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Different Methods of Management Certain Substances to The Colored Pepper Crop in The Greenhouse to The Number of Western Flower Thrips *Franklaniella Occidentalis* (Pergande)

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ABSTRACT

Experiment was conducted during the spring seasons of 2021 and 2022 in the plastic house at North-South oriented at the experimental farm of Horticultural Research Stations Qaha, Qalyubia Governorate. The study aims to compare different methods of Management certain substances to the colored pepper crop in the greenhouse to the number of Western Flower Thrips (*Franklaniella occidentalis* (Pergande)) this pest was attacking a wide spectrum of economic plants, causing great losses in their yield. Results showed that, *Franklaniella occidentalis* (Pergande) nymphs and adults had two seasonal generations during two seasons, the first generation occurred between early-April to end-April and the second generation was occurred between early- May to early – June. Using different treatments systemic pesticide (Ochen soil applied, Ochen foliar applied, Lannate soil applied, Lannate foliar applied, Movento soil applied, Movento foliar applied, Super tox soil applied, Super tox foliar applied, Dimethoate soil applied and Dimethoate foliar applied) were recorded in 2022 season (Movento soil applied and Dimethoate soil applied shows high mortality Therefore, it is preferable to use soil spraying. Lannate foliar applied indicated a low mortality effect on pest population.

Keywords: plastic house, Management, colored pepper, *Franklaniella occidentalis*, Western Flower Thrips, systemic pesticide.

1. Introduction

One of the most devastating insect pests of greenhouses is the western flower thrips, Frankliniella occidentalis (Pergande) (Thysanoptera: Thripidae), which is well-known among greenhouse growers in Egypt and across the world. The Western flower thrips (WFT) is the most common species of thrips that greenhouse growers encounter. It is highly polyphagous and feeds on a variety of horticultural crops grown in both commercial and research greenhouses (Brodsgaard 1989; Gerin *et al.*, 1994; Helyer *et al.,* 1995; Tommasini and Maini 1995; Parrella and Murphy 1996; Lewis 1997). Although this insect pest has been mentioned in pamphlets on greenhouse pest control since 1949, it wasn't until the 1980s that it was recognized as a significant pest of crops cultivated in greenhouses (Glockemann 1992; Jensen 2000; Brodsgaard 2004). According to research done by Shipp *et al.*, in 1991 this insect is known to feed on more than 500 species in 50 families and is connected to several greenhouse vegetable crops, particularly sweet peppers (*Capsicum anuum*). Western flower thrips which first detected in Egypt in 2005 on ornamental as well as weeds in Giza governorate (Abeer *et al*., 2011) was recently recorded on cucumber and sweet pepper grown in plastic houses in Qaha region Qalubia governorate in 2012 can case direct damage to sweet pepper by feeding on leaves, fruits or flowers. Feeding injury from thrips on leaves may affect leaf size; affect carbon allocation in the plant (Shipp *et al*., 1991and Mona *et al*., 2017) results in the fruit becoming bronzed and silvered. According to some farmers' observations, Western flower thrips not only directly harm flowers but also indirectly harm greenhouse producers by dispersing the most dangerous viruses, like tomato spotted wild viruses. As a result, farmers spray conventional contact insecticides heavily and frequently to control WFT. Due of the possibility of thrips

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populations developing pesticide resistance, the method is frequently challenging and not particularly successful. Kontsedalov *et al*., 1998 and active stages of thrips prefer enclosed area such as buds, flowers, under calyx of fruits and in newly opening leaves (Jensen 2003; Weinta 2007) the principal management strategy used to deal with WFT in greenhouses involves the use of insecticides (Parrella and Murphy 1996; Lewis 1997; Herron and James 2005). The key to WFT management with insecticides is too initiate applications when populations are "low," which avoids dealing with different age structures or life stages – eggs, nymphs, pupae, and adults – simultaneously over the course of the crop production cycle. Once WFT populations' reach "high" levels, then more frequent applications at three to five day intervals may be required. Insecticides must be applied prior to WFT entering terminal or flower buds, as once they do, it is very difficult to obtain adequate control, and thus prevent injury. Insecticides with contact or trans laminar activity are generally used to control or regulate WFT, because systemic insecticides typically do not move into flower parts (petals and sepals) where WFT adults normally feed (Daughtrey *et al*., 1997; Lewis 1997; Cloyd and Sadof 1998).

