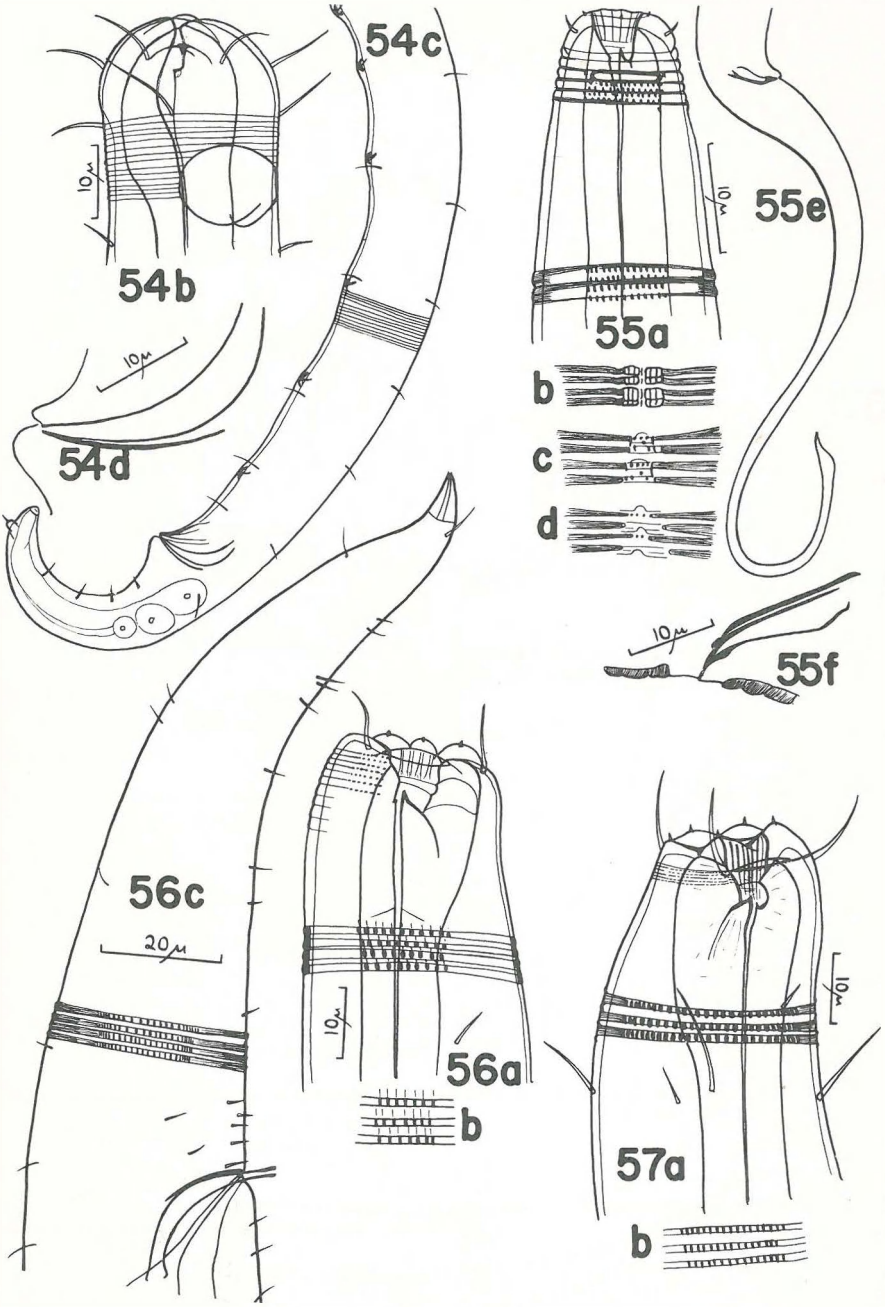

PLATE XXIII. Fig. 54. *Paramicrolaimus spirulifer.* b, anterior end of male; c, posterior end of male; d, spicular apparatus. Fig. 55. *Actinonema longicaudata.* a, anterior end of female; b, c, d, lateral cuticular differentiation in bulbar region, mid-body, and anal region, respectively; e, tail of male; f, spicular armature. Fig. 56. *Graphonema flaccida.* a, anterior end of male; b, lateral cuticular ornamentation in mid-body; c, tail of male. Fig. 57. *Graphonema clivosa.* a, anterior end of male; b, lateral cuticular ornamentation in mid-body

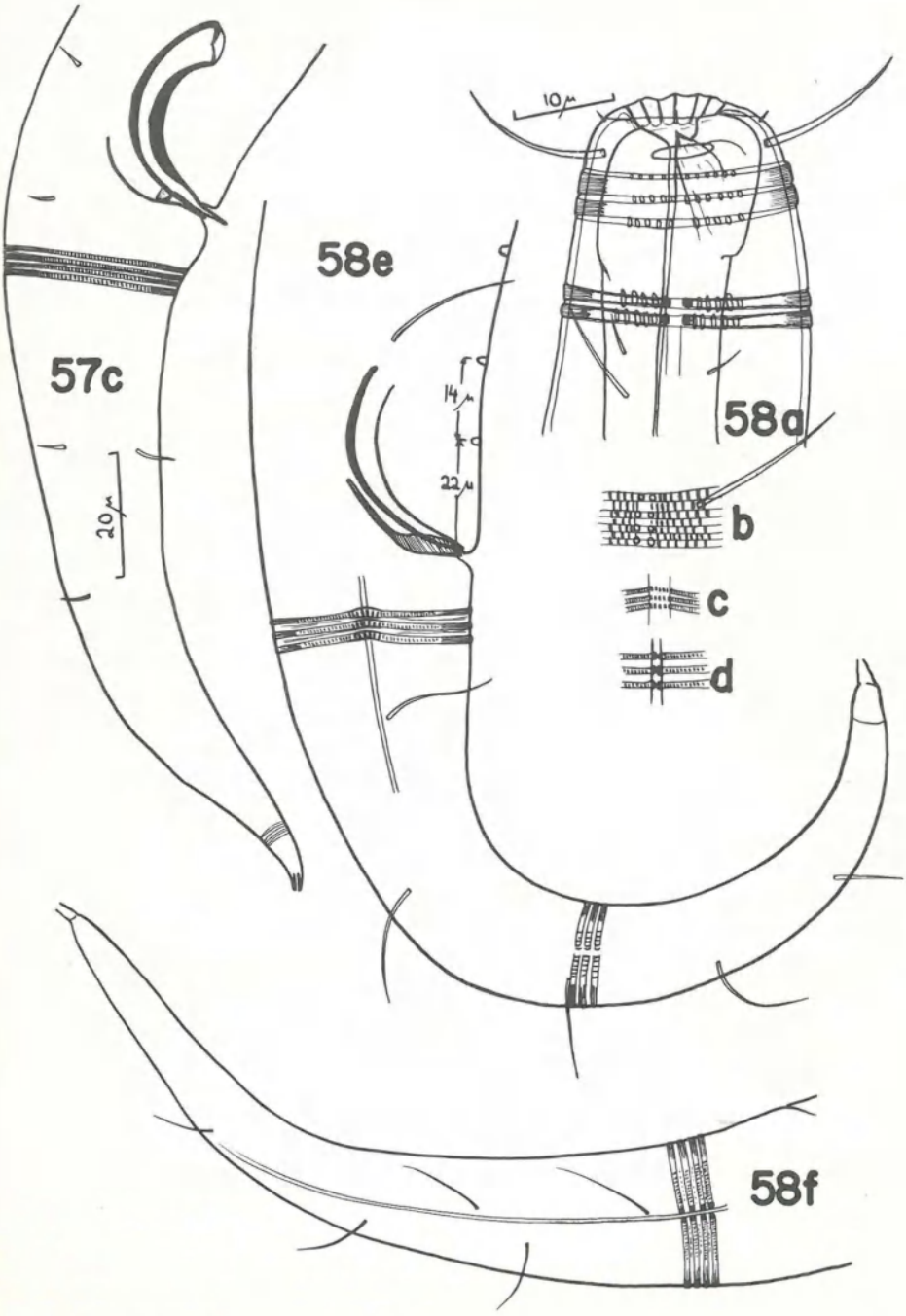

PLATE XXIV. Fig. 57. *Graphonema clivosa.* c, tail of male. Fig. 58. *Neochromadora poecilosoma.* a, anterior end of female; b, c, d, lateral cuticular differentiation in bulbar region, mid-body and anal region respectively; e, posterior end of male; f, tail of female

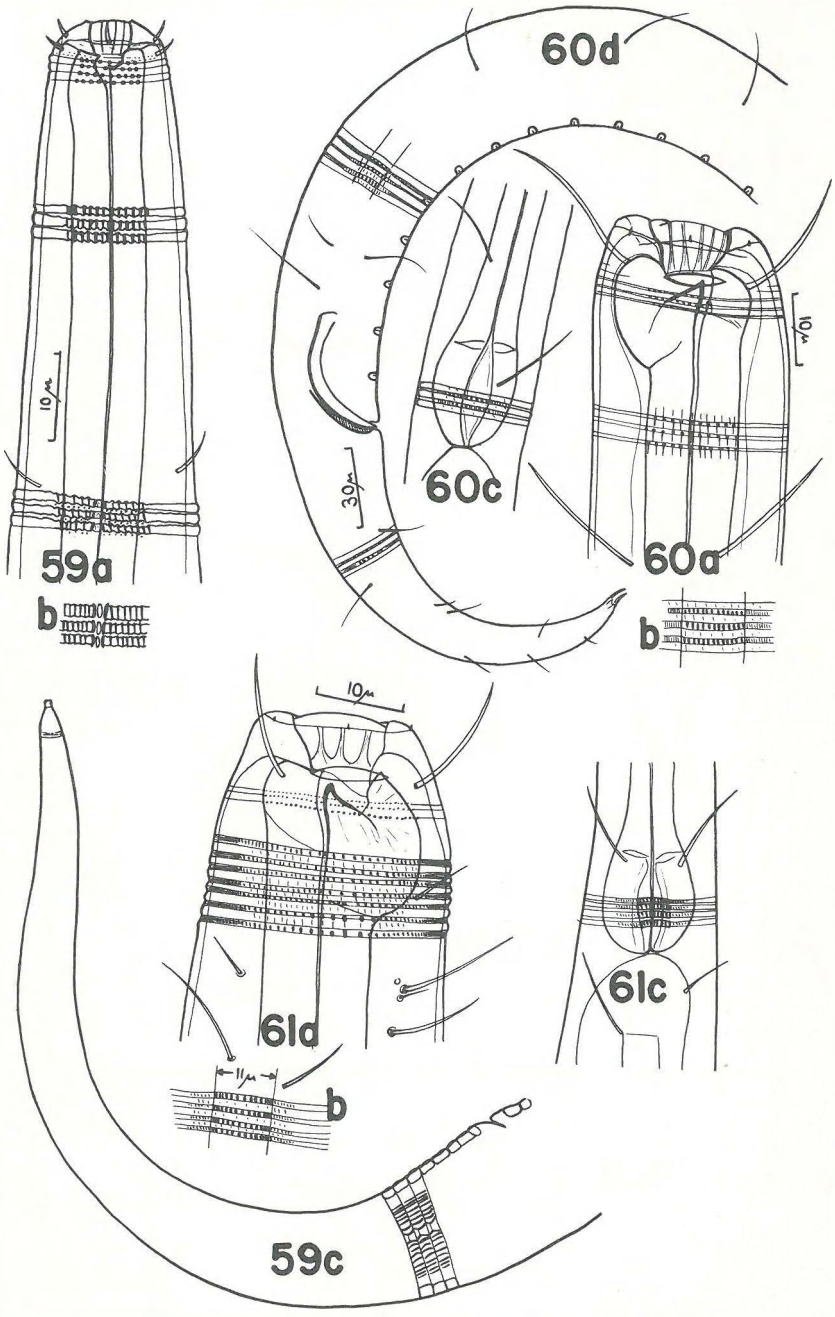

PLATE XXV. Fig. 59. *Neochromadora bicoronata.* a, anterior end of female; b, lateral cuticular differentiation in mid-body; c, tail of female. Fig. 60. *Neochromadora pugilator.* a, anterior end of male; b, lateral cuticular differentiation in mid-body; c, bulbar region; d, posterior region of male. Fig. 61. *Neochromadora appiana.* a, anterior end of male; b, lateral cuticular differentiation in mid-body; c, bulbar region

