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Literature Review on the Parasites of Fishes of Salah Al-Deen Province, Iraq

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Abstract

The literature review concerning the parasites of fishes from Salah Al-Deen province indicated the occurrence of 84 parasite species which included six ciliophorans, 21 myxozoans, 17 monogeneans, six trematodes, nine cestodes, ten nematodes, five acanthocephalans, two annelids and eight arthropods. These were recorded from 21 fish species, among which 18 fish species belonged to the family Cyprinidae. Number of parasite species recorded ranged from one species in *Alburnus caeruleus*, *A. capito* and *Mastacembelus mastacembelus* to 19 species in *Barbus grypus*. Forty-nine parasite species were monoxenous as such species were reported from a single host each, while one parasite species (*Myxobolus pfeifferi*) was reported from a maximum number of 10 host species. All parasites, as well as their hosts, are verified with the recent systematic accounts and full taxonomic account is given for the so far recorded parasites.

عرض مرجعي لطفيليات أسماك محافظة صلاح الدين، العراق

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الخلاصة

أظهر العرض المرجعي لطفيليات الأسماك في محافظة صلاح الدين، وجود 84 نوعا من الطفيليات التي شملت ستة أنواع من حاملات الأهداب، 21 نوعا من الحيوانات المخاطية، 17 نوعا من المونوجينيا، ستة أنواع من المخرّمات، تسعة أنواع من الديدان الشريطية، عشرة أنواع من الديدان الخيطية، خمسة أنواع من الديدان شوكية الرأس، نوعين من الديدان الحلقية وثمانية أنواع من مفصلية الأقدام. سجلت هذه الأنواع من 21 نوعا من الأسماك من ضمنها 18 نوعا من العائلة الشبوطية. تراوح عدد الأنواع المتطفلة مابين نوع واحد في كل من أسماك اللصاف، القشاش والمرمريج إلى 19 نوعا في الشبوط. تبين أن 49 نوعا من الطفيليات ذات مضيف واحد بينما سجل أحد الطفيليات وهو *Myxobolus pfeifferi* من أكبر عدد من المضيفات وهو عشرة مضيفات. تم التحقق من تصنيف كل الطفيليات وأسماء مضيفاتها مع أحدث أنظمة التصنيف وتم إعطاء قائمة تصنيفية كاملة للأنواع الطفيلية المسجلة لحد الآن.

الكلمات الدالة:
طفيليات ، الاسماك ، صلاح الدين

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Introduction

The scanty information concerning the parasites of fishes of Salah Al-Deen province scattered in different scientific journals, M. Sc. and Ph. D. theses as well as few conference proceedings, need to be gathered and reviewed in order to make them available for all researchers in Iraq. Hence, a full data on different hosts that harbored particular parasite and different parasites which infect different hosts can be obtained. Such data are well known as parasite- host list and host- parasite list, respectively. Among such lists published in Iraq and dealing with different groups of parasites and fishes are those of Mhaisen (1980, 1993a, b, 1995), Mhaisen *et al.* (1991, 1993, 2010).

As no previous lists concerning fish parasites of Salah Al-Deen province are available, the following article is done to achieve this task. Also, it was decided to update our knowledge on taxonomy and synonymy of all concerned parasites and provide recent data related to all infected fishes in this province. Finally, it was also planned to show the richness of fishes of this province with parasites in comparison with that of whole Iraq depending on data extracted from Mhaisen's (2012) index-catalogue of parasites and disease agents of fishes of Iraq.

Material and Methods

To prepare the present review, data from all available references on parasites of fishes of Salah Al-Deen province (research papers, theses and conference proceedings) were gathered to provide host- parasite and parasite- host lists. The scientific names of all parasites and their synonyms were checked with main electronic sites concerning with the classification (ITIS (2012; PESI, 2012; WoRMS, 2012). For fishes, the scientific names were reported as they appeared in their original references with an evaluation according with the recent account on freshwater fishes of Iraq (Coad, 2010) and some additional comments on four fish species based on the electronic site fishbase.org (Froese & Pauly, 2012).

From the index- catalogue of parasites and disease agents of fishes of Iraq (Mhaisen, 2012), the total number of fish hosts harbouring each parasite species was obtained for Salah Al-Deen province in comparison with whole Iraq. Also, the total number of parasite species harbored by each fish host is given for Salah Al-Dean province in comparison with whole Iraq depending on the same reference. The aim of such information is to provide data indicative of fish parasite richness in Salah Al-Deen province in comparison with the whole parasite fauna of fishes of Iraq.

Results and Discussion

Surveys Achieved on Fish Parasites in Salah Al-Deen Province:

The following is a short historical account on different surveys carried out on fishes of Salah Al-Deen province for the investigation of their parasites. Only a brief account on such surveys will be given here as the details will be given in the forthcoming parts of this review.

Although the first report on parasites of fishes of Iraq (Herzog, 1969) revealed the occurrence of 16 parasite species and three fungal species from 16 fish hosts from many regions of Iraq, the exact locality was not stated for some hosts and no data seemed to be from Salah Al-Deen province. Hussien & Mahdi (1986) detected one trematode species from three hosts collected from Al-Tharthar reservoir and Al-Tharthar- Tigris canal in Sammara city. Khalifa (1986) inspected four fish species from several fish ponds around Baghdad area and near Sammara city and detected two cestode species. Abdul-Ameer (1989) examined 12 fish species from Tigris river at Baiji town and detected 31 parasite species of which 16 species were reported for the first time in Iraq. Khalifa (1989) inspected five fish species from several parts of Baghdad and Sammara regions as well as Al-Tharthar canal and detected 13 parasite species but the exact locality for most of these species was not determined. One of these parasite species was reported for the first time in Iraq. Hussien & Al-Hamdane (1992) showed field observations on the fish louse *Argulus foliaceus* from three fish species taken from some private fish farms in Baghdad and Sammara. While surveying fishes from Mosul and Alton Kopri for nematodes, Nawab Al-Deen (1994) included one fish species from Tikreet to her study and detected one nematode species from that fish. Muhammed (1995) inspected 19 fish species from Tigris river at Mosul, Tikreet and Sammara for cestodes and detected 14 species but he did not state the exact locality for each infected host. Later on, he published some of his thesis investigation and indicated that five of these 14 cestode species were from Mosul (Rahemo & Mohammad, 2002; 2004), but again, in another published paper, extracted from the same thesis, Rahemo & Mohammad (2006) did not determine the exact locality of each infected host. Al-Jawda *et al.* (2000) collected 13 fish species from some stations in Tigris river north and south Tikreet city and recorded 21 parasite species among which one species was reported for the first time in Iraq. Al-Nasiri (2008) inspected eight fish species caught from Tigris river at Tikreet city and reported 14 *Myxobolus* species among which four species were reported for the first time in Iraq. Al-Nasiri (2009) examined five fish species from Tigris river at

Tikreet city and detected four diplozoid species among which one was reported for the first time in Iraq. Al-Nasiri & Mhaisen (2009a) reported one monogenean from one fish species for the first time in Iraq from Tigris river at Tikreet city. From six fish species from Tigris river, south of Tikreet city, Al-Nasiri & Mhaisen (2009b) detected nine parasite species among which two species were reported for the first time in Iraq. Al-Nasiri (2010) reported one monogenean for the first time in Iraq from on host from Tigris river at Tikreet city. Al-Ayash (2011) reported eight parasite species from 20 fish species from Tigris river at Tikreet city among which one cestode species was recorded for the first time in Iraq.

