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Impact of Modern Tactics from Integrated Pest Management and Ecosystem against the Pests Infesting Zucchini Plants

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ABSTRACT

Experiments were conducted in the experimental Farm of Plant Protection Research Institute, Qaha, Qalubiya governorate under field conditions during two successive seasons (2020 and 2021). The aim of this study to impact of the ecosystem on the pests infesting zucchini plants and usage of some modern alternatives as a tactic from integrated pest management. The results illustrated that Whitefly*, Bemisia tabaci*(Genn.), aphid, *Aphis gossypii* Glover ,thrips, *Thrips tabaci* Lind and red spider, *Tetranychus urticae* Koch the most important pest were found on squash plants, these pests are attacking a wide spectrum of economic plants, causing great losses in their yield. Results showed that the key pest *B.tabaci* had the most pests found than *A. gossypi*i , also application of some modern treatments on these pests to research on alternative materials more safety to environment, when using different treatments CP Extra WG %35 and Thiamectin 16.9% SC have a highly significant effect on decreasing pests population infesting squash growth. The mineral oil and plant extract have effect on pests population whereas decreased mean number of pests the most efficiency method compared to control (without treatment).

Keywords: economic plants, squash, treatments, plant extract, ecosystem, mineral oil, integrated control, yield*, Bemisia tabaci* (Genn.) and *Tetranychus urticae* Koch, *Aphis gossypii* Glover and thrips, *Thrips tabaci* Lind .

1. Introduction

Squash (*Cucurbita pepo* L.) is of prime important aspect for local consumption and for export purposes. This crop is infested by many pests, which are causing a considerable damage in either quantity or quality (Ven *et al.,* (2000), Hanafy, A. R. (2004), Hegab (2016) and Ibrahim (2017)). They have established attacking by many important insect pests such as whitefly, *Bemisia tabaci* (Genn.), aphid, *Aphis gossypii* Glover and *cotton thrips, Thrips tabaci* Lind., the nymph and adult stages of these pests, whereas infested Zucchini plants and direct feed on phloem sap and excrete honeydew that hamper photosynthesis and render fruits unmarketable, and they are efficient vectors of plant viruses van de Booij (2003), Efil (2003), Sahu *et al.,* (2005), Emam *et al.,* (2006), Bhatnagar (2007), Anstead *et al.,* (2010), Adriaan *et al.,* (2013) , Liang *et al.,* (2015) and Abdein, M.A.E. (2016). The Tetranychidae mite species *Tetranychus urticae* Koch feed on the plant sap injuring the epidermis resulting in blotching, stippling or bronzing causing serious damage (Park and Lee, 2007) and Deborah *et al.,* (2012) who reported that *B. tabaci* transmit Cucumber Mosaic Virus (CMV) which causes a serious disease of narrow-leafed lupine. Also, aphids cause sporadic yield losses due to direct feeding damage, Marabi *et al.,* (2017) reported that *B. tabaci* is a harmful pest on most vegetable crops, especially cucurbitaceous plants, Zucchini from it,s , where this pest direct feeding causing direct damage by reducing plant vigor, and indirect damage by honeydew secretion and transmission of several viruses. Red spider mite, *Tetranychus urticae* Koch (Fam: Tetranychidae) also consider one of the most important pests infesting squash plants both in the open field and under glasshouse conditions. Derek (2013) reported that *T. urticae* was a serious pest on squash plants under glasshouse conditions. (Abdallah *et al.,* 2014). A

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number of vegetable crops such as tomato, squash, eggplant, cucumber was also subject to *Tetranychus urticae* Koch (Acari: Tetranychidae) infestations occur during summer plantation causing numerous injuries and tremendous yield losses (Kherebe *et al.,* 2015). The aim of this study to impact of the ecosystem on the pests infesting zucchini plants and usage of some modern alternatives as a tactic from integrated pest management.

2. Materials and Methods

Two field experiments were conducted in the Experimental Farm of Plant Protection Research Institute, Qaha plant protection research station, Qalubia governorate during the summer plantation seasons (2020 and 2021). The first one conducted to study the population fluctuation and the population growth rate to *B. tabaci*, *A. gossypii, T. tabaci* and *T. urticae* infesting squash plants, *Cucurbita pepo* (Fam. Cucurbitaceae (variety: Eskandrany) . Seeds were sown in March 15th an area of about 200 m^2 inspection was started 1st April, after sowing about 15 days. Sample of 10 leaves / replicate and take 30th leaves/ treatment, the samples (leaves) were collected randomly at early morning each weekly until the harvest. sample was kept in a tightly closed paper bag and transferred to the laboratory in the same day for inspection under stereomicroscope to count the numbers of *B. tabaci* (nymphs), *A. gossypii, T. tabaci*(nymphs and adults) and *T. urticae*(Individuals) , all the experimental area received the recommended and standard cultivation.

