Description of *Ichthyascaris grandis* sp. n., redescription of *Raphidascaroides halieutaeae* Yin, 1983 and new records of some other raphidascaridid and philometrid nematodes from marine fishes off Java, Indonesia

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Abstract: Examinations of nematodes collected from some marine fishes off the southwestern coast of Java, Indonesia in 2000 and 2001 revealed the presence of the following six species: ascaridoids *Ichthyascaris grandis* sp. n. from the intestine of *Lophiomus setigerus* (Vahl), *I. cf. longispicula* Li, Liu, Liu et Zhang, 2012 from the intestine of *Conger cinereus* Rüppel, *Ichthyascaris* sp. from the body cavity of *Lobotes surinamensis* (Bloch), and *Raphidascaroides halieutaeae* Yin, 1983 from the intestine of *Haliuetaea stellata* (Vahl), and philometrids *Philometra ivaschkini* Parukhin, 1976 from the stomach wall of *Trichiura leptura* Linnaeus and *P. seteoditis* Moravec, Walter et Yuniar, 2012 from the body cavity (liver) of *Psettodes erumei* (Bloch et Schneider). Descriptions of these nematodes based on light and scanning electron microscopical studies are provided. The new species *I. grandis* sp. n. is mainly characterised by large body measurements (males and females up to 41.8 mm and 73.6 mm long, respectively), the length of spicules (0.99–1.05 mm), the tail tip usually without rudimentary spines and by the presence of 44–53 pairs of caudal papillae, eight to twelve of which being postanal. In addition to new data on the morphology of *R. halieutaeae* and other nematodes recorded, the 11 species of *Raphidascaroides* Yamaguti, 1941 poorly described from marine fishes in South Asia and reviewed in the monograph of Sood (2017) are considered species *inquitendae* and *incerta sedis*.

Keywords: Parasitic nematode, *Philometra*, taxonomy, teleost fish, Indian Ocean.
Moravec et al.: *Ichthyascaris grandis* sp. n. from fishes in Indonesia

... contributed to this problem, the results of their work were not univocal and representatives of some ascaridoid genera remained unexamined by molecular methods. An overall molecular phylogeny of ascaridoids was presented by Li et al. (2018). Many present authors accept Raphidascarididae as a family and this is also followed here, as well as the validity of the genus *Ichthyascaris* shown in the papers of Li et al. (2018) and Malta et al. (2018, 2020).

The genus *Philometra* Costa, 1845 belongs to the dracunculoid family Philometridae Baylis et Daubney, 1926, as defined by Moravec (2006) and confirmed by molecular phylogenetic studies of Černotíková et al. (2011) and Sokolov et al. (2020). However, as stated by Barton et al. (2022), more sequences are still needed to establish the extent of the relationships between the various genera and species of philometrids.

**Fig. 1.** *Ichthyascaris grandis* sp. n. ex *Lophiomus setigerus* (Vahl). A – anterior end of male, lateral view; B – cephalic end of female, lateral view; C – posterior end of male, lateral view; D – tail tip of female; E – egg; F – posterior end of male (lower magnification), lateral view; G – tail of male, ventral view; H – tail of female, lateral view; I – tail tip of male.

**MATERIALS AND METHODS**

The fishes examined were caught by artisanal fishermen and obtained from local fish dealers in Pelabuhan Ratu, southern coast of Java, Indonesia (-6.9833, 106.5333) in the period from March 2000 to April 2002. The bought fresh fish specimens were immediately transported on ice to the nearby marine biological station of the Bogor Agricultural University. Fishes were examined mainly for the presence of trypanorhynch cestodes, acanthocephalans and parasitic crustaceans, but some nematodes and specimens of other parasite groups were also collected beside, however, without quantitative data.

The nematodes recovered were washed in physiological saline and then fixed in cold 70% ethanol. For light microscopical examination (LM), they were cleared with glycerine. Drawings were made with the aid of a Zeiss microscope drawing attachment. Specimens used for scanning electron microscopical ex-
amination (SEM) were postfixed in 1% osmium tetroxide (in phosphate buffer), dehydrated through a graded acetone series, critical-point-dried and sputter-coated with gold; they were examined using a JEOL JSM-7401F scanning electron microscope at an accelerating voltage of 4 kV, GB low mode. All measurements in species descriptions are in micrometres unless otherwise indicated. The fish nomenclature follows FishBase (Froese and Pauly 2021).

RESULTS

Family Raphidascarididae Hartwich, 1954

**Ichthyascaris grandis** sp. n.  
Figs. 1–3

ZooBank number for species: urn:lsid:zoobank.org:act:BB77722D-DC61-4E1D-A538-C256C9D2D499

Description: Larger nematodes with transversely striated cuticle (Figs. 2A–E, 3A–G). Lips approximately equal in size, without lateral membranous flanges; pulp with 2 moderately developed anterior lobes, each with terminal pocket-like depression. Dorsal lip bears 2 subdorsal double papillae (Fig. 2A,D); each ventrolateral lip with 1 double subventral papilla, 1 small single papilla and amphid situated laterally (Fig. 2B,E). Interlabia absent. Narrow lateral alae extend along whole body length, united anteriorly close to ventrolateral lips on 1 side of body (Figs. 1A,B, 2B,C,F). Oesophagus short; posterior half markedly broad (Fig. 1A). Ventriculus transversely oval; ventricular appendix relatively short (Fig. 1A). Excretory pore posterior to level of nerve ring (Fig. 1A). Tail of both sexes conical.

