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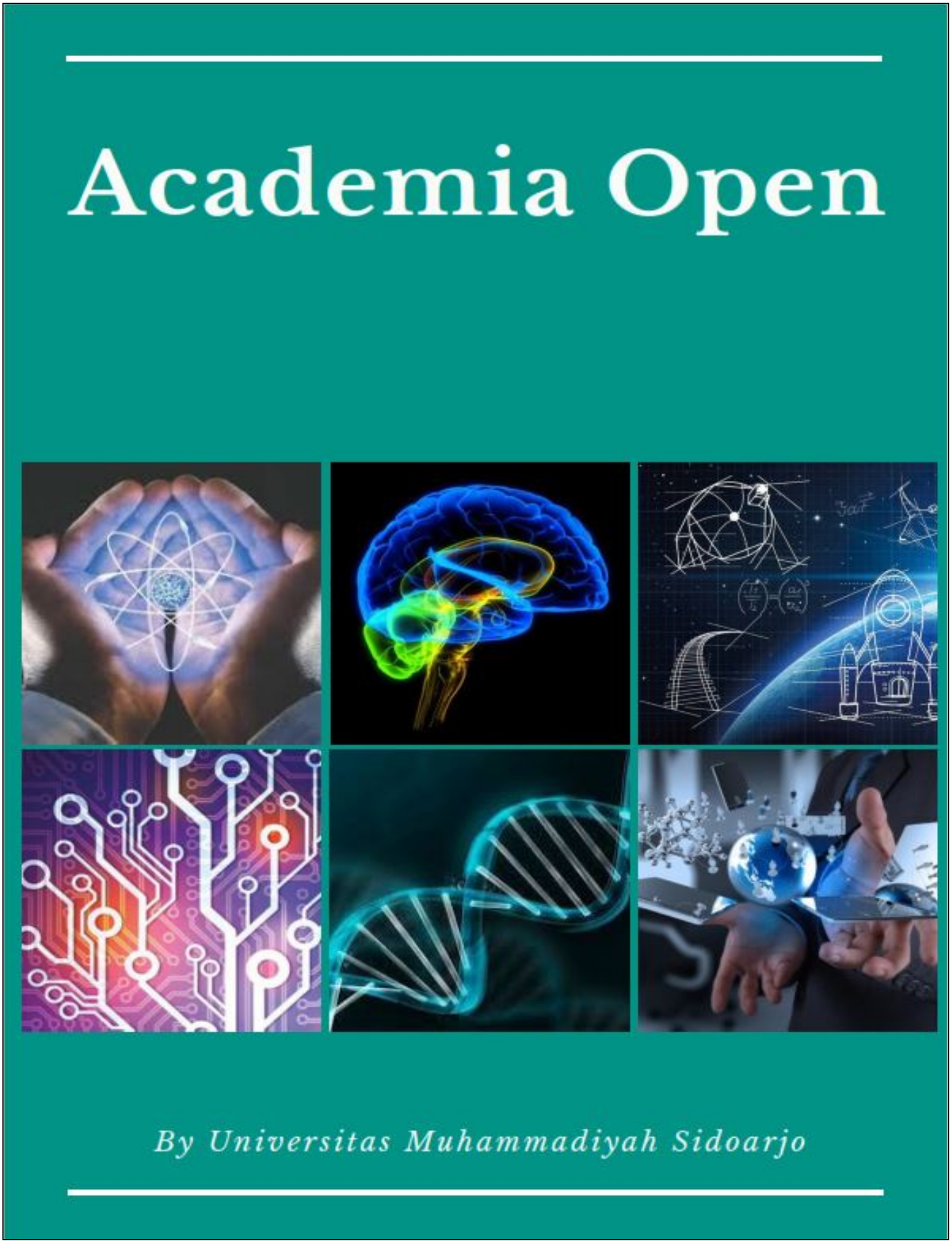

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Comparative Study of the Efficiency of Plant Extracts (Azadirachta Indica & Melia Azedarach) as a Natural Alternative to Kill Musca Domestica

Studi Komparatif Efisiensi Ekstrak Tumbuhan (Azadirachta Indica & Melia Azedarach) sebagai Alternatif Alami untuk Membunuh Musca Domestica

Shifaa Waleed Khaled, shifaabio2121@uodiyala.edu.iq, (1)
College of education for pure sciences/University of Diyala/Diyala-Iraq, Iraq