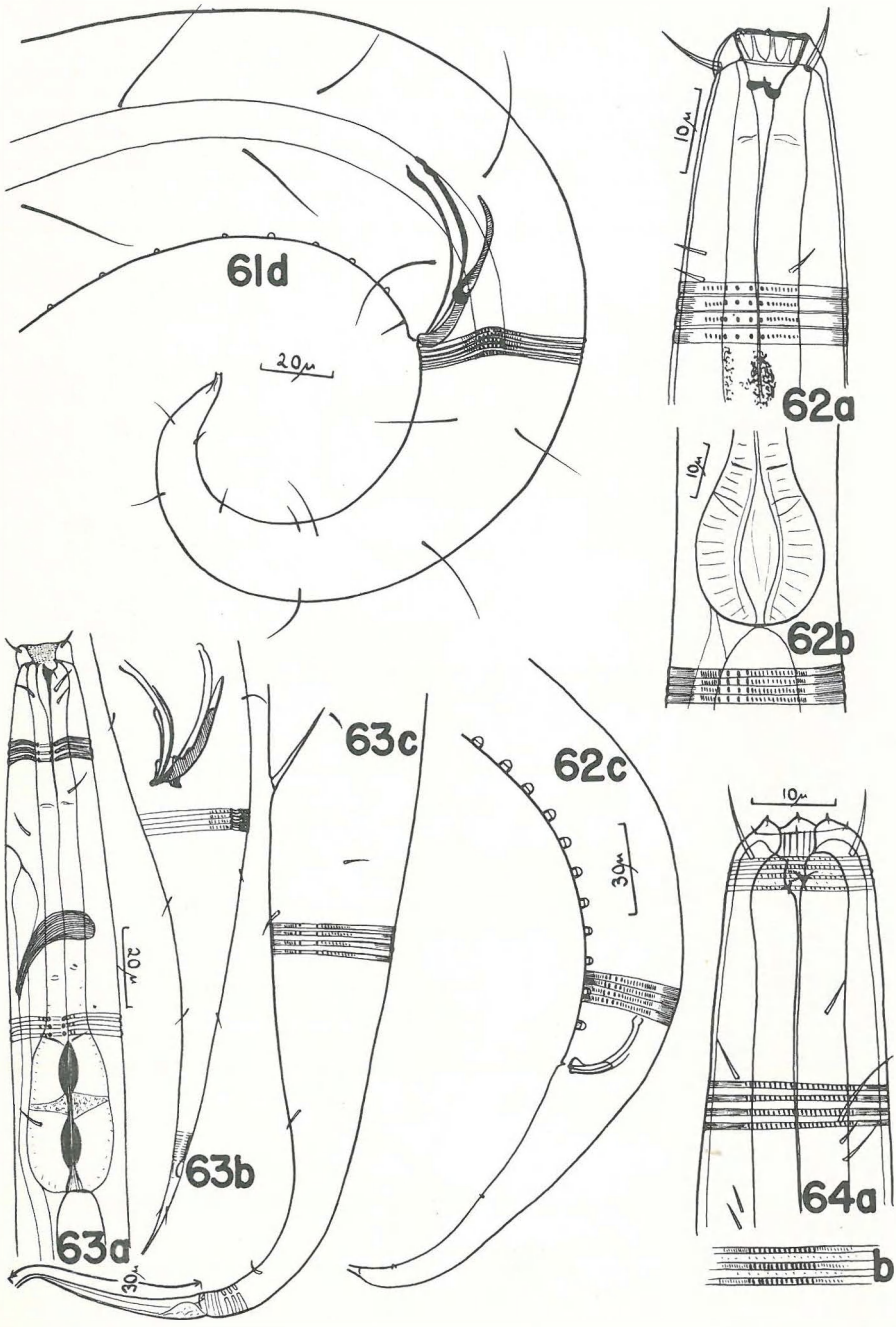

PLATE XXVI. Fig. 61. *Neochromadora appiana.* d, posterior end of male. Fig. 62. *Chromadora undecimpapillata.* a, anterior end of male; b, bulbar region; c, posterior end of male. Fig. 63. *Spilophorella paradoxa.* a, anterior end of female; b, tail of male; c, tail of female. Fig. 64. *Prochromadorella triangularis.* a, anterior end of male; b, lateral cuticular ornamentation in mid-body

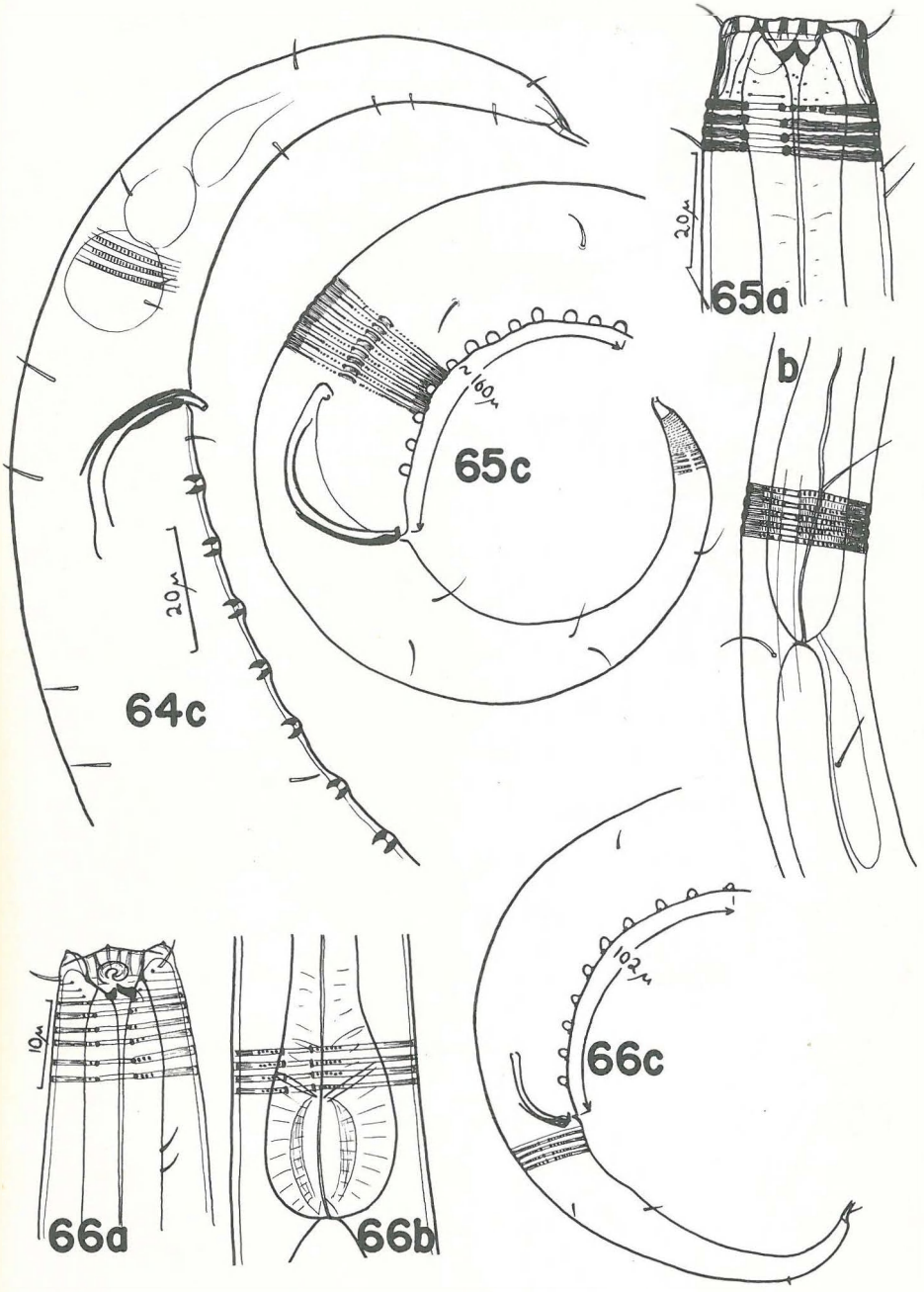

PLATE XXVII. Fig. 64. *Prochromadorella triangularis*. c, posterior end of male. Fig. 65. *Chromadorella galeata*. a, anterior end of male; b, bulbar region; c, posterior end of male. Fig. 66. *Atrochromadora obscura*. a, anterior end of male; b, bulbar region; c, posterior end of male

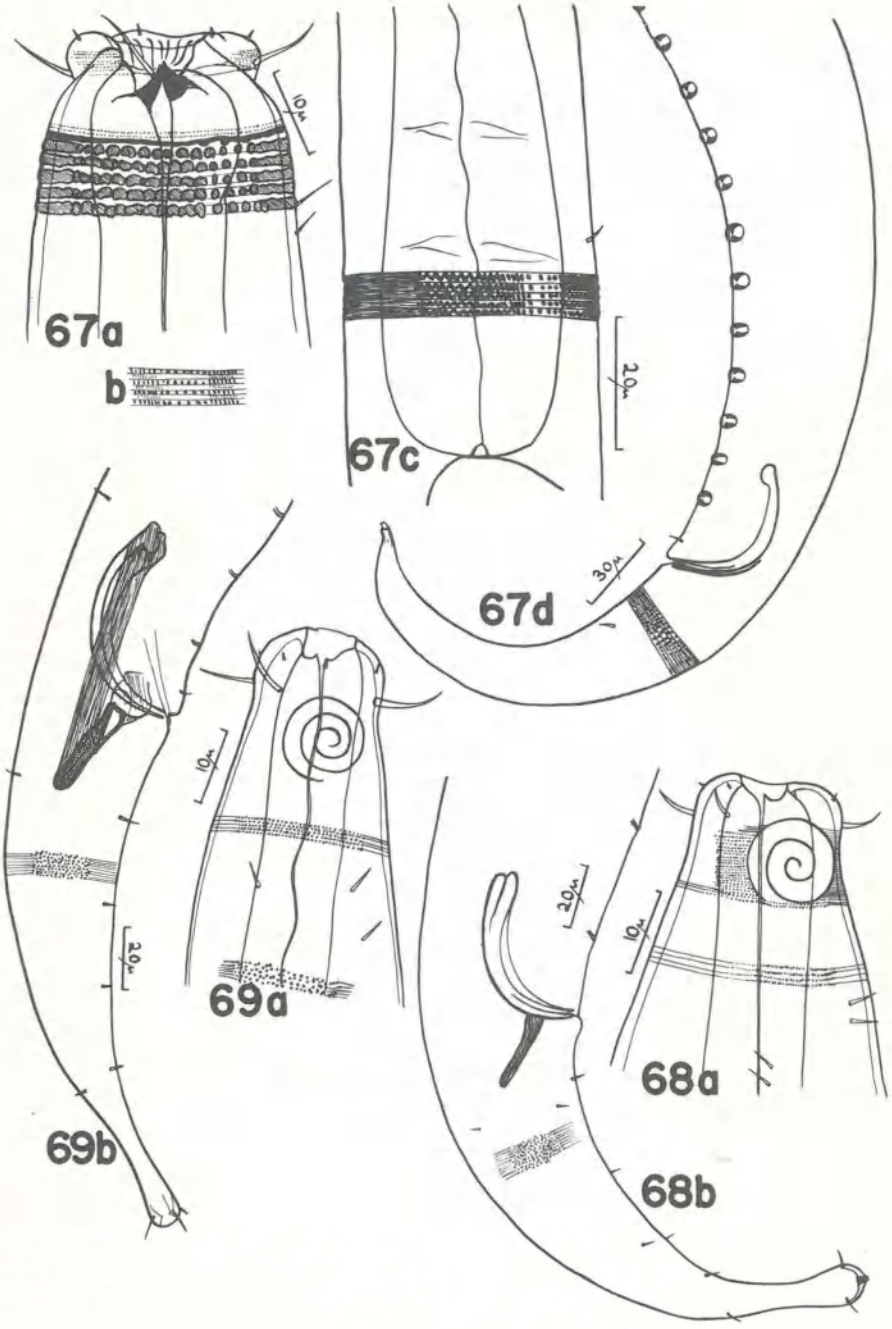

PLATE XXVIII. Fig. 67. *Chromadorella edmondsoni*. a, anterior end of male; b, lateral cuticular ornamentation in mid-body; c, bulbar region; d, posterior end of male. Fig. 68. *Sabatiera clavicauda*. a, anterior end of male; b, posterior end of male. Fig. 69. *Sabatiera americana*. a, anterior end of male; b, posterior end of male.

