

First Record of Three Species of *Cichlidogyrus* Paperna, 1960 (Monogenea) Parasitizing Gills of Redbelly Tilapia *Coptodon zillii* (Gervais, 1848) from Euphrates River, Iraq

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Abstract: The examination of gills of the cichlid fishes *Coptodon zillii* that caught from Euphrates River passing through Al-Anbar Province, Iraq, revealed the presence of three monogenean species belonging to the genus *Cichlidogyrus* which include *C. aegypticus*, *C. levequei* and *C. yanni*. All these monogeneans are recorded here for the first time in inland water of Iraq. This also represents the first record of the genus *Cichlidogyrus* from fishes of Euphrates River at Al-Anbar Province. The three species are distinguished by the differences in the shape and size of the sclerotized parts of their haptors and in their male copulatory organs. The descriptions and measurements of these parasites as well as their illustrations are given in the present study.

Keywords: Monogenea, *Cichlidogyrus*, *Coptodon zillii*, Euphrates River, Iraq

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I. Introduction

Members of the genus *Cichlidogyrus* are monogeneans infecting gills of cichlid fishes. *Cichlidogyrus* was firstly described by Paperna in 1960 as a type species; *Cichlidogyrus arthracanthus* from the cichlid fish *Coptodon zillii* (Gervais, 1848) which was reported as *Tilapia zillii* (Roux & Avenant-Oldewage, 2010).

Species of this genus were described as organisms which had the following features; they are gill parasites with three pairs of cephalic glands; their eyes included two posterior eyes with crystalline lenses and two smaller incompatible anterior eyes; a median muscular pharynx is present and connected posteriorly with simple intestinal caecum; there are two pairs of anchors (one dorsal and one ventral) and two connecting bars (dorsal bar with two auricles and curved and articulated ventral bar); the male reproductive system consists of a median posterior testis, a vas deferens on the right side and a seminal vesicle with one prostatic reservoir; the male copulatory organs comprises a penis and an accessory piece, sometimes with an auxiliary plate; the female reproductive system consists of median ovary, vaginal opening and sclerotized vagina with seminal receptacle (Pariselle & Euzet, 1997; Pariselle et al. 2003; Roux & Avenant-Oldewage, 2010).

In monogenean morphological taxonomy, copulatory organs and haptoral parts have been used for identification and remain a key diagnostic feature (Kořková et al., 2010; Igeh et al., 2017).

The genus *Cichlidogyrus* is considered as the most diverse genus of the monogenean parasites on cichlids fishes, and spread among a wide range of fish species, including more than 40 species within 11 genera (Pouyaud et al., 2006). Roux & Avenant-Oldewage (2010) referred to the existence of 85 species of this genus from fishes in all over the world. Members of genus are primarily parasites of the fish family Cichlidae, although some species may occur on a single host species, and in other cases on several fish species (Roux & Avenant-Oldewage, 2010).

In Iraq, *C. zillii* was firstly reported (as *Tilapia zillii*) in 2006 from the Euphrates River in Babylon Province by Al-Sa'adi (2007). The source of this fish in Iraq came probably through Syrian waters of the Euphrates River (Al-Sa'adi et al., 2012). However, Al-Faisal et al. (2014) believed that these are exotic fishes which were introduced from neighboring countries and find their way to inland waters of Iraq. A recent checklist of parasites of *C. zillii* in different water bodies of Iraq (Mhaisen, 2021) indicated the occurrence of 65 different parasite species which included three species of *Cichlidogyrus*: *C. sclerosus*, *C. tiberianus* and *C. tilapiae*.

According to Mhaisen (2022), only eight references are known on *Cichlidogyrus* species in Iraq (Abdul-Ameer & Atwan, 2016; Rasheed, 2016; Abdul-Ameer, 2017; Mohammed, 2017; Abbas, 2019; Al-Helli, 2019; Al-Hajimi, 2021; Al-Hajimi & Al-Saadi, 2022) in addition to unspecified species of this genus (Jori,

2006). Therefore, the aim of the present study is concerned with the record of additional *Cichlidogyrus* spp. from gills of *C. zillii* in Euphrates River, Iraq.

