Forensic Entomology and the Effect of Ortho Pesticide on Decomposition in Sunny Conditions

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ABSTRACT: A study of the effects of the use and type of insecticide on decomposition was conducted at the Rangeland Science Park in College Station, Texas. A treated and a control chicken cadaver were laid out in the field in sunny conditions to observe decomposition and insect-cadaver interactions. We hypothesized the use of insecticide would decrease the rate of decomposition compared to non-treated organisms and, specifically, that organisms treated with Ortho brand insecticide would have less insect activity than those treated with Spectracide. Results showed that the control cadaver was heavily decomposed while the treated cadaver was still in the early stages of decomposition. Both cadavers had insect activity, but fly larvae were more active on the control while adult flies were more active on the treated cadaver. Knowledge of factors that can affect decomposition is important because it can, consequently, affect post mortem interval estimates.

KEYWORDS: forensic entomology, insecticide, decomposition, insect activity

Forensic entomology is valuable field for its ability to determine post mortem intervals using insect colonization and succession. However, different factors can affect not only the time for appearance on a cadaver, but also the insect composition. It has been demonstrated that some household products, including insecticide, that can increase development time, decrease the size of adult flies, and even impact survival rates (Aubernon et al. 2014). It has also been noted that insecticide can alter insect fauna and entomological succession (de Souza Sandoval et al. 2013). Therefore, we need to evaluate the effects of insecticide on insect colonization and decomposition because the easy accessibility to insecticide can permit its use in trying to remove evidence or hide the presence of a body. Consequently, this can lead to inaccurate estimations of postmortem intervals. We hypothesized that the use of Ortho insecticide on a cadaver would decrease the rate of decomposition, and specifically, organisms treated with Ortho brand pesticide would have less insect activity than those treated with Spectracide brand. Our specific study tested the use of Ortho brand insecticide on chickens in sunny conditions and then compared the results to other experiments that tested a combination of either pig or chicken, Ortho or Spectracide, and sunny or shaded conditions. The data collected from this study should be taken as one of many initial considerations when conducting an

investigation where a post mortem interval estimate is required.

Methods and Materials

Ten groups placed two chickens, one control and one pesticide-treated, at a testing site, located a few miles from the Easterwood Airport, for a week period to observe the effects of two brands of pesticide, Ortho and Spectracide, on decomposition rate and insect activity. For the purpose of this report, the procedures observed by the by the Texas A&M University FIVS 432, section 501 students from group C of this experiment will be described.

In preparation for this experiment, two whole frozen chickens were obtained. The two chickens were thawed before the experiment treatment procedures began. Once thawed, the two chickens were placed in two, 2x5 sterile plastic containers and covered with lids. The first container contained enough of the pesticide “Ortho Home Defense Max” to allow the chicken to soak, while the second control container was empty. After 12 hours in the container, the treated and control chickens were flipped to ensure both sides received similar exposure. At approximately 24 hours, the two chickens were placed in separate five gallon Hefty brand trash bags for transport, then placed in a room temperature cooler for transport to the experiment site. Upon arrival at the site, the chickens were placed 1 ft. apart with a grassy division between the control and the treated chickens. The treated chicken was placed on the left and the control on the right, facing in a North Easterly direction. The four groups of section 501 placed their two animals approximately 10-15 feet apart in a sunlit, grassy row surrounded by trees at least five feet from the animals. The two specimens were then covered by a chicken wire cage and weighed down by cement stones and dead tree limbs. The cages were secured and the groups returned to the test site. The groups took photographs, recorded information about their two animals’ state of decomposition and insect activity, and then collected insects for later identification in kill jars and alcohol vials. Collection experiment included tweezers, a kill jar, vials of ethanol, plastic spoons and an insect net.

Results

Environmental Conditions

Collection occurred at approximately 3:30pm on April 27, 2015 weather conditions were partly cloudy and the temperature was about 23.7°C. During the week, the average temperature was about 27.8°C, with the maximum temperature being 831.7°C and the minimum temperature at approximately 11.1°C. There were also several consistent rain showers and thunderstorms through the week.

