EFFECTS OF DIFFERENT FIELD TREATMENTS AGAINST SAP SUCKING PESTS INFESTING SUNFLOWER, SESAME AND SOYBEAN

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INTRODUCTION

In Egypt, the continuous need to increase the national food supply, particularly oil is a challenge to agricultural scientists. Sunflower, sesame and soybean are three major oil crops that are cultivated in many different Governorates. These crops are subjected to attack by many insect pests, such as piercing sucking insects, causing obvious degrees of reduction in the quantity of yield and also on quality of crop seeds.

Recently, the attention has been focused upon the integrated pest control approach that appeared as an essential aim for sound future of Agriculture. The first goal of this approach depends extensively on minimizing the use of chemical pesticides, for avoiding their indiscriminate usage. Besides, the development and the application of appropriate new safe control methods against insect pests are going in the same way. As a result, there is a resurgence of interest in the use of microbial control (Franz & Krieg, 1982). The entomopathogenic fungi, *Beauveria bassiana* represented one of these beneficial biological control agents (Mansour, 1999). Also, mineral oils achieved considerable attention (Abd El-Salam, 2000). In addition, Insect Growth Regulators (IGRs) are participating in these control strategies (Attia *et al.*, 1984). For control purpose, many commercial bioinsecticides were developed against sap sucking insect pests such as Biofly (containing the fungus *B. bassiana*, which was recommended to control whiteflies on cotton, tomato and snap bean plants. The mineral oil, Kz-oil was recently recommended against thrips and

whiteflies on cotton plants. While, the chemical insecticide Selecron was used against sugar beet fly on sugar beet plants and also on snap bean plants, for controlling the broad bean fly *Lyriomyza trifolii* (Administration of Egyptian Ministry of Agriculture, 2001). Many authors obtained good control results by spraying the bioinsecticide Naturalis (containing *B. bassiana*) against *Aphis gossypii* on eggplant (Negam and El-Sayed, 2000). While, others had the same results by spraying Kz-oil against the same pest on cotton (Abd El- Salem, 2000); against *A. craccivora* on broad bean plants (Sallam, 2001/2002) and also against *Bemisia. tabaci* on cotton (Abd El-Salam, 2000) and on eggplant (Negm, 2001).

Therefore, field studies were carried out, aiming to evaluate the effects of four different materials; a bioinsecticide, a mineral oil, an insect growth regulator and a chemical insecticide, against major sap sucking insect pests attacking the three oil crops. At the same time, other insect pests were also surveyed during the period from late of June until late of September, 2002. Moreover, laboratory studies were made to determine the effects of the previous materials on the weight of resulted soybean seeds, seed contents (especially, oil and fatty acids and also on the degree of seeds germination. It is hoped that, these materials may have a role in the development of Integrated Pest Management (I.P.M.) strategies against major sap sucking insect pests attacking the three oil crops.

MATERIAL AND METHODS

Field experiments were carried out at the experimental farm of the Faculty of Agriculture at Kafr El- Sheikh Governorate, during the period from late of June to late of September, 2002. Sunflower variety "Miak", sesame variety "Shandawil" and soybean variety "Crawford", were used. Sowing of seeds was conducted on 23th June, 2002, where the three oil crops were cultivated in the three adjacent areas and at the same time. While, harvesting of these oil crops was after 105days from planting. An area of about half feddan (total area was 2100m^2, representing the total area used for the three oil crops), was chosen and divided into 25 equal plots for each of the three oil crops (totally 75 plots/ 3 crops), and arranged in randomized complete blocks. The plots were specified for 5 treatments with 5 replicates, including the untreated control. The experimental unit plot was equivalent to 1/150 feddan (i.e., 28m.2= 4mx7m, which represented the area used for each plot). All the usual cultural practices were carried during the experiments.

The following materials were tested against major sap sucking insects, according to the infestation level of the recorded pests.

a- Entomopathogenic fungi *Beauveria bassiana*, of $33x10^7$c.f.u./1ml. (that was developed by Dr. Tawfik H. Abd El- Moity, Head of Integrated control Dept. Plant Pathology Institute, A. R.C.) It was applied at a rate of 4.00 liter/feddan.

b- Kz-oil, a local mineral oil, produced by Kafr El- Zayat Co. for Pesticides and Chemicals, formulated as an emulsifiable concentrate. It was applied at a rate of 7.00 liter/feddan

c- Flufenoxuron (Cascade), (10% D.C.). It was applied at a rate of $300cm^3$./ feddan.

d- Profenofos (Selecron), (72% E.C.). It was applied at a rate of $720cm^3$./feddan. The different treatments were applied by 20L- Knapsack sprayer. They were applied at 3 weeks intervals, starting 7 weeks after sowing (i.e., at 20th August and 11th September, 2002), when the number of the target pests (the whitefly *Bemisia tabaci, Empoasca* spp. and aphids), were adequate for control purpose. Application of the previous treatments were made against the following insect pests (according to the degree of infestations):

- *B. tabaci* on sunflower, sesame and soybean plants.
- *Empoasca* spp. on sunflower plants.
- Aphids on soybean plants (*Aphis* spp. mostly *A. gossypii* and *A. craccivora)*

The numbers of lepidopterous pests were very low on the three oil crops during this study that did not need any control program.

