First Record of Five Larval Nematode Species from Fishes of Iraq

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Abstract. Five larval nematode species belong to three different superfamilies, Ascaridoidea, Physalopteroidea and Gnathostomatoidea were recorded and described from five marine fishes from north-west Arabian Gulf near Khor Al-Ummiah and two freshwater fishes from Al-Huwazah marsh during the period from July 2004 until June 2006. *Terranova* sp. Type BA larva and *Terranova* sp. Type BB larva were recorded from three species of sharks, whitecheek shark *Carcharhinus dussumieri* (Müller *et* Henle, 1839); Spot-tail shark *C. sorrah* (Müller *et* Henle, 1839) and Milk Shark *Rhizoprionodon acutus* (Rüppell, 1837). Proleptinae gen. sp. BA larva from large scale tongue sole *Cynoglossus arel* (Bloch *et* Shneider, 1801); Proleptinae gen. sp. BB larva from Asian catfish *Silurus triostegus* Heckel, 1843 and stinging catfish *Heteropneustes fossilis* (Bloch, 1794). *Echinocephalus* sp. larva from *C. arel* and Arabian carpetshark *Chiloscyllium arabicum* Goubanov, 1980. All these parasites were recorded and described for the first time in Iraq.

Introduction

The nematodes show a very wide range of ecological adaptation. Most of them are free-living (occurring in fresh or brackish and sea waters and soil), other are semiparasitic and parasitic species attacking both animals and plants, from about 16,000 described species of nematodes, about 40% are animal parasites. Some 8% of the known parasitic nematodes occur in invertebrates (5).

Larvae belonging to Ascaridoidea are common parasites of freshwater and marine fishes serving as intermediate or paratenic hosts. The adult forms of these species parasitize various piscivorous vertebrates: predatory fish, fish-eaten birds and marine mammals (27). About 300 species belonging to four superfamilies (Gnathostomatoidea, Habronematoidea, Physalopteroidea and Thelazioidea) of the nematode suborder Spirurina are known as the adult parasites of freshwater, brackish-water and marine fishes (28).

Generally, studies on nematodes parasitized marine fishes in Arabian Gulf are few. Kardousha (24) found two species of nematodes as larval stages belong to genera *Anisakis* and *Hysterothylacium* from 20 fish species from United Arab Emirate coasts. El-Naffar *et al*. (18) during their survey on helminth parasites of many fishes in UAE coasts found three genera of nematodes belong to *Anisakis*, *Philometra* and *Pseudoterranova* from 35 fish species. González-Solís *et al*. (22) isolated *Hysterothylacium* sp. larva from *Scomberomorus guttatus* near Iranian waters. Petter and Sey (36) recorded 22 species of nematodes including nine species of *Hysterothylacium* at Kuwaiti waters. In Iraq Al-Daraji (1) recorded two species of

nematodes belong to genera *Contracaecum*, *Indocuculanus* from two species of marine fishes in Khor Al-Zubair north-west Arabian Gulf, Kardousha (25) recorded female of *Philometra lateolabracis* from ovaries of eight marine fish species from Arabian Gulf. Ali (2) recorded three nematodes belong to genera *Contracaecum*, *Anisakis* and *Philometra* from three fish species from Brackish water near Fao town and Shatt Al-Arab river near Abu Al-Khaseeb town. Bannai (7) recorded larvae of two species of nematode from seven marine fish species in Khor Abdullah. Awad *et al.* (6) recorded *Echinocephalus* sp. larva from two marine species in Khor Abdullah. Moravec and Ali (29) described two new species from nematode genus *Philometra* from three needlefish in marine water near Fao city. As few work concerned identification of nematodes of fishes in Iraq especially that from marine fishes, the following article was designed for this purpose.

Materials and Methods

Five species of marine fishes including 202 large scale tongue sole *Cynoglossus arel*, 11 Arabian carpetshark *Chiloscyllium arabicum*, four *Carcharhinus dussumieri*, two Spot-tail shark *C. sorrah* and two Milk Shark *Rhizoprionodon acutus* were collected from Khor Al-Ummiah north-west of the Arabian Gulf (29◦ 50' -30◦ 10' N and 48◦ 30'-48◦ 45') during the period from July 2004 to June 2006. Also two freshwater fishes including 19 Asian catfish *Silurus triostegus* and 16 stinging catfish *Heteropneustis fossilis* were collected from Um Alnaaj, Huwazah marsh (N 31° 38’ 30’’, E 47° 35’ 21’’), Meesan province during the period from July 2004 to June 2006.

