

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* [1], is recorded moving on the shell (carapace) of Diaptomid copepods: *Mastigodiaptomus albuquerquensis* [2]. 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 parasitizes them. This is the case of *Trichodina diaptomi* [1], 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* [3], mainly fish [4-7]. In Mexico, it was found in *Astyanax mexicanus* in Cuatro Ciénegas, Coahuila [8]. The Trichodinids are endoparasites of the amphibian tractourogenital [9], as well as in *Hydra sp.* and in bivalve of the genus *Mya sp.* [3].

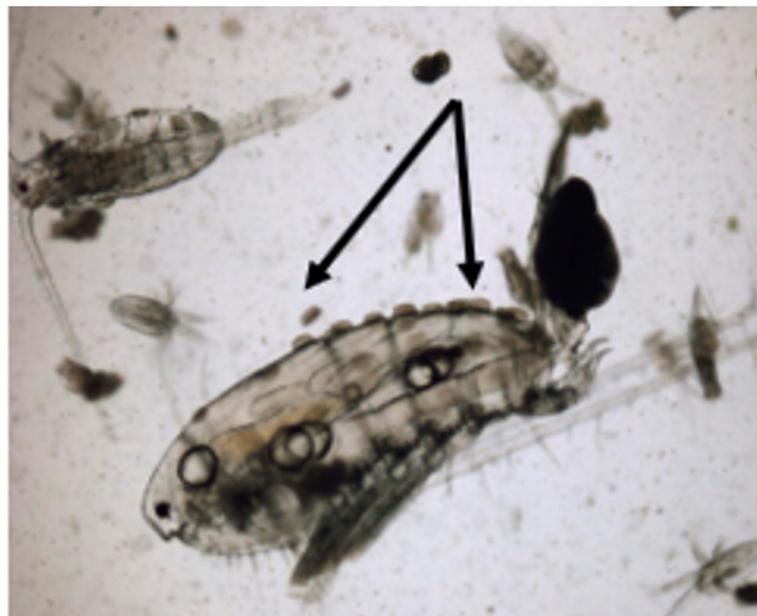


Figure 1: *M. albuquerquensis* (habitus), with *Trichodina diaptomi* in the dorsal part of the cephalothorax (arrows). Pond La Tomatina. Jesús María, Ags.

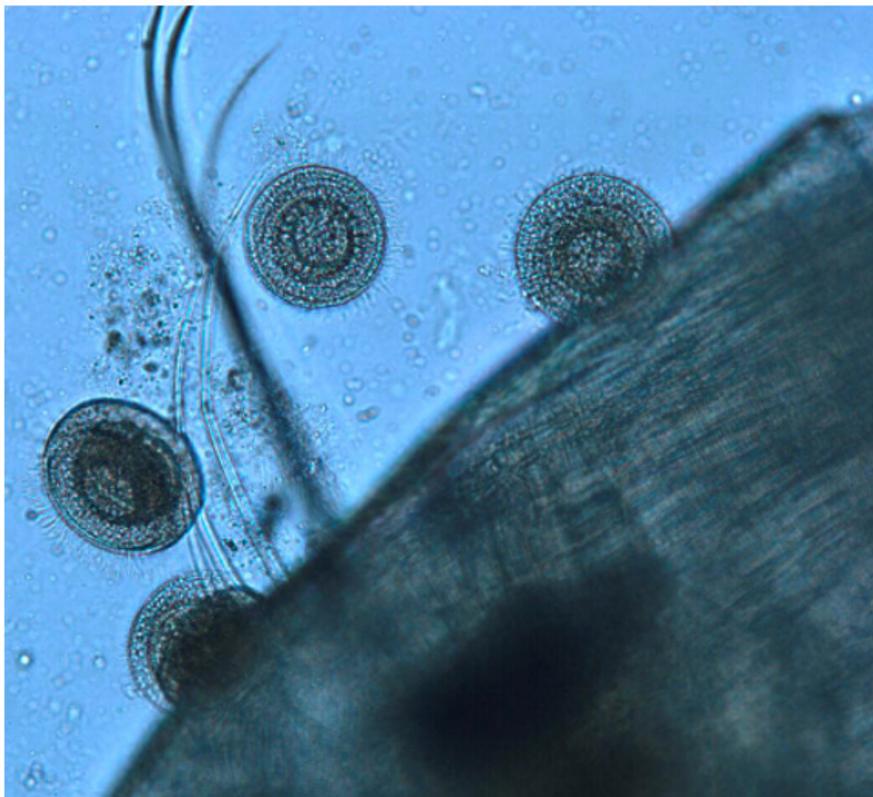


Figure 2: Zoom of *Trichodina diaptomi*, on the dorsal part of the cephalothorax of *M. albuquerquensis*. Pond La Tomatina. Jesús María, Ags.



Figure 3: *Arctodiaptomus dorsalis* (female), habitus showing *Trichodina 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 *Trichodina diaptomi*. Dam Malpaso. Calvillo, Ags.

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 6-12) of the host [2]. At first it was thought that *Trichodina diaptomi* was feeding on the calanoid copepods, *Mastigodiaptomus albuquerquensis* and *M. montezumae* [2]. 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 13 & 14). After a while of

observing them, it was possible to appreciate that they only moved across the *carapace* (cephalothorax) of these crustaceans (Figure 3 & 4). 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.