**Male** (3 specimens; measurements of holotype in parentheses. Measurements of 1 juvenile specimen in brackets): Length of body 23.23–41.77 (33.73) [13.26] mm, maximum width 1.09–1.47 (1.29) [0.48] mm. Lips 95–136 (109) [68] long. Length of oesophagus 1.88–3.67 (2.29) [1.17] mm, representing 7–8% (7%) [9%] of body length, maximum width 299–558 (394) [150]. Nerve ring and excretory pore 517–748 (571) [313] and 707–1,020 (993) [476], respectively, from anterior extremity. Ventriculus 163–272 (190) [95] long and 204–435 (313) [136] wide; ventricular appendix 558–884 (884) [381] long, 122–272 (272) [82] in maximum width. Posterior end curved ventrally. Spicules equal, alate, pointed, 933–1,047 (1,006) [476] long, representing 2.4–4.3% (3.0%) [3.6%] of body length (Fig. 1C,F). Total of 44–53 pairs of subventral papillae present, 30–43 being preanal, 2 adanal and 8–12 postanal; postanal papillae of third pair from posterior extremity doubled (Figs. 1C,D,G, 3A–D,G,H). Anterior cloacal lip with poorly developed unpaired median papilla (Figs. 1G, 3B,C). Pair of small lateral phasmids present, located anterior to tail tip (Figs. 1C,F, 2B). Tail conical, pointed, 204–245 (204) [177] long, its tip with numerous minute cuticular outgrowths (Figs. 1C,F,G,I, 3A–D,F).

**Female** (5 gravid specimens; measurements of allotype in parentheses. Measurements of 2 juvenile specimens in brackets): Length of body 41.00–73.63 (51.75) [15.42–19.48] mm, maximum width 1.33–2.24 (1.33) [0.61–0.72] mm. Lips 95–204 (163) [68–82] long. Length of oesophagus 2.87–5.51 (3.47) [1.36–1.56] mm, representing 7–8% (7%) [8–9%] of body length, maximum width 462–870 (653) [204–258]. Nerve ring and excretory pore 585–1,020 (680) [326–340] and 1.25–2.43 (1.36) [0.54–0.75] mm, respectively, from anterior extremity. Ventriculus 231–381 (299) [122] long and 408–680 (585) [150–163] wide; ventricular appendix 830–1,727 (979) [585–612] long, maximum width 177–272 (204) [95–205]. Vulva situated in anterior region of body, 5.07–8.16 (6.60) [3.06–3.70] mm from anterior extremity, at 11–13% (13%) [19–20%] of body length; vagina directed posteriorly from vulva. Uterus forms coils in region posterior to vagina, extending posteriorly to level of rectum. Eggs numerous, almost rounded, thin-walled, with uncleaved contents (Fig. 1E); diameter of eggs 54–68. Tail 857–1,714 (857) [408–435] long; its tip rounded, covered with numerous minute cuticular outgrowths (Figs. 1D,H, 2F, 3E).

Type host: *Lophiomus setigerus* (Vahl) (Lophiidae, Lophiiformes), blackmouth angler; TL of one specimen 47 cm, 1880 g.

Site of infection: Intestine.

Type locality: Indian Ocean off Pelabuhan Ratu, south coast of western Java, Indonesia (collected 30 September 2000 and 17 March 2001).

Specimens examined: 35 nematodes from 3 hosts; intensity 1–23 (mean 12) parasites per fish.

Deposition of type specimens: Holotype and allotype (MZBNA 846) and 28 paratypes (MZBNA 847) in the Museum Zoologicum Bogoriense, Bogor, Indonesia. Two paratypes (IPCAS N-1262) in the Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, Czech Republic.

Etymology: The species name *grandis* (= large) is the Latin adjective relating to the body size of this nematode parasite.

Remarks. The genus *Ichthyascaris* Wu, 1949 was established to accommodate the newly described species *I. lophii* Wu, 1949 based on specimens collected from *Lophius litulon* (Jordan) in Shanghai, China (Wu 1949). Later *Ichthyascaris* was synonymised with *Raphidascaris* Railliet et Henry, 1915 by Hartwich (1957), whereas *I. lophii* was considered a species inquirenda by Smith (1984). Bruce (1990) and Bruce et al. (1994) re-established *Ichthyascaris* as an independent genus mainly on the basis of simple lips without lateral membranous flanges and the presence of lateral alae which unite to the ventrolateral lips. However, Moravec and Nagasawa (2002) redescribed the Japanese species *Raphidascaris gigi* Fujita, 1928, transferred to *Ichthyascaris* by Bruce (1990), and found that, while the lips were typical of *Ichthyascaris*, the lateral alae were lacking. Therefore, Moravec and Nagasawa (2002) considered *Ichthyascaris*, characterised principally by the presence of lateral alae united anteriorly, as a subgenus of *Raphidascaris*.

Subsequently, *Ichthyascaris* was treated as a subgenus of *Raphidascaris* (see Yooyen et al. 2011, Li et al. 2012, Moravec and Justine 2012, 2020, Moravec et al. 2021) or as a junior synonym of *Raphidascaris* (Peng et al. 2011, Li et al. 2016a,b, Chen et al. 2018). However, recent molecular studies of Li et al. (2018) and Malta et al. (2018, 2020) showed species of *Ichthyascaris* to be monophyletic and,
consequently, they considered *Ichthyascaris* a valid genus. This is followed here.