Fishes were dissected longitudinally and nematodes were taken out of the body of fresh fish specimens and after being washed in physiological saline, nematodes were fixed in hot 4% formaldehyde and stored in 70% ethanol, Nematodes were cleared in glycerin (27). All measurements are in micrometres unless otherwise stated. Specimens were deposited in the department of Fisheries and marine resources, College of Agriculture, University of Basrah. Host classification followed Carpenter *et al*. (12) for marine fishes and Coad (14) for freshwater fishes and updating with Froese and Pauly (20). The letter B established after the scientific name of larval parasite refer to Basrah and followed with A or B instead of 1, 2 as known in previous studies (e.g. 16; 36).

Results and Discussion

Class: Secernentea

Order: Ascaridida

Superfamily: Ascaridoidea

Family: Anisakidae

***Terranova* sp. Type BA larva (Fig. 1)**

Host: *C. dussumieri*, *C. sorrah* and *R. acutus*.

Site of infection: Gills, liver, stomach and intestine.

Description based on 18 specimens from three hosts

White, small larvae 5217-10217 (7607) in length and 87-243 (175) in maximum width. Cuticle with fine transverse striations, which become highly transverse striations in the posterior of body in the mid of body. Truncate cephalic end and conical posterior end. Cephalic end have well developed boring teeth5-9 (7) in length. Esophagus muscular 729-1332 (854) in length comprising 7.6-15.2 (11.4) % from body length, and 27-99 (53) in width. Nerve ring 99-306 (215) from anterior extremity. Ventricolous 234-468 (329) in length and 36-135 (63) in width. Intestinal caecum 468-1116 (626) in length and 25-65 (45) in width. The ratio of ventricolous to the caecum 1:1.45-2.6 (1:1.88), ratio of ventricolous to the esophagus 1:1.93-3.6 (1:2.6), ratio of caecum to esophagus 1:1.15-1.56 (1:1.4). rectum is transparent 79-144 (110), with two circular glands 66 in its diameter. The tail is conical 108-270 (149) in length.

Remarks

The genus *Terranova* Leiper et Atkinson, 1914 contain 20 species parasitized elasmobranchs, reptiles and mammals (17), 15 species known from elasmobranchs, (19), However the real number of species was controversy, because many species were not well described, hence some researchers e. g. Bruce *et al*. (10) reduced valid species to seven included one uncertain species, so it has the same name of another species described from snake in the same period. Vicente and dos Santos (37) created *Pulchrascaris* (which very closely to *Terranova*) from shark in east coast of North America. Both genera sharing many characters such as presence caeca, excretory pore near the lips and the lips in adult lack appendage and interlabia. *Pulchrascaris* distinguished from *Terranova* by general and detail of lips shape, which be atrophied and lack of some prominent lips. Gibson and Collin (21) made revision on the genus *Terranova* and they fall many species as synonyms for others, some taxa considered as s*pecies inquirendae* or *insertae sedis*, transferred three species to *Pulchrascaris* including the type species of recent genus which fall in synonym of recently transferred species. Deardorff (15) redescribed the genus *Pulchrascaris* and confirmed the validity of the type species. Bruce and Cannon (9) added another character for distinguished between two genera by ratio of length of ventricolous to its width, which if less than 1:7 in the *Terranova* and more than 1:7 in the *Pulchrascaris*. According to recent character the present specimens agree with that in the genus *Terranova*. Furthermore the ratio of ventricolous length to the caecum agree with that of *Terranova* sp. type II described by Cannon (11) from 24 species belong to 13 families of marine fishes in the north-east Australia, with *Terranova* sp. by Petter and Sey (36) which described from 13 species belong to nine families from marine fishes in the Arabian Gulf.

Present species recorded from three species of sharks belong to Carcharhinidae, Cannon (11) recorded this species from three species of sharks included one shark from genus *Carcharhinus*. Recent study refer that those larva may be 3rd larva of *T. scoliodontis* (Baylis, 1931) and *T. galeocerdontis* (Thwaite, 1927) both described from

sharks occurred in the same region. This species recorded here for the first time in Iraq and three species of sharks considered new hosts record for this parasite in the Arabian Gulf.

***Terranova* sp. Type BB larva (Fig. 2)**

Host: *C. dussumieri*, *C. sorrah* and *R. acutus*.

Site of infection: Stomach and intestine.

Description based on 6 specimens from three hosts.

White, small larvae 5956-10978 (7607) in length and 126-234 (172) in maximum width in the mid of body. Cuticle with fine transverse striations, which become highly transverse striations in the posterior of body in the mid of body. Truncate cephalic end and conical posterior end. Cephalic end have well developed boring teeth 6-9 (7) in length. Esophagus muscular 711-990 (837) in length comprising 8.1-11.9 (9.9) % from body length, and 45-63 (57) in width. Nerve ring 126-270 (225) from anterior extremity. Ventricolous and caecum equal 297-599 (391) in length and maximum width of caecum 34-108 (58), and maximum width of ventricolous 27-108 (57). The ratio of ventricolous or caecum to the esophagus 1:1.3-3.1 (1:2.25), rectum is transparent 108-135 (121), with three circular glands. The tail is conical 117-171(150) in length.

