

THE OCCURENCE OF THE ECTOPARASITE *Dactylogyrus* sp. (PLATYHELMINTHES, MONOGENEA, MONOPISTHOCOTYLEA: DACTYLOGYRIDAE) ON CYPRINIDAE FISH *Cyprinus carpio* AND *Carassius gibelio* FROM THE SMALL RESERVOIRS ALONG THE PREAJBA RIVER - PRELIMINARY STUDY

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Abstract. In the present study, it is presented the monogenean ectoparasite *Dactylogyrus* sp. discovered at two fish species belonging to the Cyprinidae family, which were sampled from the ten reservoirs located along the Preajba Valley, the lower basin of the Jiu River. The samples were obtained after examining 70 fish specimens. In case of 17 specimens belonging to the species *Cyprinus carpio* and *Carassius auratus gibelio*, there was noticed the presence of 1-2 parasites at each host fish in the samples taken from the gills and fins.

Keywords: Monogenea, Dactylogyridae, *Cyprinus carpio*, *Carassius auratus gibelio*, the Preajba River.

Rezumat. Prezența ectoparazitului *Dactylogyrus* sp. (Platyhelminthes, Monogenea, Monopisthocotylea: Dactylogyridae) la pești din familia Cyprinidae (*Cyprinus carpio* și *Carassius gibelio*) din lacurile de pe cursul râului Preajba – studiu preliminar. În acest studiu este prezentat ectoparazitul monogeneu *Dactylogyrus* sp. prelevat de la două specii de pești aparținând familiei Cyprinidae, din cele zece lacuri de pe cursul râului Preajba, situat în bazinul inferior al Jiului. Probele au fost obținute în urma examinării celor 70 de exemplare de pești recoltați. La 17 dintre acestea, aparținând speciilor *Cyprinus carpio* și *Carassius auratus gibelio*, în raclatele efectuate de pe branhiile și înotătoare s-a constatat prezența a câte 1-2 paraziți, la fiecare din exemplarele de pești – gazdă cercetați.

Cuvinte cheie: Monogenea, Dactylogyridae, *Cyprinus carpio*, *Carassius auratus gibelio*, râul Preajba.

INTRODUCTION

Monogeneans (platyhelminthes) have representatives in freshwater, brackish and marine habitats, parasitizing cephalopods, fish, amphibians, reptiles and mammals (cetaceans). The vast majority are ectoparasites on the skin and/or gills and fins of agnathan, cartilaginous and bony fish. In all cases they are attached to the surface of the host by a characteristic adhesive apparatus positioned at the posterior end of the worm - *opisthaptor* (caudal disk), which is specific to the species and provided with anchoring central hooks and lateral hooklets or adhesive pads (in monopisthocotyleans), respectively hooks and suckers (in polyopisthocotyleans). The anterior end of the worm, as *prohaptor*, can be provided with clamps (suckers, adhesive pads or adhesion gland) and cephalic openings (MEHLHORN, 1998; WOO, 2006).

Usually, monogenean life cycle is direct (simple, without intermediate host), involving hermaphroditic adults, oval eggs and larvae (oncomiracidium); the eggs fix on the fish tegument by a fixing appendix and after hatching, the larva may remain attached to the fish body or actively pass to another fish. If it does not find another host, the larva can swim for 24 hours and after that it dies (VULPE, 2007).

Due to their pathogenicity monogeneans are often economically important in aquaculture systems (e.g. Cyprinidae, Asian herbivorous fish) and also in natural habitats (for example Acipenseridae and Salmonidae) (WOO, 2006; MUNTEANU & BOGATU, 2008). MOLNAR (1983) reported the identification of two parasite monogenean species on the gills of aquaculture eels: *Pseudodactylogyrus anguillae* Yin et Prostin, 1948 and *P. bini* Kikucki, 1929 (VULPE, 2007).

