SCIENTIFIC NOTE

Does *Barypenthus concolor* Burmeister (Trichoptera: Odontoceridae) Select Particles of Different Sizes for Case Building?

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Barypenthus concolor Burmeister (Trichoptera: Odontoceridae) Seleciona Partículas de Diferentes Tamanhos Para a Construção de Casulos?

RESUMO - Larvas de muitas espécies de Trichoptera utilizam partículas orgânicas ou inorgânicas para construir seus casulos nos quais ficam protegidas de predadores. O estudo da grande variedade de estruturas produzidas por tricópteros é muito importante para o entendimento da evolução do comportamento de construção de casulos. O objetivo deste trabalho foi investigar se larvas de *Barypenthus concolor* (Burmeister) são capazes de selecionar tamanhos específicos de partículas para a construção de casulos. O estudo foi realizado em um riacho de altitude no Parque Nacional da Serra do Cipó, MG. Coletaram-se casulos e amostras do substrato em três locais do riacho, para os quais foram feitas análises granulométricas. A média da massa de cada tamanho de partícula encontrada em cada local foi utilizada para a determinação das proporções dos tamanhos de partícula presentes no substrato. As proporções dos tamanhos de partícula de cada casulo (ponto I: n = 10, ponto II: n = 19, ponto III: n = 13) foram também analisadas. As possíveis diferenças entre as proporções dos tamanhos de partícula presentes e dos tamanhos de partícula utilizados pelas larvas de *B. concolor* foram avaliadas por meio de Qui-quadrado. Cascalho médio e fino predominaram nos três locais amostrados (>70%). Não houve diferenças significativas entre as proporções esperadas e as observadas para tamanhos de partícula nos casulos. Portanto, *B. concolor* não seleciona tamanhos específicos de partículas para a construção de casulos.

PALAVRAS-CHAVE: Comportamento, macroinvertebrado bentônico, córrego de altitude

ABSTRACT - Many species of Trichoptera larvae use organic or inorganic particles to build cases that protect them from predators. The study of the wide variety of structures produced by trichopterans is important to understand the evolution of case building behavior. The objective of this work was to investigate if larvae of *Barypenthus concolor* (Burmeister) are capable of selecting particles of specific sizes to build their cases. The study site was an altitudinal stream in Serra do Cipó National Park, MG, Brazil). Cases and substrate samples were collected at three sites of the stream and submitted to granulometric analyses. The average mass of each particle size found in each site was used to determine the particle size proportion present in the substrate. The proportions of particle size of each case (site I: n = 10, site II: n = 19, site III: n = 13) were also analyzed. Possible differences between the proportions of the particle sizes of the substrate and of those used by *B. concolor* larvae were assessed by the Chi-square test. Medium and fine gravel predominated at the three sites (>70%). There were no significant differences between the expected and observed particle size proportion in the cases. Therefore, *B. concolor* does not select specific particle sizes for case building.

KEY WORDS: Behavior, benthic macroinvertebrate, altitudinal stream

Odontoceridae trichopterans present a wide geographic distribution, usually being represented by a few numbers of genera and species. This is a senescent group that, once widespread, maintained its distribution and colonized habitats along time (Wiggins 1996).

Some insect groups have larvae that can build shelters

and cases, but the variety of these structures is much wider in Trichoptera. Case building habits of this order have long fascinated naturalists and were studied in detail for particular species during the 1900s (Weaver III & Morse 1986). Most Trichoptera species build cases with organic and inorganic particles bonded by an adhesive silk secreted by the larvae. The diversity of microhabitats exploited by Trichoptera larvae results from the ways this silk is used to build shelters, feeding nets and cases and, very likely, influenced the success of this order as a whole (Mackay & Wiggins 1978, Wiggins 1996). The main function of these cases is to protect the larvae against predators, usually fishes and aquatic invertebrates (Stevens *et al*. 1999). These insect structures have occasionally been used to infer on larval building behavior because similar structures are usually built by similar behavioral sequences (Stuart & Currie 2002). Thus, the study of the wide variety of structures produced by trichopterans is also important to understand the evolution of case building behavior (Wiggins 1996).

