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Integration Of Used The Fungus Beauveria Bassiana And Insecticides To Control The Cotton Leaf Worm On The Two Verities Of Eggplant.

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ABSTRCAT

This study was conducted under green house of the college of Agriculture –University of Baghdad during the year 2013-2014.It aimed to test the fungus Beauveria bassiana and two insecticides (Force and Marshall) and their combined to control the cotton leaf worm on two varities of eggplant . The results showed that the treatment Bb2 recorded a similar effect of the treatments Fo1 and Fo2 on varity Barshelona.,reached 0.35,0.31and 0.37 hole/plant .This indicates that the formulation of the fungus is an effective alternative against the pest under protected conditions. The process of mixing the insecticide (Fo) and the product of Bb did not record any effective results compared to the treatment of the pesticide and the fungus ,when they are used separately. The high concentrations of the insecticides led to an increase in the rates of the intensity as the treatment of Ma2 was 0.70 h / p, while the intensity of infection when used the same pesticide but the lowest concentration, was 0.50 h / p and this may be due to the appearance of the resistance of the larva against the insecticides. The highest severity of the infection occurred in the middle and end of December, as it reached 0.73 h / p, while it was less severe at the beginning of January, resched 0.15 h / p with a significant difference. The severity of the infection of Spodoptera littoralis on the varity of the wonder of Iraq in the treatments used in this study Bb1 ,Bb2 , (Bb2+ Ma2)and control were 0.22, 0.29, 0.28, 0.50 h / p respectively. That the varity Barshelona had a preference to the pest more than the wonder of Iraq were 0.52,0.38 h/p respectively. May be the host plant phsyology has affected the efficiency of the materials used in the control of the pest.

Keywords: The cotton leaf worm Spodoptera littoralis, Beauveria bassiana, Marshall, Force, Barshelona, The wonder of Iraq .

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INTRODUCTION

Eggplant (Solanum melongena L.) is one of the most important vegetables in Asia, where more than 90 % of the world's eggplant production occurs. Rich in nutrients, eggplant supplies vital vitamins, minerals, and dietary fiber to the human diet.(Srinivasan R. 2009,Kadhim and Faris,2006).Cotton leaf worm.

Spodoptera littoralis (Boisd) (Lepidoptera ; Noctuidae) was considered an important economic insect pests that causes heavy losses in Solanacae plants for example, eggplant, tomato and potato in Iraq. (Al.Khafaji et al,2016;Al.abeedi,2006 ;Al.halfei, 2017) .Insect pest causes enormous damage to crops (AL.Khazraji & Aljorany, 2016). Cross resistance to numerous insecticides is worldwide problem and even the most effective chemical insecticides have failed to control S.litrus .(saleem et al.2008).

This leaf worm is a destructive pest in subtropical and tropical regions, infesting many edible and ornamental crops. It is a major pest of cotton, maize, tomato, tobacco and potatoes in the Eastern Mediterranean. Potentially it is also pest of glasshouse crops and therefore regarded as quarantine pest in the European Union.

To overcome the resistance problem to insecticides enforced farmers to use higher dosages ,increased number of applications and sometimes the mixtures of insecticides which not only adversely effects the natural enemies but also increase their cost of production and environmental hazards to ecosystem.(Sharma etal,2000).

The biological plant protection with entomopathogenic fungi has a key role in sustainable pest management program.Entomopathogenic as biocontrol agents have several advantages when compared with conventional insecticides.These include low cost, high efficiency, safety for beneficial organisms,reduction of residues in environment, and increased biodiversity in human managed ecosystems (Lacey et al,2001;Al.Kafaji et al,2016).

Fungal biocontrol agents have unique mode of infection. In contrast to bacteria and viruses, they do not need to be ingested and can invade their host directly through the cuticle.That is why entomopathogenic fungi are capable of infection non feeding mesh like eggs (Ujian and Shahzad,2007 ;Anand and Tiwary, 2009) and pupa of insects (Nguyen et al,2007; Anand et al,2008).

Fungal biological control agents have demonstrated efficacy against awide range of insect pests including Spodoptera species(Purwar and Sachan,2005; Lin et al,2007 ; Amer et al,2008). The latter occurred mostly with certain fungi, Beaveria bassiana, used in glasshouses against ,cotton leafworm depending on the inside dominating high temperature and relative humidity (Meshrif et al,2011 ;Al-Khafaji et al ,2016).
Further studies are needed to assess the relation between plant varities and plant chemical constituents with quantity of yield, so ,the resistant varieties could be used as affected factor in the integrated pest management programs (Han et al,1991; Nosser ,1996).

