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Trichodina diaptomi, Epibiont or Parasite?

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Abstract

***Trichodina diaptomi* (Ciliophora: Peritrichida: Trichodinidae); epibiont or parasite?**

In the state of Aguascalientes, Mexico: The ciliate *Trichodina diaptomi* (Basson and Van As 1991), is recorded moving on the shell (carapace) of Diaptomid copepods: *Mastigodiaptomus albuquerquensis* (Herrick 1895) and *M. montezumae* (Brehm 1955) [1]. The ciliate measures 50 to 60 microns in diameter, mostly parasitizes freshwater animals and fishes. However, recently there have been other species of micro crustaceans, both cladocerans (*Daphnia laevis* Birge 1878 and *Bosmina huaronensis* Delachaux 1918), other copepods *Arctodiaptomus dorsalis* (Marsh 1907) and *Leptodiaptomus siciliodes* (Lilljeborg 1889), with the same pattern of coexistence, moving on the carapace of these species.

Keywords: Cladocera; Copepoda; Freshwater; Zooplankton

Introduction

In the waterbodies of Aguascalientes State, there is a microscopic world that is completely unknown that is part of the plankton, in addition to other groups of invertebrates. However, there seems to be a protist that is transported by some species of invertebrates or even parisitizes them. This is the case of *Trichodina diaptomi* (Basson and Van As 1991), which in the state of Aguascalientes has been found to move on the carapace of cladocerans and copepods (Figure 1-3). *Trichodina* is a ciliated 50 to 60µm in diameter that mostly parasitizes freshwater animals and fishes. However, it has been found as endo and ectoparasites or commensals of marine organisms such as Ctenophora [2], mainly fish [3-6]. In Mexico, it was found in *Astyanax mexicanus* in Cuatro Ciénegas, Coahuila [7]. The Trichodinids are endoparasites of the amphibian tractourogenital [8], as well as in *Hydra* sp. and in bivalve of the genus *Mya* sp. [2].

Trichodina diaptomi is distinguished by the presence of a belt or ring of calcium denticles (Figure 4 & 5), which provides the support to adhere to the surface (Figure 6-13) of the host [1]. At first it was thought that *T. diaptomi* was feeding on the calanoid copepods, *Mastigodiaptomus albuquerquensis* and *M. montezumae* [1].

In addition, they present an adhesive disc that probably secretes some special glue that does not allow it to be separated from the host (Figure 14 & 15). After a while of observing them it was possible to appreciate that they only moved across the carapace (cephalothorax) of these crustaceans (Figure 1 & 2). Recently it has been found that they also thrive on other zooplankters of the cladocerans group.

The aim of this study, simply to show graphically (with images) which species of zooplankton use *Trichodina diaptomi* as transport (foresia), to move or take them hostage for their development and survival, which inhabit the state of Aguascalientes.

Materials and Methods

The zooplankton samples were taken using a Wisconsin-type plankton net of 54 microns mesh size and fixed in 4% formaldehyde. The images were taken using the JEOL LV 5900 scanning electron microscope. Digital images were also taken with a digital camera using the PRO PLUS program, and an Apple iphone 5s.

Results

When *T. diaptomi* was found in Aguascalientes State, there were no records in Mexico and America in general, only a reference of this ciliate in South America [9]. This work shows *Trichodina* using several species of zooplankton as a means of transport. Recently, there was another record of *Trichodina mutabilis*

Kazubski and Migala 1968, in the characid *Astyanax mexicanus* (De Filippi 1853) of Cuatro Ciénegas, Coahuila, although not on micro crustaceans.

In general, temporary water bodies, such as a farm ponds or a small dam in the state of Aguascalientes, where the aforementioned copepods usually inhabit, there have not fish, and even the populations of these crustaceans are very large. [9], mentions that in the case of *Trichodina* not finding any fish in the water body, these organisms change their food habits and become bacterivores.

