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The effect of the volatile oil extract of lavender (*Lavandula* spp.) and lemongrass (*Cymbopogon citratus*) on the mortality rate of red mites (*Dermanyssus gallinae)*

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***Abstract*— Birds, like other animals, are exposed to parasites, which can cause symptoms that sometimes lead to their death.**

Twenty-five 10-day-old local chicks (Gallus dominos) were collected from local markets in Hillah for laboratory experiments on external parasites. Five adult birds of the same species, infected with external parasites, were collected for experimental infestation of the chicks with mites.

Filter papers were placed in small Petri dishes, then the filter paper was sprayed with essential oil extract lavender (Lavandula spp.) and lemongrass (Cymbopogon citratus) at concentrations of (5000, 2500, 1250, 625 µL) for each plant separately, at a rate of 3 ml per dish. After that, ten live parasites were placed in each dish. The dishes were covered to saturate the medium with steam to determine the effect of the essential oil on the parasites. The parasites were monitored every five minutes until all parasites were killed, and the times and the difference between them were recorded during the treatment of the parasites. After that, the experiment was repeated using the essential oil with the Petri dish covers removed.the effect of the essential oil extract of Cymbopogon citratus and lavender plant in uncovered Petri dishes. Concentrations of 625 µL and 1250 µL killed the mites after an 90 minute by 100%, and at concentrations of 2500 killed after an 75 minute by 100%. Concentrations of 5000 µL killed after only 60 minute.

As for the essential oil extract of lavender plant in uncovered Petri dishes, the mortality rate was determined at a concentration of 625 µL after an 90 minute from the start of the experiment. Concentrations of 1250 µL and 2500 µL resulted in a 100% mortality rate after only an 90 minute from the start of the experiment in the laboratory. Concentrations of 5000 µL resulted in a 100% mortality rate after an 75 minute from the start of the experiment. We conclude from this experiment that the essential oil of lemongrass without a cover in Petri dishes at a concentration of 5000 µL was the best result among the other concentrations.When treating the mites with the essential oil extract of Cymbopogon citratus and the conditions of the experiment were to place the cover of the Petri dishes, we noticed that the concentration of 625 µL needed an 60 minute to kill all the parasites by a percentage of mortality 100%after the beginning of the experiment, and at a time of 45 minutes, the mortality rate was observed to be 100% at a concentration of 1250 µL and 2500 µL, and when using the essential oil extract of lemongrass at a concentration of 5000 µL, the mortality rate was 100% at a time of 30 minutes from the beginning of the experiment , Regarding the second experiment, which involved using a lavender essential oil extract with a cover on the Petri dishes, when treated with a lavender oil extract at a concentration of 625 µL, 100% mortality occurred after an 75 minute after the start of the experiment. When treated with a concentration of 1250 µL and 2500 µL lavender oil extracts, mortality occurred after an 60 minute after the start of the experiment. The highest concentration 5000 µL of lavender oil extracts resulted in 100% mortality after 45 minutes. we conclude that Cymbopogon citratus was the best extract plants, killing in the shortest time at a concentration of 5000, better than lavender, compared to the control group, where natural mortality occurred after 60 minutes.

We concluded from our experience that the essential oil extract of lemongrass and lavender worked to kill the red mite, and the higher the concentration of the extract, the less time it took to kill the red mite.

***Keywords* — red mites, Cymbopogon citratus, lavender, volatile oil extract**

INTRODUCTION

Birds are an integral part of livestock worldwide, providing animal protein in the form of meat or eggs (1).

A study conducted by Al-Salami and Yousef (2) revealed significant global developments in bird farming and diversification in combating diseases that affect them. Their meat has become a staple food in most countries. Consequently, their farming faces serious problems that cause significant economic losses, which are linked to certain diseases. The environment, seasonal variations, day-to-night temperature changes, bird age, food type, disease, and predation are among the most important problems facing bird farming.

Parasitism is one of the problems facing poultry farmers worldwide, causing significant economic losses. These parasites spread among domestic and wild birds in various regions due to varying climatic conditions that facilitate the spread of disease-causing parasitic species. The serious effects on birds include malnutrition, delayed growth, and decreased egg production. (3). Birds, like other animals, are exposed to parasites, which causes symptoms of disease that sometimes lead to their death. (4).

