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# **Study of the efficiency of the volatile oils of *Lavandula angustifolia* and *Salvia officinalis* plants in controlling the human head lice parasite *Pediculus humanus capitis***

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**Abstract---**The study aimed to know the effectiveness of the volatile oils of lavender and sagebrush plants in combating head lice in humans. It was clear through laboratory experiments that the two plants had a positive effect in killing adults from the parasite, especially when the treatment was done with the dishes covered to ensure the saturation of the ocean with steam. The killing rates were 100% during the first ten minutes when Treatment with a concentration of 15ppm for lavender plant and the first 15 minutes for sage plant at the same concentration. While a decrease in the effectiveness of volatile oils was observed when the lids were removed from the petri dishes during the treatment with the superiority of the volatile oil of sagebrush over the volatile oil extract of lavender, the duration did not exceed (4) hours in eliminating all parasites at concentrations (10,15ppm of sagebrush), while it increased The time required to kill all parasites is four hours in the case of treatment with the volatile oil extract of lavender plant and in the same concentrations as that of sage.

**Keywords---**volatile oils, *Lavandula angustifolia*, *Pediculus humanus capitis*.

**Introduction**

Head lice are obligatory parasitoids that stay with their host for the rest of their lives and die if they leave their host. Their legs are modified to attach to the hair

of the host, absorb blood, and their feeding method (Saad and Ismail, 1990). The treatment methods used to get rid of this annoying parasite varied, it ranged between alternative medicine and pharmaceutical drugs in pharmacies, as indicated by Dhumal and Waghmare (2015) usually used manual removal of lice and various home remedies as well as known insecticides to get rid of head lice, but these methods and treatments do not provide protection enough against him. The use of *Juniperus phoenicea* as a treatment for head lice was noted by Dioscorides in the first century AD, and in 1694 John Pechey identified the use of some volatile oils approved for the treatment of lice usually including rosemary, geranium, tea tree, eucalyptus, red thyme, ginger, originum (veal, 1996).

Due to their low cost and being the least toxic among treatments, natural products have been used in traditional medicine for thousands of years, and in recent years they have become of great importance (Heukelbach *et al.*, 2007). Because of their importance in neurons, ion channels are often molecular targets of neurotoxins. Pyrethrin compounds first identified in the pyrethrum extract of *cinerariaefolium* are neurotoxins that disrupt the normal function of voltage sodium channels (VGSCs) (Wakeling *et al.*, 2012).

Because of their importance in neurons, ion channels are often molecular targets of neurotoxins. Pyrethrin compounds first identified in the pyrethrum extract of *cinerariaefolium* are neurotoxins that disrupt the normal function of voltage sodium channels (VGSCs) (Wakeling *et al.*, 2012). A study by (Wolf *et al.*, 2016) showed that oils that are tested for toxicity and sensitivity can be safe and effective alternatives to insecticide-containing lice, with lower risks.

The most effective vegetable oil was olive *olivae* and anise *utobliviscatur*, followed by thyme and sesame *Sesama*, which were effective after 48 hours of use. The effect of garlic oil is very small. As for gasoline, its effect is effective in killing lice, with or without the head covering. Anti-lice shampoos are effective after repeated treatment for four to five days. As for the regular hair shampoo, it became effective in killing lice only when used with the head covering (Obaid, 2018)

The lavender plant with its different parts has many uses due to its pleasant smell. It has been used in cleaning and cosmetics materials and in traditional treatments. It is also used as food additives for its pleasant smell and taste. It has also acted as an anti-fungal, anti-bacterial, repellent or insecticide (Erland and Mahmoud, 2016)

As an alternative to traditional methods, several compounds derived from plants with volatile oils (eg *Origanum* sp. and *Lippia* spp.) and plant extracts (eg *Allium sativum* and *Mentha* spp.) have been used as effective treatment for parasite control (Wunderlich *et al.*, 2017). The therapeutic direction for lice is challenging with the increasing global prevalence due to product failures resulting from resistance, use and misdiagnosis (Toloza *et al.*, 2008)

Despite the improvement of living standards and public health as well as the implementation of specific programs based on lice control guidelines, head lice infestation remains a worldwide health concern (Nezhadali *et al.*, 2020). With a limited number of potent lice pesticides available, plant-derived compounds

possess high potential due to parasiticide, ovulatory, repellent and nutritional activity against various arthropods including head lice (Williams *et al.*, 2015) The volatile oil of sage leaves causes a hormonal imbalance in the immature stages when the larvae feed on it by mixing it with their food and may produce distorted cocoons (Sharaby and Nujiban, 2013). The volatile oils of lavender flowers and their essential oils can be used as a natural alternative to synthetic insecticides (Germinara, 2017). Use the essential oil of sage to control bacteria and fungi that infect the plant (Zaccardelli et al 2020)

### **The method of work:**

The plants (lavender and sagebrush) were collected from the Medicinal Herbarium of Wisdom in Babylon Governorate. To get rid of impurities, the plants were sieved and crushed, then kept in a black plastic bag.