Control Chicken

The control chicken cadaver was in an advanced state of decomposition and mostly liquefied. It was infested by both larvae and adult flies, but there was more larval activity than fly activity. The larvae, later identified as *Phorima regina*, were of medium size and very actively traveling throughout the body. A significantly larger larvae was also found under the body and was later identified as a Sarcophagidae species. Beetles, later identified as Trogidae and Histeridae, were found to be more abundant around and under this cadaver.

Treated Chicken

The treated chicken cadaver was still in early stages of decomposition and mostly intact. The skin was toughened and the inside flesh was of a mush consistency. There was both fly and larval activity on the cadaver, but there was significantly more fly activity. The larvae were smaller in size compared to those found on the control chicken and were concentrated in the chest cavity. An egg mass was also in the neck/ upper chest area. A few Histeridae beetles were observed around this cadaver as well.

Discussion

The results of this study show that, when treated with pesticides, feeding by arthropods on carrion is delayed significantly and thus the process of decomposition is slowed. On our Ortho-treated chicken, we saw a toughening of the skin to an almost leather-like texture with a lack of severe decomposition, whereas the untreated control chicken reached a further level of active decay in the same amount of time. This is likely due to the chemical makeup of the pesticide, mixed with some days of consistent sun beating down on it. We also note that the colonization seen on the Ortho-treated chicken was more recent, as the *Phorima regina* larvae appeared to be in a younger instar state due to their significantly small size. The toughening of the skin could be a contributing factor to the differences in the colonization times, but it is assumed that the Ortho pesticide is what delayed colonization. It is also reasonable to assume that the rain storms could have washed the Ortho-treatment away, thus making the chicken appealing for later colonization. It is difficult to make accurate comparisons about the nature of Ortho pesticides on chicken decomposition in comparison to Spectracide brand since both of the Spectracide-treated chickens were scavenged, as well as the shaded Ortho-control chicken. A possible factor that could have influenced the increased scavenging of the Spectracide brand treated chickens is the distinctly more prominent scent of the pesticide, which was observed during the initial setup of the experiment. It was, however, unanimous that all of the subjects yielding results showed more colonization and decay on the control carrion and that the treatment with a pesticide delayed the process of colonization (Fig.9). In two instances (Sec. 501 D and 503 E), the groups saw more adult fly activity on the non-treated pig carcasses.

It is difficult to say exactly why this was, but some literature shows Piophilidae (the adult collected by Sec. 503 E) as colonizing in later stages of decay (Sharanowski et al. 2008).

Half of the subjects were placed in the sun while the other half were placed in the shade to control for other differences in decomposition and insect colonization. Unfortunately, since so many of the subjects were scavenged, it made these sorts of comparisons difficult. Moreover, the distances between the different subjects, both pig and chicken, Ortho-treated, Spectracide-treated and controls, were fairly close together, which could lead to cross contamination or an overall pesticide scent in the air that deterred some colonizers. Finally, the rain was not an ideal condition for the pesticide treated subjects to be left in, because it could have potentially confounded the results by washing away the pesticides. Should further studies take place

in the future, better cages should be used to defend against scavenging, more distances should be placed between the sample subjects (especially test and controls), and conditions would be more favorable if they are not rainy.

The purpose of this experiment was to test the effect of the insecticide treatments on the insect activity and decomposition rate of brands (Ortho and Spectracide) and two types of animal cadavers (pigs and chickens) were used in order to assess id a difference exists in the insect colonization of each experimental group compared to its control (untreated) group. Our results indicate that the insecticide did slow insect feeding on the Ortho-treated chicken, and thus, its decomposition was significantly delayed. On the other hand, the untreated chicken was heavily decomposed after the week experiment and showed significant insect activity. The results highlight the necessity to consider the possibility of chemical treatment on a cadaver when investigating and determining an estimated postmortem interval because the normal insect succession can be skewed or delayed by the use of chemicals, such as the insecticides utilized in this experiment. Further experimentation on the effects of these insecticides on decomposition rate must be conducted in various environments in order to ensure reliability of the results obtained.

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