*The total numbers were registered and the mean were calculated number of different pests on cucumber to study the Impact of maximum temperature, Minimum temp.,Mean relative humidity (R.H %) and age of plant on population dynamics of these pests, the simple correlation (r) and the partial regression (b) were calculated between each of the above mentioned factors (Xs) and the weekly mean numbers of these pests. In case of the second experimental, used eight treatments were compared with control which sprayed with water against these pests addition control. The experimental area about 900 m^2 was divided into 36 plots (each plots was 25 m^2). The experimental plots were laid out in a randomized complete block design and each treatment was represented by four plots. Sampling of squash plants started 15 days after sowing and were taken weekly until the end of experiment. In each sampling date, 10 leaves were picked randomly per plot, and the collected samples were kept in tight closed paper bags and transferred to the laboratory for investigation by stereomicroscope to count the numbers of *B. tabaci* (nymphs) and *A. gossypii* (nymphs and adults)/ leaf. Pretreatment counts were done just before application while post-treatment counts were made on days 1, 3, 5, 7,10 and 14 days after treatment. Counts were done in the early morning when flight activity is minimal according to Bulter *et al.,* (1988). Reduction percentages were calculated according to Henderson and Tilton equation (1955). The treatments were compared with each other using one way ANOVA with LSD 0.05 (SAS Statistical Software, 2000).

Table 1: Trade name, common names and field rates.

Trade name	Common name	Rate / 100 liter water
Camphor	Camphoroil	30Cm^3
Sweet basil	Sweet basil oil	30Cm^3
NEAM	Azadirachtin	30Cm^3
Orange oil	Orange oil	30Cm^3
KZ oil EC 95%	mineral oil	100 cm^3
Thiamectin 16.9% SC	Abamectin+ Thiamethoxam	35cm^3
CP ExtraWG %35	Thiamethoxam 15% +Pymetrozine 20%	80 gm
Vertemic EC%1.8	Abamectin	80 cm^3
Control	Sprayed with tap water	----

Ethyl acetate which was used as solvent of the orange oil at 0.5cm 3/L.
Control plants which were sprayed with the tap water.

3. Results and Discussion

3.1. Population fluctuations of some pests infesting squash plants, *Cucurbita pepo under* field conditions.

Study population dynamics of the pests (*B. tabaci* (egg and nymphs), *A. gossypii, T. tabaci* (nymphs and adults) and *T. urticae* (Individuals) infesting squash plant. Data in Table. (2), the results of statistical analysis revealed that there are significant differences between population densities of whitefly, *B. tabaci*, *A. gossypii, T. tabaci* and *T. urticae* Whereas F value = 21.14*** and L.S.D. = 31.80 individuals/360 leaves, could be divided six groups in first season but in the second season could be divided three groups Whereas F value = 21.67*** and $L.S.D_{05}$ = 59.21 individuals/360 leaves.

3.1.1. Bemisia tabaci (Genn.)

Data showed that the population dynamics of *B. tabaci* egg were lower in the first season was 91.5 egg/360 leaves but in the second season indicted that 163.16 egg/360 leaves, the activity period of during first season was expressed by four peaks, the peaks occur in 20th of April, 4th of May, 25th of May and 8th of June were registered 91, 81, 165 and 141 egg/ 30 leaves, respectively. On the other, in the second season the data revealed that presence three peaks in 20th of April, 18th of May and 1st of June were 98, 289 and 301 egg/ 30 leaves, respectively.

Also, data indicated that the population dynamics of *B. tabaci* nymph were lower in the first season was 140.67 individuals/360 leaves but in the second season recorded 253.17 individuals/360 leaves, the activity period of *B. tabaci* nymph during first season was expressed by four peaks, The lower peak was 61 nymph /30 leaves on 13th of April, the second peak in 27th of April was 134 nymph /30 leaves and the higher peaks were277 and 222 nymph /30 leaves, in 1st , 15th of June, respectively. In the second season was expressed by four peaks, the higher peaks were 412 and 416 nymph /30 leaves, in 18th of May and 1st of June, then it comes the third peaks in 22th of June and the fourth peak was lower peak was 121 nymph /30 leaves on 20th of April, respectively.

3.1.2. Aphis gossypii Glover

Data indicated that the population dynamics of *A. gossypii* nymph and adult were lower in the first season,2020 was 44.25individuals/360 leaves but in the second season , 2021, the results indicated that 63.42 individuals/360 leaves, the activity period of *A. gossypii* nymph and adult during first season was expressed by four peaks , the first peak in 27th of April , the second peak in 11th of May, third peak in 1st of June were56,76,90 nymph and adult /30 leaves and the lower peak was 39 nymph and adult /30 leaves ,respectively. In the second season was expressed by one peak, whereas was higher peak 179 nymph and adult /30 leaves, in 8th of May.

