Scientific Papers. Series D. Animal Science. Vol. LXIV, No. 1, 2021
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

PARASITES AND PARASITE COMMUNITIES OF *VIMBA VIMBA* (LINNAEUS, 1758) FROM THE DANUBE RIVER, NORTHWESTERN BULGARIA

Radoslava ZAHARIEVA, Diana KIRIN

Agricultural University-Plovdiv, Department of Agroecology and Environmental Protection, 12 Mendeleev Blvd, Plovdiv, 4000, Bulgaria

Corresponding author email: radoslava.zaharieva7@gmail.com

Abstract

In 2020, 37 specimens of vimba bream (Vimba vimba Linnaeus, 1758) from the Danube River near the village of Kudelin were examined for parasites. Four parasite species were established: Nicolla skrjabini (Iwanitzky, 1928) and Posthodiplostomum cuticola (von Nordmann, 1832) (Trematoda); Pomphorhynchus laevis (Zoega in Müller, 1776) (Acanthocephala) and Philometra rischta Skrjabin, 1917 (Nematoda). The study aims to provide new data on parasites and parasite communities of Vimba vimba from the Danube River's freshwater ecosystem near the village of Kudelin in northwestern Bulgaria. In the study, the prevalence (P%), mean intensity (MI), mean abundance (MA) and the Brillouin's diversity index (HB) were presented and discussed.

Key words*: Bulgaria, Danube River, parasites, parasite communities, Vimba vimba.*

INTRODUCTION

The Danube River is one of the largest rivers in Europe, with a length of 2,857 km (Ilie et al., 2017). The river passes through many countries, while for others, the river only forms its borders (Pantelica et al., 2012).

The Danube River is the border between the Republic of Bulgaria and the Republic of Romania in 470 km - a sector characterized by a great fish diversity (Zarev et al., 2013).

The fish are hosts of various parasite species (Amer, 2014). Not only the ichthyofauna of the Danube River but also the parasite fauna of different fish species from the Bulgarian section of the river is a subject of research by several authors (Chunchukova & Kirin, 2017; Chunchukova et al., 2017; Chunchukova & Kirin, 2018; Chunchukova et al., 2018; Chunchukova & Kirin, 2020; Chunchukova et al., 2020; Zaharieva & Kirin, 2020a; 2020b; Zaharieva & Zaharieva, 2020a; 2020b; 2020c; 2020d). Research on parasites of *Vimba vimba* (Linnaeus, 1758) from the Danube River and its basin was conducted by a few authors (Diaconescu et al., 2010; Djikanović et al., 2012).

The present study aims to provide new data on parasites and parasite communities of vimba bream from the Danube River, Kudelin village, northwestern Bulgaria.

MATERIALS AND METHODS

In 2020, 37 specimens of *Vimba vimba* (Linnaeus, 1758) from the upper current of the Bulgarian section of the Danube River in the Kudelin village's vicinities were caught and studied. The village of Kudelin (44°11′30″N, 22°40′5″E) is located in the Vidin Lowland, in the North-Western part of Bulgaria. The village is situated in the immediate proximity of the borders between three countries - Bulgaria, Romania and Serbia (Figure 1).

Figure 1. Danube River, Kudelin village, Bulgaria (www.icpdr.org)

Using fishing gear specified in a fishing permit were caught the fish. The permit was issued by the Executive Agency of Fisheries and Aquaculture (EAFA). According to Karapetkova & Zhivkov (2006) were identified the caught fish. The weight (G), as well as the maximum length (L) and maximum height (H) of the body of the studied specimens *V. vimba*, were recorded (Table 1).

