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Cestodes of Fishes from the Euphrates River at Al-Musaib City, Mid Iraq

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Abstract

Due to the importance of the cestodes in fish life and as no previous work was done on cestodes of fishes of Euphrates River at Al-Musaib city, mid Iraq, the present study was undertaken. A total of 472 fish specimens belonging to 24 species were inspected for parasites during the period from July 2006 till the end of June 2007. All fish specimens were externally examined for ectoparasites and then were dissected out to reveal any internal parasites in body cavity, musculature and internal organs. Seven cestode species were recorded from the intestine of six species of these fishes. These cestodes were *Caryophyllaeus laticeps* from *Barbus barbulus*, *Monobothrium auriculatum* from *Luciobarbus xanthopterus*, *Bothriocephalus acheilognathi* from both *Carasobarbus luteus* and *L. xanthopterus*, *Senga magnum* from *Mastacembelus mastacembelus*, *Senga ophiocephalina* from *M. mastacembelus*, *Proteocephalus osculatus* from *Silurus triostegus* and *Neogryporhynchus cheilancristrotus* from *Mesopotamichthys sharpeyi*. All these worms were adults except for *N. cheilancristrotus* which occurred as a larval stage. Both *M. auriculatum* and *S. ophiocephalina* are reported here for the first time in Iraq. Description and measurements of these newly recorded cestodes are given. In addition, four new host records in Iraq were reported for four species of these cestodes. Number of fish hosts reported for these cestodes fluctuated from one host in case of six cestode species to a maximum of two hosts in case of *B. acheilognathi*. Among the inspected fishes, number of cestode species fluctuated from a minimum of one cestode species in five fish species to a maximum of two cestode species in case of both *L. xanthopterus* and *M. mastacembelus*, while 18 fish species showed no any cestode infection.

Keywords

Cestoda, Freshwater Fishes, Euphrates River, Al-Musaib City, Babylon Province, Iraq

1. Introduction

The cestodes or tapeworms are flatworms which are generally characterized by segmented body (except the cestodarians and few eucestodes) with a scolex, a "neck," and one or more proglottids, which are sometimes called segments. The scolex which lies on the anterior end of the body is usually armed with various combinations of suckers, hooks, bothridia or bothria, or even tentacles, rostrum, apical cone or pad in some species, for attachment in the host intestine (Schmidt and Roberts, 2009). Apart from few exceptions, all tapeworms are hermaphroditic and characterized by the lack of an alimentary canal (Duijn, 1973). Adult cestodes infecting fishes live in their alimentary canal, while as larvae they inhabit fish body cavity, musculature and viscera. Hence, fishes serve as final, intermediate or paratenic hosts for cestodes (Amlacher, 1970; Olsen, 1974). The ~6,000 tapeworm species comprise 18 orders that differ most conspicuously in the form of their attachment structure, the scolex (Global Cestode Database, 2015).

Due to their endoparasitic style of life, cestodes exert different injuries in the body of their hosts and may cause the death to the host as in the case of the Asian tapeworm *Bothriocephalus acheilognathi* (Han *et al.*, 2010). In addition, some cestodes, such as the broad fish tapeworm *Diphyllobothrium latum*, have a zoonotical importance as they are known to be transmissible to humans through the consumption of raw or inadequately cooked fishes (Adams *et al.*, 1997). Some adult cestodes such as *Ligula intestinalis*, *Neogryporhynchus cheilancristrotus*, *Schistocephalus solidus* and *Valipora campylancristrota* infect fish-eating birds

(Jarecka, 1970; Duijn, 1973; Scholz *et al.*, 2004; Ortega-Olivares *et al.*, 2008).

Among parasitological investigations achieved on cestodes of fishes from Euphrates River within the Iraqi territory are those of Mhaisen *et al.* (1997), Asmar *et al.* (1999), Al-Jadoaa (2002), Al-Saadi (2007), Al-Karboly (2012) and Al-Salmany (2015). The present article was aimed to contribute on the cestodes of fishes from the Euphrates River at Al-Musaib city as no previous study was done on fishes of this area.