3.1.3. Thrips tabaci Lind

Data revealed that the population dynamics of *T. tabaci* nymph and adult were lower one in the first season was 11.5individuals/360 leaves and in the second season showed that 16.67 individuals/360 leaves, the activity period of *T. tabaci* nymph and adult during first season, the population was appeared in 11th of May and recorded two peaks The lower peak was 22 nymph and adult /30 leaves on 15th of June and the higher peak was 43 nymph /30 leaves, in 25th of May, respectively. In the second season was the same two peaks, the higher peaks were 47nymph and adult /30 leaves, in 1st of June, then the lower peak was 39 nymph and adult /30 leaves on 11 of May, respectively.

3.1.4. Tetranychus urticae koch

Data showed that the population dynamics of *T. urticae* egg were lower in the second season was 16.67egg/360 leaves but in the first season the number of egg are increased compared with the second spray recording 20.17 egg/360 leaves, the activity period of during first season was expressed by three peaks, the peaks occur in 4th of April , 1stof June, and 15thof June were 28, 44 and 51 egg/ 30 leaves, respectively.in the second season revealed that three peaks in4th of May, 25th of May and 15thof June were 18, 41 and 66 egg/ 30 leaves, respectively.

Data indicated that the population dynamics of *T. urticae* movable stage were lower in the first season was to 15.92individuals/360 leaves but in the second season the individuals increased to 17.58 individuals/360 leaves, the activity period of *T. urticae* movable stage during first season was note the rounding of the census during the examination and recorded three peaks were34, 35 and 39movable

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stage /30 leaves on 4th of April, 27th of 1st, 15th of June, respectively. In the second season was expressed by two peaks, the higher peaks was49 movable stage /30 leaves, in 8th of June, then the lower peak was 14 nymph /30 leaves on 4th of May, respectively.

Table 2: Population density of pests on squash plants at Qaha, Qalubiya governorate during 2020 season.

Date of inspection	Whitefly, *Bemisia tabaci*		Cotton Aphid, *Aphis gossypii*	Cotton thrips, *Thrips tabaci*	Red spider *Tetranychus urticae*		Physical factors			Age of plant
	EGG	NYMPH	Nymph + Adult stages	Nymph + Adult stages	Egg	Movable stage	Min	Max	RH%	
06/04/2020	44	38	0	0	0	0	11.30	23.01	67.73	15
13/04/2020	52	61	23	0	0	0	12.03	24.13	54.37	22
20/04/2020	91	50	44	0	0	2	14.31	25.81	58.10	29
27/04/2020	66	134	56	0	21	15	13.06	24.19	50.41	36
04/05/2020	81	90	41	0	28	34	14.73	27.37	51.70	43
11/05/2020	57	72	76	12	0	3	15.19	27.70	49.64	50
18/05/2020	124	154	48	23	15	11	13.04	24.77	53.49	57
25/05/2020	165	209	61	43	31	19	16.03	31.86	42.96	64
01/06/2020	132	277	90	18	44	35	17.30	36.11	45.73	71
08/06/2020	141	214	32	11	19	12	19.30	37.21	41.33	78
15/06/2020	90	222	39	22	51	39	20.03	36.13	42.37	85
22/06/2020	55	167	21	9	33	21	20.31	38.81	42.10	92
Mean	91.5 B	140.67 A	44.25 C	11.5D	20.17 CD	15.92 CD				

