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Utilization of Biological Control Agents for Controlling some Sugar Beet Insect Pests at Kafr El-Sheikh Region

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ABSTRACT

This study was carried out during 1998/99, 1999/00 and 2000/01 sugar beet seasons at Kafr El-Sheikh region to evaluate the effectiveness of the egg-parasitoid, *Trichogramma evanescens* West. and the two microbial insecticides Dipel 2x and Biofly in reducing some sugar beet insect populations. Data indicated that the egg-parasitoid released on 5th of March reduced *Scrobipalpa ocellatella* (Boyed) infestation by 13.96 and 31.98% at rates of 30,000 and 60,000 parasitoids /fed., respectively. The corresponding reductions in the larval populations were 43.77 & 69.52% respectively. When the parasitoid was released on 5th of April, the reductions in infestation were 23.56 & 45.44%, and those in larval populations were 35.27 & 58.29% for rates of 30,000 and 60,000 parasitoids/fed., respectively. Data also showed that the parasitoid was capable of reducing *Ostrinia nubilalis* (Hbn.) when released on 5th of April than when released on 5th of March. The early release reduced the borer infestation by 31.28% at a rate of 30,000 parasitoids, and by 61.50% at a rate of 60,000 parasitoids. While the corresponding levels on 5th of April release were 32.48 and 69.01% at both rates, respectively. The reduction in larval population took the same trend, 30.43 and 52.01% when the parasitoid release was practised on 5th of March, and 31.91 and 72.34% when the parasitoid was released on 5th of April for both rates, respectively. As for application of biocides, *Bacillus thuringiensis* var. *kurstaki* (Dipel 2X) and *Beauveria basssiana* Balsamo (Biofly); in the first season (1998/99), Dipel 2X eliminated 27.78% of *Cassida vittata* Vill. population, 28.66% of *Scrobipalpa ocellatella* and 15.82% of *Pegomyia mixta* (Vill.). In the second season (1999/00), the corresponding values were 19.01, 27.10 and 38.41%. As for Biofly, the preparation suppressed 6.53 & 35.53% of *P. mixta* population, and 27.42 & 29.65% of *C. vittata* and 39.42 & 26.43% of *S. ocellatella* in 1998/1999 and 1999/00 seasons, respectively. Both Dipel 2X and Biofly were mainly effective as biocide preparations between 72 hr and 7-days after application.

Key Words: Utilization, Biological Control Agents, Sugar Beet Insect Pests, Kafr El-Sheikh, Egypt.

INTRODUCTION

Sugar beet, *Beta vulgaris* L. is one of two principal sugar crops (sugar beet and sugar-cane) in Egypt and world wide. This crop is annually planted in Egypt in about 135623 feddans and about 54.8% of this area (74384 feddans) is concentrated in Kafr El-Sheikh Governorate (2000/01 season).

Sugar beet plants are infested with numerous insect pests, which cause economic losses in sugar yield (Bassyouny, 1993 and Mesbah, 2000).

For a long time and in many countries of the world, use of chemical insecticides in controlling insect pests in sugar beet fields has been unfavorable owing to contamination problems and their drastic consequences on all ecosystem elements. This study aimed to evaluate the egg-parasitoid, *Trichogramma evanescens* West. and two of the most promising microbial insecticides (Diple 2x and Biofly) in reducing sugar beet insect populations.

MATERIALS AND METHODS

1. Role of the egg-parasitoid, *Trichogramma evanescens* in reducing some lepidopterous borers:

This experiment was carried out at the experimental farm of Sakha Agricultural Research Station in an area of about four feddans during 1999/2000 and 2000/2001 seasons. The goal of the experiment was to test the role of the egg-parasitoid, *T. evanescens* in suppressing population of *Scrobipalpa ocelllatella* and *Ostrinia nubilalis* (Hbn.) insects. The experimental area was divided into four plots (one feddan each) and planted with Raspoly sugar-beet cultivar by mid-November. All recommended cultural practices were followed till harvest without insecticide applications. The parasitoid was released in the first and second plots on 5th of March at a rate of 30,000 and 60,000 parasitoids/feddan, respectively. The same rates were released in the third and fourth plots on 5th of April. The parasitoid, egg cards were obtained from Biological Control Department, Plant Protection Research Institute, Giza. The cards were tied to sticks using small pieces of strings, and fixed at the height of sugar-beet canopy (about 60 cm), each card contained about 2,000 parasitoids. Thus, 15 and 30 cards were used at both rates of release, respectively. The cards were distributed in the plots at equal distances (15 meter) in one feddan of each treatment when the parasitoid was just to emerge, and this was done in the late afternoon to avoid the adverse effect of high temperature on the parasitoid.

