

First records of the Asian clam *Corbicula fluminea* (Müller, 1774) (Bivalvia: Veneroidea: Corbiculidae) in the Black Sea river basin in Bulgaria

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Introduction

After the first record of the invasive mussel *Corbicula fluminea* (Müller, 1774) in Bulgarian section of the Danube River, in 2001, during the next two decades (up to 2020) the species has been found on numerous sites across the country, including the Maritsa and Tundza Rivers (Aegean Basin). Although rarely, *C. fluminea* was also recorded in standing water bodies of the two basins.

In this study we present the first record of *C. fluminea* from the Black Sea Basin from Golyama Kamchia and Kamchia Rivers.

Key words: Asian clam, Black Sea basin, invasion, environmental variables.

Material and Methods

The samples were collected in September of 2020 and October of 2021 from 8 sites (Figure 1.). Four sites were located at Golyama Kamchia River (GKamSa, GKamYa, GKamAr, GKamPa) and 4 sites - at Kamchia River (KamTso, KamGro, KamDab, KamVen). Multi-habitat sampling approach was applied. The particle size distribution of the bottom substrate was analyzed and the physicochemical parameters (WT – water temperature, pH, EC – electrical conductivity, oxy conc – oxygen concentration, oxy sat – oxygen saturation) were measured *in situ*.

Primer v6 statistical package and its function PCA were used to visualize the spatial ordination of the sampling sites according to physicochemical parameters.

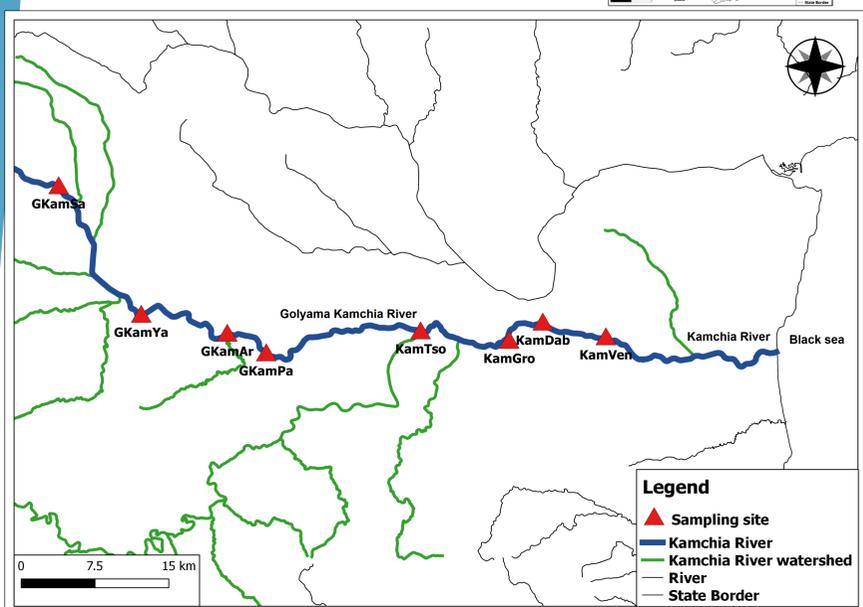


Figure 1. Map of the sampling sites

Two of the sampling sites at Golyama Kamchia River were characterized with higher percentage of small and middle sized stones, sand and detritus (GKamSa, GKamAr) and two sites (GKamYa, GKamPa) – with higher percentage of dead wood and higher plants as a substrate in the water (Figure 8.) The sampling site with higher number of individuals (KamGro), located at Kamchia River had predominantly silt, bedrock and large stones as substrate (Figure 8.).

Conclusions

The distribution of the *C. fluminea* in Bulgaria is continuing to spread and to occupy new water areas as it is confirmed by the data, presented in the current study. After the invasion of the Asian clam in the Danube and Aegean Basins, the Black sea Basin is the next with 8 new localities. A further research is needed - the pathways of invasion and the preferable environmental conditions to be found in order future trends to be outlined.

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Results

The river Kamchia is formed from the interflow of the rivers Golyama and Luda Kamchia. The individuals of *Corbicula fluminea* were found on eight new localities. The distribution of the species showed that the largest number of individuals were found on sites KamGro and KamDa (Figure 2) The last sampling point where *C. fluminea* was registered is KamVen which is situated 20 km before the river estuary in the Black Sea.

