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Prevalence of Ectoparasites of Fry Redbelly Tilapia (*Coptodon zillii*) Fishes from Euphrates River, Iraq

Firas ALALI [1]*, Marwa JAWAD [2], Sarah Mohammed ALSHEIKH [3]

[1] University of Kerbala, College of Veterinary Medicine, Department of Veterinary microbiology and Parasitology, 56001, Karbala-Iraq.

[2] University of Kerbala, College of Science-Department of Biology, 56001, Karbala-Iraq.

[3] University of Kirkuk-College of Pharmacy,36001, Kirkuk-Iraq.

ABSTRACT

Ectoparasitic infection represents one of the main challenges to freshwater and marine fish in all areas of the world. This study detected ectoparasite types in Fry Redbelly Tilapia Fishes. The specimens (250) were purchased from a market with a source of fish from the Euphrates River. Fishes were collected from December 2022 until the end of April 2023. The samples were used for macroscopic inspection, gross viscera, and microscopic exam - wet mount of fins, skin, gills and eyes. Ectoparasite species were obtained on fins, skin, and gills, and the eyes had no infection. The total prevalence was 140 (56%) of 250 fish. Significant fish types with weight and length are at ($P \leq 0.05$) and ($P \leq 0.01$), respectively. The mean and standard deviation according to weight were 71.4 and 14.7, while according to length, they were 15.6 and 1.9. Non-significant for genders in both types at ($P \geq 0.05$). The host *Coptodon zillii* is infested by four types of ectoparasites were included, with prevalence for each one being *Ichthyophthirius sp.*, 80/250 (32%); *Trichodina sp.*, 30/140 (12%); *Dactylogyrus sp.*, 20/250 (8%); *Gyrodactylus sp.*10/250 (4%). In conclusion, all parasites, namely single-host types. Management measures should be taken to save the procurement and import from reputable global markets.

Keywords: Ectoparasites, fish, Euphrates river, Iraq

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*** CORRESPONDING AUTHOR**

firas.o@uokerbala.edu.iq
Phone : 009647724611771

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Introduction

Parasitic infestations represent one of the main challenges to freshwater and marine fish, including Tilapia Fishes (Coptodon zillii) in all areas of the world (Shinn et al. 2023). The protozoans Trichodina spp. and Ichthyophthirius multifiliis are common ectoparasites of cultured freshwater. Ichthyophthirius multifiliis is a protozoan ciliate that causes the disease Ichthyophthiriasis or white spot disease, with low host specificity and broad geographical distribution (Abu-Elala et al. 2021; Li et al. 2022). Trichodina species are commonly found on the skin and gills of fish and can cause dangerous problems, such as mortality, in heavily parasitized infections. Until now, about 400 Trichodina species have been found on various aquatic animals worldwide in a range of habitats, including freshwater, brackish water, and marine environments (Wang et al. 2020). Trichodina spp. Identification based on morphological characters is still difficult because of their high intraspecific variation, high interspecific similarity, and low host specificity (Wang et al. 2019). Gill Monogeneans (Platyhelminthes) Parasites are widely distributed in Iraq and worldwide. Dactylogyrus spp. are one of Platyhelminthes ectoparasites living on the gills. Dactylogyrus spp. are characterized by a high host specific (Al-Sa'adi et al. 2013; Abdullah 2009). Gyrodactylus spp. is a monogenean ectoparasite fluke, which lives on the body surface of freshwater fish (Dos Santos et al. 2019). Although there are many species of Gyrodactylus, there is little morphological and biological diversity. On a single species of fish host, numerous distinct Gyrodactylus

species were discovered. In contrast, some gyrodactylid species were host-specific (Abdullah 2021).

In recent years, many studies focusing on Ecto-endoparasites parasites species have been carried out worldwide (Shinn et al. 2023; Abu-Elala et al. 2021; Al-Sa'adi et al. 2013; Abdullah 2009; Dos Santos et al. 2019; Öztürk and Güven 2022; Blazhekovikj-Dimovska and Stojanovski 2021; Shigoley et al. 2023).

While the previous studies in the Euphrates River (AL-Zaidy 2013) were the first record of 21 Tilapia zilli collected from AI-Delmj marsh, middle Iraq, which is located between the cities of AI-Diwania (west) and Kut (east). While (Al-Faisal and Mutlak 2014) reported *Oreochromis niloticus* (Linnaeus, 1758) as first recorded from the Shatt Al-Arab River at Basrah (Abu-al-Khasib), Iraq. Another study of the same genus (Khalifa et al. 2018) reported Oreochromis aureus as first recorded in the Diyala river / Buhriz. But, (Abulheni and Abbas 2015) were recorded first of the Tilapia *Oreochromis niloticus* (Linnaeus 1758) in Euphrates River at Al-Hindia Barrage –Middle of Iraq. The main aim of the current investigation is to identify ectoparasites from the Fry Tilapia (*Coptodon zillii*) purchased from the market and the source of fish from the Euphrates River, Iraq.

