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Identification of Flies Found at the Mojoarum Landfill, Surabaya

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Abstract. Landfills often become a source of complex environmental problems, especially in urban areas. Poorly managed waste not only poses aesthetic issues but also creates breeding grounds for various organisms that can potentially cause health problems for humans. This study aimed to identify fly species found in a landfill using fresh shrimp bait and to evaluate the effectiveness of the bait in attracting various fly species. The research was conducted at four bait placement points in the landfill area of Mojoarum, Surabaya. Observations were made at 07.00-09.00 and 15.00-17.00. Fresh shrimp bait was used to capture flies, which were then reared and identified based on their morphological characteristics. The results revealed four fly species: *Chrysomya megacephala* (331 individuals), *Musca domestica* (74 individuals), Fannia sp. (21 individuals), and *Sarcophaga haemorhoidalis* (6 individuals). *C. megacephala* was the most dominant species, indicating that the landfill provides ideal conditions for this species. M. domestica was also found in significant numbers, demonstrating its adaptability to the landfill environment. The fresh shrimp bait proved effective in attracting *C. megacephala* and *M. domestica*, but less effective for *Fannia sp.* and S. *haemorhoidalis*. These findings provide important insights into the composition of fly species in landfills and their implications for waste management and environmental health. Improved waste management is necessary to reduce the health risks posed by flies, particularly those species that can act as disease vectors.

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1. Introduction

Landfills often become a source of complex environmental problems, especially in urban areas. Poorly managed waste not only poses aesthetic issues but also creates breeding grounds for various organisms that can potentially cause health problems for humans (Bevan, 2005). One of the most commonly found organisms in landfills is flies. Flies, particularly those from the Diptera family, are known vectors of various diseases due to their ability to transmit pathogens through contact with contaminated food and surfaces (Levine, 1994). Identifying flies in landfills is crucial because it provides information about the dominant fly species in an area, their life cycles, and the potential health risks they pose to humans

(Anderson and Delvin, 1994). Flies as one of the vectors whose existence is important to monitor, are vectors of foodborne diseases. Several species of flies are the species that play the most important role in health problems, namely as mechanical vectors and biological vectors of certain diseases (Ministry of Health of the Republic of Indonesia, 2009) including diarrhea, dysentery, gastroenteritis, typhus and several species can cause myiasis. Flies are included in the type of pest insects. Fly activity is influenced by light, temperature, humidity, water, food and breeding places. Flies are able to reproduce quickly for 15 days (Purnama 2015). Flies cannot be completely eradicated but can be controlled to a safe and harmless level (Purba, 2016). Flies eat food that humans eat every day such as sugar, milk, protein, fat, human and animal waste, blood, fermented food, and rotting (Mustika et al., 2016)With a better understanding of the types of flies present, efforts to control and mitigate their negative impacts can be carried out more effectively (Timm and Bertram, 2000).

The selection of appropriate bait in fly studies is crucial to obtaining accurate data on the species present and their feeding preferences. Fresh shrimp has been used as bait in this study because it is considered highly attractive to flies (Mulyaningsih, 2023). Fresh shrimp emits a distinctive odor that can attract various fly species, allowing researchers to identify a wide range of flies that are drawn to the bait (Perich and Yams, 2002). The use of shrimp as a fly trap is quoted from the research of Krisdiyanta and Ariayani (2018) which concluded that the types of flies *M. domestica* and *C. megacephala* can be caught using shrimp bait with an effectiveness index of 42%. These results are also supported by the research of Fitriana and Mulasari (2021), examining the effectiveness of bait variations in flytraps in controlling fly density at the Temporary Disposal Site (TPS) on Andong street Yogyakarta. From this study, an average of 124.8 flies were caught using shrimp bait and 25 fish bait. The type of shrimp used is fresh shrimp consisting of the head, tail and meat which has a distinctive odor that flies like.

Based on the research results of Mulyaningsih (2023), it was found that the *C. megacephala* fly is one of the flies found in the waste collection facilities of public hospitals in Yogyakarta. In addition, as many as 120 C. megacephala were found in the Damar traditional market and 253 in the Rasamala Banyuwangi market (Manurip, 2023). In the study of Tomasowa *et al.,* (2024) showed that the *C. megacephala* insect is the dominant species found in all markets (Pasar Pacar Keling, Manukan Kulon, Wonokromo, Pabean, Keputran, Mojosongo and Legi Jombang). This is supported by food sources and places to lay their eggs and is cosmopolitan and has a dependent relationship with humans. This study uses fresh shrimp as bait to rear flies found at the Mojoarum landfill. Therefore, the research aims to identify the types of flies present at the Mojoarum landfill, evaluate the effectiveness of fresh shrimp as bait in attracting different fly species, and examine the relationship between the type of bait used and the diversity of flies attracted.

