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Crustaceans and Glochidians of Fishes from the Euphrates River at Al-Musaib City, Mid Iraq

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Abstract

Due to the importance of both the crustaceans and the glochidial larvae of bivalve molluscs in fish life as external parasites and as no previous work was done on both these two groups of parasites 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 their body cavity, musculature and internal organs. Four crustacean species and glochidial larvae of one mollusc species were recorded from gills of 19 species of these fishes. The crustaceans were *Ergasilus mosulensis* from *Glyptothorax steindachneri*, *E. peregrinus* from three fish species (*Carasobarbus luteus*, *G. steindachneri* and *Liza abu*), *E. sieboldi* from *L. abu* and *Lamproglena pulchella* from *Leuciscus vorax*. The glochidial larvae belonged to the bivalve mollusc *Unio pictorum* which infected gills of 19 fish species (*Alburnus caeruleus*, *A. orontis*, *A. sellal*, *Arabibarbus grypus*, *Barbus barbulus*, *C. luteus*, *Coptodon zillii*, *Cyprinion kais*, *C. macrostomum*, *Garra rufa*, *G. steindachneri*, *Heteropneustes fossilis*, *L. vorax*, *L. abu*, *Luciobarbus xanthopterus*, *Mastacembelus mastacembelus*, *Mesopotamichthys sharpeyi*, *Mystus pelusius* and *Silurus triostegus*). All the crustaceans were adults but the mollusc *U. pictorum* occurred as a larval (glochidial) stage. In addition, 12 new host records in Iraq were reported for two crustacean species and the mollusc larva. Number of fish hosts reported for these ectoparasites fluctuated from one host in case of three crustacean species to a maximum of 19 hosts in case of *U. pictorum*. Among the inspected fishes, number of ectoparasitic species fluctuated from a minimum of one parasite species in 16 fish species to a maximum of three parasite species in case of both *G. steindachneri* and *L. abu*, while five fish species showed no any infection.

Keywords

Crustacea, Glochidial Larva, Bivalve Mollusc, Freshwater Fishes, Euphrates River, Al-Musaib City, Babylon Province, Iraq

1. Introduction

The crustaceans as well as the glochidial larvae of some bivalve molluscs are considered as important external parasites which affect fishes in natural waters (Amlacher, 1970; Duijn, 1973) The crustaceans occur on fish host on the outer body surface or fins, in the mouth, gill chambers, nostrils, or occasionally in self-made pockets in the flesh of their hosts (Hoffman, 1999). Some crustaceans are parasitic as both juveniles and adults, although some are only parasitic as juveniles (Noga, 2010), while bivalve glochidial larvae occur on gills or fins of fishes (Hoffman, 1999).

The crustaceans are the most diverse and ubiquitous among all the metazoan groups which affect fishes (Rohde, 2005). Ahyong *et al.* (2011) provided a classification list for all the crustacean families and gave an estimate of 1,003 families, 9,522 genera and 66,914 species for recent Crustacea. However, WoRMS (2015) reported a total of 53,400 species. Generally, crustaceans have segmented, chitin-encased bodies, articulated appendages which included cephalic appendages in form of two pairs of antennae, mouth parts (one pair each of mandibles, maxillae and maxillules and two pairs of maxillipeds), thoracic and abdominal appendages. The paired appendages are typically biramous and consist of two branches: the endopod and exopod (McGraw-Hill Staff, 2003).

Certain parasitic crustaceans such as the copepod species

of *Ergasilus* and *Lernaea* are serious pests in fish culture, sometimes in nature, and have become increasingly important in recent years (Hoffman, 1999). Some crustaceans can kill or impair immature fishes so that they do not survive (Bunkley-Williams *et al.*, 2006). Fish lice play significant role in fish secondary infections as they act as mechanical vectors for fish viruses (Overstreet *et al.*, 2009) as well as for the haemoprotozoans (McKiernan *et al.*, 2005). Some crustaceans act as intermediate hosts for several fish-parasitic helminths (Zander *et al.*, 1994) or even some human helminths (Roberts and Janovy, 1996). Wounds in pond-cultured *Tinca tinca* caused by some copepods became secondarily infected with *Saprolegnia* sp. (Lester and Hayward, 2006).

