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NEW DATA ON THE PARASITES AND THE PARASITE COMMUNITIES OF *CHONDROSTOMA NASUS* (LINNAEUS, 1758) FROM THE DANUBE RIVER, NORTHWESTERN BULGARIA

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Abstract

In the spring of 2020, ecoparasitological studies were conducted on 30 specimens of common nase (Chondrostoma nasus (Linnaeus, 1758)) from the freshwater ecosystem Danube River near Kudelin village, northwestern Bulgaria. Two parasite species were determined. One species - Proteocephalus torulosus (Batsch, 1786), juvenile, belongs to the class Cestoda. The other one - Contracaecum sp., larvae, belongs to the class Nematoda. C. nasus is a new host for P. torulosus in the studied area. In the study, Contracaecum sp., larvae was a core parasite species (P% = 90.00) in the component community of C. nasus from the Danube River (Kudelin). For Contracaecum sp. larvae, the highest mean intensity (MI = 18.15) and the highest mean abundance (MA = 16.33) were found.

Key words*: Bulgaria, Chondrostoma nasus, Danube River, parasites, parasite communities.*

INTRODUCTION

The Danube River crosses the territory of ten countries in Europe (Sakan et al., 2011), connecting many cities located along it, including four European capitals – Vienna, Bratislava, Budapest, and Belgrade (Baltălungă & Dumitrescu, 2008). The river is 2,857 km long (Mocanu et al., 2020) and reaches the Black Sea (Sakan et al., 2011). The Danube River is characterized by having a great variety of fish, over 100 species (Ibănescu et al., 2020). The ichthyofauna of the Bulgarian section of the river is also rich (www.bd-dunav.org). The fish parasites are also an important element of biodiversity in freshwater ecosystems (Scholz, 1999). Various authors present data on parasites on *Chondrostoma nasus* (Linnaeus, 1758) from the Danube River basin (Djikanović et al., 2012; Djikanović et al., 2013; Marković & Novakov, 2015, etc.). Parasitological studies of common nase from the Bulgarian section of the Danube River are few (Kirin et al., 2013; Zaharieva & Kirin, 2020b; Zaharieva & Zaharieva, 2020a; 2020b). Various authors have conducted investigations on parasites of different fish species (bleak, *Alburnus alburnus*; freshwater bream, *Abramis brama*; barbel, *Barbus barbus*)) from the Danube River's Bulgaria section (Chunchukova & Kirin, 2017; Chunchukova et al., 2017; Chunchukova & Kirin, 2018; Chunchukova et al., 2018; Chunchukova & Kirin, 2020; Zaharieva & Kirin, 2020a; Zaharieva & Zaharieva, 2020c; 2020d). The present study aims to provide new data on the parasites and the parasite communities of common nase (*Chondrostoma nasus* (L., 1758)) from the Danube River near the Kudelin village, northwestern Bulgaria.

MATERIALS AND METHODS

Thirty specimens of *Chondrostoma nasus* (Linnaeus, 1758) were collected from the Bulgarian section of the Danube River after the river enters Bulgaria's territory, close to the village of Kudelin. The Kudelin village is located on the Vidin area territory, in northwestern Bulgaria, about 1.5 – 2 km from the Bulgarian-Serbian border (Figure 1). The fish were caught on the base of a fishing permit issued by the Executive Agency of Fisheries and Aquaculture. The scientific name of the species is presented by Froese & Pauly (2019). For all caught specimens, maximum length and a maximum height of the body, as well as weight (L, H and G), were recorded (Table 1).

