

Checklists of Fish Species Infected with the Asian Tapeworm *Schyzocotyle acheilognathi* (Yamaguti, 1934) (Platyhelminthes: Cestoda) in Iraq

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Abstract

Reviewing 112 references concerning the occurrence of the Asian tapeworm *Schyzocotyle acheilognathi* (Yamaguti, 1934) Brabec, Waeschenbach, Scholz, Littlewood & Kuchta, 2015, until the end of 2024, indicated that this cestode is known to infect 20 fish species in Iraq. Such records included three synonymous names of this cestode: *Bothriocephalus acheilognathi*, *B. gowkongensis* and *B. opsariichthydis*. In addition, five out of these 20 infected fish species were also reported to be infected with unspecified *Schyzocotyle* species (as *Bothriocephalus* species). The infected fishes were distributed in different water bodies in Iraq (rivers, lakes, marshes) as well as some fishponds, farms, one hatchery in seven provinces in addition to some fishes, obtained from fish markets in five provinces.

Keywords: Cestoda, *Schyzocotyle acheilognathi*, Fishes, Distribution, Iraq.

Introduction

The genus *Schyzocotyle* Ackmerov, 1960 belongs to the family Bothriocephalidae, order Bothriocephalidea, class Cestoda of the phylum Platyhelminthes (GBIF.org, 2025; WoRMS, 2025). According to these above-named cites, *Schyzocotyle* includes two valid species: *Schyzocotyle acheilognathi* (Yamaguti, 1934) and *S. nayarensis* (Malhotra, 1983). The Asian tapeworm *S. acheilognathi* infects more than 300 species of fish worldwide (Pérez-Ponce de León *et al.*, 2018). This cestode is a predominant parasite of cyprinid fishes all over the world and its introduction with the grass carp *Ctenopharyngodon idella* (Valenciennes, 1844), and some cyprinid fishes has been documented in almost every continent, except Antarctica (Salgado-Maldonado and Pineda-López, 2003).

Scholz *et al.* (2012) gave a detailed description of *S. acheilognathi* (as *B. acheilognathi*). Its unique heart-shaped scolex, with a weakly developed apical disc and a pair of deep,



slit-like grooves (bothria) positioned dorsoventrally along the scolex. The scolex is much wider than the first body segments (proglottides). The strobila (body) of the tapeworm consists of numerous proglottides each containing one set of reproductive organs. The shape of these segments differs with maturity. Immature segments lacking fully developed genital organs are always wider than they are long, whereas more developed gravid segments, bearing eggs are rectangular and longer than they are wide.

Hoole *et al.* (2001) demonstrated that symptoms associated with bothriocephalosis include sluggish movements, emaciation and swimming close to the surface of the water. Parasites, which usually accumulate at the anterior part of the intestine, posterior to the common bile duct opening, can cause intestinal blockage, enlargement of the abdomen and on some occasions rupture of the intestinal wall. According to Dick *et al.* (2006), heavy gut infections with this tapeworm may cause intestinal distension, mechanical obstruction and perforation. The clinical signs include emaciation and anaemia. Nutritional demands made may adversely affect growth, condition and fitness. Hassan *et al.* (2024) noticed significant changes in biochemical characteristics of blood and muscles of three fish species due to their infection with bothriocephalosis.

Joshi and Joshi (2024) concluded that despite the low infection of the Asian fish tapeworm in the cyprinid fish *Tor putitora* (Hamilton, 1822) in Mahakali River, Nepal, but it increases the risk of dissemination of parasites from this river to nearby fish farms and also zoonotic risk to humans who consume the gastrointestinal tract of fish in raw forms containing copepods with proceroid of this tapeworm.

In connection with the chemotherapy of *Schyzocotyle* (as *Bothriocephalus*) species, Dick *et al.* (2006) showed, in a table with references, that some herbal extracts and active ingredient niclosamide are used for this purpose.

The Institute of Fisheries Management (2018) demonstrated the life cycle of *B. acheilognathi* as a two-host cycle involving a copepod as the intermediate host and fish as the definitive host. The parasite reproduces sexually, releasing eggs into the water through the faeces of an infected fish. These eggs hatch into a free-swimming larva called a coracidium, which is then ingested by a copepod. Within the copepod, the larva develops into a proceroid. As a suitable fish eats the infected copepod, the proceroid larva develops into an adult tapeworm in the fish's intestine. Figure (1) summarizes this life cycle.