Some freshwater bivalves have obligatory parasitic stages, the glochidia, which are released by the adult clams and are passively dispersed via water currents (Noga, 2010). The larvae become encysted in fish epithelium and grossly resemble metacercarial cysts but they can be recognized by their thin, chitinoid bivalve shells, which in some species have small hooks on their inner edge (Hoffman, 1999). This action incites a hyperplastic response in fish epithelium (Gaines and Rogers, 1975). Eventually, the parasites are shed when they metamorphose into adult clams. Infestations are usually innocuous unless heavy (Noga, 2010).

Among parasitological investigations achieved on crustaceans and/ or glochidians of fishes from Euphrates River within the Iraqi territory are those of Al-Alusi (1998), Asmar *et al.* (1999), Al-Jadoaa (2002), Balasem *et al.* (2003), Al-Saadi (2007), Al-Zubaidy (2007), Hussain (2007, 2008) and Al-Salmany (2015). The present article was aimed to contribute on the crustacean and glochidial parasites 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 parasites 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) and Rahemo (1982).

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 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 four species of crustaceans which belong to one order and two families as well as the glochidial larvae of one bivalve mollusc species which belong to one order and one family as demonstrated below.

Phylum Arthropoda - Subphylum Crustacea
Class Maxillopoda
Order Cyclopoida
Family Ergasilidae
Ergasilus mosulensis Rahemo, 1982
Ergasilus peregrinus Heller, 1865
Ergasilus sieboldi von Nordmann, 1832
Family Lernaeidae
Lamproglena pulchella von Nordmann, 1832
Phylum Mollusca
Class Bivalvia
Order Unionoida
Family Unionidae
Unio pictorum (Linnaeus, 1758)

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

3.1. Phylum Arthropoda- Subphylum Crustacea

Four species of crustaceans were detected from gills of four fish species. These were *Ergasilus mosulensis*, *E. peregrinus*, *E. sieboldi* and *Lamproglena pulchella*. The following is a brief account on the occurrence of these crustaceans with emphasis on the previous concerned records in fishes of Iraq.

3.1.1. *Ergasilus mosulensis* Rahemo, 1982

This crustacean was recorded from gills of *Glyptothorax steindachneri* with an incidence of 30.8%. This crustacean was firstly detected from gills of *L. abu* from Tigris River at Mosul city by Fattohy (1975) and its full description as a new species was achieved by Rahemo (1982). Later on, it was reported from 21 other freshwater fishes from north, mid and south of Iraq as well as from some marine fishes entering freshwater habitats in Basrah province which did not include *G. steindachneri* (Mhaisen, 2015). So, *G. steindachneri* of the present investigation represents a new host record for this crustacean in Iraq. Some notes on the histopathological effects of *E. mosulensis* on gills of *Silurus glanis* were demonstrated by Al-Niaeemi (1997).

3.1.2. *Ergasilus peregrinus* Heller, 1865

This crustacean was recorded from gills of *Carasobarbus luteus*, *G. steindachneri* and *Liza abu* with an incidence of 1.3%, 23.1% and 8.3%, respectively. The first report of *E. peregrinus* in Iraq was from gills of both *Leuciscus vorax* (reported as *Aspius vorax*) and *L. abu* from Tigris River at Salah Al-Dien province by Abdul-Ameer (1989). Later on, it was reported from five other freshwater fishes from mid Iraq which included *C. luteus* but not *G. steindachneri* (Mhaisen, 2015). So, *G. steindachneri* of the present investigation represents a new host record for this crustacean in Iraq.

3.1.3. *Ergasilus sieboldi* von Nordmann, 1832

This crustacean was recorded from gills of *L. abu* with an incidence of 12.5%. The first report of *E. sieboldi* in Iraq was from gills of *L. vorax* (reported as *A. vorax*) from Al-Habbaniyah Lake by Herzog (1969). Later on, it was reported from 25 other freshwater fishes from north, mid and south Iraq as well as from some marine fishes entering freshwater habitats in Basrah province. These fishes included *L. abu* (Mhaisen, 2015). *E. sieboldi* is widespread in temperate parts of Europe and it is among the ergasilid copepods which damage the gills and cause commercially significant epizootics in cultured and wild populations of fishes (Lester and Hayward, 2006).