Sampling procedure:

The effects of the different treatments applied against major sap sucking insects attacking the three oil crops, were estimated as mean numbers/ 30 leaves and also as percentages of reduction at indicated days after treatments. The sampling period extended for 12 weeks, from 1st week of July until late of September, 2002. Weekly counts (early in the morning), were carried for the whitefly *B. tabaci* adults (on sunflower, sesame and soybean plants), aphid adults and nymphs (on soybean plants) and *Empoasca* spp. adults and nymphs (on sunflower plants), on both surfaces of the leaves of each crop. Five plants were randomly chosen for this purpose (where, 30 leaves from each plant were randomly chosen). At the same time, these 30 leaves were used for the identification of the commonly observed

predatory species. From obtained data in this study, it was found that 14th August, 56 days after planting represented the suitable date for control purpose against the major sap sucking insects, while the field experiments ended on September, 26.

Effects on resulted soybean seeds:

The effects of spraying the different compounds on soybean plants for pest control were estimated in the laboratory on seeds germination, mean weights of resulted seeds and also on the seed contents (mainly, oil and fatty acids).

Germination percentages were recorded after 7 days from planting. Ten soybean seeds were placed in a plastic cup (11.5cm. x 7.5cm.), with replicating each experiment 3 times (10seeds x 3 replicates), for every one of the five tested cases (untreated control, *B. bassiana*, Kz-oil, Cascade and Selecron). At the same time, measuring of the length of roots and stems of germinated seeds, took place to calculate their mean values. After harvesting, hundred seeds from each treatment were weighed and were compared with the same number of untreated control. Each group was replicated 5 times.

Analysis of soybean seed contents for the five treatments was made in the laboratories of Food Technology Research, Institute, A.R.C., according to the technique described by Aura *et al.* (1995). The size of the sample was 2gm. for each experiment, were calculated, which was replicated 3 times, and mean values. The percentages of soybean oil, seed oil contents and relative percentages of fatty acids, were also determined and compared with untreated control. The ratio between the total unsaturated fatty acids and the total saturated fatty acids (TU/TS) was also estimated.

The data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 levels, according to the technique described by Snedecor (1970).

RESULTS AND DISCUSSION

Recorded pests attacking sunflower, sesame and soybean plants:

Aphids on soybean, the whitefly *B. tabaci* on the three oil crops and *Empoasca* spp. on sunflower, were the most abundant insect species. In this study, the control was applied against these pests (i.e., the spraying of the different treatments were concentrated against them). It is assumed that, the weather factors

may had an affect on pest populations, resulting in recording very low numbers of the other pests, especially lepidopterous insects.

Data in Table (1) indicated that, the populations of aphids started to appear on the three oil crops when the plant age was 14 days after planting. They continued to appear until 84, 84 and 98 days on sunflower, sesame and soybean plants, receptively. The infestation of the three oil crops by aphids was mentioned by many authors. In Egypt, Harakly and Assem (1978) mentioned that, both *A. gossypii* and *Myzus periscae* were recorded on soybean plants. While, El-Shazly (1985) reported *A. craccivora* and *A. gossypii* on the same crop. El-khouly *et al.* (1998a) studied the population density of aphids (*Aphis* spp.) on soybean in Kafr El-Sheikh Governorate and they indicated that aphids had 2 generations per season. Also, Hassanein (1990) stated that, *A. gossypii* occurred after 15-45 days from sowing of sunflower seeds. However, Ali (1996) showed that *A. gossypii* represented 7.88% of the total 52 species surveyed in sesame (cv. Giza 25) in Assiut Governorate.

TABLE (I)

Pests recorded attacking sunflower, sesame and soybean plants, periods of occurrence and their total numbers during the period from late of June until late of September, 2002, at Kafr El-Sheikh Governorate.

Crops	Pest species	Order	Family	Periods of occurrence	Days after planting	Total no.
Sunflower	*Aphis gossypii*	Homoptera	Aphididae	1st week of July- mid. of September	14-84	++
	Autographa sp.	Lepidoptera	Noctuidae	1st week of August,1st week of September	49 , 77	2(larvae)
	Bemisia tabaci (Genn.)	Homoptera	Aleyrodidae	Mid. of July- late of September	21-98	+++++
	Empoasca spp.	Homoptera	Cicadellidae	Mid. of July- late of September	21-98	+++++
	Heliothis sp.	Lepidoptera	Noctuidae	1st week of August	49	1(larva)
	Nezara viridula F.	Hemiptera	Pentatomidae	Mid. of September	84	1 (nymph)
Sesame	*Aphis gossypii*	Homoptera	Aphididae	1st week of July- mid. of September	14-84	++
	Bemisia tabaci (Genn.)	Homoptera	Aleyrodidae	Mid. of July- late of September	21-98	+++++
	Empoasca spp.	Homoptera	Cicadellidae	Mid. of July- late of September	21-98	++
	Nezara viridula F.	Hemiptera	Pentatomidae	Late of August- late of September	70-98	2 (nymphs)
	Spodoptera littoralis (Boisd.)	Lepidoptera	Noctuidae	Mid. of July- 1st week of September	21-77	4(larvae)
Soybean	*Aphis* spp.	Homoptera	Aphididae	1st week of July – late of September	14-98	+++++
	Autographa sp.	Lepidoptera	Noctuidae	1st week of August, mid. of September	49,84	2(larvae)
	Bemisia tabaci (Genn.)	Homoptera	Aleyrodidae	Mid. of July – late of September	21-98	+++++
	Empoasca spp.	Homoptera	Cicadellidae	Mid. of July – late of September	21-98	++
	Icerya aegyptiaca (Douglas)	Homoptera	Margarodidae	1st week September- late of September	77-98	+++
	Nezara viridula F.	Hemiptera	Pentatomidae	Late of July – mid. of September	49-84	6 (nymphs)
	Spodoptera exigua Hbn.	Lepidoptera	Noctuidae	Mid. of August – mid. Of September	56-84	4(larvae)
	Spodoptera littoralis (Boisd.)	Lepidoptera	Noctuidae	Mid. of July – late of September	21-98	74(larvae)