(1) Corresponding author

Abstract

This study represents a comprehensive comparison between the efficiency of extracts of (Azadirachta indica) and (Melia azedarach), which is considered a natural alternative to combating Musca domestica. These experiments were conducted using different concentrations (5%, 10%, and 20%) of the extracts. Plant on equal groups of insects, with mortality measured over a 6-hour period. Which led to the results showing that the extract of Azadirachta indica was more efficient in killing Musca domesticaat different concentrations, especially at a concentration of 20%, where the killing rate reached 86.67%, compared to the extract of Melia azedarach, which had a killing rate of 73.33% at a concentration of 20%. At a concentration of 5%, the efficiency of the two extracts was approximately equal (46.67%), while it increased in the extract of Azadirachta indica at concentrations of 10% and 20%, reaching Its kill rate is 66.67% and 86.67%, respectively, compared of Melia azedarach plant, which has a kill rate of 60.00% and 73.33%. This shows that seeds of Azadirachta indica plant have a faster and more effective effect compared to Melia azedarach seeds, especially at high concentrations. According to these findings, Azadirachta indica seed extract can be regarded as a natural remedy for Musca domesticaat, reducing the related health and financial harm, with the potential for In situations where low or medium quantities are needed, Melia azedarach seed extract is a useful substitute.

Highlights:

1. Azadirachta indica is more effective than Melia azedarach in killing *Musca domestica*.
2. High concentration (20%) increases efficiency; Azadirachta indica achieves 86.67% mortality.
3. Melia azedarach serves as a substitute for low-medium concentration use.

Keywords: Azadirachta indica , Melia azedarach, Musca domestica, Plant extracts

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Introduction

Plant extracts are active chemicals extracted from various plant parts, such as leaves, roots, flowers, or seeds, and are widely used in commercial and medical fields, including food and cosmetic industries [1]. In pest control, plant extracts are considered a safe alternative to current pesticides due to their physiological activity, bioefficiency, and rapid biodegradability [2]. Recently, interest in plant extracts has increased due to their ability to protect human health and reduce their environmental impact [3]. One of these extracts that is employed is azadractin extract, due to its insect repellent characteristics. The extract is considered a natural organic pesticide from plant sources and is used in organic agriculture due to its minimal toxicity to beneficial creatures and mammals. Azadirachtin is the main effective bioactive compound from seed extract that is responsible and inhibits insect growth. In addition, seed oil contains many Secondary compounds that have lethal effects on various stages of insect life[4], It also affects some metabolic processes in insects such as protein synthesis, changes in biological fitness, sexual intercourse and chitin synthesis, making it effective in reducing the spread of pests [5]. Melia azedarach is also distinguished by its ability to secrete natural chemicals that have insect repellent and insecticidal properties. Tree parts, such as leaves, seeds and fruits, contain active compounds such as terpenoids that have repellent and anti-nutritional properties for insects. Therefore, extracts of this tree are used to combat agricultural pests and limit the spread of harmful insects[6], Flying insects are considered one of the most harmful pests that negatively affect human and animal life, contributing to the transmission of diseases and causing health and economic problems.[7]. Among these insects is the housefly (Musca domestica), which is one of the most common and widespread insects in residential and urban environments. It is also considered one of the most common insect carriers of bacterial, viral, and parasitic diseases such as salmonella, cholera, dysentery, and viral hepatitis, which makes it dangerous to public health[8], The search for effective means of expelling and spreading it has become one of the main priorities in the field of public health[9], Given its significant negative impact, modern research seeks to develop effective and sustainable strategies to control its spread. These strategies vary between the use of chemicals and biological solutions[10], There is increasing awareness of the negative harms these substances have on public health and the environment, as there has become an increasing importance for natural and biological solutions. Plant extracts are considered successful alternatives in biological control, because they have natural properties that are effective in combating insects without causing any harm to the environment. [11] One substance that works well against a variety of agricultural pests is azadractin. Inhibiting feeding, limiting growth, and interfering with reproduction are only a few of its many effects on agricultural pests. Because it can have multiple effects on insects, this compound is used as a pesticide in integrated management programs for agricultural pests and harmful insects[12]. Among them is disrupting the production of hormones important for growth, such as the youth hormone, which leads to a defect in the transformation process that leads to the death of the insect before maturity[13]. The current study aims to conduct a comparison to determine the efficiency of Azadirachta indica and Melia azedarach extracts in killing Musca domestica reduce the health and environmental impacts resulting from their increasing spread in multiple regions, and to highlight the importance of the azadractin compound derived from the seeds of the tree as an insecticide.