Khalifa (1982) was the first one in Iraq to report *S. acheilognathi* (as *B. gowkongensis* and *B. opsariichthydis*) in the common carp (*Cyprinus carpio*) from some fishponds near Baghdad City. Al-Daraji (1986), Al-Moussawi (1997) and Al-Niaeem (1999) reported unidentified *Schyzocotyle* species (as *Bothriocephalus* species) from five fish species from three water bodies in Iraq.

The present article aims is to revise all references concerning the record of *S. acheilognathi* infecting fishes of Iraq and provide an updated list of its fish host species. This article is a continuation of checklists, published during the last four years on some groups of fish parasites in Iraq. These included those on parasites of the redbelly tilapia

Coptodon zillii (Mhaisen, 2021), *Lernaea* species (Mhaisen and Abdul-Ameer, 2021a), *Contracaecum* species (Mhaisen and Abdul-Ameer, 2021b), fish parasites of floating cages (Mhaisen, 2022), *Ichthyophthirius multifiliis* (Mhaisen, 2023), *Ergasilus* species (Mhaisen and Al-Daraji, 2023), *Argulus* species (Mhaisen, 2024), both *Lamproglena* and *Pseudolamproglena* (Mhaisen *et al.*, 2024) and *Clinostomum* species (Mhaisen, 2025a).

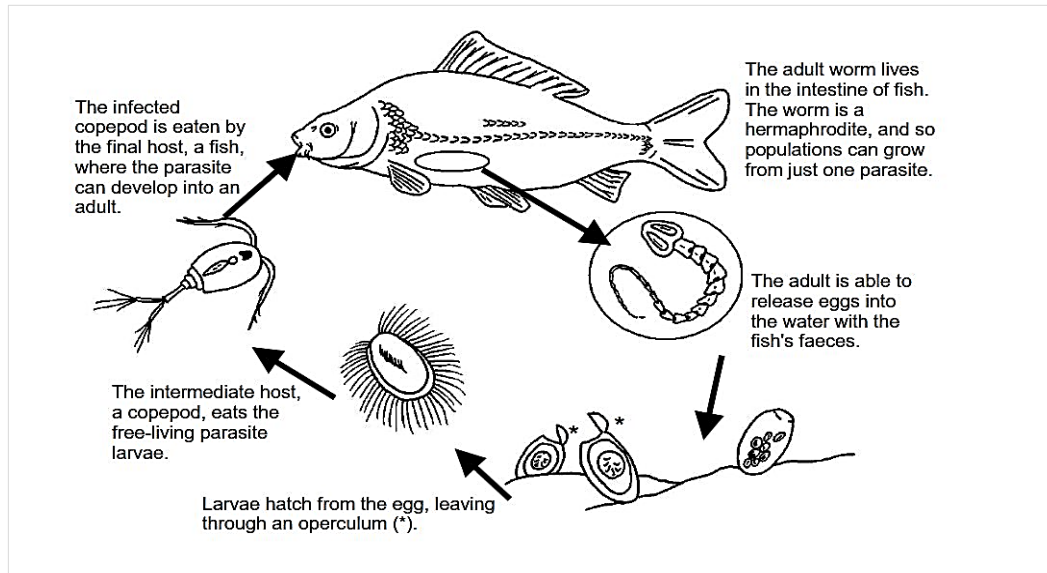


Figure 1: The life cycle of *S. acheilognathi* (extracted from the Institute of Fisheries Management, 2018).

Materials And Methods

Depending on the Index-Catalogue of parasites and disease agents of fishes of Iraq (Mhaisen, 2025b), a total of 112 references (59 published research papers, 28 unpublished M. Sc. theses, one unpublished M. Technol. thesis, 11 unpublished Ph. D. theses, seven articles published in conferences, two reports, one symposium and three abstracts in conferences) dealing with records of *Schyzocotyle acheilognathi* and its synonyms in addition to some unidentified *Schyzocotyle* species from fishes of Iraq, were used to prepare the present article. Data from such references were gathered to provide reliable information on the distribution of such parasites in fishes of Iraq. Fish valid scientific names and their authorities were corrected according to Fricke *et al.* (2025), Froese and Pauly (2025) and GBIF.org (2025). Names of fish hosts (with their synonyms) for both *S. acheilognathi* and *Schyzocotyle* species are alphabetically listed. References on each fish host are chronologically arranged with an underline for the first record of both *S. acheilognathi* and *Schyzocotyle* species.

