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SOBOLIPHYME SAHALINENSE, N. SP., (NEMATODES) FROM MARTES ZIBELLINA SAHALINENSIS OGNEV

BY

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(島倉亨次郎 • 小田島幸一)

(With two text-figures and plate X)

The genus *Soboliphyme* was established in 1930 by PETROW on the basis of an ample collection of material from Kamchatka and Siberia. This genus, including the single species *Soboliphyme baturini* PETROW, 1930, has been the sole representative of the family Soboliphymidae PETROW, 1930, which was ranked together with the family Dioctophymidae under the suborder Dioctophymeata SKRJABIN, 1927. Later the definition of the suborder Dioctophymeata and also that of the family Soboliphymidae were emended by RAUTHER (1930), who then renamed the former the suborder Dioctophymoidea[1] RAUTHER, 1930, to rank it together with the suborder Trichuroidea under the first order Hologonia RAUTHER, 1930, of the class Nematodes.

The writers have recently obtained three mature individuals, two males and one female, of a nematode probably belonging to the genus *Soboliphyme*, but with peculiarities possibly characterizing a new species, which they wish to designate under the name of *Soboliphyme sahalinense*, n. sp.

Occurrence

Two of the specimens, a couple of male and female, were found in the stomach of a female Saghalien sable, *Martes zibellina sahalinensis* OGNEV, 1925, captured about a month before she was beaten to death by an accident. About thirty-four hours after her death the sable was dissected by one (ODAJIMA) of the writers on March 15, 1932. With more or less compact physique the sable, about four years old, was in well nourished condition and possessed a fur of superior quality; she always had a good appetite for her food, except for the first two days after the capture. When her abdominal cavity was dissected,

1) In remembrance of, perhaps, the superfamily Dioctophymoidea RAILLIET, 1916.

[Trans. Sapporo Nat. Hist. Soc., Vol. XIII, Pt. 3, 1934]

the stomach was found moderately dilated with no unusual appearances externally. It was filled with pieces of horse-flesh masticated shortly before and the stomach mucous membrane appeared more or less congested and catarrhal due probably to the cause of her death. The male nematode was found attached with its large acetabular buccal capsule to the mucous membrane of the minor curvature and the female individual also, a little nearer to the pyloric part. The nematodes together with the stomach contents were carefully removed and three small rounded slight ulcerations were observed where apparently the nematodes adhered to on the mucous membrane. However, hardly any trace of the occurrence of bleeding could be seen here. The two nematodes lived about fifty-two hours in artificial gastric juice in a glass vessel kept at room temperature. Attached to the wall of the vessel with their buccal capsule, which then seemed to contract more or less, they were actively moving at even as low a temperature as 15°C. and especially the male was often observed to approach the body of the female with its copulatory bursa.

Besides the above mentioned female sable two males and four females were beaten to death at the same time and dissected; however, no *Soboliphyme* nematodes were obtained from these.

The third male nematode was obtained from another female Saghalien sable that had been captured about fourteen months before she was worried to death by her mate. The

Fig. 1. *Soboliphyme sahalinense*, n. sp., male (left) and female; preserved in 75 p. c. alcohol and photographed by reflected light; × 4. The body of the male was fixed twisted around its longitudinal axis through an angle of about 80°, and that of the female about 100°. Two brown spots are found on the cuticle of the male, one at the *niveau* of about 2/7 the entire body length from its anterior end and the other in the middle region (cf. Fig. 1, Pl. X); now they seem to be impossible of easy removal.

sable, about three years old, having good physique, and being in well nourished condition, was dissected on November 2, 1932, about seventy-one hours after her death. The nematode was found still alive in the coagulated cow's milk within her stomach, detached already from the fundus wall where it had evidently adhered until not very long before; two slight ulcerations were observed on the mucous membrane similar to those in the first animal. Regrettably this third specimen was deformed and partly broken by an accident during transportation from one (ODAJIMA) of the writers to the other. The measurements have, therefore, been executed on the former two intact specimens (preserved in lactophenol) and the third male specimen, though incomplete and not well fixed, has been cut into serial sections for anatomical examination.

Description of *Soboliphyme sahalinense*, n. sp.