II. Materials and Methods

During the period from March 2020 until the end of January 2021, 16 specimens of *C. zillii* were collected from the Euphrates River, Al-Anbar Province, Iraq. Fishes were transported to the laboratory for parasitological examination. In the laboratory, gills were removed and examined with a dissecting microscope. The monogeneans were detached from the gills, washed with distilled water and then examined the sclerotized parts according to Al-Nasiri & Balbuena (2018).

Drawings of the sclerotized pieces of the haptor, copulatory organ and vagina were made by using a drawing tube. Measurements of monogenean parasites, in micrometers, were done and presented as the range followed by the mean in parentheses.

Monogenean species were identified according to Ergens (1981) and Pariselle & Euzet (1996, 2009). The host fish (*C. zillii*) was identified according to Mutlak & Al-Faisal (2009) and its scientific name was used according to Catalog of Fishes by Fricke et al. (2022).

III. Results and Discussion

Three species of the genus *Cichlidogyrus* (*C. aegypticus*, *C. levequei* and *C. yanni*) were identified in the present study from gills of *C. zillii* that caught from Euphrates River, Al-Anbar Province, Iraq. The following is the description of these species with their measurements.

Cichlidogyrus aegypticus Ergens, 1981 (Figures 1 & 2)

This parasite was found on the gills of *C. zillii* (Table 1) with a prevalence of infection as 18.75% and a mean intensity of seven parasites/ infected fish. The infection was recorded during November only with a prevalence of infection of 33.33% and a mean intensity of seven parasites/ fish.

The following is an account on the description and measurements (in μm based on twelve specimens for each species) of this parasite.

Body length 385-782 (584) and its width 68-153 (111) at level of vagina. Pharynx nearly spherical, its diameter 25-44 (35) at widest point. Dorsal anchor of haptor with guard, twice length of shaft; blade regularly arched. Total length of the dorsal anchor 23-27 (25), blade length 18-21 (20), point length 7-11 (9), shaft length 8-12 (10). Total length of the dorsal connecting bar 26-40 (33), and its width from its widest point 3-5 (4). The ventral anchor similar to dorsal, but slightly larger, where the total length of ventral anchor 26-31 (29), blade length 23-28 (26), point length 9-12 (11), shaft length 8-14 (11). Ventral connecting bar v-shaped with rounded ends, length of one branch 31-37 (34), maximum width 4-6 (5). Lengths of the first hooklet 14-17 (16), second 11-13 (12), third 28-37 (33), fourth 30-38 (34), fifth 31-39 (35), sixth 29-37 (33) and seventh 29-34 (32). Male copulatory organ with arched tubular penis, 60-70 (65) long, and with large basal bulb. Accessory piece bent at a right angle, ended in large hook. Vagina bent in middle, with bulge in distal half, thin walled, 25-33 (29) long. The above description and measurements of the present *C. aegypticus* are in agreement with those of the same species which was described for the first time by Ergens (1981) from gills of *T. zillii* (now *C. zillii*) from the River Nile in Cairo.