According to Moravec et al. (2021), *Ichthyascaris*, as diagnosed by Moravec and Nagasawa (2002) and Malta et al. (2020), includes the following 17 nominal species, all intestinal parasites of marine fishes: *I. arii* Yooyen, Moravec et Wongsawad, 2011, *I. chirocentri* (Yamaguti, 1935), *I. elopsis* Moravec et Justine, 2020, *I. etelidis*

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**Fig. 2.** *Ichthyascaris grandis* sp. n. ex *Lophiomus setigerus* (Vahl), scanning electron micrographs of female. **A, B** – cephalic end, subdorsal and sublateral views, respectively (arrow indicates ventral connection of lateral alae); **C** – cephalic end, apical view (arrow indicates ventral connection of lateral alae); **D** – dorsal lip; **E** – subventral lip; **F** – tail, lateral view (arrow indicates lateral ala). **Abbreviations:** a – amphid; d – double labial papilla; s – single labial papilla.
Fig. 3. *Ichthyascaris grandis* sp. n. ex *Lophiomus setigerus* (Vahl), scanning electron micrographs. A – posterior end of male, ventrolateral view; B, C – tail of male, sublateral and ventral views, respectively; D – tail of male, lateral view (another specimen); E – tail tip of female, lateral view; F – tail tip of male, apical view; G – three papillae of anteriormost pairs of preanal papillae; H – double postanal papilla (at middle) and two neighbouring single postanal papillae. *Abbreviation*: e – cloaca.
The parasite of Uroconger lepturus (Richardson) (Congridae) off China (Li et al. 2012), by the conspicuously larger body (body length of males and gravid females 23.23–41.77 mm and 41.00–73.63 mm, respectively, vs 9.80–13.50 and 14.20–15.80 mm) but, on the contrary, somewhat shorter spicules (see above) representing 2.4–4.3% vs 9.3–10.3% of the entire body length. In contrast to R. longispicula, the pairs of caudal papillae of I. grandis sp. n. are more numerous (44–53 vs 32–38) and their distribution is different (30–43 preanal, 2 anal and 8–12 postanal pairs vs 25–28 preanal, 1–2 anal and 6–8 postanal pairs); the postanal papillae of the third pair from the posterior extremity are doubled in the new species, whereas no doubled papillae are reported for I. longispicula. Both species also differ in the location of the vulva of gravid females (at 11–13% of body length in R. grandis vs at 17–27% in R. longispicula) and in the size of eggs (diameter of eggs in R. grandis 54–68 µm vs size of eggs in R. longispicula 39.49–49 µm). Moreover, the hosts of these two species belong to different fish families and orders (Lophiidae, Lophiiformes vs Congridae, Anguilliformes) and their geographical distribution is also different (East Indian Ocean vs South China Sea).

**Ichthyascaris cf. longispicula Li, Liu, Liu et Zhang, 2012**

*Fig. 4, 5*

**Description of female** (2 gravid specimens): Length of body 25.39–28.79 mm, maximum width 843–952. Narrow lateral alae extend along body length, united anteriorly close to ventrolateral lips on 1 side of body (Figs. 4A–C, 5A–C). Narrow lateral alae extend along whole body length, united anteriorly close to ventrolateral lips on 1 side of body (Figs. 1A,B, 2B,C,F). Lips 95 long. Length of oesophagus 2.18–2.33 mm, representing 8–9% of body length, maximum width 340. Nerve ring and excretory pore 476–490 and 748–816, respectively, from anterior extremity. Ventriculus 136–177 long and 272–286 wide; ventricular appendix 816–1,088 long, maximum width 204–218 (Fig. 1A). Vulva situated in anterior region of body, 4.26–4.90 mm from anterior extremity, at 17% of body length; vagina directed posteriorly from vulva. Uterus forms coils in region posterior to vagina, extending posteriorly to level of rectum. Eggs numerous, almost rounded, thin-walled, with uncleaned contents (Fig. 4D); diameter of eggs 60–68. Tail 449–585 long; its tip rounded, covered with numerous minute cuticular outgrowths (Figs. 4C, 5B–D).

**Host:** Conger cinereus Rüppel (Congridae, Anguilliformes), longfin African conger; TL 76 cm, 1060 g.

**Site of infection:** Intestine.

**Locality:** Indian Ocean off Pelabuhan Ratu, south coast of western Java, Indonesia (collected 13 November 2001).

**Specimens examined:** 2 nematodes from 1 host.

**Deposition of voucher specimens:** Two specimens (MZBNa 848) in the Museum Zoologicum Bogoriense, Bogor, Indonesia.
Remarks. In having no males at disposal and considering a certain degree of host specificity of Ichthyascaris spp. at the level of fish families (Moravec and Justine 2020), the present female nematodes from C. cinereus are tentatively assigned to R. longispicula, the only known representative of this subgenus parasitising congrid fishes (Li et al. 2012). The female morphology of both these forms seems to be identical. The specimens of the present material are somewhat larger than those reported by Li et al. (2012), but this may be associated either with the age of these nematodes or a different host species. Further studies are necessary to confirm this identification.