Parasite- Host List:

All parasite species so far recorded from fishes of Salah Al-Deen province are enlisted with their hosts and references which are shown in parenthesis. These parasites are illustrated here according to their major groups. An account on the systematic of each parasite group followed with parasite- host list will be demonstrated for each major group.

Major Groups of Parasites and their Hosts:

As names of some major groups of parasites had been changed during the last few years, attention was paid to use the most recent names for the major parasite groups which infect fishes (ITIS, 2012; PESI, 2012; WoRMS, 2012). Nine major parasite groups are encountered in this study. These included the groups of Ciliophora, Myxozoa, Monogenea, Trematoda, Cestoda, Nematoda, Acanthocephala, Annelida and Arthropoda.

Protozoa - Ciliophora

The phylum Ciliophora which includes external ciliated protozoan parasites is represented with the causative agent of the white spot disease *Ichthyophthirius multifiliis* and four species of the genus *Trichodina*. In addition, *Dermocystidium percae*, once regarded as a ciliated protozoan, is now considered as belonging to the protozoan phylum Choanozoa according to EOL (2012) and WoRMS (2012), to the kingdom Fungi according to ITIS (2012) and to the kingdom Chromista according to PESI (2012). According to Index Fungorum (EOL, 2012), the genus *Dermocystidium* is considered as incertae sedis. The systematic account of ciliophoran protozoan parasites of fishes of Salah Al-Deen province followed by a parasite- host list is given here. Numbers in curly brackets occurring after the authority of each parasite refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Kingdom Protozoa
- Phylum Ciliophora
  - Class Oligohymenophorea
    - Order Mobilida
      - Family Trichodinidae
        - *Trichodina cottidarum* Dogiel, 1955 {1/6}
        - *Trichodina domerguei* (Wallengren, 1897) {1/3}
        - *Trichodina elegeni* Shul'man-Albova, 1950 {1/1}
        - *Trichodina murmaniaca* Polyanski, 1955 {1/1}
        - *Trichodina* sp. {1/6}
    - Order Hymenostomatida
      - Family Ichthyophthiriidae
        - *Ichthyophthirius multifiliis* Fouquet, 1876 {2/32}
- Phylum Choanozoa
  - Class Ichthyosporea
    - Order Incertae sedis
      - Family Incertae sedis
        - *Dermocystidium percae* Reichenbach-Klinke, 1950 {1/2}

Dermocystidium percae: *B. grypus* (Al-Nasiri & Mhaisen, 2009b).
Ichthyophthirius multifiliis: *B. xanthopterus* (Khalifa, 1989), *C. carpio* (Khalifa, 1989).
Trichodina cottidarum: *C. carpio* (Al-Nasiri & Mhaisen, 2009b).
T. domerguei: *S. triostegus* (Abdul-Ameer, 1989).
T. elegeni: *L. abu* (Al-Nasiri & Mhaisen, 2009b).
T. murmaniaca: *L. abu* (Al-Nasiri & Mhaisen, 2009b).
Trichodina sp.: *C. carpio* (Khalifa, 1989).

Animalia - Myxozoa

The phylum Myxozoa of the animal kingdom includes external and internal parasites of different fish organs (Duijn, 1973). This group was used to be known as the sporozoans of the Protozoa. Myxozoans of fishes of Salah Al-Deen province included four genera: *Glugea*, *Myxosoma* and *Thelohanellus* (one species each) and *Myxobolus* (18 species). It is appropriate to mention here that *Glugea anomala* is considered as belonging to the kingdom Fungi according to WoRMS (2012) and *Myxosoma* is accepted as *Myxobolus* by WoRMS (2012). *M. sphaericus* was misspelled as *M. sphaerica* by Abdul-Ameer (1989) and Al-Nasiri (2008). The systematic account of myxozoan parasites of fishes of Salah Al-Deen province followed by a parasite- host list is given here. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Kingdom Animalia
- Phylum Myxozoa
  - Class Myxosporea
    - Order Myxosporida
      - Family Glugeidae
        - *Glugea anomala* (Moniez, 1887) Gurley, 1893 {2/3}
      - Family Myxobolidae
        - *Myxobolus chondrostomi* Donec, 1962 {1/1}
        - *Myxobolus cyprinicola* Reuss, 1906 {2/3}
        - *Myxobolus dispar* Thélohan, 1895 {4/12}
        - *Myxobolus dogieli* Bykhovskaya-Pavlovskaya & Bykhovski, 1940 {2/8}
        - *Myxobolus ellipsoides* Thélohan, 1892 {1/2}
        - *Myxobolus karelicus* Petruschevskii 1940 {1/1}
        - *Myxobolus koi* Kudo, 1919 {1/5}

Myxobolus macrocapsularis Reuss, 1906 {1/2}
Myxobolus mülleri Bütschli, 1882 {3/6}
Myxobolus nemachili Weiser, 1949 {2/8}
Myxobolus orientalis Shul'man, 1962 {1/1}
Myxobolus oviformis Thélohan, 1882 {10/20}
Myxobolus parvus Shulman, 1962 {1/2}
Myxobolus pfeifferi Thélohan, 1895 {8/33}
Myxobolus pseudodispar Gorbunova, 1936 {1/3}
Myxobolus sandrae Reuss, 1906 {1/2}
Myxobolus schulmani Donec, 1962 {1/1}
Myxobolus sphaericus (Fujita, 1924) {2/7}
Thelohanellus catlae Chakrawarty & Basu, 1958 {1/2}
Family Myxosomatidae
Myxosoma acuta Fujita, 1912 {1/3}

