The Degradation of Polystyrene (Styrofoam) by Tenebrio Beetles and Their Larvae

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To reduce styrofoam pollution, Tenebrio beetles and their larvae, mealworms, are very effective. They can digest and biodegrade polystyrene plastic, or styrofoam, into released carbon dioxide, feces, and biomass. This project aims to investigate the best temperature and food condition for these mealworms to degrade the styrofoam. Also, another goal is to image the gut bacteria to see how Tenebrio beetles can digest it, noting the differences in imaging between experimental groups. To obtain this information, three aquariums were set up at each of these temperatures: 15°C, 20°C, and 30°C. One aquarium at each temperature had a 5 kg bag of bran, another had 5 g of bran and 40 g of styrofoam, and a third had just 40 g of styrofoam. After periodically taking the mass of the styrofoam, the worms eating just styrofoam, compared to bran and styrofoam, consumed the most mass. Worms stored at 20°C were most effective at breaking down styrofoam as this is the ideal temperature for mealworms. Mealworms at a high temperature (30°C) broke down more styrofoam than those at the lower temperature (15°C). The lengths of each mealworm were also measured and averaged to identify any differences. Styrofoam seemed to negatively affect growth as the mealworms only eating styrofoam were much shorter than those having bran available to consume. Comparing this data to the imaging data using confocal microscopy, there were tighter actin coils in the gut of styrofoam fed mealworms, which might have a correlation with the shorter length of the mealworms.

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Fourth Award of $500