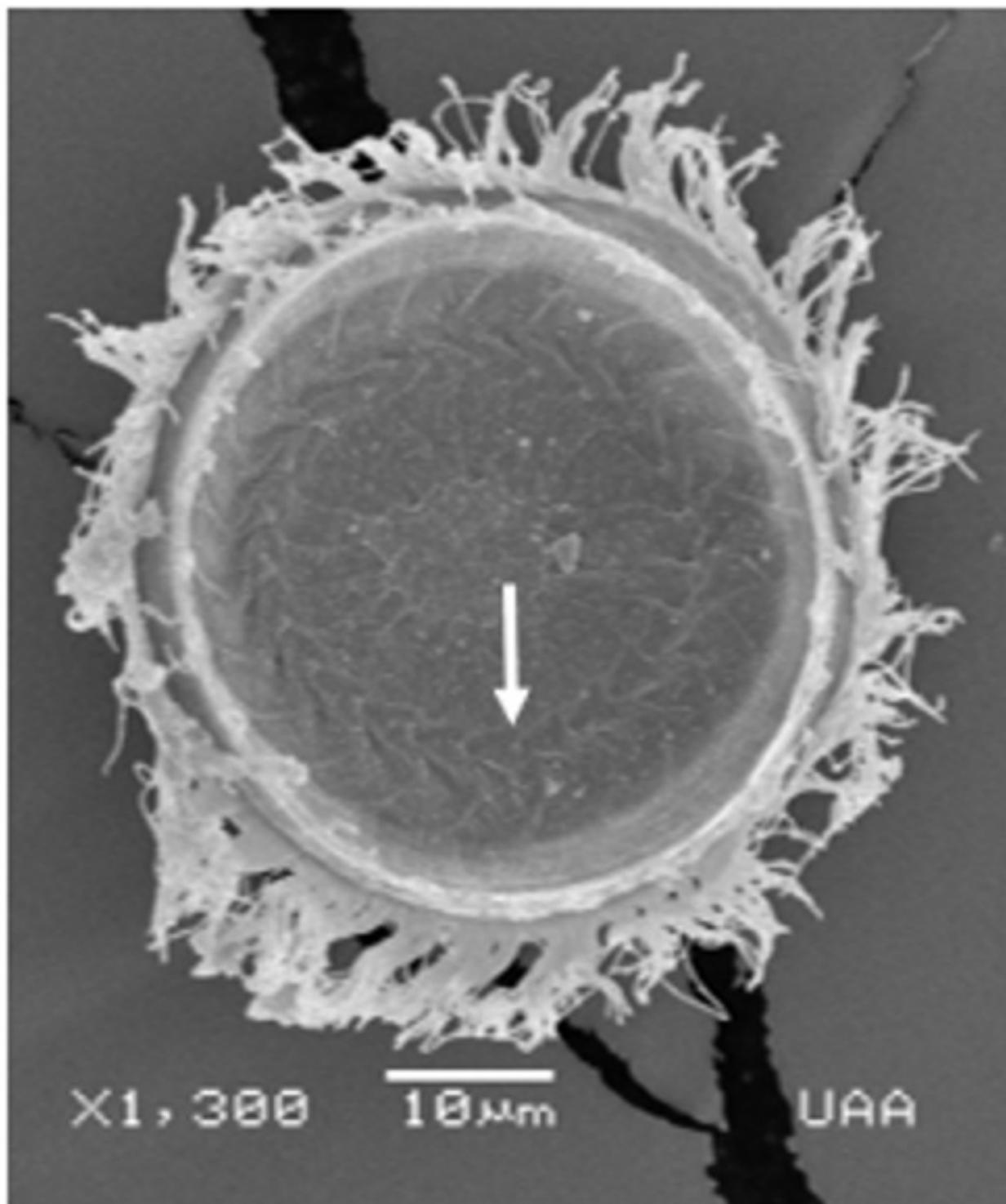


Figure 4: *Trichodina diaptomi*, habitus showing the oral part with the calcium denticles (arrow). Pond on the side of Reservoir President Rodríguez. Jesus Maria, Ags.

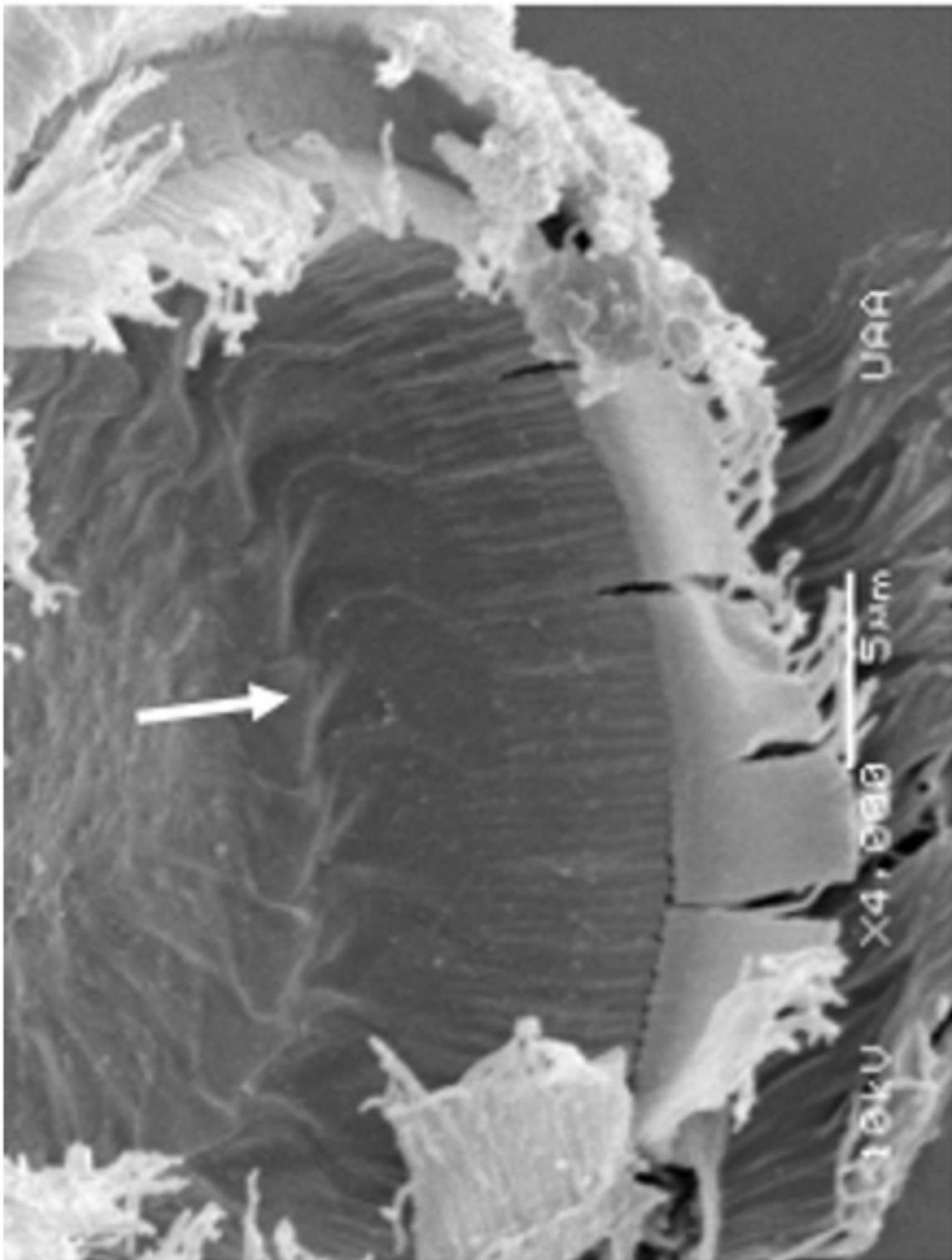


Figure 5: *Trichodina diaptomi*, detail of the calcium denticles (arrow). Pond on the side of Reservoir President Abelardo Rodríguez. Jesús María, Ags.