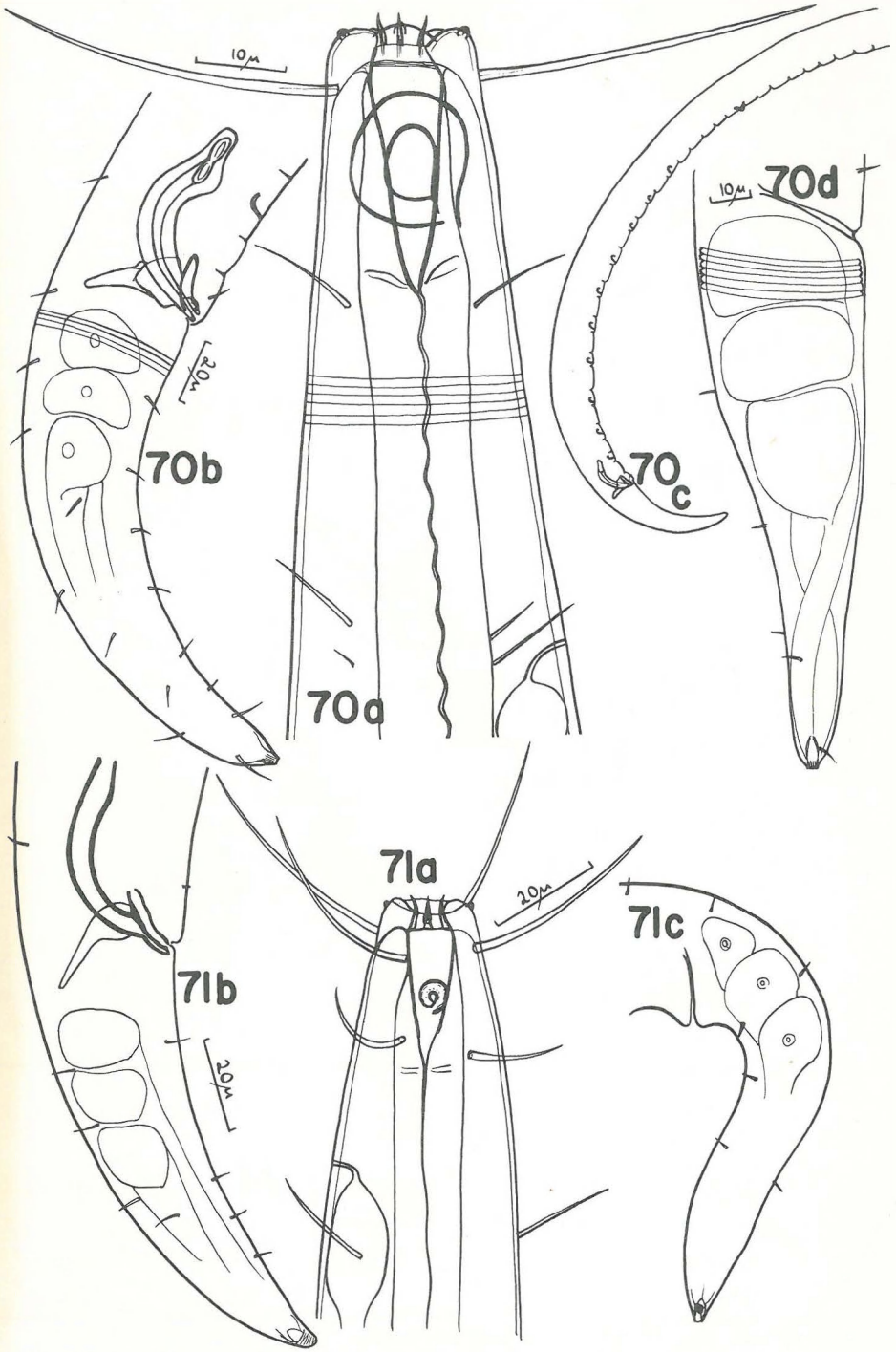

PLATE XXIX. Fig. 70. *Parascolaimus tau.* a, anterior end of male; b, tail of male; c, posterior end of male; d, tail of female. Fig. 71. *Parascolaimus unguLatus.* a, anterior end of female; b, tail of male; c, tail of female

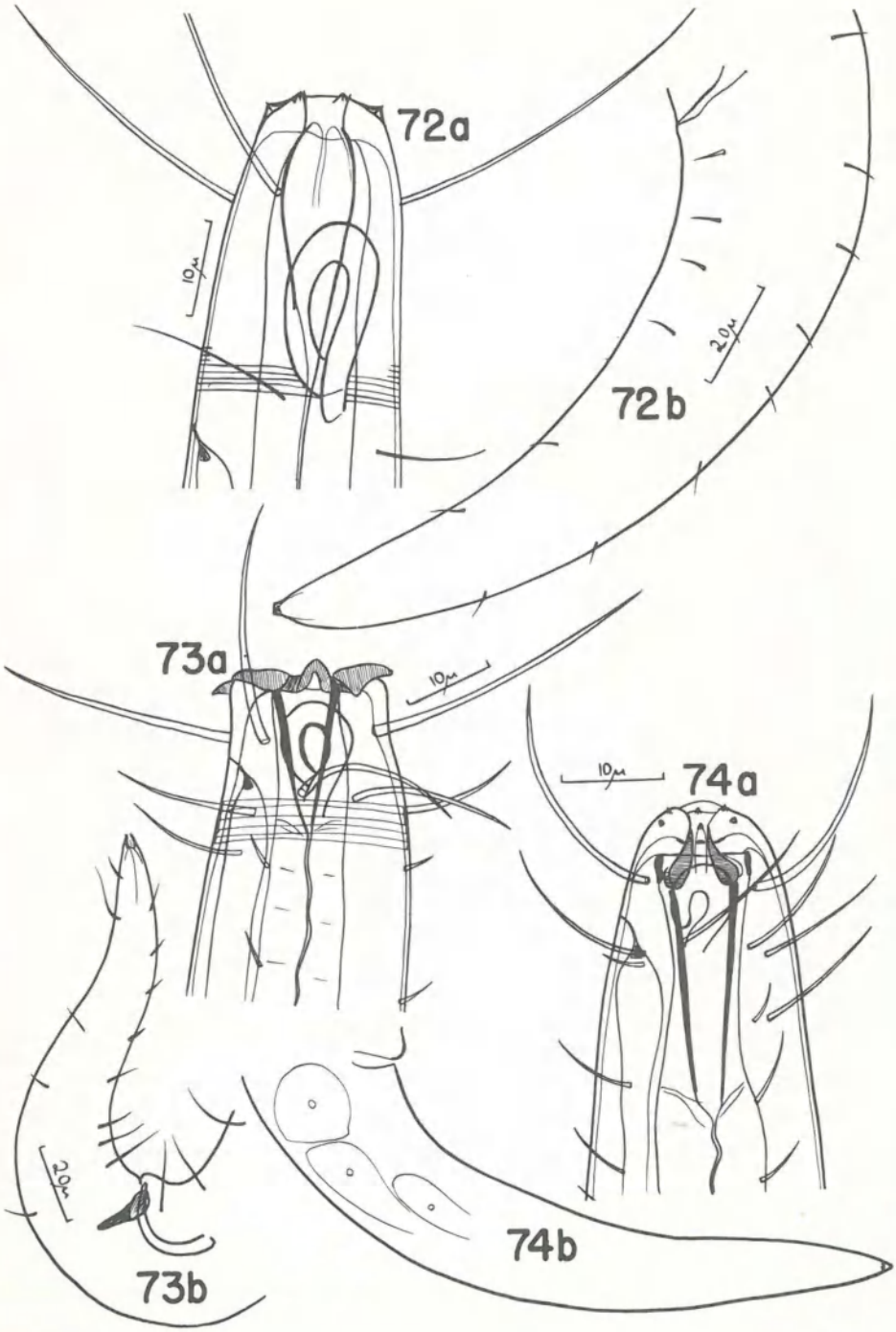

PLATE XXX. Fig. 72. *Axonolaimus interrogativus*. a, anterior end of female; b, tail of female. Fig. 73. *Odontophora lituifera*. a, anterior end of male; b, tail of male. Fig. 74. *Odontophora peritricha*. a, anterior end of male; b, tail of female; c, tail of male

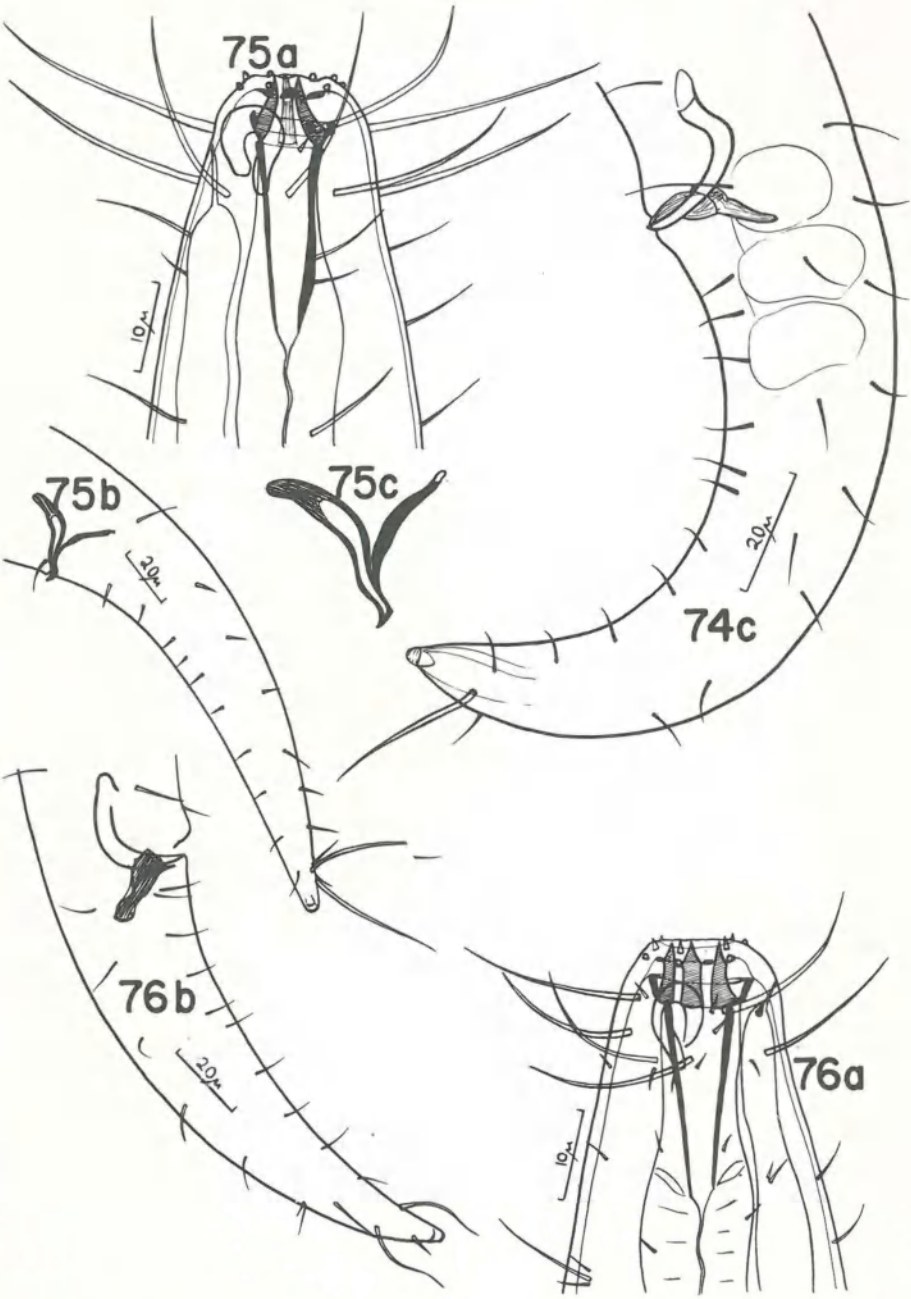

PLATE XXXI. Fig. 75. *Odontophora mercurialis*. a, anterior end of male; b, tail of male; c, spicular armature. Fig. 76. *Odontophora mucronata*. a, anterior end of male; b, tail of male