F value = 21.14*** L.S.D. $_{05}$=31.80

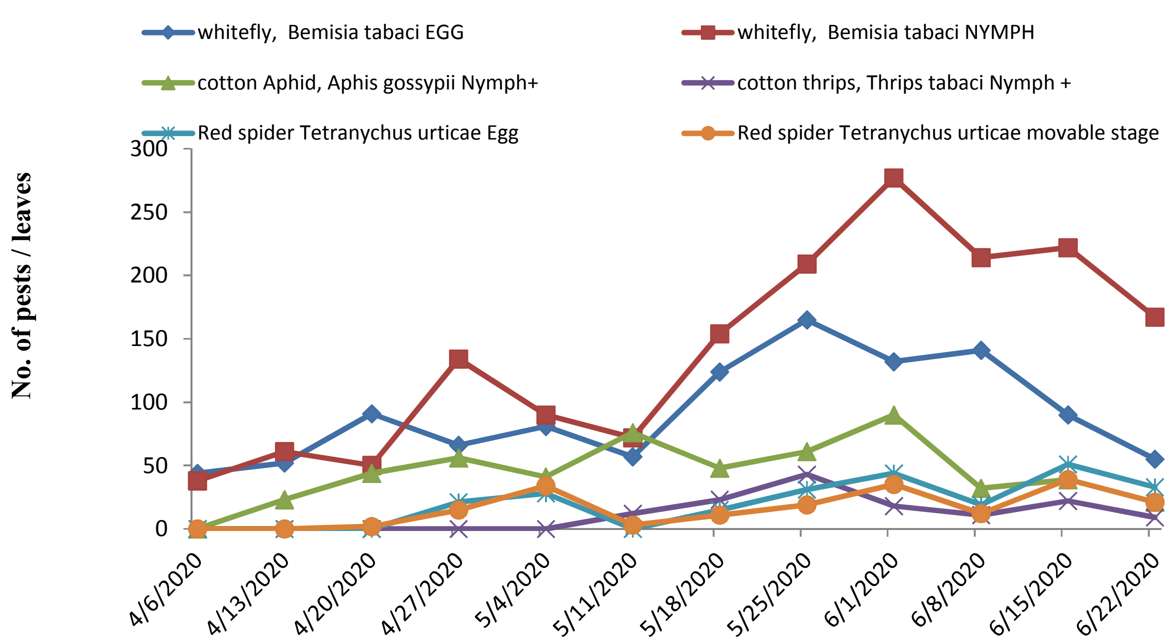

Fig. 1: Population density of pests on squash plants at Qaha, Qalubiya governorate during 2020 season.

Table 3: Population density of pests on squash plants at Qaha, Qalubiya governorate during 2021 season.

Date of inspection	whitefly, *Bemisia tabaci*		Cotton Aphid, *Aphis gossypii*	Cotton thrips, *Thrips tabaci*	Red spider *Tetranychus urticae*		Physical factors			Age of plant
	EGG	NYMPH	Nymph + Adult stages	Nymph + Adult stages	Egg	Movable stage	Min	Max	RH%	
06/04/2021	54	71	0	0	0	0	11.98	23.01	67.73	15
13/04/2021	34	78	0	0	0	0	13.00	24.13	54.37	22
20/04/2021	98	121	31	0	0	0	15.01	25.81	58.10	29
27/04/2021	69	119	52	0	12	8	13.06	24.19	50.41	36
04/05/2021	91	192	77	23	18	14	15.13	27.37	51.70	43
11/05/2021	154	213	93	39	13	6	16.10	27.70	49.64	50
18/05/2021	289	412	179	19	8	11	16.04	24.77	53.49	57
25/05/2021	213	366	132	31	41	19	17.12	31.86	42.96	64
01/06/2021	301	416	107	47	37	34	17.90	36.11	45.73	71
08/06/2021	276	371	61	22	52	49	18.30	37.21	41.33	78
15/06/2021	198	292	29	19	66	38	19.03	36.13	42.37	85
22/06/2021	181	387	0	0	42	32	20.98	38.81	42.10	92
Mean	163.17 B	253.17A	63.42C	16.67C	24.08 C	17.58C				

F value = 21.67*** L.S.D.$_{0.5}$=59.21

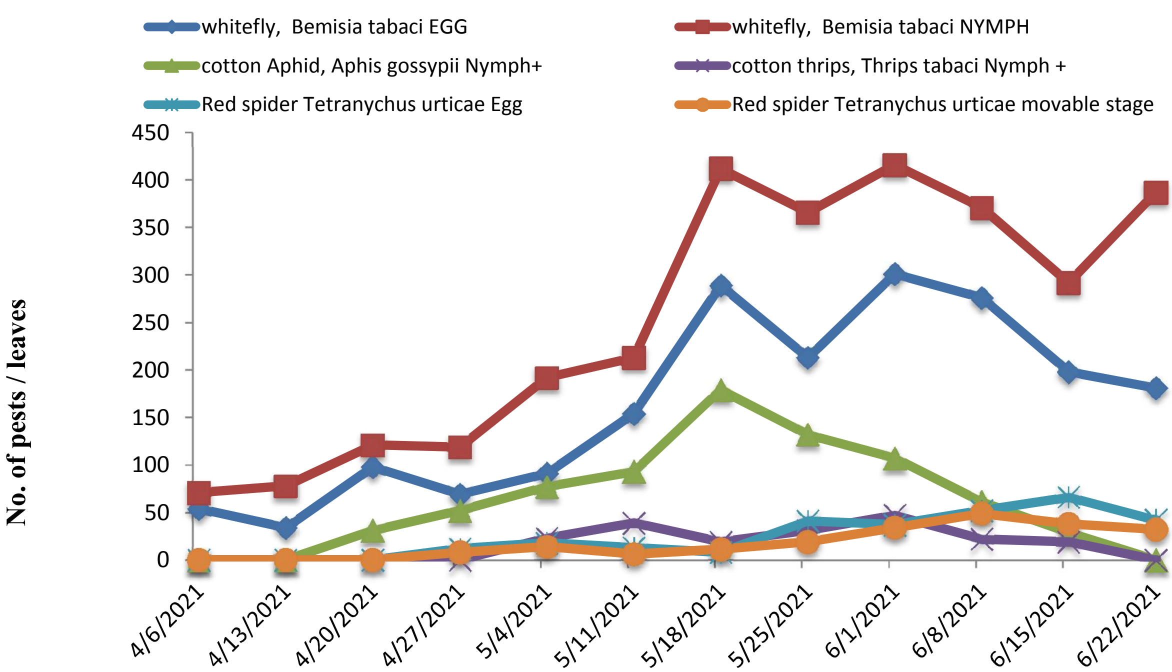

Fig. 2: Population density of pests on squash plants at Qaha, Qalubiya governorate during 2021 season.

