Engineering a Novel Cimex Lectularius Trapping Mechanism Utilizing Electrospun Recycled Polymers

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Cimex lectularius, commonly known as the bed bug, presents a resurgent public health hazard characterized by its hosts' allergic reactions, secondary skin infections, and psychological distress. Furthermore, conventional methods of bed bug eradication are expensive, environmentally harmful, and generally utilize toxic pesticides to which bed bugs may develop resistance. The goal of this work was to engineer a mechanical trap for Cimex lectularius utilizing recyclable electrospun polymers. We hypothesized that through analysis of the Cimex lectularius morphology, we could design polymer nanofibers specifically tailored to the bed bug anatomy. Solutions of recycled polylactic acid (PLA), Ecoflex, and recycled polystyrene (PS) from a recycled Styrofoam coffee cup, were electrospun onto corrugated aluminum substrates. Optical nanofiber imaging and live specimen migration experiments were then performed. Mobility assessments were executed on each nanofiber substrate and insect migration rates were measured. Results clearly demonstrated the effectiveness of the recycled nanofibers in significantly retarding the migration of Cimex lectularius. Each experimental trial utilizing recycled PS nanofibers completely immobilized the bed bugs. Subsequent microscopic analysis of the specimens revealed extensive ensnarement of nanofibers within the fine leg structures of the bed bugs. Optical imaging data of the electrospun polymers revealed variations in morphology that may account for the differences in observed migration rates. Future work will involve further examination of bed bug behavior to effectively construct a commercially viable prototype, in addition to the construction of devices utilizing similar methodologies to trap other insects.

Awards Won:
Second Award of $2,000