The goal of this study is to test B.bassiana and two insecticides and their combined to reduce the injury of pest and protect the plant to flowering stage under green house.

MATERIALS AND METHODS

The experiment was conducted under greenhouse of Collare of Agriculture –University of Baghdad – Iraq in 2013-2014 with 500m area planting eggplant Barshalona Cultivars and Iraq wonder Cultivars –when the plant natural infection by cotton leaf worm Spodoptera littoralis we used the biological control Agents Beauveria bassiana and the Granuales pesticides Force Pythroids , group)and the Marshall (from Carbamate group) , the experiment design was randomized complete block and the treatment arrangement with three relicates and it was :-

1-Fungal powder Beauveria bassiana 4g/l($1x10^7$spore/ml).(Bb^1)
2- Fungal powder Beauveria bassiana 5g/l($1x10^9$spore/ml).(Bb^2).
3-Pesticide Force 1.5g/m^2.(Fo^1).
4-Pesticide Force 2g/m^2.(Fo^2).

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5- Fungal powder Beauveria bassiana 4g($1x10^7$ spore/ml) + Pesticide Force 1.5g/m^2. (Bb^1 + Fo^1).
6- Fungal powder Beauveria bassiana 5g/l ($1x10^9$ spore/ml) +Pesticide Force 2g/m^2.(Bb^2+ Fo^2).
7-Pesticide Marslall 1.5g/m^2 .(Ma^1).
8-Pesticide Marshall 2g/m^2. (Ma^2)
9- Fungal powder Beauveria bassiana 4g ($1x10^7$ spore/ml) +Pesticide Marslall 1.5g/m^2. (Bb^1 + Ma^1)
10- Fungal powder Beauveria bassiana 5g/l($1x10^9$ spore/ml) + Pesticide Marshall 2g/m^2.(Bb^2+Ma^2). .
11- Control (only water

Spraying the stock of Beauveria bassiana included all parts of the plant Especially on the bottom surface of the leaves, and put the pesticides granular in the roots area of the plant .The number of holes and number of larvae in the plant, The data were collected weekly after the treatments.

Statistical Analysis:

The statistical Analysis system- Genstat (2014) program and used to the show effect of different factors on the study parameters.Least significant difference –LSD on % 0.05, test was used to compare the significance between means in this study.

RESULTS

The results of table (1) showed that there was no significant difference in the severity of injury to the treatments which was used on the varity Barshelona, these treatments are[Bb^1, Bb^2, Fo^1 Fo^2,Ma^1,Bb^2+Fo^2andBb^2+Ma^2,].

The mixture of the treatment (Bb^1 + Fo^1) was given the highest severity of infection compared with control were 0.97 and 0.57 hole / plant respectively. While,the treatments Bb^2 and Fo^1 were given the lowest infection rate of 0.31 and 0.35 hole / plant. The results also showed no significant differences in the severity of injury to other treatments .

We conclude from the above that the treatment Bb^2 recorded a similar effect of the treatments Fo^1 and Fo^2 .This indicates that the biological formulation of the fungus is an effective alternative against the pest under protected conditions. The process of mixing the insecticide (Fo) and the product of Bb did not record any effective results compared to the treatment of the pesticide and the fungus ,when they are used separately.

The results of table (1) also showed that the high concentrations of the insecticide led to an increase in the rates of the intensity as the treatment of Ma^2 was 0.70 h / p, while the intensity of infection when used the same insecticide but the lowest concentration, was 0.50 h / p and this may be due to the appearance of the resistance of the larva against the insecticide .This result was differed from the search under laboratory conditions found ,the interaction of B.bassiana and new chemistries showed the higher percentage of mortalities in both tested(2^{nd} and 4^{th}) instar larvae as compared to alone treatment, Bb*coragen(91.43%, 86.14%) interaction showed the highest larvae mortality followed by Bb*Belt® (84.60%, 76.88%) and Bb*Timer® (74.60%, 70.86%) for 2nd and 4th instar larvae respectively . (Ismail et.al,2017).

