ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 44(4): 1931-1946, (2006).

EVALUATION OF SOME PLANT EXTRACTS TO CONTROL THE PINK STEM BORER *SESAMIA CRETICA* (LED.)

BY

Safaa M.M. Halawa
Department of Plant Protection, Faculty of Agric., Moshtohor, Benha University

ABSTRACT

The pink stem borer *Sesamia cretica* (Led.) is one of the most serious pests of maize causing dead heart and subsequently, rot of plants. The objective of this study was to evaluate the susceptibility of three crosses of maize (S.C.10, 3062 and 30K8) to infestation with the 3rd instar larvae of *S. cretica* and the effectiveness of treating these maize crosses with petroleum ether extracts of (Clove) *Syzygium aromaticum* and (Garlic) *Allium sativum,* as well as the insecticide pyriban 48% E.C against *S. cretica* . The intensities of damage between the three tested crosses were statistically insignificant before spraying. They had nearly the same rate of susceptibility to *S .cretica* infestation. The insecticide and garlic extracts caused the highest reduction of pest infestation compared with non treated plants (control). Dead heart percentages between crosses were highly significant. Both crosses S.C.10 and 3062 had the same level of susceptibility to the dead heart phenomenon, when infested by *S. cretica* larvae. On the other hand, the maize cross, 30K8 recorded the lowest level of susceptibility. Both garlic extract and insecticide pyriban gave high weight of grain yield in all tested crosses when compared with control .

Key Words: Plant extracts, *Syzygium aromaticum, Allium sativum, Sesamia cretica,* insecticides.

INTRODUCTION

In Egypt Maize (*Zea maize* L.) is one of the most important grain crops. Maize crop is cultivated in multiple plantations throughout March to October for seed production or in order to be used as green foliage for farm animal. Maize plants are subjected to infestation with a variety of insect pests (Tawfik, *et at.*, 1974) of which *S. cretica* Led. (Lepidoptera: Noctuidae) may be fairly considered the most serious one since its infestation to plants in the seedling stage causes dead heart and, subsequently, rot of plants.

Dicke and Guthrie (1988) proposed that the late maturity corn is more attractive than early corn to the moths of the second generation of European corn borer *Ostrinia nubilalis.* The natural infestation of *S. cretica* could not discriminate between resistant and susceptible crosses. The yield under infestation conditions appears to be an important way to select the crosses with high yield when the insect attack is important, Al-Naggar *et al.* (2000).

The interactions between genotype and environment (GE) of forty-five maize hybrids were tested by Butro' n *et al.* (1999 and 2004) in five different environments characterized by different levels of natural infestation by the pink stem borer. In general, GE effects for grain yield were mainly due to earliness, vigor effects, and environmental yield limiting factors such as the mean of minimum temperature and percentage of air humidity.

According to recommendations by the Egyptian Ministry of Agriculture, this pest is controlled in maize fields by chemical pesticides. However, due to the increasing problems of pollution and insecticidal hazard consequences, besides the pressing need to satisfactory advocate pest management, it is necessary to look for safer facilities for insect pest suppression. The use of natural products from plant origin is a new trend which may prove efficient for pest control. These natural products are mainly plant extracts which prove to have deleterious effects on target insects. The efficacies on the insect pest were manifested in several ways, including direct toxicity Hiremath *et al.* (1997), growth retardation Breuer and Schmidt, (1995), feeding inhibition Wheeler and Isma, (2001), oviposition deterrence Gaaboub and Halawa (2003), suppression of calling behaviour Khan and Saxena (1986) and reduction of fecundity and fertility El-Ibrashy (1974).

The present study deals with:

a) Effect of two plant extracts, (Clove) *S. aromaticum* and (Garlic) *A. sativum*, on the 3rd larval instar of *S. cretica*
b) Response of three maize crosses to *S. cretica* under artificial infestation. By recording the intensity of damage, the percentage of infested plants and the percentage of dead hearts.
c) The impact of plant extracts from two plants for controlling infestations with *S. cretica* in maize plantations and their effect on the final yield.

MATERIALS AND METHODS

Insects:

Large numbers of egg-masses and Larvae of S. *cretica* were collected from infested maize plantations in the Agricultural Research Experimental Farm of the Faculty of Agriculture at Moshtohor, Benha University during 2005. Both egg-masses and larvae were kept in plastic cups and transferred to laboratory. Egg-masses were placed on fresh succulent rolled corn leaves as suitable food supply for the hatching larvae. Plant leaves were renewed every couple of days and as the larvae grew older; they were fed on tender cuttings of maize stems or young corn ears.

Plant extracts used:-

The fruits of clove *S. aromaticum* and the bulb of garlic *A. sativum*, have already been reported to elicit insecticidal properties against some insect species. Their parts were crushed to fine particle size. The extracts were prepared using methods described by Su and Horvat (1981) with some modifications. The tested parts of the two plants (200 gm each) were extracted with 1000 ml petroleum ether at a rate of 5 ml/gm and kept for 48 hrs under laboratory conditions. The mixtures were

mechanically shacked for 6 hrs. The extracts were then filtered over anhydrous sodium sulfate. Petroleum ether was evaporated using a rotary evaporator at 40-50 °C until the extract was dried. The resulting crude extract was weighted and kept in a deep freezer until evaluation Halawa (2001) and Gaaboub and Halawa (2003).

Chemical pesticide used:-

Pyriban 48 %E.C.
O,O- diethyl O-3,5,6- trichloro-2- pyridyl phosphrothioate.
E.C. 48% chloropyriphose W/V
Recommended at rate:-
2.5 ml. of Liter/feddan for controlling corn borer
Manufactured by:-
El-Helb pesticides & Chemicals Company.

The recommended chemical pesticide for controlling *S. cretica* (Pyriban 48% E.C.) at concentration 2.5 % W/V was kept in the refrigerator at 4 °C until the time of application in the field.

