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Comparative efficacy of botanical and chemical insecticides for the management of onion thrips, *Thrips tabaci* Lind.

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Abstract

An experiment was conducted at Qaliubiya Governorate during 2016 and 2017 onion seasons to evaluate the efficacy of different chemical and botanical materials for the management of onion thrips (*Thrips tabaci* Lind) (Thysanoptera: Thripidae) infesting onion bulb crop. Five treatments (two chemical insecticides, three botanical materials and control) were replicated four times. The chemical insecticides were actara 25 WG and diazinox 5%. All the materials used caused, significantly, higher reduction in *T. tabaci* population than the untreated check. Lemon oil proved the best showed (45.89 and 38.62% reduction), followed by neem oil (32.68 and 29.76%) and actara 25 WG (30.65 and 28.81%) during both studied seasons, respectively. The remaining insecticides showed lower percentages of thrips reduction, although those caused but were significantly, better results than control. The results recorded on yield, showed significant relationship between the incidence of the pest and the efficacies of applied materials which effected the yield quantity and quality.

Key words: chemical, botanical materials management onion *Thrips tabaci* Lind.

Introduction

Onion thrips, *Thrips tabaci* Lind. (Thysanoptera: Thripidae), is one of the most important insect pests of onion, *Allium cepa* Linnaeus in Egypt. High populations of *T. tabaci* can damage the leaves of onion in the field resulting in reduced crop yields (Edelson *et al.* 1989).This insect species is a highly polyphagous, it causes direct and indirect effects on plant development and health (Trdan *et al.*, 2006; Fail, *et al.*, 2013).

The adults and larvae of *T. tabaci* feed on epidermal and sub-epidermal cells of both meristematic and mature leaf and flower tissues, inhibiting plant growth and development and causing necrotic or light-reflective blotches on the tissue. Furthermore, they indirectly damage plants by transmitting the viruses such as the tomato spotted wilt virus (Jenser *et al.*, 2003).

The widespread use of chemical insecticides to control *T. tabaci* has led to increasing resistance against the major classes of synthetic insecticides (Macintyre - Allen *et al.*, 2005).

There are many compounds could be used as natural pesticides. Among the sources of botanical pesticides, pyrethrins from pyrethrum plants ((*Chrysanthemum cinerariaefolium*) represent one of the economically most important classes of compounds with broad usage in organic agriculture (Casida, 1973). Among botanicals, neem is widely used today in integrated pest management in various formulations in several countries around the world (Isman, 2006; Trdan *et al.*, 2007).

The present work was carried out to compare the influence of the chemical and natural materials against the onion thrips in the field.

Materials and Methods

For evaluating effectiveness of different chemicals and botanical materials against *T. tabaci*, an experiment was conducted in Completely Randomized Design (CRD) with five treatments and an untreated check. The materials used were lemon oil, neem oil, and capsicum oil in addition to actara 25 WG (Thiamethoxam) 0.25 g/L, and diazinox 5% Gr.

In both studied seasons, the experimental area was about 1050 m^2 planted with onion seedlings (Giza 20 Variety) on the 15th and 18th of December for two seasons, respectively. The whole area was divided into 24 plots (each plot was 42 m^2). Four plots were adopted for each treatment. All the usual agricultural practices were followed except for keeping the whole area free from any other insecticidal treatments.

Plots were separated by approximately 1.0 meter to avoid contamination by drift of spraying. Other 4 plots were left without any treatment as a check.

Materials from plant origin were applied using knapsack sprayer were assayed, while chemical insecticides were added to soil before irrigation directly. These treatments were applied during two successive seasons.

The trial started on March 15th and 18th for 2016 and 2017 seasons, respectively when the population of *T. tabaci* (adult and nymph) is known to be high.

Samples were randomly chosen and directly inspected as 10 plants from each plot. Spraying of the materials was carried out in the early morning with counted alive nymphs and adults on a white paper before spraying and also with 1, 3, 7 and 10 days after treatment.

Reduction percentages of population were obtained and corrected according to the equation of Handrson and Tilton (1955).

$$\% \text{ Reduction} = \left\{ 1 - \frac{\text{Treatment after x control before}}{\text{Treatment before x control after}} \right\} \text{X100}$$

The insecticides used were as follows:-

Table 1. List of treatments and rates of applications.

Treatments	Rate of application
Lemon oil (plant oil)	100 ml /20 L.
Neem oil (plant oil)	100 ml /20 L.
Actara 25 WG (Thiamethoxam), 0.25g/L	350 gm /feddan (soil)
Diazinox 5% Gr (Organophosphorus)	8.0 kg /feddan (soil)
Capsicum oil	100 ml /20 L.

After harvest, the bulb yield (in kg) was weighed for each plots and hence for each treatment. Based on these yields, estimated yield / feddan were calculated for each treatment.