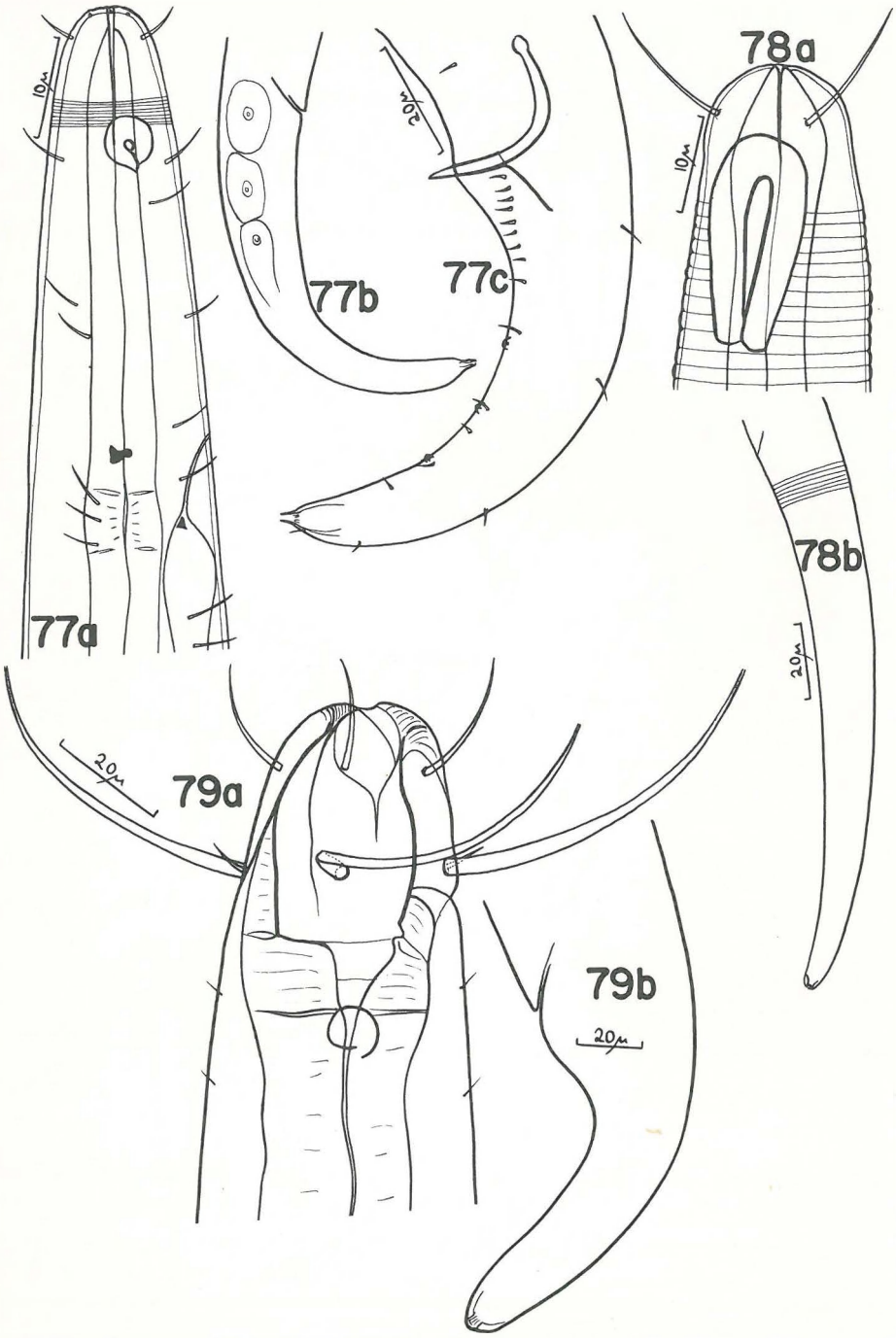

PLATE XXXII. Fig. 77. *Araeolaimus boomerangifer*. a, anterior end of female; b, tail of female; c, tail of male. Fig. 78. *Araeolaimoides botulus*. a, anterior end of female; b, tail of female. Fig. 79. *Bathylaimus bicoronatus*. a, anterior end of female; b, tail of female

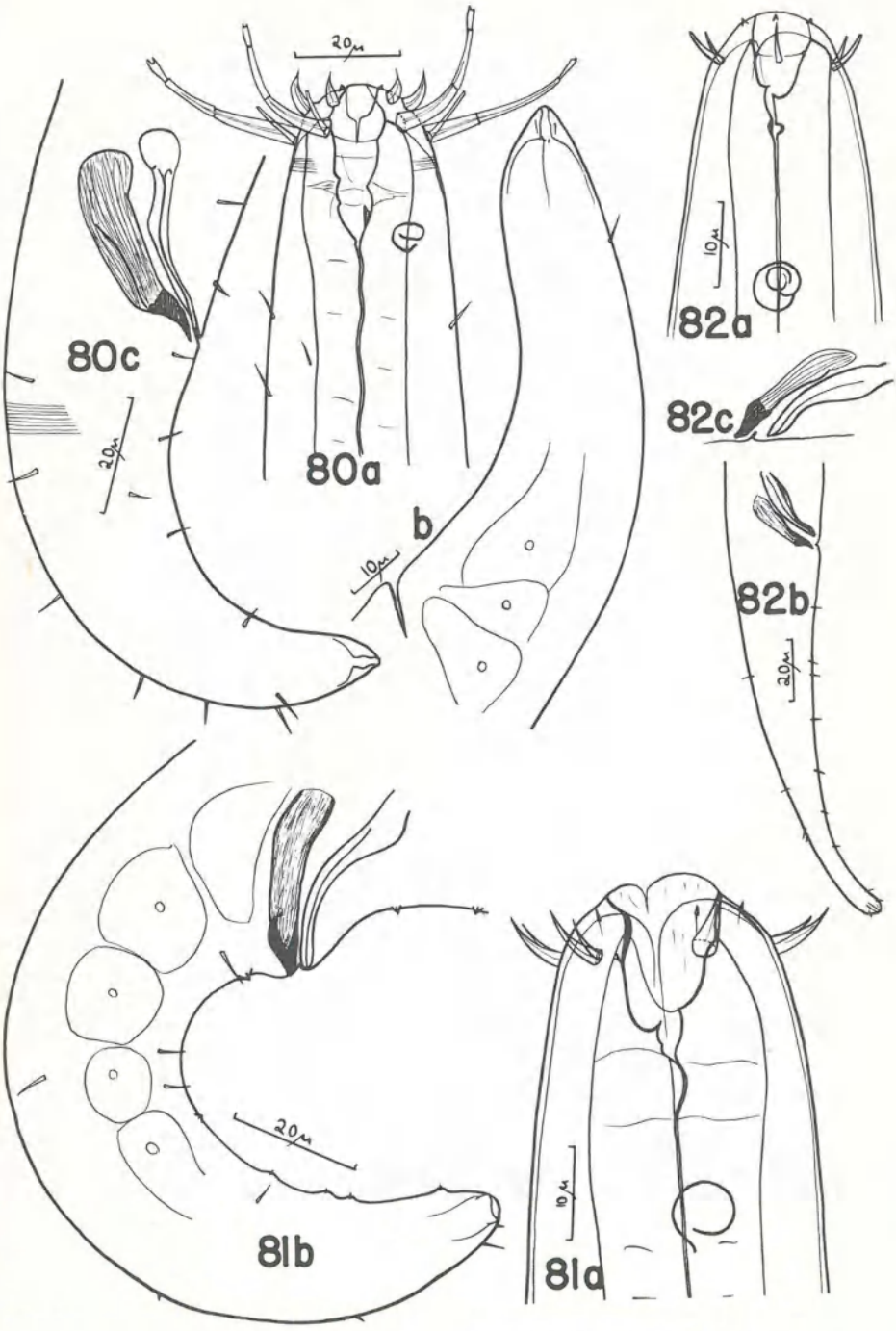

PLATE XXXIII. Fig. 80 *Bathylaimus tarsioides*. a, anterior end of female; b, tail of female; c, tail of male. Fig. 81. *Tripyloides imitans*. a, anterior end of male; b, tail of male. Fig. 82. *Tripyloides gracilis*. a, anterior end of male; b, tail of male; c, spicular armature

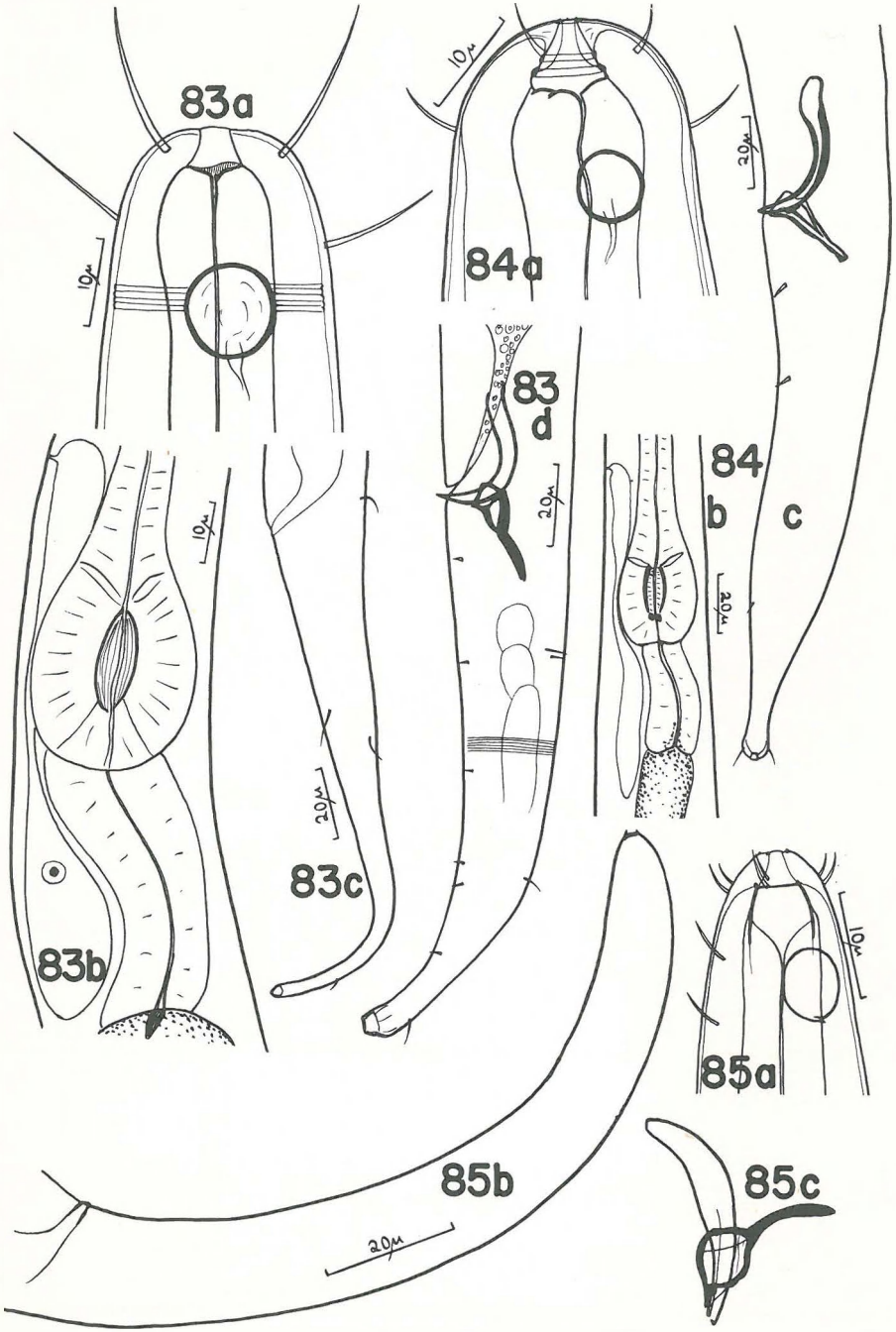

PLATE XXXIV. Fig. 83. *Metalinhomoeus setosus*. a, anterior end of female; b, bulbar region; c, tail of female; d, tail of male. Fig. 84. *Desmolaimus fennicus*. a, anterior end of male; b, bulbar region; c, tail of male. Fig. 85. *Eleutherolaimus stenosoma*. a, anterior end of female; b, tail of female; c, spicular armature