MATERIAL AND METHODS

The lacustrine complex Preajba - Făcăi is located in Dolj County, 6 km southeast of Craiova, in Preajba and Făcăi settlements. Designated a natural protected area of national interest (according to Law 5/2000), it is located on the Preajba Valley and the Ciliboica Valley, covering a total surface of 28 ha (Figs. 1, 2). The Preajba River represents the main water stream the springs of which are in the neighbourhood of Cârcea settlement. The river receives Craiovița canal 1,200 metres before the confluence with the Jiu River and succeeds to cross the left-side terraces of the Jiu on an east-west direction (Fig. 1).

The identification and numbering of the reservoirs was made from upstream to downstream, based on the orthophotoplans supplied by the Water Basin Administration Jiu using GIS techniques. Thus, this complex is made up of 10 reservoirs (9, from I to IX, on the Preajba River, and one, number X, on its tributary, the Ciliboica). The Preajba River is a permanent river, with a constant flow, as the reservoirs communicate with each other on the principle of communicating vessels through the spillways located in the dam body (IONUȘ et al., 2014) (Fig. 2).

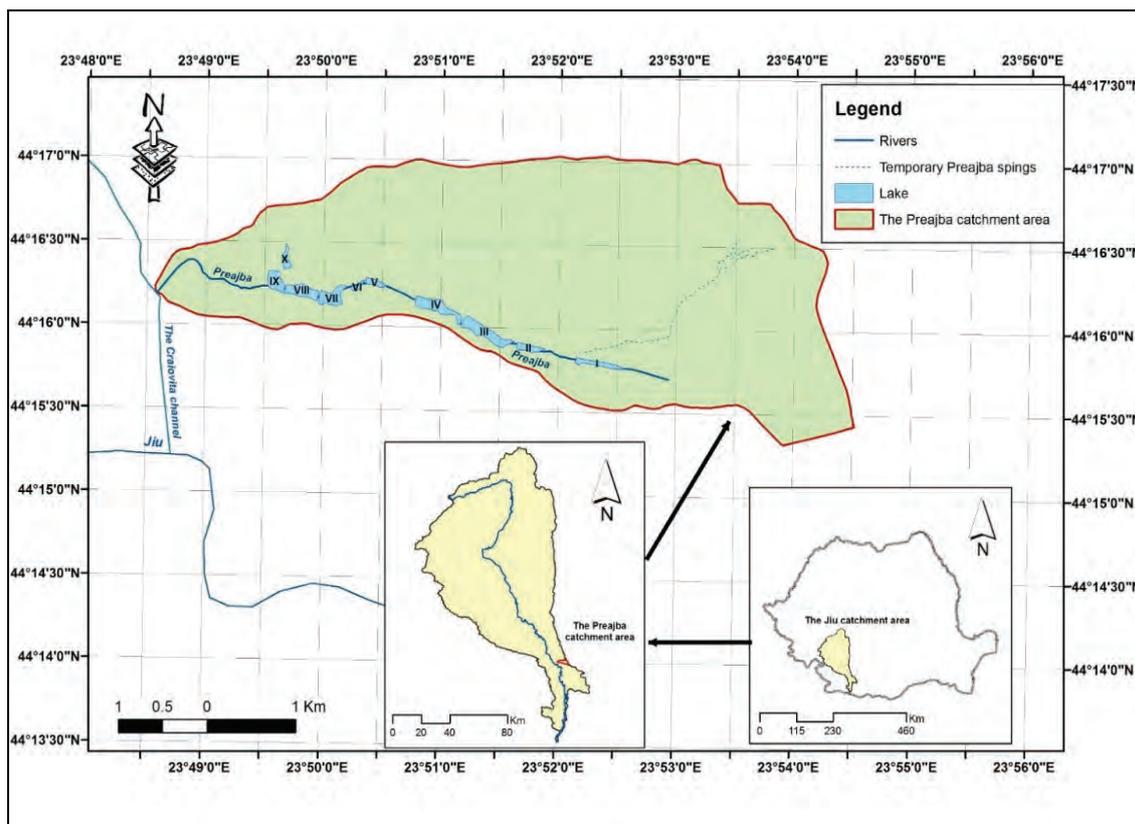


Figure 1. The classification of the Preajba hydrographical basin at national and regional level (GIS processing after the topographical map - 1:50,000 and the Atlas of Water Cadastre of Romania – 1992, after IONUȘ et al., 2014).

