

REPRESENTATIVES OF DACTYLOGYRIDAE FAMILY OF THE MONOGENEA CLASS IN GOLD FISH (*CARASSIUS AURATUS AURATUS*) IMPORTED IN BULGARIA FROM SINGAPORE

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Abstract

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The introducing of new species in different parts of the world is the main reason for changing biodiversity. Many ornamental fishes are bearers of exotic parasites, which spread in environmental waters in different ways (releasing, throwing out death fish in sewage). This give possibility of their parasites to go in environmental waters of the country where they invasive new hosts (except parasites there are viruses and bacteria spreading in this way). In this study we find five species of the genus *Dactylogyrus*, which are typical for goldfish *Carassius auratus auratus* (Linnaeus, 1758), which is similar to the native for Bulgaria *Carassius auratus gibelio* (Linnaeus, 1758). Two of the dactylogirids *Dactylogyrus vastator* Nybelin, 1924, *D. intermedius* (Weger, 1910) are extremely pathogenic. One of the others *D. baueri* (Gussev, 1955) is novelty to the helminthofauna of the country.

Key words: Dactylogyridae family, *Carassius auratus auratus*, Ornamental fish

Introduction

The aim of the present study was to investigate the helminthfauna of one of the most popular ornamental fish *Carassius auratus auratus* – a goldfish imported from Singapore.

The helminth species were transferred by fish imported in Bulgaria and the possibility for infection of other aquarium fish and such from the Bulgarian ichthyofauna provoke a great interest to aquaristics.

Distinguishing among the specific composition of helminthfauna is of great importance due to the possibilities for aquarium fish to be incidentally released in rivers and lakes or to be purposely bred in garden ponds.

Material and Methods

The study was carried out in May 2006. A total of 20 fish specimens were autopsied. Following the euthanasia of the

fish, the latter were examined after the method of the complete helminthological autopsy (Bauer et al., 1981). The detected monogeneans were isolated and embedded in permanent glycerine–gelatin preparations (Bichovsky-Pavlovska, 1985) and were species-identified.

The measurements and identification of the species was performed by the help of “Amplival” microscope (Zeiss, Jena DDR, № 730734).

Results and Discussion

The *D. intermedius* and *D. baueri* species are the ones of the highest intensity. Out of the five dactylogirids two species *D. vastator* and *D. intermedius* are with a pathogenic effect (Gussev, 1985; Wang et al., 2011).

Taxonomic features of *D. vastator* with morphometric measurements are performed in Table 1. Our measurements compared to variability of features given by Gus-

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sev (1985) and Kakacheva-Avramova (1983) showed no differences. *Dactylogyrus vastator* is highly pathogenic species and it is usually observed on the gills of *Carassius carassius*, *Carassius auratus gibelio* and *Cyprinus carpio* (Gussev, 1985). It has been found in Bulgaria in different fish farm, free-living fishes in the dams Batak and Dospat and the rivers Danube and Tundzha (Margaritov, 1975, Kakacheva-Avramova, 1983). Nedeva et al. (2003) in our country in host *Carassius auratus auratus* message it. Typical for the species are anchors, hooks and copulatory organ (Figure 1).

In Table 2 are presented data measurements of taxonomic features of *D. intermedius*. The data for taxonomic characteristics from our specimens are in the same range as these of (Gussev, 1985) and (Kakacheva-Avramova, 1983). In Europe *D. intermedius* has been found in goldfishes imported from Singapore (Di Cave et al., 2000) and in goldfishes from aquariums in Norway (Levsen, 1995). Typical for the species are anchors and copulatory organ (Figure 2).

D. intermedius is one of the important veterinary ecto parasite in Asia, Central Europe, Middle East, and North America (Wang et al., 2011). *D. intermedius* may cause gill inflammation, excessive mucus secretions, accelerated respiration and mixed infections with another parasites and secondary bacterial infections. This parasite always leads to the loss of appetite, productivity, and high mortalities (Wang et al. 2011). In recent years, the infestation of *D. intermedius* in freshwater fish has increased and caused serious economic damage (Wang et al. 2011).

The data for the taxonomic characteristics of *D. baueri* are summarized in Table 3. The data for taxonomic characteristics from our specimens are in the same range as these of Gussev (1985). This species has been found in *Carassius auratus gibelio* and *Carassius auratus* from ponds in Far East. It was described in Italy in goldfishes imported from Singapore (Di Cave et al., 2000). We have found *D. baueri* for the helminthfauna of ornamental fishes in Bulgaria for first time. The parts of opisthaptor are shown on Figure 3.

