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## Evaluation Efficiency of Some Insecticides, Plant Extracts and Plant Oils on Controlling *Myzus persicae* Infesting Squash Plants Under Plastic Greenhouses

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### ABSTRACT

This study was carried out to evaluate the efficiency of three insecticides (aphicides): (Vertimec, Malathion and Chloropyrifos), three plant extracts: (Neemazal, Azadirachta and Glycine) and three plant oils: (Citronella oil, Jojoba oil and Helianthus oil) on controlling Green Peach Aphid, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) which infesting squash plants (*Cucurbita pepo* L.) under greenhouse conditions. And this study was carried out at two locations (governorates), Perkasheh region (Giza Governorate) and Tokh region (Qaliobyah governorate) during season 2021.

At Giza Governorate, data obtained showed that the compounds effectively were arranged to descend as follows; insecticides, plant extracts and plant oils. Also, insecticides effectively were arranged to descend as follows (Vertimec, Malathion and Chloropyrifos), respectively, whereas the general effect % was 96.9, 96.5 and 96.1% respectively. The plant extracts effectively were arranged as follow: Neemazal, Azadirachta and Glycine, whereas the general effect % were 94.8, 94.3 and 94.1% respectively. Lastly, plant oils effectively were arranged as follows: Citronella oil, Jojoba oil and Helianthus oil respectively, whereas the general effect % was 91.8, 91.5 and 91.2% respectively.

Vertimec proved itself to be the most insecticide effective, Neemazal proved itself to be the most plant extracts effective and Citronella oil proved itself to be the most plant oils effective. All extracts recorded significant differences between them and control.

As the same trend data obtained at Qaliobyah Governorate at the same season 2021.

### INTRODUCTION

Squash (*Cucurbita pepo* L.) fruits consider one of the most important vegetables all over the world which are cultivated both in the open field and under plastic greenhouses. Also, its cultivated area increased gradually during the last years, especially in the newly reclaimed areas for purposes of local consumption and exportation to the foreign markets. It contains some nutritional compounds for human feeding such as a moderate quantity of mineral salts and it is a good source of fats and protein (Abdein, 2016). It has a high economic value, and is a nutritive food source especially vitamins and is one of the most popular vegetables grown in Egypt (Shehata *et al.* 2009).

Squash plants infested with a large scale of different insects such as Green Peach Aphid, *Myzus persicae* (Homoptera: Aphididae) which consider one of the most damaging insects infesting squash plants and other vegetables crops both in the open field and under greenhouse conditions whereas it causes numerous damages in both quantity and quality for the crop directly by plant juice loosen from leaves and fruits or indirectly by plant virus disease transmitting, Pinto *et al.* (2008).

This study was carried out to evaluate the efficiency of three insecticides (aphicides): (Vertimec, Malathion and Chloropyrifos) and three plant extracts: (Neemazal, Azadirachta and Glycine) and three plant oils: (Citronella oil, Jojoba oil and Helianthus oil) on controlling Green Peach Aphid, *M. persicae* which infesting squash plants under plastic greenhouses.

## MATERIALS AND METHODS

### Experimental Design:

Experiments were carried out in a plastic greenhouse at both of the two locations (governorates). The plastic greenhouse was covered with double-layered polyethylene and was an isolated area in the field and divided into ten equal parts. Nine parts for the nine tested compounds and the ten parts left free as control. Each part contains five equal plots each one size 4x7m. And this study was carried out on Squash plants (*Cucurbita pepo* L.) which were cultivated during (March- April) whereas the population of aphid at its peak in this period with same all the agricultural operations all over the greenhouse.

This study was carried out to evaluate the efficiency of three aphicides, three plant extracts and three plant oils:

#### 1-The Aphicides Which Examined and Their Rates of Application Per Feddan Were:

- a-Vertimec 1.8% EC at 0.185 liter/Feddan.
- b- Malathion 57% EC at 1 Liter/Feddan.
- c -Chloropyrifos 60% EC at 0.750 liter/Feddan.