Ichthyascaris sp.

Description of male (1 specimen): Length of body 42.54 mm, maximum width 1.06 mm. Lips 95 long (Fig. 6A). Length of oesophagus 3.20 mm, representing 8% of body length, maximum width 490. Nerve ring and excretory pore 680 and 1,292, respectively, from anterior extremity. Ventriculus 204 long and 435 wide; ventricular appendix 748 long, 163 in maximum width. Posterior end curved ventrally. Spicules equal, alate, pointed, 1,020 long, representing 2.4% of body length. Total of 51 pairs of subventral papillae present, 38 being preanal, 2 adanal and 12 postanal; papillae of third postanal pair situated more laterally than those of other postanal pairs; postanal papillae of third pair from posterior extremity doubled (Fig. 6B–F). Anterior cloacal lip with poorly developed unpaired median papilla. Pair of small lateral phasmids present, located anterior to tail tip (Fig. 6D). Tail conical, pointed, 218 long, its tip with numerous minute cuticular outgrowths (Fig. 6B–F).

Host: Lobotes surinamensis (Bloch) (Lobotidae, Acanthuriiformes), tripletail.
Site of infection: Body cavity (?).
Locality: Indian Ocean off Pelabuhan Ratu, south coast of western Java, Indonesia (collected 1 October 2000).
Specimens examined: 1 nematode from 1 host.
Deposition of voucher specimen: Not deposited, used for SEM.

Remarks. The general morphology and measurements of the only available male specimen were similar to those of I. grandis sp. n., but the arrangement of postanal papil-
lae was somewhat different (papillae of the third postanal pair situated more laterally than those of other postanal pairs). Considering a certain degree of host specificity in species of *Ichthyascaris* (see above) and the fact that it is the first record of a nematode belonging to this subgenus from Acanthuriformes, the present specimen may well represent an undescribed species. However, since only a single specimen was at our disposal, we refrain from describing it as a new species.
Raphidascaroides halieutaeae Yin, 1983

Description: Large-sized, brownish nematodes with finely transversely striated cuticle (Fig. 9A,C). Oesophageal part of body narrow, elongate. Lips of approximately equal size, elongate, with membranous flanges, these being broadest at mid-length of lips; pulp with 2 anterior lobes, anterior edges of which without dentigerous ridges (Figs. 7A,B, 8A–D). Dorsal lip bearing 2 subdorsal double papillae near anterior end of pulp (Figs. 7A, 8A,D), each subventral lip with 1 double subventral papilla and small simple papilla and amphid situated laterally (Fig. 8C,D). Interlabia well developed (Figs. 7A,B, 8A–D). Cervical alae absent. Oesophagus markedly long and narrow; ventriculus globular, ventricular appendix relatively short.

Fig. 7. Raphidascaroides halieutaeae Yin, 1983 ex Halieutaea stellata (Vahl). A – cephalic end of female, dorsal view; B – cephalic end of male, lateral view; C – anterior end of male, lateral view; D – female tail, lateral view; E – posterior end of male, lateral view; F – male tail, lateral view; G – tail tip of female.
Fig. 8. *Raphidascaroides halieutaeae* Yin, 1983 ex *Halieutaea stellata* (Vahl), scanning electron micrographs of male. **A, B** – cephalic end, dorsal and sublateral views, respectively; **C** – subventral lip; **D** – cephalic end, apical view; **E, F** – tail, lateral and ventral views, respectively (arrow indicates median papilla anterior to cloaca); **G** – region of cloaca (arrow indicates median papilla anterior to cloaca). *Abbreviations:* a – amphid; b – subventral lip; d – double labial papilla; e – cloaca; i – interlabium; s – single labial papilla; v – dorsal lip.
(Fig. 7C). Nerve ring encircling oesophagus approximately at border of first and second fourteenths of its length; excretory pore at level of nerve ring or slightly posterior to it (Fig. 7C). Tail of both sexes conical, ending in small smooth process.

**Male** (4 specimens): Length of body 40.39–53.24 mm, maximum width 1.22–1.36 mm. Lips 231–272 long, length of interlabia 95–122. Length of oesophagus 6.23–8.43 mm, representing 15–20% of body length, maximum width 299–462. Nerve ring and excretory pore 721–816 and 748–843, respectively, from anterior extremity. Venticulus 190–218 long and 218–272 wide, length of ventricular appendix 720–734, its width 68. Posterior end of body ventrally curved. Spicules equal, alate, 2.45–2.92 mm long, representing 5–7% of body length (Fig. 7E). Total of 27–29 pairs of papillae present, 20–22 being preanal and 6 postanal; papillae of 9–10 most posterior preanal pairs and postanal pairs very small; of 6 pairs of postanals, 4 anterior pairs subventral, 1 pair lateral and 1 pair subdorsal; posteriormost 2 pairs approximately at same level (Figs. 7E,F, 8E,F, 9A–D). In addition, 1 unpaired, median papilla present on anterior cloacal lip (Figs. 7F, 8F,G). Tail 204–218 long (Figs. 7F, 8E,F, 9C), with smooth tail tip (Fig. 9E).

