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Evaluating the effect of sticky trap colors in attracting houseflies (Musca domestica L.)

Evaluasi Pengaruh Warna Perangkap Lengket dalam Menarik Lalat Rumah (*Musca domestica* L.)

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ABSTRAK

Latar belakang: Stimulus visual merupakan salah satu faktor penting yang menentukan perilaku lalat, karena lebih dari separuh bagian kepala serangga ini terdiri atas dua mata majemuk berukuran besar yang disertai oleh tiga mata sederhana (ocelli). Penelitian ini bertujuan untuk mengetahui pengaruh perangkap lengket dengan warna yang berbeda terhadap daya tarik lalat rumah. **Metode:** Empat perangkap lengket dengan ukuran yang sama dan warna yang berbeda digunakan dalam penelitian ini, yaitu hitam, biru, kuning, dan merah. Setiap perangkap dilapisi dengan perekat komersial yang tersedia di pasaran (lem tikus) dan dipasang pada tongkat kayu. Perangkap dipaparkan terhadap cahaya selama 12 jam per hari selama lima hari. Pada akhir setiap periode pemaparan, perangkap dikumpulkan, kemudian jumlah lalat rumah (Musca domestica L.) yang tertangkap pada setiap perangkap dihitung dan dicatat secara terpisah berdasarkan warna. **Hasil:** Hasil penelitian menunjukkan adanya perbedaan yang signifikan pada rata-rata jumlah lalat rumah yang tertarik pada perangkap dengan warna yang berbeda. Perangkap berwarna merah menunjukkan rata-rata jumlah lalat tertinggi, yaitu 42,8 ± 7,6, diikuti oleh perangkap hitam sebesar 38,2 ± 5,26, kemudian perangkap kuning sebesar 18,6 ± 2,88. Sementara itu, perangkap biru menunjukkan rata-rata jumlah lalat rumah terendah, yaitu 13,2 ± 3,27. **Kesimpulan:** Perangkap berwarna merah memiliki efisiensi penangkapan paling tinggi, diikuti oleh perangkap hitam, kuning, dan biru. Hasil ini menunjukkan bahwa perangkap lengket berwarna merah dan hitam berpotensi lebih efisien untuk memantau keberadaan lalat rumah di sekitar lokasi pengumpulan sampah dibandingkan perangkap lengket berwarna kuning dan biru. Perbedaan yang diamati menunjukkan bahwa isyarat visual dapat memainkan peran penting dalam proses penangkapan lalat menggunakan perangkap.

ABSTRACT

Background: *Visual stimulus is one of the most important determinants in fly behavior, because these insects have over half of the head comprised of two large compound eyes accompanied by a cluster of three simple eyes (ocelli). This study aimed to determine the effect of sticky traps with different colored on the attracting of House fly.* ***Methods:*** *Four sticky traps of identical dimensions and different colors(Black, Blue, yellow and red). Each one of traps coated with commercially available adhesive (rat glue) and attached to wooden stick. The traps were subjected to light for 12 hours/day for five days. The traps were collected at the end of each exposure period and housefly (Musca domestica L.) captures on each trap were counted and recorded separately by colour.* ***Results:*** *The result of present study showed a significant difference in mean number of house flies that attracted by different colored trapped. The red trap showed high mean of flies 42.8±7.6, followed by black trap with 38.2± 5.26, then yellow trap 18.6±2.88, while the blue trap showed the low mean 13.2±3.27 of house fly.* ***Conclusion:*** *The red trap had the greatest capture efficiency followed by the black, yellow and blue traps. The results indicate that sticky traps of red and black color could be more efficient at monitoring houseflies around garbage collection sites than yellow and blue sticky traps. The observed differences suggest that the visual cues may play an important role in trapping flies using houses..*

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INTRODUCTION

The house fly, Musca domestica L. (Diptera: Muscidae), is one of the most widespread synanthropic insect pests associated with human settlements, livestock facilities, food-processing environments, and waste disposal areas. Its short developmental period, high reproductive capacity, mobility, and ability to exploit a wide variety of organic substrates enable house fly populations to increase rapidly under favourable environmental conditions, particularly where temperature, humidity, and organic waste support continuous breeding (Geden et al., 2021). In addition to causing nuisance, house flies are important from a public health and veterinary perspective because they can transport and disseminate numerous pathogenic microorganisms between contaminated substrates, food, animals, and humans (Geden et al., 2021; Valério et al., 2023).

House flies can mechanically disseminate pathogens through several routes. Microorganisms may adhere to the external body surface, particularly the legs and mouthparts, or may be transferred through regurgitation and faecal deposits after flies have contacted contaminated material. Consequently, house flies have been associated with the dissemination of bacteria and other microorganisms of medical and veterinary importance. Their frequent movement between manure, garbage, animal facilities, food sources, and human environments increases their potential role in pathogen transmission and highlights the importance of effective monitoring and management programmes (Geden et al., 2021). Routine monitoring is therefore an important component of integrated house fly management because it provides information on population activity and can help determine whether control measures are needed (Kavran et al., 2019; Valério et al., 2023).

