

Assessment of Trombidiidae (Acari) as Biondicators for Wastewater Treatment in a Constructed Wetland

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INTRODUCTION & AIM

The family Trombidiidae (superorder Acariformes), with common names such as red velvet mites, exhibits dietary habit shifts throughout their development.

Larvae are parasitic, while nymphs and adults transition to a free-living, soil-dwelling predator stage (Durkin et al., 2021). Predation by these mites is usually done in rocks, tree stumps, plants, leaf litter, and moss, with other arthropods and their eggs being their prey. These hunting environments fit the habitat created by constructed wetlands (CWs) biological wastewater treatment systems, mimicking the processes and conditions that occur in natural wetlands (Calheiros et al., 2015).

A macrofauna assessment was performed in a CW located in a tourism house in the north of Portugal, near Ponte de Lima, to understand its performance after 15 years of operation, with Trombidiidae mites being found.

METHOD

This work involved seasonal sampling of macrofauna at multiple collection spots within and around the CW, with pitfall trapping being complemented by substrate core sampling to assess both belowground and aboveground communities (Figure 1 and 2). This occurred across the Autumn of 2022 to the Summer of 2023.

The collected specimens were sorted by taxonomic group, identified further, when possible, photographed and quantified, with statistical analysis currently underway.



Figure 1 – Pitfall being set



Figure 2 – Pitfall being collected

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RESULTS & DISCUSSION

The presence of Trombidiidae was confirmed in all seasons in the 15-year-old CW, implying that this CW maintains favorable environmental conditions year-round (Figure 3 and 4). This tracks with the hypothesis of the environment created by the CW mimicking the natural habitats in which these predators hunt.

The simultaneous occurrence of spiders, preferred hosts for the larval stage of these mites, within the same system indicates that their life cycle is likely sustained within this system. The fact that these spiders are numerous might also imply a robustness in their population, with their numbers not being heavily affected by the parasitism.

As both parasites and predators of the biodiversity presented in the CW, Trombidiidae may contribute to a deeper understanding of the food web within these systems, providing proof as bioindicators of the ecological and habitat benefits CWs can provide.



Figure 3 – The Constructed Wetland



Figure 4 – Trombidiidae specimens

CONCLUSION

Preliminary results indicate a robust and well-structured ecosystem, with the consistent presence of Trombidiidae across all seasons, suggesting a stable population, with hosts for the larval stage, ensuring their cycle of life.

REFERENCES

- Durkin, E. S., Cassidy, S. T., Gilbert, R., Richardson, E. A., Roth, A. M., Shablin, S., & Keiser, C. N. (2021). Parasites of spiders: Their impacts on host behavior and ecology. *The Journal of Arachnology*, 49(3), 281-298.
- Calheiros, C. S., Bessa, V. S., Mesquita, R. B., Brix, H., Rangel, A. O., & Castro, P. M. (2015). Constructed wetland with a polyculture of ornamental plants for wastewater treatment at a rural tourism facility. *Ecological Engineering*, 79, 1-7.