Although the status of protected area regulates human interference within the perimeter of the Preajba Valley, there are many violations of these directives by the destruction of certain species habitats and the pollution of the aquatic ecosystem.

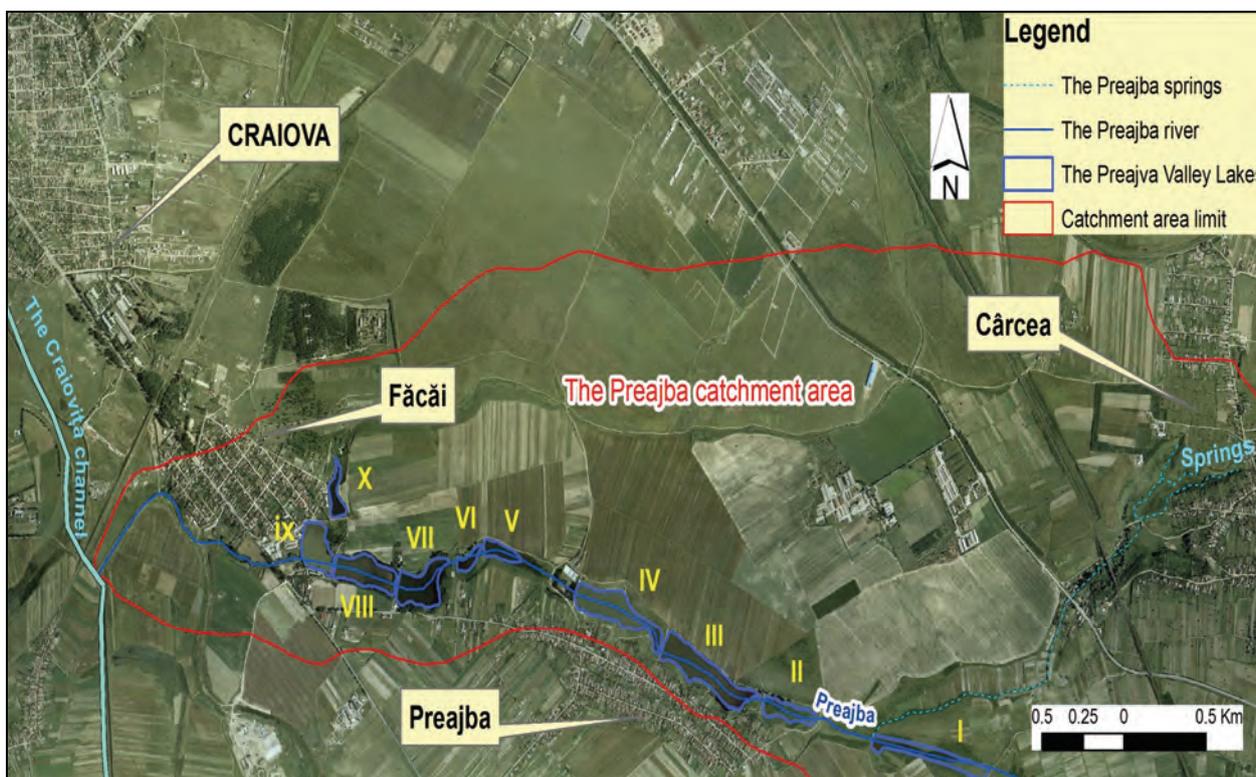


Figure 2. Location and numbering of the reservoirs located along the Preajba Valley (GIS processing after the orthophoto, 1:5,000, 2009).