2. Materials and Methods

Fish specimens were collected from the Euphrates River at Al-Musaib city (32°47'N, 44°17'E), mid Iraq during the period from July 2006 till the end of June 2007. They were caught with the aid of a cast net and were directly transported to the laboratory where they were measured, weighed and sexed. Fishes were freshly examined for the presence of any visible ectoparasites. Smears from skin, fins, gills and buccal cavity were examined for ectoparasites, while body cavity, musculature and all internal organs were inspected for endoparasites according to Amlacher (1970). Prevalence of infection was calculated according to Margolis *et al.* (1982). Parasite identification was done according to Bykhovskaya-Pavlovskaya *et al.* (1962).

Names and authorities of the concerned cestodes were checked in accordance with the Global Cestode Database (2015) in addition to some relevant literature (Scholz *et al.*, 2004; Kuchta and Scholz, 2007).

The valid scientific names of the studied fishes were based on Froese and Pauly (2015). Such names are similar to those reported by Eschmeyer (2015), except for both *Barbus grypus* and *Tilapia zillii* which were considered as synonyms of *Arabibarbus grypus* and *Coptodon zillii*, respectively by the latter reference.

3. Results and Discussion

During the period of this investigation, a total of 472 fish specimens belonging to 24 species and eight families were inspected for parasites. The updated scientific names of these fishes, according to Eschmeyer (2015) and Froese and Pauly (2015), as well as their examined numbers are demonstrated below according to their respective families.

Family Cyprinidae
16 *Alburnus caeruleus* Heckel, 1843
10 *Alburnus orontis* Sauvage, 1882
24 *Alburnus sellal* Heckel, 1843
9 *Arabibarbus grypus* (Heckel, 1843)
12 *Barbus barbulus* Heckel, 1847
2 *Capoeta damascina* (Valenciennes, 1842)
77 *Carasobarbus luteus* (Heckel, 1843)
4 *Carassius carassius* (Linnaeus, 1758)
3 *Chondrostoma regium* (Heckel, 1843)
2 *Ctenopharyngodon idella* (Valenciennes, 1844)
60 *Cyprinion kais* Heckel, 1843
15 *Cyprinion macrostomum* Heckel, 1843
7 *Cyprinus carpio* Linnaeus, 1758
22 *Garra rufa* (Heckel, 1843)
33 *Leuciscus vorax* (Heckel, 1843)
11 *Luciobarbus xanthopterus* Heckel, 1843
2 *Mesopotamichthys sharpeyi* (Günther, 1874)
Family Bagridae
18 *Mystus pelusius* (Solander, 1794)
Family Siluridae
5 *Silurus triostegus* Heckel, 1843
Family Sisoridae
13 *Glyptothorax steindachneri* (Pietschmann, 1913)
Family Heteropneustidae
12 *Heteropneustes fossilis* (Bloch, 1794)
Family Cichlidae
29 *Coptodon zillii* (Gervais, 1848)
Family Mugilidae
48 *Liza abu* (Heckel, 1843)
Family Mastacembelidae
38 *Mastacembelus mastacembelus* (Banks & Solander, 1794)

The inspection of these fishes revealed the occurrence of some external parasites such as ciliophoran and myxozoan parasites (Mhaisen *et al.*, 2015a) as well as some monogeneans (Al-Sa'adi *et al.*, 2013; Mhaisen *et al.*, 2015b) in gills of some of these fishes in addition to some internal parasites of the class Trematoda (Mhaisen *et al.*, 2015c). In this article, seven species of cestodes which belong to four orders and four families (Global Cestode Database, 2015) were detected as demonstrated below.