Glugea anomala: *A. marmid* (Abdul-Ameer, 1989), *V. trutta* (Abdul-Ameer, 1989).
Myxobolus chondrostomi: *B. grypus* (Al-Nasiri, 2008).
M. cyprinicola: *B. grypus* (Al-Nasiri, 2008), *Varicorhinus* sp. (Al-Nasiri, 2008).
M. dispar: *A. vorax* (Al-Jawda *et al.*, 2000), *B. barbulus* (Al-Jawda *et al.*, 2000), *B. sharpeyi* (Al-Jawda *et al.*, 2000), *C. regium* (Abdul-Ameer, 1989; Al-Jawda *et al.*, 2000).
M. dogieli: *B. grypus* (Al-Jawada *et al.*, 2000), *L. abu* (Abdul-Ameer, 1998).
M. ellipsoides: *B. luteus* (Al-Nasiri, 2008).
M. karelicus: *L. abu* (Al-Nasiri, 2008).
M. koi: *B. luteus* (Al-Nasiri, 2008).
M. macrocapsularis: *B. luteus* (Al-Nasiri, 2008).
M. mülleri: *B. grypus* Al-Nasiri & Mhaisen, 2009b), *L. abu* (Al-Nasiri, 2008), *Varicorhinus* sp. (Al-Nasiri, 2008).
M. nemachili: *B. grypus* (Al-Nasiri, 2008), *L. abu* (Abdul-Ameer, 1989; Al-Nasiri, 2008).
M. orientalis: *B. grypus* (Al-Nasiri, 2008).
M. oviformis: *A. vorax* (Al-Jawda *et al.*, 2000), *B. barbulus* (Al-Jawda *et al.*, 2000), *B. belayewi* (Al-Jawda *et al.*, 2000), *B. grypus* (Al-Jawda *et al.*, 2000), *B. luteus* (Al-Jawda *et al.*, 2000), *B. sharpeyi* (Al-Jawda *et al.*, 2000), *C. regium* (Al-Jawda *et al.*, 2000), *L. lepidus* (Al-Jawda *et al.*, 2000), *L. abu* (Al-Jawda *et al.*, 2000), *V. trutta* (Al-Jawda *et al.*, 2000).
M. parvus: *B. xanthopterus* (Al-Nasiri, 2008).
M. pfeifferi: *A. vorax* (Al-Jawda *et al.*, 2000), *B. barbulus* (Al-Jawda *et al.*, 2000), *B. belayewi* (Al-Jawda *et al.*, 2000), *B. grypus* (Al-Jawda *et al.*, 2000), *B. luteus* (Al-Jawda *et al.*, 2000), *B. sharpeyi* (Al-Jawda *et al.*, 2000), *C. macrostomum* (Abdul-Ameer, 1989), *L. lepidus* (Al-Jawda *et al.*, 2000).
M. pseudodispar: *C. regium* (Al-Nasiri, 2008).
M. sandrae: *B. xanthopterus* (Al-Nasiri, 2008).
M. schulmani: *B. grypus* (Al-Nasiri, 2008).
M. sphaericus: *B. grypus* (Al-Nasiri, 2008), *C. regium* (Abdul-Ameer, 1989).
Myxosoma acuta: *C. macrostomum* (Abdul-Ameer, 1989).
Thelohanellus catlae: *C. macrostomum* (Abdul-Ameer, 1989).

Animalia - Platyhelminthes - Monogenea

The flatworms (Platyhelminthes) of fishes of Salah Al-Deen province are categorized in three major groups (classes) of Monogenea, Trematoda and Cestoda. The class Monogenea, used to be known as monogenetic trematodes, includes 17 species belonging to six genera: *Ancylodiscoides* and *Microcotyle* (one species each), *Diplozoon* and *Gyrodactylus* (two species each), *Paradiplozoon* (five species) and *Dactylogyrus* (six species). According to their attachment organs, monogeneans belonging to orders Dactylogyridea and Gyrodactylidea have hooks and hooklets and hence they are known as monopisthocotyleans while those of the order Mazocraeidea have clamps as attachment organs and hence they are known as Polyopisthocotyleans. Monogeneans are ecto-parasites on skin, fins and gills of fishes (Gussev, 1985). According to PESI (2012), *Ancylodiscoides vistulensis* is a synonym of *Thaparocleidus vistulensis* (Siwak, 1932). The authority of *P. amurensis* was given without brackets by Al-Nasiri (2010). The systematic account of monogenean parasites of fishes of Salah Al-Deen province followed by a parasite- host list is given below. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Phylum Platyhelminthes
Class Monogenea
Order Dactylogyridea
Family Ancyrocephalida
Ancylodiscoides vistulensis (Siwak, 1931) {1/19}
Family Dactylogyridae
Dactylogyrus cornu Linstow, 1878 {1/13}
Dactylogyrus kulwieci Bychowsky, 1933 {2/5}
Dactylogyrus pulcher Bychowsky, 1957 {2/4}
Dactylogyrus rhodeianus Jalali, Papp & Molnár, 1995 {1/2}
Dactylogyrus varicorhini Bychovsky, 1957 {2/3}
Dactylogyrus vastator Nybelin, 1924 {3/32}
Order Gyrodactylidea
Family Gyrodactylidae
Gyrodactylus elegans von Nordmann, 1832 {1/22}
Gyrodactylus markewitschi Kulakovskaya, 1952 {1/5}
Order Mazocraeidea
Family Diplozoidae
Diplozoon kasimii Rahemo, 1980 {1/13}
Diplozoon paradoxum von Nordmann, 1832 {1/5}
Paradiplozoon amurensis (Akhmerov, 1974) {1/1}
Paradiplozoon barbi (Reichenbach-Klinke, 1951) {2/7}
Paradiplozoon bliccae (Reichenbach-Klinke, 1961) {2/2}
Paradiplozoon cyprini Khotenovsky, 1982 {1/1}
Paradiplozoon pavlovskii (Bychowsky & Nagibina, 1959) {4/12}
Family Microcotylidae
Microcotyle donavini van Beneden & Hesse, 1863 {1/10}

Ancylodiscoides vistulensis: *S. triostegus* (Abdul-Ameer, 1989).
Dactylogyrus cornu: *B. belayewi* (Al-Jawda *et al.*, 2000).
D. kulwieci: *B. esocinus* (Abdul-Ameer, 1989), *B. xanthopterus* (Abdul-Ameer, 1989).
D. pulcher: *C. macrostomum* (Abdul-Ameer, 1989), *V. trutta* (Abdul-Ameer, 1989).
D. rhodeianus: *B. luteus* (Al-Nasiri & Mhaisen, 2009b).
D. varicorhini: *B. luteus* (Abdul-Ameer, 1989), *V. trutta* (Abdul-Ameer, 1989).

D. vastator: *B. barbulus* (Al-Jawda *et al.*, 2000), *B. xanthopterus* (Al-Jawda *et al.*, 2000, *C. carpio* (Al-Nasiri & Mhaisen, 2009b).
Diplozoon barbi: See *Paradiplozoon barbi*.
D. kasimii: *C. macrostomum* (Abdul-Ameer, 1989).
D. paradoxum: *C. macrostomum* (Al-Nasiri, 2009).
D. pavlovskii: See *Paradiplozoon pavlovskii*.
Gyrodactylus elegans: *B. belayewi* (Al-Jawda *et al.*, 2000).
G. markewitschi: *V. trutta* (Abdul-Ameer, 1989).
Microcotyle donavini: *L. abu* (Al-Nasiri & Mhaisen, 2009b).
Paradiplozoon amurensis: *C. macrostomum* (Al-Nasiri, 2010).
P. barbi (Reported as *D. barbi*): *C. macrostomus* (Al-Nasiri, 2009), *C. carpio* (Al-Nasiri, 2009).
P. bliccae: *C. macrostomus* (Al-Nasiri, 2009), *C. carpio* (Al-Nasiri, 2009).
P. cyprini: *B. grypus* (Al-Nasri & Mhaisen, 2009a, b).
P. pavlovskii: *B. luteus* (Abdul-Ameer, 1989 [as *D. pavlovskii*]), *C. regium* (Abdul-Ameer, 1989 [as *D. pavlovskii*], Al-Nasiri, 2009), *C. macrostomus* (Al-Nasiri, 2009), *C. carpio* (Al-Nasiri, 2009).

