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**Description of eight nematode species of the genus  
*Hysterothylacium* Ward et Magath, 1917 parasitized in some  
Iraqi marine fishes**

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**Abstract**

Eight species of nematodes, genus *Hysterothylacium* Ward et Magath, 1917 were described from eight species of marine fishes (five bony fishes and three sharks). Fishes were collected from north west of Arabian Gulf at Khor Al-Ummia during the period from July 2004 until June 2006. *H. reliquens* (Norris et Overstreet, 1975) were found in three fish species (*Cynoglossus arel*, *Lethrinus nebulosus* and *Trichiurus lepturus*) which considered as new hosts to this parasite. Juvenile male of *Hysterothylacium* sp. from *Drepane longimana* which represents a new host record in the world. Also six species of third larval stages viz *Hysterothylacium* sp. type BA from *C. arel*, *Acanthopagrus latus*, *Chiloscyllium arabicum* and *Sphyrna mokorran*; *Hysterothylacium* sp. type BB and *Hysterothylacium* sp. type BC from both *C. arel* and *C. arabicum*; *Hysterothylacium* sp. type BD from *C. arel*; *Hysterothylacium* sp. type BE from *Rhizopriodon acutus* and *Hysterothylacium* sp. type BF from *Tylosurus crocodilus*. All these parasites were recorded and described for the first time in Iraq. All fish hosts were considered as new hosts to their parasites (3<sup>rd</sup> larval stage nematodes).

**Introduction**

Nematode genus *Hysterothylacium* Ward et Magath, 1917 included parasitic species of marine, brackish and freshwater fishes around the world (6), whereas their larvae parasitize various tissues of numerous fishes and invertebrates (27).

Generally, studies on nematodes parasitized marine fishes in Arabian Gulf are few. Furthermore studies related to genus *Hysterothylacium* are very rare. Kardousha (20) found two species of nematodes as larval stages including *Hysterothylacium* sp. MB in four fishes in United Arab Emirate coasts. El-Naffar et al. (12) during their survey on helminth parasites of many fishes in UAE coasts found three genera of nematodes

including *Hysterothylacium*. González-Solís *et al.* (16) isolated *Hysterothylacium* sp. larva from *Scomberomorus guttatus* near Iranian waters. Petter and Sey (31) recorded 22 species of nematodes including nine species of *Hysterothylacium* at Kuwaiti waters.

As no any work concerned *Hysterothylacium* was done in Iraq the following article was designed for this purpose.

## Materials and Methods

Eight species of marine fishes including 202 *Cynoglossus arel*, 31 *Lethrinus nebulosus*, 15 *Tylosurus crocodiles*, 11 *Chiloscyllium arabicum*, nine *Drepane longimana*, eight *Trichiurus lepturus*, two *Rhizoprionodon acutus* and one *Sphyrna mokorran* were collected from Khor Al-Ummia 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.

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 (21). All measurements are in micrometres unless otherwise stated. Specimens were deposited in the collection of own second author. Host classification followed Carpenter *et al.* (8) and Froese and Pauly (14). The letter B established after the scientific name of larval parasite refer to Basrah and followed with A or B or C....etc. instead of 1, 2, 3....etc. as known in previous studies (e.g. 11, 31).

## Results

Eight different species of the genus *Hysterothylacium* (two adults and six third larval stages) were designed as *Hysterothylacium* sp. Type BA, BB, BC, BD, BE and BF.

### Adult

***Hysterothylacium reliquens* (Norris *et Overstreet*, 1975)**

**Host:** *C. arel*, *L. nebulosus* and *T. lepturus*

**Site of infection:** Intestine

**Description:** 20 specimens (11 females and 9 males)

Median milky nematode with fine transverse striated cuticle, lateral alae well developed starting exactly behind the lips with narrow thickness then extended posteriorly until being broadest in the first third of body and then narrowed posteriorly. Anterior end of body has three lips approximately the same size and have lateral flanges. Dorsal lip has pair of double papillae, subventral lips with single and double papillae, three

interlabia well developed between lips comprising 40-58% of lips length, esophagus long, nerve ring encircling the anterior part of it, excretory pore slightly posterior to the nerve ring level, ventriculus spherical wider than it's long, intestinal caecum short, appendage long and slender, tail conical and its tip covered with many minute spines in both sexes.

**Female (11 specimens) (figure 1)**

Length of body 8394-28325 (18781), maximum width 234-761 (501), ratio of maximum width of body to its length 1:29-49 (1:38.1), lateral alae 18-260 in different parts of body, length of dorsal lip 81-279(137), width 63-225 (95), length of subventral lips 78-243 (129), width 63-225 (95), interlabia 30-108 (53) in length. Length of esophagus 618-2361 (2030) comprising 7.3-14.6 (10.8)% from body length, maximum width 135-326(235), nerve ring and excretory pore 276-659 (437) and 304-731 (488), respectively from anterior extremity, ventriculus 65-171 (110) in length and 57-154 (103) in width, caecum 234-408(323) in length and 81-144 (116) in width, length of appendage 639-1848 (1256), width 45-189 (118), ratio of caecum length to appendage length 1:1.6-4.2(1:3.4), ratio of caecum to esophagus 1:2.5-6.9 (1:5.4), ratio of appendage to esophagus 1:1.5-2.6 (1:1.9), vulva elevated pre-equatorial 325-10476 (6943) from anterior extremity and comprising 29.3-40.4 (35.9) % of body length, vagina muscular extended toward posterior extremity, uterus empty from eggs, tail length 144-387 (334).

**Male (nine specimens) (figure 2)**

Length of body 14087-51942(26796), maximum width 380-847(613), ratio of maximum width of body to length 1:37-61.7 (1:43.7), lateral alae 15-157 in different part of body, length of dorsal lip 100-422(182), width 65-288 (113), length of subventral lips 85-402 (176), width 54-257 (128), interlabia 62-87 (77) in length. Length of esophagus 1827-4789 (2939) comprising 7.5-14.3% (11.5) from body length, maximum width 135-225 (184), nerve ring and excretory pore 422-690 (565) and 515-729(646), respectively from anterior extremity, ventriculus 82-250(123) in length and 72-175 (120) in width, caecum 299-1350(488) in length and 55-189 (104) in width, length of appendage 1110-2223 (1660), width 72-189 (92), ratio of caecum length to appendage length 1:1.6-7.5 (1:4.6), ratio of caecum to esophagus 1:2.3-12.9 (1:7.4), ratio of appendage to esophagus 1:1.4-2.1 (1:1.78), spicules slender, similar and alate 910-1656 (1363) in length comprising 2.57-6.5% (4.95) of body length, width 32-40 (34). Cloacal papillae numerous, 17-28 pairs subventral precloacal papillae except the last pair were close to each other being ventral single mid and above cloacal opening, one pair ad-cloacal papilla present or

absent and 4-10 pairs of postcloacal papillae, two of them sublateral and the rest subventral, the tail, conical and short 123-447 (201) in length, rectal glands oval 52-60 (65)  $\times$  44-49 (47) in measurements.