Results and Discussion

List of Fish Species Infected with *Schyzocotyle acheilognathi* in Iraq

The following list includes the scientific names of all Iraqi fish species infected with *S. acheilognathi*, their full authorities as well as their orders and families, based on Fricke *et al.* (2025) and Froese and Pauly (2025).

Class Actinopteri

Order Cypriniformes

Family Cyprinidae

Arabibarbus grypus (Heckel, 1843)*Barbus lacerta* Heckel, 1843.*Carasobarbus luteus* (Heckel, 1843)*Carassius auratus* (Linnaeus, 1758)*Cyprinion macrostomus* Heckel, 1843¹*Cyprinus carpio* Linnaeus, 1758*Luciobarbus esocinus* Heckel, 1843*Luciobarbus schejch* (Heckel, 1843)²*Mesopotamichthys sharpeyi* (Günther, 1874)

Family Xenocyprididae

Ctenopharyngodon idella (Valenciennes, 1844).

Family Leuciscidae

Alburnus sellal Heckel, 1843³*Chondrostoma regium* (Heckel, 1843)*Leuciscus vorax* (Heckel, 1843)*Squalius lepidus* Heckel, 1843

Order Siluriformes

Family Bagridae

Mystus pelusius (Solander, 1794)

Family Siluridae

Silurus glanis Linnaeus, 1758*Silurus triostegus* Heckel, 1843

Order Cichliformes

Family Cichlidae

Coptodon zillii (Gervais, 1848)

Order Cyprinodontiformes

Family Poeciliidae

Gambusia holbrooki Girard, 1859

Order Mugiliformes

Family Mugilidae

Planiliza abu (Heckel, 1843)

1- The specific name of *Cyprinion macrostomus* is spelled as *macrostomus* according to Fricke *et al.* (2025), Froese and Pauly (2025) and WoRMS (2025), but as *macrostomum* according to GBIF.org (2025).

2- According to Freyhof *et al.* (2025), *Luciobarbus barbulus*, *L. mystaceus* and *L. xanthopterus* are synonyms of *L. schejch*. Therefore, all data concerning the records of

S. acheilognathi from *L. barbulus*, *L. mystaceus* and *L. xanthopterus* in Iraq are transferred to *L. schejch* in the present checklist.

- 3- According to Fricke *et al.* (2025), *Alburnus sellal* is considered as a valid name, while *A. mossulensis* as one of its synonymous names. However, in Froese and Pauly (2025), GBIF.org (2025) and WoRMS (2025), both *A. sellal* and *A. mossulensis* are regarded as valid species.

Localities of Collection of the Infected Fishes of Iraq

The record of available literature concerning the occurrence of different species of fishes from Iraq can be grouped into seven major categories according to localities of collection of the infected fishes. These are:

