J. Plant Prot. and Path., Mansoura Univ., Vol. 4 (1): 1 - 14, 2013

EFFICIENCY OF TWO FORMULATIONS OF THE PATHOGENIC FUNGI, BIOSECT (*Beauveria bassiana*) AND BIORANZA (*Metarhizium anisopliae*) AGAINST LARVAE OF *Spodoptera littoralis* (BOISD.) AND *Agrotis ipsilon* (HFN.) (LEPIDOPTERA: NOCTIDAE)

EL- Garhy, S. M. M.
Plant Protiction Res. Inst., Agric. Res. Centre, Dokki, Giza, Egypt.

ABSTRACT

Laboratory tests and a semi-field trial were carried out to determine the efficiency of two commercial preparations of the entomopathogenic fungi**,** *Beauveria bassiana* and *Metarhizium anisopliae* namely; Biosect w.p., and Bioranza10 % w.p., against the first instar larvae of the cotton leaf worm, *Spodoptera littoralis* (Boisd.) and, *Agrotis ipsilon* (Hfn.) (Lepedoptera : Noctuidae). Newly hatched, one- day and two- day old larvae of the two insects were allowed to feed on castor oil leaves (100 gram / replicate) treated with different concentrations of the two entomopathogenic fungi for 48hrs at three different temperatures, 20, 25 and 30°C. Mortality rate increased by increasing the concentration, or post treatment period and temperature. Newly hatched larvae were the most sensitive to the toxic effect especially at highest concentration and temperature(30°C), while the two- day old larvae were the most tolerant and the one-day old larvae expressed a moderate tolerance. *S. littoralis* was more sensitive than *A. ipsilon*. Calculated LC_{50s} values for initial mortality of the newly hatched larvae were (0.458, 0.309 and 0.279 mg/ml. when treated with **Biosect** and (0.676, 0.352 and 0.317 when treated with **Bioranza**) at 20, 25 and 25 °C, respectively. Consumed castor oil leaves were decreased by increasing the concentration and temperature but were lower than the control.

Keywords : *Spodoptera littoralis*, *Agrotis* ***ipsilon***, *Beauveria bassiana*, *Metarhizium anisopliae*, Efficiency.

INTRODUCTION

Over-reliance on broad-spectrum pesticides had come under severe criticism from different parts of the world. An alternative eco-friendly strategy for the management of noxious insect pests has been searched to reduce harmful effects of chemical insecticides on environment and humanity. In recent years, crop protection based on biological control of crop pests, with microbial pathogens like virus, bacteria, fungi and nematodes has been recognized as a valuable tool in pest management (Bhattacharya *et al.*, 2003).

The appropriate use of environment-friendly microbial pesticides can play a significant role in sustainable crop production by providing a stable pest management program. Among the fungi, several asexual fungi are associated with Arthropods, especially with insects Entomopathogenic fungi that parasitize insects are valuable weapons for biocontrol and play an important role in promoting integrated pest management, El-Hawary *et al*., (2009).

The use of biological agents to control pests has been known and practiced for long time. Many of the ready made biological control formulations were tested and achieved higher mortality for *S. littoralis* and *A. ipsilon* larval stages as *Bacillius thuringiensis* (Hosny *et al*., 1993). Biological formulations, Bisect and Bioranza are safe to human beings and animals, and do not cause environmental pollution or harmful effects for natural enemies. In this concern, the development of fungal control agents, *Beauveria bassiana* and *Metarhizium anisopliae* for possible use against some key lepidopterous pests received a great attention during the last two decades (Kao 2007).

The successful use of the two biological control agents, Biosect w.p (32 x 106 spores / gm. wp) and Bioranza10 % w.p (32 x 106 spores / gm. wp) is to control *S. littoralis* and *A. ipsilon* received great attention than chemical control. The present investigation evaluates the effect of the two commercial preparations of Biosect W.P. and Bioranza10 % W.P. on the first instar larvae of *S. littoralis* and *A. ipsilon*.

The significance of study is to illustrate the ability of fungi conidiospores to exhibit positive influences on larval mortality as well as malformation in different stages of treated *S. littoralis* and *A. ipsilon*.

MATERIALS AND METHODS

Insect culture:

Insect larvae used were obtained from laboratory strains of ***S. littoralis*** and *A. ipsilon* reared on castor oil leaves for several generations under controlled conditions of 25± 2˚C and 65 ± 5 % R.H at Department of Entomology, Faculty of Agriculture, Fauoum University.

Bio- insecticide preparations:

Two commercial products of Biosect w.p, (32×10^6 conidia/ ml l), recommended concentration is 200 gm / 100 liters of water and Bioranza10 % W.P., (32×10^6spore/gm w.p), recommended concentration is 200 gm / 100 liters of water.

Bioassay technique:

Five serial dilutions of the two bioinsecticides were prepared at five concentrations, 0.10, 0.25, 0.5, 0.75, and 1.0 mg / ml for the two aforementioned insect pests. Tests were done by weighing 100 gram of castor, dipping in each of different concentrations and left until completely dried. Three age-groups of 1st instar larvae were tested; newly hatched, 1-day old and 2- day old. For every concentration, forty larvae of each age-group were provided with treated castor leaves for 48hrs on 20, 25and 30˚C then transferred to untreated leaves to continue feeding on the same aforementioned temperatures. LC_{50} values were calculated to each concentration as mentioned above. Consumed quantities for each age-group larvae at different concentrations and abovementioned temperatures were calculated. Larvae of the check were reared at the seame laboratory conditions but on untreated leaves.

Bioresidual effect:

Forty age- group 1st instar larvae as replicates was allowed to feed on 100 gr. of castor leaves treated with each of the two formulations; Biosect and Bioranza at the concentrations of LC_{50} of each of the concentrations at 20, 25 and 30 ˚C. Three replicates were prepared as control.

Semi- field trails:

In the field, 10 pots of 25 cm were sown by cotton seeds, each had 5 plants of 30 days old and spread on each concentrations as replicate. Double concentrations were used, (2 x 0.1), (2 x 0.25), (2 x 0.5), (2 x 0.75) and (2 x 1.0 mg / ml). Three replicates were prepared as control per treatment, each had 10 pots. The three age– groups, newly hatched, one- day old and 2- day old larvae were applied at the rate of 2 larvae / plant in a cage. Pots in cages were covered by a shade net of 250 mish under simulated field conditions.

The same technique was used for both insect pests to the two formulations at the abovementioned concentrations. The field trail was checked after 5, 7 and 10 days. Twenty five infested leaves per replicate were collected randomly in paper page and transferred to the laboratory.

