B. **Maize (Corn)** *Sesamia cretica*

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INTRODUCTION

The present study was planned to evaluate the Bioenhancer compound in combinations with chemical insecticides and/or bio-insecticides against major corn insect pests under Egyptian field and lab conditions. In addition, the adverse influence of these combinations on the natural enemies associated with these pests was also estimated.

MATERIALS AND METHODS

Pesticides used:

1. **Bioenhancer:** It is an insect feeding stimulant and attractant. It contains 35% active ingredients (disaccharides, hydrolyzed starch, whey and vegetable oil) and 65% inert ingredients. Application rate was 5% /feddan (feddan = acre = 0.4 hectare).
2. **Chemical insecticides:**
   - **Diazinox KZ:** Diazinox 40% WP, 4 EC, 14% granules. Formulation: (Organic phosphate insecticide), O-O- diethyl-O-(2- isopropyl-6- methyl-5 pyrimidinly) phosphorothioate. Application rate of 6 Kg/feddan. In laboratory, it was used at concentrations of 10, 20, 40, 80 and 160 ppm.
   - **Reldan:** (Chlorpyrifos-methyl) 2 EC, 25% WP, 1% G, 6 1b/gal oil. Formulation: O, O-dimethyl O-(3, 5, 6-trichloro-2-pyridimyl) phosphorothioate). Application rate of 0.005-0.75, a.i./A. In laboratory, it was used at concentrations of 0.025, .05, 0.1, 0.2, 0.4 and 0.8 ppm.
   - **Dursban:** 48% EC. Application a rate of 1liter /feddan. In laboratory, it was used at the concentrations 0.05, 0.1, 0.2, 0.4 and 0.8 ppm.
3. **Bioinsecticides:**
   - **Xentari:** (Selective bacterial insecticide) *Bacillus thuringiensis* subsp. *aizawai* 35.000 Diamond back moth Units/ mg. Application rate was 454g / feddan. In the laboratory, it was used at concentrations of $5x10^5$,$10x10^5$, $20x10^5$, $40x10^5$, $80x10^5$ and $160x10^5$ Diamond back moth Units.
   - **Agerin:** *Bacillus thuringiensis* 35,000 International Units/mg. Application rate was 250g/ feddan. The utilized concentrations, in laboratory, were $10x10^5$, $20x10^5$, $40x10^5$, $80x10^5$ and $160x10^5$ I.U. for *S.littoralis* larvae. In case of *P. gossypiella* and *E. insulana* concentrations became $5x10^4$, $10x10^4$, $20x10^4$, $40x10^4$, $80x10^4$and $160x10^4$I.U..

Laboratory Experiments:

Procedure: *Sesamia cretica* Led. were reared under the laboratory conditions, at a constant temperature of 27±1°C and 65±5% R.H. *S. cretica* were reared using the technique described by **Abdel Hakim (1996)** and **Ibrahim (1974)**.

Parts of maize plants were dipped in each compound and left till dry then offered to 2nd instar *S. cretica* larvae.

The following procedures were followed in all experiments:

1- Three replicates of ten larvae each into a cup (6x7.5cm) were fed on potato leaves contaminated with bioenhancer and bioinsecticides for a period of 48 hours. After treatment,

the surviving larvae were fed on untreated foods till pupation. Mortality was recorded daily. Also, the percentage of pupation and emerged adults were observed.
2- Before introducing the larvae to treated food, they were starved for six hours in order to obtain rapid simultaneous ingestion of the offered food.
3- The control tests were conducted using foods dipped in water only and left to dry.

Statistical analysis:
The LC_{50} was determined by using Finney (1952) and corrected according to Abbott's formula (1925).

Field experiments:
Planting date was April 28th 2000 with Maize variety " Giza 2".

Target Pest: *S. cretica*

Design: An area of about half feddan was chosen and divided into 18 equal plots in randomized complete blocks with 3 replicates per treatment. Treatments consisted of an untreated control, Bioenhancer, the Bioinsecticide (Xentari), the chemical insecticides (Diazinox) and the combinations (½ Bioenhancer + ½ Diazinox and ½ Bioenhancer + ½ Xentari) and again two weeks later.

The experimental unit plot was equivalent to 1/100 feddan i.e. $42m^2$. Every plot consisted of 10 rows with 25 hills for seeds separated by 25 cm and 70cm apart.

