

Decomposition of Pigs on Guam.

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Abstract- I purchased one 15 kg pig from Pangelinan pig farm in Yigo, and was given two 15 kg (each) pigs from a friend in Talofofo. Pigs were killed on 9, September 2010 between 1133-1139 hours. The three carcasses were numbered site 1, 2, and 3. Carcass at site 1 was placed on a wire mesh screen frame and placed directly on soil. Carcass on site 2 was placed on a wire mesh screen frame and placed directly on soil. Carcass at site 3 was placed directly on soil. All three sites were 50 meters apart, surrounded by tall (approximately 2 to 2.5 meters high) sword grass (Sakati). A Davis Instrument, Advantage Pro II weather station was set up between site 1 and 2. Rates of decay were compared between all three sites. Site one and two were relatively similar, however site three had a much more rapid rate of decay. Body weight, occurrence of blow fly larvae, pictures, surface, maggot mass, and soil temperatures were recorded daily in intervals of 10 minutes. All three carrion were exposed to direct sunlight. Maggot mass development with site three appeared to be a major factor in the overall decomposition process compared to sites one and two. In accordance with Lee Goff Protocol for Decomposition Studies (unpublished) and working with Professor's Ross H. Miller and Aubrey

Moore, I set out to collect data regarding decomposition rates on Guam and the affect the blow fly and other insects have on the process, in comparison to Hawaii and the continental United States.

Introduction

A decomposition study on Guam is needed to compare data collected on Guam with similar pig studies in the state of Hawaii. Guam is in dire need of forensic entomology data to help pin point time of death in local homicide cases. A number of homicides (bodies) are covered with adult flies, larvae, etc.

Objective 1 is to collect data from study, as we suspect environmental changes such as a higher temperature and humidity on Guam may speed up the decay process compared to that of Hawaii and the continental United States. On 3 November, 2009 two pigs were killed for a similar study. One was hung by the neck and the other placed directly on soil. In five calendar days, the carcass placed directly on soil went from full bloat to skin barely visible on exposed bones. The hanging carcass went from full bloat to bone exposure after 7 days. Observations on the species of flies visiting the decaying carcasses were noted. No temperature reading where recorded.

Objective 2 was to perform three decomposition studies throughout the island of Guam (South, Central and North). The goal is to compare and publish data collected from all three locations. Data to be analyze to see if there are any significant differences throughout the island. Data will be compared with that of Hawaii and other tropical islands in the Pacific.

Materials and Methods

Three domesticated pigs must be used for all three locations weighing approximately the same and all with similar conditions. Example: The first location, all three pigs were placed in the open sunlight and very similar surroundings. For location two, it's our intention to conduct study on the interior of a home to mimic a decaying body without the direct environmental weather elements you receive in an open field or jungle area. For location number three, it's our plan to locate a jungle area undercover from direct sunlight or wrap the carrion in carpets, plastic sheeting/ trash bags, etc. to mimic previous homicides on Guam and place each carcass on the side of a rough jungle area road way. Results may vary, depending on the time of year. Data collected and results will be shared with our medical examiner and local/ Federal law enforcement agencies.

Three domesticated pigs were used for current study, weighing 15 kg each and similar in age. One pig came from a Yigo farm and two pigs came from Ipan, Talofofo. All three sites were in open air and in direct sun light, rain, and the direct elements of our daily environment. A vegetated sword grass (Sakati) area approximately (2 to 3.5 m in height) and red clay soil located on Lot 1148-1NEW, Barrigada, Guam with coordinates - 13.471675 N, 144.785987 E at 63 m was used for the study. All three sites were 50 m apart.