Remarks

By presence the ratio of length of ventricolous to it width less than 1:7 fall these larva in genus *Twerranova*. Present species differ from *Terranova* sp. BA larva in the ratio of ventricolous length to caecum length, which is 1:1 in compared to 1:1.88 in the *Terranova* sp. BA, and in ratio of caecum to esophagus 1:2.25 (caecum length consist of 40% esophagus length) in compared to 1:1.4 (caecum length consist of 71% esophagus length).

Present character agree with that of *Terranova* sp. Type I recorded by Cannon (1977) from six belong to four families of marine fishes in Australia. While it recorded from three sharks species already harbored *Terranova* sp. BA larva in this study. Cannon (11) supposed that this 3rd larval stage of *T. chiloscyllii* Johnston *et* Mawson, 1951 [Now *Pulchrascaris chiloscyllii* (Johnston *et* Mawson, 1951)] that recorded from the same region. This species recorded here for the first time in Iraq and Arabian Gulf and three species of sharks considered new hosts record for this parasite in the Arabian Gulf.

Order: Spirurida

Superfamily: Physalopteroidea

Family: Physalopteridae

Proleptinae gen. sp. BA larva (Fig. 3)

Host: *C. arel*.

Site of infection: mesenteries.

Description based on 13 specimens.

White, small larva 5634-11348 (7913) in length and 134-288 (221) in maximum width in mid body, with rounded cephalic end and sharp pointed posterior end. Cuticle with finely transverse striation, cephalic extremity expanded to form moderate cephalic collar 2-134 (45) in length. Esophagus distinctly divided into short muscular part and long glandular part, muscular esophagus117-486 (223) in length and 26-81 (45) in maximum width. Glandular esophagus 669-1755 (1446) in length and 47-11 (88) in width. Total esophagus 786-2241 (1666), comprising 14.4-22.7 (20.9) % from body length. The ratio of glandular to muscular part 1:3.2-13.2 (1:7). Nerve ring situated in the posterior part of muscular esophagus, nerve ring just posterior to nerve ring but at anterior part of glandular esophagus. Nerve ring and excretory pore 185-333 (238) and 247-513 (327) from anterior extremity. Valve (between esophagus and intestine) 26-55 (44) in length and 51-104 (78) in width. Analope was well developed 18-99 (32) in length. Rectum transparent 59 (in single specimen) with two circular glands 26-35 (30)×26-35 (30). Tail conical 185-351 (218) with sharply pointed tip.

Remarks

Morphological characters of present specimens agree with subfamily Propletinae, and according to Chabaud (13), the generic identification of these larvae impossible to established because distinguished characters among different genera are found in adult only, such as situation of the vulva and type of spicules.

Yamaguti (38) review four genera in the family Physalopteridae, *Proleptus* Dujardin, 1845; *Heliconema* Travassos, 1919; *Paraleptus* Wu, 1927 and *Pseudoproleptus* Khera, 1955. Chabaud (13) added genus *Bulbocephalus* Rasheed, 1966 to the Physalopteridae and transferred *Pseudoproleptus* to Cystidicolidae. Chabaud (13) put the above four genera which parasitizing fishes in subfamily Proleptinae. The present specimens belong to one of the three genera *Paraleptus*, *Proleptus* and *Heliconema*, while *Bulbocephalus* was excluded from probability identification due to lack the cephalic collar. the final host of *Paraleptus* and *Proleptus* was Chondrichthys, while Anguilliformes in most time the final host of *Heliconema* (34). All these hosts were found in. Also Arabian Gulf. Furthermore very recently Ali (3) described adult of *Paraleptus* sp. from Arabian carpetshark *C. arabicum* from Iraqi marine waters. This parasite recorded here for the first time in Iraq and Arabian Gulf and *C. arel* considered new host record for this parasite in the Arabian Gulf.

Proleptinae gen. sp. BB larva (Fig. 4)

Host: *H. fossilis* and *S. triostegus*.

Site of infection: body cavity.

Description based on 10 specimens (8 from *H. fossilis* and 2 from *S. triostegus*).

White, small larva 7623-8532 (8077) in length and 1276-316 (290) in maximum width in posterior quarter body, with rounded cephalic end and sharp pointed posterior end. Cuticle with finely transverse striation, cephalic extremity without cephalic collar. Esophagus distinctly divided into short muscular part and long glandular part, muscular esophagus 158-292 (225) in length and 40-59 (50) in maximum width. Glandular esophagus 829-1109 (969) in length and 118-178 (148) in width. Total esophagus 1122-1267 (1194), comprising 14.7-14.8 (14.7) % from body length. The ratio of glandular to muscular part 1:2.8-7.3 (1:5). Nerve ring situated in the posterior part of muscular esophagus, nerve ring just posterior to nerve ring but at anterior part of glandular esophagus. Nerve ring and excretory pore 195-252 (225) and 331 (based on single specimen) from anterior extremity. Valve (between esophagus and intestine) 55-67 (62) in length and 94-129 (111) in width. Analope was weakly developed. Tail conical 165-193 (179) with sharply pointed tip.

