E49 The Development of Two Forensically Important Blow Flies Collected From Human Remains in Western Colorado

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Learning Overview: The goal of this presentation is to provide attendees with information regarding the necrophagous flies that colonize human remains in western Colorado, with an emphasis on the development of two species poorly represented in the literature.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information on the two dominate species of blow flies found during the late fall to early spring months at the Forensic Investigation Research Station (FIRS) located in Mesa County, CO. Data on the two fly species, *Calliphora latifrons* and *Calliphora coloradensis*, are either poorly represented or absent in the literature, and this research will help fill an important information gap. This developmental data will also be useful throughout the multi-state range for these two species.

Necrophagous insects provide a wealth of information during death investigations. This information includes time since death, whether neglect or abuse took place antemortem, and if remains were moved.[1] In particular, flies in the family Calliphoridae are generally the first insects to visit remains and are usually the most forensically informative. They are often used to estimate the Time Of Colonization (TOC) and, thus, the Postmortem Interval (PMI). However, to properly use insects for this purpose, it is important to know which necrophagous insects are present in a given area and the rate at which they develop.

FIRS is a facility dedicated to researching human decomposition. FIRS represents the only such facility in the semi-arid region of the southwestern United States, providing a unique opportunity to study human decomposition under these conditions. The presence of donated human remains placed in the facility throughout the year allows for a continuous survey of blow fly species active during the different seasons of the year.

Cadavers were inspected daily at FIRS and maggots were collected when seen on cadavers. To identify the blow flies that colonized human remains in the area, maggots were collected and reared out using methods identified in the FIRS protocols.[2] Pupae and deceased adult flies were sent to Cornell University, where they were identified to species. Two species, *Calliphora latifrons* and *Calliphora coloradensis*, were found to be the dominant colonizers of human remains during the late fall to early spring (November–March). The lack, or minimal amount, of developmental data in the literature for these two species suggested that a basic study on temperature-related development would be useful to the forensic community, so this project developed a study.

Development trials were completed at Cornell University's Shields Laboratory using reach-in environmental chambers set at different temperatures as replicates. Initially, development was documented across a broad range of temperatures (15°C, 20°C, 25°C, and 30°C). This was followed by more focused trials looking at development at a low range of temperatures (4°C, 8°C, 11°C, and 13°C). These lower temperatures were chosen to reflect the common ambient temperatures at the FIRS facility during the seasons when *C. latifrons* and *C. coloradensis* are most common. Three replicates were run at each temperature with each replicate consisting of four enclosures where maggots were allowed to develop from egg to adult with sampling conducted at regular intervals to measure maggot length and determine life stage. The resultant data was used to make isomegalen and isomorphen diagrams as well as a thermal summation model. Validation trials are planned to test the lab-collected temperature data in a field environment at the FIRS facility.

Findings generated from this work provide important baseline information regarding insect activity at the FIRS facility. This information will allow FIRS to more fully assist law enforcement in the area and pave the way for future experiments exploring the human necrobiome and the development of other insects that colonize human remains at the FIRS facility. It has ramifications for estimation of the PMI throughout the semi-arid areas of the western United States.

Reference(s):

1. Greenberg, B. Flies as Forensic Indicators. *Journal of Medical Entomology.* 1991 (28) 565-577.
2. Smith, A.J. Entomology Protocols. *FIRS Technical Manual 5*. Series editor, M. Connor. Forensic Investigation Research Station, Colorado Mesa University, Grand Junction CO. 2018.

Forensic Entomology, Blow Flies, Development