

The Effectiveness of Some Plant Extracts on the Viability of the First Larval Instar and Adults of House Flies

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Abstract

The current study included an examination the effect of some plant extracts such as lemon peel extract, mint leaf, and tobacco on the life of the first instar larvae and adults of Musca domestica in terms of knowing the percentages of killing larvae and adult of the insect treated with the plant extract. The results of the study showed that the extract of lemon peels has the highest effect on the life of the insect compared with other extracts and by different concentrations and duration of treatment, as it gave the highest killing rate of larva 100% at the concentration of 2000 ppm and the killing rate of 100% at the concentration of 1500 ppm and the lowest killing rate of 22.33, 27.77% at the concentration 100ppm during 24, 48 hours of treatment, respectively, while mint leaves gave the highest percentage of killing 90, 93.33% at the concentration of 2000 ppm, and the lowest percentage of killing is 15.55, 20% at the concentration of 100 ppm, while the tobacco plant extract gave the highest percentage of killing amounted to 83.33, 88.88% at a concentration of 2000ppm and the lowest percentage was 0, 10% at a concentration of 100ppm during 24 and 48 hours of treatment the first larval instar of the Musca domestica respectively.

The results of the study conducted a higher effect of plant extracts during treating adult of Musca domestica, the lemon peel extract gave the highest killing rate of 100% at a concentration of 2000ppm, while the percentage was 100% at a concentration of 1500ppm, and the extract gave the lowest killing rate of 33.33, 45.88% at a concentration of 100ppm, respectively. After 24, 48 hours of treatment of insect adults, the peppermint plant extract had the highest killing rate of 86.66, 100% at the concentration of 2000ppm, and the lowest killing rate of 26.66, 36.66% at the concentration of 100ppm, while the extract of the tobacco plant gave the highest killing rate of 80.22, 92.88% at a concentration of 2000ppm, and the lowest percentage of killing was 18.66, 33.55% at a concentration of 100ppm during treating the adult of Musca domestica respectively.

Keywords: House flies, Plant extracts, Musca domestica, The peppermint plant.

Introduction

Insects are considered one of the most common and widespread of the animal kingdom on the earth, as they are found in different environmental places and are widely spread all over the world. Most of them have medical importance because they are carriers of diseases and feed on various types of plants and animal remains (1).

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Most countries in the world suffer from medical importance pests that cause and transmit dangerous diseases to humans and animals. Insects are considered one of the most important house pests that the whole world suffers from (2). Studies have shown that the number of insects reaches about six thousand types including insects that are harmful for humans and animals, and the losses that occur due to these pests is estimated at one-third of the global production in terms of infecting crops as well as the health field related to human (3).

Musca domestica L., belonging to the Muscidae family, belongs to the order Diptera, and is considered one of the most important disease vectors from a medical and veterinary point of view, as it is one of the most vectors of pathogens (4). because of its great ability to transmit pathogens by mechanical means, as it is characterized by its wide spread in different parts of the world (5). Insects in general, and flies in particular, are characterized by having a clear impact on health of man, as they are among the most important insects accompanying him so, it is source of disturbance to humans and animals and a source of transmission of many dangerous diseases that threaten health due to their frequent presence in stables, barns, dirt places and poultry fields, which are considered the appropriate place to lay their eggs, which are turned into larvae (6).

Musca domestica is one of the most important insect species closely associated with human life and cohabitation wherever he is. It is considered the most widespread and most fertile type of insect inside homes. House flies adapt greatly with the animal and human environment, as it is presented in all areas of human activities, such as hospitals. Markets for foodstuffs, restaurants, butcher's shops, and places for raising chickens and livestock, as it has the ability to complete its life cycle in those places (7).

Early research confirmed the vital effect of many plant materials extracted on house flies as environmentally friendly and safe alternatives to pesticides. These plants contain secondary metabolite compounds that contain toxic substances used in controlling various types of pests. So, the researcher use of natural products of plant origin, which have an effect on insects in general and have little toxicity to other organisms (8). The plant kingdom includes various plants that contain highly effective substances because they are highly toxic and have an effective role in controlling insect pests, especially medical ones that have a role in transmitting pathogens, as the importance of these substances is no less than the importance of chemical pesticides in controlling insects. The researchers in life and chemistry sciences use the direct and effective effect of plant extracts in different concentrations (9).