All three pigs were killed on 9, September 2010 between 1133-1139 hours with a single gunshot (9mm) the bullet laterally traversing the head of each pig from ear to ear. The bullet exited approximately 4 to 6cm below the left ear, death was immediate. All three carcasses were immediately placed in double lined black trash bags. They were then covered with

coconut palm leaves to eliminate direct sun light and transported in the rear bed of a Frontier Nissan pickup truck. Carcasses were transported to the location in Barrigada immediately after being put down. Pig 1 was killed at 1139 hours and placed at site 1 at 1238 hours. It took 59 minutes from time of death to place pig at site 1. Pig 2 was killed 1136 hours and placed at site 2 at 1247 hours. It took 71 minutes from time of death to place pig at site 2. Pig 3 was killed at 1133 hours and placed at site 3 at 1251 hours. It took 78 minutes from time of death to place pig at site 3. Upon carcasses arriving at location, there was no insect activity (flies) observed on or around bed of pickup truck. Site 1, carcass was placed on an 80 X 80 cm mesh wire and metal frame platform, measuring 5 cm in height. A .5 cm diameter nylon rope was tied at all four corners of the platform to allow carcass to be weighed by hanging scale. Three 5 X 12 cm wooden planks were used to create a tri-pod to hold hanging scale above carcass. Empty trash bags with pig blood were then discarded approximately three meters from carcass location. A Hobo thermocouple probe was inserted into the anus approximately 15 cm deep. Site 2, carcass was placed on same mesh wire screen as site one, however no scale was used to monitor carcass weights. Site 3, carcass was placed directly on red clay soil surface. All three sites were fenced in with plastic orange construction fencing measuring 185 X 185 cm X 122 cm high to keep out feral animals and any other varmint that may attack carcasses. An access door opening was constructed (92 cm wide square X 122 cm high). A frame constructed out of #4 and #5 rebar was used to secure fencing. A protocol for decomposition studies developed by Lee Goff was used in this study.

A Weather station (Advantage Pro II, A Davis Instrument) was installed between Site 1 and 2 to record relative humidity, maximum, minimum and average temperatures, wind speed, rain fall and solar radiation were recorded every 10 minutes. Refer to Figure 2.

Each site was visited a minimum twice daily with the first recorded time approximately 1 hour pass solar zenith. Visits began on 9, September 2010 until 22, September 2010. Then daily visits beginning 23, September 2010 until 7, October 2010.

Adult flies and other insects were collected daily from site two using a fine mesh insect sweep net approximately 30 cm above carcass and near vegetation. All insects collected were frozen in a chest freezer. Larvae were collected from carcass at site two from the head, abdomen and rear. Larvae was then placed in KAAD for 1 hour and then transferred to 95% ETOH. Larvae samples were also collected under the carcass, from an area approximately 10 cm in diameter and 0.5 cm in depth. This sampling was done every three days. All larvae collected were then reared in a closed in fine mesh screen cage located 72 m away next to a 13.3 m shipping container. Larvae samples collected from site two were placed in a Berlese funnel to separate larvae from mud and debris. The larvae were then collected in 95% ETOH at the bottom of the funnel cone.

Results

The abundance of flies caught during Site 2 net sweeps over carcass were identified as *Chrysomya rufifacies* (Macquart). This was the predominate species collected followed by *Chrysomya megacephala* (F.). No specific numbers of flies were counted due to the high number visible. At times they're over a thousand flies present on fencing, blades of sword grass, etc. On day two, we began observing *Sarcophagids* approximately 2 to 2.5 m away from carcass.

Observations were made in which both *Chrysomya megacephala* (F), and *rufifacies* (Macquart) eggs were laid around the exposed ear and lower abdomen area of pigs. A conclusion as to why this type of behavior is temperature. The surface temperature on each pig reached 40' C within a short period of time of each pig being placed on soil. We noticed a significant difference in the amount of eggs laid during the first three hours of pigs being placed on soil compared to the abundant increase in eggs laid during the cooler time of 1730 hours. 40 C' plus are lethal temperatures to flies, thus flies having to wait until the carcass cools before moving in to lay their eggs. See figure 2, Weather temperature data.

Another observation is relative humidity, in which data received showed an average of over 90%. Increasing during the night and drastically decreasing in the early morning hours when sunrise occurs. We received a considerable amount of rainfall throughout the 28 day study with only one day the 19, September, 2010 no rain.

