Nat. Volatiles & Essent. Oils, 2021; 8(6):641-646

NVEO
Natural Volatiles &
Essential Oils

Comparison Of Meat As Trap Bait For Adult Fly Collection And Control

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Abstract

The house fly (Muscidae), flesh fly (Sarcophagidae), and blowfly (Calliphoridae) are ubiquitous pests commonly associated with urban waste and medically essential insects worldwide. They can transmit various pathogens microorganisms. Therefore, this preliminary study aimed to record the number of flies caught in the meat bait. This work is a study of pre-experiment design (one-shot case study). Meat waste baits used in this study were fresh meat [beef (*Bos indicus*), chicken (*Gallus gallus domesticus*), milkfish (*Chanos chanos*), and riceland prawn (*Macrobrachium lanchesteri*)]. Treatment is carried out from 8 a.m. until noon at 4 p.m. for two days. Data collection was done on the second day after 4 p.m. Experimentand data collection is done once a week. Flies are counted, recorded, and analyzed with descriptive statistics. Interestingly, there are three families of flies: Muscidae, Calliphoridae, and Sarcophagidae, with Calliphoridae being the majority (68.3%; 239/350), followed by Muscidae. Riceland prawn produced the highest attraction (58.6%; 140/239), followed by fresh milkfish (26.8%), and the lowest is beef (5.9%). Thus, flytrap with bait help make decisions for fly control strategies.

Keywords: Calliphoridae, Muscidae, Sarcophagidae, Riceland Prawn, Milkfish

Introduction

The house fly (Muscidae), flesh fly (Sarcophagidae), and blowfly (Calliphoridae) are ubiquitous pests commonly associated with urban waste and medically essential insects worldwide (Boonchu *et al.,* 2003; Gerry, 2020). They are often found in abundance in areas of human life such as; houses, markets, food centres or restaurants, landfills, slaughterhouses, hospitals, poultry and livestock farms (Awache and Farouk, 2016). *Musca domestica* (housefly) is easy to find near human housing and quickly adapt to human life (Awache and Farouk, 2016; Gerry, 2020). Housefly (Muscidae) and Sarcophagidae are of medical importance as myiasis-producing agents (Sukontason *et al.,* 2014; Upakut *et al.,* 2017). According to

Sukontason *et al.*, sarcophagidae is not well investigated (Sukontason *et al.,* 2014). Calliphoridae are the first insects and the first flies to come to the carcass in a few minutes (De Azevedo *et al.,* 2018)

They can negatively impact humans through annoyance and the transmission of pathogens if they are in large numbers (Boonchu *et al.,* 2003; Gerry, 2020). They have transmitted various pathogens, such as enteric bacteria (*Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Vibrio cholera, Bacillus anthracis, Pseudomonas, Staphylococci, Streptococci, Clostridium, Enterococci, Enterobacter agglomerans, Klebsiella oxytoca, Klebsiella pneumonia, Burkholderia pseudomallei, Morganella morganii, Enterobacter cloacae, Proteus mirabilis*), viruses (Senecavirus A, Ebola virus, Avian Influenza subtype H5N1, and Newcastle disease virus), helminths (*Ascaris lumbricoides, Trichuris trichiura, Taenia, Hymenolepis, Toxocara*), protozoa (*Entamoeba coli, Entamoeba histolytica, Giardia lamblia, Cryptosporidium, Sarcocystis, Toxoplasma gondii, Isospora, Endolimax nana, Pentatrichomonas hominis, Hammondia*), fungi (*Candida, Aspergillus, and Penicillium*) (Graczyk *et al.,* 2005; Ibrahim *et al.,* 2018; Khamesipour *et al.,* 2018; Upakut *et al.,* 2017).

Various fly control strategies have been carried out, including chemical, mechanical or biological control. For a short-term plan, the application of chemical insecticides is mandatory management. However, some countries have reported resistance of flies to various insecticides (Ong *et al.,* 2016; Scott *et al.,* 2013; Wang *et al.,* 2019). Bait traps are widely used to control fly populations and collect flies and continue to study fly populations (Boonchu *et al.,* 2003). Flytraps have advantages, including simple and inexpensive materials, are available everywhere, do not contain chemicals, do not harm the environment, can be used for both short-term and long-term control, and attract the adult fly population (Boonchu *et al.,* 2003). There are not many bait trap exploration studies in Indonesia. Therefore, this preliminary study aimed to record the number of flies caught in the meat bait device. Meat waste baits used in this study were beef, chicken meat and skin, fish meat and heads, and shrimp meat.

Materials and Methods

This study is a study Pre experiment designs (one-shot case study). The study was approved by the Research Ethics Committee of Faculty of Medicine, Universitas Ciputra, Indonesia (100/EC/KEPK-FKUC/VII/2021). The study was conducted from June to December 2021 in the residential complex (latitude 7°22'05 and longitude 112°41'59) of the Sidoarjo, Indonesia. Treatment is carried out from 8 a.m. until noon at 4 p.m. for two days. Data collection was done on the second day after 4 p.m. Traps for flies are made by plastic bottles used to bottle mineral water packaging size 1,500 mL, which is empty without water. Cut the plastic bottle into two pieces with a cutter. The top cut is 10 cm high from the mouth of the bottle. Plastic bottles are divided into four groups with three replications. Each bait used was fresh meat [beef (*Bos indicus*), chicken (*Gallus gallus domesticus*), milkfish (*Chanos chanos*), and riceland prawn (*Macrobrachium lanchesteri*)]. Each meat weighs 100 grams. Replication is done three times. After applying the meat bait, the top piece of the bottle is inserted in reverse into the mouth of the bottom bottle piece. The next Experiment and data collection are done once a week to allow fly offspring to complete the life cycle to adulthood. Fly animals are turned off by carefully watering hot water in the soil area to kill fly animals, pathogenic microbes and parasites in meat, and the possibility of maggots on meat. Dead fly animals are counted, recorded, and analyzed with descriptive statistics.