Table 1: The effect of different insecticides and fungus Beauveria bassiana in the severity of injury of cotton leaf worm Spodoptera littoralis (Boisd.) on varity Barshelona..

Date / Treatment	Hole/ Plant				Severity of infestion						Average
	10 /12 /2013	17/12	29 /12	7 /1 /2014	16 /1	23 /1	6 /2	18 /2	25 /2	2 /3 /2014	
Bb1	1.2	1.0	1.27	0.13	0.40	0.07	0.13	0.20	0.60	0.40	0.54
Bb2	0.47	0.67	0.47	0.13	0.00	0.00	0.73	0.47	0.27	0.33	0.35

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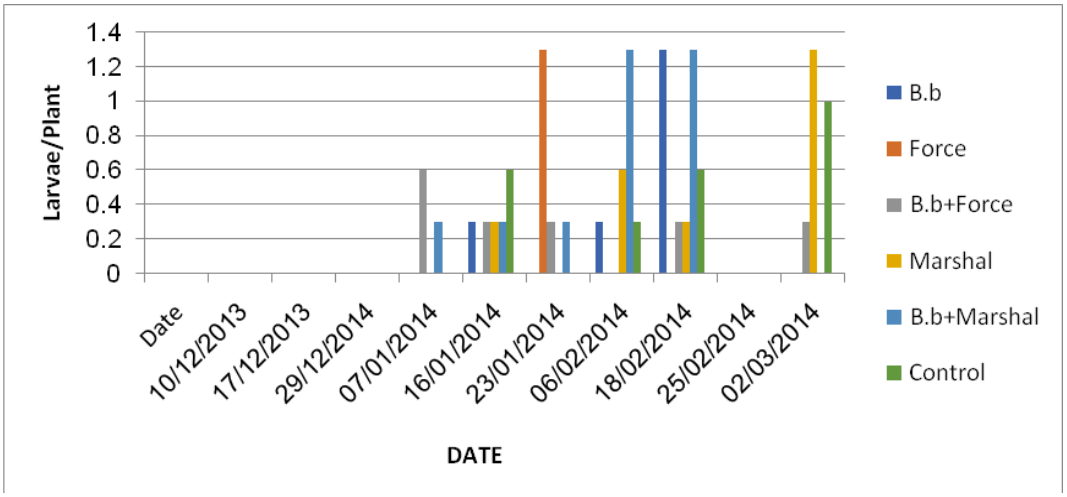
Fo1	0.67	0.47	0.33	0.27	0.20	0.20	0.13	0.33	0.13	0.33	0.31
Fo2	0.33	1.13	0.67	0.07	0.13	0.00	0.20	0.73	0.13	0.33	0.37
Bb1+Fo1	0.67	1.27	2.00	1.17	1.07	0.07	0.07	1.13	0.80	0.87	0.97
Bb2+Fo2	1.00	0.53	0.40	0.47	0.07	0.27	1.33	0.73	0.13	0.13	0.51
Ma1	0.67	0.60	0.27	0.13	0.13	0.13	0.67	0.27	1.67	0.40	0.50
Ma2	0.13	0.80	0.93	0.00	0.53	0.47	1.33	1.40	0.73	0.67	0.70
Bb1+Ma1	0.93	0.73	0.47	0.13	0.00	0.00	0.53	0.53	1.13	0.53	0.50
Bb2+Ma2	0.07	0.27	0.47	0.07	0.07	0.00	1.00	1.07	0.00	0.93	0.40
Control	0.40	0.60	0.80	0.20	0.40	0.47	0.53	0.67	0.87	0.73	0.57
Average	0.59	0.73	0.73	0.25	0.27	0.15	0.66	0.69	0.59	0.51	0.52
L.S.D	Date=0.22 TREATMENT=0.24 TREATMENT X Date=0.75										

The results showed that the highest severity of the infection occurred in the middle and end of December, as it reached 0.73 h / p, while it was less severe at the beginning of January, resched 0.15 h / p with a significant difference .

As well as rapid a decline in the Rate of infection of pests at the beginning of January to its end, which coincided with the low temperature in this month, and then ,the average of temperature was 17.5% c° maximum and was 5% c° in minimum ,in 21/1/2014.(Ajeel,2015). then increased rates of infection in February. In his study, AL Hilfi (2017) showed the effect of different temperatures in the life of Spodoptera littoralis, as the temperature of 15 c as it has been excluded for the growth and development of larvae and pupae in this degree.