Class Cestoda
Subclass Eucestoda
Order Caryophyllidea
Family Caryophyllaeidae
Caryophyllaeus laticeps (Pallas, 1781) Mueller, 1787
Monobothrium auriculatum Kulakowskaja, 1961
Order Bothriocephalidea
Family Bothriocephalidae
Bothriocephalus acheilognathi Yamaguti, 1934
Senga magnum (Zmeev, 1936) Protasova, 1977
Senga ophiocephalina (Tseng, 1933) Dollfus, 1934
Order Proteocephalidea
Family Proteocephalidae
Proteocephalus osculatus (Goeze, 1782) Nybelin, 1942
Order Cyclophyllidea
Family Dilepididae
Neogryporhynchus cheilancristrotus (Wedl, 1855) Baer & Bona, 1960

The following is a brief account on the occurrence of these cestodes with emphasis on the previous concerned records in fishes of Iraq.

3.1. *Caryophyllaeus laticeps* (Pallas, 1781) Mueller, 1787

This parasite was recorded from the intestine of *B. barbulus* with an incidence of 8.3%. The first report of this parasite in Iraq was from the intestine and body cavity of *A. caeruleus*

and *L. xanthopterus* (reported as *B. xanthopterus*) from Al-Tharthar Lake (Al-Saadi, 1986). Later on, it was reported from three other hosts which did not include *B. barbulus* (Mhaisen, 2015). So, *B. barbulus* of this study represents a new host record, which is the sixth for this worm in Iraq.

In addition to *C. laticeps*, two other species of *Caryophylleus* were so far reported from fishes of Iraq. These included *C. brachycollis* which was firstly reported from *Barbus lacerta* by Muhammed (1995) and *C. fimbriceps* from *B. barbulus* by Abdullah (1990). The genus *Caryophyllaeus* includes six valid species (Global Cestode Database, 2015).

3.2. *Monobothrium auriculatum* Kulakowskaja, 1961

This parasite was recorded from the intestine of *L. xanthopterus* with an incidence of 9.1%. This is the first occurrence of this parasite in Iraq and hence a brief description and its measurements are given here.

Body, 15-45 mm long x 1.5 mm wide, is characterized with expanded cephalic end with lateral "ears". Ovary is H- shaped with short lobes (lobes of ovary are 0.7 mm long each) and long narrow bridge. Vitellarial follicles run immediately behind the cephalic expansion and surround testes on all sides and also cluster at end of body in form of small, 9-15 follicles of postovarian group. Seminal duct is long and slightly convoluted. Testes lie in three longitudinal double rows. Uterus has few loops containing small number of eggs, 0.075-0.083 x 0.048-0.054 mm. The above description of *M. auriculatum* agrees with that given by Bykhovskaya-Pavlovskaya *et al.* (1962). Microphotograph of this parasite was documented in the student's thesis (Al-Sa'adi, 2007) and voucher specimen was deposited in the Iraq Natural History Research Center and Museum, University of Baghdad (serial number INHM-CC 133). It is appropriate to mention here that after the present record of this parasite during July 2006 till the end of June 2007, *M. auriculatum* was reported from both *B. barbulus* and *Arabibarbus grypus* (reported as *B. grypus*) from Tigris river at Tikrit city (Al-Ayash, 2011; Al-Ayash *et al.*, 2011). In addition to *M. auriculatum*, another species of *Monobothrium* was so far reported from Iraq which is *M. wageneri* which was firstly reported from *B. barbulus* by Ali (1989). The genus *Monobothrium* includes seven valid species (Global Cestode Database, 2015).

3.3. *Bothriocephalus acheilognathi* Yamaguti, 1934

This parasite was recorded from the intestine of *C. luteus* and *L. xanthopterus* with an incidence of 2.6% and 18.2%, respectively. The first report of this parasite in Iraq was from the intestine of *C. carpio* from different fish farms near Baghdad (Khalifa, 1982). It is appropriate to mention here that two other species of *Bothriocephalus*: *B. gowkongensis* Yeh, 1955 from the intestine of four fish species and *B. opsariichthydis* Yamaguti, 1934 from six fish species were reported from Iraq (Mhaisen, 2015). According to Molnár (1977), both these two species are considered as synonyms of *B. acheilognathi*. At the present time, *B. acheilognathi* and both of its above- named synonyms has so far a total of 21 host species from north, mid and south Iraq (Mhaisen, 2015) which included both *C. luteus* and *L. xanthopterus*. In addition to *B. acheilognathi* and its two synonyms (*B. gowkongensis* and *B. opsariichthydis*), unspecified specimens of *Bothriocephalus* were reported from five different freshwater fishes of Iraq (Mhaisen, 2015). The genus *Bothriocephalus* includes 22 valid species (Global Cestode Database, 2015).