Bioassay of the tested extracts:

Experiments were conducted to study the effects of tested plant extracts on the 3rd larval instar of the pink stem borer. For treatment, three equal pieces of tender parts of maize plant stems were dipped in the desired solution for about two minutes after which the treated parts were left in shade for about 10 minutes to dry. The test larvae were kept starved for about 4 hours, before offering the treated food to assure rapid ingestion. Larvae were allowed to feed on the treated maize parts, of each treatment, for 3 days. The total number of treated larvae per treatment was 40 (4 replicates of 10 larvae each). Five concentrations (1%, 0.5%, 0.25%, 0.125% and 0.0625%) of *S. aromaticum* and *A. sativum*, petroleum ether extracts were tested. Mortality counts were recorded after 24, 48, and 72 hrs. The control test was conducted using the same technique of larvae feeding on maize stems dipped for about two minutes in water only, then kept for about 10 minutes to dry.

All concentrations were prepared by using distilled water adding two small drops of Tween 20 as emulsifying agent to both plant extracts and control. The experiments were conducted under laboratory conditions of 30±1°C and 60 ± 5 % R.H. The obtained data were corrected according to the Abbott's formula (Abbott, 1925).

LC50 and LC90 values for *S. cretica* 5% confidence limits and slope regression lines represented and interpreted, using probit analysis statistical method of (Finney, 1971).

Field experiments:-

Field experiments were carried out on maize crop under artificial infestation conditions in the Agricultural Research Experimental Farm of the Faculty of Agriculture at Moshtohor, Benha University during 2005 corn seasons. Crosses S.C.10, 3062 and 30K8 of maize were chosen to be evaluated under artificial infestation by the pink stem borer, *S. cretica* Led. Maize crosses were planted on June 1st. The area was divided into 24 plots of 3.5 X 3.0 meters each

(about 1/400 of feddan). Each plot contained five rows at a distance of 70 cm. between rows. A randomized complete block design was used for each experiment, with 4 treatments and 4 replicates each. Thinning was done 18 days after sowing, leaving 2 plants/hill. All treatments received the normal agricultural practices.

Table (1): LC50 and LC90 of the two plant extracts on 3rd instar larvae of *S. cretica* after three days of exposure.

Plants	Slope ± SE	LC50	95%cofidence limits		LC90	95%cofidence limits	
			Lower	Upper		Lower	Upper
S. aromaticum	0.166± 0.02	0.103	0.074	0.131	0.608	0.443	0.987
A. sativum	0.139± 0.02	0.162	0.119	0.27	0.135	0.925	2.43

Field infestation:-

In the field, 40 maize plants (23 days old) free of infestation with *S. cretica* divided in four replicates were artificiallv infested with 3 rd instar larvae of *S. cretica*, 4 larvae/plant, as reported by Bode & Calvin (1990) and Kumar & Saxena, (1992). After 5 days the intensity of damage, the percentage of infested plants and percentage of dead hearts for the three Crosses were estimated according to the following formulas of Hosain (2003):

$$\text{The intensity of damage (ID)} = \frac{ID_1 + ID_2 + \ldots\ldots + ID_N}{N}$$

Where: $ID_1 + ID_2 \ldots\ldots ID_N$ denote intensity of damage of the tested infested . No. 1, No. 2,.....No. of N plants.

$$\text{The percentage of infested plants} = \frac{\text{No. of infested plants}}{\text{Total No. of plants}} \times 100$$

$$\text{The percentage of dead heart} = \frac{\text{No. of dead heart plants}}{\text{Total No. of plants in sample}} \times 100$$

$$\text{Reduction percentage} = \frac{\text{Control - Treatment}}{\text{Control}} \times 100$$

Application of the assayed material took place by using one litter hand sprayer. Treatments started 7 days after artificial infestation .The second treatment was applied 10 days after the first. The effect of the intensity of damage, the percentage of infested plants percentages of dead hearts for the three Crosses were estimated.

Concentration of the tested materials:-

S. aromaticum (Clove) 6.08 ml/ L.
A. sativum (Garlic) 13.54 ml/ L.
Pyriban 48%E.C. 2.5ml./L

Effect of treatments on yields:-

At harvest time (about 120 days after sowing), maize ears were picked from all plants of each treatment, left to dry. Agronomic characters were

determined, means of ears diameter, ear length, and the weight of 100 grains .The obtained yield/treatment was adjusted to find out the yield/feddan .

Statistical analysis:-

Data from four replicates were used for statistical analysis. Analysis of variance for the randomized complete block design and "F" tests were used to compare between the three genotypes of maize and treatment under infestation with *S. creatica* .Statistical analysis of data was carried out also by using a computer software package, "Costat", a product of Cohort Software Inc., Barkeley, California, USA. Duncan's multiple range test (Duncan, 1955) was used to differentiate between means.

RESULTS AND DISCUSSION

Results about the susceptibility of the three maize crosses to infestation with the *S. creatica* Led. before and after spraying by the extracts of (Clove) *S. aromaticum*) and (Garlic) *A. sativum,* and the recommended insecticide-Pyriban 48% E.C indicated the following:

a-Effect on the intensity of damage:-

Data tabulated in Table (2) and Fig. (1) show that the intensities of damage among the three tested crosses S.C.10, 3062 and 30K8 were statistically insignificant before spraying. The mean reduction of intensity of damage was 2.91, 2.98 and 2.67 % for S.C.10, 3062 and 30K8, respectively. This further indicates that the three tested crosses had, nearly the same rate of susceptibility to *S .cretica* infestation. Also, Table (2) show highly significant differences between clove, garlic and pyriban on one side and control, on the other side the averages of infestations were 1.12, 0.85, 0.85%, respectively while the mean of the control was 2.6%. Regarding to the reduction percentage of the intensity of damage caused by the two plant extracts (clove and garlic) and the recommended insecticide indicated the highest percentages of reduction than control. they were 63.2, 70.2 and 77.1, respectively for the single cross S.C.10 when compared with the other two maize crosses. The variation in the relative susceptibility of maize genotypes to infestation with *S. cretica* was reported by many authors such as Mostafa, (1981); Ali *et al.* (1987& 1989); Abd El Karim (1991) and El Naggar (1991). The obtained results agree with Hosain (2003) who found that the three genotypes of maize (G2, S.C.122 and T.C.320) showed no significant differences in the intensity of damage.