The data for the taxonomic characteristics of *D. formosus* are summarized in Table 4. The species is often met with its host – *Carassius auratus* (Gussev, 1985). According to the last author it is accidentally found in all other kind of hosts. *D. formosus* is established in goldfishes in Czech Republic and in Italy (Rehulkova and Rehulka, 1999; Di Cave et al. 2000). In our country it is messaged from Margaritov (1964) over gills of *Carassius auratus gibelio* in fish farm in Plovdiv. For this species is typical the horseshoe-shape of the dorsal bar and

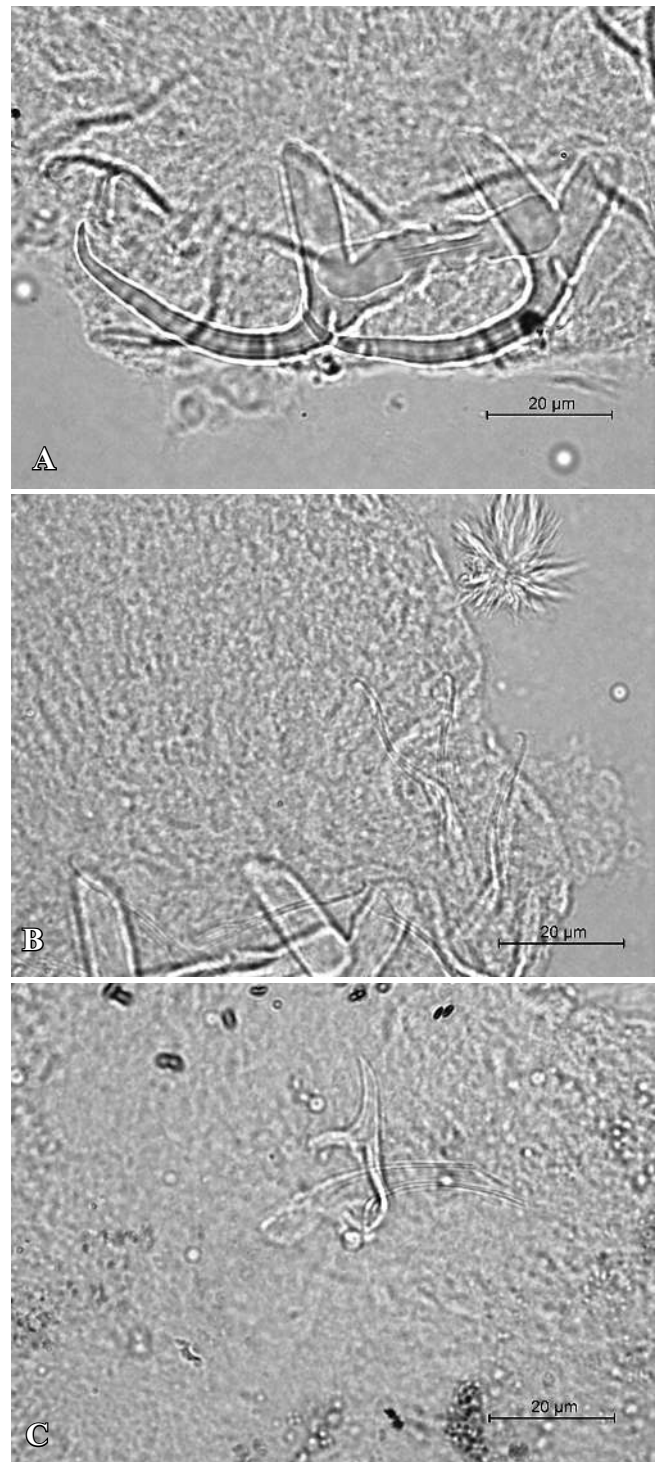
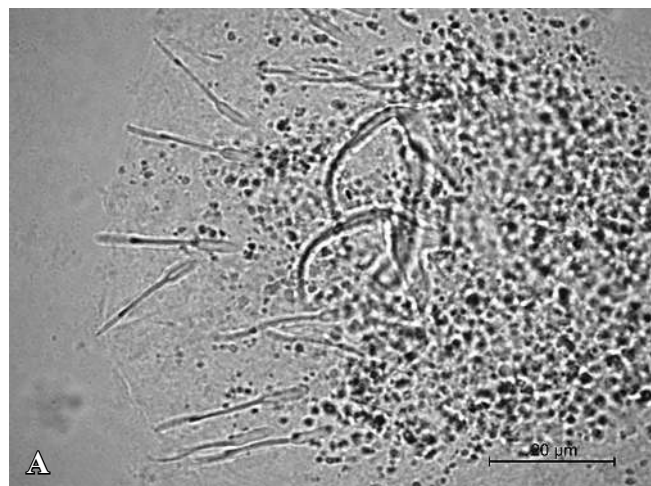