The study was achieved during the summer of 2014, when there were taken 6 samples from the ten reservoirs (GOGA, 2009, 2010; GOGA & TÎMBURESCU, 2011; GOGA & CODREANU-BĂLCESCU, 2011; GOGA, 2012; GOGA & TÎMBURESCU, 2012, 2013, 2015; GOGA & CODREANU-BĂLCESCU, 2013; IONUȘ et al., 2014; GOGA et al., 2014;).

There were caught 70 specimens of Cyprinidae belonging to the species *Carassius auratus gibelio*, *Cyprinus carpio* and *Abramis brama*; we used rods and three monofilament nets, 100 m long and a mesh size of 4.5-6 cm. The fish specimens were examined in the day they were caught in the parasitology laboratory of the Sanitary Veterinary Direction Dolj, after spinalization. At two of the species, respectively *Carassius auratus gibelio* and *Cyprinus carpio*, there were found lesions at the body surface and there were identified flat ectoparasite helminths. In order to diagnose the material sampled from the lesions (gills, fins and tegument) from the parasitological point of view, there were made fresh preparations (Figs. 3, 4); thus, the mucus was gently scrapped with a surgical knife, put into a drop of water on a lamella and examined with the optic microscope Olympus BX 43, camera lens 2x, 10x; ocular WHN 10x/22 (Fig. 5). As the precise diagnosis cannot be established only by microscopic examination of the wounds where parasites were identified, there were also examined the gills with lesions, the water used to clean the fish gills, fins and teguments with the stereomicroscope Olympus SZX7 (2x, 3.2x camera lens; ocular WHSZ 10x/22), in a Petri dish.



Figure 3. Scraping of the gill mucus with the surgical knife, at the level of the haemorrhagic area, at the species *Carassius gibelio* and *Cyprinus carpio*, for the fresh preparation. (original).



Figure 4. Scraping of the mucus from the caudal fin for the fresh preparation at the species *Cyprinus carpio*. (original).

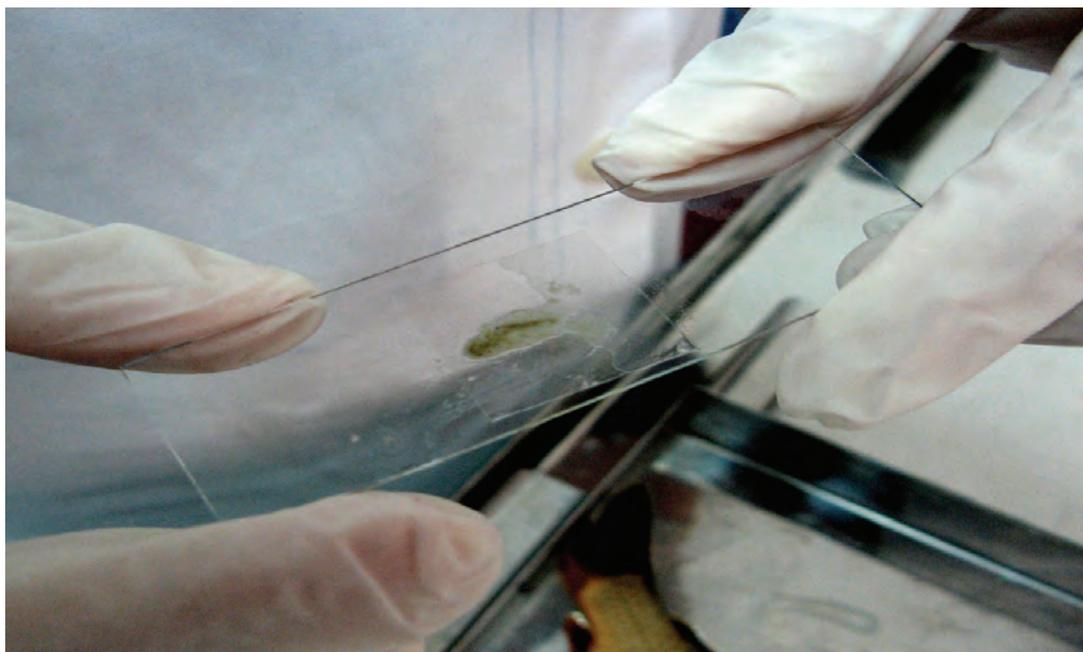


Figure 5. Fresh slide-coverglass preparation obtained after the scraping of the mucus. (original).

