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Orton Williams, Ken J., and M. Shamim Jairajpuri, 1984. Observations on the morphology and systematics of *Thalassogenus* Andrassy, 1973 (Nematoda: Thalassogeneridae n. fam.). *Records of the Australian Museum* 36(1): 1–5. [15 June 1984].

doi:10.3853/j.0067-1975.36.1984.321

ISSN 0067-1975

Published by the Australian Museum, Sydney

nature culture **discover**

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Observations on the Morphology and Systematics of *Thalassogenus* Andrássy, 1973 (Nematoda: Thalassogeneridae n.fam.)

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ABSTRACT. *Thalassogenus archaeops* n.sp., the second species belonging to the extraordinary enoplid genus of predatory terrestrial nematodes first described by Andrássy (1973), is described from Western Samoa. The importance of the arrangement of the stoma, structure of the cardia and its accompanying glands, and the presence of an eye-spot and six caudal glands is discussed and a new family Thalassogeneridae is proposed for the genus.

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In recent years a number of unusual nematodes have been discovered in Australia, New Zealand and the islands of the Central and South Pacific, resulting in the erection of several genera that have not always fitted easily into existing classifications. During preliminary examination of material from a survey of Pacific Island groups collected by one of us (KJOW) in 1976-1977, an interesting nematode, apparently a mononch, was noted in a single sample. On closer investigation it proved to belong to the monotypic enoplid genus *Thalassogenus* Andrássy, 1973, which was described from Papua New Guinea. Our species, from Western Samoa, though closely related to the generitype, *T. paradoxus* Andrássy, 1973, represents a new species. The observations on its morphology given in the description below throw more light on this remarkable genus and its affinities.

Materials and Methods

Specimens were heat-fixed in F.A. 4:10, cleared in warm lactophenol and processed to a glycerine mountant containing traces of picric acid by a modified Baker method. One female and the single juvenile were processed to the same mountant by a glycerine-alcohol slow evaporation technique.

Thalassogenus archaeops n.sp.

Figs 1-18

Dimensions. *Females* (4): L = 1.66-1.90 mm (mean 1.81); a = 29-34 (31); b = 4.3-4.7 (4.4); c = 34-47 (38); V = 59-62 (61).

Holotype female: L = 1.9 mm; a = 30; b = 4.7; c = 36; V = 62.

Description. *Females.* Body stout, an open spiral on heat death with a slight taper anteriorly and posteriorly. Cuticle smooth, about 3.5 μ m at base of lip region, 3.5-4.5 μ m at midbody, increasing to 5 or 6 μ m on tail. Hyaline portion of terminus 6-8 μ m thick.

Lip region continuous, 36-41 μ m wide at level of amphid apertures, flattened anteriorly to produce a truncate outline. Lips six, four submedian and two lateral, rounded, each bearing two projecting labial papillae, one on the inner and one on the outer side. Papillae consisting of small convex base thinning abruptly to short setose apex and arranged in two circles; the inner circle with narrower bases inclined towards the mouth, the outer circle with wider bases inclined outwards. Four additional submedian cephalic papillae present at level of amphids. Amphid aperture a small slit about 3.5 μ m wide, located at 32-34 μ m from the base of stoma, leading into a large sensillar pouch about 8 μ m wide which extends posteriorly to a maximum of 15 μ m from amphid aperture.

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Stoma barrel-shaped, 22–23 μm wide by 41–47 μm long, composed of a set of three vertical plates and a set of three oblique plates. The vertical plates are larger and unarmed, and slope inwards anteriorly to form an aperture 8–9 μm across below the mouth. The basal oblique plates (oesophagostome) each bear a prominent tooth which occupies 20–25% of stomal length and comes to a point 9–11 μm above stomal base. Teeth of equal size arranged in a circle about 120° apart, one dorsal and two subventral. Oesophageal glands opening through dorsal tooth. Oesophagus surrounding oblique plates at anterior end, strongly muscular, terminating 380–430 μm from lip region. Lumen highly cuticularized. Neither oesophageal glands nor orifice visible in oesophagus. Nerve ring 147–165 μm from anterior, connected by means of a short commissure to an eye-spot (ocellus) sited midventrally 20–33 μm behind anterior edge of nerve ring, 167–187 μm from lip region.