Parasites cause several disorders, including sleep deprivation, instability, weight loss, feather loss, decreased egg production, and anemia. They also make birds susceptible to secondary infections and may lead to the death of infected birds, causing significant losses (5, 6).

External parasites such as lice, mites, ticks, and fleas, which permanently or temporarily infest the skin and feathers of chickens, lead to significant economic losses, especially in poultry, because they transmit blood borne protozoa to chickens, as well as numerous pathogens such as pastuerellosis, fowl pox, Newcastle disease, and Chlamydia, which directly affect meat and egg production due to their feeding on chicken blood (7).

The red mite, *Dermanyssus gallinae*, also known as the red poultry mite (PRM), is a temporary ectoparasites that feeds on the blood of birds. It has a short life cycle of 7 to 10 days, enabling it to reproduce rapidly and extensively, especially in warm, humid environments. According to a study by Sparagano et al., (8), this parasite is widespread worldwide, particularly in areas with intensive poultry production. The red mite is most active at night, attacking birds to feed on their blood, and during the day it hides in cracks and crevices within barns.

According to Decru, *et al.* (9), the red mite causes significant damage, reducing poultry welfare and increasing mortality rates. It also causes allergies among poultry industry workers. The disease affects the skin and its appendages and orifices, especially the scalp, face, pubic hair, external ears, eyelids, urogenital openings, and rectum.

Treatment of these parasites, both external and internal, involves the use of chemical antiparasitic treatments. Over time, resistance to these drugs has developed due to their overuse (10).

Medicinal plants are important for treating or improving infections or disorders, both in humans and animals. Medicinal plants are used as medicines in animals. The medicinal importance of natural herbs is based on their biologically active components, which originate from raw plants and exert a specific effect on the body (11).

Essential oils are lipophilic chemical extracts obtained from various plant sources and are used as treatments for various diseases caused by parasites and other ailments (12).

In a study by Hashim *et al*., (13), it was shown that the use of essential oils in aromatherapy has been ongoing for many years and that the therapeutic benefits of these oils are undeniable, as they have the potential to treat and combat diseases caused by parasites.

It was shown that these oils have the ability to alter the life cycle of parasites by affecting their reproduction, thus reducing the transmission of infection to susceptible hosts (14).

Lavender plant: The lavender (*Lavandula* spp.) It is a flowering plant from the mint family Lamiaceae, native to the Mediterranean region. It is considered a global plant, as it is spread in the tropical regions of southern Africa, reaching the southeastern regions of India. Due to its commercial importance, it is now cultivated in southern Europe, Russia, Bulgaria, and the United States. There are 39 species, many of which are hybrids, and there are 400 registered varieties (15). It has aromatic oils and carries the main components of the oils Linalool, acetate Lineally of high medical and economic value, which made it the focus of many studies for scientists and researchers (16). Aromatic and medicinal properties of high value in the perfume, pharmaceutical, food and flavour industries. Lavender is also a popular ornamental plant (17).

Lemongrass (*Cymbopogon citratus*) is a tropical perennial plant that produces an essential oil. Essential oils are highly concentrated secondary receptors that perform diverse functions in the plant system. Hundreds of organic compounds, including Terpenoids, benzenes, organ sulfur, and nitrogenous compounds, form these compounds, which act at various levels. The name lemongrass is derived from the characteristic lemony aroma of the essential oil (18). Lemongrass (globally known as *Cymbopogon citratus*) belongs to the Poaceae family, known as a source of cellulose, hemicellulose, and lignin. This plant is widely used in pharmaceutical activities due to its antiseptic, antibacterial, antifungal, and anti-inflammatory properties (19).

Given the importance of livestock in our lives, the danger of parasites to poultry and all animals, and their danger to humans as well, the importance of plants in veterinary medicine, and the scarcity and limited nature of studies on the subject in Babil Governorate, this study aimed to determine the prevalence of external parasites (red mites) and the risks associated with the effectiveness of concentrations of volatile oils from lavender and lemongrass plants in inhibiting the growth and viability of the parasite in vitro.

MATERIALS AND METHODS

Twenty-five 10-day-old local chicks (Gallus dominos) were collected from local markets in Hillah for laboratory

experiments on external parasites. Five adult birds of the same species, infected with external parasites, were collected for experimental infestation of the chicks with mites. External parasite infestation was diagnosed by examining specific areas of the body (wings, rump, legs, and beak) as well as the feathers, and observing the parasite under a magnifying glass with the help of a veterinarian.

