Dermestid Beetles in Cleaning Osteological Specimens: Best Practices

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INTRODUCTION

Multiple methods for using dermestid beetles (Fig. 1) to process animal remains have produced similar results with regards to soft tissue removal. Previously researched factors include temperature and humidity within the colony, specimen moisture level, location of the specimen regarding air flow, and the amount of light reaching the colony (Borell, 1938; Tiemeier, 1940; Sommer, 1947; Vorhies, 1948; Laurie and Hill, 1951; Hooper, 1956; Case, 1970; Hefti et al., 1980; Richardson and Goff, 2001; Bemis et al., 2004). **The goal of this research was to compare these procedures to determine which practice(s) are most efficient at cleaning specimens with the most well-preserved articulation.**

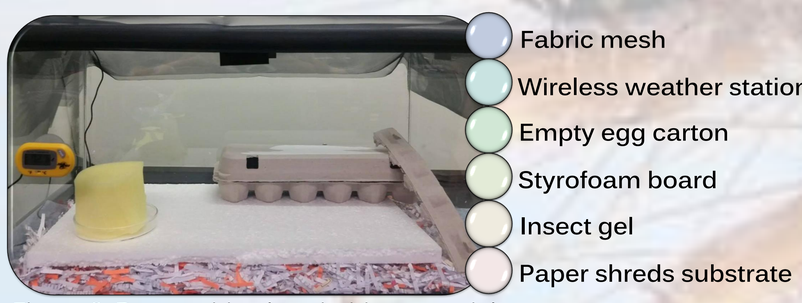

Figure 2. Dermestid colony habitat materials

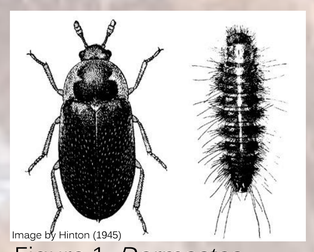

Figure 1. *Dermestes maculatus* adult beetle and larva

MATERIALS AND METHODS

- Materials include the beetle habitat (Fig. 2), meat thermometer, scale, dissection tools, wire baskets and stand, insect gel, plastic containers, 3% hydrogen peroxide solution, wireless weather station and cardboard storage boxes
- Dermestid cleaning of 32 house mouse (*Mus musculus*) carcasses was evaluated using the following quantified factors:
  - Temperature (degrees F) and % humidity in the colony
  - Specimen moisture level (Fig. 3; freshly dissected vs. dissected and dehydrated 48 hours)
  - Lighting type (natural vs. full light vs. full dark)
  - Specimen location (Fig. 4; unelevated vs. elevated wire baskets)

Figure 3. (Left) freshly dissected and (right) dehydrated specimens

Figure 4. Unelevated wire basket and elevated wire basket in colony

- Complete cleaning was identified as when there were no longer beetles, larvae, or visible pupa within specimen crania
- Daily check-ins at 4:00 p.m. were used to monitor specimen progress
- Specimen articulation was recorded prior to being soaked in a 3% hydrogen peroxide solution for 24 to 72 hours (Fig. 5)
- Resulting data (i.e., cleaning duration, temperature, humidity, and varying factors/combinations of factors) was assigned a coded value and statistically analyzed using a series of One-way Analysis of Variance (ANOVA) to determine which factors most influenced cleaning efficiency

Figure 5. Example of an excellently articulated, finished specimen

Figure 6. Dermestid adult beetle

RESULTS

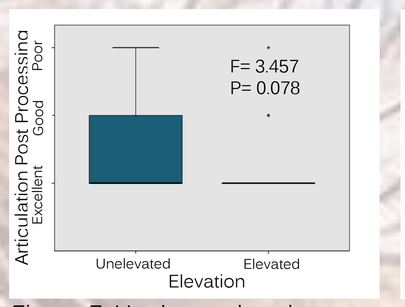

Figure 7. Unelevated and elevated specimens had excellent articulation.

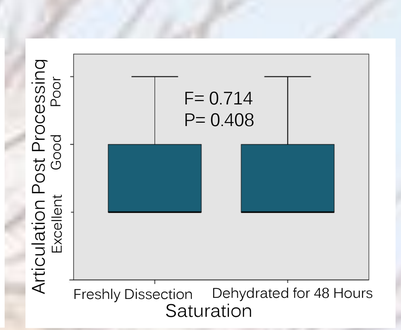

Figure 8. Freshly dissected and dehydrated specimens had excellent articulation.

