

ON SOME MORPHOLOGICAL ABNORMALITIES IN ADULT FAIRY SHRIMP *BRANCHIPUS SCHAEFFERI* FISCHER, 1834, FROM SERBIA

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Abstract – *Branchipus schaefferi* Fischer, 1834, is a common and one of the most abundant large brachiopods widely distributed in Europe. In this work, for the first time, we describe and classify some of the most frequently observed morphological anomalies in this species. These are deformities in the head structures as well as in cercopods. Possible causes of such anomalies are discussed in detail.

Key words: abnormalities, morphology, *B. schaefferi*

INTRODUCTION

Morphological abnormalities are well known phenomena in crustaceans (de Oliveira Dias, 1999; Cuesta et al., 2002; Lupi and Spivak, 2007; Hoch and Yuen, 2009; González-Gordillo et al., 2010; Pombo and Martinelli-Filho, 2012), and in many other animal taxa as well (Poinar, 1988; Ćurčić et al., 1995; Mitov, 1995; Ćurčić et al., 1996; Reinert, 1999; Jahanifard et al., 2008; Barczuk and Madej, 2011; Peltzer et al., 2011; Janssen, 2013). However, data are still rare in literature and usually are not included in traditional species descriptions. In crustaceans, anomalies can occur not only in adults, but also in different larval stages (Cuesta et al., 2002). Abnormal morphologies and/or behaviors have been observed in laboratory studies, in which larvae and adults usually cannot feed, swim, molt or grow normally (Anger et al., 1994; McKenney, 2005).

Many biological and non-biological reasons are considered as possible causes of discrepancies in external body morphology. Beside genetic factors, the

most frequently reported are environmental stress and pollution (Lopez Greco et al., 2000), increasing urbanization, agricultural use of floodplains, farming (Zierold, 2006), as well as parasites and predators (Peltzer et al., 2011). In many cases, trait-specific susceptibility to environmental factors was also observed (Moller and Swaddle, 1997). Furthermore, causes that could distort soft-bodied animal morphology or affect their coloration may occur due to fixation, preservation, lighting and drying methods which are implemented during the preparation for microscopy (Beladjal and Mertens, 1999; Hegna, 2010).

Branchipus schaefferi Fischer, 1834, is a common and one of the most abundant large brachiopod crustaceans (Brachiopoda, Anostraca) widely distributed in Europe (Lukić et al., 2012). This filter-feeding crustacean successfully colonizes small, turbid, shallow, temporary waters, several centimeters in depth. Its body is cylindrical and completely naked, without carapax. The species shows clear sexual dimorphism both in sexual and non-sexual body parts (Miličić et al., 2013). In this work, for the first time,

we describe and classify some of the most frequent morphological anomalies in this species observed in Serbian populations.

MATERIALS AND METHODS

Study material

A sample of 120 individuals (sex ratio 50:50) of *Branchipus schaefferi* Fischer, 1834, was collected from natural habitats (freshwater inland pans) and immediately fixed in 70% ethyl alcohol. The study material comes from several localities in Serbia.

The external morphology of *B. schaefferi* is characterized by a free, mobile and short head with two pairs of antennae. In males, the basal parts of the second antennae are fused into a hexagonal clypeus; distal parts are with spine-like extensions. They are usually strongly modified and transformed into a prehensile organ. In both sexes, the thorax is composed of 11 somites with a pair of foliaceus appendages at each segment. The abdomen is composed of 8-9 somites, and free of appendages. The last segment (telson) bears a pair of elongations (cercopods). The rows of setae are located along the internal and external sides of each cercopod. They are bent inward in the distal parts in males, while they are rather straight and parallel in females.

Laboratory procedure

Specimens of *B. schaefferi* were observed under a dissecting microscope (Zeiss Discovery V8 Stereomicroscope). We selected morphologically odd individuals and photographed their body details with a Leica camera. The specimens with malformations were analyzed in relation to sex and type of morphological anomalies. Crustaceans used in this study are housed in the Institute of Zoology, Faculty of Biology in Belgrade.