Copepods show numerous pores on the surface of the cephalothorax (Figure 16) that definitely shows the presence of this adhesive or mucus (Figure 15) secreted by *Trichodina*, which suggests that there is sensitivity.

Figure 1: *M. albuquerquensis* (habitus), with *T. diaptomi* in the dorsal part of the cephalothorax (arrows). Pond La Tomatina. Jesús María, Ags.

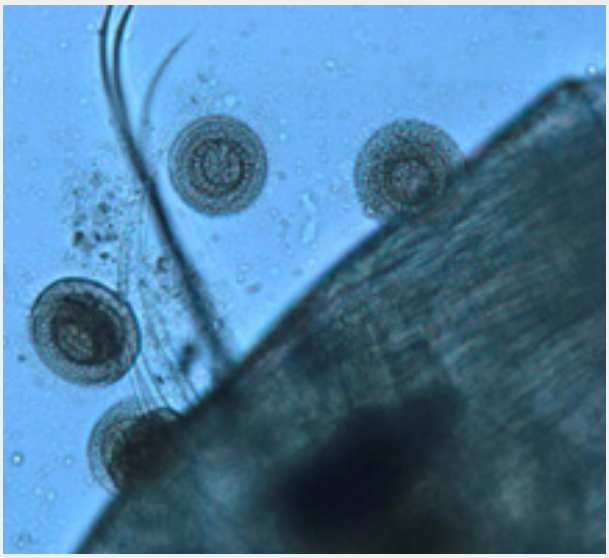

Figure 2: Zoom of *T. diaptomi,* on the dorsal part of the cephalothorax of *M. albuquerquensis*. Pond La Tomatina. Jesús María, Ags.

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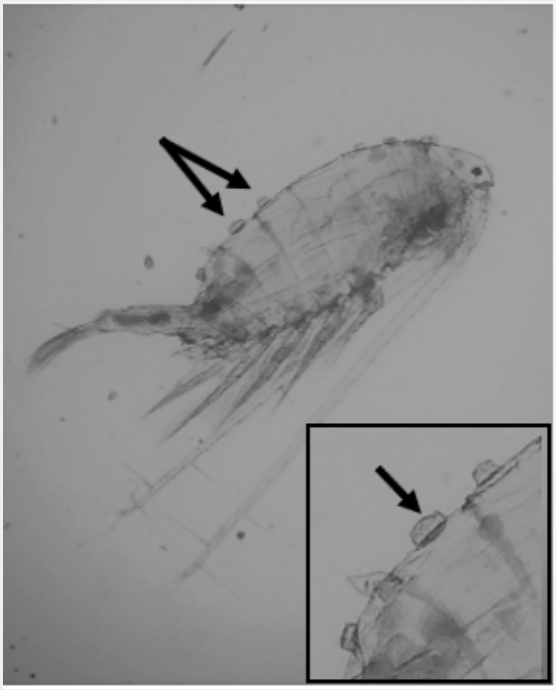

Figure 3: *Arctodiaptomus dorsalis* (female), habitus showing *T. diaptomi* (arrows) sliding on the dorsal part of the cephalothorax. Bottom right, box showing zoom of the two diagnostic growths of the species located in the posterior dorsal part of the cephalothorax, showing *T. diaptomi*. Dam Malpaso. Calvillo, Ags.