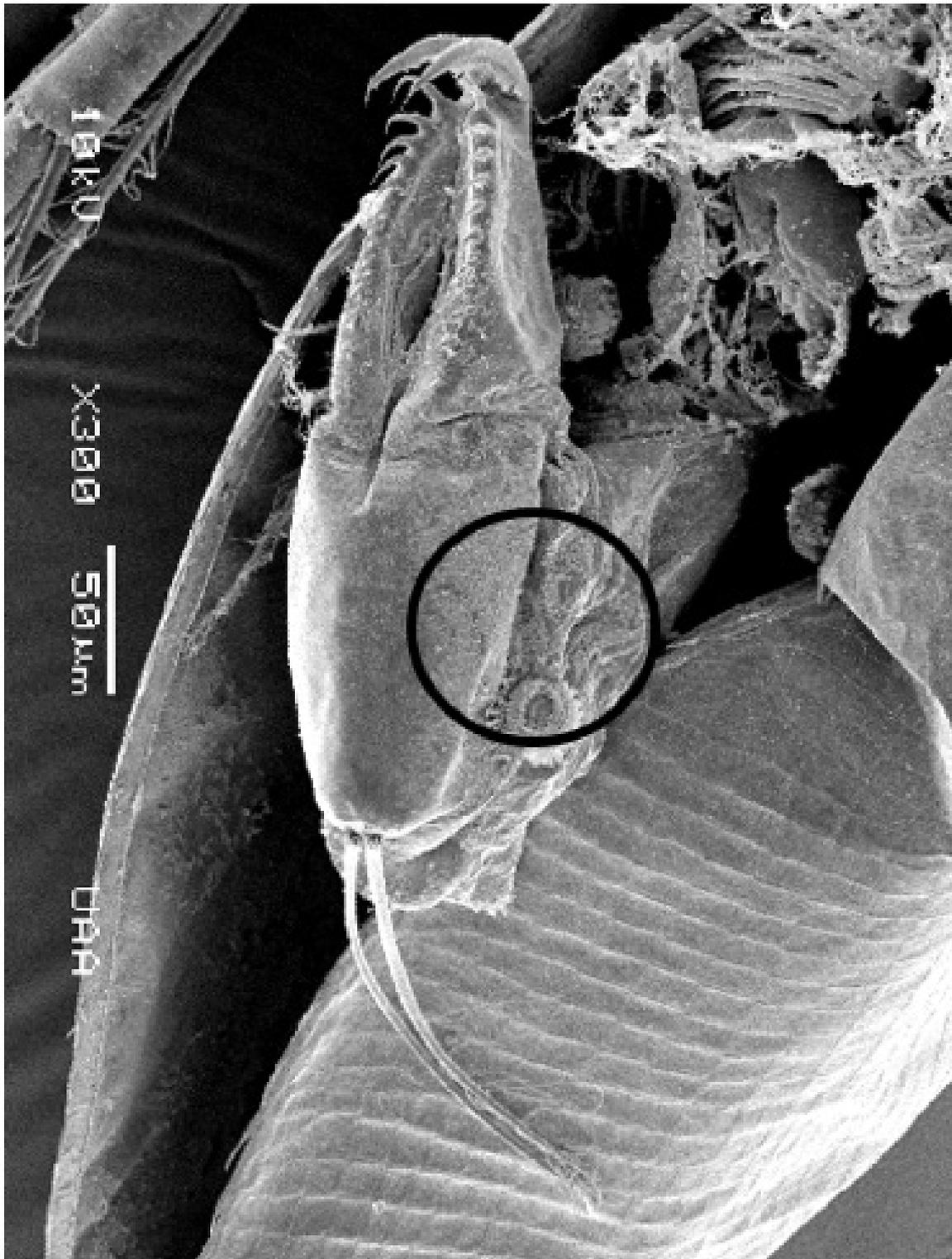


Figure 6: *Trichodina diaptomi*, attached to the post abdomen of *Daphnia laevis* (circle). Pond on the side of town Tortugas. Romos corner, Ags.

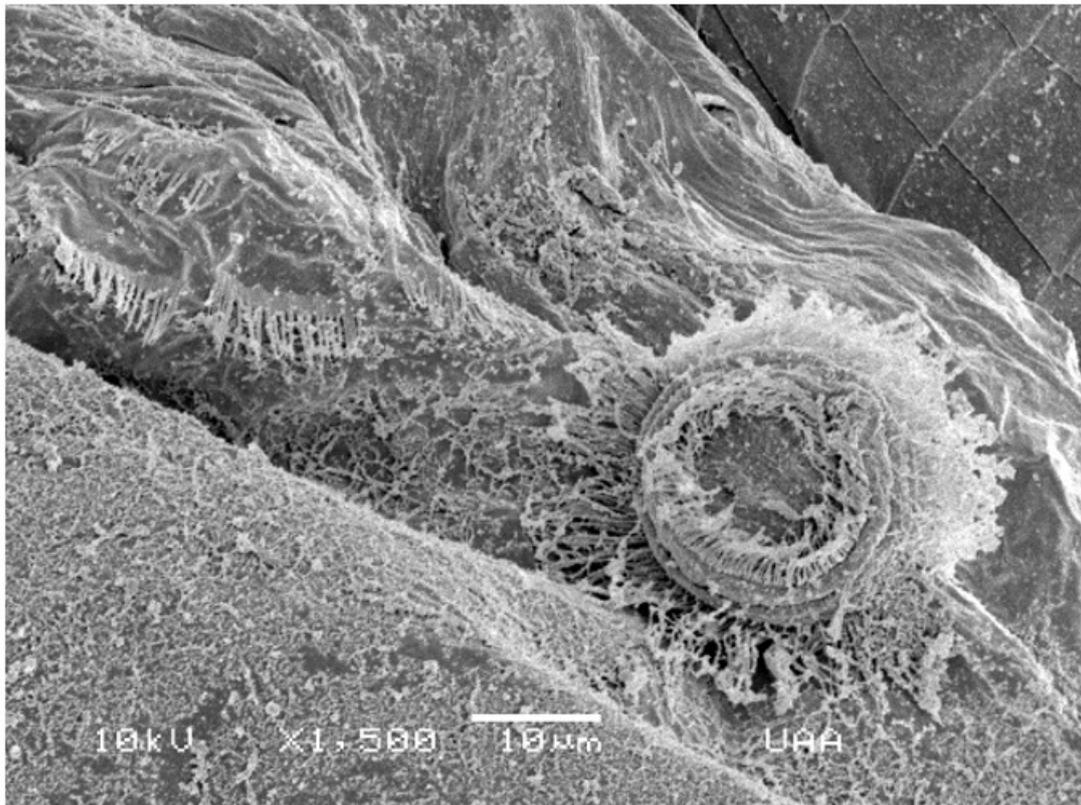


Figure 7: *T. diaptomi*, (zoom) attached to the postabdomen of *Daphnia laevis*. Pond on the side of town Tortugas. Rincón de Romos, Ags.