The objective of this experiment was compare the effectiveness of soil and foliar application methods of the five selected insecticides for control flower thrips. on sweet pepper plants under greenhouse conditions.

2. Material and method

2.1. Field experiment

Experiment was conducted during the spring seasons of 2021 and 2022 in a plastic house measuring (9 x 60 x 4) (North- South oriented at the experimental farm of Horticultural Research Stations Qaha, Qalyubia Governorate. The plastic house area was divided into fire-parallel double rows with a distance of 110 cm between each pair of rows on 22nd February of two seasons 2021 and 2022 colored pepper seedlings were transplanted into raised beds with black mulch with drip irrigation under normal agricultural practices. Inspection was started 15 days after sowing and continued weekly till the harvest period. Numbers of (*Franklaniella occidentalis*) nymphs and adults were counted on ten flowers were collected randomly per replicate at the early morning. These Samples were kept in paper bag and transferred to examine in the laboratory and were kept in paper bag and transferred to examine in the laboratory and count the numbers of investigated pests.

2.2. Number and duration of generations:

The number of Western Flower Thrips *Franklaniella occidentalis* on sweet pepper flower weekly were count throughout two successive seasons and was taken in consideration to estimate the number and duration of seasonal field generations of different pests on sweet pepper at Qaha- Qalubiya Governorate. The method suggested by Audemard and Milaire (1975) and emulated by Iacob (1977) was applied. The graphical representation of figures on semi-Gaussion paper (scale Gauss) shows the number of generations for each species represented by regression lines.

Toxicity of certain compound

Five treatments including the control were distributed in a complete randomized block design replicated four times. Each plot had 24 plants in double rows that were 50 cm apart on the bed, with 50 cm between plants in the rows. Two plants from the beginning and end of each row was considered the borderline between each two plots. Recommended cultural practices for colored pepper were followed throughout the season. Plots were initially sprayed on (12nd of April.) when the density of thrips averaged 20 / one flower. An additional application was made 3 time about ten days for different application (foliar and soil). Foliar applications were applied with a hand-held spray mister until that flowers were wet, while soil application were done via a soil drench. The insecticide required for soil application for 24 plants (plot) was mixed with 2400 ml of water and poured over the row (100ml/ plant). The flowing ten treatments were evaluated, soil and foliar applied (Table 1).

Table 1: Control agent's treatment.

Trade name	Common name	Soil applied rate / 20 liter water	Foliar applied rate / 20 liter water
Lannate	Methomyl 90% SP	30 gm	15 gm
Dimethoate	Organophosphorus 40% EC	50 ml	30 cm
Movento	Spirotteramat SC	30cm	16 cm,
Ochen	Dinotefuran 20% SG	24 gm	12 gm
Super tox	Neonicotinoid, Clothianidin 48% SC	20 ml	10 cm
Control plants (without any applied)		--	--

Sampling was done just before treatment and also 2, 4, and 7 days after treatment for sampling five open flowers were randomly collected from each plot, wrapped in a paper, towel to prevent moisture build up, placed into ice box and return to the laboratory. Flowers were examined within 24 hours of collection under a stereomicroscope. The nymph and adult stages were recorded. The efficacy was evaluated based on Henderson and Tilton (1955). F value Analysis of variance of mean efficacy of treatments was done in SAS, followed by Duncan.

3. Results and Discussion

3.1. Number and duration of generations of *Franklaniella occidentalis* (Pergande) infesting sweet pepper under greenhouse conditions.

