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BIOLOGICAL CONTROL OF THE HONEYDEW MOTH, *CRYPTOBLABES GNIDIELLA* MILL. IN GRAPE ORCHARDS USING THE LOCAL EGG PARASITOID, *TRICHOGRAMMA EVANESCENS* WEST. AND AGERIN (*BACILLUS THURINGIENSIS*) AS COMPARED WITH RECOMMENDED INSECTICIDES IN MIDDLE EGYPT.

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Abstract: The role of inunudation by the egg parasitoid , *Trichogramma evanescens* West alone and combined with Agerin (*Bacillus thuringiensis*) compared with recommended insecticides(Relidan and Somithion) was evaluated against the honeydew moth (HDM) *Cryptoblabes gnidiella* Mill. infesting grape orchards in Mina region during two successive seasons of (2006 and 2007) .The results obtained showed that the highest general percentage of parasitism on HDM eggs was observed in grape orchard treated with egg parasitoid and Agerin (*B.t.*) together followed with those treated with only egg parasitoid, while it was nil in those treated with insecticides and untreated areas (control). Also spraying insecticides in grape orchard significant reduced the number of predators compared with the other two treatments. Furthermore , the release of the egg parasitoid plus spraying Agerin (*B.t.*) in grape orchards demonstrate the highest general mean percent reduction in infestation by *C. gnidiella* (67.65 and 68.99 %) followed with 63.39 and 44.56 % reduction in grape orchards treated with insecticides and 59.35 and 44.78 % reduction in those treated with the egg parasitoid alone compared to the untreated orchard in both years seasons, respectively. The statistical analysis showed significant difference between the effectiveness of the three tested control methods in reducing damage by this pest. Also, the costs of honeydew moth control compared with chemical treatments were reduced by 41.1% and 62.5 % in grape trees treated with egg- parasitoid combined with Agerin (*B.t.*) and only egg parasitoid , respectively.

On the other hand, the percentage of increasing in grape fruit yield/tree was significantly higher in the grape orchards treated with egg parasitoid plus Agerin than (27.43 and 29.09 %) in those treated with egg parasitoid alone (21.90 and 22.77 %) and insecticides (25.45 and 24.27%) compared to the control ones in both seasons, respectively.

These results seems to be of great significance when planning for control program against this pest.

Key words: Biological control, *Cryptoblabes gnidiella* Mill., grape orchard, *Trichogramma evanescens* West., *Bacillus thuringiensis*, insecticides, middle Egypt.

Introduction

Grape is considered the first fruit in the world and the second crop after the citrus in Egypt. This crop has been exposed to infestation during different growing stages with several insect pests such as grapevine moth, *Lobesia botrana* Schiff. and honeydew moth, *Cryptoblabes gnidiella* Mill. (Anshelevich *et al.*, 1993).

Recently, the honeydew moth *Cryptoblabes gnidiella* Mill (Lepidoptera: Pyralidae) become a serious and wide insect pest infesting grape fruits in Middle Egypt and cause considerable loss in quality and quantity of grape staple. This pest produces 3- 4 generations a year on grape crops (during May to September) and over winters in the larval stage in the fresh and dry fruits of neighboring hosts (Gurevitz and Gothilf , 1986). The first generation larvae attack vegetable and flowering pods in May and June, while the second-generation larvae attack the small and green fruits in June and July. The great damage has been occurred when the third generation larvae attack the ripe fruits in July and August causing fall down and putrefaction it. These larvae also spin silken threads which connect the vegetable pods, with non-ripe and ripe fruits and eat it from inside causing mould (Ben-Yehuda *et al.*, 1993).

Nowadays, there is a worldwide conviction about the disastrous side-effect of applying chemical pesticides with regard to the environmental pollution ,hazards for humans , residual toxicity and environmental pollution, insect resistance , outbreak of secondary pests, high costs and increasing of the pests as result of killing the natural enemies (El- Sebae, 1981).

There for, the use of biological control methods by using different biological has been a promising alternative In this respect , the egg parasitoids *Trichogramma* spp. are strongly recommended especially that *T. evanescens* has been successfully utilized in Egypt against many lepidopterous insect pests since 1987. (Abbas *et al.* 1987; Tohamy,2002; Tohamy and El-Naggar, 2003 and Abbas ,2004).

Also , *Bacillus thuringiensis* is the most famous bioinsecticides commonly used to control many agricultural and vector insect pests during the last three decades (Dulmage, 1993).

Several authors showed the important role of using egg parasitoid alone or combined with Agerin (*Bacillus thuringiensis*) for controlling the lepidopteros insect pests in grape groves having no adverse effect on beneficial insects (prasities and predators) and having non toxic effect to plant , animals and people (Wysoki *et al.*, 1975; Kiku and Teshler ,1994; Hommay *et al.*, 2002).

However, the present work was initiated with the aim to evalulate the

efficacy of egg parasitoid (*Trichogramma evanescens* West.) and Agrein (*Bacillus thuringiensis*) as compared with recommended insecticides in controlling honeydew moth (*Cryptoblabes gnidiella* Mill.) in grape orchards.