**Female** (3 gravid specimens): Length of body 47.93–62.74 mm, maximum width 1.31–1.95 mm. Lips 231–313 long, length of interlabia 95–136. Length of oesophagus 6.94–7.32 mm, representing 11–15% of body length, maximum width 313–476. Nerve ring and excretory pore 748–952 and 748–952, respectively, from anterior extremity. Vetriculus 163–204 long and 231–313 wide, length of ventricular appendix 408–462, width 122–136. Vulva situated at anterior part of body, 14.09–16.86 mm from anterior extremity (at 25–33% of body length); vagina directed posteriorly from vulva. Eggs non-embryonated, almost rounded, thin-walled, size 60–68 × 40–48. Tail 435–476 long, with smooth tail tip (Fig. 7D,G).

**Host:** *Halieutaea stellata* (Vahl) (Ogcocephalidae, Lophii-formes), minipizza batfish; TL 16 cm.

**Site of infection:** Intestine.

**Locality:** Indian Ocean off Pelabuhan Ratu, south coast of western Java, Indonesia (collected 17 February 2001).

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**Fig. 9.** *Raphidascaroides halieutaeae* Yin, 1983 ex *Halieutaea stellata* (Vahl), scanning electron micrographs of male. **A** – posterior end, ventrolateral view; **B** – precloacal region of body, lateral view; **C** – tail, ventrolateral view; **D** – posterior end of body, lateral view; **E** – tail tip, apical view. *Abbreviation:* e – cloaca.
Specimens examined: 9 nematodes from 1 host.

Deposition of voucher specimens: Seven specimens (MZ-BNa 849) in the Museum Zoologicum Bogoriense, Bogor, Indonesia. Two specimens (IPCAS N-1263) in the Institute of Parasitology, Biology Centre, Czech Academy of Sciences, Česká Budějovice, Czech Republic.

Remarks. *Raphidascaroides halieutaeae* was inadequately described, based on LM, by Yin (1983) from *H. stellata* in Hainan Island, China (South China Sea) (see also Peng et al. 2011). Later Sheenko (1992) synonymised *R. halieutaeae* Yin, 1983 with *Raphidascaroides nipponensis* Yamaguti, 1941, considering *Raphidascaroides* Yamaguti, 1941 to be a junior synonym of *Raphidascaris* Railliet et Henry, 1915. However, the synonymisation of *Raphidascaroides* with *Raphidascaris* proposed by Sheenko (1992) has not been accepted by subsequent authors (e.g., Bruce et al. 1994, Moravec and Nagasawa 2000, Gibbons 2010, Pereira et al. 2015, Li et al. 2018), because members of these two genera distinctly differ morphologically (e.g., presence/absence of interlabia).

Nevertheless, Moravec and Nagasawa (2000) identified their nematodes collected from the stomach of *H. stellata* in the East China Sea off Japan as *R. nipponensis*. However, considering that the morphology of *R. nipponensis* is insufficiently known, the type specimens cannot be now re-studied because of their poor condition (Moravec and Nagasawa 2000) and *Ateleopus japonicus* Bleeker, the type host of *R. nipponensis*, belongs to a different fish family and order (*Ateleopodidae*, *Ateleopodiformes*) than *H. stellata* (*Ogcocephalidae*, *Lophiiformes*), it indicates that the Japanese nematodes from the latter host were probably misidentified. Their much greater body measurements (body length of male and gravid female 32–68 mm and 68–73 mm, respectively, vs 21–32 mm and 40–43 mm) suggest that these might belong to *R. halieutaeae* described from the same host species in China.

Later, Li et al. (2016a) collected many adults and fourth-stage larvae of *Raphidascaroides* from *H. stellata* in the East and South China Sea off China. Based on LM and SEM examination, the authors again identified their nematodes as *R. nipponensis*, mentioning that some of the specimens were very large (over 100 mm long); they also provided their genetical characterisation. These specimens from *H. stellata* were again reported as *R. nipponensis* by Li et al. (2016b) in their catalogue of the ascaridoids in China. They also listed *R. halieutaeae* as a valid species, mentioning that it probably represents a synonym of *R. nipponensis*.

However, from the reasons mentioned above, it is reasonable to consider *R. halieutaeae* a valid species, until *R. nipponensis* is redescribed from specimens newly collected from the type host species (*A. japonicus*) to confirm or deny such synonymy. Consequently, the present specimens, as well as those reported by Moravec and Nagasawa (2000) and Li et al. (2016a) as *R. nipponensis* from *H. stellata* in Japan and China, respectively, should be identified as *R. halieutaeae*.

Moravec and Nagasawa (2000) considered *R. nipponensis* and *R. nipponensis lophii* Yamaguti, 1941 to be conspecific, even though the type hosts of both these forms belong to different fish orders (*Ateleopodiformes* vs *Lophiiformes*). However, since there are, in addition to a certain degree of presumed host specificity, morphometrical differences between the former and the latter forms, e.g., in the number of pairs of caudal papillae (27–28 vs 23–25) or in the ratio of vulva dividing the body length (1 : 1.75–1.85 vs 1 : 2.2), we consider it reasonable to elevate the latter subspecies to a separate species *R. lophii* Yamaguti, 1941, in disagreement to Moravec and Nagasawa (2000).

The present specimens from *H. stellata* have similar body measurements as those studied by Yin (1983) and Moravec and Nagasawa (2000), which are typical of *R. halieutaeae* but different from those in the smaller-sized *R. nipponensis* (see above). However, it is necessary to remark that the original description of *R. halieutaeae* is very brief and incomplete and some of the provided data are evidently unreliable. For example, this concerns the spicules, which are described in the absence of interlabia.

