

THE FREE LIVING NEMATODES OF THE MEDITERRANEAN

II. THE CAMARGUE

by

J. H. SCHUURMANS STEKHOVEN Jr.

Zoological Laboratory, Utrecht

In 1933 Dr. G. J. van Oordt together with a number of biological students made an excursion to the Camargue. During that trip he collected some samples of mud from brackish ponds and pools in the Rhône Delta, which collection he entrusted me for further research. At this place I will bring him my renewed thanks for his contribution to nematology. Although the collection was not great, it brought to light some interesting new species. Moreover it allows us to say something about the penetration of marine forms into brackish waters. A comparison of the list of forms given below with the lists I have given from Nematodes found to occur in the former Zuidersea shows that the penetration of marine forms into brackish waters in the Mediterranean is performed in the same way as for instance in the Zuidersea. Here and there we find forms belonging to genera and even species, that are either the same or closely related. The species found in the habitats in the Camargue apparently are just as in the Zuidersea species adapted to life in brackish water and are able to live in surroundings with variable salinities. At least species like *Theristus oxycerca*, *Anoplostoma viviparum* and *Tripyloides marinus*, but apparently also *Sphaerolaimus gracilis* are oligohalophile.

In total 37 specimens belonging to 11 species were studied. They were collected in the following localities:

I. Salin de Giraud, no. 44, excursion Dr. G. J. van Oordt, June 9, 1933.

Ecological conditions of the habitat: 5 cm³ white sand mixed with shells of *Cardium* and other molluscs, some Amphipods, and Foraminifera. Nemic index 0.6.

Anoplostoma viviparum De Man, 1♂; a *Monhystera* species in bad condition, 2 specimens.

II. Salin de Giraud, no. 47, excursion Dr. G. J. van Oordt, June 9, 1933.

Ecological conditions of the habitat: much mud, Foraminifera, detritus.
Nemic index 2.

Oncholaimus paroxyuris nov. spec., 1 ♂; *Anoplostoma viviparum* De Man, 1 ♀; *Dichromadora parapoecilosoma* (Micoletzky), 2 ♂♂, 1 ♀; *Spilophorella mediterranea* (Micoletzky), 1 ♀; *Theristus oxycerca* De Man, 2 ♂♂, 1 ♀.

III. St. Maries, Étang de l'Impératrice, no. 51, excursion Dr. G. J. van Oordt, June 4, 1933.

Ecological conditions of the habitat: white sand, few Foraminifera, small quantity of mud. Nemic index 1.68.

Tripyloides demani Filipjev, 1 ♂, 2 ♀♀, 5 juv.; *Bathylaimus assimilis* De Man, 4 juv.; *Mononcholaimus elegans* Kreis, 1 ♂; *Oncholaimus paroxyuris* nov. spec., 1 ♂; *Anoplostoma viviparum* De Man, 1 ♂; *Theristus oxycerca* De Man, 1 ♀; *Sphaerolaimus gracilis* De Man, 1 ♀, 2 juv.

IV. Petite Camargue à l'Est de Aigues Mortes, no. 32, excursion Dr. G. J. van Oordt, June 9, 1933.

Ecological conditions of the habitat: white sand, small quantity of mud.

Dichromadora parapoecilosoma (Micoletzky), 1 ♀; *Oncholaimus paroxyuris* nov. spec., 2 juv.; *Mononcholaimus elegans* Kreis, 2 juv.; *Hypodontolaimus monodon* nov. spec., 1 ♂, 2 juv.

Distributed over the orders of Nematodes we get the following list:

Order Enoptoidea

Family Oncholaimidae: *Anoplostoma viviparum* De Man, *Oncholaimus paroxyuris* nov. spec., *Mononcholaimus elegans* Kreis.

Order Chromadoroidea

Family Chromadoridae: *Dichromadora parapoecilosoma* (Micoletzky), *Hypodontolaimus monodon* nov. spec., *Spilophorella mediterranea* (Micoletzky).

Order Araeolaimoidea

Family Tripyloidae: *Tripyloides demani* Filipjev, *Bathylaimus assimilis* De Man.

Order Monhysteroidea

Family Monhysteridae: *Theristus oxycerca* De Man, *Monhystera* spec.

Family Sphaerolaimidae: *Sphaerolaimus gracilis* De Man.

