

Two species of *Philometra* (Nematoda, Philometridae) from serranid fishes off New Caledonia

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Abstract

Two nematode species of the genus *Philometra* Costa, 1845, *P. ocularis* Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002 (gravid and nongravid females) and *P. lateolabracis* (Yamaguti, 1935) (males and nongravid females), were recorded from the ocular cavity and ovaries, respectively, of serranid fishes (Serranidae, Perciformes) off New Caledonia, South Pacific. The gravid female of *P. ocularis* was found to attain a body length up to 96 mm (as compared to 59 mm in the original description). The males of *P. lateolabracis* are described from fishes of the Pacific region for the first time; their spicules were found to be 147–213 µm in length, suggesting thus the synonymy of the recently re-established species *P. jordanoi* (López-Neyra, 1951) with *P. lateolabracis*. The findings of *P. ocularis* in *Epinephelus coioides*, *E. cyanopodus*, *E. rivulatus* and *Variola louti*, and *P. lateolabracis* in *Epinephelus cyanopodus* and *E. fasciatus* represent new host records. Both nematode species are reported for the first time from the region of New Caledonia, and *P. ocularis* from the South Pacific Ocean.

Résumé

Deux espèces de Nématodes du genre *Philometra* Costa, 1845, *P. ocularis* Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002 (femelles gravides et non gravides) et *P. lateolabracis* (Yamaguti, 1935) (mâles et femelles non gravides), ont été recensées des cavités oculaires et des ovaires, respectivement, de mérus (Perciformes, Serranidae) de Nouvelle-Calédonie, Pacifique Sud. La femelle gravide de *P. ocularis* atteint une longueur de 96 mm (à comparer aux 59 mm de la description originale). Les mâles de *P. lateolabracis* sont décrits de poissons du Pacifique pour la première fois; leurs spicules sont longs de 147–213 µm, ce qui suggère la synonymie de l'espèce récemment ré-établie *P. jordanoi* (López-Neyra, 1951) avec *P. lateolabracis*. *P. ocularis* chez *Epinephelus coioides*, *E. cyanopodus*, *E. rivulatus* et *Variola louti*, et *P. lateolabracis* chez *Epinephelus cyanopodus* et *E. fasciatus* fournissent des mentions de nouveaux hôtes. Les deux espèces de Nématodes sont mentionnées pour la première fois de Nouvelle-Calédonie, et *P. ocularis* pour la première fois dans l'Océan Pacifique Sud.

Key words

Parasitic nematode, *Philometra*, marine fish, Serranidae, *Epinephelus*, *Variola*, New Caledonia

Introduction

Nematodes of the dracunculoid family Philometridae are frequent parasites of various body tissues and cavities of fresh-water and marine fishes. Because of difficulties in studying these parasites associated with their morphological and biological peculiarities (Rasheed 1963, Moravec 2004), most philometrids remain poorly known. In particular, species of *Philometra* Costa, 1845 from marine fishes are known prima-

rily from the large-sized females with a rather uniform morphology, whereas the minute conspecific males have not yet been discovered and described. During recent years, the importance of *Philometra* spp. parasitizing marine fishes has increased due in particular to the rapid development of marine aquaculture, because these pathogenic parasites may cause serious damage to infected fishes or, when parasitic in gonads, significantly decrease fish reproduction (Ramachandran 1975, Sakaguchi *et al.* 1987, Moravec 2004).

