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Original Article

First record of the monogenic *Gyrodactylus magadiensis* Dos Santos, Maina & Avenant-Oldewage, 2019 from the gills of the red belly cichlid fish *Coptodon zillii* in Iraq

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Abstract: This study reports the first record of the monogenean parasite *Gyrodactylus magadiensis* Dos Santos, Maina, and Avenant-Oldewage (2019) in the gills of the redbelly cichlid, *Coptodon zillii*, in Iraq. A total of 37 fish were collected from the Tigris River from July to November 2024. Then, the examined specimens yielded a prevalence of 13.5%. The morphological measurements and description of *Gyrodactylus* are based on the opisthaptor or the haptor, which is a posterior attachment apparatus. The hamulus was narrow and long; the ventral bar had small, rounded processes, with a distinct, tongue-shaped membrane. The marginal hooks, where the slender sickles are angled forward. Morphological analysis of the haptoral sclerites matched the original description of *G. magadiensis*. Despite notable variations in the lengths of the anchor shaft and ventral bar, these differences suggest morphological plasticity in both host and parasite. These findings expand the known host fish range and geographic distribution of *G. magadiensis*, contributing to the understanding of monogenean diversity among cichlids in Iraq.

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Introduction

Fish ectoparasites are defined as those that infect fish gills and skin, are highly diverse, and develop complex adaptations for attaching to their hosts, feeding, and reproducing (Narvaez et al., 2024). The number of newly recorded species of external fish parasites is increasing, particularly in the gills, across fish species worldwide (Abdul-Ameer and Obaid, 2021). One of the common parasites, *Gyrodactylus* Nordmann, 1832, is found in teleosts (Abdullah, 2021), which leads to increased mortality and substantial economic losses in aquaculture.

Among the 23 genera of Gyrodactylidae, 19 are viviparous, while four are oviparous (Bakke et al., 2007). The Gyrodactylidae family has a broader host range than any other monogenean family, occurring across 19 orders of bony fish, while numerous species have been recorded from a single host (Bakke et al., 2002). These viviparous gyrodactylids exhibit low morphological and biological diversity (Bakke et al., 2002; Zeng et al., 2025). *Gyrodactylus* species are widespread ectoparasites that inhabit freshwater, brackish, and marine fishes (Barzegar et al., 2018). They primarily infect the fish's skin, fins, and gills (Özer et al., 2004; Buchmann and Bresciani, 2006). These parasites have a direct life cycle; adult *Gyrodactylus* carry fully developed embryos identical to the adults in their uteri. This allows for the immediate generation of the next generation of parasites (Cable and Harris, 2002; Bakke et al., 2007). A total of 409 potentially valid species names have been recorded within the genus, from 400 host species (Harris et al., 2004). According to widely used electronic resources, 602 species of *Gyrodactylus* are recorded across various fish species (WoRMS, 2023).

In Iraq and neighboring countries, such as Turkey, Iran, and Syria, various Gyrodactylus species have been identified from different fish species (Jalali et al., 2005; Al-Samman et al., 2006; Vilizzi et al., 2015; Barzegar et al., 2018). For instance, *G. bychowskianus* was found in the gills of the cyprinid fish, *Arabibarbus grypus* (Sheyaa and Abdul-Ameer, 2019), *G. taimeni* has been recorded in *Cyprinus carpio* gills (Abdul-Ameer and Al-Saadi, 2013), and 19 *Gyrodactylus*

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Table 1. Prevalence of *Gyrodactylus magadiensis* infection in *Coptodon zillii*.

Host Infection Status	Number of Fish (n)	Percentage (%)
Infected	5	13.5%
Non-infected	32	86.5%
Total	37	100%

species were identified in *Coptodon zillii* in Kenya (Dos Santos et al., 2019; Mhaisen, 2025). The current study reports the ectoparasitic monogenean *Gyrodactylus* magadiensis from the redbelly cichlid, *Coptodon zillii*, for the first time in Iraq, collected from the Tigris River, which passes through Al-Rashdiya in the northern region of Baghdad Province.

Figure 1. The collected redbelly cichlid fish, *Coptodon zillii*, from the Tigris River.

Materials and Methods

Sampling: Thirty-seven redbelly cichlid fish were collected from the Tigris River in Al-Rashdiya at latitude 33°42′ North and longitude 44°34′ East, located in the north of Baghdad Province (Fig. 1), between July and November 2024. Al-Rashdiya is an agricultural area in the northern part of Baghdad Governorate, bordering the Tigris River on the west. Many water bodies along the Tigris River in this area are used for fishing for local sale. The live fish were caught weekly by fishermen using gill nets and cast nets. They were transported to the laboratory in a cool box containing river water. The collected fish were identified based on Coad (2010), Çiçek et al. (2023), and Saad et al. (2023).