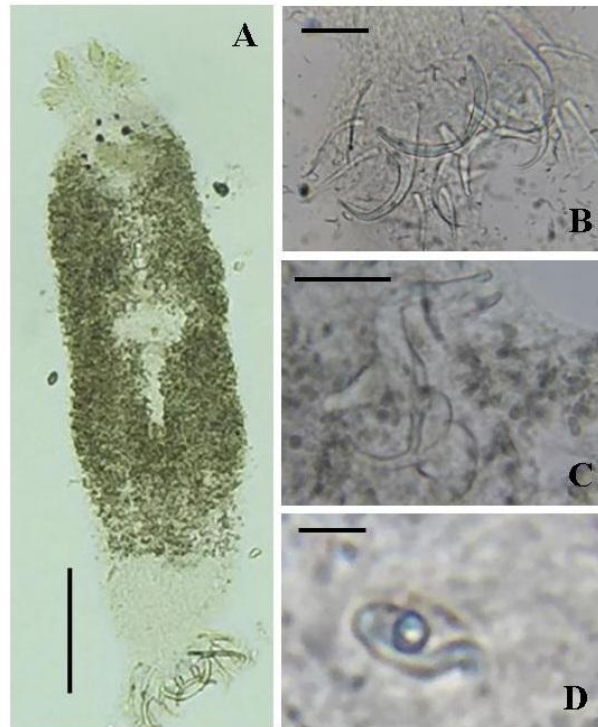


Figure 1: *Cichlidogyrus aegypticus*- Photomicrographs of whole worm (A), sclerotized parts of haptor (B), copulatory organ (C) and vagina (D). Scale bar: A= 100 μ m, B & C= 20 μ m & D= 10 μ m.

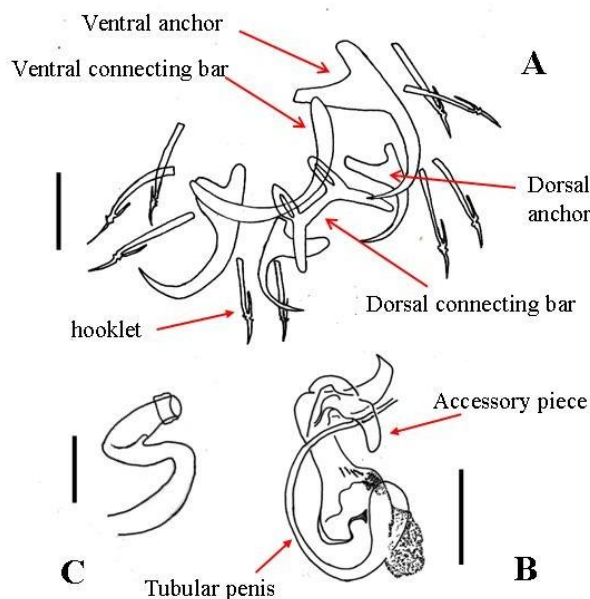


Figure 2: *Cichlidogyrus aegypticus*- Line drawings of sclerotized parts of haptor (A), copulatory organ (B) and vagina (C). Scale bar: A & B= 20 μ m. & C= 10 μ m.

***Cichlidogyrus levequei* Pariselle & Euzet, 1996 (Figures 3 & 4)**

C. levequei was found on gills of *C. zillii* (Table 1) with a prevalence of infection of 25.00% and a mean intensity of 34 parasites/ infected fish. The highest prevalence and intensity of infection was recorded during December, with a value of 75.00%, and 42 parasites/ infected fish, respectively, while the lowest prevalence and intensity of infection was during November with a value of 11.11% and ten parasites/ infected fish, respectively. There was no infection in the other months of the present study.

The following is an account on the description and measurements (in μ m based on twelve specimens for each species) of this parasite.

Body length 344-506 (425), width 57-118 (88) at level of vagina. Pharynx 22-36 (29) at widest point. Dorsal anchor with guard, twice as long as shaft, with thin regularly arched blade. Total length of dorsal anchor 27-31 (29), blade length 23-26 (25), point length 9-11 (10), shaft length 7-11 (9). Total length of the dorsal connecting bar 25-31 (28), and its width from its widest point 4-5 (5). The ventral anchor similar to the dorsal, but slightly larger, where the total length of ventral anchor 30-34 (32), blade length 26-30 (28), point length 9-13 (11), shaft length 7-11 (9). Ventral connecting bar v-shaped, length of one branch 21-27 (24), maximum width 2-5 (4). Length of the first hooklet 12-15 (14), the second 10-13 (12), the third 13-17 (15), the fourth 15-19 (17), the fifth 15-18 (17), the sixth 14-18 (16) and the seventh 13-15 (14). Male copulatory organ with thin, arched penis, 31-39 (35) long. Accessory piece, with thin digitation at junction of basal bulb and penis, ending in a single hook. The vagina short and thin, 12-18 (15) in length. The description and measurements of *C. levequei* of the present investigation are in agreement with those of the same species which was described for the first time by Pariselle & Euzet (1996) from gills of *Tilapia coffea* (now *Coptodon coffea*) from Oulé River at Niambala and Koulé (Guinea).