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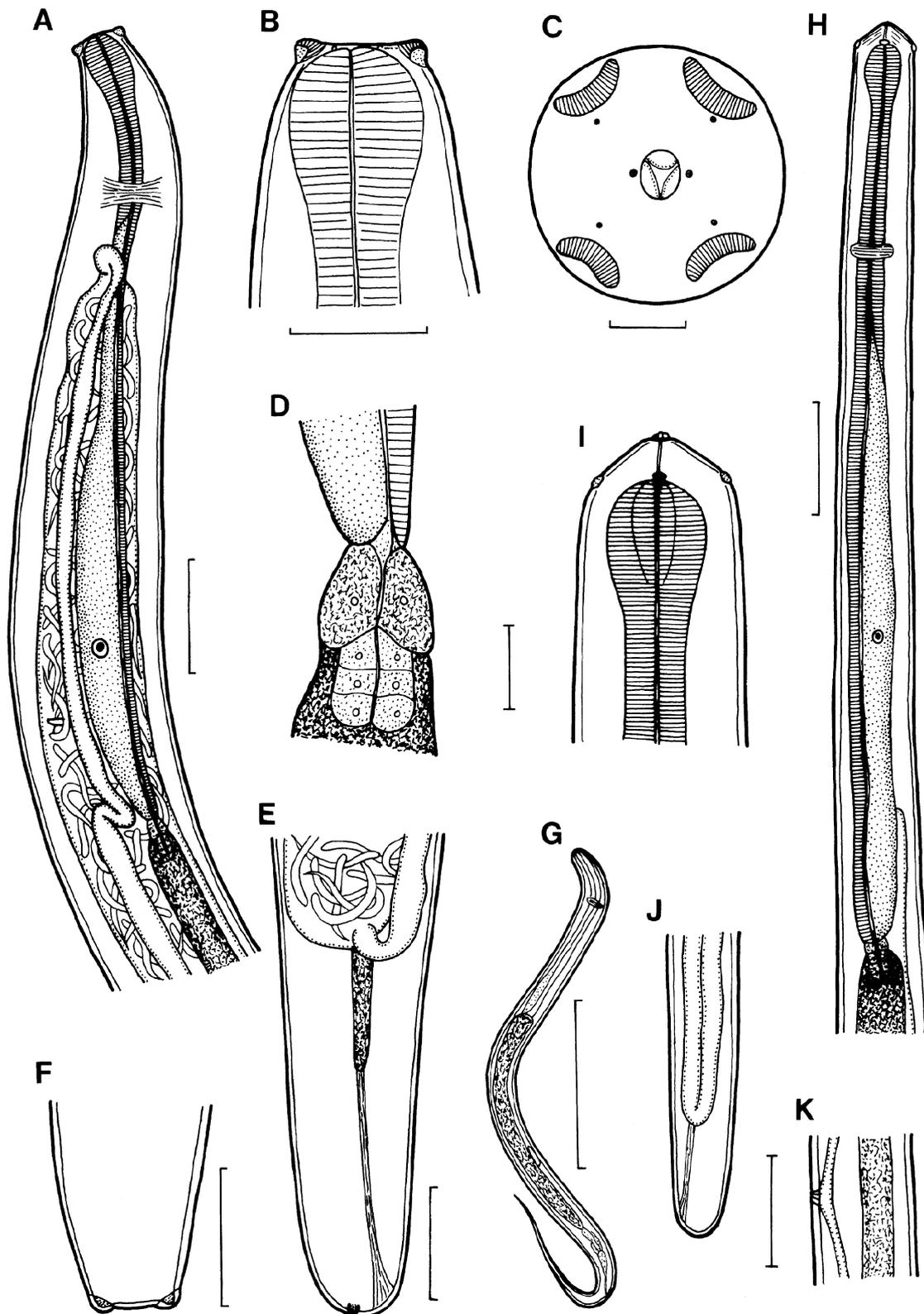


Fig. 1. *Philometra ocularis* Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002. **A-G** – gravid female from *Epinephelus rivulatus* (**A** – anterior end; **B** and **C** – cephalic end, lateral and apical views; **D** – oesophago-intestinal junction; **E** and **F** – posterior end of body, lateral and dorsoventral views; **G** – larva from uterus). **H-K** – nongravid female from *Epinephelus cyathopodus* (**H** – anterior end of body; **I** – cephalic end; **J** – caudal end, lateral view; **K** – region of vulva, lateral view). Scale bars: **A** = 200 μm ; **B**, **E-H**, **J**, **K** = 100 μm ; **C**, **D**, **I** = 30 μm

The fauna of philometrid nematodes parasitizing fishes in the Pacific region of Australia and Oceania is poorly known. Members of the genus *Philometra* reported to date from marine and estuarine fishes from East-Australian waters include four species (*P. percalates* Johnston et Mawson, 1940, *P. sydneyi* Rasheed, 1963, *P. kohnae* Moravec et Rohde, 1992, *P. lomi* Moravec et Rohde, 1992) and one species, *P. lateolabracis* (Yamaguti, 1935), has been reported from marine fishes off New Zealand (Johnston and Mawson 1940; Rasheed 1963; Hine and Anderson 1982; Moravec and Rohde 1992; Sharples and Evans 1995a, b). From the remaining vast region of Oceania, only *Philometra* sp. from the subcutaneous tissue of the carangid fish *Caranx melampygus* Cuvier has been reported by Deardorff *et al.* (1986) from Hawaii; this undescribed species, morphologically similar to *P. sydneyi*, was also observed by them to invade a puncture wound in a fisherman's hand while he was filleting an infected fish.

During 2003–2005, while studying the parasites of marine fishes off New Caledonia, a few samples of philometrid nematodes were collected from fishes of the perciform family Serranidae. Examination of this material has provided some new knowledge about the morphology, distribution and host specificity of these parasites. The results are presented herein.