+ = 1-10, ++= 10-20, +++=20-50, ++++=50-100, +++++ = > 100.

The whitefly *B. tabaci* was first observed after 21 days from planting the three crops and after that its population gradually increased, then fluctuated up and down until reaching the end of the studied season after 98 days (Table,1). This pest was previously recorded on the three oil crops in Egypt. Harakly and Assem (1978); El-Shazly (1985); and Tantawai (1995) considered *B. tabaci* as a soybean pest. Ali (1996) showed that, *B. tabaci* was one of the arthropod species found on sesame plants in Assiut Governorate forming 5.50% of the total population. El-Khouly *et al.* (1998a) showed that the whitefly *B. tabaci* had one generation per season on soybean in Kafer El-Sheikh Governorate. However, El-Khouly *et al.* (1998b) found high populations of aphids and relatively moderate numbers of jassids and whiteflies on the soybean cultivar Crawford in Kafr El-Sheikh Governorate. They added that, the total populations of *Aphis* spp., *Empoasca* spp. and *B. tabaci* were correlated insignificantly and negatively with the three climatic factors; temperature, relative humidity and wind. Also, Hassanein (1990) and Salem (1999) surveyed *B. tabaci* on sunflower plants. Harakly and Assem (1978) demonstrated that, *B. tabaci* had two to three peaks of activity, when plants of sunflower reachd 15-35 days old.

Data showing the infestation period by *Empoasca* spp. revealed that, these piercing sucking pests were found on sunflower, sesame and soybean plants after 21 days from planting and their populations continued to appear until the end of the studied season, after 98 days (Table, 1). Infestation of soybean plants by *Empoasca* spp. was previously reported by Harakly and Assem (1978), El-Shazly (1985) and Salem (1999). While, its attack to sunflower plants was recorded by Hassanein (1990) and Salem (1999). In addition, Hassanein (1990) studied the seasonal populations of *Empoasca* spp. on sunflower plants at Sharkia Governorate. He found that, there were two to three peaks of activity of *Empoasca* spp., when the sunflower plants reached 15-35 days old. Ali (1996) surveyed *Empoasca decipens* with a percentage of 57.89% of the total pest population in sesame plants in Assiut Governorate. Also, El-Khouly *et al.*(1998a) recorded *Empoasca* spp. in Kafr El-Sheikh Governorate on soybean plants having one generation per season.

Recorded predatory species:

Data involving the field observations of the most common predatory species associated with the pests found attacking sunflower, sesame and soybean plants are shown in Table(2). Six predaceous species were observed and recorded during the period from late of June to late of September, 2002. These predatory species belong to 5 orders of 6 families. True spiders (unidentified species) were also found during this study. However eggs of the predator *Chrysoperla carnea*

were the highest in their numbers on the three oil crops (where, 53,20 and 4 eggs were counted on sunflower, sesame and soybean plants, respectively, indicating their highest numbers on sunflower compared to the other two oil crops), in comparing with those numbers of other predators (either adults or developmental stages). The period of occurrence of *Chrysoperla* eggs was during late of August to late of September on the three cultivated crops. The same predator was recorded in Egypt on sesame and soybean plants. Ali (1996) cleared that the predator *C. carnea* was found between arthropods surveyed in Assiut Governorate in sesame plants. In addition, El-Khouly *etal.* (1998a) revealed that, *C. carnea* was one of the recorded predatory species found associated with *Aphis* spp., *B. tabaci* and *Empoasca* spp. on soybean plants in Kafer El-Sheikh Governorate.

TABLE (II)

Predatory species found in the fields of sunflower, sesame and soybean, during the period from late of June to late of September, 2002, at Kafr El-Sheikh Gonvernarate.

