

## Impact of successive sprays of different insecticides on the most common pests infesting guar plants and the resultant yield

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### ABSTRACT

Insect's infestation development on guar plants in Kaha region, Qalyoubia Governorate, during 2016 and 2017 seasons was estimated. Four insecticides were sprayed on guar plants and their effect on the whitefly, *Bemisia tabaci* and the cotton aphid, *Aphis gossypii* and the seeds' yield were estimated, to choose the suitable pesticide that may improve plant protection for better performance of guar. Significant decreases were noticed in insect's population of all treatments with increasing successive sprays. The yield of guar seeds was highest by application of natural oil (437.69 kg. / feddan) followed by the botanical extract Azadirachtin (393.78 kg.), opposed to 250.2 kg. for the control treatment.

**Key words:** Guar, *Cyamopsis tetragonoloba* (L.), Insect, Control, Seed, Yield.

### Introduction

Guar, or clusterbean, *Cyamopsis tetragonoloba* (L.); Family: Fabaceae) is a drought-tolerant legume characterised by a spring-summer life-cycle. It has many uses such as human nutrition, animal fodder and industrial purposes (Prajapati *et al.*, 2013). It is also used for oil and methane extraction (hydraulic fracturing) (Nemecek *et al.*, 2012). The total world production of guar is about 1.0-1.6 Mt per year, with considerable fluctuations depending on climate trends, such as monsoons, which influence market quotations (Sharma and Gummagolmath, 2012). India produces approximately 80% of the world's guar, followed by Pakistan (15%), while the remaining 5% is produced in USA, Australia and South Africa. This annual field crop is not exigent; it tolerates saline soils and drought well, which allows its cultivation in southern Italy with good results (Sortino and Gresta, 2007; Gresta *et al.*, 2013). Due to their water scarcity, Mediterranean areas could develop an interest in guar cultivation as an alternative crop (Gresta *et al.*, 2013) in rotation with other vegetable crops or cereals in open fields, taking advantages of its beneficial effects on soil in terms of nitrogen fixation, boosted through inoculations of specific symbiotic microorganisms (Elsheikh and Ibrahim, 1999). At the time being, the area cultivated with guar in Egypt is about 1000 feddans as experimental areas.

As there is a lack in studies on guar in Egypt, the present study was carried out to verify the percentage of infestation on guar plants by aphids and whitefly, and to assay the effect of successive applications of each of 4 insecticides on infestation rates.

### Material and Methods

#### Field experimental layout :

The present study was conducted at Kaha district, Qalubia Governorate during the two guar growing seasons of 2016 and 2017. An area of about 610 m<sup>2</sup> was divided to 15 plots including 4 insecticidal treatments (3 plots for each treatment), in addition to 3 plots for the control treatment. Each plot measured 16 m<sup>2</sup>. A distance of 1 m was left between every 2 plots and 2 m between every two blocks to avoid pesticide drift and inter-plot interference. All plots were arranged in a randomized complete block design (RCBD). Guar seeds (Balady variety) were sown in rows with three to four seeds per hills at 5 cm depth in soil on April 16<sup>th</sup> and 19<sup>th</sup> of for 2016 and 2017 seasons. The distance between

hills was about 20 cm, thinning was done two weeks after sowing where two plants were left per hill and six crop rows were established in each plot. Weeding took place manually to ensure clean plots .

### Application of pesticides:

Four compounds belonging to different groups of pesticides were applied at the recommended rates, being sprayed on guar plants to evaluate their effectiveness against *B. tabaci* and *A. gossypii* attacking plants under field conditions. Spraying was applied 4 times successively at two-week intervals early in the morning by using a 20 liters Knapsack motor sprayer, whereas the control plots were sprayed with water only. The first spray of guar started on June 20<sup>th</sup> and 23<sup>th</sup> during 2016 and 2017 seasons.

