

CHECKLISTS OF DIPLOZOID SPECIES (MONOGENEA) FROM FISHES OF IRAQ

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ABSTRACT

Surveying 59 references concerning the occurrence of the monogeneans of the family Diplozoidae parasitizing fishes of Iraq showed the occurrence of 15 valid species of this family which included one species of *Diplozoon*, one species of *Eudiplozoon* and 13 species of *Paradiplozoon*. In addition to these species, some unidentified adult and larval (diporpa larvae) specimens of the genus *Diplozoon* were reported from 12 fish hosts among which four fish species showed no infection with any of the nominated diplozoid species while the others showed mixed diplozoid infections. These diplozoids were reported from 27 fish host species in Iraq. All the diplozoids were recorded from freshwater habitats except one *Diplozoon* sp. which was recorded from a marine habitat. Hosts recorded for each of these diplozoids ranged from a minimum of one host in case of both *P. ergensi* and *P. tadjikistanicum* to a maximum of 13 hosts in case of *P. kasimii*. Among the infected fishes, 13 hosts harboured only one diplozoid species each while a maximum of 10 diplozoid species were reported from both *Aspius vorax* and *Cyprinion macrostomum*.

INTRODUCTION

Members of the class Monogenea include small hermaphroditic flat worms that parasitize fishes and other aquatic animals. They infect fins, skin and gills of freshwater and marine fishes (Duijn, 1973). The class Monogenea, used to be known as monogenetic trematodes, includes skin and gill flat worms with direct life cycles (Amlacher, 1970). The monogeneans are important fish pathogens, especially for carp fingerlings under extensive fish culture practice and their direct life cycles and fish crowding are good conditions for their easy spread among fishes (Bauer *et al.*, 1969).

According to their attachment organs that are found in the posterior part of their bodies (haptor), monogeneans are divided into two subclasses: Monopisthocotylea which are provided either with hooks and hooklets and Polyopisthocotylea which are provided with clamps (Gussev, 1985). According to Pugachev *et al.* (2009), these two subclasses are considered as Polyonchoinea and Oligonchoinea, respectively. The Class Monogenea includes 62 families, of which the family Diplozoidae has seven genera (MonoDB, 2014). The range of the family Diplozoidae includes Eurasia (except Siberia) and the Afro-tropical regions (Aioanei, 1996).

Each individual of the two young fused diplozoid worms, forming a cross (Fig.1), differentiates into two parts (Pugachev *et al.*, 2009): The anterior foliate part, which lies before the cross, contains the vitellaria and bulk of intestine. The posterior part, which lies behind the cross, is differentiated into three sections: anterior portion carrying the genital gland, mid

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portion with termination of intestine trunk and posterior portion with ventral surface bearing attachment clamps. The posterior part can have folds and dilations of different shapes which are used to differentiate different genera (Fig. 2).

In Iraq, since the detection of the first diplozoid species from fishes of Iraq (Fattohy, 1975), many surveys were achieved which contributed in recording more diplozoids in Iraq. Results of such surveys are scattered in different local scientific journals, M. Sc. and Ph. D. theses as well as in one report and one conference abstract. Some of such diplozoids have been misidentified or given with wrong authorities and some parasite names are misspelled. Some of the infected fishes were given in synonymous names. For these reasons, it was decided to review these surveys in accordance with list of fishes of Iraq (Coad, 2010) as well as with up-to-date fish scientific names (Froese and Pauly, 2014), to correct scientific names and authorities of the concerned diplozoids according to some major taxonomical references and a web site (Gussev, 1985; Gibson *et al.*, 2005; Pugachev *et al.*, 2009; MonoDb, 2014) and to provide a host- diplozoid checklist. The monogeneans of fishes of Iraq constitute 30.5% of the total items of the parasitic species of fishes of Iraq (Mhaisen, 2014). The present checklist is the second checklist on monogeneans of Iraq, a continuation to a previous one concerned with gyrodactylids of fishes of Iraq (Mhaisen and Abdul-Ameer, 2013).

SOURCES AND METHODS

A total of 59 references (34 research papers, 19 M. Sc. theses, four Ph. D. theses, one report and one conference abstract) with information concerning diplozoids of fishes of Iraq were used to prepare the present review and checklists. Data from such references was gathered to provide diplozoid list and fish- diplozoid list. Names and authorities of these gyrodactylids were checked according to some taxonomical accounts (Bykhovskaya-Pavlovskaya *et al.*, 1962; Gussev, 1985; Khotenovsky, 1985; Pugachev *et al.*, 2009) as well as some well known specialized electronic sites (Gibson *et al.*, 2005; MonoDB, 2014). The scientific names of fishes were reported as they appeared in the reviewed Iraqi literature but they were then checked with the recent account on freshwater fishes of Iraq (Coad, 2010), but the valid names used here were based on a well-known electronic site (Froese and Pauly, 2014).