Table 1. Length, height and weight (L, H and G) of *Chondrostoma nasus* from the Danube River (Kudelin)

CHONDROSTOMA NASUS **(N = 30)**	**MIN-MAX**	**MEAN ± SD**
L (cm)	30.9-38	33.45 ± 1.96
H (cm)	6.5-9.8	8.09 ± 0.75
G (g)	280-506	369.33 ± 55.04

Figure 1. Danube River (Kudelin) (www.icpdr.org)

All 30 specimens of common nase were subjected to ecoparasitological examination by the methods specified by Petrochenko (1956); Zashev & Margaritov (1966); Kakacheva-Avramova (1983); Bauer (Ed.) (1987); Moravec (2013). For each identified parasite species, mean intensity (MI), mean abundance (MA), and prevalence (P%) were recorded according to Bush et al. (1997). In accordance with the prevalence, the parasite species were defined as accidental (P% < 10), component (10 < P% < 20) and core (P% > 20) by Kennedy (1993). In the study, were reported the total number of species, the mean number of parasites and the Brillouin's diversity index (HB) (Magurran, 1988).

RESULTS AND DISCUSSIONS

During the spring of 2020, 30 specimens of *Chondrostoma nasus* were caught from the Danube River near the village of Kudelin.

The collected specimens were subjected to ecoparasitological investigation.

The common nase (*Chondrostoma nasus* L., 1758) belongs to the family Cyprinidae. The species is found in the Danube River and other rivers on the territory of Bulgaria.

The common nase uses aquatic plants for food (Karapetkova & Zhivkov, 2006).

Helminth community structure

For the spring of 2020, two species of parasites were identified - one species from class Nematoda (*Contracaecum* sp., larvae) and one species from class Cestoda (*Proteocephalus torulosus* (Batsch, 1786), juvenile) (Table 2).

Table 2. Diversity of parasite species of *Chondrostoma nasus* from the Danube River (Kudelin village) in 2019 and 2020

Parasite species	***Chondrostoma nasus*, Danube River, Kudelin**	
	Spring, 2019 (Zaharieva & Kirin, 2020b)	**Spring, 2020**
Allocreadium isoporum (Looss, 1894)	•	
Bothriocephalus acheilognathi (Yamaguti, 1934), immature	•	
Proteocephalus torulosus (Batsch, 1786), juvenile		•
Pomphorhynchus laevis (Müller, 1776)	•	
Raphidascaris acus (Bloch, 1779), larvae	•	
Contracaecum sp., larvae	•	•
Hysterothylacium sp., larvae	•	
Pseudocapillaria tomentosa (Dujardin, 1843)	•	

Zaharieva & Kirin (2020b) studied 49 specimens of *C. nasus* from the Danube River (Kudelin) in the spring of 2019 and reported seven parasite species.

The cestode *P. torulosus*, which was reported in 2020, was not identified in the 2019 study (Table 2). The reasons for the lower infection in 2020 compared to 2019 are probably related to the large differences in water levels of the two years and general to the different climatic conditions during these two periods.

Kirin et al. (2013) studied the parasite fauna of 16 species of fish from Lake Srebarna and the Danube River's lower current in Bulgaria.
One of the studied fish species was a common nase. The authors found that the studied specimens of *C. nasus* were not infected. Few authors examined parasites on *Chondrostoma nasus* from the Danube River basin.
P. torulosus was reported as a parasite on *Alburnus alburnus* (Linnaeus, 1758), *Leuciscus idus* (Linnaeus, 1758), *Rutilus rutilus* (Linnaeus, 1758) (Margaritov, 1959; Kakacheva et al. 1978), *Squalius cephalus* (Linnaeus, 1758) (Syn. *Leuciscus cephalus*; Cakić et al., 2004); from the Danube River for the territory of Bulgaria.
Djikanović et al. (2012) reported the cestode *Proteocephalus torulosus* (Batsch, 1786) in common nase from the Danube River, Serbia.
Marković & Novakov (2015) established the trematode *Posthodiplostomum cuticola* (Nordmann, 1832) on common nase from Međuvršje Reservoir located along the West Morava River, part of the Danube River basin in Serbia.

