

The grass is always greener on the other side: *Triplectides* Kolenati, 1859 (Leptoceridae) and *Marilia* Müller, 1880 (Odontoceridae) occupying cases of other Trichoptera species

A grama é sempre mais verde do outro lado: *Triplectides* Kolenati, 1859 (Leptoceridae) e *Marilia* Müller, 1880 (Odontoceridae) ocupando casulos de outras espécies de Trichoptera

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Abstract: Aim: Larvae of *Triplectides* spp. and *Marilia* sp. occupying cases of other species are recorded and photographed; **Methods:** The material was collected in different sites and dates in Atlantic Forest and Central Amazon regions; **Results:** The *Triplectides* larvae seem to have an opportunistic behavior, occupying a great variety of cases, which reflects their common habit of enter in hollow twigs instead of build complex cases. However, this behavior is not frequently recorded in *Marilia* larvae, and we believe that the difference on the roughness of the interior walls, as well as the difference of the color of the material of the cases limit the opportunistic behavior in this genus; **Conclusions:** Experimental studies with different species can help the understanding of this behavior in the light of adaptive values.

Keywords: opportunistic behavior, case building, biology, Integripalpia, aquatic insects.

Resumo: Objetivo: Larvas de *Triplectides* spp. e *Marilia* sp. ocupando casulos de outras espécies são registradas e fotografadas; **Métodos:** O material foi coletado em diferentes localidades e datas em regiões de Mata Atlântica e Amazônia Central; **Resultados:** As larvas de *Triplectides* parecem ter um comportamento oportunista, ocupando uma grande variedade de abrigos, o que reflete seu hábito comum de entrar em galhos vazios ao invés de construir casulos complexos. Entretanto, este comportamento não é registrado frequentemente em larvas de *Marilia*, e nós acreditamos que a diferença na rugosidade das paredes interiores, assim como a diferença na cor dos tipos de materiais dos casulos limitam o comportamento oportunista entre as espécies deste gênero; **Conclusões:** Estudos experimentais com diferentes espécies podem ajudar o entendimento desse comportamento à luz dos valores adaptativos.

Palavras-chave: comportamento oportunista, construção de casulo, biologia, Integripalpia, insetos aquáticos.

The great diversity and the occupation of many aquatic environments by the caddisfly larvae have a significant contribution from the silk production by the labial glands (Mackay and Wiggins, 1979). Different species build cases, retreats and nets for food uptake in distinct forms which reflect its habits (Wiggins, 2004).

The construction of tubular portable cases by the larvae of the suborder Integripalpia represents a different feature that allows its occupation in different niches in relation to other Trichoptera groups, as they can pursuit their food more actively (Wiggins, 2004), gain protection due to camouflage (Nielsen, 1942) and can survive in warm and poor

oxygenated environments through an unidirectional water flux within the case (Milne, 1938; Wiggins, 1996; Williams et al., 1987). These cases can be made of different types of material, including great variety of sand grains, tree leaves, small twigs, shells and even silk only (Wiggins, 2004).

It is known that some larvae of the genus *Triplectides* occupy empty cases of species of *Grumicha* Müller, 1879 (Müller, 1878; Flint Junior et al., 1999; Crisci-Bispo et al., 2004), *Parasericostoma* Schmid, 1957 (Flint Junior et al., 1999) and *Nectopsyche* Müller, 1879 (Crisci-Bispo et al., 2004). This invasive behavior is also recorded in a *Marilia* species (*Marilia elongata* Martynov, 1912) in the larval

case of *Grumichella* Müller 1879. Here we record and illustrate for the first time the opportunistic behavior with *Triplectides* on larval cases of *Marilia*, *Grumicha* and *Amazonatolica hamadae* Holzenthal and Pes, 2004, and *Marilia* on *Grumicha* cases.

The material was collected in different sites of Atlantic Forest and Central Amazon region, Brazil, in different periods as listed below. A D-net as well as hand sleeves were used to collect the larvae in different substrates (Table 1). The specimens were identified with the keys of Pes et al. (2005) and Calor (2007). The larvae were fixed in 100% alcohol, and are deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA).