Materials and methods

Nematodes of the family Philometridae used in this study were recorded from the following species of New Caledonian serranid fishes: orange-spotted grouper, *Epinephelus coioides* (Hamilton, 1822) (1 specimen examined), speckled blue grouper, *Epinephelus cyanopodus* (Richardson, 1846) (3), blacktip grouper, *Epinephelus fasciatus* (Forsskål, 1775) (16), half-moon grouper, *Epinephelus rivulatus* (Valenciennes, 1830) (4), and yellow-edged lyretail, *Variola louti* (Forsskål, 1775) (2). No philometrids were recorded from the eyes of other representatives of the Serranidae examined: *Epinephelus merra* Bloch, 1793 (3), *E. maculatus* Bloch, 1790 (2), *E. polyphkadion* (Bleeker, 1849) (1), *E. malabaricus* (Bloch et Schneider, 1801) (1), *E. cyanopodus* (Richardson, 1846) (1), *E. howlandi* (Günther, 1873) (1), *Cephalopholis urodeta* (Bloch et Schneider, 1801) (2), *Diploprion bifasciatum* Cuvier, 1828 (4), *Plectropomus leopardus* (Lacépède, 1802) (3). No philometrid was found in the ovaries of *Cromileptes altivelis* (Valenciennes, 1828) (2). It was also observed that the eyes of the following fish did not contain philometrids: the labrids *Bodianus perditio* (Quoy et Gaimard, 1834) (2) and *Thalassoma lutescens* (Lay et Bennett, 1839) (2), the balistid *Sufflamen fraenatus* (Latreille, 1804) (1), the lethrinid *Gymnocranius euanus* Günther, 1879 (1) and *Lethrinus rubrioperculatus* Valenciennes, 1830 (5) and the lutjanid *Lutjanus kasmira* (Forsskål, 1775) (1). Fishes were caught by line or speared, at distances less than 30 km from Nouméa, New Caledonia. All fish were measured, weighed and photographed. A unique number (JNC) was assigned to each fish. The parasitological material was then assigned a corresponding JNC linked to the

respective fish host. In the lists of material examined, dates of collection of hosts are given, and measurements of hosts are abbreviated as FL (Fork Length) in millimetres and W (Weight) in grams, for possible future comparison of parasite prevalence, host age and seasonality in other localities. The nematodes for morphological studies were fixed in hot 4% formaldehyde solution in physiological saline. For light microscopical examination, they were cleared with glycerine. Drawings were made with the aid of a Zeiss microscope drawing attachment. The specimen used for scanning electron microscopy (SEM) was stored in 4% formaldehyde solution and then postfixed in 1% osmium tetroxide, dehydrated through a graded ethanol series, critical point dried and sputter-coated with gold; it was examined using a JEOL JSM-6300 scanning electron microscope at an accelerating voltage of 15 kV. All measurements are in micrometres unless otherwise stated. Fish names are according to Froese and Pauly (2005).

Results

Philometra ocularis Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002 (Figs 1 and 2)

Description of gravid females (4 specimens from *E. coioides*, *E. rivulatus* and *V. louti*; measurements of 1 smaller, damaged specimen from *E. rivulatus* in parentheses): Body of specimens with larvae in uterus filiform, yellowish, with smooth cuticle, 77.22–96.08 (21.06) mm long, maximum width 408–462 (354); width/length ratio 1:167–214 (1:60). Anterior end of body truncated, 109–122 (109) wide, bearing four single, conspicuously large, crescent-shaped, fleshy submedian papillae 9–15 (9) high in outer circle and four minute submedian single papillae of inner circle situated near to crescent-shaped papillae; two small lateral papillae present near oval oral aperture. Three small oesophageal lobes present in mouth as flat surfaces. Oesophagus relatively long, with expansion near mouth forming a distinct bulb, 108–129 (117) long and 105–135 (90) wide, not separated from remaining part of oesophagus; dorsal oesophageal gland well developed, anteriorly not reaching level of nerve ring and posteriorly extending to small ventriculus. Overall length of oesophagus 1.836–1.850 (1.578) mm, representing 1.9–2.4 (7.5)% of body length, maximum width of cylindrical part of oesophagus including oesophageal gland 215–218 (136). Large cell nucleus of oesophageal gland observed only in smallest specimen, located (1.224 mm) from anterior extremity. Ventriculus of smallest specimen (45) long and (45) wide. Oesophagus opening into intestine through distinct valve. Intestine straight, light brown, with posterior end atrophied, forming ligament attached almost terminally to body wall of posterior extremity. Nerve ring comparatively far posterior to anterior extension of oesophagus, 340–449 (340) from anterior extremity. Posterior end of body rounded, bearing two lateral, subterminal papilla-like protrusions. Vulva and vagina absent. Ovaries