The infestation by *S. ocellatella* and *O. nubilalis* in the tested plots was compared with that in the check area (without parasitoid). The latter area was far from the plots receiving the parasitoid by about 500 m to avoid the migration of the released parasitoid. The infestation percentages by both insects were estimated three times; 4, 7 and 14 days after release. In each examination, four samples per treatment (ten plants per sample) of sugar-beet plants were pulled out. The plants were examined to record percentage of infestation and harbored larvae for the two considered insects.

2. Effect of insect pathogens in reducing sugar-beet insect populations:

Efficacy of two biocide preparations was tested against some sugar-beet insects in 1998/1999 and 1999/00 seasons. These are Diple 2x (6.4% WP, 3200 IU) having *Bacillus thuringiensis*, var. *kurstaki* and Biofly (3×10^7 conidia/ml) having *Beauveria bassiana.* The experimental field located at Sakha Agricultural Research Station was divided into 9 plots (3 treatments × 3 replicate), each plot measured 1/50 fed. Raspoly sugar-beet variety was sown on 15th November in both years, and all agricultural practices, were followed without insecticide application. When sugar-beet plants reached 4 month-old, the plants were treated with the tested preparations. Dipel 2x at a rate of 400 g/fed, and Biofly at a rate of 300 ml/fed., both were sprayed using CP3 knapsack sprayer. The efficacies of the two preparations on the populations of *Pegomyia mixta* (Vill.), *S. ocellatella* and *Cassida vittata* Vill. were evaluated. The sugar-beet plants were examined after 1, 2, 3, 7 and 14 days after treatments. In each examination, 5 plants/plot were inspected to count the occurring insects. Population reductions due to the treatments were calculated as compared to untreated plots in each case. Percentages of reduction infestation were estimated according to the formula of Henderson and Tilton (1955) as follows:

$$\%\ \text{population reduction} = \left(1 - \frac{Ta \times Cb}{Tb \times Ca}\right) \times 100$$

RESULTS AND DISCUSSION

1. Role of the egg-parasitoid, *Trichogramma evanescens* West. in reducing population of some lepidopterous insect pests:

1.1. The beet moths, *Scrobipalpa ocellatella*:

Data presented in Table (1) show the effect of *T. evanescens* release as an egg-parasitoid on the beet moth, *S. ocellatella.* The parasitoid was released on 5th of March and 5th of April in the experimental plots.

Table (1): Effect of release the egg-parasitoid *T. evanescencs* on infestation by *S. ocellatella* to sugar-beet plants (Sakha Agric. Res. Station) during 1999/00 and 2000/01 seasons

Treatment	Infestation %				Larvae/10 plants			
	1999/2000	2000/2001	Average	Reduction %	1999/2000	2000/2001	Average	Reduction %
Release on 5th of March								
Check	82.50	84.00	83.25	-	28.00	30.25	29.13	-
30,000	72.50	70.75	71.63	13.96	16.25	16.50	16.38	43.77
60,000	55.00	58.25	56.63	31.98	8.75	9.00	8.88	69.52
Release on 5th of April								
Check	90.00	88.25	89.13	-	21.25	13.50	17.38	-
30,000	66.25	70.00	68.13	23.56	14.00	8.50	11.25	35.27
60,000	51.50	45.75	48.63	45.44	9.50	5.00	7.25	58.29

On the 5th of March treatment, average infestation by *S. ocellatella* in 1999/2000 and 2000/2001 sugar-beet seasons was 83.25% in check treatment (without parasitoid release). When the parasitoid was released at a rate of 30,000 individuals/feddan, the infestation was decreased to 71.63% (13.96% reduction compared to the check). The parasitoid released at 60,000 individuals/feddan had more advantage in decreasing the moth infestation to 56.63%, which represented 31.98% infestation reduction. The average larval population was 29.13 larvae/10 plants in plots without the parasitoid. The larval population decreased to 16.38 and 8.88 larvae/10 plants in plots receiving the parasitoid at rates of 30,000 and 60,000 individuals/fed., respectively. Thus, *T. evanescens* performed a good control to *S. ocellatella* population as it reduced the larval population by 43.77 and 69.52% compared to the check at rates of 30,000 and 60,000 parasitoid/fed, respectively.

On 5th of April treatment, the check plots averaged 89.13% infestation by *S. ocellatella*. Levels of infestation were reduced to 68.13% (23.56% reduction) at a rate of 30,000 parasitoid and to 48.63% (45.44% reduction) at a rate of 60,000 parasitoids. On the other hand, average larval population was 17.38 larvae/10 plants in case of check (without parasitoid release), and decreased to 11.25 and 7.25 larvae/10 plants at 30,000 and 60,000 parasites/fed, respectively. The latter values represented 35.27 and 58.29% reductions in larval population due to release of the egg-parasitoid at both rates.