Among these species *Theristus oxycerca*, *Anoplostoma viviparum*, *Bathylaimus assimilis* and *Sphaerolaimus gracilis* are frequently found in the North Sea. At the other hand *Dichromadora parapoecilosoma* and *Spilo*

phorella mediterranea are typical mediterranean forms, so that the nemic fauna of the Camargue apparently is a mixture of northern more or less cosmopolitan and more typical mediterranean forms.

Family ONCHOLAIMIDAE

Genus **Oncholaimus** Dujardin 1845

Oncholaimus paroxyuris nov. spec. (fig. 1 A, B)

1 ♂, Camargue, St. Maries, Étang de l'Impératrice, no. 51.

1 ♂, Camargue, Salin de Giraud, no. 47.

At first I thought the specimens belonged to *O. oxyuris* Ditlevsen. The present species, however, is much shorter and the subventral rows of setae round the cloaca are composed of no more than half the number of setae found in the closely related *O. oxyuris*. Moreover these setae are distinctly less slender than in that species, so that I think it is justified to create for it a new species.

Dimensions: ♂ L. 1.512 mm; $\alpha = 42$; $\beta = 5.7$; $\gamma = 47$.

$$\begin{array}{ccccccc} 0 & 20 & 58 & 264 & M & 1480 & \\ \hline & 24 & & 36 & 36 & 24 & 1512 \mu. \end{array}$$

Head comparatively broad and dome-shaped, rounded anteriorly. Cephalic setae, 10 in number. Lateral and submedian setae equally long, 25 % of the corresponding diameter. Amphids distinct at a level with the lower half of the subventral tooth. Buccal cavity 2.15 times as long as the greatest width. Tooth projecting till the base of the cephalic setae. Oesophageal portion of the body with some scattered, very minute setae.

Genital armature consisting of sword-shaped, rather long spicula, distinctly swollen at their proximal end, slightly widened near the distal end, 1.5 times as long as the anal diameter. Cloaca surrounded by 2 rows of 7 claw-shaped setae; some short similar setae in front of the cloacal crown and a few similar setae at the dorsal side of the tail. Tail short, curved, 1.1 times as long as the anal diameter, with a praeapical wart and apical spinneret, just as in *C. oxyuris*.

Genus **Mononcholaimus** Kreis 1929

Mononcholaimus elegans Kreis (fig. 2 A-D)

1 ♀, Camargue, St. Maries, Étang de l'Impératrice, no. 51.

2 juv., Petite Camargue, à l'Est de Aigues Mortes, no. 32.

Dimensions: ♂ L. 1.388 mm; $\alpha = 63$; $\beta = 5.3$; $\gamma = 15.7$.

$$\begin{array}{ccccccc} 0 & 18 & 300 & M & 1300 & & \\ \hline 10 & & 20 & 22 & 16 & & 1388 \mu. \end{array}$$