Statistical analysis:

LC_{50} slop values and fiducial limits of mortality rates were statistically calculated using a Proban Software Computer Program. In addition, the persistence of each biocide was studied in the laboratory on the three age-groups at the concentrations of LC_{50s} on the aforementioned temperatures. Toxicity index (Ti) was determined by using Sun's equation (1950) as follows:

$$\text{Toxicity index (Ti)} = \frac{LC_{50}\ (LC_{90}) \text{ of the compound A}}{LC_{50}\ (LC_{90}) \text{ of compound B}} \times 100$$

Where A is the most effective compound.

B: is the other tested compound.

Mortality percentages were calculated according to the following equation:

$$\% \text{ Reduction of infestation} = \frac{C - T}{C} \times 100$$

Where, C = Estimated parameter in the control.

T = Same parameter in the treatment.

RESULTS AND DISSCUSION

As presented in table (1) presents the results of feeding 1st instar larvae of *S. littoralis*, on various concentrations of the two formulations of *Beauveria bassiana* and *Metahizium anisopliae*. Obtained data indicated that the two formulations had great effects on the three age-groups of 1st instar larvae. A positive relationship existed between larval mortality and concentration. For *S. littoralis*, the mortality rates were (68.4, 74.3and 76.1 %) of the newly hatched larvae after 48hr, at the highest concentration (1.0 mg / ml) of Bisect, accompanied with high consumptions (22.3, 28.5 and 38.9

grams) and (60.3, 70.3 and 73.1%) in Bioranza with consumptions of (25.5, 30.1 and 32.7 gr.), at 20, 25 and 30 ˚C, respectively.

Table (1): Efficiency of Biosect and Bioranza formulations on 1st instar larvae *S. littoralis* at 20, 25 and 30 ˚C under laboratory conditions.

Conc / % Mortality		Age – group of 1st instar larvae								
		% Mortality r			% Mortality			% Mortality		
		Newly hatched larvae			1- day old larvae			2- day old larvae		
		Biosect W.P								
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	27.6	34.9	36.7	20.4	30.4	35.1	17.5	28.8	32.4
	Cons.	30.2	35.8	45.9	35.4	45.9	54.5	44.2	56.7	67.3
0.25	% Mortality	36.8	41.2	43.1	24.3	39.6	44.2	20.6	32.5	36.7
	Cons	28.5	32.0	43.5	33.5	44.5	54.0	43.1	55.1	65.4
0.50	% Mortality	47.3	55.6	55.9	25.4	50.1	50.6	22.9	33.4	38.9
	Cons	26.4	31.5	40.2	31.6	43.2	53.4	42.0	53.2	63.5
0.75	% Mortality	57.8	64.2	66.2	26.9	59.8	60.5	25.7	37.4	41.5
	Cons	25.1	30.4	39.5	30.2	41.3	52.2	41.2	51.8	62.4
1.0	% Mortality	68.4	74.3	76.1	29.9	68.3	68.6	27.3	39.5	55.9
	Cons	22.3	28.5	38.9	27.5	40.1	51.3	50.4	50.9	60.7
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	35.7	39.5	55.6	42.1	53.2	66.3	50.4	63.5	72.4
Slope		1.03	1.011	1.00	-	0.96	0.82	-	-	0.61
LC_{50}		0.458	0.309	0.279	-	0.405	0.346	-	-	1.173
95 % fiducial		0.706 1.352	0.692 1.328	0.686 1.322	-	0.642 1.280	0.503 1.131	-	-	0.288 0.927
Toxicity index (TI)		100	100	100	-	100	100	-	-	-
L.S.D 0.05		3.01	3.51	4.09	2.09	3.44	4.02	1.89	1.01	0.84
		Bioranza W.P								
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	22.6	33.6	34.9	19.6	25.5	32.7	15.7	26.5	30.8
	Cons.	29.8	33.2	35.6	26.8	49.5	50.2	48.9	58.6	70.2
0.25	% Mortality	30.2	40.0	41.4	22.4	36.4	43.1	18.6	28.2	34.6
	Cons	28.5	32.5	35.1	25.8	49.0	49.2	46.5	58.0	68.4
0.50	% Mortality	42.1	52.7	53.4	23.6	45.2	47.9	20.8	30.5	36.7
	Cons	28.0	32.0	35.0	24.5	47.4	48.2	45.2	56.3	65.4
0.75	% Mortality	51.3	62.5	65.0	25.4	53.2	58.6	23.1	35.8	39.2
	Cons	27.2	31.6	32.9	23.0	46.5	46.5	45.0	55.9	63.9
1.0	% Mortality	60.3	70.3	73.1	27.9	65.3	67.6	23.9	35.5	45.9
	Cons	25.5	30.1	32.7	21.5	45.6	45.5	44.0	54.6	63.0
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	35.7	39.5	55.6	42.1	53.2	66.3	50.4	63.5	72.4
Slope		1.01	0.95	0.99	-	0.98	0.845	-	-	-
LC_{50}		0.676	0.352	0.317	-	0.538	0.401	-	-	-
95 % fiducial		0.679 1.337	0.633 1.268	0.670 1.306	-	0.655 1.302	0.529 1.161	-	-	-
Toxicity index (TI)		67.55	87.78	80.01	-	75.28	86.28	-	-	-
L.S.D 0.05		3.08	4.12	2.82	2.28	2.49	3.02	0.54	1.89	3.78

N.B: Forty age – groups 1st instar larvae were exposed.

The mortality rates were (27.6, 34.9 and 36.7 %) with the consumption of (30.2, 35.8 and 45.9 gr.) of Bisect and (22.6, 33.6 and 40.1 %) with the consumption of (22.6, 33.6 and 34.9 gr.) of Bioranza, respectively, at the lowest concentration (0.1mg/ml) of the two formulations. Older larvae (1 and

2-day old) seemed to be more resistant to the two tested formulations caused 20.4, 30.4 and 35.1% mortality to one day old larvae after 48 hrs. with the consumptions of (35.4, 45.9 and 54.5 gr.) and (17.5, 28.8 and 32.4 %) with the consumptions of (44.2, 56.7 and 67.3 gr.) for the two day old larvae. The highest concentration caused 29.9, 68.3 and 68.6 %, with the consumptions of (27.5, 40.1 and 51.3 gr.) to the former age-group and (27.3, 39.5 and 55.9 %) with the consumptions of (50.4, 50.9 and 60.7 gr.), respectively, to the latter age-group on the abovementioned temperatures.