Pig 1 was weighed twice daily for the first 14 days, then daily thereafter. As you'll see in figure 3, the weight reduction was relatively steady, however a little change in the increase of weight during rainy days was observed.

Figures 4, 5 & 6 detail the temperatures collected from each Site on carcass surface, maggot mass and exposed soil compared to air temperature collected from the Advantage Pro II weather station which was located between Site 1 and 2.

Table 1. Classification of insects collected on and around carcasses at all 3 sites.

	<u>Visual observation</u>
<u>Calliphoridae</u>	
Chrysomya megacephala (F.)	100 plus
Chrysomya rufifacies (Macquart)	
100 plus	100 plus
<u>Sarcophagidae</u>	
Sarcophaga Gressitti	3
<u>Staphylinidae</u>	
Rove Beetle	2

Figures 7, 8, 9 & 10, show the visual decomposition process from the date each carcass was placed on the ground, 3 days later, 5 days later and 14 days. As you can see, within the first 5 days of the study, 80% of all activity takes place.

Discussion

One can say what have we learned from this study? The time spent on collecting data on all factors will help guide us in the future on estimating time of death on a human body. It's

interesting to note, though a few results have mirrored studies done by (Goff) over the past decades in Hawaii and the Continental United States, Guam has very unique weather conditions, such as the high rates of carcass surface temperature and humidity. As we continue to plan the next two studies in the South and the North, we have begun to collect data that will be used to compare not only studies in Hawaii and the US but also what's done here on our tiny little island of Guam we call home. More work must be done, but persistence in the name of Forensic Science, in the end, will pay off and provide our Local and Federal Law Enforcement agencies the tools necessary to estimate time of death, thus placing a suspect (s) at the scene of the crime.

Acknowledgements

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References Cited

Goff, M. Lee. 2010. Protocol of Decomposition Studies (unpublished).

Goff, M. Lee. 2000. A fly for the Prosecution.
The Bugs on the Body. 2:21-30

Goff, M. Lee. 2000. A fly for the Prosecution.
The Pigs Tale. 3:31-49

Bohart, George E. & Gressitt, J. Linsley. 1951. Filth – Inhabiting Flies of Guam. Bernice P. Bishop Museum, Bulletin 204

Triplehorn, Charles A. & Johnson, Norman F. 2005. Borror and DeLong's Introduction to the Study of Insects 7th Edition.

Entomological Society of America. 1982. Environmental Entomology Volume 11. Number 4.