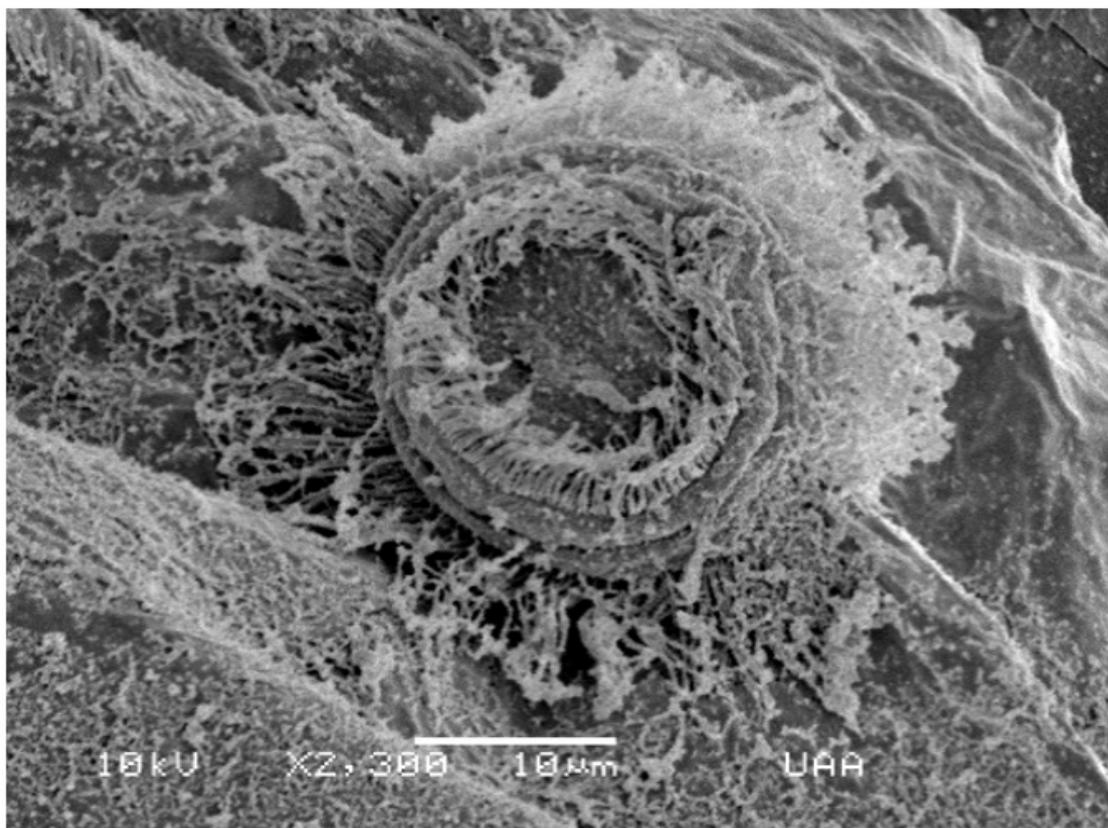


Figure 8: *T. diaptomi*, (zoom) attached to the postabdomen of *Daphnia laevis*. Pond on the side of town Tortugas. Rincón de Romos, Ags.

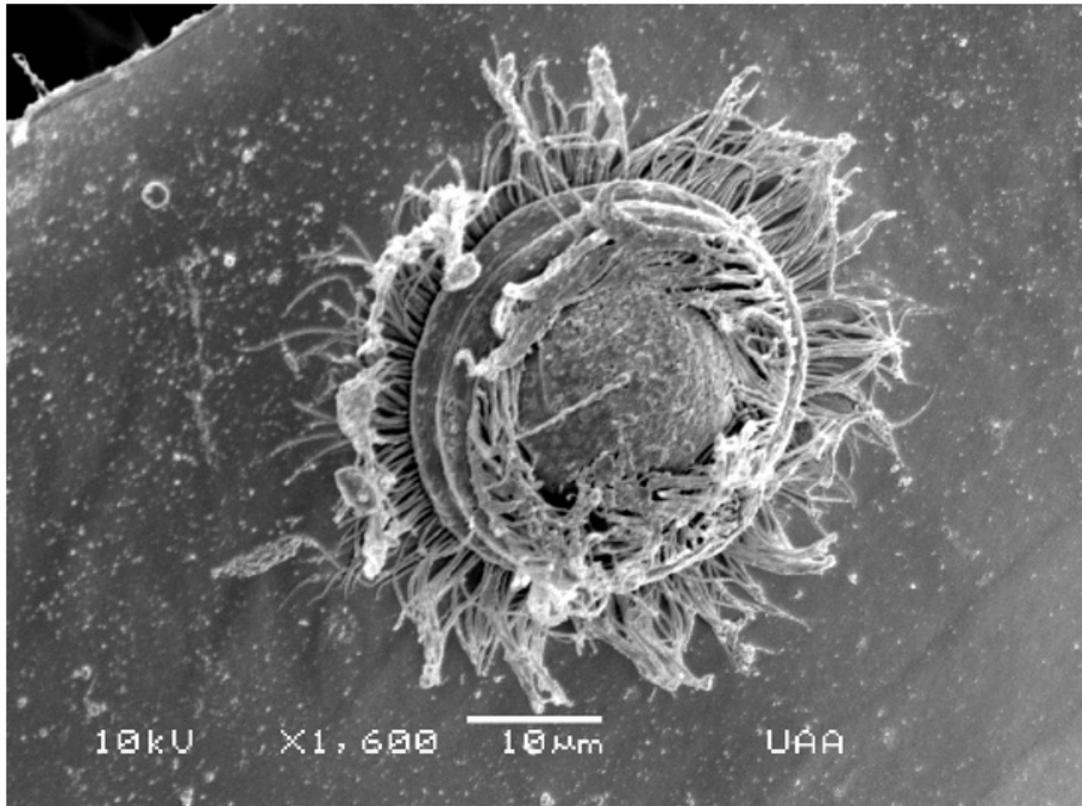


Figure 9: *Trichodina* (zoom) attached to the carapace of *Bosmina huaruensis*. Reservoir El Tecuancillo, Ags.

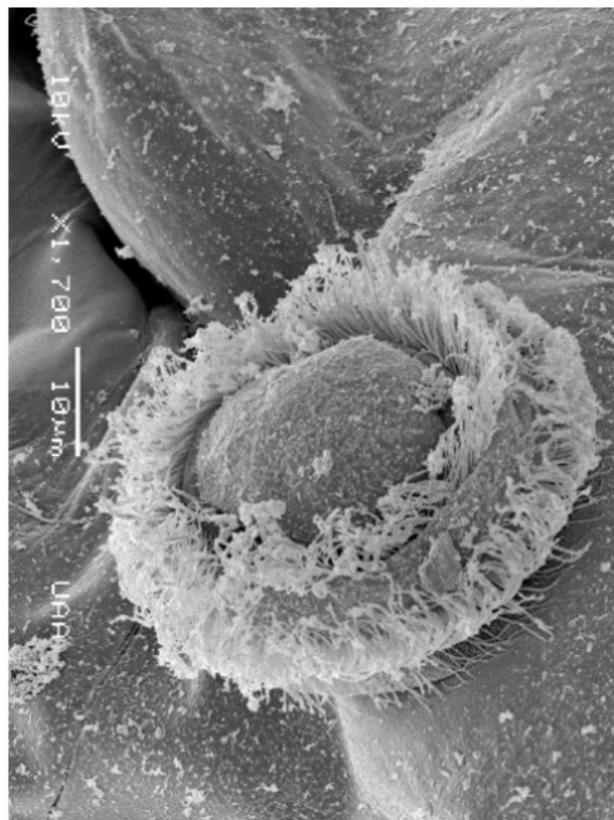


Figure 10: *L. siciloides* (female), zoom of habitus of *T. diaptomi*, attached to the dorsal part of the cephalothorax. Puddle near town Tanque El Refugio. Asientos, Ags.