RESULTS AND DISCUSSION

Surveys achieved on diplozoids of fishes in Iraq.

The review of available Iraqi literature indicated that since the description of the first diplozoid species from fishes of Iraq (Fattohy, 1975), many surveys were achieved in different inland waters and fish farms and ponds which contributed in recording more diplozoids. The records of diplozoids of fishes of Iraq can be grouped into eight major categories according to localities of inspected fishes. These are:

- 1- Tigris River (Fattohy, 1975; Rahemo, 1980; Ali *et al.*, 1987; Abdul-Ameer, 1989; Rasheed, 1989; Rahemo and Ami, 1991; Balasem *et al.*, 1993; Al-Niaeemi, 1997; Rahemo and Al-Kallak, 1998; Adday *et al.*, 1999; Rahemo and Al-Niaeemi, 2001; Al-Jawda *et al.*, 2003; Al-Nasiri, 2009, 2010; Al-Nasiri and Mhaisen, 2009a,b; Al-Jubori, 2013; Rahemo and Ami, 2013) as well as some tributaries of Tigris River which included Greater Zab river (Ali, 1989; Abdullah, 2002; Abdullah and Mhaisen, 2004) and Lesser Zab River (Abdullah, 2002; Abdullah and Mhaisen, 2004; Nasraddin, 2013).
- 2- Euphrates River and its branches (Mhaisen *et al.*, 1997; Al-Awadi, 2003; Al-Waaly, 2005; Al-Jadoa and Al-Waaly, 2007; Al-Saadi, 2007; Al-Sa'adi, 2007; Hussain, 2007; Al-Saadi *et al.*, 2009, 2010).

- 3- The region of Shatt Al-Arab River, Basrah which included Garmat Ali River (Al-Ali, 1998; Abdul-Rahman, 1999; Al-Salim and Al-Ali, 2000; Al-Niaem, 2006; Al-Janae'e, 2010), Al-Salihiya River (Al-Janae'e, 2010) and Mehajeran Creek (Khamees, 1983; Mhaisen *et al.*, 1986).
- 4- Some lakes, depressions and marshes: These included surveys from Kasnazan Lake, Erbil (Abdullah, 2004), Darbandikhan Lake (Abdullah, 2013), Dokan Lake (Abdullah, 1990; Abdullah and Rasheed, 2004), Al-Qadisiya Dam Lake (Asmar *et al.*, 1999; Balasem *et al.*, 2003) and Al-Hammar Marsh (Al-Daraji, 1986; Al-Daraji and Al-Salim, 1990).
- 5- Some drainage networks (Al-Waaly, 2005; Al-Jadoa and Al-Waaly, 2007; Balasem *et al.*, 2002; Asmar *et al.*, 2003; Mhaisen *et al.*, 2003).
- 6- Khor Al-Zubair Estuary in southern Iraq (Mhaisen and Al-Maliki, 1996).
- 7- Fish hatcheries (Mama, 2012; Mama and Abdullah, 2012a,b).
- 8- Fish ponds and farms which included some from Sulaimania (Ali, 2002), Al-Amiriya region, Baghdad (Al-Nasiri, 2000, 2003), Babylon (Al-Zubaidy, 1998; Muhammed, 2000; Al-Taei, 2013) in addition to some floating cages at Shatt Al-Hilla (Al-Taei, 2013).

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The review of literature indicated that a total of 15 valid diplozoid species, belonging to genera *Diplozoon*, *Eudiplozoon* and *Paradiplozoon* are so far known from fishes of Iraq in addition to some unidentified specimens of the genus *Diplozoon*. Table (1) shows an up-to-date list of all diplozoids so far recorded from fishes of Iraq.

As the identification of the three diplozoid genera was confused in some Iraqi literature, the following key, modified from Seddon (2004) and Pugachev *et al.* (2009), is given to fulfill their exact and easy recognition.

- 1(2). There are no dilations of the middle part of the posterior end of the body *Paradiplozoon*.
- 2(1). The middle part of the posterior end of the body toward the posterior end has dilations of different shapes 3.
- 3(4). Dilations of the middle part of the posterior end of the body have large folds..... *Eudiplozoon*.
- 4(3). Dilations of the middle part of the posterior end of the body are without folds..... *Diplozoon*.

The following is an account of the alphabetical list of such parasites in Iraq. Diplozoid names and their authorities are checked according to some major taxonomical accounts and web sites (Gussev, 1985; Gibson *et al.*, 2005; Pugachev *et al.*, 2009; MonoDb, 2014). The alphabetically arranged names of hosts for each parasite are quoted as they appeared in their original literature but the valid names have been updated according to Froese and Pauly (2014) and the full authority of each valid fish host is shown in the host-diplozoid list. References on

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records of each host infected with each diplozoid species are chronologically arranged but references of the same year are alphabetically arranged.