Table (1) shows also that larval mortality rates were related to the concentration and temperature. The mortality rates increased to 27.6, 34.9 and 36.7, to 20.4, 30.4 and 35.1, and 17.5, 28.8 and 32.4 % in the treatment of the newly hatched, 1-day and 2-day old larvae at the lowest concentration of Biosect10% W.P), respectively. At the highest concentration, the mortality rates reached to 68.4, 74.3 and 76.1, 29.9, 68.3 and 68.6, 27.3, 39.5 and 55.9 %, respectively. On the other hand, the mortality rates for (Bioranza10 %) were 22.6, 33.6 and 34.9, 19.6, 25.5 and 32.7, and 15.7, 26.5 and 30.8 % at the lowest concentrations and 60.3, 70.3 and 73.1, and 27.9, 65.3 and 67.6, and 23.9, 35.5 and 45.9 % at the highest one.

These findings agree with Gomaa and Ibrahim 2006 who reported that both formulations were effective on the 2- and 4 instar larvae of *S. littoralis.* Farag, 2008 tested Bonanza, Biovar products, Delfin wg, and Neem-Azal-T/S on the 3rd instar larvae of *S. littoralis*. Biovar induced the highest percentage of mortality, followed by Bioranza.

As for *A. ipsilon*, 1st instar larvae seemed to be more tolerant to the adverse effect of Biosect than *S. littoralis*. Considerable mortality among treated larvae was recorded at 20, 25 and 30˚C. As in *S. littoralis*, mortality rates were positively related to the concentration of any of the two tested formulations and temperatures while they were negatively related to the larval age. Data in table (2) revealed that, the newly hatched larvae treated with Biosect and Bioranza concentrations expressed different rates of mortality; 17.8 – 62.5 with the consumptions of (40.8 – 30.2 gr.) and 15.7- 60.4% (35.2 – 27.6 gr.) , respectively, at 20˚C from treatment, with increase of larval age to 1-day old larvae, mortality percentages rates increased to (15.8 – 27.4 and 15.0 – 25.5 %) with consumptions of (45.9 – 40.2 and 39.8 – 32.6) for Biosect and Bioranza, respectively. Further decrease in mortality was observed in 2 day old larvae, 14.9 – 25.8 and 13.9- 22.9 % with the consumptions of (67.3 – 59.6 and 45.2 – 40.0 gr.), respectively.

Increase of mortality among treated larvae as a percentage of corrected mortality recorded was 71.3 – 74.2, 65.3 – 65.6 and 37.5 – 51.5 % with the consumptions of (47.3 – 62.1, 50.1 – 53.2 and 63.5 – 73.5) at 25 and 30˚C after treatment of newly hatched, 1- day and 2– day old larvae with highest concentration of Biosect, respectively. Corresponding mortalities for Bioranza were 70.5 – 74.0, 63.4 – 63.8 and 35.6 – 50.1 %, with the consumptions of (35.0 – 41.0, 40.7 – 40.2 and 68.0 – 72.0), respectively.

Table (2): Efficiency of Biosect and Bioranza formulations on 1st instar larvae of *A.ipsilon* under different controlled temperatures under laboratory conditions.

Conc. / % Mortality		Age – group of 1st instar larvae								
		% Mortality r			% Mortality			% Mortality		
		Newly hatched larvae			1- day old larvae			2- day old larvae		
Biosect W.P										
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	17.8	22.6	28.4	15.8	22.3	23.5	14.9	20.9	21.5
	Cons..	40.8	55.4	68.5	45.9	56.8	60.5	67.3	72.5	82.5
0.25	% Mortality	35.2	40.3	42.5	23.2	31.5	35.8	19.5	28.3	30.7
	Cons.	38.5	53.5	66.1	43.5	54.2	58.6	65.9	70.2	80.1
0.50	% Mortality	45.1	53.8	54.9	24.2	40.2	45.2	20.7	30.4	34.5
	Cons.	35.4	51.2	64.8	43.0	53.0	56.8	63.2	68.1	78.6
0.75	% Mortality	54.9	62.4	61.8	25.1	55.7	57.7	23.7	34.6	39.4
	Cons.	32.5	50.0	63.2	41.0	51.4	55.0	61.8	65.4	75.9
1.0	% Mortality	62.5	71.3	74.2	27.4	65.3	65.6	25.8	37.5	51.5
	Cons.	30.2	47.3	62.1	40.2	50.1	53.2	59.6	63.5	73.5
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	45.7	60.2	75.4	50.6	65.7	73.5	68.9	80.1	95.4
Slope		1.19	1.27	1.14	-	1.13	1.10	-	-	0.73
LC_{50}		0.574	0.397	0.351	-	0.585	0.511	-	-	1.326
95 % fiducial		0.860 1.528	0.942 1.599	0.818 1.464	-	0.801 1.464	0.772 1.426	-	-	0.401 1.058
Toxicity index (TI)		100	100	100	-	100	100	-	-	100
L.S.D 0.05		2.14	3.66	4.23	1.79	2.89	3.11	1.22	0.89	1.01
Bioranza W.P										
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	15.7	20.4	26.1	15.0	20.9	21.6	13.9	19.1	20.5
	Cons.	35.2	40.2	47.6	39.8	45.2	47.5	45.2	72.4	80.6
0.25	% Mortality	33.9	38.6	40.4	21.2	29.6	33.2	17.8	26.7	28.7
	Cons.	32.5	37.2	45.6	38.2	44.2	46.0	44.5	70.2	75.4
0.50	% Mortality	43.1	50.2	52.0	22.3	37.8	42.5	19.5	27.8	33.5
	Cons.	31.4	36.5	44.1	36.9	43.0	44.6	41.8	70.0	75.0
0.75	% Mortality	51.9	60.5	69.5	23.2	53.7	56.7	21.5	32.7	37.5
	Cons.	28.7	35.2	42.3	34.9	42.0	41.9	40.5	68.7	72.3
1.0	% Mortality	60.4	70.5	74.0	25.5	63.4	61.8	22.9	35.6	50.1
	Cons.	27.6	35.0	41.0	32.6	40.7	40.2	40.0	68.0	72.0
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	45.7	60.2	75.4	50.6	65.7	73.5	68.9	80.1	95.4
Slope		1.20	1.30	1.30	-	1.13	1.13	-	-	0.73
LC_{50}		0.642	0.439	0.354	-	0.651	0.567	-	-	1.498
95 % fiducial		0.863 1.539	0.970 1.634	0.970 1.626	-	0.798 1.468	0.796 1.457	-	-	0.402 1.065
Toxicity index (TI)		89.4	90.43	99.15	-	89.86	90.12	-	-	88.52
L.S.D 0.05		2.06	2.77	4.01	1.63	2.41	2.99	1.11	0.78	0.89

N.B: Forty age – groups 1st instar larvae were exposed.