Results in Table 2, Fig. 1, revealed that, *F. occidentalis* nymphs and adults had two seasonal generations during the 2021 season, the first generation occurred between early-April to end-April and lasted for about 24 days, the second generation was occurred between early-May to early–June and lasted also for about 30 days. Data revealed that *F. occidentalis* nymphs and adults had the same at two seasonal generations in the season during 2022 season the first generation occurred between early-April to early-May and lasted for about 30 days, the second generation occurred between Mid-May to early–June and lasted also for about 23 days (Table, 2 and Fig. 2).

These results were in line with those obtained by Cherif *et al*. (2013), Ibrahim *et al*. (2016) and Mona *et al*. (2017).

Table 2: Approximated numbers and duration of seasonal generations of *F. occidentalis* nymphs and adults on colored pepper at Qaha, Qalubiya Governorate during 2021 & 2022 seasons.

	2021			2022		
No. of	**Approximated date of occurrence**		**Duration**	**Approximated date of occurrence**		**Duration**
Generations	From	To	in days	From	To	in days
First	5 April.	26 April	23 days	5, April.	3- May	30 days
Second	3 May.	1- June	30 days	10 May.	1- June	23 days

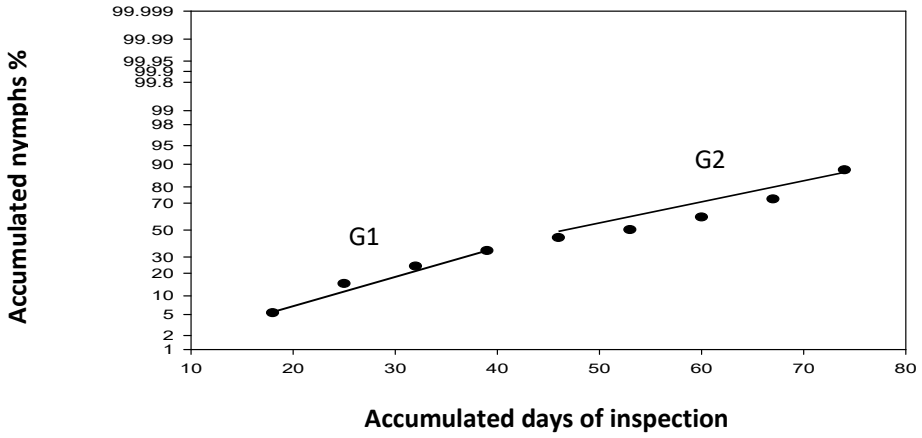

Fig. 1: The sequence of annual generations of *F. occidentalis* nymph and adults on sweet pepper at Qaha, Qalubiya Governorate during 2021.

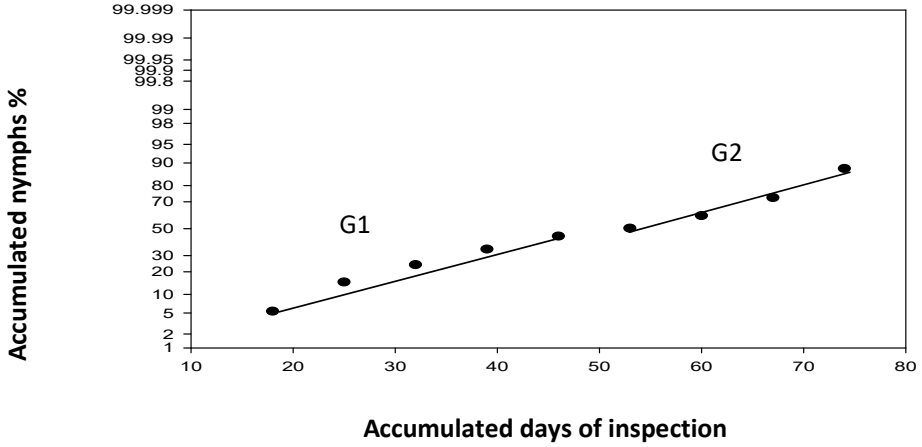

Fig. 2: The sequence of annual generations of *F. occidentalis* nymph on sweet pepper at Qaha, Qalyubia Governorate during 2022.