- 1- Tigris River at Nineveh Province (Rahemo and Ami, 1991; Al-Kallak, 1992; Al-Kallak and Rahemo, 1992; Al-Kallak and Rahemo, 1994; Muhammed, 1995; Al-Niaeemi, 1997; Al-Kallak, 1998; Rahemo and Al-Kallak, 1998; Rahemo and Al-Niaeemi, 2001; Al-Jawda *et al.*, 2003; Al-Kallak *et al.*, 2004; Al-Naftachi, 2006; Rahemo and Mohammad, 2006; Al-Kallak *et al.*, 2008; Zangana, 2008; Al-Kallak, 2010; Al-Naftaji and Al-Khan, 2011; Al-Niaeemi, 2011; Al-Kallak and Al-Hyalli, 2013; Al-Niaeemi and Dawood, 2017; Dawood *et al.*, 2020; Al-Niaeemi and Dawood, 2023), Salah Al-Din Province (Al-Ayash, 2011; Al-Ayash *et al.*, 2011; Al-Jubori, 2013; Jasim *et al.*, 2018; Jasim, 2019; Al-Ayash, 2020; Jasim, 2022; Jasim and Abdullah, 2022, 2023), Kirkuk Province (Rahemo and Nawwab Al-Deen, 2008) and Baghdad Province (Ali *et al.*, 1987b; Al-Moussawi, 1997; Salih *et al.*, 2000; Mansor *et al.*, 2014) as well as some tributaries of Tigris River which included Greater Zab River (Abdullah, 2002; Abdullah and Mhaisen, 2011; Muhammad *et al.*, 2013; Hashim, 2014; Hashim *et al.*, 2015; Hassan *et al.*, 2024), Lesser Zab River (Abdullah, 2002; Abdullah and Mhaisen, 2006; Mama, 2012; Mama and Abdullah, 2012; 2013; Al-Obaidy, 2019; Hasan, 2023; Ismael, 2023), Bahdinan River at Erbil Province (Bilal, 2006; Bilal and Abdullah, 2009), Mortuka stream at Erbil Province (Abdullah, 2004, Diyala River (Ali *et al.*, 1987a; Balasem *et al.*, 2001; Mhaisen *et al.*, 2002).
- 2- Euphrates River and its branches at Al-Anbar Province (Al-Salmany, 2015), Babylon Province (Al-Sa'adi, 2007; Mhaisen *et al.*, 2015) and Al-Diwaniyah Province (Al-Mahi, 2014; Al-Mahi and Al-Mayali, 2016, 2017).
- 3- Shatt Al-Arab River, Garimat Ali River (Abdul-Rahman, 1999; Al-Niaeem, 1999; Al-Niaeem and Al-Azizz, 2002; Al-Niaeem *et al.*, 2002; Al-Salim and Al-Niaeem, 2002; Al-Niaeem, 2006; Kadhim, 2009), Al-Salihiya River (Al-Janae'e, 2010) and Mehajjeran creek (Khamees, 1983; Mhaisen *et al.*, 1986).
- 4- Some lakes, depressions and marshes: These included Mosul Dam Lake (Rahemo and Ami, 2013), Darbandikhan Lake (Abdullah, 2005), Dokan Lake (Abdullah, 1990; Abdullah and Rasheed, 2004), Al-Anbar Province: Al-Rutba Dam Lake (Al-Karboly, 2012), Al-Qadisiya Dam Lake (Al-Alusi, 1989), Al-Habbaniyah Lake (Ali *et al.*, 1988), Hemrin Dam Lake in Diyala Province (Balasem *et al.*, 2000), Al-Tharthar- Tigris canal

in Salah Al-Din Province (Khalifa, 1989), Huwayzah Marsh at Maysan Province (Ali, 2008; Al-Musaedi, 2020), Umm an Ni'aj Marsh at Maysan Province (Al-Saady and Chekhyor, 2020) and Al-Hammar Marsh in Thi Qar Province (Ali, 2008) and in Basrah Province (Al-Daraji, 1986; Dawood, 1986), as well as in Al-Mashab Marsh in Basrah Province (Abbas, 2007; Awad and Abbas, 2009).

5- Fish hatcheries at Ainkawa of Erbil Province (Mama, 2012).

6- Fish ponds and farms which included some at Erbil Province (Ali, 2002; Abdullah, 2004; Obaid *et al.*, 2021; Mala, 2022), Salah Al-Dean Province (Khalifa, 1986, 1989), Baghdad Province (Khalifa, 1982, 1986, 1989; Al-Shaikh, 1993; Mohammad-Ali *et al.*, 1999; Salih *et al.*, 2000; Asmar *et al.*, 2001), Babylon Province (Jawad and Hussain, 1989; Mhaisen *et al.*, 1990; Mhaisen and Abul-Eis, 1991; Mhaisen *et al.*, 1993a; Al-Zubaidy, 1998; Asmar *et al.*, 2001) Wasit Province (Salih *et al.*, 1988; Mhaisen *et al.*, 1993b), Thi Qar Province (Rasool, 2017) and Basrah Province (Jassim, 2007; Rasool, 2017) in addition to some floating cages at Al-Habbaniya Lake (Ali *et al.*, 1988) and Babylon Province (Hussain, 2019).

7- Fish markets at Duhook Province (Ali, 2002; Abdullah, 2023), Nineveh Province (Ali and Al-Kallak, 2022; Abdullah, 2023), Al-Tameem Province (Hassan *et al.*, 2016; Hassan *et al.*, 2024), Baghdad Province (Hasan, 2004; Hasan *et al.*, 2015) and Basrah Province (Mhaisen, 1986).

***Schyzocotyle acheilognathi*-Host List**

The following is a list of *S. acheilognathi* so far recorded from valid fish species of Iraq with their references. Fish's scientific names are alphabetically arranged and their synonymous names are given in parentheses after their valid names, when reported by some researchers. References reported *S. acheilognathi* as *Bothriocephalus acheilognathi* are marked with a superscript number 1, those as *B. opsariichthydis* are marked with a superscript number 2, while those as *B. gowkongensis* are marked with a superscript number 3.