Regarding the cumulative mortality after treatment of *S. littoralis*, newly hatched and 1–day old larvae showed higher mortality percentages at all concentrations at 20˚C of treatment, Table. 1. Mortality continued according to pathogen concentration. At higher and lower concentrations, most larvae died within 30˚C.

It could be stated, therefore, that exposing larvae to 25, and 30˚C caused more mortality among the three age group larvae. Accordingly, highest percentages rates of mortality occurred at different tested concentrations at 30˚C. Treatment of 2–day old larvae, at the highest concentration of Biosect (1.0 mg / ml) showed lower initial mortality (27.3%) rate than the newly hatched (68.4 %) or 1–day old larvae (29.9 %), respectively, table 1.

EL-Hawary *et al*., (2009) evaluated the efficiency of the entomopathogenic fungi products, Bio- Power (*B. bassiana*), Bio-Catch (*Lecanicillium lecanii*) and Priority (*Paecilomyces fumosoroseus*)) against *S. littoralis* and *A. ipsilon* larvae under laboratory conditions at the concentrations of $0.125x10^9$, $0.250x10^9$, $0.5x10^9$ and $1x10^9$ and found that Bio- Power was the most effective and calculated LC_{50} and LC_{90} were $0.2x10^9$ and $1.5\ x10^9$, respectively. Gosselin, *et al*., (2009) found that the entomopathogenic fungus, *B. bassiana* had a lower efficacy, with an estimated LC_{50} of 7×107 spores mL-1. on third instar larvae of *A. ipsilon*.

As for *A.ipsillon*, table (2) larval mortality rates continued to increases progressively within increased temperatures. Comparison between *S. littoralis* and *A. ipsilon* indicated that mortality rate started later, but continued faster in the case of *A. ipsilom* as no progressive mortality occurred at 25˚C with 1 and 2–day old larvae of *A. ipsillon,* using lowest concentration of Biosect.

Data in tables (1 and 2) show that the activity of the two pathogens formulations not differed for the two considered pests according to the larval age. Based on the LC_{50} values and toxicity index (Ti), Biosect was more toxic (the LC_{50} = 0.458 mg / ml & Ti = 100), (0.309 mg / ml & Ti = 100) and (0.279 mg / ml & Ti = 100) to the newly hatched larvae of *S. littoralis* than Bioranza (the LC_{50} = 0.676 mg / ml & Ti = 67.55), (0.352 mg / ml & Ti = 87.78) and (0.317 mg / ml & Ti = 80.01, as presented at 20, 25 and 30 ˚C. As for Bisect on *A. ipsilon* newly hatched larvae (LC_{50}, were 0.574 mg / ml & Ti = 100), (0.397 mg / ml & Ti = 100) and (0.351 mg / ml & Ti = 100) and Bioranza was less effective (LC_{50} = 0.642 mg / ml & Ti = 89.4), (0.439 mg / ml & Ti = 90.43) and (0.354mg / ml & Ti = 99.15). Levels of toxicity were determined on some cotton insect pests by many investigators (Sabbour and Sahab 2005; Gardezi, 2006 and Garcia 2010).

. Statistical analysis of the obtained data showed significant differences in *S. littoralis* and *A. ipsilon* infestation between the two testing formulations.

Bioresidual effect:

As presented in table (3) mortality percentages were recorded at several concentrations on the aforementioned temperatures. The mortality percentages of treated *S. littoralis* newly hatched,1–day old and 2- day old larvae at the lowest concentration of Biosect at 20, 25 and 30˚C were 12.7,10.1and 7.0, 14.9, 14.0 and 13.4, 16.8, 16.0 and 15.0. The percentages of mortality increased at higher concentration to 21.9, 20.8 and 15.7 and 25.7, 21.6 and 20.6 and 27.5, 25.9 and 28.7, respectively. The mortality percentages of the newly hatched larvae were 12.7 – 21.9, 14.9 – 25.7 and 16.8 – 27.5 at the aforementioned temperatures. Older larvae (1 and 2-day

old) seemed to be more resistant to Biosect while the mortality percentages increased to 10.1 – 20.8, 14.0 – 21.6 and 16.0 – 25.9 and 7.0 – 15.7, 13.4 – 20.6 and 15.0 – 28.7, respectively.

S. littoralis seemed to be tolerant to Bioranza. Obtained data were 12.5,10.4 and 10.0, 16.5, 14.3and 12.7, 19.7, 18.7 and 16.4with the lower concentration (0.1mg / ml) and increased to 19.8, 18.5 and 18.0, 22.1, 22.0 and 21.5, 45.7, 33.4 and 30.2 to the three age-groups, at tested temperatures at highest concentration (1.0 mg / ml), respectively. The newly hatched larvae seemed to be sensitive than the two other age- groups. The mortality percentages ranged 12.5 – 19.8, 16.5 – 22.1, and 19.7 – 45.7 and decreased mortality percentages were obtained by 1- day and 2- day larvae and ranged 10.4 – 18.5, 13.4 – 22.0, 18.7 – 33.4and 10.0 – 18.5, 12.7 – 21.5, and 16.4 – 30.2%, at 20, 25 and 30 ˚C, respectively. *S. littoralis* was susceptible to the fungi; *B. bassiana* and *M. anisopilae* and respective LC_{50}s values for *S. littoralis* were: $163x10^4$ and $175x10^4$ spores/ml. (Sahab and Sabbour 2011).

Table (3): Persistene of Biosect and Bioranza formulations at LC_{50s} on 1st instar larvae *S. littoralis* under different controlled temperatures.