Crops	Pest species	Order	Family	Periods of occurrence	Days after planting
Sunflower	Ants	Hymenoptera	Formicidae	Mid. of August	56
	Chrysoperla carnea (Steph.) (eggs)	Neuroptera	Chrysopidae	Late of August - late of September	70-98
	Coccinella undecimpunctata (eggs & larvae)	Coleoptera	Coccinellidae	Late of August, mid. of September	70,84
	True spiders	Unidentified	species	Mid. of August	56
Sesame	Ants	Hymenoptera	Formicidae	1st week of September	77
	Chrysoperla carnea (Steph.) (eggs)	Neuroptera	Chrysopidae	Late of August – late of September	70-98
	Mantis religiosa L. (egg masses)	Dictyoptera	Mantidae	Mid. of September	84
	Paederus alfierii Koch.	Coleoptera	Staphylinidae	Late of September	98
	True spiders	Unidentified	species	1st week of August, late of August – late of September	49, 70-98
Soybean	Ants	Hymenoptera	Formicidae	Late of July – late of September	35-98
	Chrysoperla carnea (Steph.) (eggs)	Neuroptera	Chrysopidae	Late of August– late of September	70-98
	Orius sp.	Hemiptera	Anthocoridae	1st week of September	77
	Paederus alfierii Koch.	Coleoptera	Staphylinidae	1st week of September	77
	True spiders	Unidentified	species	1st week of September-mid. of September	77-84

Ants (unidentified species) were found on the three oil crops, during (mid. of August), (1st week of September) and (from late of July to late of September), in association with pests attacking sunflower, sesame and soybean plants, respectively (Table, 2). However, the highest numbers (50 individuals) were observed on soybean plants during the whole season. Their existence may be related to the extensive numbers of *Aphis* spp. on soybean plants.

As for the predator *Coccinella undecimpunctata*, this species was recorded during late of August and mid. of September, only on sunflower plants (where, the total numbers of egg masses of *C. undecimpunctata*. were only two, one adult and one larva were also found). Ali (1996) recorded *C. undecimpunctata* on sesame plants. Similarly, El-Khouly *et al.*(1998a) showed that, *C. undecimpunctata* was found on soybean plants in Kafr El-Sheikh Governorate associated with *Aphis* spp., *B. tabaci* and *Empoasca* spp.

Two egg masses of the predator *Mantis religiosa* were found on sesame plants, during mid. of September.

Moreover, the predator *Paederus alfierii* was detected during late of September on sesame plants (only two adults) and during the 1st week of September on soybean plants (only one adult was recorded). The same predator was recorded on soybean plants in Kafr El-Sheikh Governorate by El-Khouly *et al.* (1998a).

While, the predator *Orius* sp. was only occurred on soybean plants (where, the total number was one adult), during the 1st week of September (after 77 days from planting), as shown in Table (2). Ali (1996) surveyed *O. albidipennis* on sesame plants in Assiut Governorate

Regarding the occurrence of the true spiders (unidentified species), they were recorded during the periods; (mid. of August), (1st week of August & late of August to late of September) and (from 1st week of September to mid. of September, 2002), in case of sunflower (where, the total number was one), sesame (where, the total numbers were 4) and soybean plants (where, the total numbers were 2), respectively. Ali (1996) observed spiders (Araneae) species on sesame plants in Assiut Governorate. In addition, the same author showed that the four predators; *C. carnea, O. albidipennis, C. undecimpunctata* and spider (Aranеae) species, were the most abundant predators (representing 12.08% of the arthropod population), surveyed in sesame plants in Assiut Governorate.

From Table (2), it could be mentioned that, the predatory species occurrence was synchronized with that of the pests recorded during this study. The difference of the host plant (sunflower, sesame or soybean), may had a role on affecting the types of the predatory species recorded. Besides, the time of carrying out this study may affect on the occurrence of these different predatory species. El-Khouly *et al.* (1998a) studied the population density of aphids, whitefly and jassids on soybean plants in relation to common associated predators surveyed (*P. alfierii, C. carnea,* and *C. undecimpunctata*), during two seasons. They revealed that, the

total population of the associated predators peaked twice annually. The first peak appeared in the second half of July for the two seasons. While, the second peak appeared on 27th September for the 1st season and on 6th September for the 2nd one.

Effects of treatments on *B. tabaci* adults:

The mean numbers of *B. tabaci* adults/30leaves (attacking sunflower plants), were 50.88±36.36 (24.00-116.00), 42.57± 29.38 (24.00-107.20), 37.71± 27.76 (24.00-99.00), 47.83 ± 28.70 (24.00-109.20) and 2.57± 6.97 (6.00-24.00), for untreated control, *B. bassiana*, Kz-oil, Cascade and Selecron, respectively (Fig., 1, A). The mean percentages of reduction in relation to the untreated control were 16.33, 25.88, 5.99 and 75.30%, respectively, for the last four treatments. The correspondent mean numbers of *B. tabaci* adults/30 leaves (attacking sesame plants), were 36.26± 17.52 (15.80-69.80), 29.14± 15.10 (15.80-60.00), 27.37± 14.97 (15.80-57.80), 33.74±17.54 (15.80-68.20) and 9.63± 6.24 (2.20-20.20), respectively (Fig., 1, B). The means percentages of reduction in numbers of whitefly in the untreated control were 19.64, 24.52, 6.95 and 73.54%, for *B. bassiana*, Kz-oil, Cascade and Selecron treatments, respectively. While, the mean numbers of *B. tabaci* adults/ 30 leaves (attacking soybean plants), were 18.51± 8.95 (3.80-30.80), 13.83± 6.81 (3.80, 24.00), 12.21± 6.17 (3.80-20.00), 16.83± 8.29 (3.80-27.80) and 5.57± 3.48 (2.20-12.00), (Fig., 1, C). The percentages of reduction in numbers of whitefly in relation to the untreated control were of 25.28, 36.09, 9.08 and 69.91%, for *B. bassiana*, Kz-oil, Cascade and Selecron treatments, respectively. Obtained results showed that, treatment with the Selecron had the highest effect on *B. tabaci* adults in all the three oil crops, followed by Kz-oil, and *B. bassiana*, respectively. Cascade treatment showed slight effects on the population of *B. tabaci* adults. Mineral oil had the ability of reducing the population density of whitefly on cotton plants (Hegab *et al.*, 1992; Hayder *et al.*, 1996 and Metwally *et al.*, 1999). In addition, Abd El-Salam (2000) mentioned that, the percent of reduction of *B. tabaci* individuals after spraying with Kz-oil was 74.80%. While, Farrag and Zakzouk (2000) found that, the percentages of reduction of *B. tabaci* adults on cauliflower were 56.20 and 0.00%, after 2 and 7 days post treatment with Biofly (containing the fungus *B. bassiana*).

Statistical analysis of data cleared that, a significant difference was only found in the mean numbers of *B. tabaci* between Selecron and other treatments (untreated control, *B. bassiana*, Kz-oil and Cascade), (where, the F- value was 10.17 and the $L.S.D._{0.05}$ value was 13.95 sprayed sunflower plants. But, in sesame plants, there were significant differences in the mean numbers of *B. tabaci* between the untreated control and *B. bassiana*, Kz-oil and Selecron treatments (where, the F-

value was 16.69 and the $L.S.D._{0.05}$ value was 7.49) and also between Selecron and all other treatments. As for the spraying of soybean plants, significant differences were recorded between the untreated control and *B. bassiana,* Kz-oil and Selecron in soybean treatments (where, the F- value was 25.02 and the $L.S.D._{0.05}$ value was 2.93).

Effects of treatments on *Emposca* spp. (adults and nymphs)

The mean numbers of *Empoasca* spp. (adults and nymphs)/30 leaves (attacking sunflower plants), were 47.96± 9.20 (35.20-60.80), 26.57± 12.20 (35.20-48.00), 26.19± 8.84 (35.20-39.80), 39.56± 8.31 (35.20-48.80) and 12.04± 11.52 (2.00-35.20), in case untreated control, *B. bassiana*, Kz-oil, Cascade and Selecron, respectively (Fig., 2). The mean percentages of reduction were of 44.33, 45.35, 17.64 and 74.84%, for *B. bassiana*, Kz-oil, Cascade and Selecron treatments, respectively.

Statistical analysis showed significant differences in the mean numbers of *Empoasca* spp. between the untreated control and the treatments of *B. bassiana*, Kz-oil and Selecron and also between Selecron and all other treatments, in sunflower.

Effects of treatments on aphids (adults and nymphs)

The mean numbers of aphids (adults and nymphs)/30 leaves (attacking soybean plants), were 22.63± 10.46 (11.20-41.00), 14.06± 6.07 (11.20-26.20), 9.00± 3.76 (11.20-13.00), 18.86± 9.68 (11.20-38.20) and 6.74± 5.17 (2.20-15.00), in untreated control, *B. bassiana*, Kz-oil, Cascade and Selecron, respectively. The mean percentages of reduction in numbers of aphids in relation to untreated control were 37.87, 60.23, 16.66 and 70.22%, for *B. bassiana*, Kz-oil, Cascade and Selecron treatments, respectively (Fig., 3).

However, mineral oil was able to reduce the population density of aphids on cotton plants (Hegab *et al.*, 1992; Haydar *et al.*, 1996 and Metwally *et al.*, 1999). Abd El-Salem (2000) demonstrated that, the percent of reduction of infestation of aphid on cotton plants by Kz-oil treatment was 75.20%. While, Sallam (2001/2002) tested Kz-oil against *A. craccivora* on broad bean plants, indicating its effectiveness against this pest. Also, the bioinsecticide Biofly (that contain the fungus *B. bassiana*), was tested by Farrag and Zakzouk (2000), where they found that the reduction in adults of aphids on cauliflower was 88.30% after 2 days post treatment. While, the reduction percentage became 90.00% after 7 days post treatment. Negam and El-Sayed (2001) obtained good control by spraying Naturalis (containing *B. bassiana*) against *A. gossypii* on eggplant