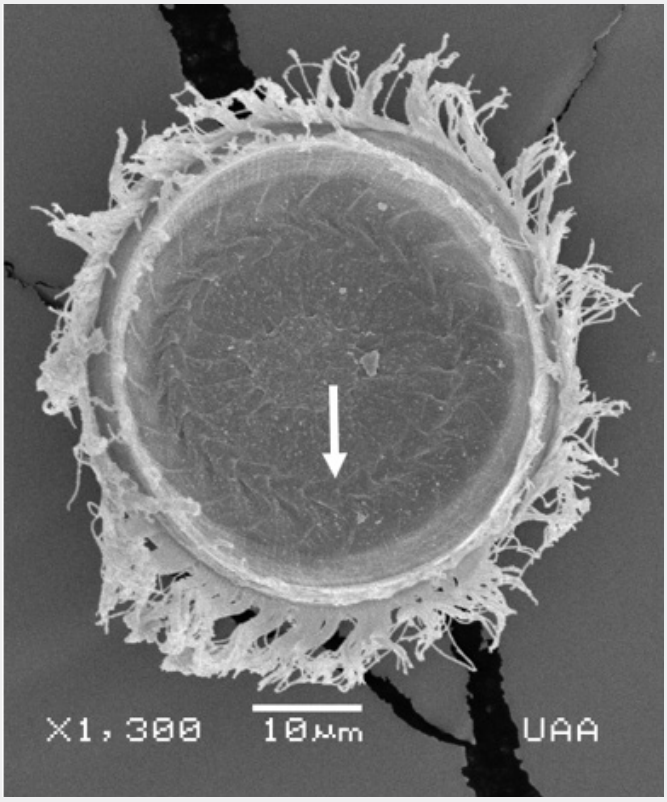

Figure 4: *Trichodina diaptomi,* habitus showing the oral part with the calcium denticles (arrow). Pond on the side of Reservoir Presidente Rodríguez. Jesús María, Ags.

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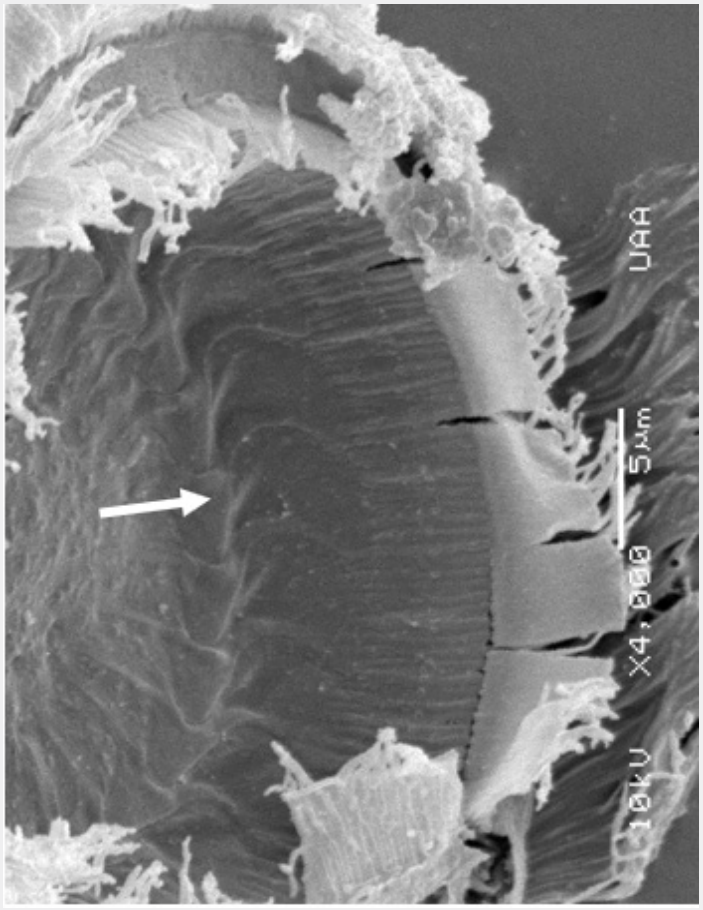

Figure 5: *T. diaptomi,* detail of the calcium denticles (arrow). Pond on the side of Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