Conc / % Mortality		Age – group of 1st instar larvae								
		% Mortality r			% Mortality			% Mortality		
		Newly hatched larvae			1- day old larvae			2- day old larvae		
		Biosect W.P								
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	12.7	14.9	16.8	10.1	14.0	16.0	7.0	13.4	15.0
	Cons.	32.4	37.5	48.6	37.6	48.7	55.4	46.8	58.9	69.5
0.25	% Mortality	15.4	18.6	18.7	12.4	16.9	19.5	8.5	15.2	17.5
	Cons	29.5	35.0	45.8	35.1	46.8	52.6	43.8	55.5	65.4
0.50	% Mortality	18.4	20.4	22.4	13.8	18.5	20.1	8.6	19.4	21.7
	Cons	26.4	32.1	42.3	33.4	43.5	50.4	41.3	52.4	62.7
0.75	% Mortality	20.6	22.1	23.5	18.9	19.8	21.4	12.5	14.2	23.0
	Cons	23.1	30.6	39.4	31.8	40.5	47.3	39.7	50.7	60.0
1.0	% Mortality	21.9	25.7	27.5	20.8	21.6	25.9	15.7	20.6	28.7
	Cons	20.3	25.3	35.8	30.9	38.0	44.7	36.5	45.8	59.4
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	35.7	39.5	55.6	42.1	53.2	66.3	50.4	63.5	72.4
		Bioranza W.P								
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	12.5	16.5	19.7	10.4	13.4	18.7	10.0	12.7	16.4
	Cons.	32.4	35.4	35.6	26.8	49.5	50.2	48.9	58.6	70.2
0.25	% Mortality	13.9	17.6	21.9	12.9	14.4	21.9	12.6	18.6	18.9
	Cons	35.2	39.3	38.4	28.9	53.4	55.4	50.3	60.3	72.3
0.50	% Mortality	17.5	19.8	24.5	18.0	15.5	23.4	15.2	20.5	25.4
	Cons	37.9	41.0	41.6	29.6	56.3	56.6	52.4	63.4	75.4
0.75	% Mortality	19.4	20.4	25.7	18.4	20.0	29.8	16.5	20.9	27.5
	Cons	39.7	43.1	45.8	31.5	60.0	62.1	55.1	65.4	77.9
1.0	% Mortality	19.8	22.1	45.7	18.5	22.0	33.4	18.5	21.5	30.2
	Cons	42.1	45.6	48.7	34.5	63.5	65.0	60.2	66.1	80.4
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	35.7	39.5	55.6	42.1	53.2	66.3	50.4	63.5	72.4

N.B: Forty age – groups were exposed.

Older larvae (1 and 2-day old) seemed to be more resistant to Biosect the mortality percentages were increased to 8.2 – 26.8, 11.9 – 29.9 and 12.8 – 36.6 and 7.0 – 16.5, 10.6 – 24.5 and 11.9 – 33.0, on 20, 25 and 30°C, respectively, obtained data also indicated that the newly hatched larvae were the most sensitive than the two other age-group under laboratory conditions.

Obtained data in table 4 shows that the mortality percentages of *A. ipsilon* with Biosect at the lowest concentration of Biosect (LC_{50} of the concentration of (0.1mg / ml) were 8.5, 8.2 and 7.0, 12.1, 11.9 and 10.6, 15.2, 12.8 and 11.9 % increased to 38.7, 26.8 and 16.5, 42.1, 29.9 and 24.5, 12.8 – 36.6, 7.0 – 16.5 ,10.6 – 24.5 and 11.09 – 33.0 % against the three age groups, respectively.

On the other hand, the mortality percentages with Bioranza LC_{50s} of *A. ipsilon* at the lowest concentration were 7.5, 7.2 and 7.0,14.5, 10.8 and 10.,17.6, 14.5 and 11.2% increased to 43.8, 31.8 and 25.3, 47.6, 35.7 and 29.9, 48.0, 38.6 and 36.5% at the highest concentration on the three age-groups.

Newly hatched larvae seemed to be more sensitive than the two age-groups larvae and the recorded mortality percentages ranged 7.5 - 43.8, 14.5 – 47.6, 17.6 – 48.0 ,7.2 – 31.8 ,10.8 – 35.7, 14.5 – 38.6, 7.0 – 25.3, 10.1 – 29.9 and 11.2 – 36.5% at the three age-groups, respectively.

Semi-field trial assessment:

Tabulated data in table (5) show that the lower concentration (2 x 0.1 mg / ml) achieved lowest mortality percentages vice versa was the highest one (2 x 1.0 mg / ml) of Biosect on *S. littoralis*. The mortality percentages at the concentration of 2 x 0.1 after 5, 7 and 10 days were 70.0, 50.0 and 42.0 and 76.0, 56.0 and 50.0 and 84.0 68.0 and 56.0%, respectively. At the highest concentration, the mortality percentages were 90.0, 66.0 and 62.0 and 92.0, 72.0 and 70 and 94.0, 86.0 and 80.0% after the same periods. Survival rat was 100% and the mortality percentages were 0.0%, in the control. A significant decrease in the population of *S. littoralis* larvae was recorded after one week from application of Biosect on peanut. The first instar was zero in all treatments compared with control (309 control was 3.9 larvae/day on the same date) (Zaki and Abdel-Raheem 2010).

In addition, the mortality percentages at the lower concentration of Bioranza were 56.0, 48.0 and 32.0, 64.0, 52.0 and 36.0, 72.0, 60.0 and44.0%. The mortality percentages at the concentration of the highest one were 69.0, 64.0 and 53.0, 83.0, 67.0 and 61.0, 88.0, 83.0 and 72.0% while the survival rate of the three age groups of *S. littoralis* after 5, 7 and 10 days was 100% in the control.

These results agree with those obtained by Sahab and Sabbour (2011) who reported that under field conditions, the tested fungi showed significant infestations' decrease in the plots treated with *B. bassiana*, followed by *M. anisopliae.* El-Husseini *et al*., (2008) bioassay *B. bassiana* in two formulations; for spraying and dusting applications, in sugar beet fields for controlling *S. littoralis* and other chewing pests. They reported that Pests feed by chewing all leaf tissues showed high reduction rates whatever the

applied technique, *i.e*. the noctuid larvae of *S. littoralis*, *Trichoplusia ni*, *Antographa gamma* and *Syngrapha circumflexa* [*Cornutiplusia circumflexa*].

Amer *at al*., (2008) studied the ability of fungi, *B. bassinet* and *M. anisopliae* conidiospores to exhibit positive influences on larval mortality as well as malformation in different stages of *S. littoralis* treated. These effects showed that, the mortality percentage increased with increasing concentrations and time elapsed after treatment.

Table (4): Persistence of Biosect and Bioranza formulations at the concentrations of LC_{50s} on 1st instar larvae of *A. ipsilon* under different controlled temperatures under laboratory conditions.