Isolation and identification: The fins and skin of fish were examined, along with microscopic smears for both the skin and gills. The observed parasite was isolated, placed on a slide, and stained with neutral red in aqueous solution. Permanent smears were prepared using glycerin and examined under a light microscope (Al-Nasiri, 2013). A drawing of the haptor with its sclerotized components was made using the camera lucida.

The identification of the parasite followed the guidelines of Dos Santos et al. (2019). All measurements used to describe the parasite were taken in millimeters with the ocular micrometer, and the results report the average of the minimum and maximum values. The hamuli measurement and the other haptoral sclerites were taken according to Shinn et al. (2004) and GarcíaVásquez et al. (2007). The previously recorded data on *Gyrodactylus* species from Iraqi fishes were reviewed using an index catalogue, which includes Iraqi fish's parasites and their disease agents (Mhaisen, 2025).

Results

This study is the first recording of the parasite *G. magadiensis* in Iraq (Fig. 2). Of 37 *C. zillii* examined, 5 were infected with *G. magadiensis*, yielding a prevalence of 13.5% and a mean intensity of 2.4 (Table 1). In the corrected specimens, the hamulus is long and narrow, while the ventral bar has small, rounded processes, a membrane, and a distinct, tongue-shaped process. The marginal hooks, where the slender sickles are angled forward. However, the toe is clearly trapezoid to square, with a rounded heel. In addition, a long bridge before reaching the marginal sickle shaft.

Morphometric characters from six collected *G. magadiensis* were compared with the findings of the previous study in Table 2. *Gyrodactylus magadiensis* is small, with a body length of 0.24-0.28 (0.26) mm. The measurements of the total length of marginal hooks were 0.027-0.03 (0.028), and the hooklet is 0.008. The measured morphometrics are the total length of the anchor 0.062-0.068 (0.065), main part 0.054-0.058 (0.056), point 0.024-0.026 (0.025), inner root 0.018-0.022 (0.02), ventral bar 0.025-0.027 (0.026), width 0.005-0.011 (0.008), length and length

Table 2. Morphological measurements of *Gyrodactylus magadiensis* isolated from *Coptodon zillii* in the present study are compared with those of Dos Santos et al. (2019).

Characteristics	*Gyrodactylus magadiensis* Present study n = 6 (μm)	*Gyrodactylus magadiensis* Dos Santos *et al*., 2019 n = 24 (μm)
The body length	260 (240-280)	267.1 (202–387.2)
Total length of the marginal hooks	28 (27–30)	27.7 (23.4–30)
The hooklet (Marginal hook sickle)	8	5.4 (4.7–6.1)
The total length of the anchor	65 (62–68)	62.8 (53.6–73.7)
The main part	56 (54–58)	38.6 (34.8–43.6)
The point	25 (24–26)	24.2 (19.9–29.5)
The inner root	20 (18–22)	22.3 (16.9–29.9)
The size of the ventral bar		
- Width	26 (25–27)	20.8 (14.6–26.4)
- Length	8 (5–11)	27.5 (22.6–33.3)
Length of the membrane	27 (26–28)	18.7 (15.9–22.8)
The size of the dorsal bar (L × W)	2 ×15 (14–16)	2.6 (2.2–3.6) × 13 (9.9–17.78)