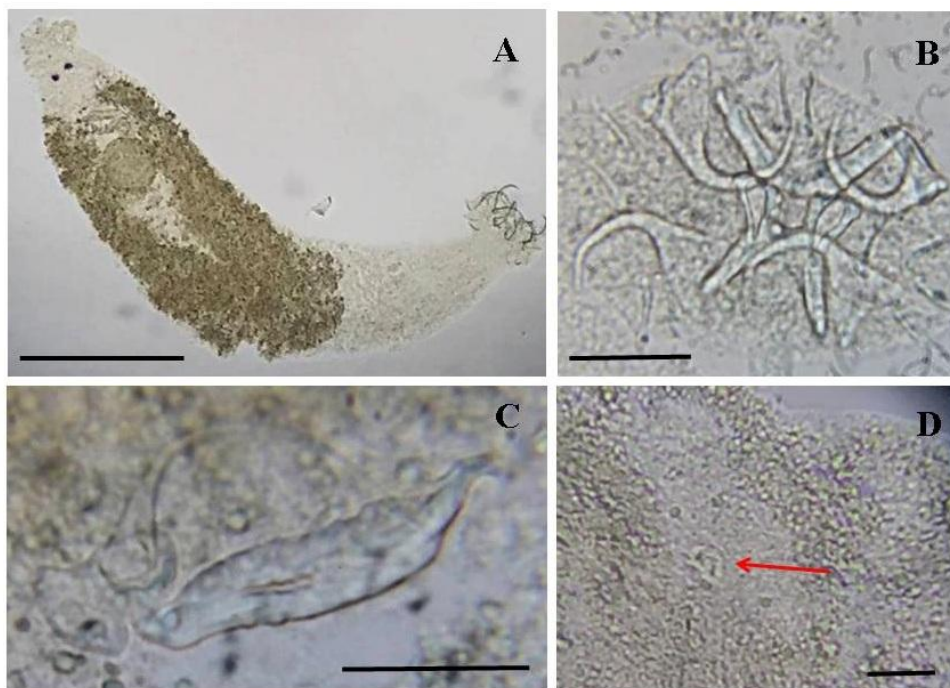


Figure 3: *Cichlidogyrus levequei*- Photomicrographs of whole worm (A), sclerotized parts of haptor (B), copulatory organ (C) and vagina, arrow (D). Scale bar: A= 100 μ m, B & C= 20 μ m & D= 20 μ m.

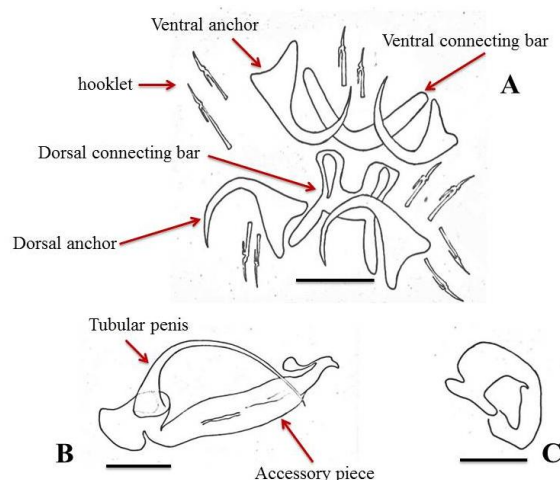


Figure 4: *Cichlidogyrus levequei*- Line drawings of sclerotized parts of haptor (A), copulatory organ (B) & vagina (C). Scale bar: A= 20 μ m, B & C= 10 μ m.

***Cichlidogyrus yanni* Pariselle & Euzet, 1996 (Figures 5 & 6)**

This parasite was diagnosed on gills of *C. zillii* (Table 1) with a prevalence of infection of 6.25% and a mean intensity of seven parasites/ infected fish. The infection was recorded during December only, with a prevalence of infection of 25.00% and a mean intensity of seven parasites/ infected fish.