RESULTS AND DISCUSSIONS

The macroscopic examination emphasized the presence of an important amount of mucus and small parts with haemorrhagic lesions in the gill cavity and on the caudal fin (Fig. 3) at the two species (*Carassius auratus gibelio* and *Cyprinus carpio*), due to the mechanical and chemical action of the parasites. At a more detailed stereomicroscopic and microscopic analysis, it was emphasized the presence of an ectoparasite worm, with a flatten dorso-ventral body. After examining the 70 specimens sampled from the ten reservoirs, it was noticed the presence of 1-2 parasites per host at 17 specimens (about 30%), in the scraping taken from the gills and the caudal fin (Fig. 5). In the anterior part of the platyhelminthes there are four cephalic contractile papillae with four dark-coloured pigmentation spots that represent the prohaptor (Figs. 6, 7). The posterior part of the body functions as an attachment organ (opisthaptor) (Fig. 7), by means of which it attaches to the host surface. It presents two large median chitinous hooks, sickle-shaped, joined by 1-2 connection plates, as well as small hooks marginally disposed.

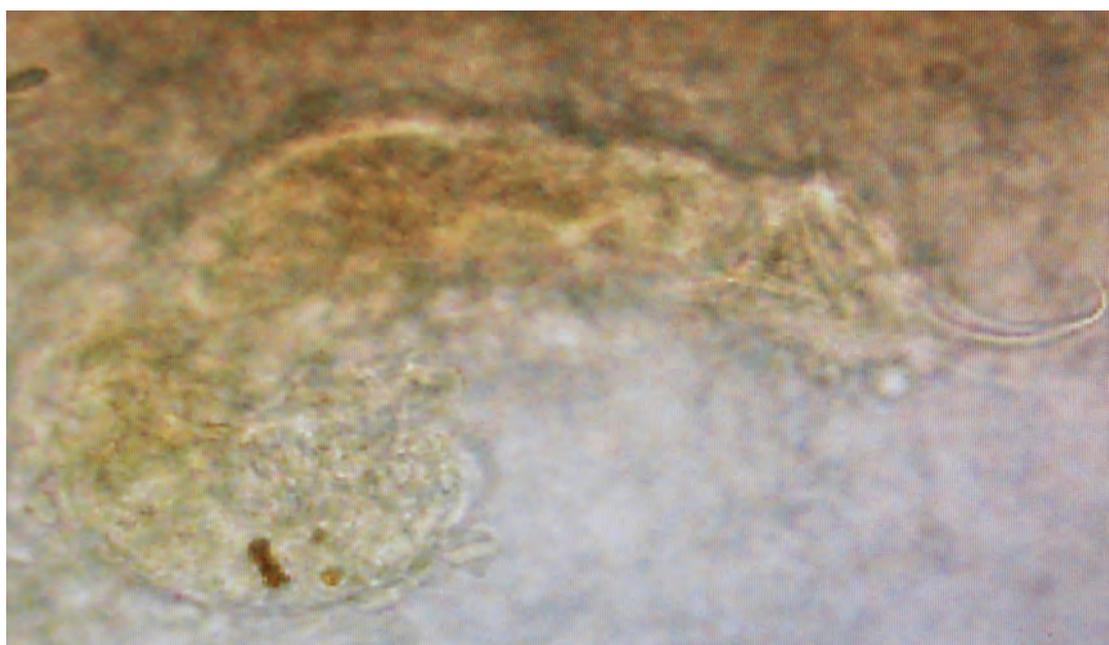


Figure 6. *Dactylogyrus* sp. visualisation of the cephalic pigmentation spots and of the two large median hooks (opisthaptor) obtained from the gill scraping at the optic microscope Olympus BX 43 (camera lens 10x; ocular WHN 10x/22). (original).