Remarks

It differs from Proleptinae gen. sp. BA by lack the cephalic collar and the distance of excretory pore from anterior extremity. This species recorded previously in some countries of Asia, Moravec and Amin (30) recorded it from body cavity of cyprinid *Barilius vagra* from Afganistan, Moravec and Sey (32) recorded it from three fish species in Vietnam. González-Solis *et al.* (22) recorded it from body cavity of two species of Cyprinid in Iran. Moravec *et al.* (33) recorded it from mesenteries of *Monopterus albus* in China. *H. fossilis* and *S. triostegus* in this study considered paratenic hosts for this parasite, similar case in González-Solis *et al.*(22) considered *Carasobarbus luteus* and *Alburnus sellal* as paratenic hosts for it, and the final host for these larvae probably was predatory fish belong to *Mastacembelus* and *Chanus* (33). These larva may be belong to genus *Heliconema* due to matured mainly in teleosts, and it was not belong to genus *Bulbocephalus* because latter genus was found in marine environment. This species recorded here for the first time in Iraq and and *H. fossilis* and *S. triostegus* considered new paratenic hosts record for this parasite in Iraq.

Superfamily: Gnathostomatoidea

Family: Gnathostomatidae

***Echinocephalus* sp. larva (Fig. 5).**

Host: *C. arel* and *C. arabicum*.

Site of infection: mesenteries.

Description based on 10 specimens (9 from *C. arel* and 1 from *C. arabicum*).

Red, small larva 6078-9862 (7146) in length and 218-473 (302) in the posterior quarter of body. Cuticle highly transverse striations. Esophagus 841-1890 (1304) in length and 50-108 (79) in maximum width, comprising 13.2-24.8 (19.2)% from body length. Simple pseudolips 32-34 (33) in length. Cephalic bulb 109-180 (140) in length and 168-

306 (241) in maximum width, armed with six transverse rows of large claw-like spines, which increased in the size from the first until the last one. The length of spines 3-16 (7), 7-20 (12), 13-25 (16), 11-25 (18), 12-32 (23) and 13-35 (26) respectively. Two group of ventro-dorsally minute spines between pseudolips and first row of large spines, each group consist of three transverse rows, the first and second row has two minute spines and the last row has three minute spine. Nerve ring and excretory pore 207-236 (221) and 280-304 (292) from anterior extremity. Four cervical sacs unequal 485-1287 (961) in length, comprising 54-91 (68)% from esophagus length. Tail is conical 168-225 9200) with sharp tip which has single large spine 20-27 (24).

Remarks

Present larvae have six transverse rows of spines which similar larvae of *E. pseudouncinatus* Millemann, 1951 which recorded with its adults from shark *Heterodontus francisci* and ray *Myliobatus californicus* from California, U.S.A. (26) and larvae of *E. sinensis* Ko, 1975 recorded from six teleosts species on the east Atlantic ocean at Nigerean coast (35), *Echinocephalus* sp. larvae reported from five teleosts species on Arabian Gulf (36) and 4th larval stage of *E. overstreeti* Deardorff and Ko, 1983 from Skate *Aetobatus narinari* on new Calidonia, U.S.A. (31). All previous studies recorded six row of spines except Millemann (26) where recorded 6-8 spinal rows, However according to Beveridge (8) identified the larva to specific level impossible, because lack stability in morphological characters among different developmental stages.

Moravec and Justine (31) suggest the use of rows of minute spines situated between rows of large spines and pseudolips as systematic character in distinguished between different larvae species, when they found three different types among various studies on larvae of *Echinocephalus*. The present larvae have minute spines in arrangement 2,2,3 similar to un published study made on *Echinocephalus* larva from teleosts in Mexico cited in Moravec and Justine (31). The present larvae have six spinal rows in compared to four rows that recorded in Awad *et al.* (6) and Jori (23) from Khor Abdullah, north-west Arabian Gulf and from that recorded from *S. triostegus* from Al-Hammar marsh in Basrah, Iraq respectively. Ali *et al.* (4) reported minute larva (414-437 µm in length) of *E. uncinatus* Molin, 1858 from intestine of *Mystus pelusius* (reported as *M. halepensis*) from Habbanya lake, mid-western Iraq. Present nematode larvae have characters and measurements similar to *Echinocephalus* sp. larva recorded from five marine boney fishes by Petter and Sey (36) except our study could distinguished three minute spines arrange in 2,2,3 in compared to only two rows of minute spine arrange 2, 3. It is common in most studies to unnoticed all rows of minute spines as existed in Petter and Sey (36) that apparently they missed the first row of minute spines. This finding confirmed Moravec and Justine (31) opinion about it is in most times difficult to seen these spine by compound microscope. However impossible to presence larvae with two rows of minute spines in specimens of Petter and Sey (36), and the differences between various species of larvae could be restricted in number of minute spines in each row, not in number of rows (31), hence we consider present species conspecific with that species.