The following is an account on the description and measurements (in μm based on twelve specimens for each species) of this parasite.

Body length 454-764 (609), width 64-113 (89) at level of vagina. Pharynx 21-32 (27) at widest point. Dorsal anchor with guard, much longer than shaft, thin blade bent in distal third, total length of the dorsal anchor 33-43 (38), blade length 23-32 (32), point length 9-14 (12), shaft length 11-17 (14). Thick dorsal connecting bar with large auricle, total length 26-36 (31), and its width from its widest point 6-11 (9). The ventral anchor large with short guard and shaft, where the total length of ventral anchor 29-39 (34), blade length 27-36 (32), point length 12-18 (15), shaft length 6-13 (10). Ventral connecting bar v-shaped, length of one branch 31-45 (38), maximum width 4-7 (6). Length of the first hooklet 20-28 (24), the second 10-13 (12), the third 15-21 (18), the fourth 17-25 (21), the fifth 18-26 (22), the sixth 18-25 (22) and the seventh 15-24 (20). Male copulatory organ with short penis and lightly sinuous, with fine, straight heel 29-37 (33) long. Accessory piece, linked to base of penis, ending in a single short, rounded hook. The vagina is long and tortuous, 27-35 (31) long. The above description and measurements of *C. yanni* of the present investigation are in agreement with those of the same species which was described for the first time by Pariselle & Euzet (1996) from gills of *T. zillii* (now *C. zillii*) from Kogon River (Guinea) and from Volta Noire River (Burkina Fasso) as well as from *T. dageti* (now *Coptodon dageti*) from Gambia River (at Niokolo-Koba National Park, Senegal) and in the Niger River (Bamako, Mali), from *T. guineensis* (now *C. guineensis*) at Layo Research Station, Ebrié Lagoon (Ivory Coast) and in the Sénégal River (Senegal), from *T. louka* (now *Coptodon louka*) in the Bourouma River (Guinea) and from *T. walteri* (now *Coptodon walteri*) in the Cavally and Nipoué rivers (Ivory Coast).

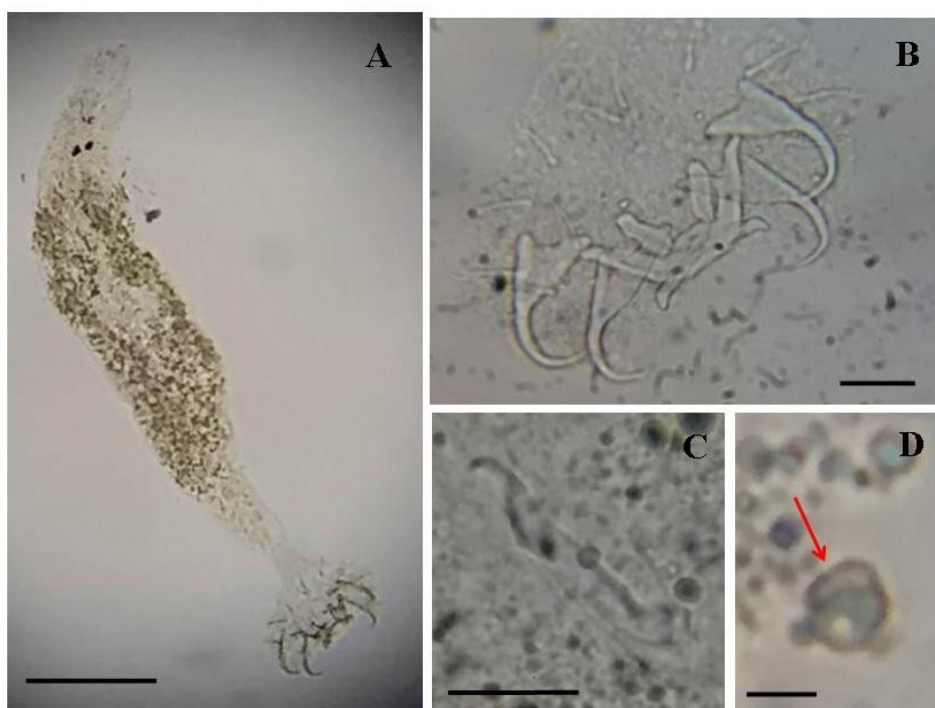


Figure 5: *Cichlidogyrus yanni*- Photomicrographs of whole worm (A), sclerotized parts of haptor (B), copulatory organ (C) & vagina, arrow (D). Scale bar: A= 100 μm , B & C= 20 μm & D= 10 μm .