b- Effect on the percentages of infestation:-

The percentages of infestation by *S. cretica* 3rd. larval instar to plants of the three crosses S.C.10, 3062 and 30K8 were summarized in Tables (3 &5) and illustrated in Fig. (2) .Data indicate that the percentage of infestation of the two crosses S.C.10 and 3062 were significant, (68.1 and 64.4%, respectively) as compared with the insect infestation of cross 30K8 (60%).This means that both S.C.10 and 3062 were more susceptible to *S. cretica* 3rd. instar larvae infestation. Kumar and Saxena (1992) measured the resistance susceptibility levels of 10 maize cultivars to denote and 3rd instar larvae of Pyralid *Chilo partellus* in field

Table (2): Averages and reduction percentages of the intensity of damage in maize crosses infested with *S. cretica* 3rd instar larvae before and after spraying by the two extracts and insecticide.

Maize Crosses	*Syzygium aromaticum*			*Allium sativum*			Pyriban 48%E.C			Control		Mean of Crosses	
	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	(B)	(A)
Sc10	2.75±0.2 ab	1.05±0.2 b	63.2	2.95±0.1ab	0.85±0.1b	70.2	2.6±0.4ab	0.65±0.11b	77.1	3.35±0.5ab	2.85±.45 a	2.91a	1.35 a
3062	3.05±01ab	1.13±0.2 b	58.9	2.7±0.4 ab	0.85±0.1b	64.4	2.65±0.3ab	1.13±0.2cd	58.9	3.5±0.3ab	2.75±0.3 b	2.98 a	1.47 a
30k8	2.85±02 ab	1.2±0.2 b	45.5	2.6±0.2 ab	0.85±0.2 b	54.5	2.25±0.3 b	0.78±0.1b	65.9	2.95±0.1ab	2.2±0.32 a	2.67 a	1.26 a
Mean of treatments	3.88 ab	1.12 b		2.75 ab	0.85 b		2.5 b	0.85 b		3.27 a	2.6 a		
L.S.D (B)	0.54											0.47	0.39
L.S.D (A)	0.16												

Table (3): Infestation percentages of three maize crosses infested with *S. cretica* 3rd instar larvae before and after spraying by the two extracts and insecticide.

Maize Crosses	*Syzygium aromaticum*			*Allium sativum*			Pyriban 48%E.C			Control		Mean of Crosses	
	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	R %	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	(B)	(A)
Sc10	60±0.0bc	30±3.5 bc	50	67.5±4.2 ab	20±0.0cd	66.8	65±2.5 bc	15±2.5d	75	80±0.0a	60±0.0 a	68.1 a	31.3a
3062	65±4.3bc	27.5±4.2bd	45	67.5±4.1a b	20±0.0cd	60	55±2.9 c	25±2.9bcd	50	70±3.5ab	50±2.5 a	46.4ab	30.6a
30k8	55±4.3 c	30±3.5 bc	14.29	65±2.5 bc	20±0.0 cd	42.9	60±0.0 bc	15±2.5 d	57.1	60±0.0 bc	35±3.4b	60 b	25 a
Mean of treatments	60 b	29.17 b		66.67 ab	20 c		60 b	18.3 c		70 a	48.3 a		
L.S.D (B)	7.23											6.26	5.97
L.S.D (A)	6.89												

(B) = Before spraying. (A) = After spraying with treatment R%= Reductions than control.

Within columns, means followed by a common letter don't differ significantly (LSD test, P<0.05).

and house experiments. They found that most cultivars were susceptible to 3rd instar larvae based on the incidence of dead heart, symptoms, foliar feeding and stem tunneling. Also, Soliman *et al.* (2001) evaluated six commercial maize i.e. S.C.10, S.C.122, S.C.129, S.C.155, S.C.21 and S.C.161, hybrids and in hybrid lines in field experiments under artificial infestation with newly hatched larvae of *S. cretica* .Results showed that parental lines Sd.7, Gz612 and Gm1002 displayed high resistance degree of the three resistance traits and contributed a good level of resistance to the single crosses in which they were involved. On the other hand Abd El-Rhaman (2002) indicated that infestation by *S. cretica* was slightly higher, on all tested genotypes, in early plantation of May than in late plantation of July. S.C.9, TWC 320 and S.C10 were the least susceptible varieties and G2 was moderately susceptible in early and late plantations.

After treating the three crosses of maize by the two extracts of clove and garlic and recommended insecticide, statistical analysis showed insignificant differences between the three tested crosses .The percentages of infestation were 31.3, 30.6 and 25% for S.C.10, 3062 and 30K8, respectively. According to the obtained L.S.D. (6.89), and statistical analysis of data, Table (5) shows no significant differences were recorded between garlic extract and insecticide pyriban as the percentage of infestation were 20 and 18.3 %, respectively, when compared with control (48.3%).

Results in Table (3) show that, insecticide and garlic extract caused the highest reduction percent of infestation compared with control. These were 75, 50 & 57.1 % for the insecticide and 66.8, 60 & 42.9 % for the garlic extract in the case of the three crosses S.C.10, 3062 and 30K8, respectively. These finding agree which those of Deb Kirtaniya *et al* (1980) who reported that aqueous & ethanol solution and the crude juice of garlic were highly potent as contact toxicant. Data also indicate that clove showed the lower infestation reduction (50, 45 and 14.29%) between the three crosses S.C.10, 3062 and 30K8, respectively compared with other tested materials.

