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**NEOECHINORHYNCHUS ANGUILLUM SP. N. (ACANTHOCEPHALA:
NEOECHINORHYNCHIDAE) FROM THE FRESHWATER EEL,
ANGUILLA ANGUILLA, IN SOHAG, EGYPT.**

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ABSTRACT

Neoechinorhynchus anguillum sp.n., the third species of the genus from African freshwater fishes, is described by light and scanning electron microscopy from *Anguilla anguilla* Linnaeus, 1766 (Anguillidae) from the River Nile in Sohag. It differs from other *Neoechinorhynchus* species of African freshwater fishes in having unequal proboscis hooks in the anterior circle and in many other characters. Possession of unequal proboscis hooks in the anterior circle aligns *Neoechinorhynchus anguillum* with the 2 other species of *Neoechinorhynchus* which are known to occur in fishes. *Neoechinorhynchus anguillum* is similar to *N. doryphorus* Van Cleave and Bangham, 1949, but it is characterized by its smaller latero-terminal proboscis hooks and eggs. Also, *N. anguillum* is distinguished from the second species, *N. dimorphospinus* Amin & Sey, 1996, by having fusiform eggs, posterior testis longer than the anterior one, subequal lemnisci reaching the level of the anterior testis and larger size of all parts, except for the relatively smaller proboscis hooks. The present new species is also separated from *Neoechinorhynchus* species infecting fishes elsewhere in the world by having fusiform ripe eggs.

INTRODUCTION

Reviewing the available literature, various gaps of knowledge were found concerning the different parasite species of Nile fishes. The taxonomical studies of the helminth parasites of freshwater fishes in Egypt are very important from the zoogeographical point of view. Generally speaking, acanthocephalan parasites of African freshwater fishes are still rarely tackled. The genus *Neoechinorhynchus* Stiles and Hassall, 1905, is known from a great number of fishes and some amphibians and reptiles all-over the world. The taxonomy and the geographic morphological variation within this genus have been studied by many authors (Podder, 1937; Petrochenko, 1956; Tripathi, 1956; Bullock, 1969; Ching, 1984; Amin, 1985b; Amin and Heckmann, 1992 and Buckner and Buckner, 1993).

Amin (1985a) recognized 75 species, two of which occur in African freshwater fishes. The first species, *Neoechinorhynchus africanus*, was described by Troncy (1969) from *Citharinus distichodoides* caught from Tchad. The second one, *N. ichthyobori*, was described by Saoud *et al.* (1974) from a rare fish, *Ichthyoborus besse*, caught from the White Nile in Sudan. Recent

examination of acanthocephalans obtained from the eel, *Anguilla anguilla* Linnaeus, 1766, caught from the River Nile at Sohag in 1996 revealed a new species of *Neoechinorhynchus*. This species is herein described.

MATERIALS AND METHODS

Fishes were collected from the River Nile at three different locations along 85 Km in Sohag Governorate, Upper Egypt. These locations (from the north to south) were Tema, Sohag and Gerga, respectively. The caught eels, *Anguilla anguilla*, were kept in iced water and examined within 24 hr of catching. Acanthocephalan worms were placed in cold distilled water to evaginate the proboscis and then fixed in AFA. Specimens were stained with Mayer's alum carmine, dehydrated, cleared, and mounted in DPX. Some specimens were preserved in a mixture of 70% alcohol and 5% glycerol and then mounted on slides with a few drops of lactophenol. Drawings were made using a microprojector. For SEM examination, some fresh worms were fixed in a mixture of 1:3 glutaraldehyde 2% and osmium tetroxide 1%, dehydrated in upgraded series of ethanol, critical-point dried with CO₂ using Samdri (PVT-3B) device, mounted on copper grids, coated with gold by ion sputtering device (JEOL JFC-1100 E), and examined under JEOL-5300 SEM at high voltage ranging from 10 Kv-30Kv at EM Unit, Sohag Faculty of Science, Egypt. All measurements were made in micrometers, with average in parentheses, unless noted. Body length (=trunk length) did not include proboscis or male bursa. Width measurements refer to maximum width. Measurements were made for 15 adult specimens, 6 males and 9 females.