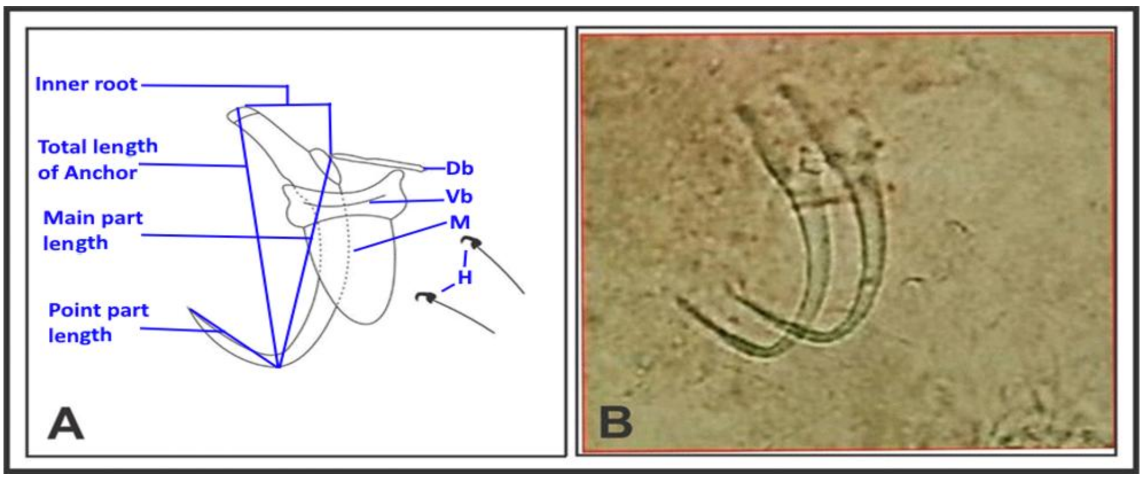

Figure 2. Morphological details of the haptor of *Gyrodactylus magadiensis* isolated from *Coptodon zillii*. (A) Drawing of the haptor illustrating key sclerotized structures, and (B) photomicrograph of the haptor (400x). Db: dorsal bar; Vb: ventral bar; H: hooklet and M: ventral bar membrane (Scale bar =0.022 mm).

of membrane 0.026-0.028 (0.027), and dorsal bar 0.002 x 0.014-0.016 (0.015).

Discussions

The monogenean parasite is the most abundant gill parasite in freshwater fish worldwide (Bilal and Nasraddin, 2025). The present study recorded *G. magadiensis* in the gills of *Coptodon zilli* collected from the Tigres River, Iraq. Both the morphological measurements and description of *G. magadiensis,* match those recorded by Dos Santos et al. (2019) from the gills of *Alcolapia grahami*, endemic to Lake Victoria, Kenya. The most distinctive morphological character of Monogenea is the opisthaptor, or haptor, a posterior attachment apparatus (Walter et al., 2023).

In Iraq, the first identified species of gyrodactylid was *G. elegans* Nordmann, 1832, which was recorded from the gills of *Cyprinus carpio* and *Planiliza abu* (Ali and Shaaban, 1984). A total of 25 *Gyrodactylus* species had been documented in various freshwater fish throughout Iraq (Mhaisen and Abdul-Ameer, 2013). Recent studies of fish parasites from different water bodies have identified 78 species of *Gyrodactylus* affecting a variety of freshwater fish (Shalal, 2024; Mhaisen, 2025). The current study records the species *Gyrodactylus magadiensis* for the first time in Iraq, thereby increasing the total number of *Gyrodactylus* species recorded in Iraq to 79. Among these species, 19 have been found in *C. zillii* (Mhaisen, 2025). The following species of the genus *Gyrodactylus* have been known to infect this fish in different water bodies in Iraq: *G. alexanderi,* *G. baicalensis, G. barbi, G. bychowskianus, G. dzhalilovi, G. elegans, G. gussevi, G. latus, G. longihamus, G. longiradix, G. macronychus, G. markevitschi, G. masu, G. matovi, G. medius, G. menschikowi, G. mikailovi, G. seravschani, G. sprostonae*, in addition to unclassified species of this genus. The identification of *G. magadiensis* on *C. zillii* represents an important expansion of the known host range for this parasite.

While the prevalence was relatively low (13.5%), the successful attachment to the host's epithelial tissue, facilitated by the 16 marginal hooklets and strong anchors, demonstrated the parasite's adaptability (Rahimian, 2007). The slight morphological variations in the haptor, particularly the shaft and ventral bar dimensions, may result from the parasite adapting to the specific mucosal density or scale morphology of *C. zillii*, which can be affected by environmental factors such as water temperature (Maseng, 2010). These findings suggest that *G. magadiensis* may be less host-specific than previously thought, capable of infecting multiple fish species in shared or adjacent aquatic environments.

Conclusions

Every year, many new parasite species are found in various fish species in the Tigris and Euphrates Rivers and other water bodies, some of which may cause fish deaths. The effects of these parasites are reflected in fish wealth and economic value, as well as in ecosystems, which call for attention to the main reasons for their spread and presence, and to finding treatments capable of limiting their spread. This study reported the presence of *G. magadiensis* in *Coptodon zillii*, providing the first comparative morphological data since its original description in 2019. While the core diagnostic features remain consistent with those of the Kenyan population, the observed variation in sclerite dimensions highlights the importance of localized taxonomic studies. Future research should use molecular barcoding, such as the Internal Transcribed Spacer (ITS2) region, to confirm whether these morphological shifts represent a distinct strain or simply phenotypic plasticity within the same species.

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