1.2. The European corn borer, *Ostrinia nubilalis:*

Data presented in Table (2) show the effect of *T. evanescence* release on levels of infestation by the European corn borer, *O. nubilalis*. The parasitoid was released twice, each in separate plots.

In case of 5th of March treatment, the average of infestation by *O. nubilalis* was 34.75%, and decreased to 23.88% when the parasitoid was released at a rate of 30,000 individual/fed. Thus the infestation was reduced by 31.28%. The borer infestation averaged 16.38% (61.50% reduction compared to the check) when the plots received the parasitoid at a rate of 60,000 individuals/fed. The check treatment harbored 5.75 larvae/10 sugar beet plants, and decreased to 4.00 and 2.75 larvae/10 plants when the parasitoid was released at 30,000 and 60,000 individuals/fed, respectively. The corresponding values of reduction in the larval population were 30.43 and 52.17%.

Table (2): Effect of release the egg-parasitoid *T. evanescencs* on infestation by *O. nubilalis* to sugar-beet plants (Sakha Agric. Res. Station) during 1999/2000 and 2000/2001 seasons.

Treatment	Infestation %				Larvae/10 plants			
	1999/2000	2000/2001	Average	Reduction %	1999/2000	2000/2001	Average	Reduction %
Release on 5th of March								
Check	24.50	45.00	34.75	-	5.50	6.00	5.75	-
30,000	17.25	30.50	23.88	31.28	3.75	4.25	4.00	30.43
60,000	12.50	20.25	16.38	61.50	2.50	3.00	2.75	52.17
Release on 5th of April								
Check	42.00	75.00	58.50	-	9.0	14.50	11.75	-
30,000	28.25	50.75	39.50	32.48	6.00	10.00	8.00	31.91
60,000	20.75	15.50	18.13	69.01	3.75	2.75	3.25	72.34

Parasitoid release practiced on 5th of April reduced the borer infestation from 58.50 to 39.50 and 18.13% at rates of 30,000 and 60,000 parasitoid individuals/fed, respectively. Calculated reductions in infestation were 32.48 and 69.01% for both parasitoid rates, respectively. Similar trend was attained in case of larval population. They averaged 11.75 larvae/10 plants in check plots, and were reduced to 8.000 and 3.25 larvae/10 plants for rates of 30,000 and 60,000 parasite/feddan, respectively. Reduction in larval population averaged 31.91 and 72.34% for both parasitoid rates, respectively. In general, parasitoid release conducted on 5th of April gave more promising results in reducing the corn borer infestation and borer larval population compared to that conducted on 5th of March.

Some authors used *Trichogramma* parasitoid to control some of lepidopterous insects in sugar-beet fields as a single method or in combinations with some control methods. Petruk (1981) in USSR, Ciochia (1982) in Romania, Slavchev (1984) in Bulgaria used *Trichogramma* parasitoid in sugar-beet fields to control lepidopterous insects, as *Mamestra oleracea, Autographa gamma,* and *Agrotis segetum.*

Lagutochkin (1987) released the egg parasitoid *Trichogramma* sp. in an area of 100,000 ha. to control the cutworms in sugar-beet and the European corn borer, *O. nubilalis* in maize and reported that the parasitoid control levels were 68, 72 and 76% at rates of 40,000, 60,000 and 45,000 (divided into three releases 15,000 each), respectively.

Varenik and Yatsenko (1991) and Hassan (1993) reported that commercial use of *Trichogramma* reduced the insect damage in several crops including sugar-beet.

2. Effect of insect pathogens in reducing insect populations:

2.1. *Bacillus thuringiensis*:

Applications of biocide, *B. thuringiensis* (Dipel 2x) reduced variably the populations of sugar-beet insects (Table 3). In 1998/99, overall average reduction in *C. vittata* population due to Dipel 2x was 27.78%, while that of *S. ocellatella* was 28.66 and that of *P. mixta* was 15.82%. The corresponding values of the three insects in 1999/00 were 19.01, 27.10 and 38.42%. Dipel was more effective against *C. vittata* 48 hr. and 72 hrs. after application in the first season, but in the second one, most of insects were killed 72 hrs. and 7 days after application. In case of *S. ocellatella*, the biocide was effective 7 and 14 days in the first year, and 72 hrs. and 7 days in the second. For *P. mixta*, the majority of population was killed by this biocide preparation during 72 hr-7days in the first season, and during 48 hr-72 hr in the second one.

Generally, it could be reported that Dipel 2X, used as a biocide preparation, was mainly effective between 72 hr and 7 days after application.