3.2. The efficiency of control agents on *F. occidentalis* (Pergande) nymphs and adults

Gradual reduction percentages of *F. occidentalis* numbers as a result of systemic pesticide (Ochen soil applied, Ochen foliar applied, Lannate soil applied, Lannate foliar applied, Movento soil applied, Movento foliar applied, Super tox soil applied, Super tox foliar applied, Dimethoate soil applied and Dimethoate foliar applied) were recorded in 2022 season (Tables 3-6).

3.2.1. First spray

Data indicated significant differences between the ten compounds where F. value = 29.61 and L.S.D = 0.31%. These compounds could be divided into ten groups. The first group contained on Movento foliar applied to show a high mortality 80.77%, The second, third, fourth and fifth group contained Dimethoate soil applied, Movento soil applied, Dimethoate foliar applied, Super tox soil applied, Lannate foliar applied, showing a moderate effect of 79.15%, 78.57%, 78.28%, 72.38% and 70.88%, respectively. The Ochen soil applied, Lannate soil applied and Ochen foliar applied, Super tox foliar applied showed low effect of 69.97%, 68.92%, 68.37% and 63.60%, respectively Table (3, Fig 3).

Table 3: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on first spray at Qaha, Qalubiya Governorate during 2022.

Treatments	Rat /20L Water		No. of insects Pre-Spray		Fist spray						Mean Mortality %
					After 2 days		after 4 days		after 7 days		
			Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	
Ochen soil applied	24gm	Mean	13	6	4	1	4.6	2.4	4	1.8	2.97
		Mortality %	--	--	68.3	75.2	65.6	74.2	57.8	78.7	69.97 G
Ochen foliar applied	12 gm	Mean	10	5.4	5	0.6	4.4	1.2	3.2	1.6	2.67
		Mortality %			48.5	83.5	57.3	85.7	56.2	79.0	68.37 I
Lannate soil applied	30 gm	Mean	11.2	10.8	4.2	2	5	3.4	2.8	3.4	3.47
		Mortality %			61.3	72.4	56.7	79.7	65.8	77.6	68.92 H
Lannate foliar applied	15 gm	Mean	6.6	5	2	0.6	2	1.6	2	2.4	1.77
		Mortality %			68.8	82.1	70.6	79.4	58.5	65.9	70.88 F
Movento soil applied	30 cm	Mean	7	6.8	1.2	1.2	1.4	2.6	1	2	1.57
		Mortality %			82.3	73.7	80.6	75.3	80.4	79.1	78.57 C
Movento foliar applied	16 cm	Mean	5.8	6	1.2	1	0.8	0.8	1	2	1.13
		Mortality %			78.7	75.2	86.6	91.4	76.4	76.3	80.77 A
Super tox soil applied	20cm	Mean	5	6.8	1	1.6	1.2	2.6	1.2	2.8	1.73
		Mortality %			79.4	65.0	76.7	75.3	67.1	70.8	72.38 E
Super tox foliar applied	10 cm	Mean	7.2	3.4	2	1.2	2.6	1.6	1.8	1.8	1.83
		Mortality %			71.4	47.5	64.9	69.6	65.8	62.4	63.60 J
Dimethoate soil applied	50 cm	Mean	9	3.8	1.4	0.6	1.6	1.4	1.2	1.4	1.27
		Mortality %			84.0	76.5	82.7	76.2	81.7	73.8	79.15 B
Dimethoate foliar applied	30 cm	Mean	8.6	4	1.4	0.4	2.0	1.2	2.0	1.4	1.40
		Mortality %			83.2	85.1	77.4	80.7	68.1	75.2	78.28 D
Control	---	Mean	13.4	8	13	9	13.8	12.4	9.8	11.2	11.53