A set of replicates was made to test the optimal concentration of the essential oil of the plant extract to find out (LD50)

All tests were done outside the human body (inverte)

Test by method Micro-atmosphere

The volatile oils extracted from the experimental plants were evaporated and placed in a closed petri dish containing ten live head lice samples in order to saturate the medium with steam to know the effect of the volatile oil on head lice. Concentrations (5 ppm, 10 ppm and 15 ppm) of the extracted volatile oils were distributed over the

Dishes prepared for the study in the presence of the parasite transferred to the dish and placed on the filter paper ten parasites in each dish, taking into account the environmental conditions.

The volatile oils extracted from the experimental plants were evaporated and placed in a petri dish without a lid containing ten samples of live head lice in order to saturate the medium with steam to know the effect of the volatile oil on head lice. Concentrations (5 ppm, 10 ppm and 15 ppm) of the extracted volatile oils were distributed on the dishes prepared for the study, in the presence of the parasite transferred to the dish and placed on the filter paper, ten parasites in each dish, taking into account the environmental conditions.

## Results Discussion

Table (1) The effect of the volatile oil extract of lavender and sage plants in the control of head lice *Pediculus humanis capitis* with the presence of the cover

volatile oil extract rate	The concentration of the volatile oil extract				killing time	volatile oil extract
	%10	%5	%1			
44.66	60.00	40.00	10.00		1hour	Sage plant
	80.00	70.00	40.00		2hour	
	100.00	100.00	70.00		4hour	
	0.00	0.00	100.00		8hour	
	0.00	0.00	0.00		12hour	
46.00	70.00	30.00	10.00		1hour	lavender plant
	100.00	40.00	30.00		2hour	
	0.00	80.00	50.00		4hour	
	0.00	100.00	80.00		8hour	
	0.00	0.00	100.00		12hour	
	41.00	46.00	49.00		Focus rate	
12hour	8hour	4hour	2hour	1hour	average kill time	
16.66	46.66	66.66	60.00	36.66		
overlap	concentration	killing time	extract oil extract	LSD		
11.157	3.5282	4.5549	2.8808			
0.05	0.05	0.05	Not Found	morale level		

The results presented in Table (1) indicated the effectiveness of the volatile oil extract of sage and lavender plants in combating head lice .It was found that the volatile oil extract of lavender plant is more efficient than the volatile oil extract of sage when the dishes were covered after spraying the filter papers with the volatile oils of the plants .Where the killing rate was 100% within ten minutes of treatment with lavender oil at a concentration (15 ppm), which is the highest concentration that was used, while all parasites died within 15 minutes) at a concentration (10 ppm) and during the first twenty minutes all parasites died when treated with the lowest concentration Taken (5ppm).

When the treatment was done with sage oil extract with the same previous concentrations (15ppm, 10ppm, 5ppm), it was observed that parasites were killed by 100% within (15, 20, 30) minutes, respectively .From the statistical data, it was found that the type of volatile oil had a high significant effect (2.6671) at the level of significance (0.05), which gave preference to lavender when the dishes were covered.

There was also a significant difference (4.217) for the time taken on the parasites' mortality rate, as there is a direct proportion between the time and the killing

rates. The results of the current study showed through Table (1) that the extract of the volatile oil of both plants (lavender and sage) is effective in combating head lice in varying proportions. Filtering with volatile oils for plants This is in agreement with what Sertkaya (2010) observed when treating *Tetranychus* spider mite with volatile oil extract of lavender plant, which gave a 100% killing rate and had no toxic effect on the plant itself.

The study also agreed with what was observed by Germinara (2017) that the essential oils isolated from lavender flowers had a repellent activity for the adult palm weevil *Rhynchophorus ferrugineus*. He also found a clear fumigation toxicity against the stored grain weevil *Sitophilus granarius*, which increased by contact. The toxicity of the volatile oil increased significantly in contact with the insect. Mortality rate is 100% after 24 hours of exposure.