The results of(Fig. 1) showed that the rates of larvae of Spodoptera littoralis on the eggplant of the varity Barshelona were fluctuated according to the treatments used in the study. The treatment of Bb^1 was recorded alow average of larvae in the first weeks of January until the end of the study compared with the two treatments (Fo^1, Ma^1) and the control as it reached the highest rate of larvae in the treatment of the insecticide Fo^1 was 1.3 l/p in mid-January, and then gradually decreased and continued to decline until the end of the study, was 0.0 l/ p.



Lsd Treat +Date=0.38

Figure 1: The effect of different insecticides and the fungus formulation Beauveria bassiana on the population of larvae Spodoptera littoralis on the varity Barshelona .

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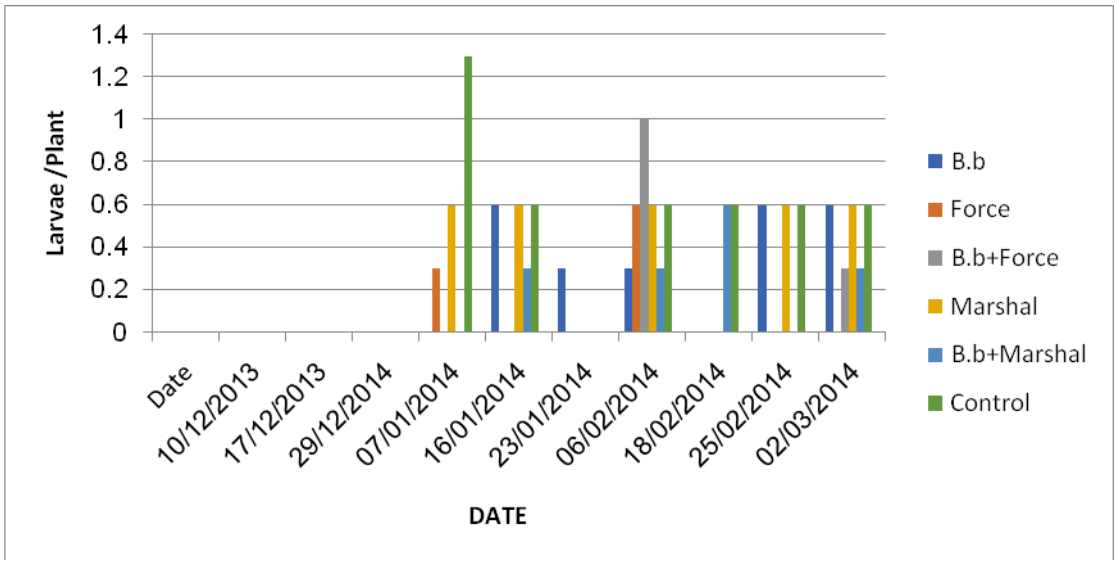
The results of the figure (1) also showed that the treatment of $Ma^1$was not effective on the preparation of the pest and did not produce positive results control as it reached the highest rate of larvae 1 and 0.6 l / p, respectively. Unfortunately heavy insecticides in Urban environments causes increased selection pressure and thus has led arthropod pest resistance database established and maintained by Whalon etal .2015,Six (30%) of the top 20 insecticide resistant arthropods are include (Spodoptera littoralis,S.litura ,S.exigua ,ext.) .

The highest average of larvae of the treatment (Bb^1+ Fo^1)and (Bb^1 + Ma^1), it reached 1 and 0.6 l / p respectively, this result was differed from studies that the myco pathogen makes the host to become more susceptible to chemical insecticides and inresponse insecticides weaken the pest sufficiently to make it more vulnerable to disease.(Achornley and Sicus,2007).



LSD Treat +Date=0.24

Figure 2: The effect of high concertration of different insecticides and the fungus formulation Beauveria bassiana Of on the population of larvae Spodoptera littoralis on the varity the Barshelona .

The high concertrating of insecticides and the fungus showed asegnificant differences in the average of larvae, they ranged between 0-1 l/p compared to the control it has ranged between 0-1.3 l/p (Fig.2). The treatments Fo^2 and the mixture (Bb^2+Fo^2) more effective against the larvae .It hasn't showed any infected for the larvae ,except the first week of January and Fabruary.The treatment Fo^2 was reached 0.3 and 0.6 l/p respectively.While the treatment (Bb^2+Fo^2) it reached 1 and 0.6 l/p,in the first week of Fabruary and March, respectively.