F value =29.61*** L.S.D= 0.31

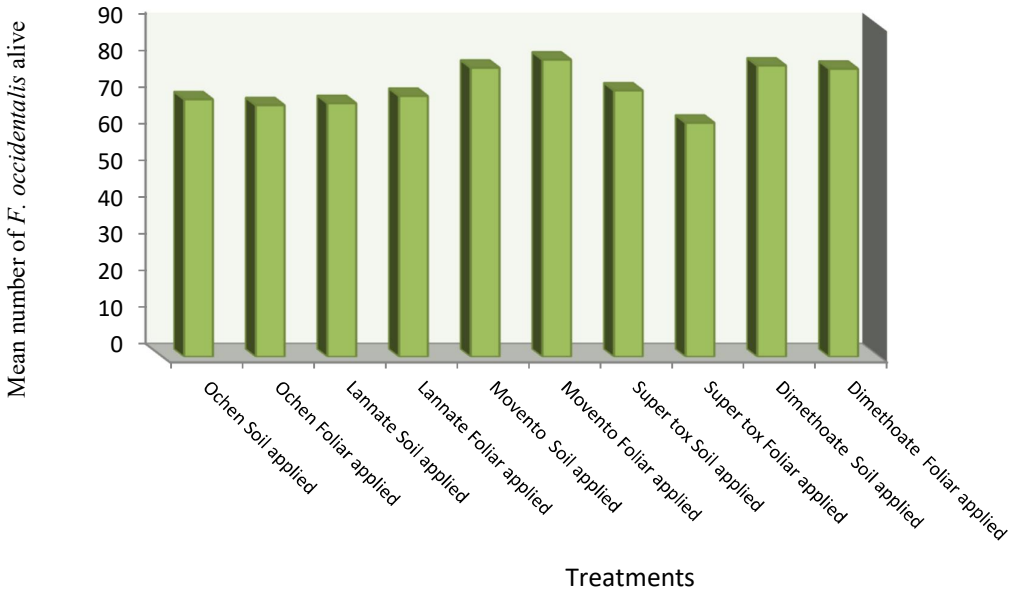

Fig. 3: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on the first spray at Qaha, Qalubiya Governorate during 2022.

3.2.2. Second spray

Data showed significant differences between the ten compounds where F. value = 35.20 and L.S.D = 0.30%. These compounds could be divided into eight groups. The first and second groups contained on Super tox soil applied, Movento soil applied, showing high mortality (86.73% and 85.61%), respectinely. The third, fourth and fifth groups contained Movento foliar applied, Ochen soil applied, Dimethoate soil applied, Super tox Foliar and Ochen foliar applied, showing moderate effects 84.37%, 82.83%, 82.67%, 78.9% and 78.75%, respectively. The Dimethoate foliar applied, Lannate

soil applied and Lannate foliar applied showed low effect 72.13%, 70.98% and 70.2%, respectively. Table (4, Fig 4).

Table 4: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on second spray at Qaha, Qalubiya Governorate during 2022.

Treatments	Rat /20L water		No. of insects Pre-Spray		Second spray After 2 days		After 4 days		After 7 days		Mean Mortality %
			Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	
Ochen Soil applied	24gm	Mean	13	6	2.6	1.6	2.4	2.2	0.8	0.6	1.7
		Mortality %			73.2	83.6	74.8	80.5	93.4	90.5	82.67 D
Ochen foliar applied	12 gm	Mean	10	5.4	2.2	1	2	1.6	2.4	1	1.7
		Mortality %			70.5	88.6	72.7	84.2	74.1	82.4	78.75 E
Lannate soil applied	30 gm	Mean	11.2	10.8	2.4	3.6	2.4	4.8	3.8	4	3.5
		Mortality %			71.3	79.5	70.7	76.3	63.4	64.7	70.98 G
Lannate foliar applied	15 gm	Mean	6.6	5	1.2	1.6	1.4	2	2.6	2.2	1.83
		Mortality %			75.6	80.3	71.0	78.7	57.5	58.1	70.2 H
Movento soil applied	30 cm	Mean	7	6.8	0.8	1.6	0.4	1.6	1.8	0.6	1.13
		Mortality %			84.7	85.5	92.2	87.5	72.2	91.6	85.61 B
Movento foliar applied	16 cm	Mean	5.8	6	0.8	1	0.6	1.8	1.2	0.8	1.03
		Mortality %			81.5	89.8	85.9	84.0	77.7	87.3	84.37 C
Super tox Soil applied	20cm	Mean	5	6.8	0.6	2	0	1.8	0.8	1	1.03
		Mortality %			83.9	81.9	100	85.9	82.7	86.0	86.73 A
Super tox foliar applied	10 cm	Mean	7.2	3.4	1	0.8	1.6	0.6	0.2	0.8	0.83
		Mortality %			81.4	85.5	69.6	82.2	97.0	57.7	78.9 E
Dimethoate Soil applied	50 cm	Mean	9	3.8	0.8	1.4	0.0	0.6	0.4	0.6	0.63
		Mortality %			88.1	77.3	100	77.2	95.2	59.2	82.83 D
Dimethoate foliar applied	30 cm	Mean	8.6	4	1.4	1.8	1.6	2.0	2.2	1.6	1.77
		Mortality %			78.2	72.3	74.6	73.4	72.4	61.9	72.13 F
Control	---	Mean	13.4	8	10	13	9.8	15	12.4	8.4	11.43

