

SHORT COMMUNICATION

## Phoretic association between larvae of *Rheotanytarsus* (Diptera: Chironomidae) and genera of Odonata in a first-order stream in an area of Atlantic Forest in southeastern Brazil

Beatriz F. J. Vescovi Rosa<sup>1, 2</sup>; Renato T. Martins<sup>1</sup>; Vívian C. de Oliveira<sup>1</sup> & Roberto da G. Alves<sup>1</sup>

<sup>1</sup> Laboratório de Invertebrados Bentônicos, Programa de Pós-graduação em Ciências Biológicas em Comportamento Animal e Biologia, Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Juiz de Fora. 36036-330 Juiz de Fora, Minas Gerais, Brasil.

<sup>2</sup> Corresponding author. E-mail: beatrizjabour@yahoo.com.br

**ABSTRACT.** In this note, the occurrence of phoresy between larvae of *Rheotanytarsus* sp. (Diptera: Chironomidae) and larvae of *Heteragrion* sp. (Odonata: Megapodagrionidae) and of unidentified genera of Calopterygidae (Odonata) collected in a first-order stream in an area of Atlantic Forest in southeastern Brazil is reported. During the dry season of 2007 and the rainy season of 2008, with the aid of a Surber sampler, 15 samples of each of the following mesohabitats were collected: litter from riffle areas, litter from pool areas and sediment in pool areas. Eighty-five Odonata larvae were obtained, 10 (11.76%) with cases of phoresy by *Rheotanytarsus* sp.. These chironomids were associated with only one specimen of Megapodagrionidae, whereas the other larvae were recorded in association with Calopterygidae. Most of the Odonata with cases of phoresy by *Rheotanytarsus* sp. were recorded in the dry season. In the present study, the absence of the phoretic association with other potential hosts for *Rheotanytarsus* sp. found in the samples indicates a possible preference of these larvae for Odonata, which accounted for only 2.42% of the collected macroinvertebrates in litter and sediment.

**KEY WORDS.** Calopterygidae; *Heteragrion*; mesohabitats.

Phoresy, a relationship in which an organism lives on the body of another organism and is thus carried (TOKESHI 1993), occurs among various organisms from aquatic environments. It has been described as a commensal interaction for several invertebrate taxa, especially chironomid insects, which is the group with the greatest number of records of phoretic association with different genera and species of invertebrates (SEGURA *et al.* 2007). The commensal hosts for this family are mostly members of the Plecoptera (EPLER 1986), Ephemeroptera (CALLISTO & GOULART 2000), Megaloptera (PENNUTO 2003), Odonata (FERREIRA-PERUQUETTI & TRIVINHO-STRIXINO 2003), and Trichoptera (ROQUE *et al.* 2004).

Most works on chironomid larvae in phoretic association with other organisms are concentrated in North America and Europe (TOKESHI 1993). In Brazil, this relation was previously recorded in lotic environments from the states of São Paulo (FERREIRA-PERUQUETTI & TRIVINHO-STRIXINO 2003), Rio de Janeiro (DORVILLE *et al.* 2000), Mato Grosso do Sul (ROQUE *et al.* 2004), and Minas Gerais (CALLISTO *et al.* 2006). The present study records the occurrence of phoresy between larvae of *Rheotanytarsus* Thienemann & Bause, 1913 (Chironomidae) and

larvae of Odonata (Calopterygidae and Megapodagrionidae) in a first-order stream in an area of Atlantic Forest in southeastern Brazil.

The stream is located in a secondary forest, which comprises an area of biological conservation called Reserva Biológica Municipal Poço D'Anta (21°45'S, 43°20'W; altitude varying from 800 to 1040 m). This reserve is located in the municipality of Juiz de Fora, state of Minas Gerais, Brazil. The stream is a shallow environment ( $5.63 \pm 1.43$  cm), whose bed is mostly constituted of sand and patches of substrate of stones and leaf litter. The water is transparent and well oxygenated ( $10.03 \pm 0.42$  mg/l), with electric conductivity and pH varying around  $17.75 \pm 2.06$   $\mu$ S/cm and  $6.38 \pm 0.41$ , respectively.

