G71 Postmortem Microbiology: Culturable Bacteria of the Maggot Mass

Lauren Chun, Chaminade University of Honolulu, 115 Wesselkamper Science Ctr, 3140 Waialae Avenue, Honolulu, HI 96816; Marcus Miguel, Chaminade University of Honolulu, 115 Wesselkamper Science Ctr, 3140 Waialae Avenue, Honolulu, HI 96816; Shari Forbes, PhD, University of Technology Sydney, PO Box 123, Broadway, NSW 2007, AUSTRALIA; and David O. Carter, PhD, Chaminade University of Honolulu, Div of Natural Sciences & Math, 3140 Waialae Avenue, Honolulu, HI 96816*

After attending this presentation, attendees will understand that a maggot mass is a reducing environment of high temperature that becomes more acidic over time and selects for bacteria commonly associated with putrefaction.

This presentation will impact the forensic science community by providing a better understanding of the ecology of a maggot mass and corpse decomposition, which will help death investigators and forensic entomologists to establish more reliable reconstructions of death scenes and estimates of estimating postmortem interval.

It has recently been shown that postmortem microorganisms have potential value as physical evidence for estimating postmortem interval and tracing the movement of remains. This potential has yet to be fully realized, because we still have only a rudimentary understanding of postmortem microorganisms and their ecology. For example, it is understood that different locations on a corpse have different bacteria; maggot masses are one conspicuous area of a corpse that has yet to be researched. Understanding the microbiology of the maggot mass will provide investigators with a novel source of investigative information that can be used as stand-alone evidence or as evidence that corroborates forensic entomology. This study proposed to characterize culturable postmortem microbial communities and analyze trends in chemical properties.

The experimental unit was a swine carcass (*Sus scrofa domesticus*) placed on the soil surface at the Chaminade University of Honolulu Facility for Forensic Taphonomy within a few hours of death. This facility is a 900m^2 outdoor facility located in a Tropical Savanna climate on the western slope of the Palolo Valley near Honolulu, Hawaii. The site is approximately 285 feet above sea level. Mean annual precipitation equals approximately 700mm, 70% of which arrives in the autumn and winter (October-March). The vegetation at the site is representative of a tropical savanna ecosystem on Oahu; it is rocky and dominated by pili grass (*Heteropogon contortus*) with night-blooming cereus (*Hylocereus undatus*), shrub aloe (*Aloe arborescens*), and carrion plants (*Stapelia* spp.). Few scavengers are present at the site; only the small Asian mongoose (*Herpestes javanicus*) has been observed.

Decomposition was monitored daily for 312 hours postmortem. Maggot masses were present from 70 to 120 hours postmortem and were swabbed daily with sterile cotton swabs and immediately placed in sterile tubes for transport to the laboratory. The swabs were streaked onto standard nutrient agar and incubated at 22°C. Morphologically unique bacterial colonies were isolated and identified via matrix-assisted laser desorption/ionization time of flight mass spectrometry. In addition to swabbing, the chemistry of the maggot masses was characterized using portable sensors to measure temperature, pH, electrical conductivity, and oxidation-reduction potential. Temperature and relative humidity of the decomposition site was measured at intervals of one hour.

Carcasses decomposed to skeletons within 13 days (312 hours) postmortem. Mean maggot mass temperature ranged from 34°C to 40°C, but differences as great as 10°C were observed between masses. The pH of maggot masses was initially slightly basic (7.4), but became slightly acidic over time (6.6). Measurements of electrical conductivity appeared to be unreliable as values ranged from 19µS to 18,000µS with extreme variation in between and no consistency among the three carcasses. The oxidation-reduction potential was consistently between -200 millivolts and -250 millivolts, which represents a highly reducing environment related to methane generation and sulfate reduction. The average temperature for each day of decomposition ranged from 24.4°C to 28.3°C, while the mean relative humidity for each day ranged from 68.6% to 96.4%. The most commonly observed bacteria in the maggot mass included *Proteus mirabilis* and *Providencia stuartii.* Also observed were genera *Bacillus, Staphylococcus,* and *Enterococcus.* In general, a decrease in bacterial diversity was observed over time. More detailed analyses will be presented and the results observed in this study are the basis for further research in microbe-insect interactions.

Entomology, Taphonomy, Death Investigation

 ** Presenting Author*