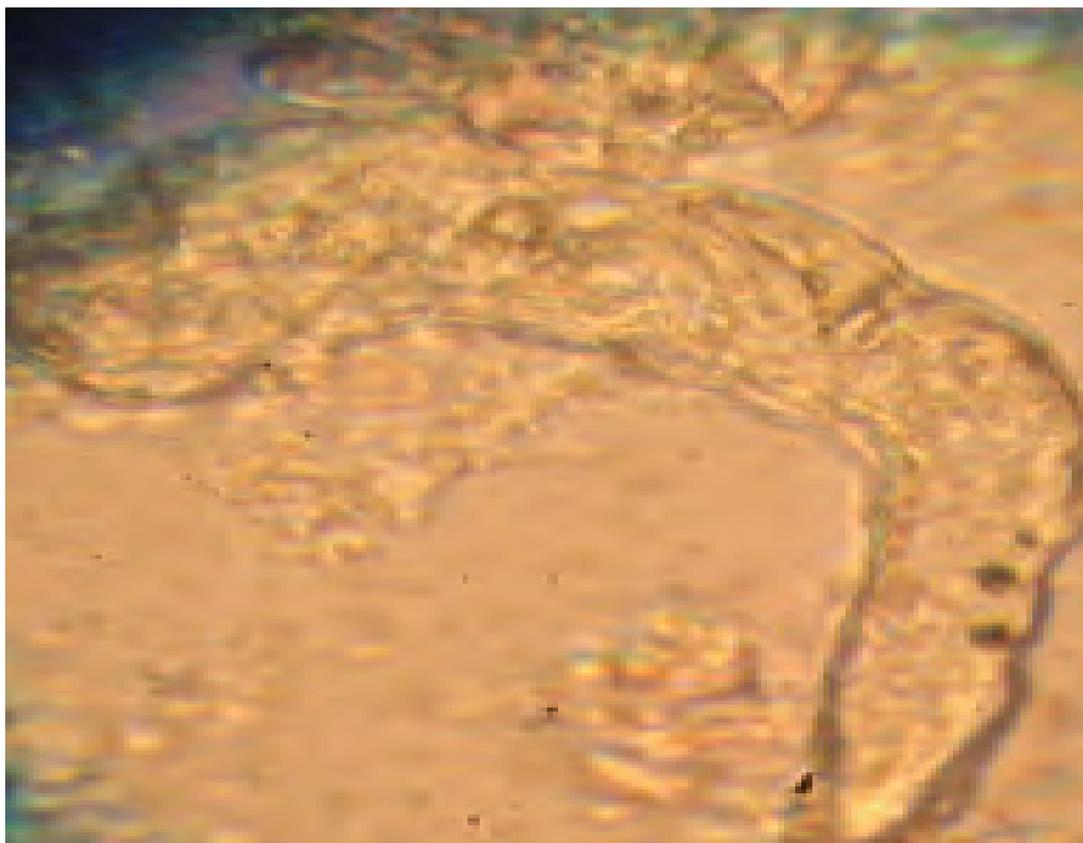


Figure 7. *Dactylogyrus* sp. visualisation of the gill scraping at the optical microscope Olympus BX 43; there are emphasized the anterior part of the worm (prohaptor) and the four pigmentation spots – fresh slide-coverglass preparation (original).

MUNTEANU & BOGATU (2008) estimates that the length of the body in case of the *Dactylogyrus* spp. may reach up to 1 mm, while MEHLHORN (1998) indicates dimensions of 1.3 x 0.3 mm for *Dactylogyrus vastator* (a widely spread parasite on carp gills).