Materials and method of work:

In order of breeding house flies, the flies were placed inside wooden cages that were manufactured locally, with dimensions of 40 x 40 x 40 cm. The upper layer and one of its sides are covered with a special soft cover known as the window clip, with very small openings that do not allow the exit of adults. Inside the breeding cages, food was placed. It is suitable for insects which consists of sugar and milk in a ratio of 1:1, dissolved in 30 ml of distilled water, and food put in dishes covered with a piece of cotton in order to allow insects to stand while feeding and prevent them from sticking (10).

The breeding cages were placed in laboratory conditions suitable for the growth of the insect and the completion of its life cycle at a temperature of 30 ± 2 C, a relative humidity of $70 \pm 5\%$, and a lighting period is 12 hours. In order of flies laying their eggs, plastic dishes were placed inside the breeding cages containing The medium on which eggs are to be laid and generations of insects are produced for the purpose of the study. This medium was prepared from mixing (500) grams of ground sheep droppings, (20) grams of yeast, (100) grams of wort and distilled water (11).

Collecting plant samples used in the study:

The plants to be studied were collected during the period from June to August 2022, which include lemon peels, mint plant *Mintha piperita*, and tobacco *Nicotiana tabacum*. Then the required samples for the study were taken and cleaned by washing from the dirt and dust attached to them, and then they were dried by a drying oven to prevent moisture from entering the studied parts, and then they were spread at the temperature of the laboratory, taking into account that they were constantly stirred to prevent the plant parts from rotting, and then they were placed inside the bags until the start of preparation for the extraction process.

How to prepare plant extracts:

The plant extracts were prepared according to (12). methods, as the plant parts selected in the study were ground after drying to convert them into powder by means of an electric mill, and then weighed (40) gm of the powder of the plants used in the study (lemon, mint and tobacco) for three experiments and placed in Extraction thimble and then transferred to the extraction device (Sox let extractor) and (500) ml of ethanol alcohol with a concentration of (99.9%) is added then the device is operated for a period of (10-12) hours at a temperature of (60) C ° and the experiment continues until the solution in Thimble changes to the normal color of alcohol, then the filtrate is taken to an evaporation device or what is known as a rotary evaporator to remove the annual solvent and obtain the crude extract, and then the extract is collected in clean and sterile bottles and kept in the refrigerator until it is used.

Preparation of concentrations for the experiment of plant extracts:

The concentrations of the required basic solution stok Solution, were obtained from taking (1) gm of the aforementioned plant extracts, and they were placed separately in a glass container of (100) ml capacity, and (99) distilled water was added and the mixture consisting of distilled water and extract was added to drops of Polysorbate, which helps to convert the mixture into a substance that is easy to mix and spray, thus obtaining a solution whose concentration is equal to (1)% equivalent to (10000) parts per million (ppm) according to the equation used to dilute the concentrations for Dalton $C1V1 = C2V2$ and then The required concentrations were prepared in the study, which includes concentrations (100, 500, 1000, 1500, 2000) ppm of plant extracts, and the control treatment was distilled water.

Bioactivity test of plant extracts against adult of *Musca domestica*:

To conduct this test, the spraying method was used to treat the adult house flies, where modern adults were isolated at the age of 24 hours in the treatment cages . As (10) females were treated in the treatment cages, and the spraying process began with five sprays at a distance of (12). cm, while the control treatment was with distilled water only, and after (12, 24, 48) hours the results of this test were recorded, and the results were corrected. Percentages of transactions in which killing was observed using Abbott's equation (13). which includes.

Corrected death percentages =

$$\frac{\text{Comparator in death percentile} - \text{Test in death percentile}}{100 - \text{Comparator in death percentile}} \times 100$$

Bioactivity test of plant extracts against first instar larvae of the *Musca domestica*:

The same method mentioned in Paragraph (3-13-1) was used by using manual sprayers, at the rate of five sprays for each container containing larvae, and they were incubated in the laboratory at a temperature of (28-32) °C and a humidity of (65-75) °C, and the results were recorded after passing the same time in the above method.

Statistical analysis:

The results were analyzed by statistical tests using the Analysis of Variance (ANOVA) system in the implementation of the experiments, and then Dunkin's multiple test was performed at the probability level (5)% to ensure the significance of the differences between all the different treatments (14).

Results and discussion

Effect of plant extracts after (24) hours of treatment of the first larval stage:.

Table (1) shows that there are percentages of plant extracts killed after (24) hours after treatment of the first larval stage of *Musca domestica* at concentration (100, 500, 1000, 5001, 2000) ppm, as the results in the table showed an effect all plant extracts on the death of the larvae of the first stage of the house fly insect, depending on the The results of the table showed in the statistical analysis that there are significant differences in the killing rates due to the concentration effect of the toxicity contained in these extracts and depending on the type of extract used in this study. These percentages increase with increasing concentration of the extract.

