



H130 Coupled Microbiome and Insect Evidence in Death Investigations

*M. Eric Benbow, PhD**, Michigan State University, Depts of Entomology & Osteopathic Med Specialties, 288 Farm Lane, East Lansing, MI 48824; *Jennifer L. Pechal, PhD*, Michigan State University, 243 Natural Science Bldg, Dept of Entomology, East Lansing, MI 48824; *Heather R. Jordan, PhD*, Mississippi State University, PO Box GY, Mississippi State, MS 39762; *McKinley Brewer, BS*, Michigan State University, Dept of Entomology, East Lansing, MI 48864; and *Carl J. Schmidt, MD*, Wayne County MEO, 1300 Warren, Detroit, MI 48207

After attending this presentation, attendees will understand how human postmortem microbiome profiles can be coupled with entomological evidence to estimate time since death. Attendees will gain a deeper appreciation for microbial evidence and how it compares to other established sources of biological evidence in estimating a minimum Postmortem Interval (minPMI). While several studies have demonstrated the tremendous potential for using microbial community succession during decomposition for estimating a minPMI range, there is much less understanding of how the postmortem microbiome succession compares with other forms of evidence in death investigation. Entomological evidence has been successfully used to estimate the Period of Insect Activity (PIA), an estimate that is usually a close approximation of the minPMI. Thus, comparing how microbial community profile estimates align with associated entomological PIA estimates will inform scientists and investigators of how microbes perform in instances in which the time of death is known.

This presentation will impact the forensic science community by providing: (1) a comparison of microbe and insect evidence collected during a unique case study; and, (2) a critical evaluation of the benefits and challenges of using microbial community evidence in 120 cases from Detroit, MI (referred to as the Human Postmortem Microbiome (HPMM) database). This presentation will evaluate a case study in which both microbial and insect evidence were collected and will compare how the different estimates of minPMI represented the known time since death. Thus, this presentation will also impact the forensic science community by providing an examination of the viability of using microbial evidence from the HPMM database.

The first goal of this study was to evaluate how microbial community (or microbiome) profiles and insect developmental stage estimates compared to a known time of death. The second goal of this study was to compare the postmortem microbiome profile of the case study to similar death circumstances and estimated PMIs of cases that were part of the HPMM database. The last goal of this study was to evaluate the case characteristics of the HPMM database and provide an assessment of the usefulness and limitations of collecting and analyzing the postmortem microbiome during routine death investigation.

In the case study, a cadaver was recovered in Lansing, MI, during the late summer (Lansing Case). It was located in a grassy area under the overhanging trees of a vacant lot in a residential area located between two occupied houses. The decedent was a 27-year-old Black male suspected homicide victim in advanced stages of decomposition. Insect and microbial specimens were collected as described in recent studies and used to make estimates of the PIA and minPMI, respectively.^{1,2} For the microbial profiles, samples taken from the buccal cavity were compared to the HPMM database and with estimated PMIs for the following ranges: 1h-24h, 25h-48h, 49h-72h, and >72h.

Insect evidence, based on third instars and presumed pupae of *Phormia regina* (Diptera: Calliphoridae), suggested a PIA range of 13-20 days for the Lansing Case, which was in agreement with the known PMI of 19



Pathology/Biology - 2017

days provided by the investigators. When the Lansing Case microbial communities were compared to the larger metropolitan city dataset, there were marked differences in the profiles between cases with estimated PMIs from 1h-72h, but more similarities with those cases with a PMI >73h. For instance, *Sporosarcina* was only found in cases with a PMI >73h, suggesting that this taxon may be an indicator of PMIs of three days or more. Bacteroidia were nearly absent in this time interval and the Lansing Case, whereas they comprised 5%-11% of the communities for all other cases. These results indicate that certain microbial taxa may be indicative of long-term (e.g., >one week) PMIs that may be associated with later developmental stages of blow flies that colonize cadavers; however, additional studies with more cadavers with long-term PMIs are needed to address this important question.

Reference(s):

1. Byrd J., Castner J., editors. *Forensic entomology: the utility of arthropods in legal investigations*. Second Edition ed. Boca Raton, FL: CRC Press, 2009.
2. Pechal J.L., Crippen T.L., Benbow M.E., Tarone A.M., Dowd S., Tomberlin J.K. The potential use of bacterial community succession in forensics as described by high throughput metagenomic sequencing. *Int J Legal Med.* 2014;128:193-205.

Postmortem Microbiome, Forensic Entomology, Necrobiome