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Notes and Comments

First record of Epibiont ciliates (Ciliophora: Peritrichia) associated with *Dero digitata* Müller, 1773 (Oligochaeta: Naididae) in Brazil

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Epibiosis is the facultative association between two organisms: the epibiont (colonizes the surface of living substrates) and the basibiont (the host). The association effects can have both positive and negative aspects (Wahl, 1989; Fernandez-Leborans and Tato-Porto, 2000; Dias et al., 2007). In aquatic environments, one of the positive effects of epibiosis is the transport of epibionts for places with greater food availability and dissolved oxygen (Regali-Seleghim and Godinho, 2004). However, for hosts, this relationship may cause negative effects, as recorded in the work of Henebry and Ridgeway (1979), whose presence of protozoa impaired the host's swimming efficiency. Also, Laird (1959) reported that heavy of epibiont on mosquito larvae limited their feeding activities, which came close to establishing a parasitism relationship, which can decrease the host's ability to survive.

Epibiont ciliates play an important ecological role in freshwater ecosystems such as control of bacterial density (Sanders et al., 1989; Berninger et al., 1991; Zingel et al., 2007) and alteration of the morphological and taxonomic composition of bacterial communities by predation (Jurgens and Gude, 1994; Jurgens et al., 1997). However, most research related to these organisms is of morphological and taxonomic aspects (Baldock, 1986). Many epibionts use animals and plants as a substrate during their lives (Dias et al., 2007). For example, the organisms from the genus *Rhabdostyla* Kent, 1880 (Peritrichia, Epistylidae) live associated with freshwater invertebrates, such as rotifers, crustaceans (Cladocerans, Copepods), insects of the orders Ephemeroptera and Diptera (Chironomidae) and annelids (Oligochaeta and Polychaeta) (Fernandez-Leborans and Tato-Porto, 2000; Regali-Seleghim and Godinho, 2004; Dias et al., 2007). Other species of Epibiont ciliates were also recorded in Plecoptera insects (Avelino-Capistrano, 2010) and in the larval stage of Odonata and Ephemeroptera (Corbi et al. 2017; Abrahão et al., 2017).

The Oligochaeta Class is one of the most abundant groups in freshwater systems. With wide distribution, these worms playing a fundamental role in the decomposition and cycling of organic matter (Loteste and Marchese, 1994; Martins et al., 2008; Esteves et al., 2011). Oligochaeta inhabit several microhabitats from aquatic environments, which can be registered in sediments and water column (Rodriguez and Reynoldson, 2011), in association with other organisms, such as aquatic macrophytes (Gorni and Alves, 2008), bryophytes (Gorni and Alves, 2007), sponges (Alves and Gorni, 2007), insect larvae (Corbi et al., 2004) and amphibians (Oda et al., 2015). In addition, these organisms are recognized as biological indicators of the water quality in aquatic environments (Prygiel et al., 2000).

In general, research involving the association of Epibiont ciliates with oligochaetes refers only to the occurrence and description of species. However, there are studies that have registered this association and its ecological relationships with aquatic oligochaetes of the families: Tubificidae, Lumbriculidae and Naididae (Kahl, 1935; Precht, 1935; Nenninger, 1948; Righi, 1973; Smith, 1986; Foissner et al., 1992; Dias et al., 2009).

We report the first record of Epibiont ciliates (Ciliophora: Peritrichia) associated with an aquatic Oligochaeta, *Dero digitata* Müller, 1773 in Brazil. Previously, there is only one record of Rhabdostyla (Ciliophora: Peritrichia) on *D. digitata* in Ozaukee County, Wisconsin - United States (Smith, 1986). The organisms were collected in September 2015, in the Monjolinho reservoir region (47° 53'W and 22° 01'S), using aquatic "D" net, during a survey of benthic macroinvertebrates. This reservoir is located on the campus of the Federal University of São Carlos (São Carlos, São Paulo, Brazil). The Oligochaeta species was identified using the taxonomic criteria adopted by Brinkhurst and Jamieson (1971) and Brinkhurst and Marchese (1989). The epibiont ciliates (Ciliophora: Peritrichia) were found associated with the branchial fossa region of the oligochaetes (Figure 1).