Methods

2.1 Study site.

The climatic conditions of Diyala Governorate/Iraq, such as high temperatures and moderate humidity in the summer, are ideal for the reproduction and spread of Musca domestica, making it a suitable location for conducting experiments on the efficiency of plant extracts in repelling these insects.

2.2 Sample Collection.

Musca domestica samples were collected using pheromone traps and bait traps, with 150 insect each sex (males and females), from multiple locations in the governorate, such as farms and residential areas, to ensure a good representation of the local environment.

2.3 Sample Classification.

The samples are divided into groups based on gender (males and females) with equal numbers for each of the test groups and the control group, with 15 Musca domestica for each gender.

2.4 Preparation of plant extracts.

2.4.1 Collecting seeds:

(Azadirachta indica) and (Melia azedarach) seeds were collected from trees in their appropriate season when the seeds were mature. The seeds must be cleaned of dirt and impurities before the extraction process.

2.4.2 Seed Drying:

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After collecting the seeds, they are dried well to ensure that the oil content is maintained. The seeds were then dried using industrial dryers at low temperatures to avoid damage to the active components in the seeds.

2.4.3 Grinding seeds.

After drying the seeds, they were ground using a grinder to obtain a fine powder that facilitates subsequent extraction by increasing the surface exposed to the solvent.

2.4.4 Extracting oil using the maceration method.

The seed powder is placed in a bowl and a methanol solvent is added to cover the seeds completely. The mixture is then left to soak for a few days (from 3 to 7 days) stirring periodically to ensure good extraction of the active ingredients. The solution is then filtered to separate the extracted oil from the solids (seeds) [14].

Result and Discussion

Result

Concentration (%)	Number of Insects	Number of hours	Mortality rate at 1 hour	Mortality rate at 6 hours	Killing Percentage (%)
5	15	6	0	7	46.67%
10	15	6	0	10	66.67%
20	15	6	1	13	86.67%

Table 1. *Efficiency of (Azadirachta indica) Seed Extract on Houseflies by Concentration*

Table (1) shows the effect of Azadirachta indica seed extract on Musca domestica, at a concentration of 5%: during the first hour, no deaths were observed (death rate = 0), but by the sixth hour, the number of deaths was 7 out of 15, i.e. a kill rate of 46.67 %. While at a concentration of 10%: no deaths were observed during the first hour (mortality rate = 0), and by the sixth hour, the number of deaths had increased to 10 out of 15, with a killing rate of 66.67%. As for a concentration of 20%: the first One death during the first hour (death rate = 1) and by the sixth hour, the number of deaths was 13 out of 15, with a kill rate of 86.67%.

Concentration (%)	Number of Insects	Number of hours	Mortality rate at 1 hour	Mortality rate at 6 hours	Killing Percentage (%)
5	15	6	0	7	46.67%
10	15	6	0	9	60.00%
20	15	6	0	11	73.33%

Table 2. *Efficacy of Melia azedarach seed extract on houseflies according to concentration*

Table (2) shows the effect of Melia azedarach seed extract on Musca domestica. At a concentration of 5%, no deaths were recorded (death rate = 0) during the first hour, and by the sixth hour, the number of deaths reached 7 out of 15, which is equivalent to a percentage A kill rate of 46.67%, and at a concentration of 10%, no deaths were recorded during the first hour (death rate = 0). By the sixth hour, the death rate had risen to 9 out of 15, with a kill rate of 60.00%, while at concentration 20%: no deaths were recorded during the first hour (death rate = 0) and by the sixth hour, the death rate was 11 out of 15, with a kill rate of 73.33%.

Concentration (%)	Mortality rate at 6 hours	killing percentage	Death rate at 6 hours swimming	Killing Percentage of Chinaberry
5	7	46.67%	7	46.67%
10	10	66.67%	9	60.00%
20	13	86.67%	11	73.33%

Table 3. *A comprehensive comparison between the effect of and sebah extracts at all concentrations*

Table (3) shows a direct comparison between the effect of Azadirachta indica and Melia azedarach extracts on Musca domestic at three different concentrations. At a concentration of 5%, the mortality rate at 6 hours was equal for both Azadirachta indica and Melia azedarach, reaching 7 deaths out of 15, with a killing rate of 1%. 46.67 for each, while at a concentration of 10%, the number of deaths reached 10 out of 15, with a killing rate of 66.67% for Azadirachta indica extract, while the number of deaths was 9 out of 15 For Melia azedarach extract, the number of deaths was 13 out of 15, with a killing rate of 86.67% for Azadirachta indica extract , while the number of deaths

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for Melia azedarach extract was 11 out of 15, with a killing rate of 73.33%.