Spray applications:

Different pesticides were applied by means of 20L. knapsack sprayer using a total volume of 200 L/feddan. Different treatments were applied in bi-weekly interval in the second experiment.

Procedure: At each treatment, random samples of 50 maize plants were taken regularly every week. The population of collected *S. cretica* larvae was counted in the laboratory. Direct counts of predators on 50 plants were also made weekly.

Statistical analysis:

Data were statistically analyzed by ANOVA and mean values were separated by the least significant difference (L.S.D.) procedure **(Snedecor and Cochran, 1980)** at P = 5%. An estimate for percent reduction for each treatment was calculated using Henderson's formula **(Henderson & Tilton, 1955).**

RESULTS AND DISCUSSION

Laboratory experiments
Table (1) shows the LC_{50} values of 2nd instar ***S. cretica*** larvae treated with bioenhancer; xentari; diazinox; bioenhancer + xentari and bioenhancer + diazinox, reached 0.00, $25.60x10^5$ D.U., 20.20 ppm, $14.57x10^5$ D.U. and 13.18 ppm, respectively.

Obtained results indicated that bioenhancer was exhibited a high degree of efficiency against target lepidopterous larvae when combined with chemical insecticide and with bioinsecticides. But when it was used alone, it had no obvious effects.

Field experiments

1- Effect of bioenhancer and combinations on target pests

- **The corn borer**

The population of *S. cretica* larvae reduced significantly in diazinox alone and its combination with Bioenhancer compared with the control. The two B.t. applications alone or in combination with Bioenhancer were numerically best although none of them were significantly different from each of the other treatments (Table, 4). The (monthly) reduction in *S. cretica* larvae were 33.96, 47.83, 80.62, 66.75 and 86.13 % for bioenhancer, xentari, diazinox, ½ bioenhancer + ½ xentari and ½ bioenhancer + ½ diazinox, respectively (Fig.,2).

Our findings agree with those of **Fédière *et al.* (1997)** who showed that a sharp reduction in *S. cretica* larval population (75 to 7/ 100 plants) when using the chemical insecticide. **Samy (1999)** indicated that the *B. thuringiensis* formulation Ecotech, Dipel and Thuricide HP. against *S. cretica* exhibited infestation reduction of 82.99, 54.78 and 56.50%, respectively.

Effect of bioenhancer and its combinations on predators in maize field

Eight predaceous species were collected in this study, six were coleopteran species: *Coccinella undecimpunctata*, and *Scymnus* spp. (*interruptus* Goeze, *syriacus* Mars., *bipunctatus* Klug. and *punctillum* WS.) (Coccinellidae) and *Paederus alfireii* (Staphilinidae) and two were the hemipterous species: *Orius* spp. (*albidipennis* Reut. and *laevigatus* Fieb.) (Anthocoridae).

The (monthly) mean number of predaceous species associated with *S. cretica*, were 11.78, 11.11, 10.33, 5.00, 10.89 and 5.67 individuals for control, bioenhancer, xentari, diazinox, ½bioenhancer + ½xentari and ½bioenhancer + ½ diazinox, respectively (Table, 5). These numbers were insignificantly lower than those counted in the control after bioenhancer, xentari and bioenhancer + ½ xentari treatments. But insecticides and their combinations had significantly effects compared to control. Predaceous species were reduced (monthly) by 5.69, 12.31, 57.56, 7.56 and 51.87 individuals from the control, at different treatments, respectively (Table, 5 & Fig.2).

The safety of bacterial bio-insecticide on different predatory species was previously reported by **McCutcheon *et al.* (1990), Samy (1999).** Also, the effect of insecticides on predaceous insects was discussed by **Abo-Elghar *et al.*(1985)** indicated that *Coccinella* and *Chrysoperla* tolerated to the insecticidal treatments compared with *Scymnus* and *Paederus*, while **Farag *et al.* (1989)** indicated that insecticides highly affected *Scymnus* spp., followed by *Orius* spp.

CONCLUSION

Finally, it could be concluded that in laboratory tests, bioenhancer had no obvious effects when used alone. On the contrary, in the field application, it relatively succeeded to control pests alone indirectly, probably because of its low harmful effect on the entomophagous insects. Besides, bioenhancer had a high degree of efficiency against lepidopterous larvae when combined with bio-and chemical insecticides, in both lab. and field applications.