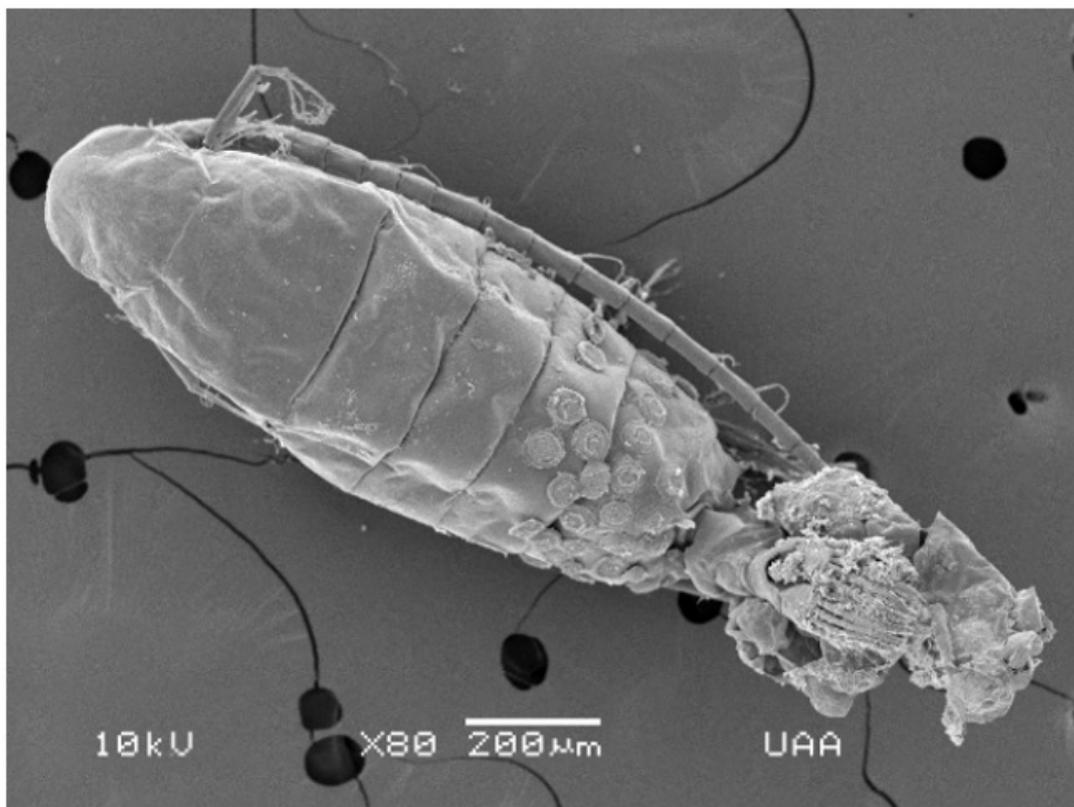


Figure 11: *M. montezumae* (female), habitus showing *T. diaptomi* attached to the dorsal part of the cephalothorax. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.



Figure 12: Zoom of *T. diaptomi*, attached to the cephalothorax of *M. montezumae*. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

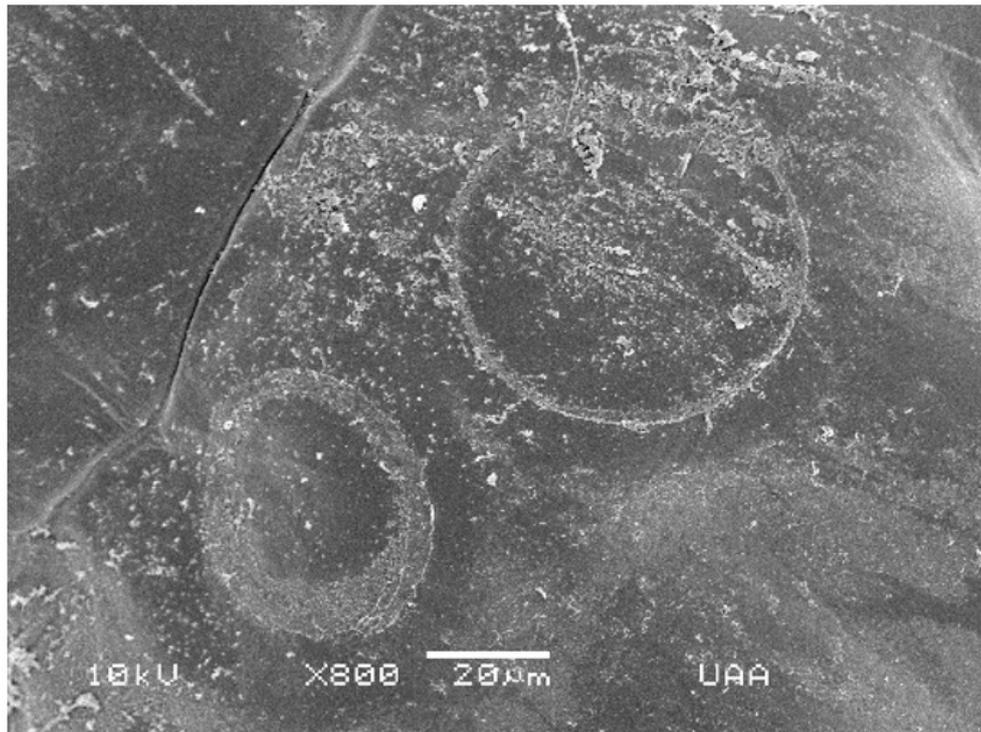


Figure 13: General view of the circle-shaped imprint left on the shell of *M. montezumae* by the ciliate *T. diaptomi*. Pond on one side Reservoir Presidente Abelardo Rodríguez. Jesús María, Ags.

