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FIRST RECORD OF *SOLOSTAMENIDES PAUCITESTICULATUS* KRITSKY & ÖKTENER, 2015 (MONOGENOIDEA, MICROCOTYLIDAE) FROM GILLS OF ABU MULLET *PLANILIZA ABU* (HECKEL, 1843) FROM EUPHRATES RIVER OF SAMAWA CITY, SOUTHERN IRAQ

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ABSTRACT

A total of 54 abu mullet *Planiliza abu* (Heckel, 1843) were collected from two stations (north and south stations) along the Euphrates River near Samawa City, Al-Muthanna province and were examined during the period from October 2016 till September 2017 for parasites. Six out of 35 examined fishes from the north station (17.1%) and one out of 19 examined fishes (5.3%) from south station were infected with the microcotylid *Solostamenides paucitesticulatus* Kritsky & Öktener, 2015. The parasite was illustrated and described, and it is considered as a new record for the parasitic fauna of fishes of Iraq. *S. iraqensis* Al-Nasiri & Balbuena, 2018 is considered a synonym of *S. paucitesticulatus*.

Keywords: Fish, Iraq, Microcotylidae, Mugilidae, *Planiliza abu*, *Solostamenides*.

INTRODUCTION

The fish family Mugilidae comprises 77 species, so called mullets or grey mullets. It includes mostly marine and brackish-water coastal fishes occurring in tropical and temperate seas worldwide, and only abu mullet *Planiliza abu* occurs in southwestern Asia including Iraq (Eschmeyer, 2018; Froese and Pauly, 2018).

The abu mullet *Planiliza abu* has a dominance in numerical abundance of fish assemblage in most water bodies in Iraq, which comprises 21-61% with 36% annual mean in east Al-Hammar marshes and 41-77% with 62% annual mean in Chebaish marshes in Southern Iraq (Mohamed, 2014), and it is in the fourth dominant species out of 111 fish species in the Shatt Al-Arab River (Mohamed and Abood, 2017).

Eleven monogenoid species belong to the order Mazocraeidea have so far been recorded from *P. abu* in Iraq (Mhaisen, Pers. Comm.). In order to economize space, only the first record of these parasites (in an alphabetical Order) will be given here. *Diplozoon paradoxum* von Nordmann, 1832 was reported from Euphrates River at Al-Musaib city by Al-Sa'adi

(2007), *Diplozoon* sp. from Garmat Ali River, Basrah province by Abdul-Rahman (1999), *Discoctyle sagittata* (Leuckart, 1842) Diesing, 1850 from Euphrates River at Al-Qadisia dam lake as well as from drainage network at Al-Madaen, south Baghdad by Mhaisen *et al*. (1997). But the full description of that parasite was published later on by Mhaisen *et al*. (2003), *Discocotyle* sp. from Al-Qadisiya dam lake by Asmar *et al*. (1999), *Eudiplozoon nipponicum* (Goto, 1891) from Diyala River, Diyala province by Mohammed (2017), *Mazocraeoides dorosomata* (Yamaguti, 1938) from Garmat Ali River, Basrah province by Jori (1998), *Microcotyle* sp. from Diyala River, southeast Baghdad by Ali *et al.* (1986) which was then recognized by Ali *et al*. (1989) from Babylon fish farm as *Microcotyle donavini* van Beneden & Hesse, 1863; *Paradiplozoon bliccae* (Reichenbach-Klinke, 1961) from Tigris River passing through Tikrit city by Al-Jubori (2013), *Paradiplozoon cyprini* Khotenovsky, 1982 from Diyala River, Diyala province by Mohammed (2017); *Paradilozoon kasimii* (Rahemo, 1980) Khotenovsky, 1982; which was reported as *Diplozoon kasimii* from Al-Salihiya canal, Basrah province by Al-Janae'e (2010), and *Paradiplozoon pavlovskii* (Bychowsky & Nagibina, 1959) Khotenovsky, 1982 from Tigris River at Baghdad province by Al-Jawda and Asmar (2015). It is reliable to state here that the record of members of Diplozoidae from non-cyprinid hosts was considered as unusual record, due to fact that members of Diplozoidae are mainly parasites of Cyprinidae (Pugachev *et al*., 2009; Al-Nasiri and Balbuena, 2016).

During extensive survey of parasites of freshwater fishes belong to ten families from two stations along Euphrates River near Samawa city, Al-Muthanna province, southwestern Iraq, unknown microcotylid specimens were detected from gills of *P. abu* in both stations. The present article deals with the description of such specimens.