Table (1): Comparative toxicity of bioenhancer, bioinsecticides (after 72 hours of treatments), chemical insecticides(after 24 hours of treatments) and combinations of bioenhancer with different insecticides against *S. cretica* larvae.

Treatments	LC_{50}	Slope
S. cretica		
Bioenhancer	**0.00**	**0.00**
Xentari	**25.60 x 10^5**	**1.27**
Diazinox	**20.20**	**1.15**
Xentari+ Bioenhancer	**14.57 x 10^5**	**1.83**
Diazinox+ Bioenhancer	**13.18**	**1.65**

Fig.(2): Percent reduction of *S. cretica* larvae and associated predatory species at different treatments in Egypt maize fields, 2000.

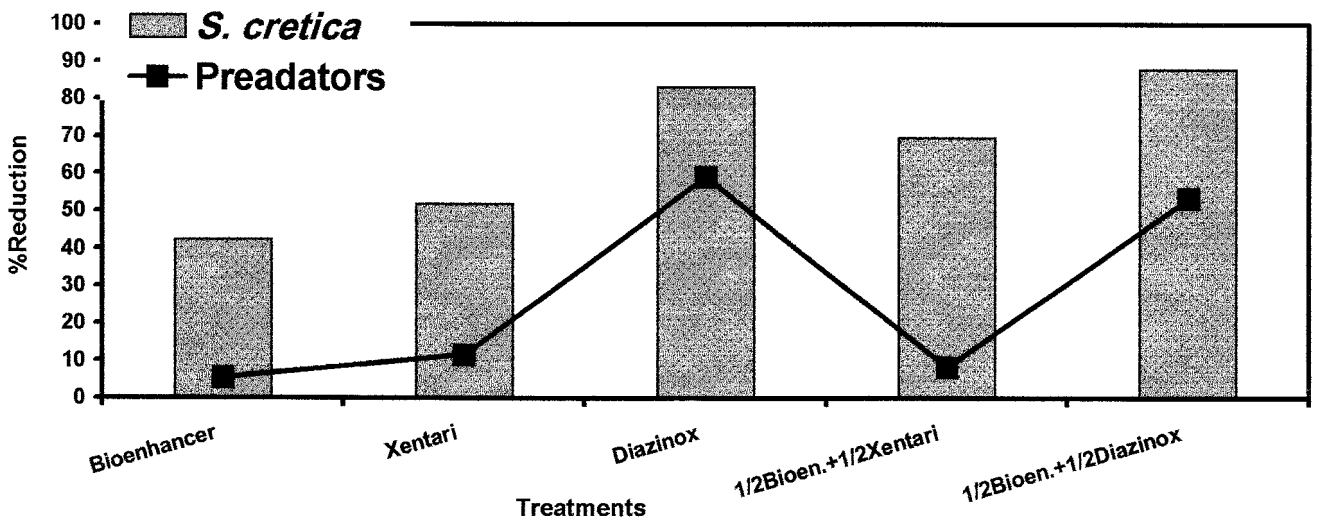

Table (4): Average number of S. cretica larvae/ 50 plants in untreated and treated plots, in Egypt maize fields, 2000.

Months	Average numbers *S. cretica* larvae / 50 plants					
	Control	Bioenhancer	Xentari	Diazinox	½ Bioen.+ ½ Xentari	½ Bioen.+ ½ Diazinox
May	76.00	55.00	45.50	18.50	29.50	13.00
June	27.50	14.00	9.00	1.75	5.25	1.50
July	1.00	0.00	0.00	0.00	0.00	0.00
Mean	33	20.75	15.88	5.5	10	4
%Reduction		-42.42	-51.89	-83.33	69.70	-87.87
L.S.D. 5%	20.0275					

Table (5) Average numbers of predators counted in different treatments in Egypt maize fields, season 2000.

Months	Control	Bioen-hancer	Xentari	Diazimox	½ Bioenhancer + ½ Xentari	½ Bioenhancer + ½ Diazimox
May	19.00	17.67	16.33	7.67	17.00	8.33
June	10.00	9.67	9.33	4.33	9.67	5.00
July	6.34	6.00	5.33	3.00	6.00	3.67
Mean	13.21	12.50	11.71	5.42	12.13	6.17
%Reduction		-5.32	-11.34	-58.98	-8.17	-53.30
L.S.D. 5%	4.3012					