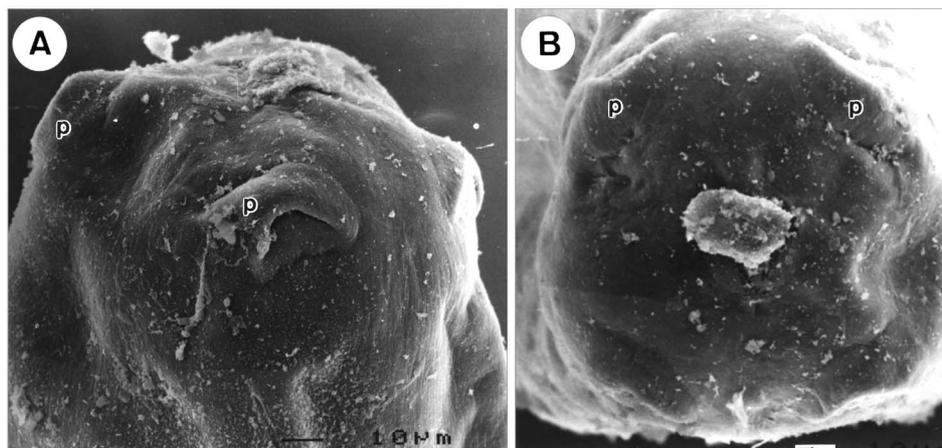


Fig. 2. *Philometra ocularis* Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002. SEM micrographs of cephalic end of gravid female from *Variola louti*: **A** – sublateral view; **B** – apical view; p – outer cephalic papilla. Scale bar = 10 µm

very long, narrow, situated near anterior and posterior ends of body; anterior ovary not reaching anteriorly to nerve ring, posterior ovary extending almost to end of intestine. Uterus occupying major part of body, being filled with larvae 369–420 (not measured) long and 12–15 (not measured) wide, with sharply pointed tail.

Nongravid female (1 specimen from *E. cyanopterus*): Body filiform, whitish, 8.76 mm long, maximum width 105; width/length ratio 1:83. Cuticle smooth. Cephalic end considerably narrowed anteriorly from level of cephalic papillae to mouth. Four distinct cephalic papillae present. Oral aperture with three small anteriorly protruding oesophageal lobes. Oesophagus 870 long (9.9% of body length), with anterior bulb 48 long and 42 wide, starting at level of cephalic papillae (21 from anterior extremity); maximum width of cylindrical part of oesophagus including oesophageal gland 36. Intestine blind, its posterior end attached by ligament to body wall. Vulva with plug, situated 5.698 mm from anterior extremity (at 65% of body length). Uterine tube narrow, empty. Ovaries long, narrow; anterior ovary reaching anteriorly to end of oesophagus, posterior ovary to some distance from posterior extremity. Posterior end of body rounded, without distinct caudal protrusions.

Male: Unknown.

Hosts: *Epinephelus coioides*, *E. cyanopodus*, *E. rivulatus* and *Variola louti* (all Serranidae, Perciformes).

Site of infection: Orbit (fat tissue behind eye). In one case found free in the mouth of *E. coioides*.

Locality: South Pacific Ocean, off Nouméa, New Caledonia.

Prevalence and intensity: *E. coioides*: 1 fish infected/1 fish examined; intensity 1 specimen per fish. *E. cyanopodus*: 1/4; 1. *E. rivulatus*: 2/4; 2. *V. louti*: 1/2; 3.

Details about infected hosts: *E. coioides*, JNC 1535, 13.05.2005, FL 860, W 7800; *E. cyanopodus*, JNC 1267,

19.09.2004, FL 670, W 5350; *E. rivulatus*, JNC 1368, 05.10.2004, FL 335; JNC 1545, 31.05.2005, FL 290, W 358; *V. louti*, JNC 1406, 22.10.2004, FL 385, W 850.

Deposition of voucher specimens: Muséum National d'Histoire Naturelle, Paris (JNC 1368, JNC 1406, JNC 1435) and Institute of Parasitology, ASCR, České Budějovice (N-782).

Comments: The morphology of gravid females of the present material corresponds, more or less, to that of the recently described species *Philometra ocularis* Moravec, Ogawa, Suzuki, Miyazaki et Donai, 2002 based on five female specimens collected from the ocular cavity of *Epinephelus septemfasciatus* (Thunberg) from Japan (Moravec *et al.* 2002). This is the only known species of *Philometra* from the host's ocular cavity possessing four large crescent-shaped cephalic papillae in the gravid female (Moravec *et al.* 2002). Four large fleshy cephalic papillae are present also in *Philometra balistii* (Rasheed, 1963), but these are not crescent-shaped, and the body of gravid females is substantially longer (up to 210 mm).

