E49 Casework Analysis When Reference Data Aren't Available for the Observed Insect Species

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After attending this presentation, attendees will better understand how to use closely related blow fly species growth data to determine Postmortem Interval (PMI) for cases where species growth and development data is not available.

This presentation will impact the forensic science community by enabling estimation of the PMI when growth and developmental data are not available for the blow fly species which are found on decomposing remains. This is accomplished by using known developmental data on closely related species which are available.

The use of insect evidence to determine the Postmortem Interval (PMI) and to answer other questions surrounding a death scene has been in common use in hundreds of case investigations for more than two decades around the globe. In most cases, blow flies (*Diptera: Calliphoridae*) are used singly or in combination as the Primary Indicator Species for the known time of their growth and development which can then be used to calculate an estimated range of time (minimum to maximum) of when the death of the individual occurred. In this calculation, there is usually an additional estimated time for various delays which may occur prior to initial colonization (egg laying). Thus, after the blow fly species is identified, the developmental table for that specific species is then consulted. By factoring in the known environmental temperatures coupled with the growth and developmental data, the estimated range of when death most likely occurred is determined.

However, there are times when a species of blow fly is recovered from remains and the developmental data has not been determined for that species. This is usually due to the enormous effort required in resources, time, and funding to generate reliable growth data for a species. In addition, the species may be limited to a geographic area, but very commonly, the area has not been well surveyed as to what species are present, and thus the species has not been studied to any extent. The forensic entomologist is faced with the dilemma of which data set to select for that unknown (growth-wise) species. Usually, these understudied species will have a closely related, sister species which has been studied extensively. Therefore, it is possible to apply the known rearing data of extensively studied species to the species for which there is little or no data available.

This forensic entomologist has used the data set for blow fly and flesh fly species of Adel Kamal, which have been available for more than 50 years. With a few exceptions for tropical species data sets which have been found to be reliable, these growth and development tables of Kamal have proven reliable, accurate, and verified by information of the known time-of-death for a particular case. With this established, the Kamal data can then be used as the base data for sister species estimations for which there is no established growth and development data.

The most commonly used species in North America is *Phormia regina*, a warmer weather blow fly, and in the same tribe as the screw worm species. Through case work and research, it was seen that *Cochliomyia macellaria* was very near the development range of *P. regina*. Thus, before data were available for *C. macellaria*, data for *P. regina* was applied to *C. macellaria*. Once publication of the developmental data was compiled for *C. macellaria*, it was seen that *C. macellaria* was approximately 12 to 24 hours quicker for the completed total life cycle than *P. regina*. When larval stages were present and the time of development for those larvae was half the total time or less, the difference was negligible. This rational also followed for the *Lucilia* species complex consisting of the most common green bottle flies, those being *Lucilia sericata*, *Lucilia illustris*, and *Lucilia coeruleiviridis*. There was ample data for *L. sericata*, but nothing for the other two species which were commonly encountered in hundreds of cases across North America. Therefore, the data for *L. sericata* was used as the data for these other two species. Again, once data had been accumulated for growth and development of *L. illustris* and *L. coeruleiviridis*, it was found that these two species were slightly slower than *L. sericata* by 24 to 48 hours for the total life cycle duration. As in the case with *P. regina* and *C. macellaria* where only a portion of the total life cycle was involved, the differences were greatly diminished. Since *L. sericata* is the fastest of the three species studied, when *L. sericata* was used it would establish the absolute minimum time for the time-since-death for that case. Also, the inclusion of variability into the estimated range far exceeded the small difference in the specific calculation.

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