Table 1. Maximum body length, height and weight (L, H and G) of *Vimba vimba* from the Danube River (Kudelin village)

Vimba vimba **(N = 37)**	**Min. - max.**	**Mean ± SD**
L (cm)	15.5-33	20.68 ± 5.90
H (cm)	3.3-8.5	4.87 ± 1.55
G (g)	32-486	111.24 ± 116.14

All 37 collected specimens of vimba bream were tested for parasites according to methods described by Petrochenko (1956); Zashev & Margaritov (1966); Kakacheva-Avramova (1983); Bauer (Ed.) (1987); Moravec (2013). Permanent and temporary microscopic slides were prepared, according to Zashev & Margaritov (1966); Georgiev et al. (1986), and Moravec (2013), to identify the parasite species. In this study, the prevalence (P%); mean intensity (MI); mean abundance (MA) and Brillouin's diversity index (HB) were calculated and presented (Magurran, 1988; Bush et al.,1997).

RESULTS AND DISCUSSIONS

The subject of this parasitological research were 37 specimens of vimba bream (*Vimba vimba* Linnaeus, 1758). The fish were caught in 2020 from the Danube River near Kudelin, located in the northwestern part of Bulgaria. *Vimba vimba* is a freshwater, brackish, benthopelagic fish from the Cyprinidae family (Karapetkova & Zhivkov, 2006; Froese & Pauly, 2020).

Helminth community structure

Parasitological examination of vimba bream *V. vimba* from the Danube River (Kudelin) revealed the presence of four species of parasites: two parasite species of class Trematoda: *Nicolla skrjabini* (Iwanitzky, 1928) and *Posthodiplostomum cuticola* (von Nordmann, 1832); one parasite species of class Acanthocephala: *Pomphorhynchus laevis* (Zoega in Müller, 1776) and one parasite species of class Nematoda: *Philometra rischta* (Skrjabin, 1917) (Table 2).

Table 2. Parasite species diversity of *Vimba vimba* from the Danube River, Kudelin

Parasite species	***Vimba vimba*, Danube River, Kudelin, 2020**
Nicolla skrjabini (Iwanitzky, 1928)	•
Posthodiplostomum cuticola (von Nordmann, 1832), metacercaria	•
Pomphorhynchus laevis (Zoega in Müller, 1776)	•
Philometra rischta (Skrjabin, 1917)	•

Component community

The component community of *Vimba vimba* from the Danube River, Kudelin, northwestern Bulgaria, was studied. The trematodes were present at the highest number (2 species with > 1,205 specimens), followed by the acanthocephalans (1 species with 99 specimens). The nematodes had the smallest number of specimens (1 species with four specimens). In the component community of

V. vimba from the Danube River, Kudelin, *Posthodiplostomum cuticola*, and *Pomphorhynchus laevis* were core parasite species with a prevalence (P%) respectively P% = 32.43 and P% = 29.73. *Philometra rischta* (P% = 8.11) and *Nicolla skrjabini* (P% = 5.41) were accidental parasite species in the parasite community of vimba bream. The highest mean intensity (MI) and the highest mean abundance (MA) were found for the parasite *P. cuticola* (MI = 100.00; MA = 32.43) (Table 3).

Table 3. Main ecological terms of parasite and parasite communities of *Vimba vimba* from the Danube River, Kudelin

Parasite species	Kudelin N = 37					
	n	p	MI	MA	P%	Range
Nicolla skrjabini (Iwanitzky, 1928)	2	5	2.50	0.14	5.41	1-4
Posthodiplostomum cuticola (von Nordmann, 1832), metacercaria	12	> 1,200	100.00	32.43	32.43	> 100
Pomphorhynchus laevis (Zoega in Müller, 1776)	11	99	9.00	2.68	29.73	1-47
Philometra rischta Skrjabin, 1917	3	4	1.33	0.11	8.11	1-2

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

Infracommunity

Of the thirty-seven specimens of vimba bream subjected to parasitological examination, it was found that 13 specimens of *V. vimba* or 35.14% were not infected; 20 specimens of *V. vimba* or 54.05% were infected with one parasite species, and four specimens of *V. vimba* or 10.81% were infected with two parasite species (Figure 2; Table 4).