Materials and Methods

Field experiments:

The present study was carried out at Matai and Mallawi regions, Minia Governorate of northern Upper Egypt, in three grape orchards (5 fed. each) during two successive years (2006 and 2007) to evaluate the role of the local egg-parasitoid, *T. evanscens* alone or combined with Agerin (*B.t.*) as biological control agents against the honeydew moth, *C. gnidiella* compared with application of the recommended insecticides(Reiidan and Somithion). Complete randomized block design (BCR) was used in four replicates. All normal agriculture practices excluded any pesticides use, were done in the releasing plots during the seasons of study in three grape orchards. The other pests and diseases which attack three grape orchards were controlled by biocompounds (biopesticides) during the study seasons. The egg parasitoid was obtained from *Trichogramma* Research Laboratory in Mallawi Agricultural Research Station, Plant Protection Research Institute, Agricultural Research Center, Giza. Techniques for mass production of *Trichogramma* parasitoid were as described before by Tohamy (2002). Two feddans were used as the control and set 500 m^2 away from the experimental field. No releases or other controls occurred in the control plots. The research procedure aims to embrance the following points:

Three grape groves (5 fed., each) from red roomy cultivar were chosen in Agricultural Research Station, D.rHowida Abdel-Azeam at Beni Hafez (Mallawi) and Mercos at Berdonoha (Matai). Such area was divided into four equal parts, each parts four plots, The plots area was 1312.5 m^2 Each part far apart 100 m from other to reduce movement parasitoid wasp across treatments and to prevent connection between the parasitoid and chemical treatments. The three parts were randomly chosen and specialized for each treatment. The first part each grape orchard was specialized for (to distributed) releasing egg-parasitoid cards at rate of 90000 individuals/fed, in distant 12 m from releasing points (the distance between grape trees 6 m), at two-week intervals (30 cards/fed., each produced 3000 individuals) against the anthopgagous (May, June) and carpophagous generations (July, August) of the honey dew moth during 2006 and 2007 seasons within seven releases or in seven different dates; when the honey dew moth started to lay eggs and continue for about 8 weeks or until eggs are no longer present in the replicates of parts. The releasing process was done

during the first and the second generation of honey dew eggs. The second part (each grape orchard) specialized for releasing egg-parasitoid cards at the same rate combined with Agerin (*B.t.*) which applied two times in the first week of June (flowering stage) and the first week of July (fruiting stage) at dose of 150 gm/100 LW. The third plots were specialized for spraying Relidan insecticide in June and Somithion in July at dose of 200 cm^3/100 LW in each grape orchard. The latter plot was left without treatments for comparison (control).

Sampling techniques and evaluation measurements:

The egg parasitoid survey began one week after releasing in May to August in the three grape orchards. Weekly samples of 10 trees in each plot were randomly checked from each treatment, eggs of honey dew moth were collected by cutting the leafs and put individually into glass tubes, and brought back to the laboratory. The number of eggs was recorded and both parasitized and non-parasitized eggs were counted in order to determine the percentage of parasitism in all treatment in three grape orchards compared with non treated (control) during the period of study.

Also, the same sample were carefully examined every two weeks starting from June to August to determine the total infestation honeydew moth expressed as the infested pod, injured green and ripe grape fruits and calculated total infestation from the following formula:

$$\text{total infestation \%} = \frac{\text{infested pods + injured green grape + injured ripe grape fruits}}{\text{total pods + green grape and ripe grape fruits}} \times 100$$

The percentage of reduction in the infestation has been calculated in all treatment /grape orchard according to the following equation:

$$\text{reduction\%} = \frac{\text{Mean no. grape fruit infestation in untreated plots - Mean no. grape fruit infestation in treated plots}}{\text{Mean no. grape fruit infestation in untreated}} \times 100$$

Assessment of predators :

The species and numbers of predators associated with grape pests were counted weekly from May to August in the first, second and the third grape orchards treated with *Trichograma* parasitoid alone and parasitoid plus Agerin (*B.t.*) compared with the recommended insecticides during 2006 and 2007 seasons. Five trees were chosen at random from each part/treatment and the predators were counted using lens (5x). The

percentage of increasing in plots treated with egg-parasitoid and those treated with wasps and Agerin together were calculated compared with plots treated with insecticides.

Assessment of yield :

At harvest, the three grape orchards, samples of 10 trees were randomly chosen from each plot/treatment and, each tree were carefully examined to determine the following parameters compared with untreated plots (control).

Number of mature grape; number of fallen grape; percentage of fallen grape; Weight of mature grape/tree (kg) and weight of premature grape /tree (kg) The percentage of increasing in the yield was calculated by the follow formula:

$$\text{The percent increasing} = \frac{\text{grape fruits weight in treated plots - grape fruits weight in the control}}{\text{grape fruits weight in treated plots}} \times 100$$

Assessment of control cost :

The control cost of honeydew moth and other pests has been calculated in one feddan (4 replicate)/treatment/grape orchard. The price of egg parasitoids, 300 gm of Agerin (300 gm), 1000 cm^3 of Relidan 1000 cm^3 of Somithion, wages of labours in each treatment and charter of spray motor at six times were estimated. The reduction percent of honey dew moth control cost in grape trees treated with egg-parasitoids, *T. evanescens* and those treated with egg parasitoids plus Agerin were calculated compared with trees treated with recommended insecticides by the follow formula:

$$\text{The percentage of reduction in control costs} = \frac{\text{The control costs in plots treated with } \textit{Trichogramma} \text{ - control costs in plots treated with insecticides}}{\text{the control costs in plots treated with insecticides}} \times 100$$

Statistical analysis :

Data were statistically analyzed by using F test and Duncan's multiple-rang at 0.05 probability level (Gomez and Gomez ,1984) through SAS-computer program to know the best treatment which gave less damage and more safe and yield.

