INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
*https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs*

# Effectiveness of Garlic Extract Aromatherapy Candles as Repellents Against Houseflies (*Musca domestica*)

Ni Putu Maharani Wulandari[1], I.G.A.M. Aryasih[1,2], D.A.A.Posmaningsih[1,2], I Wayan Sali[1,2]

[1] Environmental Health Department, Polytechnic of Health Denpasar, Bali
[2] Center of Excellence for Science and Technology Health Polytechnic Ministry of Health for Health Tourism and Cancer

**Article history**
Posted : 2025-09-20
Reviewed : 2025-11-08
Received : 2025-12-13

**Abstract**

Houseflies (*Musca domestica*) are mechanical vectors that play a role in the transmission of various environment-based diseases, including diarrhea, cholera, dysentery, and typhoid. Until now, fly control has relied heavily on chemical insecticides, which, although effective, have the potential to cause environmental pollution and long-term health effects, such as chronic toxicity and the risk of cancer due to exposure to pesticide residues. As a safer alternative, natural plant-based repellents can be developed to suppress fly populations. Garlic (*Allium sativum*) is known to contain bioactive compounds such as allicin, flavonoids, alkaloids, and saponins that are toxic to insects but safe for humans and the environment. This study aimed to analyze the effectiveness of garlic extract aromatherapy candles in repelling houseflies at concentrations of 5%, 10%, and 15% using a Post-Test Only Control Group Design with six replications. The control group was treated with a candle without garlic extract, while the intervention groups were treated with aromatherapy candles containing 5%, 10%, and 15% garlic extract. Data analysis was performed using the Shapiro-Wilk, Levene, One-Way ANOVA, and Tukey HSD tests. The results showed a significant difference between the control and treatment groups ($p=0.001$). The 15% concentration provided the highest protection rate of 60% compared to the 10% (35.56%) and 5% (20%) concentrations. Thus, garlic extract aromatherapy candles have the potential to be an effective, environmentally friendly natural repellent that supports vector-borne disease prevention efforts while reducing health risks from synthetic chemical insecticides.

**Keywords:** aromatherapy candles, garlic, chemical pesticides, natural repellents

Corresponding author: ayuaryasih733@gmail.com

VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
*https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs*

## INTRODUCTION

Flies are a type of insect classified in the order Diptera and usually breed in dirty environments with unpleasant odors. The most common fly found in residential areas is the housefly (*Musca domestica*). Houseflies act as mechanical vectors that can transmit or spread various pathogens such as bacteria, viruses, protozoa, and worm eggs. Diseases transmitted by flies include cholera, diarrhea, dysentery, typhoid, gastrointestinal viruses, diphtheria, polio, and skin infections such as itching. The potential for disease transmission by houseflies (*Musca domestica*) is very high, so proper control is necessary to improve public health and maintain environmental hygiene.

People in general still use insecticides to eradicate houseflies. Insecticides themselves are a mixture of chemicals formulated to prevent, control, or kill pests, including disease transmitting insects and certain microorganisms, with the aim of protecting health and improving human well being. However, this method is considered less effective in significantly repelling flies and may have adverse impacts on both health and the environment.

Long-term exposure to insecticides, influenced by their formulated contents, can cause chronic toxicity and endanger health. This type of poisoning is often associated with the emergence of cancer due to continuous use of insecticides, especially in enclosed areas with prolonged usage duration (Raini, 2019). In addition, several types of pesticides have been linked to an increased risk of blood cancer (leukemia), non-Hodgkin's lymphoma, brain cancer, liver cancer, and thyroid cancer (Kumar, 2008; Suhartono, 2014) in (Pamungkas, 2016). This occurs because pesticides can be mutagenic, damage DNA, and disrupt the normal regulation of body cells. Thus, the use of chemical insecticides is not only harmful to the environment but also contributes to the increased incidence of cancer in humans.

As an alternative, natural insecticides such as plant based repellents are safer and more environmentally friendly. Repellents are substances that drive away insects, including flies, by disturbing their senses, making them a safer and more eco friendly option. This is because natural insecticides are more easily degraded by environmental factors, so their breakdown products return to nature in the form of non toxic compounds (Zega et al., 2021). The toxic content in natural pesticides is generally specific only to the target organisms, making them relatively safe for humans and the environment.

Corresponding author: ayuaryasih733@gmail.com

VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
*https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs*

Garlic (*Allium sativum*) is one of the plants proven to have potential as a natural repellent. Based on phytochemical screening conducted by (Damayanti & Tahirah Hasan, 2024), it was found that garlic contains alkaloid, terpenoid, flavonoid, and saponin compounds. In addition, phytochemical screening conducted by (Taupik et al., 2021) showed that garlic contains essential oils, as evidenced by the distinctive odor of garlic. These active compounds are environmentally safe, easily degradable, and effective as a housefly repellent through mechanisms that interfere with the insect's sense of smell, metabolism, and respiration, ultimately causing repelling effects and even death.