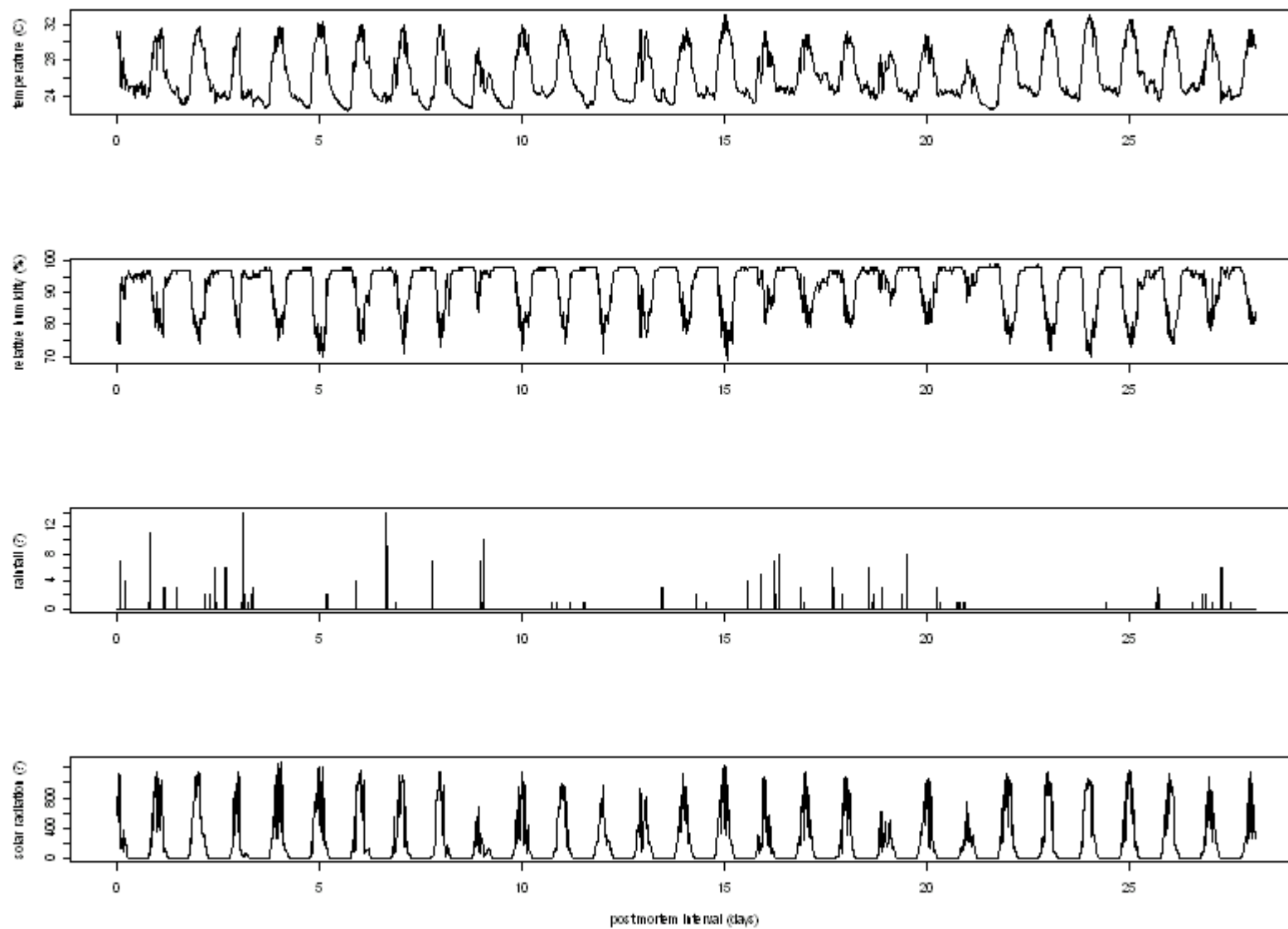


Figure 2. Weather data recorded during experiment by an automated weather station within 25 m of each pig.