This species recorded here for the first time in Iraq and *C. arel* and *C. arabicum* considered new hosts record to this parasite in the Arabian Gulf.

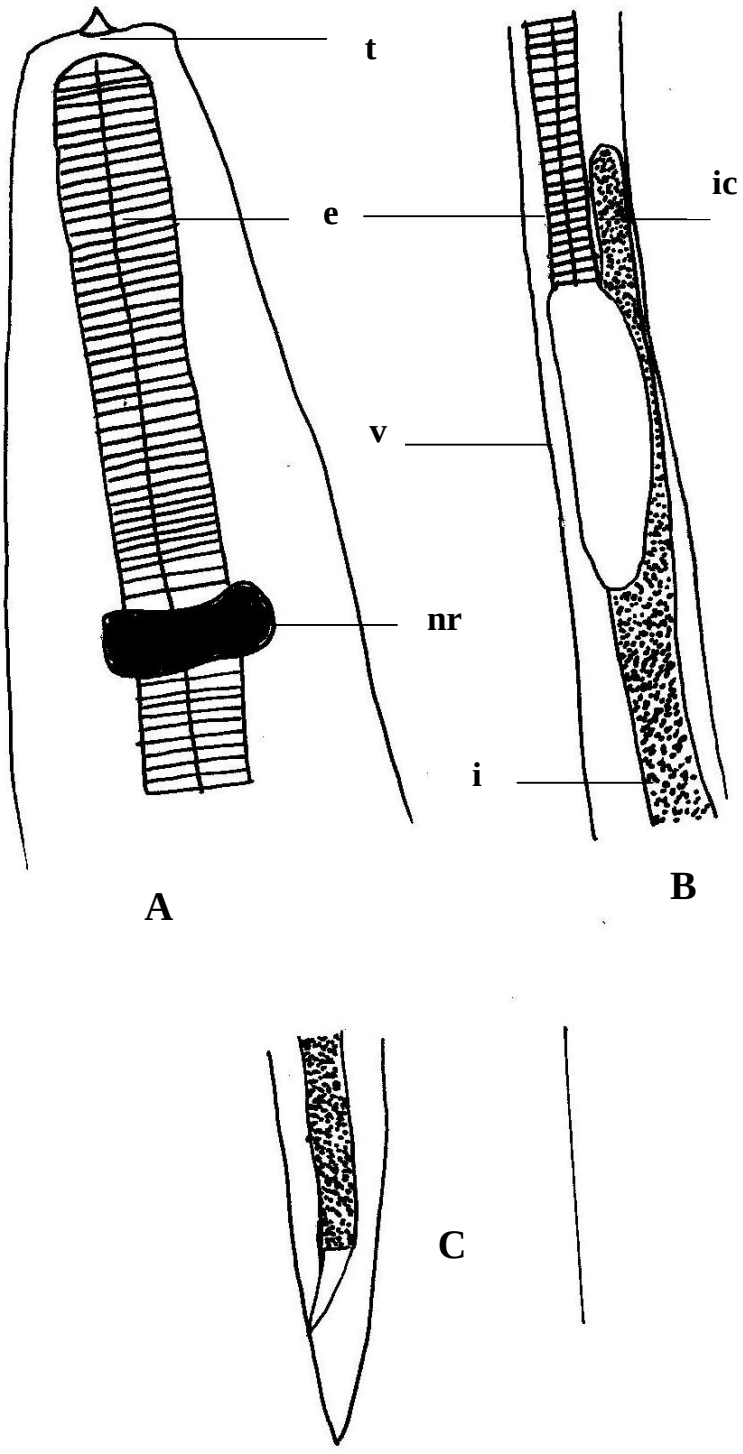

Fig. 1: ***Terranova* sp. Type BA larva**. (A) cephalic end, esophagus (e), boring tooth (t), nerve ring (nr), (B) esophagus-intestine junction, intestine (i), intestinal caecum (ic), ventricolous (v), (C) posterior end. Scale bar, fig.1=90µm, fig.2-3=450 µm.