Animalia - Platyhelminthes - Trematoda

The class Trematoda, used to be known as the digenetic trematodes, of fishes of Salah Al-Deen province includes five species belonging to five genera: *Ascocotyle*, *Aspidogaster*, *Pseudochetosoma* and *Sanguinicola* in addition to a specimen which was determined to the generic level (*Diplostomum*). In addition, Abdul-Ameer (1989) reported *Distomum globiporum* from the gall bladder of *Aspius vorax*. According to Dawes (1946), this species is considered as one of the synonyms of *Sphaerostoma bramae*. Trematodes of *Ascocotyle* are metacercarial forms which encyst on skin and gills of fishes while those of *Diplostomum* are also metacercariae which live in fish eyes and hence may cause worm cataract and blindness (Mhaisen, 2004). Adult stages of both *Ascocotyle* and *Diplostomum* live in the alimentary canal of fish- eating aquatic birds (Mhaisen, 1983). The remaining trematodes are adults which live in fish intestine (*Aspidogaster*), gall bladder (*Pseudochetosoma*) and the blood (*Sanguinicola*). Only eggs of the latter parasite were detected from gills and kidneys of two fish species (Khalifa, 1989). The systematic account of trematode parasites of fishes of Salah Al-Deen province followed by a parasite- host list is given here. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Class Trematoda
Order Plagiorchiida
Family Heterophyidae
Ascocotyle coleostoma (Looss, 1896) {8/31}
Family Opecoelidae
Sphaerostoma bramae (Müller, 1776), reported as *Distomum globiporum* {1/1}
Family Steganodermatidae
Pseudochetosoma salmonicola Dollfus, 1951 {3/12}
Order Aspidogastrida
Family Aspidogastridae
Aspidogaster limacoides Diesing, 1835 {3/14}
Order Diplostomida
Family Sanguinicolidae
Sanguinicola sp. {2/2}
Family Diplostomidae
Diplostomum sp. {3/23}

Ascocotyle coleostoma: *A. capito* (Al-Jawda *et al.*, 2000), *A. vorax* (Al-Jawda *et al.*, 2000), *B. belayewi* (Al-Jawda *et al.*, 2000), *B. luteus* (Al-Jawda *et al.*, 2000), *B. sharpeyi* (Al-Jawda *et al.*, 2000), *C. regium* (Al-Jawda *et al.*, 2000), *L. Lepidus* (Al-Jawda *et al.*, 2000), *L. abu* (Al-Jawda *et al.*, 2000).
Aspidogaster limacoides: *A. vorax* (Hussien & Mahdi, 1986), *B. sharpeyi* (Hussien & Mahdi, 1986), *B. xanthopterus* (Hussien & Mahdi, 1986).
Diplostomum sp.: *B. belayewi* (Al-Jawda *et al.*, 2000), *B. luteus* (Al-Jawda *et al.*, 2000), *C. regium* (Al-Jawda *et al.*, 2000).
Pseudochetosoma salmonicola: *A. vorax* (Al-Jawda *et al.*, 2000), *B. barbulus* (Al-Jawda *et al.*, 2000), *B. grypus* (Al-Jawda *et al.*, 2000).
Sanguinicola sp.: *B. sharpeyi* (Khalifa, 1989), *C. carpio* (Khalifa, 1989).
Sphaerostoma bramae, reported as *Distomum globiporum*: *A. vorax* (Abdul-Ameer, 1989).

Animalia - Platyhelminthes - Cestoda

Nine tapeworms of the class Cestoda were reported from fishes of Salah Al-Deen province. These belong to seven genera: *Bothriocephalus*, *Caryophyllaeus*, *Ligula*, *Monobothrium* and *Postgangesia* (one species each) and *Khawia* and *Proteocephalus* (two species each). It is appropriate to indicate here that Khalifa (1986, 1989) had reported *B. gowkongensis* from the intestine of two fish hosts, but according to Molnár (1977), both *B. gowkongensis* and *B. opsariichthydis* are in fact synonyms of *B. acheilognathi*. *Postgangesia hemispherous* was firstly assigned the name *Proteocephalus hemispherous* by Rahemo & Al-Niaeemi (2001) from Mosul but then was transferred to the genus *Postgangesia* by Scholz *et al.* (2007). All reported cestode species were adults, living in the intestine of their hosts, apart from *Ligula* which was reported as larval stage living in the abdominal cavity of its host. The systematic account of cestodes of fishes of Salah Al-Deen province followed by a parasite- host list is given here. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Class Cestoda
Order Bothriocephalidea
Family Bothriocephalidae
Bothriocephalus acheilognathi Yamaguti, 1934 {6/19}
Order Caryophyllidea
Family Caryophyllaeidae
Caryophyllaeus sp. {1/8}
Family Lytocestidae
Khawia armeniaca (Cholodkovski, 1915) {1/5}
Khawia rossittensis (Szidat, 1927) {2/2}
Family Caryophyllaeidae
Monobothrium auriculatum Kulakovskaya, 1961 {2/3}
Order Diphyllobothriidea
Family Diphyllobothriidae
Ligula intestinalis (Linnaeus, 1758) {1/13}
Order Proteocephalidea
Family Monticellidae
Postgangesia hemispherous (Rahemo & Al-Naiaeemi, 2001) {1/2}
Family Proteocephalidae
Proteocephalus osculatus (Goeze, 1782) {1/8}
Proteocephalus torulosus (Batsch, 1786) {2/2}

Bothriocephalus acheilognathi: *A. vorax* (Al-Ayash, 2011), *B. sharpeyi* (Khalifa, 1986 [as *B. gowkongensis*]), *C. auratus* (Al-Ayash, 2011), *C. carpio* (Khalifa, 1986; 1989 [as *B. gowkongensis*]), *L. lepidus* (Al-Ayash, 2011), *S. triostegus* (Al-Ayash, 2011).
B. gowkongensis: See *B. acheilognathi*.
Caryophyllaeus sp.: *C. carpio* (Khalifa, 1989).
Khawia armeniaca: *B. xanthopterus* (Al-Ayash, 2011).
K. rossittensis: *A. vorax* (Al-Ayash, 2011), *C. macrostomum* (Al-Ayash, 2011).
Ligula intestinalis: *A. caeruleus* (Khalifa, 1989).
Monobothrium auriculatum: *B. barbulus* (Al-Ayash, 2011), *B. grypus* (Al-Ayash, 2011).
Postgangesia hemispherous: *S. triostegus* (Al-Ayash, 2011).
Proteocephalus osculatus: *A. vorax* (Al-Ayash, 2011).
P. torulosus: *B. grypus* (Khalifa, 1986), *C. carpio* (Khalifa, 1986).