1- *Diplozoon paradoxum* von Nordmann, 1832:

This parasite was reported for the first time in Iraq from *Barbus luteus*, which is a synonym of *Carasobarbus luteus*, from Al-Husainia creek, Karbala province by Al-Saadi (2007). Now, it has five hosts (Mhaisen, 2014). These are: *Aspius vorax* (Al-Sa'adi, 2007), *B. luteus*, which is a synonym of *C. luteus* (Al-Saadi, 2007; Al-Saadi *et al.*, 2009; 2010), *Cyprinion macrostomum* (Al-Nasiri, 2009; Al-Jubori, 2013), *Cyprinus carpio* (Al-Sa'adi, 2007; Al-Taei, 2013) and *Liza abu* (Al-Sa'adi, 2007).

2- *Diplozoon* spp.:

Different adult specimens of unidentified *Diplozoon* were reported from different parts of Iraq from the following 11 fish hosts (Mhaisen, 2014). These are: *Alburnus caeruleus* (Al-Jawda *et al.*, 2003), *Alburnus capito*, which is a synonym of *A. mossulensis* (Al-Jawda *et al.*, 2003), *A. vorax* (Abdul-Rahman, 1999), *B. luteus*, which is a synonym of *C. luteus* (Al-Waaly, 2005; Al-Jadoa and Al-Waaly, 2007), *C. macrostomum* (Abdullah, 2004), *C. carpio* (Abdul-Rahman, 1999; Muhammed, 2000; Ali, 2002), *Heteropneustes fossilis* (Abdul-Rahman, 1999), *Leuciscus lepidus*, which is a synonym of *Squalius lepidus* (Abdullah, 2004), *L. abu* (Abdul-Rahman, 1999), *Mastacembelus mastacembelus* (Abdul-Rahman, 1999) and *Periophthalmus waltoni* (Mhaisen and Al-Maliki, 1996). The above record of *Diplozoon* sp. from *P. waltoni* is the only record of diplozoids from marine fishes of Iraq.

In addition to the above mentioned records of adult unidentified *Diplozoon* specimens, larval stages (diporpa) of unidentified *Diplozoon* species were reported from three fish hosts in Iraq. These are: *A. vorax* (Al-Daraji, 1986; Al-Ali, 1998; Al-Salim and Al-Ali, 2000), *B. luteus*, which is a synonym of *C. luteus* (Al-Nasiri, 2000) and *Silurus glanis* (Al-Niaemi, 1997; Rahemo and Al-Niaemi, 2001).

3- *Eudiplozoon nipponicum* (Goto, 1891):

This parasite was recorded for the first time in Iraq from *C. carpio* by Al-Nasiri (2003) as *Diplozoon nipponicum* but then, it was reported as *E. nipponicum* by all subsequent researchers. So far, three hosts are known for *E. nipponicum* in Iraq (Mhaisen, 2014). These are: *A. vorax* (Al-Jubori, 2013), *Barbus sharpeyi*, which is a synonym of *Mesopotamichthys sharpeyi* (Al-Saadi, 2007; Al-Saadi *et al.*, 2010) and *C. carpio* (Al-Nasiri, 2003 as *D. nipponicum*; Al-Sa'adi, 2007; Al-Jubori, 2013; Al-Taei, 2013).

4- *Paradiplozoon amurense* (Akhmerov, 1974):

This parasite was recorded for the first time in Iraq from *C. macrostomum* by Al-Nasiri (2010) and then from the same host as well as from *B. luteus*, which is a synonym of *C. luteus* by Al-Jubori (2013). It is appropriate to mention here that both Al-Nasiri (2010) and Al-Jubori (2013) had stated the specific name as *amurensis* instead of *amurense* and Al-Nasiri (2010) erroneously stated the authority of this parasite without bracket. According to Gussev (1985), Pugachev *et al.* (2009) and a personal communication between the senior author of this paper and Dr. David I. Gibson of the British Museum (Natural History) on 24th April, the specific name should be *amurense* and not *amurensis* as it was erroneously stated (Al-Nasiri, 2010; Al-Jubori, 2013). Also, the authority should be inside the brackets (Gussev, 1985, Gibson *et al.*, 2005; Pugachev *et al.*, 2009).