The combination of garlic extract with candles produces an effective natural repellent, as the candle acts as a binder that regulates the gradual release of aroma, thereby extending the duration of insect repulsion. Its mechanism works through the insect's respiratory tract, where micro particles from the candle smoke enter the trachea and trigger avoidance or insect death (Djarot & Ambarwati, 2019). As for the base material, paraffin is less environmentally friendly because it contains chlorine that can damage the respiratory tract, so soy wax derived from soybean oil is more recommended as it produces lower pollutants (Nining & Yeni, 2021).

Garlic extract aromatherapy candles are an effective and safe natural repellent, making them a potential alternative to chemical insecticides that pose risks of pollution and cancer due to residue exposure. This study tested concentrations of 5%, 10%, and 15% in candle form as an innovative approach to housefly (*Musca domestica*) control that is more practical, environmentally friendly, and supports efforts in disease prevention as well as cancer risk reduction.

## METHOD

This study employed a true experimental design with a Post-Test Only Control Group Design to assess the effectiveness of garlic extract (*Allium sativum*) aromatherapy candles in repelling houseflies (*Musca domestica*). The research was conducted in April 2025 at Warung Be Segara, Denpasar, Bali.

**Preparation of Garlic Aromatherapy Candles:**

Paraffin wax was melted and mixed with garlic extract at concentrations of 5%, 10%, and 15%. The mixture was stirred until homogeneous, poured into molds with cotton wicks, and allowed

Corresponding author: ayuaryasih733@gmail.com

VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
*https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs*

to cool and solidify at room temperature. A control candle without garlic extract was also prepared.

**Experimental Design and Treatment Groups:**

Four groups were tested, consisting of one control group and three treatment groups. The control group used a burning candle made of pure paraffin wax without garlic extract, while the treatment groups used aromatherapy candles containing garlic extract at concentrations of 5%, 10%, and 15%, respectively. Each treatment group consisted of one burning candle placed at the center of a 1 $m^3$ observation area containing shrimp bait as an attractant. Observations were carried out during daytime (09:00–15:00) for 60 minutes per replication, and the number of houseflies landing on the bait was recorded manually. Each treatment, including the control, was replicated six times.

**Data Collection and Analysis:**

Data were collected through direct counting using instruments such as aromatherapy candles, shrimp bait, a stopwatch, and recording sheets. Data were analyzed using the Shapiro-Wilk test for normality, Levene's test for homogeneity, One-Way ANOVA to compare treatments, and Tukey HSD for post-hoc analysis. The results were used to determine the most effective concentration of garlic extract as a natural housefly repellent.

## RESULTS

The study was conducted at Warung Be Segara, Denpasar, under average conditions of 31.0°C temperature and 73.3% humidity, which support the activity of houseflies (*Musca domestica*). The observations showed differences in the number of flies landing on the bait at each concentration of garlic extract aromatherapy candles.

**Table 1.** Number of House Flies Landing on Bait

| Garlic Extract Concentration | Average (flies) | Total (flies) | Percentage (%) |
|---|---|---|---|
| Control | 7,50 | 45 | 35,16 |
| 5% | 6,94 | 36 | 28,13 |
| 10% | 4,83 | 29 | 22,66 |
| 15% | 3,00 | 18 | 14,06 |

Corresponding author: ayuaryasih733@gmail.com

VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
*https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs*

The normality test (Shapiro-Wilk) showed that the data were normally distributed ($p>0.05$), while the homogeneity test (Levene's Test) indicated homogeneous variances among groups ($p=0.634$). The One-Way ANOVA analysis yielded $p=0.001$ ($p<0.05$), indicating significant differences between groups. The Tukey HSD post-hoc test revealed that the 15% concentration differed significantly from all other groups, and the 10% concentration differed significantly from the control.

The effectiveness of garlic extract aromatherapy candles as a repellent was calculated using the protection power formula. The results showed an increase in protection power with increasing concentrations.

**Table 2.** Effectiveness Of Garlic Extract Aromatherapy Candles

| Garlic Extract Concentration | Number Of Flies | Protective efficacy (%) |
|---|---|---|
| 5% | 36 | 20,00 |
| 10% | 29 | 35,56 |
| 15% | 18 | 60,00 |

The interpretation of the results indicates that the 15% garlic extract concentration was the most effective in reducing the number of houseflies landing on the bait, with a protection power of 60%.