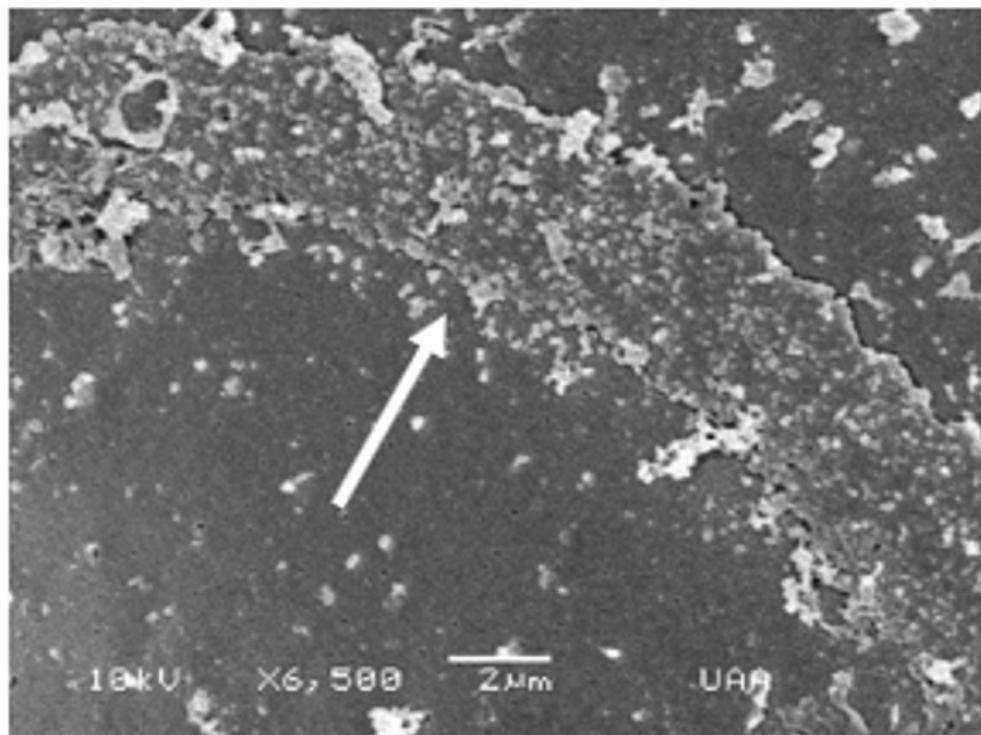


Figure 14: Zoom of the circle-shaped imprint left on the shell of *M. montezumae* by the ciliate *T. diaptomi*. Pond on one side Reservoir Abelardo Rodríguez. Jesús María, Ags.

Material 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.

Result

When *Trichodina 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 [1]. 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. Da Silva et al., [1] 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 15) that definitely shows the presence of this adhesive or mucus (Figure 14) secreted by *Trichodina*, which suggests that there is sensitivity. At first it was thought that *Trichodina diaptomi* was feeding on the *calanoid copepods*, *Mastigodiatomus albuquerqueensis* 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 3 & 4). 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.

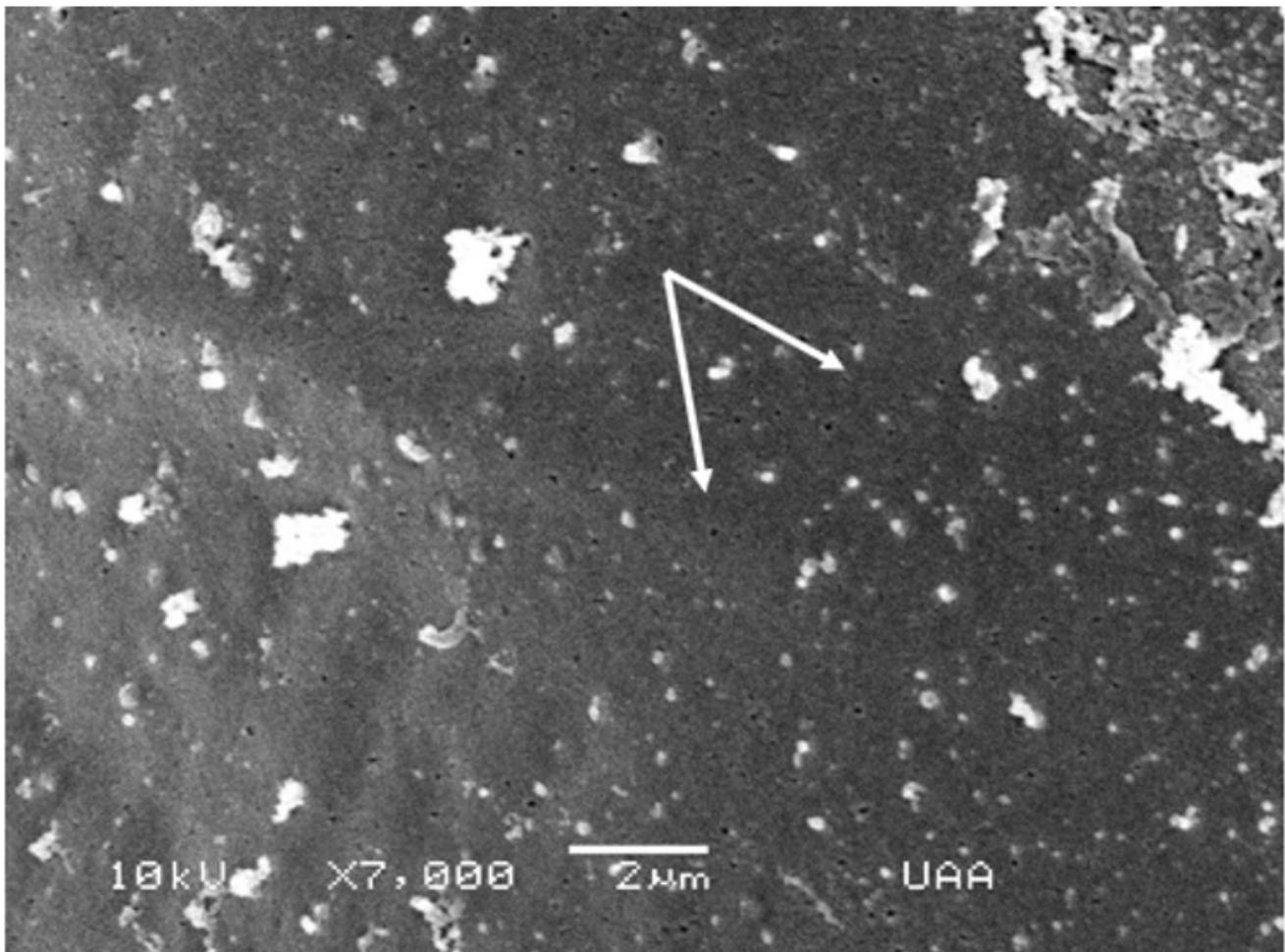


Figure 15: View of the shell of *M. montezumae*, where numerous pores are observed, which may indicate that there is sensitivity to *T. diaptomi*, especially when it is fixed to this surface. Pond on one side Reservoir Abelardo Rodríguez. Jesús María, Ags.

