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Research Article

The Effectiveness of Galltrap Compared to Commercial Fly Trap

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ABSTRACT

Background: Synanthropic flies such as *Musca domestica* are capable of transmitting pathogens that cause diseases in humans, including diarrhea, cholera and dysentery. One effective method for controlling adult flies is the use of baited fly traps. The Ranch Fly Trap is a widely used commercial trap but has drawbacks such as being difficult to clean and relatively expensive. Galltrap was developed as an alternative made from disposable gallon containers (5L water bottles), offering a more economical, easy-to-use, and environmentally friendly option.

Method: This research was an experimental study with a post-test only control group design, comparing Galltrap (experimental group) and Ranch Fly Trap (control group). Data collection was carried out over 16 repetitions at a poultry farm in Karanganjir, Sleman, in May 2025. Data were analyzed using an Independent Samples T-Test with significance level (α) = 0.05.

Results: A total of 1,108 flies were trapped during the study, with 699 caught by Galltrap and 409 by Ranch Fly Trap. The average number of flies caught per day was 43.7 for Galltrap and 25.6 for Ranch Fly Trap. The T-test revealed a significant difference (p = 0.025), indicating that Galltrap was more effective, with a 71% higher daily catch rate compared to the Ranch Fly Trap.

Conclusion: Galltrap demonstrated significantly greater effectiveness in capturing adult flies and offers a promising, low-cost solution for vector control in resource-limited settings.

Keywords: Fly traps; Trap design; Synanthropic flies; Vector control

INTRODUCTION

Synanthropic flies are flies that have a close relationship with and live in human environments.[1] Common examples of synanthropic flies include house flies (*Muscidae*), blow flies (*Calliphoridae*), and flesh flies (*Sarcophagidae*).[2] These flies can cause various health problems in humans and animals because they act as vectors for pathogens such as bacteria and parasites.[3] Pathogens can be acquired due to the flies' habit of landing on unhygienic places containing many pathogenic microorganisms, such as trash piles, animal feces, human feces, and carcasses.[4,5] House flies, for example, are known to transmit several disease-causing pathogens, including those responsible for diarrhea, anthrax, cholera, and dysentery.[3] Pathogen transmission can occur mechanically when flies come into direct contact with humans or food.[6] The correlation between the presence of flies and the incidence of diarrhea can demonstrate the role of flies in the spread of pathogens.[4] For example, a study in Pakistan showed that insecticide spraying to control fly populations led to a reduction in diarrhea cases among children under five years old.[7] Similarly, a study in Bangladesh found that house flies contributed to as much as 37% of Shigella infections in children living in rural areas.[8] A significant association was also found between fly population density and diarrhea incidence in residential areas surrounding slaughterhouses.[9]

Flies cannot be eradicated, but their populations can be suppressed to levels that do not pose a nuisance or public health risk.[10] Fly control can be achieved through physical, biological, chemical, and cultural methods.[4] One example of physical control is the use of fly traps, which are designed to capture adult flies.[11] Various types of fly traps commonly used include UV light traps, sticky traps, and baited fly traps.[12] Ultraviolet (UV) light has long been used as an attractant for capturing flies[4]. UV light traps are effective, particularly for indoor use,[4,13] but they typically involve high initial and maintenance costs. Sticky traps can also be employed for fly control, but they have limitations in terms of the number of flies they can catch and may be less effective in dusty environments.[4,14] Baited fly traps, such as the Ranch Fly Trap, are more suitable for outdoor use. While technically reusable, these traps are often used only once due to the relatively difficult cleaning process. The trap material is made of thin, easily torn mesh and requires hanging for installation. However, hanging traps may be less effective because flies tend to fly closer to the ground to avoid wind and because their feeding and breeding sites are usually located at ground level.[15] The cost per unit of these traps is also considered quite expensive.

It turns out that used items like mineral water bottles, paint buckets, or gallons can be repurposed to make fly traps.[11,16,17] Reusing these materials is not only economical but also contributes to reducing plastic waste pollution in Indonesia. This is particularly important, considering that Indonesia is the second-largest contributor to global plastic waste, after China.[18]

To address fly-related problems, researchers have attempted to develop an affordable, simple, and environmentally friendly fly trap called the Galltrap, made from a single-use 5-litre water gallon. This trap operates on a similar principle to the Ranch Fly Trap, but it is designed for repeated use and offers a more convenient cleaning process. The materials used are readily available, although the construction requires some technical adjustments to ensure it meets the intended design. It is hoped that this device can serve as a more effective, economical, and sustainable solution for fly control.

