Redtail Flesh Fly, *Sarcophaga haemorrhoidalis* (Fallen 1817), Maggot Contamination of Commercially Prepared Fried Chicken

Authors: Christina Williams, Darrell Bay

Texas A&M University, Department of Entomology

Editor: Colette Daulton

Abstract: Subsequent to a case of live flesh fly larvae (family Sarcophagidae) being found in commercially prepared fried chicken from a fast-food establishment, an experiment was conducted to determine the source of the contamination. In this experiment, first-instar larvae of the red-tailed flesh fly, *Sarcophaga haemorrhoidalis* (Fallen 1817) were transferred to fried chicken immediately after cooking and at ten-minute intervals over a one-hour interval, at which times temperature of the chicken was also determined. Results demonstrated that flesh fly larvae were unable to survive in fried chicken at its initial temperature of 88℃ at the time of sale and after 10- and 20-minutes when mean temperatures decreased to 47.2 and 41.7℃, respectively. Mean temperatures of the chicken dropped to 33.7℃ during the 20-to-30-minute intervals post purchase and continued decreasing to 27.1℃ at the end of one the 50 minutes and to 26.5 at the end of one hour, during which times larva were able to survive and develop. It was concluded therefore that contamination could not occur within the commercial establishment, assuming the chicken was either sold immediately after cooking or that it was held under a heat lamp at an appropriate temperature after preparation and therefore must have resulted after its sale.

Keywords: Flesh Fly, Sarcophaga haemorrhoidalis, Fried Chicken, Food Contamination

---

To the public, one of the most important considerations when consuming commercially prepared food is proper sanitation of the product to avoid potential contaminants. While contaminates such as bacteria and molds are of common concern, the infestation of food by fly maggots can sometimes be overlooked. However, it may occur and can be potentially harmful to human health due to subsequent intestinal myiasis (Judd 1956, Mullen and Durden 2002, Das et al. 2010, Showman and Connelly, 2011). Food contamination by fly larvae most commonly occurs as a result of house flies (*Musca domestica* Linnaeus 1758) and various species of blow flies (family Calliphoridae) depositing eggs directly onto the surfaces of food (Palmer 1970) but may also be the result of flesh fly species (family Sarcophagidae) depositing live larvae. Although there are numerous reports concerning food contamination by fly maggots in the popular press (e.g., Burke 2018), no such reports were readily found in

the scientific literature. One such case of maggot contamination of commercially prepared food involved the purchase of fried chicken from a fast-food establishment by a consumer who transported the product to an outdoor location where it remained unattended for a period of time (Bay, personal communication). Sometime later, upon returning to consume the meal, live maggots were discovered on the chicken. Since no more than several hours had passed between purchase and detection of the maggots, the suspect larvae almost certainly were a species of flesh fly as the eggs of other problematic flies (e.g., blow flies and house flies) would not have hatched within this short time interval (Keiding 1986, National Library of Medicine). As a result of this contamination, the consumer initiated legal action against the food establishment which was brought to trial as a civil case in a court of law. The research conducted in this experiment will seek to determine whether it is possible for live flesh fly larvae to occur in pre-purchase commercial fried chicken, thereby potentially holding the establishment responsible for the contamination, or whether such contamination subsequently occurs post-purchase as a result of outside environmental adulteration. It is hypothesized that flesh fly larvae are not able to survive at the temperature of the food at the time of purchase and that maggot contamination does not occur within the confines of the food establishment under standardized cooking and holding protocols. In this experiment, flesh fly larvae will be tested for their ability to survive in fried chicken strips immediately pre-purchase. If the larvae do not survive, the food temperature and post-purchase time required for survival and development will be ascertained, thus resulting in subsequent product contamination.

Materials and Methods

Fly Larvae Collection Procedure

Uncooked catfish fillets were placed in the external environment on the Texas A&M University campus in College Station, Texas for larviposition by gravid female flesh flies. Flesh fly larvae were collected on 14 October 2023, and were subsequently identified as the red-tail flesh fly, *Sarcophaga haemorrhoidalis* (Fallen 1817), after adult emergence beginning 9 November 2023.

Procedure and Materials Post-Collection

Fried chicken strips from a local fast-food chain (Raising Cane's, Baton Rouge, LA) were purchased immediately following its preparation. Standard food preparation protocol at this establishment consists of cooking the chicken strips at 177℃ for 5 minutes after which the product is either immediately served or held under a heat lamp at 195℃ for no more than six minutes and then removed from sale.