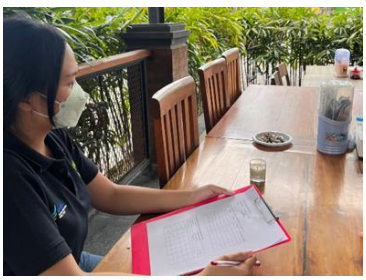

**Figure 1.** Monitoring of Flies Landing on the Bait

## DISCUSSION

The observation was carried out for six hours, from 09:00 to 15:00 WITA. According to Schou (2013) in (Fitri & Sukendra, 2020), housefly activity tends to increase during the daytime, particularly when the temperature reaches around 30°C. This condition is consistent with the present study, where the observation period provided an optimal window to monitor fly activity in searching for food.

Corresponding author: ayuaryasih733@gmail.com

Each treatment was replicated six times, consisting of a control group (without garlic extract) and aromatherapy candles with garlic extract (*Allium sativum*) at concentrations of 5%, 10%, and 15%. The purpose of these treatments was to evaluate the effectiveness of garlic extract aromatherapy candles in repelling houseflies (*Musca domestica*).

The results showed differences in the number of flies landing across treatments. In the control group, the highest number was recorded, with 45 flies or 35.16%. This condition indicates that in the absence of garlic aroma, flies were free to approach and land on the bait. Meanwhile, at concentrations of 5% and 10%, the number of flies decreased to 36 (28.13%) and 29 (22.66%), respectively. However, at these concentrations, flies still tended to return after initially leaving, indicating that the repellent effect was not yet stable.

The decrease in fly numbers with increasing garlic concentration is related to its bioactive compounds, such as alkaloids, terpenoids, flavonoids, and saponins. According to (Tanian et al., 2023), flavonoids and alkaloids act as neurotoxins to insects. Through spiracles on the body surface, these compounds can enter and damage the nervous and respiratory systems, leading to wing muscle paralysis, stiffness, and loss of flight ability. This explains why higher garlic concentrations result in fewer flies attracted to the bait.

Other environmental factors may also have influenced the results of this study. Air velocity, for example, could affect the dispersion rate of garlic aroma and smoke particles, thus altering the intensity perceived by flies. Moreover, variations in ambient temperature, humidity, and light intensity may affect fly activity patterns. Although the experiment was conducted during a stable daytime period, these factors might still contribute to variations in fly behavior. Future studies are recommended to employ interventional conditioning, such as using an enclosed environment or controlling air circulation, to minimize external influences and obtain more consistent data.

In addition, the role of the candle itself also influenced the observation results. According to (Djarot,. and Ambarwati, 2019) , smoke produced by aromatherapy candles contains micro particles that can enter the insect trachea, causing discomfort or even death at high exposure. This explains the phenomenon of flies that landed, then moved away, and returned once the effect diminished. Thus, candles not only serve as a medium to bind the garlic aroma but also support the reduction of flies through the effect of the smoke produced.

Corresponding author: ayuaryasih733@gmail.com

Overall, the study showed that the higher the concentration of garlic extract in aromatherapy candles, the fewer flies landed on the bait. This is presumably due to the increased content of active compounds such as allicin and diallyl disulfide, which have insect repellent properties. At higher concentrations, the resulting aroma becomes more pungent, producing a stronger repellent effect on houseflies.

Garlic (*Allium sativum*) has been widely studied for its therapeutic benefits, including antibacterial, antiviral, antifungal, antithrombotic, antibiotic, anticancer, antioxidant, immunomodulatory, anti inflammatory, and hypoglycemic effects (Prasonto et al., 2017). Organosulfur compounds such as S-allylcysteine (SAC) and S-allylmercaptocysteine (SAMC) have been shown to inhibit the growth of colon cancer cells through apoptosis induction and G2-M phase arrest (Shirin et al., 2001) in (Zafrial & Amalia, 2018). Therefore, the potential of garlic's bioactive compounds in cancer prevention remains theoretical and requires further toxicological and clinical research. Nonetheless, using garlic extract as a repellent may indirectly reduce exposure to carcinogenic chemical insecticides, providing a safer and more environmentally friendly alternative.

On the other hand, the choice of candle base material also affects health. Parrafin candles are known to contain up to 11 carcinogenic compounds, including Polycyclic Aromatic Hydrocarbons (PAHs), which can be released into the air both during combustion and through natural oxidation processes, thereby increasing cancer risk (Dewi et al., 2021). This condition may worsen if paraffin is mixed with synthetic fragrances and fixatives. As an alternative, soy wax based candles are safer because they are derived from renewable vegetable oils, non toxic, and more environmentally friendly. Therefore, combining soy wax with garlic extract can be an innovative solution in producing aromatherapy repellent candles that are not only effective in repelling vectors but also minimize exposure to harmful carcinogenic compounds.