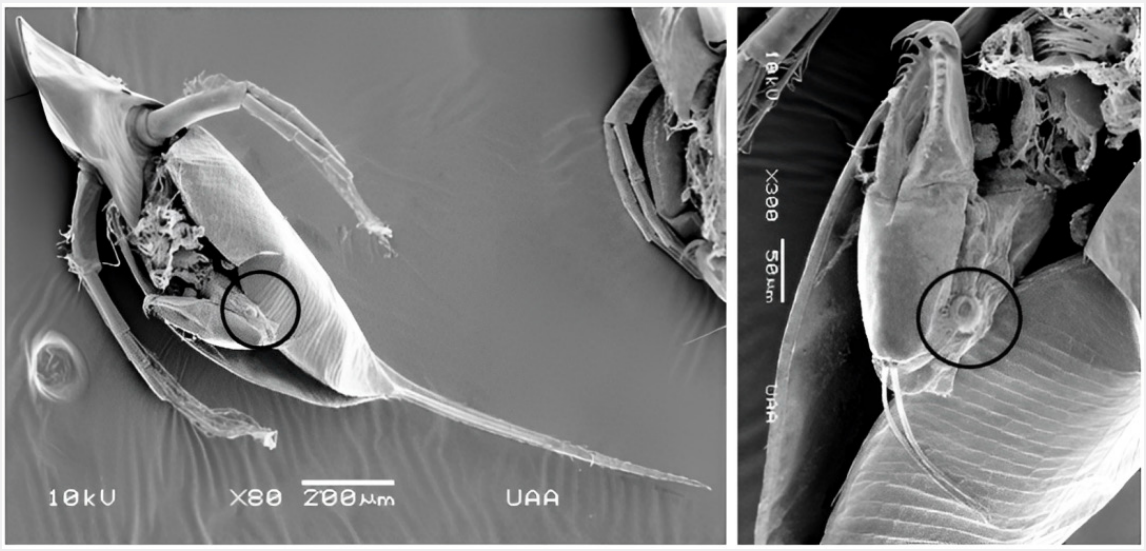

Figure 6 & 7: *T. diaptomi,* attached to the postabdomen of *Daphnia laevis* (circle). Pond on the side of town Tortugas. Rincón de Romos, Ags.

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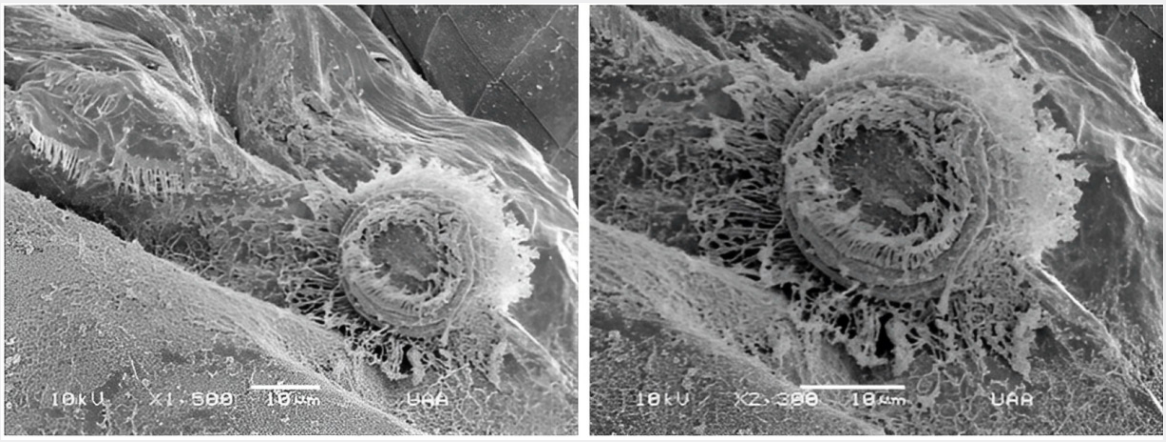

Figure 8 & 9: *T. diaptomi* (zoom) attached to the postabdomen of *Daphnia laevis* (circle). Pond on the side of town Tortugas. Rincón de Romos, Ags.