RESULTS

Neoechinorhynchus anguillum sp.n.

(Figs. 1 - 14)

Description

General: Neoechinorhynchidae, Neoechinorhynchinae with characteristics of the genus *Neoechinorhynchus*. The proboscis and all shared structures are larger in females than in males. Trunk is cylindrical, widest in the anterior half and gradually tapering toward both anterior and posterior ends of the worm. Dorsal and ventral body wall is of equal thickness. Giant hypodermal nuclei are normally 6 dorsal and 2 ventral. They appear boat-like shaped (Fig. 9). Proboscis is short, stubby and slightly wider than longer with a prominent apical organ which is longer than wider in both sexes (Figs. 3, 8, 12). The anterior circle of proboscis hooks is longer than those of the middle and posterior circles. The 2 lateral hooks in the anterior circle are horizontally directed and longer than the other 4 hooks in the circle (Fig. 8,12). All hooks are rooted and those in the posterior circle are not much smaller than those of the middle one. Proboscis receptacle is single-walled and about 3 times as long as the proboscis (Fig. 7). Lemnisci are subequal and reaching the mid-level of the anterior testis (Fig.10).

Lacunar system is anastomosing, visible and connected to the hypodermis; its transverse canals give the body an appearance of pseudosegmentation (Figs. 7, 14).

Males (Figs. 1 - 3): Trunk is 5.87 - 9.14 (7.31) mm long by 0.73 - 1.30 (0.89) mm wide. Tegument thickness is 68 - 121 (94) μm . Hypodermis thickness is 121 - 290 (204) μm . Proboscis is 95 - 135 (109) μm long by 105 - 144 (123) μm wide. The two lateral hooks in the anterior circle are 51 - 82 (71) μm long, while the dorsal and ventral ones in the same circle are 41 - 64 (52) μm long. Hooks in the middle circle are 30 - 41 (34) μm long, those in the posterior circle are 24 - 31 (28) μm long. The apical organ is 54 - 85 (71) μm long by 36 - 52 (45) μm wide. Proboscis receptacle is 354 - 420 (400) long by 93 - 140 (119) μm wide. Uninucleate lemniscus is 1.07 - 3.01 (2.80) mm long, while the binucleate lemniscus is 1.12 - 3.51 (3.01) mm long. The lemnisci occupying 20 - 39% (37%) of trunk length. Male reproductive system is 5.10 - 6.52 (5.63) mm long, occurring in posterior $\frac{2}{3}$ of trunk. The two testes are oblongate, contiguous and lying in the middle third of the body. The anterior testis is relatively smaller than the posterior one, 785-1,360 (1,055) μm long by 360 - 450 (415) μm wide. The posterior testis is 700-1,840 (1,115) μm long by 310 - 590 (467) μm wide. The cement gland is elongate, measures 1,000 - 1,740 (1,360) μm long by 350-560 (425) μm wide. The cement reservoir is an ellipsoid sac of 330 - 607 (456) μm long by 230 - 403 (255) μm wide. Meanwhile, the seminal vesicle is an elongate duct, opening separately into the genital bursa. It measures 325-1,680 (1,114) μm long by 230 - 256 (223) μm wide. Saeftigen's pouch is 292 - 840 (560) μm long by 130-270 (208) μm wide. Bursa is 170 - 590 (367) μm long by 90 - 230 (169) μm wide.