This medium sized nematode, cylindrical in shape and slightly attenuated anteriorly and a little more posteriorly, is semitransparent and almost colourless in its living condition, except for the wall of the anterior greater half of the male's mid-gut, which is deeply bluish green, and the mass of eggs, which is dull orange, in the uterus of the female; when fixed with alcohol, the muscular tissues especially become white and semiopaque (Text-fig. 1; Figs, 2, 3, 5, Pl. X). The cuticle is thin, transparent, and coarsely striated transversely (except on the surface of the buccal capsule, see below), without spines or elevations. The musculature of the body wall is typically polymyerial. Excretory organs are absent. The anterior end of the body is developed into a large thick-walled buccal capsule turned anteroventrad, whose wall is more developed dorsally than ventrally (Text-fig. 1; Fig. 1, Pl. X). The outer cuticle of the buccal capsule is minutely striated meridionally (Fig. 2) and provided with no spines. Surrounding the oral opening six small cone-shaped papillae are present, dorsolateral, lateral, and ventrolateral in position on each side (Fig. 2) arranged in a circle. The wall of the buccal capsule, which apparently serves as an acetabulum, is richly furnished with radial muscles (Text-fig. 2), these viewed from the end sometimes giving a false appearance of the "brickwork-like" cuticle. The inner surface of the capsule is generally smooth. The anterior tip of the oesophagus is visible as a relatively small rounded slight elevation surrounded by a circular groove at the bottom of the buccal capsule (Fig. 3). An equilateral triangle inscribed in the circle forms the oesophageal opening, one of its apices lying medioventral. Each side of the triangle is often slightly protruded inward at its center and here opens, as a small V-shaped slit with its apex turned inward (Fig. 3), the duct of the corresponding sectoral

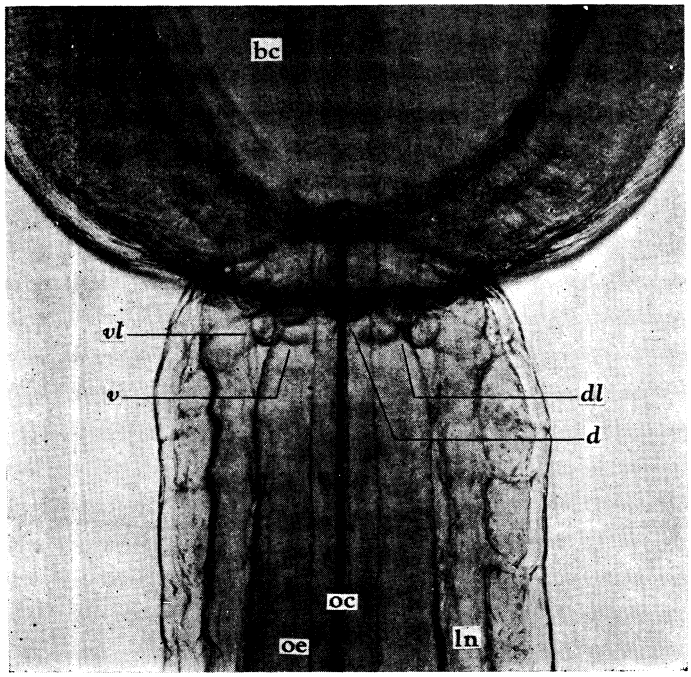

Fig. 2. Cervical region of the female, in slightly oblique dorsal view; cleared in lactophenol and photographed by reflected light; × 36. **bc,** buccal capsule; ***d,*** dorsal cervical sac; ***dl,*** dorsolateral c. s.; **ln,** lateral longitudinal nerve trunk; **oc,** triradiate oesophageal cavity; **oe,** oesophagus; ***v,*** ventral *cervical sac*; ***vl,*** ventrolateral c. s.

group of the oesophageal glands (cf. p. 345). The circumoesophageal nerve ring is situated near the anterior end of the oesophagus and just beneath the bottom of the buccal capsule. From the nerve ring arise the ventral main and a pair of lateral longitudinal nerve trunks, the latter (Text-fig. 2) supplying nerve fibers to the corresponding series of sensory papillae (Text-fig. 2; Figs. 6, 7, Pl. X), which constitute lateral lines along the entire body length. About forty-one papillae are found in each lateral line and they are more densely arranged in the anterior and posterior terminal portions, excepting the buccal capsule where only a single very small papilla is found. The dorsal longitudinal nerve trunk seems to faint out anteriorly not attaining to the nerve ring. Immediately posterior to and in close contact with the nerve ring there are seven spheroid bodies (as observed superficially) of at least two distinct grades in size, arranged in a circle surrounding the oesophagus (Text-fig. 2). One is mediodorsal in position, two dorsolateral (one on each side), and another two ventrolateral,