### Compounds used:

1- Common name: Azadirachtin (Crude aqueous extract of Azedarach, *Azadirachta indica* ).

Trade name: Achook 0.15 % EC

Rate of application: 115.5 g of crushed kernels/2 litres of water

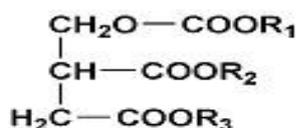
2- Common name: (Natural oil).

Trade name: Natur'lo oil 93% SC

Rate of application: 625 ml/100 liters of water.

Composition: Active Ingredient (Natural oil 93%). Emulsifiable substance 7%.

Chemical formulation: Mixture of triglyceride and fatty acids Chemical structure:



3- Common name: Mineral oil

Trade name: Super misrona 94 % EC

Recommended rate of application: 1.5 liter/100 liters of water.

Composition: aliphatic hydrocarbons, both saturated and unsaturated.

4- Common name: Spinetoram (Biopesticide)

Trade name: Radiant.

This insecticide is a mixture of major and minor components:

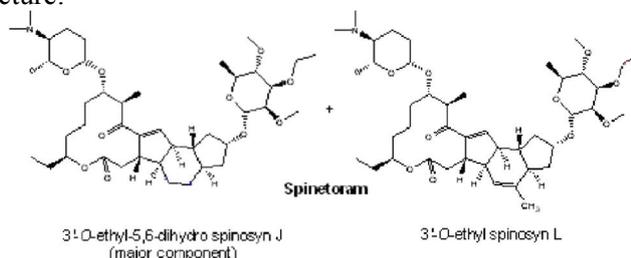
Major component (3'-O-ethoxy-5,6-dihydro spinosyn J)

Minor component (3'-O-ethoxy spinosyn L)

Rate of Application: 35ml/feddan

Formulation used: ( 12% Sc. )

Chemical structure:



### Data recording and analysis :

Estimations of the population densities of various insect species were taken every couple of weeks. The numbers of *B. tabaci* adults were recorded on 20 leaves in the field in the early morning (before 6 o'clock). The same 20 leaves were picked from each treatment and placed, gently, in paper bags and transferred to the laboratory to be examined at 10x binocular stereomicroscope. The number of infested leaves and the population densities of immature stages of whitefly and all stages of aphids were

recorded. All data were analysed by using ANOVA with three factors at 0.05 significance level for the whole results using SPSS (ver. 22). Data were treated as complete randomization design according to Steel *et al.* (1997). Multiple comparisons of significance were carried out applying LSD values.

## Results and Discussion

### Efficacy of Azadirachtin, Natural oil, Mineral oil and Spinetoram on the *B. tabaci* attacking leaves of guar plants.

Data presented in Table (1) show the efficacy of Azadirachtin, Natural oil, Mineral oil and Spinetoram on the cotton and tomato whitefly, *B. tabaci* attacking leaves of guar plants. Treatments were able to reduce the numbers of this insect found in the treated plots.

Eight weeks after spraying, low insect counts were found in treated plots. Also, it could be stated that the average number of *B. tabaci* (adults & immatures) was high significantly affected by the successive use of different pesticides. Non-significant difference was observed between the treatments. Application of Natural oil was more effective against *B. tabaci* than the others, showing the lowest average of (8.92±1.53) individuals/inch<sup>2</sup>. Spinetoram was the least efficient one recording the highest averages of *B. tabaci* (12.52±1.79) individuals/inch<sup>2</sup>.

Statistical analysis showed significant difference between all treatments compared to untreated control (30.33±3.35 individuals/inch<sup>2</sup>), during the two-investigating season. Significant decrease in the population was noticed in all treatments after the increase in successive sprays. so, all the tested insecticides recorded high efficacy after the fourth spray (8<sup>th</sup> week).