Results and Discussion

Data in Table (1) showed parasitism rate on HDM eggs in three grape orchards which treated with egg parasitoid, *T. evanescens* alone seven

time, biweekly intervals, at rate of 90000 individuals, within 10 m of the release point, egg parasitoid plus Agerin (*B.t*) and recommended insecticides compared with ones non treated (control) in different sites of Minia region during 2006 and 2007. The parasitism on HDM eggs was started as a low in early season in May (the first generation of HDM) after five days from timing of releases and increased gradually in June during the second generation and reached a maximum at July and August during the third generation of HDM in plots of vineyards which treated with only parasitoid and parasitoid combined with Agerin in both seasons. Whereas, the parasitism rates were nil in plots treated with insecticides and plots untreated (control) in the two seasons. The percentage of parasitism of HDM eggs ranged between 50.7-79.3 with an average of 68.9%; 49.0-83.2 with an average of 71.37% and 45 -80 % with an average 65.41% in the first, second and third grape orchard treaded with egg parasitoid alone, respectively during 2006 season. But, it was varied from 48.0-85.0 with an average of 71.09%; 56.0–88.5 with an average of 76.59% and 52.0-82.2 % with an average of 69.84% after using the *Trichogramma* parasitoid plus Agerin in the first, second and third grape orchard, respectively during 2006 season. The same trends was recorded in 2007 season, where the highest mean percentages parasitism on HDM eggs (70.30; 72.63 and 67.23%) were commonly observed in plots which treated with egg parasitoid and Agerin (*B.t*) , followed with 65.71, 67.23 and 63.34% in only released plots of the first, second and third vineyards, respectively On the other hand, the obtained data showed that there are significant differences in parasitism levels in all treatments (three methods of control).

The present results are in agreement with the finding by Sengonca and Leisse (1987) in German, who showed that the parasitism by *T. semblidis* on egg of the tortricid grape pests in the 1st generation averaged 50% in all vineyards, ranging from 0 to 100%. Parasitism was 26.7 in the 2 nd generation and 25% in the third, resulting in reduced infestation of the grapes by larvae of both generation. They recorded the parasitism of the exposed. It eggs was highest in May-June and again in September following a decrease in population density. Also, Nasr *et al.*, (1997) in Egypt recorded that the percentage of parasitism by *T. evanescens* ranged from 22 to 46% on eggs grapevine moth in Alexandria region. Mona *et al.* (2004) showed that the mean rates of parasitism on *Ostrinia nubilalis eggs* by *Trichogramma* reached 74.22, 76.83 and 77.23% in the plots treated with parasitoid alone and 72.90, 4.21 and 75.56% in the plots treated with *Trichogramma* combined *with B.t* for 2001; 2002 and 2003 seasons, respectively.

Table(1): Parasitism% on *Cryptoblabes gnidiella* eggs per 100 grape leaves/10 tree after using *T.evanescens* alone and combind with Agerin *(B.t.)* and recommended insecticide in three grape orchards Minia region, 2006 and 2007 growing seasons.

The first grape orchard in Farm Mallawi									
Samp. Date	Parasitism % during 2006				Sampling date	Parasitism % during 2007			
	T	T + A	RI	C		T	T + A	RI	C
4/5/ 2006	50.7	48.0	0	0	2/5/2007	40.0	51.2	0	0
19/5	52.0	55.1	0	0	17/5	55.7	57.5	0	0
3/6	63.3	62.7	0	0	1/6	60.0	63.4	0	0
18/6	73.5	77.0	0	0	16/6	70.0	74.8	0	0
3/7	80.2	83.6	0	0	1/7	75.5	78.6	0	0
18/7	82.7	86.2	0	0	16/7	77.8	81.6	0	0
3/8	79.3	85.0	0	0	1/8	81.0	85.0	0	0
Mean	68.9	71.09	0.0	0.0	Mean	65.71	70.30	0.0	0.0
Means Transfer*	8.33b	8.46a	0.71c	0.71c	Means Transfer*	8.48b	8.78a	0.71c	0.71c
The second grape orchard in Beni Hafez (Mallawi region)									
9/5/2006	49.0	56.0	0	0	6/5/2007	45.7	54.0	0	0
24/5	57.3	63.5	0	0	21/5	50.2	60.2	0	0
8/ 6	73.2	75.6	0	0	5/6	65.7	70.3	0	0
23/6	75.4	79.8	0	0	20/6	70.0	72.7	0	0
8/7	80.0	85.7	0	0	5/7	76.7	80.7	0	0
23/7	81.5	87.0	0	0	20/7	80.0	83.5	0	0
7/8	83.2	88.5	0	0	4/8	82.0	87.0	0	0
Mean	71.37	76.59	0.0	0.0	Mean	67.23	72.63	0.0	0.0
Means Transfer*	8.12b	8.39a	0.71c	0.71c	Means Transfer*	8.13b	8.41a	0.71c	0.71c
The Thrid grape orchard in Berdonola (Matai region)									
14/5/2006	45.0	50.0	0	0	11/5/2007	42.5	46.5	0	0
29/5	51.0	52.0	0	0	26/5	51.7	55.2	0	0
13/6	61.7	69.5	0	0	10/6	58.7	65.4	0	0
28/6	65.7	77.4	0	0	25/6	63.5	70.0	0	0
13/7	75.4	78.0	0	0	10/7	71.8	75.4	0	0
28/7	79.1	80.0	0	0	25/7	76.7	77.1	0	0
12/8	80.0	82.2	0	0	9/8	78.5	81.0	0	0
Mean	65.41	69.84	0.0	0.0	Mean	63.34	67.23	0.0	0.0
Means Transfer*	8.23b	8.55a	0.71c	0.71c	Means Transfer*	7.99b	8.23a	0.71c	0.71c

Means of parasitism % have the same letters of each grape orchard not differ in significancy at $P < 0.05$, as determined by Duncan's multiple range test.

T= grape plots treated with only *Trichogramma* RI = plots treated with recommended insecticides

T+A= plots treated with *Trichogramma* plus Agerin C = control plots (Untreated)

Means Transfer = $\sqrt{\text{Original data} + 0.5}$

Table(2): Total infestation (infested pods, green and ripe grape fruits) caused by *C. gnidiella* after using *T.evanescens* alone and combind with Agerin (*B.t.*) and recommended insecticide in three grape orchards, Minia region, 2006 and 2007 growing seasons.