5- *Paradiplozoon barbi* (Reichenbach-Klinke, 1951):

This parasite was reported for the first time in Iraq from *Chondrostoma nasus*, *C. regium* (erroneously reported as *C. regius*) and *C. carpio* by Rasheed (1989) as *Diplozoon barbi* Reichenbach-Klinke, 1951. Also, all the subsequent records in the Iraqi literature referred to this parasite as *D. barbi*. According to Khotenovsky (1985), *D. barbi* is a synonym of *P. barbi*. Eight hosts are so far known for this parasite in Iraq (Mhaisen, 2014). These are: *Acanthobrama marmid* (Abdullah, 2002; Abdullah and Mhaisen, 2004), *Barbus esocinus*, which is a synonym of *Luciobarbus esocinus* (Rahemo and Ami, 2013), *B. luteus*, which is a synonym of *C. luteus* (Rahemo and Al-Kallak, 1998; Al-Saadi, 2007; Al-Saadi *et al.*, 2010), *C. nasus* (73), *C. regium* (73; Abdullah, 2002; Abdullah and Mhaisen, 2004), *C. macrostomum* (Ali, 1989; Al-Nasiri, 2009), *C. carpio* (73; Al-Zubaidy, 1998; Al-Saadi, 2007; Al-Nasiri, 2009; Al-Saadi *et al.*, 2010) and *Leuciscus spurius*, which is a synonym of *Squalius spurius* (Ali, 1989).

6- *Paradiplozoon bliccae* (Reichenbach-Klinke, 1961):

This parasite was reported for the first time in Iraq from both *C. macrostomum* and *C. carpio* by Al-Nasiri (2009). Later on, it was recorded from both *C. macrostomum* and *L. abu* by Al-Jubori (2013). So, three hosts are so far known for *P. bliccae* in Iraq.

7- *Paradiplozoon cyprini* Khotenovsky, 1982:

This parasite was reported for the first time in Iraq from *Barbus grypus* (Al-Nasiri and Mhaisen, 2009a). Later on, it was reported from the same hosts (Al-Nasiri and Mhaisen, 2009b) as well as three other hosts: *B. luteus*, which is a synonym of *C. luteus* (Al-Jubori, 2013), *C. macrostomum* (Al-Jubori, 2013) and *C. carpio* (Mama, 2012; Mama and Abdullah, 2012a, b; Nasraddin, 2013).

8- *Paradiplozoon ergensi* (Pejčoch, 1968):

This parasite was reported for the first time in Iraq from *A. vorax* by Al-Jubori (2013). No more records are so far available in Iraq (Mhaisen, 2014).

9- *Paradiplozoon homoion* (Bychowsky & Nagibina, 1959):

This parasite was reported for the first time in Iraq from *Barbus xanthopterus*, which is a synonym of *Luciobarbus xanthopterus* by Al-Saadi (2007). Later on, it was reported from *Aspius vorax* (Al-Sa'adi, 2007), *Barbus xanthopterus*, which is a synonym of *Luciobarbus xanthopterus* (Al-Sa'adi, 2007; Al-Saadi *et al.*, 2009, 2010), *C. macrostomum* (Nasraddin, 2013) and *C. carpio* (Al-Sa'adi, 2007).

10- *Paradiplozoon kasimii* (Rahemo, 1980):

This parasite was reported for the first time in Iraq from *C. macrostomum*, erroneously reported as *C. macrostomus*, from Tigris River in Mosul by Fattohy (1975) and published by Rahemo (1980) as *Diplozoon kasimii*. Khotenovsky (1985) transferred this parasite to the genus *Paradiplozoon* and considered it as a species inquirenda as in its description it was unknown about the presence or absence of folds on the ventral posterior part of the body, a clamp structure, size and shape of the median hooks, sizes of suckers and eggs form. Now, *P. kasimii* has 13 fish hosts in Iraq (Mhaisen, 2014) although all references concerned with this parasite in Iraq still refer to it as *D. kasimii*. These hosts are *A. caeruleus* (Asmar *et al.*, 2003; Mhaisen *et al.*, 2003), *A. vorax* (Balasem *et al.*, 1993; Mhaisen *et al.*, 1997; Abdul-Rahman, 1999; Asmar *et al.*, 1999; Al-Janae'e, 2010), *B. esocinus*, which is a synonym of *L. esocinus* (Asmar *et al.*, 1999), *B. luteus*, which is a synonym of *C. luteus* (Al-Daraji and Al-Salim, 1990; Abdul-Rahman, 1999; Asmar *et al.*, 1999; Al-Awadi, 2003; Al-Waaly, 2005; Al-Jadoa and Al-Waaly, 2007; Al-Saadi, 2007; Al-Saadi *et al.*, 2010) in addition to *C.*

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luteus (Khamees, 1983; Al-Daraji, 1986; Mhaisen *et al.*, 1986), *B. sharpeyi*, which is a synonym of *M. sharpeyi* (Abdul-Rahman, 1999; Balasem *et al.*, 2002), *B. xanthopterus*, which is a synonym of *L. xanthopterus* (Asmar *et al.*, 1999; Hussain, 2007), *Carassius carassius* (Abdul-Rahman, 1999), *Chalcalburnus sellal*, which is a synonym of *Alburnus sellal* (Abdul-Rahman, 1999), *C. macrostomum* (Fattohy, 1975; Rahemo, 1980; Ali *et al.*, 1987; Abdul-Ameer, 1989; Abdullah, 2002; Abdullah and Mhaisen, 2004; Hussain, 2007), *C. carpio* (Abdul-Rahman, 1999; Al-Niaeem, 2006), *Garra rufa* (Balasem *et al.*, 2002), *L. abu* (Al-Janae'e, 2010) and *Liza subviridis* which is a synonym of *Chelon subviridis* (Abdul-Rahman, 1999).