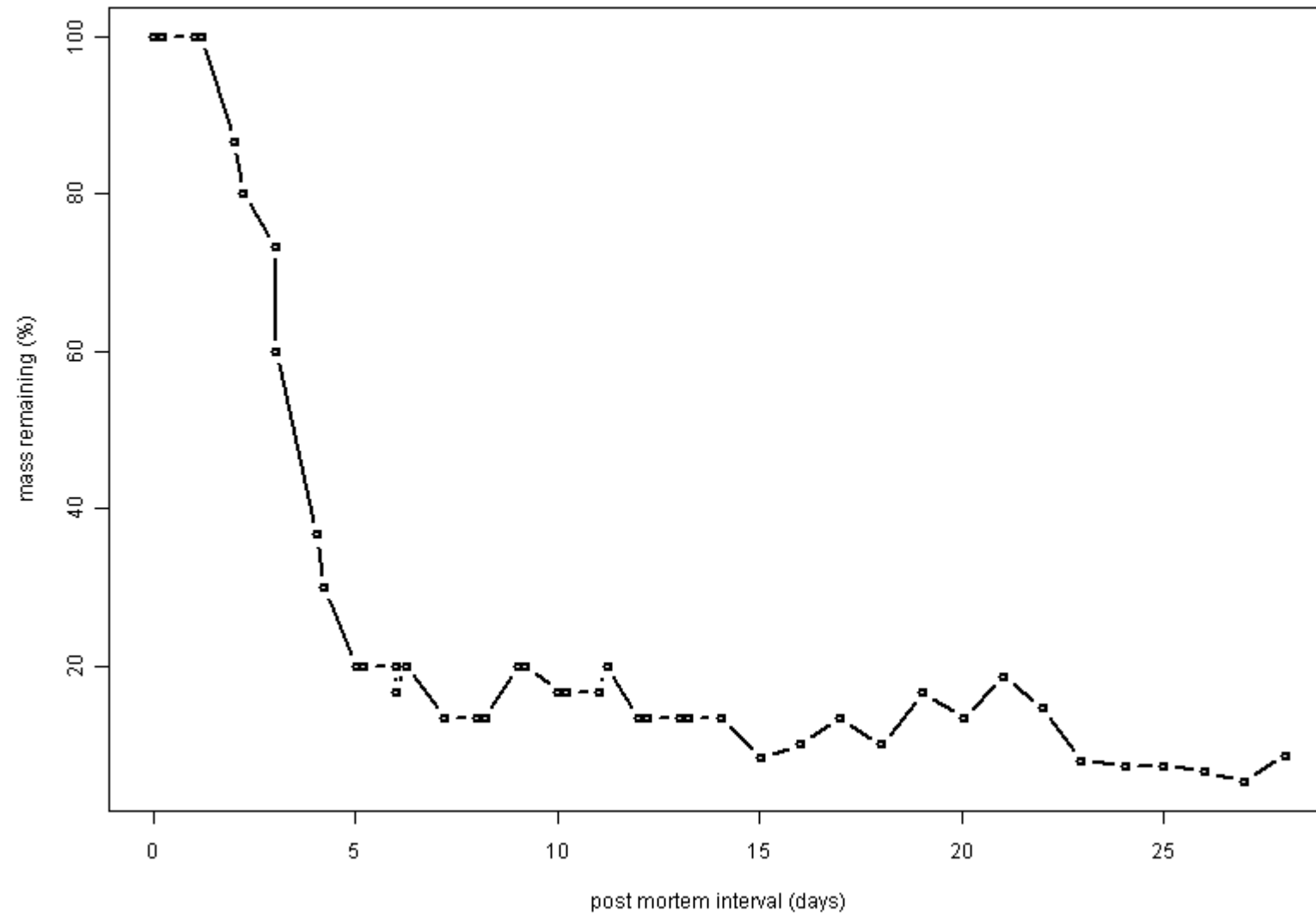


Figure 3. Mass remaining for pig 1.