**Juvenile male of *Hysterothylacium* sp.**

**Host:** *D. longimana*

**Site of infection:** Intestine

**Description:** One specimen (**figure 2:C**)

Median whitish, smooth cuticle, length of body 15302, lateral alae absent, maximum width 347 in mid body, ratio of maximum width to length of body 1:44.1, lips equal in size, dorsal lip 74 in length and 27 in width, length of subventral lips 69, width 47, length of esophagus 1488 comprising 9.7% from body length, maximum width 112, four giant nuclei located beside anterior part of the esophagus (between nerve ring and lips base) 30-40 $\times$ 15-20 in measurement, nerve ring and excretory pore 381 and 406, respectively from anterior extremity, ventriculus 129 in length and 79 in width, caecum 194.5 in length and 79 in width, length of appendage 911, width 59, ratio of caecum length to appendage length 1:4.7, ratio of caecum to esophagus 1:7.6, ratio of appendage to esophagus 1:1.6, tail conical pointed with many minute spines on its tip, rectal glands two oval 49-79 (65)  $\times$  30 in measurement. Spicules and cloacal papillae not fully developed yet.

**Fourth larval stage of *H. reliquens* (Norris et Overstreet, 1975)**

**Host:** *C. arel* and *L. nebulosus*

**Site of infection:** Intestine

**Description:** Seven specimens (**figure 3**)

Small whitish with fine striated cuticle, lateral alae present on entire body 9-60 in different parts of body, length of body 5000-13565 (7708), maximum width 117-391 (215) in mid body, lateral flanges not developed on lips, dorsal lip 30-58 (44) in length and 20-56 (38) in width, length of subventral lips 25-66 (47), width 20-58 (37), length of esophagus 584-1782 (978) comprising 10.1-17.1 (13)% from body length, maximum width 109-391 (215), nerve ring and excretory pore 157-558 (330) and 160-630 (379), respectively from anterior extremity, ventriculus 22-89 (61) in length and 29-108 (62) in width, caecum 124-360 (263) in length and 27-79 (47) in width, length of appendage 260-1044 (601), width 25-63 (46), ratio of caecum length to appendage length 1:1.75-3.5 (1:2.7), ratio of caecum to esophagus 1:2.6-5.9 (1:4.4), ratio of appendage to esophagus 1:1.3-2.3 (1:1.6), tail conical pointed with many minute spines on its tip 84-180 (130) in length, rectum hyaline 62-99(88) in length and has 3-4 oval rectal glands 15-22 (19) $\times$  12-17 (15) in measurements.

### **Third larval stages**

#### ***Hysterothylacium* sp. Type BA larva**

**Host:** *C. arel*, *A. latus*, *C. arabicum* and *S. mokorran*

**Site of infection:** Body cavity (*C. arel* and *A. latus*) and intestine (*C. arabicum* and *S. mokorran*)

**Description:** 14 specimens (**figure 4: A, B and C**)

Median pale reddish nematode with fine striated cuticle, lateral alae present narrow in anterior and posterior parts of the body less than 10 but broader in the first third or mid of body 32-59, length of body 4540-12623 (9320), maximum width 198-326 (264) in mid body, boring tooth 5-11 (7) in length, length of esophagus 643-2870 (1157) comprising 7.8-24.7 (12.2)% from body length, maximum width 36-152 (68), nerve ring and excretory pore 40-282 (191) and 50-315 (205), respectively from anterior extremity, ventriculus rounded 40-103 (62) in diameter, caecum 237-990 (596) in length and 30-72(50) in width, length of appendage 2502-9336 (5027) about 25.7-81.1 (54) % from body length, width 25-109 (58), ratio of caecum length to appendage length 1:6.2-13.5 (1:8.7), ratio of caecum to esophagus 1:1.1-2.4 (1:2.2), ratio of appendage to esophagus 1:0.1-0.4 (1:0.2) or (appendage equal to five times of esophagus), tail conical smooth tip 79-270 (130) in length, rectum hyaline 81-177 (114) in length and has 3-4 oval rectal glands 17-56 (31)×13-26 (19) in measurement.

#### ***Hysterothylacium* sp. Type BB larva**

**Host:** *C. arel*, *C. arabicum*

**Site of infection:** Body cavity

**Description:** Three specimens (**figure 4:D**)

Median, pale reddish nematode with fine striated cuticle, lateral alae absent, length of body 8942-10520(9886), maximum width 196-302 (262) in mid body, boring tooth 5-9 (7) in length, length of esophagus 307-450 (358) comprising 2.9-4.4 (6.3) % from body length, maximum width 21-36 (24), nerve ring and excretory pore 85-171 (128) and 105-207 (156), respectively from anterior extremity, ventriculus spherical 18-34 (26) in length and 15-44(32) in width, caecum 96-218 (152) in length and 27-41 (34) in width, length of appendage 5440-7568 (6750) about 60.8-71.9 (68.2) % from body length, width 17-26 (23), ratio of caecum length to appendage length 1:33-79 (1:50), ratio of caecum to esophagus 1:2-3.2 (1:2.4), ratio of appendage to esophagus 1:0.04-0.06 (1:0.05), appendage equal to 18.8 times of esophagus, tail conical smooth tip 99-123(111) in length, rectum hyaline 61-81(77) in length and has two spindle rectal glands 20-51 (33)×16-22 (18) in measurements.

***Hysterothylacium* sp. Type BC larva (= *Hysterothylacium* sp. Type KE)**

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

**Site of infection:** Body cavity and stomach serosa respectively

**Description:** Two specimens (**figure 5:A**)

Median dark reddish nematode with fine striated cuticle, lateral alae absent, esophagus and intestine dark red, white caecum and grey appendage, length of body 8435-11073 (9765), maximum width 198-270 (234) in first quarter of the body, boring tooth 5-9 (7) in length, length of esophagus 154-1278 (1177) comprising 12.2-15 (13.6)% from body length, maximum width 45-72 (58), nerve ring and excretory pore 97-350 (223) and 117-382 (250), respectively from anterior extremity, ventriculus spherical 47-56 (51) in length and 40-64 (52) in width, caecum 175-207 (191) in length and 47-72 (60) in width, length of appendage long 3504-4475 (3989) about 31.6-53 (42.3)% from body length, width 10-107 (105), ratio of caecum length to appendage length 1: 0.28-21.6 (20.8), ratio of caecum to esophagus 1:6.2-7 (6.95), ratio of appendage to esophagus 1:0.28-0.38 (1:0.33), appendage equal to three times of esophagus, tail conical smooth tip 126-127 (126) in length, rectum hyaline 72-111 (91) in length and has two spindle rectal glands 40-43 (41)×28-29 (28) in measurement.