Females (Figs. 4 - 6): Trunk is 6.42 - 17.21 (15.45) mm long by 0.45 - 1.62 (0.99) mm wide. Tegument thickness is 64 - 142 (106) μm . Hypodermis thickness is 119 - 298 (212) μm . The proboscis is 106 - 143 (121) μm long by 114 - 161 (134) μm wide. The two lateral hooks in the anterior circle are 53 - 92 (76) μm long, while the dorsal and ventral hooks in the same circle are 44 - 75 (56) μm long. Hooks in the middle circle are 32 - 54 (39) μm long and in the posterior circle are 26-38 (33) μm long. The apical organ is 57 - 91 (82) μm long by 36 - 57 (52) μm wide. Proboscis receptacle is 359 - 535 (485) μm long by 94 - 169 (136) μm wide. Uninucleate lemniscus is 1.16 - 3.88 (3.27) mm long and the binucleate lemniscus is 1.25 - 4.52 (3.65) mm long. The lemnisci occupy 19 - 32% (27%) of trunk length. Female reproductive system is 0.62 - 1.51 (1.08) mm long, occupying 11% of trunk length. The uterus is longer than the uterine bell and is 390 - 520 (440) μm long. The vagina is a short muscular tube with a small sphincter. It measures 120 - 190 (160) μm long and the gonopore is terminal. The eggs are fusiform with a small round polar prolongation of the fertilization membrane. These measure 20 - 36 (29) μm long and 9-14 (12) μm wide (Figs. 6, 11).

DISCUSSION

Regarding the species belonging to the genus *Neoechinorhynchus* Stile and Hassall, 1905, *N. africanus* Troncy, 1969, is considered the first species to be described from African freshwater fishes, while Khalil (1971) maintained that the family *Neoechinorhynchidae* is represented in African freshwater fishes by a single species, *Hexaspiron nigericus* Dollfus and Golvan, 1956. Saoud *et al.* (1974) described another species, *Neoechinorhynchus ichthyoborus*, in the Sudan. They stated that this species represents the first African species of the genus *Neoechinorhynchus*. Thus, it is obvious that there has been no consensus on the true taxonomical status of fish parasites in Africa. This may be due to the difficulty of getting all the relevant literature by these authors.

In Egypt, El-Naffar *et al.* (1983) reported *Neoechinorhynchus* sp., from the intestine of *Bagrus docmac*, during their survey of the helminth parasites of some fishes from Lake Nasser. By comparing the present species with both species, *N. africanus* Troncy, 1969 and *N. ichthyoborus* Saoud *et al.*, 1974, previously described from African freshwater fishes, it is evident that it differs from them regarding many features.

Possession of two lateral terminal proboscis hooks markedly larger than the dorsal and ventral hooks in the same circle aligns *N. anguillum* with the two other species of *Neoechinorhynchus* which are known to occur in fishes. These two species were *Neoechinorhynchus doryphorus* Van Cleave and Bangham, 1949, described from *Jordanella floridae* in the Englewood area of Florida and *Neoechinorhynchus dimorphospinus* Amin and Sey, 1996 described from *Dorsoma nasus* Bloch, 1795 in the Arabian Gulf off the coast of Kuwait. *Neoechinorhynchus anguillum* sp. n. bears some resemblance to *N. doryphorus* in such characters as body form, the egg with a small polar prolongation of the middle membrane and extension of lemnisci to the level of the anterior testis in the only one male allotype. In *N. doryphorus*, however, the 2 highly modified lateral hooks are markedly longer (105-132 μm) than those of *N. anguillum* sp. n. Also, the eggs of *N. doryphorus* are considerably larger (48-55 by 14-16 μm). Van Cleave and Bangham (1949) provided only 4 figures of the two proboscides and 2 anterior hooks and reported a brief account of a few females' trunks, hooks and egg measurements; one male allotype was included in the type material. Thus, further comparison with the present material is impossible.

Neoechinorhynchus anguillum is the closest to *N. dimorphospinus*. The two species are similar in body shape, proboscis, lateral terminal proboscis hooks, which are obviously larger than the dorsal and ventral ones in the same circle, and the proportion of the reproductive system to the trunk size.

