

**Relative Importance of some Natural Products acting as Pesticides Alternatives against *Tetranychus urticae* Koch, (Tertranychidae : Acari)**

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**Abstract**

Eight kinds of natural botanical origin oils (three fixed and five essential) were investigated through lab. experiment and another field applied experiment on the *Tetranychus urticae* in kidney beans plantations. The two main techniques: 1 – dipping disc bioassay and 2- spray. Observations lasted along the life cycle. Number of dead individuals and their percentages during the first 3 days were taken as indicator for the ascending ranking of the eight kinds of oils, in comparison with water as a control. Results of the lab. experiments revealed that the eight investigated compounds were categorized in 3 groups: The first one include Ginger, Garlic and Thyme oil with mortality percentage 58.33, 53.33 and 52.22%, respectively. The second group, have a medium effect contains: Sun – flower seed, row cotton seed and linseed oil, respectively. The Third group contains basil and mandrine oil which recorded the lowest values directly before the control treatment.

Results also showed that the total numbers of dead individuals in dipping technique were considerably higher than those of spray case. The three (3) oils of first group were conducted in a field experiment to spray kidney bean plantation in, Kafr el Tawila, village, Dakahila Governorate against *T.urticae*. Results showed that garlic oil was the highest effect followed with thyme and ginger oils, respectively.

**Key words:** Pesticide alternatives-Fixed oils- essential oils- *Tetranychus urticae*.

**Introduction**

Using essential and Fixed oils to control pests is a recent trend to create more pesticides alternatives. It is well known that some of both botanical essential and or fixed oils have their importance as phytotherapy agents for their content of antioxidants and other medicinal compounds. (Gulcin *et al* 2007), in addition, these oils played a considerable role to be pesticides alternatives against some important pests e.g. the two spotted spider mite and other pests.

Cloyd *et al.* (2009) conducted a quantitative study which demonstrated that the commercially plant- derived essential oils products vary in their effectiveness against some arthropods pests. They also indicated efficacy phytotoxicity of these plant-derived essential oil products on arthropod pests including *T.urticae*. Results indicated that mite product, which contains (cotton seed, dove, and garlic oil) was most effective against the two- spotted spider mite > 90% mortality.

Nath and Sapna Mahajan (2005) in their studies to control *T. urticae*, investigated azadirachtin and garlic oils. It was reported that these extracts were safety to natural enemies of the phytophagous mite species in comparison of fenazaquin, which showed maximum toxicity. Abbasy *et.al* (1998) in their studies, investigated the toxic effect of some plant extracts e.g. *Pancreatium maritimum* and soosan on some pests e.g. *Aphis gossypii*, *Spodoptera littoralis*, *Culex pipiens* and *T.urticae*.

They reported that, the oil of soosan bulbs was toxic to *T.urticae*. In addition they found that there was a synergistic effect for the principal alkaloid of

soosan bulbs, when added to cyanophos, reducing its  $LC_{50}$  value from 120 to 48 ppm. only on *A. gossypii*.

This study aimed to investigate eight (8) of botanical origin essential and fixed oils on the two-spotted spider mite *Tetranychus urticae* in laboratory and field.

**Materials and Methods**

To evaluate the effect of the 8 botanical origin oils on *T.urticae*. Three (3) of the investigated oils were fixed oils obtained by seeds cold press method, while the other (5) oils were essentials (volatile) oils obtained by vapour distillation method. The eight investigated oils represented 8 treatments as follow: 1- Raw cotton seed oil (A), 2-Mandrine oil (Citrus leaves pure oil) (B), 3- pure basil oil (C), 4- Linseed oil (D), 5- Thyme oil (E), 6- Ginger oil (F), 7- Sun flower seed oil (G) and 8- Garlic oil (H). The solutions for dipping and spray were prepared using 1 ml of the pure oil per 1 liter of distilled water and 2ml of artificial detergent as a diffusion material, in addition to control treatment (dipping in and spray with: 9- water (I)). The fixed oils were: raw cotton seed, linseed and sun-flower oil. The two bio-assay main techniques followed were: 1- leaf – disc dipping and 2- spraying discs. In both, (10) ten adult individuals of *T.urticae* were carefully taken from a previously prepared lab. culture reared on the room temperature  $25 \pm 2^{\circ}C$  and 75% relative humidity.

