Putrefaction Impact of Bivariate Differences in Decomposition Environments: Substantiated through a Plastic Tarp

Avery Wiley

Edited By: Madeline Kampes, Haley Golab, Lane White, Raph Rolwes

Texas A&M University, Department of Entomology

Abstract: The use of a plastic tarp to dispose of a dead body is portrayed frequently in true crime media and often seen in actual investigated murder cases. In these instances, the suspect wraps a victim's body completely in a plastic tarp and disposes of it, hoping that because the remains are not actively exposed, they will not be discovered. This paper explores the differences between a natural, open decomposition and a closed decomposition in which the body is wrapped in a plastic tarp and analyses the effectiveness of utilizing a plastic tarp for body disposal. Using two wild Texas hogs, *Sus Scrofa*, as surrogates for human bodies, the decomposition process was monitored biweekly for ten weeks. The temperature, moisture level, insect presence, animal activity, and overall condition of the bodies were measured to determine which decomposition process occurred at a quicker rate and what factors of decomposition had the greatest effect on the rate at which the bodies reached Butyric Fermentation. While the pig wrapped in the tarp underwent faster internal decomposition changes, the presence of increased insect and animal activity to the exposed pig caused its body to deteriorate faster. Therefore, it can be determined that while, in a theoretical, concealed environment, a plastic tarp would be a more effective method to decompose a body because the tarp holds the victim at higher internal temperatures and accumulates moisture. However, because of the importance of insect and animal activity in the decomposition process, leaving a body without covering would help eliminate and scatter the bodily evidence faster and more effectively.

Key Words: Decomposition, Forensic Taphonomy, Forensic Entomology

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The main variables which affect the rate and efficacy of decomposition are: the temperatures which the body is exposed to, the amount of moisture present in the body's environment and insect and animal activity on the body (Davies 2013). Therefore, if a body is wrapped in a material that alters these decomposition factors, the rate of decomposition will be affected. This strategy of concealment, specifically using a plastic tarp, has been seen in multiple murder cases as a methodology to provide cover for bodies in an attempt to make them harder to locate. A recent example of this is the murder of Juanita Rodriguez in Dallas, Texas on April 21, 2022, in which the victim's body was discovered wrapped in the plastic tarp and dumped on the side of the road allowing the still undiscovered murderer to escape (CBS NEWS 2022).

While the use of plastic tarps in murder cases is far from uncommon, it is still unclear whether their use is effective for successfully hiding a body. According to the Environmental Reviews Journal, a closed decomposition, seen in cases where a body is buried or wrapped in some sort of material, traps moisture which increases the humidity of the body, increases the overall internal temperature of the decomposition process, and allows a suitable, closed environment for bacteria growth (Walse, Berg, and Sverdrup 1998). However, insect activity plays one of the largest roles in the rate of decomposition and the encapsulation of a body could limit the access that insects have. (Jirón 1981). In addition, animal feeding can quickly break down parts of a body and expose more skin surface area for oxygenation and entomological activity.

Decomposition is classified into a various number of stages according to different scientific definitions and classifications, but for the purpose of this experiment the decomposition process will be classified into five stages according to the Australian Research Museum: Initial Decay, Putrefaction, Black Putrefaction, Butyric Fermentation, and Dry Decay. (Australian Museum 2020). To begin, within the first five days that the body is deceased, the initial processes of decay will begin. This first step is characterized by the initial insect activity of blood-sucking organisms drawn to the body by its heat, as well as the internal decomposition of bodily organs by internal enzymes and bacteria, known as Autolysis. Next, within ten days of the body's decease, the process of Putrefaction begins in which bacteria presence continuous to grow and break down the body causing the release of gasses and fluids that bloat the body and attract further insect and animal activity. Then, the next stage of Putrefaction known as Black Putrefaction usually takes place within 10-30 days of the body's death resulting in the release of internal fluids and the subsiding of bloat caused by increased microorganismal activity and the presence of fully grown maggot populations. The body then begins the process of drying out during Butyric Fermentation in which most of the flesh is removed and the body begins to mold. Finally, Dry Decay takes place when bacteria consume the remaining hair and tissue from the bones.

The experiment being conducted exists to analyze the effects of wrapping a body in a plastic tarp in order to determine which

methodology of body disposal proves to be the most effective in allowing a body to not be discovered, and permitting the suspect to get away with their crime undiscovered.

Materials and Methods:

Initial Setup: In order to test the effectiveness of a plastic tarp on the decomposition of a body an experiment was set up comparing the bodies of two wild Texas hogs. The hogs were shot with a .280 caliber Remington and brought to the area for decomposition exactly two hours after they were shot. Each hog was hunted in the same area, a 35-minute drive west from the College Station water tower, and killed within thirty minutes of each other to ensure neither was able to begin their decomposition processes before the other. The pigs used in this specific experiment were 72 and 74 pounds respectively, were both males, and were of similar stature. Immediately after each pig was killed a meat thermometer (TP-05, Kuluner, Denver, CO) was inserted into their chest in order to keep track of their original internal temperature. The pigs were then transferred to an area lightly shaded by trees and shrubs and near a stream to begin their decomposition processes. The 72-pound pig was placed on top of a 5 millimeter thick, 8 foot by 10 foot, plastic blue tarp (Blue Tarps, Metaire, LS) and wrapped tightly, with the ends of the tarp being secured to each other with zip ties (CV-XL, Kai Suh Suh Enterprise Co., LTD.,Taipei, Taiwan). The 74-pound pig was placed directly onto the soil five feet away from the tarp pig. The original position and conditions of the animals were recorded.

