

First Report of *Branchiobdella kozarovi* SUBCHEV, 1978 (Annelida: Clitellata) in Iran, and Its Distribution in the Eastern Euro-Mediterranean Subregion

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Abstract: Narrow-clawed crayfish, *Astacus leptodactylus* ESCHSCHOLTZ, 1823, collected from Aras Reservoir, provided the first record of *Branchiobdella kozarovi* SUBCHEV, 1978, in Iran. A review of the distribution of *B. kozarovi* in the Euro-Mediterranean subregion (BĂNĂRESCU 1990) is described and places the new information in context. As *A. leptodactylus* is an important commercial crayfish, its potential for introducing *B. kozarovi* into new areas in the subregion is considered.

Key words: Branchiobdellidans, narrow-clawed crayfish, Iran, Euro-Mediterranean distribution.

Introduction

Branchiobdellidans or crayfish worms form a small group of leech-like clitellate annelids. They have an ectosymbiotic association primarily with astacoidean crayfish (GOVEDICH *et al.* 2010) and a disjunct Holarctic distribution (GELDER 1999) in North America, East Asia and Europe. Recent research on archived material in various European museums (SUBCHEV 2007, 2008, 2009) has extended our knowledge of the range of *Branchiobdella* species which now are known to extend beyond Europe into the adjacent Ponto-Caspian Basin of western Asia. This expansion of range, combined with the *Branchiobdella* species of Europe (GELDER 2006), coincides with the ecological freshwater faunal habitat area of the Euro-Mediterranean subregion defined by BĂNĂRESCU (1990).

The first record of a branchiobdellidan in Iran was *Branchiobdella hexodonta* GRÜBER, 1883 found

on narrow-clawed crayfish, *Astacus leptodactylus* ESCHSCHOLTZ, 1823, captured at Sefidrood Fisheries Research Station in Astaneh, Guilan Province, near Caspian Sea (ASGHARNIA 2005). This record established the currently known southeastern limit of crayfish worms in the subregion; however, *B. hexodonta* in Iran was unexpected as this species is considered to be localized in Central Europe (SUBCHEV 2011). In contrast, *Branchiobdella kozarovi* SUBCHEV 1978, has been described from several countries in the southeastern Euro-Mediterranean subregion (SUBCHEV, GELDER 2010). Therefore a review of the distribution of *B. kozarovi* in the subregion was prepared and our new information added.

Material and Methods

Specimens of *A. leptodactylus* were caught in Aras Dam Reservoir, Azarbaijan Province, Iran

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(39.190717N 45.238875E) during 2009. Crayfish with body lengths (rostrum to telson) ranging from 6.8 to 15.0 cm long were randomly selected immediately after the catch was brought on board a fishing boat, placed in separate insulated plastic bags with a small amount of water. The specimens were kept cool in insulated boxes during their transport to Shahid Kazemi Fisheries office laboratory in Poldasht City which took a maximum of 24 h. Crayfish were disarticulated alive and the external surface of the parts and gill chambers were examined underwater with the aid of a dissecting microscope for live branchiobdellidans and their cocoons. Details and analyses of the number of branchiobdellidans recovered are not presented here as they are the subject of another paper. Live worms were removed and preserved immediately in 70% ethanol, and ten specimens were selected for permanent microscope slide mounting (GOVEDICH *et al.* 2010) for species identification.

Results and Discussion

Location and microhabitat

All slide mounted worms were identified as *Branchiobdella kozarovi* SUBCHEV 1978, providing the first record of the species in Iran. Worms were observed on crayfish only from April to October; no branchiobdellidans were found during winter months. Specimens primarily congregated on the walking legs and oral region, particularly the antennae, eyes, and third maxillipeds. Two crayfish collected in October were each found to have one *B. kozarovi* in their gill chambers. Although gill-dwelling appears unusual in Iranian collections, significant numbers of *B. kozarovi* have been reported on occasion in the gill chambers by BOSHKO (1983), SUBCHEV (2007), and SUBCHEV, GELDER (2010). Cocoons were observed only on the ventral thorax and legs but never in the gill chambers.

Distribution of *B. kozarovi* in Euro-Mediterranean subregion

BĂNĂRESCU (1990) divided the freshwater bodies of the world into eight zoogeographic regions, and Holarctic region into eight subregions, Ia to Ih. Our

review focuses on a portion of Euro-Mediterranean subregion, Id, which constitutes the drainages of Europe, Ponto-Caspian, and Mediterranean coast of Africa (BĂNĂRESCU 1990).