3.4. *Senga magnum* (Zmeev, 1936) Protasova, 1977

This parasite was recorded from the intestine of *M. mastacembelus* with an incidence of 18.4%. The first report of this parasite in Iraq, as *Polyonchobothrium* (misspelled as *Polyoncobothrium*) *magnum* (Zmeev, 1936) was from the intestine of *C. macrostomum* from manmade lakes at Al-Nibae, north Baghdad (Ali *et al.*, 1988). Later on, it was reported from two other hosts which did not include *M. mastacembelus* (Mhaisen, 2015). So, *M. mastacembelus* of this study represents a new host record which is the fourth host for this parasite in Iraq. Kuchta and Scholz (2007) regarded *S. magnum* as a valid species. It is appropriate to mention here that after the present record of this parasite during July 2006 till the end of June 2007, this worm (also as *P. magnum*) was reported from *M. mastacembelus* from Greater Zab River at Iski Kalak town, west of Erbil city, Kurdistan region, Iraq (Bashê, 2008; Bashê and Abdullah, 2010).

3.5. *Senga ophiocephalina* (Tseng, 1933) Dollfus, 1934

This parasite was recorded from the intestine of *M. mastacembelus* with an incidence of 2.6%. This is the first occurrence of this parasite in Iraq and hence a brief description and its measurements are given here.

Worms are up to 150 mm x 3 mm. Scolex is rectangular, 0.5-1.0 mm long, with slit like bothria. Sincipital disc is umbeliform, with 57-62 hooks lying along edges. Their size increases from midline to edges. Small hooks attain length of 0.007-0.013 mm while large hooks attain 0.063-0.084 mm. Testes are numerous and lie in the lateral sides of the worm. Cirrus sac is muscular, 0.049 x 0.039. Ovary is bilobed, with long narrow bridge occupying the central position. Its lobes reach a width of 0.785 mm. Uterus sac is large and asymmetrical. Eggs are ellipsoidal, 0.041 x 0.024 mm. Vitelline follicles lie in a single layer in lateral zone, the entire central field of strobila is free of vitellaria. The above description of *S. ophiocephalina* agrees with that given by Bykhovskaya-Pavlovskaya *et al.* (1962) as *Polyonchobothriun ophiocephalina*. Microphotograph of this parasite was documented in the student's thesis (Al-Sa'adi, 2007).

In addition to *S. magnum* and *S. ophiocephalina*, two other species of *Senga* were so far reported from fishes of Iraq. These included *S. claris* (reported as *P. claris*) from *S. triostegus* by Jori (2006) and *S. mastacembeli* which was

claimed to be as a new species from *M. mastacembelus* (incorrectly reported as *M. simach*) by Rahemo (1996). Some unspecified specimens of both *Polyonchobothrium* and *Senga* were also reported from two freshwater fishes of Iraq (Mhaisen, 2015). According to Kuchta and Scholz (2007), *S. mastacembeli* is considered as a synonym of *S. lucknowensis*. The genus *Senga* includes 30 valid species (Global Cestode Database, 2015).

3.6. *Proteocephalus osculatus* (Goeze, 1782) Nybelin, 1942

This parasite was recorded from the intestine of *S. triostegus* with an incidence of 40%. The first report of this parasite in Iraq was from the intestine of *L. vorax* (reported as *A. vorax*) from Al-Tharthar Lake (Al-Saadi, 1986). Later on, it was reported from six other hosts (Mhaisen, 2015) which did not include *S. triostegus*. So, *S. triostegus* of this study represents a new host record, which is the eighth host for this parasite in Iraq.