Among the sensory mechanisms involved in house fly behaviour, visual stimuli play an important role in orientation, movement, landing, and attraction to potential resources or resting sites. Insects perceive visual information mainly through compound eyes containing photoreceptors that respond differently to various wavelengths of light. Colour vision in insects depends not only on spectral sensitivity but also on the interaction between photoreceptors, retinal structures, neural processing, light intensity, and the visual characteristics of surrounding objects (van der Kooi et al., 2021). In house flies, visual information detected by the compound eyes and ocelli can influence behavioural responses to coloured targets and visual patterns (Diclaro et al., 2012).

Previous studies have demonstrated that M. domestica does not respond equally to different colours. Diclaro et al. (2012), for example, reported behavioural differences among house flies exposed to coloured visual targets and demonstrated that colour, intensity, and visual pattern can influence attraction or avoidance. Likewise, Geden (2006) showed that the characteristics of visual targets affected the capture of house flies, indicating the potential use of colour in trap development. More recent studies have also demonstrated that trap colour can influence the efficiency of house fly monitoring. Valério et al. (2023) found significant differences in catches among coloured pan traps used to monitor house flies in poultry facilities, whereas Colacci et al. (2021) showed that glue-board colour influenced the performance of light traps used for sampling and controlling M. domestica. These findings suggest that visual characteristics should be considered when designing trapping devices.

However, the preferred colour of house flies has not been consistent across studies. Some investigations have reported relatively strong attraction to blue or white targets, whereas others have found greater responses to black, red, or other colours (Diclaro et al., 2012; Geden, 2006; Valério et al., 2023). Such variation may result from differences in trap design, light conditions, background contrast, experimental environment, adhesive materials, and the behavioural response being measured. Therefore, additional field-based evaluation is needed to determine whether particular colours can improve the effectiveness of simple sticky traps under specific environmental conditions.

Accordingly, this study aimed to evaluate the effect of different sticky-trap colours—red, black, yellow, and blue—on the attraction and capture of house flies (Musca domestica L.) near a garbage collection site. The findings are expected to provide practical information for selecting inexpensive visual traps for monitoring house fly populations in environments where organic waste favours their occurrence.

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RESEARCH METHOD

The study was carried out in an open area near a garbage collection site characterized by high house fly occurrence and activity. Four sticky traps of identical dimensions and different colors(Black, Blue, yellow and red). Each one of traps coated with commercially available adhesive (rat glue) and attached to wooden stick.

The four traps were set at the same sampling point about 80 cm above ground level and 1 m apart from the traps. The traps were subjected to light for 12 hours/day for five days. The traps were collected at the end of each exposure period and housefly (Musca domestica L.) captures on each trap were counted and recorded separately by colour.

To reduce the positional bias, the location of the four coloured traps was shifted in a random manner daily with the spacing and the height above ground level remaining the same. Fresh sticky traps were used for each sampling day. To minimize the effect of environmental factors which might affect housefly activity and trap response, all traps were exposed at the same time under the same environmental conditions. Houseflies were captured daily for each colour and differences in the performance of the traps were assessed. All the results were statistically analyzed to find out if there was any difference significant between the four trap colors observed.

Statistical analysis. The data were analyzed with SPSS statics, the number of flies were measured daily for five days and the results was presents as mean with standard deviation. Statistical significance was set at $P < 0.05$.

RESULTS AND DISCUSSION

The result of present study as shown in table (1) and figure (1) showed a significant difference in mean number of house flies that attracted by different colored trapped. The red trap showed high mean of flies 42.8±7.6, followed by black trap with 38.2± 5.26, then yellow trap 18.6±2.88, while the blue trap showed the low mean 13.2±3.27 of house fly.

Table 1. mean number of house flies that attracted by different colored traps

Replicates/ days	red	blue	Black	yellow
Day1	42	10	38	15
Day2	40	15	36	21
Day3	49	11	41	22
Day4	51	18	45	18
Day 5	32	12	31	17
Mean± SD	42.8±7.6	13.2±3.27	38.2±5.26	18.6±2.88
P-value	0.02			

