

Studies on a Nematode Parasitic in the Air Bladder of the Eel

I. Description of *Anguillicola crassa* n. sp. (Philometridea, Anguillicolidae)

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A kind of nematode was collected from the air bladder of eels, *Anguilla anguilla* and *A. japonica*, cultivated near Hamamatsu, Shizuoka prefecture from 1972 to 1974. The worms were examined and identified as a new species of the genus *Anguillicola*, *A. crassa* n. sp. The worms are very commonly found in the air bladder of *A. anguilla*.

Material and methods

Living worms were fixed in warmed (70°C) 5% formalin after mucus was removed from the worms in normal saline. Then the parasites were cleared with lactophenol for 3 days. Observations and measurements were made of 20 male and female cleared specimens respectively. Some of the male worms were fixed in formalin, dehydrated in graded alcohols and embedded in paraffin; and serial sections were cut and stained with hematoxylin and eosin in order to observe the fine structure of the male caudal part.

Description of *A. crassa* n. sp.

Adult males 20.5-55.9 mm long, 0.9-2.8 mm wide; adult females 47.1-71.5 mm long 3.0-5.6 mm wide. Head end is rounded off. The body is dark brown in colour, thick, cylindrical and soft. The anterior part of body tapers to the bulbous oesophageal part in fixed specimens. Tail end is abruptly pointed.

Tail tip is pointed and able to be clearly discriminated from the residual part of body by a constriction.

Buccal cavity is cylindrical, with serrated anterior edge suggesting a leaf-crown with many elements; capsule 0.040-0.053 mm wide, 0.015-0.025 mm long in male, 0.045-0.060 mm and 0.018-0.028 mm respectively in female. Oesophagus is strongly muscular and widening gradually toward the base. Oesophagus containing a number of nuclei along the inner cavity is 0.68-1.03 mm long and 0.24-0.41 mm wide in male; 0.86-1.10 mm long, 0.30-0.49 mm wide in female. The ratio of body to oesophagus is 27.0-69.0 in male and 39.0-65.9 in female. The posterior end of oesophagus is attached by three appendix cells, which measure 0.070-0.143 mm long in male and 0.085-0.180 mm long in female and project into the intestine. Nerve ring is situated 0.19-0.27 mm in male and 0.23-0.31 mm in female from head end and excretory pore on a prominence in region of posterior end of oesophagus. Intestine is very thick, filled with a dark material which is blood of eels sucked by the parasite. Rectum, a very narrow tube, runs posteriorly along the dorsal wall of body and passes through down among three large oval caudal cells, which measure a diameter of 0.230-0.430 mm in male and 0.330-0.575 mm in female. After receiving seminal duct, rectum reaches the prominent pro-

cess, on which anus is open.

In male, spicules are lacking. Vesicula seminalis is well developed, and different in size in each of the specimens: 0.73–7.20 mm long, 0.25–1.27 mm wide. Seminal duct goes along the dorsal wall of body and then joins rectum, among three large oval caudal cells, to become a common duct which opens on the tip of the prominent process situated on the ventral surface to caudal part of body. On ventral surface of tail, there are 5 pairs of large caudal papillae, two in front of the prominent process, one either side of it and two behind. Posterior papillae are larger than the anterior ones.

In female, there is a very prominent cone on the ventral body wall, distant from the tail tip one-sixth of body length. The cone is vulva, so that vulva is visible to the unaided eye. Uterus is divided into two ducts at vulva. The ovarian tubes are well developed and convoluted, and they can be clearly observed as numerous white belt-like lines through the body wall. They extend from the oesophageal end to the area anterior to the large oval caudal cells. There are numerous embryos in uterus and ovarian tubes. Embryos measure 0.05–0.07 mm and thin-membraned “eggs” including “sheathed” larvae 0.09–0.11 mm in diameter. Rarely, “sheathed” larvae escaping from egg membranes are found in uterus near vulva. Deposited larvae, 0.240–0.270 mm long, 0.017–0.020 mm wide; the larvae are wrapped with an easy “sheath” and provided with 2 “boring” teeth.

All the types are deposited (No. 19093) in the Meguro Parasitological Museum, Tokyo.

Discussion

At present, two species have been reported of the genus *Anguillicola*. One of them is *Anguillicola globiceps* YAMAGUTI, 1935 and the other is *A. australiensis* JOHNSTON et MAWSON, 1940. Our species differs from the above mentioned two species in ratios of body length/ body breadth and body length/ oesophagus length, size of mouth

cavity, the number and size of large oval caudal cells, and the number of caudal papillae. The strongly muscular bulb of oesophagus is peculiar to *A. globiceps*, and the enlargement of the head end is characteristic to *A. australiensis*, but such features are not recognized in *A. crassa*. One of the differentiating features of the present species from *A. globiceps* and *A. australiensis* is the length of the oesophagus; that is, it is shorter in *A. crassa* than in the other two species. Johnston and Mawson (1940) described the oesophagus had a ratio about 1:30 of body length in a female 25 mm long. And no description was given of the ratio by Yamaguti (1935), but, judging from the measurements of the oesophagus and body length by him, *A. globiceps* appears to have the oesophagus longer than that of the present species.