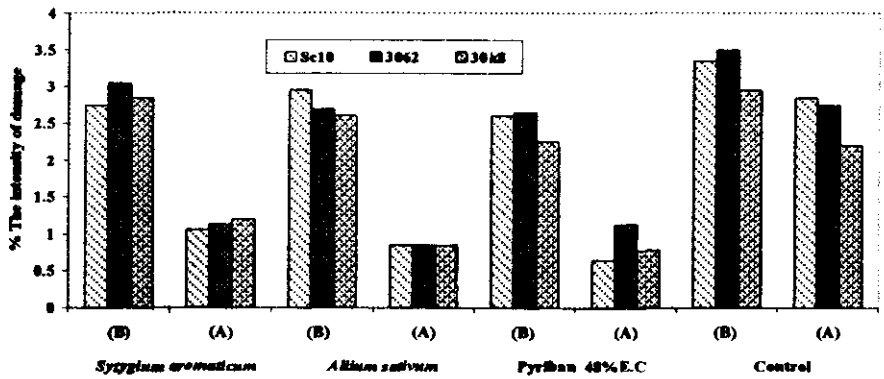

Fig (1): Averages and the percentages of the intensity of damage in the three crosses of maize infested with *S cretica* 3rd. instar larvae before (B) and after (A) spraying by the plant extracts and insecticide

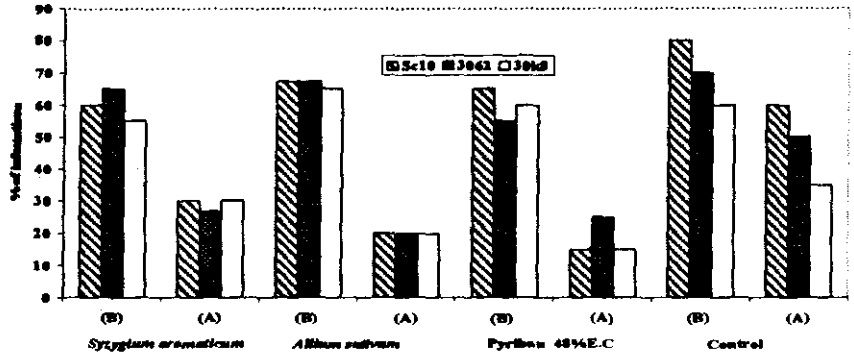

Fig. (2): The infestation percentages of the three crosses of maize infested with *S. cretica* 3rd instar larvae before (B) and after (A) spraying by the two plant extracts and insecticide.

C- Percentage of dead hearts:-

The percentages of plants that show dead heart were estimated among plants of each maize crosses, (Tables, 4 & 5) and Fig.(3). Both crosses S.C.10 and 3062 have the same level of susceptibility to the dead heart phenomenon. While the maize cross, 30K8 shows low level of susceptibility, 18.8 % of dead heart plants. Statistical analysis showed highly significant relationship between the three maize crosses and the percentage of dead heart, Tables (4 & 5). The percentage of dead heart plants of the three tested crosses S.C.10, 3062 and 30K8 were 26.3, 31.9 and 22.5%, respectively. Also, results showed highly significant between treatments; the reduction in the percentage of dead heart plants were 13.3 and 12.5 % for both of *A. sativum* extract and Pyiban 48% E.C., respectively when compared with control, while *S. aromaticum* extract recorded the highest percentage of dead heart plant (46.67%) when compared with control (35%) .The use of *S. aromaticum* extract (clove) caused phytotoxicity to the three tested crosses, but there was significant difference between their susceptibility. The single cross S.C.10 was more sensitive than the others two cross tested, it was tolerant. Bainard, *et. al* (2006) recorded the herbicidal activities of clove oil and its primary constituent eugenol on broccoli and redroot pigweed and the role of crystalline leaf epicuticular wax (LEW) in susceptibility and retention of these essential oils. *A. sativum* extract has been assayed with no phytotoxicity for all maize plants. The high effectiveness of treatments in reduction percentages of dead heart was the recommended insecticide Pyiban 48%E.C which indicated 10, 12.5 and 15% dead heart plants and 75, 68.8 and 40% reduction in dead heart plants compared with control for the three tested crosses S.C.10,3062 and 30K8, respectively. Garlic extract was effective, it showed 10, 15 and 15% dead heart plants for the S.C.10, 3062 and 30K8, maize crosses, respectively and expressed by 75, 62.5 and 40% reductions in dead heart cases than control, while clove oil recorded negative reduction than control. The results were (-12.5, -50 and -40)dead heart plants for S.C.10,3062 and 30K8 maize crosses. This may be due to the phytotoxicity of clove extract.

Table (4): Percentages of dead heated maize plants of three crosses resulted from *S. cretica* 3rd instar larvae infestations and the reduction percentages of dead hearted after treated with the *S. aromaticum*, *A. sativum* extracts or insecticide Pyriban 48%E.C.

Maize Crosses	*Syzygium aromaticum*			*Allium sativum*			Pyriban 48%E.C			Control		Mean of Crosses	
	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	R%	(B) Mean ± SE	(A) Mean ± SE	(B)	(A)
Sc10	25±4.3a b	45±8.3 b	-12.5	27.5±4.2 a	10±0.6 ef	75	17.5±2.2b	10±0.8 ef	75	30±3.5 a	40±3.5 b	25 a	26.3 b
3062	20±3.5 ab	60±7.1 a	-50	30±3.5 a	15±2.5 def	62.5	20±1.5 ab	12.5±4.2 cd	68.8	30±2.5ab	40±0.62 b	25 a	31.9 a
30k8	20±0.0 ab	35±4.3 ab	-40	17.5±2.2 b	15±0.8 ef	40	17.5±3.5c	15±2.5 f	40	20±4.1 b	25±5.6 de	18.8 b	22.5 c
Mean of treatments	21.67 a	46.67 a		25 a	13.3 c		18.3 b	12.5 c		26.7 a	35 b		
L.S.D (B)	5.32											4.6	6.48
L.S.D (A)	7.48												

Table (5): Analysis of variance among infested maize crosses before and after spraying by treatments.

