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Limited Uptake and Effects of End-of-life Tire particles in the gut of the Pavement Ant, *Tetramorium immigrans*: A First Assessment

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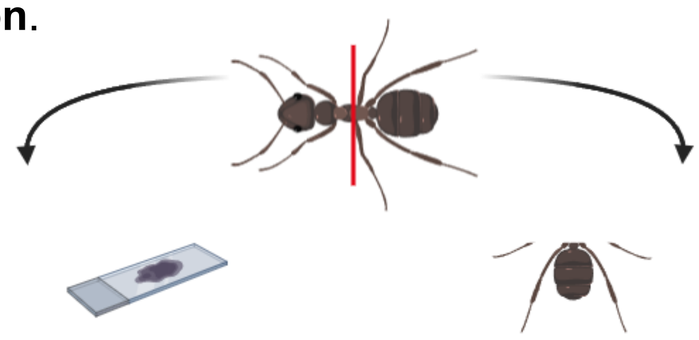
INTRODUCTION & AIM

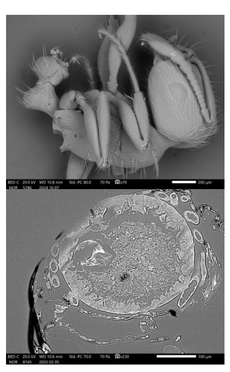
Residues resulting from tire wear are increasingly considered major environmental pollutants [1]. However, limited information exists on the impact of **End-of-Life Tire (ELT) particles**, a specific class of tire debris **used in artificial turf, playgrounds, and rubberized asphalt**. Indeed, although some studies revealed negative effects of these particles on aquatic fauna [2], **little is known about their impacts on terrestrial habitats**. **Ants** are **adequate model organisms** for such investigations, given their **abundance in urbanized habitats** and their **proved capability of carrying pollutants.**
Our objective was to **evaluate the uptake and histological alteration induced by ELT powder in** the pavement ant ***Tetramorium immigrans.***

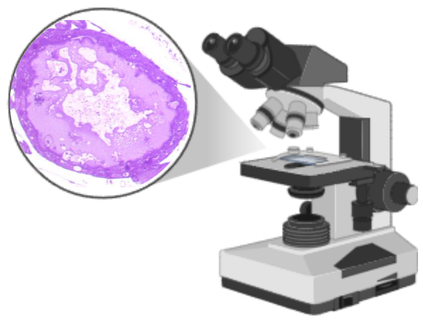
METHODS

Ants coming **from three colonies** were **exposed** in the laboratory **for 15 days to different treatments and increasing doses** (not representative of environmental ones) to maximize the uptake, represented by **ELT powder** (62,5 mg; 125 mg; 250 mg), **ELT-contaminated food** (250 mg/L; 500 mg/L; 1000 mg/L), or **both** (250 mg/L + 62,5 mg; 500 mg/L + 125 mg; 1000 mg/L + 250 mg). **Scanning Electron Microscopy** (**SEM**) and **Energy Dispersive X-Ray Spectroscopy** (**EDS**).were used to analyse ELT powder, the particles on the ants' head and thorax and the content of the midgut lumen. Abdomens included in epoxy resin were cut into 5 and 0,99 µm sections for ESD and light transmission microscopy respectively. We searched for irregularly shaped particles on the cuticle and in the gut lumen that showed traces of **Zn**, a **known marker** for the **presence of ELT particles**. Using the 0,99 µm sections we quantified the **potential epithelial damage** caused by the **ingestion of the ELT powder**, such as **damaged brush border** and **excessive vacuolization**.