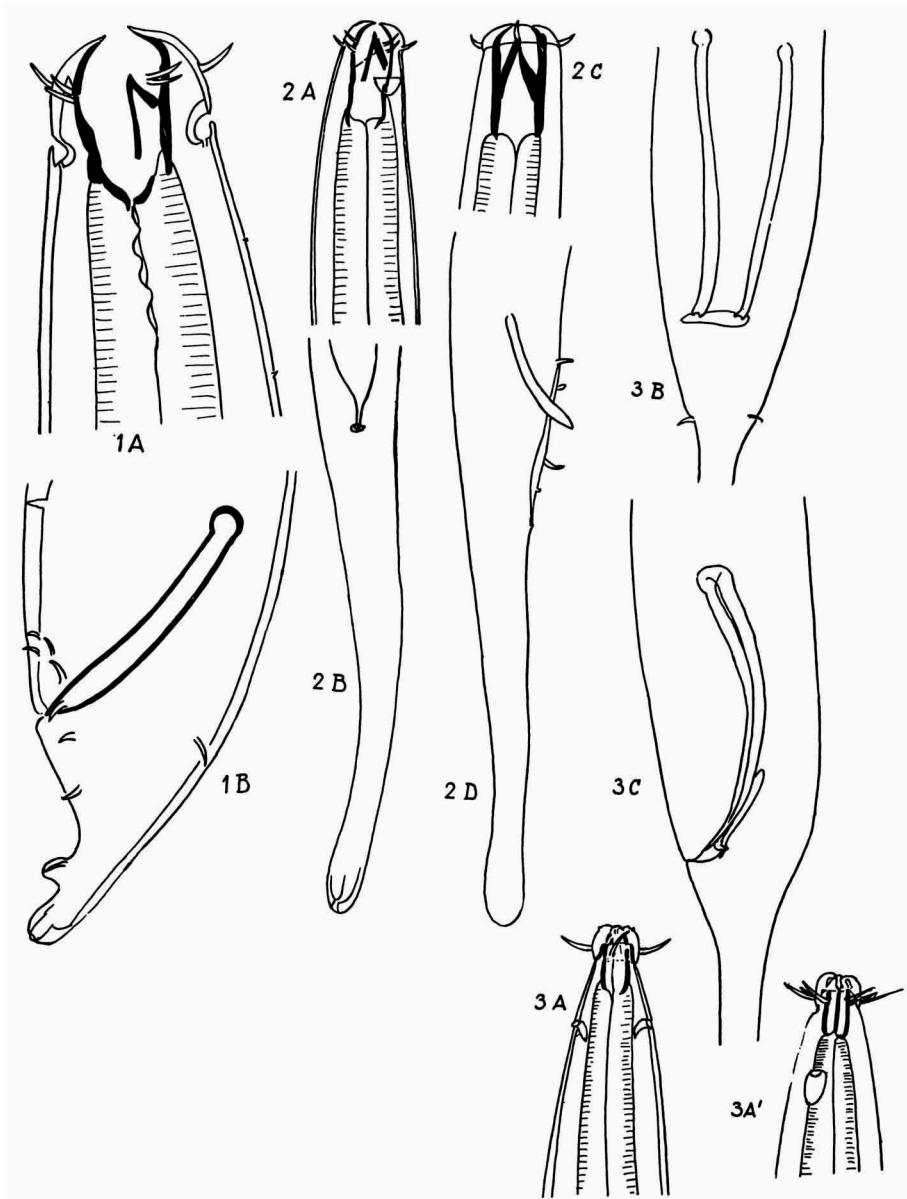


Fig. 1. *Oncholaimus paroxyuris* Schuurmans Stekhoven. A, male head. B, male tail.
 Fig. 2. *Monocholaimus elegans* Kreis. A, female head; B, female tail; C, male head;
 D, male tail.
 Fig. 3. *Anoplostoma viviparum* De Man. A, A', male head; B, male tail, ventral view;
 C, the same, lateral view.
 Fig. 1A, $\times 875$; 1B, $\times 1000$; 2A, $\times 600$; 2B, $\times 550$; the other figures, $\times 750$.

juv. L. 1.452 mm; $\alpha = 60.8$; $\beta = 6.5$; $\gamma = 13$.

$$\begin{array}{rcccccc} 0 & 16 & 140 & 240 & M & 1340 & \\ \hline 10 & & & 22 & 24 & 16 & 1452 \mu. \end{array}$$

Head slightly swollen anteriorly, the lips set off from the remainder of the body like a cap. Labial papillae indistinct. Cephalic setae 20 % of the corresponding body diameter. Oral cavity cylindrical, with a long dorsal tooth, 84.6 % of the total length of the buccal cavity, the greatest length of which equals 3 times the width. Nerve ring at 58.5 % of the oesophageal length.

Genital armature: Spicula dagger-shaped, slightly curved, hardly swollen at the proximal end, where they are pointed, 1.44 times as long as the anal diameter. Round the cloaca some large and a few small setae. Tail elongate cylindrical slightly swollen at the tip. Length of tail 5.68 anal diameters.

Genus **Anoplostoma** Buetschli 1874

Anoplostoma viviparum De Man (fig. 3 A-D)

1 ♂, Camargue, Salin de Giraud, no. 44.

1 ♂, Camargue, St. Maries, Étang de l'Impératrice, no. 51.

Dimensions: ♂ L. 1.152 mm; $\alpha = 28.8$; $\beta = 6$; $\gamma = 6.28$.

$$\begin{array}{rcccccc} 0 & 8 & 192 & M & 968 & & \\ \hline 8 & & 36 & 40 & 20 & & 1152 \mu. \end{array}$$

♀ L. 1.267 mm; $\alpha = 21.25$; $\beta = 6.38$; $\gamma = 8.2$; $V. = 61.2\%$.

$$\begin{array}{rcccccc} 0 & 200 & 948 & 1116 & & & \\ \hline 20 & 64 & 60 & 40 & & & 1276 \mu. \end{array}$$

Although there are some differences between my specimens and those described by De Man from more northern seas, I believe the specimens from the Camargue do belong to the said species, like this is also the case with those found by Filipjev in the Black Sea.