Pig 1

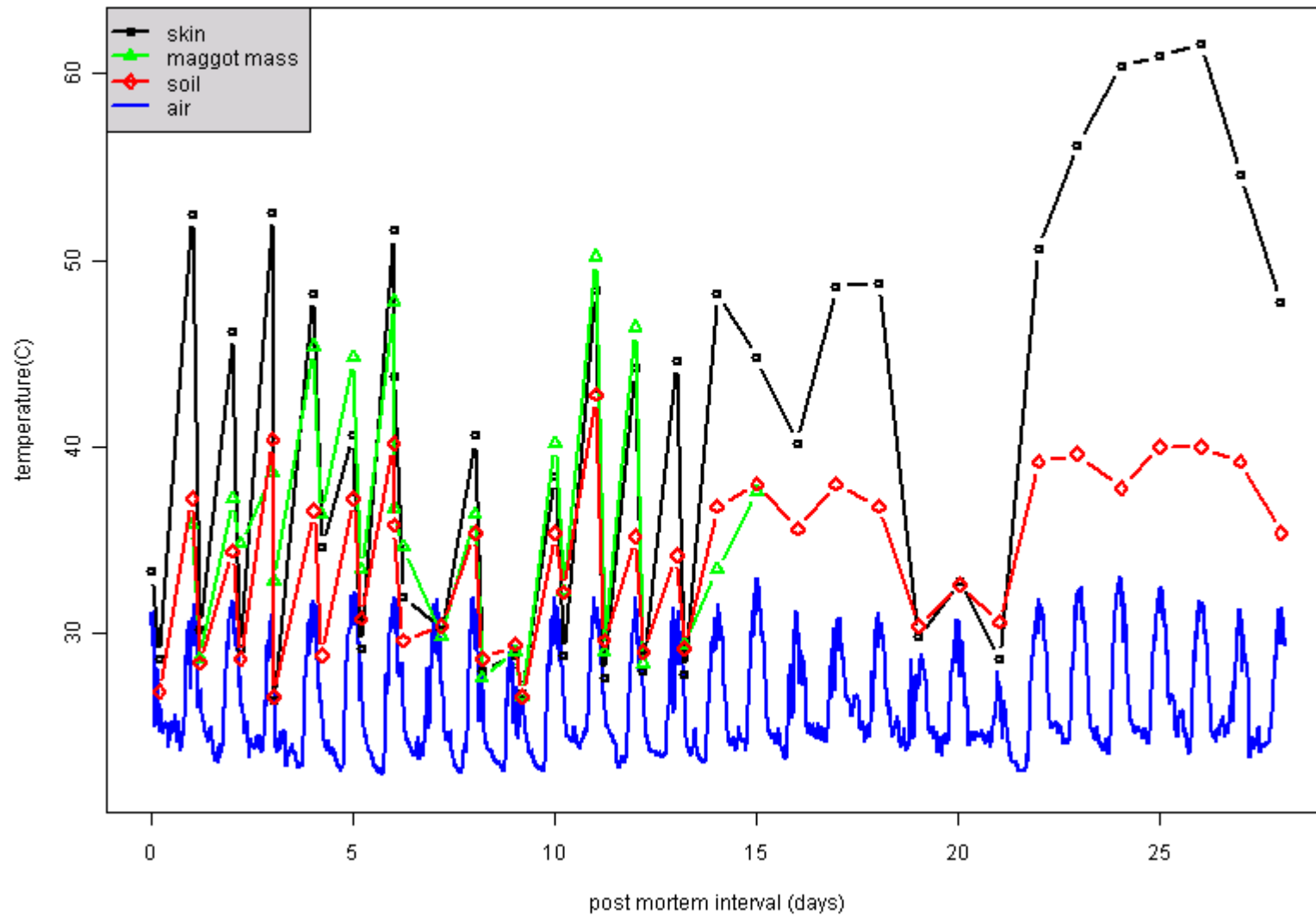


Figure 4. Temperature profiles for pig 1. Temperature of skin, maggot mass and soil measured twice per day for first 10 days, daily thereafter using an infrared thermometer. Ambient air temperature measured by an automated weather station at a height of 2 m. Distance between pig and weather station was 25 m.