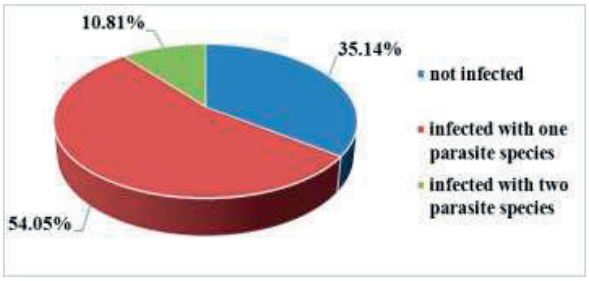

Figure 2. Infection of *Vimba vimba* from the Danube River, Kudelin

The study showed that in the parasite infracommunity of vimba bream, the number of detected parasites ranged from 1 to > 100. The subject of research was more than 1,308 specimens of parasites. Brillouin's diversity index is low (Table 4).

Table 4. Infracommunity of *Vimba vimba* from the Danube River, Kudelin

Number of specimens *Vimba vimba*	Number of parasite species		
	0	1	2
	13	20	4
Total number of species (Mean number of species ± SD)	4 (0.18 ± 0.36)		
Total number of specimens (Mean number of specimens ± SD)	> 1.308 (8.84 ± 14.15)		
Brillouin's diversity index (HB)	0.308		

Few authors have carried out studies on parasites of *Vimba vimba* (Linnaeus, 1758) from the Danube River and rivers in the Danube basin. For the Bulgarian section of the river, the species *N. skrjabini* has been reported for the region of the city of Vidin (Koshava village; Novo selo village; Vetren village, etc.). *V. vimba* is a new host record for *N. skrjabini*. Kudelin is a new locality of the Danube Water Basin for the parasite species. *N. skrjabini* has been reported for other species of freshwater fish (Margaritov, 1959; Kakacheva-Avramova, 1977; Kakacheva et al., 1978; Atanasov, 2012; Kirin et al., 2013; Zaharieva & Kirin, 2020a). *P. citicola* was reported for *Alburnus alburnus* near the villages of Kudelin and Novo Selo (Zaharieva & Kirin, 2020a). The species *P. laevis* was known for the Bulgarian section of the Danube River of the host *V. vimba*, from the region of Vidin, but is not reported for Kudelin (Kakacheva-Avramova, 1977; Kakacheva et al., 1978), and also as a parasite of *Alburnus alburnus* and *Chondrostoma nasus* from Kudelin (Zaharieva & Kirin, 2020a; 2020b). The nematode *Ph. rischta* has not been reported for the parasite fauna of *V. vimba* in Bulgaria. The species is reported for the first time for the Bulgarian section of the Danube River. Zaharieva & Zaharieva (2020c; 2020d) found 6 and 5 parasite species of *Abramis brama* from the Danube River (Kudelin), including *N. skrjabini*, *P. cuticola* and *P. laevis*. Nedeva et al. (2003) reported *P. laevis* in the Danube River in the Republic of Serbia and the Bulgarian sector of the river (the villages Archar, Botevo, Gomotartsi), including on host *V. vimba*. Leimgruber et al. (2005) reported *P. laevis* in the Austrian section of the Danube River. The species was announced in the Danube River's Czech Republic and Slovakia sections (Moravec, 2001). Diaconescu et al. (2010) studied 11 fish species for parasites from the Danube River Delta in Romania. The authors found the trematode *Posthodiplostomum cuticola* on *V. vimba*, etc.

CONCLUSIONS

In 2020, 37 specimens of *Vimba vimba* (Linnaeus, 1758) from the Bulgarian section of the Danube River close to the village of Kudelin were caught and subjected to ecoparasitological studies. Twenty four specimens of *V. vimba* were infected with four parasite species – the trematodes *N. skrjabini* and *P. cuticola*, the acanthocephalans *P. laevis* and the nematodes *Ph. rischta*. Two species of parasites *P. cuticola* (P% = 32.43) and *P. laevis* (P% = 29.73) were core parasite species in the component community of *V. vimba*. The Brillouin's diversity index was low (HB = 0.308) due to the presence of only four species and the apparent dominance of one species with a very high number (*P. cuticola*). *V. vimba* is a new host for *N. skrjabini*, *P. cuticola*, *Ph. rischta* in Bulgaria. *Ph. rischta* is reported for the first time for the Bulgarian section of the Danube River. The Danube River, Kudelin village, is a new habitat for *Ph. rischta* as parasites of *V. vimba* from this study.