Head end distinctly set off against the remainder of the body, with a head capsule. Buccal capsule with longitudinal lists. Cephalic setae 10 in number, the longer submedian setae as long as the corresponding diameter; smaller submedian setae 42 % of the corresponding diameter. Lateral setae measuring 83 % of the corresponding diameter. Amphids pouch-shaped, slightly more than 2 times the cephalic diameter from the anterior end. Width of the amphidial opening 23.6 % of the corresponding diameter. Length of spicula equal to 2.44 anal diameter. There is a faint bursa, with at the lower end 2 claw-like setae and the indication of an anterior seta on the same bursa. The intermediate seta observed by De Man in his specimen

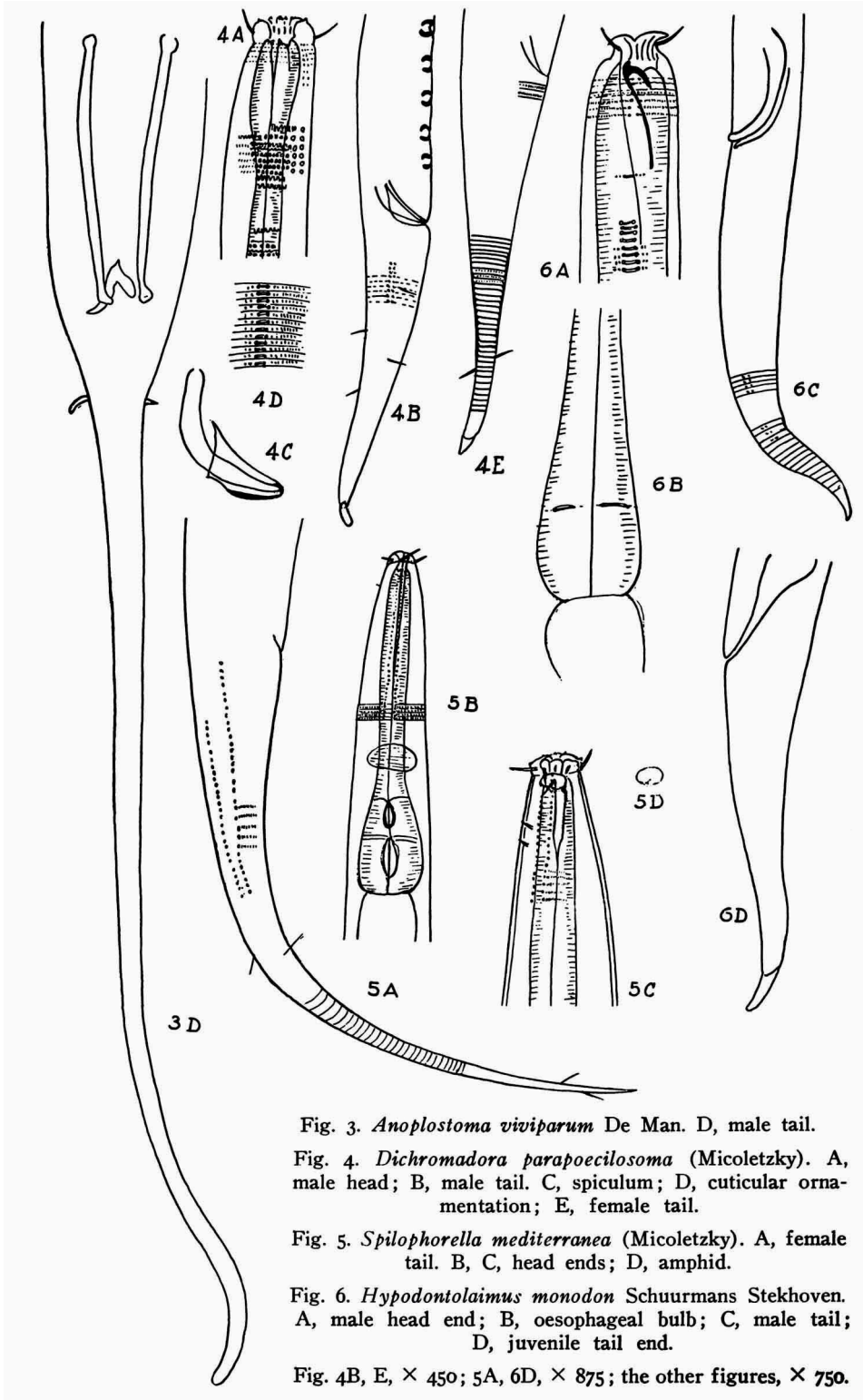


Fig. 3. *Anoplostoma viviparum* De Man. D, male tail.