Table 2: The effect of different insecticides and fungus Beauveria bassiana in the severity of injury of cotton leaf worm Spodoptera littoralis (Boisd.) on varity the wonder of Iraq

Date / Treatment	Hole/ Plant / Severity of infestion										Average
	10 /12 /2013	17/12	29 /12	7 /1 /2014	16 /1	23 /1	6 /2	18 /2	25 /2	2 /3 /2014	
Bb1	0.07	0.80	0.00	0.13	0.07	0.07	0.27	0.93	0.13	0.20	0.27
Bb2	0.00	1.00	0.13	0.13	0.00	0.00	0.27	0.67	0.07	0.67	0.29
Fo1	0.00	0.47	0.40	0.27	0.33	0.00	0.00	0.27	0.73	0.80	0.33
Fo2	0.20	0.93	0.20	0.00	0.27	0.27	0.13	0.60	0.20	0.60	0.34

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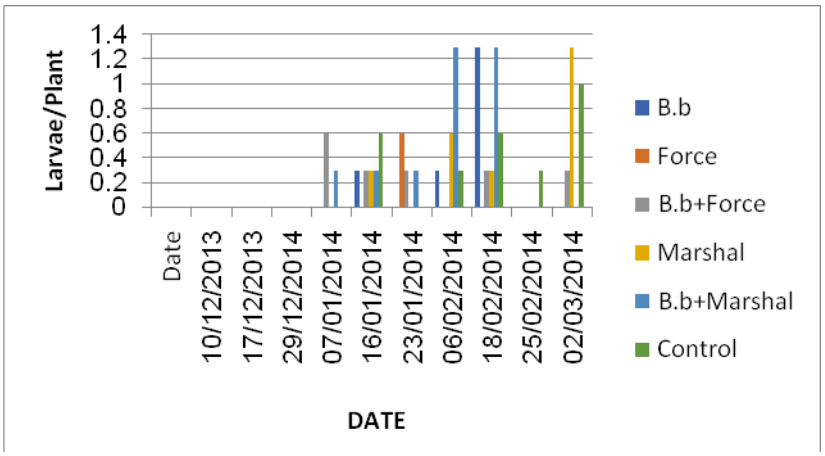
Bb1+Fo1	0.27	0.87	0.07	0.07	0.07	0.40	0.00	0.60	0.93	0.73	0.40
Bb2+Fo2	0.13	0.60	0.47	0.47	0.47	0.47	1.07	0.53	0.33	1.20	0.57
Ma1	0.00	0.93	0.27	0.00	0.07	0.07	0.27	0.87	0.33	1.13	0.39
Ma2	0.00	0.93	0.07	0.00	0.20	0.00	0.80	0.53	0.67	0.93	0.41
Bb1+Ma1	0.00	1.00	0.00	0.07	0.00	0.07	0.07	0.93	0.93	0.73	0.38
Bb2+Ma2	0.00	0.27	0.00	0.07	0.13	0.20	0.27	0.13	1.27	1.47	0.28
Control	0.40	0.73	0.40	0.20	0.20	0.27	0.53	0.87	0.67	0.73	0.50
Average	0.10	0.78	0.18	0.13	0.16	0.16	0.33	0.63	0.48	0.84	0.38
L.S.D	Date=0.17			TREATMENT=0.18			TREATMENT X Date=0.57				

The results of table (2) showed significant differences in the severity of the infection of Spodoptera littoralis on the eggplant. The varity of the wonder of Iraq in the treatments used in this study Bb^1 ,Bb^2 , (Bb^2+ Ma^2)and control were 0.22, 0.29, 0.28, 0.50 h / p respectively. This corresponds with the field study conducted in Iraq for Potato crop with Bb the incidence was 22.3 and 11.8 hole / leaf after 14 and 21 days after the treatment, respectively, compared with the control of 34.9 and 31 hole / leaf respectively after the same period (AL-Obeidi et al., 2008).