Morphologically, three main characteristics separate the two species which are: (1) The ripe egg of *N. anguillum* is somewhat fusiform with a small polar prolongation of the fertilization membrane (Figs. 6, 11). However, the ripe egg of *N. dimorphospinus* is oblong without a prolongation. (2) The subequal lemnisci of *N. anguillum* extend to the level of the anterior testis (Figs. 1, 9),

while the nearly equal lemnisci of *N. dimorphospinus* drawings by Amin and Sey's (1996) fail to reach the anterior testis. (3) Although the male reproductive system occupies the posterior $\frac{2}{3}$ of the trunk in both species, the posterior testis is longer than the anterior one in *N. anguillum*. However, the opposite is true for *N. dimorphospinus*. Morphometrically, the diminutive size of all features of *N. dimorphospinus*, except for the relatively smaller proboscis hooks of *N. anguillum*, clearly separates the two species. It is worth mentioning that the presence of the fusiform egg with a small polar prolongation in *N. anguillum* brings it closer to species of the genus *Hebesoma* Van Cleave, 1928, which is separated from the species of *Neoechinorhynchus* based on its egg shape. Amin and Bullock (1998) stated that more careful study of *Hebesoma* might show that it is much more closely related to *Neoechinorhynchus* than previously thought.

Other species of *Neoechinorhynchus* from fishes with fusiform eggs having a polar prolongation include *N. agilis* (Rudolphi, 1819) Van Cleave, 1916, *N. doryphorus* Van Cleave and Bangham, 1949, and *N. rostratum* Amin and Bullock, 1998. *Neoechinorhynchus anguillum* sp. n. may be distinguished from these other 3 species of *Neoechinorhynchus* by the following: The anterior proboscis hooks of *N. agilis* are longer (84-140 μm long), the differences with *N. doryphorus* are mentioned earlier in this discussion, the eggs of *N. rostratum* are markedly larger (32 – 45 μm by 13 – 22 μm) than in *N. anguillum*, and also the anterior testis is longer than the posterior one in *N. rostratum*, while the opposite occurs in *N. anguillum*.

The present study showed that the scanning electron microscopy is a good tool for illustrating some details of the present worms such as the proboscis hooks and the connection of the lacunar system canals to the hypodermis.

The recovery of similar fish acanthocephalan species elsewhere in the world (Amin *et al.*, 1984 and Amin, 1998) suggests that the geographical distribution of *Neoechinorhynchus* with unequal proboscis hooks in the anterior circle is considerably wider than previously thought and it may play a role in the distribution of *Neoechinorhynchid* parasites.

Taxonomic Summary:

Differential diagnostic features: *Neoechinorhynchus anguillum* sp. n. is characterized by having:

- (1) The ripe egg is small and fusiform, with a small polar prolongation of the fertilization membrane.
- (2) The two subequal lemnisci reaching the level of the anterior testis.
- (3) The posterior testis is longer than the anterior one.
- (4) The small size of the proboscis hooks.
- (5) The larger size of all partes.

Host: *Anguilla anguilla* Linnaeus, 1766 (Anguillidae).

Infection site: Intestine.

Locality: The River Nile, Sohag Governorate, Upper Egypt.

Type specimens: Holotype, Allotype and Paratypes are deposited in the parasites collection, Zoology Dept., Sohag Faculty of Science, South Valley Univ., Egypt.

Etymology: Species name refers to the specific name of the fish host.

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Explanation of Figures

Neoechinorhynchus anguillum sp.n.

- Fig.1: Microprojector drawing of a holotype male.
- Fig.2: Microprojector drawing of the proboscis of a paratype male.
- Fig.3: Microprojector drawing of proboscis hooks of a paratype male showing lateral hook of anterior circle (A) Dorsal hook of anterior circle (B) Hook of middle circle (C) Hook of posterior circle (D).
- Fig.4: Microprojector drawing of an allotype female.
- Fig.5: Microprojector drawing of reproductive system of a paratype female.
- Fig.6: Microprojector drawing of ripe eggs from the female body cavity.
- Figs.7-11: Light microscopy photomicrographs showing:
- Fig.7: Anterior end of a paratype female showing the proboscis receptacle (PR) and an anastomosing lacunar system (LS). X 130.
- Fig.8: The proboscis of a paratype male showing lateral terminal hooks (LTH) and the apical organ (AO). X 260.
- Fig.9: Giant hypodermal nucleus (HN) of a paratype male. X 130..

Fig.10: Mid-region of a paratype male showing an extension of the subequal lemnisci (L) to the anterior testis (AT) level. X130.

