Rapid Communication

The first occurrence of *Barbronia weberi* (Blanchard, 1897) (Hirudinea: Arhynchobdellida: Erpobdelliformes: Salifidae) in Hungary

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Abstract

The *Barbronia weberi* (Blanchard, 1897) appeared as a new species in the Hungarian aquatic macroinvertebrate fauna. In 2018, the *B. weberi* was found on two sampling sites in the River Danube and the stream called Perint. The occurrence location in the Danube is at Paks, while the location in the Perint is near the wastewater treatment plant of Szombathely. To collect the animals we used „kick and sweep" with a standard pond net. According to the results obtained *B. weberi* has self-sustaining populations in the warmer section of the Danube, which is affected by the cooling water of the power plant. Both direct and indirect vectors form the distribution pattern of the species. On the one hand the Danube is one of the major spreading routes of non-native species in Europe. So *B. weberi* can spread directly; on the other hand, the sampling points of the Danube and the Perint are almost 200 km away from each other, which suggests the possibility of indirect spreading; i.e. through waterfowls or aquarium trade.

Key words: the Danube, non-native species, spreading routes

Introduction

The original distribution of *Barbronia weberi* was restricted to Afghanistan, Pakistan, Java, Sumatra, Borneo, Korea and southern China (Genoni and Fazzone 2008; Haaren et al. 2004; Neubert and Nesemann 1999; Pavluk et al. 2011; Potel et al. 1998). Neubert and Nesemann (1999) mentioned that they were the most common leech of the Indian subcontinent. The first specimens on New Zealand were collected by Mason (1976). The occurrence on the Seychelles is proved by Gerlach (1997) and its distribution range also includes Australia (Govedich et al. 2002) and South-America (Pamplin and Rocha 2000).

The first European specimen was found in England in the 1970s, but the first evidence that the species also occurs on the European mainland, was the individuals collected from the old branch of the Rhine called Neuhofener Altrhein (Potel et al. 1998); in 1995, some individuals were found in Lake Millstatt (Nesemann 1997). The first occurrence data from Italy originate from 2006 (Genoni and Fazzone 2008), while the first specimens in Spain were collected in 2010 (Pavluk et al. 2011) in the River

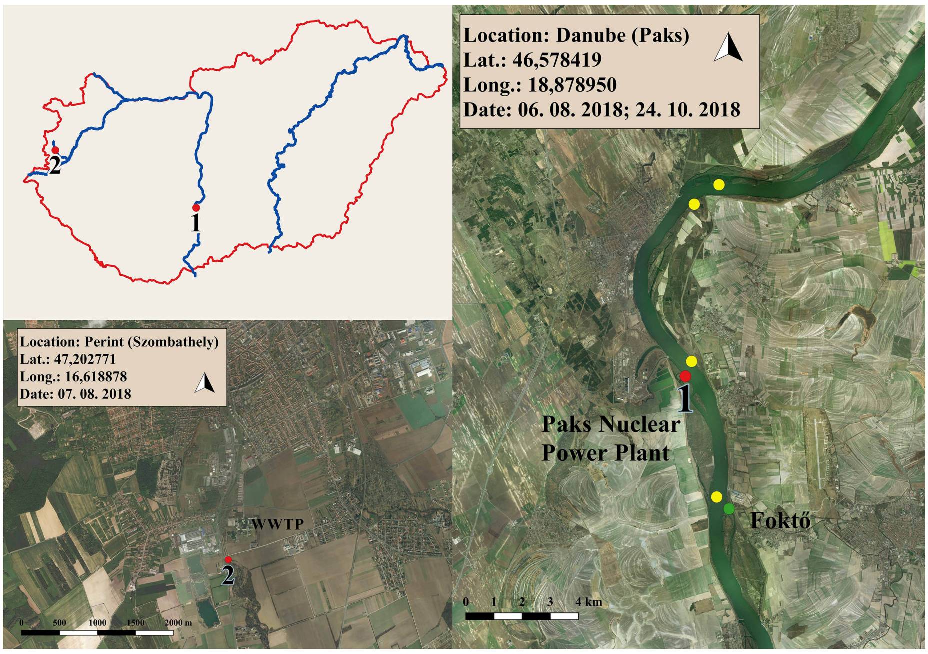

Figure 1. Map of the sampling locations of *Barbronia weberi* in Hungary (red point: presence of *B. weberi*; green point: control point; yellow points: *B. weberi* absent) (based on Bing Map) (wwtp: wastewater treatment plant).