Alburnus sellal (as *Alburnus capito* and as *Chalcalburnus sellal*): Abdul-Rahman (1999)¹ and Al-Jawda *et al.* (2003)¹.

Arabibarbus grypus (also as *Barbus grypus*): Ali *et al.* (1987a)², Rahemo and Ami (1991)¹, Abdullah (2004)¹, Al-Mahi (2014)¹, Al-Mahi and Al-Mayali (2016, 2017)¹ and Al-Ayash (2020).

Barbus lacerta: Al-Alusi (1989)².

Carasobarbus luteus (also as *Barbus luteus*): Khamees (1983)³, Mhaisen (1986)³, Mhaisen *et al.* (1986)³, Rahemo and Al-Kallak (1998)³, Abdul-Rahman (1999)¹, Hasan (2004)¹, Al-Sa'adi (2007)¹, Hasan *et al.* (2015)¹, Mhaisen *et al.* (2015)¹, Al-Ayash (2020), Al-Musaedi (2020) and Alsaady and Chekhyor (2020).

Carassius auratus: Al-Ayash (2011)¹ and Al-Ayash *et al.* (2011)¹.

Chondrostoma regium: Al-Jubori (2013)¹, Jasim (2022) and Jasim and Abdullah (2022, 2023).

Coptodon zillii: Al-Salmany (2015)¹.

Ctenopharyngodon idella: Mhaisen *et al.* (1990)¹, Abdul-Rahman (1999)¹, Asmar *et al.* (2001)¹ and Jassim (2007)¹.

Cyprinion macrostomum: Ali *et al.* (1987b)².

Cyprinus carpio: Khalifa (1982)^{1, 3}, Dawood (1986)¹, Khalifa (1986)³, Ali *et al.* (1988)², Salih *et al.* (1988)², Jawad and Hussain (1989)³, Khalifa (1989)³, Abdullah (1990)², Mhaisen and Abul-Eis (1991)¹, Al-Shaikh (1993)¹, Mhaisen *et al.* (1993a, b), Al-Zubaidy (1998)², Abdul-Rahman (1999)¹, Mohammad-Ali *et al.* (1999)¹, Salih *et al.* (2000)¹, Balasem *et al.* (2001)³, Abdullah (2002)¹, Ali (2002)³, Mhaisen *et al.* (2002)¹, Abdullah (2004)¹, Abdullah and Rasheed (2004)¹, Hasan (2004)¹, Abdullah (2005)¹, Abdullah and Mhaisen (2006)¹, Al-Niaeem (2006), Jassim (2007)¹, Ali (2008)¹, Rahemo and Nawwab Al-Deen (2008)³, Al-Niaeemi (2011)¹, Al-Karboly (2012)², Mama (2012)¹, Mama and Abdullah (2012)¹, Al-Jubori (2013)¹, Mama and Abdullah (2013)¹, Muhammad *et al.* (2013)¹, Hashim (2014)¹, Mansor *et al.* (2014)³, Hasan *et al.* (2015)¹, Hashim *et al.* (2015, 2016)¹, Hassan *et al.* (2016)¹, Al-Niaeemi and Dawood (2017)¹, Rasool (2017), Jasim *et al.* (2018), Hussain (2019)², Jasim (2019), Ali and Al-Kallak (2022)¹, Jasim (2022), Jasim and Abdullah (2022), Mala (2022), Abdullah (2023)¹, Al-Niaeemi and Dawood (2023)¹, Hasan (2023), Jasim and Abdullah (2023) and Hassan *et al.* (2024)¹.

Gambusia holbrooki: Kadhim (2009)¹.

Leuciscus vorax (also as *Aspius vorax*): Abdul-Rahman (1999)¹, Rahemo and Nawwab Al-Deen (2008)³, Al-Ayash (2011)¹, Al-Ayash *et al.* (2011)¹, Al-Ayash (2020) and Hasan (2023).

Luciobarbus esocinus (as *Barbus esocinus*): Rahemo and Ami (1991)³, Al-Kallak (1992)³, Al-Kallak and Rahemo (1992, 1994)³, Muhammed (1995)³, Al-Kallak (1998)¹, Al-Kallak *et al.* (2004)¹, Rahemo and Mohammad (2006)³, Al-Kallak *et al.* (2008)¹, Al-Kallak (2010)¹, Al-Kallak and Al-Hyalli (2013)¹, Rahemo and Ami (2013)¹ and Dawood *et al.* (2020)¹.