#### 2-The Plant Extracts Which Examined and Their Rates of Application Per Feddan:

- a-Neem extract (Neemazal): Neemazal-W (a powder of a botanical insecticide containing 10% azadirachtin), Neemazal extract (powder 10%), using per 300 cm at 100-liter water, El-Lakwah and El-Kashlan (1999).
- b-Azadirachta (*Azadirachta indica*): fam. Meliaceae contains Azadirachin A+B, Margostic acid, Azaridine, Margosine, Margospierne, using per 300 cm at 100-liter water (Duke 1985).
- c-Glycine (*Glycine max* L.): Contains oil (19-22%), protein (20%), Flavonoids (Genectine, Diadzene). And also seeds contain Lycetine, Vitamins (B, E) and Carotiens, using per 300 cm at 100 Liter water (Thulin 2013).

#### 3-The Plant Oils Which Examined and Their Rates of Application Per Feddan:

- a-Citronella oil (1.5% EC at 1.5 liter): As a concentrated form of antioxidants and phytochemicals taken from the plant leaves and stem, contain citronellal, geraniol, gerany acetate and limonene. This oil essential repellent insects, using per300 cm at 100 Liter water (Duke 1985).
- b-Jojoba oil (1.5% EC at 1.5 liter): The jojoba oil wax is extracted from the seeds of the jojoba (*Simmondsia chinensis*), a perennial shrub that grows in semi-desert areas in some parts of the world. The main uses of jojoba oil wax are in the cosmetics and pharmaceutical industry, but new uses could be related control some insects, using per300 cm at 100 Liter water (Laureano *et al.* 2016).

c-Helianthus oil (1.5% EC at 1.5 liter): Contains Lenolec acid (58-67%), Dicafeoyl putrescine and coumaroyl spermioline, using per 300 cm at 100-liter water (Rheenen *et al.* 2005).

All treatments were applied at the two successful locations on the first of March 2020 when aphids had begun to colonize the plants, Hamlen 1977 (sample size was a number of alive aphids found on three plants). The second application was given after 14 days. Counts of aphid were recorded at first immediately before treatment and after 1, 7, 14, 21, 28, 35 and 41 days after treatment. An ordinary hand sprayer of 20 liters capacity with a bent down Nozzle was used. Normal agricultural practices for greenhouse squash (fertilization, irrigation, light intensity pinching, photoperiod and temperature) were carried out regularly (Raymond 2007). White wonder was conducted in a private plastic greenhouse 7.5 X 20.6 m at the two successive locations.

### Statistical Analysis:

The data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 and 0.01 levels (Stell and Torrie 1980). The reduction in the population density of aphids due to insecticidal treatment was calculated according to the equation of Henderson and Tilton (1955).

## RESULTS AND DISCUSSION

### Giza Governorate:

Data tabulated in Table (1) show the effectiveness of experimented aphicides, plant extracts and plant oils on the population density and reduction percentages of the green peach aphid, *Myzus persicae* (Sulzer) infesting squash plants (*Cucurbita pepo* L.) under plastic greenhouses.

**Table 1:** Numbers of aphids/plant and reduction percentages of the green peach aphid, *Myzus persicae* infesting squash plants as influenced by the tested compounds at Giza Governorate during season 2021.