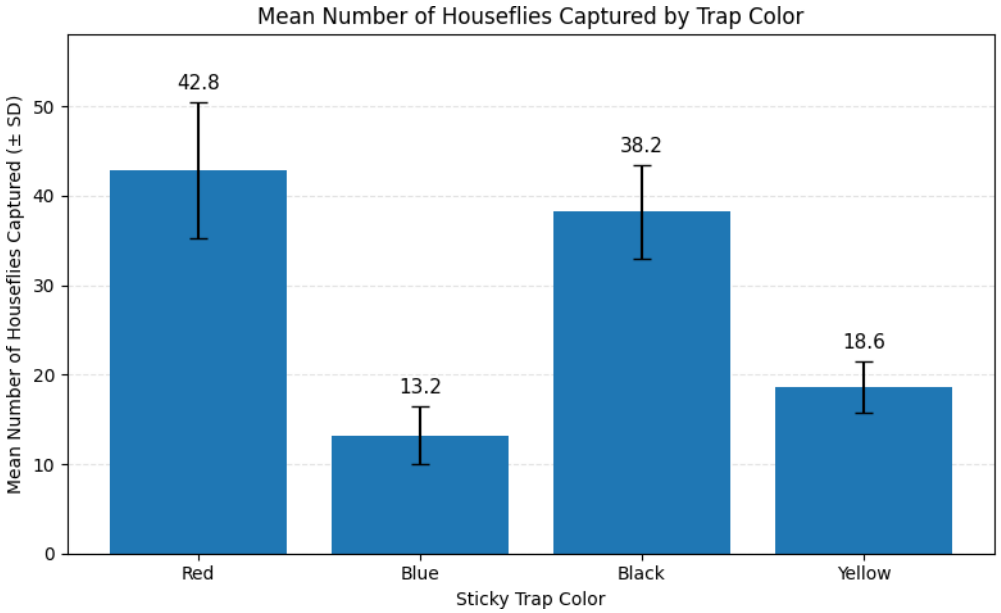


Figure 1. Mean number of house flies that attracted by different colored traps

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The results indicate that the nature of the trap colour may affect the collection of housefly in the environmental conditions studied.The red trap showed a relatively high capture rate which compared well with the results of a recent study carried out by Sundar et al. (2022), with 718 houseflies testing color preferences in a dodecagon maze. The study revealed red to be the colour preference, with black, green, yellow, blue and white following. 30.41% of the colors recorded were red, with black being 21.99% of those colors. The similarity in the correlation with red and black preference in that study and the present study indicates that color preferences may be helpful to the housefly as a visual cue.

The high percentage of the trapped black trap could be due to visual contrast between the trap and surrounding area. Houseflies have compound eyes and simple eyes (ocelli) that are sensitive to visual stimuli, and aid in orientation and flight behavior. Diclaro et al. (2012) demonstrated that there were different behavioural responses of *M. domestica* to the various colours of the visual target. They found that blue and white targets were attractive, and that yellow targets were less attractive and under some experimental conditions could result in avoidance responses. The authors also reported that visual patterns could also influence attraction, therefore, responses would be influenced by the visual properties of the target as well as the nominal color.

This is somewhat lower than some of the previous studies, where the blue trap had relatively high capture rates. Kafle et al. (2019), determined that the bait of blue color was preferred over white, yellow, red, purple and green baits, Likewise, Geden (2006) suggested for houseflies, blue visual targets were effective in field tests. These variations may be linked to the variation of the design of the traps, the adhesive used, type of targets, lighting conditions, and experimental conditions. For example, coloured bait, fabric targets and adhesive paper traps are not directly comparable as the measured outcome might be an attraction, approach, landing, and retention combination. The lower blue-trap catch reported in this study is therefore not necessarily in opposition to previous results; it simply indicates that the effectiveness of a specific color in a specific trapping system and/or environment can be different.

Field evidence further supports the importance of considering trap design when interpreting color preferences. Valério et al. (2023) tested coloured pan traps in a poultry facility and observed that white traps caught the most with a mean monthly catch, followed by yellow, blue and red traps. However, in a light trap with white glue boards. Likewise, Colacci et al. (2020) reported that the white glue boards collected more houseflies than the yellow boards while the latter did not differ significantly from the black glue boards in another comparison. These results are not in line with the present study where red and black traps gave the highest mean catches. These differences suggest that no one color is best for all housefly-trapping situations.

Recent evidence also supports the idea that colours beyond the commonly tested red, blue, yellow, and black may be effective. A recent field study in Kenya by Okal et al. (2025) also showed that the violet target was more effective at capturing houseflies than the blue or black target under the tested conditions in Kenya. While not part of the present experiment, this result indicates that a larger scale of colors could be used to determine the other effective visual targets.

The results from this study will have ramifications for housefly monitoring and management near garbage collection areas (Khan et al., 2013). The red and black sticky traps caught more prey than the yellow and blue ones in the conditions tested, and may be used as color alternatives to further field test. Daily changes in fly activity and environment may also have influenced the number of flies caught. Other research with larger numbers of sites, sampling times, color and normalized reflectance measurements of traps would help determine whether observed ranks are representative in different settings.

CONCLUSION

It was observed from the present study that the colour of the sticky traps had an influence on the number of house fly, (Musca domestica L.) caught under the field condition which were investigated. The red trap had the greatest capture efficiency followed by the black, yellow and blue traps. The results indicate that sticky traps of red and black color could be more efficient at monitoring houseflies around garbage collection sites than yellow and blue sticky traps. The differences observed indicate that the visual cues may be an important factor in catching flies in houses.

ETHICS AND DECLARATIONS

Ethical Approval and Consent

This study involved field observation and trapping of house flies (Musca domestica L.) using coloured sticky traps near a garbage collection site. The study did not involve human participants, personal data, vertebrate animals, or clinical procedures. Therefore, ethical approval and informed consent were not required. All procedures were conducted in accordance with standard practices for entomological field

research.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The author declared no competing interests.

Funding

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Author Contributions

The author was responsible for the conceptualisation and design of the study, preparation and installation of the coloured sticky traps, field data collection, data analysis and interpretation, and preparation and revision of the manuscript. The author read and approved the final version of the manuscript..

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