The results showed that there is a clear discrepancy between the effect of plant extracts, as it was noted that one plant was superior to another in terms of effect, and this difference is due to the difference in plants in containing the quantity and quality of effective compounds that have a direct effect on the insect in terms of its injury and its effect on the insect's nerves, so its movement stops completely so that, it has a strong shock that ends with the death or killing of the insect, or as a result of its effect on the vital processes because it directly affects the mechanics of the enzymes and their work, and thus stops the metabolism in the body, which leads to death (15).

It was observed through the results of table (1) that the extract of lemon peels had the highest effect in killing the first instar larvae of the house fly, the killing rate within 24 hours reached (100)% at a concentration of (2000) ppm, and the lowest killing rate for the same extract reached (22.33).)% at a concentration of (100) ppm, and this is due to the accumulation of the extracted substance in the digestive canal of the larva, which contains the active substance, which increases with increasing concentration and this result agrees with (16). It causes damage to the epithelial cells present in the middle alimentary of the insect and thus reduces the insect's ability to feed, as well as, it is considered a toxic substances affecting the nervous system of the larvae and thus paralyzing the movement of the larva, leading to its death.

Through this study, the results referred that the mint plant extract comes after the lemon peel extract in terms of effect, as this extract gave the highest corrected percentage killing rates that reached (90)% at a concentration of (10000) ppm in 24 hours of treatment of the first instar larvae of house flies. The reason for this is that the lemon peels contain more complex oily aromatic liquids or compounds than what is contained in the leaves of the mint plant. These oils or liquids are concentrated in the respiratory system of the insect, leading to its death. These results are consistent with what was mentioned during the second chapter with a study (17). which confirmed that the oils Aromatic extracts from citrus fruits have antioxidant properties that contribute to insect control, as well as antioxidants against some types of bacteria.

In terms of the effect of mint leaf extract, its results are consistent with what was reached by (18). Through their research to evaluate the effectiveness of *Ocimum basilicum* L., and its (estragole) on an insect of *gossypii* Aphis, as the extract gave percentage killing rates that reached (100)% .At concentration (3u1/1) and concentration (2u1/1) from its main component. As for the results of the tobacco plant extract, it had the least effect on the larvae, as the highest percentage of killing was (83.3)% at a concentration of (2000) ppm,

while the lowest percentage of killing was (0) at a concentration of (100) ppm within 24 hours of the treatment of the first larval stage. As shown in the table.

The results of the current study agree with what was stated by (19). as their study showed that nicotine (tobacco) has a role in getting rid of insect pests through the ability of the extract to penetrate into the body of the insect pest and thus affect on its nervous system, which results in continuous tremor followed by paralyzing the movement of the insect then her death.

Table (1): Percentages of killing of plant extracts after (24) hours of treatment of the first larval stage of house flies..

Plant type	Percentages of killing at a concentration of ppm					Average of plant type
	100	500	1000	1500	2000	
Lemon peel	22.33 f	33.3 E	75.5 cd	88.5 B	100 A	63.8 A
Mint leaf	15.55 g	26 F	73.3 cd	80 Bc	90 Ab	56.9 B
Tobacco leaf	0 i	18.5 G	43.3 g	75 Cd	83.33 Cd	44 C
Concentration average	12.5 d	25.9 C	64 b	81.1 a	91.1 A	

*Similar capital letters in one column mean that there are no significant differences between them.

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Effect of plant extracts after (48) hours of treatment of the first larval stage..

Through the results of table (2), it was found that there is a noticeable increase in the percentage of killing the larvae of the first stage of the domestic fly insect as a result of treating the larvae with plant extracts for a period of (48) hours, and the reason is due to the increase in the exposure period of the extract on the body of the larva, which results in an increase in the killing rates Percentage of larvae, as we notice through the results that the duration of exposing the effective agent has a significant effect in increasing the killing rates on the insect compared to the amount of the dose used, and these results are consistent with what is reached by (20).

The results of table (2) showed that the extract of lemon peels outperformed the rest of the extracts used in the study in terms of its effect on the life of the first instar larvae of the house fly insect, as the highest killing rate was (100)% at a concentration of (1500) ppm, and the lowest killing rate was (27.7). % at a concentration of (100)ppm after 48 hours of treatment of larvae, and this result gives better results for control compared to the exposure period within 24 hours. In addition to the exposure period, lemon peels contain a high percentage of fixed oils that directly affect the respiratory system of the larva, and these results It agrees with a study (21). The study showed that lemon peels contain volatile oils that have a toxic effect on the larvae of *Culex quiqueascitus* mosquitoes.

