

Volatile Organic Compounds (VOC) of Decomposition of Tissues Exposed to Diphenhydramine and Ibuprofen Influence on Fly Attraction

Chiara Mei-Wah Conlon, Ashley Almeida, B.S., Jovina Monteiro, B.S, and Samantha J. Sawyer, PhD, M-ABFE.

Learning Overview: After attending this presentation, attendees will understand variation in attraction of necrophagous flies to decomposing remains with the presence of abused over the counter medications and associated changes in Volatile Organic Compound (VOC) profiles.

Impact Statement: This presentation will impact the forensic science community by discussing volatile profiles of decomposing tissues with forensically relevant doses of abused over the counter medications on necrophagous fly attraction. This information informs entomologists' role in establishing forensically relevant timelines with cases involving overdoses of diphenhydramine and ibuprofen.

Forensic entomology utilizes the presence of flies and other insects to help generate forensically important timelines, such as inferring time of death, neglect, or abuse. Necrophagous flies are attracted to remains through VOCs produced by microbial metabolomics. Changes in VOCs can influence necrophagous fly attraction to or avoidance of remains. Secondly, drugs can also alter the development of flies consuming these tissues. This, in turn, can affect finding important timelines of a decedent.

Between 2019 and 2020, 10.5% of overdoses included the presence of diphenhydramine and 15% included ibuprofen. In cases where these drugs are present, potential changes in microbial communities may alter VOC profiles, influencing insect attraction, warranting investigation. To do this, 45 grams of beef liver were treated with 0.141g diphenhydramine and 0.024g crushed ibuprofen mixed with 1 ml of bovine blood respectively. Diphenhydramine and ibuprofen treatments were placed alongside one control inside vertebrate exclusion cages respectively for 600 accumulated degree hours. Additional samples were enclosed in sanitized jars in the laboratory and allowed to accumulate headspace for two hours. Headspace was then collected through a VOC trap. Sample lids were then replaced with a Wypall lid before being allowed to accumulate for 600 accumulated degree hours before repeating headspace extraction. All samples were processed utilizing a GC-MS. Insects were identified to family and by function (i.e., necrophagous, fungivores, ect.) as well as sex, and reproductive status (gravid and non-gravid).

Necrophagous flies were generally more attracted to controls than to samples with diphenhydramine. Amines in samples with diphenhydramine increased over time, where the control saw an increase in aromatics, likely driving these differences. Necrophagous flies were generally more attracted to the control than to the samples with ibuprofen. Additionally, gravid females were more attracted to controls, influencing colonizers of remains with ibuprofen. A

variety of compounds in the initial sample containing ibuprofen and over time there was an increase in aromatic compounds, acids, and ketones. Volatile profiles between ibuprofen and controls became closer in profile over time, where controls were initially composed of sulfides, increasing aromatics, acids, and ketones over time. Ibuprofen had a variety of compounds initially, increasing in aromatics, acids, and ketones, similarly to the control. Suggesting differences in insect activity may have been due to earlier compounds initiating attraction, than in later periods of exposure. This presentation will discuss these variations and influence on casework in forensic entomology.

Keywords

Entomology, Toxicology, Entomotoxicology