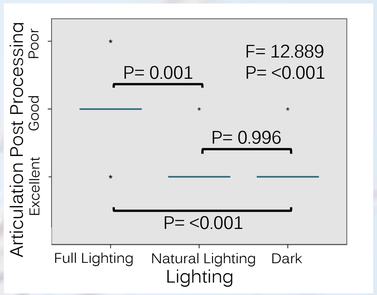

Figure 9. Naturally lit and dark specimens had excellent articulation while fully lit specimens had good articulation.

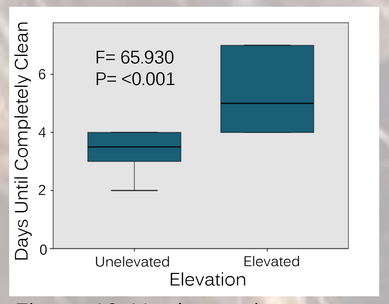

Figure 10. Unelevated specimens averaged 3-4 days until completely clean; elevated specimens averaged 5 days until completely clean.

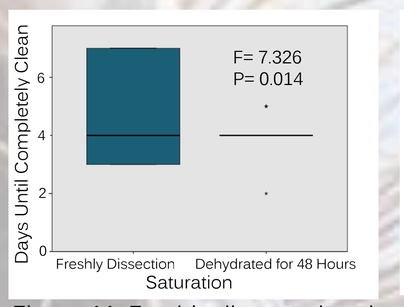

Figure 11. Freshly dissected and dehydrated specimens averaged 4 days until completely clean.

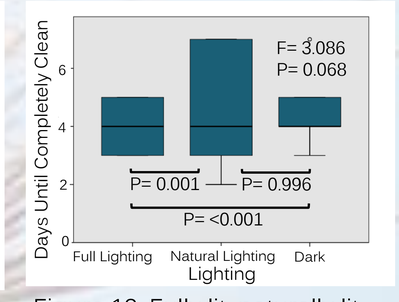

Figure 12. Fully lit, naturally lit and dark specimens averaged 4 days until completely clean.

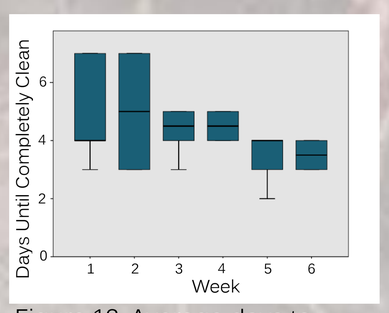

Figure 13. Average days to process specimens decreased over time during this experiment.

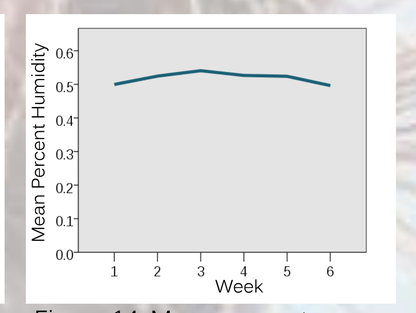

Figure 14. Mean percent humidity within the colony over the experimental period.

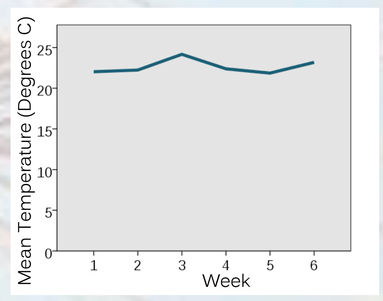

Figure 15. Mean temperature (degrees C) within the colony over the experimental period.

DISCUSSION AND CONCLUSIONS

- The most important factor for cleaning efficiency was the specimen remaining unelevated
- The most important factor in preserving articulation was the lighting remaining natural or dark, with dark specimens taking the least time to be completely cleaned with the most complete articulation
- The specimens were cleaned more efficiently towards the end of the experiment, suggesting the beetle colony grew in size during the experiment
- This experiment allowed the compilation of best practices for dermestid cleaning and enables labs to select techniques based on individual needs such as speed and articulation. By identifying these best practices, this research benefits labs, museums and private collections that wish to utilize dermestid beetles to process osteological specimens for teaching or research.

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