Source of variation	d.f.	The intensity of damage		Percentages of infestation		Percentages of dead heart	
		(B)	(A)	(B)	(A)	(B)	(A)
Replications	3	2.68	0.36	33.33	8.33	207.63	191.66
Crosses	2	0.87	0.17	308.33*	175.0	539.58**	1408.33**
Treatments	3	3.68*	8.10**	300.0*	2275.0**	352.08**	3158.33**
C x T	6	0.59	0.2	108.33	208.3*	56.52	175.0*
Error	33	14.2	0.29	75.75	68.94	40.97	81.06
Total	47						

(B) = Before spraying.
(A) = After spraying with treatments.
* Significant at the 0.05 probability level.
** Significant at the 0.01 probability level

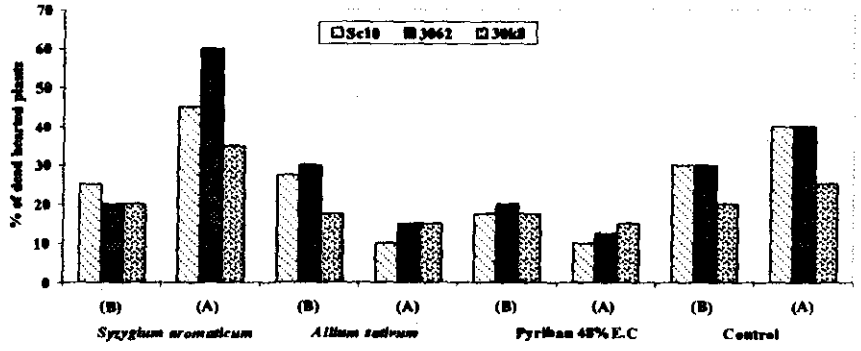

Fig. (3): Percentages of dead hearted maize plants of three crosses due to *S. cretica* 3rd instar larvae infestations and the reduction percentages of dead hearted before (B) and after (A) treatment with the *S. aromaticum* and *Allium sativum* extracts and insecticide Pyriban 48%E.C.

d- Effect of treatments on maize yield:

At harvest time (about 120 day after sowing), the relationship between damage caused by *S. cretica* and grain yield reduction on the three tested crosses S.C.10, 3062 and 30K8 maize plant were measured among five damage parameters on yield (No. of ears, mean of ears length (cm.), average of ears diameter (cm.), weight of ears/ row (kg.) and weight of 100 grains (gm).

Numbers of ears:

The highest mean numbers of ears/row (7.65) were recorded from the tested cross 30K8 while S.C.10 and 3062 gave 6.88 and 5.45 ears/row, respectively Tables (6 & 7). However, these increases in mean numbers of ears/row when compared with those of the control plants were insignificant, for S.C.10 and 30K8. As they were 6 & 6.3 ears/row when compared with The maize cross 3062 gave the lowest mean numbers of ears/row (3.5) . Data in Table (6) indicates high significant difference between treatments. The clove extract recorded the lowest mean number of ears/ row (4, 4 and 6 ears/ row) for the maize tested crosses S.C.10, 3062 and 30K8, respectively. While, garlic extract gave average number of ears/row (8.5, 6.8, 8.5) for the three tested crosses, respectively. However pyriban showed the highest average numbers of ears (9.0, 7.5, 9.8) for the same crosses.

Ear's length:

The recorded means of ear's length in Table (6) varied significantly among the three maize crosses infested by *S. cretica* 3rd instar larvae. In case of 30K8 maize cross, the mean length of ears was 16.38 cm. The shortest ears were recorded from the other two crosses plants (15.98 and 14.45 cm. for S.C.10 and 3062, respectively). The variations in ears length were highly significant in cases of both garlic extract and insecticide pyriban. The other two treatments (clove extract and control showed less than the average in most cases. Pyriban recorded the longest means of ear's length (18.0 cm) in ears collected from infested plants of S.C. 10. In case of ears collected from plants of 3062 the longest mean of ear's length was 15.6cm On the other hand, the 30K8 plants measured 16.9 cm. long. In conclusions, we can say that all treatments had positive effect of ear's length than control except the clove extract which recorded the shortest ears length.

Table (6): Parameters of maize yield resulted from maize crosses infested with *S. cretica* 3rd instar larvae after treatement by insecticide Pyriban 48%E.C and extracts of both *Syzygium aromaticum* and *Allium sativum*.