3.2. Effect of some ecological factors and age of plant on population dynamics of pests infesting squash plants.

This study involved the seasonal fluctuation of the investigated pests in relation to certain weekly mean of the weather factors (Maximum temperature, Minimum temperature. and Mean relative humidity (R.H %) and age of plant obtained from Experimental Farm of Plant Protection Research Institute, Qaha, Qalubiya governorate at the investigated seasons.

3.2.1. Bemisia tabaci (Genn.)

Statistical analysis for the effects of the three selected abiotic factors, one biotic factors and age of plant on the population dynamics of *B. tabaci* immature during both seasons at Qalubiya Governorate are shown in Table (4). The results showed significant negative effects to maximum temperature on the seasonal fluctuations of *B. tabaci* on both seasons (2020 &2021 and 2021&2022), whereas “r” values were -0.59 and -0.941, respectively. Minimum temperature indicated insignificant negative effects in the first season, in the second season found significant negative effects whereas “r” values were -0.31 and -0.892, respectively. Data cleared that, the mean percentage of relative humidity had significant positive effect, whereas “r” values were 0.71 and 0.854, respectively during two successive seasons. In case of plant age the results showed that the age of plant had significant positive effect in both seasons, whereas “r” values were 0.540 and 0.755, respectively. The combined effect of maximum , minimum temperature and the mean percentage of relative humidity and age of plant factors as a group (E.V) showed responsible of 84% and 97 % effects on the population dynamics of *B. tabaci* immature throughout in seasons 2020 &2021 and 2021&2022, respectively (“F” values were 5.66 and 17.9) Table, (4).

3.2.2. T .tabaci

The obtained results revealed that significant negative effects of maximum temperature on the seasonal fluctuations of *T. tabaci* throughout in first season where “r” values was -0.61, but in the second season showed that highly significant positive effects where “r” values was 0.96, respectively. The minimum temperature found insignificant effects of *T. tabaci* throughout in two seasons where “r” values were -0.43 and -0.39, for the two seasons, respectively. While the mean percentages of relative humidity had significant positive effect where “r” value 0.58 and 0.76, respectively in the two seasons. Also, the results indicated that the age of plant was highly significant positive effects whereas “r” value was 0.63 and 0.87, respectively through two seasons. The combined effect of these factors as a group (E.V) showed responsible of 79 % and 88 % effects on the population dynamics of *T. tabaci* throughout the both seasons 2020/2021&2021/2022, respectively (“F” values were 4.81*& 12.3***). Table, (4).

3.2.3. A. gossypii:

The results revealed that significant negative effects of maximum and minimum temperature on the seasonal fluctuations of *A. gossypii* throughout two seasons where “r” values were (-0.52 & -0.73 sig.) and (-0.70 & -0.80), respectively. The relative humidity had positive effect where “r” values (0.31 & 0.25), respectively in both seasons. The plant age indicated that insignificant positive effects in first season where “r” value 0.49 but in the second season showed significant positive effects where “r” value 0.71. The explained variance value were 89% and 96 %, respectively in both seasons (“F” value were 11.9*** &16.9***) Table, (4).

3.2.4. Tetranychus urticae:

Values of correlation (r) for *T. urticae* population expressed insignificant positive effect with maximum temperature in the first season were “r” value was 0.444, but in the second season found significant negative effects were “r” value was -0.562. the minimum temperature showed that significant positive effects but in the second season found significant negative effects whereas,“r” values were 0.561 & -0.59., respectively.In the same data indicated that, insignificant positive correlation was confirmed between *T. urticae* population and relative humidity whereas,“r” values were, 0.401 and 0.387 respectively. The plant age through two seasons indicated that significant positive 0.523 and 0.61, respectively. The explained variance value (E.V. %) were 87 & 91%, while “F” value were 8.9* and 7.6*, respectively. Table, (4).

These results closed to Hanafy *et al.,* (2014) who noted that there is a significant and positive correlated with maximum temperature and maximum relative humidity. While, the population density of *B. tabaci* positively correlated and non-significant with minimum temperature and Mona and Abolmaaty (2016) who reported that the combined effect (E.V) of selected ecological factors on *B. tabaci* (egg and nymph) , *F. intonsa* and *T. urticae* (egg and immature) showed that these factors were responsible as a group for 94, 79, 83, 89, 98, 87, 99, 99, 93, 95% effects on the population dynamics of pests on cucumber plant throughout both seasons, respectively. Similarly, Gallab *et al.,* (2011) stated that the four cucumber varieties, *Cucumis sativus* were sensitivity to piercing sap sucking pests' infestation including the onion thrips, *T. tabaci* and two spotted spider mite, *T. urticae* under field conditions. However, Maklad *et al.,* (2012) studied the effect of shade nets on some environmental factors on the population fluctuation of *T. urticae, Frankliniela intonsa*, *B. tabaci* and *A. gossypii*. The hot and dry weather can lead to an increase in and *T. urticae* populations and the severity of the thrips and the two spotted spider mite to cucumber plants. The season behind this is likely a combination of factors including a shorter generation time and a reduction in mortality from abnormal condition and plant pathogens.

