## G159 Phenotypic Plasticity of *Cochliomyia Macellaria Fabricius* (Diptera: *Calliphoridae*) in Texas: How Intraspecific Variation Can Impact Forensic Entomology

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After attending this presentation, attendees will be more familiar with the concept of phenotypic plasticity, different phenotypic responses of blow flies reared under the same environmental conditions, and ramifications such plasticity can have in death investigations.

This presentation will impact the forensic science community by emphasizing the inherent variability that exists within natural populations of forensically important arthropods.

Phenotypic plasticity, or the ability of a single genotype to produce multiple phenotypes under alternative stresses, has been documented in genetic and ecological literature and spans across many phyla.[1-2] Genotype by Environment interactions (GxE) may influence conspecific populations facing alternative conditions.[3] Given this, subpopulations of forensically relevant insects should also possess the ability to adapt to a shifting environment as exposure to distinct stresses increases. Recent literature in forensic entomology has focused on this phenomenon, particularly in relation to growth substrate and geographic distribution of blow flies (Diptera: Calliphoridae).[4-5] In these studies, development rates of conspecific blow fly subpopulations were significantly different from each other when reared in distinct environments. The implications of plasticity between conspecific blow fly populations lie in estimating the Time Of Colonization (TOC) with published developmental data. If conspecific blow fly populations do not exhibit similar biology but are treated as equals when forming this estimate, less accurate TOC and, thus, minimum Postmortem Interval (mPMI) estimates may be made. These errors may have drastic outcomes, such as a faulty verdict in a court of law.

This study was conducted at the Forensic Laboratory for Investigative Entomological Sciences (F.L.I.E.S.) Facility on the Texas A&M University campus, College Station, Texas. The goal of this research was to explore variable responses of three conspecific populations of the secondary screwworm, *Cochliomyia macellaria* (Diptera: *Calliphoridae*), in two distinct environments. Phenotypes measured include mean development time (divided into immature and pupal development time), and mean pupal and adult mass. In this research, three geographically distinct populations of *C. macellaria* were reared at 31°C, 70% RH and 21°C, 65% RH. Each temperature treatment contained 15 population replicates, with each replicate housing 100 fly larvae on 50g beef liver. All replicates were placed randomly within two growth chambers and were observed every twelve hours until the wandering third instar stage. At this time, observations were switched to every eight hours. All pupae were collected, weighed, and returned to the appropriate incubator to observe for adult eclosion. Adults were frozen at -20°C, dried at 55°C for 24 hours, sexed, and weighed. Data were not normally distributed and could not be appropriately transformed. Thus, Friedman ANOVA tests and Wilcoxon paired comparisons were used to determine differences between populations and temperature ($p<0.05$).

It was demonstrated that all three strains exhibited genetically different developmental responses for immature and pupal duration ($p<0.0001$). However, unlike the immature stage, responses in the pupal stage were not similar and, thus, showed evidence of adaptation of at least one population to a distinct environment. This is represented by a significant GxE interaction in pupal duration ($p<0.0001$) and pupal mass ($p=0.0232$).

In conclusion, this research demonstrates the importance of considering geographic distribution as a source of variability when estimating a TOC event. In order to comply with the last requirement of the *Daubert* statute (known error rate), the forensic entomologist must have some idea of the variation that a species can exhibit via phenotypic plasticity.[6]

**References:**

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