these five being more or less equal in size and relatively large. The remaining two, which are smaller, lie one on each side of the anterior end of the ventral nerve trunk. The oesophagus is slightly constricted where it is surrounded by these spheroid bodies (Text-fig. 2) and the latter in turn are more or less flattened between he former and the body wall. Examined in sections, these spheroid bodies have proved to be sacs rather thick-walled and containing mucous or "plasma-like" substance. They are unknown in function, however, they may be temporarily referred to as "cervical sacs" [1]. The oesophagus is muscular, relatively thick, long and almost cylindrical in shape, slightly dilated posteriorly, without a bulb, and it has a slight constriction near its anterior end (see above). The well developed oesophageal glands are distributed in three sectors partitioned by the triradiate oesophageal cavity, each comprizing a number of syncytial, polynucleated glandular portions provided with a central canal. The mid-gut is straight, thin-walled, and flattened without constrictions (Fig. 1). The hind-gut is more or less thick-walled with muscle fibers, rather long in the male, while shorter and distally flattened dorsoventrally in the female (Figs. 6, 7, Pl. X). The alimentary canal is suspended by mesenteries and some transverse muscular bands to the lateral body walls. The anus of the female opens subterminally on the ventral surface as a transverse slit (Fig. 8, Pl. X), whose posterior lip is thick and more or less protruded ventrally (Fig. 7). The caudal end of the female is rather more pointed than rounded off (Text-fig. 1; Figs. 1, 6, 7). The gonad is single for both sexes and hologonial. The testis is a thick tubule running anteriad with deep alternating one-sided constrictions or windings (Fig. 1). The vas deferens (Fig. 1) is coiled and convoluted back and forth several times, but as a whole runs posteriad. The ejaculatory duct is long and thick-walled with longitudinal external and circular internal muscle layers, its lumen being lined with two or three cell layered glandular epithelium; it runs straight posteriad (Fig. 1), except for a loop in its distal portion. The caudal end of the male, where the cloaca opens, is surrounded by a large muscular modified bell-shaped copulatory bursa, whose margin is more or less trapezoidal in face view (cf. Fig. 5), turned posteroventrad (Text-fig. 1; Figs. 1, 5), without rays. The bursal wall is more developed dorsally than ventrally and its internal surface is provided with a pair of ridge-like lateral longitudinal thickenings (Fig. 5) running parallel to and opposite the lateral lines (cf. p. 344) on the external surface. The spicule (Fig. 5) is single, setiform, and canaliculated. No gubernaculum. The vulva (Fig. 1) of the female is situated medioventrally at the *niveau* of about 2/5 the length of the

1) Whether or not these are comparable to the "cervical sacs" of Gnathostomidae (cf. RAUTHER, 1930, p. (4) 270) is also a question at present.

oesophagus from the anterior end of the latter. The vagina is relatively long, thick-walled tubular, and slightly winding (Fig. 1). The single uterus is considerably dilated at its anterior (distal) end and gradually attenuated posteriorly (Fig. 1); it is filled with eggs (Fig. 4), the mass of which is dull orange in colour. The ovarium is a very long tubule, gradually thickened distally, running forth and back through the body cavity with involved coilings and windings (Text-fig. 1; Fig. 1)

Deposited eggs were collected by one (ODAJIMA) of the writers, but the preparation of them was very regrettably lost prior to closer observation. An egg in the uterus or the vagina appears almost colourless under the magnification of 100 times or more. It is thick-shelled and, in shape, a prolate spheroid with peculiar plug-like modifications at both poles; the outer surface of the shell appears almost smooth when observed through the walls of the body and of the uterus or the vagina.

The male measures 28.60 mm. in length (L) and 1.511 mm. in maximum diameter of the body (D) in its middle region; the diameter of the body in the neighbourhood[1] of the base of the buccal capsule is 1.222 mm. and in the neighbourhood of the base of the bursa 1.111 mm. The diameter of the oral opening is 1.156 mm., the maximum external diameter of the buccal capsule (C) is 2.600 mm., and the depth of the capsule along its axis is 1.556 mm. The oesophagus is 4.889 mm. in length and 0.822 mm. in maximum diameter at the *niveau* of about 1/3 its length from its posterior end. The maximum external diameters of the copulatory bursa are 2.133 mm. transversely (Bt) and 2.489 mm. dorsoventrally (Bd); its maximum depth is 1.156 mm. The spicule is 4.556 mm. in length, 0.0852 mm. in the greatest diameter at its proximal end, and 0.0355 mm. in its middle region.