Crosses	Treatments	No of ears/row	Mean of ears length (Cm)	Mean of ears diameters (Cm)	Weight of 100grain (Gm)	weight of ears/row (Kg)	weight of yield Ton/feddan	% Increase than control
S.C.10	*Syzygium aromaticum*	4±0.7 d	13.6 ±0.1 ef	3.6±0.7 bc	29.5±1.2 d	0.66 ±0.2 cd	1.13	-5.8
	Allium sativum	8.5 ±0.4 ab	16.8 ±0.2 abc	3.9±0.1 ab	35.3±0.6 ab	1.8 ±0.2 a	3.08	156.66
	Pyriban 48%E.C	9 ±0.5 a	18.0 ±0.2 a	4.1±0.1 ab	37.3±0.6 a	2.03 ±0.1 a	3.48	190
	Control	6 ±0.7 c	15.53±0.4bcde	3.8±0.3 abc	31.3±1.4 cd	0.7 ±0.8 cd	1.2	-------
Mean		6.88 a	15.98 a	3.85 b	33.35 a	1.3 b	2.22	
3062	*Syzygium aromaticum*	4±0.7 d	14±0.4 def	3.4±0.3 c	28.3±0.6 d	0.68±0.1 cd	1.17	10.38
	Allium sativum	6.8±0.3 bc	14.8±0.2 cdef	3.8±0.3 abc	30.8±0.9 cd	1.16±0.2 bc	1.99	87.74
	Pyriban 48%E.C	7.5±0.3 abc	15.6±0.5 bcd	4±0.2 ab	33.8±1.5 bc	1.23±0.2 b	2.11	99.06
	Control	3.5±0.3 d	13.4±0.3 f	3.8±0.2 abc	29.5±1.3 d	0.62±0.1 d	1.06	------
Mean		5.45 b	14.45 b	3.75 b	30.6 b	0.92 c	1.58	
30K8	*Syzygium aromaticum*	6±0.6 bc	15.7±0.4 bcd	4.1±0.2 ab	29.5±1.2 cd	1.25±0.3 b	2.14	15.68
	Allium sativum	8.5±0.4 ab	16.9±0.6 ab	4.1±0.1 a	32.3±0.8 cd	1.82±0.1 a	3.12	68.65
	Pyriban 48%E.C	9.8±0.2 a	16.9±0.6 ab	4.2±0.1 a	34.5±1.04 ab	2.16±0.1 a	3.7	100
	Control	6.3±0.7 c	16±0.4 bcd	3.9±0.2 ab	29.3±0.9 d	1.08±0.2 bcd	1.85	------
Mean		7.65a	16.38 a	4.08 a	31.4 b	1.58 a	2.7	
L.S.D. between crosses		0.92	0.91	0.22	1.52	0.23		

Within columns, means followed by a common letter don't differ significantly (LSD test, P<0.05). L.S.D. between treatments= 1.75

Table (7): Analysis of variance among parameters of maize yield resulted from maize crosses infested with *S. cretica* 3rd instar larvae before and after treatments.

Source of variation	d.f.	No of ears/row	Mean of ears length (Cm)	Mean of ears diameters (Cm)	Weight of 100grain (Gm)	weight of ears/row (Kg)
Replications	3	10.08	4.27	0.45	17.58	0.66
Crosses	2	19.39**	17.20**	0.50*	31.58**	1.75**
Treatments	3	47.91**	15.45**	0.37*	80.97**	3.10**
C x T	6	1.79	2.23	0.06	5.78	0.18
Error	33	1.63	1.61	0.09	4.46	0.1
Total	47					

(B) = Before spraying. (A) = After spraying with treatments.
* Significant at the 0.05 probability level.
** Significant at the 0.01 probability level

Ear's diameter:

All differences in ear's diameter among all treatments and crosses of artificial infestation by *S cretica* to maize seedlings and control were statistically insignificant between S.C.10 and 3062, (Tables, 6 & 7). The mean diameters of ear's were 3.85 and 3.75 cm. While, in the case of the cross 30K8 the mean diameter of ear was wider (4.08 cm) than diameters recorded of the other crosses. In case of the clove extract, ears measured the lowest diameter for all crosses. These were 3.6, 3.4 and 4.1 cm. in S. C.10, 3062 and 30K8, respectively. While in control plants measured 3.8, 3.8 and 3.9 cm for ears of the three tested crosses, respectively.

Weight of 100 grains:

The mean weight of 100 grains obtained from each of the four treatments and their effects on the three tested crosses infested by *S .cretica* 3rd. larval instar were used as one of the criteria to measure the effect on yield loss. The variations in all mean weights of 100 grains between different treatments and control were statistically insignificant Tables (6 & 7), in case of 3062 and 30K8 maize plants. The heaviest maize grains were recorded from plants which were infested in the seedling stage by *S. cretica* larvae (mean weights of 30.6 and 31.46 gm/100 grains, respectively. Statistical analysis showed high significant, between the single cross and the other two crosses in mean weight of 100 grains. The highest weight obtained in the S.C.10 when treated with garlic extract 35.3 gm./100 grain and by the insecticide pyriban 37.3 gm./100grain . Bosque and Mareck (1991) studied the level of damage and yield reductions caused by *Eldana saccharina* to maize. Grain weight per plant in artificially infested plots was up to 36% lower than that in insecticide-protected plots. Artificially infested plots had significantly lower 100-grain weight than insecticide-protected ones.

Weight of ears:

Maize ears were picked from all plants of each treatments, dried and weighted. The obtained yield/ treatment was adjusted to find out the yield/ feddan. The mean weights of maize ears harvested/row, of the tested crosses were

high significant. The mean average were 1.3, 0.92 and 1.58 kg/ row for the three tested crosses S. C.10, 3062 and 30K8 respectively. Also, both of garlic extract and insecticide pyriban recorded high weight of grain yield with all tested crosses, than that obtained from control plants. (Tables, 6 & 7) and Fig (4). In clove extract, the collected maize ears plants weighed 0.66, 0.68 and 1.25 kg/row for S. C.10, 3062 and 30K8 crosses, respectively.

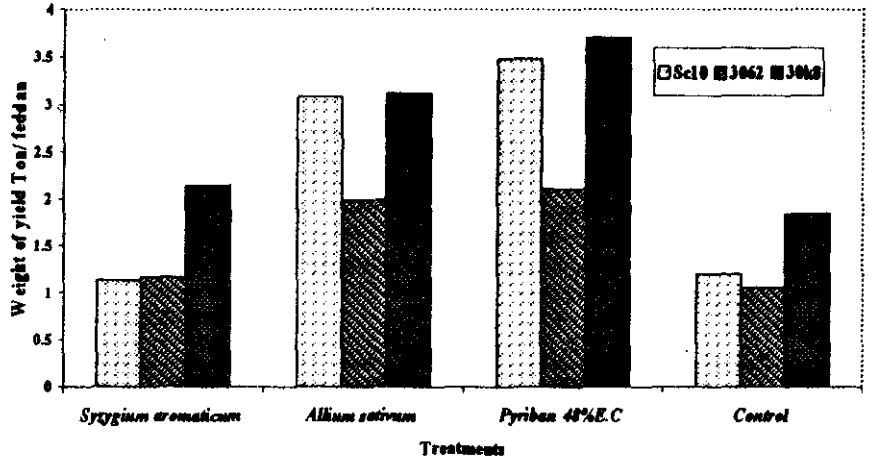

Fig. (4): Maize yield resulted from treated infested maize crosses by insecticide Pyriban 48% E.C and extracts of both *Syzygium aromaticum* and *Allium sativum*.