Table 4: Correlation and partial regression values of the three weather factors and plant age on pests and corresponding percentages of explained variance on squash plants at Quabyia Governorate during 2020&2021 and 2021&2022 seasons.

		2020						2021					
Pests stage	**Variables**	**Correlation**		**Regression coefficient**		**E.V %**	**F value**	**Correlation**		**Regression coefficient**		**E.V%**	**F value**
		r	**p**	**b**	**p**			**r**	**p**	**b**	**p**		
***B. tabaci* (Nymph)**	**Max. temp.**	-0.59	0.05	9.62	0.10	84%	5.66*	-0.941	0.001	6.33	0.01	97%	17.9***
	Min. temp.	-0.31	0.53	7.87	0.40			-0.892	0.002	-4.57	0.16		
	RH%	0.71	0.01	9.40	0.03			0.854	0.0004	5.31	0.006		
	Age of plant	0.540	0.01	8.77	0.05			0.755	0.001	8.33	0.001		
***A. gossypii* (Nymph)**	**Max. temp.**	-0.61	0.09	-9.25	0.06	79%	4.81*	0.961	0.009	25.08	0.03	88%	12.3***
	Min. temp.	-0.43	0.38	-6.71	0.38			-0.931	0.001	10.24	0.04		
	RH%	0.58	0.02	3.45	0.08			0.762	0.009	10.09	0.07		
	Age of plant	0.63	0.003	7.1	0.02			0.877	0.002	11.09	0.01		
***T. tabaci* (Nymph)**	**Max. temp.**	-0.52	0.28	-2.95	0.14	89%	11.9***	-0.733	0.001	-18.80	0. 01	96%	16.9***
	Min. temp.	-0.702	0.54	-2.89	0.05			-0.804	0.005	-0.60	0.02		
	RH%	0.312	0.11	2.36	0.05			0.254	0.59	0.72	0.79		
	Age of plant	0.491	0.05	-1.80	0.99			0.712	0.04	2.09	0.01		
***T. urticae* (Movable stage)**	**Max. temp.**	0.444	0.31	4.90	0.09	87%	8.9*	-0.562	0.04	-3.95	0.04	91%	7.6*
	Min. temp.	0.561	0.05	3.10	0.02			-0.599	0.04	-2.44	0.05		
	RH%	0.401	0.82	2.18	0.11			0.387	0.61	8.36	0.17		
	Age of plant	0.523	0.01	5.23	0.01			0.612	0.02	6.08	0.01		

Max. temp. = Maximum temperature
Min. temp.= Minimum temperature
R.H%= Relative Humidity

3.3. The effect of different treatments on squash pests

3.3.1. Bemisia tabaci (Genn.)

3.3.1.1. First spray

The mean reduction percentages of whitefly *B. tabaci* numbers (nymph) as a result after applications of eight compounds it is clear that the eight control agents can be arranged in descending orders as follows: CP Extra WG %35, Thiamectin 16.9%, KZ oil EC 95% , Vertimec EC%1.8, Sweet basil oil, Camphor oil, NEAM extraction and the lowest one Orange oil with mean reduction of 96.4, 95.8, 93.6, 87, 83.2, 80.2, 79.4and 71.6for the eight agents, respectively.

According to the mean, percentage of reduction in *B. tabaci* counts after treatment, the compounds significantly divided into six groups (F value=4.92*** $L.S.D_{.05}$=11.56%).

Table 5: Effect of different treatments on *Bemisia tabaci* infesting squash plants under field condition at Qaha, Qalubiya Governorate during 2020 and 2021 seasons.

Treatments		No. Nymph Per Treatments	Initial kill	Reduction % after application					Average %
			After 24 hours	3 Days	5 Days	7 Days	10 Days	14 Days	
First spray	Camphor	234	42	71	86	94	79	71	80.2 cd
	Sweet basil	271	45	76	89	93	87	71	83.2 bc
	NEAM extract	222	49	73	92	98	71	63	79.4 cd
	Orange oil	296	42	73	81	73	70	61	71.6 d
	KZ oil EC 95%	301	61	87	100	100	93	88	93.6 ab
	Thiamectin 16.9% SC	247	65	96	100	100	94	89	95.8 a
	CP ExtraWG %35	277	69	84	100	100	100	98	96.4 a
	Vertimec EC%1.8	279	51	88	100	89	81	77	87 abc
	Control	281	--	--	--	--	--	--	--
F value=4.92*** L.S.D. $_{05}$=11.56									
Second spray	Camphor	148	44	65	88	86	82	74	79 c
	Sweet basil	163	48	61	100	89	81	74	81bc
	NEAM	150	47	66	100	91	77	72	81.2bc
	Orange oil	133	38	61	78	80	73	69	72.2 c
	KZ oil EC 95%	123	62	90	100	100	93	85	93.6ab
	Thiamectin 16.9% SC	98	61	90	100	100	91	88	93.8ab
	CP ExtraWG %35	71	63	81	100	100	100	92	94.6 a
	Vertimec EC%1.8	110	53	87	100	84	80	74	85abc
	Control	423	--						
F value= 3.38*** L.S.D.$_{05}$ =12.89									