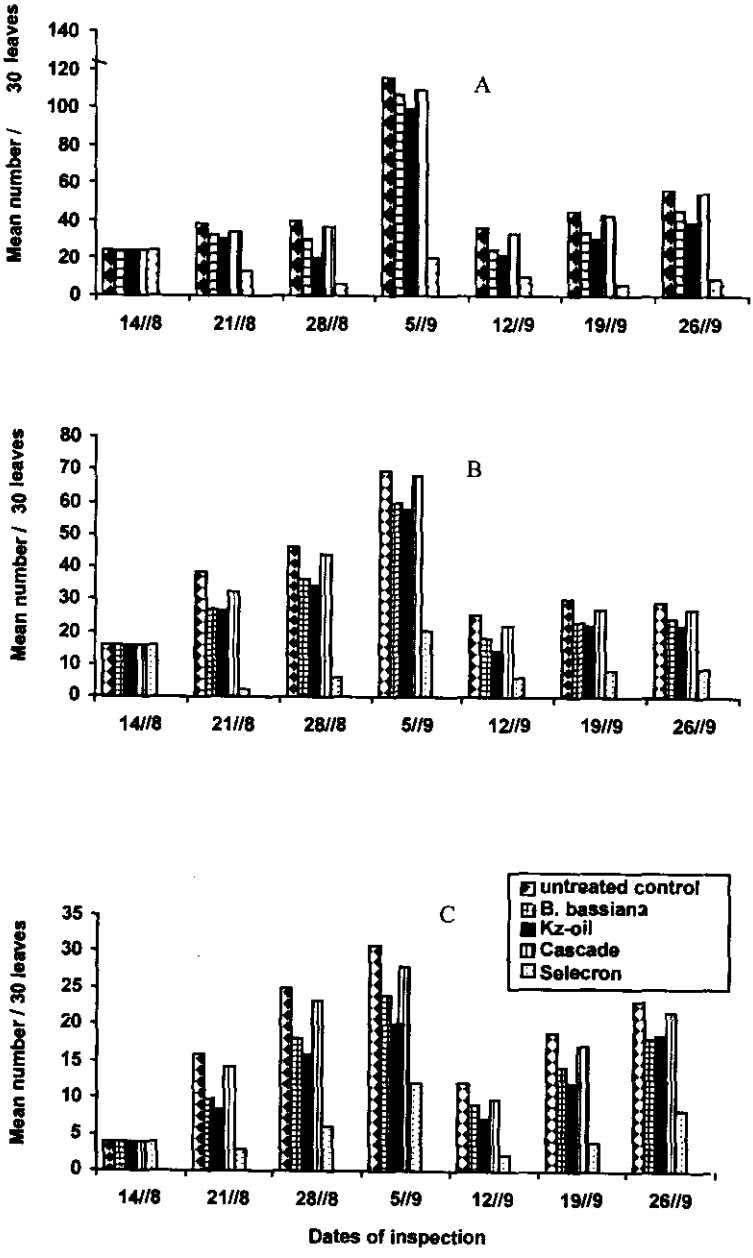

Fig. (1): Mean numbers of *B. tabaci* adults /30 leaves attacking sunflower (A), sesame (B) and soybean plants (C), for the treatments used, during the period from 14th August to 26th September. 2002.

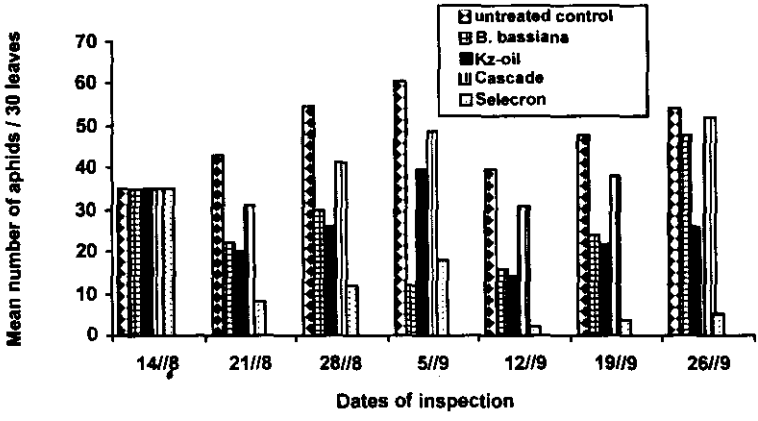

Fig. (2): Mean numbers of *Empoasca* spp. (adults and nymphs)/ 30 leaves attacking sunflower plants, for the treatments used, during the period from 14th August to 26th September, 2002.

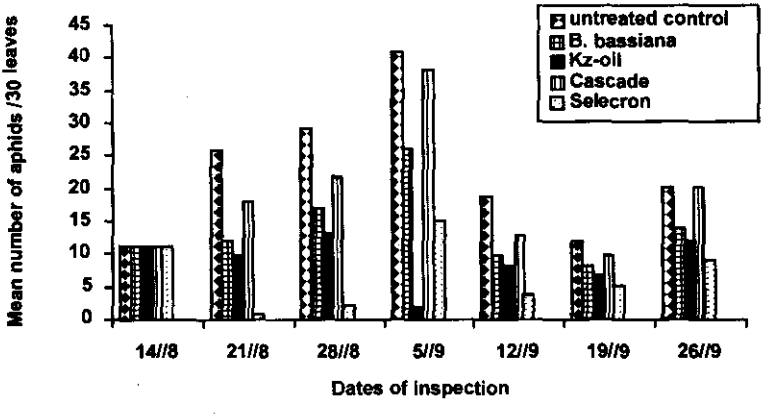

Fig. (3): Mean numbers of aphid individuals (adults and nymphs)/ 30 leaves attacking soybean plants, for the treatments used, during the period from 14th August to 26th September, 2002.