According to the obtained yield from different treatments and to the percentages of increase in this yield than control, it is possible to classify the data to the following categories:

1- **Highly efficient**: Pyriban proved as the most efficient to produce yield,it gave 3.48, 2.11 and 3.7 ton/ feddan with increasing percentage 190, 99.6 and 100% in the final maize yield than control for S. C.10, 3062 and 30K8 crosses, respectively.
2- **Moderately efficient**: represented by garlic extract, the obtained yield was 3.08, 1.99 and 3.12 ton/ feddan with increasing percentage 156.6, 87.7 and 68.6% in the final maize yield than control for S. C.10, 3062 and 30K8 crosses, respectively.
3- **Least efficient**: the clove extract which gave yield, 1.17 and 2.14 ton/ feddan with increasing percentage 10.38 and 15.68% in the final maize yield than control for 3062 and 30K8 crosses, respectively, while S. C.10 recorded 1.13 ton/feddan with decreasing percentage (-5.8 %) than control.

Both crosses 30K8 and S.C.10 showed high level of resistance to *S. cretica* infestation. *A. sativum* extract proved to be a best material for controlling this insect with no phytotoxicity. and may be used in the near future as an alternatives to the classical control methods to protect environment.

REFERENCES

Abbott, W.S. (1925): A method of computing the effectiveness of insecticides. J. Econ. Entomol. 18: 265-267.

Abd El-Karim, M.H. (1991): Studies on insect pests of maize at Kafr El- Sheikh Governorate. M. Sc. Thesis, Fac. Of Agric., Tanta Univ., Egypt.

Abd El-Rahman, M.S. (2002): Evaluation of certain corn varieties to yield, yield components and its susceptibility to infestation by some insects. M. Sc. Thesis, Fac. of Agric., Moshtohor, Zagazig Univ., Egypt.

Ali, M.A.; Metwally, M.M.; Abd El-Ghaffar, M.M. and Metwally, A.S., (1987): Influence of some local maize cultivars on the development and oviposition preference of the G S B, *Sesamia cretica* Led. (Lepidoptera: Noctuidae). Al-Azhar J.Agric.Res,7: 177-186.

Ali, M.A.; Metwally, M.M.; Abd El-Ghaffar, M.M. and Metwallty, A.S., (1989): Susceptibility of four local maize varieties to corn borer infestation under natural conditions in Egypt. Acta Phytopathologica et Entomologica Hungarica,24(1-2): 13-16.

Al-Naggar, A.M.; El-Ganayni, A.A.; El-Lakany, M.A.; El-Sherbeiny, H.Y. and Soliman, M.S.M. (2000): Mode of inheritance of maize resistance to the pink stem borer *Sesamia cretica* Led. under artificial infestation. Egbt J. Plant breed. 4: 13-35.

Bainard D. Luke; Murray B. Isman and Mahesh K. Upadhyaya (2006): Phytotoxicity of clove oil and its primary constituent eugenol and the role of leaf epicuticular wax in the susceptibility to these essential oils *Weed Science:* Vol. 54, No. 5, pp. 833–837.

Bode, W.M. and Clavin, D.D. (1990): Yield loss relationships and economic injury levels for Eurpoean corn borer, *Ostrinia nubilalis* (Lepidoptera: Pyralidae) populations infesting Pennsylvania field corn Journal of Economic Entomology. 83:4, 1595- 1603.

Bosque, N.A.P. and Mareck, J.H., (1991): Effect of the stem borer *Eldana saccharina* (Lepdoptera: Pyralidae) on the yield of maize. Bulletin of Entomological Research. 81:3, 243 - 247

Breuer, M. and Schmidt, G.H. (1995): Influence of a short period treatment with *Melia azerdarach* extract on food intake and growth of the larvae of *Spodoptera frugiperda* (J.E. Smith) (Lep., Noctuidae). J. Plant Diseases Protect. (102): 633 - 654.

Butro'n, A.; Malvar, R.A.; Velasco, P.; Vales, M.I. and Orda's, A. (1999): Combining abilities for maize stem antibiosis, yield loss, and yield under infestation and no infestation with pink stem borer attack. Crop Sci. 39:691–696.

Butro'n, A.; Velasco, P.; Orda's, A. and Malvar, R.A. (2004): Yield Evaluation of Maize Cultivars across Environments with Different Levels of Pink Stem Borer Infestation. Crop Science, Vol. 44:741–747

Deb Kirtaniya Si Ghosh; Aditychaulhury M.R.; ISL and Ckatterjee A. (1980): Extracts of garlic *Allium Sativum* as possible source of insecticides. Indian J. Agric. Sci., (6):507-510.

Dicke, F.F. and Guthrie, W.D. (1988): The most important corn insects.p. 767–867. In G.F. Sprague and J.W. Dudley (ed.) Corn and corn improvement. Agron. Monogr.18. ASA. CSSA. and SSSA, Modison, WI.

Duncan, D. B. (1955): Multiple rang and multiple F tests . Biometrics 11:1-42

El-Ibrashy, M.T. (1974): Sterilization of the Egyptian cotton leafworm *Spodoptera littoralis* (Biosd.) with a foliage extract of *Podocarpus gracilior* P. J. Appl. Ent., (75): 107- 109.