The genus *Barypenthus* has six species described in the Neotropics (Flint *et al.* 1999); on previous studies carried out in Serra do Cipó, MG, Brazil, Galdean *et al*. (2000) found two Odontoceridae genera (*Marilia* and *Barypenthus*). The present study is concerned to the species *Barypenthus concolor* (Burmeister), found in southeastern Brazil (Flint *et al.* 1999, Paprocki & Holzenthal 2002). The objective was to investigate the following hypothesis: larvae of *B. concolor* are capable of selecting particles of specific sizes to build their cases. If this hypothesized mechanism is valid, the particle size proportion of larval cases and substrate should differ.

Samples were collected in July 2002 on a forth order reach of Indaiá stream, a small stream belonging to the Doce River watershed, located in Serra do Cipó National Park. This stream has a rocky bed, excellent quality water (pH 3.8; 7-9 mg/l dissolved oxygen and electric conductivity <15 mS/cm), and exhibits a rich and diverse benthic fauna (Galdean *et al.* 2000, Callisto *et al.* 2002). In addition, it is located in a Conservation Unit and suffers little anthropogenic influences, thus keeping its features very similar to the primitive ones. The climate is classified as Cwb (Köppen) with rainy summer and dry winter, and an average annual rainfall of 1,500 mm (Galdean *et al.* 2000).

Both *B. concolor* cases and substrate were sampled at three different sites (sites I, II and III). Three samples of stream substrate were collected at each site. Each sample was submitted to granulometric analyses of sediments, and the particle size was classified according to the Wentworth scale (Suguio 1973). The mean of the three samples was used to determine the size proportion of the particles present in the substate. Ten, 19 and 13 cases were collected at the sites I, II, and III, respectively. To determine the particle size proportion used by *B. concolor* larvae, each case was carefully pounded, to avoid the destruction of particles, and the particles were measured. The expected particle proportions in the cases were calculated from those determined in the substrate, taking into account the initial mass of each case. The relation between observed and expected values was tested by Chi-square test (Zar 1984).

Results from the granulometric analyses are presented in Table 1. Medium and fine gravel predominated at the site I (30.8% and 41.3%, respectively), II (46.7% and 36.8%, respectively) and III (58.0% and 28.9% respectively); these two particle sizes together represented more than 70% of all particles in the substrate. At all sites, silt (particles smaller than 0.063 mm) was available in very low quantities. This results from the swift current, characteristic of the altitudinal streams of this region, which prevents silt sedimentation (Allan 1995).

Table 1. Sediment particle size composition (%) the three studied sites in Indaiá stream, Serra do Cipó National Park, MG, Brazil.

Size category	Particle diameter (mm)	*Phi* (ϕ) *value* [1]	Site I	Site II	Site III
Medium gravel	> 4.000	$\leq$ -2	30.8	46.7	58.0
Fine gravel	2.000	-1	41.3	36.8	28.9
Very coarse sand	1.000	0	21.8	12.8	8.0
Coarse sand	0.500	1	4.0	2.4	2.3
Medium sand	0.250	2	1.7	1.0	1.9
Fine sand	0.125	3	0.2	0.2	0.5
Very fine sand	0.063	4	0.1	0.1	0.2
Silt	< 0.063	$\geq$ 5	0.1	0.0	0.1

[1]-log_2 diameter

There were no significant differences between the expected and observed proportions of each particle size found in *B. concolor* cases (Fig. 1). Therefore, this species uses all different particle sizes present in the substrate, at random, except for medium gravel. The absence of medium gravel on trichopteran case composition may reflect a larval restriction to use this particle size, determined by the insect body size. However, even in the absence of medium gravel, the χ^2 test showed no significant differences between observed and expected frequencies of particle sizes used by *B. concolor*. Stuart & Currie (2002) found examples of Trichoptera species that built similar structures and presented different behavior. They also found *taxa* that built different structures using similar behavior patterns, independently of their phylogenetic distance. We believe that, if the behavior pattern is specific, it must be repeated in other *B. concolor* populations indigenous of sites with a substrate composition similar to the studied one.