Materials and Methods

Study Area

The greater part of the Euphrates Basin is in Turkey, Syria, and Iraq. The Euphrates source region is the Taurus Mountains. Firstly, three rivers add water to the Euphrates: the Khabur, the Balikh and the Sajur. The Khabur is the largest of these three, in terms of length from Turkey. These rivers rise in the foothills of the Taurus Mountains along the Syro–Turkish border and add comparatively little water to the river, from where the Khabur flows southeast past to Syria. Once the Euphrates enters Iraq, toward the Gulf at the south of Iraq, in its upper reaches, the Euphrates flows through the mountains of Southeast Turkey and their southern foothills. The length of the Euphrates from the source of the Murat River to the confluence with the Tigris is 3,000 km, of which 1,230 km is in Turkey, 710 km in Syria and 1,060 km in Iraq. The length is Approx. 2,800 km. Euphrates province is located at (31º-18ºnorth latitude, 47º- 26º east longitude). The river passes in cities in three countries: Birecik, Raqqa, Deir ez-Zor, Mayadin, Haditha, Ramadi, Habbaniyah, Fallujah, Kufa, Samawah, Nasiriyah. Then Al-Qurnah (Kurnah or Qurna, joint is a town in southern Iraq about 74 km northwest of Basra, where the Tigris and Euphrates rivers fused to form the Shatt al-Arab Sea.

Sampling

A total of 250 fish were purchased from different markets. The fish are selected randomly, and the source is the Euphrates River. The method was collected by gill nets. Fishes were collected from December 2022 until the end of April 2023. Fish was transferred and examined directly two to three times weekly. The pathological findings were obvious on the infected fish and affected the structure and function of the body. The observations were carried out by examining the alterations in the morphology, pigmentation, and tissue firmness of all external organs of the fish. Each specimen's weight and length were recorded before testing. The diagnostic methods included standard wet-mount specimens consisting of skin scraping (mucus smears), fin biopsy (fin clip) and gill biopsy (gill clip). The eyes were removed and put in a Petri dish for detecting infection.

The other operation made a longitudinal incision to search for other parasites like nematodes. The prevalence of infection was calculated as demonstrated by Margolis et al. (1982) 24. ectoparasites assessment under a light compound microscope at 4-10X magnification. Prevalence (P)= (number of infected fish/total number of examined fish) ×100; MI= (number of parasites/number of infected hosts).

Data Analysis

The total number of parasites was confirmed directly by numerical count. The number of fish sampled and the mean and Standard deviation of protozoa and helminth parasites were analyzed and interpreted according to (Shigoley et al. 2023). and was used to compare the data among weight and length with infection. Another comparison of genders with health status was made using SPSS version 24 for data analysis.

Results

Parasite diversity and prevalence

After examining 250 individual fish, four parasites were identified. We identified *Ichthyophthirius sp., Trichodina sp., Dactylogyrus sp., Gyrodactylus sp*. Fig 1.2.3and 4. The total prevalence was 56% (140/250), Table 1 Figure 1: The correlation of infection with weight and length differs significantly based on fish weight ($p<0.05$) and length ($p<0.01$), Table 2. The mean and standard deviation according to weight was (71.4, 14.7), while according to length was (15.6, 1.9), Table 3. Non-significant for genders in both types, Table 4. The prevalence for each one was *Ichthyophthirius sp.*, 80/140(57.1%); *Trichodina sp*., 30/140(21.4%); *Dactylogyrus sp.*, 20/140(14.3%); *Gyrodactylus sp.*10/140(7.1%) Table (5). The SPSS statistical software (version 24) is used to analyze data.

Table 1. Prevalence of infected and non-infected Fish.

	infected	Non- infected	total
No.	140	110	250
Percentage	56%	44%	100%

Clinical signs

Results of the analysis of the different infected fishes revealed the presence of several clinical signs Table 2. Indeed, we observed the appearance of necrotic areas, ulcerations and hemorrhage on the gills. We found Protozoa and Monogeneas parasites on other body parts that caused inflammations and mechanical injuries.

Table 2. Correlation of infection with weight and length.