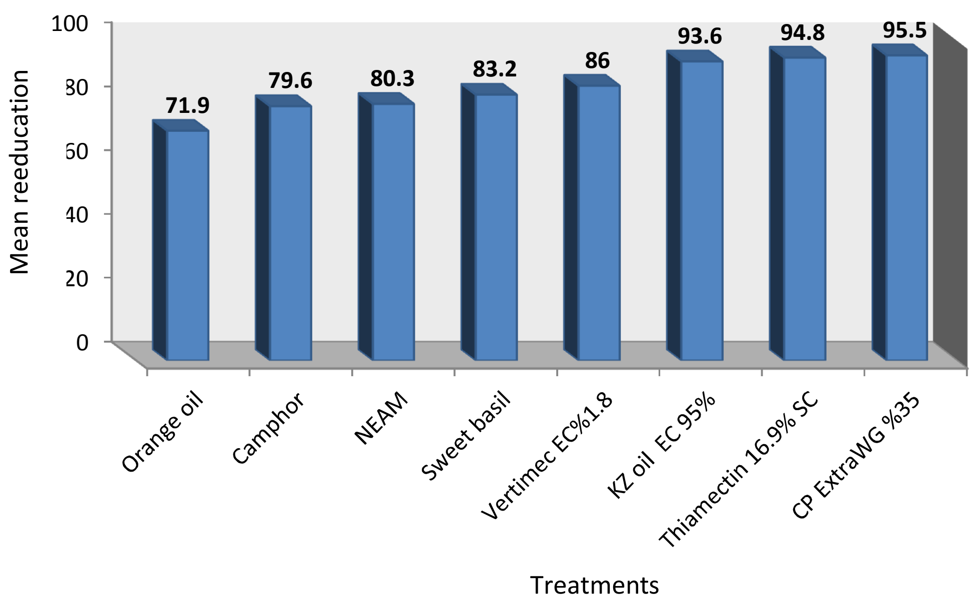

Fig. 3: Effect of different treatments on *Bemisia tabaci* infesting squash plants under field condition at Qaha, Qalubiya Governorate during 2020 and 2021 seasons.

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3.3.1.2. Second spray

Data indicated that there are significant differences between the eight compounds where F. value = 3.38 *** L.S.D.$_{05}$ = 12.89%. These compounds could be divided to five groups. The first group contained on CP Extra WG %35, Thiamectin 16.9%, KZ oil EC 95% , showing highly mortality 94.6, 93.8 and 93.6%, respectively. The moderate group contained Vertimec EC%1.8, NEAM extraction and Sweet basil oil, showing moderate effect 85%, 81.02% and 81%, respectively. The lowest effect for Camphor oil, and Orange oil with 79 and 72.2, respectively.

A. gossypii:

Gradual reduction percentages of cotton aphids, *A. gossypii* numbers as a result spray of CP Extra WG %35, Thiamectin 16.9%, KZ oil EC 95% , Vertimec EC%1.8, Sweet basil oil, Camphor oil, Neam extraction and Orange oil treatments were recorded in both seasons 2020 and 2021 (Tables 6). Data indicated that there were significant differences between the eight compounds where F. value = 5.09*** L.S.D$_{05}$=9.61%. These compounds could be divided four groups. The first group include CP Extra WG %35, Thiamectin 16.9% and KZ oil EC 95% showed highly mortality 98.8, 98.6% and 97.2%, respectively. The second group contained Camphor and Vertimec EC%1.8 were 89.6 and 89.2%, respectively. While moderate effect note with Sweet basil oil and Neam extraction with mean reduction 87.2% and 86.48%, respectively. The fifth group was orange oil showing low effect 76.8%.

Table 6: Effect of different treatments on *Aphis gossypii* infesting squash plants under field condition at Qaha, Qalubiya Governorate during means 2020 and 2021 seasons.