***Hysterothylacium* sp. Type BD larva**

**Host:** *C. arel*

**Site of infection:** Body cavity

**Description:** One specimen (**figure 5:B**)

Median pale reddish nematode with fine striated cuticle, lateral alae absent, esophagus and intestine dark red, white caecum and grey appendage. length of body 1309, maximum width 282 in mid body, boring tooth 9 in length, length of esophagus 1395 comprising 10.2% from body length, maximum width 75, nerve ring and excretory pore 345 and 397, respectively from anterior extremity, ventriculus spherical 67 in length and 75 in width, caecum 165 in length and 67 in width, appendage very long 8967 in length about 65.9% from body length, width 75, ratio of caecum length to appendage length 1: 46, ratio of caecum to esophagus 1:7.1, ratio of appendage to esophagus 1:0.15, appendage equal to six times of esophagus, tail conical smooth tip 144 in length, rectum hyaline 128 in length and has four spindle rectal glands 34-45 (39) ×18-25 (22) in measurement.

***Hysterothylacium* sp. Type BE larva**

**Host:** *R. acutus*

**Site of infection:** Gills

**Description:** Two specimens (**figure 6**)

Median white nematode with fine striated cuticle, lateral alae absent, length of body 3739-8435 (7587), maximum width 135-225 (180) in mid body, boring tooth 9 in length, esophagus 675-792 (733) in length comprising 9.4-10 (9.7) % from body length, maximum width 45-63 (54), nerve ring and excretory pore 211-252 (231) and 223-273 (248) respectively from anterior extremity, ventriculus spherical 36-81 (58) in length and 23-81 (52) in width, caecum 247-360 (303) in length and 27-54 (40) in width, appendage equal to caecum 276-387 (303) in length about 4.1-4.5 (4.2) % from body length, width 45-49(47), ratio of caecum length to appendage length 1: 1.1, ratio of caecum to esophagus 1:2.2-2.7(1:2.4), ratio of appendage to esophagus 1:1.2-1.4 (1.22), appendage less than 2.2 times of esophagus, tail conical smooth tip 135-157 (146) in length, rectum hyaline 90-101 (95) in length. Rectal glands not clear.

***Hysterothylacium* sp. Type BF larva**

**Host:** *T. crocodilus*

**Site of infection:** Body cavity

**Description:** One specimen (**figure 7**)

Median pale orange nematode with very fine striated cuticle, lateral alae absent, length of body 16414, maximum width 478 in mid body, boring tooth 7 in length, length of esophagus 900 comprising 5.5% from body length, maximum width 72, nerve ring and excretory pore 212 and 288, respectively from anterior extremity, ventriculus spherical 108 in diameter, caecum very short 117 in length and 72 in width, appendage long 3159 in length about 19.2% from body length, width 117, ratio of caecum length to appendage length 1:27, ratio of caecum to esophagus 1:7.7, ratio of appendage to esophagus 1:0.28, appendage equal to 3.5 times of esophagus, tail conical smooth tip 171 in length, rectum hyaline 180 in length and has single spindle rectal gland 43×29 in measurement.

## Discussion

The genus *Thynnascaris* was created by Dollfus in 1933 on the bases of possessing appendage and absence of the caecum,. Two years later Dollfus reduced the generic level and placed it to subgenus situation belonging to the genus *Contracaecum* after the distinguishing of caecum. Hartwich (17) resurrected the genus *Thynnascaris* which was distinguished from *Contracaecum* by having excretory pore near the nerve ring and matures in the fishes in the first genus instead of the situation of excretory pore between the lips and maturity in birds and mammals in the second genus.