F value = 35.29*** L.S.D=0.30

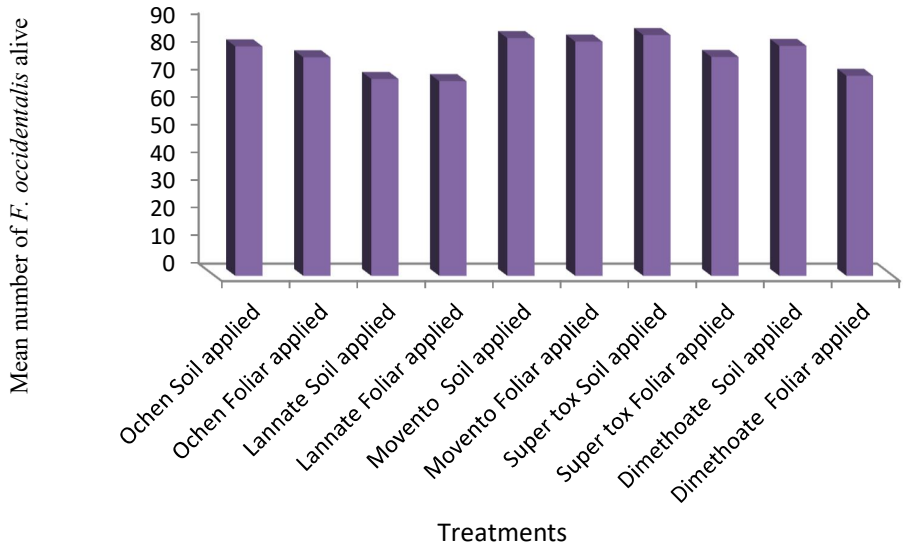

Fig. 4: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on second spray at Qaha, Qalubiya Governorate during 2022.

3.2.3. Third spray

Data indicated significant differences between the ten compounds where F. value = 14.05 and L.S.D = 0.66%. These compounds could be divided into nine groups. The first and second groups contained on Movento soil applied and Dimethoate soil applied showing high mortality (95.38% and 92.65%), respectively. The third, fourth and fifth groups contained Dimethoate foliar applied, Super tox soil applied, Super tox foliar applied and Movento foliar applied showing moderate effects 87.20%,

86.03%, 82.15% and 81.65%, respectively. The Ochen soil applied, Ochen foliar applied, Lannate foliar applied and Lannate soil applied showed low effects 78. 35%, 74.87%, 72.68% and 69.33%, respectively Table (5, Fig 5).

Table 5: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on third spray at Qaha, Qalubiya Governorate during 2022.