In addition to *E. mosulensis*, *E. peregrinus* and *E. sieboldi* shown above, eight species of *Ergasilus* are so far known from fishes of Iraq. These included: 1- *E. barbi* which was firstly detected from gills of *Arabibarbus grypus* (reported as *Barbus grypus*) from Tigris River at Mosul city by Fattohy (1975) and its full description as a new species was achieved by Rahemo (1982). 2- *E. boleophthalmi* which was firstly detected from gills of both *Bathygobius fuscus* and *Boleophthalmus dussumieri* as a new species by Adday and Ali (2011). 3- *E. iraquensis* which was firstly detected from gills of *Chelon subviridis* (reported as *Liza subviridis*) as a new species by Amado *et al.* (2001). 4- *E. lizae* Krøyer, 1863 which was reported only from *C. subviridis* by Adday (2013). 5- *E. ogawai* Kabata, 1992 which was firstly reported from four fish species by Adday (2001). 6- *E. pararostralis* which was firstly detected from gills of *C. subviridis* (reported as *L. subviridis*) as a new species by Amado *et al.* (2001). 7- *E. rostralis* Ho, Jayarajan *et* Radhakrishnan, 1992 which was firstly detected from gills of *L. abu* by Khamees and Mhaisen (1995) and 8- *E. synanceinsis* which was firstly detected from gills of *Pseudosynanceia melanostigma* as a new species by Amado *et al.* (2001). It is appropriate to mention here that *E. ovatus* Shen, 1957 which was detected from gills of three fish species from Basrah by Abdul-Rahman (1999) was re-examined by Adday (2001) and was considered to belong to *E. ogawai*. Also, *E. amplectens* Dogiel *et* Akhmerov, 1952 reported by Zangana (2008) was considered as a synonym of *Dermoergasilus amplectens* by WoRMS (2015). In addition to all the above mentioned species of *Ergasilus*, some specimens of unspecified *Ergasilus* species were so far reported from 12 fish species from north, mid and south Iraq (Mhaisen, 2015). Worldwide, the genus *Ergasilus* includes 66 valid species (WoRMS, 2015).

3.1.4. *Lamproglena pulchella* von Nordmann, 1832

This crustacean was recorded from gills of *L. vorax* with an incidence of 12.1%. The first report of *L. pulchella* in Iraq was from gills of both *Chondrostoma regium* and *Capoeta trutta* (reported as *Varicorhina trutta*) from Tigris River at Mosul city by Rahemo (1977). Later on, it was reported from 17 other freshwater fishes from north, mid and south Iraq which included *L. vorax* (Mhaisen, 2015).

In addition to *L. pulchella*, only one other species of *Lamproglena* is so far known in Iraq (Mhaisen, 2015). This was *L. chinensis* Yü, 1937 by Zangana (2008) from *C. trutta* (reported as *V. trutta*) from north of Iraq.

3.2. Phylum Mollusca

Glochidial larvae of one mollusc species were detected from gills of 19 fish species. These larvae belong to *Unio pictorum*.

3.2.1. *Unio pictorum* (Linnaeus, 1758)

Glochidial larvae of this mollusc were recorded from gills of the following 19 fish species with their incidences of infection: *Alburnus caeruleus* (6.3%), *A. orontis* (10%), *A. sellal* (13%), *Arabibarbus grypus* (33.3%), *Barbus barbulus* (41.7%), *C. luteus* (45.5%), *Coptodon zillii* (41.4%), *Cyprinion kais* (30%), *C. macrostomum* (53.3%), *Garra rufa* (13.6%), *G. steindachneri* (15.4%), *Heteropneustes fossilis* (8.3%), *Leuciscus vorax* (24.2%), *Liza abu* (52.1%),