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

(Figure 16). The groups under study are: *Cladocera* and *Copepoda*, whose list is presented below:

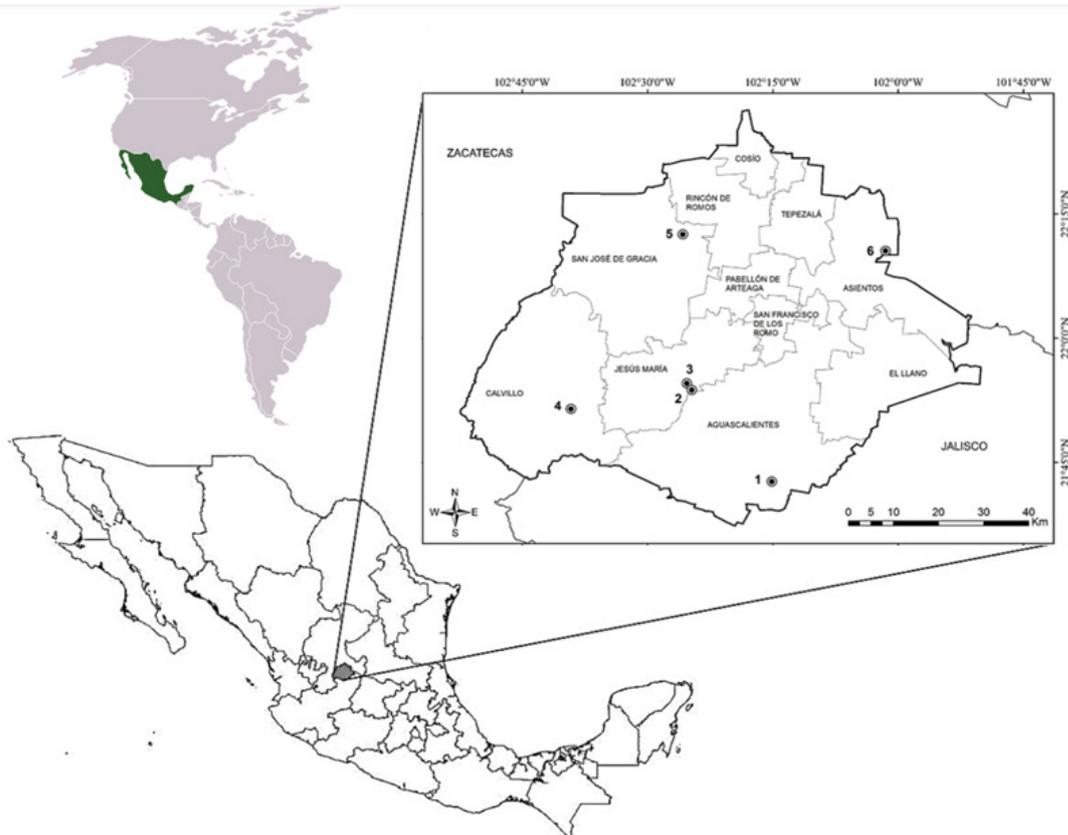


Figure 16: Aguascalientes State (Mexico). Coordinates of waterbodies where *Trichodina diaptomi* was found as an epibiont. 1.-Reservoir El Tecuancillo, Ags: 21° 42' 41.95" N; 102° 15' 09.26" W; 2.-Pond La Tomatina. Jesús María, Ags: 21° 53' 45.31" N; 102° 24' 44.36" W; 3.-Pond on the side of Reservoir 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.

Cladocera:

Daphniidae

Daphnia laevis (Figure 6-8 & 17)

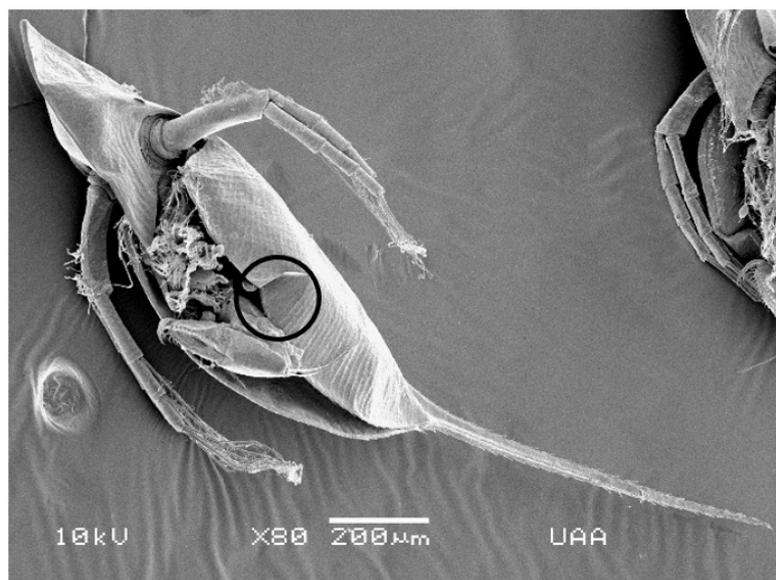


Figure 17: *T. diaptomi*, attached to the postabdomen of *Daphnia laevis* (circle). Pond on the side of town Tortugas. Rincón de Romos, Ags.

Bosminidae

Bosmina huaronensis (Figure 9 &18).