Eye-spot heart-shaped in optical section, 9–14 μm long, composed of two functionally distinct parts: photoreceptive and sensory. The small dark pigment granules that constitute the photoreceptor cover the outer surface of the eye-spot except at its apices; the curved side, which lies directly beneath the body cuticle, having more granules because of its greater size than the flatter and smaller inner surface, which is pressed against the oesophagus. From this it would seem that although light is mainly received ventrally through the cuticle, it can also be detected coming dorsally through the body. The sensory portion, visible at the anterior but mainly at the posterior end, consists of a cell (or cells?) joined anteriorly to the nerve commissure. Cuticle bulging slightly over ocellus probably acting as a lens. In ventral view (1 ♀) eye-spot 12 μm long by 15 μm wide, attached along its anterior edge to a strap-like extension of the nerve ring.

Cardia muscular, 38–48 μm long with four large gland cells arranged sublaterally around the oesophageal-intestinal junction. Cardia with a complicated system of branching tubules which may represent ducts of the cardiac gland cells, although neither the point of origin nor the course of these tubules is clear. Intestine a single layer of cells with a wide lumen. Anterior intestinal cells with long, filamentous microvilli which disappear gradually away from the oesophageal-intestinal junction. Gut contents include several different nematodes, intact or partially digested, including the remains of odontostyles and spicules. Paired trophi of rotifers were also seen. Prerectum absent. Rectum 30–36 μm long by 25 μm wide (measured in one female), dorsoventrally flattened. Anus a large curved slit, 30 μm wide (1 ♀) about 70% of anal body width.

Reproductive system di-amphidelphic; ovaries reflexed, the flexed portion of the posterior branch extending past vulva in three out of four specimens (the exception being young with an incompletely developed reproductive system). Anterior ovary lying mainly on the left side of the body; posterior ovary on the right side (in one paratype both ovaries were on the right).

Tip of ovaries turned dorsally. Oocytes few, large, with large nuclei, in a single row. Oviduct and uterus undifferentiated. The single uterine egg measured a massive 218 \times 42 μm . Vagina short, 10–11 μm , less than 20% of vulval body width. Vulva a transverse slit.

Tail bluntly conoid, convex dorsally, flat to slightly concave ventrally, 39–53 μm long, 0.9–1.3 anal body-widths. Body width at anus 38–45 μm . Caudal glands large and prominent, six in number, arranged in tandem in two sets of three. Anterior glands preanal in position. Gland nuclei prominent. Each gland with a separate duct which leads to a well developed sexpartite sac. This in turn connects with the outside via a narrow duct through the terminal cuticle, its opening sunk in a small, circular cuticular pit.

Juvenile female: Stoma 13 μm wide by 28 μm long, armed with three teeth. Replacement teeth absent. Eye-spot, four cardiac glands and six caudal glands present. Other characteristics as in adult.

Male: Not found. Spermatozoa not present in uteri of females.

Diagnosis. *T. archaeops* n.sp. is closely related to *T. paradoxus* Andr ssy, 1973 but can be differentiated by its smaller body length (1.66–1.90 mm compared to 2.3–2.5 mm in *T. paradoxus*), smaller length of buccal cavity (41–47 μm compared to 61–63 μm), truncate lip region, inward orientation of the inner ring of labial papillae, amphid apertures that are slit-like not pore-like and presence of four cardiac glands not three. According to the original description *T. paradoxus* possessed three caudal glands. However, examination of a female and the juvenile paratype showed that six glands were actually present arranged in three pairs as in *T. archaeops*. The generic diagnosis is accordingly emended.

Type habitat and locality. Soil around roots of taro, *Colocasia esculenta* (L.) Schott at 3,000 ft (914 m) on Mt Mata o le Afi, Savai'i Island, Western Samoa. Collected September 1976.

Type material. The holotype, one female paratype and one juvenile have been deposited at the Commonwealth Institute of Parasitology, St. Albans, Herts, England. An additional female, cut and mounted in several ways is in the same collection. One further female paratype is with the Department of Zoology, Aligarh Muslim University, Aligarh, India.

Etymology of specific epithet. *Archaeops*, Greek, from $\alpha\rho\chi\alpha\iota\omicron\varsigma$ = ancient + $\omega\psi$ = eye.

Discussion

Andr ssy (1973) considered *Thalassogenus* a true marine residual because of several of its unusual morphological features, in particular the presence of an eye-spot which had hitherto been reported only in marine nematodes. He placed *Thalassogenus* in the order Enoplida Chitwood, 1933; suborder Oncholaimina De Coninck, 1965; superfamily Pelagonema-

toidea De Coninck, 1965 and family Pelagonematidae De Coninck, 1965.