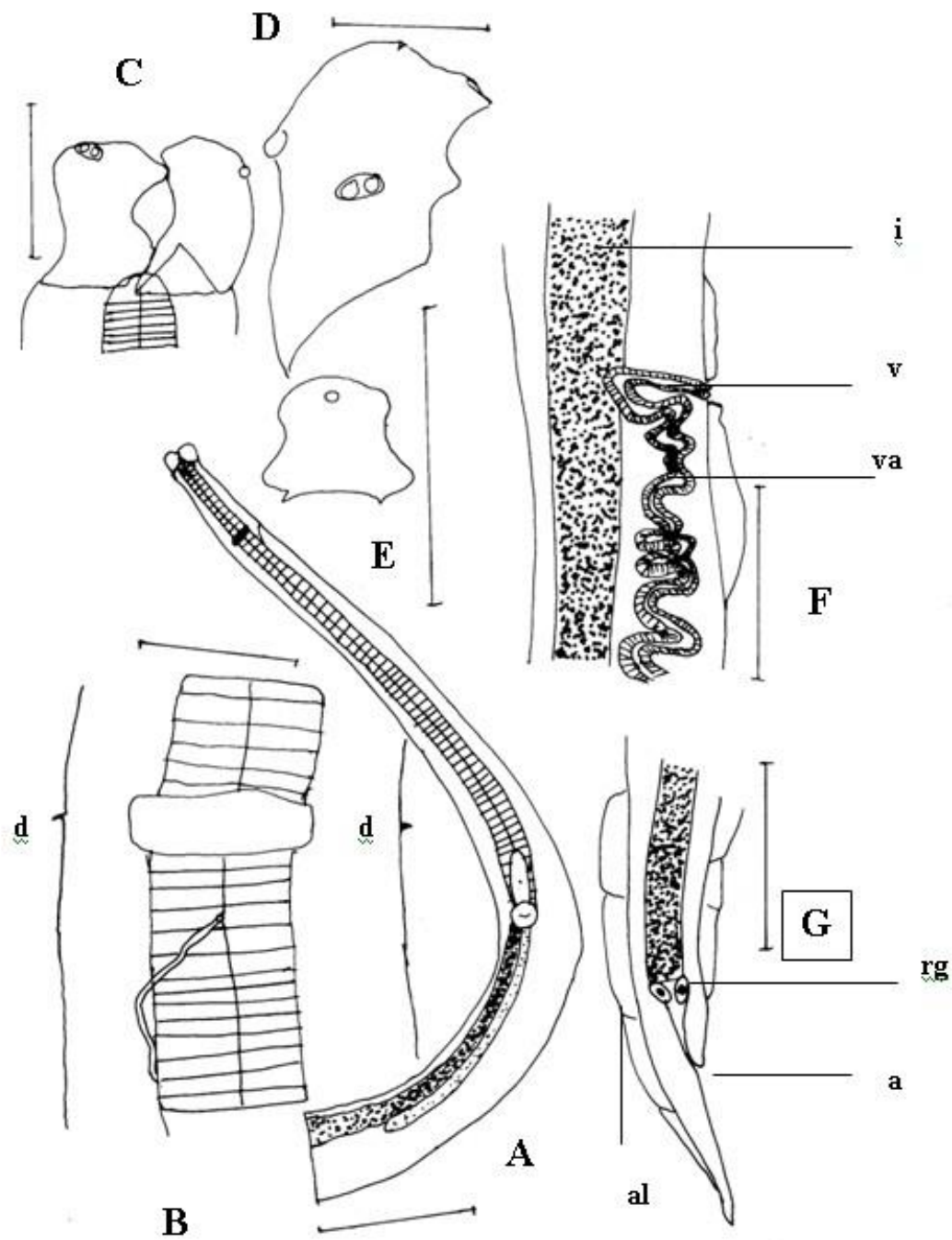


Fig. (1): Female of *Hysterothylacium reliquens* (A): anterior part (B): nerve ring region showing deries (d) and excretory canal and excretory pore (C): ventral view of two lips and interlabia (triangle shape) (D): subventral lip, (E): dorsal lip, (F): vulva region, i: intestine; v: vulva opening; va: vagina (G) tail, a: anus; al: alae, rg: rectal gland. Scale bar: Fig. (A, E-G)= 450  $\mu$ m; Fig. (B-D)= 90  $\mu$ m.



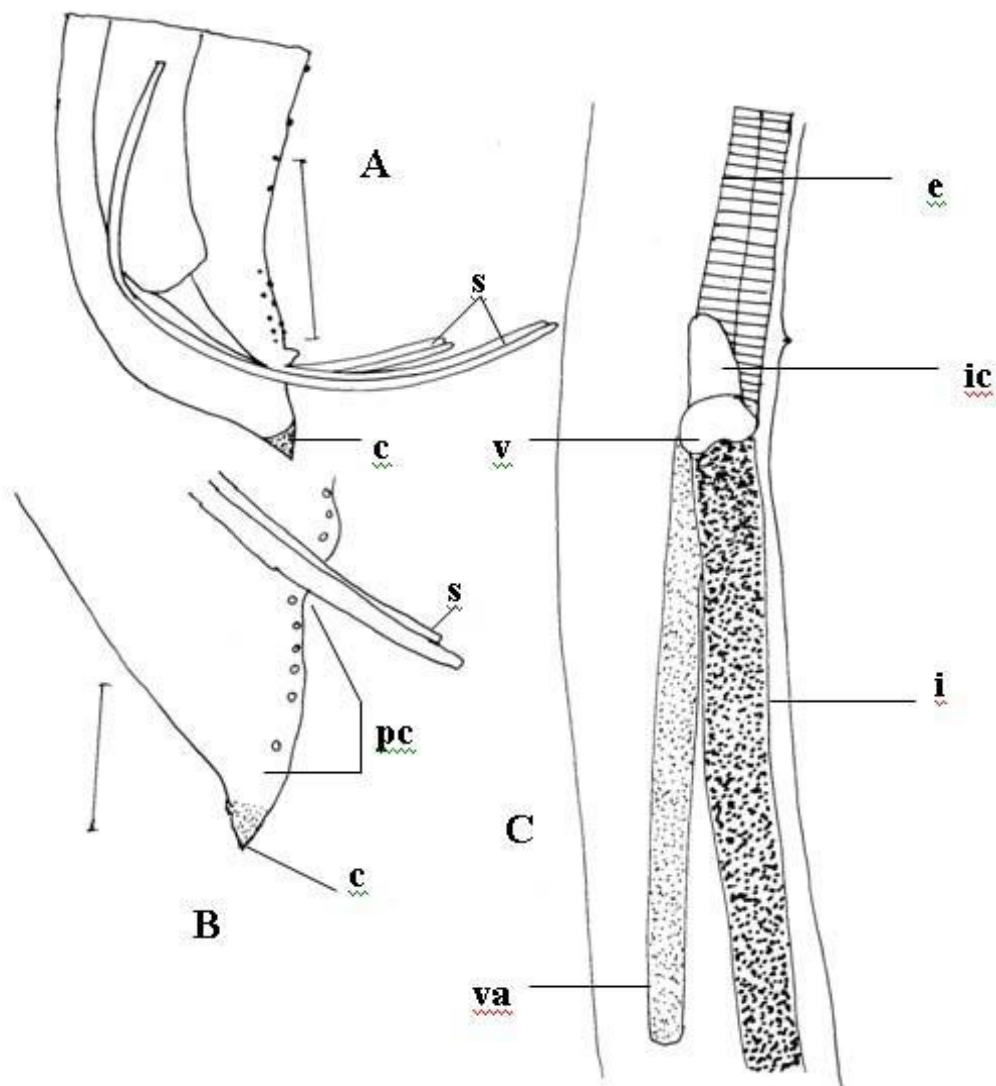


Fig. (2): Posterior part of *H. reliquens* male (A) note alate spicules (s); spinous tip of tail (c), (B) Another specimen showing postcloacal papillae (pc) and some part of precloacal papillae (C) Juvenile male of *Hysterothylacium* sp. esophagus-intestine junction showing, e: esophagus, i: intestine, ic: intestine caecum, v: ventriculus, va: ventral appendage,. Scale bar: Fig. (A& C)= 450  $\mu\text{m}$ , Fig. (C)= 90  $\mu\text{m}$ .