Conc.		Age – group of 1st instar larvae								
		% Mortality			% Mortality			% Mortality		
% mortality.		Newly hatched larvae			1- day old larvae			2- day old larvae		
Biosect W.P										
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	8.5	12.1	15.2	8.2	11.9	12.8	7.0	10.6	11.9
	Cons.	41.5	56.8	62.5	46.7	58.4	63.5	68.6	73.2	86.4
0.25	% Mortality	18.2	21.5	23.1	13.4	17.2	18.7	10.6	14.0	15.1
	Cons.	43.4	57.4	63.5	48.9	60.2	65.4	70.2	75.6	88.7
0.50	% Mortality	26.4	27.3	30.4	15.9	20.9	23.1	13.6	17.5	18.9
	Cons.	45.8	59.4	66.4	50.1	63.5	68.4	73.5	76.4	88.9
0.75	% Mortality	29.8	36.8	36.5	23.6	26.7	31.1	15.4	21.1	26.5
	Cons.	48.8	60.7	67.9	52.3	65.4	70.1	73.9	78.9	90.5
1.0	% Mortality	38.7	42.1	42.9	26.8	29.9	36.6	16.5	24.5	33.0
	Cons.	51.3	63.5	70.7	55.2	66.0	70.6	75.4	80.6	91.7
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	55.4	65.8	75.4	60.8	70.0	76.4	77.4	85.1	95.6
Bioranza W.P										
C.˚ Temp.		20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C	20 ˚C	25 ˚C	30 ˚C
0.10	% Mortality	7.5	14.5	17.6	7.2	10.8	14.5	7.0	10.1	11.2
	Cons.	36.0	41.1	48.0	40.1	46.1	48.5	46.4	73.5	81.6
0.25	% Mortality	17.1	25.9	29.6	14.2	17.2	21.0	7.5	15.4	18.3
	Cons.	36.4	43.5	48.0	41.3	46.8	48.6	47.2	74.5	82.3
0.50	% Mortality	30.4	39.3	36.8	18.9	22.2	27.3	11.2	19.1	26.4
	Cons.	38.7	44.2	50.2	41.2	47.6	50.2	48.7	75.6	83.4
0.75	% Mortality	39.0	43.2	44.2	26.7	31.1	33.8	18.2	25.6	30.4
	Cons.	41.0	45.5	53.2	42.1	48.9	52.1	49.6	77.5	85.6
1.0	% Mortality	43.8	47.6	48.0	31.8	35.7	38.6	25.3	29.9	36.5
	Cons.	44.3	46.8	55.5	43.9	50.1	54.1	50.1	78.6	87.2
Control	% Mortality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cons.	45.9	48.3	56.5	43.5	52.1	57.2	53.4	80.2	88.7

N.B: Forty age – groups were exposed.

Table (5): Efficiency of Biosect and Bioranza formulations on *S. littoralis* age – group larvae under semi- field conditions.

The pest / Conc.		Age – group of 1st instar larvae								
		% Mortality			% Mortality			% Mortality		
		Newly hatched larvae			1- day old larvae			2- day old larvae		
		Biosect W.P								
S. littoralis	Period / days	5	7	10	5	7	10	5	7	10
	2 x 0.10	70.0 (30.0)	76.0 (24.0)	84.0 (16.0)	50.0 (50.0)	56.0 (44.0)	68.0 (32.0)	42.0 (58.0)	50.0 (50.0)	56.0 (44.0)
	2 x 0.25	74.0 (26.0)	80.0 (20.0)	86.0 (14.0)	52.0 (48.0)	62.0 (38.0)	70.0 (30.0)	45.0 (55.0)	54.0 (46.0)	60.0 (40.0)
	2 x 0.50	82.0 (18.0)	86.0 (14.0)	90.0 (10.0)	58.0 (42.0)	66.0 (34.0)	74.0 (26.0)	50.0 (50.0)	60.0 (40.0)	68.0 (32.0)
	2 x 0.75	86.0 (14.0)	88.0 (12.0)	92.0 (8.0)	62.0 (38.0)	68.0 (32.0)	80.0 (20.0)	56.0 (44.0)	66.0 (34.0)	72.0 (28.0)
	2 x 1.0	90.0 (10.0)	92.0 (8.0)	94.0 (6.0)	66.0 (34.0)	72.0 (28.0)	86.0 (14.0)	62.0 (38.0)	70.0 (30.0)	80.0 (20.0)
	Control / survival	100	100	100	100	100	100	100	100	100
	L.S.D 0.05	2.05	2.15	3.01	1.09	1.66	1.02	2.55	2.11	2.02
		Bioranza W.P								
	Period / days	5	7	10	5	7	10	5	7	10
	2 x 0.10	56.0 (44.0)	64.0 (36.0)	72.0 (28.0)	48.0 (52.0)	52.0 (48.0)	60.0 (40.0)	32.0 (68.0)	36.0 (64.0)	44.0 (56.0)
	2 x 0.25	58.0 (42.0)	68.0 (32.0)	74.0 (26.0)	50.0 (50.0)	58.0 (42.0)	70.0 (30.0)	36.0 (64.0)	42.0 (58.0)	56.0 (44.0)
	2 x 0.50	62.0 (38.0)	74.0 (26.0)	82.0 (18.0)	52.0 (48.0)	62.0 (38.0)	76.0 (24.0)	42.0 (58.0)	46.0 (54.0)	66.0 (34.0)
	2 x 0.75	66.0 (34.0)	78.0 (22.0)	84.0 (16.0)	60.0 (40.0)	64.0 (36.0)	82.0 (18.0)	46.0 (54.0)	56.0 (44.0)	70.0 (30.0)
	2 x 1.0	69.0 (31.0)	83.0 (17.0)	88.0 (12.0)	64.0 (36.0)	67.0 (33.0)	83.0 (17.0)	53.0 (47.0)	61.0 (39.0)	72.0 (28.0)
	Control / survival	100	100	100	100	100	100	100	100	100
	L.S.D 0.05	1.05	1.09	2.1	0.04	0.75	0.80	0.54	1.62	1.89

Table (6) show that the mortality percentages were 50.0, 40.0 and 34.0, 60.0, 44.0 and 38.0, 70.0, 56.0 and 40.0% at the lowest concentration (0.1 mg / ml) increased to 74.0, 60.0 and 50.0, 80.0, 65.0 and 55.0, 86.0, 78.0 and 70.0% at the highest concentration (1.0 mg / ml) of Biosect on *A. ipsilon* after 5, 7 and 10 days, while the survival rate of larvae of the three age groups, in the control was 100% and the mortality percentages was 0.0%. On the other hand, the mortality percentages in the three age- groups were 48.0, 44.0 and 26.0, 52.0 48.0 and 30.0,and 62.0, 54.0 38.0% at the lowest concentration of Bioranza on *A. ipsilon*, increased to 67.0, 59.0 and 45.0, 74.0, 64.0 and 54.0, 80.0, 76.0 and 66.0% at the highest concentration after 5, 7 and 10.0 days, while the survival 1st instar age groups larvae was 100% and the mortality percentage was 0.0% in the control.