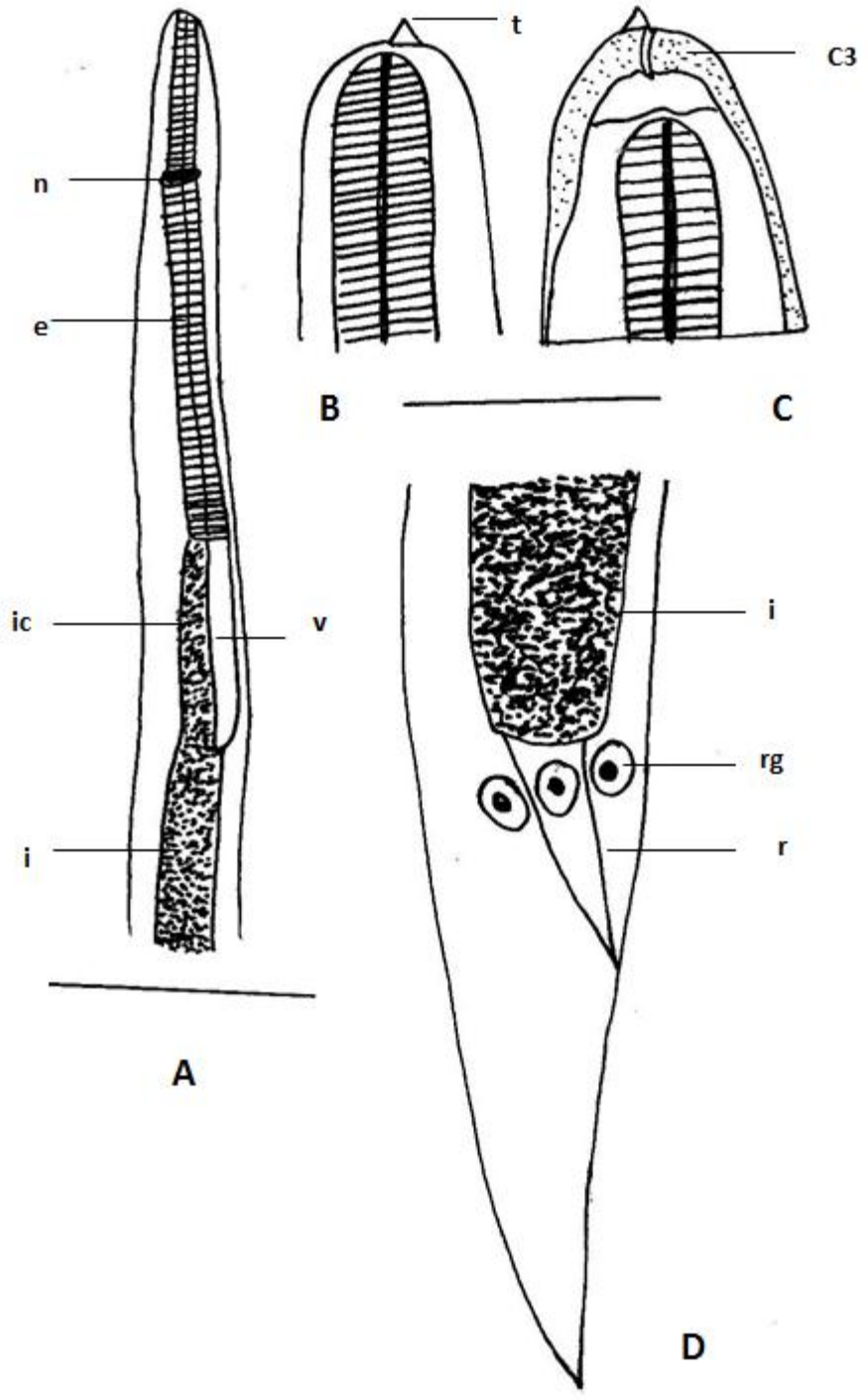

Fig. 2: ***Terranova* sp. Type BB larva**. (**A**) Anterior part of body, note esophagus-intestine junction, esophagus (e), intestine (i), intestinal caecum (ic), nerve ring (n), ventricolous (v) (**B**) cephalic end: boring tooth (t) (**C**) Posterior end of body: rectum (r), rectal gland (rg) (**D**) cephalic end of 4th larval stage inside cuticle of 3rd larval stage (C3). Scale bar, fig. A=450µm, fig. B-D=90µm.