The results appointed that the extract of the mint plant had a lesser effect than the extract of lemon peels in terms of the percentage of killing shown in Table (2), where the concentration (2000) ppm gave the highest percentage of killing amounted to (93.33)% and the lowest percentage of killing amounted to (20)% when the concentration (20)ppm, but its lethal effect on the first larval instar increased with the increase of the exposure time due to the accumulation of the toxic substance of the extract in the body of the larva, and these results are consistent with a study (22). which showed that the plant extracts such as olives and oleander has a lethal effect on the insect stages of house flies, where the results of his study proved the superiority of the oleander plant extract over the olive

plant extract, so the killing percentages of oleander were (61.7, 70.8)% for the time period (48.24) hours, while the olive plant gave (44.4) , 50.5%) for the same exposure period, and this proves that increasing the concentration of the active substance increased the percentage of killing.

The results of the table also showed that the effect of the tobacco plant extract gave less results compared to the rest of the plant extracts when treating the first larval stage of the house fly for a period of (48) hours, where the highest percentage of killing when the concentration (2000)ppm was (88.8%) and the lowest percentage of killing was (88.8%). At a concentration of (100) ppm, which is (10)% after 24 hours of treatment of the larvae, the reason for the lack of effect of this extract compared to the rest of the extracts on the larvae of the first stage of the house fly is due to the type and quantity of the active substances of this extract and the inability of these substances to penetrate the cuticle layer and reach it to the biological target and killing compared to the rest of the extracts We note that these results are consistent with what was reached by (23). as it showed that the aqueous, alcoholic extract of fig leaves, inflorescences of basil, mint, and myrtle leaves had no effect on the development and growth of mosquito ovaries (*Culex pipiens molestus*), and the reason is that these extracts do not contain sufficient active substances to reach the biological target and thus the lack of effect.

Table (2) Killing percentages of plant extracts after (48) hours of treatment the first larval stage of house flies.

Plant	Percentages of killing at a concentration of ppm					Average of plant type
	100	500	1000	1500	2000	
Lemon peel	27.7 g	60.6 D	85.8 B	100 A	100 A	74.8 A
Mint leaf	20 f	33.3 E	80.8 Bc	88.3 Bc	93.33 AB	63.1 B
Tobacco plant	10 hg	25.5 F	66.6 D	70.5 Cd	88.6 BC	52.2 C
Concentration average	19.2 e	39.8 D	77.7 B	86.2 A	93.9 A	

*Similar capital letters in one column mean that there are no significant differences between them.

**Similar lowercase letters in one column mean that there are no significant differences between them.

Effect of plant extracts on adult of *Musca domestica* after (24) hours of treatment.

The results recorded in table (3) and according to the results of the statistical analysis showed that there are significant differences in the toxicity of plant extracts, where the results of using lemon peel extract came to a greater degree in terms of effect compared to other extracts, as it gave the highest killing rate (100)% when concentrated (2000) ppm after 24 hours of treatment, while the lowest percentage of killing is (30.33)% at a concentration of (100) ppm during the same time period, and through these results it can be seen that it is consistent with what was stated by (24).in its study on the effect of some extracts plants on the vitality of *Culex* mosquitoes, as it found that there are significant differences in the toxicity of the extracts, and that there is a direct relationship between the concentration of the extract and the percentage of killing, so, increasing the concentration of the extract increased the killing percentages.

The results of the study showed that the extract of mint leaves also has an effect on the life of adult houseflies, but it came in the second place compared to the results of the extract of lemon peels. Mint was (86.66)% at a concentration of (10000) ppm, and the lowest percentage of killing reached (26.66)% at a concentration of (100) ppm during 24 hours of treatment. The study conducted that mint extract is used to control of *Anophles*

mosquitoes and *Aedes* mosquitoes which contains aromatic oil compounds by 3% and also contains menthol by 30-50%, which shows the high efficiency of the extract in repelling mosquitoes (25).

Through the results of the same table, it was found that the tobacco plant extract has a clear effect on the life of adult house flies, but this effect is the least in terms of killing results compared to the rest of the extracts under study, noting that there are significant differences through the results of statistical analysis, as it reached the highest percentage. The death rate of adults was (80.22)% at a concentration of (10000) ppm, while the lowest rate of death for adults was (18.66)% at a concentration of (100) ppm within 24 hours of the treatment of whole house flies.