During the dry season of 2007 (July to September) and the rainy season of 2008 (January to March), 15 samples of each of the following mesohabitats were collected with the aid of a Surber sampler (250  $\mu$ m mesh): litter from riffle areas, litter from pool areas and sediment from pool areas. In each month, patches from the four mesohabitats, located in a stretch of 300 m of the stream, were individually sampled during 30 seconds. The samples were fixed in formaldehyde solution 4%,

washed in current water and passed through a sieve with a 0.21 mm mesh. The restrained organisms were sorted in a stereoscopic microscope, quantified and preserved in 70% alcohol. Chironomidae larvae were identified up to genus according to WIEDERHOLM (1983), EPLER (1992) and TRIVINHO-STRIXINO & STRIXINO (1995). Odonata larvae with cases of phoresy by Chironomidae were identified up to the lowest possible taxonomic level using the key of COSTA *et al.* (2004). The larvae of *Rheotanytarsus* sp. and Odonata were deposited in the Invertebrate Collection of the Universidade Federal de Juiz de Fora (IC-UFJF) 004 and 005.

In order to verify if there was a significant difference among the number of larvae collected with or without larval cases in the two sample seasons, the Mann-Whitney test was performed. This statistical test was also used in order to verify if there was a significant difference of the mean velocity of the water and the outflow between the dry and the rainy season. The computer program Past, version 1.49 (HAMMER *et al.* 2001), was employed for performing the statistical tests.

In this work, 3507 specimens of macroinvertebrates previously recorded in the literature as potential hosts for larvae of Chironomidae were collected. These potential hosts were individuals of the Ephemeroptera (31.00%), Trichoptera (30.54%), Coleoptera (15.63%), Plecoptera (11.58%), Hemiptera (6.50%), Odonata (2.42%) and Megaloptera (2.34%). However, the present study recorded the phoretic association of *Rheotanytarsus* sp. with larvae of Odonata only.

Eighty-five Odonata larvae were collected, distributed as follows: Calopterigidae ( $n = 20$ ), Libellulidae ( $n = 14$ ), fragmented Zygoptera ( $n = 7$ ), Megapodagrionidae ( $n = 3$ ), Gomphidae ( $n = 2$ ), Aeshnidae ( $n = 1$ ) and Corduliidae ( $n = 1$ ). From these specimens, 10 Odonata (11.76%) showed cases of phoresy by *Rheotanytarsus* sp., being recorded nine associations

with Calopterygidae and one with *Heteragrion* Selys, 1862 (Megapodagrionidae). It was not possible to separate *Haetaerina* Hagen in Selys, 1853 from *Mnesarete* Cowley, 1934, both belonging to the Calopterygidae, because of the difficulty in identifying the larvae of each of them (COSTA *et al.* 2004). According to GARRISON (2006), although both genera are considered valid, there are no known morphological characters that distinguish their larvae.

Most of the larval cases (83.33%) were attached on the sternal portion of the Odonata specimens, with the head capsule pointing to the posterior portion of the host's body (Figs 1 and 2). Only two hosts presented more than one case of phoresy by *Rheotanytarsus* sp.: in *Heteragrion* sp. one larval case with larvae and another without larvae were found, both on the sternum, while in one individual of Calopterygidae we observed that there were two larval cases with larvae, one located on the sternum and another on the prothoracic leg. Empty larval cases were recorded in 40% of the hosts (Tab. I).