Season	2006					2007			
	Samp. Dates	% Total infestation by HDM				Samp. dates	% Total infestation by HDM			
		T	T + A	RI	C		T	T + A	RI	C
The first Grape orchard	3/6	1.2	1.0	1.2	5.2	1/6	4.5	3.0	3.5	8.5
	18/6	1.8	1.3	1.5	8.0	16/6	4.7	2.8	3.8	11.4
	3/7	3.2	1.7	2.1	9.3	1/7	6.6	5.4	5.7	12.4
	18/7	3.5	2.8	3.2	11.5	16/7	5.5	4.2	5.9	13.7
	3/8	5.5	4.5	5.0	10.2	1/8	6.7	5.7	4.7	19.7
	18/8	8.0	6.4	7.0	12.0	16/8	8.5	7.5	7.8	25.6
	Mean	3.86 a	2.95 a	3.30 a	9.37b	Mean	6.08 a	4.77a	5.23a	15.22b
	Red.	58.80c	68.52a	64.78b	-	Red.	60.05c	68.66a	65.64b	-
The Second Grape Orchard	8/ 6	2.8	2.2	2.8	7.0	5/6	3.7	3.0	2.8	9.5
	23/6	3.1	2.7	3.0	9.2	20/6	4.2	3.2	3.5	12.5
	8/7	4.2	3.1	3.5	10.3	5/7	5.7	4.5	4.8	10.7
	23/7	6.2	4.7	6.0	12.5	20/7	4.6	3.5	3.7	14.5
	7/8	5.4	5.2	5.1	15.0	4/8	5.8	4.0	5.2	16.7
	23/8	8.7	6.5	7.3	18.5	19/8	4.7	2.5	4.5	19.5
	Mean	5.06a	4.07a	4.62a	12.08b	Mean	4.78a	3.45a	4.08a	13.90b
	Red.	58.11 c	66.31a	61.75b	-	Red.	65.61c	75.18a	70.65b	-
The Third Grape Orchard	29/5	2.1	1.7	2.0	8.1	26/5	5.5	5.0	4.7	10.2
	13/6	3.4	2.7	2.9	9.8	10/6	6.7	5.9	5.5	14.3
	28/6	6.6	5.5	4.5	13.8	25/6	8.5	7.5	8.8	17.7
	13/7	5.9	6.4	7.8	17.7	10/7	9.7	8.2	10.2	19.5
	28/7	8.5	6.6	8.1	20.5	25/7	10.5	9.0	9.8	25.3
	12/8	10.6	7.5	9.4	25.5	9/8	11.6	7.5	10.8	29.9
	Mean	6.18a	5.07a	5.78a	15.90b	Mean	8.67a	7.18a	8.30a	19.48b
	Red.	61.13b	68.11a	63.65b	-	Red.	55.49b	63.14a	57.39b	-

Means of Total infestation % having the same letters of each grape orchard are not significantly different at $P < 0.05$, as determined by Duncan's multiple range test. Red.= Reduction percent HDM= Honey dew moth

Results in Table (2) represent the total infestation by HDM, *C. gnidiella* expressed as percent of infested pods, green and ripe grape fruits from June to August in three grape orchards in Minia region. Results showed that the percentage of the total infestation caused by HDM ranged from 1.2-8.0 with an average 3.86 %; 2.8-8.7 with an average 5.06 % and 2.1-10.6 with an average of 6.18% in plots treated with parasitoid alone; 1.0-6.4 with an average of 2.95%; 2.2-6.5 with an average of 4.07 % and 1.7-7.5 with an average of 5.07% in plots treated with those parasitoid and Agerin together; ranged 1.2-7.0 with an average 3.30 %; 2.8-7.3 with an average of 4.62 % and 2.0-9.4 with an average of 5.78% in plots treated with insecticides compared with 5.2-12.0 with an average of 9.37 %; 7.0-18.5 with an average of 12.08 % and 8.1-25.5 with an average of 15.90 % in untreated

plots (control) of the first and second and third grape orchards, respectively in 2005 season. On the other hand, the obtained data showed the highest percentage of reduction in damaged (injured) grape fruits was in plots treated with parasitoid and Agerin (68.52, 66.31 and 68.11%) followed with 64.78, 61.75 and 63.65% in plots treated with insecticides and 58.80 k 58.11 and 61.13% in plots treated with only parasitoid in the first, second and third of grape orchards, respectively compared to the control plots during 2006 season. The same results were observed in 2007 season, where the total infestation by HDM deceased from 15.22 in control plots to 4.77, 5.23 and 6.08 with 68.66, 65.64 and 60.05% reduction infestation in the first vineyard; decreased from 13.90% in the control plots to 3.45, 4.08 and 4.78 % with 75.18, 70.65 and 65.61% reduction infestation in the second vineyard and decreased from 19.48 % in control plots to 7.18, 8.30 and 8.67% with 63.14, 57.39 and 55.49% reduction of damage grape fruits by HDM in the third vineyard in the plots which treated with parasitoid plus Agerin , insecticides and parasitoid alone, respectively. In general, Data in Table (2) recorded significant differences in mean percentage of reduction of total infestation between grape orchard treated with parasitoid combined with Agerin (*B.t.*) and both grape orchard treated with only parasitoid and these treated with insecticides in both seasons, but no significant differences were found between the effectiveness of parasitoid alone and chemical treatments. However, the percent reduction in grape fruits damage in released plots by *T.evanescens* did not significant differ from in plots treated with insecticides, probably due to may effect on natural enemies and create a favorable condition for increase the pest. (Pham *et. al.* 1994). Such results are in agreement with those reported by Castaneda *et al.*, (1993). They mentioned that when *T. cacareciae, T. embryophagum* and *T. dendrolimi* were released against the grape tortricds in vineyards at Germany, the damage reduction ranged from 22.5% to 83.3%. Abo-Sheaesha and Agamy (2004) in Egypt, showed the percent reduction in the *Prays citri* larval infestation (compared to the untreated orchard) were 62.2, 76.4 and 78.3 % in 2002 and 65.9, 80.4 and 75.9% in 2003 after using inundative releases of the egg parasitoid *T. evanescens* at dose of 90000 wasps/fed./release, application of Agerin (*B.t.*) at 75 gm/100 LW and application of Ethion insecticide at 150 cc/100 LW, respectively in lime orchards at Middle of the Delta. They found no significant difference among the effectiveness of the three tested control methods in reducting infestation with the pest.