In addition to *P. osculatus*, two species of *Proteocephalus* were so far reported from fishes of Iraq. These were *P. coregoni* from *L. esocinus* (reported as *B. esocinus*) which was firstly reported by Abdullah (1990) and *P. torulosus* from *C. carpio* by Khalifa (1982). In addition, some unspecified specimens of *Proteocephalus* were reported from four freshwater fishes of Iraq (Mhaisen, 2015). The genus *Proteocephalus* includes 27 valid species (Global Cestode Database, 2015).

3.7. *Neogryporhynchus cheilancristrotus* (Wedl, 1855) Baer & Bona, 1960

Larval stage (metacestode) of this worm was recorded from the intestine of *M. sharpeyi* with an incidence of 50%. The first report of this parasite in Iraq was from the intestine of *L. abu* from Diyala River (Ali *et al.*, 1987). Later on, it was reported from the intestine of *C. carpio* from Al-Furat Fish Farm, under the name of *Gryporhynchus cheilancristrotus* by Al-Zubaidy (1998) and from *S. triostegus* from Greater Zab River near Guwer district, southwest of Erbil city (Shwani, 2009; Abdullah and Shwani, 2010). No more reports are available on the occurrence of this worm in Iraq (Mhaisen, 2015). So, *M. sharpeyi* of this study represents the fourth host record for this worm in Iraq.

N. cheilancristrotus is the only species of the genus *Neogryporhynchus* so far recorded from fishes of Iraq (Mhaisen, 2015). According to Scholz *et al.* (2004), *N. cheilancristrotus* was recorded from 44 fish species all over the world. This worm develops to adult in the grey heron *Ardea cinerea* according to Jarecka (1970). The genus *Neogryporhynchus* includes only two valid species (Global Cestode Database, 2015).

4. Conclusions

To conclude on the cestode infections of fishes from the Euphrates River at Al-Musaib city, only seven cestode species were detected from the intestine of six fish species (*B. barbulus*, *C. luteus*, *L. xanthopterus*, *M. mastacembelus*, *M. sharpeyi* and *S. triostegus*), while 18 fish species (*A. caeruleus*, *A. orontis*, *A. sellal*, *A. grypus*, *C. damascina*, *C. carassius*, *C. regium*, *C. zillii*, *C. idella*, *C. kais*, *C. macrostomum*, *C. carpio*, *G. rufa*, *G. steindachneri*, *H. fossilis*, *L. vorax*, *L. abu* and *M. pelusius*) showed no any cestode infection. Only one cestode larval stage (metacestode) of *N. cheilancristrotus* was reported in the present investigation although larval stages of other cestodes like *Ligula*, *Schistocephalus* and *Valipora* are known to infect some fish species in the Euphrates River within the Iraqi territory (Mhaisen *et al.*, 1997; Asmar *et al.*, 1999; Al-Jadoaa, 2002; Al-Salmany, 2015).

In connection with fish richness with the studied species of cestodes, four fish species (*B. barbulus*, *C. luteus*, *M. sharpeyi* and *S. triostegus*) harboured only one cestode species each, while two fish species (*L. xanthopterus* and *M. mastacembelus*) harboured two cestode species each. Such richness is quite low when compared with the monogenean infections of the same fishes from the same area (Mhaisen *et al.*, 2015b) as 36 monogenean species were recorded from 19 fish species in the latter study. On the other hand, this richness is similar to that detected in the trematode infections of the same fishes of the same area (Mhaisen *et al.*, 2015c) as seven trematode species were recorded from 10 fish species in the latter study. The similarity between trematode and cestode infections is due to their indirect life cycles in comparison with the infections with the monogeneans which have direct life cycles (Ginetsinskaya, 1961; Olsen, 1974).

Number of fish hosts reported for these seven cestode species was one host in case of all the investigated cestode species except for *B. acheilognathi* which was detected from two fish hosts. Among the inspected fishes, number of cestode species fluctuated from a minimum of one cestode species in five fish species to a maximum of two cestode species in case of both *L. xanthopterus* and *M. mastacembelus*, while 18 fish species showed no any cestode infection. The present investigation also revealed the record of four new fish hosts for four of the previously known cestode species from Iraq. These were *B. barbulus* for *C. laticeps*, *M. mastacembelus* for *P. magnum*, *S. triostegus* for *P. osculatus* and *M. sharpeyi* for *N. cheilancristrotus*.