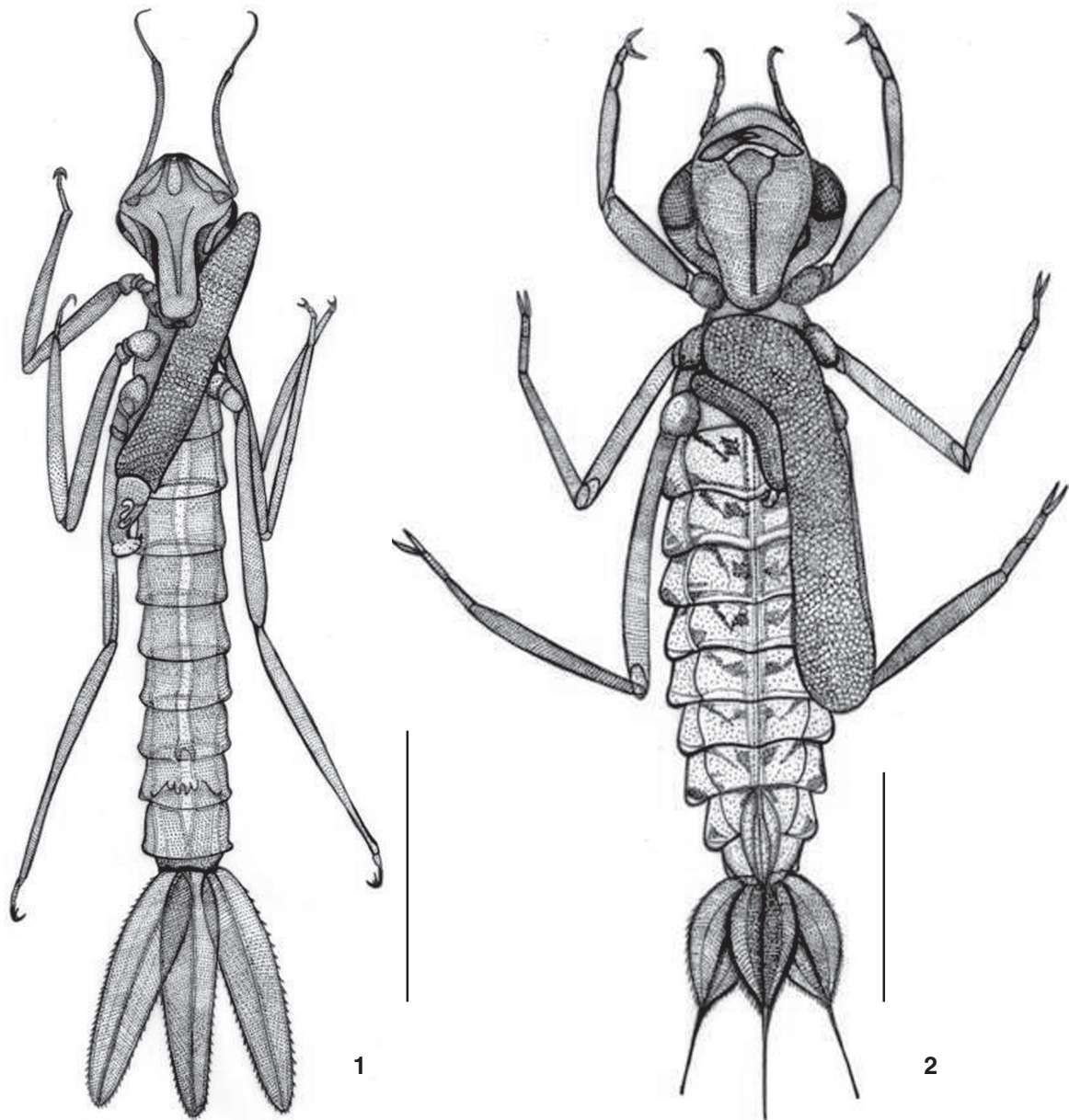
The number of larvae without larval cases was significantly higher than that of larvae with larval cases ( $p < 0.05$ ) in both seasons of the analysis (Fig. 3). In the rainy season, only a single Odonata specimen with a case of phoresy by Chironomidae was found. The mean velocity of the water and the outflow were significantly higher ( $p < 0.05$ ) in the rainy season, possibly increasing the carrying of vegetal debris and their associated organisms, and thus making the phoretic association more difficult during this period. However, CALLISTO & GOULART (2000) recorded a higher number of *Nanocladius* sp. larvae (Chironomidae) in phoresy with nymphs of Ephemeroptera in the rainy season, relating this fact to the dispersion of vegetal debris in the studied stream.