The association of *B. kozarovi* on *A. leptodactylus* appears to be endemic to the eastern Euro-Mediterranean subregion, with an apparent focus in the countries around the Black Sea. The first report of *B. kozarovi* came from specimens found on *A. leptodactylus* at Razdelna near Varna, Bulgaria (Fig. 1, Bu), on crayfish that had been brought from the river Beli Lom near the village of Gorotsvet some 90 km away (SUBCHEV 1978: 80). Subsequently, additional specimens were collected from sites at Popina and Silistra on the River Danube, and in the River Veleka, Bulgaria (SUBCHEV, STANIMIROVA 1998). At the latter site, *B. kozarovi* was removed from *Astacus astacus* LINNAEUS 1758. Recently, archived specimens in the Natural History Museum of Vienna, Austria were found demonstrating the presence of *B. kozarovi* in Western Turkey at Bursa and Lake Sabantscha (SUBCHEV, GELDER 2010). The most extensive studies of *B. kozarovi* have been conducted in Ukraine (Fig. 1, Uk) by BOSHKO (1983, 2005, 2010) particularly in Dnieper and South Bug river drainages, and by KOLESNIKOVA *et al.* (2008) in Kharkiv area. In contrast there are no reports of the species from the intervening countries of Moldova and Romania. The detailed review of European *Branchiobdella* species by POP (1965) included locations in Romania; however, this occurred before *B. kozarovi* had been described. It is almost certain that *B. kozarovi* is present in these two countries but new collections will be needed to confirm its presence. In Caucasus Mountain area between Black and Caspian Seas, BOSHKO in SUBCHEV, GELDER (2010) found *B. kozarovi* on introduced *A. leptodactylus* collected from an unknown location in Lake Sevan, Armenia. Our report extends the distribution of the species southward into Northwestern Iran.

Reports of *B. kozarovi* distant from Black Sea area include Turkestan in Kazakhstan (SUBCHEV, GELDER 2010), in the River Peksha near Moscow, Russia (BOSHKO 2005), and Koszalin, Szczecin, and Opole Provinces in Poland (ŚMIETANA, WIERZBICKA 1999). It is not known whether these peripheral locations are part of an endemic range or the result of



Fig. 1. Distribution of *Branchiobdella kozarovi* in Eastern Euro-Mediterranean subregion with locations marked by a solid black disc, the geographical boundary of Europe and Asia is shown with dashed lines, and the boundary of Euro-Mediterranean subregion indicated by a dotted line; where the two boundaries coincide, dots and dashed alternate. The map is a Two Point Equidistant Projection redrawn and modified from National Geographic, Atlas of the World, 1995.

commercial crayfish introductions. The report of *B. kozarovi* in Poland could be accounted for by either explanation; however, it is known that *A. leptodactylus* was imported into the area over a hundred years ago from Russia (HOBBS *et al.* 1989). The reverse situation appears to operate in Iran as this country is an important exporter of *A. leptodactylus* with no home consumption for religious reasons (KARIMPOUR 2003). As a result, there appears to be no reason for *A. leptodactylus* to be imported into the country, and so the ectosymbiotic association is most likely endemic. However, the presence of Central European, *B. hexodonta*, at Sefidrood Fisheries Research Station on Caspian Sea (ASGHARNIA 2005) is unexpected, and cannot be explained with the information currently available.

Transportation of European, Australian and North American crayfish into and around Europe has resulted in their associated epifauna appearing in new locations (SOUTY-GROSSE *et al.* 2006; HOLDICH *et*

al. 2009). According to SKURDAHL, TAUGBØL (2002: 472) and HOLDICH *et al.* (2006), *A. leptodactylus* has been supplied for aquaculture and food to most of the countries in the Euro-Mediterranean subregion for many years. Therefore, it should be anticipated that *B. kozarovi* are already in many parts of the subregion even if they have not been reported yet. An additional factor to be remembered is that branchiobdellidans on introduced crayfish can successfully adopt not only other crayfish species (GELDER *et al.* 1999) but also other crustaceans (GELDER, MESSICK 2006). In addition to the scientific value of the information presented, these data are also necessary for the development of management plans by regulatory agencies charged with safe-guarding threatened endemic crayfish populations in Europe. This is a dynamic situation and so continued monitoring of crayfish epibionts is essential if management plans and enforcement are to react to future changes in a timely manner.

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