Statistical analysis of data indicated significant differences in the mean numbers of aphids between *B. bassiana*, Kz-oil and Selecron with other cases (untreated control and Cascade). Also, a significant difference was found between Selecron treatment and all other treatments in soybean (Fig., 3).

In general, all tested materials, had showed effects on the major sap sucking insects, attacking the three oil crops, this effects related directly to the main

components of each tested material. The present study showed that, Kz-oil and /or Cascade can be used with low rates of the chemical insecticide Selecron for getting more effective control. Also, the bioinsecticide of *Beauveria bassiana* may be in the first treatment then, followed by low rates of Selecron, in order to decrease pollution. However, the time of application depends greatly on the economic increase in *B. tabaci* , aphids and *Empoasca* spp. populations.

Effects of treatments on the germination of resulted seeds:

Seeds of soybean resulted from the different five treatments were totally germinated normally (100% germination of seeds). These results indicated that, there was no effect of the tested materials on the percentages of seed germination. Magdoline (1985) found that the chemical insecticide Permethrin did not affect wheat seeds germination. Mahmoud (1990) conducted a germination test after six months of storage of maize grains treated with Sumithion and Sumicidine, to evaluate its activity on the stored grains. Germination of grains treated with 2p.p.m.was not affected.

TABLE (III)

Percentages of soybean seed germination mean lengths of roots and stems, after a week from seed planting outdoor and also the mean weights of 100 soybean seeds resulted from treated crops.

Treatments	%of seeds germination	*Mean lengths of roots (cm.)	*Mean lengths of stems (cm.)	**Mean weights (gms)/100 seeds
Untreated control	100.00	2.08±0.69 A	4.07 ± 1.09 A	15.70 ± 0.44 B
B. bassiana	100.00	2.36± 0.40 A	5.20 ± 1.34 A	16.85 ± 0.37 A
Kz-oil	100.00	2.33 ± 0.74 A	4.22 ± 2.01 A	15.90± 0.33 B
Cascade	100.00	2.58 ±0.18 A	5.09 ± 0.96 A	15.41 ± 0.23 C
Selecron	100.00	2.32 ± 1.35 A	4.11 ± 1.91 A	16.13 ± 0.39 B
F- value		0.15	0.42	11.01
$L.S.D_{0.05}$		N.S.	N.S.	0.48

* Means for 3 replicates
** Means for 5 replicates
Note: means with the same letter are not significantly different

Moreover, data in Table (3) revealed that, the mean lengths of roots of germinated soybean seeds were 2.08±0.69, 2.36 ± 0.40, 2.33±0.74, 2.58±0.18 and 2.32 ± 1.35cm. While, the mean lengths of stems of germinated soybean seeds were 4.07±1.09 , 5.20 ±1.34, 4.22 ± 2.01, 5.09 ±0.96 and 4.11 ± 1.91cm., for seeds resulted from untreated soybean plants and those from plants treated with *B. bassiana*, Kz-oil, Cascade and Selecron, respectively The longest roots were measured from Cascade treatment. While, the shortest ones were in the untreated control. But, the longest stems were in *B. bassiana* treatment, and the shortest ones were in the untreated control. Magdoline (1985) indicted that, no obvious

differences were noticed in both shoot and root radical lengths of wheat seedlings, till the fourth months after Permethrin application. Also, Mahmoud (1990) revealed that, both Fenvalerate and Fenitrothion insecticides did not affect the germination strength of treated maize grains.

Statistical analysis of data showed no significant differences in both the mean lengths of germinated roots and stems in all treatments.

Effects of treatments on the weight of resulted seeds:

The mean weight of 100 soybean seeds in the untreated control, *B bassiana*, Kz-oil, Cascade and Selecron treatments were 15.70 ±0.44, 16.85±0.37, 15.90± 0.33, 15.41± 0.23 and 16.13 ± 0.39 gm., respectively (Table, 3). The highest mean weight was in *B. bassiana* treatment. While, the lowest weight of seeds was in Cascade treatment.

Statistical analysis indicated that, there was significant difference between the untreated control and *B. bassiana* treatment, which gave the heaviest weight of soybean seeds.

Effects of treatments on the contents of resulted seeds:

Data in Table (4) cleared that, the highest percentage of oil in soybean seeds was in Kz-oil treatment (20.86%), followed by Cascade treatment (20.74%) But, the lowest percentage of oil in soybean seeds (19.74%), was in Selecron treatment. This lower percentage may be attributed to the effects of the chemical compound on plant the physiological processes.

TABLE (IV)

Percentages of oil in soybean seeds and the relative percentages of fatty acids of resulted soybean seeds after different treatments.