The PCA analysis of the physicochemical parameters showed that sampling sites located at Golyama Kamchia River were characterized with higher values of EC and oxygen concentration and lower values of WT. (Figure 4.). The number of individuals was also lower at those sampling sites and it was increasing downstream (Figure 2.).

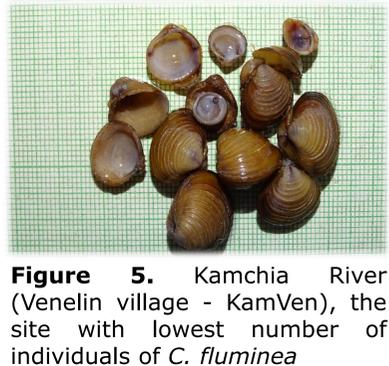


Figure 5. Kamchia River (Venelin village - KamVen), the site with lowest number of individuals of *C. fluminea*

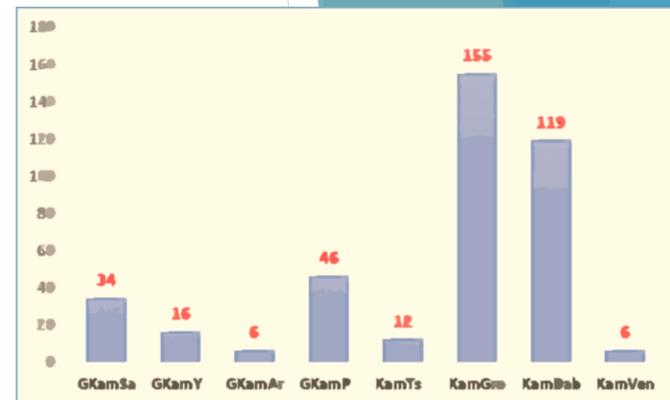


Figure 2. Number of collected specimens at the sampling sites (the sampling sites are ordered by their location downstream).



Figure 3. Kamchia River (Grozdyovo village – KamGro), the site with the highest number of individuals of *C. fluminea*

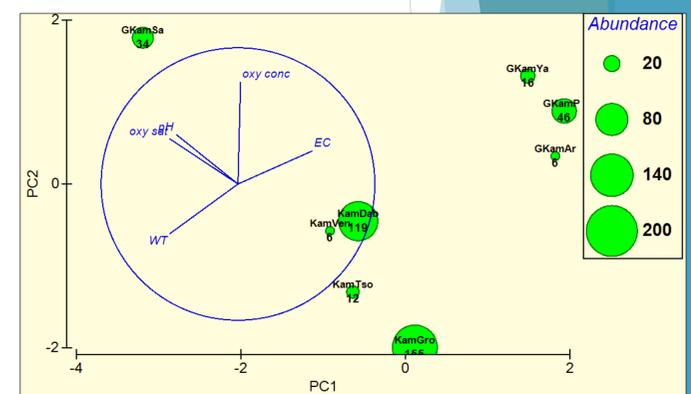


Figure 4. PCA of the physicochemical parameters and the sampling sites. The number of individuals of *C. fluminea* per sampling site is shown.



Figure 6. Golyama Kamchia River (Arkovna village - GKamAr)

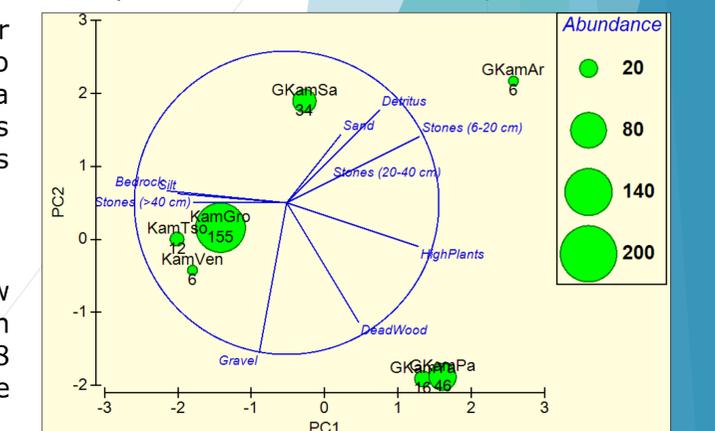


Figure 8. PCA of the substrate distribution and the sampling sites. The number of individuals of *C. fluminea* per sampling site is shown.