Pearson correlation			
	weight	**Long(cm)**	**infected**
Weight (gm)	1	0.595**	0.396*
Length (cm)	0.595**	1	0.654**
infected	0.396*	0.654**	1

* Correlation is significant at 0.05 (2-tailed).
** Correlation is significant at the 0.01 level(2-tailed).

Table 3. Correlation of mean weight and length with standard deviation.

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Weight (gm)	250	37.0	95.5	71.4	14.7
Length (cm)	250	13.0	19.6	15.6	1.9

Table 4. Correlation of genders with infection.

			health status		**Total**
			infected	**no infected**	
Gender	male	Count	110	60	170
		% within gender	65%	35%	100%
	female	Count	30	50	80
		% within gender	38%	63%	100%
Total		Count	140	110	250
		% within gender	56%	44%	100%
X^2	1.634	P value	**0.201**		

Non-significant at P ≥0.05

gender * health status Cross tabulation

Table 5. Prevalence of each parasite.

Species of nematodes	**No. of infected**	**%**
Ichthyophthirius multifiliis	80	32
Trichodina spp.	30	12
Dactylogyrus sp.	20	8
Gyrodactylus sp.	10	4
Total no. of infected	140	100

Figure 1. Distribution of infected and non-infected Fish.

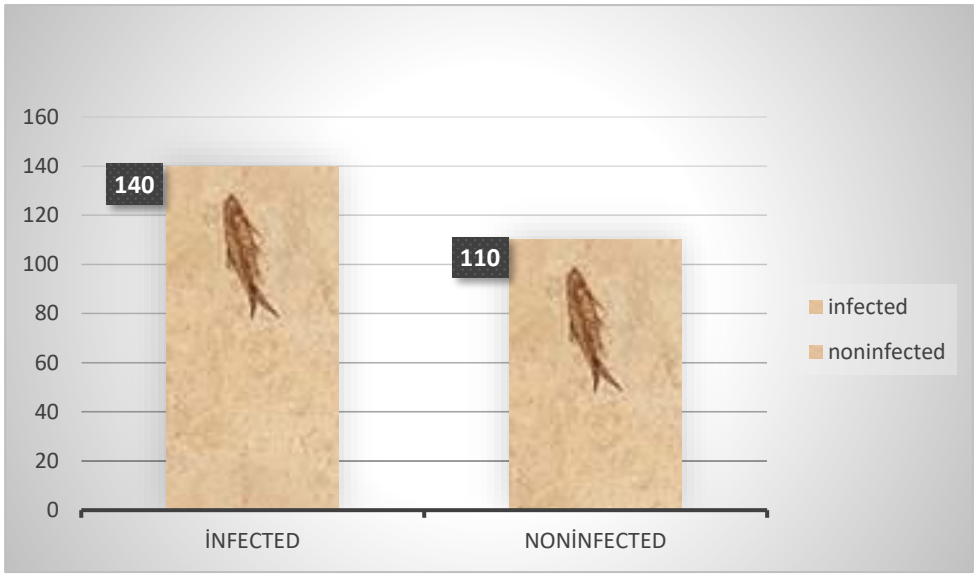

Figure 1. *Ichtyopthirius multifiliis* tomont stage X40.

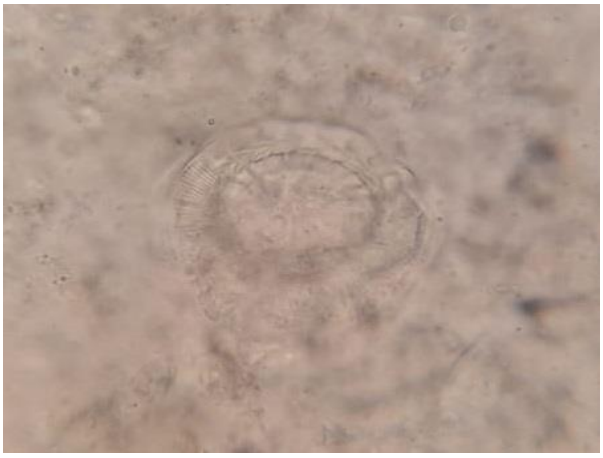

Figure 2. *Trichodina* sp. X100.