Fig. 4. *Dichromadora parapoecilosoma* (Micoletzky). A, male head; B, male tail. C, spiculum; D, cuticular ornamentation; E, female tail.

Fig. 5. *Spilophorella mediterranea* (Micoletzky). A, female tail. B, C, head ends; D, amphid.

Fig. 6. *Hypodontolaimus monodon* Schuurmans Stekhoven. A, male head end; B, oesophageal bulb; C, male tail; D, juvenile tail end.

Fig. 4B, E, $\times 450$; 5A, 6D, $\times 875$; the other figures, $\times 750$.

was not present. Gubernaculum small, irregular. Tail quickly tapering to the rather long effilate, posteriorly rounded flagellum. Length of tail 9.2 anal diameters.

Geographical distribution: Northern Europe, North Sea, Baltic, White Sea, Mediterranean: Camargue, Black Sea.

Family CHROMADORIDAE

Genus *Dichromadora* Kreis 1928

Dichromadora parapocilosoma (Micoletzky) (fig. 4 A-C)

1 ♀, Petite Camargue, à l'Est de Aigues Mortes, no. 32.

2 ♂♂ Camargue, Salin de Giraud, no. 47.

Dimensions: ♂ L. 0.618 mm; $\alpha = 25.5$; $\beta = 7$; $\gamma = 6.3$.

$$\frac{0 \quad 88 \quad 132 \quad 516}{12 \quad 24 \quad 24 \quad 20} \quad 618 \mu.$$

♀ L. 0.748 mm; $\alpha = 20.7$; $\beta = 8.1$; $\gamma = 7.1$; $V. = 43\%$.

Although the species is relatively well known, I made some figures of the head end and of the tail of both male and female, which may be of importance for a recognition of the species. Head distinctly set off with the usual labial and cephalic papillae. Cephalic setae 47 % of the cephalic diameter. Amphids slitlike. Cuticle with a double row of points on the lateral fields, occupying about 12 ½ % of the body diameter at the anterior end. Buccal cavity: vestibulum with longitudinal bars. Dorsal tooth distinct, subventral teeth minute. Oesophagus slightly swollen in front. Excretory cell ending at 170 % of oesophageal length from head end. Female tail almost 5 anal diameters long, beset with some setae. Male with 5 praeanal papillae (in the other specimen there were 7 of these papillae). Gubernaculum ensheathing the spicula, more or less triangular. The spiculum is 1 anal diameter long. Male tail 5.3 anal diameters long.

Geographical distribution: Mediterranean: Suez, Alexandria, Sea of Marmara, Adria.

Genus *Spilophorella* Filipjev 1918

Spilophorella mediterranea (Micoletzky) (fig. 5 A-D)

1 ♀, Camargue, Salin de Giraud, no. 47.

Dimensions: L. 0.680 mm; $\alpha = 22.8$; $\beta = 6.3$; $\gamma = 5.6$; $V. = 47\%$.

$$\frac{0 \quad 108 \quad 320 \quad 560}{6 \quad 26 \quad 30 \quad 16} \quad 680 \mu.$$

The species in its general appearance is a typical *Spilophorella*. The only thing about which I am not quite sure is the structure of the amphids. I

have depicted them as spiral, situated behind the lips, but in this genus they ought to be slitlike, so that I am in some doubt if I might have made a mistake in respect to this point. Micoletzky (1924) says nothing about the amphids. In all other respects the species is a typical *Spilophorella*. Head swollen with minute labial and cephalic papillae. Setae distinct, 60 % of the corresponding cephalic diameter. Cuticle with two rows of points along the lateral field, occupying about 12½ % of the body diameter at the anterior end. Here too one finds some short setae, Oral cavity, vestibulum with longitudinal folds. From the bottom a tooth rises, which is, however, less vigorous than in *S. euxina*. Opposite to it the indication of a faint sub-ventral tooth. Oesophagus with 2 unequal bulbs. Tail very long and slender and with some setae, the spinneret very long with some setae just as they are depicted in the figure of Micoletzky.

Geographical distribution: Mediterranean: Suez, Adria, Rovigno, Ombla Bay, Meleda, Bocche di Catarro, Naples and Ischia.

Genus **Hypodontolaimus** De Man 1888

Hypodontolaimus monodon nov. spec. (fig. 6 A-D)

1 ♂ (type), 2 juv., Petite Camargue, à l'Est de Aigues Mortes, no. 32.