El-Naggar, M.A.Z. (1991): Ecological factors influencing some insect pests diversity in maize fields. M.Sc. Thesis. Fac. of Agric., Menoufia Univ., Egypt, 161 pp.

Finney, D.J. (1971): Propit analysis. Cambridge University Press, Cambridge. 318pp.

Gaaboub, I., and Halawa, S.M.(2003): Oviposition deterrent in larval frass of *Spodoptera littoralis* (Boisd.) First International Egyptian- Romanian Conference (101-116).

Halawa. S.M, (2001): Studies on the use of some plant extracts as factors in pest management. Ph. D Thesis Fac. of Agric., Moshtohor, Zagazig Univ., Egypt, 319 pp..

Hiremath, I.G.; Ahn, Y.J. and Kim, S.I. (1997): Insecticidal activity of Indian plant extracts against *Nilaparvata lugens* (Homoptera: Delphacidae). Appl. Entomol. Zool., (32): 159 - 166.

Hosain, A.M., (2003): Effect of different artificial infestation levels by the pink stem borer; *Sesamia cretica* (Led.) on *Zea mays* plants and relation with crop yield. M.Sc. Thesis, Fac. of Agric., Moshtohor, Zagazig Univ., Egypt, 226 pp..

Khan, Z.R. and Saxena, R.C., (1986): Effect of steam distillate extracts of resistant and susceptible rice cultivars on behavior of *Sogatella furcifera* (Homoptera: Delphacidae). J. Econ. Entomol.,79: 928 -935.

Kumar, H. and Saxena, K.N. (1992): Resistance in certain maize cultivars to first and third instar *Chilo partellus* larvae. Entomolog Experimentalis et Applicata. 65:1, 75 - 80.

Metwally, S.M.I. (1967): Insect fauna of maize plants with special references to the interrelationship between major pests and their predators and the effect of certain insecticides on the populations. M. Sc. Thesis, Fac. of Agric.Cairo Univ.

Mostafa, F.F. (1981): Biological and ecological studies on the pink borer *Sesamia cretica* Led. Ph. D. Thesis., Fac. of Agic. Cairo Univ., Egypt.

Soliman, M.S.M.; Gabr, A. I. A. and Khalifa, K. I., (2001): Natural artificial infestation in evaluation of some maize hybrids for resistance to *Sesamia cretica* Led. J. Agric. Sci. Mansoura. Univ.; 26,6: 3419-3433, Egypt.

Su, H. and Horvat, R., (1981): Isolation, identification and insecticidal properties of *Pipper nigrum* amides. J. Agric Food Chem., 29: 115-118

Tawfik, M.F.S.; Kira, M.T. and Metwally, S.M.T., (1974): Survay of the insect fauna of .corn fields in Egypt. (Bull. Ent. Soc. Egypt Econ., LVIII. pp. 145-152)

Wheeler, D.A. and Isman, M.B., (2001): Antifeedant and toxic activity of *Trichilia americana* extract against the larvae of *Spodoptera litura*. Entomol. Exp. Appl., 98: 6-16, (c.f. Sadek, M.M.; 2003, J. Appl. Ent., 127:396-404).

تقييم بعض المستخلصات النباتية فى مكافحة ثاقبة الذرة القرنفلية سيزاميا كريتيكا

صفاء محمود محمد حلاوة

قسم وقاية النبات -كلية الزراعة بمشتهر- جامعة بنها

تعتبر ثاقبة الذرة القرنفلية *Sesamia cretica* من أهم الآفات التى تصيب الذرة والتى قد تقضى عليه فى المرحلة الأولى من حياتة وتؤدى لظهور القلب الميت وتعفن النبات. تعتمد هذه الدراسة على تقييم ثلاث هجن فردية من الذرة الشامية 10 S.C، 3062 و 30K8 من حيث الحساسية النسبية لكل منهم للإصابة بثاقبة الذرة القرنفلية. وقد تم هذا التقييم من خلال إحداث عدوى صناعية بيرقات العمر الثالث لـ *Sesamia cretica* وتقدير النسبة المئوية لشدة الإصابة ، النسبة المئوية للنباتات المصابة والنسبة المئوية للقلب الميت ومدى تأثيرها على المحصول النهائى للنباتات وأيضا استهدفت هذه الدراسة تقدير كفاءة المستخلص الأثير بترولى لكلا من نباتى الثوم والقرنفل وكذلك المبيد الموصى به بيوريبان E.C%٤٨ عند رشها فى بلعوم النباتات المصابة فى الثلاث هجن المختبرة وحساب مدى فاعليتها فى تقليل شدة الأصابة، النسبة المئوية للنباتات المصابة والنسبة المئوية للقلب الميت .

أوضحت النتائج عدم وجود فروق معنوية بين الهجن الثلاث من حيث درجة حساسيتها للإصابة بثاقبة الذرة القرنفلية، كما دلت النتائج أيضا على أن المبيد الموصى به بيوريبان E.C%٤٨ ومستخلص الثوم أحدثا نقصا كبيرا فى النسبة المئوية للنباتات المصابة مقارنة بالكونترول. سجل كلا من الهجين 10 S.C، 3062 درجة عالية من الحساسية للقلب الميت فى النباتات المعدية بيرقات العمر الثالث لـ *Sesamia cretica* عند مقارنتهم بالهجين 30K8، كذلك أثبتت النتائج بصفة عامة زيادة المحصول فى الهجن المختبرة عند استخدام كلا من مستخلص الثوم والمبيد الموصى به مقارنة بالكونترول الغير معامل.

ومما تقدم نوصى باستخدام مستخلص الثوم كبديل للمبيدات فى مكافحة ثاقبة الذرة القرنفلية كوسيلة آمنة للبيئة والكائنات النافعة فى أطار المكافحة المتكاملة لهذة الآفة.