Results and Discussion

In this study, we found at least three families of flies: Muscidae, Calliphoridae, and Sarcophagidae, with Calliphoridae being the majority (68.3%; 239/350), followed by Muscidae (Table 1).

Table 1. Families and the number of flies collected using a bait trap.

Family	Number	(%)
Calliphoridae	239	68.3
Sarcophagidae	30	8.6
Muscidae	81	23.1
Total	350	100.0

As for the majority of Calliphoridae in these collections, Table 2 showed that riceland prawn produced the highest attraction (58.6%; 140/239), followed by fresh milkfish (26.8%), and the lowest is beef (5.9%). Muscidae is the second most common family after Calliphoridae (23.1%; 81/350). Family Muscidae love chicken bait (*Gallus gallus domesticus*) (37.0%; 30/81), followed by fresh riceland prawn (26.8%), and the lowest is beef (11.1%). The family Sarcophagidae is the most diminutive family caught in traps using bait. Family Sarcophagidae is more commonly found in beef bait (50.0%; 15/30), followed by chicken bait (*Gallus gallus domesticus*) (33.3%).

Table 2. Number of flies collected using different baits in a fly-trap.

Bait	Calliphoridae	(%)	Sarcophagidae	(%)	Muscidae	(%)	Total
Beef	14	5.9	15	50.0	9	11.1	38
Chicken	21	8.8	10	33.3	30	37.0	61
Milkfish	64	26.8	4	13.3	19	23.5	87
Riceland prawn	140	58.6	1	3.3	23	28.4	164
Total	239	100.0	30	100.0	81	100.0	350

Figure 1. Flies caught with bait in a fly trap.

The findings in the study are similar to previous studies, in which Calliphoridae was more caught by bait, and very few Sarcophagidae flies were collected in this study. It is possible because the bait is less potent as an attractant, the number of offspring produced is small, or the population is small (Boonchu *et al.,* 2003). In addition, it can also experience the smell of meat that has been felt before. The experience is played by memory cells in the center of the brain (mushroom bodies) and gustatory cells of flies scattered on proboscis, pharynx, appendages, and wings (Masek and Keene, 2016; Thoma *et al.,* 2017). These factors may apply to all families, which leads to variations in the number of flies on each bait.

The attraction of flies comes to the bait due to the stench that comes out of the bait for two days. Odor molecules are derived from decay (autolysis and putrefaction) of organic matter (Campobasso *et al.,* 2016) and are detected by odorant receptors (ORs) flies. Putrefaction is the essential destruction process of organic matter by anaerobic bacteria (mostly habitual saprophytic intestine hosts) and aerobic bacteria (mostly airborne). The bacterial enzymatic structures break down proteins, carbohydrates, and lipids and produce some gases such as nitrogen, methane, hydrogen sulfide, ammonia, and so on (Campobasso *et al.,* 2016). Previous research found as many as 6 and 7 volatile compounds identified from rotten beef and chicken liver, such as isovaleraldehyde, 4-methylpentan-2-one, dimethyl disulfide, 3-Methylbutanol, dimethyl trisulfide, 2-phenylethanol, p-cresol, ethyl acetate, isoamyl acetate, 1-pentanol, acetic acid, 2-phenylethyl acetate, and 2-phenylethanol (Zhu *et al.,* 2013).

The location of odorant receptors (ORs) is located in dendrite olfactory sensory neurons (OSNs)/olfactory receptor neurons (ORNs) hair sensilla basiconic and coeloconic antenna [3rd segment] and maxillary palpus in the head of flies (Ramdya and Benton, 2010; Semaniuk, 2015; Vosshall and Stocker, 2007). Olfactory information is passed to the antennal lobe (containing glomeruli). The information is transmitted to the center of the brain (mush-room body and lateral protocerebrum/lateral horn) through insect projection neurons (PNs) and then produces a response (Semaniuk, 2015). Olfactory cues associated with a role in female Cochliomyia macellaria (Calliphoridae) oviposition site selection, such as odor from decaying animal remains (e.g. rotten beef and chicken livers) (Zhu *et al.,* 2013). Olfaction is the main factor influencing the egg-laying behavior of female house flies and vinegar fly (Drosophila melanogaster) (Tang *et al.,* 2016). That theory is also similar to the results of this study, where we found many larvae with adult flies in fly traps. The smell on the second day is already very pungent compared to the scent on the first day. The findings add to the information that fly-trap use is less than optimal for the long term, especially in public places.

Calliphoridae and Muscidae are the most abundant fly families. They have potential as a mechanical carrier of pathogenic microorganisms, so practical control efforts are needed (Graczyk *et al.,* 2005; Ibrahim *et al.,* 2018; Khamesipour *et al.,* 2018; Upakut *et al.,* 2017). These results provide information and help make decisions for fly control strategies for 1-2 days quickly, cheaply, non-toxic, and overcome the problem of fly resistance to chemical insecticides.

Conclusion

There are three families of flies: Muscidae, Calliphoridae, and Sarcophagidae, with Calliphoridae being the majority, followed by Muscidae. Riceland prawn produced the highest attraction, followed by fresh milkfish, and the lowest is beef.

ACKNOWLEDGMENT

This work was supported by Universitas Ciputra, Surabaya, Indonesia. We thank Robby Firman Santoso for the help during the experiment.

CONFLICTS OF INTEREST The authors have no conflicts of interest to declare.

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