According to The Abu al-Habb method (20) was used to examine the obtained samples. The experimental samples (mites) were then transferred to 70% ethyl alcohol to preserve them. They were then washed with distilled water and placed in xylole for 1-2 minutes. They were placed on a glass slide using Canada Balsam, covered, and left to dry for examination and identification. The plant samples included the aerial parts of lavender plants purchased from the local market, and lemongrass plants were harvested from the botanical garden of the College of Science, University of Baghdad. the plants were cleaned, washed with tap water, dried at room temperature, and stored in clean conditions until use. Preparation of lavender and lemongrass essential oils

The essential oils of lavender and lemongrass were extracted separately, using the method established in the European Pharmacopoeia (1997). The extraction process was carried out in the graduate laboratory at the University of Baghdad, College of Science, Department of Life Sciences. This process involved distilling the essential oil for three hours in a Clevenger essential oil extraction device. The crude oils were extracted from the two plants separately using a Clevenger distillation device. A standard solution (stock) of the essential oil was prepared by taking a concentration of 1000 microliters of the essential oil and diluting it with 70% ethyl alcohol. This resulted in the standard solution being made from the six concentrations required in the current study, as follows: (5000, 2500, 1250, and 625 µL). The solution was then stored in the refrigerator away from light (21). Ten parasites were isolated from the mite in a small Petri dish of 50 dishes, and the ten samples were transferred to other Petri dishes equipped with filter paper, which were sprayed with volatile oil at concentrations of: (5000, 2500, 1250 and 625 µL) for plant extracts.

Treating mites parasites with essential oil extracts of lavender and lemongrass flowers:

Filter papers were placed in small Petri dishes, then the filter paper was sprayed with essential oil extract at concentrations of (5000, 2500, 1250, 625 µL) for each plant separately, at a rate of 3 ml per dish. After that, ten live parasites were placed in each dish at a specific concentration of the previous concentrations. The dishes were covered to saturate the medium with steam to determine the effect of the essential oil on the parasites. The parasites were monitored every five minutes until all parasites were killed, and the times and the difference between them were recorded during the treatment of the parasites. After that, the experiment was repeated using the essential oil with the Petri dish covers removed.

Statistical analysis

The study results were statistically analyzed using a completely randomized design. The significance of differences between rates was tested using the least significant difference (LSD) at a significance level of P≤0.05. The results were statistically analyzed using analysis of variance (ANOVA), extracting the standard error (SE) and the mean ±. The data were analyzed using the SAS program (SAS, 2012).

RESULT & DISCUSSION

we can observe the effect of the essential oil extract of Cymbopogon citratus and lavender plant in uncovered Petri dishes. Concentrations of 625 µL and 1250 µL killed the mites after an 90 minute by 100%, and at concentrations of 2500 killed after an 75 minute by 100%. Concentrations of 5000 µL killed after only 60 minute Table (1).

As for the essential oil extract of lavender plant in uncovered Petri dishes, the mortality rate was determined at a concentration of 625 µL after an 90 minute from the start of the experiment. Concentrations of 1250 µL and 2500 µL resulted in a 100% mortality rate after only an 90 minute from the start of the experiment in the laboratory. Concentrations of 5000 µL resulted in a 100% mortality rate after an 75 minute from the start of the experiment. We conclude from this experiment that the essential oil of lemongrass without a cover in Petri dishes at a concentration of 5000 µL was the best result among the other concentrations.

Table 1: The effect of lemongrass and lavender at different concentrations on killing mites is demonstrated by the time-dependent effect of uncovered Petri dishes.