## CONCLUSION(S)

This study demonstrates that garlic extract (*Allium sativum*) aromatherapy candles are effective as a natural repellent against houseflies (*Musca domestica*), with the highest effectiveness observed at a 15% concentration, providing a protection rate of 60%. These findings emphasize that the use of natural based repellents not only helps reduce the risk of

Corresponding author: ayuaryasih733@gmail.com

vector borne disease transmission but also has the potential to lower long term health impacts, such as cancer risks associated with exposure to synthetic chemical insecticide residues. Therefore, garlic extract aromatherapy candles can serve as a safe, environmentally friendly, and sustainable alternative for fly control.

## Conflict of Interest

The author(s) declare that they have no conflict of interest.

## Acknowledgment

The author(s) would like to thank Poltekkes Kemenkes Denpasar for the support in the implementation of this research, as well as the management of Warung Be Segara, Denpasar, for providing the location as a field study site. Special gratitude is also expressed to the academic supervisors who provided valuable guidance and direction throughout the research process. Appreciation is further extended to all parties who contributed to the completion of this study.

## REFERENCES

Damayanti, R., & Tahirah Hasan. (2024). Skrining Fitokimia dan uji Aktivitas Antioksidan Ekstrak Etanol Bawang Putih (Allium sativum L.) dengan Metode ABTS. *Jurnal Novem Medika Farmasi*, *3*(1), 11–20. https://doi.org/10.59638/junomefar.v3i1.869

Dewi, H., Quzwain, F., & Wulansari, N. (2021). Histology Slide Quality Compara Tive Study; Impregnation and Embedding Using Beeswax and Paraffin. *Jmj*, *10*(2), 291–298.

Djarot, P., & Ambarwati, D. (2019). *LILIN AROMATIK MINYAK ATSIRI KULIT BATANG KAYU MANIS ( Cinnamomum burmannii ) SEBAGAI REPELEN LALAT RUMAH ( Musca domestica ) Program Studi Biologi , FMIPA-Universitas Pakuan Program Studi Farmasi , FMIPA-Universitas Pakuan AROMATIC CANDLE BARK ESSENTIAL . 19*.

Fitri, A., & Sukendra, D. M. (2020). Efektivitas Variasi Umpan Organik pada Eco Friendly Fly Trap sebagai Upaya Penurunan Populasi Lalat. *HIGEIA (Journal of Public Health Research and Development)*, *4*(2), 448–459.

Nining, N., & Yeni, Y. (2021). Pelatihan Pembuatan Lilin Aromaterapi sebagai Tambahan Keterampilan Andikpas di LPKA Kelas II Bandung. *E-Dimas: Jurnal Pengabdian Kepada Masyarakat*, *12*(1), 142–146. https://doi.org/10.26877/e-dimas.v12i1.3393

Pamungkas, O. S. (2016). Bahaya Paparan Pestisida terhadap Kesehatan Manusia. *Bioedukasi*, *14*(1), 27–31.

Corresponding author: ayuaryasih733@gmail.com

Prasonto, D., Riyanti, E., & Gartika, M. (2017). UJI AKTIVITAS ANTIOKSIDAN EKSTRAK BAWANG PUTIH (Allium sativum). *ODONTO : Dental Journal*, *4*(2), 122. https://doi.org/10.30659/odj.4.2.122-128

Raini, M. (2019). angga dan Pencegahan Keracunan. In *Media Penelitian dan Pengembangan Kesehatan* (Vol. 19, pp. 527–531).

Tanian, M. A., Rumiati, F., & Susilowati, R. P. (2023). Uji Neurotoksin Insektisida Berbahan Ekstrak Daun Kemangi dan Piretrum terhadap Mortalitas Lalat Rumah (Musca domestica). *Jurnal Kedokteran Meditek*, *29*(3), 283–291. https://doi.org/10.36452/jkdoktmeditek.v29i3.2636

Taupik, M., Andy Suryadi, A. M., Hiola, F., & Rannu, J. (2021). Karakterisasi Senyawa Minyak Atsiri Ekstrak Etil Asetat Bawang Putih (allium sativum l.). *Indonesian Journal of Pharmaceutical Education*, *1*(2), 127–135. https://doi.org/10.37311/ijpe.v1i2.11767

Zafrial, R. M., & Amalia, R. (2018). Artikel Tinjauan : Anti Kanker Dari Tanaman Herbal. *Farmaka*, *16*(1), 15–23.

Zega, U., Fau, A., & Sirsak, D. (2021). *Sebagai Insektisida Alami Dalam Membasmi Lalat Rumah ( Musca Domestica )*. *9*(2), 616–620.

Corresponding author: ayuaryasih733@gmail.com