The species in question is closely related to *Hypodontolaimus ponticus* Filipjev, but may be distinguished from the latter by the shape of the genital armature and the structure of the buccal cavity, the walls of which are less vigorously cuticularized than in *H. ponticus*. The buccal tooth may be upturned like in the typical *Hypodontolaimus*-species or more flat. If there is a double oesophageal bulb like in *Hypodontolaimus ponticus*, where the oesophageal bulb shows a medial transverse protoplasmatic interruption of the musculature could not be stated with certainty. At any rate these structures are less distinct than in *ponticus*. There is such a protoplasmatic interruption of the musculature of the bulb, but I am not sure that this interruption likewise divides the cuticular lining of the oesophageal bulb in two compartments.

Dimensions: ♂ (type) L. 0.648 mm; $\alpha = 27$; $\beta = 5.4$; $\gamma = 9.8$.

$$\frac{0 \quad 120 \quad 220 \quad 580}{14 \quad 24 \quad 20 \quad 16} \quad 648 \mu.$$

The buccal tooth has a long root, is upturned in the type specimen, more flat in one of the juveniles. Lips distinct, cephalic setae rather long, 66 % of the corresponding cephalic diameter, longer than in the typical *ponticus*. Cuticle with the usual two longitudinal rows of dots along each lateral field, 16 % of the corresponding body diameter, broad at the level of the oesophagus. Oesophagus with elongate bulb with median interruption. Excretory

cell ending at 183 % of the oesophageal length from the anterior end. Spicula curved, slightly inflated at the proximal end. Gubernaculum ensheathing the spicula over $\frac{2}{3}$ of their length. Tail with distinct spinneret. Tail length equal to 6 anal diameters.

Family TRIPYLOIDIDAE

Genus **Tripyloides** De Man 1886

Tripyloides demani Filipjev (fig. 7 A, B)

1 ♂, 2 ♀♀, 5 juv., Camargue, St. Maries, Étang de l'Impératrice, no. 5.

Dimensions: ♀ L. 0.84 mm; $\alpha = 30$; $\beta = 5.6$; $\gamma = 14$; V. = 50%.

$$\begin{array}{cccc} 0 & 148 & 420 & 780 \\ \hline 14 & 24 & 28 & 18 \end{array} 840 \mu.$$

This species although closely allied to *Tripyloides marinus* Buetschli may be distinguished from the latter by the more forward position and slightly different shape of the amphids, in the still less slender tail and in the differently shaped buccal capsule.

Head end with the usual 3 lips, each with 2 groups of cephalic setae, some of which are double, the other single. Proximal locus of the buccal cavity with tooth. Amphid circular in outline, spiral in structure, its diameter 23 % of the corresponding diameter, just behind the buccal cavity. The longer setae no longer than 45 % of the corresponding cephalic diameter. Tail blunt, broad at base, soon narrowing with a blunt and short cylindrical end, provided with a dorsal seta.

Genus **Bathylaimus** Cobb 1894

Bathylaimus assimilis De Man (fig. 8 A-C)

4 juv., Camargue, St. Maries, Étang de l'Impératrice, no. 51.

Although smaller in size, which is dependent on the age of the respective specimens, these resemble so closely the specimens of *Bathylaimus assimilis* De Man from the Belgian coast, which were studied by De Coninck and myself that I have not hesitated to bring them to the same species.

Dimensions: L. juv. 1 mm; $\alpha = 36$; $\beta = 4.5$; $\gamma = 12.5$.

$$\begin{array}{cccc} 0 & 220 & M & 920 \\ \hline 14 & 24 & 28 & 20 \end{array} 1000 \mu.$$

Head with three lips, the lips with short setiform papillae, shorter than in the fulgrown specimens from the Belgian coast. Lips distinctly demarcated, at their lower end ornated with setae, the submedian setae double, consisting of one long and a shorter hair. The long hair measures 95 %