**Table 1:** Mean counts, (two years average of adults and immatures numbers) of *B. tabaci* infesting leaves on guar plants treated with different insecticides (No./ inch<sup>2</sup>):

Pesticide	Successive Sprays				Mean
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
Azadirachtin	13.58±5.63 <sup>cA</sup>	12.00±4.84 <sup>bA</sup>	8.47±3.24 <sup>cB</sup>	7.32±2.45 <sup>bB</sup>	10.34±2.04 <sup>b</sup>
Natural oil	9.28±3.28 <sup>dA</sup>	9.12±3.57 <sup>cA</sup>	8.88±3.17 <sup>cA</sup>	8.38±3.07 <sup>bA</sup>	8.92±1.53 <sup>b</sup>
Mineral oil	15.27±3.59 <sup>bA</sup>	11.4±3.47 <sup>bAB</sup>	11.20±2.61 <sup>cAB</sup>	8.88±2.74 <sup>bB</sup>	11.69±1.54 <sup>b</sup>
Spinetoram	9.02±1.54 <sup>dB</sup>	15.93±3.47 <sup>bA</sup>	17.73±5.03 <sup>bA</sup>	7.40±1.98 <sup>bB</sup>	12.52±1.79 <sup>b</sup>
Control	42.28±5.49 <sup>aA</sup>	27.03±8.66 <sup>aB</sup>	22.62±4.22 <sup>aC</sup>	29.37±6.36 <sup>aB</sup>	30.33±3.35 <sup>a</sup>

a, b .....: There is non-significant difference ( $P>0.05$ ) between any two means, within the same column having the same superscript letter.

A, B .....: There is non-significant difference ( $P>0.05$ ) between any two means, within the same row having the same superscript letter.

### Efficacy of Azadirachtin, Natural oil, Mineral oil and Spinetoram on the *A. gossypii* attacking leaves of guar plants .

Data in Table (2) show the effect of the different examined materials on the population density of the, *A. gossypii* , infesting guar leaves.

All treatments decreased the number of aphids compared with control. Data also showed that the population of aphids decreased with the use of successive sprays with all insecticides. Significantly affected by the successive use of different pesticides. Non-significant difference was observed between the treatments. Application of Natural oil was more effective against *B. tabaci* than the others, showing the lowest average of (2.50±0.1) individuals/ leaves. Spinetoram was the least efficient one recording the highest averages of *B. tabaci* (10.37±0.12) individuals/ leaves.

Statistical analysis showed significant difference between all treatments and untreated one (control), that record  $22.52 \pm 0.19$  individuals/ leaves.

**Table 2:** Mean counts, (two years average of adults and immatures numbers) of *A. gossypii* infesting leaves on guar plants treated with different insecticides (No./20 leaves):

Pesticide	Successive Sprays				Mean
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
Azadirachtin	$8.20 \pm 0.21^{bca}$	$3.70 \pm 0.16^{cB}$	$0.30 \pm 0.02^{dC}$	$0.20 \pm 0.02^{dC}$	$3.10 \pm 0.09^c$
Natural oil	$6.70 \pm 0.31^{cA}$	$0.30 \pm 0.02^{dB}$	$0.30 \pm 0.02^{dB}$	$2.50 \pm 0.15^{cB}$	$2.50 \pm 0.1^c$
Mineral oil	$8.80 \pm 0.17^{bcA}$	$4.80 \pm 0.08^{cB}$	$4.70 \pm 0.27^{cB}$	$4.30 \pm 0.03^{cB}$	$5.70 \pm 0.09^c$
Spinetoram	$10.95 \pm 0.30^{bA}$	$10.37 \pm 0.15^{bA}$	$10.10 \pm 0.14^{bA}$	$10.05 \pm 0.14^{bA}$	$10.37 \pm 0.12^b$
Control	$30.67 \pm 0.32^{aA}$	$19.50 \pm 0.18^{aB}$	$19.70 \pm 0.28^{aB}$	$20.20 \pm 0.22^{aB}$	$22.52 \pm 0.19^a$