Animalia - Nematoda

Ten thread worms were reported from fishes of Salah Al-Deen province. These belong to genera *Capillaria*, *Contracaecum*, *Porrocaecum*, *Procamallanus* and *Spiroxys* (one species each), *Cucullanus* (two species) and *Rhabdochona* (three species). Only the genus *Capillaria* belongs to the primitive class of Adenophorea while the remaining genera belong to the class Secernentea. Larvae of *Contracaecum* were found in the body cavity, intestine, liver and gonads of seven host species. These larvae are very common in freshwater fishes of Iraq as they were, so far, reported from 38 fish host species (Mhaisen, 2012). The adult worms of such larvae are found in some aquatic birds in Iraq (Al-Hadithi & Habish, 1977). Larvae of *Capillaria* sp. lived in the liver, those of *Spiroxys* sp. in the heart and those of *Porrocaecum* sp. in the body cavity. The remaining nematodes were adults and found in the alimentary canal of their hosts. *R. hellichi* was misspelled as *R. belichii* by Abdul-Ameer (1989). Moravec *et al.* (2009) considered *R. grandipapillata* as a synonym of *Rabdochona R. tigridis* Rahemo, 1978 (emend) and Moravec *et al.* (1991) considered *R. mesopotamica* as a synonym of *Rhabdochona denudata* (Dujardin, 1845). The systematic account of nematodes of fishes of Salah Al-Deen province followed by a parasite- host list is given below. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Phylum Nematoda
Class Adenophorea
Order Enoplida
Family Trichuridae
Capillaria sp. {1/10}
Class Secernentea
Order Ascaridida
Family Anisakidae
Contracaecum sp. {7/38}
Family Ascarididae
Porrocaecum sp. {1/2}
Family Cucullanidae
Cucullanus cyprini Yamaguti, 1941 {1/14}
Cucullanus pseudeutropi Agrawal, 1967 {2/4}
Order Spirurida
Family Camallanidae
Procamallanus viviparus Ali, 1956 {1/3}
Family Gnathostomatidae
Spiroxys sp. {1/6}
Family Rhabdochonidae
Rhabdochona grandipapillata Rahemo & Kasim, 1979 {2/2}
Rhabdochona hellichi (Šrámek, 1901) {2/8}
Rhabdochona mesopotamica Rahemo & Kasim, 1979 {1/8}

Capillaria sp.: *C. macrostomum* (Abdul-Ameer, 1989).
Contracaecum sp.: *A. marmid* (Abdul-Ameer, 1989), *A. vorax* (Abdul-Ameer, 1989, Al-Jawda *et al.*, 2000), *B. grypus* (Khalifa, 1989; Al-Jawda *et al.*, 2000), *B. xanthopterus* (Abdul-Ameer, 1989; Khalifa, 1989), *C. regium* (Abdul-Ameer, 1989), *S. triostegus* (Abdul-Ameer, 1989), *V. trutta* (Abdul-Ameer, 1989).
Cucullanus cyprini: *L. Lepidus* (Al-Ayash, 2011).
C. pseudeutropi: *A. vorax* (Abdul-Ameer, 1989), *B. esocinus* (Abdul-Ameer, 1989).
Porrocaecum sp.: *V. trutta* (Abdul-Ameer, 1989).
Procamallanus viviparus: *M. mastacembelus* ([Reported as *M. simach*] Nawab Al-Deen, 1994).
Rhabdochona hellichi: *B. grypus* (Abdul-Ameer, 1989), *B. xanthopterus* (Abdul-Ameer, 1989).
R. grandipapillata: *C. macrostomum* (Abdul-Ameer, 1989), *G. ruffa* (Abdul-Ameer, 1989).
R. mesopotamica: *C. macrostomum* (Abdul-Ameer, 1989).
Spiroxys sp.: *B. belayewi* (Al-Jawda *et al.*, 2000).

Animalia - Acanthocephala

Only five thorny or spiny- headed worms were reported from fishes of Salah Al-Deen province. One species belongs to the genus *Paulisentis* while the remaining four belong to *Neoechinorhynchus*. All these are adult parasites living in the intestine of their hosts. According to Mhaisen (2002), Al-Jawda *et al.* (2000) as well as many other researchers applied the

name *N. agilis*, which is a marine species, for the actual specimens of *N. iraqensis*. The systematic account of acanthocephalans of fishes of Salah Al-Deen province followed by a parasite- host list is given below. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Phylum Acanthocephala
Class Eoacanthocephala
Order Neoechinocephalida
Family Neoechinocephalidae
Neoechinorhynchus cristatus Lynch, 1936 {1/2}
Neoechinorhynchus iraqensis Amin, Al-Sady, Mhaisen & Bassat, 2001 {1/24}
Neoechinorhynchus rutili (Müller, 1780) {1/16}
Neoechinorhynchus zabensis Amin, Abdullah & Mhaisen, 2003 {4/7}
Paulisentis fractus Van Cleave & Bangham, 1949 {1/3}

Neoechinorhynchus agilis: See *N. iraqensis*.
N. cristatus: *V. trutta* (Abdul-Ameer, 1989).
N. iraqensis: *L. abu* ([Reported as *N. agilis* by Al-Jawda *et al.*, 2000], Al-Ayash, 2011).
N. rutili: *V. trutta* (Abdul-Ameer, 1989).
N. zabensis: *B. belayewi* (Al-Ayash, 2011), *C. auratus* (Al-Ayash, 2011), *L. abu* (Al-Ayash, 2011), *S. triostegus* (Al-Ayash, 2011).
Paulisentis fractus: *B. barbuus* (Al-Jawda *et al.*, 2000).

Animalia - Annelida

Only two leeches of the phylum Annelida were reported from fishes of Salah Al-Deen province. These belong to genera *Hemiclepsis* and *Piscicola*. These are external parasites which suck blood from skin and gills of their hosts and act as vectors for distribution of some protozoan blood parasites such as those of genera *Trypanosoma* and *Cryptobia* from one fish to another one (Amlacher, 1970). It is interesting to know that both EOL (2012) and ITIS (2012) considered the year of authority of *P. geometra* as 1761 while WoRMS (2012) considered it as 1758. The systematic account of leeches parasitizing fishes of Salah Al-Deen province followed by a parasite- host list is given below. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Phylum Annelida
Class Clitellata
Order Rhynchobdellidae
Family Glossiphoniidae
Hemiclepsis marginata (O. F. Müller, 1774) {1/4}
Piscicola geometra (Linnaeus, 1761) {1/3}

Hemiclepsis marginata: *C. carpio* (Khalifa, 1989).
Piscicola geometra: *B. grypus* (Al-Jawda *et al.*, 2000).

Animalia - Arthropoda

Eight crustaceans of the phylum Arthropoda were found on fishes of Salah Al-Deen province. These included one branchiuran fish lice of the genus *Argulus* and seven species of copepods which belong to genera *Lamproglena*, *Lernaea*, *Pseudolamproglena* and *Tracheliastes* (one species each) and three species of the genus *Ergasilus*. *Argulus* and *Tracheliastes* were detected from skin and fins of their hosts, *Lernaea* was found on skin and gills and sometime buccal cavity of its hosts, while those of genera *Ergasilus*, *Lamproglena* and *Pseudolamproglena* were found on fish gills. *A. foliaceus* is well known for its destructive effects on fishes in general and fish fingerlings in particular (Bauer *et al.*, 1969). The systematic account of crustacean arthropods parasitizing fishes of Salah Al-Deen province followed by a parasite- host list is given below. Numbers in curly brackets occurring after the authority of each parasite species refer to number of hosts in Salah Al-Deen province/ number of hosts from the whole inland waters of Iraq (Mhaisen, 2012).