Treatments	Rat /20L water		No. of insects Pre-Spray		Third spray After 2 days		after 4 days		after 7 days		Mean Mortality %
			Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	
Ochen soil applied	24gm	Mean	13	6	1.6	1.4	0.8	2	1.2	1.6	1.43
		Mortality %			83.5	76.7	89.9	73.9	75.3	70.8	78.35F
Ochen foliar applied	12 gm	Mean	10	5.4	1.4	0.8	1.6	1	1.8	1.4	1.33
		Mortality %			81.2	85.2	73.9	85.5	51.8	71.6	74.87 G
Lannate soil applied	30 gm	Mean	11.2	10.8	2.2	2.2	2.4	2.8	1.4	2.30	2.30
		Mortality %			73.7	79.6	65.0	79.7	66.5	71.6	72.68 H
Lannate foliar applied	15 gm	Mean	6.6	5	1.4	1.2	1.6	1.6	1	1.2	1.33
		Mortality %			71.6	76.0	60.4	74.9	59.4	73.7	69.33 I
Movento soil applied	30 cm	Mean	7	6.8	0	0.2	0	1.6	0	0.4	0.37
		Mortality %			100	97.1	100	81.6	100	93.6	95.38 A
Movento foliar applied	16 cm	Mean	5.8	6	0.8	0.6	0.6	1	0.8	0.8	0.77
		Mortality %			81.5	90.0	83.1	86.9	63.0	85.4	81.65E
Super tox soil applied	20cm	Mean	5	6.8	0	0.6	0.6	1	0.4	1.4	0.67
		Mortality %			100	91.2	80.4	88.5	78.6	77.5	86.03 D
Super tox foliar applied	10 cm	Mean	7.2	3.4	0	0.6	0.4	0.8	0.8	1	0.60
		Mortality %			100	82.4	90.9	81.6	70.2	67.8	82.15 E
Dimethoate soil applied	50 cm	Mean	9	3.8	0.4	0.6	0.0	0.8	0.0	0.2	0.33
		Mortality %			94.0	84.2	100	83.5	100	94.2	92.65 B
Dimethoate foliar applied	30 cm	Mean	8.6	4	0.2	0.4	0.8	0.6	1.0	0.2	0.53
		Mortality %			96.9	90.0	84.8	88.2	68.8	94.5	87.20 C
Control	---	Mean	13.4	8	10	8	8.2	10.2	5	7.3	8.12

F value = 14.05 *** L.S.D= 0.66

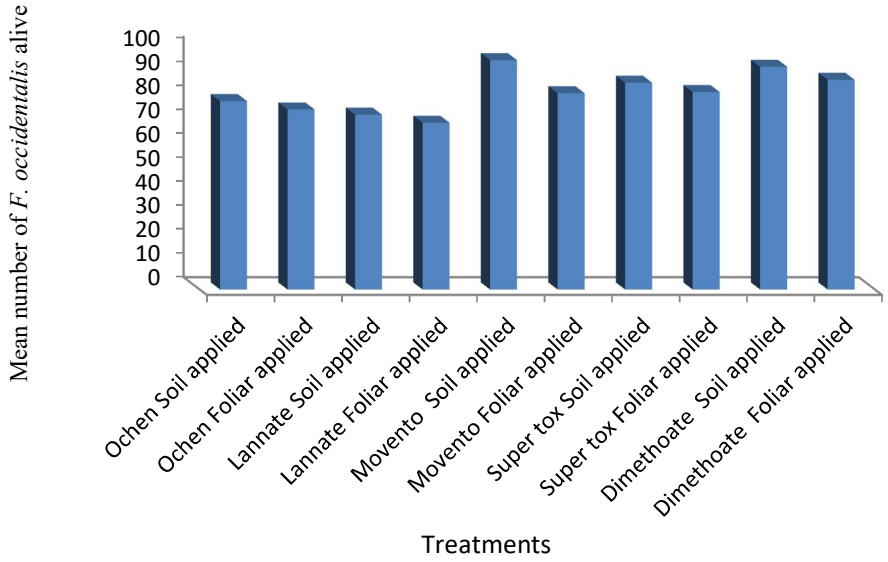

Fig. 5: Mean reduction percentage of *F. occidentalis* alive nymphs and adults/ Flower on colored pepper plants on third spray at Qaha, Qalubiya Governorate during 2022.