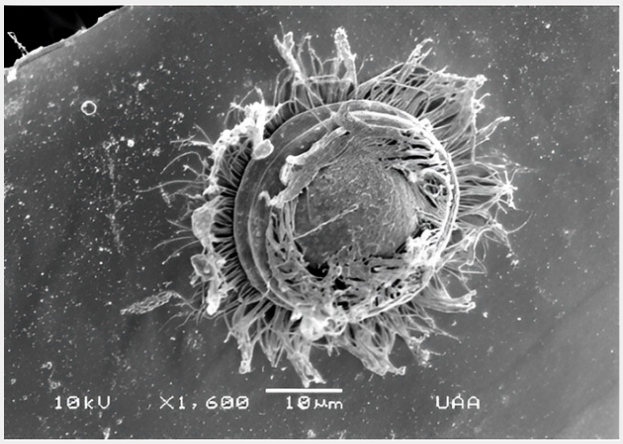

Figure 10: *T. diaptomi* (zoom) attached to the carapace of *Bosmina huaroensis*. Reservoir El Tecuancillo, Ags.

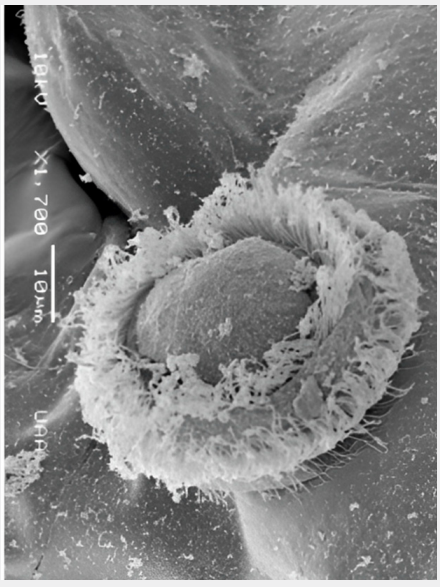

Figure 11: *L. siciloides* (female), zoom of habitus of *T. diaptomi,* attached to the dorsal part of the cephalothorax. Puddle near town Tanque El Refugio. Asientos, Ags.

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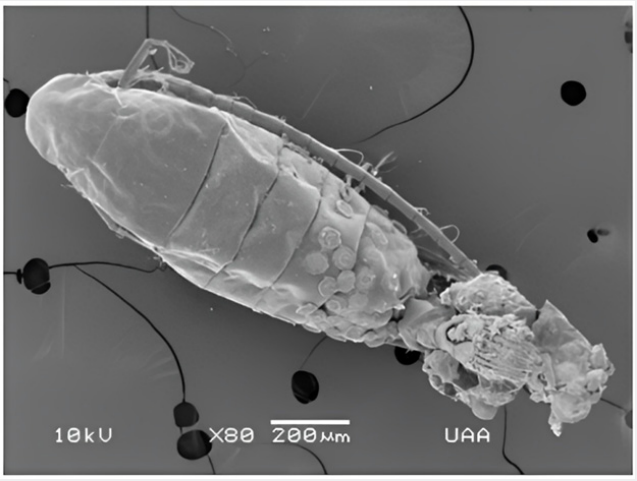

Figure 12: *M. montezumae* (female), habitus showing *T. diaptomi* attached to the dorsal part of the cephalothorax. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

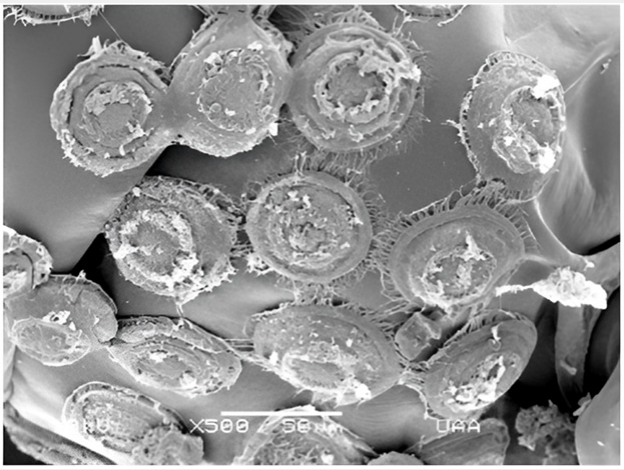

Figure 13: Zoom of *T. diaptomi*, attached to the cephalothorax of *M. montezumae*. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