Some species of aquatic oligochaetes have respiratory gills and appendages in the posterior region of the body and these structures increase the absorption of oxygen (Raposeiro et al., 2009). Among these species, *D. digitata* is considered tolerant to organic pollution - a characteristic linked to the ability to tolerate environments with reduced oxygen availability (Brinkhurst and Marchese, 1989; Takeda, 1999). According to some authors, the oxygen supply is an important factor for the location of ciliates in specific

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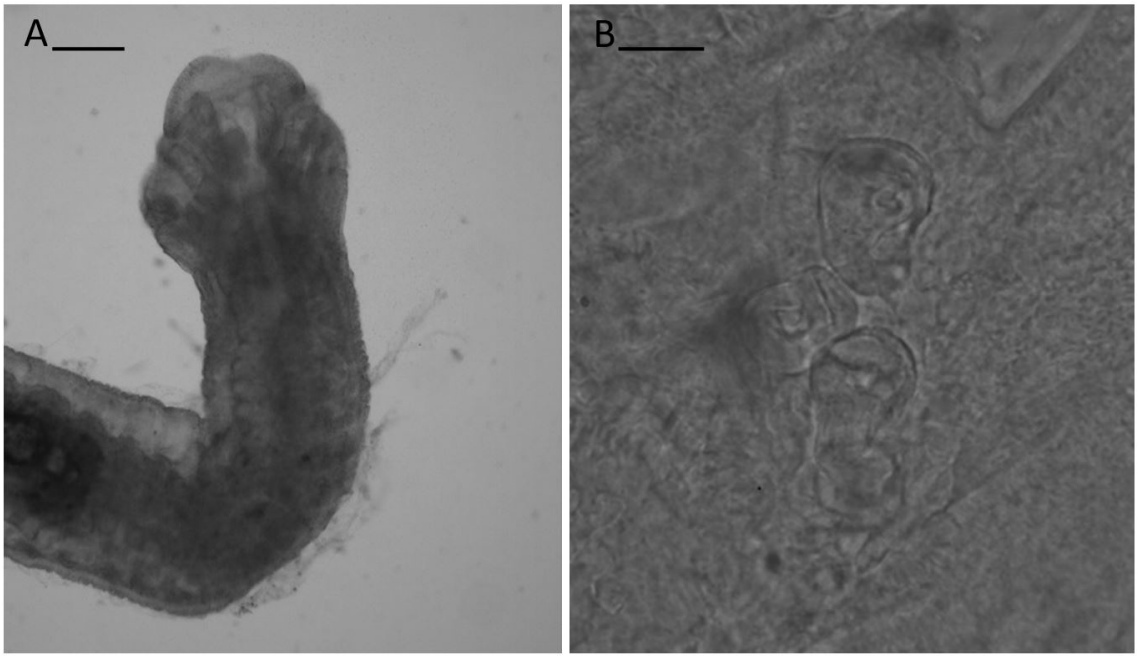

Figure 1. *Dero digitata.* (A) brachial fossa; (B) epibiont ciliates associated with the posterior region. Scale bars: (A) 100 µm and (B) 10 µm.

regions in the body of the hosts (Smith, 1986; Dias et al., 2007). This preference reflects the ecological needs of the epibiont, determined by the environmental conditions, as well as the biology and behavior of the hosts (Fenchel, 1965; Fernandez-Leborans et al., 1997). Smith (1986) attributed the presence of the largest number of Epibiont ciliates in the posterior region of *Dero nivea* Aiyer, 1930 to the ventilation generated by the gills of these organisms. Similarly, Dias et al. (2009) recorded in a polluted stream in the neotropical region highest concentration of ciliate in the posterior region of *Limnodrilus hoffmeisteri* Claparède, 1862.

The presence of ciliates associated with the gill's region of *D. digitata* does not seem to offer negative effects. However, adherence to the prostomial region would probably harm your diet. Some authors report that ciliates feed mainly on bacteria, and their location in the body of the hosts is indifferent (Henebry and Ridgeway, 1979; Zingel et al., 2007). Therefore, considering the information on the biology and ecology of Epibiont ciliates, our observations may be related to the preference of ciliate adhesion to a basibiont that provides ideal conditions for their survival.

In this study, we obtained the first record of associated Epibiont ciliates in one individual of the species *D. digitata*. Thus, we consider it important to carry out further studies in order to provide details on the ecological interactions between Epibiont ciliates and aquatic Oligochaeta.

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