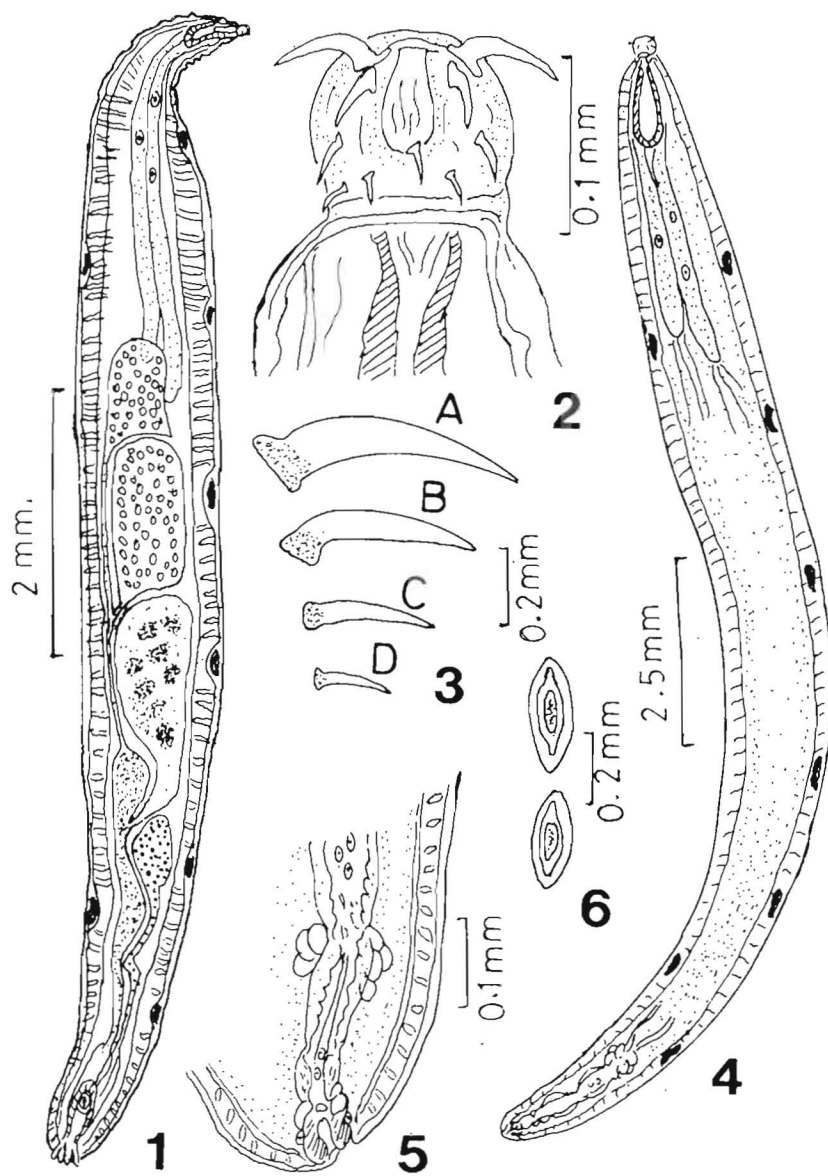
Fig.11: Egg from the body cavity. X 1300.