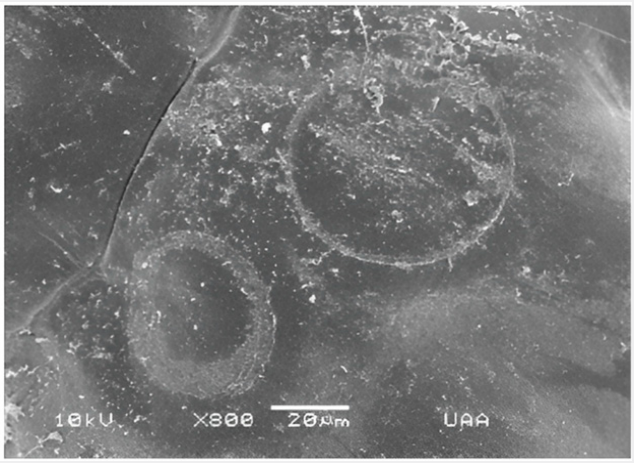

Figure 14: General view of the circle-shaped imprint left on the shell of *M. montezumae* by the ciliate *T. diaptomi*. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

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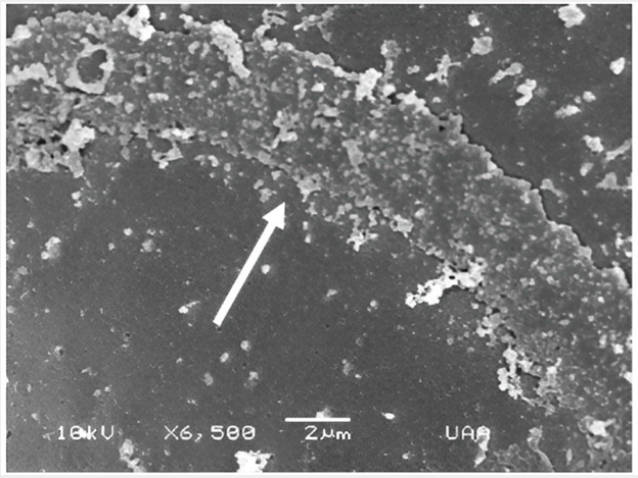

Figure 15: Zoom of the circle-shaped imprint left on the shell of *M. montezumae* by the ciliate *T. diaptomi*. Pond on one side Reservoir Abelardo Rodríguez. Jesús María, Ags.

At first it was thought that *T. diaptomi* was feeding on the calanoid copepods, *Mastigodiaptomus albuquerquensis* and *M. montezumae*. After a while of observing them it was possible to appreciate that they only moved through the carapace (cephalothorax) of these crustaceans (Figure 1 & 2). In other groups such as the cladocerans where *Trichodina* has recently been found, it has not been possible to observe if the surface of the carapace shows any damage.

Following the collections of zooplankton (Rotifera, Cladocera and Copepoda), recently *T. diaptomi* has been found in different micro crustaceans, so they all represent new records (Figure 17).