Data Analysis

Data collected were analyzed using SAS 9.2 software and least significant difference (L.S.D) was used for treatment mean comparison.

Results and Discussion

Effect of some chemical and botanical insecticides on *Thrips tabaci* infesting onion.

A) First season 2015/2016:

The results in (Table 2) show the mean number of onion thrips /plant and their respective reduction percentages caused after 24 hours from using materials and also after 3, 7 and 10 days from spraying. All the evaluated materials against thrips on onion crop were significantly better than the control plots. After 24 hrs of spraying, lemon oil caused 80.18 % reduction followed by actara 25 WG (49.68 %), neem oil (41.68 %), diazinox 5% Gr (22.99 %) and capsicum oil (20.94 %). Three days after treatment, the highest reduction percent was recorded for actara 25 WG (47.89%) followed by lemon oil (44.73 %) while the lowest reduction percent was recorded for diazinox 5% Gr (30.1 %) followed by capsicum oil (22.13 %). After 7 days from treatment, reduction percent was high in plots treated with lemon oil and neem oil (40.06 and 37.6%, respectively). On the other hand, the remaining insecticides showed lower reduction percentages, although those were significantly better than control. After ten days, highest reduction percentage was also recorded from lemon oil treatment (18.6 %), while lowest reduction percent was observed again for capsicum oil (1.89 %).

B) Second season 2016/2017:

The results in Table (3) demonstrated the mean numbers of onion thrips per plant and reduction percentages caused after application of different materials during the second season. All of the evaluated materials against *T. tabaci* were significantly better than the control plots. After 24 hrs of spray, lemon oil caused the highest reduction in thrips counts (50.45%), followed by actara 25 WG (49.71%), neem oil (41.3%), diazinox 5% Gr (22.44%) and capsicum oil (20.58%). After 3 days, the highest reduction percent was recorded for lemon oil showed (44.89%) followed by actara 25 WG (39.02%), neem oil (26.12%) and diazinox 5% Gr (15.82%) while the lowest reduction percent was recorded for capsicum oil (7.4%). After 7 days, highest reduction percent was recorded for lemon oil (40.41%) followed by neem oil (38.22%), actara 25 WG (23.64%), capsicum oil (21.4 %) and lowest value of (20.08%) was shown by diazinox 5% Gr. After ten days, the same trend was detected.

The results obtained in this study are in quite conformity with the findings of previous workers who used synthetic insecticides for management of the onion thrips in different parts of the world and got a considerable a knockdown effect (Gandhale *et al.*, 1984; Kisha, 1979 and Hussain *et al.*, 1997). Salem *et al.* (2016) stated that the lemon oil and neem oil extracts showed superior efficiency in the management of *T. tabaci* in the field.

The results on yield showed significant relationship between the incidence of the pest and materials applied which effected the yield quantity and quality. The untreated plots recorded the highest number of damaged leaves and least total yield and were significantly inferior compared to the other treatments applied. Lemon oil extract appeared as the most important botanical extract for controlling onion thrips. The overall mean yield amounts for both seasons were 16.65; 16.25; 15.8. 14.95 and14.2 ton/feddan recorded in plots treated with lemon oil; actara 25 WG; neem oil; diazinox 5% Gr and capsicum oil, respectively (Table 4).

Bulb yields did not show significant differences between the lemon oil, neem oil and actara 25 WG treated plots, however, these results were significantly greater than those weighed from capsicum oil treated and untreated plots during first season. On the other hand, the same trend was detected during second season

Table 2. Mean number of onion thrips per plant and reduction percent after spray at various intervals during first season (2015/2016):

Treatments	Population / plant before spraying	Population / plant after spraying				% Reduction after				Overall mean
		24 h.	3 days	7 days	10 days	24 h.	3 days	7 days	10 days	
Lemon oil	15.27	2.47d	5.60c	7.73b	11.10	80.18	44.73	40.06	18.60	45.89
Neem oil	14.83	7.33bc	7.60b	7.70b	11.63	41.68	38.54	37.60	12.90	32.68
Actara 25 WG	12.87	5.40c	5.47c	8.37b	11.30	49.68	47.89	22.80	2.23	30.65
Diazinox 5% Gr.	13.17	8.50b	7.80ab	8.97ab	10.17	22.99	30.10	19.43	13.90	21.61
Capsicum oil	13.43	8.97b	8.73ab	8.97ab	11.77	20.94	22.13	20.54	1.89	16.38
Control	13.43	11.33a	9.33a	11.27a	12.00					
LSD	2.65	2.18	1.59	2.37	2.24					

*Values with the same letter in a column are not significantly different at 5% level of probability (One way ANOVA).

Table 3. Mean number of onion thrips per plant and reduction percent after spray at various intervals during second season (2016/2017).