Immediately after purchase, the internal temperature of three pieces (replicates) of chicken strips were determined using a meat probe thermometer (Thermopro TP-1, Atlanta, GA) and promptly transported in an insulated container to the laboratory. The chicken strips were then placed in a warming oven (General Electric JB735DP, Louisville, KY) set to the mean temperature for the three chicken strips previously determined at the time of purchase to account for any heat loss

that may have occurred during transport to the laboratory.

After determining that the mean temperature of the chicken strips was the same as that at the time of purchase, temperature measurements of three chicken strips were made and recorded at that time (i.e., 0-minutes) as well as for each of six ten-minute intervals over a one-hour time interval (i.e., 10-, 20-, 30-, 40-,50-, and 60-minutes) until ambient room temperature of the chicken strips was reached at 26℃ at the end of one hour.

Twenty first-instar flesh fly larvae were transferred, using a small camel's-hair brush directly onto the surface of each of three pieces of chicken strips at the temperature determined to be the same as that at the time of purchase as well as each of the six ten-minute time intervals post purchase. Each replication of the infested chicken strips at the six-time intervals was then placed into a 32-ounce plastic food container with lids (EDI Supplies, Los Angeles, CA) and held for emergence of adult flies.

A one-way ANOVA statistical analysis and Tukey's test was conducted to determine the results.

Results

The number of adult flies recovered for each time interval across the three replications was quantified (Figure 1). There was found to be a significant difference in the number of adult flies present on the chicken strips across the seven different time intervals (0-, 10-, 20-, 30-, 40-, 50-, and 60-minutes), with a p-value of 1.551e-13 ($p<0.05$). A Tukey's pairwise test yielded results showing the differences in adult flies present on the chicken strips comparing all time intervals. The adult flies present at time intervals 0-, 10-, and 20- were significantly different from intervals 30- ($p= 2.578e-10$), 40- ($p= 1.367e-10$), 50- ($p= 5.177e-11$) and 60- ($p= 5.177e-11$).

Regarding temperature, the adult flies did not appear on the chicken until the 30-minute time interval in which the mean temperature dropped below 42ºC (Figure 2). The variables of time and temperature were inversely correlated, so that as time increased, the temperature decreased. From Tukey's test, there was a significant difference between the time interval 0-minutes and time interval 30-minutes ($p=4.195e-12$) when comparing temperature data across the time intervals. The mean temperature at time interval 0-minutes was 88ºC and the mean temperature at time interval 30-minutes was 34ºC, with a significant difference in both the temperature and number of adult flies present found between intervals 0- and 30- minutes.