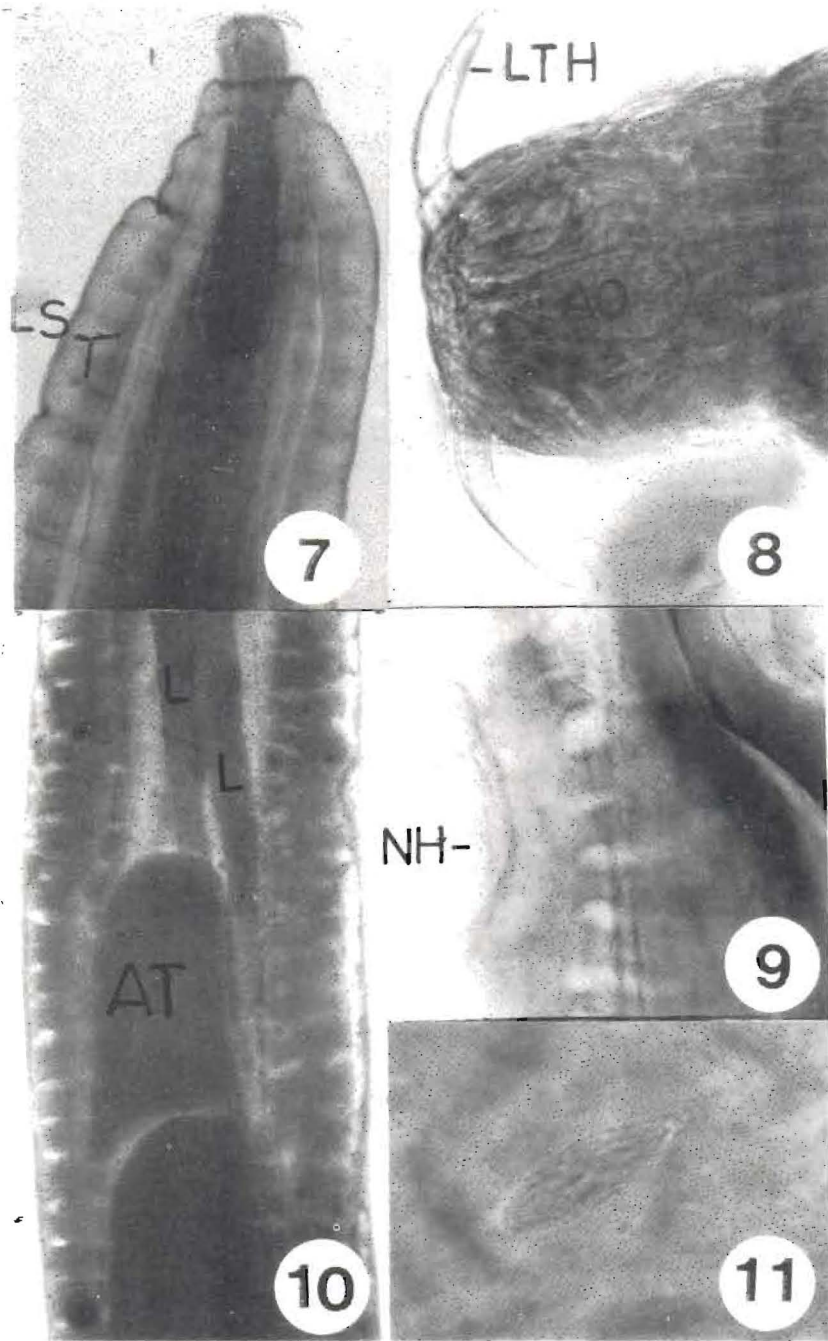
Figs.12-14: Scanning electron micrographs.