Compound	Rate of application	No. of aphids /Plant (pre-treatment)	Post-treatment periods (in days)					General effect%	
			1 (Initial effect%)	7	14	21	28		35
Vertimec	0.185 lit/feddan	37.5	(0.0)	(0.1)	(9.0)	(0.0)	(0.2)	(1.0)	96.9
			100	99.8	83.3	100	99.7	98.6	
Malathion	1 Lit/feddan	35.7	(0.0)	(0.3)	(9.0)	(0.0)	(0.3)	(1.5)	96.5
			100	99.4	82.5	100	99.5	97.7	
Chloropyrifos	0.750 lit/feddan	36.8	(0.0)	(0.5)	(10.0)	(0.0)	(0.5)	(1.8)	96.1
			100	98.9	81.1	100	99.2	97.3	
Neemazal	0.3 lit/feddan	34.5	(0.3)	(1.0)	(10.0)	(1.0)	(1.8)	(2.2)	94.8
			99.2	97.7	79.8	98.3	97.1	96.5	
Azadirachta	0.3 lit/feddan	32.8	(0.5)	(1.0)	(10.0)	(1.0)	(2.0)	(2.5)	94.3
			98.6	97.6	78.8	98.2	96.6	95.8	
Glycine	0.3 lit/feddan	35.7	(0.6)	(1.2)	(11.0)	(1.2)	(2.2)	(2.8)	94.1
			98.5	97.4	78.5	97.9	96.5	95.7	
Citronella oil	1.5 lit/feddan	36.2	(1.5)	(2.0)	(12.5)	(3.0)	(4.0)	(4.0)	91.8
			96.3	95.7	75.9	95.0	93.8	93.9	
Jojoba oil	1.5 lit/feddan	34.5	(1.5)	(2.0)	(12.0)	(3.0)	(4.0)	(4.0)	91.5
			96.1	95.5	75.7	94.8	93.5	93.6	
Helianthus oil	1.5 lit/feddan	33.7	(1.5)	(2.2)	(11.9)	(3.2)	(4.1)	(4.1)	91.2
			95.9	94.9	75.4	94.3	93.1	93.3	
Control	-	35.8	39.7	45.9	51.4	59.8	63.4	65.2	-

LSD<sub>0.05</sub> Insecticides: 5.73

LSD<sub>0.05</sub> Days: 4.63

LSD<sub>0.01</sub> Insecticides: 8.23

LSD<sub>0.01</sub> Days: 7.26

After 1-day post-treatment, the three aphicides: Vertimec, Malathion and Chloropyrifos effectively reduced populations of *M. persicae* to 0.0, 0.0 and 0.0 respectively, while the three plant extracts: (Neemazal, Azadirachta and Glycine) reduced the population to 0.3, 0.5 and 0.6 respectively, while the three plant oils: (Citronella oil, Jojoba oil and Helianthus oil) reduced the population to 1.5, 1.5 and 1.5 respectively.

After 7-day post-treatment, the three aphicides effectively reduced the population to 0.1, 0.3 and 0.5 respectively, while the three plant extracts reduced the population to 1.0, 1.0 and 1.2 respectively, while the three plant oils reduced the population to 2.0, 2.0 and 2.2 respectively.

After 14-day post-treatment, the three aphicides effectively reduced the population to 9.0, 9.0 and 10.0 respectively, while the three plant extracts reduced the population to 10.0, 10.0 and 11.0 respectively, while the three plant oils reduced the population to 12.5, 12.0 and 11.9 respectively.

After 21-day post-treatment, the three aphicides effectively reduced the population to 0.0, 0.0 and 0.0 respectively, while the three plant extracts reduced the population to 1.0, 1.0 and 1.2 respectively, while the three plant oils reduced the population to 3.0, 3.0 and 3.2 respectively.

After 28-day post-treatment, the three aphicides effectively reduced the population to 0.2, 0.3 and 0.5 respectively, while the three plant extracts reduced the population to 1.8, 2.0 and 2.2 respectively, while the three plant oils reduced the population to 4.0, 4.0 and 4.1 respectively.

After 35-day post-treatment, the three aphicides effectively reduced the population to 1.0, 1.5 and 1.8 respectively, while the three plant extracts reduced the population to 2.2, 2.5 and 2.8 respectively, while the three plant oils reduced the population to 4.0, 4.0 and 4.1 respectively.