Generally, the percentage incidence of infection of the six fish hosts with the seven cestode species was as low as 2.6% in case of both *S. ophiocephalina* in *M. mastacembelus* and *B. acheilognathi* in *C. luteus* and reached its maximum value of 50% in case of *N. cheilancristrotus* in *M. sharpeyi*.

References

[1] Abdullah, S.M.A. 1990. Survey of the parasites of fishes of Dokan Lake. M. Sc. Thesis, Coll. Sci., Univ. Salahaddin: 115pp (In Arabic).

[2] Abdullah, S.M.A. and Shwani, A.A.A. 2010. Ectoparasites of the Asian catfish *Silurus triostegus* (Heckel, 1843) from Greater Zab River- Kurdistan region- Iraq. J. Duhok Univ., 13(1): 164-171.

[3] Adams, A.M., Murrell, K.D. and Cross, J.H. 1997. Parasites of fish and risk to public health. Rev. Sci. Tech. Off. Int. des Epizoot., 16(2): 652-660.

[4] Al-Ayash, Y.Y.H. 2011. A study of prevalence of the helminthic parasites for some fishes in Tigris River passing through Tikrit city. M. Sc. Thesis, Coll. Educ., Univ. Tikrit: 96 pp (In Arabic).

[5] Al-Ayash, Y.Y.H., Al-Jubory, A.H.A. and Al-Tikrity, I.A.A. 2011. A survey study on intestinal helminthic parasites for some types of fishes from Tigris River passing through Tikrit city. Res. 1st Sci. Conf. Fac. Vet. Med., Univ. Kufa, Kufa: 28-29 Dec. 2011: 93-105. (In Arabic).

[6] Ali, B.A.-R. 1989. Studies on parasites of some freshwater fishes from Greater Zab- Iski-Kalak. M. Sc. Thesis, Coll. Sci., Univ. Salahadden: 120pp (In Arabic).

[7] Ali, N.M., Abul-Eis, E.S. and Abdul-Ameer, K.N. 1988. On the occurrence of fish parasites raised in manmade lakes. Sixth Conf. Europ. Ichthyol., Budapest: 15-19 Aug. 1988: 60. (Abstract).

[8] Ali, N.M., Al-Jafery, A.R. and Abdul-Ameer, K.N. 1987. Parasitic fauna of freshwater fishes in Diyala River, Iraq. J. Biol. Sci. Res., 18(1): 163-181.

[9] Al-Jadoaa, N.A.A. 2002. The parasitic infections and pathological changes of some local and cultured fishes from Al-Qadisiya and Babylon provinces. Ph. D. Thesis, Coll. Educ., Al-Qadisiya Univ.: 158pp (In Arabic).

[10] Al-Karboly, R.W.K. 2012. The dispersal on intestinal parasites in fish in Al-Rutba Dam. Iraqi J. Desert Stud., 4(1): 1-4. (In Arabic).

[11] Al-Saadi, A.A.J.J. 1986. A survey of alimentary canal helminths of some species of fishes from Tharthar Lake. M. Sc. Thesis, Coll. Sci., Univ. Baghdad: 94pp (In Arabic).

[12] Al-Saadi, A.A.J.J. 2007. Ecology and taxonomy of parasites of some fishes and biology of *Liza abu* from Al-Husainia creek in Karbala province, Iraq. Ph. D. Thesis, Coll. Educ. (Ibn Al-Haitham), Univ. Baghdad: 155pp (In Arabic).

[13] Al-Sa'adi, B.A.-H.E. 2007. The parasitic fauna of fishes of Euphrates River: Applied study in Al-Musaib city. M. Tech. Thesis, Al-Musaib Technic. Coll., Found. Technic. Educ.: 102pp (In Arabic).

