Exploring developmental and metabolic impacts of polystyrene micro- and nano-plastics exposure in the arboviral mosquito vector *Aedes albopictus*

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Background: Urban water reservoirs and wastewaters exhibit the highest concentrations of small plastics, posing risks to species, ecosystems and human health. These habitats are ideal for the mosquito *Aedes albopictus,* a key arbovirus vector. The effects of small plastics on its metabolism and behavior remain largely unexplored, yet impacting public health.

Methods and Results: We explored the impact of polystyrene micro- and nanoplastics (MNPLs) on *Ae. albopictus* larvae using a multidisciplinary approach integrating epifluorescence and confocal imaging, insect physiology and high-throughput metabolomics. Larvae ingested MNPLs, which crossed the intestinal barrier and accumulated in tissues. Despite this, no significant impact on mosquito development or survival was observed. However, metabolomics revealed changes in 81 metabolites, with downregulation in central carbon metabolism (glycolysis, pentose phosphate pathway) and upregulation of amino acids involved in stress responses, suggesting metabolic adjustments to plastic exposure.

Conclusions and Significance: Although no immediate developmental delays were noted, metabolic disruptions suggest MNPL exposure could affect mosquito physiology. Further research is needed to explore long-term ecological impacts, including effects on mosquito behavior, immunity, and vector competence, which may provide insights into the broader public health implications of plastic pollution and vector-borne diseases.

Keywords: Micro- and nanoplastics, *Aedes albopictus*, mosquito physiology, Metabolomics, Plastic pollution and public health

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