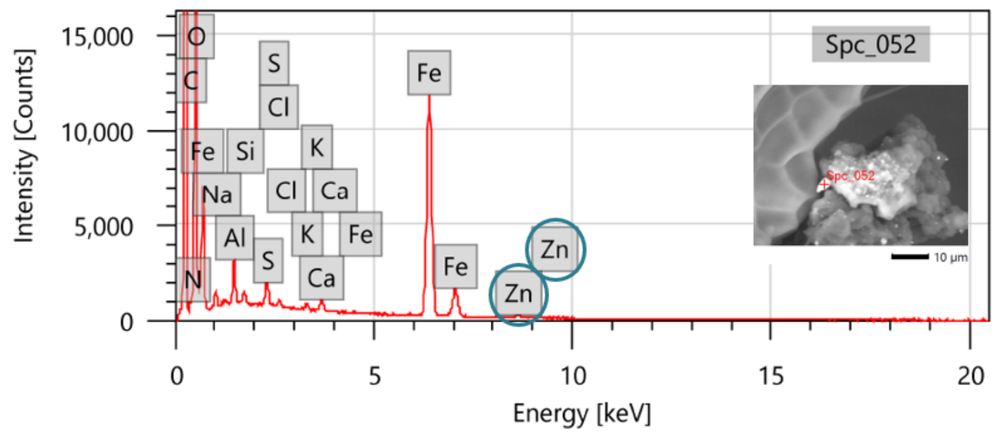

EDS analyses



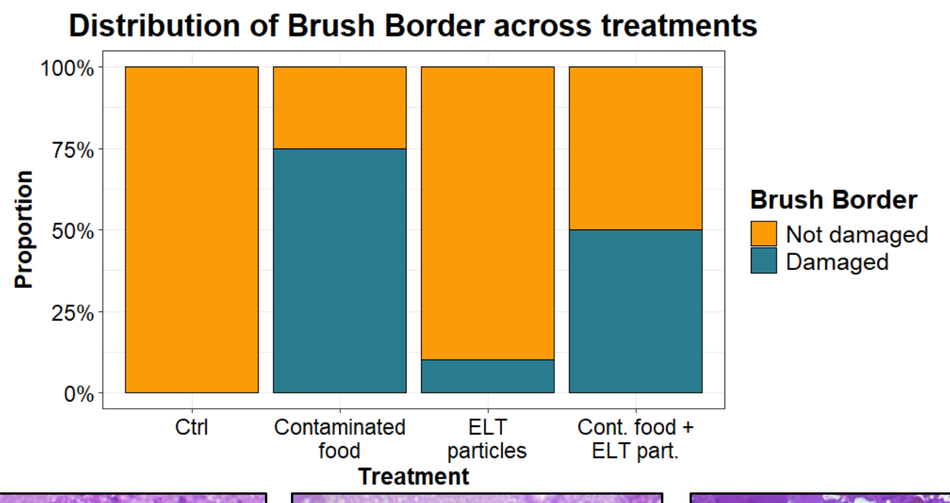

Optical microscopy

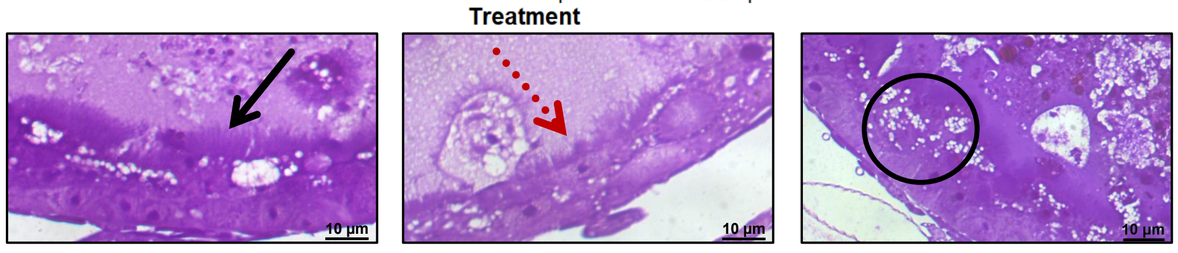
RESULTS & DISCUSSION

Overall, we found **limited effects** of these particles on this species. **Most ants did not show any ELT particle on the body surface**, with few, primarily those exposed to the ELT powder, having maximum of 4. **Ants consumed the contaminated food**, and the absence of ELT particles in the gut lumen suggests that they passed through the digestive tract and were defecated. Despite this, **ELTs passage appeared to induce limited histological damage**. **Ants that ingested contaminated food** showed a **higher probability to present altered or completely absent brush border compared to controls**, with a marginally not significant increase at higher ELT concentration. Conversely, epithelial vacuolization was not affected by either treatment or dose.



EDS analyses of a particle on the cuticle of *T. immigrans*





Intact brush border | Damaged brush border | Intense vacuolization

CONCLUSION

These preliminary results suggest that these **ants may be weakly affected by ELT particles**, at least when considering the analysed traits, but **further investigations** with a larger sample, other ecotoxicological tools, from biomarkers to Omics, and a wider spectrum of traits **are needed to confirm this hypothesis**.

REFERENCES

[1] Kole et al., 2017. Wear and tear of tyres: a stealthy source of microplastics in the environment. *International journal of environmental research and public health*, *14*(10), 1265.
[2] Magni et al., 2022. Ecological impact of end-of-life-tire (ELT)-derived rubbers: acute and chronic effects at organism and population levels. *Toxics*, *10*(5), 201