The efficiency of the extract of the volatile oil of the sage plant is not much less than the treatment with the volatile oil of the lavender plant. The reason for the ability of the sage oil to combat head lice is that the essential oil causes an imbalance in the hormonal balance of the insect, which affects its growth. This result agreed with the findings of Sharaby and Nujiban (2013) When conducting experiments to evaluate the biological activity of the essential oil isolated from the leaves of the sage plant against the black cutworm *Noctuidae*, it was noted that the oil caused starvation of the larvae, which led to the death of 75% of them after 8 days of treatment, and all the larvae died on the tenth day. This is because the essential oil causes a hormonal imbalance in the larvae when they feed on it by mixing it with their food and may produce distorted cocoons

Table (2) Effect of volatile oil extract of lavender and sage plants in controlling head lice *Pediculus humanis capitis* with lids removed from petri dishes

volatile oil extract Rate	The concentration of the volatile oil extract				killing time	volatile oil extract
	%15	%10	%5			
50.66	30.00	10.00	0.00		5 minutes	sage plant
	80.00	70.00	40.00		10 minutes	
	100.00	80.00	70.00		15 minutes	
	0.00	100.00	80.00		20 minutes	
	0.00	0.00	100.00		30 minutes	
36.00	60.00	40.00	20.00		5 minutes	lavender plant
	100.00	40.00	30.00		10 minutes	
	0.00	100.00	50.00		15 minutes	
	0.00	0.00	100.00		20 minutes	
	0.00	0.00	0.00		30 minutes	
	37.00	44.00	49.00		Focus rate	
30 minutes	20 minutes	15 minutes	10 minutes	5 minutes	average kill time	
16.66	46.66	66.66	60.00	26.66		
overlap	concentration	killing time	volatile oil extract		LSD	
10.39	3.2665	4.217	2.6671			
0.05	0.05	0.05	0.05		morale level	

The results in Table No. (2) indicated the efficiency of the volatile oil extract of sagebrush in combating head lice with no petri dish covers. It was observed that the volatile oil extract of sagebrush at concentrations (5ppm) and (10ppm) was more efficient than the extract of lavender oil at the same concentrations, as the period did not exceed four hours in eliminating all parasites at a concentration (10ppm) of sage and the same case when treated with volatile oil extract Lavender plant with the same concentration (10ppm), it was also observed that all parasites were killed during eight hours of treatment with the volatile oil extract of sage at the concentration (5ppm), while the volatile oil extract of lavender showed less efficiency in the control where insects remained up to 12 hours at the same concentration (5ppm)

While the volatile oil extract of lavender showed a higher efficiency than the volatile oil extract of sagebrush at the concentration (15ppm), all parasites were killed in the dish within only two hours, while the parasites were killed within four hours of treatment with the volatile oil extract of sagebrush at the concentration (15ppm).

No significant effect of plant type was observed when analyzing the data statistically. When observing the time, an increase in the rates of death was observed with an increase in the hours of exposure to the extract. It was noted that the optimal time, which witnessed the largest rates of death, was four hours of treatment, where the killing rate reached (66.66%), as it was noted from the statistical interpretation that there are significant differences between the times that were adopted in The current study is (4.5549) at the level of significance (0.05)

As for the concentrations used, it was found that there was a speed in the rates of death by increasing the concentration adopted in the experiment. The higher the concentration, the fewer hours the insects spent. As shown by the statistical analysis, there is a significant effect (3.5282) of focusing on the killing rate .It was noted that the interaction had a significant effect (11.157) between the factors included in the study (plant type, extract concentration, time required to kill) at the level of significance (0.05).

It is worth noting that this disparity that occurred for the oils in the fight against the parasite when the lids were removed from the dishes confirms that the volatile oil works more efficiently when using the method Micro-atmosphere and this was confirmed by (Yang et al (2004), who indicated that the deadly effect of volatile oils as a result of its action In the vapor phase, the effect of volatile oils on head lice is more effective when kept in closed containers compared to open containers.

The disparity between the two plants and the decrease witnessed by lavender oil in the control of head lice when the treatment was carried out after removing the covers from the dishes is due to the fact that the volatile oil of lavender has a lower heat of evaporation than the volatile oil of sage and this was confirmed by Duce et al (2017) through his study For the thermal behavior of lavender, sage, and other volatile oils note that lavender evaporates faster than any other sample tested.

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