MATERIALS AND METHODS

Fifty- four specimens (35 and 19 specimens from North and south stations respectively) of *P. abu* were caught by electrical fishing or gill net from the north station (31°22'14.9"N, 45°12'49.2"E) and the south station (31°18'54.4"N 45°20'21.4"E) during the period from October 2016 till September 2017 from both stations. The fishes were transferred to the laboratory in a cool box half filled with river water. In the laboratory, the fishes were killed by spinal cord pithing and gill lamellae of each individual fish were removed and put in individual vial with hot (60°C) 5% formalin solution. The vials were then shaken vigorously for 15-30 sec and labeled; after that, the contents were allowed to settle down, the clear liquid was decanted and the sediment was placed in smaller labeled containers.

Some worms were picked from the sediments with a fine probe under dissecting microscopy, mounted unstained on microscope slides (Kritsky *et al*., 2013) in lactic acid for the study of their sclerotized structures (Solak *et al*., 2007). The fixed specimens in formalin were moved to 70% ethanol for four hours, stained with Mayer-Schuberg's aceto carmine (Palm, 2004), dehydrated with ascending series of ethanol, cleared in xylene and mounted in D.P.X. The terms prevalence and mean intensity were used as defined by Bush *et al*. (1997).

Illustrations were prepared with the aid of a camera lucida (China) attached on compound microscope, (Leica, Germany); measurements, all in micrometers, were expressed as a range and followed by both the mean of structures measured and the standard variation in parentheses. Fish taxonomy followed Coad (2010) and the common and scientific name of fish species were followed Froese and Pauly (2018). Four stained specimens on two slides were deposited in Iraq Natural History Research Center and Museum (Code no. INHM-TRC21).

RESULTS AND DISCUSSION

Solostamenides paucitesticulatus Kritsky & Öktener, 2015

Description is based on 12 stained specimens and one unstained specimen in lactic acid.

Plant leaf or lanceolate-like body (Fig. 1A) gradually tapering toward both ends. The length of body is 1071-2417 (1939±392.8), maximum width 438-683 (580±73.5) in postgermarium. The subterminal mouth is attached to the anterior edge of the suckers; suckers are two, elliptical in shape, 31-68×50-88 (44.8±10.7 × 65.2±14.2); many small papillae are located on the posterior and the middle edges of suckers, 40-52 (46.7±3.9) in number (Fig. 1B).

Pharynx is spherical, 31-62 (36.3±8.9) and situated directly posterior of suckers in mid longitudinal line of body; esophagus is long thin tube, bifurcates anterior of genital pore into two parallel intestinal caeca which extend posteriorly into the anterior portion of haptor.

The haptor is 480-775 (688.4±100.7) in the length and carries two longitudinal rows of similar clamps, 36-40 (37.4±1.4) in the number, the anterior clamps are 60-88 (74±7.3) in width and the posterior one is 41-70 (57.7±0.7) in width; middle part of sclerotize carried T-shaped end, another sclerotize raised from dorsal side of clamp (Fig. 1C).

Testes are intercaecal and postgermarial, 7-10 (8.8±1.2) in number and 71-92 (82.5±6.6) in length, and 51-65 (56±6.4) in width; genital atrium sub spherical, 41-70 (59.7±13.2) and difficult to see due to dense vitellaria; Male copulatory organ (MCO) globular, 26-44 (31.6±6.2) and armed with 11-13 (12.3±0.7) small hooks arranged circularly around the male opening (Fig. 1D); the hooks have bulby base and curved blade.

Ovary (Germarium) has a question mark shape, intercaecal in the mid longitudinal line, 390-612 (475±62.1) in length; the uterus forms narrow tube and contains 1-3 (2.2±0.7) eggs; the eggs are oval, carrying short filament on one of their terminal end (Fig. 1E), and measure 170-208 × 52-96 (192.1±12.5 × 70.5±14.4). Vitellaria are dense and filled the area between intestinal bifurcation and the anterior of the haptor; the Y- shaped vitellarium reservoir is located behind the ovary (postgermarium). Prevalence and mean intensity of infection is 12.96% and 1-12 (3.3), respectively.