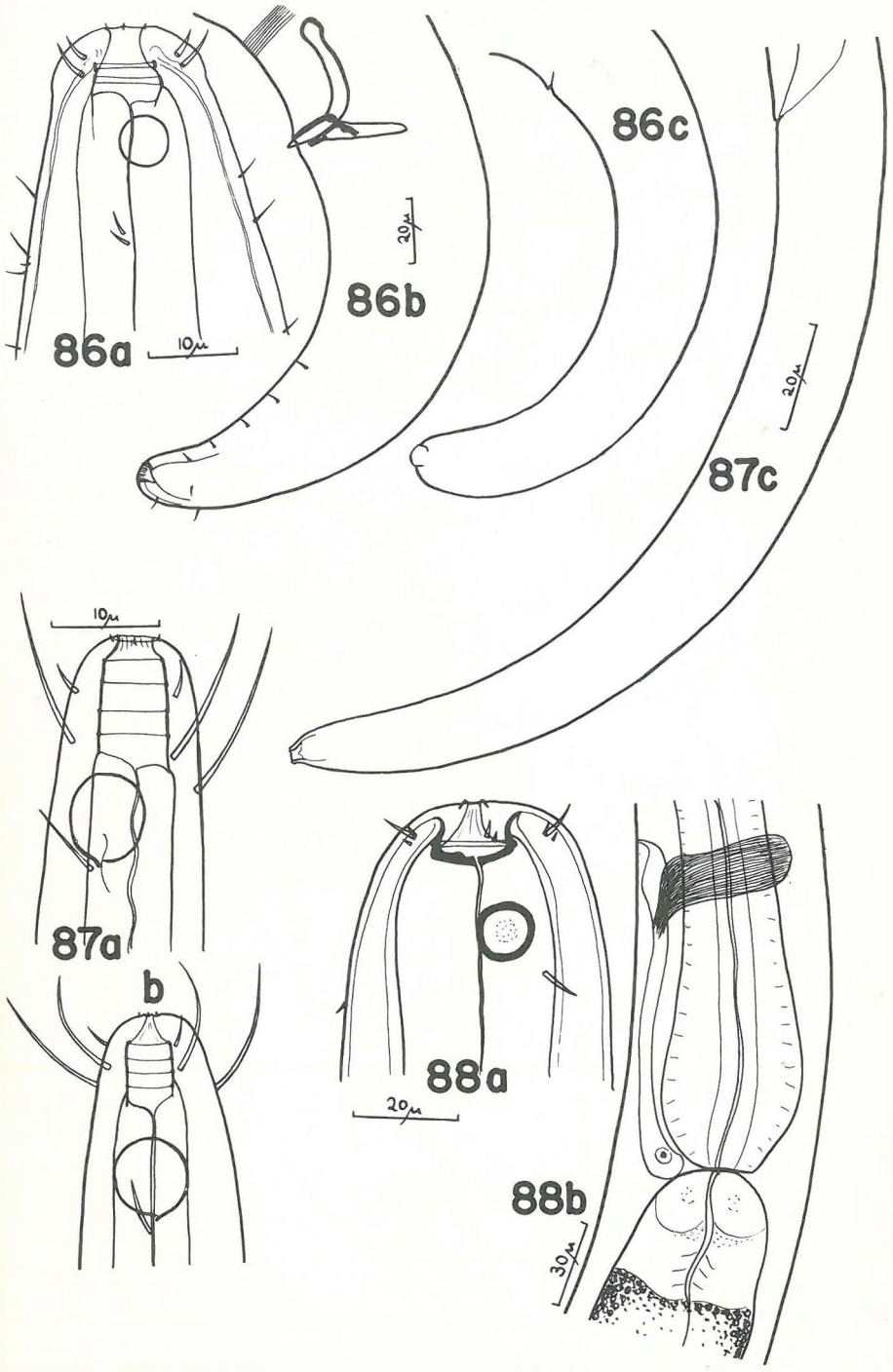

PLATE XXXV. Fig. 86. *Eleutherolaimus obtusicaudatus*. a, anterior end of male; b, tail of male; c, tail of female. Fig. 87. *Filipjevinema doliolum*. a, anterior end of female; b, anterior end of another female; c, tail of female. Fig. 88. *Linhomoeus undulatus*. a, anterior end of male; b, bulbar region

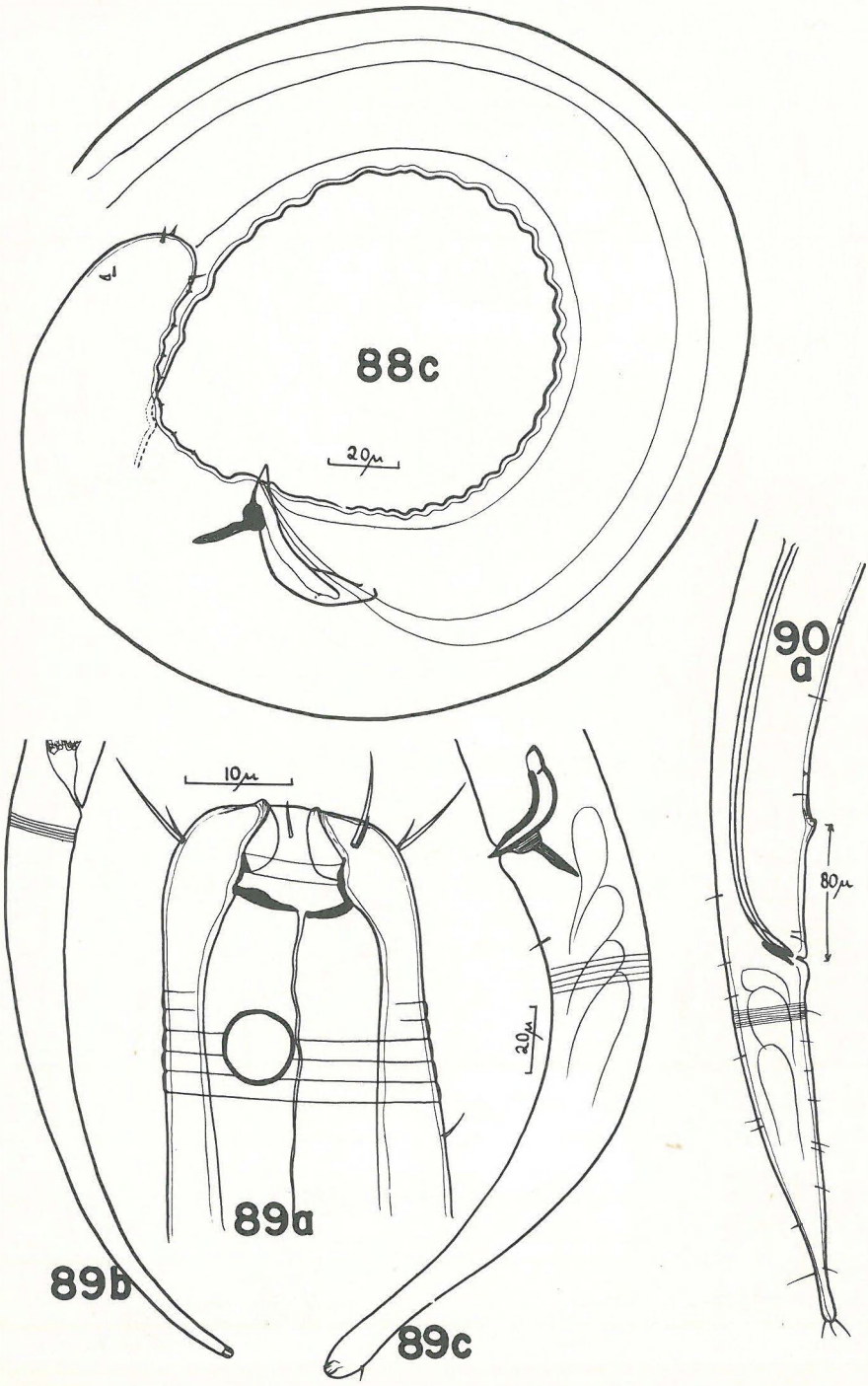

PLATE XXXVI. Fig. 88. *Linhomoeus undulatus*. c, posterior end of male. Fig. 89. *Linhomoeus buculentus*. a, anterior end of female; b, tail of female; c, tail of male. Fig. 90. *Sphaerolaimus penicillus* var. *pugetensis*. a, tail of male

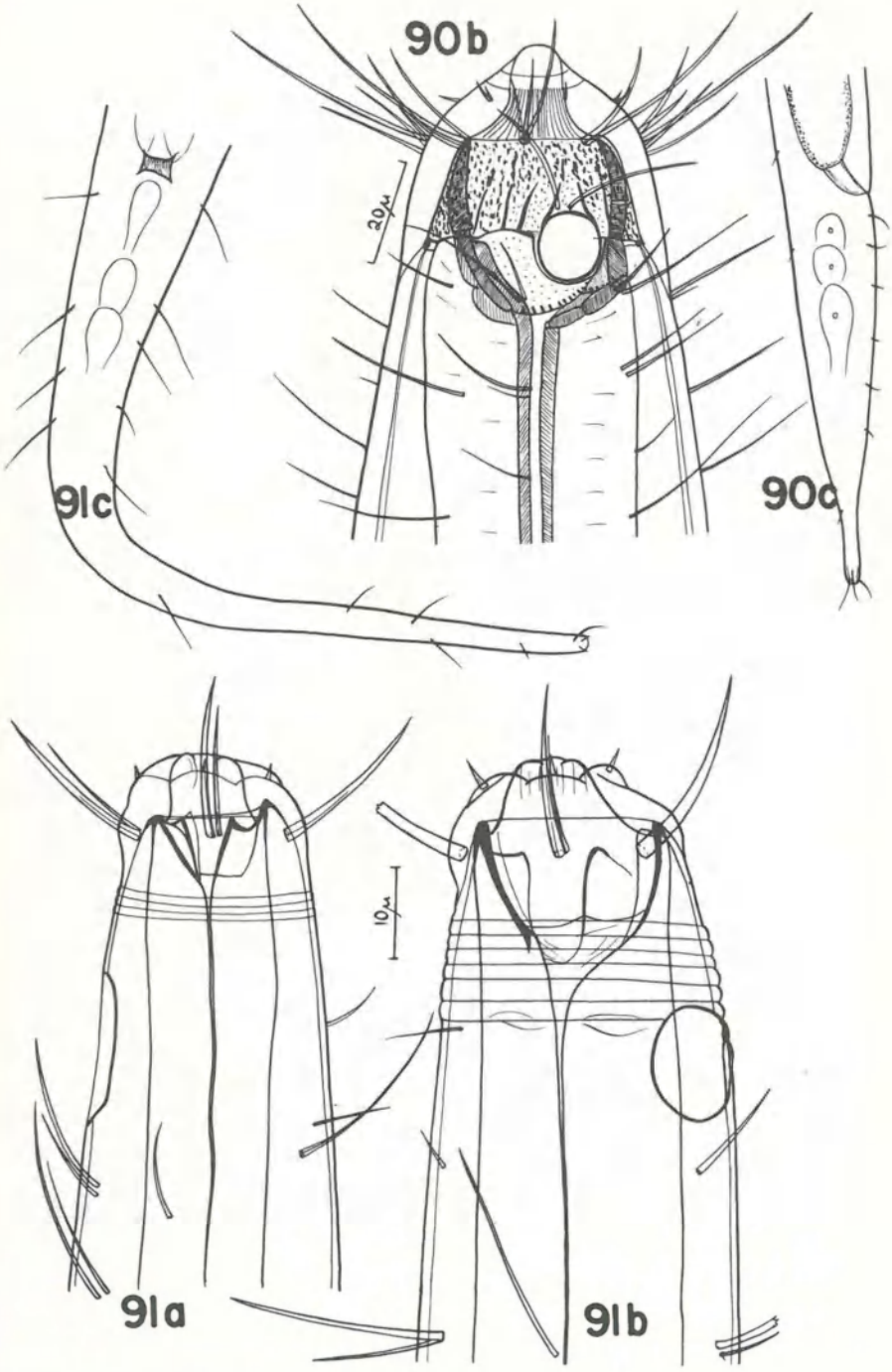

PLATE XXXVII. Fig. 90. *Sphaerolaimus penicillus* var. *pugetensis*. b, anterior end of male; c, tail of female. Fig. 91. *Cobbia truncata*. a, anterior end of male; b, anterior end of female; c, tail of female ventral view