ACKNOWLEDGEMENTS

We are grateful to the Agricultural University – Plovdiv and the Centre of Research, Technology Transfer and Protection of Intellectual Property Rights for the approved funding for project No. 05-20, "Support of doctoral programs".

REFERENCES

Amer, O.S.A. (2014). The impact of fish parasites on human health (Review Article). *Journal of the Egyptian Society of Parasitology*, *44*(1), 249–274.

Atanasov, G. (2012). *Fauna, morphology and biology on the endohelminths of fish from Bulgarian part of the Danube River*. PhD these, Sofia.

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.

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. (2018). New data on endohelminth communities of barbell *Barbus barbus* from the Bulgarian part of the River Danube. *Helminthologia*, *55*, 222–229.

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.

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., & Kuzmanova, D. (2020). Arsenic content in the parasite-host systems: *Pomphorhynchus laevis-Abramis brama* and *Acanthocephalus lucii-Abramis brama*. *Scientific Papers. Series D. Animal Science*, *LXIII* (2), 387–392.

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.

Diaconescu, C., Urdeș, L., Diaconescu, Ș., & Hangan, M. (2010). The Distribution of *Posthodiplostomum cuticola* and *Rossicotrema donicum* in *Scardinius erythrophthalmus* and *Hypophtalmichthys molitrix* Stemming from the Danube Delta. *Scientific Papers*: *Animal Science and Biotechnologies*, *43*(2), 24–26.

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.

Froese, R., & D. Pauly. (Ed.) (2020). FishBase. World Wide Web electronic publication.www.fishbase.org, version (12/2020)

Georgiev, B., Biserkov, V., & Genov, T. (1986). In toto staining method for cestodes with iron acetocarmine. *Helminthologia*, *23*, 279–281.

Ilie, M., Marinescu, F., Ghita, G., Anghel, A.M., Tociu, C., Popescu, I., Matei, M., Elena, H., Deák, G., Raischi, M., Cirstinoiu, C., & Bogdan, U. (2017). Spatial distribution of heavy metal contamination and ecological risk assessment in water from the Danube River. *International Journal of Environmental Science, 2*, 118–1124.

Kakacheva-Avramova, D. (1977). Studies on helminths of fishes in the Bulgarian section of the Danube River. *Helminthologia*, 3, 20–45 (in Bulgarian).

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

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.

Leimgruber, S., Schludermann, C., Konecny, R., & Chovanec, A. (2005). Helminth communities of the barbell *Barbus barbus* from large river systems in Austria. *Journal of Helminthology*, *79*, 143–149.

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.

Moravec, F. (2001). *Checklist of the Metazoan Parasites of the Czech Republic and the Slovak Republic (1873-2000)*. Praha, CZ: Academia Publishing House, 172.

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

Nedeva, I., Atanasov G., Karaiwanova, E., Cakic, P., & Lenghardt, M. (2003). *Pomphorhynchus laevis* (Mueller, 1776) from the river Danube. *Experimental Pathology and Parazitology*, *6*(13), 14–16.

Pantelica, A., Ene, A., & Georgescu, I. I. (2012). Instrumental neutron activation analysis of some fish species from Danube River in Romania. *Microchem Journal*, 103, 142–147.

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

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 September 25 - 27, 2020, 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 September 25 - 27, 2020, 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.

Zarev, V.Y., Apostolou, A.I., Velkov, B.K., & Vassilev, M.V. (2013). Review of the distribution of the family Gobiidae (Pisces) in the Bulgarian Danube tributaries. *Ecologia Balkanica*, *5*(2), 81–89.

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

*** www.icpdr.org