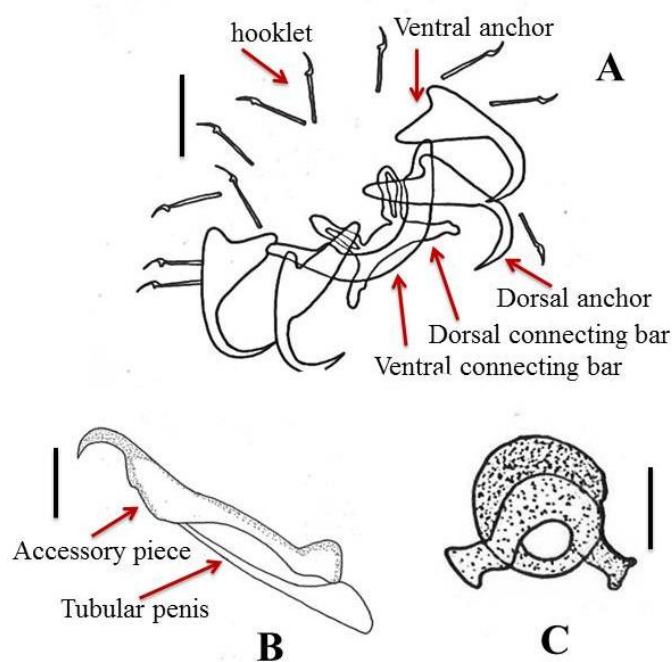


Figure 6: *Cichlidogyrus yanni*- Line drawings of sclerotized parts of haptor (A), copulatory organ (B) & vagina (C). Scale bar: A= 20 μ m, B & C=10 μ m.

Table 1: Percentage prevalence (and intensity) of infection of gills of *C. zillii* with three monogenean parasites of the genus *Cichlidogyrus*.

Parasite	<i>C. aegypticus</i>			<i>C. levequei</i>			<i>C. yanni</i>		
	No. examined fishes	No. infected fishes	Prevalence (intensity)	No. examined fishes	No. infected fishes	Prevalence (intensity)	No. examined fishes	No. infected fishes	Prevalence (intensity)
March 2020	0	0	0	0	0	0	0	0	0
July 2020	1	0	0	1	0	0	1	0	0
August 2020	0	0	0	0	0	0	0	0	0
September 2020	0	0	0	0	0	0	0	0	0
October 2020	2	0	0	2	0	0	2	0	0
November 2020	9	3	33.33 (7)	9	1	11.11 (10)	9	0	0
December 2020	4	0	0	4	3	75.00 (42)	4	1	25.00 (7)
January 2021	0	0	0	0	0	0	0	0	0
Total	16	3	18.75 (7)	16	4	25.00 (34)	16	1	6.25 (7)

According to the index-catalogue of parasites and disease agents of fishes of Iraq (Mhaisen, 2022), the three species of the present investigation (*C. aegypticus*, *C. levequei* and *C. yanni*) now represent their first records in Iraq. Hence, the total number of *Cichlidogyrus* species in Iraq now reached six species in addition to one unidentified species of this genus. The result also confirms the host-specificity of the monogenean genus *Cichlidogyrus* to infect fishes of the family Cichlidae. It is expected to record more monogeneans in general and *Cichlidogyrus* species in particular in different water bodies in Iraq after invading of this fish to waters of Euphrates, Tigris and Shatt Al-Arab rivers, some marshes in Mid and South Iraq as well as some fish ponds in Basrah Province (Mhaisen, 2021).

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