Data Collection: The factors that were observed and recorded throughout the experiment were the internal temperature of the body, the moisture present around and on the body, the number and type of insects on the body, and the overall condition of the body. The independent variable is whether the pig is wrapped in a tarp or not and the dependent variable is the decomposition condition of the pig. Every two weeks the pigs were visited and visual observations regarding the conditions of the body were written down. When visiting the hogs, the subject left in the open without the tarp was simply looked upon and observations were recorded; however, when examining the tarp pig, the tarp was not completely removed and was instead opened slightly to glance upon the body and the insects present, without disturbing the moisture and fluid that would accumulate in the tarp. In addition, their temperature was taken with a meat thermometer inserted into their chests every visit, and the amount of moisture present was recorded as a visual observation. Pictures of bugs were taken to be identified with the assistance of the internet later and overall observations of bug activity and the amount of organisms present were recorded. Finally, any signs of animal presence were noted and identified, but the specific species of animals present were unable to be identified simply by feeding marks. After each observation session, the tarp pig was wrapped back up tightly, secured with zip ties, and left to continue decomposition.

Results:

After watching the surrogate hogs for ten consecutive weeks and recording their internal decomposition processes, it was discovered that the 72-pound Tarp Pig was held in more suitable conditions for internal decomposition, while the Open Pig was held in more suitable external decomposition conditions. The Tarp Pig was kept at higher internal temperatures than the atmospheric temperature and cooled down gradually over a longer period of time, because the tarp held heat in. Additionally, the tarp acted as a bag, holding in large volumes of moisture, causing to the hog to be almost completely submerged in fluid while decomposing (Table 1). Whereas on the other hand, the Open Pig quickly cooled to atmospheric temperature after the first week and moisture surrounding the body was absorbed into the soil, leaving the hog in a dry decomposition environment (Table 2).

Table 1: Temperature and humidity recordings of the closed decomposition hog wrapped in a plastic tarp over the span of ten weeks.

Date	Week #	Internal Temperature (°F)	Temperature Comparison to Air Temp.	Moisture/Fluid Present?
3-Oct	1	103.8	Warmer	Yes
17-Oct	3	73.2	Same	No, absorbed into soil
31-Oct	5	--	--	--
13-Nov	7	--	--	--
2-Dec	10	--	--	--

Table 2: Temperature and humidity recordings of the open decomposition hog left exposed over the span of ten weeks.

Date	Week #	Internal Temperature (°F)	Temperature Comparison to Air Temp.	Moisture/Fluid Present?
3-Oct	1	102.5	Warmer	Yes
17-Oct	3	77.4	Warmer	Yes
31-Oct	5	67.3	Warmer	Yes
13-Nov	7	65.3	Same	Yes
2-Dec	10	62.4	Same	Yes

However, when looking at the role of insect and animal activity in the decomposition process, the data was significantly different. The Open Pig attracted insect activity within seconds of being placed, giving it an extremely short Time of Colonization. This caused the Open Pig to be fully exposed to full-grown maggots of several different species within three weeks (Table 3). In addition, the animal activity on the Open Pig played the largest role in this experiment with large openings and tears in the flesh

being visible after three weeks, allowing insects greater access to internal components. After the fifth week, the Open Pig's carcass was completely dismembered with a majority of the body having been moved and unable to be located. Left behind from the body were large amounts of blood that had soaked into the soil as well as six teeth and a surplus of burrowing insects (Table 4).

Table 3: Observations of insect activity present on and around the open decomposition hog surrogate.

Week #	Insects Present	Insect Activity
1	Mosquitos	Immediately attracted mosquitos in large numbers
3	Blackflies, Blow flies, Tiger Beetles, Maggots	Mature Maggots of different species, high insect activity near open wounds
5	--	--
7	--	--
10	--	--

Table 4: Observations of animal activity on the open decomposition hog surrogate.

Week #	Animal Activity
1	--
3	Lots of holes and openings in the flesh of the body
5	Body was taken by some sort of large animal, noticeable drag markings in the soil and leaves, blood and insects left behind
7	--
10	--

On the other hand, the Tarp Pig was not colonized immediately, and, as a result saw less insect activity in the first week. The tarp inhibited large insect access to the body and, while maggots were visible by week three, they were in much lower concentrations than those on the Open Pig. Mature maggots of different species could not be seen until week five on the Tarp Pig and large numbers of bugs drowned in the fluid present in the tarp before being able to reach the body (Table 5). In regards to animal activity, the tarp protected the body from most animal feeding and, while there were scratches and marking that indicated animal activity, no visible marks on the carcass could be seen. (Table 6).