Component community
In the present study, the nematodes were represented by the largest number of specimens (a total of 490 specimens, of which the maximum number of parasite specimens (*Contracaecum* sp., larvae) established in one specimen common nase was 109 specimens). The nematode *Contracaecum* sp. larvae was a core parasite species (P% = 90.00), while the cestode *P. torulosus*, juvenile, was an accidental parasite species (P% = 3.33) in the parasite community of common nase. *Contracaecum* sp. had the highest mean intensity (MI) and the highest mean abundance (MA), respectively MI = 18.15 and MA = 16.33 (Table 3). Zaharieva & Kirin (2020b) identified seven parasite species of common nase from the Danube River (Kudelin) for the spring season of 2019 and reported the highest mean intensity (MI = 36.38) and the highest mean abundance (MA = 17.82) for the nematode *Contracaecum* sp., larvae, which was also a core species in the parasite community of common nase (P% = 48.98). The nematode *Raphidascaris acus*, larvae was also mentioned as a core species (P% = 44.90).

Table 3. Ecological terms of parasites and parasite communities of *Chondrostoma nasus* from the Danube River (Kudelin)

Parasite species	Kudelin N = 30					
	n	p	MI	MA	P%	Range
Proteocephalus torulosus (Batsch, 1786), juvenile	1	2	2.00	0.07	3.33	2
Contracaecum sp., larvae	27	490	18.15	16.33	90.00	1-109

N - number of examined fish, n - number of infected fish, p - number of fish parasites, MI - mean intensity, MA - mean abundance, P% - prevalence.

Infracommunity
Of the studied 30 specimens of *C. nasus*, three specimens of common nase (10%) were not infected, 26 specimens of common nase (86.67%) were infected with one parasite species, and one specimen of common nase (3.33%) was infected with two parasite species (Figure 2; Table 4).
The parasites number in the infracommunity of common nase from the Danube River (Kudelin) varied from 1 to 109 in one specimen of *C. nasus*. During the study, 492 parasite specimens were investigated. The Brillouin's diversity index is very low (HB = 0.024) due to the infection with only two species of parasites, one of which (*P. torulosus*) was represented by only two specimens (Table 4).

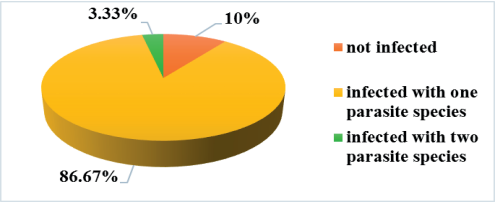

Figure 2. Infection of *C. nasus* from the Danube River (Kudelin)

Table 4. Infracommunity of *C. nasus* from the Danube River (Kudelin)

Number of specimens *Chondrostoma nasus*	Number of parasite species		
	0	1	2
	3	26	1
Total number of species (Mean number of species ± SD)	2 (0.96 ± 0.36)		
Total number of specimens (Mean number of specimens ± SD)	492 (9.48 ± 27.67)		
Brillouin's diversity index (HB)	0.024		

CONCLUSIONS

Thirty specimens of common nase (*Chondrostoma nasus* L., 1758) were studied for the presence of parasites. The fish were collected from the Bulgarian section of the Danube River near the village of Kudelin in the spring of 2020. During the ecoparasitological examination, two species of parasites were found - *Proteocephalus torulosus*, juvenile (class Cestoda) and *Contracaecum* sp., larvae (class Nematoda). *C. nasus* is a new fish host for *P. torulosus* in the studied area (Kudelin). The highest prevalence (P% = 90.00) was for the nematode *Contracaecum* sp. The number of larvae *Contracaecum* sp. found in one specimen of common nase ranged from 1 to 109. The Danube River near the village of Kudelin is a new habitat for *P. torulosus* as a parasite of common nase. *C. nasus* is a new host for *P. torulosus* in Bulgaria.