RESULTS

The most frequently observed abnormalities consist of deformities in the head structures (in males),

as well as in the cercopods (in both sexes). A great number of morphological differences in our study were observed in male head morphology, defined as 'visnyai' form in literature (Mura, 1996). A *visnyai* head has more or less swelling of the second antennal parts, which completely cross over each other. Fig. 1 shows a normal (a) and *visnyai* (b) form of male head morphology. However, some of the males possessed some discrepancies in the head structures. Head anomalies are divided into two groups: the first group covers abnormalities that not caused by injuries (Figs. 1 c-f). The second one encompasses different head injuries (Fig. 2), especially observed in the distal parts of the second antennae.

Anomalies related to the cercopods can be divided into two groups: a) non-equal length in left and right cercopod, and b) obvious cercopod injuries with formed traumatic tissue (Fig. 3).

DISCUSSION

Large branchiopods usually occur in small and turbid pools with a lack of oxygen, which are considered as unfavorable habitats for most living organisms. In species that inhabit such unstable and unpredictable environments, anomalies could be the result of embryonic and/or postembryonic developmental disruptions, as well as a reaction to suboptimal environmental conditions and predators. Despite the fact that temporary ponds are often considered as an 'enemy free' spaces due to their cruel living conditions, this is not true in general (Brendonck et al., 2002), and we speculate that some of the injuries are not only a result of intraspecific competition, but also a result of close encounters with predators.

Our results show damaged or injured tissues, even the absence of certain body parts. It seems that some abnormalities can be considered to be the result of genetic and developmental factors. Although the discrete stages of embryonic development of some crustaceans are well-known (Zarattini and Mura, 2004; Wolf, 2009; Ito, et al., 2011), detailed description of the complete course of embryogenesis in *B. schaefferi* is largely lacking. Developmental distur-