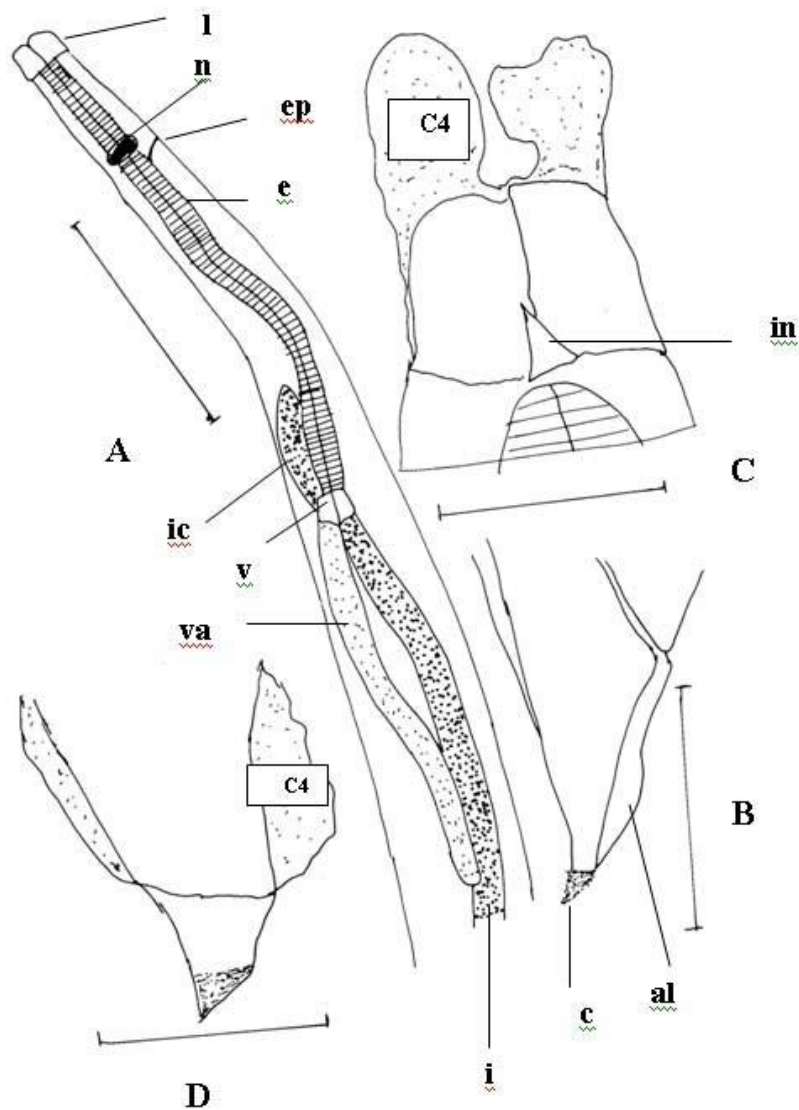
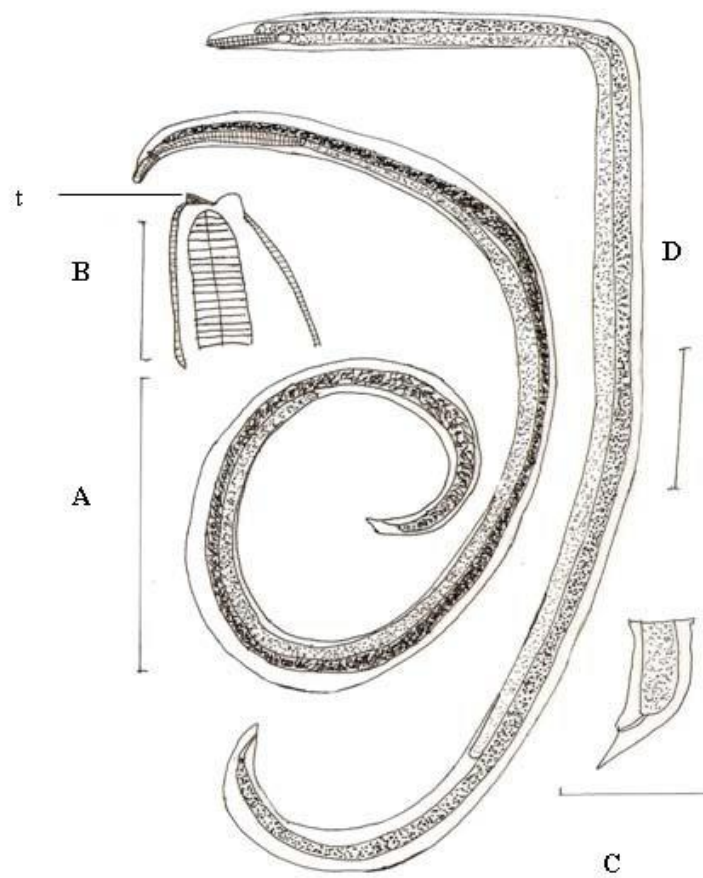
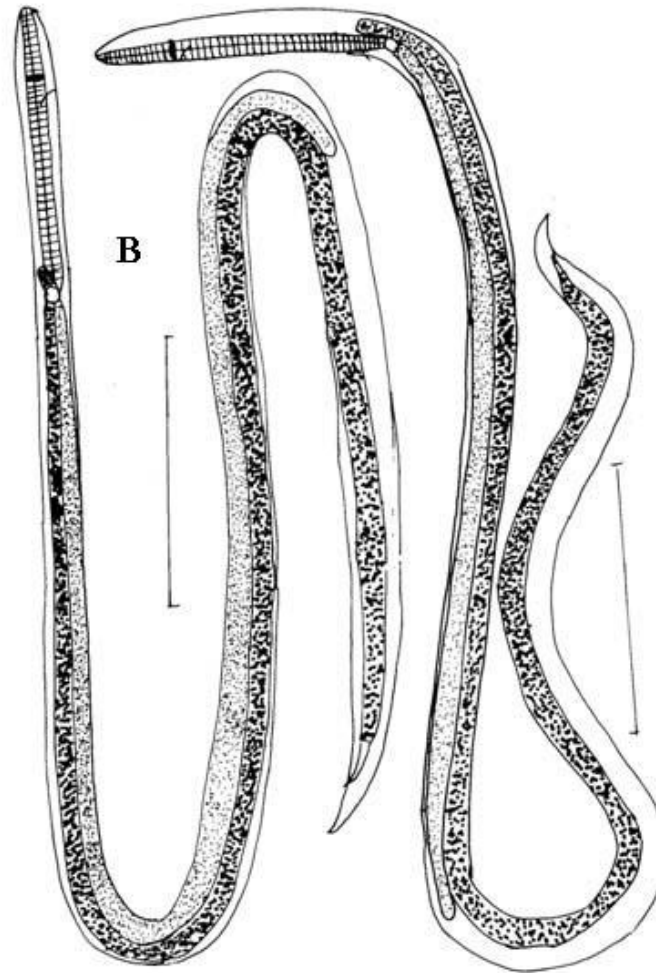