11- *Paradiplozoon leucisci* Khotenovsky, 1982:

This parasite was reported for the first time in Iraq from both *Hemiculter leucisculus* and *S. lepidus* by Abdullah (2013). No more records are so far available in Iraq (Mhaisen, 2014).

12- *Paradiplozoon Megan* (Bychowsky & Nagibina, 1959):

This parasite was reported for the first time in Iraq from both *A. vorax* and *B. xanthopterus*, which is a synonym of *L. xanthopterus*, by Al-Saadi (2007). Later on, it was reported from the above two hosts (Al-Saadi *et al.*, 2009, 2010) as well as from *B. luteus*, which is a synonym of *C. luteus* (Al-Sa'adi, 2007).

13- *Paradiplozoon pavlovskii* (Bychowsky & Nagibina, 1959):

This parasite was reported for the first time in Iraq from *A. vorax* by Khamees (1983) under the name *Diplozoon pavlovskii*. Some other reports referred to it as *D. pavlovskii* (Mhaisen *et al.*, 1986; Abdul-Ameer, 1989; Abdullah, 1990; Rahemo and Ami, 1991; Adday *et al.*, 1999; Al-Nasiri, 2000; Abdullah, 2002; Balasem *et al.*, 2003; Abdullah and Mhaisen, 2004; Abdullah and Rasheed, 2004) but some other reports referred to it under its valid name *P. pavlovskii* (Al-Daraji, 1986; Al-Daraji and Al-Salim, 1990; Al-Niaeemi, 1997; Abdul-Rahman, 1999; Rahemo and Al-Niaeemi, 2001; Al-Saadi, 2007; Al-Nasiri, 2009; Al-Saadi *et al.*, 2010; Abdullah, 2013; Al-Jubori, 2013). The overall hosts for this parasite and its synonyms (indicated with an asterisk) are so far 11 hosts in Iraq (Mhaisen, 2014). These are: *A. vorax* (Khamees, 1983*; Al-Daraji, 1986; Mhaisen *et al.*, 1986*; Al-Daraji and Al-Salim, 1990; Abdul-Rahman, 1999; Adday *et al.*, 1999*; Al-Nasiri, 2000*; Al-Saadi, 2007; Al-Saadi *et al.*, 2010), *Barbus barbulus* (Abdullah, 1990*; 2002*; Abdullah and Mhaisen, 2004*), *B. luteus*, which is a synonym of *C. luteus* (Abdul-Ameer, 1989*; Al-Daraji and Al-Salim, 1990; Abdul-Rahman, 1999; Balasem *et al.*, 2003*; Al-Saadi, 2007; Al-Saadi *et al.*, 2010), *C. luteus* (Al-Daraji, 1986), *B. sharpeyi*, which is a synonym of *M. sharpeyi*: (Balasem *et al.*, 2003*), *B. xanthopterus*, which is a synonym of *L. xanthopterus*: (Abdullah, 2002*; Balasem *et al.*, 2003*; Abdullah and Mhaisen, 2004*; Al-Saadi, 2007; Al-Saadi *et al.*, 2010), *C. carassius* (Abdul-Rahman, 1999), *C. regium* (Abdul-Ameer, 1989*; Adday *et al.*, 1999*; Al-Nasiri, 2009; Abdullah, 2013), *C. macrostomum* (Abdullah, 1990*; Abdullah and Rasheed, 2004*; Al-Nasiri, 2009; Al-Jubori, 2013), *C. carpio* (Al-Nasiri, 2009), *S. glanis* (Al-Niaeemi, 1997; Rahemo and Al-Niaeemi, 2001) and *Varicorhina trutta*, which is a synonym of *Capoeta trutta* (Rahemo and Ami, 1991*).

14- *Paradiplozoon rutili* (Gläser, 1967):

This parasite was reported for the first time in Iraq from both *A. vorax* and *C. macrostomum* by Al-Jubori (2013). No more records are so far available in Iraq (Mhaisen, 2014).

15- *Paradiplozoon tadjikistanicum* (Gavrilova & Dzhililov, 1965):

This parasite was reported for the first time in Iraq from *C. trutta* by Nasraddin (2013). It is appropriate to mention here that Nasraddin (2013) erroneously reported the name as *P.*

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tadjikistanicum while the correct name is *P. tadjikistanicum* (Gussev, 1985; Khotenovsky, 1985; Aioanei, 1996; Gibson *et al.*, 2005) and she didn't put the authority inside the brackets. The second name in the authority of this parasite was given as Djalilov by Pugachev *et al.* (2009) and Nasraddin (2013) while it was stated as Dzhililov by Gussev (1985) and Gibson *et al.* (2005). No more records are so far available for this parasite in Iraq (Mhaisen, 2014).