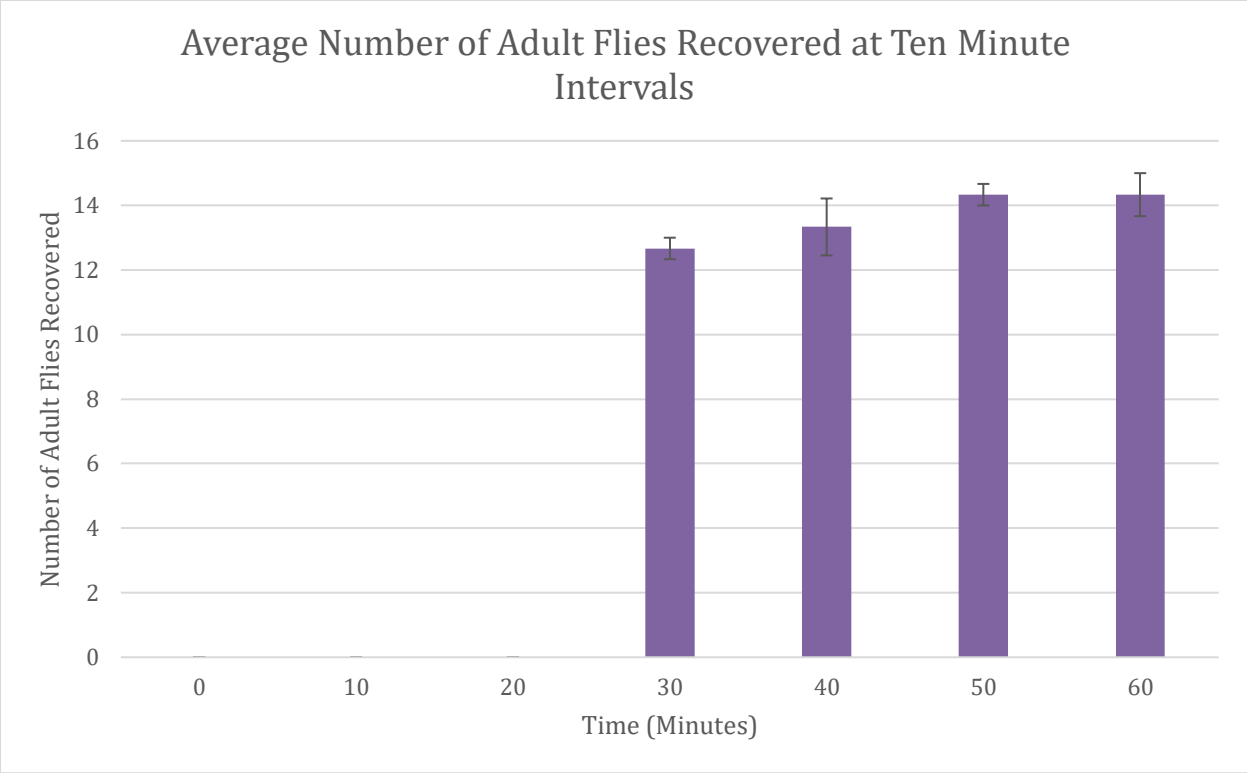

Figure 1: The average number of adult *Sarcophaga haemorrhoidalis* flies recovered in commercially prepared chicken strips at time of purchase and at ten-minute intervals over a span of one hour.

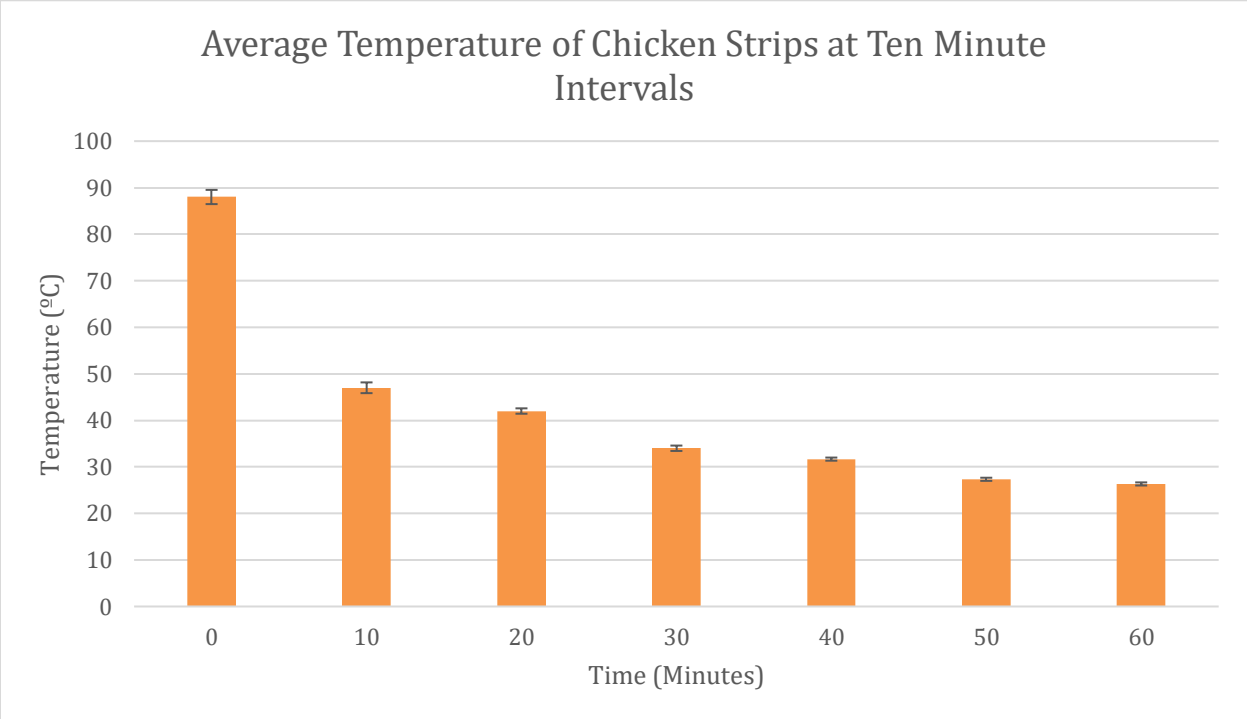

Figure 2: Mean temperature of commercially prepared chicken strips at time of purchase and at ten-minute intervals over a span of one hour.