Phylum Arthropoda
Class Maxillopoda
Order Arguloidea
Family Argulidae
Argulus foliaceus (Linnaeus, 1758) {4/14}
Order Poecilostomatoida
Family Ergasilidae
Ergasilus mosulensis Rahemo, 1982 {1/19}
Ergasilus peregrinus Heller, 1865 {2/8}
Ergasilus sieboldi von Nordmann, 1832 {2/25}
Order Cyclopoida
Family Lernaeidae
Lamproglena pulchella von Nordmann, 1832 {1/19}
Lernaea cyprinacea Linnaeus, 1758 {4/25}
Pseudolamproglena annulata Boxshall, 1976 {2/7}
Order Siphonostomatoida
Family Lernaeopodidae
Tracheliastes polycolpus Nordmann, 1832 {1/4}

Argulus foliaceus: *B. esocinus* (Hussien & Al-Hamdane, 1992), *B. grypus* (Hussien & Al-Hamdane, 1992), *B. xanthopterus* (Khalifa, 1989), *C. carpio* (Hussien & Al-Hamdane, 1992; Al-Jawda *et al.*, 2000).
Ergasilus mosulensis: *B. luteus* (Abdul-Ameer, 1989).
E. peregrinus: *A. vorax* (Abdul-Ameer, 1989), *L. abu* (Abdul-Ameer, 1989).
E. sieboldi: *B. luteus* (Al-Jawda *et al.*, 2000), *B. xanthopterus* (Khalifa, 1989).
Lamproglena pulchella: *G. rufa* (Abdul-Ameer, 1989).
Lernaea cyprinacea: *B. belayewi* (Al-Jawda *et al.*, 2000), *B. sharpeyi* (Khalifa, 1989), *B. xanthopterus* (Khalifa, 1989), *C. carpio* (Khalifa, 1989).

Pseudolamproglena annulata: *B. luteus* (Abdul-Ameer, 1989, Al-Jawda *et al*., 2000), *C. macrostomum* (Abdul-Ameer, 1989).
Tracheliastes polycolpus: *B. belayewi* (Al-Jawda *et al*., 2000).

Host-Parasite List:

Names of all infected fish hosts with their parasite species so far detected from Salah Al-Deen province are alphabetically arranged, below, and the parasites of each fish species are also alphabetically arranged. Numbers, shown in curly brackets, at the end of the list of parasites of each fish host, indicate number of parasite species so far recorded from that fish in Salah Al-Dean province/ number of parasite species recorded from the same fish from the whole Iraqi inland waters (Mhaisen, 2012).

Acanthobrama marmid Heckel, 1843: *Contracaecum* sp. and *Glugea anomala* {2/30}.

Alburnus caeruleus Heckel, 1843: *Ligula intestinalis* {1/23}.

Alburnus capito Heckel, 1843: *Ascocotyle coleostoma* {1/23}.

Aspius vorax Heckel, 1843: *Ascocotyle coleostoma*, *Aspidogaster limacoides*, *Bothriocephalus acheilognathi*, *Contracaecum* sp., *Cucullanus pseudeutropi*, *Ergasilus peregrinus*, *Khawia rossittensis*, *Myxobolus dispar*, *M. oviformis*, *M. pfeifferi*, *Proteocephalus osculatus*, *Pseudochetosoma salmonicola* and *Sphaerostoma bramae* (reported as *Distomum globiporum*) {13/73}.

Barbus barbulus Heckel, 1847: *Dactylogyrus vastator*, *Myxobolus dispar*, *M. oviformis*, *M. pfeifferi*, *Monobothrium auriculatum*, *Paulisentis fractus* and *Pseudochetosoma salmonicola* {7/34}.

Barbus belayewi Menon, 1960: *Ascocotyle coleostoma*, *Dactylogyrus cornu*, *Diplostomum* sp., *Gyrodactylus elegans*, *Lernaea cyprinacea*, *Myxobolus oviformis*, *M. pfeifferi*, *Neoechinorhynchus zabensis*, *Spiroxys* sp. and *Tracheliastes polycolpus* {10/12}.

Barbus esocinus (Heckel, 1843): *Argulus foliaceus*, *Cucullanus pseudeutropi* and *Dactylogyrus kulwieci* {3/35}.

Barbus grypus Heckel, 1843: *Argulus foliaceus*, *Contracaecum* sp., *Dermocystidium percae*, *Monobothrium auriculatum*, *M. chondrostomi*, *M. cyprinicola*, *M. dogieli*, *M. mülleri*, *M. nemachili*, *M. orientalis*, *M. oviformis*, *M. pfeifferi*, *M. schulmani*, *M. sphaericus*, *Paradiplozoon cyprini*, *Piscicola geomerta*, *Proteocephalus torulosus*, *Pseudochetosoma salmonicola* and *Rhabdochona hellichi* {19/83}.

Barbus luteus (Heckel. 1843): *Ascocotyle coleostoma*, *Dactylogyrus rhodeianus*, *D. varicorhini*, *Diplostomum* sp., *Ergasilus mosulensis*, *E. sieboldi*, *Myxobolus ellipsoides*, *M. koi*, *M. macrocapsularis*, *M. oviformis*, *M. pfeifferi*, *Paradiplozoon pavlovskii* and *Pseudolamproglena annulata* {13/125}.

Barbus sharpeyi Günther, 1874: *Ascocotyle coleostoma*, *Aspidogaster limacoides*, *Bothriocephalus acheilognathi*, *Lernaea cyprinacea*, *Myxobolus dispar*, *M. oviformis*, *M. pfeifferi* and *Sanguinicola* sp. {8/69}.

Barbus xanthopterus (Heckel, 1843): *Argulus foliaceus*, *Aspidogaster limacoides*, *Contracaecum* sp., *Dactylogyrus kulwieci*, *D. vastator*, *Ergasilus sieboldi*, *Ichthyophthirius multifiliis*, *Khawia armeniaca*, *Lernaea cyprinacea*, *Myxobolus parvus*, *M. sandrae* and *Rhabdochona hellichi* {12/79}.

Carassius auratus (Linnaeus, 1758): *Bothriocephalus acheilognathi* and *Neoechinorhynchus zabensis* {2/25}.

Chondrostoma regium (Heckel, 1843): *Ascocotyle coleostoma*, *Contracaecum* sp., *Diplostomum* sp., *Myxobolus dispar*, *M. oviformis*, *M. pseudodispar*, *M. sphaericus* and *Paradiplozoon pavlovskii* {8/36}.