*Rheotanytarsus* sp. has already been recorded from Brazil in association with Odonata larvae of Aeshnidae, Coenagrionidae,

Table I. *Rheotanytarsus* sp. associated to Odonata larvae found in a first-order stream in an area of Atlantic Forest, state of Minas Gerais, southeastern Brazil.

Host*	Mesohabitat	Cases with larvae	Cases without larvae	Sites of attachment
Megapodagrionidae ( <i>Heteragrion</i> sp.)	litter from riffle areas	1	1	Sternum
Calopterygidae	litter from riffle areas	1	–	Sternum
Calopterygidae	litter from riffle areas	1	–	Sternum
Calopterygidae	litter from riffle areas	1	–	Sternum
Calopterygidae	litter from pool areas	1	–	Sternum
Calopterygidae	litter from pool areas	1	–	Sternum
Calopterygidae	litter from pool areas	–	1	Sternum
Calopterygidae	litter from pool areas	2	–	Sternum and prothoracic leg
Calopterygidae	litter from pool areas	–	1	Anterior leg
Calopterygidae	fine sediment from pool areas	–	1	Sternum

\*It was not possible to distinguish the genera *Hetaerina* Hagen in Selys, 1853 and *Mnesarete* Cowley, 1934 (Calopterygidae). See text for details.



Figures 1-2. Odonata larvae of an unidentified genus of Calopterygidae (1) and *Heteragrion* sp. (2) with cases of phoresy by *Rheotanytarsus* sp. attached to the sternum. Scale: 4 mm.

Megapodagrionidae and Libellulidae (FERREIRA-PERUQUETI & TRIVINHO-STRIXINO 2003, ROQUE *et al.* 2004). The phoretic association of this chironomid with the Calopterygidae is herein for the first time recorded from Brazil.

The phoretic association was observed in mesohabitats of litter in riffle areas and sediment in pool areas, possibly because the accumulation of leaves in these areas makes possible the maintenance of a greater abundance of invertebrates. Such

abundance is related to the stability of the substrate and to the significant amount of debris (HYNES 1970). These conditions result in a greater availability of hosts to *Rheotanytarsus* sp. larvae, making possible the establishment of the phoretic association (TOKESHI 1993).

*Rheotanytarsus* sp. is a filter-feeding organism (COFFMAN & FERRINGTON 1984), which usually builds its tubes in lotic waters (SANSEVERINO & NESSIMIAN 2001). The individuals found in

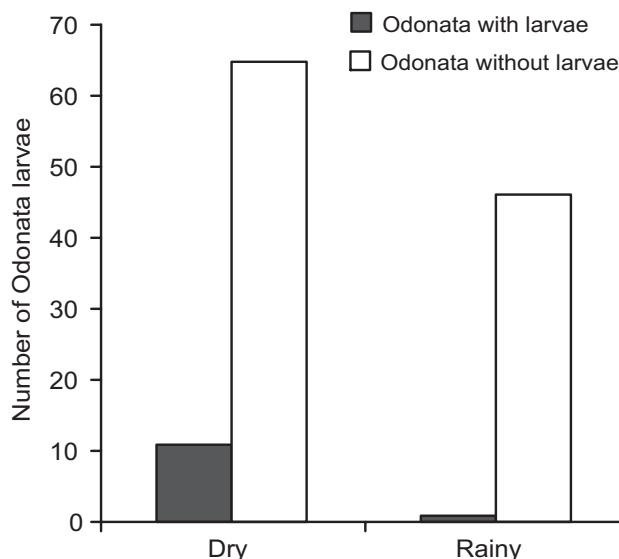


Figure 3. Number of Odonata larvae with and without cases of phoresy by *Rheotanytarsus* sp. collected in the dry season of 2007 and in the rainy season of 2008 in a first-order stream in south-eastern Brazil.