Treatments		No. Nymph Per Treatments	Initial kill	Residual effect treatments					Average %
			After 24 hours	3 Days	5 Days	7 Days	10 Days	14 Days	
First spray	**Camphor**	44	49	89	100	92	88	79	89.6 AB
	Sweet basil	49	51	85	100	94	81	76	87.2 B
	NEAM	62	54	87	100	98	77.4	70	86.48 B
	Orange oil	54	47	79	84	79	73	69	76.8 C
	KZ oil EC 95%	71	63	91	100	100	100	95	97.2 A
	Thiamectin 16.9% SC	49	69	100	100	100	100	94	98.8 A
	CP ExtraWG %35	67	71	100	100	100	100	93	98.6 A
	Vertimec EC%1.8	55	59	92	100	90	83	81	89.2 AB
	Control	51	--	--	--	--	--	--	--
		F value= 5.09* L.S.D$_{05}$=9.61**							
Second spray	**Camphor**	32	55	89	100	90	90	82	90.2 BC
	Sweet basil	33	58	85	100	95	82	77	87.8 C
	NEAM	28	59	87	100	98	82	76	88.6 C
	Orange oil	29	52	79	84	82	76	71	78.4 D
	KZ oil EC 95%	21	69	93	100	100	100	95	97.6 AB
	Thiamectin 16.9% SC	17	71	100	100	100	100	97	99.4 A
	CP ExtraWG %35	18	74	100	100	100	100	96	99.2 A
	Vertimec EC%1.8	16	63	97	100	100	92	87	95.2 ABC
	Control	81	--	--	--	--	--	--	--
		F value= 6.72* L.S.D. $_{05}$= 8.03**							

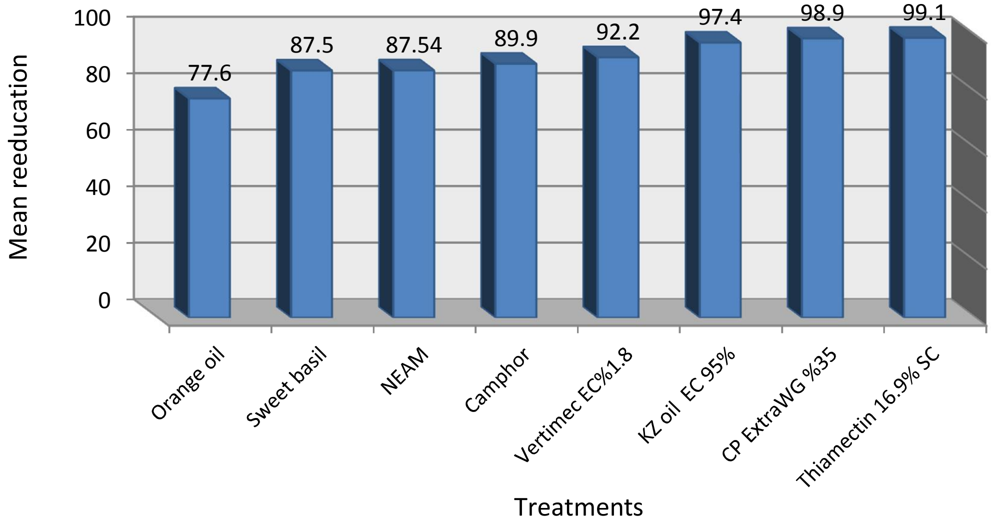

Fig. 4: Effect of different treatments on *Aphis gossypii* infesting squash plants under field condition at Qaha, Qalubiya Governorate during 2020 and 2021 seasons.

Second spray

Data in tabulated in Table 6. Indicated that there are significant differences between the eight compounds where F. value = 6.72*** L.S.D.$_{05}$ = 8.03%. These compounds could be divided six groups. The first group contained Thiamectin 16.9% and CP Extra WG %35 showing highly mortality 99.4 and 99.2%, respectively. The second and third groups contained KZ oil EC 95% and Vertimec EC%1.8 were 97.6 and 95.2 %, respectively. Showing moderate effect noted with Camphor, Neam extraction and Sweet basil oil with mean reduction 90.2, 88.6% and 87.8%, respectively. The fifth group was orange oil showing low effect 78.4%.

The study agreement with some author as, Soliman and Tarasco (2009) in Egypt stated that abamectin (Vertimec 1.8% EC) reduced significantly whitefly and aphid populations on cucumber, in field experiments. Abou-Yousef *et al.,* (2010) and Wahba *et al.,* (2019) The results revealed that was significant differences between using three systemic insecticides and five botanical oils on population densities of some pests (whitefly, thrips, aphid *and* spider mite. it is clear from the previous view that each of the treatment Final oil and garlic Oil extraction economically feasible compared to experiments either (Thiamethoxam, Imidaclopride , Acetamiprid, Rosemarie oil, Sesame oil, Lemon oil , control).

4. Conclusions

Whitefly*, Bemisia tabaci* (Genn.), aphid, *Aphis gossypii* Glover, thrips *Thrips tabaci* Lind. and two spotted spider mite*, Tetranychus urticae* Koch the most important pest were found on squash plants, these pests are attacking a wide spectrum of economic plants, causing great losses in their yield. Results showed that the key pest *Bemisia tabaci* had the most pests found than *A. gossypi*i when using different treatments CP ExtraWG %35 and Thiamectin 16.9% SC have a highly significant effect on decreasing pests population infesting squash growth. The mineral oil and plant extract have effect on pests population whereas decreased mean number of pests the most efficiency method compared to control (without treatment).

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