Luciobarbus schejch (reported as *B. mystaceus*, *B. xanthopterus*, *L. barbulus*, *L. mystaceus* and *L. xanthopterus*): Ali *et al.* (1987b)², Al-Al-Alusi (1989)², Al-Sa'adi (2007)¹, Mhaisen *et al.* (2015)¹, Al-Obaidy (2019)¹, Jasim (2022), Jasim and Abdullah (2022), Hasan (2023) and Jasim and Abdullah (2023).

Mesopotamichthys sharpeyi (also as *Barbus sharpeyi*): Khalifa (1986)³, Abdul-Rahman (1999)¹, Al-Niaeem and Al-Azizz (2002)¹, Al-Niaeem *et al.* (2002)¹, Mhaisen *et al.* (2002)¹, Zangana (2008)¹ and Al-Obaidy (2019)¹.

Mystus pelusius: Abdul-Rahman (1999)¹.

Planiliza abu (as *Liza abu*): Al-Janae'e (2010)¹, Al-Mahi (2014)¹, Al-Mahi and Al-Mayali (2017)¹ and Hassan *et al.* (2024)¹.

Silurus glanis: Al-Niaeemi (1997)², Rahemo and Al-Niaeemi (2001)².

Silurus triostegus (also as *Parasilurus triostegus*): Al-Daraji, 1986; Abdul-Rahman (1999)¹, Abbas (2007)¹, Awad and Abbas (2009)¹, Al-Ayash (2011)¹, Al-Ayash *et al.* (2011)¹, Jasim (2022), Jasim and Abdullah (2022, 2023) and Hassan *et al.* (2024)¹.
Squalius lepidus (also as *Leuciscus lepidus*): Abdullah (2002)¹, Bilal (2006)¹, Bilal and Abdullah (2009)¹, Abdullah and Mhaisen (2011)¹, Al-Ayash (2011)¹, Al-Ayash *et al.* (2011)¹ and Ismael (2023).

In addition to the above list of *S. acheilognathi*, the following list includes all the Iraqi references that reported unidentified *Bothriocephalus* species. Such unspecified *Bothriocephalus* species are considered here as *Schyzocotyle* species.

Carasobarbus luteus (also as *Barbus luteus*): Al-Daraji (1986), Al-Naftachi (2006) and Al-Naftachy and Al-Khan (2011).

Cyprinus carpio: Al-Niaeem (1999), Al-Salim and Al-Niaeem (2002) and Obaid *et al.* (2021).

Leuciscus vorax (as *Aspius vorax*): Al-Moussawi (1997) and Abdul-Rahman (1999).

Mystus pelusius: Al-Moussawi (1997).

Silurus triostegus (also as *Parasilurus triostegus*): Al-Daraji (1986) and Balasem *et al.* (2000).

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قوائم مرجعية لأنواع الأسماك المصابة بالدودة الشريطية السمكية
Schyzocotyle acheilognathi (Yamaguti, 1934) (شعبة الديدان المسطحة: صنف الديدان
 الشريطية) في العراق

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المستخلص

بينت مراجعة 112 من المصادر المعنية بظهور الدودة الشريطية الأسبوية *Schyzocotyle acheilognathi* (Yamaguti, 1934) Brabec, Waeschenbach, Scholz, Littlewood & Kuchta, 2015، حتى نهاية عام 2024 أن هذه الدودة الشريطية معروفة بإصابة 20 نوعاً من الأسماك في العراق. تضمنت تلك التسجيلات ثلاثة أنواع مرادفة لهذه الدودة الشريطية هي *Bothriocephalus* *acheilognathi*، *B. gowkongensis* و *B. opsariichthydis* وعلاوة على ذلك، هناك خمسة أنواع من بين 20 نوعاً من الأسماك المصابة، كانت أيضاً مصابة بأنواع غير مشخصة من الجنس *Schyzocotyle*. كانت الأسماك المصابة منتشرة في مختلف المسطحات المائية في العراق (أنهار، بحيرات، أهوار) وكذلك في بعض برك، مزارع الأسماك ومفقس واحد في سبع محافظات في العراق، إضافة إلى بعض الأسماك من أسواق بيع الأسماك في خمس محافظات في العراق. الكلمات المفتاحية: ديدان شريطية، *Schyzocotyle acheilognathi*، أسماك، التوزيع، العراق.