Pig 2

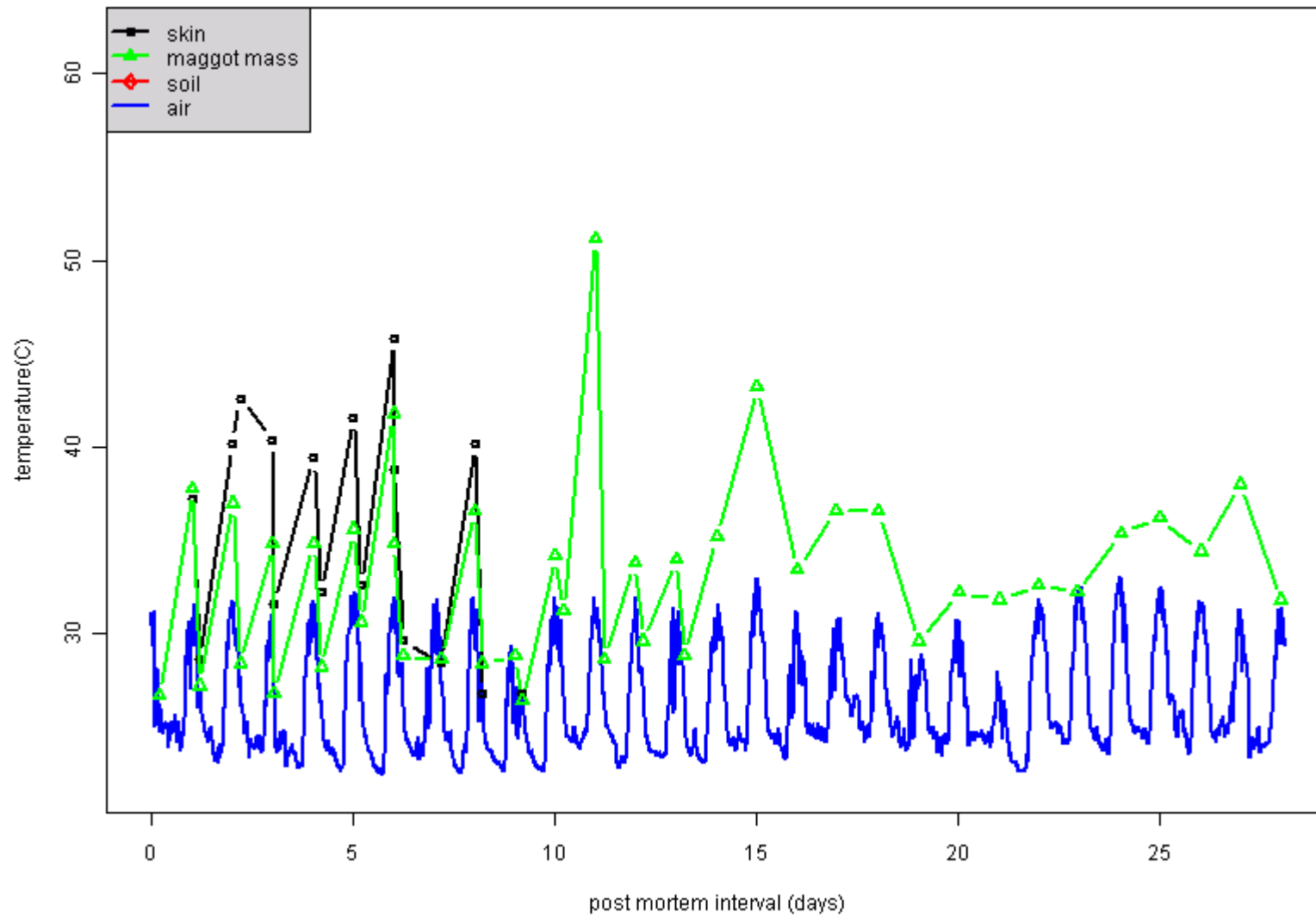


Figure 5. Temperature profiles for pig 2.. Temperature of skin, maggot massm and soil measured twice per day for first 10 days, daily thereafter using an infrared thermometer. Ambient air temperature measured by an automated weather station at a height of 2 m. Distance between pig and weather station was 25 m.