Data in Tables 3 and 4 show the species and numbers of predators associated with grape pests which conducted in Minia region from May to August in grape orchards treated

Table(3): Mean number of certain predators associated with *C. gnidiella*/ 10 trees in grape orchards treated with *T. evanescens* alone and combined with Agerin compared with the recommended insecticides in Mina region, 2006 season.

Farm name	Samp. Date	*C. undecimpuctata*			*C. carnea*			*O. albidipennis*			*P. alfieril*			True spiders			Predators total		
		T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI
The first orchard	19/5	2	1	0	0	0	0	2	0	0	1	2	0	5	7	2	10	10	2
	3/6	4	3	1	2	3	0	2	3	1	5	7	2	13	15	6	26	31	10
	18/6	15	11	2	6	8	2	7	8	3	9	11	4	17	20	8	54	58	19
	3/7	27	22	7	10	9	3	4	5	1	5	6	3	25	26	9	71	68	23
	18/7	24	21	10	8	7	2	5	6	2	10	8	2	21	23	5	68	65	21
	3/8	17	14	3	5	6	0	2	3	1	4	5	0	12	15	2	40	43	6
	Total	89	72	23	31	33	7	22	25	8	34	39	11	93	106	32	269	275	81
	Mean	14.8 a	13.7 a	3.8 b	5.2a	5.5a	1.2b	3.7a	4.0a	1.3b	5.7a	6.5a	1.8b	15.5b	17.7a	5.3b	44.8a	45.8a	13.5b
The second orchard	24/5	3	4	0	2	1	0	1	1	0	2	3	0	9	8	3	17	17	3
	8/6	17	20	4	5	7	1	4	6	1	8	10	3	15	19	8	49	62	17
	23/6	22	19	7	15	17	7	5	8	2	15	17	5	21	25	11	78	86	32
	8/7	28	31	8	18	19	8	11	15	5	19	21	3	29	32	8	105	112	32
	23/7	22	18	5	10	12	2	10	14	4	13	10	2	16	13	5	71	67	18
	7/8	15	14	3	5	7	0	3	2	0	6	7	0	10	11	2	39	41	5
	Total	107	106	27	55	63	18	34	46	12	63	68	13	100	108	37	359	385	107
	Mean	17.8 a	17.7 a	4.5 b	9.2a	10.5a	3.0b	5.7b	7.7a	2.0c	10.5a	11.3a	2.2b	16.7a	18.0a	6.2b	59.8b	64.2a	17.8c
The third orchard	29/5	2	2	0	1	1	0	1	0	0	2	2	1	4	5	1	10	10	2
	13/6	3	2	1	2	1	0	2	1	0	4	6	1	10	12	3	21	22	5
	28/6	10	12	3	5	7	2	4	3	1	8	10	2	14	13	5	41	45	13
	13/7	21	25	7	9	8	4	6	7	2	12	14	5	16	14	4	64	68	22
	28/7	19	20	5	6	4	1	5	6	2	8	10	2	9	11	3	47	51	13
	12/8	11	12	2	2	1	0	2	2	0	5	3	1	7	8	0	27	26	3
	Total	66	73	18	25	22	7	20	19	5	39	45	12	60	63	16	210	222	58
	Mean	11.0a	12.2 a	3.0 b	4.2a	3.7a	1.2b	3.3a	3.2a	0.8b	6.5a	7.5a	2.0b	10.0a	10.5a	2.7b	35.0a	37.0a	9.7b

Means of mean total of predators have the same letters of each grape orchard not differ in significancy at $P < 0.05$, as determined by Duncan's multiple range test.

Table(4) : Mean number of certain predators associated with *C. gnidiella*/ 10 trees in grape orchards treated with *T. evanescens* alone and combined with Agerin compared with the recommended insecticides in Mina region, 2007 season.