**A- lab experiment:** in lab. dipping and spray was carefully carried out to ensure equal time of disc dip in the solution and homogeneity of spraying drops. Ten (10) adult mite individuals were carefully

transferred to each disc, three (3) discs were used per 1 petri-dish and 3 dishes were used per each treatment. Number of living and dead individuals were recorded. Total numbers and percentages of dead individuals for each treatment after 24, 48 and 72 hours was the main indicator to consider the ascending ranking of the treatment. Ranking in case of spray (Rs) and in case of dipping (Rd) were used to calculate the final ranking ( $\times R$ ) as an average of the two values using it to ascending rank for the nine treatments. Three tests were repeated each test have 3 replicates and the average values and standard deviation (SD) were calculated.

Gorski and Piatek (2008) studied the effect of natural essential oils i.e. geranium, lavender, peppermint, pine and thyme oil in the control of two-spotted spider mite occurring on dwarf bean. Mortality of the pest was evaluated 24, 48 and 72 hours after treatment. Applications of the oils were at concentrations of 0.02, 0.05 and 0.1% for peppermint and geranium and of 0.05 and 0.1% for thyme oil, while applications for lavender were of 0.02 and 0.05%. In their results they reported that using of the tested essential oils resulted 92.7 – 99.8 % mortality for 72 hours treatment.

**B-The field experiment:** the most three (3) effective oils, as deduced from the lab. work: thyme, ginger and garlic oils were used in a completely random experiment in (Kafr el tawela) village, Mansoura, Dakahlyia governorate, North-eastern Delta.

In this field experiment, kidney-bean plants of 45 days age were sprayed against *T.urticae*. three replicates of (36) leaves samples were collected and investigated 1, 3 and 7 days after spray. A new ascending ranking for these 3 treatments was considered. (Table 4)

## Results and Discussion

Results show that total numbers of dead individuals of *T.urticae* within 3 days in dipping method through 3 tests, (each have 3 replicates) were about 28% higher than those of spray for the whole treatments.

Table (1) shows the effect of spray in all treatments and mortality percentage for the different oils. Ascending ranking (Rs) was considered according to the mortality values. Ginger oil occupied the first rank as it recorded 47.78% followed with Garlic and sun- flower oils with 43.33% and 41.67% respectively.

It seems that this 3 pre-mentioned oils represents the first group with the highest value of efficiency. The second groups of oils with a moderate effect on the *T.urticae* individuals were: linseed and thyme oil with 35% mortality percentage for both of them, in addition to raw cotton seed oil with 32.78%, which recorded the 5<sup>th</sup> ranking of all treatments. Basil oil

and mandrine recorded 6<sup>th</sup> and 7<sup>th</sup> ranking with 31.11 and 29.89%, respectively directly come before the control treatment. Table 2 indicates the similar data e.g. the total dead individuals of *T.urticae* affected by the same treatments through dipping discs in the prepared solutions. In addition ranking of the treatments (Rd) was recorded.

Data show that the first group of oils, with the high effect on *T.urticae* were: Thyme, Ginger and Garlic oils with mortality percentage 69.44, 68.88 and 63.33%, respectively.

Also the same table shows that, the second group of oils, with a medium effect on the *T.urticae* individuals were Sun flower seed oil, Raw cotton seed oil and Basil oil, in the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> ranking with mortality, percentage 52.22, 37.22 and 36.11%, respectively.

About linseed oil and mandrine oil the results recorded near values of mortality percentage 33.89 and 32.22% respectively while the control treatment recorded 3.33% only.

Kazem and El-Sherief(2010) investigated toxicity of some plant extracts e.g. capsicum and garlic in some pests e.g. aphids and red mite. In their studies they reported that using these two extracts in the boiled linseed oil increased the effectiveness of boiled linseed oil opposite the effectiveness of boiled linseed oil against the red mite.

The acaricidal effects of some essential and fixed oils on the two – spider mite, *T.urticae* were investigated by Ismail *et al.* (2011). In their studies a comparison was made for studying the effect of the essential oils : Rosemary, garlic, Jojoba and a fixed the highest significant decrease in the numbers of deposited eggs as compared to the other tested oils. Vegetable oil greatly affected the percentage of number that reached adults, followed by Jojoba oil then garlic oil while rosemary had no effect on nymph's developments.

Table (3) shows that the final ranking for the eight (8) oil compounds (RR) which was the average values of spray and dipping rank. Ginger, Garlic and Thyme oils occupied the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> ranks with an average mortality percentage 58.33, 53.33 and 52.22%, respectively. The second group of oils with medium effect on *T.urticae* was Sun- flower seed oil, Raw cotton seed and linseed oil with 46.95, 35.00 and 34.45%, respectively.