Treatments	%of oil in soybean seeds	Relative percentages of fatty acids									
		Saturated				Unsaturated					
		Myristic	Palmitic	Stearic	Total %	Lenolenic	Linoleic	Oleic	Total %	Total %of fatty acids	TU/TS*
Untreated control	20.61 C	0.00 B	11.60 C	3.96 D	15.56	6.90 B	54.41 A	23.13 A	84.44	100 A	5.43
B. bassiana	20.03 D	0.00 B	11.44 C	3.93 D	15.37	5.97 C	53.68 B	24.98 B	84.63	100 A	5.51
Kz-oil	20.86 A	3.61 A	18.76 A	5.40 A	27.77	1.81 D	34.80 D	35.62 C	72.23	100 A	2.60
Cascade	20.74 B	0.00 B	11.14 D	4.02 C	15.16	7.03 A	54.83 A	22.98 D	84.84	100 A	5.60
Selecron	19.74 E	0.00 B	11.84 B	4.06 B	15.90	6.78 B	52.63 C	24.06 D	83.47	99.37B	5.24
F- value	2621.44	3231.10	3391.15	3738.56		3158.11	3311.16	3282.67	2976.75		
$L.S.D._{0.05}$	0.03	0.09	0.18	0.03		0.13	0.49	0.31	0.02		

* TU/TS = Total unsaturated fatty acids/ Total saturated fatty acid Note: means with the same letter are not significantly different

Statistical analysis of the data showed significant differences in the percentages of oil in soybean seeds between the untreated control and all other treatments.

Six fatty acids were identified from soybean seeds. These were; Myristic, Palmitic, Stearic, Lenolenic, Linoleic and Oleic acids (Table, 4). The obtained data indicated that, Myristic acid was only recorded in Kz- oil treatment. The highest percentages of Palmitic, Stearic and Oleic acids, were in Kz-oil treatment. While, the lowest percentages of Palmitic and Oleic acids occurred in Cascade treatment, while, Lenolenic and Linoleic acids were in Kz-oil treatment, and Stearic acid was in *B. bassiana* treatment (Table, 4). The total percentages of saturated fatty acids were 15.56, 15.37, 27.77, 15.16 and 15.90%. While, the total percentages of unsaturated fatty acids were 84.44, 84.63, 72.23, 84.84 and 83.47%, in the five treatments; the untreated control, *B. bassiana*, Kz-oil, Cascade and Selecron, respectively. Obtained results showed that, both *B. bassiana* and Cascade had the lowest percentages of saturated fatty acids. While, *B. bassiana* had the lowest percentages of unsaturated fatty acids.

Statistical analysis of the data revealed the following:

1- As for saturated fatty acids:

   a- Significant differences in the relative percentages of the saturated fatty acids between the treatment with Kz-oil and all other treatments, in case of Myristic acid.

   b- Significant differences were obtained between the untreated control and either of Kz-oil, Cascade or Selecron treatments, and also between Selecron and all other treatments used, in case of Palmitic and Stearic acids.

2- As for unsaturated fatty acids:

   a. Significant differences between the untreated control and either of B. bassiana, Kz-oil and Cascade treatments and also between Selecron and either of B. bassiana, Kz-oil or Cascade, in case of Lenolenic acid.

   b. Significant differences between the untreated control and all other treatments except Cascade and also between Selecron and all other treatments used, in case of Linoleic acid.

   c. Significant differences were achieved between the untreated control and all other treatments and also between Selecron and all other treatments except Cascade, in case of Oleic acid.

Data in Table (4) also revealed that, the ratio between the total unsaturated fatty acids and the total saturated fatty acids (TU/TS) increased with the treatment by both *B. bassiana* (5.51) and Cascade (5.60), compared with a ratio of 5.43 in the untreated control. At the same time, the treatments with Kz-oil and Selecron showed a decreased ratio (2.60 and 5.24, respectively). The decrease in TU/TS ratio in case of Kz-oil treatment may be attributed to some commercial additives to the main product. While, the increase in TU/TS ratio as a result of the treatment with *B. bassiana* and Cascade may be attributed to the effects of their components on the enzymes that catalyse the biosynthesis of the unsaturated fatty acids. So the treatments of soybean plants with *B. bassiana* or Cascade increased the total unsaturated fatty acid content and the TU/TS ratio, compared with the untreated control. Therefore, their application has more beneficial effects than Kz-oil or Selecron treatments on man health and his surrounding environment. Sawan *et al.*(2001), who showed that, a low content of saturated fatty acids (especially Palmitic) and a higher ratio of TU/TS are desirable in food.

SUMMARY

The present work was carried out to record the major insect pests attacking sunflower, sesame and soybean plants and related predators found during the period from late of June to late of September, 2002, at Kafr El- Sheikh Governorate,and to study the effects of four different treatments; *Beauveria bassiana*, Kz-oil, Cascade and Selecron on the sap sucking insects attacking the three previous oil crops. The obtained data revealed that, the whitefly *Bemisia tabaci* was the most abundant pest found on the three crops. *Empoasca* spp. were extensively recorded on sunflower plants, while, aphids were obviously found on soybean plants. Selecron was the most effective compound, followed by Kz-oil, *Beauveria bassiana* and Cascade, respectively. Selecron induced the highest percentages of reduction in the population density of the previous three sap sucking insect pests. Moreover, the effects of such materials were evaluated on weights of resulted soybean seeds their germination and also on seed contents (especially, the percentages of oil seeds and fatty acids).

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