[14] Al-Sa'adi, B.A., Mhaisen, F.T. and Al-Rubaie, A.-R.L. (2013). The first record of two monogeneans: *Dactylogyrus dogieli* Gussev, 1953 and *Octomacrum europaeum* Roman & Bykhovskii, 1956 from fishes of Iraq. Basrah J. Agric. Sci., 26 (Spec. Issue 1): 1-7.

[15] Al-Salmany, S.O.K. 2015. Parasitic infection of some fish species from Euphrates River at Al-Qaim city, Anbar province. M. Sc. Thesis, Coll. Sci., Univ. Tikrit (Under preparation).

[16] Al-Zubaidy, A.B. 1998. Studies on the parasitic fauna of carps in Al-Furat Fish Farm, Babylon province, Iraq. Ph. D. Thesis, Coll. Sci., Univ. Babylon: 141pp (In Arabic).

[17] Amlacher, E. 1970. Textbook of fish diseases (Engl. transl.). T.F.H. Publ., Jersey City: 302pp

[18] Asmar, K.R., Balasem, A.N., Mhaisen, F.T., Al-Khateeb, G.H. and Al-Jawda, J.M. 1999. Survey of the parasites of some fish species from Al-Qadisiya Dam Lake, Iraq. Ibn Al-Haitham J. Pure Appl. Sci., 12(1): 52-61.

[19] Bashê, S.K.R. 2008. The parasitic fauna of spiny eel *Mastacembelus mastacembelus* (Banks and Solander, 1794) from Greater Zab River- Kurdistan region- Iraq. M. Sc. Thesis, Coll. Sci. Educ., Univ. Salahaddin: 62pp

[20] Bashê, S.K.R. and Abdullah, S.M.A. 2010. Parasitic fauna of spiny eel *Mastacembelus mastacembelus* from Greater Zab River in Iraq. Iran. J. Vet. Res., Shiraz Univ., 11(1), Ser. 30: 18-27.

[21] Bykhovskaya-Pavlovskaya, I.E., Gusev, A.V., Dubinina, M.N., Izyumova, N.A., Smirnova, T.S., Sokolovskaya, I.L., Shtein, G.A., Shul'man, S.S. and Epshtein, V.M. 1962. Key to parasites of freshwater fish of U.S.S.R. Akad. Nauk, S.S.S.R., Moscow: 727pp (In Russian).

[22] Duijn, van C. Jnr. 1973. Diseases of fishes, 3rd ed., Iliffe Books, London: 372pp

[23] Eschmeyer, W.N. (Ed.) 2015. Species by family/ subfamily in the Catalog of fishes. http://research.calacademy.org/research/ichthyology/Catalog/SpeciesByFamily.asp. (Accessed May 2015).

[24] Froese, R. and Pauly, D. (Eds.) 2015. FishBase. World Wide Web electronic publication. www.fishbase.org. (Accessed May 2015).

[25] Ginetsinskaya, T.A. 1961. The life cycles of fish helminths and the biology of their larval stages. In: V.A. Dogiel; G.K. Petrushevski and Yu. I. Polyanski (Eds.). Parasitology of fishes (Engl. transl.). Oliver and Boyd, Edinburgh: 140-179.

[26] Global Cestode Database 2015. A survey of the tapeworms (Cestoda: Platyhelminthes) from vertebrate bowels of the earth. http://tapewormdb.uconn.edu (Accessed May 2015).

[27] Han, J.E., Shin, S.P., Kim, J.H., Choresca, C.H., Jr., Jun, J.W., Gomez, D.K. and Park, S.C. 2010. Mortality of cultured koi *Cyprinus carpio* in Korea caused by *Bothriocephalus acheilognathi*. Afr. J. Microbiol. Res., 4(7): 543-546.

[28] Jarecka, L. 1970. On the life cycles of *Paradilepis scolecina* (Rud., 1819) Hsu, 1935, and *Neogryporhynchus cheilancristrotus* (Wedl, 1855) Baer and Bona, 1958-1960 (Cestoda: Dilepididae). Bull. Acad. Polon. Sci. Classe II. Ser. des Sci. Biol., 18(3): 159-163.