Basil and Mandrine oil recorded the lowest values 33.61 and 31.06% respectively and comes directly before the control treatment, which was only 8.89% (fig.1). Table (4) show that the result of field experiment which declared that garlic oil (I) was the most effective with 81.8 % after 3 days followed with thyme (E) with only 31.6 %.

In order to control *T.urticae* lim Eu Gene *et al.* (2011) investigated fumigation of 34 commercial essential oils on different stages of the mite, at 3 different temperatures 5, 15 and 25 C°. Results indicated that common thyme, cinnamon and lemon

grass oils were equally effective on the adult stage showing 85.8 - 100 % mortality at 25 C°. Also it was reported that common thyme oil showed the highest ovicidal activity at 25 C°. However, citrol oil was more active than other compounds to two- spotted spider mite eggs at 15°C. Therefore it was concluded that citrol has the best potential for development as a fumigant against *T. urticae* on agricultural products

harvested late in the growing season which carry botanical litters with mite eggs.

El Gengaihi *et. al.* (1996) studied the effect of thyme oil and thymol against *T.urticae*, it was concluded that, thymol was more potent than thyme oil as a factor to reduce egg laying by the mite. Mortality reached 100% with both materials used., even with low concentration the effect was more pronounced with theymol than thyme oil.

**Table 1.** Total numbers of dead individuals of *Tetranychu s urticae* (Td), Percentages (%) and Ranking (Rs) of all treatments in spray lab. Technique.

Replicates Treatments	R1	R2	R3	Total	X ± SD	%	Rs
A	24	21	14	59	19.67 ± 4.19	32.78	5
B	15	18	19	52	17.33 ± 1.70	29.89	7
C	25	19	21	65	21.67 ± 2.49	31.11	6
D	22	26	15	63	21.00 ± 4.55	35.00	4
E	17	25	21	63	21.00 ± 3.27	35.00	4
F	37	21	28	86	28.67 ± 6.55	47.78	1
G	19	28	28	75	25.00 ± 4.24	41.67	3
H	30	25	23	78	26.00 ± 2.94	43.33	2
I	9	9	8	26	8.67 ± 0.47	14.44	8

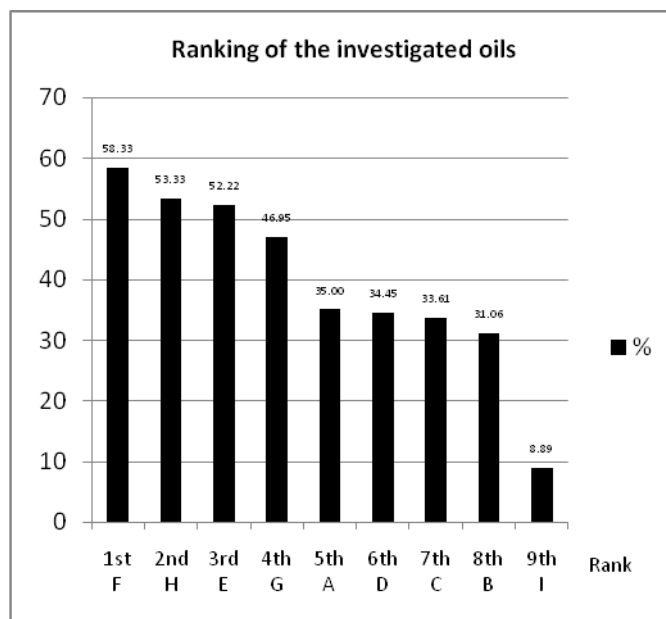
**Table 2.** Total numbers of dead individuals of *Tetranychus urticae* (Td), Percentage (%) and Ranking of all treatments in disc - dipping lab. Technique

Replicates Treatments	R1	R2	R3	Total	X ± SD	%	Rd
A	17	23	27	67	22.33 ± 4.11	37.22	5
B	26	19	13	58	19.33 ± 5.31	32.22	8
C	22	22	21	65	21.67 ± 0.47	36.11	6
D	17	26	18	61	20.33 ± 4.03	33.89	7
E	48	43	34	125	41.67 ± 5.79	69.44	1
F	48	36	40	124	41.33 ± 4.99	68.88	2
G	41	31	22	94	31.33 ± 7.76	52.22	4
H	44	32	38	114	38.00 ± 4.90	63.33	3
I	0	0	6	6	2.00 ± 2.83	3.33	9