The presence of the two median hooks at the opisthaptor level, as well as the four ocular spots at the anterior end of the body, make us consider that the identified monogenean plathelminth belongs to the genus *Dactylogyrus* Diesing, 1850, Family Dactylogyridae, Order Monopisthocotylea; moreover, we have to take into account that, in Romania, there are known only representatives of the genus *Dactylogyrus* for Dactylogyridae (ROMAN-CHIRIAC, 1960). Considering that the obtained microscopic images did not clearly emphasize other morphologic details, we could not exactly identify the species of the genus *Dactylogyrus* detected in case of *Cyprinus carpio* and *Carassius auratus gibelio* sampled from the Preajba Valley.

Dactylogyridae are parasites of freshwater teleost fish, especially gill ectoparasites of the fish belonging to the family Cyprinidae, and they produce dactylogyrosis. In a recent study on monogenean fauna from the Würm River (Bavaria, Germany), DZIKA et al. (2010) reported 13 monogenean ectoparasite species at 8 examined freshwater fish species. It was emphasized the predominance of the genus *Dactylogyrus* Diesing, 1850, with 10 spp.

Many of the species belonging to the genus *Dactylogyrus* manifest parasitic specificity that may influence the geographical distribution of the parasites according to that of the hosts. For example, *D. crucifer*, *D. nanus*, *D. amphibothrium* are found only in Europe, while *D. intermedius*, *D. borealis*, *D. phoxini* are found in Eurasia and *D. wunderi*, *D. solidus*, *D. anchoratus* are characteristic to Eurasia and North America. There are also some species that have a discontinuous distribution, such as *D. minutus* and *D. bicornis*, which are found only in Europe and the Far East, missing from the other parts of Asia.

As they attach to the host body through hooks, monogeneans mainly exert a traumatic action upon fish and secondly a spoliation action, as they feed on the mucus present on the body and on the blood from the gill capillaries. These actions lead to haemorrhages at the level of the skin and gills, which exhaust the host and favour the development of secondary infections. The species *Dactylogyrus vastator* and *D. solidus*, which affect the gills and fins of both the wild carp and the carp bred in captivity, are extremely dangerous. The carp mortality provoked by these parasites can be assessed in ponds or small enclosed basins. The sick fish swim slowly along the shores and they can be easily caught even by hand. Sick fish stop feeding and the gills got covered by a thick mucus layer.

Although the *Dactylogyrus* sp. found by us at carp and Prussian carp in the reservoirs located along the Preajba Valley was identified in summer and, in the respective area, intensive fishing has not been practiced for a long time, dactylogyrosis evolved subclinically and it did not provoke mass mortality. Most of the collected host fish had hypoxia

marks. The literature in the field mentions that an infestation with 30 such ectoparasites per host may determine mass mortality (RĂDULESCU et al., 1976).

The factors that may trigger the emergence of the parasitosis, taking into account that the reservoirs have not been unclogged for 20 years, are – degradation of the water quality, oxygen deficiency due to eutrophication, deficient food, and increase of the layer of organic substances resulted after the decomposition of the macrophytes that grow excessively in the area.

Certain researchers mention that the abiotic factor (temperature) may have a major influence upon the dynamics of the parasite population (PAPERNA, 1963a, 1963b) and the abundance of the species of *Dactylogyrus* is much higher in case of mature fish as compared to the young specimens in many cases. As they have a reduced number of hosts, in most of the cases, they do not cause pathogen problems in nature (KOSKIVAARA et al., 1991, 1992).