3.3. General mean reduction percentage of *F. occidentalis* (Pergande).

Data showed significant differences between the ten compounds where F. value = 17.31and L.S.D = 3.86%. These compounds could be divided into nine groups. The first and second groups contained on Movento soil applied and Dimethoate soil applied showing high mortality (86.57% and 84.81%), respectively. The third, fourth and fifth groups contained Movento foliar applied, Super tox soil applied,

Dimethoate foliar applied and Ochen soil applied showing moderate effects 82.28%, 81.77%, 79.19% and 77.09%, respectively. The Super tox foliar applied, Ochen foliar applied, Lannate soil applied and Lannate foliar applied showed low effect 74. 72%, 73.91%, 70.88% and 70.21%, respectively. Table (6, Fig 6)

Table 6: General mean reduction percentage of *F. Occidentalis* alive nymphs and adults/ Flower on colored pepper plants on three sprays at Qaha, Qalubiya Governorate during 2022.

Treatments	Rat/20L Water	General mean reduction
Ochen soil applied	Mortality % 24gm	77.09 DE
Ochen foliar applied	Mortality % 12 gm	73.91 EFG
Lannate soil applied	Mortality % 30 gm	70.88 FG
Lannate foliar applied	Mortality % 15 gm	70.21 G
Movento soil applied	Mortality % 30 cm	86.57 A
Movento foliar applied	Mortality %16 cm	82.28 BC
Super tox soil applied	Mortality % 20cm	81.77 BC
Super tox foliar applied	Mortality % 10 cm	74.72 EF
Dimethoate soil applied	Mortality % 50 cm	84.81 AB
Dimethoate foliar applied	Mortality %30 cm	79.19 CD

F value = 17.31*** L.S.D= 3.86%

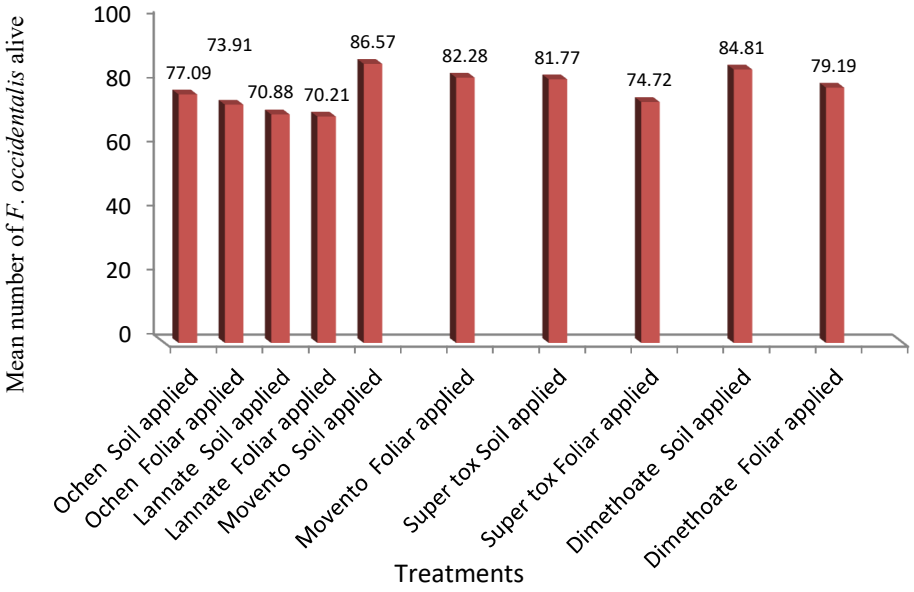

Fig. 6: Mean reduction percentage of *F. occidentalis* alive nymph and adults/ Flower on colored pepper plants on second spray at Qaha, Qalubiya Governorate during 2022.

4. Conclusion

Franklaniella occidentalis. nymph and adults had two seasonal generations during two seasons, the first generation was occurred between early-April. to end- April and the second generation was occurred between early- May to early – June. Using Movento soil applied and Dimethoate soil applied shows high mortality Therefore, it is preferable to use soil spraying. Lannate Foliar applied indicated a low mortality effect on pests population.

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