Jarama near Madrid. It might also occur in the Netherlands, although the specimen from the River Waal was not clearly defined (Haaren et al. 2004).

Barbronia weberi belongs to the suborder Erpobdelliformes, to the family of Salifidae and to the genus of *Barbronia* (Neubert and Nesemann 1999). These animals are typical freshwater predators that feed on invertebrates (e.g. oligochaeta, insect larvae and small molluscs), swallowing the entire prey organism (Govedich et al. 2002, 2003; Neubert and Nesemann 1999; Pavluk et al. 2011; Reed 2001).

It mostly lives in running waters as well as ponds and eutrophic lakes. It is often associated with aquatic vegetation using plants as a substrate (Genoni and Fazzone 2008; Govedich et al. 2003; Neubert and Nesemann 1999).

According to the Fauna Europaea (2018) and European Alien Information Network (2018), the *B. weberi* has not occurred in Hungary yet, although based on its distribution range, its occurrence was expected in Hungary. The first Hungarian specimen was found by our team in 2018.

Materials and methods

In 2018 during the samplings of two aquatic macroinvertebrate based projects in Hungarian rivers, we used eight sampling sites in the Danube and five sampling sites in the Perint. Individuals were only found on two sampling sites. One of the sampling points is located in the Danube near Paks where the cooling water coming from the Nuclear Power Plant flows into the river, while the other location can be found under the wastewater treatment plant of Szombathely in the Perint. These two locations are almost 200 kilometers away in a straight line from each other. The exact information about the locations of occurrence can be found in Figure 1.

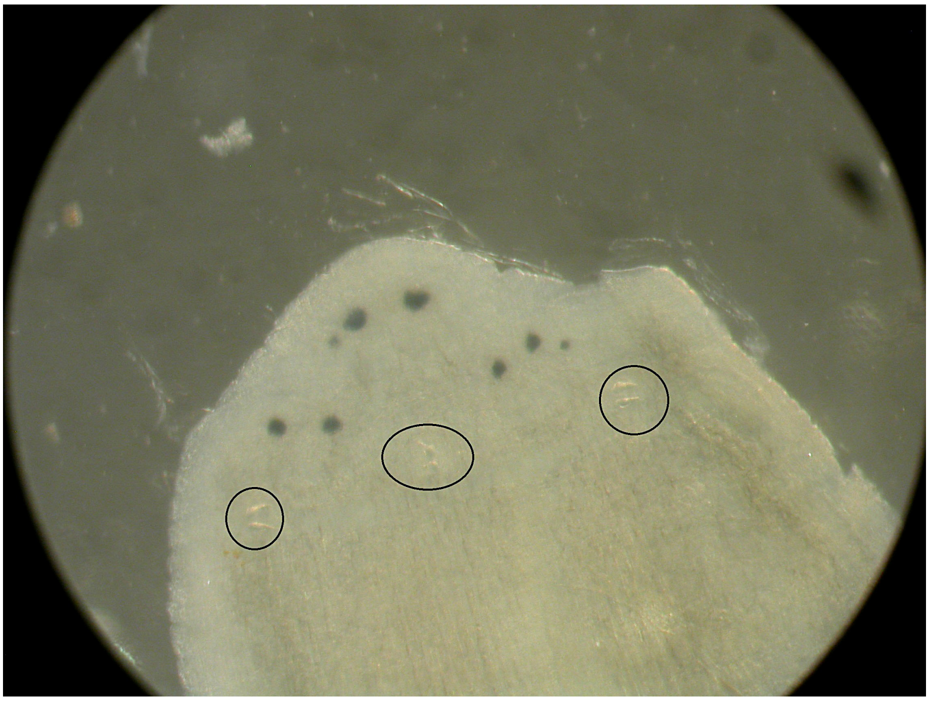

Figure 2. The pharyngeal stylets of *Barbronia weberi* (three-pairs). Photo by M. Ludányi.

Leeches were sampled according to the NBmR "multi habitat sampling" protocol for macro-invertebrates (Juhász et al. 2009). Different microhabitats were sampled in proportion to their percentage presence, which was determined prior to sampling. The "kick and sweep" with a standard pond net (with a 950 μm mesh fabric and a 25 × 25 cm metal frame) was applied to collect the animals (Juhász et al. 2009; Ludányi et al. 2016). Macroinvertebrates were preserved in 70% alcohol till the identification which was performed in the lab with a Nikon SMZ 1000, the magnification range of which is from 4x to 480x. After the identification, following the work of Pavluk et al. 2011, the individuals were put into glycerol for 72 hours, because this substance increases the transparency of the body. After 3 days, the individuals were prepared and pictures were taken of the stylets and gonopores with a Nikon E4500 digital camera.