The female measures 34.63 mm. in length (L) and 1.746 mm. in maximum diameter of the body (D) in its middle region; the body diameter in the neighbourhood[1] of the base of the buccal capsule is 1.400 mm., at the *niveau* of the vulva 1.378 mm., and at the *niveau* of the anus 0.678 mm. The diameter of the oral opening is 1.489 mm., the maximum external diameter of the buccal capsule (C) is 3.000 mm., and the depth of the capsule along its axis is 1.667 mm. The oesophagus is 6.000 mm. in length and 0.889 mm. in maximum diameter in its posterior portion corresponding to about 1/3 of its entire length. The vulva is situated 3.933 mm. distant along the body axis from the anterior end (oral opening) of the nematode. The average external diameter of the vagina,

1) At the base of the buccal capsule there is a constriction (Text-figs. 1, 2; Fig. 1), where the body diameter is 1.089 mm. in the male and 1.045 mm. in the female.

in its middle region, is 0.311 mm. The anus is situated 0.573 mm. distant along the body axis from the caudal end.

The eggs in the uterus measure roundly 0.09048 mm. in length and 0.04126 mm. in maximum diameter.

Systematic Considerations

The characteristics of the nematode described in the preceding section conform to those of the order Hologonia RAUTHER, 1930, the suborder Dioctophymoidea RAUTHER, 1930, and the family Dioctophymidae PETROW, 1930, emended by RAUTHER (1930). They are also in general conformity to the characteristics of the genus *Soboliphyme* PETROW, 1930, except that the caudal end of the female is rather more pointed than rounded off and that numerous minute depressions are not traceable with certainty on the surfaces of the eggs in the uterus or the vagina. However, these two points of discrimination, of which one, in reality, may be a matter of very slight distinction and the other not quite certain at present, can hardly justify establishing a separate new genus to include the nematode in question. The writers may thus probably be allowed to consider the new nematode as another representative of the genus *Soboliphyme* and incidentally to modify slightly the definition of the genus in respect to the points in question, as will be later stated (p. 349).

The new nematode differs, on the other hand, from *Soboliphyme baturini* PETROW, 1930, in the following points.

(1) It is obviously larger, but relatively more slender. The male individual (cf. p. 343) is 2.2396-1.6677 times as long as the male of *Soboliphyme baturini* and the female individual 2.0613-1.8131 times as long as the female of *Soboliphyme baturini*. The value of the ratio L/D [1] is 18.928 for the male and 19.834 for the female in the case of the new nematode, while it is 11.963-12.098 [2] for the male and 13.151-12.840 [2] for the female in the case of *Soboliphyme baturini*.

(2) The copulatory bursa of the new nematode seems to be relatively larger than that of *Soboliphyme baturini*. The ratio B/D [1] is 0.8525-0.8642 [2] for the latter, while Bt/D is 1.4117 and Bd/D 1.6473 for the former. The ratio B/L is 0.071260-0.071430 [2] for *Soboliphyme baturini*, while Bt/L is 0.074580 and Bd/L 0.087026 for the new nematode.

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1) As to the meanings of the symbols, L, D, B, etc., cf. p. 346.

2) The smallest and the largest body lengths (of more than 100 individuals) have been compared respectively with the smallest and the largest maximum diameters of the body, utilizing the data given by PETROW (1930); the same applies to similar treatment of figures in various other cases.

(3) The caudal end of the female is more or less rounded off in *Soboliphyme baturini*, while it is rather pointed in the new nematode.

(4) The egg-shell surface is provided with numerous minute depressions in *Soboliphyme baturini*, but possibly not in the new nematode.

(5) The "papillae" surrounding the anterior end of the oesophagus of *Soboliphyme baturini* may be, in all probability, identified with the "cervical sacs" described in the present paper (p. 345); then their numbers, reported to be six for the former and seven for the latter, are in striking discrepancy with each other.

On these accounts the new nematode should probably be regarded as constituting a new species, which the present writers wish to call *Soboliphyme sahalinense*, n. sp.

The vulval opening of *Soboliphyme baturini* has been recorded by PETROW (1930) to lie 0.4915–0.6475 mm. distant "vom Kopfende," but these figures seem hardly reasonable to the present writers, taking into account all the possibilities which may arise from his rather ambiguous expression. PETROW's Fig. 2 clearly shows, on the contrary, that the opening is situated at the *niveau* of about 2/5 the length of the oesophagus from the anterior end of the latter, a condition entirely similar to the case of *Soboliphyme sahalinense*, n. sp. (cf. pp. 345 and 346).