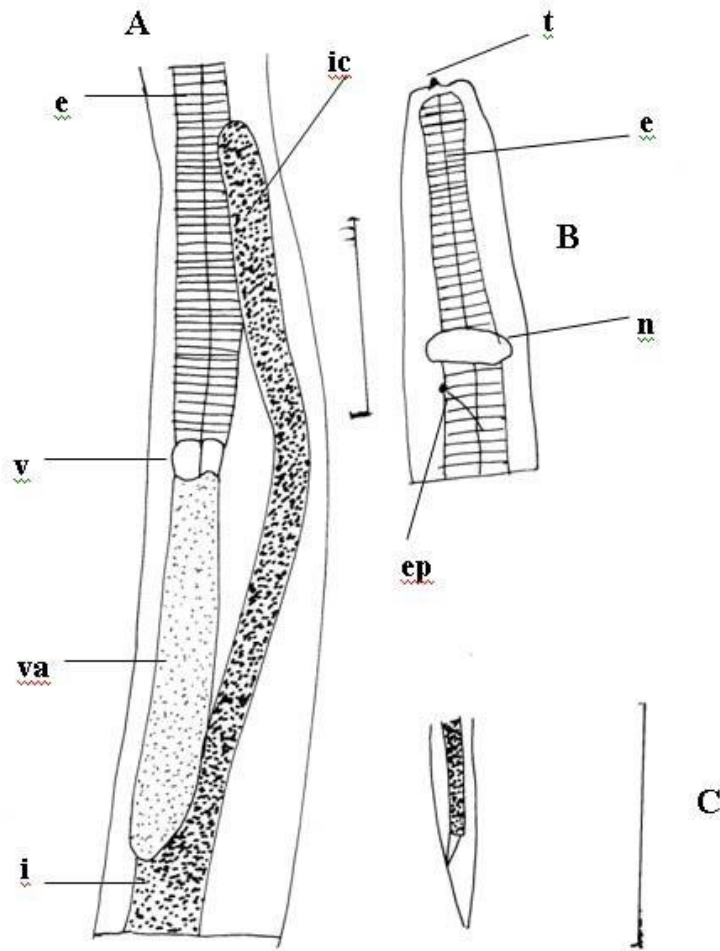
Fig. (3): Fourth larval stage of *H. reliquens* (A) anterior part showing, e: esophagus, ep: excretory pore, i: intestine, ic: intestinal caecum, l: lip, n: nerve ring, v: ventriculus, va: ventral appendage, (B) tail tip showing, c: spinous tip, al: alae, (C): early fourth larval stage in cuticle of previous stage anterior end showing, in: interlabia, **C4** cuticle of previous stage (D): tail end, **C4**: cuticle of previous stage, scale bar: Fig. (A)= 90  $\mu\text{m}$ , Fig (B-D)= 45  $\mu\text{m}$ .



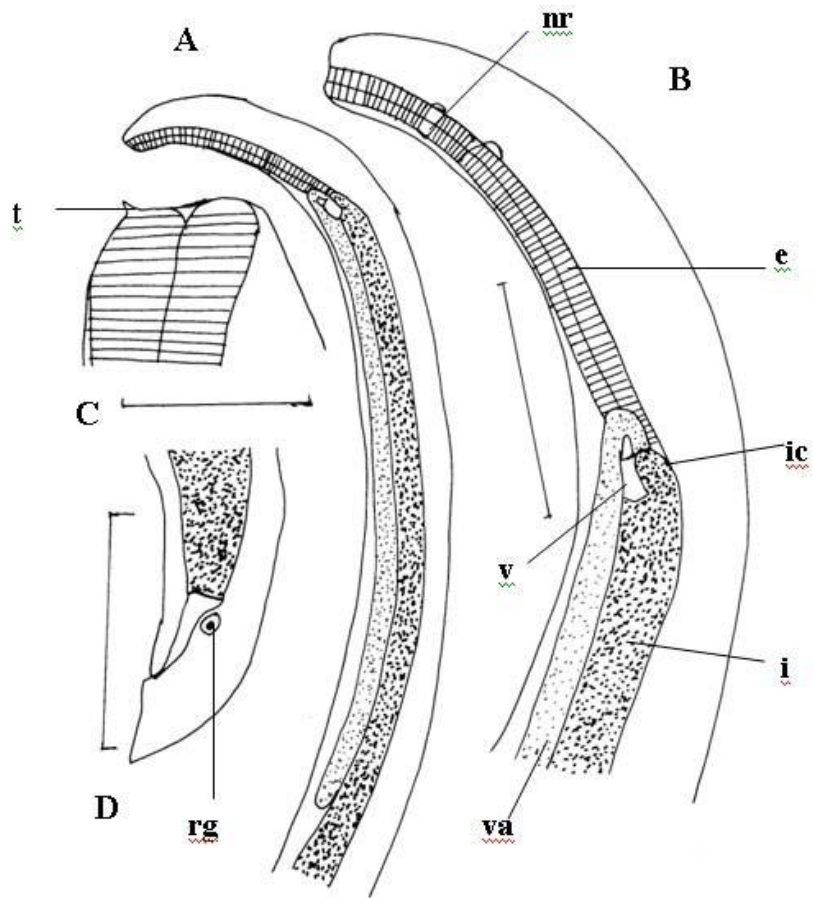
**Fig (4):** *Hysterothylacium* sp. Type BA larva, (A): entire body, (B): anterior end showing, t boring tooth, (C): posterior end (D): *Hysterothylacium* sp. Type BB larva. Scale bar: Fig. (A) = 2127  $\mu$ m, Fig. (B) = 110  $\mu$ m, Fig. (C) = 445  $\mu$ m, Fig. (D) = 1 mm.



**Fig. (5):** (A): *Hysterothylacium* sp. Type BC larva, (B): *Hysterothylacium* sp. Type BD larva. Scale bar: Fig (A&B)= 1361  $\mu$ m.



**Fig. (6):** *Hysterothylacium* sp. Type BE larva, (A): esophagus-intestine junction, (e): esophagus, (i): intestine, (ic): intestinal caecum, (v): ventricolous, (va) ventral appendage, Fig. (B): anterior end, showing, (e): esophagus, (ep): excretory pore, (n): nerve ring and (t): boring tooth, Fig. (C): posterior end. Scale bar: Fig. (A& B)=90 µm, Fig. (C)=450 µm.



**Fig. (7):** *Hysterothylacium* sp. Type BF larva, (A): Anterior part, (B): the same in different magnification, showing (e): esophagus, (i): intestine, (ic): intestinal caecum, (nr): nerve ring, (v): ventricolous, (va): ventral appendage (C): anterior end showing (t): boring tooth, (D): posterior end showing, (rg): rectal gland. Scale bar: Fig. (A) =1 mm, Fig. (B & D) =450  $\mu$ m, Fig. (C) =90  $\mu$ m.



In his monograph, Yamaguti (36) designed his keys depending on the presence of appendage and caecum and considered *Contracaecum* as the only valid genus and left *Thynnascaris* as a synonym of it. Chabaud (9) differentiated the two genera in the subfamily Anisakinae, while Hartwich (18) established *Thynnascaris* in the subfamily Raphidascarinae and *Contracaecum* in the subfamily Anisakinae without mentioning any of importance to the genus *Hysterothylacium*.