It was concluded that, the adverse effect of Biosect and Bioranza included decrease of larval percentage according to both concentration and age- group of larvae. Newly hatched larvae seemed to be more sever than other groups, while the opposite was true in the case of 1 and 2 –day old larvae.

Table (6): Efficienecy of Biosect and Bioranza formulations on *A. ipsilon* age – group larvae under semi field conditions.

The pest		Age – group of 1st instar larvae								
		% Mortality r			% Mortality			% Mortality		
		Newly hatched larvae			1- day old larvae			2- day old larvae		
	Conc.	Biosect W.P								
A. ipsilon	Period / days	5	7	10	5	7	10	5	7	10
	2 x 0.10	50.0 (50.0)	60.0 (40.0)	70.0 (30.0)	40.0 (60.0)	44.0 (56.0)	56.0 (44.0)	34.0 (66.0)	38.0 (62.0)	40.0 (60.0)
	2 x 0.25	52.0 (48.0)	66.0 (34.0)	76.0 (24.0)	46.0 (54.0)	48.0 (52.0)	60.0 (40.0)	36.0 (64.0)	36.0 (64.0)	44.0 (56.0)
	2 x 0.50	60.0 (40.0)	70.0 (30.0)	80.0 (20.0)	52.0 (48.0)	54.0 (46.0)	66.0 (34.0)	40.0 (60.0)	42.0 (58.0)	48.0 (52.0)
	2 x 0.75	66.0 (34.0)	76.0 (24.0)	86.0 (14.0)	58.0 (42.0)	62.0 (38.0)	70.0 (30.0)	48.0 (52.0)	52.0 (48.0)	54.0 (46.0)
	2 x 1.0	74.0 (26.0)	80.0 (20.0)	86.0 (14.0)	60.0 (40.0)	65.0 (35.0)	78.0 (22.0)	50.0 (50.0)	55.0 (45.0)	70.0 (30.0)
	Control / survival	100	100	100	100	100	100	100	100	100
	L.S.D 0.05	1.55	1.68	2.01	0.99	0.78	0.88	0.56	0.65	0.59
		Bioranza W.P								
	Period / days	5	7	10	5	7	10	5	7	10
	2 x 0.10	48.0 (52.0)	52.0 (48.0)	62.0 (28.0)	44.0 (56.0)	48.0 (52.0)	54.0 (46.0)	26.0 (74.0)	30.0 (70.0)	38.0 (62.0)
	2 x 0.25	56.0 (44.0)	56.0 (44.0)	66.0 (34.0)	46.0 (54.0)	52.0 (48.0)	58.0 (42.0)	38.0 (62.0)	38.0 (62.0)	48.0 (52.0)
	2 x 0.50	58.0 (42.0)	60.0 (40.0)	68.0 (32.0)	52.0 (48.0)	56.0 (44.0)	70.0 (30.0)	40.0 (60.0)	46.0 (54.0)	54.0 (46.0)
	2 x 0.75	64.0 (36.0)	70.0 (30.0)	78.0 (22.0)	56.0 (44.0)	64.0 (36.0)	76.0 (24.0)	42.0 (58.0)	44.0 (56.0)	62.0 (38.0)
	2 x 1.0	67.0 (33.0)	74.0 (26.0)	80.0 (20.0)	59.0 (41.0)	64.0 (34.0)	76.0 (24.0)	45.0 (55.0)	54.0 (46.0)	66.0 (34.0)
	Control / survival	100	100	100	100	100	100	100	100	100
	L.S.D 0.05	1.05	1.09	2.1	0.04	0.75	0.80	0.54	0.60	0.51

REFERENCES

Amer, M. M.; El-Sayed, T. I.; Bakheit, H. K.; Moustafa, S. A.; El-Sayed, Y. A (2008):Pathogenicity and genetic variability of five entomopathogenic fungi against *Spodoptera littoralis*. Res. J. of Agric. and Biol. Sci.; 8. 4: 5, 354-367.

Bhattacharya, A.K.; Mondal, P Ramamurthy, V.V. and Srivastava R.P. (2003). *Beauveria bassiana* : apotential bioagent for innovative integrated pest management program. In: Srivastava, R.P Ed.), Biopesticides and Bioagents in Integrated Pest Management of Agricultural Crops. International Book Distributing Co. Lucknow 860 pp.

El-Hawary, F.M and Abd El-Salam, A.M.E (2009): Laboratory bioassay of some entomopathogenic fungi on *Spodoptera littoralis* (Boisd.)and *Agrotis ipsilon* (Hufn.) larvae (Lepidoptera: Noctuidae). Egypt. Acad. J. biol. Sci., 2 (2): 1- 4

El-Husseini, M. M.; Agamy, E. A.; Mesbah, A. H.; El-Fandary, O. O.; Abdallah, M. F.(2008):Using *Beauveria bassiana* (Bals.) Vuillemin in spraying and dusting applications for biological control of sugar beet insect pests in Egypt. Egy. J. of Biol. Pest Cont. 18: 2, 369-375.

Farag, N. A. (2008): Susceptibility of the cotton leaf worm, *Spodoptera littoralis* 3rd instar larvae to some bio-insecticides (Lepidoptera: Noctuidae). Egy. J. of Biol. Pest. Cont. Vol. 18 No. 2pp. 343 – 346.

Garcia-Gutierrez, C.; Rosas-Garcia, N. M.; Norzagaray-Campos, M.; Chairez-Hernandez, I. (2010): Efficacy of *Beauveria bassiana* and *Metarhizium anisopliae* to control *Pieris rapae* on cabbage in the field. Southwestern Entomologist; 35: 1, 75-83.

Gardezi, S. R. A.(2006): Studies on the application of fungi and bacteria controlling insect pests in Azad Jammu and Kashmir, Pakistan. Arch. of Phytopath. and Plant Prot. 39: 1, 49-67.

Gomaa, A. E; Ibrahim, R. A. (2006): Laboratory evaluation of certain compounds on the cotton leaf worm *Spodoptera littoralis*(Boisd.) (Lepedoptera : Noctudae). Manufiya. J. Agric. Vol. 31 No. 5: 1281 – 1293

Gosselin, M. -E.; Belair, G.; Simard, L.; Brodeur, J. (2009): Toxicity of spinosad and *Beauveria bassiana* to the black cutworm, and the additivity of sub lethal doses. Biocon.Sci. and Tech, Vol. 19, No. 2, pp. 201-217(17).