The groups under study are: Cladocera and Copepoda, whose list is presented below:

Cladocera:

Daphniidae

a) *Daphnia laevis* (Figure 6-9)

Bosminidae

a) *Bosmina huaronensis* (Figure 10 & 18)

Copepoda:

Diaptomidae

a) *Leptodiaptomus siciliodes* (Figure 11,19 & 20)

b) *Arctodiaptomus dorsalis* (Figure 3 & 21)

c) *Mastigodiaptomus albuquerquensis* (Figure 1 & 2)

d) *M. montezumae* (Figure 12 & 13)

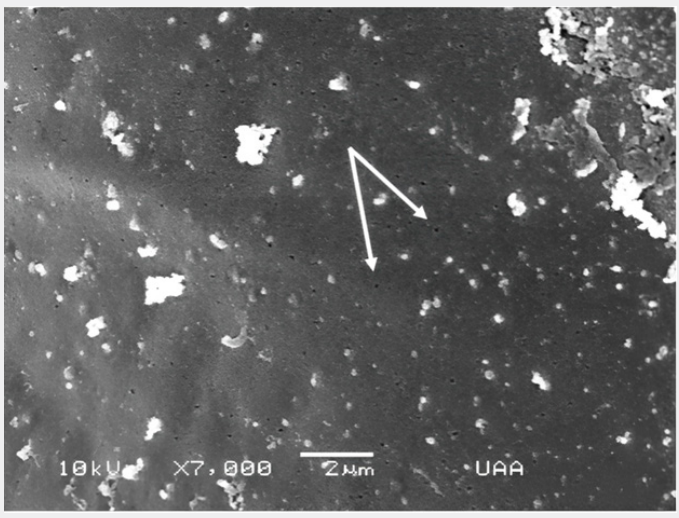

Figure 16: View of the shell of *M. montezumae*, where numerous pores are observed, which may indicate that there is sensitivity to *T. diaptomi*, especially when it is fixed to this surface. Pond on one side Reservoir Abelardo Rodríguez. Jesús María, Ags.

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Figure 17: Aguascalientes State (Mexico). Coordinates of waterbodies where *Trichodina diaptomi* was found as an epibiont.1.-Reservoir El Tecuancillo, Ags: 21° 42' 41.95'' N; 102° 15' 09.26'' W; 2.-Pond La Tomatina. Jesús María, Ags: 21° 53' 45.31'' N; 102° 24' 44.36'' W; 3.-Pond on the side of Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags: 21°54' 32.84" N; 102° 25' 19.62" W; 4.-Reservoir Malpaso. Calvillo, Ags: 21° 51' 27. 12'' N; 102° 39' 11.95'' W; 5.-Pond on the side of town Tortugas. San José de Gracia, Ags: 22° 12' 32.40'' N; 102° 25' 48.35'' W; 6.- Puddle near town Tanque El Refugio. Asientos, Ags: 22° 10' 33.26'' N; 102° 01' 31.93'' W.

Figure 18: *T. diaptomi* attached to the carapace of *Bosmina huaroensis*. Reservoir El Tecuancillo, Ags.

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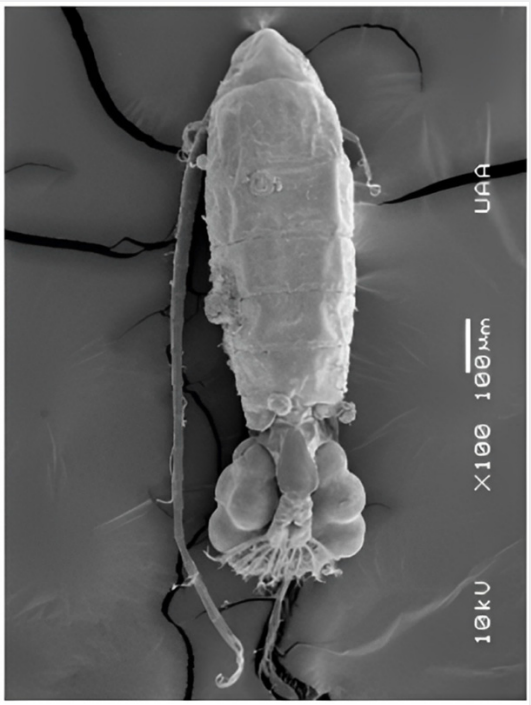

Figure 19: *Leptodiaptomus siciloides*, female with eggs (habitus), with *T. diaptomi*, attached to the anterior part of the dorsal side of the cephalothorax. Puddle near town Tanque El Refugio. Asientos, Ags.