Even though males of *P. ocularis* have not yet been described and the gravid females of the present material attain a body length up to 96 mm (as compared to 59 mm in specimens from Japan), there is no reason to consider the New Caledonian nematodes a separate species and, therefore, they are identified as *P. ocularis*. The nongravid female from *E. cyanopodus* differs from gravid specimens collected from other serranid fishes in the structure of the cephalic end but, considering the host type and the localization in the host (orbit), this should also be assigned to *P. ocularis*. The cephalic papillae probably become large and crescent-shaped only in large females, as observed in some other philometrids (Moravec 2004).

To date, a few species of *Philometra* are known to be parasites of the host's ocular cavity. Only three of them occur in marine fishes: *Philometra balistii* (Rasheed, 1963) in tetra-

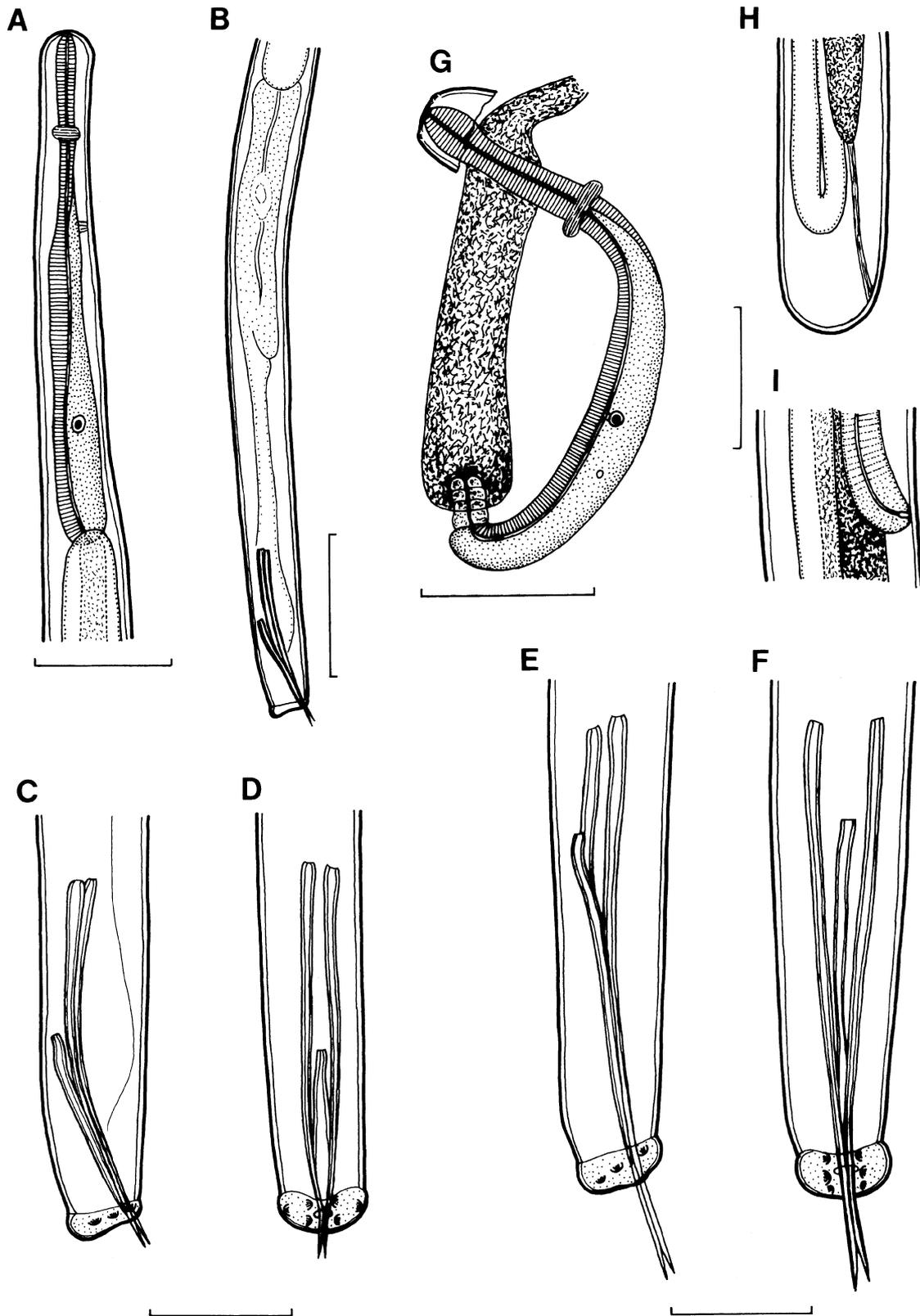


Fig. 3. *Philometra lateolabracis* (Yamaguti, 1935). **A-F** – male (**A** – anterior end; **B** – posterior end; **C** and **D** – caudal end, lateral and ventral views; **E** and **F** – same, another specimen); **G-I** – mature female (**G** – oesophagus; **H** – caudal end; **I** – region of vulva). Scale bars: A, B, G = 100 µm; C-F, H, I = 50 µm (A-D from *Epinephelus fasciatus*; E-I from *Epinephelus cyanopodus*)