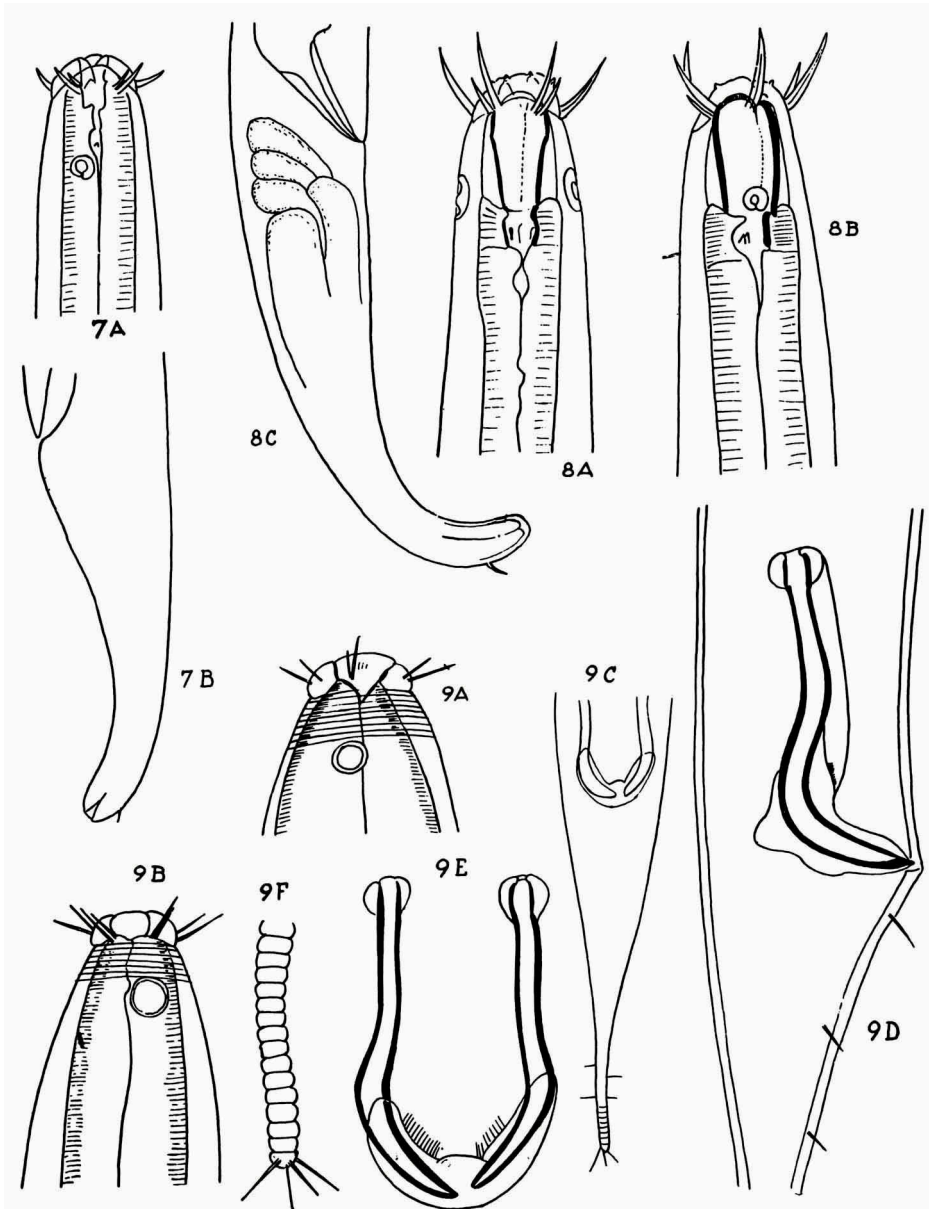


Fig. 7. *Tryptoloides demani* Filipjev. A, female head end; B, tail.

Fig. 8. *Bathylaimus assimilis* De Man. A, B, head end; C, tail.

Fig. 9. *Theristus oxycerca* De Man. A, female head end. B, male head end; C, male tail; D, spicular apparatus; E, spiculum, ventral view; F, tail end.

Fig. 9C, $\times 400$; the other figures, $\times 750$.

of the corresponding body diameter, the shorter 43 % of the same diameter. Buccal cavity complicate. Behind the vestibulum there follows a long cylindrical portion, distinctly separated from the posterior more irregular locus, in which two teeth are to be found. The relation $\frac{\text{length of portion I}}{\text{length of portion II}} = \frac{3}{1}$. The amphids spiral in shape are situated opposite to the posterior end of the first portion of the buccal cavity. Tail elongated conical with a blunt tip, provided with a dorsal seta. Length of tail equal to 4.3 anal diameters. Geographical distribution: North Sea, Mediterranean.

Family MONHYSTERIDAE

Genus **Theristus** Bastian 1865

Theristus oxycerca De Man (fig. 9 A-F)

2 ♂♂, 1 ♀, Camargue, Salin de Giraud, no. 47.

1 ♀, Camargue, St. Maries, Étang de l'Impératrice, no. 51.