Thalassogenus bears a strong resemblance to predatory nematodes of the order Monochida Jairajpuri, 1969, particularly forms such as *Cobbonchus* or *Miconchus*. This led Jensen (1976) to the belief that it was not a member of the Pelagonematidae but belonged in either the Tripyloidea De Man, 1876 or the Mononchida. Lorenzen (1981) took this one step further and transferred *Thalassogenus* to the family Mononchidae Filipjev, 1934 of the order Mononchida because of its stoma, oesophagus and tail.

Our study clearly shows that despite superficial resemblances, *Thalassogenus* cannot be a member of the Mononchida because it possesses partly setose papillae (papillae in the Mononchida are mamilliform), a stoma composed of unarmed vertical plates and armed oblique plates (only the vertical plates are ever armed in the Mononchida), oesophageal gland ducts opening through the dorsal tooth (not into the oesophageal lumen) and cardiac glands and an eye-spot (both of which are absent in the Mononchida). We consider these differences to be of a fundamental nature and agree with Andr ssy's classification of the genus in the Enoplida, Oncholaimina and Pelagonematoidea. However, we do not accept its placement with the Pelagonematidae. In our opinion the characters of the stoma and the presence of an eye-spot in a terrestrial nematode justify the creation of a new family. This is formally set out below.

The position of the eye-spot in *Thalassogenus*, its mode of connection to the nerve ring, its lenticular shape in optical cross section, its greater width than length in ventral view, even the fact that the cuticle has to bulge over it slightly to accommodate it are all very reminiscent of the hemizonid of the Tylenchoidea and it is not impossible that the hemizonid and eye-spot are homologous structures.

This is not to suggest that *Thalassogenus* is a near relative of the tylenchs; rather, its two species appear to have evolved from a single marine form that came ashore, adapted to a terrestrial predatory habit, speciated and left its descendants as relicts on their respective mountains separated by nearly 4000 kilometres of sea.

Family THALASSOGENERIDAE n.fam.

Diagnosis. Pelagonematoidea. Stoma large, vertical plates unarmed, basal oblique plates armed with three sharply-pointed teeth of equal size, apices directed anteriorly. Oesophagus very muscular, cylindrical. Cardiac glands large. Single eye-spot present immediately posterior and ventral to nerve ring. Two sets of three caudal glands present. Predatory, terrestrial.

Type and only genus. *Thalassogenus* Andr ssy, 1973.