Farm name	Samp. Date	*C. undecimpuctata*			*C. carnea*			*O. albidipennis*			*P. alfieril*			True spiders			Predators total		
		T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI	T	T + A	RI
The first orchard	17/5	1	2	0	0	1	0	1	1	0	2	1	0	3	2	2	7	7	2
	1/6	3	5	0	1	3	1	2	3	1	4	6	1	8	11	3	18	28	6
	16/6	12	16	1	3	5	2	5	7	2	7	9	3	12	22	10	43	59	18
	1/7	20	25	5	8	7	4	3	7	2	9	12	5	19	15	7	59	66	23
	16/7	15	16	4	5	12	2	4	8	3	4	6	2	16	20	6	44	62	17
	1/8	10	13	2	4	7	1	2	2	1	2	2	2	12	15	3	30	39	9
	Total	61	77	12	21	35	10	17	28	9	28	36	13	70	85	31	201	261	75
	Mean	10.2 a	12.8 a	2.0 b	3.5 a	5.8a	1.7 b	2.8 a	4.7 a	1.5 b	4.7 a	3.6 a	2.2 b	11.7a	14.2a	5.2 b	33.5b	43.5a	12.5c
The second orchard	21/5	5	7	0	3	4	0	2	2	0	2	1	i	7	9	2	19	23	1
	5/6	11	15	3	7	10	3	6	5	1	7	5	4	13	18	9	44	53	20
	20/6	27	30	9	21	20	10	9	15	4	17	20	6	26	30	14	100	115	43
	5/7	35	39	12	17	23	7	16	21	7	22	28	4	35	39	6	125	150	36
	20/7	30	32	7	15	18	3	13	15	5	15	17	3	17	21	8	90	103	26
	4/8	18	20	5	6	9	1	5	7	2	5	7	2	13	15	3	47	58	15
	Total	126	143	36	69	84	24	51	65	19	68	78	20	111	122	42	425	502	141
	Mean	21.0 a	23.8 a	6.0 b	11.5b	14.0a	4.0c	8.5a	10.8a	3.2 b	11.3a	13.0a	3.3 b	18.5 a	20.3 a	7.0 b	70.8b	83.7 a	23.5c
The third orchard	26/5	1	1	0	1	1	0	1	1	0	1	2	0	2	3	1	6	8	1
	10/6	2	2	1	1	3	1	1	3	0	3	4	1	5	7	2	12	19	5
	25/6	7	10	2	3	5	2	3	4	1	5	7	2	11	10	3	29	36	10
	10/7	15	19	4	5	4	3	6	9	3	8	8	4	8	12	4	42	52	18
	25/7	13	15	5	7	8	2	4	6	3	5	10	3	15	18	2	44	57	15
	9/8	8	10	1	1	3	1	2	3	0	3	2	1	7	5	1	21	23	4
	Total	46	57	13	18	24	9	17	26	7	25	33	11	48	55	13	154	195	53
	Mean	7.7 a	9.5 a	2.2 b	3.0 a	4.0 a	1.5b	2.8a	4.3 a	2.3 b	4.2a	5.5 a	1.8 b	8.0 a	9.2 a	2.2 b	25.7b	32.5 a	8.8 c

Means of mean total of predators have the same letters of each grape orchard not differ in significancy at $P < 0.05$, as determined by Duncan's multiple range test.

with *Trichograma* parasitoid alone and parasitoid plus Agerin (*B.t.*) compared with the recommended insecticides during 2006and 2007 seasons. Five predaceous insects included: the ladybird beetle, *Coccinella undecimpunctata* Reiche,common green lacewing *Chrysoperla carnea* Steph., minute pirate bug, *Orius albidipennis* (Rrut.), the rove beetle large *Paederus. alfierii* Koch and true spiders were the most abundant as natural enemies associated with HDM and other pests in grape orchards On the other hand, predators i.e. *Coccinella undecimpunctata* and species of true spiders were the most important.

Generally, The maximum mean numbers of predators per ten trees were found in plots treated with the egg-parasitoid *T. evanescens* combined with Agerin (*B.t.*) and represented 45.8, 64.2 and 37.0 with increasing 70.5, 72.3 and 73.8% during 2006 season and 43.5; 83.7 and 32.5 with increasing 71.3, 71.9 and 72.9% over the plots treated with insecticides during 2007 season in the first, second and third grape orchard, respectively . The next maximum mean numbers of predators were recorded on plots treated with parasitoid alone and represented 44.8, 59.8 and 35.0 with increasing 69.9, 70.2 and 72.3% during the first year and 33.5, 70.8 and 25.7 with increasing 62.7, 66.8 and 71.9% compared to the insecticides treated plots during the second year in three grape orchards, respectively. While the lowest mean numbers were recorded in plots treated with recommended insecticides, where it were 13.5, 17.8 and 9.7 in 2006 and 12.5, 23.5 and 8.8 in 2007 in the first, second and the third grape orchards, respectively. Statistical analysis of the data revealed significant differences between insecticides treatment and both the egg parasitoid alone and egg parasitoid plus Agerin treatments in both seasons.

The obtained results revealed that the organophosphorus insecticide (Relidan and Somithion) had the highly significant side effect on the natural enemies compared with other two methods of control. Similar results were recorded by Pham *et al.*, (1994), who showed that the efficiency of IPM and the role of natural enemies were increased in the released fields by *T. japonicum*. However, the number of natural enemies were significantly different. Also, the utilization of chemical insecticides at wrong time might effect on natural enemies and create a favourable condition for the increase of the pests. in China, Wu and Gue (2005) showed that the pest management tactics associated with the bacterium cotton (*B.t*) have resulted in atavistic reduction in insecticides use, which usually results in a significant increase in populations of beneficial insects and thus contributes to the improvement of the natural control of some pests. Tohamy and Kassem (2007) in Middle Egypt, recorded that the highest mean

numbers of predators were found in cotton fields treated with *Trichogramma* parasitoid plus Agerin (*B.t.*), followed by fields treated with *Trichogramma* alone, while the lowest mean numbers of predators were found in fields treated with insecticides.

Costs for producers (irrigation, fertilizer, hoeing ,etc.) were the same in the three treatments, the only difference was the cost for grape trees protection.

Table(5): Estimated costs of using *T. evanescens* and Agrine for controlling the *C.gnidiella* compared with recommended insecticides in vine orchards, Minia region, 2006 and 2007 growing seasons.