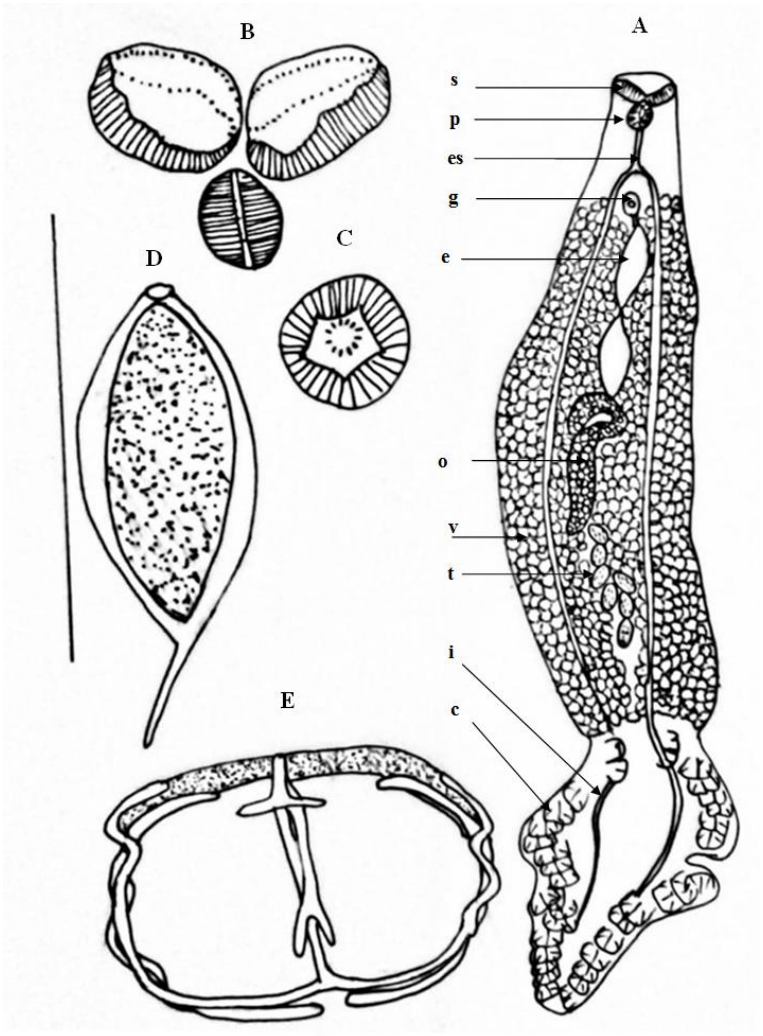

Figure (1): *Solostamenides paucitesticulatus* from *Planiliza abu*; (A) Whole mount (ventral view), (B) oral sucker and pharynx, see the small papillae, (C) Genital atrium and male copulatory organ, ventral view, (D) Egg, (E) Clamp, dorsal view. (Scale bar: A= 1mm, B & C= 250 µm, D and E=100 µm. Abbreviations: c: clamp, e: egg, es: esophagus, g: genital atrium, i: intestinal caecum, o: ovary, p: pharynx, s: sucker, t: testis, v: vetillaria)

Unnithan (1971) created the genus *Solostamenides* and accommodated five species of the genus *Microcotyle* van Beneden & Hesse, 1863; these were *M. mugilis* Vogt, 1878 (=*Solostamenides mugilis* (Vogt, 1878) Unnithan, 1971 as a type-species), *M. chrysophryi* van Beneden & Hesse, 1863, *M. mouwoi* Ishi & Sawada, 1938, *M. suzuki* Ishii & Sawada, 1938 and *M. pseudomugilis* Hargis, 1956. He distinguished the new genus (*Solostamenides*) from other *Microcotyle* species by possessing the hooks on the head of the cirrus (penishead) only, while the armature with hook found on genital atrium and the cirrus being smooth in *Microcotyle* species. Mamaev (1977, 1986) accepted *Solostamenides*, but accepted only two species reported from Mugilidae, *S. mugilis* and *S. pseudomugilis*. Jianyin and Tingbao (2001) added the third species, *S. platyorchis* from flathead grey mullet *Mugil cephalus* from China. On the other hand; Kritsky and Öktener (2015) described *S. paucitesticulatus* from *Liza abu* (=*Planiliza abu*) from Ataturk reservoir on the Euphrates River, southern Turkey. Moreover, the present record of *S. paucitesticulatus* is considered as the first record from Iraq and the second for the world, and extends the distribution of the parasite species from upper drainage of Euphrates to the lower part of the river.

Based on high host specificity of most monogenoides, Kritsky and Öktener (2015) explained that the description of *S. pseudomugilis* by Williams (1991) from *Mugil cephalus* in Western Australia might have dealt with undescribed species of *Solostamenides*, as well as many other records of *S. mugilis* and *S. pseudomugilis* from other than the type host (*Mugil cephalus*) in the Mediterranean region and from Chile and Brazil coasts which would need a confirmation.