We conclude from the above that the environmental conditions in the green houses have an effect on the Bb spores in the effect on the Spodoptera littoralis. Also, we conclude that the treatment of the insecticide (Fo or Ma) has no significant effect compared with the control. The host plant has affected the efficiency of the materials used in the control of the pest where we note in table (1 and 2) that the varity Barshelona had a preference to insects more than the wonder of Iraq were 0.52,0.38 h/p respectively.



L.S.D.Treat+Date=0.30

Figure 3: The effect of different insecticides and the fungus formulation Beauveria bassiana on the population of larvae Spodoptera littoralis on the varity the wonder of Iraq .

The results of Figure (3) showed that the average of larvae on the wonder of Iraq showed significant differences between the treatments used and the control were (0.3, 0.0, 0.3,0.3,0.3,0.6) l/p respectively ,declined and fluctuated during the following weeks, as the treatment Fo^1 recorded the highest occurrence of larvae until the end of January was 0.3 l /p this Agrees with Saadi (2015).The study showed that significant of insecticide G, Force through speed of its effect in the killing of the larvae and adults of Oryctes spp ,in labrotary was estimated at 100% for 10 days after treatment.While the percentage of mortality reached 94.4 , 27.7% respectively, when used Marshall and Diasinon after the same period.

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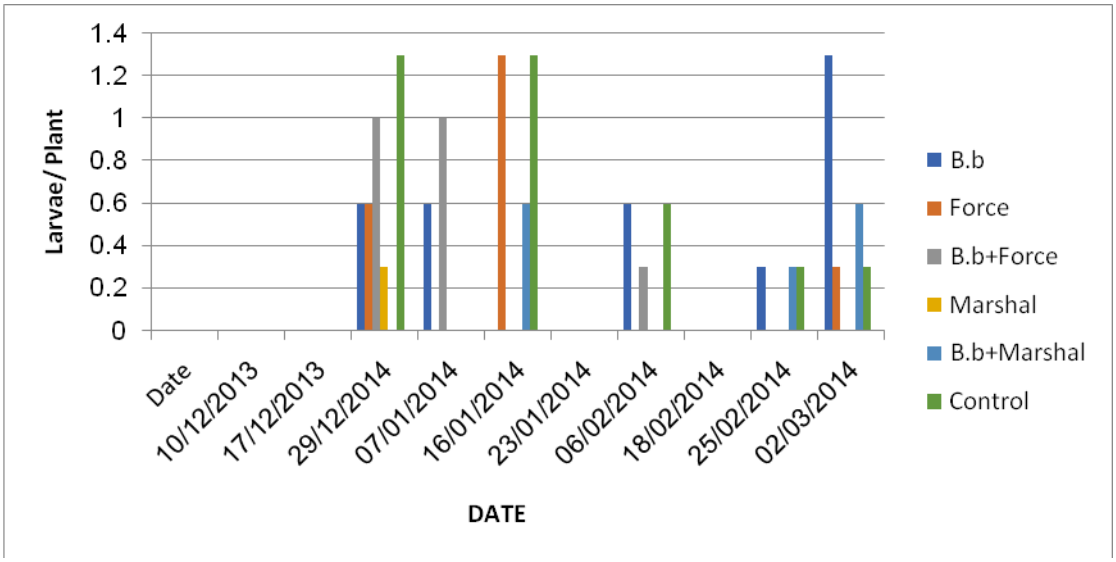

L.S.D Treat +Date =0.38

Figure 4: The effect of high concertration of different insecticides and the fungus formulation Beauveria bassiana Of on the population of larvae Spodoptera littoralis on the varity the wonder of Iraq

The results of Figure (4) also showed that the treatments of Ma^2 and (Bb^2 + Ma^2)were superior to the rest of the other treatments, with the lowest of larvae were 0.3 and 0.6 l / p respectively, while The treatments (Bb^2,Fo^2 ,Bb^2 +Fo^2) the highest of larvae were (1.3, ,1.3,1,1.3) l/ p Respectively, We conclude from the above in Figs. 3 and 4 that the larvae of Spodoptera littoralis on the varity wonder of Iraq are higher than those of the variety Barshelona, This may be due to the morphological and physiological differences of the varity affecting the preference of the insect to the host plant. Study on the eggplant sensitivity to mites show that's Karema var.pusses trichomos than Abed Aswed and Barshelona. This trait has an obvion impact on the mites , therefore ,Barshelona was more preferable by the organism for its growth and development ,while Karema was the lowest (Hasoon and AL-Sallame.2014).

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