Item	Costs of *C. gnidiella* control in the grape orchards (one feddan) treated with		
	Trichogramma	*Trichogramma* +Agerin (*B.t.*)	Recommended insecticides
Labours Wages	30	50	20
Charter of spraying motor	-	20	20
Price of insecticides	--	--	240
Price of Agerin (300g)	--	20	--
Price of Tricogramma parasite	75	75	--
Total	105	165	280
% Reduction	62.5	41.1	--

As shown in Table (5), the cost of HDM production per feddan were 105 ,165 and 280 L.E. in three treatments (egg parasitoid alone; egg parasitoid plus Agerin (*B.t.*) and recommended insecticides), respectively .Consequently, the costs were reduced by 62.5% and 41.1% in the parasitoid release areas and those combined with Agerin (*B.t.*) compared with chemical treatments. Such results are in agreement with those reported by El-Heneidy *et al.*, (2004) who mentioned that, in the parasitoid release areas, number of insecticidal application was reduced to almost the half and consequently, the costs were dropped by 29.3 to 36%, in both seasons, respectively. Also, Tohamy and Kassem (2007), reported that using the *Trichogramma* parasitoid alone or combined with Agerin (*B.t*) against bollworms in cotton fields in Middle Egypt resulted to 60.15 and 27.10 % reduction in the protection costs.

From the previous result it was evident that pesticidal treatment not recommended for the honeydew moth (*C. gnidiella*) control because it's adverse effect on the insect parasitoids and predators. As well as the dangerous effect of the residue on human and its environment and the development of control methods with biotic agents such as *Trichogramma* parasitoid and microbial control is

needed. Here in the complete coverage of the honeydew moth with seven releases of *T. evanescens* with two sprays of Agerin (*B. t.*) seemed to be the most suitable method for grape orchards protection from HDM infestation.

Data presented in Table (6) clear that the highest number fruit yield/tree (weight and number of grape fruits) were obtained from grape orchard treated with egg parasitoid plus Agerin (*B.t*); egg parasitoid alone and insecticides with out any significant differences compared to untreated grape orchards (control) in both seasons. Differences in effect were significant between both the control and three treatments during the two seasons. The maximum weight of mature grape/tree was 11.3, 11.0 and 10.5 kg with an increasing as 27.43, 25.45 and 21.90% in the first grape orchard; 10.4, 10.0 and 9.5 kg with an increasing as 25.0, 22.0 and 17.89 % in the second grape orchard and 11.8, 11.2 and 11.3 kg with an increasing 26.27, 22.30 and 23.0% in the third grape orchard treated with parasitoid combined Agerin; insecticides and parasitoid alone, respectively compared with untreated grape orchards in 2006 season. In 2007 season weight mature grape/tree followed the same trend where it was significantly increased from 7.8 kg in the control to 11.0, 10.1 and 10.3 kg in the first grape orchard; from 8.7 kg in the control to 11.2, 10.8 and 10.5 kg in the second grape orchard and increased from 8.5 kg in the control to 12.4, 12.0 and 11.7 kg after using egg parasitoid plus Agerin; only egg parasitoid and insecticides, respectively. No significant difference found among the effectiveness of the three tested control methods in yield increasing %.

On the other hand, the lowest percentage of fallen grape/tree was achieved in plots treated with egg parasitoid plus Agerin followed with plots treated with only parasitoid and these treated with insecticides without any significant differences. While, the highest percentage fallen grape/tree was recorded in untreated plots in the first, second and third grape orchard, where it was 18.16, 14.22 and 24.64% during 2006 and 22.90, 19.37 and 25.89%, during 2007, respectively. Also, the loss in yield decreased from 34.15% in untreated grape orchards (control) to 4.42, 7.14 and 5.91% in the first grape orchard, from 28.21% in the control to 1.92, 2.63 and 2.5 % in the second grape orchard and from 36.78 % in the control to 5.72, 7.52 and 8.04 % in the third grape orchard treated with egg parasitoid plus Agerin; only parasitoid and chemical insecticides, respectively. The loss % in yield in 2007 season showed the same trend, where it was ranged 2.32-3.63%; 2.96-5.45% and 3.33-5.83% in plots treated with parasitoid plus Agerin; parasitoid only and insecticides, respectively compared to 27.06-32.11% in untreated grape orchards (control). These results are

Table(6): Amount of premature fallen grape fruits and fruit yield/tree (weight and number) in grape orchards treated with *T. evanescens* alone and combined with Agerin compared with the recommended insecticides in Minia region, 2006 and 2007 growing seasons.

Season	2006											
Item	The first grape orchard				The second grape orchard				The third grape chard			
	T	T+A	RI	C	T	T+A	RI	C	T	T+A	RI	C
No of mature grape/tree	1901 b	2160 a	1856 b	1790 c	1702 b	1842 a	1739 b	1518 c	2116 b	2335 a	2238 a	1952 c
No of premature fallen grape /tree	75 b	59 c	63 c	325 a	30 b	24 c	27 b	216 a	107 b	95 c	115 b	481 a
% fallen grape	3.95 b	2.73 b	3.39 b	18.16 a	1.76 b	1.30 b	1.55 b	14.22 a	5.06 b	4.07 b	5.13 b	24.64 a
Weight of mature grape/tree kg	10.5 a	11.3a	11.0a	8.2 a	9.5 a	10.4 a	10.0 a	7.8 b	11.3 a	11.8 a	11.2 a	8.7 b
Weight of premature grape/tree	0.75	0.50	0.65	2.8	0.25	0.20	0.25	2.20	0.85	0.675	0.90	3.2
% Increasing in yield/ control	21.90 b	27.43 a	25.45 a	--	17.89c	25.0 a	22.0 b	--	23.0 b	26.27 a	22.32 b	--
% loss	7.14 b	4.42c	5.91 b	34.15a	2.63 b	1.92 b	2.50 b	28.21 a	7.52 b	5.72c	8.04 b	36.78 a
Season	2007											
No of mature grape/tree	1855 b	1987 a	1819 b	1683 c	1620 b	1759 a	1652 b	1425 c	2018 b	2219 a	1981 b	1773 c
No of premature fallen grape /tree	49b	35b	42b	371a	21c	15c	25c	276a	44b	31b	47b	459a
% fallen grape	2.64b	1.76b	2.31b	22.90a	1.30b	0.85b	1.51b	19.37a	2.18b	1.39b	2.37b	25.89a
Weight of mature grape/tree	10.1 a	11.0 a	10.3 a	7.8 b	10.8 a	11.2 a	10.5 a	8.7 b	12.0 a	12.4 a	11.7 a	8.5 b
Weight of premature grape/tree	0.55b	0.27c	0.60b	2.5a	0.32b	0.26c	0.35b	2.6a	0.57b	0.45c	0.60b	2.3a
% Increasing in yield/ control	22.77 b	29.09 a	24.27 b	--	19.44 b	22.32 a	17.14 b	--	29.17 b	31.45 a	27.35 b	--
% loss in yield	5.45 b	2.45c	5.83 b	32.11 a	2.96 b	2.32 b	3.33 b	32.10 a	4.75 b	3.63c	5.13 b	27.06 a

