E51 Profiling the Odorant Chemicals Present in *Cimex Lectularius*

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Learning Overview: After attending this presentation, attendees will better understand the Volatile Organic Compounds (VOCs) emitted from *Cimex lectularius* (bed bugs), a well-known human parasite that is commonly detected by scent detection canines in the United States.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by studying the scientific foundation for the use of pest/insect detection canines, which is important due to the current development of guidelines surrounding their use by the Organization of Scientific Area Committees (OSAC).

In 2017, the Dogs and Sensors Subcommittee within the Crime Scene/Death Investigation Committee of OSAC began to establish guidelines on the training and certification of pest/insect detection canines. The goal of these guidelines is to improve the performance, reliability, and courtroom defensibility of detection dog teams in the field. Current best practices dictate that training shall be performed on actual live *C. lectularius* adults. There is currently a major knowledge gap in the VOCs produced by *C. lectularius*, and limited current research being conducted in this topic area. Surrogate training aids are available for *C. lectularius*; however, these are not recommended by current practices. In addition, very little is known about the difference in odor profile between live and dead *C. lectularius* adults, as well as the various life stages of this species. The overall aim of this work is to provide chemical data that can improve detector canine operational performance and provide a scientific foundation for training, certification, and use guidelines. The objective of the current study was to establish a VOC profiling method for *C. lectularius* that can be used in future work and to provide a preliminary comparison of living and dead *C. lectularius* adults.

Adult *C. lectularius* were profiled in sealed headspace vials using Solid-Phase Microextraction (SPME) Arrow. This is a technique that permits non-contact sampling of the insects, while allowing a high capacity of VOC loading onto the Arrow fiber. The samples were then analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). A VOC signature could be detected from two adults in a single vial; however, a 10min exposure time was recommended to increase the intensity of the signal for GC/MS analysis. This preliminary work identified that some compounds were specific to live *C. lectularius* (e.g., phenol, 6-methyl-5-hepten-2-one) and some were specific to dead C. *lectularius* (e.g., 2-octenal). In addition, some compounds were found to be in common between the live and dead insects but were found either in higher concentrations in the live individuals (e.g., decanal, caprolactam) or dead individuals (e.g., 2,4-ditertbutylphenol). A single compound, nonanal, was found to be in both live and dead bed bugs at approximately equal concentrations. Additional work is needed to validate the identity of these specific compounds and whether these trends can be consistently seen across insects that may have been bought from different sources or have been stored for different lengths of time. Improving this chemical foundation for the use of live *C. lectularius* insects during detection dog training may assist in developing improved or more convenient training procedures. It may also permit the development of suitable surrogate training aids.

This research is significant because it is the first primary study that provides a chemical foundation for the use of live *C. lectularius* for training bed bug detection canines. This can assist in improving standards for training, certification, use, documentation, and management of detection canines as a valuable forensic tool. It will also serve to improve the reliability and courtroom defensibility of pest/insect detection canines.

Scent Detection Canines, Volatile Organic Compounds (VOCs), Bed Bugs

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