Yin (1983) illustrated the spicules of *R. halieutaeae* as partly extruded from the body, but, apparently, only their incomplete portions inside the body were observed. This is suggested by the fact that the spicules of the present specimens and those reported by Moravec and Nagasawa (2000) were much longer than those given by Yin (1983) in the male with a similar body length (64 mm). Also the spicules of *Raphidascaroides* specimens that were reported by Li et al. (2016a) as *R. nipponensis* from *H. stellata*, now considered to be *R. halieutaeae*, were much longer (and of a similar length) than those given for *R. halieutaeae* by Yin (1983).

According to Yin (1983), the male of *R. halieutaeae* possesses a total of 37 pairs of small caudal papillae, of which 27 are preanals, 2 adanals and 8 postanals. However, it is necessary to note that caudal papillae in this species are hardly visible by LM and the only reliable method how to study these papillae is the use of SEM. Therefore, the numbers and arrangement of caudal papillae reported, based solely on LM, by Yin (1983) and Moravec and Nagasawa (2000) could not be exact. The present SEM examination of *R. halieutaeae* shows that there are 20–22 pairs of preanal and 6 pairs of postanal papillae in this species, the dorsolateral pair of postanals probably representing the phasmids. The presence of an unpaired, median preanals papilla on the anterior cloacal lip (Fig. 8G) of this species is reported for the first time. A similar median preanal papilla was observed in the congeneric species *A. africanus* Khalil et Oyetayo, 1988, *A. brasiliensis* Moravec et Thatcher, 1997, *R. diodonis* (Thwaite, 1927) Olsen, 1952 and *R. moraveci* Pereira, Tavares, Scholz et Luque, 2015 (see Thwaite 1927, Khalil and Oyetayo 1988, Moravec and Thatcher 1997, Pereira et al. 2015), as well as in the males reported as *R. nipponensis* (= *R. halieutaeae*) by Li et al. (2016a).
Moravec and Nagarawa (2000) reported the presence of fine rudimentary spines on the terminal caudal process of these nematodes studied by LM, but the recent re-examination of four specimens deposited in the Helminthological Collection of the Institute of Parasitology, BC CAS (N-734) did not confirm any spines on their caudal process. Rudimentary spines are neither reported nor illustrated in the original description of R. halieutaeae by Yin (1983), whereas a few minute spines are visible on the tail tip of specimens studied by SEM by Li et al. (2016a).

At present, the genus Raphidascaroides Yamaguti, 1941 includes the following nine valid species, three of them, R. bishaii Khalil, 1969, R. brasiliensis and R. moraveci, being parasites of freshwater fishes in Africa and South America, and six species, R. africanus, R. chilomycteri Yamaguti, 1961, R. diodonis, R. halieutaeae, R. lophi and R. nipponensis, are known as parasites of marine fishes in Africa and Asia.

An additional 11 species of Raphidascaroides were reported from marine fishes in South Asia (see Sood 2017): R. armatusi Gupta et Srivastava, 1985, R. bengalii Lakhsmi, 1995, R. blochii Bilqees et Khanum, 1974, R. elongatus Bilqees, Shaukat, Medi Naqvi et Muti-ur-Rehman, 2005, R. guttatus Lakshmi et Lakhsmi, 1994, R. indicus Lakhsmi, 1994, R. jagganathi Gupta et Srivastava, 1984, R. olsoni Garg, 1886, R. siddiqui Gupta et Masoodi, 1987, R. trachinocephalus Lakhsmi, Rao et Shyamasundari, 1985 and R. zygaenai Lakhsmi, 1995. However, all of them were poorly described and, in the fact, their generic allocation is doubtful. Consequently, all these should be considered as species inquirendae and incertae sedis; seven of them were previously designated as species inquirendae by Moravec and Thatcher (1997).

Besides R. halieutaeae, the only other congeneric species parasitising lophiiform fishes is R. lophi described from Lophius litulon (Jordan) off Japan (Yamaguti 1941). It differs from R. halieutaeae in the situation of vulva at 45% (vs 25–33%) of the body length and in usually much smaller body lengths (males 30–37 mm, female 45 mm vs males 32–69 mm, females 48–73.5 mm); in addition, there are numerous rudimentary spines on the tail tip (vs tail tip smooth or with very few spines). Moreover, their hosts belong to different fish families (Lophiidae vs Ogocephalidae).

The present finding of R. halieutaeae in Indonesian waters represents a new geographical record of this parasite, extending considerably the known distribution area of R. halieutaeae.