Means have the same letters of each grape orchard not differ in significancy at $P < 0.05$, as determined by Duncan's multiple range test.

in-accordance with those obtained by Hegazi *et al.*, (2004), who showed that the olive groves received both treatments (mating disruption and *Trichogramma* parasitoid) characterized by lowest male catches in delta-wing traps, gave the lowest weight of pre-mature fallen olive fruits and highest weight of fruit harvest/tree.

In conclusion, our data is suggest hat the biological control methods with the egg-parasitoid *T. evanescens* alone, or egg-parasotoid and combined with Agerin (*B.t.*) are suitable and safe method more than applying chemical application for controlling the honeydew moth (*C. gnidiella*).

The combined use of Agerin (*B.t.*) and the egg- parasitoid *T. evanescens* can be an effective method, which controls not only honeydew moth but also other lepidopterous pests in olive. fig date palm grape orchards and fodder fields where *Bacillus thuringiensis (B.t)* applications targeted the larvae escaped from the parasitism with *T. evanescens* during the egg stage. It was found that the release of parasitoid in grape orchards might help to reduce the population of other lepidopterous pests in citrus, olive orchards, fig and date palm and fodder fields.

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المكافحة الحيوية لفراشة الندوة العسلية فى مزارع العنب باستخدام طفيل الترايكوجراما ايفانسنس والمركب الحيوى اجرين (بكتريا باسليس) مقارنة بالمبيدات الموصى بها فى مصر الوسطى.

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية

تم تقييم التأثير المشترك لاستخدام طفيل الترايكوجراما مع المركب البكتيري أجـرين (*B.t*) وطفيل الترايكوجراما منفردا ضد فراشة دودة الندوة العسلية التي تصيب مزارع العنب مقارنـة باستخدام المبيدات الموصى بها (ريلدان وسوميثيون) في محافظة المنيا خلال موسـمي ٢٠٠٦و ٢٠٠٧ . أوضحت النتائج أن أعلى متوسط عام للنسبة المئوية لتطفل الترايكوجراما علـى بـيض فراشة الندوة العسلية كان في مزارع العنب المعاملة بطفيل الترايكوجراما والأجرين معـا يليـه تلك المعاملة بالطفيل فقط بينما لم يكن هناك أي تتطفل على بيض الآفة في حالة أشجار العنـب المعاملة بالمبيدات وكذلك تلك الغير معاملة (كنترول) في كل من الموسمين على التوالي . أيضا وجد أن استخدام المبيدات الحشرية في مزارع العنب أدى إلى خفض معنوي في تعداد المفترسات مقارنة بالمعاملات الأخرى.

أوضحت النتائج أيضا أن إطلاق طفيل الترايكوجراما مع رش الأجرين في مزارع العنب أدى إلى الحصول على أعلى متوسط عام لخفض الإصابة بهذه الآفة (٦٧,٦٥ و ٦٨,٩٩ %) تليهـا المزارع المعاملة بالمبيدات (٦٣,٣٥و٤٤,٥٦%) ثم المزارع المعاملة بطفيل الترايكوجراما فقط بالمقارنة بمزارع العنب الغير معاملة في كل من الموسمين علـى التـوالى .وأوضـح التحليـل الإحصائي وجود اختلافات معنوية في تأثير طرق المكافحة الثلاثة المختبرة في تقليل الضرر بهذه الآفة في كلا الموسمين.

كما أدى استخدام طفيل الترايكوجراما منفردا أو مشتركا مع مركب الأجرين إلى خفض فـي نسبة تكاليف مكافحة فراشة الندوة العسلية بمعدل ٦٢,٥ و ٤١,١ % على التوالي مقارنة بمزارع العنب المعاملة بالمبيدات الحشرية في نفس الموقع .

ومن ناحية أخرى أوضحت النتائج أيضا أن النسبة المئوية للزيادة في إنتاجية محصول ثمـار العنب/ فدان كان أعلى في مزارع العنب المعاملة بطفيل الترايكوجراما ومركب الأجرين مما عن تلك المعا ملة بالمبيـدات (٢٥,٤٥ و ٢٤,٢٧ %) وكـذلك عـن المـزارع المعاملـة بطفيـل الترايكوجراما فقط (٢١,٩٠ و ٢٢,٧٧ %) في كلا الموسمين على التوالي مقارنة بالمسـاحات الغير معاملة (كنترول) في نفس الموقع . وتظهر أهمية هذه النتائج عند عمـل خطـة لبرنـامج مكافحة هذه الآفة .