16- *Paradiplozoon vojteki* (Pejčoch, 1968):

This parasite was reported for the first time in Iraq from *B. xanthopterus*, which is a synonym of *L. xanthopterus* by Al-Saadi (2007). Later on, it was reported from the same hosts (Al-Saadi *et al.*, 2009, 2010) as well as from *A. vorax* (Al-Sa'adi, 2007; Al-Jubori, 2013) and *B. luteus*, which is a synonym of *C. luteus* (Al-Jubori, 2013). It is appropriate to mention here that Gibson *et al.* (2005) and Pugachev *et al.* (2009) spelled the authority name of this parasite as Pejcoch instead of Pejčoch.

FISH-DIPLOZOIDS LIST

The following list shows which diplozoids are so far recorded from fishes of Iraq. Fish scientific names, both valid and synonymous, are alphabetically arranged. The full authorities of the valid hosts only are also cited according to Froese and Pauly (2014). Diplozoid species reported from each valid fish species, together with diplozoids of fish synonym (when applicable) were gathered within the valid host and also alphabetically arranged. To minimize the size of this article, references for each gyrodactylid species from each host are not provided here. Such references can be easily obtained from the relevant diplozoid species mentioned earlier in this paper.

Acanthobrama marmid Heckel, 1843: *Paradiplozoon barbi*.

Alburnus caeruleus Heckel, 1843: *Diplozoon* sp. and *Paradiplozoon kasimii*.

Alburnus capito: See *A. mossulensis*.

Alburnus mossulensis Heckel, 1843, reported as *A. capito*: *Diplozoon* sp.

Alburnus sellal Heckel, 1843, reported as *Chalcalburnus sellal*: *Paradiplozoon kasimi*.

Aspius vorax Heckel, 1843: *Diplozoon paradoxum*, *Diplozoon* sp. (adult and diporpa larva), *Eudiplozoon nipponicum*, *Paradiplozoon ergensi*, *P. homoion*, *P. kasimii*, *P. megan*, *P. pavlovskii*, *P. rutili* and *P. vojteki*.

Barbus barbulus Heckel, 1847: *Paradiplozoon pavlovskii*.

Barbus esocinus: See *Luciobarbus esocinus*.

Barbus grypus Heckel, 1843: *Paradiplozoon cyprini*.

Barbus luteus: See *Carasobarbus luteus*.

Barbus sharpeyi: See *Mesopotamichthys sharpeyi*.

Barbus xanthopterus: See *Luciobarbus xanthopterus*.

Capoeta trutta (Heckel, 1943), also reported as *Varicorhinus trutta*: *Paradiplozoon pavlovskii* and *P. tadjikistanicum*.

Carasobarbus luteus (Heckel, 1843), also reported as *B. luteus*: *D. paradoxum*, *Diplozoon* sp. (adult and diporpa larva), *Paradiplozoon amurense*, *P. barbi*, *P. cyprini*, *P. kasimii*, *P. megan*, *P. pavlovskii* and *P. vojteki*.

Carassius carassius (Linnaeus, 1758): *Paradiplozoon kasimii* and *P. pavlovskii*.

Chalcalburnus sellal: See *Alburnus sellal*.

Chelon subviridis (Valenciennes, 1836), reported as *Liza subviridis*: *Paradiplozoon kasimii*.

Chondrostoma nasus (Linnaeus, 1758): *Paradiplozoon barbi*.

Chondrostoma regium (Heckel, 1843): *Paradiplozoon barbi* and *P. pavlovskii*.