Results

B. weberi was collected from different kinds of substrate, e.g. artificial stone scatterings and gravel, as well as from the Danube (on two different occasions and a total of 57 specimens were found), while in the Perint the species occurred on submerged macrophytes (1 occasion and 1 specimen) (Figure 1). The *B. weberi* can be clearly distinguished from other Erpobdellidae species through the three pairs of pharyngeal needle-shaped stylets (Figure 2). Moreover, the presence of two accessory copulatory pores, one anterior and one posterior to the male and female gonopores are undoubtedly the characteristic features of this species (Neubert and Nesemann 1999; Pavluk et al. 2011; Sawyer 1986; Sawyer and Sawyer 2018)

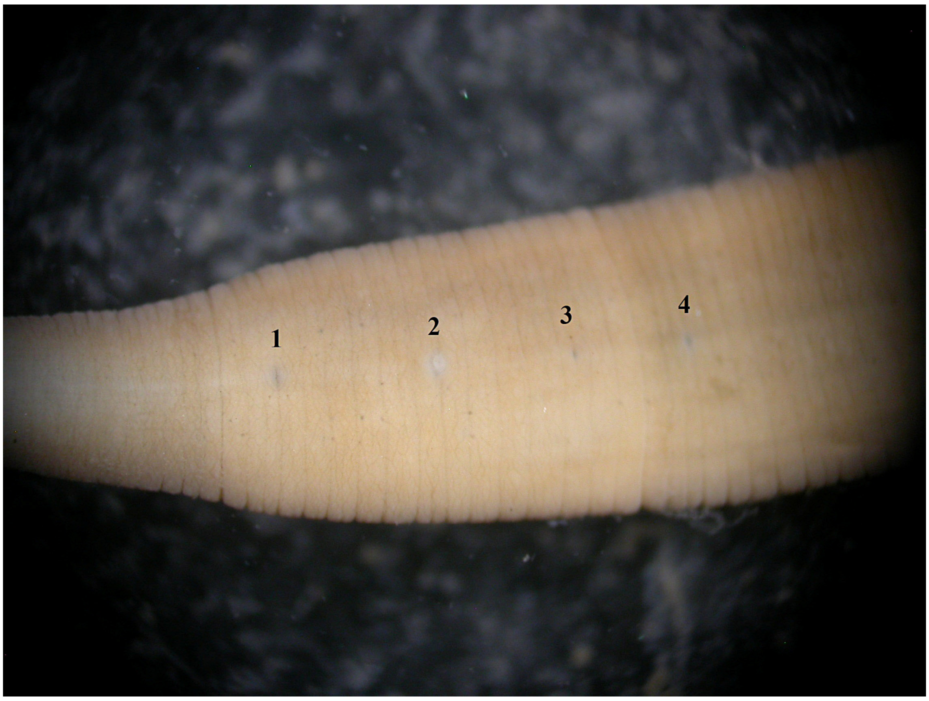

Figure 3. Ventral view of *Barbronia weberi* (1, 4 : accessory pores, 2: female gonopore 3: male gonopore). Photo by M. Ludányi.

Table 1. The results of background variable measurements in the Danube at Paks and Foktő (control site, 4 km away from Paks).

Date		14. 08. 2018		30. 10. 2018	
		Danube at Paks Nuclear Power Plant	control location (Foktő)	Danube at Paks Nuclear Power Plant	control location (Foktő)
pH	[–]	8.20	8.57	8.07	8.33
Conductivity	[µS/cm]	384	356	439	441
DO	[mg/l]	8.18	11.57	9.69	9.56
O_2	[%]	118.2	148.6	107.8	95.8
Twater	[°C]	27.8	23.1	19.7	15.7
Nitrite	[mg/l]	2.90	2.56	6.26	6.0
NO_3-N	[mg/l]	0.66	0.58	1.41	1.43
Nitrate	[mg/l]	0.03	0.03	0.030	0.02
NO_2-N	[mg/l]	0.009	0.009	0.009	0.006
Ammonia	[mg/l]	< 0.02	< 0.02	<0.02	< 0.02
NH_4-N	[mg/l]	< 0.016	< 0.016	<0.016	< 0.016
orthophosphate	[mg/l]	< 0.03	< 0.03	0.420	0.37
PO_4-P	[mg/l]	< 0.010	< 0.010	0.137	0.121
Average density ± S.E.	Individuals/ m^{-2}	3.67 ± 3.67	–	15.33 ± 9.94	–