Pig 3

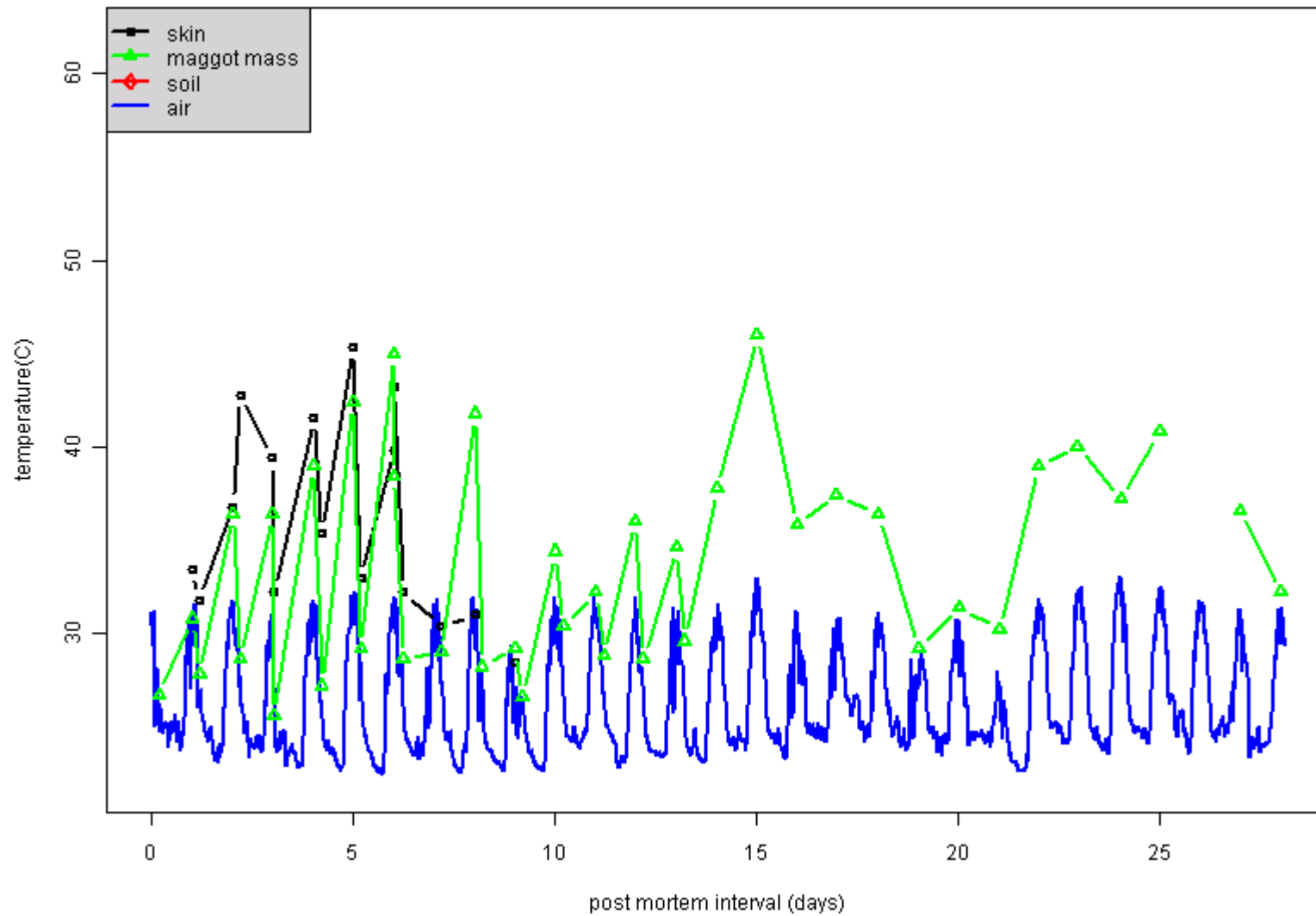


Figure 6. Temperature profiles for pig 3. Temperature of skin, maggot mass and soil measured twice per day for first 10 days, daily thereafter using an infrared thermometer. Ambient air temperature measured by an automated weather station at a height of 2 m. Distance between pig and weather station was 25 m.



Pig 1, 0.05 days Post Mortem



Pig 2, 0.05 days Post Mortem



Pig 3, 0.06 days Post Mortem

Figure 7, Pigs 1, 2 & 3 first placed on surface 9, September 2010.



Pig 1, 3 days Post Mortem



Pig 2, 3 days Post Mortem



Pig 3, 3 days Post Mortem

Figure 8, Pigs 1, 2 & 3, 12, September 2010.



Pig 1, 5 days Post Mortem



Pig 2, 5 days Post Mortem



Pig 3, 5 days Post Mortem

Figure 9, Pigs 1, 2 & 3, 14, September 2010.



Pig 1, 14 days Post Mortem



Pig 2, 14 days Post Mortem



Pig 3, 14 days Post Mortem

Figure 10, Pigs 1, 2 & 3. 23, September 2010.