Cyprinion macrostomum Heckel, 1843: *Capillaria* sp., *Dactylogyrus pulcher*, *Diplozoon kasimii*, *D. paradoxum*, *Khawia rossittensis*, *Myxobolus pfeifferi*, *Myxosoma acuta*, *Paradiplozoon amurensis*, *P. barbi*, *P. bliccae*, *P. pavlovskii*, *Pseudolamproglena annulata*, *Rhabdochona grandipapillata*, *R. mesopotamica* and *Thelohanellus catlae* {15/61}.

Cyprinus carpio Linnaeus, 1758: *Argulus foliaceus*, *Bothriocephalus acheilognathi*, *Caryophyllaeus* sp., *Dactylogyrus vastator*, *Hemiclepsis marginata*, *Ichthyophthirius multifiliis*, *Lernaea cyprinacea*, *Paradiplozoon barbi*, *P. bliccae*, *P. pavlovskii*, *Proteocephalus torulosus*, *Sanguinicola* sp., *Trichodina cottidarum* and *Trichodina* sp. {14/136}.

Garra rufa (Heckel, 1843): *Lamproglena pulchella* and *Rhabdochona grandipapillata*. {2/29}.

Leuciscus lepidus (Heckel, 1843): *Ascocotyle coleostoma*, *Bothriocephalus acheilognathi*, *Cucullanus cyprini*, *Myxobolus oviformis* and *M. pfeifferi* {5/14}.

Liza abu (Heckel, 1843): *Ascocotyle coleostoma*, *Ergasilus peregrinus*, *Microcotyle donavini*, *Myxobolus dogieli*, *M. karelicus*, *M. mülleri*, *M. nemachili*, *M. oviformis*, *Neoechinorhynchus iraqensis*, *N. zabensis*, *Trichodina elegini* and *T. murmaniaca* {12/90}.

Mastacembelus mastacembelus (Banks & Solander in Russell, 1794): *Procamallanus viviparus*. This fish was erroneously reported as *Mastacembelus simach* (Walbaun, 1792) by Nawab Al-Deen (1994) {1/44}.

Silurus triostegus Heckel, 1843: *Ancylodiscoides vistulensis*, *Bothriocephalus acheilognathi*,

Contracaecum sp., *Neoechinorhynchus zabensis*, *Postgangesia hemispherous* and *Trichodina domerguei* {6/89}.

Varicorhinus trutta (Heckel, 1843): (Reported as *Varicorhinus* sp. by Al-Nasiri, 2008): *Contracaecum* sp., *Dactylogyrus pulcher*, *D. varicorhini*, *Glugea anomala*, *Gyrodactylus markewitschi*, *Myxobolus cyprinicola*, *M. mülleri*, *M. oviformis*, *Porrocaecum* sp., *Neoechinorhynchus cristatus* and *N. rutili* {11/25}.

According to Coad (2010), all these above- named fishes belong to the family Cyprinidae, except for *L. abu* (Mugilidae), *M. mastacembelus* (Mastacembelidae) and *S. triostegus* (Siluridae). The full authority of each fish is given above according to Coad (2010) and Froese & Pauly (2012). It is necessary to state here that some few misspellings had occurred in some fish names. Abdul-Ameer (1989), Nawab Al-Deen (1994) and Rahemo & Mohammad (2006) erroneously spelled *C. regium* as *C. regius*. Also, the name *C. macrostomum* was misspelled as *C. macrostomus* by Abdul-Ameer (1989) and Nawab Al-Deen (1994). According to (Coad, 2010), four fish species are now considered as synonyms of other fishes. These included *Alburnus capito* as a synonym of *Alburnus mossulensis* Heckel, 1843; *B. belayewi* as a synonym of *Capoeta damascina* (Valenciennes, 1842), *L. lepidus* as a synonym of *Squalius lepidus* Heckel, 1843 and *V. trutta* as a synonym of *Capoeta trutta* (Heckel, 1843). In addition, four fish scientific names from the above host- parasite list are now synonyms to other names according to Froese & Pauly (2012) and the accepted names, accordingly, are *Luciobarbus esocinus* Heckel, 1843 instead of *Barbus esocinus* (Heckel, 1843), *Carasobarbus luteus* (Heckel, 1843) instead of *Barbus luteus* (Heckel, 1843), *Mesopotamichthys sharpeyi* (Günther, 1874) instead of *Barbus sharpeyi* Günther, 1874 and *Luciobarbus xanthopterus* Heckel, 1843 instead of *Barbus xanthopterus* (Heckel, 1843).

To sum up, although 21 fish hosts were involved in this review, which consisted 39.6% of the total number of freshwater fishes of Iraq, excluding some marine fishes entering freshwater (Coad, 2010), only 84 parasite species were reported. This in fact represents only 20.8% of the total number of parasites so far recorded from freshwater fishes of Iraq (Mhaisen, 2012). Number of parasite species reported from fishes of Salah Al-Deen province is much less than that reported from the whole Iraqi inland waters. This reflects the fact that parasites of fishes of Salah Al-Deen province received little attention from the parasitologists and hence extensive inspection of these fishes will reveal more parasite species which are waiting to be discovered.

References

Abdul-Ameer, K. N. (1989). Study of the parasites of freshwater fishes from Tigris river in Salah Al-Dien province, Iraq. M. Sc. Thesis, Coll. Sci., Univ. Baghdad: 98 pp., (In Arabic).

Al-Ayash, Y. Y. H. A. (2011). 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).

Al-Hadithi, I. A. W. and Habish, A. H. (1977). Observations on nematode parasite *Contracaecum* sp. in some Iraqi fishes. Bull. Basrah Nat. Hist. Mus., 4: 17-25.

Al-Jawda, J. M.; Balasem, A. N.; Mhaisen, F. T. and Al-Khateeb, G. H. (2000). Parasitic fauna of fishes from Tigris river at Salah Al-Deen province, Iraq.Iraqi J. Biol. Sci., 19 & 20: 16-24.

Al-Nasiri, F. S. (2008). *Myxobolus* spp. (Myxosporea: Myxozoa) infections in some fishes of Tigris river at Tikreet city, Iraq. Fourth Sci. Educ. Symp., Tikreet Univ., Tikreet: 17-18 March 2008: 847-861, (In Arabic).

Al-Nasiri, F.S. (2009). Diplozoid species (Monogenea) parasitizing gills of some cyprinid fishes from Tigris river passing through Tikreet city, Salah Al-Deen province. Iraqi J. Agric. (Spec. Issue), 14(5): 182-186.

Al-Nasiri, F. S. (2010). First record of *Paradiplozoon amurensis* (Monogenea: Diplozoidae) in Iraq from gills of the cyprinid fish *Cyprinion macrostomum*. Parassitologia, 52: 439-440.

Al-Nasiri, F. S. and Mhaisen, F. T. (2009a). First record of *Paradiplozoon cyprini* Khotenovsky, 1982 (Monogenea: Diplozoidae) in Iraq, from gills of the cyprinid fish *Barbus grypus*. J. Tikrit Univ. Agric. Scs., 9(1): 535-540.