Gibson (15) questioned the review of Hartwich (18) about synonymies of *Hysterothylacium* for *Raphidascaris* (presence of appendage and absence of caecum). Deardorff and Overstreet (10) improved the priority of *Hysterothylacium* Ward *et* Magath, 1917 after they examined type species of it (*H. brachyurum*), which erroneously described by absence of the caecum by genus author. they examined many other specimens and considered *Thynnascaris* as a synonym of *Hysterothylacium* on the basis of priority and they transferred 47 species (which were previously located in *Thynnascaris* and *Contracaecum*) as adult in fishes to *Hysterothylacium* and left eight species *numen nudem* because their type specimens were not found and other 11 species because they were larvae. Although recent revision by Deardorff and Overstreet (10), many species erroneously described as adults from fishes belong to *Contracaecum*, especially from northern Indian ocean, about 40 species belong to *Contracaecum* were described from 1970 until 1982 (5), Soota (32) considered 11 species as *species inquirenda* while expressing reservations about the validity of the further 29 species, and unfortunately only 20% from all species of *Hysterothylacium* until 1989 were adequately described (5).

### ***Hysterothylacium reliquens* (Norris *et* Overstreet, 1975)**

Norris and Overstreet (26) described *T. reliquens* from five fish species in the north Gulf of Mexico and East USA that belong to five families of Batrachoididae, Diodontidae, Labridae, Sparidae and Sciaenidae, but larger specimens were collected from the type host (Sparidae). Deardorff and Overstreet (10) recorded it from Gulf of Mexico, North of Brazil, Panama and Pacific ocean from 14 host species belonging to seven families of Ariidae, Batrachoididae, Diodontidae, Muraenidae, ogocephalidae, Sparidae and Sciaenidae. Petter and Cabaret (29) collected this species from two families (Sparidae and Soleidae) in Eastern Atlantic ocean near Morocco. Petter and Sey (31) recorded it from nine families (Bothidae, Carangidae, Clupeidae, Paralichthyidae, Plotosidae, Serranidae, Soleidae, Sparidae and Teraponidae). Three families are now added in the present study (Cynoglossidae, Lethrinidae and Trichiuridae). So, this parasite has a wide host range (19 families)

which makes gives it as an unspecialized parasite although the Sparidae was found in all records and it harbours larger and gravid specimens.

The present materials were found in three different species of fishes (*C. arel*, *L. nebulosus* and *T. lepturus*). They have morphological criteria very similar to that of Deardorff and Overstreet (10) and Petter and Sey (31) except that the females of the present specimens were non gravid. This is the first record of this nematode in Iraq and hence the three previous fish species are recorded as new hosts.

#### **Juvenile male of *Hysterothylacium* sp.**

Combination of the presence of minute spines on tail, absent of alae and ratio of caecum to appendage (1:4.7) and caecum to esophagus (1:7.6) and appendage to esophagus (1:1.6) in the present nematode are not similar to any known species.

Ratio of caecum to appendage and ratio of caecum to esophagus in present specimen similar to those in *H. cornotum* (Stossich, 1904), *H. trichiuri* (Thawite, 1927), *H. eurycheilum* (Olsen, 1952), *H. ogocephali* (Olsen, 1952), *H. pelagicum* Deardorff et Overstreet, 1982 and *H. physiculi* Moravec et Nagasawa, 2000, but present specimen differs from all these species by absent of alae, and differs from the first, third, fourth and fifth species by the presence of minute spines on the tail.

Absence of alae and presence of minute spines on tail tip were reported in five species only : *H. marinum* (L.), *H. centae* (Pearse, 1936), *H. brachyarum* Ward et Magath, 1917, *H. analarum* Rye et Baker, 1984 and *H. patagonense* Moravec et al., 1997. However, all these species have appendage shorter than caecum or slightly longer than the caecum (appendage not exceeds on 2.4 times of caecum). According to our knowledge, no any species was recorded from Drepenidae. According to the above information, this nematode is now recorded for the first time in Iraq and Arabian Gulf, and *D. longimana* is considered as a new host record for this parasite.

#### **Fourth larval stage of *H. reliquens* (Norris et overstreet, 1975)**

1 It is known that some anisakid nematodes have a ratio of caecum length to appendage length (23) or a ratio of appendage to esophagus (11, 3) which very similar or the same in the specific species in the third and fourth larval stages and in adult stage.

The occurrence of fourth larval stage in the same host which harboured the adult was common in previous studies. Moravec et al. (25) described the fourth larval stage from three species of salmon in Argentine. Torres et al. (34) and Torres and Soto (33) recorded *H. geschi* Torres et al., 1998 and *H. winteri* Torres et Soto, 2004 from fresh and marine water fishes of Chile, respectively.



In present study, the ratio of caecum to appendage and the ratio of each of them to esophagus were the same in the fourth larval stage and adult stage. Also, spinous tail and the presence of lateral alae were similar in different developmental stages.

### **Third larval stages**

#### ***Hysterothylacium* sp. Type BA larva**

By having long appendage equal to 6-13 times of the caecum and 2.5-10 times of esophagus and the esophagus equal to 2-4 times of caecum are in agreement with *Thynnascaris* sp. larva Type I in Cannon (7) which was recorded from 13 families including Cynoglossidae and Sparidae, However, *C. arel* and *A. latus* are excluded from them in south-east Australia. This is the first record of this parasite in Iraq and all four hosts (two bony fishes and two sharks) are now considered as new host records in Iraq.

#### ***Hysterothylacium* sp. Type BB larva**

On the bases of very short esophagus (2.9-4.4% from body length), very long appendage (60.8-71.9% from body length), esophagus (4-6% from appendage), and caecum (equal to 1.2-3% from appendage), this larva is different from any known species larva. The present species differs from the previous species by the absence of alae, short esophagus and the ratio of caecum to appendage and caecum to esophagus which larger in the present species. The occurrence of parasite is considered now as the first record in Iraq.

#### ***Hysterothylacium* sp. Type BC larva (= *Hysterothylacium* sp. Type KE)**

Petter and Sey (31) recorded this larva from seven fish species (excluding the two hosts) in Kuwaiti water. Also, this larva very similar to *Contracaecum* sp. larva Type 2 (PC2) of Bilqees and Fatima (4) in Pakistan coasts.

The present larva is different from the two previous species in ratio of caecum to appendage (1:20.8 in comparison with 1:8.7 and 1:50, respectively), ratio of caecum to esophagus (1:7 in comparison with 1:2.2 and 1:2.4, respectively) and appendage to esophagus (appendage equal to three times of esophagus in comparison with five and 18.8 times, respectively). Also, it differs from *Hysterothylacium* sp. larva type BA in absence of alae. This parasite is recorded here for the first time in Iraq.

***Hysterothylacium* sp. Type BD larva (= *Hysterothylacium* sp. Type MB)**

Deardorff and Overstreet (11) described *Hysterothylacium* sp. Type MB from nine fish species that belong to five families (excluding Cynoglossidae) in Gulf of Mexico. Kardousha (20) recorded it from 15 species of fish (excluding Cynoglossidae) in the Arabian Gulf.