Family Philometridae Baylis et Daubney, 1926

Subfamily Philometrinae Baylis et Daubney, 1926

Philometra ivaschkini Parukhin, 1976

Description of sub gravid female (2 ovigerous specimens): Body of fixed specimens filiform, brownish, 6.07–8.43 mm long, maximum width 490; maximum width/body length ratio 1: 6–8. Cephalic end rounded, 163–177 wide. Cephalic papillae very small, indistinct in lateral view. Oral aperture circular, large, surrounded by 14 small cephalic papillae arranged in 2 circles; outer circles formed by 4 submedian pairs, inner circle by 4 single submedian and 2 lateral papillae (Figs. 10B, 11A,C,E,F). Three distinct forwardly protruding papilla-like oesophageal teeth present on anterior lobes of oesophagus, 1 dorsal and 2 lateral; dorsal tooth doubled in 1 specimen (Figs. 10B, 11A–F). Oesophagus 816–1,020 long including its anterior, bulbous inflation; anterior inflation 163–165 long and 141–163 wide; maximum width of posterior part of oesophagus including well-developed dorsal gland 122–163 (Fig. 10A). Nerve ring and oesophageal nucleus 218–231 and 585–680, respectively, from anterior extremity. Small ventriculus 27–30 long, 54–60 wide (Fig. 10A). Intestine narrow, straight, ending blindly; posterior end of intestine atrophied, forming ligament 272 long attached ventrally to body wall close to posterior extremity. Vulva and anus absent. Ovaries reflexed near body ends. Uterus filled with numerous spherical eggs 24–30 in diameter. Posterior end rounded, 95–109 wide, without caudal projections (Figs. 10C, 11G).

Male: Not known.

Host: Trichiurus lepturus Linnaeus (Trichiuridae, Scombriiformes), largehead hairtail; TL 54 cm, 125 g.

Site of infection: Stomach wall.

Locality: Indian Ocean off Pelabuhan Ratu, south coast of western Java, Indonesia (collected 31 March 2000).

Specimens examined: 2 nematodes from 1 host.

Deposition of voucher specimens: Two specimens
Fig. 11. Philometra ivaschkini Parukhin, 1976 ex Trichiurus lepturus, scanning electron micrographs of subgravid female. **A** – cephalic end, apical view; **B** – region of oral aperture, apical view (arrows indicate lateral papillae of inner circle); **C** – cephalic end, apical view (another specimen); **D** – region of oral aperture, apical view (another specimen); **E** – cephalic end, lateral view; **F** – cephalic end, lateral view (another specimen); **G** – posterior end of body, subapical view. **Abbreviations:** a – submedian cephalic papilla of inner circle; b – submedian pair of cephalic papillae of outer circle.

mounted on SEM stub (IPCAS N-1261) in the Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, Czech Republic.

Remarks. Philometra ivaschkini was inadequately described by Parukhin (1976) from gravid females found in the stomach wall of *T. lepturus* in the Gulf of Aden (coast of Oman, Masira Bay) and the Indian Ocean near the coast of southeastern Africa (Safala shallow waters) (see also Moravec 2006) and has not been reported since. The present nematode specimens from Indonesia show similar mor-
Fig. 12. Philometra psettoditis Moravec, Walter et Yuniar, 2012 ex Psettaserus erumei, gravid female. A – anterior end, lateral view; B – cephalic end, apical view; C – posterior end, lateral view; D – larva from uterus, lateral view; E – caudal end, lateral view.

Philometra psettoditis Moravec, Walter et Yuniar, 2012
Figs. 12, 13

Description of gravid female (1 larvigerous specimen): Body of fixed specimen filiform, yellowish, 27.50 mm long, maximum width 408; maximum width/body length ratio 1: 67. Cephalic end rounded, 136 wide. Cephalic papillae very small, indistinct in lateral view. Oral aperture circular, large, surrounded by 14 small cephalic papillae arranged in 2 circles; outer circle formed by 4 submedian pairs of papillae, inner circle includes 4 submedian and 2 lateral single papillae (Fig. 12B). Bottom of mouth formed by 3 anterior oesophageal lobes (Figs. 12B, 13A,B). Oesophagus 1.84 mm long including its anterior bulbous inflation, representing 7% of body length; anterior inflation 120 long and 114 wide; maximum width of posterior part of oesophagus including well-developed dorsal gland 136 (Fig. 12A). Nerve ring and oesophageal nucleus 367 and 1.17 mm, respectively, from anterior extremity. Small ventriculus 27 long, 54 wide (Fig. 12A). Intestine narrow, straight, ending blindly; posterior end of intestine atrophied, forming ligament 367 long attached to body wall close to posterior extremity (Fig. 12C). Vulva and anus absent. Ovaries reflexed near body ends. Uterus filled with numerous larvae extends anteriorly to level of nerve ring. Larvae 483–501 long and 15–18 wide; length of oesophagus 120–129 (25–26% of larval body length), of tail 105–123 (21–25% of larval body length) (Fig. 12D). Posterior end of female rounded, 122 wide, with 2 minute, hardly visible papilla-like caudal projections at tip (Fig. 12C,E).

Male: Not known.

Host: Psettaserus erumei (Bloch et Schneider) (Psettodidae, Pleuronectiformes), Indian halibut; TL 27 cm, 255 g.

Site of infection: Body cavity (liver).

Locality: Pelabuhan Ratu, Java, Indonesia (collected 3 June 2000).

Specimens examined: 1 nematode.

Deposition of voucher specimen: Not deposited, used for SEM.