RAUTHER (1930), who ranked the family Soboliphymidae PETROW, 1930, emended by RAUTHER (1930), which included at that time the single genus and species *Soboliphyme baturini* PETROW, 1930, under the suborder Dioctophymoidea RAUTHER, 1930, must probably have ascertained the presence of "6, 12, or 18 papillae in one or two circles" surrounding the oral opening of *Soboliphyme baturini*. PETROW did not note such papillae in his original paper (1930), though he described the presence of six "papillae" (see above) surrouding the anterior end of the oesophagus, accordingly present in the body cavity and not to be confounded with the "papillae" under consideration. Though small and rather inconspicuous (Fig. 2), six papillae are present in one circle surrouding the oral opening of *Soboliphyme sahalinense*, n. sp.

Meridional striations (cf. p. 343) are present in the outer cutilcle of the buccal capsule of *Soboliphyme sahalinense*, n. sp., and similar striations (possibly more numerous and minute) are very clearly traceable in PETROW's Fig. 3, though, notwithstanding that, he says in his text, "Oberfläche der Mundkapsel mit einer dichten, feinen, ziegelartig gebauten Kutikula überzogen." The writers found that the optical transverse sections of the radial muscles constituting the wall of the buccal capsule appear brickwork-like (p. 343). The wall of the buccal capsule is more developed dorsally than ventrally in *Soboliphyme sahalinense*

(p. 343) and such appears also to be traceable, though it may be less in degree, in PETROW's Figs. 1 and 2 of *Soboliphyme baturini*.

By reason of all the above facts and considerations an emended definition of the genus *Soboliphyme* may be stated as follows.

Genus ***Soboliphyme*** PETROW, 1930.

Definition. A representative of the family Soboliphymidae PETROW, 1930, emended by RAUTHER (1930): anterior end of the body developed into a large buccal capsule, more or less turned anteroventrad, and its wall more developed dorsally than ventrally; the cuticle of the capsule minutely striated meridionally, without spines; (at least) a circle of six small papillae surrounding the oral opening; cuticle of the body (excepting the buccal capsule) coarsely striated transversely, without spines or elevations; (in some at least) a pair of lateral lines of sensory papillae present. Oesophagus cylindrical, slightly dilated posteriorly, without a bulb; a circle of six or seven cervical sacs is found immediately posterior to the nerve ring, which is situated near the anterior end of the oesophagus. Male: caudal end, where cloaca opens, is surrounded by a large muscular modified bell-shaped copulatory bursa turned posteroventrad; bursal wall more developed dorsally than ventrally, without rays, but with a pair of ridge-like lateral thickenings on its internal surface. Spicule long and setiform. Gubernaculum absent. Female: vulva in the oesophageal region; caudal end more or less rounded off or sometimes rather pointed; anus subterminal, on the ventral surface. Egg: thick-shelled and, in shape, a prolate spheroid with plug-like modifications at both poles and with (or without) minute depressions on its external surface except the poles.

Adult: parasite in the alimentary canals of carnivorous mammals.

Type species: *Soboliphyme baturini* PETROW, 1930.

At present including two species, *Soboliphyme baturini* PETROW, 1930, and *Soboliphyme sahalinense*, n. sp., the former distributed in Kamchatka and Siberia and the latter in Saghalien.

Key to the Determination of Species.

The ratio L/D (cf. p. 347) is approximately
12 for the male and 13 for the female ..... *Soboliphyme baturini*.
The ratio L/D is approximately
19 for the male and 20 for the female ..... *Soboliphyme sahalinense*.

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Explanation of Plate X

Fig. 1. *Soboliphyme sahalinense*, n. sp., male (left) and female; cleared in lactophenol and photographed by transmitted light; ×5.4. The body of the male is twisted around its longitudinal axis through an angle of about 40° and that of the female about 100°; **e,** the circular muscle layer of the ejaculatory duct; **g,** mid-gut; **oe,** oesophagus; **ov,** ovarium; **t,** testis; **u,** uterus; **v,** vulva; **vd,** vas deferens; **vg,** vagina.

Fig. 2. Buccal capsule of the female in slightly oblique face view; preserved in alcohol and photographed by reflected light; ×24. The arrows show the positions of the six papillae arranged in one circle surrounding the oral opening.

Fig. 3. Ditto, showing oesophageal opening at the bottom.