Table 5: Observations of insect activity present on and around the closed decomposition, tarp covered hog surrogate.

Week #	Insects Present	Insect Activity
1	--	Nothing noticeable when body was dropped
3	Mosquitoes, Blackflies, Blow flies, Tiger Beetles, Rainbow Scarab, Maggots	High insect activity, high concentrations around open wounds
5	Blackflies, Blow flies, Tiger Beetles, Maggots (from different species)	Less visible, flying insect activity, larger maggots coming from different species
7	Blackflies, Blow flies, Tiger Beetles, Maggots (from different species)	Number of maggots decreased
10	Tiger Beetles, Ground Beetles, Dermestids	Further decreased maggot and fly activity, increased beetle presence

Table 6: Observations of animal activity on the closed decomposition, tarp covered surrogate.

Week #	Animal Activity
1	--
3	--
5	Small rips in the tarp from animal scratchings
7	Small rips still present but no noticeable new marks
10	No visible animal markings on the body

Both hogs spent the first week in a stage of Initial Decay in which blood feeding insects such as mosquitos and flies colonized the bodies. It was during the third week check-in where the first notable changes could be seen. Both hogs had exposed bone around the skull and spine and were covered in maggot and fly activity. The Open Hog had large chunks missing from its flesh due to animal activity and these open wounds attracted large insect activity. The body parts on the Open Hog that were exposed were black in color and the entire body felt rigid to the touch. The Tarp Pig did not possess this same black color and the body felt moist and flaccid, with an almost slimy skin consistency. The insect activity was concentrated around the open bullet wound and was significantly less than that on the Open Hog. By the fifth week, the Open Hog was gone, and the Tarp Hog had small rips in the tarp from attempted animal activity. The Tarp Hog's Body was significantly flatter than the previous weeks and insect activity was still present but characterized by maggots and crawling insects with less flying insect activity. Coagulations of internal organs and blood were held in place by the tarp, keeping an extremely moist environment. On week seven, very small

amounts of flesh were present on the animal and large areas of bone were visible. There was high amounts of rainfall this week and the moisture appeared to have soaked into holes in the tarp, providing more moisture to the environment. After the tenth week, the body appeared to dry out slightly and maggot activity slowed significantly. Areas of exposed bone had expanded and the body continued to flatten over the last two weeks (Table 7).

Table 7: Estimations of the decomposition stages of each hog surrogate, based off insect activity and body condition.

Week #	Tarp Hog	Open Hog
Week 1	Initial Decay	Initial Decay
Week 3	Putrefaction	Black Putrefaction
Week 5	Putrefaction	Black Putrefaction
Week 7	Black Putrefaction	Butyric Fermentation
Week 10	Butyric Fermentation	Butyric Fermentation

Discussion: Because the pig left in the open was taken by animals, the complete decomposition process could not be measured and observed, however estimations could be made about the decomposition processes of the hog due to data from the first three weeks of recorded data and comparisons to other studies on hog decomposition (McDaneld 2016). From elaboration of other studies as well as analysis of data conducted in this experiment, it can be concluded that if observed in an ideal, controlled environment a closed decomposition would occur at a quicker rate because of the higher levels of moisture and higher temperatures; however because insect and animal activity is present and uncontrollable in the real world, an open decomposition would fully disintegrate and dispose of a body faster and more effectively. This means that the utilization of a plastic tarp would actually cause the remains to be discoverable for longer periods of time, if the body was disposed of in an area with access to animal and insect activity. In addition, it can be concluded that biotic extrinsic factors, as classified by entries in the National Library of Medicine database, have a greater impact on decomposition rates than abiotic extrinsic factors (Wescott 2018).

Not only can animal activity cause the remains to decompose faster, but feeding on the facial areas and other identifying features can make is harder to identify the remains, lengthening the investigation time of a case (Erkol 2017). In addition, internal organs and genital conditions may be altered by animal activity making it extremely difficult to identify the cause of death and circumstances which the victim was exposed to premortem, such as whether the murder was sexually motivated.

Furthermore, the presence of insects is the most important factor in the rate of decomposition as stated by publications in the Journal of Forensic Sciences (Simmons

2010). Therefore, because the plastic tarp was observed to inhibit entomological access to the remains, the decomposition process would once again take place at a slower rate than it would if exposed to natural, open decomposition circumstances.

If conducting the experiment again, a larger number of hog surrogates should be used in order to create more statistically accurate data. Subjects should be placed in four controlled environments, one open decomposition protected from animal and insect feeding, one unprotected open decomposition, one protected closed decomposition, and one unprotected closed decomposition, with multiple hog surrogates in each environment. Although this experiment proved that animal and insect activity play an extremely large role in the decomposition process, it is uncertain how often bodies are exposed to conditions with frequent animal access and feeding.

In conclusion, in terms of decomposition effectiveness, the use of a plastic tarp as a tool to cover a murder is less effective than simply disposing of the remains openly in the wilderness. This occurs as a result of animal and insect activity causing large mutilation and dispersion of the victim's remains.

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