The *Triplectides* larvae usually add leaves to the front opening of the occupied case, like Figure 1a, b. This possible occurs when the larva is growing larger than the invaded case. In Figure 1c, there is an evident cut in one side of the case, like they do with a hollow twig (Müller, 1878). In Figure 1d, despite being occupied by a *Triplectides* sp. larva, the *Grumicha* sp. case has stones added to the front opening, like the one occupied by a *Marilia* larva in l.f. Maybe it was originally invaded by a *Marilia* sp. larva, and then the *Triplectides* sp. occupied it after the first invader emerged or get predated. On the amazonian streams, *T. eglerti* Sattler, 1963 up to the third instar usually occupy empty silk cases of *Amazonatolica hamadae* (Figure 1e), commonly observed on *kinon*, a biocoenosis drifting along the amazonian rivers in a floating mass of roots, logs, fruits and leaves (Fittkau, 1977).

The fact that the *Triplectides* larvae do not really build cases, just occupying hollow twigs or burrowing the not yet empty ones (Müller, 1878), may explain this common opportunistic



Figure 1. a-b) *Triplectides* sp. from Quatro Barras and from Rio de Janeiro respectively; in *Marilia* sp. case c-d) *Triplectides* sp. from Quatro Barras in *Grumicha* sp. case; e) *Triplectides eglerti* Manaus in *Amazonatolica hamadae* case; f) *Marilia* sp. from Ponte Serrada in *Grumicha* sp. case. Scale: 1 mm.

Table 1. The different taxa, survey sites and habitats of the caddisflies found on cases of another species.

Taxon	Case	Site	Date	Coordinate	Specimens	Habitat
<i>Triplectides</i> sp.	<i>Marilia</i> sp.	Recanto Engenheiro Lacerda, municipality of Quatro Barras, PR	11.vii.2011	25° 20' 2.39" S 48° 54' 6.88" W	2	Sand/Pool
<i>Triplectides</i> sp.	<i>Marilia</i> sp.	Paulo e Virgínia cavem, Rio Cascatinha, Parque Nacional da Tijuca, municipality of Rio de Janeiro, RJ.	30.vi.2011	22° 58' 12.71" S 43° 15' 25.60" W	1	Sand/Pool
<i>Triplectides</i> sp.	<i>Grumicha</i> sp.	Recanto Engenheiro Lacerda, municipality of Quatro Barras, PR	11.vii.2011	25° 20' 2.39" S 48° 54' 6.88" W	4	Leaves/ Riffle
<i>Triplectides eglerti</i>	<i>Amazonatolica hamadae</i>	Igarapé do Tinga, Reserva Ducke, municipality of Manaus, AM.	8.v.2002	02° 57' 00" S 59° 57' 00" W	30	Leaves and roots/ Riffle
<i>Marilia</i> sp.	<i>Grumicha</i> sp.	Rio Irani; BR 282, Parque dos Butieiros, municipality of Ponte Serrada, SC.	04.ix.2009	26° 55' 49.2" S 51° 52' 29.3" W	1	Roots/ Riffle

behavior with various species, since they do not need to build or prepare the case. They simply use a case of resistant material as a camouflage and/or a respiratory device like they naturally do with a twig. The larvae do not invade only empty cases of other Trichoptera species, since some individuals are observed even in body parts of dead arthropods (Figure 2).

On the other hand, the opportunistic behavior of *Marilia* larvae was recorded (Rueda-Martín, 2008) before this work, and even here it was uncommon. The advantages of using a case already built is the optimization of energy costs, which is somewhat predicted by the optimal foraging theory (MacArthur and Pianka, 1966). Also, cases of *Grumicha* are as resistant as *Marilia* cases.

However, some species line the interior wall of the case with silk, to facilitate the undulation movement and prevent the gill abrasion (Williams and Penak, 1980; Okano and Kikuchi, 2009). Other species, like some of Odontoceridae, select particles with at least one smooth surface to cover the interior walls (Okano et al., 2010). This difference between the interior walls of the cases can explain the lack of more evident opportunistic caddisflies in many surveys. Besides that, the different types of material, like the dark silk of *Grumicha* cases and the stony *Marilia* cases can disturb the camouflage with the natural substrate of the opportunistic species.

Experimental studies with various species can be done to explain more questions about that behavior. It is possible that some species do not use even an already built case of the same species, while others save time and energy and take the opportunity to enter in any type of cases. These studies may also focus on the adaptive values of the different behavioral strategies.



Figure 2. *Triplectides egleri* from Manaus in a part of a shrimp leg. The head and torax of the larva are visible in the middle portion of the structure, marked by the arrow.

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