The nerve ring is situated more posteriorly in *A. globiceps* than in *A. australiensis* and *A. crassa* in proportion to oesophageal length as shown in the table.

Yamaguti (1935) described the anus was absent in *A. globiceps* and Johnston and Mawson (1940) mentioned that in *A. australiensis*, the anus, which was not observed actually, would be a slight indentation in the females and formed a projection composed of the protruded rectal wall. In *A. crassa* the anus opens on the tip of the caudal process. In the male worms the rectum joins the seminal duct between the two anterior large oval caudal cells and this was confirmed in the serial sections of male caudal part. (Fig. 7)

A dark material was reported to be observed in the intestine of *A. globiceps* and *A. australiensis*, which would be blood of eels sucked by the parasites. Red blood cells of eels were found in the intestine of *A. crassa* in huge numbers and also in the rectum in smaller numbers, most of which remained undigested.

A young worm of *A. crassa* about 10 mm long was accidentally observed sucking the blood in the air bladder. The nematode was sucking blood with the mouth attached

Characteristics of the species of genus *Anguillicola*

	<i>A. crassa</i>	<i>A. globiceps</i>	<i>A. australiensis</i>
Body Length (BL)	: ♂ 20.5 -55.9 (32.6) ♀ 41.5 -71.5 (51.2)	♂ 26.0 ♀ 60.0	♂ 25.0-30.0 ♀ 60.0-70.0
Body Breadth (BB)	: ♂ 0.9 - 2.8 (1.5) ♀ 3.0 - 5.6 (3.7)	♂ 0.8 ♀ 1.8	♂ 0.5 ♀ 1.5
Ratio of BL/BB	: ♂ 18.1 -25.7 (21.7) ♀ 11.9 -15.4 (13.8)	♂ 32.5 ♀ 33.3	—
Head End	: rounded off	rounded off	enlargement
Mouth Cavity	: ♂ 0.040-0.053 (0.047) ×0.015-0.025 (0.021) ♀ 0.045-0.060 (0.052) ×0.018-0.028 (0.023)	0.060-0.100 × —	♂ — ♀ 0.028 ×0.010*
Oesophagus Length (OL)	: ♂ 0.680-1.030 (0.864) ♀ 0.860-1.100 (0.986)	1.130	♂ — ♀ 0.820*
Breadth	: ♂ 0.240-0.410 (0.328) ♀ 0.300-0.490 (0.379)	—	—
Bulb	: absent	♂ 0.380** ♀ 0.700**	absent
Appendix Cell (in length)	: ♂ 0.070-0.143 (0.095) ♀ 0.085-0.180 (0.110)	0.200-0.300	—
Ratio of BL/OL	: ♂ 27.0 -69.0 (37.6) ♀ 39.0 -65.0 (52.0)	—	♂ — ♀ 30*
Head-Nerve Ring Distance	: ♂ 0.190- 0.270(0.235) ♀ 0.230- 0.310(0.256)	0.500-0.600	♂ — ♀ 0.180*
Vesicula Seminalis Length	: 0.73 - 7.20 (3.32)	2.30	—
Breadth	: 0.25 - 1.28 (0.62)	0.50	—
Head-Vulva Distance (H-V)	: 33.10 -59.25 (42.38)	—	—
Ratio of BL/H-V	: 1.12 - 1.29 (1.21)	1.20	1.20
Large Oval Caudal Cell	: 3 ♂ 0.230- 0.430(0.326)** ♀ 0.330- 0.575(0.397)**	4 0.150**	4 —
Anus	: opening on the caudal process	absent	slight indentation
Male Caudal Papillae	: 5 pairs	6 pairs	4 pairs
Habitat	: air bladder of <i>Anguilla anguilla</i> and <i>A. japonica</i>	air bladder of <i>A. japonica</i>	air bladder of <i>A. reinhardtii</i>
Locality and Date	: near Hamamatsu, Shizuoka 1972-1974	Lake Hamana, Shizuoka January 24, 1927	near Sydney, New South Wales

Measurements in mm

Figures in parentheses show mean values.