Discussion

No adult flesh flies were found in any of the three replications at zero-, ten-, and twenty-minutes post purchase, respectively, during which times the average temperatures within the chicken strips were at or exceeded an average temperature of 42℃. However, beginning at 30 minutes post-purchase, at which time the mean temperatures of the chicken strips decreased to 34℃ and to 31.7, 27.3, and 26.3℃, respectively, at 40-, 50-, and 60-minutes post-purchase, adult flies were recovered from all these temperature intervals. Furthermore, there was a significant difference in flies emerging from the last three temperature intervals and the first three from which zero flies were recovered. These results are in agreement with those of Bansode et al. (2016) who indicated that *Parasarcophaga ruficornis* (Fabricius 1794) developmental stages grew normally up to 35ºC but exhibited significant mortality at higher temperatures. The results are also in agreement with those of Byrd and Butler (1998) who determined a developmental range of 11 to 21 days for *Sarcophaga haemorrhoidalis* at a constant temperature of 25℃ with a maximum preferential temperature of 30℃, and Madubunny (1986) who reported that *Sarcophaga haemorrhoidalis* developed from egg to adult in approximately 32 days at 23 to 28℃.

The results of this study appear to accept the hypothesis that flesh fly larvae are unable to survive at the temperature of the commercially prepared chicken strips at the time of sale and that maggot contamination therefore did not occur within the confines of the food establishment under proper standardized cooking and holding protocols. Furthermore, a minimum of 20 minutes following cooking was required for the chicken strips to cool down to a temperature supportive of flesh fly larval survival that would result in subsequent contamination. Our results also confirm the court ruling in the previously stated case that the contamination of the fried chicken in question must have occurred after its purchase and that the commercial establishment was not held to be accountable.

Acknowledgements

We would like to thank the Department of Entomology at Texas A&M University, especially the laboratory and students of Dr. Jeffrey Tomberlin for providing materials necessary to conduct this experiment.

References Cited

Bansode, S.A.; More, V. R.; and Sambare, S. P. 2016. Effect of Constant Temperature (20℃, 25℃, 30℃, 35℃, 40℃) on the Development of *Parasarcophaga ruficornis* (FAB) (Sarcophagidae: Diptera. Journal of Petroleum and Environmental Biotechnology. 7:275-279.

Bay, D. E. Personal Communication.

Byrd, Jason H. and Butler, Jerry F. 1998. Effect of Temperature on *Sarcophaga haemorrhoidalis* (Diptera: Sarcophagidae). 1998. Journal of Medical Entomology. 35:694-698.

Burke, Jasmine. 2018. KFC hits back over 'maggots' in my chicken' claim. The Courier Mail (Newspaper), Brisbane, Australia .

Das, A.; Pandey, A.; Madan, M.; Asthana, A.K.; and Gautam, A. Accidental intestinal myiasis caused by genus Sarcophaga. Indian J Med Microbio. 2010. 28:176-78.

Judd, W.W. 1956. Intestinal Myiasis of a Human Caused by Maggots of the Flesh-fly, *Sarcophaga haemorrhoidalis* (Fin.) (Diptera: Sarcophagidae), in Southwestern Ontario. The Canadian Entomologist. 88:117-118.

Keiding, J. (1986). *The House-Fly - Biology and Control* (p. 7). The World Health Organization.

Madubuny, L. Chuka. 1986. Laboratory Life History Parameters of the Red-Tailed Fleshfly, *Sarcophaga haemorrhoidalis* (Fallen) (Diptera: Sarcophagidae). International Journal of Tropical Insect Science. 7:617-621.

Mullen G, and Durden L. 2002. Medical and Veterinary Entomology. Academic Press. San Diego. 597 pp.

Palmer, E D. 1970. Entomology of the Gastrointestinal Tract: A Brief Review. Military Medicine. 135:165-76.

Showman, Angelique; and Connelly, C. Roxanne. 2011. Featured Creatures: *Sarcophaga haemorrhoidalis* (Fallen) (Insecta: Diptera: Sarcophagidae). University of Florida Press Publication Number EENY-495.

The National Library of Medicine. (n.d.). *Visible Proofs: Forensic Views of the Body:Galleries*

Technologies: Life cycle of the black blow fly. Www.nlm.nih.gov.