Hosny, M. M., G. EL – Saadany, G. M. Moawad and C. Topper. (1993): Evaluation of efficacy of certain bacterial insecticides (*Bacillius thuringiensis*) in controlling *Spodoptera littoralis* in Egypt. Agric. Res. Rev., 61 (1), 45 - 56

Kao SueySheng (2007): Current status of bio-pesticides development, farmers' acceptance and utilization, and future perspective in Taiwan. Exten. Bull- Food & Fert. Techn. Cen. 599, 20 pp.

Sabbour, M. M.; Sahab, A. F.(2005): Efficacy of some microbial control agents against cabbage pests in Egypt. Pakistan Journal of Biological Sciences; 8: 10, 1351-1356.

Sahab, A. F.; Sabbour, M. M. (2011): Virulence of four entomopathogenic fungi on some cotton pests with special reference to impact of some pesticides, nutritional and environmental factors on fungal growth. Egy. J.of Biol. Pest Cont.; 2011. 21: 1, 61-67.

Sun, Y. P. (1950): Toxicity index on improved method of comparing the relative toxicity of insecticides. J. Econ. Ent. 43: 45 - 53

Zaki, F. N.; Abdel-Raheem, M. A. (2010): Use of entomopathogenic fungi and insecticide against some insect pests attacking peanuts and sugar beet in Egypt. Arch. of Phytopath. and Plant Prot; 2010. 43: 16/18, 1819-1828.

فاعليــة مستحضــرين مــن الفطريــات الممرضــة للحشــرات *Beauveria bassiana* و *Metarhizium anisopliae* علي يرقات دودة ورق القطن *Spodoptera littoralis* و والدودة القارضة السوداء *Agrotis ipsilon*

سيد محمد مصطفي الجارحي
معهد بحوث وقاية النبات – مركز البحوث الزراعية – الدقي – الجيزة

أجريت أختبارات معملية وأخري حقلية لتقدير قاعلية مستحضري بيوسكت و بيورانزا علي يرقات العمر الأول لكل من دودة ورق القطن والدودة القارضة السوداء. غذيت يرقات الحديثة الفقس ويرقات العمر الأول عمر يوم واحد و يومان لكلا الحشرتين علي أوراق الخروع المعاملة بتركيزات مختلفة من كلا المستحضرين الحيويين المختبرين لمدة ٤٨ ساعة. وجد أن نسبة الموت تزيد بزيادة التركيز المستخدم وكذلك درجة الحرارة في المعمل. وكانت اليرقات الحديثة الفقس أكثر حساسية للتأثير السمي واليرقات عمر يومان أكثر تحملا له أما اليرقات عمر يوم واحد فقد أظهرت تحملا متوسطا . كذلك يرقات دودة ورق القطن كانت أكثر حساسية للتأثير السمي للمستحضرين من الدودة القارضة السوداء حيث كانت نسب التأثير القاتل لنصف عدد الأفراد من اليرقات حديثة الفقس لدودة ورق القطن و الدودة القارضة السوداء هو ٠.٤٥٨و ٠.٣٠٩ ٠.٢٧٩ لليرقات حديثة الفقس لدودة ورق القطن علي درجات حرارة ٢٠ و ٢٥ و ٣٠ درجة مئوية للمستحضر بيوسكت. بينما كانت ٠.٦٧٦ و ٠.٣٥٢ و ٠.٣١٧ لمستحضر بيورانزا علي نفس درجات الحرارة. أما نسب التأثير القاتل للبيوسكت لنصف عدد الأفراد من اليرقات حديثة الفقس للدودة القارضة السوداء فكانت ٠.٥٧٤ و ٠.٣٩٧ و ٠.٣٥١ علي درجات الحرارة المذكورة. أما نسب التأثير القاتل لنصف عدد الأفراد أو اليرقات الحديثة الفقس لمستحضر بيورانزا هو ٠.٦٤٢ و ٠.٤٣٩ و ٠.٣٥٤ علي التوالي.

ولقد دلت النتائج الحقلية أن نسبة الموت تزداد بزيادة التركيز المستخدم وبطول الفترة بعد المعاملة. ففي حالة إستخدام مستحضر البيوسكت كانت النسبة المئوية للموت في الطور اليرقي الحديث الفقس لدودة ورق القطن هي ٩٠.٠ و ٩٢.٠ و ٩٤.٠ بينما كانت ٦٦.٠ و ٧٢.٠ و ٨٦.٠ للطور اليرقي عمر يوم وفي حالة الطور اليرقي عمر يومان كانت النسبة المؤية للموت هي ٦٢.٠ و ٧٠.٠ و ٨٠.٠ وذلك عند التركيز الأعلي وهو ٢ جم / لتر بعد مرور ٥ و ٧ و١٠ أيام. أما عند إستخدام مستحضر بيورانزا كانت النسبة المئوية للموت في الطور اليرقي الحديث الفقس هي ٦٩.٠ و ٨٣.٠ و ٨٨.٠ % بينما كانت ٦٤.٠ و ٦٧.٠ و ٨٢.٠ % للطور اليرقي عمر يوم وفي حالة الطور اليرقي عمر يومان ٥٣.٠ و ٦١.٠ و ٧٢.٠ % وذلك عند التركيز الأعلي بعد مرور ٥ و ٧ و١٠ أيام علي التوالي.

أظهرت النتائج الحقلية في جالة إستخدام مستحضر بيوسكت أن النسبة المئوية للموت في الطور اليرقي حديث الفقس للدودة القارضة السوداء هي ٧٤.٠ و ٨٠.٠ و ٨٦.٠ % بينما كانت ٦٠.٠ و ٦٥.٠ و ٧٨.٠ % للطور اليرقي عمر يوم وفي حالة الطور اليرقي عمر يومان ٥٠.٠ و ٥٥.٠ و ٧٠.٠ % وذلك عند التركيز الأعلي وهو ٢ جم / لتر بعد مرور ٥ و ٧ و١٠ أيام. أما عند إستخدام مستحضر بيورانزا كانت النسبة المئوية للموت في الطور اليرقي الحديث الفقس هي ٦٧.٠ و ٧٤.٠ و ٨٠.٠ % بينما كانت ٥٩.٠ و ٦٤.٠ و ٧٦.٠ % للطور اليرقي عمر يوم وفي حالة الطور اليرقي عمر يومان كانت النسبة المئوية للموت هي ٤٢.٠ و ٥٤.٠ و ٦٦.٠ % وذلك عند التركيز الأعلي بعد مرور ٥ و ٧ و١٠ أيام علي التوالي.

قام بتحكيم البحث

أ.د / عبد البديع عبد الحميد غانم — **كلية الزراعة – جامعة المنصورة**
أ.د / احمد حسين الهنيدى — **مركز البحوث الزراعية**