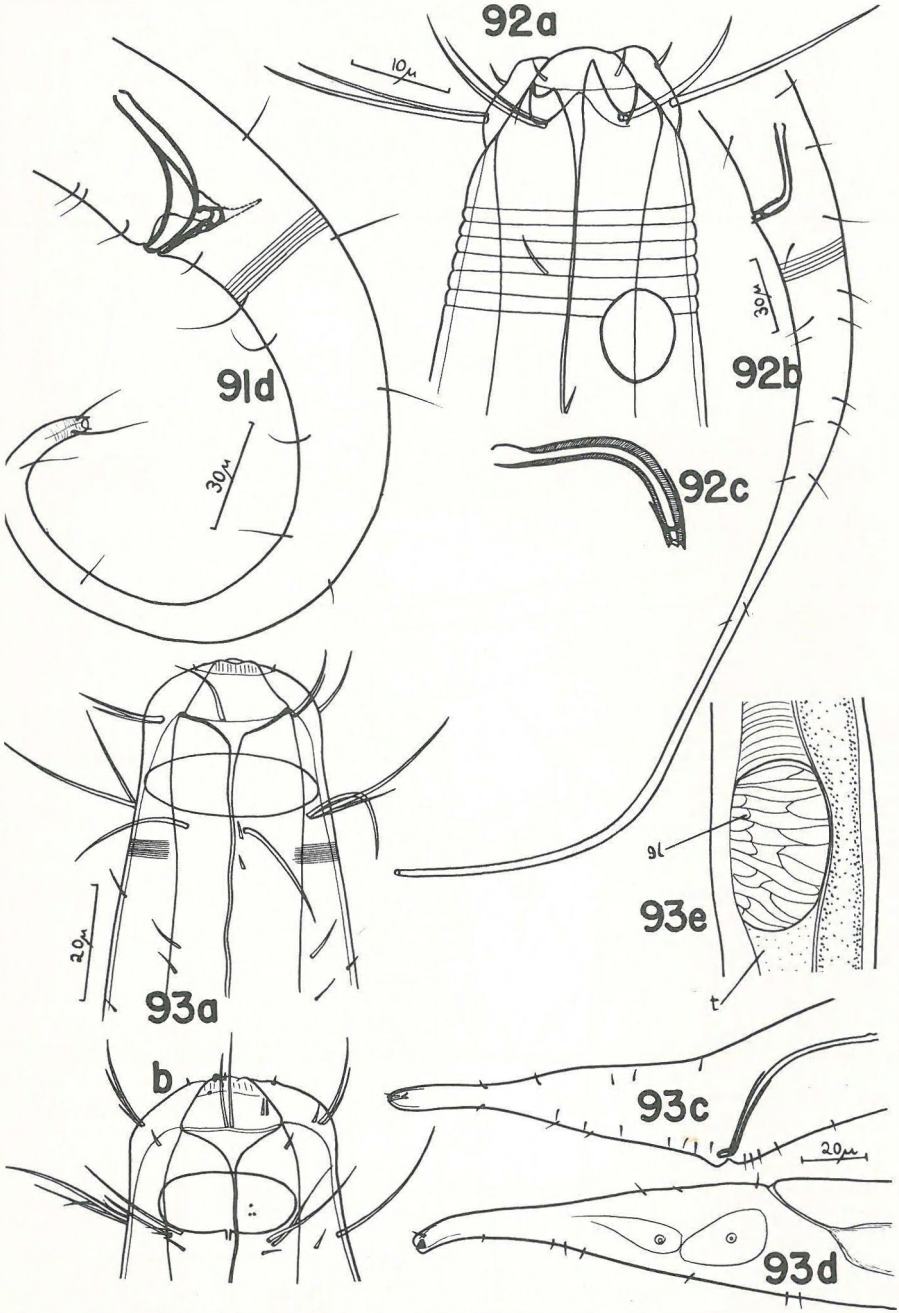

PLATE XXXVIII. Fig. 91. *Cobbia truncata.* d, tail of male. Fig. 92. *Cobbia urinator.* a, anterior end of male; b, tail of male; c, spicular armature. Fig. 93. *Paramonhystera elliptica.* a, anterior end of male; b, anterior end of female; c, tail of male; d, tail of female; e, region of glandular cells in male; gl = glandular cells; t = testis

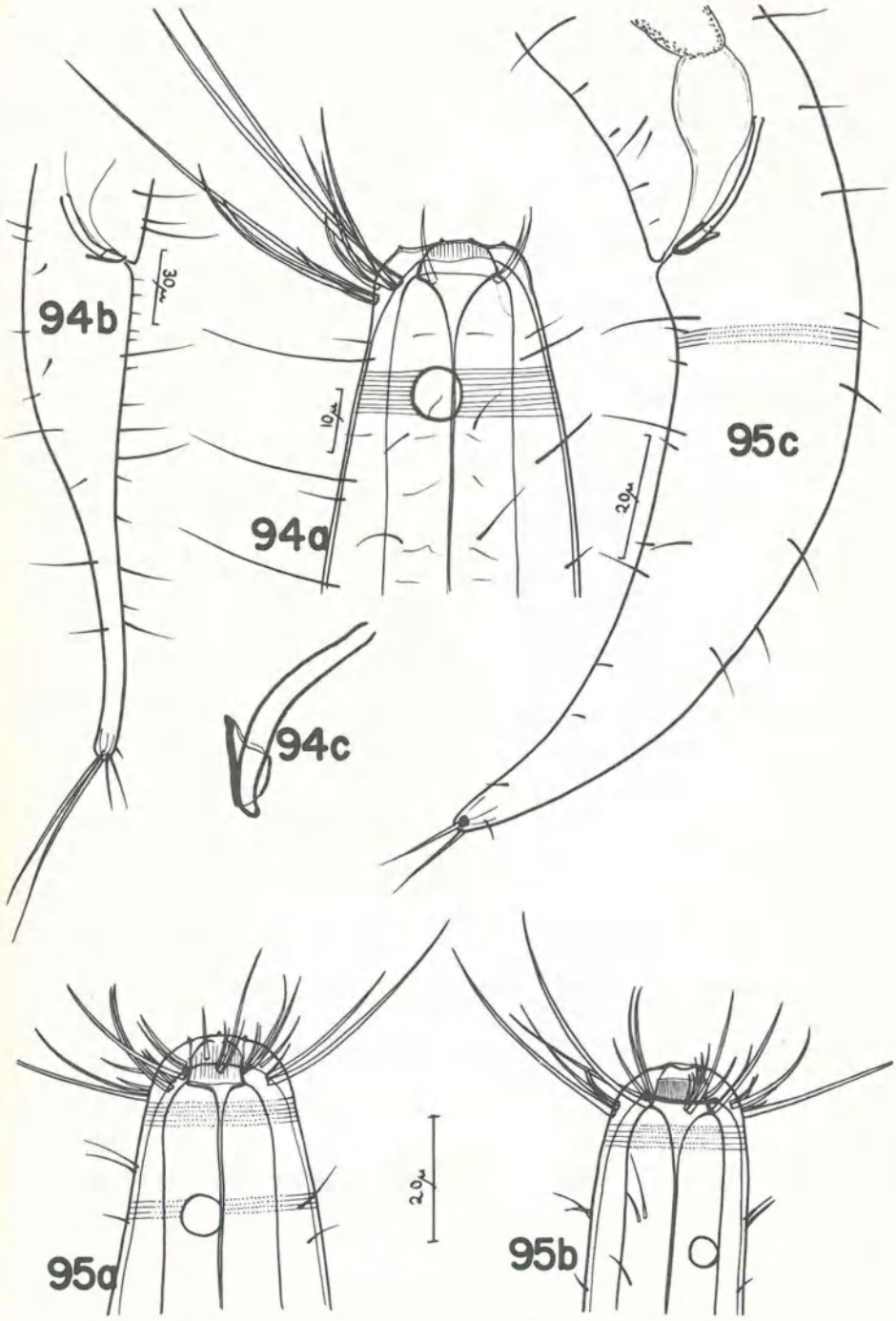

PLATE XXXIX. Fig. 94. *Steineria phimifera.* a, anterior end of male (only two groups of subcephalic setae drawn); b, tail of male; c, spicular armature. Fig. 95. *Steineria gerlachi.* a, anterior end of male; b, anterior end of female; c, tail of male

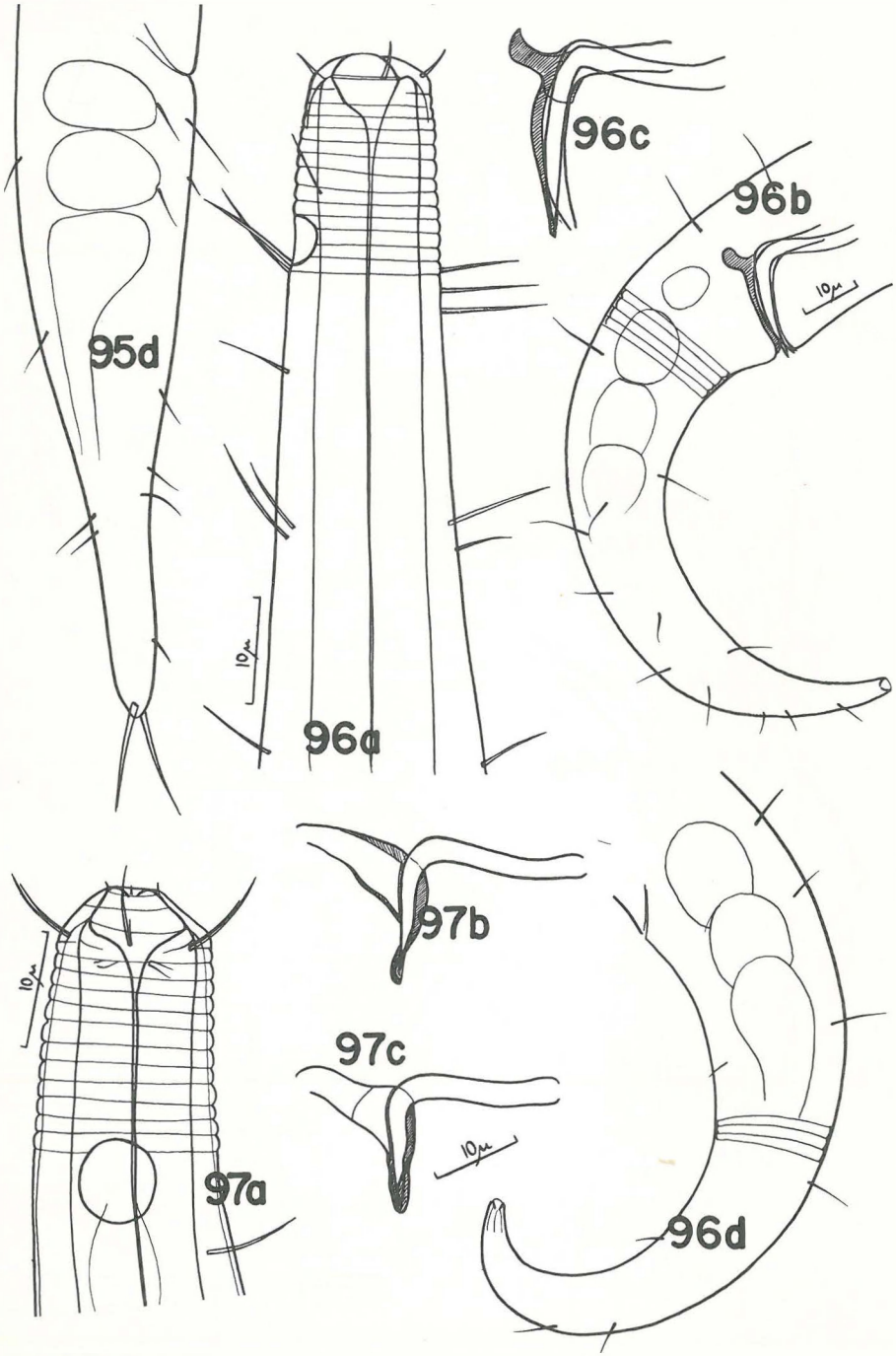

PLATE XL. Fig. 95. *Steineria gerlachi*. d, tail of female. Fig. 96. *Theristus wimmeri*. a, anterior end of female; b, tail of male; c, spicular armature; d, tail of female. Fig. 97. *Theristus modicus*. a, anterior end of male; b, spicular armatures of two males

