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Microplastics' Effects on Painted Lady Butterfly Survivorship, Migratory Behavior, and Fecundity

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Background

Human activity is affecting our planet at a microscopic level. In 2021, scientists discovered microplastics in honeybees for the first time.[1] Subsequent research has found that honeybee gut bacteria concentrations decrease because of microplastic ingestion, decreasing honeybee survivorship.[1] The unique morphology of honeybees, specifically their hairy legs, allows them to effectively collect pollen.[2] Furthermore, when honeybees fly, they develop a positive electrostatic charge which also attracts pollen.[1,2] Due to the similar particulate structure of pollen and microplastics, it's possible that bees collect microplastics in addition to pollen. Although a lot of research in this area has been conducted on honeybees, there is no literature surrounding microplastics and butterflies. When butterflies visit flowers to feed, they simultaneously collect pollen on their wings.[3] This means butterflies could also be collecting microplastics like honeybees. This is particularly concerning due to the location of butterflies on the food chain. While honeybees are not usually sought as prey, butterflies are commonly consumed by organisms at higher trophic levels, meaning microplastics could be indirectly ingested by predators and biomagnified through the food chain. To determine if butterflies are being threatened by plastic pollution, we used painted lady butterflies to investigate if microplastics negatively impact survivorship, migratory behaviors, and fecundity.

Methods

A total of 156 painted lady caterpillars were raised in the lab. Once reaching the adult stage of development, butterflies were divided randomly into two groups and given two different diets. One group was fed a normal sugar and water mixture using four parts water and one part sugar. The second group was fed the same sugar water recipe; however, microplastics were added to the solution. Using dissection scissors, we cut 100% polyester threads into the smallest pieces possible and added them to the sugar water at a concentration of 100 mg/L. Butterflies were fed using nectar drops and the remaining volume was measured to ensure they were feeding. Flight was analyzed using a flight mill, and butterfly speed, duration, and distance were recorded. To measure fecundity, we dissected the abdomens of female butterflies and counted how many eggs were in each butterfly. These variables were compared between the control and experimental groups to determine the impact of microplastic consumption on painted lady survivorship, migratory behavior, and fecundity.

Flight Mill Video:

Acknowledgements

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References

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3. Butler HC and Johnson SD. 2020. *Botanical Journal of the Linnean Society*.