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REFERENCES

Baltălungă, A.A., & Dumitrescu, D. (2008). The Role of the Danube River as the Main Waterway of Central and South Eastern Europe. Geopolitical and Economic Aspects. *Romanian Review on Political Geography*, *1*. 57–66.

Bauer, O. (Ed.) (1987). *Key to the Parasites of Freshwater Fishes of the USSR*. Leningrad, RU: Nauka Publishing House (in Russian).

Bush, A., Lafferty, K., Lotz, J., & Shostak, A. (1997). Parasitology meets ecology on its own terms. *Journal of Parasitology*, *83*, 575–583.

Cakić, P., Lenhardt, M., Kolarević, J., Nedeva, I., Radev, V., Karaivanova, E., & Atanassov G. (2004). The first data on chub (*Leuciscus cephalus* L.) parasites in the Serbian part of the Danube River. In: *Proceedings of the 35th Conference of IAD*, 49–55.

Chunchukova, M., & Kirin, D. (2017). Relationships in the system *Barbus barbus* - *Pomphorhynchus tereticollis* - *Unio tumidus* in connection with the circulation of lead in the freshwater ecosystem of the Danube River, Bulgaria. *Agricultural Sciences*, *9*(21), 71–75.

Chunchukova, M., Kirin, D., Kuzmanova, D., & Shukerova, S. (2017). Accumulation of lead in *Abramis brama* and its parasite *Pomphorhynchus tereticollis* from Danube River (Vetren area), Bulgaria. *Scientific Papers, Series D, Animal Science*, *LX*, 327–332.

Chunchukova, M., & Kirin, D. (2018). New data on endohelminth communities of barbel *Barbus barbus* from the Bulgarian part of the River Danube. *Helminthologia*, *55*, 222–229.

Chunchukova, M., Kirin, D., & Kuzmanova, D. (2018). Gastrointestinal helminth fauna and helminth communities of bleak (*Alburnus alburnus*, L. 1758) from lower section of Danube river, Bulgaria. *Bulgarian Journal of Veterinary Medicine*, *22*(3), 344–352.

Chunchukova, M., & Kirin, D. (2020). New data on the helminth fauna of *Abramis brama* from the Danube River, Bulgaria. *Scientific Papers. Series D. Animal Science*, *LXIII* (2), 473–478.

Djikanović, V., Paunović, M., Nikolić, V., Simonović, P., & Cakić, P. (2012). Parasitofauna of freshwater fishes in the Serbian open waters: a checklist of parasites of freshwater fishes in Serbian open waters. *Reviews in Fish Biology and Fisheries*, *22*, 297–324.

Djikanović, V., Skorić, S., & Cakić, P. (2013). Representatives of tapeworms (Cestoda) of fishes in Belgrade section of the Danube River. In: *VI. International Conference "Water & Fish" Faculty of Agriculture*, Belgrade-Zemun, Serbia, 402–408.

Froese, R., Pauly, D. (Ed.) (2019). FishBase. World Wide Web electronic publication. Retrieved October 10, 2019, www.fishbase.org.

Ibănescu, D., Popescu, A., & Vasilean, I. (2020). An analysis of the dynamics of fishing catches in the romanian danube sector. *Scientific Papers. Series D. Animal Science*, *LXIII* (2), 521–525.

Kakacheva-Avramova, D. (1983). Helminths of freshwater fishes in Bulgaria. Sofia, BG: Bul. Acad. Sci. (in Bulgarian).

Kakacheva D., Margaritov N., Grupcheva G., (1978). Fish parasites of Bulgarian part of the Danube River. Limnology of Bulgarian part of the Danube River, *Bulg. Acad. Sci*., 250-271 (In Bulgarian).

Karapetkova, M., Zhivkov, M. (2006). *Fishes in Bulgaria*. Sofia, BG: GeaLibris Publishing House (in Bulgarian).