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The Galltrap was compared to a commercially available fly trap of the same type and bait to assess its effectiveness in capturing flies. The commercial trap used for comparison was the Ranch Fly Trap. The testing of both traps was conducted at a poultry farm in Karanganjir, Sleman. This location was selected based on the results of a preliminary survey and trial, in which a prototype of the Galltrap was installed at the site for two days, with two repetitions. The trap successfully captured 71 and 127 flies, respectively.

METHOD

A quasi-experimental study was conducted using a post-test only control group design to compare the effectiveness of a Galltrap with a commercial fly trap (Ranch Fly Trap). The study was carried out at a poultry farm located in Karanganjir, Sumberarum, Moyudan, Sleman, Yogyakarta, from May 8 - 23, 2025.

The target population for this study consisted of all adult flies (Diptera: *Muscidae* and related families) present in the study area during the research period. The sample consisted of all flies captured by both traps across 16 repetitions, representing 16 separate observation days. The traps were placed simultaneously at the same site, with a fixed distance of one meter between them to prevent cross-attraction, and their positions were alternated daily to control for location bias. Each trial was conducted from 09:00 to 14:00 local time, based on the known peak activity of house flies during daylight hours.

Both traps used the same type and amount of bait: 55 grams of fish waste, selected due to its strong olfactory attraction for flies and supported by prior studies.[10,11,15] The bait was placed in bait containers (surface area~64 cm²) located at the base of each trap and was replaced daily. The Galltrap was constructed from recycled 5-litre plastic water bottles and paint buckets, whereas the Ranch Fly Trap was a commercially available hanging mesh trap. The Galltrap was positioned directly on the ground. At the same time, the Ranch Fly Trap was hung using a wooden frame, maintaining equal entry height for both traps to avoid confounding due to trap elevation.

Environmental variables, such as temperature and humidity, were measured at the beginning (9:00) and end (14:00) of each session using a digital thermohygrometer. Data were excluded from analysis if environmental conditions fell outside the optimal activity range for flies, defined as 20–34°C temperature and 45–90% relative humidity.[19,20]

The primary variable measured was the number of adult flies captured per trap per day. The number of trapped flies was counted, processed and analyzed using an Independent Samples T-Test. The level of significance used was 0.05. No further taxonomic identification of fly species was performed, as the study focused on overall trap effectiveness rather than species-specific capture rates.

RESULTS

A total of 1,108 flies were captured throughout 16 repetitions of trap deployment. The Galltrap captured 699 flies (63.1%) while the Ranch Fly Trap captured 409 flies (36.9%).

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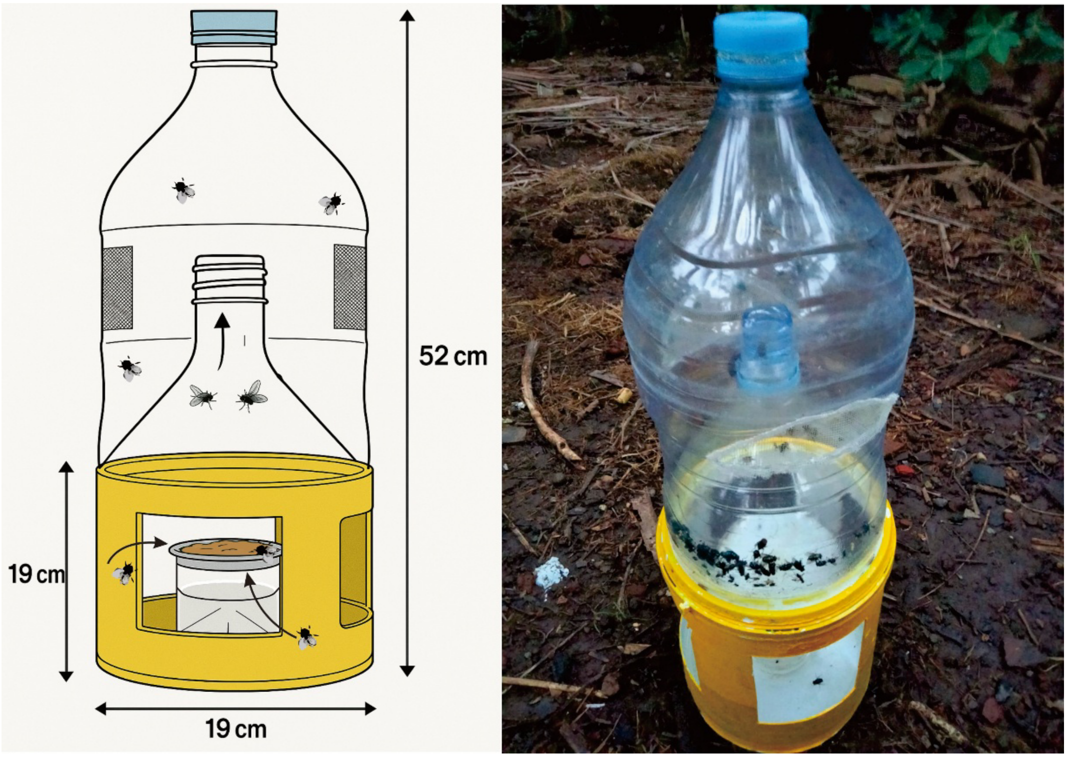