odontiform fishes of the family Balistidae (*Abalistes stellaris*, *Balistes* sp.) in the Indian Ocean, Gulf of Siam, Red and South China Sea (Rasheed 1963; Parukhin 1971, 1989), *P. ocellaris* in *E. septemfasciatus* (Serranidae, Perciformes) in Japan (see above), and *P. salgadoi* Vidal-Martínez, Aguirre-Macedo et Moravec, 1995 in *Epinephelus morio* (Valenciennes) in Mexico (Vidal-Martínez et al. 1995, Moravec et al. 2001). The last named species differs markedly from *P. balistii* and *P. ocellaris* in having eight large cephalic papillae in the gravid female. Consequently, the present finding of *P. ocellaris* in New Caledonian fishes represents the first record of an ocular species of *Philometra* in the South Pacific and *E. coiooides*, *E. cyanopodus*, *E. rivularis* and *V. louti* are new host records for this nematode species.

Many species of philometrids have a pronounced seasonal cycle in maturation, with larvigerous females occurring only within a short period in spring and summer, whereas some others have not (Moravec 2004). Therefore, data on the occurrence of larvigerous females of these parasites are important. In New Caledonia, gravid females of *P. ocellaris* with larvae in uterus were recorded from *E. coiooides*, *E. rivulatus* and *V. louti* in October, whereas only a nongravid female was found in *E. cyanopodus* in September. Moravec et al. (2002) recorded larvigerous females of *P. ocellaris* in *E. septemfasciatus* in Japan in July. Of course, these data are not comparable, because Japan is in the Northern Hemisphere (with four seasons) and New Caledonia in the Southern Hemisphere (with only two seasons, cold season June–September and hot season October–May). Seasonal maturation cycles of fish nematodes are generally determined by local ecological conditions. Moravec et al. (2002) mentioned that this parasite probably caused damage to tissues surrounding the eye of *E. septemfasciatus* cultured in Japan, resulting in abnormal swimming of the host fish.

***Philometra lateolabracis* (Yamaguti, 1935)** (Figs 3 and 4)

Syns: *Sanguinifilaria lateolabracis* Yamaguti, 1935; *S. jordanoi* López-Neyra, 1951; *Philometra rajani* Mukherjee, 1966

Description of male (6 specimens from *E. fasciatus*; measurements of 1 male from *E. cyanopodus* in parentheses): Body filiform, whitish, 2.75–3.32 mm (body fragment 1.58 mm) long, maximum width at middle 51–63 (66), slightly tapering towards both ends. Cuticle smooth. Cephalic end rounded. Mouth small, surrounded by indistinct cephalic papillae. Oesophagus narrow, 373–386 (-) long, without distinct inflation at anterior end; posterior part of muscular oesophagus with well developed dorsal oesophageal gland with large cell nucleus. Nerve ring 129–150 (-) from anterior extremity. Posterior end of body blunt, with broad, U-shaped, lobular mound and with one pair of preanal and two pairs of postanal very flat, hardly visible caudal papillae. Spicules slender, needle-like, equally long, with somewhat expanded proximal and sharply pointed distal tips; length of spicules 147–156 (213), 5–6 (-)% of body length. Gubernaculum narrow, 69–84 (147)

long, with approximately its proximal third somewhat dorsally bent; distal tip of gubernaculum sharply pointed, simple, without usual reflected dorsal barb. Length ratio of gubernaculum and spicules 1:1.86–2.17 (1:1.45). Spicules orange-coloured, their proximal ends colourless; gubernaculum less sclerotized, colourless. Cloacal opening subterminal. Length of tail 3–6 (6).

Mature female (1 specimen with broken anterior end from *E. fasciatus*): Body filiform, whitish, 3.16 mm long, maximum width 63. Cuticle smooth. Cephalic end rounded, cephalic papillae indistinct in lateral view. Oesophagus 390 long, with slightly outlined anterior bulb; its maximum width including well developed dorsal oesophageal gland 33; cell nucleus of oesophageal gland 240 from anterior extremity. Nerve ring 105 from anterior end of body. Small ventriculus present. Oesophagus opening into intestine through distinct valve. Anterior end of intestine comparatively broad. Intestine ending blindly, being attached by ligament to ventral body wall near caudal end. Vulva postequatatorial, situated 2.14 mm from anterior extremity (at 68% of body length); short vagina directed anteriorly from vulva. Amphidelphic. Uterus empty. Ovaries short. Posterior end of body rounded, without any projections.