Remarks. Philometra psettoditis was described by Moravec et al. (2012) from the musculature of P. erumei of the same locality in Java, Indonesia on the basis of only one available incomplete gravid female without caudal end and a body fragment of another female specimen. The present finding made possible the first description of the female caudal end of this species and extended considerably the range of body lengths of gravid females of P. psettoditis. Hosseini et al. (2013) reported Philometra sp. females from the intestine of P. erumei in the Persian Gulf off southeastern Iran; these might be conspecific with Ph. psettoditis.

differ from each other in the presence/absence of cuticular ornamentations in gravid females, the presence of three conspicuous oesophageal teeth in P. ivaschkini, which are absent in P. trichiuri, and in the site of infection in the host (stomach wall vs dorsal fin).
DISCUSSION

As indicated by recent findings of many new species of Ichthyascaris in a variety of marine fishes (e.g., Moravec and Justine 2020, Moravec et al. 2021), the nematodes of this genus, both adults and larvae, appear to be rather common parasites of teleosts in some regions. Of the 18 valid species of Ichthyascaris, only R. vicentei occurs in the West Atlantic Ocean, whereas 17 species are reported from the region of the West Pacific Ocean including adjacent seas (off Japan, China, Thailand, Philippines, Australia and New Caledonia). Ichthyascaris grandis sp. n. is the first species of this genus recorded from the Indian Ocean. However, this is not surprising, because some fish hosts of these nematodes are known to have Indo-West Pacific distribution and the same probably concerns their parasites. Also another ascaridoid nematode reported in this paper, Raphidascaroides halieutaeae, originally described from H. stellata in the Pacific region (South China Sea near China) and later found in the same region (East China Sea off Japan) (see above) is now recorded from the same host species (H. stellata) in the Indian Ocean off Indonesia. Neither I. grandis nor R. halieutaeae were previously recorded from Indonesian waters. According to Theisen (2019), previous records of Raphidascaroides sp. from nemipterids and trichiurids in Indonesia probably concerned R. (I.) nemipteri (= I. nemipteri) and R. (I.) trichiuri (= I. trichiuri), respectively.

Philometrid nematodes (Philometridae) are usually pathogenic parasites occurring frequently in commercially important wild and cultured fish hosts (Moravec 2006). To date, 13 nominal species of philometrids belonging to the genera Digitiphilometroides Moravec et Barton, 2018 (1 species), Philometra Costa, 1845 (9 species), Philometroides Yamaguti, 1935 (2 species) and Spirophilometra Dewi et Palm, 2013 (1 species) have been found and documented as parasites of marine fishes in Indonesia (Jägerskiöld 1893, 1894, Rückert et al. 2010, Moravec et al. 2012, Dewi and Palm 2013, 2017). Moreover, Theisen (2019) provided presumed identifications of three additional species of Philometra, P. balistii (Rasheed, 1963), P. priacanthi Moravec et Justine, 2009 and P. sciaenae Yamaguti, 1941, previously reported from Indonesian fishes as Philometra sp. However, considering the usual high degree of host specificity of philometrids (e.g., Moravec et al. 2016) and, on the other hand, the fact that one fish species may be parasitised by more than one congeneric species of these parasites in the same locality (e.g., Moravec et al. 2010), these undocumented data need not be quite reliable.

The previous records of Philometroides sanguineus (Rudolphi, 1819) (reported as Philometra sanguinea) and Philometra lateolabracis (Yamaguti, 1935) in Indonesian marine fishes (Theisen 2009) were evidently based on misidentifications; whereas the former species (P. sanguineus) is a parasite of Palaeartic freshwater cyprinids (Carassius spp.), the latter (P. lateolabracis) is a specific parasite of Lateolabrax japonicus (Cuvier) (Lateolabracidae) (Quaison et al. 2008), the fish that does not occur in Indonesia. According to Theisen (2019), the specimens from Indonesia misidentified as P. lateolabracis should be designated as Philometra sp.

In spite of numerous nominal philometrid species recorded from marine fishes in Indonesian waters (see above), it is remarkable that the great majority (12 species) of them are the parasites of the host’s abdominal cavity, body musculature, fins, opercula or ocular orbits, whereas only three nominal species, Philometra nemipteri Luo, 2001, P. otothi Moravec et Manoharan, 2013 and P. sciaenae Yamaguti, 1941, and those designated as Philometra sp. from the gonads of four species of serranids and one species of stomatoids, are gonad-infecting parasites (Theisen 2019). Considering a high degree of host specificity in gonad-infecting species of Philometra parasitising serranids and some other marine fishes (see above), it is highly probable that the philometrids from gonads of the serranids Cephalopholis cyanostigma (Valenciennes), Epinephelus coeruleopunctatus (Bloch), E. ongus (Bloch), E. sexfasciatus (Valenciennes) and Variole louti (Forsskål) belong to new, hitherto undescribed species.

On the other hand, gonad-infecting species of Philometra are by far more common philometrid parasites of marine fishes in other regions (Moravec 2006, Moravec and de

![Fig. 13. Philometra psuetoditis Moravec, Walter et Yuniar, 2012 ex Psettodes erumei, scanning electron micrographs of gravid female. A – cephalic end, lateral view; B – cephalic end, apical view.](image)
Burton 2013) than those parasitising other organs in the host. Therefore, it can be expected that future studies will reveal the presence of many additional gonad-infecting philometrid species in marine fishes from off Indonesia. This is suggested by the recent records of unidentified philometrids, reported by Dewi and Palm (2017) as Philometridae gen. sp. *or Philometra sp.*, found in the gonads of *C. cyanostigma*, *E. coeruleopunctatus*, *V. louti* (all Serranidae) and *Sonorolox fluminis* Trewavas (Sciaenidae) bought in the fishmarket of Kedonganan, Bali, Indonesia (see also Theisen 2019).

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