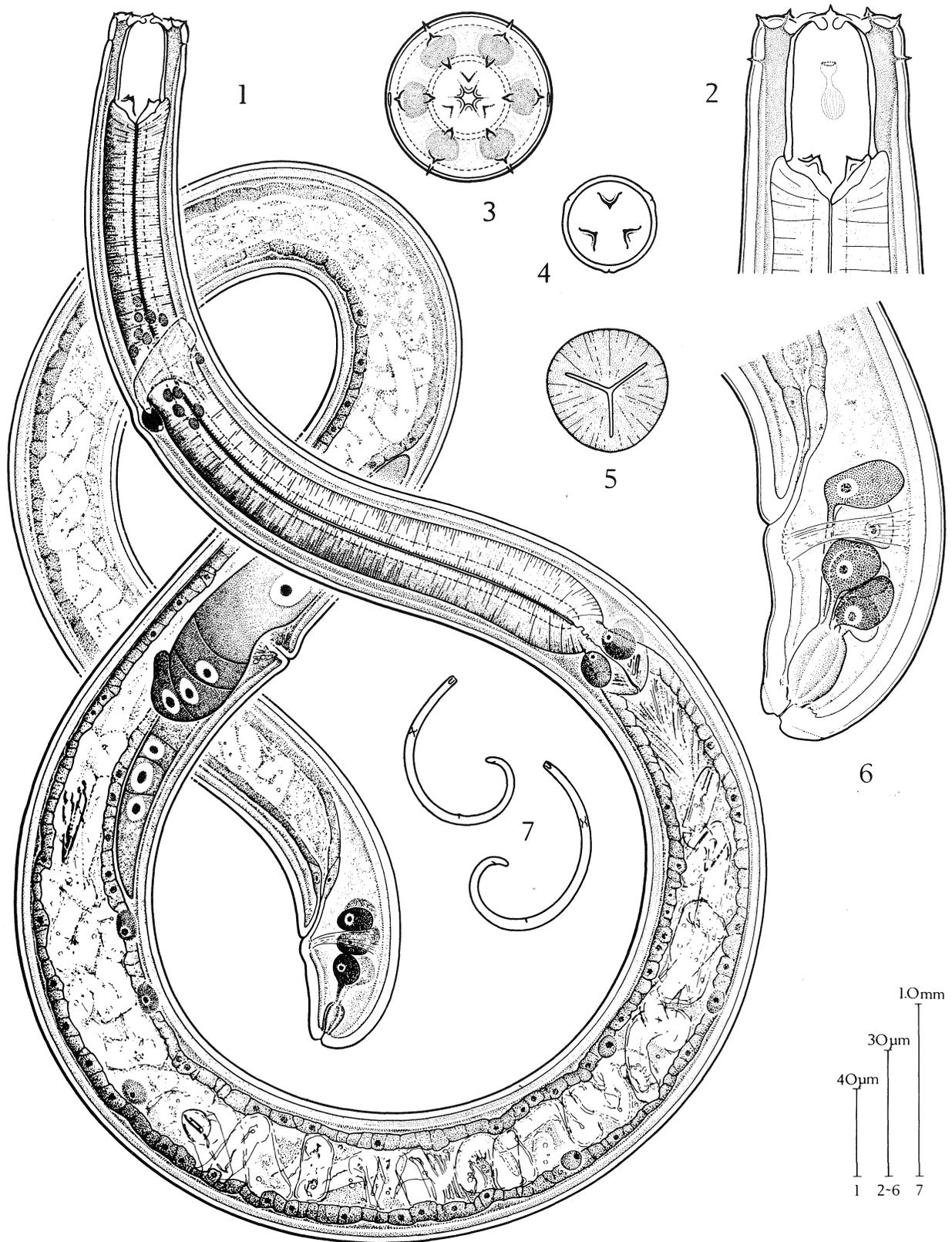
Generic diagnosis (emended). Head with six lips bearing two rings of six papillae. Papillae setose at least in part. Four additional cephalic papillae borne at level of amphid apertures. Amphid apertures small, pore-like or slit-like, in anterior half of buccal cavity. Buccal cavity barrel-shaped, longer than wide, mainly parallel, sided, composed of vertical and oblique plates, the latter forming the base and armed with three teeth of equal size, one dorsal, two sublateral. Oesophagus cylindrical, muscular. Eye-spot present immediately posterior and ventral to nerve ring, connected to it by short commissure. Cardiac glands prominent. Female gonads paired, reflexed. Tail rounded with six caudal glands arranged in two lines of three. Sexpartite terminal sac present communicating to exterior by fine duct. Juveniles similar to female except for gonad development, replacement teeth absent. Male unknown.

Type species: *T. paradoxus* Andr ssy, 1973.