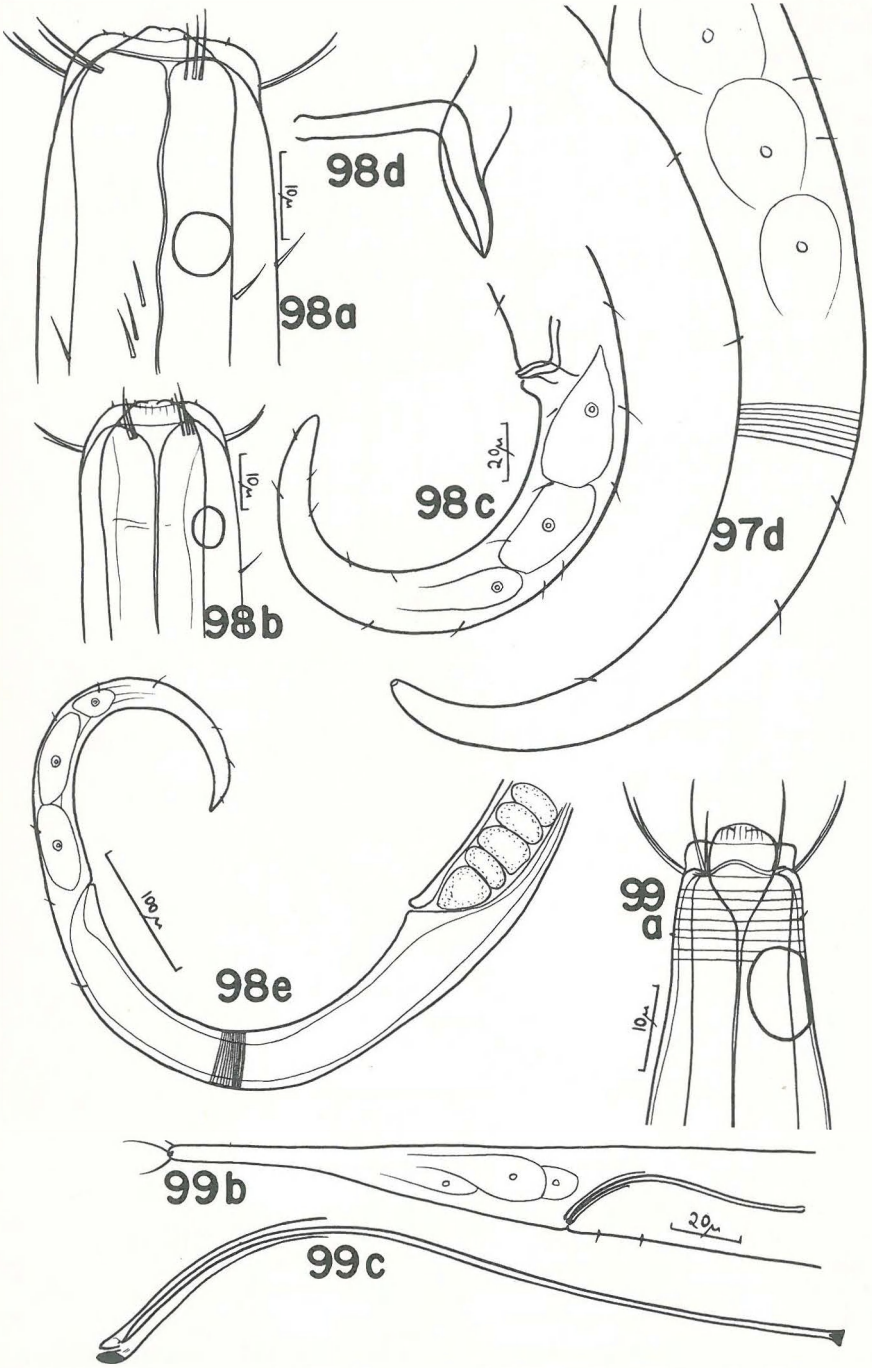

PLATE XLI. Fig. 97. *Theristus modicus*. d, tail of female. Fig. 98. *Theristus acer*. a, anterior end of male; b, anterior end of female; c, tail of male; d, spicular armature; e, posterior region of female. Fig. 99. *Theristus sinuosus*. a, anterior end of male; b, tail of male; c, spicular armature

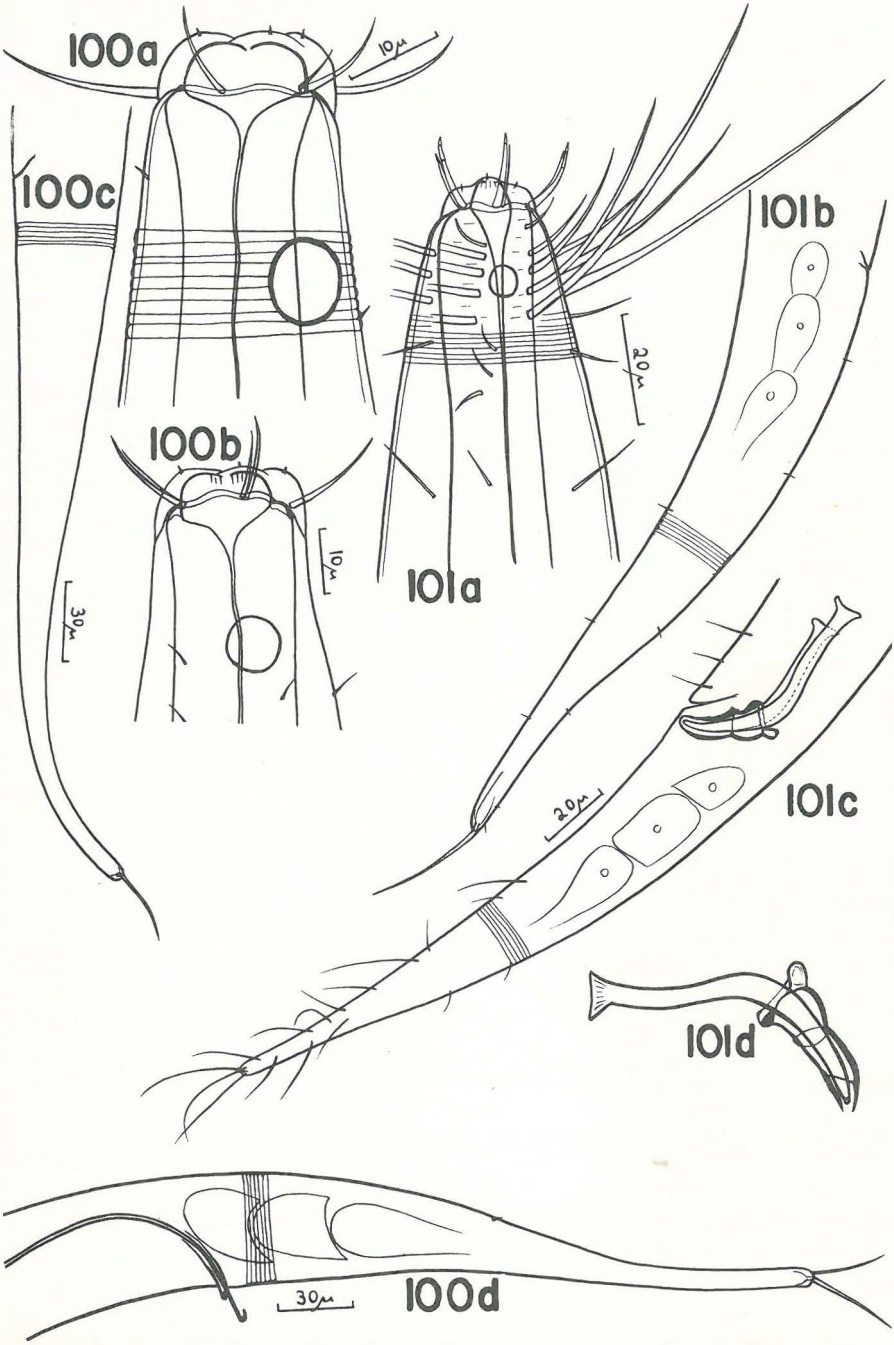

PLATE XLII. Fig. 100. *Theristus uncinatus*. a, anterior end of male; b, anterior end of female; c, tail of female; d, tail of male (only distal portion of spicula drawn). Fig. 101. *Theristus anticipans*. a, anterior end of female (only two groups of cervical setae drawn); b, tail of female; c, tail of male; d, spicular armature

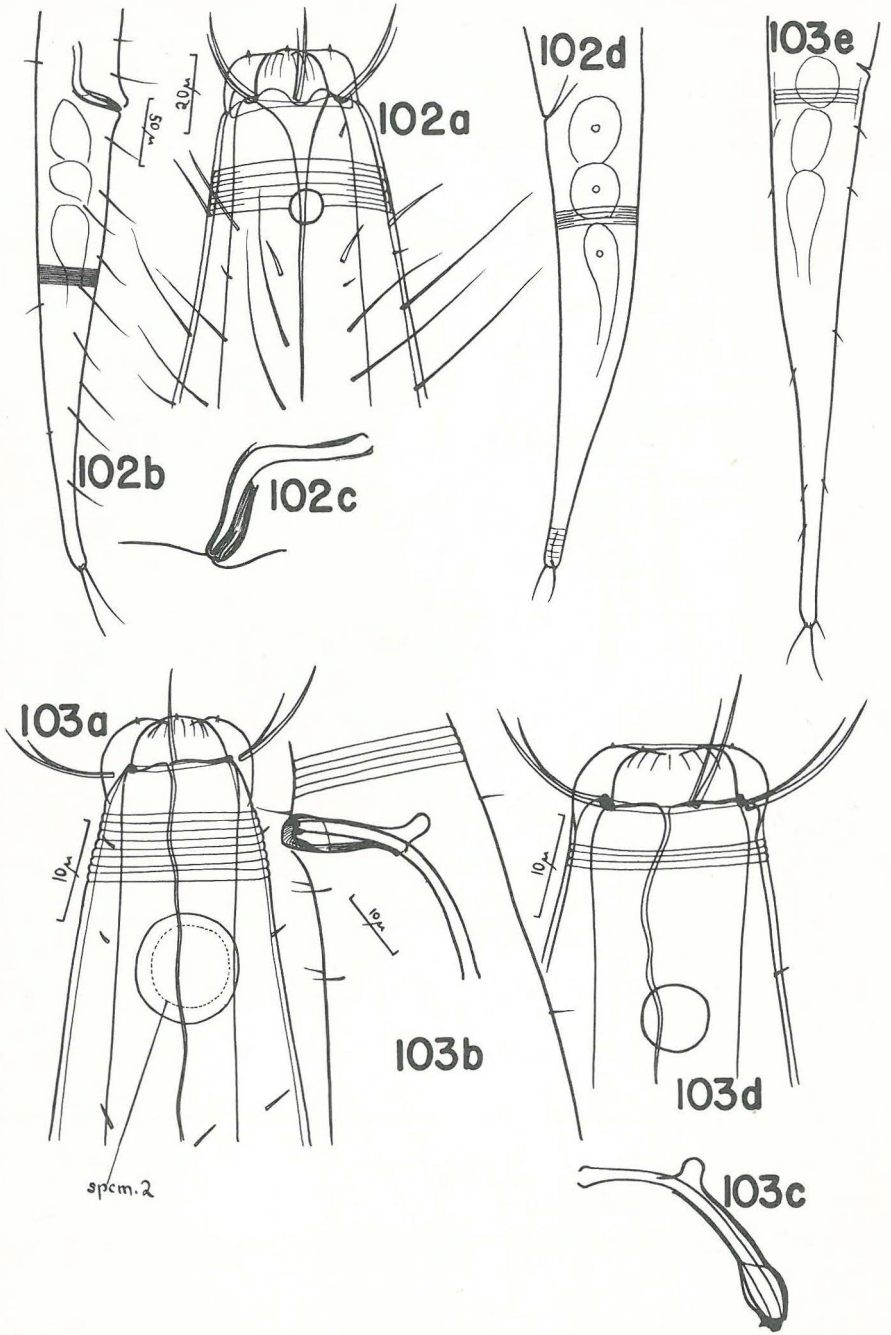

PLATE XLIII. Fig. 102. *Theristus circumscriptus*. a, anterior end of female; b, tail of male; c, spicular armature; d, tail of female. Fig. 103. *Theristus resimus*. a, anterior end of male (spcm. 2 = outline of amphid in another male); b, anal region of male; c, anal region of another male; d, anterior end of female; e, tail of female