Odonata larvae an appropriate body surface to the setting of their tubes and the accomplishment of their physiological and behavioral activities (SANSEVERINO *et al.* 1998).

Calopterygidae larvae and *Heteragrion* sp. larvae live in lotic habitats and they can be found in riffle areas and pool areas (CARVALHO & NESSIMIAN 1998) with a lot of marginal vegetation (FERREIRA-PERUQUETTI & DE MARCO 2002, COSTA *et al.* 2004, DE MARCO & PEIXOTO 2004). The establishment of the phoretic association between Chironomidae and Odonata, reported in the present work, may be related to the co-occurrence of the organisms in habitats with similar physical characteristics.

The results obtained in the present study suggest, even with the relatively low percentage of the phoretic relation observed, that Odonata larvae represent steady substrates for *Rheotanytarsus* sp., providing an increase in the mobility and in the capacity of the chironomid of exploring the environment (TOKESHI 1993, DOSDALL & PARKER 1998). Moreover, although *Rheotanytarsus* sp. is considered a commensalist without preference for a specific host (TOKESHI 1993), the results of this study indicate a possible preference for larvae of Odonata as the hosts, since the latter were found in the stream in a lower percentage in relation to other potential hosts.

## ACKNOWLEDGMENTS

We would like to thank Fundação de Apoio à Pesquisa do Estado de Minas Gerais (FAPEMIG) for the financial support (CRA APQ-01285-08).

## LITERATURE CITED

- CALLISTO, M. & M.D.C. GOULART. 2000. Phoretic Association Between *Nanocladius* (*Plecoteracoluthus*) sp. (Chironomidae: Diptera) and *Thraulodes* sp. (Leptophlebiidae: Ephemeroptera). *Anais da Sociedade Entomológica do Brasil* 29 (3): 605-608.
- CALLISTO, M.; M.D.C. GOULART; P. MORENO & R.P. MARTINS. 2006. Does predator benefits prey? Commensalism between *Corynoneura* Winnertz (Diptera, Chironomidae) and *Corydalus* Latreille (Megaloptera, Corydalidae) in Southeastern Brazil. *Revista Brasileira de Zoologia* 23 (2): 569-572.
- CARVALHO, A.L. & J.L. NESSIMIAN. 1998. Odonata do estado do Rio de Janeiro, Brasil: habitats e hábitos das larvas, p. 3-28. In: J.L. NESSIMIAN & A.L. CARVALHO (Eds). *Ecologia de Insetos Aquáticos*. Rio de Janeiro, PPGE-UFRJ, Série Oecologia Brasiliensis, vol. 5, XVII+309p.
- COFFMAN, W.P. & L. FERRINGTON. 1984. Chironomidae, p. 635-754. In: R.W. MERRIT & K.W. CUMMINS (Eds). *An introduction to the aquatic insects of North America*. Dubuque, Kendall/Hunt Publishing, 862p.
- COSTA, J.M.; L.O.I. SOUZA & B.B. OLDRINI. 2004. Chave para as famílias e gêneros das larvas de Odonata citadas para o Brasil: Comentários e Registros Bibliográficos. *Publicações Avulsas do Museu Nacional* 99: 1-43.
- DE MARCO JR, P. & P.E.C. PEIXOTO. 2004. Population dynamics of *Hetaerina rosea* and its relationship to abiotic conditions (Zygoptera: Calopterygidae). *Odonatologica* 33 (1): 17-25.
- DORVILLE, L.F.M.; J.L. NESSIMIAN & A.M. SANSEVERINO. 2000. First record of symphoresy between nymphs of the stonefly *Kamponia tijucana* (Plecoptera: Perlidae) and a Chironomidae larva *Nanocladius* (*Plecoteracoluthus*) in the neotropics. *Studies on Neotropical Fauna and Environment* 35 (2): 109-114.
- DOSDALL, U.M. & W.D. PARKER. 1998. First Report of Symphoretic Association Between *Nanocladius branchicolus* Saether (Diptera: Chironomidae) and *Argia moesta* Hagen (Odonata: Coenagrionidae). *The American Midland Naturalist Journal* 139 (1): 181-185.
- EPLER, J.H. 1986. A novel new Neotropical *Nanocladius* (Diptera: Chironomidae), symphoretic on *Traverella* (Ephemeroptera: Leptophlebiidae). *Florida Entomologist* 69 (2): 319-327.
- EPLER, J.H. 1992. *Identification manual for the larval Chironomidae (Diptera) of Florida*. Tallahassee, Department of Environmental Regulation, 427p.
- FERREIRA-PERUQUETTI, P. & P. DE MARCO JR. 2002. Efeito da alteração ambiental sobre comunidades de Odonata em riachos de Mata Atlântica de Minas Gerais, Brasil. *Revista Brasileira de Zoologia* 19 (2): 317-327.
- FERREIRA-PERUQUETTI, P. & S. TRIVINHO-STRIXINO. 2003. Notas sobre relações foréticas entre espécies de Chironomidae e Odonata do Estado de São Paulo, Brasil. *Entomotrópica* 18 (2): 569-572.