With regard to the mean number of aphids at 35 days post first treatment, the tested compounds could be arranged to descend as follows: aphicides group then plant extracts group and lastly plant oils group. Also, aphicides group arraigned descending as follows: Vertimec, Malathion and Chloropyrifos. Then plant extracts arraigned descending as follow: Neemazal, Azadirachta and Glycine. Lastly, the plant oils group arraigned descending as follows: Citronella oil, Jojoba oil and Helianthus oil whereas the corresponding reduction percentages (general effect %) for the nine tested compounds were 96.9, 96.5, 96.1, 94.8, 94.3, 94.1, 91.8, 91.5 and 91.2 respectively.

From the above-mentioned data, Vertimec proved itself to be the most effective aphicides, Neemazal proved itself to be the most effective plant extract and Citronella oil proved itself to be the most effective plant oil. All compounds recorded significant differences between them and control.

#### **Qaliobyia Governorate:**

Data tabulated in Table (2) show the effectiveness of experimented aphicides, plant extracts and plant oils on the population density and reduction percentages of the green peach aphid, *Myzus persicae* (Sulzer) infesting squash plants (*Cucurbita pepo* L.) under plastic greenhouses.

After 1-day post-treatment, the three aphicides: Vertimec, Malathion and Chloropyrifos effectively reduced populations of *M. persicae* to 0.0, 0.0 and 0.0 respectively, while the three plant extracts: (Neemazal, Azadirachta and Glycine) reduced the population to 0.2, 0.4 and 0.6 respectively, while the three plant oils: (Citronella oil, Jojoba oil and Helianthus oil) reduced the population to 1.3, 1.5 and 1.7 respectively.

After 7-day post-treatment, the three aphicides effectively reduced the population to 0.1, 0.3 and 0.4 respectively, while the three plant extracts reduced the population to 0.7,

0.8 and 0.9 respectively, while the three plant oils reduced the population to 2.0, 2.0 and 2.2 respectively.

**Table 2:** Numbers of aphids/plant and reduction percentages of the green peach aphid, *Myzus persicae* infesting squash plants as influenced by the tested compounds at Qaliobya Governorate during season 2021.

Compound	Rate of application	No. of aphids /Plant (pre-treatment)	Post-treatment periods (in days)						General effect%
			1 (Initial effect%)	7	14	21	28	35	
Vertimec	0.185 lit/feddian	38.9	(0.0) 100	(0.1) 99.8	(7.0) 87.7	(0.0) 100	(0.1) 99.9	(0.9) 98.8	97.7
Malathion	1 Lit/feddian	36.8	(0.0) 100	(0.3) 99.4	(7.0) 87.1	(0.0) 100	(0.3) 99.6	(1.5) 97.8	97.3
Chloropyrifos	0.750 lit/feddian	37.5	(0.0) 100	(0.4) 99.2	(7.2) 86.9	(0.0) 100	(0.5) 99.3	(1.6) 97.6	97.1
Neemazal	0.4 lit/feddian	36.4	(0.2) 99.5	(0.7) 98.5	(8.0) 85.0	(1.0) 98.3	(1.8) 97.2	(2.3) 96.6	95.8
Azadirachta	0.5 lit/feddian	35.8	(0.4) 98.9	(0.8) 98.2	(8.5) 83.8	(1.2) 97.9	(2.0) 96.9	(2.5) 96.2	95.3
Glycine	0.2 lit/feddian	37.2	(0.6) 98.5	(0.9) 98.1	(9.0) 83.5	(1.4) 97.7	(2.2) 96.7	(2.7) 96.1	95.1
Citronella oil	1.5 lit/feddian	36.8	(1.3) 96.8	(2.0) 95.7	(10.5) 80.6	(3.0) 95.0	(3.5) 94.6	(4.0) 94.1	92.8
Jojoba oil	1.5 lit/feddian	34.9	(1.5) 96.1	(2.0) 95.5	(10.0) 80.4	(3.0) 94.8	(4.0) 93.5	(4.0) 93.8	92.4
Helianthus oil	1.5 lit/feddian	35.1	(1.7) 95.6	(2.2) 95.1	(10.0) 80.6	(3.2) 94.5	(4.0) 93.6	(4.5) 93.1	92.1
Control	-	36.5	39.9	46.5	53.6	59.9	65.3	67.4	-