Treatments	Population / plant before spraying	Population /plant after spraying				% Reduction after				Overal l mean
		24 h.	3 days	7 days	10 days	24 h.	3 days	7 days	10 days	
Lemon oil	15.33	6.27c	5.67c	7.83b	11.23	50.45	44.89	40.41	18.71	38.62
Neem oil	14.93	7.43bc	7.67b	7.80b	11.73	41.30	26.12	38.22	13.40	29.76
Actara 25 WG	12.97	5.53c	5.53c	8.47b	11.30	49.71	39.02	23.64	2.88	28.81
Diazinox 5% Gr.	13.23	8.50b	7.90b	9.03b	10.27	22.44	15.82	20.08	14.43	18.19
Capsicum oil	13.53	9.07ab	8.80ab	9.07b	11.87	20.58	7.40	21.40	2.47	12.96
Control	13.50	11.27a	9.50a	11.50a	12.17					
LSD	2.61	2.20	1.57	2.20	2.09					

*Values with the same letter in a column are not significantly different at 5% level of probability (One way ANOVA).

Table 4. Mean weight of onion yield (ton /feddan) during two seasons.

Treatments	Mean yield of feddan/ton		Overall Mean
	2015/2016	2016/2017	
Lemon oil	16.7 a	16.6 a	16.65
Actara 25 WG	16.5 ab	16.0 ab	16.25
Neem oil	16.3 ab	15.3 abc	15.8
Diazinox 5% Gr.	15.1 bc	14.8 bc	14.95
Capsicum oil	14.5 c	13.9 cd	14.2
Control	13.0 d	12.8 d	12.9
LSD	1.42	1.65	

*Values with the same letter in a column are not significantly different at 5% level of probability (One way ANOVA).

It could be concluded that, lemon oil is the most effective material and can trustfully be incorporated into the management of the pest.

Conclusion and Recommendations

The previously explained results indicated that, lemon oil could be considered as the best treatment against *T. tabaci* infesting onion fields. It can trustfully be incorporated into the management

programs of the pest. The onion should be regularly monitored of thrips attack and if the number of thrips individuals increased to 20 thrips per plant, at that time, the crop should be sprayed with recommended insecticides at the recommended concentration. Spraying can be repeated whenever thrips population exceeds this number.

Also, the results showed that the application of insecticides of plant origin on onion crop at bloom stage significantly ($P< 0.05$) reduced the adult populations of *Thrips tabaci* Lind., when compared with untreated plots. Thus confirming the importance of technology in the management of this pest. The use of botanical extracts (crude or extracts) for pests control or avoidance of crops infestation has been recorded as one of the oldest highly successful methods. The high effect of the treated materials could be attributed to insecticidal properties they contain that are lethal to a wide range of insects including thrips. Concerning the high effect of neem oil or lemon oil may be attributed to its genetic property that posses better insecticidal properties that enhanced its performance (Salem *et al.*, 2016}.

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مقارنة تاثير بعض الزيوت النباتية وبعض المبيدات الكيميائية فى مكافحة تربس البصل

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اجريت بعض التجارب بمحافظة القليوبية لتقييم بعض المواد ذات الاصل النباتى وبعض المبيدات الكيميائية فى مكافحة تربس البصل على محصول البصل خلال موسمى ٢٠١٦ ,٢٠١٧.

تم تطبيق ست معاملات شملت (مبيدان كيميائيان وهما أكتارا و الديازينوكس بالاضافة إلى ثلاث زيوت نباتية وهم زيت الليمون, زيت النيم و زيت الشطة).

أظهرت النتائج ان كل المواد المستخدمة ادت الى تقليل أعداد الافة عن المقارنة.

كما أظهرت النتائج أن زيت الليمون أدى الى افضل النتائج فى تقليل أعداد الافة حيث كانت نسب خفض التعداد (٤٥.٨٩ ,٣٨.٦٢%) تلاة فى ذلك زيت النيم (٣٢.٦٨ ,٢٩.٧٦ %) المبيد الكيميائى اكتارا (٣٠.٦٥ ,٢٨.٨١%) وذلك خلال موسمى الدراسة على التوالى فى حين أن المواد المتبقية أدت الى أقل نسب خفض التعداد للافة ولكن كانت نتائجهم أفضل من الكونترول.

أظهرت النتائج أيضاأن متوسط محصول البصل خلال موسمى الدراسة كان ١٦.٦٥ , ١٦.٢٥ , ١٥.٨, ١٤.٩٥ و ١٤.٢ طن / فدان سجلت للقطع المعاملة بزيت الليمون, المبيد الكيميائى اكتارا, زيت النيم, المبيد ديازينوكس واخيرا زيت الشطة, على التوالى.

كما أظهرت النتائج ايضا أنة كانت هناك علاقة معنوية بين تعداد الافة وتلك المواد المستخدمة والتى أدى أستخدامها الى زيادة المحصول كما ونوعا.