Essential oil extract rate	Essential oil extract concentration 625 µL	1250 µL	2500 µL	5000 µL	Killing time	essential oil extract
41.67	00.00	00.00	00.00	10.00	15 minute	*Cymbopogon citratus* Without Petri dish cover
	00.00	20.00	20.00	40.00	30 minute	
	30.00	40.00	50.00	70.00	45 minute	
	40.00	70.00	70.00	100.0	60 minute	
	60.00	80.00	100.00	00.00	75 minute	
	100.0	100.0	00.00	00.00	90 minute	
37.5	00.00	00.00	00.00	00.00	15 minute	Lavender plant Without Petri dish cover
	00.00	10.00	20.00	20.00	30 minute	
	20.00	30.00	30.00	50.00	45 minute	
	30.00	40.00	50.00	80.00	60 minute	
	50.00	60.00	80.00	100.0	75 minute	
	70.0	100.0	100.0	00.00	90 minute	
	100.00	00.00	00.00	00.00	105 minute	
	38.46	34.15	41.54	36.15	concentration rate	

105 minute	90 minute	75 minute	60 minute	45 minute	30 minute	15 minute	Average kill time
25.00	58.75	66.25	60.00	40.00	16.25	1.25	

Statistical interference		concentration	Killing time	essential oil extract	LSD
14.84 *		6.91 *	9.75 *	4.02 NS	
.(P≤0.05) *					

When treating the mites with the essential oil extract of Cymbopogon citratus and the conditions of the experiment were to place the cover of the Petri dishes, we noticed that the concentration of 625 µL needed an 60 minute to kill all the parasites by a percentage of mortality 100%after the beginning of the experiment, and at a time of 45 minutes, the mortality rate was observed to be 100% at a concentration of 1250 µL and 2500 µL, and when using the essential oil extract of lemongrass at a concentration of 5000 µL, the mortality rate was 100% at a time of 30 minutes from the beginning of the experiment , show Table 2.

Regarding the second experiment, which involved using a lavender essential oil extract with a cover on the Petri dishes, when treated with a lavender oil extract at a concentration of 625 µL, 100% mortality occurred after an 75 minute after the start of the experiment. When treated with a concentration of 1250 µL and 2500 µL lavender oil extracts, mortality occurred after an 60 minute after the start of the experiment. The highest concentration 5000 µL of lavender oil extracts resulted in 100% mortality after 45 minutes. From Table 2, we conclude that Cymbopogon citratus was the best extract plants, killing in the shortest time at a concentration of 5000, better than lavender, compared to the control group, where natural mortality occurred after 60 hours.

Table 2: The effect of lemongrass and lavender at different concentrations on killing mites is demonstrated by the time-dependent effect of with covered Petri dishes.

Essential oil extract rate		Essential oil extract concentration				Killing time	essential oil extract
		625 µL	1250 µL	2500 µL	5000 µL		
50.66		00.00	00.00	00.00	10.00	5 minute	*Cymbopogon citratus* With Petri dish cover
		00.00	00.00	10.00	20.00	10 minute	
		00.00	30.00	50.00	70.00	20 minute	
		40.00	60.00	80.00	100.00	30 minute	
		70.00	100.00	100.00	00.00	45 minute	
		100.00	00.00	00.00	00.00	60 minute	
36.00		00.00	00.00	00.00	00.00	5 minute	Lavender plant With Petri dish cover
		00.00	00.00	00.00	00.00	10 minute	
		00.00	0.00	10.00	30.00	20 minute	
		20.00	40.00	60.00	50.00	30 minute	
		50.00	70.00	90.00	100.00	45 minute	
		80.00	100.00	100.00	00.00	60 minute	
		100.00	00.00	00.00	00.00	75 minute	
			37.00	44.00	49.00	concentration rate	
75 minute	60 minute	45 minute	30 minute	20 minute	10 minute	5 minute	Average kill time
16.66	46.66	72.5	56.25	66.66	60.00	26.66	
Statistical interference				concentration	Killing time	essential oil extract	LSD
10.39				3.2665	4.217	2.6671	
.(P≤0.05) *							

The results of our current study are consistent with (22, 23, 24, 25, 26, 27)

The red mite is the most damaging parasite of poultry worldwide. The impact of red mite infestations in Europe has been thoroughly described in the scientific literature for over 20 years. Red mite infestations pose significant health, welfare, and public health risks to poultry (28).

In addition to the high prevalence of the disease, another concern is the severity of the effects on bird health and welfare. The first clinical sign observed in infected animals is severe anemia due to repeated parasite bites (29).

The red mite poses a significant threat to chickens and egg-laying populations in many parts of the world. The economic costs associated with robotic control and production losses due to infestations have been estimated at €130 million annually (30).