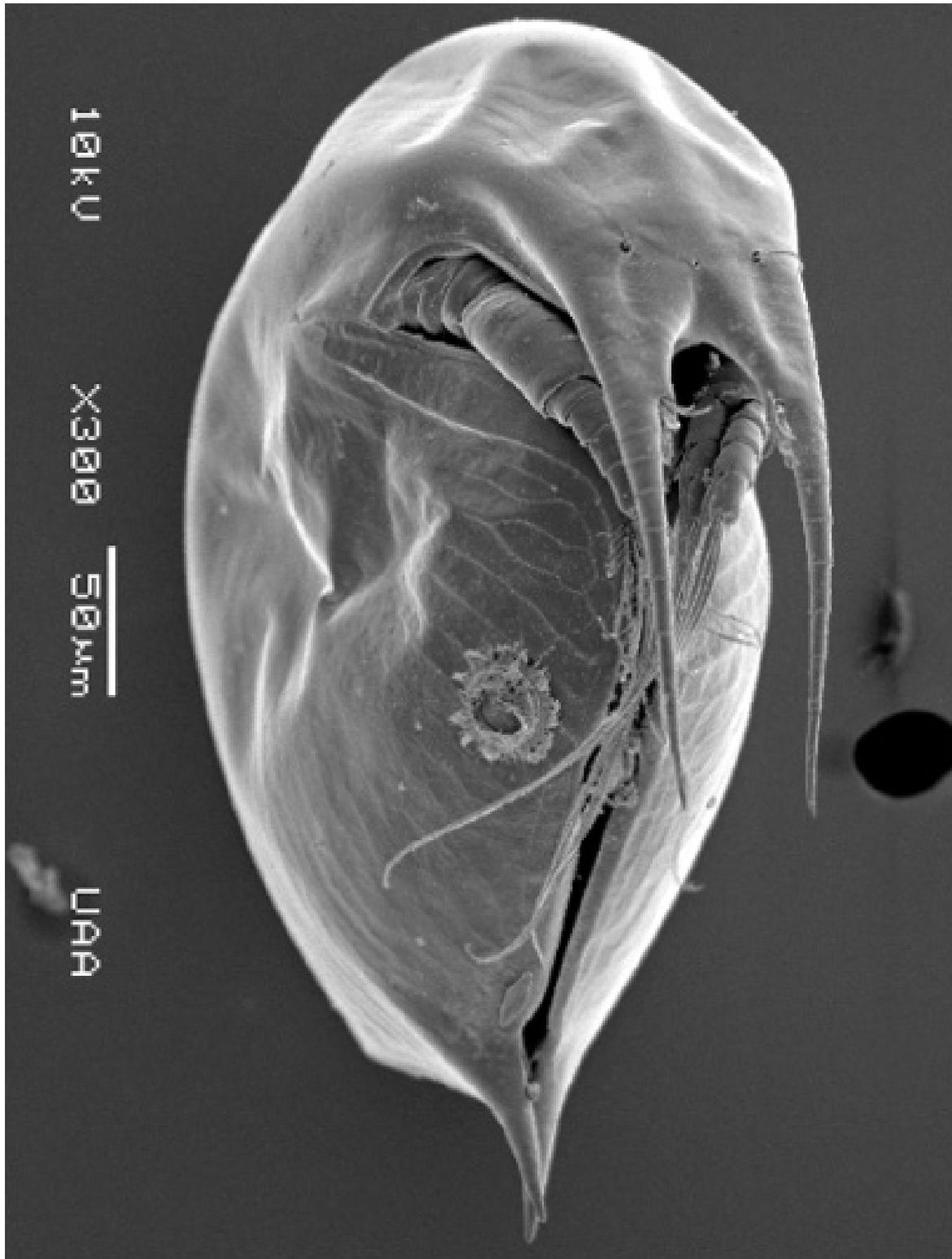


Figure 18: *T. diaptomi* attached to the carapace of *Bosmina huaronensis*. Reservoir El Tecuancillo, Ags.

Copepoda:

Diaptomidae

Leptodiptomus sicilioides (Figure 10, 19 & 20)



Figure 19: *Leptodiptomus sicilioides*, 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.

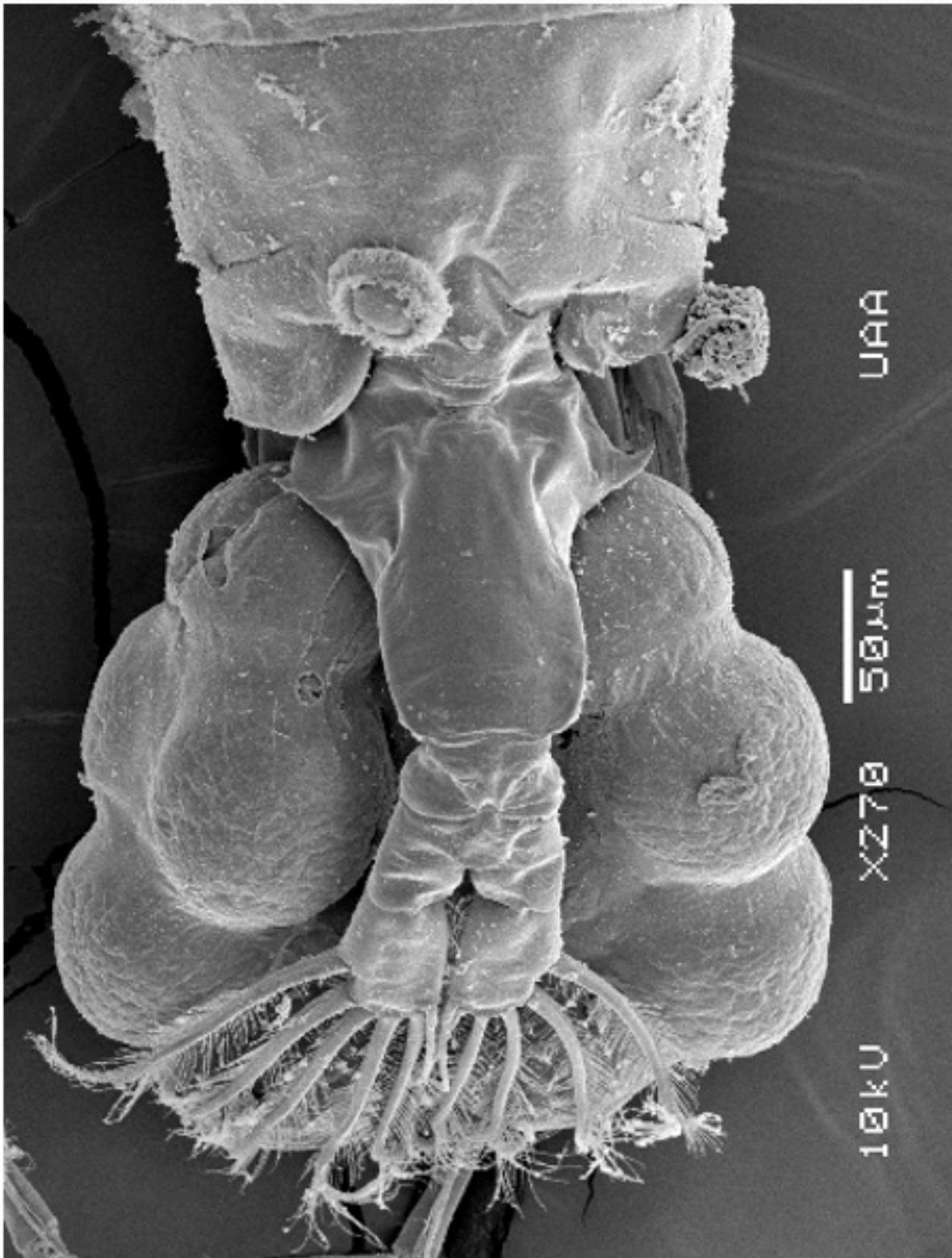


Figure 20: *L. siciloides*, furca of female with eggs bag, showing *T. diaptomi*, adhered to the dorsal part of the cephalothorax. Puddle near town Tanque El Refugio. Asientos, Ags.

Arctodiaptomus dorsalis (Figure 3 & 21)



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.

Mastigodiaptomus albuquerquensis (Figure 1 & 2)

M. montezumae (Figure 11 & 12)

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 [8] where *Trichodina mutabilis* infects the characid *Astyanax mexicanus*. Another report mentions that in Brazil, *Trichodina diaptomi* was found in the Calanoid *Notodiaptomus deitersi* [1] moving along its cephalothorax (*carapace*) [1]. 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 *Trichodina 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 *Epistylis sp.*, which has been stored in large quantities over the head, *carapace*, antennae and post-abdomen in a massive way.

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