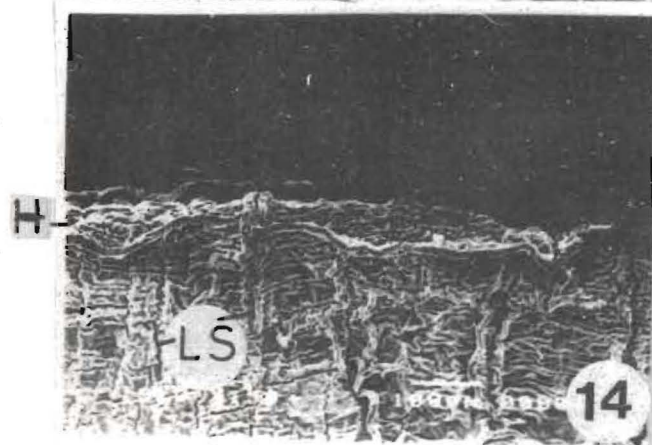
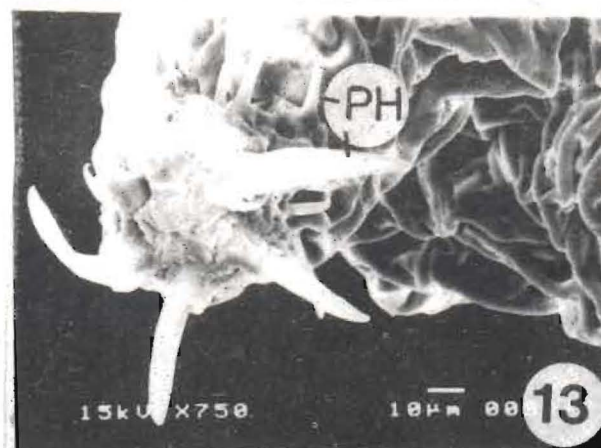
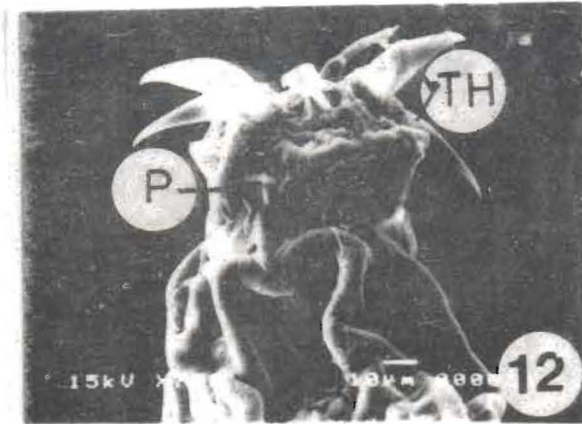
Fig.(12): Lateral view of the female anterior end showing proboscis (P) and terminal proboscis hooks (TH). X 750.

Fig.(13): En-Face view of the female anterior end showing proboscis hooks (PH) .X 750.

Fig.(14): Lateral view of the male showing the pseudosegmentation of the body and the connection of lacunar system (LS) canals to the hypodermis (H). X 350.







نيواكتينوريكتس أنجويلم نوع جديد (أكتنوسيفالا - نيواكتينوريكتيدي) من سمكة أنكيس المياه العذبة ، أنجويلا أنجويلا

من سوهاج ، مصر

مئمن الضمن انى

قسم علم الحيوان - كلية العلوم بسوهاج - جامعة جنوب الوادى

فى هذا البحث وصف نوع جديد من شوكيات الرأس ، نيواكتينوريكتس أنجويلم ، من سمكة الأنكيس ، أنجويلا أنجويلا ليتيوس ، ١٧٧٦ (أنجويليدي) من نهر النيل بسوهاج . وهذا هو النوع الثالث من جنسه الذى يصيب أسماك المياه العذبة الأفريقية. وقد استخدم فى وصفه الميكروسكوبان الضوئى والالكترونى الماسح .
ويختلف هذا النوع عن بقية الأنواع التى وصفت فى أفريقيا بأن له أشواكا فى الحلقه الأمامية للرأس غير متساوية الطول ، كما يختلف عنها فى كثير من الصفات الأخرى ، ويقارب النوع الجديد مع نوعين آخرين يصيبان الأسماك ، نظراً لأن أشواك الحلقه الأمامية للرأس غير متساوية الطول . ويشابهه نوع إكتينوريكتس أنجويلم مع نيواكتينوريكتس دورفوس فان كليف و بنجاهام ، ١٩٤٩ ، ولكنه يختلف عنه بصغر أشواكه الطرفية الجانبية وصغر بويضاته . بينما يتميز النوع الجديد عن نيواكتينوريكتس دايمورفو سبتينوس أمين و سائ ، ١٩٩٦ بأن له بويضات مغزلية الشكل وخصية خلفية أطول من الأمامية وشريطين غير متساويين يمتدان إلى مستوى الخصية الأمامية وكذلك كبر حجم جميع الأجزاء فيما عدا أشواك الرأس الصغيرة نسبياً فى النوع الجديد . ويستقل النوع الجديد عن الأنواع التى تتبع جنس نيواكتينوريكتس ولها بويضات مغزلية الشكل والتى تصيب الأسماك فى أماكن أخرى من العالم .

المجلة المصرية لعلم الحيوان

٣٦

يونيو ٢٠٠١

دورية علمية تصدر عن جمعية علم الحيوان بجمهورية مصر العربية