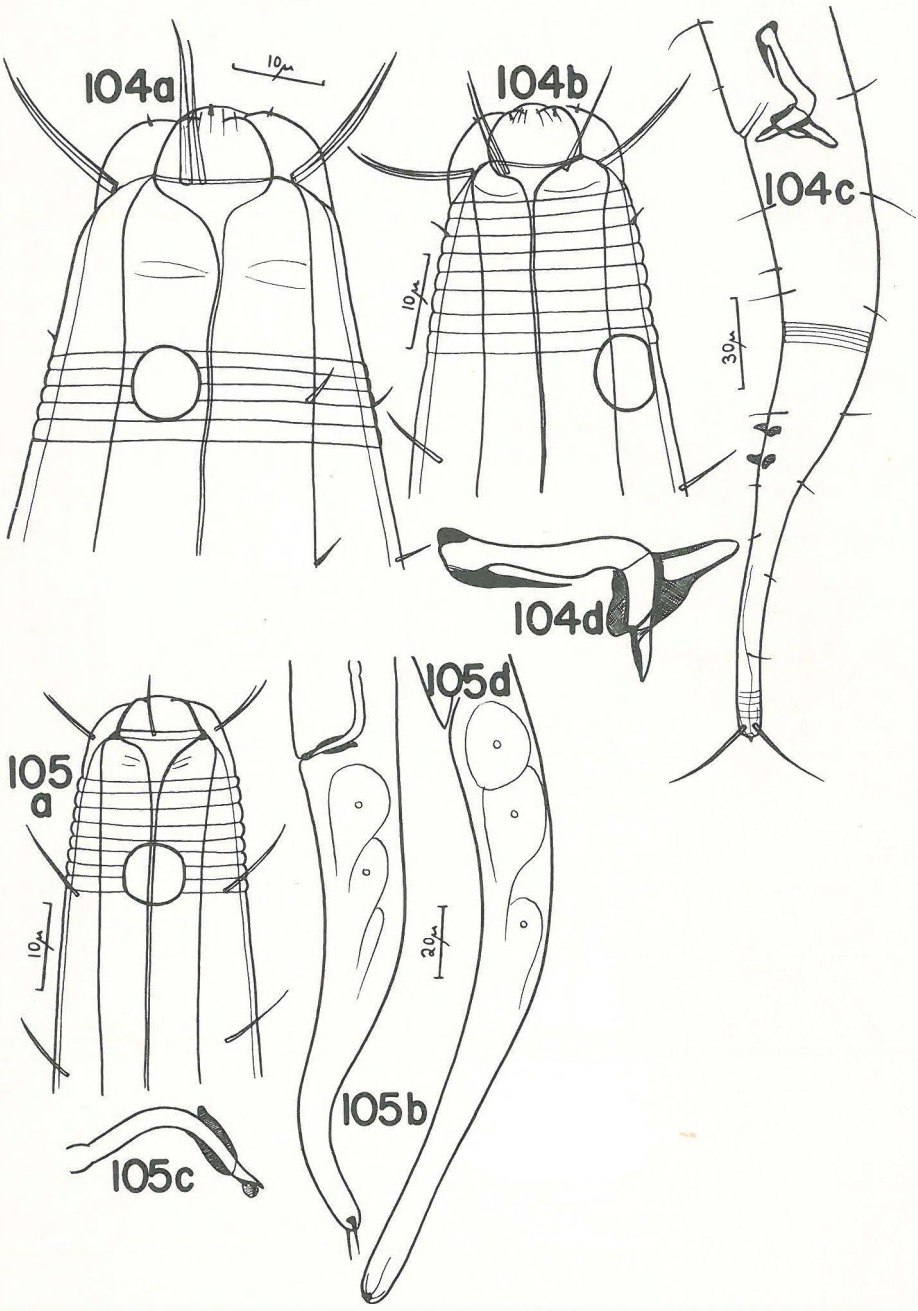

PLATE XLIV. Fig. 104. *Theristus ecphygmaticus*. a, anterior end of female; b, anterior end of male; c, tail of male; d, spicular armature. Fig. 105. *Theristus trecuspidatus*. a, anterior end of male; b, tail of male; c, spicular armature; d, tail of female

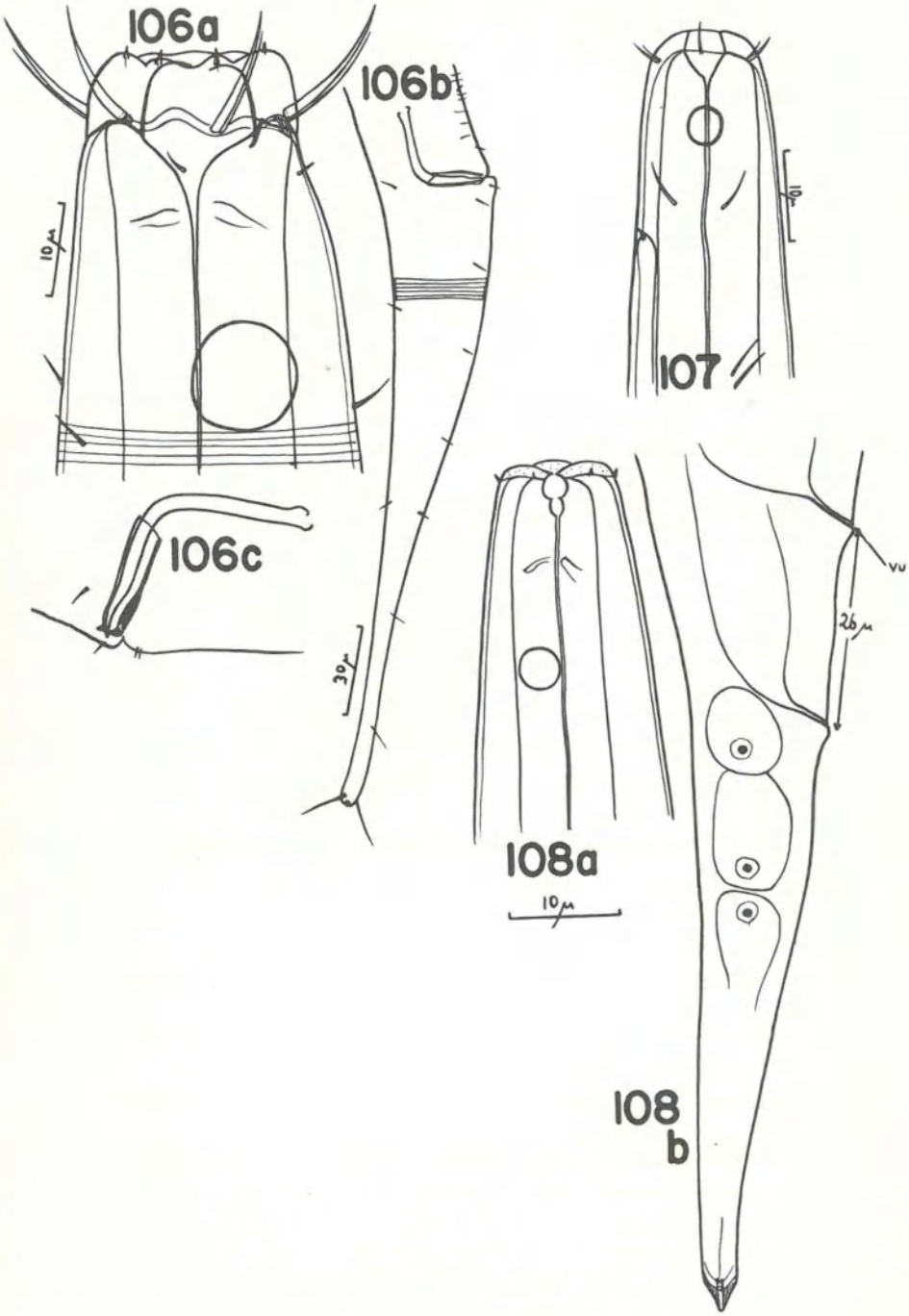

PLATE XLV. Fig. 106. *Theristus kornöensis*. a, anterior end of male; b, tail of male; c, spicular armature. Fig. 107. *Monhystera refringens*. anterior end of male. Fig. 108. *Monhystera disjuncta*. a, anterior end of female; b, posterior end of female; vu=vulva

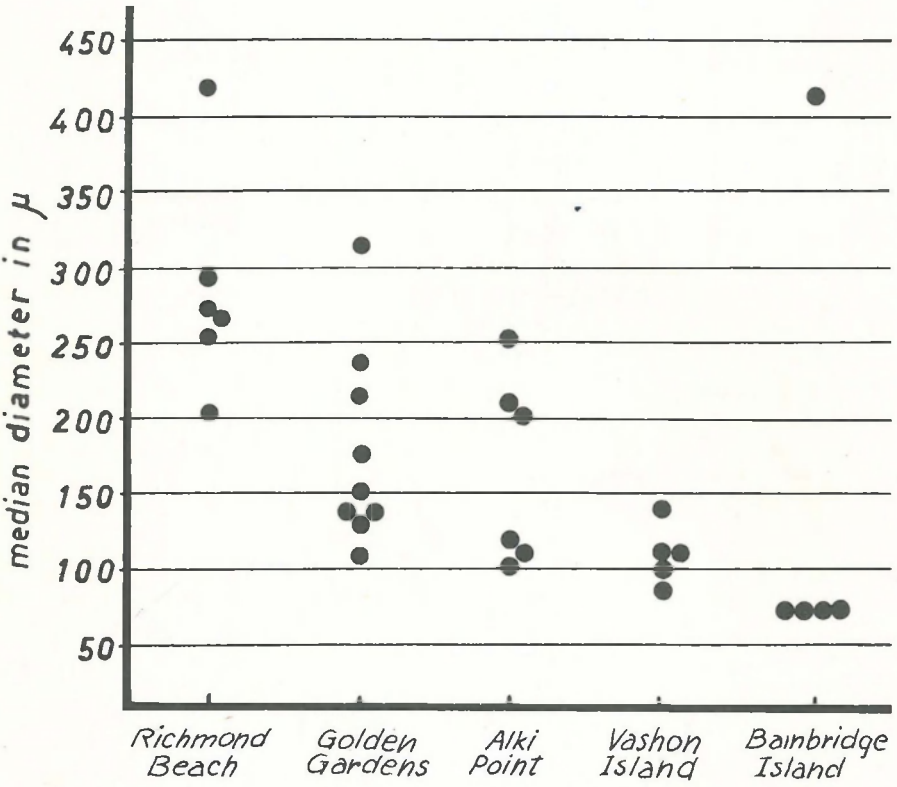

PLATE XLVI. Fig. 109. Mechanical composition of samples, as expressed by "median diameter," in the five localities investigated. Each circle represents one sample

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INDEX

Identifications are due to: (Mrs.) G. C. Carl (Victoria, B.C.): Cumacea; P. A. Chappuis (Toulouse, France): Copepoda; O. Hartman (Los Angeles): Polychaeta; M. Hatch (Seattle): Isopoda, Chelifera; C. R. Shoemaker (Washington, D.C.): Amphipoda; W. L. Tressler (Washington, D.C.): Ostracoda; W. Wieser: Nematoda, Gastrotricha, Hydrozoa, Archiannelida.

All the underlined species were found in Puget Sound.