Nongravid female (1 specimen from *E. cyanopodus*): Body filiform, brownish, 18.32 mm long, maximum width 299; its width/length ratio 1:61. Anterior part of body somewhat wider than posterior part. Cuticle smooth. Cephalic end rounded, cephalic papillae indistinct in lateral view. Oesophagus 830 long (4.5% of body length), with anterior bulb 69 long and 72 wide; maximum width of its posterior cylindrical part including oesophageal gland 68. Nerve ring 159 from anterior extremity. Small ventriculus present. Oesophagus opening into intestine through well developed valve. Intestine brown-coloured, ending by ligament near posterior end of body. Vulva and vagina absent. Uterus empty. Ovaries situated near ends of body. Caudal end rounded, with a minute terminal papilla-like projection.

Hosts: *Epinephelus cyanopodus* and *E. fasciatus* (Serranidae, Perciformes).

Site of infection: Ovary.

Locality: South Pacific, off Nouméa, New Caledonia.

Prevalence and intensity: *E. cyanopodus*: 2 fish infected/3 fish examined; intensity 1 specimen per fish. *E. fasciatus*: 3/16; 1–4.

Details about infected hosts: *E. cyanopodus*, JNC 546, 18.06.2003, FL 600, W 2500; JNC 945, 28.10.2003, FL 587, W 3000; *E. fasciatus*, JNC 1251, 15.09.2004, FL 190, W 102; JNC 1257, 15.09.2004, FL 205, W 123; JNC 1258, 15.09.2004, FL 175, W 75.

Deposition of voucher specimens: Muséum National d'histoire Naturelle, Paris (JNC 945, JNC 1251, JNC 1258) and Institute of Parasitology, ASCR, České Budějovice (N-252).

Comments: The identification of specimens of the present material is mainly based on the male morphology, location in the host, and types of fish hosts.