A comprehensive study by Boulanger et al., (31) demonstrated that red mite infestations lead to a range of health and productivity problems. Among the most prominent health effects is anemia, which in severe cases can lead to bird death. The red mite also affects bird behavior, causing anxiety and restlessness, leading to decreased productivity, particularly in egg production. A study by Mahmoud et al. (32) indicated that this parasite not only affects the general health of poultry but also causes a decline in egg quality and increased rates of lethargy due to the stress caused by constant itching.

The growing need for a sustainable approach to controlling the spread of this disease has been described. Currently, very few chemical treatments are available to treat mite infestations. Many conventional mite products have been withdrawn from European markets or banned in recent years because they do not comply with European or national regulatory requirements for human and consumer safety (33). Studies such as Silva et al., (34), have identified the main affected products as carbamates, organophosphates, and pyrethroids. The organophosphate fucicum is the only veterinary medicinal product registered in Europe for the treatment of D. gallinae infestations. The use of these products as a solution to control mite infestations is limited by widespread resistance to D. gallinae, such as acaricides (35). This poses serious risks to consumer safety, but it also leads to the development of resistance due to low doses. A recent survey in Poland revealed that 50% of 32 registered laying hens used products containing "unknown ingredients" to treat D. gallinae infestations (36).

While the use of diesel oil or washing-up liquids to treat mite infestations has been described, access to an effective, convenient, and safe medical treatment for red mite infestations has been difficult. All other currently available solutions are non-chemical products with unproven efficacy, or chemical sprays with limited value due to their application method or widespread development of resistance (37).

Medicinal plants play a vital role in the production of a large number of new medicines. Because they are a readily available source of herbal medicines, they are highly safe and non-toxic. Therefore, many plants have demonstrated anti-parasitic activity against parasites and organisms, producing complex chemical compounds such as flavonoids, alkaloids, phenols, sterols, terpenes, and alcohol esters (26).

The discovery of chemotherapy-resistant parasites highlights the importance of plant essential oils as antiparasitic agents,

such as those used in schistosomiasis, malaria, and visceral leishmaniasis (38). Some plant oils have immunomodulatory effects that can modify the immune biology of the parasite host. The World Health Organization has emphasized that the inappropriate use of traditional medicines or practices can have negative or dangerous effects (39).

Its use as an antibacterial agent, as demonstrated in a study by Sertkaya (40). To know the extent of the effect of essential oils on the life of the spider mite, among them was the volatile oil of the lavender plant, which gave a killing rate of 100% and had no toxic effect on the plant itself. Germinara (22) noted that the essential oils isolated from lavender flowers had repellent activity against the adult palm weevil. He also found clear fumigation toxicity against the stored grain weevil Sitophilus granarius, which increased with contact, as the toxicity of the essential oil increased well upon contact with the insect, and the mortality rate was 100% after 24 hours of exposure. Therefore, the essential oils of lavender flowers and their essential oils can be used as a natural alternative to synthetic insecticides. (25).

Lemongrass (globally known as Cymbopogon citratus) belongs to the Poaceae family, known as a source of cellulose, hemicellulose, and lignin. This plant is widely used in pharmaceutical activities due to its antiseptic, antibacterial, antifungal, and anti-inflammatory properties (19).

Lemongrass has been used as a folk medicine in many countries for a variety of purposes, including antibacterial, antifungal, antiprotozoal, anti-inflammatory, antioxidant, and anticancer activities. Several studies indicate that lemongrass has been used as a folk medicine to lower blood pressure in various countries such as Spain (Canary Islands), Cuba, Cameroon, Egypt, and Brazil (23).

Lemongrass essential oil, extracted from the oil-rich lemongrass, is gaining prominence as a versatile natural product due to the growing demand for safe health solutions. It contains beneficial compounds such as citral, isoneral, geraniol, and citronellal, which offer diverse pharmacological benefits, including antioxidant, antifungal, antibacterial, antiviral, and anticancer effects. It finds applications in food preservation, cosmetics, and pharmaceuticals, boosting profitability across these sectors. (27)

Lemongrass contains various phytochemical components such as saponins, phenols, resins, alkaloids, tannins, flavonoids, glycosides, terpenes, and minerals, in addition to vitamin C, which has various pharmacological effects (antioxidant, anti-inflammatory, antibacterial, antibiotic and antifungal). (24).

CONCLUSION

We concluded from our experience that the essential oil extract of lemongrass and lavender worked to kill the red mite, and the higher the concentration of the extract, the less time it took to kill the red mite.

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