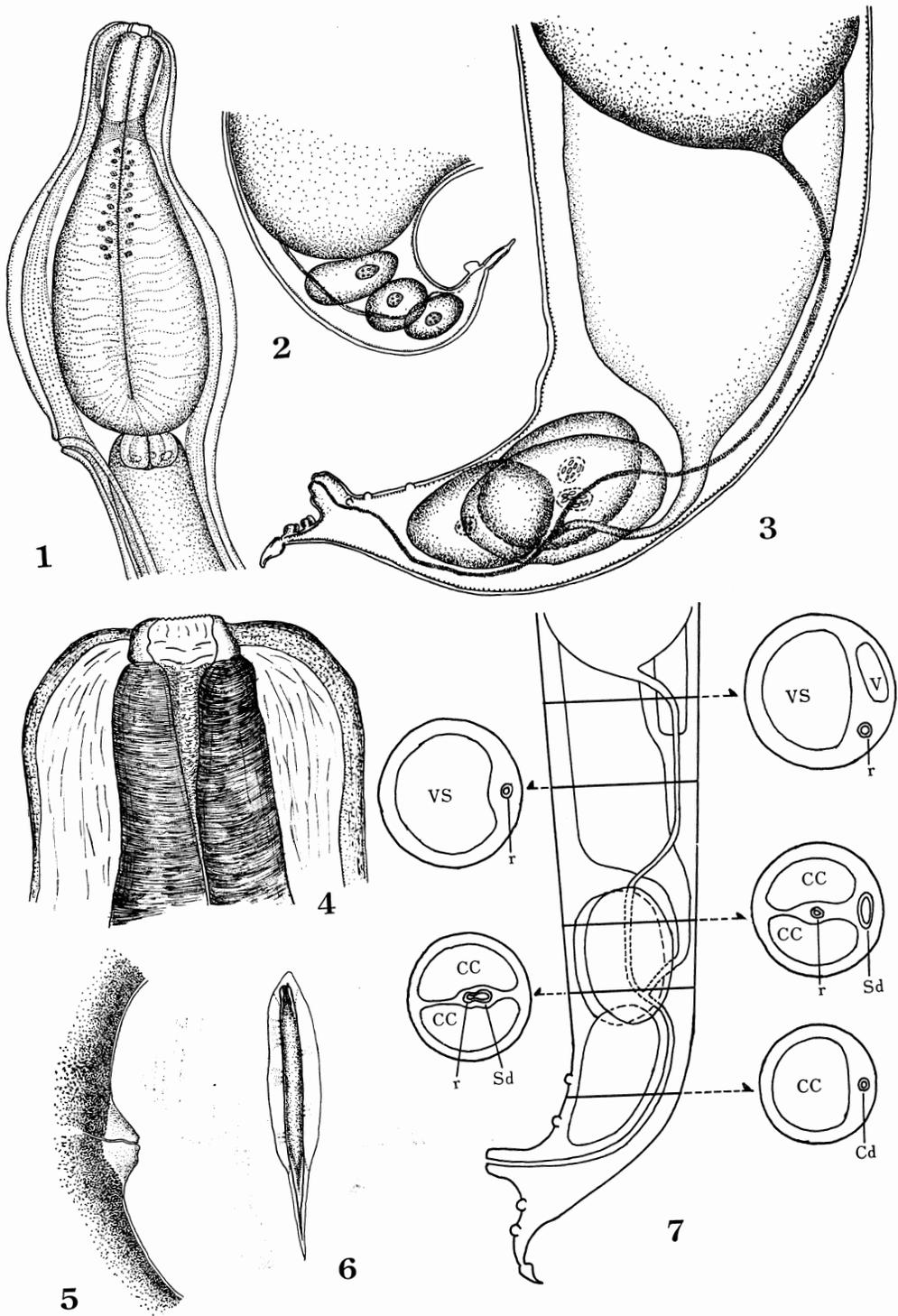
* in female 25 mm long

** in diameter

Explanation of Figures

1. Head, lateral view
2. Tail end of female, lateral view
3. Tail end of male, lateral view
4. Head end, lateral view
5. Vulva, lateral view
6. Deposited "sheathed" larva
7. Diagram showing lateral view of male, with inserts to show transverse sections of posterior part of body at indicated levels.

cc: large oval caudal cell, cd: common duct, r: rectum, sd: seminal duct, v: vesicule, vs: vesicule seminalis



to the capillaries distributed in the wall of the air bladder by means of the expanding movement of the posterior part of oesophagus. Blood of eels was taken into the cavity by dilation of the oesophagus and then pumped into the intestine by constriction of the organ.

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ウナギのウキブクロ寄生線虫に関する研究

I. *Anguillicola crassa* n. sp. の形態

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静岡県浜松市付近で養殖されたヨーロッパウナギ *Anguilla anguilla* および少数の日本ウナギ *A. japonica* のウキブクロから得た多数の線虫を検索した結果、Genus *Anguillicola* に属するものであることが明らかになった。

現在、Genus *Anguillicola* には、日本ウナギのウキブクロに寄生する *Anguillicola globiceps* YAMAGUTI, 1935 およびオーストラリアの *Anguilla reinhardtii* のウキブクロに寄生する *A. australiensis* JOHNSTON & MAWSON, 1940 の2種が報告され

ている。

本線虫を上述の2種と比較したところ、*A. globiceps* に認められる食道前端の球状部、*A. australiensis* に認められる頭部の背腹の膨らみが認められない点や、Large oval caudal cell の大きさおよび数、体長に対する体幅の比、雌虫の肛門の形態、雄虫の尾端の乳頭の数などに明瞭な差が認められた。

これらのことより、本種を新種とし、*Anguillicola crassa* と命名した。