LSD<sub>0.05</sub> Insecticides : 6.25

LSD<sub>0.05</sub> Days : 5.33

LSD<sub>0.01</sub> Insecticides : 7.82

LSD<sub>0.01</sub> Days : 8.51

After 14-day post-treatment, the three aphicides effectively reduced the population to 7.0, 7.0 and 7.2 respectively, while the three plant extracts reduced the population to 8.0, 8.5 and 9.0 respectively, while the three plant oils reduced the population to 10.5, 10.0 and 10.0 respectively.

After 21-day post-treatment, the three aphicides effectively reduced the population to 0.0, 0.0 and 0.0 respectively, while the three plant extracts reduced the population to 1.0, 1.2 and 1.4 respectively, while the three plant oils reduced the population to 3.0, 3.0 and 3.2 respectively.

After 28-day post-treatment, the three aphicides effectively reduced the population to 0.1, 0.3 and 0.5 respectively, while the three plant extracts reduced the population to 1.8, 2.0 and 2.2 respectively, while the three plant oils reduced the population to 3.5, 4.0 and 4.0 respectively.

After 35-day post-treatment, the three aphicides effectively reduced the population to 0.9, 1.5 and 1.6 respectively, while the three plant extracts reduced the population to 2.3, 2.5 and 2.7 respectively, while the three plant oils reduced the population to 4.0, 4.0 and 4.5 respectively.

With regard to the mean number of aphids at 35 days post first treatment, the tested compounds could be arranged to descend as follows: aphicides group then plant extracts group and lastly plant oils group. Also, aphicides group arranged descending as follows: Vertimec, Malathion and Chloropyrifos. Then plant extracts arranged descending as follow: Neemazal, Azadirachta and Glycine. Lastly, the plant oils group arranged descending as follows: Citronella oil, Jojoba oil and Helianthus oil whereas the

corresponding reduction percentages (general effect %) for the nine tested compounds were 97.7, 97.3, 97.1, 95.8, 95.3, 95.1, 92.8, 92.4 and 92.1 respectively.

From the above-mentioned data, Vertimec proved itself to be the most effective aphicides, Neemazal proved itself to be the most effective plant extract and Citronella oil proved itself to be the most effective plant oil. All compounds recorded significant differences between them and control.

These results agree with those obtained by Dalia (2015) in Egypt who reported that Vertimec had a good effect on control of *Myzus persicae* and other species of aphids who infested cucumber plants under greenhouse conditions. Laisvune and Rasa (2008) in Spinach studied the effect of Neemazal on the *Aphis fabae* Scop. and found the efficiency of Neemazal was 74.36, 81.41 and 84.65% mortality percentage after 5, 7 and 14 days, respectively after application. Shirck (2012) studied the effect of malathion on several strains of the green peach aphid, *M. persicae* and found that insecticide had a high effect on most strains of this aphid. Pereira *et al.* (2016) studied the effect of neem extract on the cotton aphid *A. gossypii* and the effects of extracts of neem (Neemazal) seed powder on the development, survival and fecundity of *A. gossypii* were evaluated. The mortality rate during the nymphal development for aphids on cotton leaf with the two highest concentrations of the neem extract were 60% and 100%, respectively. Also, Nabil *et al.* (2014) studied controlling *Tuta absoluta* (Lepidoptera: Gelechiidae) and *Aphis gossypii* (Hemiptera: Aphididae) by aqueous plant extracts include chinaberry (Azadirachta) in greenhouse and laboratory. And found that chinaberry (Azadirachta) and geranium showed the highest mortality percentages of *A. gossypii* in laboratory and greenhouse after 2, 4, 6 and 8 days after treatment. Al-Antary and Abdel-Wali (2016) studied the toxic effect of some insecticides on green peach aphid, *M. persicae* and this insecticide was applied directly to infested plants by spraying aphids and found that high effect of this insecticide after treatment. Fazal *et al.* (2015) studied the effect of different plant extracts with a chemical insecticide for management of the Aphid, *Aphis gossypii* in sunflower, and the result of this study revealed that extracts derived from the leaves of Azadirachta were the most successful treatment in term of population reduction of remaining treatments 2% of *Azadirachta indica*. Begona *et al.* (2006) found that mineral oils such as Glycine caused the highest mortality of aphids (over 80%) for the control of *Myzus persicae*. Charles *et al.* (2006) studied the effect of essential oil from Citronella on Aphids, *Hyadaphis foeniculi* and found that when using concentrations 1, 3, 5 and 7% of Citronella oil causes mortality percentages 81, 98, 98 and 93% respectively.