Among previous studies regarding the presence of Dactylogyridae ectoparasite monogeneans at Cyprinidae in Romania, we mention: N. Leon (in the period 1908-1911 in Iasi - *D. auriculatus* at bream); RĂDULESCU & VASILIU (1944) – mentioned *D. anchoratus* on the gills at carp and Prussian carp in the ponds from Nucet, and, in 1947, they studied the disappearance of the carp juveniles in the experimental ponds from Nucet due to a massive infestation with *D. vastator* var. *minor* (both works quoted by ROMAN, 1953); the same authors reported the presence of *D. minutus* at carp in Brateș Lake (1954). ROMAN (1955) determined many species of *Dactylogyrus* parasitizing the gills of the common roach, barbel, common rudd, carp, ide, Prussian carp and common bream in the Danube (Călărași, Mila 23 and Greaca); for the carp and Prussian carp, he mentions *D. anchoratus* for the Danube (Corabia, Călărași, Delta) and its pools (Greaca, Bugeac, Oltina). The most important work is “*Plathelminthes. Clasa Monogenoidea*” from *Fauna României* (ROMAN-CHIRIAC, 1960), where there are presented the main species of *Dactylogyrus* (34) that frequently parasitize both wild cyprinids and the cyprinids bred in captivity. Among these, at *Cyprinus carpio* (wild and aquaculture), *Carassius carassius* and *C. auratus gibelio*, there were registered seven species: *D. anchoratus* (Dujardin, 1845) at carp and *Carassius carassius* in the Danube, Brateș Lake, Nucet station, Razelm-Sinoe lacustrine complex; *D. formosus* Kulwiec, 1927 at *Carassius carassius* and *C. auratus gibelio*, Greaca pool; *D. intermedius* Wegener, 1909 at *Carassius carassius* and *C. auratus gibelio* in the Danube; *D. minutus* Kulwiec, 1927, at the wild and aquaculture carp in Brates Lake; *D. solidus* Wegener, 1909, the wild and aquaculture carp in the Danube and many of its pools; *D. vastator* Nybelin, 1924 at carp, *Carassius carassius* and *C. auratus gibelio*, Nucet Station, Delta and the pools of the Danube, Comana pool; *D. wegneri* Kulwiec, 1927, at *Carassius carassius* and *C. auratus gibelio* in the Danube, Brateș Lake and Comana Pool.

SCHAPERCLAUS (1979, quoted by GHITTINO, 1985) mentions four pathogen species at carp: *Dactylogyrus vastator* Nybelin, 1924; *D. extensus* Mueller; *D. minutus* Kulwiec, 1927; *D. anchoratus* (Dujardin, 1845), and in the monograph edited by WOO (2006), the first three aforementioned species are mentioned as being very important for the parasitological pathology at carp and Prussian carp; there are also added four species of the genus *Dactylogyrus* Diesing, 1850 (*D. lamellatus*, *D. ctenopharingodoni*, *D. hypophthalmichthis*, *D. aristichthis*), parasites of Asian origin of the cyprinids, which were acclimatized in Romania as well, in aquaculture, (genera *Ctenopharingodon*, *Hypophthalmichthis*, *Aristichthis*). MUNTEANU & BOGATU (2008) show that the *Dactylogyrus* species that frequently parasitize cyprinids (wild and captivity) are *D. vastator*, *D. extensus*, *D. hypophthalmichthis*, *D. aristichthis*, *D. lamellatus*, *D. ctenopharingodonis*. As well, in a reservoir on the lower Vistula River (Poland), MIERZEJEWSKA et al. (2010) found one local monogenean *Dactylogyrus* sp. at a colonized asian fish *Percottus glenii* but also determined non-indigenous monogenean *Gyrodactylus proterorhini*, a possible case of parasitic specificity known among monogenean ectoparasite and their host-fish.

CONCLUSIONS

Dactylogyrus sp. was sampled in summer at *Carassius auratus gibelio* and *Cyprinus carpio*, two species of Cyprinids this ectoparasite monogenean genus manifests affinity for, being localized both at the level of the gills and the caudal fin (at the species *Cyprinus carpio*).

The increased water temperature, the presence of macrophytes in excess, eutrophication process and the fact that parasitized fish can easily penetrate downstream, swimming from one reservoir to another, through spillways, are just some of the causes that may trigger the appearance and development of the parasite.

As in these reservoirs it is exclusively practiced rod fishing and only by amateur fishermen, the parasitosis evolved subclinically, which can be a consequence of another massive infestation from the previous years, when fish acquired over-invasional immunity that limit further invasions.

In order to treat the reservoirs affected by the disease the specialized literature recommends 0.5 mg/l of Triclorfon solution.

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