



### H29 The Characterization of Louisiana Winter Carrion Decomposition and Its Effects on Accumulated Degree Day (ADD) Estimations

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After attending this presentation, attendees will better understand the potential errors related to postmortem estimations based on ADDs of blow fly development during cooler months of the year. The goal of this presentation is to illustrate differences between observed thermal heat units versus those hypothetically available for growth.

This presentation will impact the forensic science community by demonstrating the importance of understanding the external (ambient) and internal cadaver sources of thermal heat at a crime scene.

Insects are poikilotherms (i.e., cold-blooded animals), thus, their growth and development rates are temperature-dependent. As a result, the summation of degree hours or days (thermal units) at a crime scene can be used to predict the overall energy budgets required to complete specific life stages of necrophilous insects present on human remains.<sup>1</sup> For entomologists to estimate postmortem intervals based on ADDs, three basic requirements must be met: (1) access to species-specific published development data; (2) scientifically based and general acceptance of species-specific development thresholds for growth (i.e., biological minimum and maximum); and, (3) accurate climatological information (ambient temperature, relative humidity, precipitation, etc.) associated with the crime scene or Cadaver Decomposition Island (CDI). Development data are available for various forensically important fly species (i.e., Calliphoridae, Muscidae, Sarcophagidae). In recent years, there has been an increase in forensic entomology studies focusing on improvements for both laboratory-reared blow fly development and thermal summation models (ADDs calculations), particularly associated with the curvilinear portion of insect; however, limited seasonal field experiments have been conducted to document the external and internal sources and fluctuations of thermal heat units associated with blow fly larval masses during cooler seasonal temperatures (i.e., biological minimums for growth).<sup>2,3</sup>

This study analyzed the effects of ambient and carcass temperatures throughout decomposition of adult swine carrion during the winter 2017 season in Hammond, LA. Winter decomposition of large vertebrate carcasses in Louisiana is characterized by prolonged carcass decomposition and periods of reduced insect activity due to fluctuating ambient temperatures.<sup>4</sup> Southeast Louisiana has a humid subtropical climate with long, hot, humid summers and short, mildly warm winters. This region rarely experiences freezing temperatures and regularly records dramatic ambient temperature swings within a 24-hour period (i.e., temperatures dropped from 27.2°C to 1.1°C overnight from January 25 to January 26, 2017). Wide-ranging temperature fluctuations occur sporadically through the cooler months in Louisiana and can cause considerable problems when postmortem estimations are based on traditional ADD formulas. The “typical winter forensically important species” of Calliphoridae in Louisiana varies greatly depending on how warm the winter is. Winter indicator species typically include *Calliphora vicina* (Robineau-Desvoidy), *Phormia regina* (Meigen), and *Lucilia coeruleiviridis* (Macquart), whereas spring and summer species include: *L. coeruleiviridis*, *Cochylimyia macellaria* (F.), *Chrysomya rufifacies* (Macquart), and *Chrysomya megacephala* (F.). As a result of mild winters and occasional summer-like temperatures, it is not uncommon to recover crime scene evidence in December or January that includes all of the above species at a single site.<sup>5</sup>

This research includes two phases: (1) winter 2017 field study using three adult swine carcasses (36kg-50kg) placed in a hard-bottom flatwoods forest at Southeastern Louisiana University’s Outdoor Classroom from January 26, 2017 to May 17, 2017; and, (2) laboratory study using Caron Products® Insect Growth Chamber to simulate observed winter ambient field conditions (thermal units minus carcass affect). Carcasses were sampled daily, every other day, biweekly, and weekly until day 112. Each sampling event included manual sampling of insects, digital photography, and multiple temperature measurements within the CDI, including: (1) FLIR® C2™ compact thermal imaging system (infrared camera) to document carcass surface temperatures and maggot mass activities within the carcass; and, (2) dual-digit temperature probe for internal carcass temperatures (mouth, anus), maggot mass, and ambient temperature. ADD estimations were calculated for *C. vicina* and *P. regina* using observed thermal heat units at the carcasses and climatology data from Hammond Regional Airport.

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#### *Calliphora vicina*, Postmortem Estimation, Forensic Entomology