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Cyprinion macrostomum Heckel, 1843: *Diplozoon paradoxum*, *Diplozoon* sp., *Paradiplozoon amurense*, *P. barbi*, *P. bliccae*, *P. cyprini*, *P. homoion*, *P. kasimii*, *P. pavlovskii* and *P. rutili*.
Cyprinus carpio Linnaeus, 1758: *Diplozoon paradoxum*, *Diplozoon* sp., *Eudiplozoon nipponicum*, *Paradiplozoon barbi*, *P. bliccae*, *P. cyprini*, *P. homoion*, *P. kasimii* and *P. pavlovskii*.
Garra rufa (Heckel, 1843): *Paradiplozoon kasimii*.
Hemiculter leucisculus (Basilewsky, 1855): *Paradiplozoon leucisci*.
Heteropneustes fossilis: *Diplozoon* sp.
Leusiscus lepidus: See *Squalius lepidus*.
Leusiscus spurius: See *Squalius spurius*.
Liza abu (Heckel, 1843): *Diplozoon paradoxum*, *Diplozoon* sp., *Paradiplozoon bliccae* and *P. kasimi*.
Liza subviridis: See *Chelon subviridis*.
Luciobarbus esocinus Heckel, 1843, reported as *B. esocinus*: *Paradiplozoon barbi* and *P. kasimii*.
Luciobarbus xanthopterus Heckel, 1943, reported as *B. xanthopterus*: *Paradiplozoon homoion*, *P. kasimii*, *P. Megan*, *P. pavlovskii* and *P. vojteki*.
Mastacembelus mastacembelus (Banks & Solander, 1794): *Diplozoon* sp.
Mesopotamichthys sharpeyi (Günther, 1874), reported as *B. sharpeyi*: *Eudiplozoon nipponicum*, *Paradiplozoon kasimii* and *P. pavlovskii*.
Periophthalmus waltoni Koumans, 1941: *Diplozoon* sp.
Silurus glanis Linnaeus, 1758: *Diplozoon* sp. (diporpa larva) and *Paradiplozoon pavlovskii*.
Squalius lepidus Heckel, 1843, also reported as *Leusiscus lepidus*: *Diplozoon* sp. and *Paradiplozoon leucisci*.
Squalius spurius Heckel, 1843, reported as *Leusiscus spurius*: *Paradiplozoon barbi*.
Varicorhinus trutta: See *Capoeta trutta*.

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Table (1): An updated list of diplozoids of fishes of Iraq*

Phylum Platyhelminthes
Class Monogenea
Subclass Polyopisthocotylea
Order Mazocraeidea
Suborder Discocotylinea
Family Diplozoidae
Subfamily Diplozoinae
Diplozoon paradoxum von Nordmann, 183
Diplozoon spp. (adults and diporpa larvae)
Eudiplozoon nipponicum (Goto, 1891)
Paradiplozoon amurense (Akhmerov, 1974)
Paradiplozoon barbi (Reichenbach-Klinke, 1951)
Paradiplozoon bliccae (Reichenbach-Klinke, 1961)
Paradiplozoon cyprini Khotenovsky, 1982
Paradiplozoon ergensi (Pejčoch, 1968)
Paradiplozoon homoion (Bychowsky & Nagibina, 1959)
Paradiplozoon kasimii (Rahemo, 1980)
Paradiplozoon leucisci Khotenovsky, 1982
Paradiplozoon Megan (Bychowsky & Nagibina, 1959)
Paradiplozoon pavlovskii (Bychowsky & Nagibina, 1959)
Paradiplozoon rutili (Gläser, 1967)
Paradiplozoon tadjikistanicum (Gavrilova & Djalilov, 1965)
Paradiplozoon vojteki (Pejčoch, 1968)

* According to Khotenovskii (1985) and Pugachev *et al.* (2009).

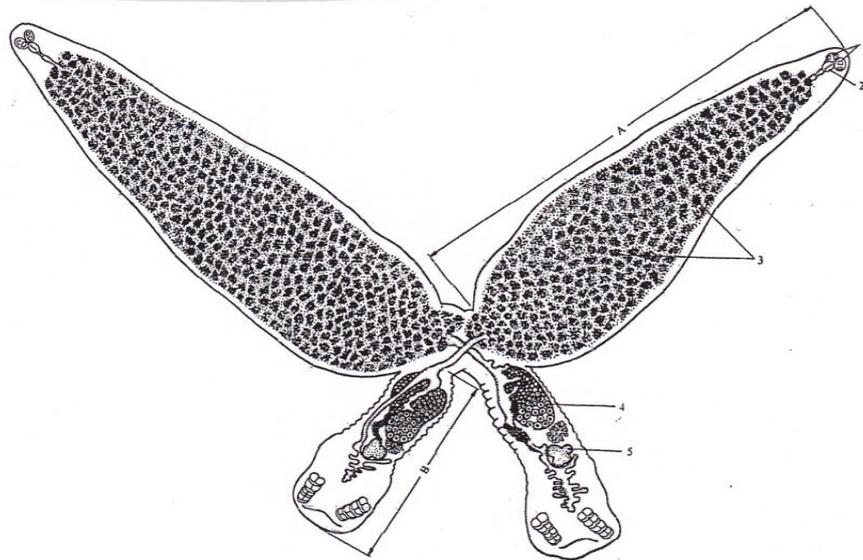


Fig. (1): Illustration of *Paradiplozoon bliccae* showing the typical cross of two fused diploid specimens (after Pugachev *et al.*, 2009). A- Anterior part of the body, B- Posterior part of the body, 1- Suckers, 2- Pharynx, 3- Vitellaria, 4- Testis, 5- Ovary.