Fig. 1. Microscopic images of opisthaptor and copulatory organ of *Dactylogyrus vastator* from *Carassius auratus auratus*: a – anchors, b – hooks, c – copulatory organ

Table 1**Summary data for taxonomic characteristics of *D. vastator* Nybelin, 1924**

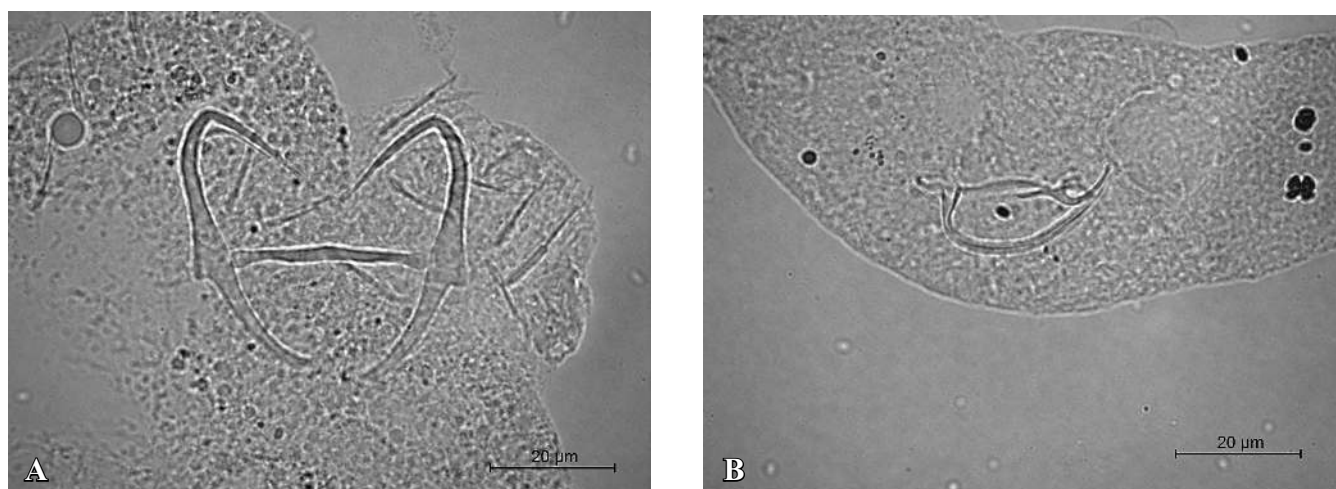
Taxonomic characteristics	Variability of characteristics by Gushev (1985) in mm	Variability of characteristics by Kakacheva-Avramova (1983) in mm	Variability of characteristics by our measurements in mm
Inner length of anchor	0.036 – 0.045	0.036 – 0.049	0.035 – 0.045
Outer length of anchor	0.049 – 0.065		0.046 – 0.055
Inner root	0.016 – 0.025	0.018 – 0.020	0.013 – 0.027
Outer root	0.009 – 0.015	0.008 – 0.011	0.005 – 0.013
Recurved point	0.034 – 0.040		0.033 – 0.036
Dorsal bar	0.005 – 0.009 x 0.035 – 0.044	0.006 – 0.007 x 0.022 – 0.033	0.005 – 0.009x 0.031 – 0.039x
Total length of copulatory organ	0.040 – 0.069	0.043 – 0.057	0.031 – 0.049
Total length of hooks	0.025 – 0.045	0.028 – 0.036	0.024 – 0.036

**Fig. 2. Microscopic image of anchors, dorsal bar, hooks (a) and copulatory organ (b) of *D. Intermedius*****Table 2****Summary data for taxonomic characteristics of *D. intermedius* Weger, 1910**

