



Pathology/Biology Section - 2015

H34 Engaging Undergraduate Students in Forensic Entomology Research: Life History Studies of Three Necrophilous Beetles

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The goals of this presentation are to provide attendees with: (1) knowledge of the development times of two carrion beetle species, *Oiceoptoma inaequale* (F.) and *Necrodes surinamensis* (F.) (Coleoptera: Silphidae) at four constant temperatures; (2) instar determination of the hairy rove beetle, *Creophilus maxillosus* (L.) (Coleoptera: Staphylinidae); and, (3) the value of undergraduate research experience and mentorship in forensic entomology.

This presentation will impact the forensic science community by demonstrating the importance of understanding biological and life history data of common necrophilous beetles collected at a crime scene as well as by emphasizing the need for undergraduate research experience for all students interested in pursuing careers in forensic science.

Insects are poikilotherms (i.e., cold-blooded animals); thus, their growth and development rates are temperature-dependent. Furthermore, the summation of degree hours (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; however, entomologists must have access to published development data and the species-specific development thresholds for growth (min/max) in order to estimate postmortem intervals based on accumulated degree days. Development data are available for various forensically important fly species belonging to families such as Calliphoridae, Muscidae, and Sarcophagidae. There is limited-to-no controlled, laboratory-derived data available for predatory beetles commonly collected at decomposing remains (e.g., Histeridae, Silphidae, and Staphylinidae).

Watson-Horzelski determined the time of development and survivorship per life stage of the hairy rove beetle, *Creophilus maxillosus* (L.).¹ Following the same rearing protocol, development times were established for two carrion beetle species, *Oiceoptoma inaequale* (F.) and *Necrodes surinamensis* (F.) (Silphidae). Both species are common scavengers and predators of fly eggs and larvae associated with human cadavers and wildlife carcasses. Development studies were conducted at four constant temperatures (16oC, 20oC, 24oC, and 28oC) using a Caron Products® Insect Growth Chamber (Model 6025-1). All study specimens were maintained at 50% relative humidity and a 12:12 hour light:day photoperiod. All immature insects (egg, 1st, 2nd, and 3rd instar, and pupal life stages) were reared in separate containers and inspected twice daily (eggs) or daily (all remaining life stages) for survival, embryo development, time of molt, pupation, and adult emergence. Larval molts to progressive instars were determined by changes in cranial and pronotal width of the silphid larvae and confirmed by the presence of exuvia (cast skin) of the previous life stage.²

Identification of the correct life stage is critical in forensic entomology and for the estimation of time since death. Instar determination for the hairy rove beetle, another common predator of fly eggs and larvae, was performed according to protocols established by Watson and Carlton.² Study specimens of *C. maxillosus* were removed from Southeastern Louisiana University's Forensic Entomology Laboratory colony at known instar stages and preserved in 95% Ethanol (ETOH) (i.e., a total of 144, 153, and 208 1st, 2nd, and 3rd instars, respectively, were selected for the study). Morphological measurements included maximum cranial width, maximum pronotal width, and total body length (anterior margin of clypeus to tip of tenth abdominal segment). All measurements were performed under a Leica® MZ-16 stereomicroscope using digital calipers. The knowledge gained from both of these studies (morphological and development data) will enhance the ability to estimate time since death by providing additional life history information for three common predatory beetles present at the crime scene.

References:

1. Watson-Horzelski, EJ. Survival and time of development for *Creophilus maxillosus* (L.) (Coleoptera: Staphylinidae) at three constant temperatures. *Coleop Bulletin* 2012;66(4):365-370.
2. Watson EJ, Carlton CE. Succession of forensically significant carrion beetle larvae on large carcasses (Coleoptera: Silphidae). *Southeast Nat* 2005;4(2):335-346.

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