Antibiotic Effects on Tenebrio molitor Ingestion of Styrofoam

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Mealworms (Tenebrio monitor) digest polystyrene with conversion into CO2 + biomass. Antibiotics were given to mealworms to modify gut microbiome + measure changes in styrofoam digestion. Adverse effects of Styrofoam ingestion on mealworm gut were studied. Hypotheses: antibiotic administration alters mealworm gut microbiome + decreases efficiency of Styrofoam digestion; and styrofoam ingestion is associated with histopathologic changes + oxidative stress in gut epithelium. For methods, 7 groups of worms were organized: worms fed bran, bran + Styrofoam, Styrofoam, Styrofoam + antibiotics (penicillin, ciprofloxacin, ampicillin, clindamycin). Styrofoam blocks were weighed + laser scanned at beginning + end of experiment. Microbiome testing: DNA extracted from intestines, V4 region on 16S rRNA gene sequenced, sequences compared to reference database to identify bacteria. For histopathology evaluation, intestines stained, studied for inflammatory changes. Oxidative stress testing: intestinal glutathione + catalase measured. For results, gut microbial diversity was decreased with antibiotics. Antibiotic-exposed worms digested less Styrofoam than worms fed Styrofoam alone. Spiroplasmataceae was most resistant bacteria to antibiotics. Worms exposed to Styrofoam demonstrated midgut epithelial cell vacuolization. Worms exposed to Styrofoam alone, or Styrofoam + antibiotics, demonstrated decreased catalase levels compared with bran-only worms. For conclusions, microbial diversity is key to maximal Styrofoam consumption. Suppression of microbiome diversity with antibiotics was associated with decreased Styrofoam digestion. Spiroplasmataceae likely contributes markedly to styrofoam digestion. Ingestion of Styrofoam was associated with gut inflammation + damage.

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