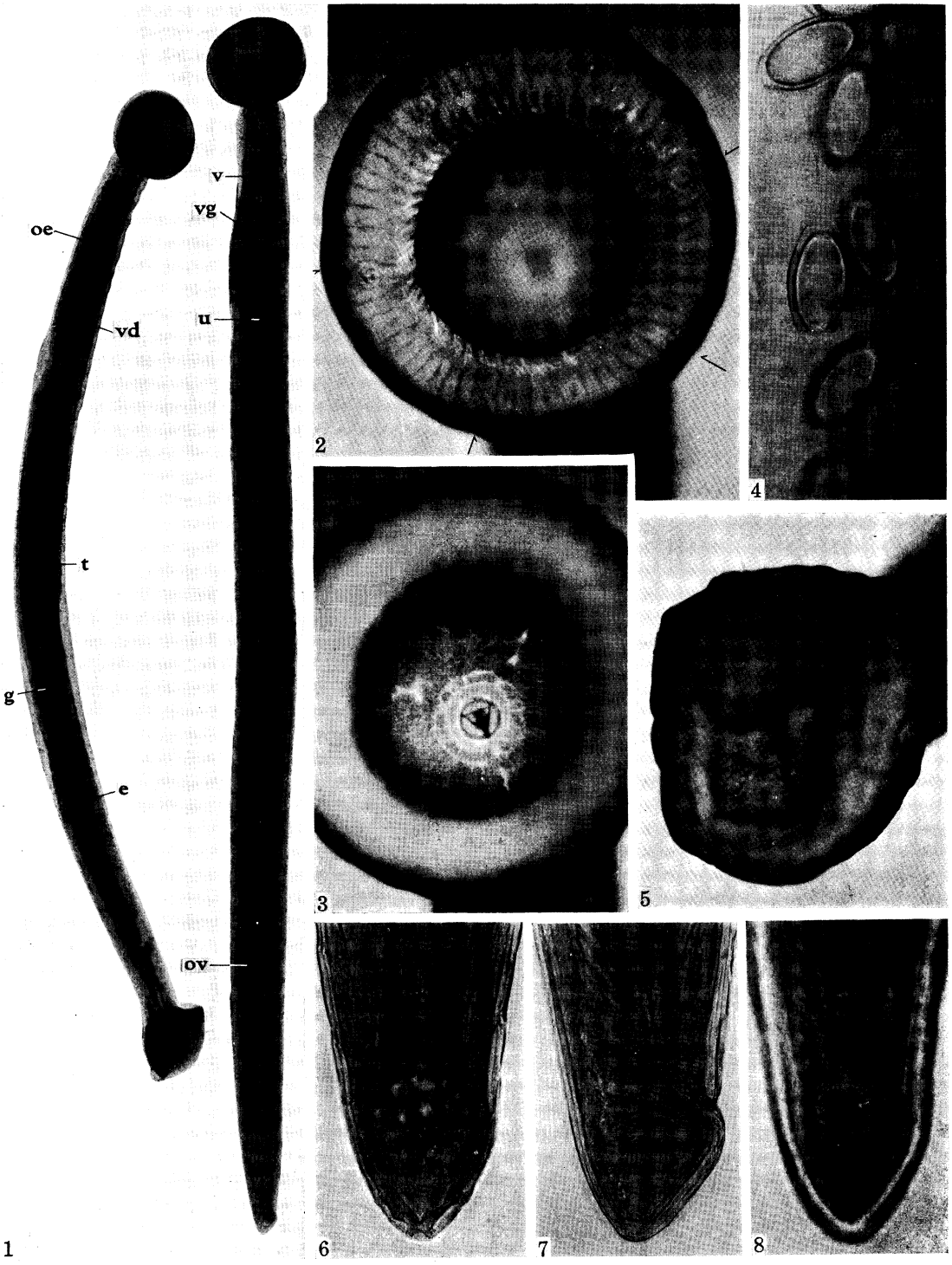
Fig. 4. Eggs in the uterus; cleared in lactophenol and photographed by transmitted light; ×240.

Fig. 5. Copulatory bursa, in oblique posterior view; preserved in alcohol and photographed by reflected light; ×24.

Fig. 6. Posterior extremity of the female, in facial optical section through the lateral lines; cleared in lactophenol and photographed by transmitted light; ×36.

Fig. 7. Ditto, in median longitudinal optical section.

Fig. 8. Ditto, showing anus, in ventral view.



SHIMAKURA and ODAJIMA Photo.