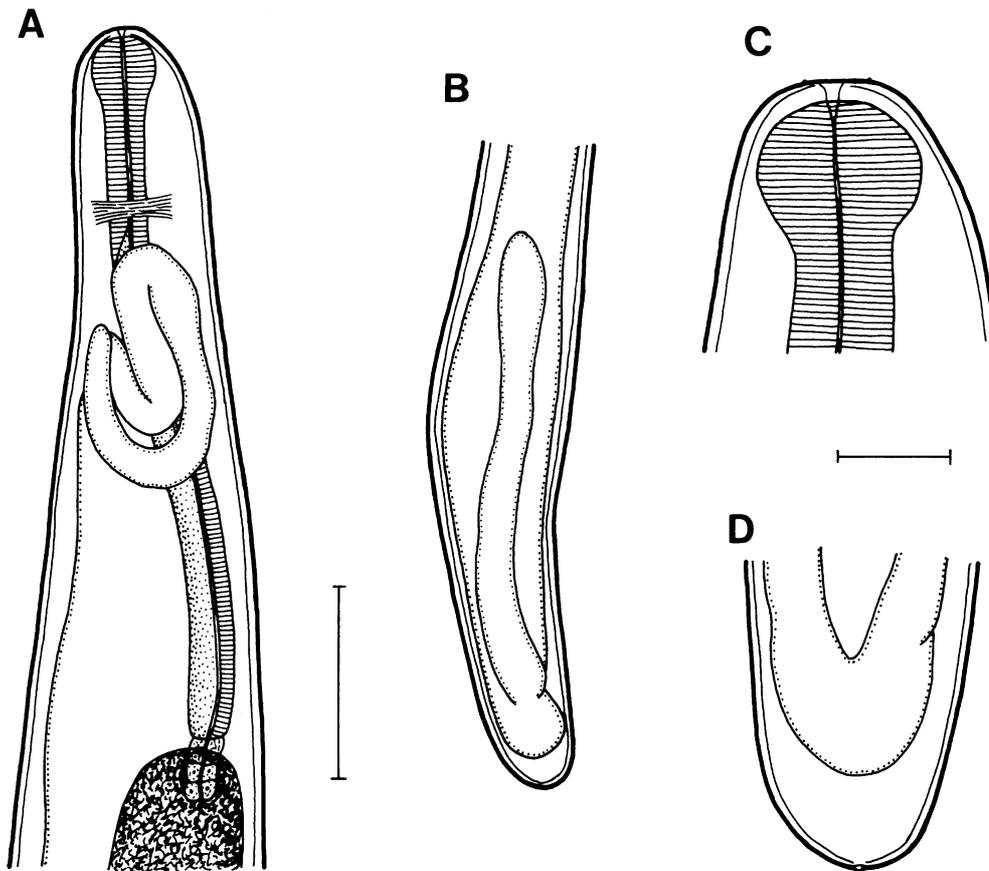


Fig. 4. *Philometra lateolabracis* (Yamaguti, 1935), non gravid female from *Epinephelus cyanopodus*. **A** – anterior part of body; **B** – posterior part of body; **C** – cephalic end; **D** – caudal end. Scale bars: A, B = 200 μm ; C, D = 50 μm

Philometra lateolabracis was originally described from Japan by Yamaguti (1935) from females found in the gonads of three marine perciform fishes belonging to different families: *Lateolabrax japonicus* (Cuvier) (Percichthyidae), *Parapristipoma trilineatum* (Thunberg) (Haemulidae) and *Epinephelus akaara* (Temminck et Schlegel) (Serranidae). Later it was reported from more than 20 other fish species of the perciform families Carangidae, Centropomidae, Glaucosomidae, Haemulidae, Lutjanidae, Mullidae, Polynemidae, Serranidae, Sciaenidae and Sparidae, but also Paralichthyidae and Psettodontidae (both Pleuronectiformes), mainly from tropical and subtropical regions of the Pacific, Indian and Atlantic Oceans (Moravec 2006). However, because the male of *P. lateolabracis* has not yet been described from the type host in Japan and almost all subsequent records are based on females, it cannot be excluded that, in fact, *P. lateolabracis* includes more than one species (Moravec *et al.* 1998).

The male of *P. lateolabracis* was first inadequately described from a single specimen found in the grunt, *Haemulon plumieri* (Lacépède) (Haemulidae), from the Atlantic Ocean near the coast of Brazil by Crisp and Klein (1973). Later

Moravec and Genc (2004) described the male of this species from six specimens found in *Mycteroperca rubra* (Bloch) (Serranidae) from the Mediterranean Sea near Turkey and Merella *et al.* (2004) reported a single male of *P. lateolabracis* from *Epinephelus marginatus* (Lowe) (Serranidae) in the Mediterranean Sea near Spain. However, later Merella *et al.* (2005) used the same male specimen [possessing slightly longer spicules (about 260 μm) as compared to those from *H. plumieri* and *M. rubra* (at most 189 μm)] for a re-establishment of the species *Philometra jordanoi* (López-Neyra, 1951), which had previously been synonymized with *P. lateolabracis* by Moravec *et al.* (2003). But the reasons (somewhat longer spicules, slight difference in the position of the nerve ring in female) used for considering *P. jordanoi* a separate species seem to be insufficient, which is also suggested by the present findings (spicules of the male from *E. cyanopodus* were 213 μm long); therefore, *P. jordanoi* should be considered a junior synonym of *P. lateolabracis*. Apparently, there is a certain intraspecific variability in the spicule lengths in these nematodes associated with the nematode body length and the degree of sclerotization of their spicules. In the pres-

ent material, proximal ends of spicules were poorly sclerotized in specimens from *E. fasciatus*, but well sclerotized in that from *E. cyanopodus*.

Philometra lateolabracis is a widespread species. It was reported from the Inland Sea and off the Pacific coast in Japan (Yamaguti 1935), the Arabian Sea and off the coast of Pakistan (Karachi) and India (Malabar) (Rasheed 1963, 1965), off the Philippines (Palawan) (Schmidt and Kuntz 1969), Bermuda (Rees 1970) and Cuba (Martínez and Ventosa 1982), off the Atlantic coast of Brazil (Crisp and Klein 1973), off the coast of Oman, North Vietnam and Gulf of Siam (Parukhin 1976, 1989), off the coast of Somalia (Moravec *et al.* 1988) and from the Mediterranean Sea (off the Balearic Islands, Spain, Morocco, Iskenderun Bay), Tyrrhenian Sea (off Sicily, Italy) and south-eastern Adriatic Sea (Croatia) (Moravec *et al.* 2003; Moravec and Genc 2004; Merella *et al.* 2004, 2005), from the Indian Ocean near West Australia (Hesp *et al.* 2002) and the Pacific Ocean near New Zealand (Hine and Anderson 1982; Sharples and Evans 1995a, b). The present finding of *P. lateolabracis* represents the first record of this parasite from the region of New Caledonia and *E. fasciatus* and *E. cyanopodus* are new hosts. Males of *P. lateolabracis* are described for the first time from fishes of the Pacific region.

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