Figure 1. Design and appearance of the Galltrap. (Left) A diagram illustrating the trap's components, including a 5-litre water gallon, a yellow paint bucket base, and the internal entry cone. (Right) A photograph of the Galltrap deployed in the field.

Table 1. Comparison of Fly Capture Between Galltrap and Ranch Fly Trap (n = 16)

Trap Type	Mean ± SE	SD	*p*-value
Galltrap	43.69 ± 6.50	25.99	0.025*
Ranch Fly Trap	25.56 ± 4.04	16.17	

*Independent Samples T-Test, significance (α): 0.05

The comparison of fly capture between Galltrap and the commercial Ranch Fly Trap is presented in Table 1. Galltrap consistently demonstrated higher capture rates, with a mean of 43.69 ± 6.50 flies and a standard deviation (SD) of 25.99. In contrast, the Ranch Fly Trap showed a lower capture performance, with a mean of 25.56 ± 4.04 flies and an SD of 16.17. These results indicate that, on average, Galltrap trapped more flies compared to Ranch Fly Trap during the study period.

Statistical analysis using the Independent Samples T-Test further confirmed that the difference in capture efficiency between the two trap types was statistically significant ($p = 0.025$, $\alpha = 0.05$). The relatively higher SD observed in Galltrap suggests greater variability in the number of flies captured, yet the difference in mean captures remained robust. Taken together, these findings demonstrate that Galltrap performed significantly better than the Ranch Fly Trap in attracting and capturing flies under the experimental conditions.

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DISCUSSION

Fly traps often take advantage of two common fly behaviors: their attraction to odor and light.[15] Odor-based attractants lure flies into the trap, while sunlight helps to keep them inside. This is due to the flies' positive phototaxis, a tendency to move toward light sources.[21] Flies typically move toward the brightest parts of the trap, such as transparent walls or surfaces. Therefore, the transparency of the trap material plays a crucial role in retaining flies once they are inside.[15] Based on this, the Galltrap utilizes clear plastic water gallon containers to maximize internal light exposure and increase the likelihood of flies remaining trapped. The bait used in this study was fish waste, based on several previous studies that have demonstrated its effectiveness in attracting flies.[10,11,15] Both the Galltrap and the Ranch Fly Trap utilized fish waste bait with standardized weight and surface area, 55 grams and 64 cm², respectively. This standardisation aimed to minimise potential bias from the attractant, as differences in bait mass and surface area can affect the volatility or aroma concentration of the bait.[22,23]

The study was conducted at a poultry farm. Insects, including flies, are capable of detecting food sources through olfactory cues, and can still identify specific odors even when mixed with other smells.[24] Therefore, flies were expected to detect the scent of the bait despite the presence of poultry manure odors. The bait used, fish waste, undergoes decomposition and emits a scent of decay, which blow flies can detect within minutes.[25] Trap placement followed the recommendations of Gerry,[14] ensuring that traps were not positioned too close to concentrated odor sources such as manure piles. Based on the results of the study, it was found that over 16 repetitions, the Galltrap captured a total of 699 flies, while the Ranch Fly Trap captured 409 flies. This means that the Galltrap caught 290 more flies than the commercial trap. The results of the Independent Samples T-Test showed that this difference was statistically significant ($p = 0.025 < 0.05$) at the 95% confidence level. These findings indicate that the Galltrap is statistically more effective at capturing flies compared to the commercial fly trap.