Kennedy, C. (1993). The dynamics of intestinal helminth communities in eels *Anguilla anguilla* in a small stream: long-term changes in richness and structure. *Parasitology*, *107*, 71–78.

Kirin, D., Hanzelova, Vl., Shukerova, S., Hristov, St., Turcekov, L., & Spakulova, M. (2013). Helminth communities of fishes from the River Danube and Lake Srebarna, Bulgaria. *Scientific Papers, Series D. Animal Science*, *LVI*, 333–340.

Magurran, A. (1988). *Ecological diversity and its measurement*. London, UK: Cambridge University Press.

Margaritov N. (1959). *Parasites of some freshwater fishes*. Varna, BG: NIRRP Publishing House.

Marković, G., & Novakov, N. (2015). Distribution and some ecological impacts of fluke *Posthodiplostomum cuticola* (Digenea, Trematodes) on the ichthyofauna of the Zapadna Morava River (Danube Basin, Serbia). In: *"One Health - New Challenges",* First International Symposium of Veterinary Medicine (ISVM2015), Vrdnik, Serbia, 374–378.

Mocanu, M., Oprea, L., Cordeli (Săvescu), A. N., & Crețu, M. (2020). *Alosa immaculate* Bennet, 1835: A short review of the species and its biology. *Scientific Papers. Series D. Animal Science*, *LXIII* (1), 516–521.

Moravec, F. (2013). *Parasitic Nematodes of Freshwater fishes of Europe*. Praha, CZ: Academia Publishing House.

Petrochenko, V. (1956). *Acanthocephalus domestic and wild animals*. Moskow, RU: AN USSR (in Russian).

Sakan, S., Đorđević, D., Dević, G., Relić, D., Anđelković, I., & Đuričić, J. (2011). A study of trace element contamination in river sediments in Serbia using microwave-assisted aqua regia digestion and multivariate statistical analysis. *Microchemical Journal*, *99*, 492–502.

Scholz, T. (1999). Parasites in cultured and feral fish. *Veterinary Parasitology*, *84*, 317–35.

Zaharieva, R., & Kirin, D. (2020a). New data on parasites and parasite communities of*Alburnus alburnus* (Linnaeus, 1758) from the Danube River. *Scientific Papers. Series D. Animal Science*, *LXIII* (2), 393–400.

Zaharieva, R., & Kirin, D. (2020b). Parasites and parasite communities of the common nase (*Chondrostoma nasus* (Linnaeus, 1758)) from the Danube River. *Scientific Papers. Series D. Animal Science*. *LXIII* (2), 409–416.

Zaharieva, P., & Zaharieva, R. (2020a). Ecologohelminthological investigations and circulation of arsenic in the system water – sediments – *Chondrostoma nasus* – *Contracaecum* sp., larvae from the Danube River. In: *International May Conference on Strategic Management – IMCSM20*, Bor, Serbia, *XVI* (1), 120–126.

Zaharieva, P., & Zaharieva, R. (2020b). Helminth communities of *Chondrostoma nasus* (Linnaeus, 1758) and their bioindicator role for the accumulation of cadmium from the Danube River, Bulgaria. In: *International May Conference on Strategic Management – IMCSM20*, Bor, Serbia, *XVI* (1), 127–135.

Zaharieva, R., & Zaharieva, P. (2020c). Parasite communities and a content of cadmium in the system water - sediments – *Abramis brama* from the Danube River, Bulgaria. In: *International May Conference on Strategic Management – IMCSM20*, Bor, Serbia, *XVI* (1), 136–144.

Zaharieva, R., & Zaharieva, P. (2020d). Parasite communities of *Abramis brama* and accumulation of some pollutans from Danube River, northwestern Bulgaria. In: *International May Conference on Strategic Management – IMCSM20*, Bor, Serbia, *XVI* (1), 145–154.

Zashev, G., & Margaritov, N. (1966). *Diseases of fish*. Sofia, BG: Nauka i izkustvo (in Bulgarian).

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