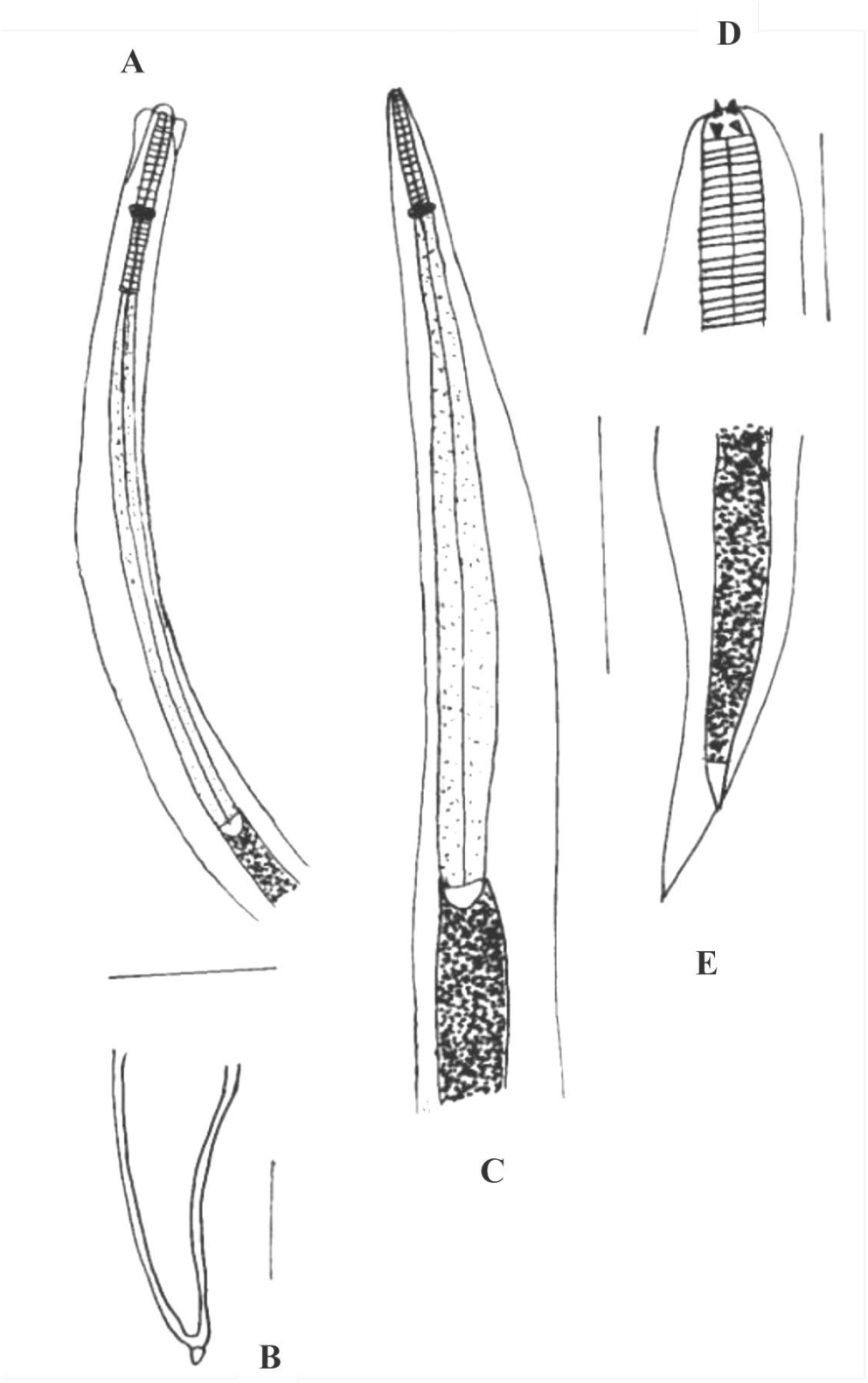

Fig. 3: **Proleptinae gen. sp. type BA larva** (A) anterior part of body (B) distal tip of the tail. Fig. 4: **Proleptinae gen. sp. type BB larva** (C) anterior part of body (D) cephalic end with number of cephalic papillae (E) posterior end of body. Scale bar fig. A=1304 µm, fig. B, D=90 µm, fig. C, E= 450µm.