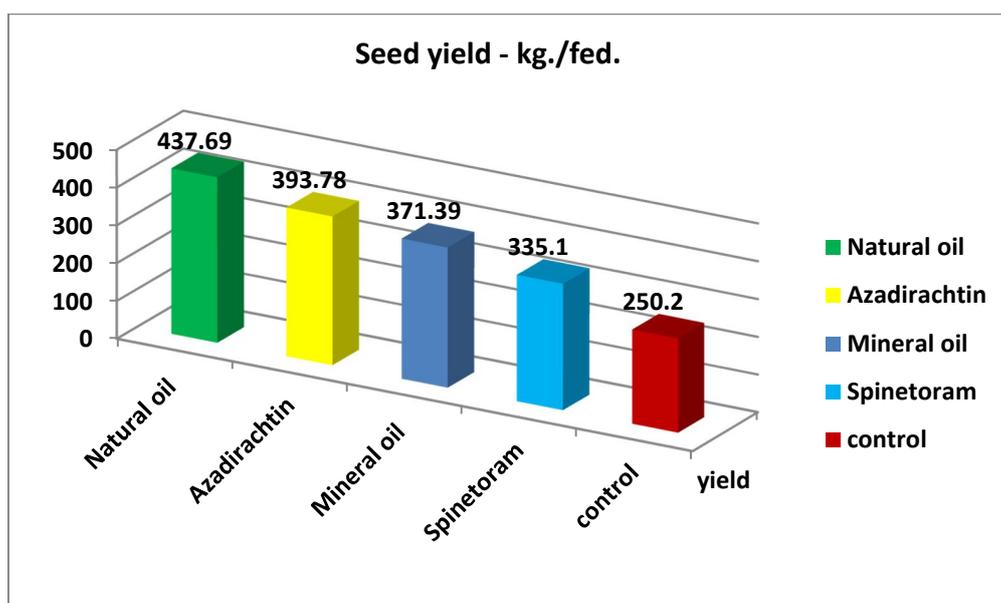
*a, b .....: There is non-significant difference ( $P > 0.05$ ) between any two means, within the same column having the same superscript letter.*

*A, B .....: There is non-significant difference ( $P > 0.05$ ) between any two means, within the same row having the same superscript letter.*

### Seed yield (kg/Fed.):

Data in Fig. (1) shows the differences between averages of seeds yield in kg. /fed. The results showed that yield produced from plants treated with insecticides was significantly, higher than that obtained from the control plot (250.2 kg. /fed.).

In this figure the highest average of seed yield in (437.7 kg. /fed.) was obtained with water extract of Natural oil followed by Azadirachtin, Mineral oil and Spinetoram, (393.8, 371.4 and 335.1 kg. , respectively ) (Fig. 1).



**Fig. 1:** Guar seeds yield losses due to insect's infestation

Guar plants were affected by feeding activities of various insects. High insects' population in the untreated control plots decreased the plant growth and subsequently reduced the resultant seeds' yield. The botanical insecticides were not effective during the first two weeks of spraying.

Delayed effect was reported to be one of the major problems of botanical insecticides (Yadav and Khinchi, 2015). The yield of Guar seeds was higher after the application of Natural oil followed by the botanical extract Azadirachtin, Mineral oil and Spinetoram, respectively. The efficacy of ten insecticides and bioagents against sucking insect pests, viz., leaf hopper, *Empoasca motti* Pruthi; whitefly, *Bemisia tabaci* (Genn.) and aphid, *Aphis craccivora* Koch were assayed by Dodia *et al.*, (2003) and Ganapathy and Karuppiyah (2004) on cluster bean *Cyamopsis tetragonoloba* (Linn.) Taub. Their results revealed that dimethoate (0.03%), imidacloprid (0.005 %) and thiamethoxam (0.025 %) proved to be the most effective and *Metarrhizium anisopliae* ( $2 \times 10^7$  spores) proved to be the least effective.

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