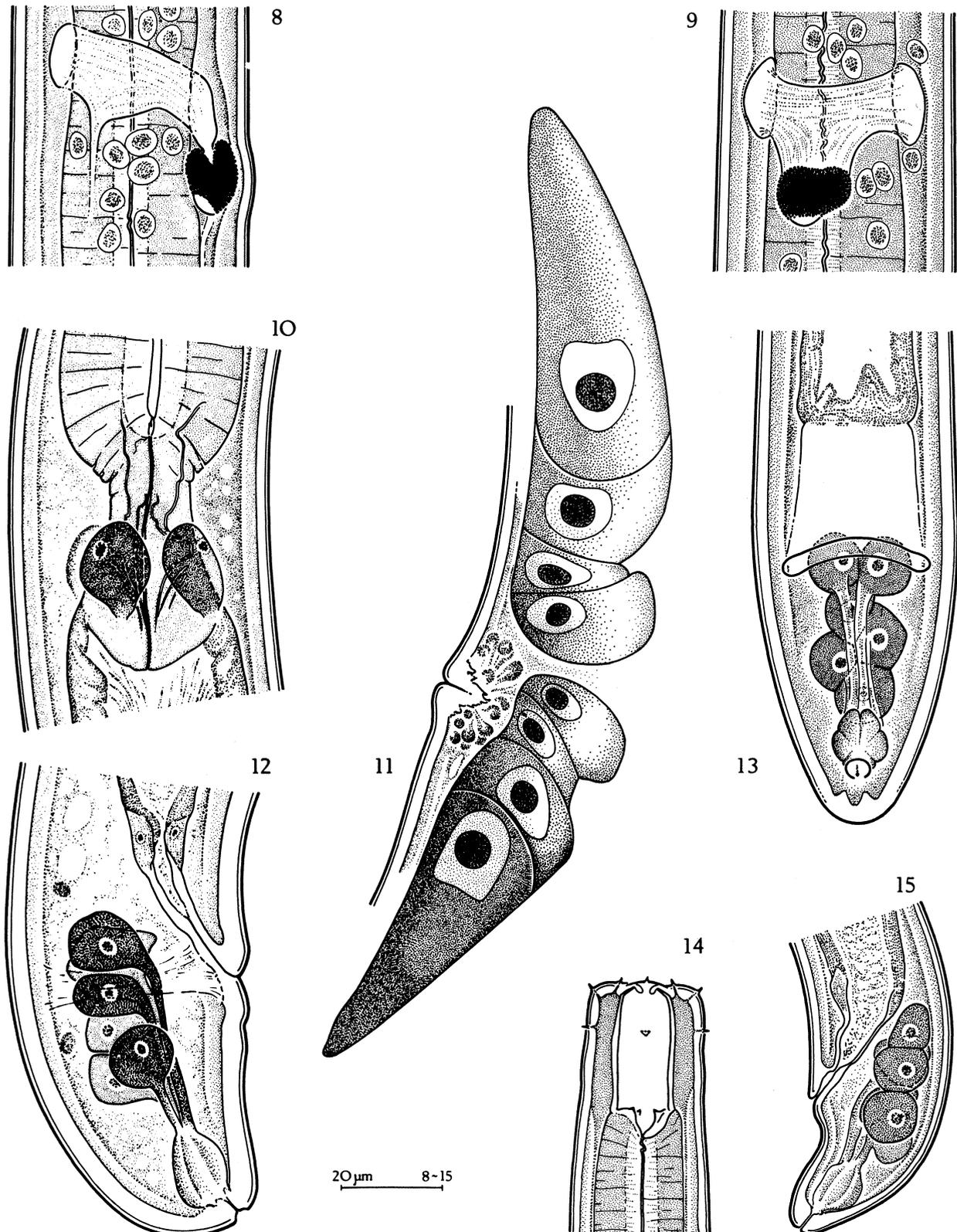
Other species: *T. archaeops* n.sp.

