E11 The Current Use and Research Investigating Insect Succession for Determining the Postmortem Interval

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After attending this presentation, attendees will be aware of how carrion insect succession is currently used in forensic casework, as well as the current deficiencies in forensic succession research that inhibit its utility in forensic cases.

This presentation will impact the forensic science community by outlining the research steps in process, that are necessary for developing a dataset that is suitable for postmortem interval statistics.

In forensic entomology casework, the use of blow fly and flesh fly growth and development is unequivocally the most common method for estimating a postmortem interval (PMI). In these cases, determining the PMI can be crucial to reconstructing the events associated with a suspicious death. The use of insect succession to estimate the postmortem interval is exceedingly rare, and is uncommon in published case reports. In 100 cases worked by a practicing entomologist, over a 10 year period, no cases utilized a classical succession approach.

Insect succession, in the classical sense, has meant the change in species composition inhabiting a corpse over time. This allows a forensic entomologist to estimate the PMI by associating the assemblage of species collected on a corpse with a certain time elapsed since death. A contributing factor to the virtual absence of the use of succession in forensic entomology casework is the lack of validation of this technique, as well as the lack of a standard method for its use.

Two shortcomings of published forensic insect succession research include the absence of using an Accumulated Degree Hour (ADH) model to describe succession and a lack of replication of appropriate decomposition models. An ADH model utilizes the linear relationship of

an insect's growth rate and temperature, between an upper and lower developmental threshold, to describe the amount of time it takes for an insect to reach a certain developmental stage. The ADH model has been widely used in estimating a PMI from dipteran growth and development, as well as in the decomposition of human bodies. Similarly, an ADH model should be considered in developing a succession model. Using ADH to describe succession would allow this method to be used in future years when the temperature regimes significantly differ from the experimental period.

The domestic pig, *Sus scrofa,* is an accepted model for human decomposition. *S. scrofa* is an attractive surrogate for a human corpse because they are relatively cheap and easy to obtain in high numbers. Experimental succession studies using *S. scrofa* commonly used only 3 pigs per experimental condition. This sample size is too small to investigate the inherent variation in succession patterns. Without this knowledge it is impossible to have a high degree of statistical confidence in a PMI estimation from insect succession. This lack of replication leaves much succession research anecdotal and improper for forensic use.

In an effort to develop a data set suitable for determining a PMI from an insect succession analysis, a total of 53 *S. scrofa* were exposed to insect colonization during three consecutive summer periods (2 in 2008, 20 in 2009, 31 in 2010). This study took place in Rensselaer, Indiana, on a rural 800+ acre corn and soybean farm. Daily collections were made for 14 consecutive days during the months of July and August. Collections included sweep netting and hand picking of adult and larval specimens. All pigs were placed on the ground in full shade and covered with a wire cage to deter scavenging. Hourly temperature data for the field site was recorded throughout the entire experimental period, as well as daily temperature at each pig placement site.

While this data set has not been fully analyzed, preliminary analyses are of forensic importance. The precision and accuracy of a PMI estimate based on an ADH model of succession will be compared to that based on an absolute time model. The relative reliability of each insect species for succession-based PMI estimation will also be evaluated.

This research represents the largest succession dataset generated using *S. scrofa*, and supports a novel statistical approach to PMI estimation. This data will be immediately applicable to rural Indiana outdoor death scenes during summer. Future research is needed to determine the extent to which they can be applied to other areas or seasons. **Forensic Entomology, Insect Succession, Postmortem Interval**

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