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## ARABIC SUMMARY

تقييم فاعلية بعض المبيدات الحشرية والمستخلصات النباتية والزيوت النباتية في مكافحة حشرة *Myzus persicae* على نباتات الكوسة تحت ظروف الصوب البلاستيكية

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - 12618 مصر

أجريت هذه التجارب بغرض تقييم فاعلية بعض المبيدات الحشرية والمستخلصات النباتية والزيوت النباتية في مكافحة حشرة من الخوخ الأخضر *Myzus persicae* على نباتات الكوسة تحت ظروف الصوب البلاستيكية. كما أجريت هذه التجارب خلال موسم 2021 في منطقتي برقاش (محافظة الجيزة) ، طوخ (محافظة القليوبية) حيث تم تقييم فاعلية ثلاثة (3) أنواع من المبيدات الحشرية: (فيرتيميك، مالاثيون، كلوربيريفوس) وثلاثة أنواع من المستخلصات النباتية وهم: مستخلص النيم (نيمزال) Neemazal , مستخلص الأزدرخت (الزنزلخت) *Azadirachta indica* و مستخلص فول الصويا *Glycine sp.* وثلاثة (3) أنواع من الزيوت النباتية: (زيت السيترونيليا *Citronella sp.* , زيت الجوجوبا *Jojoba sp.* , زيت عباد الشمس *Helianthus sp.*)

وتوصلت النتائج التي تم التوصل إليها إلى أن فاعلية المركبات التي تم دراستها تم ترتيبها تنازليا كالاتي : المبيدات الحشرية ثم المستخلصات النباتية ثم الزيوت النباتية كما تم ترتيب فاعلية المبيدات الحشرية تنازليا كالاتي: فيرتيميك ثم مالاثيون ثم كلوربيريفوس وترتيب المستخلصات النباتية تنازليا كالاتي: مستخلص النيم (نيمزال) ثم مستخلص الأزدرخت (الزنزلخت) ثم مستخلص فول الصويا كما تم ترتيب فاعلية الزيوت النباتية تنازليا كالاتي: زيت السيترونيليا ثم زيت الجوجوبا ثم زيت عباد الشمس. وذلك في كلا من موقعي الدراسة خلال عام 2021 تشير النتائج المتحصل عليها كذلك إلى أن جميع المبيدات الحشرية والمستخلصات النباتية والزيوت النباتية المستخدمة تختلف معنويا عن المقارنة (control). حيث كانت النسبة المئوية للتأثير العام للمركبات التسعة موضع الدراسة على الترتيب خلال عام الدراسة 2021 في منطقة برقاش (محافظة الجيزة) (94.3 , 94.1 , 91.8 , 91.5 , 91.2 % ) على الترتيب. على نفس المنوال كانت النسبة المئوية للتأثير العام لهذه المركبات التسعة موضع الدراسة في منطقة طوخ (محافظة القليوبية) (97.7 , 97.3 , 97.1 , 95.8 , 95.3 , 95.1 , 92.8 , 92.4 , 92.1 % ) على الترتيب.