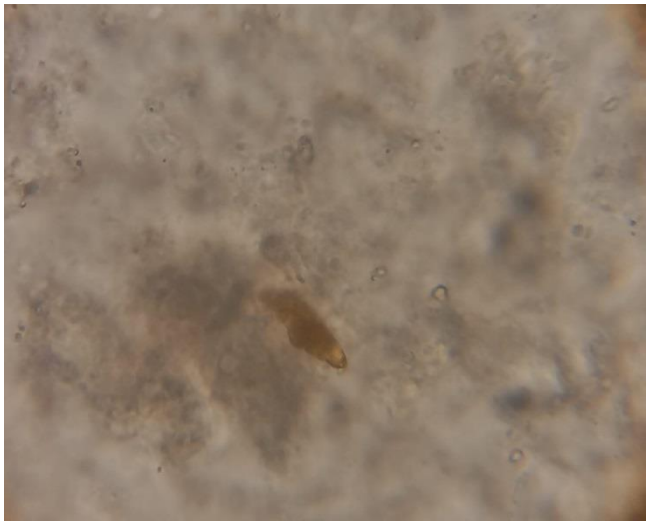

Figure 3. *Dactylogyrus* sp. X40.

Figure 4. *Gyrodactylus* sp. X40.

Discussion

Fish are regarded as a superior food source for humans and are preferred as the ideal diet due to their higher percentages of unsaturated fatty acids **(**Jain 2017). Head mucus, fin mucus, body mucus and gills of fish are the parts affected by ectoparasites (Iriansyah et al. 2020). For example, fish infect not only ectoparasites but endoparasites like the Anisakidae family's most crucial genus, Contracaecum, which contains various host species participating in their life cycles and considerably negatively influencing population health (Jawad et al. 2022). Therefore, this makes fish the source of basic income for millions of people and the economy globally (Blazhekovikj-Dimovska and Stojanovski 2021). Recently, several parasitic species have been recorded in various fish types. Although, several studies around the globe have revealed cases of infection in (*Tilapia*) with various ectoparasites (Iriansyah et al. 2020; Abu-Elala et al.2021; Shinn et al. 2023). These ectoparasitic infections can cause high morbidity among them, which may disrupt the environment and health of fish, leading to death and causing economic losses (Jain 2017).

In the current study, laboratory examination was performed on a set of 250 fish purchased from the market and selected randomly with the source of fish from the Euphrates River, Iraq. The total prevalence was (56%) with the detection one species *Ichthyophthirius multifilis*, and three genera *Trichodina sp.*, *Dactylogyrus sp.*, and *Gyrodactylus sp.; t*his result was similar to (Iriansyah et al. 2020) in freshwater fishes in Mulur Reservoir of Sukoharjo District, Indonesia who detected prevalence of more than 50% in tilapia (*Oreochromis niloticus*) and other fish types.

Accordingly, the environment was suitable, but there are some parasites that have infected tilapia. The infection by ectoparasites affected fish populations and caused several clinical signs. The current study reported the appearance of necrotic areas, ulcerations and hemorrhage on the gills.

We found Protozoa and Monogeneas parasites on other body parts that caused inflammations and mechanical injuries. These results agree with (Obaid

et al. 2021), who reported several injuries and ulcerations were observed within the gills, over fins and skin of infected fish, which were associated with high mortality rates in common carp (*Cyprinus carpio*) in aquacultures in the Erbil region. Another study by (Koyuncu et al.2022) in a private aquarium farm Koi fish (*Cyprinus carpio*) in Mersin, Turkey. The symptoms included melting of the fins, skin hyperemia, petechial haemorrhages and wounds drew attention, anorexia, swimming disorders, pale colour of the fins, melting, skin redness, haemorrhage and death.

The current study has no significant effect on infection between males and females. This agreement with another study on common carp Cyprinus carpio in AlForat River Al-Mussayab, which showed no recording of differences in chosen infection site and sex and host either in the skin, Fins and gills (Hussein 2018). In the current study, we detected a correlation of infection with weight and length (Shigoley et al.2023), and confirmed that new species in Morocco of gyrodactylids infecting hosts by specimens from the gills of 738 African cyprinid has a longer Hamulus total length, a longer hamulus root, a downward projecting toe, a trapezium shaped ventral bar membrane with slightly striated median portion and small rounded anterolateral processes.

Ichthyophthirius multifiliis is an important protozoan pathogen that infects the gills, skin and fins of freshwater fish, with broad geographical distribution and low host specificity. However, the epizootic occurrence of ichthyophthiriasis in high plateau has rarely been recorded (Li et al.2022). This ciliate cause threatens the global aquaculture, causing white spot disease in several countries (Yang et al.2023). Ichthyophthiriasis in Farmed Fishes in the Tigris River in Iraq was reported in four types, and the number of infections ranged from 10-35 (Khalifa et al.1983), while in the current study, ichthyophthiriasis infection was 32%. This result, in agreement with other studies (Hussein 2018), reported *Ichthyophthirius multifiliis* infection from 84 samples of common carp *Cyprinus carpio* in AlForat River Al-Mussayab, the presence of parasite on the skin, Fins and gills were examined. The highest percentage of infection recorded in April was 53.33% (Hussein 2018). Another study by (Blazhekovikj-Dimovska and Stojanovski 2021) who analyze protozoan distribution in farmed cyprinid fish from Macedonia. A total of 1134 fish samples were examined, from which parasite infestation with Protozoa was determined in 533 fish, with a total prevalence of 47%. Eight protozoan parasite representatives were identified: *Ichthyophthirius multifiliis* and *Trichodina* sp.