Flies rely primarily on olfactory cues to detect resources from a distance, while visual cues become more important at closer range.[26] It has been found that flies from the genus Musca are sensitive to blue-green (490 nm), yellow (570 nm), and ultraviolet (330–350 nm) wavelengths.[27,28] Meanwhile, flies from the genus Calliphora show the highest sensitivity to UV, blue (470 nm), blue-green (490 nm), and yellow (520 nm) light wavelengths.[29] A study by Diclaro et al. (2012) revealed that house flies respond strongly to the colors blue, white, and yellow.[30] Although flies show a high physiological response to yellow, they exhibit low behavioral attraction to it.[30] Green, while within the visual spectrum of flies, elicits minimal response both physiologically and behaviorally.[30] Despite yellow's limited visual appeal, its strong physiological response indicates that flies are still able to recognize and detect the color. When applied to traps, yellow has demonstrated greater effectiveness compared to green. This is supported by a study conducted by Rahayuningsih et al. and Margareta et al., which found that yellow-colored baited traps captured more flies than green-coloured.[31,32] In line with these findings, the present study also showed that the yellow-colored Galltrap was more effective than the green-colored Ranch Fly Trap.

Fly foraging behavior is also strongly influenced by visual contrast, which refers to the difference in intensity or color between an object and its background.[26] The greater the contrast, such as a bright object against a dark background or vice versa, the more visually prominent and detectable the object becomes, even from a distance.[26,33] The effectiveness of

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visual traps therefore, depends heavily on the color characteristics and contrast relative to the surrounding environment.[34] In this study, the yellow-colored Galltrap provided high contrast against the darker, bare-soil background, making it more visually striking and attractive to flies. In contrast, the dark green Ranch Fly Trap offered lower visual contrast with the background, making it less visible and less appealing to flies. Color contrast is suspected to play a key role in enhancing the effectiveness of yellow-colored traps, even though flies are generally less attracted to both yellow and green.[30] Contrast levels appear to have a greater impact on fly attraction than the color itself.[21,27] Studies have shown that flies are more drawn to white objects placed against black backgrounds, and vice versa.[35] Further investigation into visual contrast may help optimize the effectiveness of the Galltrap. This could include testing background conditions where the trap is placed, as well as direct visual elements on the trap itself. For instance, adding vertical black stripes or black dots, which visually resemble clusters of flies, could enhance attraction.[27,30,35,36]

There is also evidence suggesting that semiochemical compounds from fly feces and regurgitate may enhance trap attractiveness.[21] Holl and Gries demonstrated that volatile compounds released from fly excretions can attract additional flies to the area.[37] In this study, the researchers observed that the Galltrap showed significant accumulation of feces and regurgitate inside the trap. In contrast, the mesh-based Ranch Fly Trap did not allow such accumulation due to its open structure. This observation indicates that the Galltrap may be producing a secondary attractant, which reinforces the initial bait and enhances overall trap effectiveness

According to the researchers, the Galltrap has significant potential as a vector control tool. The trap components, such as used water gallons and paint buckets, are locally available, inexpensive, and effective. The trap is expected to be durable, low-maintenance, and unlikely to fill up quickly due to its 5-litre capacity. Captured flies are well-contained within the trap, reducing environmental contamination risks and allowing for easy cleaning.

CONCLUSION

This study demonstrates that Galltrap, designed using recycled materials, is significantly more effective than a commercially available Ranch Fly Trap in capturing adult flies under field conditions. Its ability to trap a greater number of flies highlights the potential of simple, low-cost innovations in enhancing vector control strategies. The findings support the practical application of Galltrap as a sustainable, user-friendly, and efficient tool for fly population management, particularly in rural and resource-limited settings. Future research may focus on optimizing visual cues, such as contrast and trap markings, as well as developing long-lasting attractants that remain effective over time and can inhibit larval development.

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Declarations

Authors' contribution

BR contributed to study design, data collection, data analysis, literature review, and writing the original draft. AKR, SEW, and RA contributed to the study design, provided supervision, critical feedback, and reviewed the final manuscript for publication

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Conflict of interest

There is no conflict of interest in this research.

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