(Figure 3). On the basis of capture frequency and density values (Table 1), it can be stated that *B. weberi* has constantly present populations in the warmer section of the Danube at Paks. This location is approximately 700 m away from the cooling water inflow of the Nuclear Power Plant. Despite the fact that this section of the Danube was investigated on six sites, which are only a few kilometres (0.5–5 km) away from each other and are located in upstream and downstream directions from the occurrence location, the species only occurred on this sampling site.

Measurement dataset for the chemical background variables are also available from the Danube sampling locations of Paks and Foktő (Table 1). As control values, we used a dataset about the chemical features of Foktő, which is located about 4 km away from Paks. Quite striking differences were found between water temperatures of Paks and Foktő. The highest values were at the warm water inflow of the power plant (varying between 19–27 °C, depending on the seasonal fluctuations). The nitrite content was also higher at Paks (higher with 0.34 mg/l in August and with 0.26 mg/l in October), whereas we observed opposite deviation in pH (Table 1) in both sampling period, however these differences are not significant.

The monitoring activity of the macroinvertebrate community was carried out in the above mentioned Danube section since 2016 with the same protocol, but the presence of *B. weberi* had not been proven before 2018.

The Perint sampling location might be affected by the wastewater treatment plant of Szombathely, but the exact backgorund variables of the watercourse are not available.

Discussion

The exact distribution of this species in Hungary has not been verified yet since these are the first records of *B. weberi*. In Europe, one of the principal corridors of invasion is the "Southern Invasion Corridor" (SIC) linking the Black Sea basin with the North Sea basin via the Danube-Main-Rhine waterway which also includes the Main-Danube Canal (Panov et al. 2009; Paunović et al. 2015; Zorić et al. 2014), so the emergence of *B. weberi* was expected. The high reproductive rate and tolerance to a wide range of environmental conditions make *B. weberi* an excellent colonizer, and once established it can be transported to new systems by natural vectors, such as waterfowl, or through connecting waterways (Genoni and Fazzone 2008; Govedich et al. 2003; Potel et al. 1998). So the distribution through direct and indirect vectors is also conceivable. This is also proven by our dataset, which shows that the sampling points of the Danube and the Perint are almost 200 km away from each other. It cannot be excluded that the species may occur along its direct distribution route like the Raab, but the comprehensive study carried out in the Raab watershed, found *B. weberi* only in the Perint. So the indirect spreading through aquaculture, aquarium trade (Nunes et al. 2015; Pavluk et al. 2011) or waterfowl (Green 2016) of this species is much more likely.

Being a predator with rapid development, *B. weberi* has the potential to compete with and/or feed on native invertebrate species (Genoni and Fazzone 2008; Govedich et al. 2002). In addition, it has a tolerance to a wide range of ecological factors like high water temperature (Genoni and Fazzone 2008; Pavluk et al. 2011); moreover, habitats with a higher temperature are preferred rather than tolerated by *B. weberi*, as it has been found in our study. The warm water inflow at Paks increases the temperature with 7–9 °C. Szolnoky and Raum (1991) found that 500 meters from the inflow point nominal value of 9 °C decreases to 6–8 °C (Szolnoky and Raum 1991).

According to Pavluk et al. (2011), the species was found in the location with higher temperature (14.9–20.3 °C) in Spain. During the investigation of the River Ganga, *B. weberi* was only collected at the maximum water temperature of 27 °C (Akolkor 2017). Considering the literature and our dataset, we can say that the water temperature may be a defining factor in the colonization of *B. weberi*, and further distribution in Hungary is expected, especially in the warmer years, like 2018, when the average temperature was higher and water level conditions were lower than usual.

To determine the spreading mechanism and the risk being posed on aquatic-communities, further, targeted studies are needed on the spreading, habitat preferences and the necessary ecological factors (e.g. temperature, nitrite concentration, pH, conductivity) of *B. weberi*. To support these objectives 500 µm mesh fabric should be used to increase the catch efficiency during samplings, thereby providing more accurate distribution range of *B. weberi*.

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