2. The Methods

This study was conducted at the Mojoarum landfill, known as one of the areas with active waste management activities, located next to the Mojoarum Market. This site was chosen due to various factors, such as the high volume of waste produced daily, the diversity of waste types disposed of, and the environmental conditions that support the growth of fly populations. The research was carried out over one month, in March 2024, to capture seasonal data and variations in the composition of fly species that might emerge. Materials and tools used in this study include fresh shrimp bait (approximately 200 grams per sample), mini trash containers, fly capture tools (insect nets and sticky traps), a stereo microscope, and a digital camera.

2.1 Site and bait preparation

The initial stage involved selecting specific locations within the landfill area where fly activity was high, such as around piles of organic waste. Mini trash containers filled with fresh shrimp were placed at predetermined points. Each container was placed at a certain distance to avoid overlapping the scent range that might attract flies.

2.2 Fly capture

Flies attracted to the bait were captured using insect nets or sticky traps placed around the bait containers. Insect nets were used for manual fly capture, while sticky traps were used to capture flies landing on the trap's surface. Capture was conducted during two main time periods: morning (around 07:00-09:00) and afternoon (around 15:00-17:00), as fly activity tends to be higher during these times.

2.3 Species identification

Once the flies reached the adult stage, they were identified based on morphological characteristics using a stereo microscope. Features such as wing shape and color, wing vein patterns, antennae shape, and other structures were used as the basis for identification. Literature and insect identification guides served as the primary references to determine the species of flies found.

2.4 Data analysis

The collected data were analyzed both quantitatively and qualitatively. Quantitative analysis included counting the number of flies captured at each point. This analysis was conducted using statistical software to determine patterns and trends in the data. Qualitative analysis involved evaluating the effectiveness of fresh shrimp as bait by comparing the number and types of flies captured at each location point.

3. Result and Discussion

The hardware display of the dynamic multi-sensor and multi-storage data logger can be seen in Figure 5. This study successfully identified four fly species found at four bait placement points within the landfill site. Each bait placement point yielded a varying number of flies, depending on the species attracted by the fresh shrimp bait. The fly species identified during this study were *Chrysomya megacephala*, *Musca domestica, Fannia* sp., and *Sarcophaga haemorhoidalis*. The results of the fly count can be seen in Table 1 and Figure 1.

Table 1. Number of captured fly individuals

No.	Insect type	Placement point				Total
		1	2	3	4	
1.	*Chrysomya megacephala*	72	84	82	93	331
2.	*Musca domestica*	20	17	15	22	74
3.	*Fannia* sp.	8	7	4	7	21
4.	*Sarcophaga haemorhoidalis*	3	0	1	2	6

3.1 Fly species

3.1.1 Chrysomya megacephala

C. megacephala, commonly known as the blowfly, was the most dominant species in this study, with the highest count of 331 individuals. This fly is typically found in tropical and subtropical regions and is often associated with decaying organic matter, including carcasses and waste (Gruner *et al.*, 2016). At

the landfill, this species has a dominant presence due to its strong attraction to decomposing organic materials.

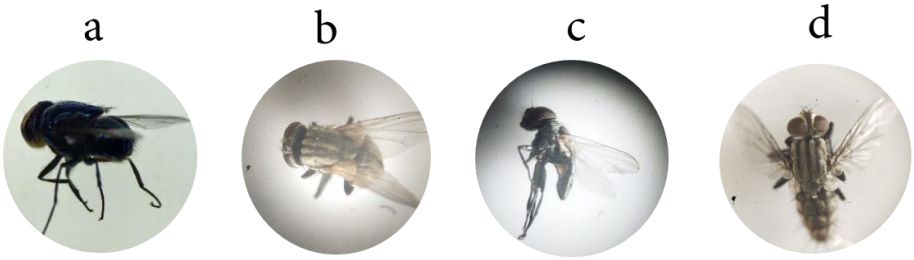

Figure 1. The four captured fly in Mojoarum landfill. a. *Chrysomya megacephala,* b. *Musca domestica*, c. *Fannia* sp. and d. *Sarcohaga haemorhoidalis.*

3.1.2 Musca domestica

M. domestica, or the common housefly, was found in a total of 74 individuals. This species is known as one of the most commonly found flies in urban environments and exhibits a high level of adaptability to various food sources, including household waste. Its significant presence indicates that Musca domestica can compete with other fly species in the landfill environment.