The second ectoparasites of numerous aquatic invertebrate and vertebrate hosts, Trichodinids, are well known in both wild and cultured fish (Öztürk and Güven, 2022). Trichodina spp. is an economically and ecologically important genus of ectoparasitic protozoan ciliates pathogen (Wang et al. 2020). In the present study, we reported a 12% infection rate. This result agreement with (Mansoor 2010) who detected *Trichodina domerguei* (21.6%) in cyprinid fish *Cyprinus carpio* from fish markets east of Baghdad city, while (Öztürk and Güven 2022) who confirmed prevalence range (7.5-100%) for *Trichodina rectuncinata, T. ovonucleata, T. jadranica,* and *T. domerguei* in four species of marine fishes from Sinop coasts of the Black Sea, Turkey. Additionally, some Cyprinid fish species living naturally in the Murat River in the Bingöl University Zoology Research Laboratory and parasite fauna and their distribution from 365 fish were examined, and 100 fish (27.4%) were infected with at least one Protozoan or Crustacean parasite (Korkut and Koyun 2022).

Many monogenean parasites have been co-introduced along with their fish hosts (García-Vásquez et al. 2021). In the current study, we reported Dactylogyrus sp. was (8%); this agreement with Al-Sa'adi et al. 2013, who diagnosed *Dactylogyrus dogieli* from gills of *Cyprinion kais, Alburnus sellal, Carassobarbus luteus, Mesopotamichthys sharpeyi* and *Ctenopharyngodon idella*. The prevalence was 1.7%, 4.3%, 5.2%, 50% and 50%, respectively, of 471 fishes from the Euphrates River at Al-Musaib City, Iraq. While (Abdullah 2009) recorded a prevalence range (of 15-33.33%) of 48 freshwater fishes belonging to four species of the family Cyprinidae were collected from Darbandikhan Lake, southwest Sulaimaniya City, Kurdistan region, in the north of Iraq. The inspection of gills revealed four species of monogenetic trematoda belonging to the genus Dactylogyrus, namely: *D. alatus*, *D. cyprinioni*, *D. macracanthus* and *D. microcirrus*.

Although several ectoparasites are found in domesticated fish than in wild fish (Iriansyah et al. 2020), this theory disagrees with the current source and the source of fishes from the wild environment. In the current study, *Gyrodactylus sp.* was (4%). This study agrees with the results by (Abdullah 2009), who reported an infection rate (5.2-28.5%) of *Gyrodactylus angorae* on the body of two nemachilid fishes (*Oxynoemacheilus zarzianus* and *Eidinemacheilus proudlovei*) from Iraq. Approximate *Gyrodactylus sp* abundance have reported (0.15-17.90) in Tilapian fish Mexico (García-Vásquez et al. 2021). Another study has similar results (20-100) on 10 fishes for each type. The results showed that 5 types of ectoparasites were *Epistylis* sp., *Ichthyophthirius multifilis*, *Trichodina* sp., *Dactylogyrus* sp., and *Gyrodactylus* sp.

(Iriansyah et al. 2020). In conclusion, the study referred to the nature of ectoparasites in freshwater environments. parasites infecting Fry Redbelly Tilapia (*Coptodon zillii*) in the Euphrates River from markets are *Ichtioptioptirius multifiliis*, *Trichodina* sp., *Dactylogyrus* sp.and *Gyrodactylus* sp. Before market sale, there should be a visual inspection of the fish industry. All parasites namely single-host types. Management measures should be taken to save the procurement and import from reputable global markets under the Food and Agriculture Organization (FAO) and World Health Organization (WHO) supervision.

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Ethical Statement

Ethics required are approved by the Ethical Committee of the College of Veterinary Medicine/University of Kerbala under acceptance number- UOK.VET. MI.2022.064.

Competing Interests

The authors declared that there is no conflict of interest.

Authors' Contributions

Firas Alali, Marwa Jawad and Sarah Mohammed ALSHEIKH: Writing- Original draft preparation, Conceptualization, Methodology, Funding acquisition, Investigation, Data analysis.

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