Plant	Concentration (%)	Mortality rate at 1 hour	Mortality rate at 2 hours	Mortality rate at 3 hours	Mortality rate at 4 hours	Mortality rate at 5 hours	Mortality rate at 6 hours
	5	0	2	3	4	6	7
	10	0	2	4	5	9	10
	20	1	3	5	7	10	13
Chinaberry	5	0	1	3	4	5	7
Chinaberry	10	0	2	3	4	6	9
Chinaberry	20	0	2	4	6	8	11

Table 4. *Composite analysis of number of deaths over time for each concentration*

The results of Table (4) showed the mortality rate of Musca domestica when using Azadirachta indica and Melia azedarach extracts across a specific time zone and at different concentrations.

At a concentration of 5% for Azadirachta indica extract, the death rate began at two o'clock with 2 deaths, and increased at six o'clock to reach 7 deaths, while the death rate for Melia azedarach extract at the same concentration began at two o'clock with 1 death, and at six o'clock it reached 7 deaths.

At a concentration of 10% for Azadirachta indica extract, the death rate at the second hour reached 2 deaths, and reached 10 deaths at the sixth hour. At the same concentration of the Melia azedarach extract, the number of deaths reached 2 at the second hour, while 9 deaths were recorded by the sixth hour.

While deaths appeared early at a concentration of 20%: for Azadirachta indica extract from the first hour, at a rate of 1 death, and increased clearly to reach 13 deaths by the sixth hour, while deaths appeared for Melia azedarach extract at the same concentration at the second hour, at a rate of 2 deaths, and gradually increased until the number of deaths reached 11 by six o'clock.

Discussion

This study's findings indicated that seed extract (Azadirachta indica) was more effective than seed extract of the plant (Melia azedarach), as the seed extract aqueous extract at a concentration of 20% gives the killing rate of house fly Musca domestica reached 86.67% for compared to 73.33. %. The results can be attributed to the high concentration of azadirachtin found in the seeds of the aforementioned plant, which has known potent anti-feeding and development-disrupting powers on the hormones responsible for growth in insects. Ali et al. also supported this (8). (2023), It demonstrated that the high azadirachtin concentration of Azadirachta indica seed extract, which reduces feeding activity and negatively affects the hormonal growth of the targeted insects, makes it extremely effective[15], At most doses, the safflower seed extract was less effective than the seed extract. This is because the azadractin chemical is more effective than terpenes, which are one of the compounds used as pesticides to kill insects, at targeting the biological processes of insects. These are consistent with the findings conducted by Odibo and Ojianwuna (2020). Which showed that plant extracts, especially in agricultural environments, are considered safe and effective alternatives in killing insects when compared to traditional pesticides[16This study might not align with the research by Adak et al. (2020), which showed that depending on the target insect type and environmental factors, seed extract and other plant extracts, like eucalyptus oil, can be more effective than seeds in specific situations [17]. According to the research findings, plant extracts can effectively kill insects, particularly when they are present in high concentrations. This is in line with a study by Zhang et al. (2022) that found that the extract's active ingredients kill insects sooner than other extracts by drastically altering their physiological processes[18]. The use of plant extracts instead of conventional chemical pesticides is essential from an environmental perspective as it reduces negative environmental consequences. Several studies have shown that biopesticides, such as Azadirachta indica extract, reduce environmental pollution while maintaining good pest control performance. One such study was conducted by Kamaraj et al. (2018) [19]. According to a research by Tavares et al. [20], neem seed extracts also provide environmentally beneficial pest management properties that promote sustainable agriculture and reduce pollution. In addition, Wahjono et al. (2024) emphasized the capabilities of neem trees [21].

Conclusion

1. The study's findings demonstrated the effectiveness of Azadirachta indica seed extract in killing insects, as it had the maximum percentage of insect deaths (86.67%) at a 20% concentration.

2. At a 20% concentration, the Melia azedarach seed extract demonstrated a lower death rate (73.33%) than the Azadirachta indica seeds.

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3. Since it was demonstrated that high doses of plant extracts accelerated the rate of dying, the more concentrated the extracts, the more effective they were at killing Musca domestica. The terpenes in the seeds of the Melia azedarach plant and the azadraktin compound in the seeds of the Azadirachta indica plant are the causes.

4. The study's findings demonstrated that plant extracts are safe for both human and animal health and that they are highly effective in controlling insects when compared to conventional insecticides.

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