Luciobarbus xanthopterus (36.4%), *Mastacembelus mastacembelus* (23.7%), *Mesopotamichthys sharpeyi* (100%), *Mystus pelusius* (16.7%) and *Silurus triostegus* (40%). The first report of glochidial larvae of *U. pictorum* in Iraq was from gills of eight fish species which were *A. grypus* (reported as *B. grypus*), *C. luteus* (reported as *B. luteus*), *Chondrostoma regium*, *Cyprinus carpio*, *L. vorax* (reported as *A. vorax*), *L. abu*, *L. xanthopterus* (reported as *B. xanthopterus*) and *M. pelusius* from Diyala River (Ali *et al.*, 1987). Later on, it was reported from six other hosts, inclusive of *B. barbulus*, *H. fossilis* and *M. mastacembelus* but did not include *A. caeruleus*, *A. orontis*, *A. sellal*, *C. zillii*, *C. kais*, *C. macrostomum*, *G. rufa*, *G. steindachneri*, *M. sharpeyi* and *S. triostegus* (Mhaisen, 2015). So, *A. caeruleus*, *A. orontis*, *A. sellal*, *C. zillii*, *C kais*, *C. macrostomum*, *G. rufa*, *G. steindachneri*, *M. sharpeyi* and *S. triostegus* of the present study represent new host records for *U. pictorum* in Iraq. It is appropriate to mention here that the authority of *U. pictorum* was erroneously stated as Zhadin, 1938 in all Iraqi literature except Al-Salmany (2015). Beside *U. pictorum*, the genus *Unio* includes four valid species (WoRMS, 2015).

In addition to the glochidial larvae of *U. pictorum*, unspecified glochidial larvae were also reported from four freshwater fishes in Basrah province only (Jori, 1998; Adday, 2001; Al-Salim and Jori, 2002; Jori, 2006; Abbas, 2007).

4. Conclusions

To conclude on the crustacean and glochidial infections of fishes from the Euphrates River at Al-Musaib city, only four crustacean species and one mollusc species were detected from gills of 19 fish species (*A. caeruleus*, *A. orontos*, *A. sellal*, *A. grypus*, *B. barbulus*, *C. luteus*, *C. zillii*, *C. kais*, *C. macrostomum*, *G. rufa*, *G. steindachneri*, *H. fossilis*, *L. xanthopterus*, *L. vorax*, *L. abu*, *M. mastacembelus*, *M. sharpeyi*, *M. pelusius* and *S. triostegus*), while five fish species showed no any infection with crustaceans and glochidial larvae (*Capoeta damascina*, *Carassius carassius*, *Chondrostoma regium*, *Ctenopharyngodon idella* and *Cyprinus carpio*). All the crustacean species were adults living on gills of their hosts but the mollusc *U. pictorum* appeared as a glochidial larval stage on gills of their hosts.

In connection with fish richness with these crustacean and glochidian parasites, 16 fish species (*A. caeruleus*, *A. orontos*, *A. sellal*, *A. grypus*, *B. barbulus*, *C. zillii*, *C. kais*, *C. macrostomum*, *G. rufa*, *H. fossilis*, *L. xanthopterus*, *L. vorax*, *M. mastacembelus*, *M. sharpeyi*, *M. pelusius* and *S. triostegus*) harboured only one parasite species each, *C. luteus* harboured two parasite species and both *G. steindachneri* and *L. abu* harboured three parasite species each.

Number of fish hosts reported for these four crustacean and glochidial species was one host in case of *E. mosulensis*, *E. sieboldi* and *L. pulchella*, three hosts in case of *E. peregrinus* and 19 hosts in case of *U. pictorum*.

The present investigation also revealed the record of 12 new fish host species for two of the previously known crustacean species and one glochidial species from Iraq. These were *G. steindachneri* for both *E. mosulensis* and *E. peregrinus* as well as *A. caeruleus*, *A. orontis*, *A. sellal*, *C. zillii*, *C kais*, *C. macrostomum*, *G. rufa*, *G. steindachneri*, *M. sharpeyi* and *S. triostegus* for *U. pictorum*.

Generally, the percentage incidence of infection of the 19 infected fish species with the four crustacean species and one mollusc species was light as it ranged from a minimum value of 1.3% in case of *E. pergrinus* in *C. luteus* to a maximum of 100% in case of *U. pictorum* in *M. sharpeyi* with 63.2% of the incidences were less than 20%.

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