Al-Nasiri, F. S. and Mhaisen, F. T. (2009b). Parasites of fishes collected from Tigris river, Salah Al-Deen province, Iraq. Ibn Al-Haitham J. Pure Appl. Sci., 22(2): 1-8.

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

Bauer, O. N.; Musselius, V. A. and Strelkov, Yu. A. (1969). Diseases of pond fishes. Izdat. Kolos, Moscow: 220 pp., (In Russian).

Coad, B. W. (2010). Freshwater fishes of Iraq. Pensoft Publ., Moscow: 274 pp. + 16 pls.

Dawes, B. (1946). The Trematoda with special reference to British and other European forms. Cambridge University Press: 644 pp.

Duijn, van C. Jnr. (1973). Diseases of fishes, 3rd edn., Illife Books, London: 372 pp.

EOL (2012). (Encyclopedia of Life) on-line database, http://www.eol.org. Retrieved Feb, 29.

Froese, R. and Pauly, D. (Eds.). (2012). FishBase. World Wide Web electronic publication. www.fishbase.org, version 02.

Gussev, A. V. (1985). Parasitic metazoans: Class Monogenea. In: Bauer, O. N. (Ed.). Key to the parasites of freshwater fish fauna of U. S. S. R., vol. 2. Nauka, Petersburg: 424 pp., (In Russian).

Herzog, P. H. (1969). Untersuchungen über die parasiten der süßwasserfische des Irak. Arch. Fischereiwiss., 20(2/3): 132-147.

Hussien, J. H. and Al-Hamdane, A. H. (1992). Field and experimental observations on infestation and treatment of the fish lice *Argulus foliaceus*. Iraqi J. Vet. Sci., 5(2): 13-19, (In Arabic).

Hussien, J. H. and Mahdi, S. A. (1986). The parasite *Aspidogaster*, a new record in Iraqi fish. Eighth Sci. Conf., Iraqi Vet. Med. Assoc., Baghdad: 18-20 Feb. 1986: 45, (Abstract).

ITIS (2012). (Integrated Taxonomic Information System) on-line database, http://www.itis.gov. Retrieved Feb, 29.

Khalifa, K. A. (1986). Cestodes of freshwater farmed fishes in Iraq. J. Wildl. Dis., 22(2): 278.

Khalifa, K. A. (1989). Incidence of parasitic infestation of fishes in Iraq. Pak. Vet. J., 9(2): 66-69.

Mhaisen, F. T. (1980). Fish parasitology in Iraq. Basrah Nat. Hist. Mus., Publ. No. 3: 36 pp. + IX pls.

Mhaisen, F. T. (1983). Diseases and parasites of fishes. Basrah Univ. Press: 227 pp., (In Arabic).

Mhaisen, F. T. (1993a). Fish parasites of Neinava province: A review and check- lists. Iraqi J. Vet. Med., 17: 110-125.

Mhaisen, F. T. (1993b). Check- lists of parasites and disease agents of *Barbus* spp. (Teleostei: Cyprinidae) of Iraq. Mar. Mesopot., 8(3): 236-253.

Mhaisen, F. T. (1995). Parasites of fishes of Basrah province marshy area, Iraq. J. Environ. Sci. Hlth., A 30(1): 41-49.

Mhaisen, F. T. (2002). Literature review and check lists of acanthocephalans of fishes of Iraq. Al-Mustansiriya J. Sci., 13(1): 13-25.

Mhaisen, F. T. (2004). Worm cataract in freshwater fishes of Iraq. Ibn Al-Haitham J. Pure Appl. Sci., 17(3): 25-33.

Mhaisen, F. T. (2012). Index- catalogue of parasites and disease agents of fishes of Iraq (Unpublished: mhaisenft@yahoo.co.uk).

Mhaisen, F. T.; Al-Niaeem, K. S. and Jassim, A. R. J. (2010). Parasites and disease agents of cultured fishes of Basrah province, Iraq: The present status. Basrah J. Agric. Sci., 23 (Spec. Issue 2): 92-106.

Mhaisen, F. T.; Khamees, N. R. and Al-Daraji, S. A. M. (1991). Parasites and disease agents of carps in Iraq: A check-list. Basrah J. Agric. Sci., 4(1 & 2): 133-139.

Mhaisen, F. T.; Khamees, N. R. and Al-Daraji, S. A. M. (1993). Parasites and disease agents of marine and freshwater fishes of Basrah province, Iraq. Mar. Mesopot., 8(1): 45-61.

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

Moravec, F.; Ali, N. M. and Abul-Eis, E. S. (1991). Observations on two *Rhabdochona* species (Nematoda: Rhabdochonidae) from freshwater fishes in Iraq, including description of *R. similis* sp. n. Fol. Parasitol., 38: 235-243.

Moravec, F.; Saraiva, A.; Abdullah, S. M. A.; Bilal S. J. and Rahemo Z. I. F. (2009). Two species of *Rhabdochona* Railliet, 1916 (Nematoda: Rhabdochonidae) parasitizing cyprinid fishes in

Iraq, with a redescription of *R. tigridis* Rahemo, 1978 (emend.). Syst. Parasitol., 74, 125-135.

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

Nawab Al-Deen, F. M. (1994). Studies on the nematode parasites in many species of freshwater fishes in Iraq. M. Sc. Thesis, Coll. Sci., Univ. Mosul: 116 pp., (In Arabic).

PESI. (2012). (Pan-European Species dictionaries Infrastructure). http://www.eu-nomen.eu/portal/taxon.php? Retrieved Feb, 29.

Rahemo, Z. I. F. and Al-Niaeemi, B. H. S. (2001). A new cestode species from a freshwater catfish. Riv. Parassitol., 18(62), No. 1: 71-74.

Rahemo, Z. I. F. and Mohammad, S. A. (2002). *Khawia barbi* sp. n. (Cestoda: Caryophyllidae) from the common freshwater fish, *Barbus luteus* from river Tigris, Mosul, Iraq. Riv. Parassitol., 20(63), No. 3: 187-190.

Rahemo, Z. I. F. and Mohammad, S. A. (2004). Four species of monozoic cestodes from the intestine of cyprinid fishes in Iraq. Dirasat (Med. Biol. Sci.), 31(2): 149-155, (In Arabic).

Rahemo, Z. I. F. and Mohammad, S. A. (2006). Ten species of polyzoic cestodes from Iraqi freshwater fishes. Proc. 4th Sci. Conf., Coll. Vet. Med., Univ. Mosul. Mosul: 20-21 Sept. 2006, vol. 1: 55-65, (In Arabic).

Scholz, T.; Hanzelová, V.; Škeříková, A.; Shimazu, T. and Rolbiecki, L. (2007). An annotated list of species of the *Proteocephalus* Weinland,1858 aggregate *sensu* de Chambrier *et al.* (2004) (Cestoda: Proteocephalidea), parasites of fishes in the Palaearctic region, their phylogenetic relationships and a key to their identification. Syst. Parasitol., 67: 139-156.

WoRMS. (2012). World Register of Marine Species at http://www.marinespecies.org, Retrieved Feb, 29.