[29] Jori, M.M. 2006. Parasitic study on the Asian catfish *Silurus triostegus* (Heckel, 1843) from Al-Hammar marshes, Basrah, Iraq. Ph. D. Thesis, Coll. Educ., Univ. Basrah: 192pp

[30] Khalifa, K.A. 1982. Occurrence of parasitic infections in Iraqian fish ponds. Second Sci. Conf., Arab Biol. Union, Fés: 17-20 March 1982: 333. (Abstract).

[31] Kuchta, R. and Scholz, T. 2007. Diversity and distribution of fish tapeworms of the "Bothriocephalidea" (Eucestoda). Parassitol., 49: 129-146.

[32] Margolis, L., Esch, G.W., Holmes, J.C., Kuris, A.M. and Schad, G.A. 1982. The use of ecological terms in parasitology (Report of an *ad hoc* committee of the American Society of Parasitologists). J. Parasitol., 68(1): 131-133.

[33] Mhaisen, F.T. 2015. Index-catalogue of parasites and disease agents of fishes of Iraq (Unpublished: mhaisenft@yahoo.co.uk).

[34] Mhaisen, F.T., Al-Rubaie, A.L. and Al-Sa'adi, B.A. 2015a. Ciliophoran and myxozoan parasites of fishes from the Euphrates River at Al-Musaib City, Babylon Province, Mid Iraq. Amer. J. Biol. Life Sci., 3(1): 12-16.

[35] Mhaisen, F.T., Al-Rubaie, A.L. and Al-Sa'adi, B.A. 2015b. Monogenean parasites of fishes from the Euphrates River at Al-Musaib City, Mid Iraq. Amer. J. Biol. Life Sci., 3(2): 50-57.

[36] Mhaisen, F.T., Al-Rubaie, A.L. and Al-Sa'adi, B.A. 2015c. Trematodes of fishes from the Euphrates River at Al-Musaib City, Mid Iraq. Amer. J. Biol. Life Sci., 3(4): 91-95.

[37] Mhaisen, F.T., Al-Khateeb, G.H., Balasem, A.N. and Mutar, A.J. 1997. On a collection of some fish parasites from Euphrates River, Anbar province, Iraq. Babylon Univ. J., Pure Appl. Sci., 2(3): 267-272.

[38] Molnár, K. 1977. On the synonyms of *Bothriocephalus acheilognathi* Yamaguti, 1934. Parasitol. Hung., 10: 61-62.

[39] Muhammed, S.A. 1995. Studies on the cestodes parasitize in some teleost fishes in Tigris River. Ph. D. Thesis, Coll. Sci., Univ. Mosul: 128pp (In Arabic).

[40] Olsen, O.W. 1974. Animal parasites: Their life cycles and ecology, 3rd ed., Univ. Park Press, Baltimore: 562 pp

[41] Ortega-Olivares, M.P., Barrera-Guzmán, A.O., Haasová, I., Salgado-Maldonado, G., Guillén-Hernández, S. and Scholz, T. 2008. Tapeworms (Cestoda: Gryporhynchidae) of fish-eating birds (Ciconiiformes) from Mexico: New host and geographical records. Syst. Parasitol., 75(2): 182-195.

[42] Rahemo, Z.I.F. 1996. Parasites of the Iraqi spinyback *Mastacembelus simach* (Walbaum, 1792). Iraqi J. Biol. Sci., 15: 42-52.

[43] Schmidt, G.D. and Roberts, L.S. 2009. Gerald D. Schmidt & Larry S. Roberts' foundations of parasitology, 8th ed., McGraw-Hill Co., New York: 701pp

[44] Scholz, T., Bray, R.A., Kuchta, R. and Řepová, R. 2004. Larvae of gryporhynchid cestodes (Cyclophyllidea) from fish: A review. Fol. Parasitol., 51: 131-152.

[45] Shwani, A.A.A. 2009. The parasitic fauna of Asian catfish *Silurus triostegus* (Heckel, 1843) from Greater Zab River-Kurdistan Region- Iraq. M. Sc. Thesis, Coll. Sci. Educ., Univ. Salahaddin: 75pp