Raw cotton seed oil (A), Mandrline oil (Citrus leaves pure oil) (B), pure basil oil (C), Linseed oil (D) Thyme oil (E), Ginger oil (F), Sun flower seed oil (G), Garlic oil (H), water (I)

**Table 3.** Ranking of all treatments in spray (Rs), dipping (Rd) and average ranking (RR) for the investigated oils according to their effect on T.urticae

Ranking Treatments	Rs.	Rd.	XR	RR	%
A	5	5	5	4	58.33
B	7	8	7.5	7	53.33
C	6	6	6	6	52.22
D	4	7	5.5	5	46.95
E	4	1	2.5	2	35.00
F	1	2	1.5	1	34.45
G	3	4	3.5	3	33.61
H	2	3	2.5	2	31.06
I	8	9	8.5	8	8.89



**Table 4.** The average numbers of live (L) and dead (D) individuals of *T.urticae* in the field experiment after 1,3 and 7 days of spray

	Control			Za			Zn			Gr		
	L	D	%	L	D	%	L	D	%	L	D	%
1 day	51	17	25	31	14	31	13	5	27.7	20	21	51
3 days	61	12	16	13	6	31.6	6	2	25	2	9	81.8
7 days	57	27	32	14	7	33	14	2	12.5	19	5	20.8

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#### الأهمية النسبية لبعض المواد الطبيعية كبدايل للمبيدات ضد العنكبوت الأحمر ذو البقعتين

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لعدم إتجاه إستخدام المركبات الطبيعية كبدايل للمبيدات فى مكافحة الآفات تم إختبار (8) ثمانية زيوت طبيعية ذات أصل نباتى لدراسة تأثيرها على العنكبوت الأحمر ذو البقعتين بإستخدام طريقتى: الرش والغمر لشرائح نباتية (ديسكات) فى أطباق بتري بالمعمل بهدف بيان الأهمية النسبية للمعاملات تحت الفحص.

الأفراد الناضجة من العنكبوت الأحمر تم الحصول عليها من تربية معملية على درجة حرارة الغرفة  $25 \pm 2$ °م ورطوبة نسبية قدرها 75%. والزيوت النباتية التى تم اختبارها هى : 1- زيت بذرة القطن الخام، 2- زيت الماندرين (زيت أوراق الموالج)، 3- زيت الريحان ، 4- زيت الكتان ، 5- زيت الزعتر ، 6- زيت الزنجبيل ، 7- زيت عباد الشمس ، 8- زيت الثوم ، علاوة على استخدام الرش والغمر بـ 9 - الماء كمعاملة للمقارنة. وطبقاً لمدى تأثير المعاملة على العنكبوت الأحمر تم عمل ترتيب تصاعدي Ascending Ranking للمعاملات طبقاً للنسب المئوية للأفراد الميتة.

وتم تصميم وتنفيذ تجربة حقلية كاملة العشوائية لرش أقوى ثلاث معاملات (طبقاً لنتائج المعمل ) فى الحقل على نباتات الفاصوليا بقرية كفر الطويلة - مركز المنصورة - محافظة الدقهلية بشمال شرق الدلتا. وكانت :

أ- نتائج التجارب المعملية: تفيد بأن مواد الرش الثمانية إنتظمت فى ثلاث مجموعات : الأولى الأقوى تأثيراً وهي : تضم زيت الزنجبيل والثوم والزعتر بنسبى 58.33 ، 53.33 ثم 52.22% على الترتيب ومجموعة ثانية ذات تأثير متوسط هى زيت بذرة عباد الشمس وزيت بذرة القطن الخام وزيت بذرة الكتان بنسبة 46.95 ، 35.00 ثم 34.45% على الترتيب .

وكان زيت الماندرين والريحان هما أقل الزيوت تأثيراً حيث سجلا نسب موت 31.06% ، 33.61% على الترتيب وجاء ترتيبهما مباشرة قبل معاملة المقارنة (الرش والغمر بالماء).

ب- نتائج التجربة الحقلية: اظهرت تفوق زيت الثوم فى قتل الأفراد بنسبة 81.8% متبوعاً - ويفارق محسوس - بزيت الزعتر 31.6% بينما لم يظهر زيت الزنجبيل فى الحقل تأثيراً واضحاً.