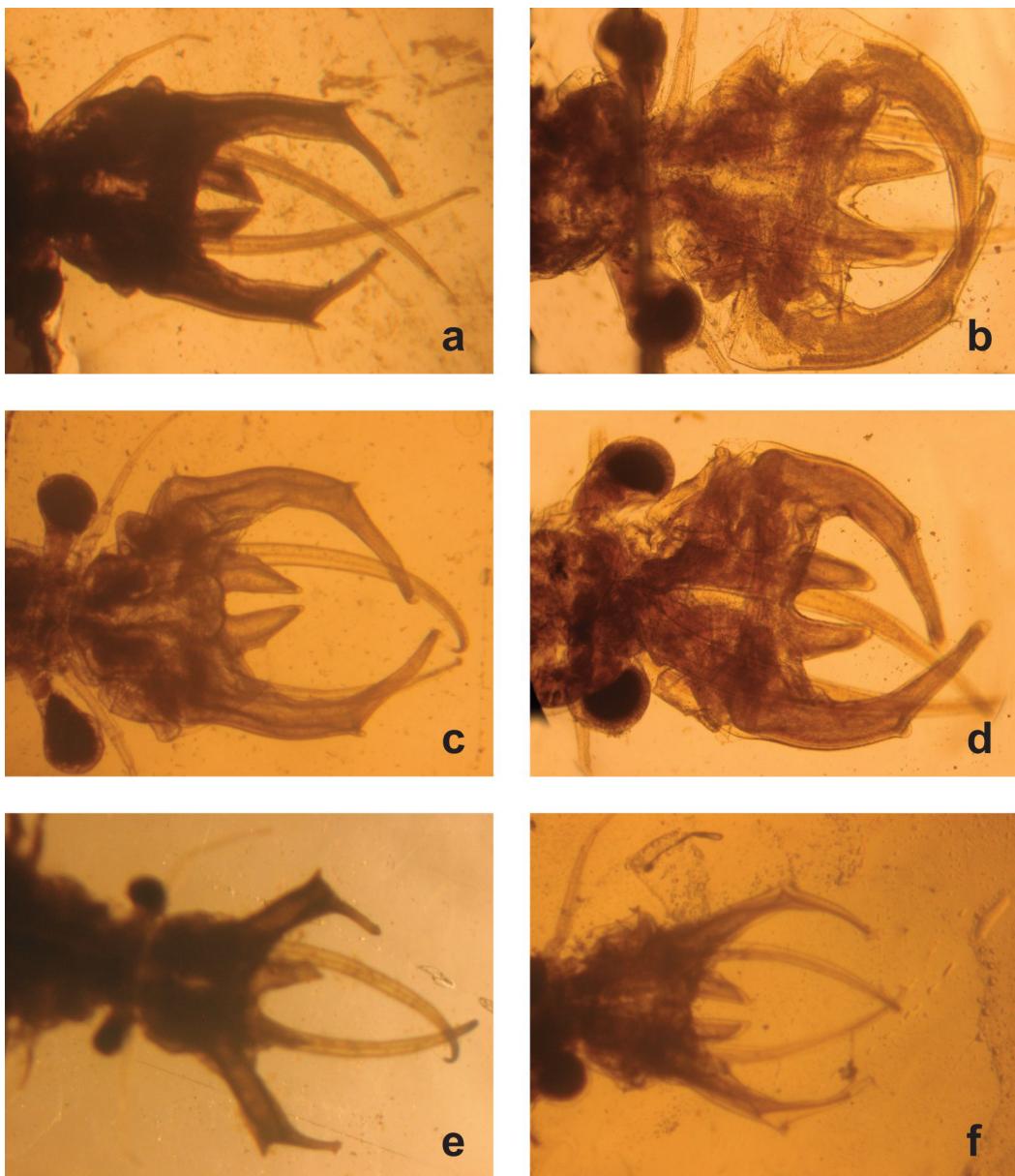


Fig. 1. Morphology of male head in *B. schaefferi*: normal head (a), *visnyai* head (b), assymetric morphology of second antenna (c and d), unusual large distance between antennae (e and f).

bances may occur as a consequence of failures in the molting cycle, or at ecdysis. A part of them can also be explained as a plastic response to stressful environmental conditions (Cuesta et al., 2002) or predators. This is particularly true for the most protruding parts of the body, such as terminally situated cercopods and the distal articles of antennae.

Fixation and preservation could be considered as a possible cause of some deviations in the soft body parts, since alcohol can deform specimens by accelerating fluid loss. Differences observed in male *B. schaefferi* head morphology, defined as the *visnyai* form in literature (Mura, 1996), are manifested as more or less swelling of the second antennal parts

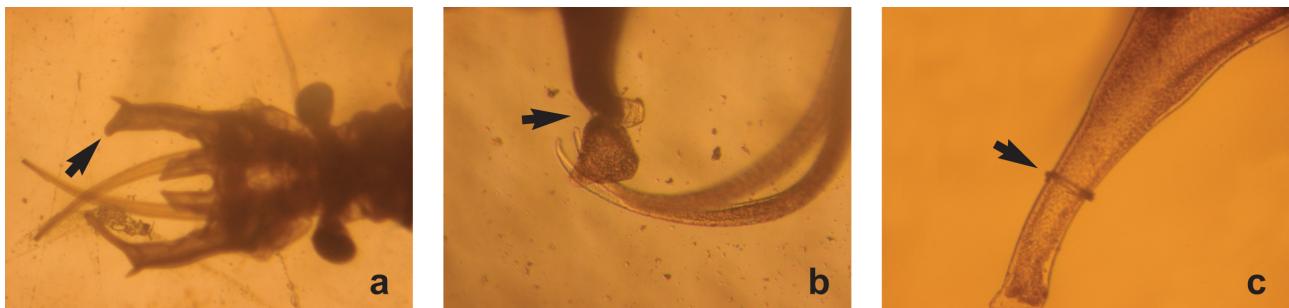


Fig. 2. Head injuries in distal parts of the second antennae (pointed by arrows).