This species discovered by De Man in Walcheren was only partly depicted. So we missed till so far adequate figures of the head end. I am now able to fill out the gaps. Since the present material comprised some males and the genital armature was quite in accordance with what De Man has found on this point, the species could be identified with certainty.

Dimensions: ♂ 1 L. 0.76 mm; $\alpha = 17$; $\beta = 6$; $\gamma = 8.6$.

$$\frac{0}{12} \quad \frac{128}{36} \quad \frac{M}{44} \quad \frac{648}{28} \quad 760 \mu.$$

♂ 2 L. 1.032 mm; $\alpha = 17$; $\beta = 6.8$; $\gamma = 8$. $\frac{0}{12} \quad \frac{152}{52} \quad \frac{M}{60} \quad \frac{904}{40} \quad 1032 \mu.$

♀ L. 1.136 mm; $\alpha = 14$; $\beta = 5.88$; $\gamma = 7.7$; $V. = 76\frac{0}{10}$.

Head distinctly set off, lips rather low, but swollen. 12 cephalic setae, in 6 pairs, the components of each pair being subequal in length, the longer setae measure 66 %, the shorter 43 % of the corresponding cephalic diameter in the male sex. In the female sex the same data are 50% and 30%. Cuticle distinctly ringed. Amphids in the male sex larger than in the female sex, in the first they measure 33 %, in the latter 25 % of the corresponding body width. Male genital armature consisting of rather long and slightly curved spicula, with distinctly swollen head end, resembling those of *Theristus normandicus*. Gubernaculum a winged plate with proximal fimbriae, ensheathing the distal third of the spicula. Length of spicula equal to 1.33 anal diameters. Gubernaculum with short dorsal apophysis. Tail at first cylindrical, then in its distal $\frac{2}{5}$ filiform with 4 rather long setae at its apex and some setae along the ventral side.

Geographical distribution: North Sea, Camargue, brackish water.

Family SPHAEROLAIMIDAE

Genus **Sphaerolaimus** Bastian 1865

Sphaerolaimus gracilis De Man (fig. 10 A-C)

1 ♀, 2 juv., Camargue, St. Maries, Étang de l'Impératrice, no. 51.

The specimens so strongly resemble the typical specimens of *Sph. gracilis* De Man that I have brought them to that species. The only difference is

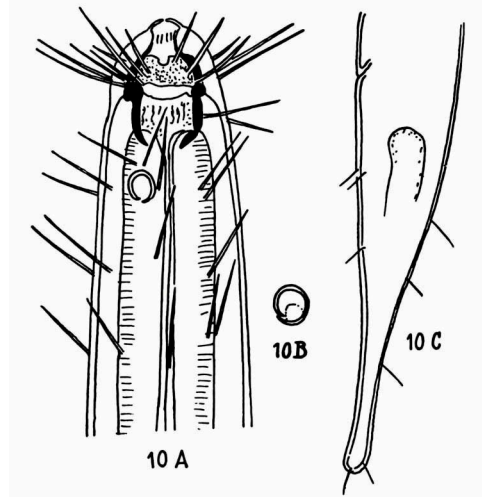


Fig. 10. *Sphaerolaimus gracilis* De Man.
A, head end; B, amphid; C, female tail.
Fig. 10A, B, × 875; 10C, × 150.

the slightly longer size of the cephalic setae and of the body setae, whereas I miss the broken transverse bars at the beginning and end of the third buccal porion. For easy identification I give here some figures, in which the cryptospiral amphids may be easily recognised as such.

Dimensions: ♀ L. 0.86 mm; $\alpha = 21.5$; $\beta = 4.5$; $\gamma = 7.4$; V. = 62.3%.

$$\frac{0 \quad 18 \quad 28 \quad 188 \quad 536 \quad 746}{16 \quad \quad \quad 40 \quad 40 \quad 30} \quad 860 \mu.$$

juv. L. 0.684 mm; $\alpha = 24.4$; $\beta = 5$; $\gamma = 7.7$ $\frac{0 \quad 16 \quad 24 \quad 136 \quad 596}{12 \quad 24 \quad 28 \quad 22} 684 \mu.$

juv. ♀ L. 0.856 mm; $\alpha = 24$; $\beta = 5.2$; $\gamma = 7.1$; V. = 65%.

$$\frac{0 \quad 20 \quad 28 \quad 160 \quad 560 \quad 748}{16 \quad \quad \quad 32 \quad 36 \quad 28} \quad 856 \mu.$$

Geographical distribution: North Sea, Mediterranean.

For references, see at the end of Part III.