The study agreed with the study of (26). in which it is concluded that the boiling water extract of tobacco plant had the highest effect and effectiveness on the life of the peach insect, *Myzus persicae*, compared with the cold water extract of tobacco, and the study showed that alcoholic extracts have a great effect on insect mentioned above comparing with Boiled and hot water as well as the extract other solvents.

Table (3) Killing percentages of plant extracts after (24) hours of treatment of the adult stage of house flies.

plant	Killing percentages at a concentration of ppm					Average of plant type
	100	500	1000	1500	2000	
Lemon peel	30.33 G	36.66 G	78.88 D	90.66 a	100 A	67.3 A
Mint leaves	26.66 I	33.33 H	70.5 E	75.77 d	86.66 Ab	58.5 B
Tobacco plant	18.66 J	26.66 I	63.33 F	70.33 e	80.22 B	51.8 C
The concentration average	25.2 D	32.2 C	70.9 B	78.9 a	88.9 A	

*Similar capital letters in one column mean that there are no significant differences between them.

** Similar lowercase letters in one column mean that there are no significant differences between them.

Effect of plant extracts on adult of *Musca domestica* after (48) hours of treatment.

Through the results of Table (4) and the statistical analysis, there is a clear significant difference in the percentage of killing as a result of the effect of the concentrations used in the study for plant extracts, as the differences can be seen by increasing the killing rates that increase directly with the increase in the concentrations of the extracts, where the concentration (5000) ppm for lemon peels gave the highest Killing percentages reached (100)%, and the lowest killing percentage is (45.88)% at a concentration of (100) ppm. Also, the results of the study showed that there is a significant increase in the death of adult flies compared to the results that preceded it, and this is due not only to the increase of the active substance by increasing the concentration. It is due to the time period of exposure of the insect to the plant extract, as the factor of the duration of exposure had a significant effect on increasing the killing of adult flies.

These results are consistent with what was stated by (27) about the effect of the alcoholic extract of rue and castor when treating the adult house fly, where the percentage of killing the insect increased by increasing the concentration of the plant extract of the two mentioned types of the plant by contact, and the results showed that the extract of the mint plant came after the extract of lemon peels in terms of the effect on the life of the

adult house fly, but it was through what came from the results of this table, it was also shown that this extract had a significant effect, as the killing rate increased after increasing the exposure period compared to the results that were recorded within 24 hours, as the concentration (1000) ppm gave the highest killing rate, which amounted to (100)%, while the lowest concentration of the extract (100) ppm gave the lowest percentage of killing, which amounted to (36.33)% within 48 hours of treating the adults house fly insect, and the results shown for the same table agreed with what was found (28). through their study in which they proved the effect of plant leaf extract of (*Ocimum suave*) and its superiority in controlling the adults of house flies when using different concentrations of this type of extracts and observing their effect with increasing exposure time.

The results showed that the tobacco plant extract showed an increase in the percentage of killing and the effect on adults when treated within 48 hours compared to the treatment period within 24 hours, although this extract had the least effect on the adult stage compared to the plant extracts used in the study and for the same concentrations, as it gave the highest percentage of killing, it was (92.88)% at a concentration of (10000) ppm, while the lowest percentage of killing was (33.55)% at a concentration of (100) ppm during 48 hours of treatment of the adult stage, and these results agreed with what was indicated (29). which indicated that (Nicotine) resulting from the tobacco plant was used as a pesticide against insects, as these substances interact directly with the ganglia of the nervous system in insects, which leads to irritation the insect if a low concentration is used, and when the concentration of this substance is increased, it will lead to paralysis and insect death.

Table (4) Killing percentages of plant extracts after (48) hours of treatment the adults stage of house flies.

plant	Killing percentages at a concentration of ppm					Average of plant type
	100	500	1000	1500	2000	
Lemon peel	45.88 D	56.55 Cd	85.88 b	100 a	100 A	77.66 A
Mint leaves	36.33 E	48.88 D	72.77 c	93.33 a	100 A	70.26 B
Tobacco plant	33.55 J	42.55 E	55.55 e	83.33 bc	92.88 B	61.57 C
Average of concentration	38.5 D	49.3 C	71.4 b	92.22 a	97.6 A	

*Similar capital letters in one column mean that there are no significant differences between them.

**Similar lowercase letters in one column mean that there are no significant differences between them.

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