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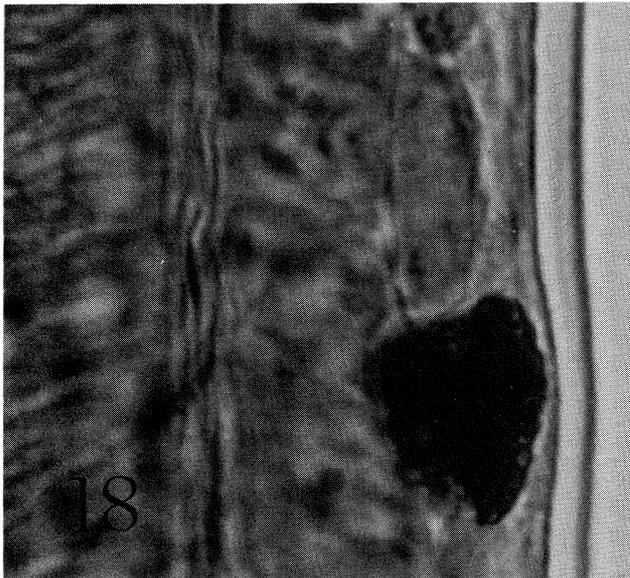
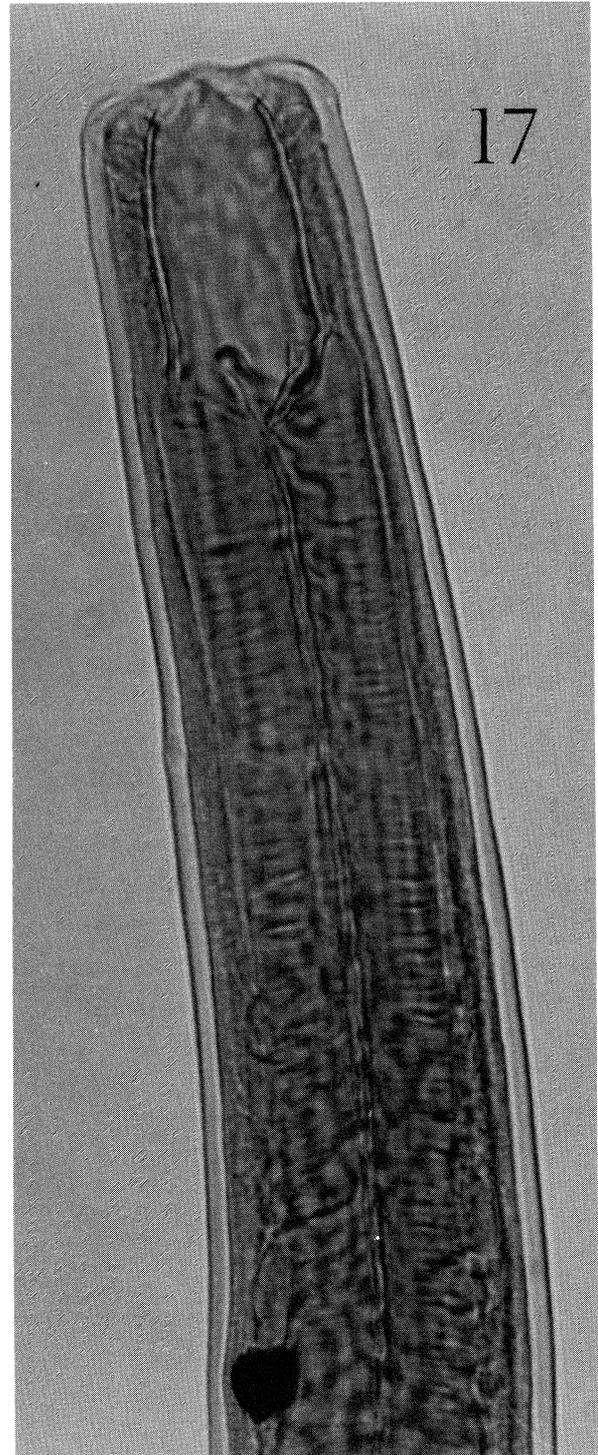
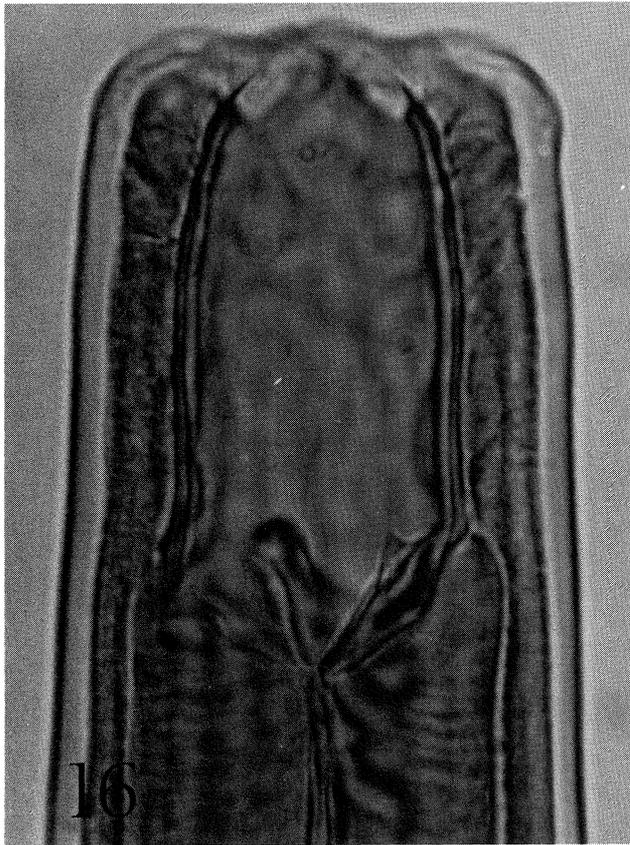
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Figs 1-7. *Thalassogenus archaeops* n.sp. adult female. 1, entire animal. 2, anterior end. 3, face view. 4, cross-section of stoma. 5, cross-section of oesophagus near stoma. 6, posterior end. 7, habitus.



Figs 8-15. *Thalassogenus archaeops* n.sp. 8-13, adult female. 8, nerve ring and eye-spot, lateral. 9, nerve ring and eye-spot, ventral. 10, oesophageal-intestinal junction showing cardiac glands. 11, reproductive system. 12, posterior end (see also Fig. 6). 13, posterior end, ventral view. 14, juvenile, anterior end. 15, juvenile, posterior end.



Figs 16-18. *Thalassogenus archaeops* n.sp., adult female. 16 & 17, anterior end. 18, detail of eye-spot.