S. paucitesticulatus is distinguished from the three other species by possessing lesser number of testes (7-10 vs. 83-113, 60-69 and 16-22 in *S. mugilis*, *S. pseudomugilis* and *S. platyorchis*, respectively) in the lesser number of haptoral clamps (36-40 vs. 60-80, 56-62 or 72-78 and 40-46, respectively) and lesser number of genital hooks (11-13 vs. 25-28, 16-20 and 15-17, respectively). The description and measurements of the present specimens of this parasite agreed with the original description of the same species from the same host from Turkey. The infection existed in April and June in Iraq, while it occurred in August, September and December in Turkey (Kritsky and Öktener, 2015).

Recently, Al-Nasiri and Babuelna (2018) described a new *Solostamenides* species (*S. iraqensis*) from the gills of *Liza abu* (= *P. abu*) from Tigris River near Tikrit City. *S. iraqensis* has the same body length, number of clamps, number of spines in MCO and eggs dimensions. The authors offered some characters for distinguishing the two species which were already described from the same fish host (*P. abu*) e. g. absence or presence of muscular bands in the oral sucker, diameter of testes, lengths of spines in MCO, nature of egg's filament and the shape of median part of clamp (X or Y- like). However, all above used characters used have not taxonomical value and they are even variable within the same species as resulting from different fixations and staining from intraspecific variations. Hence, *S. iraqensis* is considered as a synonym of *S. paucitesticulatus*; also, both species were described from the same host and the geographical distribution (Mesopotamia, Turkey and Iraq). It is well known that each species of *Solostamenides* is infects a single species of mullet (Kritsky and Oktener, 2015). The invalidity of *S. iraqensis* from *P. abu* from Tigris River, Iraq is based on the opinion provided by the expert Dr. Delane Kritsky (D. Kritsky, Pers. Comm.).

As indicated in the introduction, 11 mazocraeid species were so far recorded from *P. abu* in Iraq (Mhaisen, Pers. Comm.); seven out of 11 species of mazocraeids are so far reported from *P. abu* which belong to Dilozoidae: 2 species of *Diplozoon*, 1 species of *Eudiplozoon* and 4 species of *Paradiplozoon*). All of them are clearly distinguished from *S. paucitesticulatus* by

twin worm shape and four clamps on the haptor. Both *Discocotyle* spp. and *M. dorosomata* can be easy distinguished from *S. paucitesticulatus* by having four pairs of clamps which are arranged as four clamps on each side of the haptor in comparison with the haptor with many clamps (17-20 pairs), as well as the presence of larval hook on terminal lappet of haptor in comparison with their absence in *S. paucitesticulatus*. The only so similar parasite that was recorded from the same host (*P. abu*) is *M. donavini*; both genera have the same sclerotized parts and reproductive organs.

The nature of the genital atrium armature between *Microcotyle* and *Solostamenides* is the only distinguished character. However, the description of both *M. donavini* or *Microcotyle* sp. in Iraqi studies (e.g. Al-Daraji, 1986; Ali *et al*., 1986; Mehdi, 1989; Al-Daraji and Al-Salim, 1990) were inadequate and never dealt with the spinal armature of the genital atrium. As well as whether the spines are found on male copulatory organ (MCO) only or distributed on genital atrium is not clear also.

According to the above discussion, it is so probable that some of Iraqi records of *M. donavini* from gills of *L. abu* (=*P. abu*) might represent a misidentification with *S. paucitesticulatus*.

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تسجيل أول للدودة أحادية المنشأ *Solostamenides paucitesticulatus* Kritsky & Öktener, 2015 (Monogenoidea, Microcotylidae) من غلاصم سمكة الخشني *Planiliza abu* (Heckel, 1843) من نهر الفرات عند مدينة السماوة، جنوب العراق

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الخلاصة

فحصت ٥٤ عينة من سمكة الخشني *Planiliza abu* (Heckel, 1843) من المحطتين الشمالية والجنوبية على طول نهر الفرات المار في مدينة السماوة، محافظة المثنى للمدة من تشرين الأول ٢٠١٦ وحتى أيلول ٢٠١٧ بحثاً عن الطفيليات. وجد ان ستة أسماك من أصل ٣٥ عينة (١٧,١%)، و سمكة واحدة من أصل ١٩ عينة (٥,٣ %) مصابة بنوع الطفيلي أحادي المنشأ *Solostamenides paucitesticulatus* Kritsky & Öktener, 2015 في المحطتين الشمالية والجنوبية، على التوالي.

رسم و وصف الطفيلي و عد تسجيلا جديدا للمجموعة الطفيلية في أسماك العراق؛ و ان النوع *S. Iraqensis* Al-Nasiri & Balbuena, 2018 يعتبر مرادفا للنوع *S. paucitesticulatus*.