Taxonomic characteristics	Variability of characteristics by Gushev (1985) in mm	Variability of characteristics by Kakacheva-Avramova (1983) in mm	Variability of characteristics by our measurements in mm
Inner length of anchor	0.023 – 0.031	0.025 – 0.029	0.016 – 0.025
Outer length of anchor	0.023 – 0.031		0.018 – 0.028
Inner root	0.009 – 0.015	0.009 – 0.013	0.009 – 0.014
Outer root	0.003 – 0.005	0.003 – 0.005	0.002 – 0.006
Recurved point	0.007 – 0.011	0.008 – 0.010	0.011 – 0.017
Main part	0.020 – 0.025	0.021 – 0.023	0.015 – 0.020
Dorsal bar	0.003 – 0.004 x 0.023 – 0.030	0.004 – 0.023	0.002 – 0.003 x 0.014 – 0.024
Total length of copulatory organ	0.033 – 0.060	0.033 – 0.040	0.020 – 0.042
Total length of hooks	0.015 – 0.037	0.018 – 0.026	0.017 – 0.027

Table 3. Summary data for taxonomic characteristics of *D. baueri* Gussev, 1955

Taxonomic characteristics	Variability of characteristics by Gussev (1985) in mm	Variability of characteristics by our measurements in mm
Inner length of anchor	0.041 – 0.054	0.039 – 0.049
Inner root	0.020 – 0.030	0.014 – 0.025
Recurved point	0.021 – 0.028	0.014 – 0.027
Main part	0.020 – 0.026	0.016 – 0.028
Dorsal bar	0.002 – 0.003 x 0.026 – 0.036	0.001 – 0.003 x 0.017 – 0.038
Total length of copulatory organ	0.031 – 0.067	0.024 – 0.038
Total length of hooks	0.013 – 0.025	0.011 – 0.020

**Fig. 3. Microscopic image of anchors, dorsal bar, hooks (a) and copulatory organ (b) of *D. Baueri*****Table 4****Summary data for taxonomic characteristics of *D. formosus* Kulwiec, 1927**

Taxonomic characteristics	Variability of characteristics by Gussev (1985) in mm	Variability of characteristics by Kakacheva-Avramova (1983) in mm	Variability of characteristics by our measurements in mm
Inner length of anchor	0.060 – 0.074	0.060 – 0.070	0.046 – 0.055
Inner root	0.030 – 0.035		0.016 – 0.031
Recurved point	0.018 – 0.022 (0.019 – 0.028)		0.013 – 0.016
Main part	0.040 – 0.045		0.027 – 0.036
Dorsal bar	0.003 – 0.005 x 0.014 – 0.025	0.003 – 0.004 x 0.023 – 0.026	0.002 – 0.004 x 0.013 – 0.020
Total length of copulatory organ	0.025 – 0.032	0.025 – 0.032	0.018 – 0.031
Total length of hooks	0.012 – 0.030	0.012 – 0.032	0.014 – 0.024

copulatory organ with many branches of accessory piece (Figure 4).

Taxonomic features of *D. anchoratus* with morphometric measurements are presented in Table 5. The data for taxonomic characteristics from our specimens are in

the same range as these of Gussev, 1985 and Kakacheva-Avramova (1983). *D. anchoratus* has been found on gills of *Carassius auratus*, *Carassius auratus gibelio* and *Cyprinus carpio*. Thus it was transferred in North America by introduction of *Carassius auratus* (Hoffman, 1999).