3.1.3 Fannia sp.

Fannia sp., which belongs to the lesser house fly group, was found in a total of 21 individuals. This species is typically found in moist environments and is often associated with decaying organic matter. Although its numbers are lower compared to Chrysomya megacephala and Musca domestica, the presence of Fannia sp. remains significant as it indicates the diversity of fly species at the landfill.

3.1.4 Sarcophaga haemorhoidalis

S. haemorhoidalis, known as the flesh fly, was the least common species found in this study, with a total of 6 individuals. This species is typically attracted to decaying meat and can serve as an indicator of the level of organic decay at the site. Its low number may reflect the limited availability of suitable decaying meat at the research location.

3.2 Analysis of ecological dynamics of flies in the landfill

From the study, it was found that the landfill serves as a habitat for various fly species, with *C.megacephala* being the most dominant. The large presence of *C. megacephala* indicates that the landfill provides ideal conditions for the growth and development of this species, primarily due to the abundant organic material that serves as a primary food source for the larvae. *M. domestica* was also found in significant numbers, demonstrating its ability to adapt to various food sources in the landfill environment. Its high presence may also be influenced by its opportunistic nature and its ability to reproduce rapidly in supportive environmental conditions. *Fannia* sp. and *S. haemorhoidalis* were found in smaller numbers, suggesting they might have more specific environmental preferences or face less competition compared to other species. This could also be due to the bait's suitability for other species, reducing the number of individuals from these species captured. The use of fresh shrimp as bait in this study proved effective in attracting various fly species, particularly *C. megacephala* and *M. domestica.* Fresh shrimp emits a distinctive odor, which is particularly attractive to species drawn to decaying organic material.

The very high number of *C. megacephala* indicates that the bait was highly effective in attracting this fly, which is known to be strongly attracted to the strong and sharp odor of decaying organic matter. Meanwhile, *M domestica*, although not as strongly attracted as *C. megacephala*, also responded positively to the bait, likely due to its more generalized feeding habits. However, for F*annia* sp. and S.

haemorhoidalis, the effectiveness of the fresh shrimp bait appeared to be lower. This may be due to different food preferences or because the bait's odor was not strong enough to attract these species in large numbers. Further research using different bait types or bait combinations may be needed to further test the responses of these species.

The diversity of flies found at the landfill reflects the complex interactions among species in this micro-ecosystem. The dominance of *C. megacephala* suggests that this species may have a competitive advantage in terms of access to food resources and reproduction in the environment. The substantial presence of *M. domestica.* also indicates competition for food resources, although these two species may target slightly different types of food. F*annia* sp. and S. *haemorhoidalis*, with their lower numbers, may occupy a lower position in the competition hierarchy or have more specific ecological niches that do not rely on the same food resources as *C. megacephala* and *M. domestica.* Further studies are needed to understand the dynamics of these interspecies interactions, including factors affecting the distribution and abundance of each species at the landfill.

The findings of this study have important implications for waste management and environmental health. The dominance of *C. megacephala* at the landfill indicates a greater potential health risk, given that this species is known to be a pathogen vector that can cause diseases in humans. Therefore, improved waste management practices are needed to reduce fly populations at the landfill, including more effective handling of organic waste to minimize attractiveness to these flies (Tomosowa *et al.,* 2024). Additionally, understanding the diversity of fly species at the landfill can help in designing more targeted control strategies, such as using appropriate baits to manage the population of specific species with higher potential health risks.

Conclusion

From the results of this study, it can be concluded that the landfill serves as a habitat for various fly species, with *C megacephala* being the most dominant. The use of fresh shrimp as bait proved effective in attracting flies, particularly *C. megacephala* and *M. domestica.* However, for species such as F*annia* sp. and S. *haemorhoidalis*, the effectiveness of the bait was less optimal. These findings provide important insights for waste management and fly control strategies, especially in the context of preventing fly-borne diseases.

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