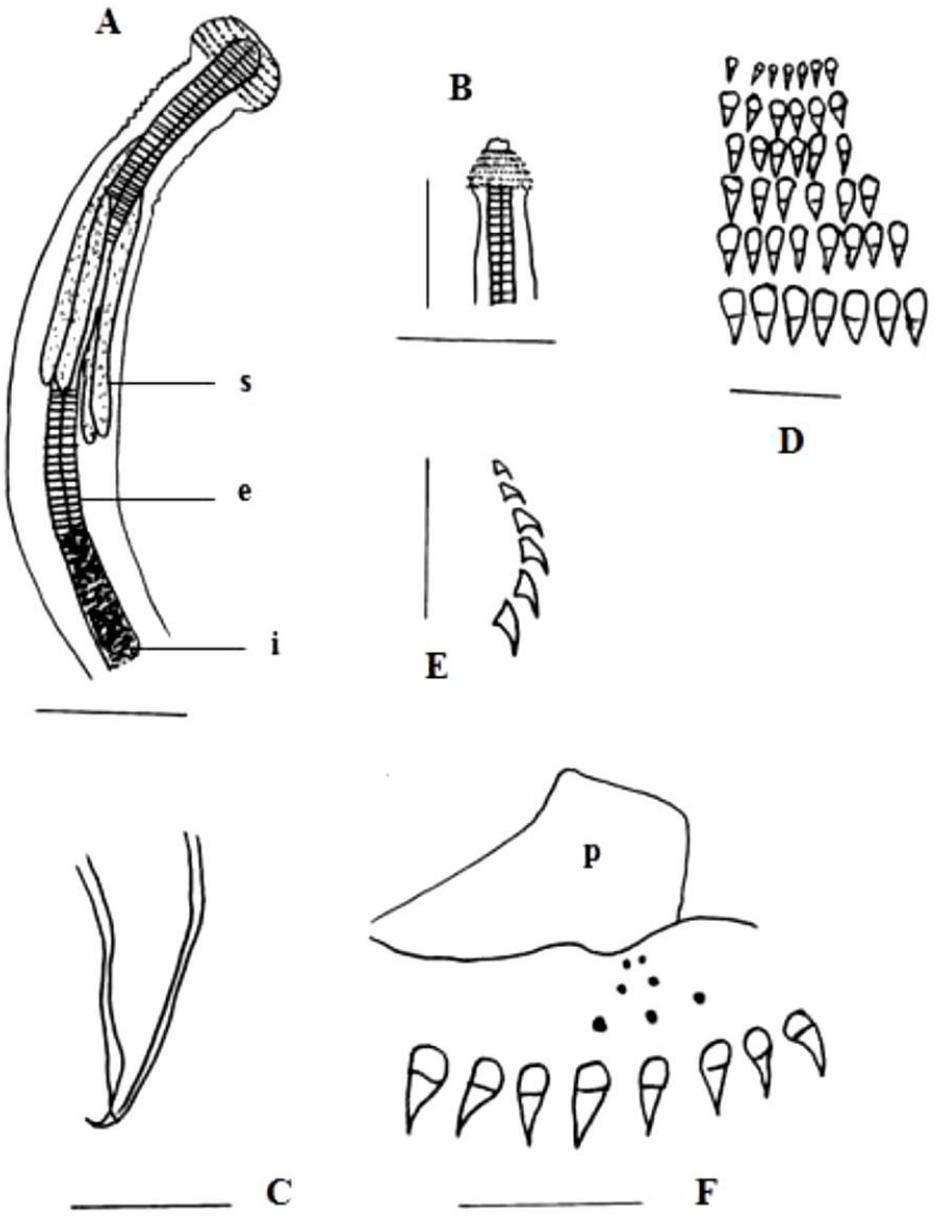

Fig. 5: ***Echinocephalus sp. larva***. (A) anterior part of body withdrawn pseudolips and existed four sacs (B) anterior part of larva with existed pseudolip (C) tail with large spine on its tip (D) cephalic rows, ventral view (E) cephalic rows of spine, lateral view (F) number and arrangement of minute spines, scale bar, fig. A, B=445µm, C, E=110 µm, fig. D=90 µm, fig. F=45 µm.

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أول تسجيل لخمسة أنواع من يرقات الديدان الخيطية من الأسماك في العراق

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الخلاصة. سجلت خمسة أنواع من يرقات الديدان الخيطية والتي تعود إلى ثلاثة فوق عوائل هي Ascaridoidea و Physalopteroidea و Gnathostomatoidea من خمسة أنواع من الأسماك البحرية من شمال غرب الخليج العربي قرب خور العمية ومن نوعيين من أسماك المياه العذبة في هور الحويزة خلال الفترة الممتدة من تموز 2004 وحتى حزيران 2006. سجلت يرقة الدودة الخيطية *Terranova* sp. Type BA ويرقة الدودة الخيطية *Terranova* sp. Type BB من ثلاثة أنواع من القروش هي القرش الرمادي أبيض الخد (Müller *et* Henle, 1839) *Carcharhinus dussumieri* والقرش الرمادي منقط الذنب (Müller *et* Henle, 1839) *C. sorrah* وقرش الحليب (Rüppell, 1837) *Rhizoprionodon acutus*. كما سجلت يرقة الدودة الخيطية Proleptinae gen. sp. BA من سمكة لسان الثور (Bloch *et* Shneider, 1801) *Cynoglossus arel* وسجلت يرقة الدودة الخيطية Proleptinae gen. sp. BB من سمكة الجري الأسيوي Heckel, 1843 *Silurus triostegus* ومن سمكة الجري اللاسع (Bloch, 1794) *Heteropneustes fossilis*. سجلت يرقة الدودة الخيطية *Echinocephalus* sp. من سمكة لسان الثور ومن قرش الخيزران العربي Goubanov, 1980 *Chiloscyllium arabicum*. جميع الطفيليات المسجلة في هذه الدراسة تسجل وتوصف لأول مرة في العراق.