This larva is distinguished from all previous larvae by having very long appendage. Hence, it is similar to the second larval stage species (Type BB), but the Type BD differs from Type BB by the ratio of appendage to esophagus (1:0.15 in comparison with 1:0.05) and ratio of caecum to esophagus (1:7 in comparison with 1:2.4). This parasite is recorded here for the first time in Iraq.

***Hysterothylacium* sp. Type BE larva**

Due to the equal of the caecum with appendage in this species, it is very similar to *H. aduncum* (Rud., 1802), the cosmopolitan species which was recorded from very numerous hosts, but erroneously established in some records with other species (19, 6). In Asia, Moravec *et al.* (24) and Moravec and Nagasawa (22) recorded the adults and larvae from many freshwater and marinerwater fishes, respectively, near Japan.

Morphological criteria of the present specimens agree with that of the same species in Moravec (21) which was recorded from numerous hosts in Europe. Gills of sharks are unusual site of infection as this parasite is emitted in mouth or gills after pulling the fish to the surface from deep water during fishing process (28). The parasite is recorded here for the first time in Iraq.

***Hysterothylacium* sp. Type BF larva**

Six species of this genus have very short caecum viz.: *H. fabri* (Rud., 1819), *H. cornotum* (Stossich, 1904), *H. eurycheilum* (Olsen, 1952), *H. pelagicum* Deardorff *et* Overstreet, 1982, *H. scomberoidei* Bruce *et* Cannon, 1989 and *H. muraenesox* (Luo, 1999). The present specimen agrees with *H. fabri* (Rud., 1819) third larval stage Which was described in Moravec (21) from marine and freshwater fishes in Europe. *H. fabri* differs from the five previous larvae by esophagus length which is equal to one quarter or one third of appendage in comparison with the esophagus which equal to 1-20 times of appendage and in ratio of caecum to esophagus (less than 1:7.7 ) comparison with to 1:12.4-100 in other species.

Petter and Maillard (30) removed the adult of this parasite from *Uranoscopus scaber* in Mediterranean. Farjallah *et al.* (13) and Valero *et al.* (35) recorded the third and fourth larval stages in two Cod *Phycis* spp. from East and West Mediterranean, respectively. *Hysterothylacium* sp.

Type KA and *Hysterothylacium* sp. Type KB were recorded in Petter and Sey (31) which had very short caecum, but the present species differs from those species by the absence of alae and smooth tip of tail in comparison with the presence of alae and tail tip with 6-8 spines and single spine on it, respectively. Appendage comprising 19.2% of body length in comparison with 8% and 9% of body length, respectively. This parasite is recorded here for the first time in Iraq.

In Iraq, no any records related to *Hysterothylacium*, are available, but Al-Daraji (1) and Bannai (2) recorded gravid females of *Contracaecum* sp. from one and five marine fishes, respectively, in Iraqi territorial waters. but as known *Contracaecum* parasites of birds and mammals which could not mature in fishes. Therefore these records transferred here to the genus *Hysterothylacium* Ward et Magath, 1917, and as only females are available, it is impossible to identify it to the species level and so considered as *Hysterothylacium* sp.

To clarify the differences between all nematode species of the present study following key is designed:

- 1- Nematode with lateral alae... 2
- Nematode without lateral alae... 3
- 2- Tip of tail smooth, third larval stage.....***Hysterothylacium* sp. type BA**
  - Tip of tail has minute spines, adult or fourth larval stage  
.....***H. reliquens***
- 3- Tip of tail with minute spines, ratio of caecum to appendage 1:4.7, caecum to esophagus 1:7.6, appendage to esophagus 1:1.6  
.....juvenile male ***Hysterothylacium* sp.**
  - Tip of tail smooth... 4
- 4- Caecum very short, about the same length of ventriculus, ratio of caecum: appendage 1:27, esophagus about quarter of appendage  
.....***Hysterothylacium* sp. type BF**
  - Caecum longer than ventriculus ..... 5
- 5- Caecum has the same length of appendage  
..... ***Hysterothylacium* sp. type BE**
  - Caecum and appendage are dissimilar in length ..... 6
- 6- Appendage very long about 60-72 % of body length.....7
  - Appendage long, about 31.6-53% of body length, ratio of caecum to appendage 1:20.8, caecum to esophagus 1:6-7, appendage about three times of esophagus ..... ***Hysterothylacium* sp. type BC**
- 7- Appendage equals seven times of esophagus, caecum to esophagus 1:7  
..... ***Hysterothylacium* sp. type BD**
  - Appendage equals 20 times of esophagus, caecum to esophagus 1:2.4  
..... ***Hysterothylacium* sp. type BB**

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## وصف ثمانية أنواع من الجنس *Hysterothylacium* Ward et Magath, 1917 لمتطفلة في بعض الأسماك البحرية العراقية

نادرة آناظم لسالمو أثير حسين علي  
سجلت أول مرة في العراق في عام 1917

### الخلاصة

وصفت ثمانية أنواع من الديدان الخيطية *Hysterothylacium* Ward et Magath, 1917 من ثمانية أنواع من الأسماك البحرية (خمسة عظمية وثلاثة قروش)، جمعت الأسماك من شمال غرب الخليج العربي وتحديداً من خور العمية خلال الفترة الممتدة من تموز ٢٠٠٢ إلى حزيران ٢٠٠٢، وجدت الدودة *H. reliquens* (Norris et Overstreet, 1975) في ثلاثة أنواع من الأسماك هي لسان الثور *Cynoglossus arel*، الشعري *Lethrinus nebulosus* والسدكة شعرية الذنب *Trichiurus lepturus* والتي اعتبرت أمضيف جديد لهك ذائفي، مثل تسجيل الداء من *sp. Hysterothylacium* ليافع للطفيلي سدكة مشط الغاو *Drepane longimana* التي تمثل مضيفاً جديداً للطفيلي في العالم، وأذلك سجلت ستة أنواع من الطور اليرقي من *sp. Hysterothylacium* BA Type ثلاث *Acanthopagrus* *C. arel*; *Sphyrna mokorran*; *Chiloscyllium arabicum* *Hysterothylacium* sp. Type BB و *Hysterothylacium* sp. Type *latus* BC من لسان الثور والقرش العربي *C. arabicum*، النوع *Hysterothylacium* sp. Type BD من لسان الثور، النوع *Hysterothylacium* sp. Type BE من القرش *Rhizoprionodon acutus* والنوع *Hysterothylacium* sp. Type BF من المذيط ألب الحرا *Tylosurus crocodilus*. ستة أله هذه الطفيليات تسجل وتوصف لأول مرة في العراق. جميع لمضائف (لسمكية تعد مضيف جديد لطفيلياتها الطور اليرقي). ثلاث