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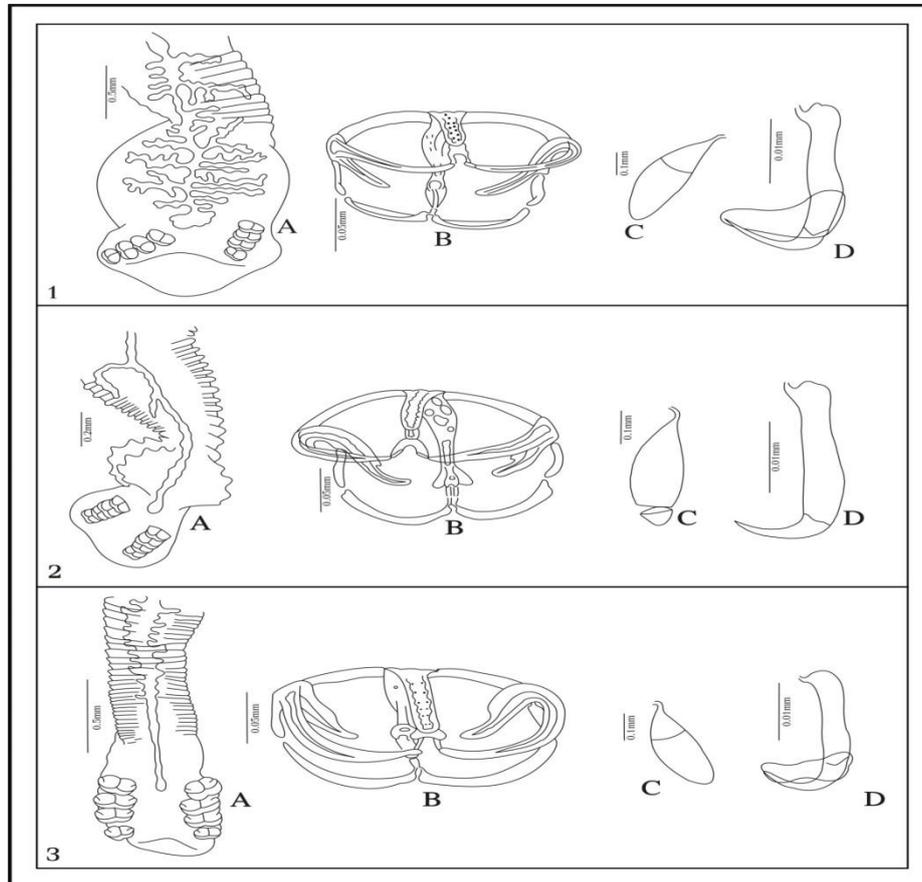


Fig. (2): Comparative illustrations of three genera of diplozoids from fishes of Iraq (after Gussev, 1985). 1- *Diplozoon paradoxum*, 2- *Eudiplozoon nipponicum* and 3- *Paradiplozoon pavlovskii*. (A- Posterior part of body, B- Clamp structure, C- Egg with operculum vesicle, D- Central hook).

قوائم مرجعية لأنواع عائلة Diplozoidae (صنف أحادية المنشأ) من أسماك العراق

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الخلاصة

أظهر إستعراض ٥٩ مصدرا معنيا بظهور الديدان أحادية المنشأ العائدة لعائلة دبلوزويدي Diplozoidae المتطفلة على أسماك العراق وجود ١٥ نوعا شرعيا من هذه العائلة ضمت نوعا واحدا من الجنس *Diplozoon* ونوعا واحدا من الجنس *Eudiplozoon* و ١٣ نوعا من الجنس *Paradiplozoon*. وإضافة لهذه الأنواع تم تسجيل بعض النماذج البالغة واليرقية (يرقات الدايبوربا *diporpa larvae*) غير المشخصة من الجنس *Diplozoon* من ١٢ مضييفا من الأسماك من ضمنها أربعة أنواع من الأسماك لم تظهر بها إصابة بأي من أنواع الدبلوزويدات المشخصة في حين أظهرت المضيفات الباقية حصول إصابات مختلطة بالدبلوزويدات. سجلت هذه الدبلوزويدات من ٢٧ نوعا مضييفا من الأسماك في العراق. سجلت كل هذه الأنواع من بيئات مائية عذبة باستثناء نوع واحد غير مشخص من الجنس *Diplozoon* مسجل من بيئة بحرية. تراوح عدد أنواع المضيفات المسجلة لكل من هذه الطفيليات من مضييف واحد كحد أدنى في كل من الطفيلي *P. ergensi* والطفيلي *P. tadzhikistanicum* إلى أقصى عدد من المضيفات وهو ١٣ نوعا في حالة الطفيلي *P. kasimii*. من ضمن هذه الأسماك المصابة، أوى ١٣ مضييفا نوعا واحدا من الدبلوزويدات لكل منها في حين سجل أقصى عدد وهو عشرة أنواع من الدبلوزويدات في كل من سمكة الشلك والبنيني كبير الفم.