G106 Species Interactions Between Forensically Important Blowfly Species and the Invasive Hairy Maggot Blowfly (Diptera: Calliphoridae)

Erin J. Watson-Horzelski, PhD, Southeastern Louisiana University, Department of Biological Sciences, SLU Box 10736, Hammond, LA 70402; and James P. Geaghan, PhD, Louisiana State University, Department of Experimental Statistics, 161 Martin D. Woodin Hall, Baton Rouge, LA 70803*

After attending this presentation, attendees will become familiar with species interactions of native and invasive calliphorid species observed at decomposing animal and human remains.

This presentation will impact the forensic science community by demonstrating the importance of understanding biological and ecological aspects of forensically important blowfly species commonly collected at the crime scene.

Introduction: Native to tropical regions of Australia and the Orient, the hairy maggot blowfly, *Chrysomya rufifacies* (Macquart), was first reported in the New World in 1978 (Costa Rica) and then in the United States in 1980 (Texas). As an aggressive species, *Chrysomya rufifacies* has disrupted the natural balance of insect communities associated with corpses and carcasses in the continental United States. First-instar larvae are necrophagous, while second and third-instar *Ch. rufifacies* are facultatively cannibalistic and predaceous on other blowfly larvae.

The secondary screwworm fly, *Cochliomyia macellaria* (F.), is abundant throughout the New World and is often the first arrivers at human and animal remains. Due to overlapping niches, species interactions between *Ch. rufifacies* and *C. macellaria* not only affect their life histories but also impact forensically important predatory beetles. Prior to arrival of *Ch. rufifacies* in Louisiana in 1995, Tessmer and Meek (1996)[1] study seasonal abundances of adult Calliphoridae. They determined that >95% of the emerged adults in summer and fall 1992 were C. macellaria, as well as, approximately 52% of *C. macellaria* larvae migrated <0.9 m away from carcasses, and 65% moving in a SE/SW direction.

Material and Methods: Five experiments were conducted during summer and fall seasons in 2008-09 in a grassland habitat in Hammond, Louisianna. Each experiment included three fresh swine carcasses (55-70 kg), placed 30 m apart, with heads facing north. Two research phases per experiment: (1) carcass utilization by calliphorid larvae; and, (2) larval dispersion and adult emergence. Phase 1 sampling protocol: all carcasses manually sampled daily until majority of blowfly larvae migrated and/or pupated, with emphasis on species interactions within five regions of carcass (head, anterior portion, anterior limbs, posterior portion, and posterior limbs) and monitoring of resource quality per region (high, medium, low). Phase 2 sampling protocol: collection method designed to resemble Tessmer and Meek (1996). Nine emergence cages were constructed from PVC pipe and fiberglass screening: one center cage (1 x 1 x 0.6 m) placed directly over each carcass, eight cages (1 x 0.6 x 0.6 m) placed 60 cm away from center cage and each other. Emerged flies aspirated daily until no calliphorid adults were observed for two consecutive days. Temporal and spatial models were determined using logistic regression analyses (Proc Glimmix, SAS 9.1).

Results: Fifteen carcasses studied in 2008-09 were analyzed for spatial and temporal patterns of calliphorid larvae within five carcass regions (Phase 1). Seven species of blowfly larvae were collected until 10-15 d of decomposition, with majority of occurrences being *C. macellaria* and *Ch. rufifacies* larvae. Logistic regression models clearly demonstrated behavioral, spatial and temporal patterns observed in nature, including: delayed oviposition by *Ch. rufifacies*, relocation of *C. macellaria* to lower quality resources (limbs) to avoid predation, early migration of *C. macellaria* larvae away from carrion, and increased probability of *Ch. rufifacies* at all regions of carcass with favorable resources. All Type III tests were highly significant ($Pr > F$, $P < 0.05$) for time and carcass region, as well as, Tukey-Kramer pair-wise comparisons for species and region. Nine swine carcasses studied in 2009 were analyzed for spatial and temporal patterns of migrating post-feeding larvae (Phase 2). A total of 90,112 adults were aspirated between 11-19 d of decomposition: *C. macellaria*: 62,470 (69%), *Ch. rufifacies*: 27,568 (31), and *Lucilia sericata*: 74 (> 0.0008). Predicted adult emergence for *C. macellaria* and *Ch. rufifacies* peaked on days 13 and 16-17, respectively. All Type III tests were highly significant ($Pr > F$, $P < 0.05$) for time, cage position (north-south, east-west), and all interactions. Tukey-Kramer pair-wise comparisons were also significant for species and carcass region. Majority of *C. macellaria* were collected in the center cage (~ 89%), with less larvae migrating south and west. Whereas, *Ch. rufifacies* larvae migrated predominantly south and east.

Conclusions: In comparison to Tessmer and Meek (1996), a decrease in abundances of adult *C. macellaria* were documented. However, *C. macellaria* remained the predominant blowfly species collected in emergence cages (69%) despite the presence of Ch. rufifacies. In addition, the majority of *C. macellaria* larvae did not migrate a notable distance away to pupate as was hypothesized. Understanding species interactions of forensically important blowflies at a crime scene is of utmost importance for postmortem estimations.

Reference:

1. Tessmer, J.W., and C.L. Meek. 1996. Dispersal and distribution of Calliphoridae (Diptera) immatures from animal carcasses in southern Louisiana. J. Med. Entomol. 33(4): 665-669.

Forensic Entomology, Blowfly Species Interactions, Hairy Maggot Blowfly

 ** Presenting Author*