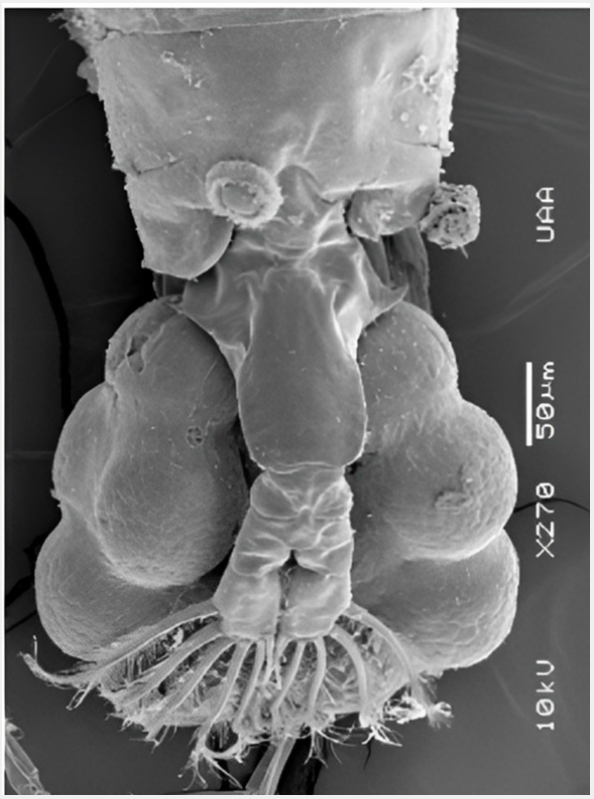

Figure 20: *L. siciloides*, furca of female with eggs bag, showing *T. diaptomi*, adhered to the dorsal part of the cephalothorax. Puddle near town Tanque El Refugio. Asientos, Ags.

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Figure 21: Zoom of the two typical growths in the posterior dorsal part of the cephalothorax in *A. dorsalis*, showing colonies of *Colacium vesiculosum*. Dam Malpaso. Calvillo, Ags.

Discussion

In general, the effects of *Trichodina* on fish are reported in the literature. In Mexico there are no reports of this fact, except the report of Islas-Ortega & Aguilar-Aguilar [7] where *Trichodina mutabilis* infects the characid *Astyanax mexicanus*. Another report mentions that in Brazil, *T. diaptomi* was found in the Calanoid *Notodiaptomus deitersi* (Poppe 1890) moving along its cephalothorax (carapace) [9]. However, there are no reports about the presence of *Trichodina* in other zooplanktons, until today they have been registered in the state of Aguascalientes.

It seems that *T. diaptomi* has a wide variety of groups and species of micro invertebrates used as a transport, since at first it had only been reported in copepods. Cladocerans are also included in this type of interaction.

As it was possible to verify, it does not produce any damage (or at least no damage was observed) to the hosts, although the trace left on the host can be observed.

It is necessary to continue with this type of research to know more about this type of ecological interactions with *Trichodina diaptomi*, since the implications of the species involved and this ciliate are unknown.

It is also necessary to know if they are hosts of other groups of invertebrates, since they have not yet been observed in rotifers, as with other protists that invade them such as *Carchesium*, *Epistylis*, *Scyphidia*, *Vorticella* and *Colacium vesiculosum*, as well as several species of algae.

According to the observations made in the species reported with *Trichodina* in their shell, there is no damage, probably because they have not been found in large quantities as in the case of *Epystilis* sp., which has been stored in large quantities over the head, carapace, antennae and post-abdomen in a massive way.

Acknowledgement

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