Some benthic macroinvertebrates are specialized in specific substrate types (Allan 1995). Yet, our results showed that *B. concolor* depends directly on the particle size composition present in the substrate. The knowledge of this behavior pattern is important for conservation reasons, since changes on the composition of the substrate particle size caused by anthropogenic impacts can have a direct influence on the species survival. Dam building, water diversions, river channels, pollution and landscape alterations are examples of anthropogenic impacts that have caused

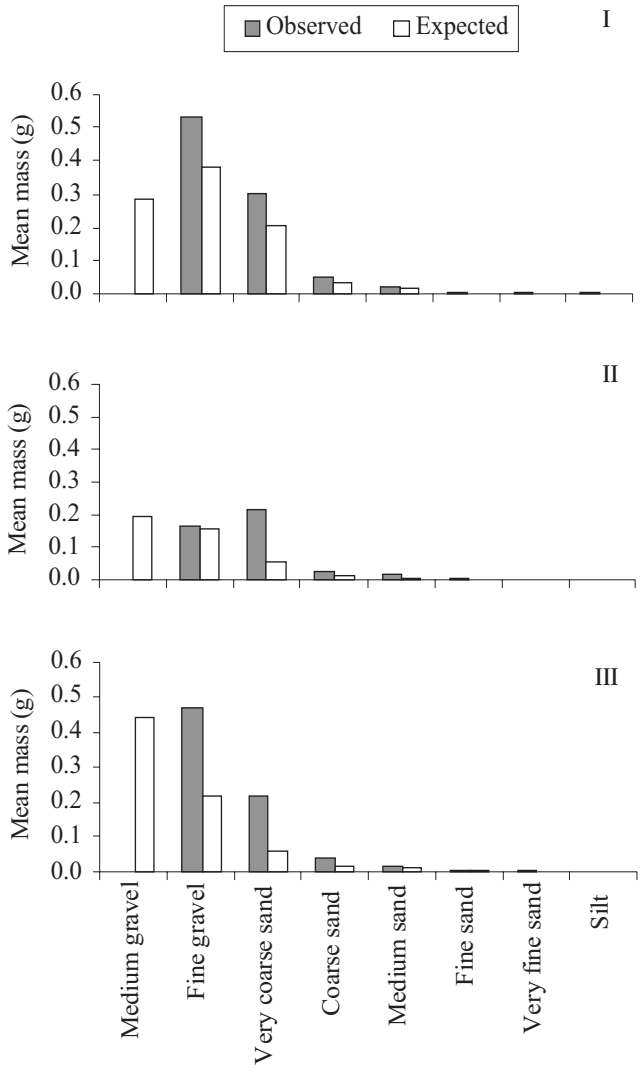

Figure 1. Observed and expected mean mass of *B. concolor* cases collected at the study sites I , II and III in Indaiá Stream, Serra do Cipó National Park, MG, Brazil.

substantial changes towards substrate homogenization (Allan 1995, Karr & Chu 1999). Such a substrate alteration can have detrimental consequences to *B. concolor* because, to build their cases, the larvae utilize particles sizes in the same proportion as they are available in the habitat. Cases with homogeneous particle sizes could be less resistant to predators pressure. Also the insects could spend more time and require more adhesive substance to build their cases (which would represent a significant increase on energy costs), and cases' architecture could differ from the one necessary for adequate breathing. Behavioral studies of *B. concolor*, as well as the results here presented, are environmentally important, because *Baryphentus* is an endemic genus of Brazilian lotic ecosystems (Flint *et al.* 1999) and the larvae of the order Trichoptera are widely used as biological indicators of water quality (Rosemberg & Resh 1993).

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