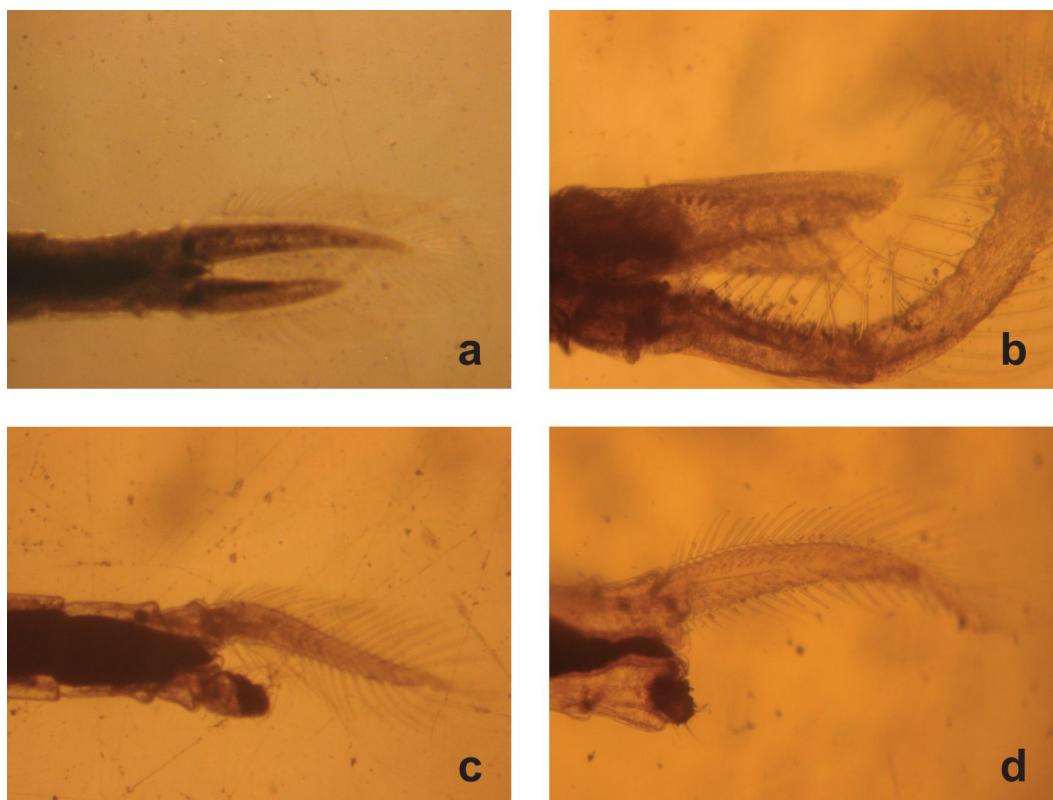


Fig. 3. Anomalies in cercopods of *B. schaefferi*: a) non-equal length (female); b) non-equal length (male); c) injury of the right cercopod (female), d) injury of the left cercopod (male).

which cross each other. According to allozyme analyses (Zaratini et al., 2001) *visnyai* is considered as an 'unusual' form of *Branchipus* head morphology. Previously, this form was explained to be a result of antennal contraction due to alcohol fixation (Petkovski, 1997; Beladjal and Mertens, 1999). In our sample, both types of individuals (normal and *visnyai*) were

sampled on the same day and fixed using an equivalent procedure, so the alcohol itself could not cause such changes to the head morphology.

Regardless of their origin, the survival of anomalous specimens in the field could be difficult. As ancient organisms, large branchiopods must constantly

swim in order to be able to eat and breathe, when certain body appendices (especially cercopods) could play a significant role. The antennae, which are also significant, especially in males for their indispensable role in courtship behavior, should not be neglected.

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