- GARRISON, R.W. 2006. A synopsis of the genera *Mnesarete* Cowley, *Bryoplathanon* gen. nov., and *Ormenoplebia* gen. nov. (Odonata: Calopterygidae). **Contributions in Science** 506: 1-4.
- HAMMER, Ø.; D.A.T. HARPER & P.D. RYAN. 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. **Palaeontologia Electronica** 4 (1): 1-9.
- HYNES, H.B.N. 1970. The Ecology of Stream Insects. **Annual Review of Entomology** 15: 25-42.
- PENNUTO, C.M. 2003. Population dynamics and intraspecific interactions of an ectosymbiotic midge in a river in Southern Maine, USA. **Journal of the North American Benthological Society** 22 (2): 249-262.
- ROQUE, F.O.; S. TRIVINHO-STRIXINO; M. JANCOS & E.N. FRAGOSO. 2004. Records of Chironomidae larvae living on other aquatic animals in Brasil. **Biota Neotropica** 4 (2): 1-9.
- SANSEVERINO, A.M. & J.L. NESSIMIAN. 2001. Habitats de larvas de Chironomidae (Insecta, Diptera) em riachos de Mata Atlântica no Estado do Rio de Janeiro. **Acta Limnologica Brasiliensia** 13 (1): 29-38.
- SANSEVERINO, A.M.; J.L. NESSIMIAN & A.L.H. OLIVEIRA. 1998. A fauna de Chironomidae (Diptera) em diferentes biótopos da Serra do Subaio (Teresópolis, RJ), p. 253-263. *In*: J.L. NESSIMIAN & A.L. CARVALHO (Eds). **Ecologia de Insetos Aquáticos**. Rio de Janeiro, PPGE-UFRJ, Série Oecologia Brasiliensis, vol. 5, XVII+309p.
- SEGURA, O.M.; A.A. FONSECA-GESSNER & T.C.A. BATISTA. 2007. Associação forética entre larvas de *Rheothanytarsus* (Chironomidae, Tanytarsini) e adultos de Elmidae (Coleoptera), coletados em córregos no Parque Estadual de Campos do Jordão, São Paulo, Brasil. **Revista Brasileira de Zoologia** 24 (2): 503-504.
- TOKESHI, M. 1993. On the evolution of commensalism in the Chironomidae. **Freshwater Biology** 29 (3): 481-489.
- TRIVINHO-STRIXINO, S. & G. STRIXINO. 1995. **Larvas de Chironomidae (Diptera) do Estado de São Paulo: Guia de identificação e diagnose dos gêneros**. São Carlos, PPG/ERN/UFSCar, 29p.
- WIEDERHOLM, T. 1983. Chironomidae of the Holarctic – Keys and diagnoses. Part 1. Larvae. **Entomologica Scandinavica** (Suppl. 19): 1-457.

---

Submitted: 05.I.2009; Accepted: 24.XI.2009.

Editorial responsibility: Gabriel Mejdalani