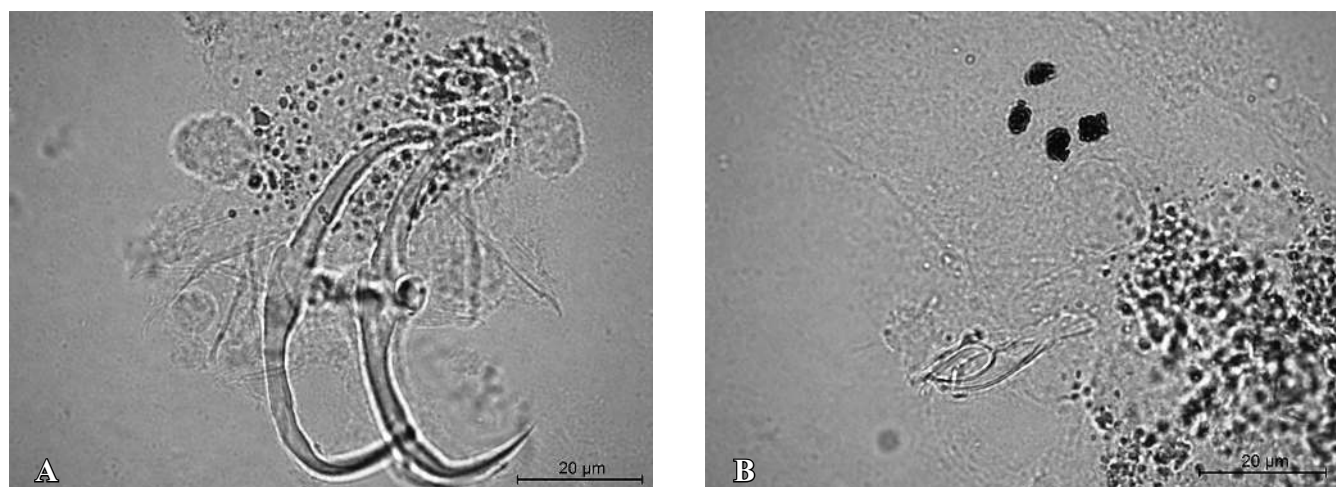


Fig. 4. Microscopic image of anchors, dorsal bar, hooks (a) and copulatory organ of *D. Formosus*

Table 5

Summary data for taxonomic characteristics of *D. anchoratus* Dujardin, 1845

Taxonomic characteristics	Variability of characteristics by Gussev (1985) in mm	Variability of characteristics by Kakacheva-Avramova (1983) in mm	Variability of characteristics by our measurements in mm
Inner length of anchor	0.092 – 0.130	0.096 – 0.099	0.079 – 0.0110
Inner root	0.043 – 0.070	0.05 – 0.069	0.049 – 0.063
Recurved point	0.024 – 0.032	0.025 – 0.029	0.016 – 0.022
Main part	0.057 – 0.076	0.049 – 0.069	0.039 – 0.055
Dorsal bar	0.005 – 0.008 x 0.018 – 0.029	0.006 – 0.008 x 0.024 – 0.029 to 0.04	0.002 – 0.005 x 0.014 – 0.017
Total length of copulatory organ	0.020 – 0.036		0.013 – 0.022
Total length of hooks	0.014 – 0.035	0.014 – 0.035	0.014 – 0.022

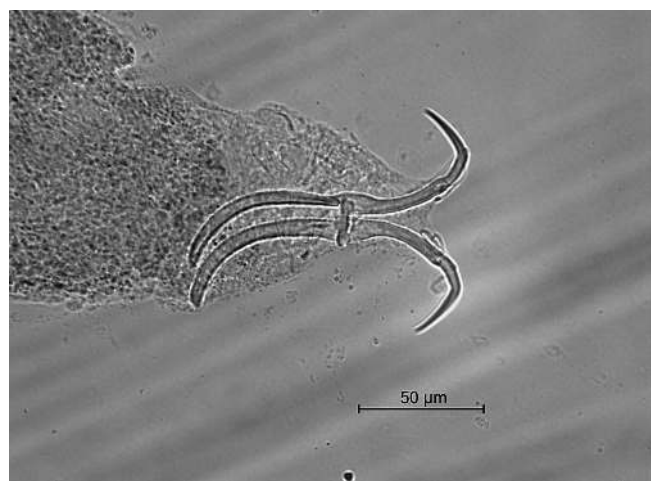


Fig. 5. Microscopic image of anchors, hooks and dorsal bar of *D. Anchoratus*

According to Bichovsky (1933) there are differences between specimens found on the gills of *Cyprinus carpio* and *Carassius auratus*. For example the specimens found in carp have shorter inner root than these from goldfish (Gussev, 1985). *D. anchoratus* in greater quantity (several hundred per fish) might cause hypertrophy of gill tissue and eventually death. It has been established in goldfishes in Europe (Czech Republic (Rehulkova and Rehulka, 1999), Italy (Di Cave et al, 2000) and Norway (Levsen, 1995)). It has been found in fish farms in Plovdiv, Yambol, Chelopechene, Blagoevgrad, Belene, and the rivers Maritsa Danube and Tundzha (Kakacheva-Avramova, 1983). Typical taxonomic features of *D. anchoratus* are bigger anchors (Figure 5).

Conclusions

Dactylogyrids are common monogenean parasites with more than 900 described species (Knipes and Yanovi, 2009) and they may cause a serious pathogen in the aquaculture of many freshwater fish (Ogawa, 2002). As a result from the study, it has been established that the imported goldfish from Singapore are bearers of typical monogenean species to the Bulgarian helminthfauna and species that have never been reported in the fish of our waters. *C. auratus auratus* is a potential bearer of dactylogyrids and might be playing a role in their spreading not only in ornamental fish but also in fish from the Bulgarian ichthyofauna.

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