Table (3): Efficacy of *B. thuringinsis* (Dipel 2X), and *B. bassiana* (Biofly) biocides against sugar-beet insects at Kafr El-Sheikh region (Sakha Agric. Res. Station) during 1998/1999 and 1999/2000 seasons.

Insect species	% Reduction after different periods of application											
	1998/1999					Overall average	1999/2000					Overall average
	24 hr	48 hr	72 hr	7 days	14 days		24 hr	48 hr	72 hr	7 days	14 days	
Dipel 2X (400 g/fed.)												
C. vittata	11.52	39.65	54.90	25.71	7.14	27.78	0.0	19.49	30.04	33.79	11.72	19.01
S. ocellatella	0.0	5.88	38.46	54.55	44.44	28.66	19.32	27.39	48.66	32.33	7.80	27.10
P. mixta	3.03	18.94	28.57	28.57	0.0	15.82	26.28	36.14	78.75	25.00	25.92	38.42
Biofly (300 ml/fed.)												
C. vittata	22.73	22.81	37.25	54.29	0.0	27.42	0.0	5.08	28.85	66.89	47.41	29.65
S. ocellatella	0.0	11.76	49.23	57.27	0.0	39.42	0.0	8.21	23.11	64.66	36.19	26.43
P. mixta	3.03	5.26	24.39	0.0	0.0	6.53	2.06	8.43	66.25	75.00	25.92	35.53

2.2. *Beauveria bassiana*:

Efficacy of *B. bassiana* (Biofly) against the considered sugar beet insects is also presented in Table (3). In 1998/99, *P. mixta* was the least affected by the application (overall reduction of 6.53%), while the same insect suffered the highest reduction in 1999/00 (35.53%). However, the biocide gave similar efficiency against *C. vittata* resulting in 27.42 and 29.65 % insect population reduction in both seasons, respectively. On the other hand, *S. ocellatella* had higher mortality in the first season (39.42%) than in the second one (26.43%).

As in the Dipel 2X, it was found that Biofly was more efficient against the tested insect pests in a period elapsed from 72 hr to 7 days after application.

In previous experiments, preparations of *B. bassiana* was efficient against beet moth, *S. ocellatella* (El-Sufty, 1987) but not efficient against tortoise beetle, *C. vittata* (Abo-Aiana, 1991). The results of the current study are in line with those of Mansour (1999) who found that populations of *S. ocellatella, P. mixta* and *C. vittata* were lowered by the applications of *B. bassiana.* Applications of *B. thuringiensis* preparations reduced the infestation by *C. vittata* (El-Khouly, 1998) and *S. littoralis* and *A. ipsilon* (Mohamed *et al.*, 2000).

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استخدام بعض عناصر المكافحة البيولوجية لمكافحة بعض الآفات الحشرية فى حقول بنجر السكر فى منطقة كفرالشيخ

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يعتبر بنجر السكر واحد من أهم محصولى انتاج السكر فى مصر والعالم بعد قصب السكر ونظرا لما تتمتع به نباتات بنجر السكر من مجموع خضرى كثيف وجذر كبير لذلك يكون عرضة للمهاجمة والاصابة بالعديد من الافات الحشرية والتى تحدث خسارة فى محصول السكر· وبإتجاه معظم دول العالم الان نحو عدم استخدام المبيدات الكيميائية على المحاصيل الغذائية ، لذا كانت هذه الدراسة ضرورية لدراسة فاعلية بعض عناصر المكافحة البيولوجية فى خفض تعداد بعض الافات الحشرية فى حقول بنجر السكر· وفيما يلى ملخص للنتائج المتحصل عليها:

١-دور طفيل البيض (التريكوجراما) فى تقليل أعداد بعض حشرات حرشفية الأجنحة فى حقول بنجر السكر:

أ- **فراشة البنجر:** أدى إطلاق الطفيل (مبكرا) فى ٥ مارس إلى تقليل الإصابة بالحشرة بنسبة ١٣٫٩٦ ، ٣١٫٩٨% كما إنخفضت أعداد اليرقات بمعدلات ٤٣٫٧٧، ٦٩٫٥٢% عندما كانت نسبة الإطلاق ٣٠، ٦٠ ألف طفيل/للفدان على التوالى· وعندما أطلق الطفيل متأخرا لمدة شهر (٥ أبريل) ، أدى ذلك إلى خفض نسبة الإصابة بمعدلات ٢٣٫٥٦ ، ٤٥٫٤٤% عند اطلاق ٣٠٠٠٠٠ ، ٦٠٠٠٠٠ طفيل/فدان على التوالى· وخفض تعداد اليرقات بمعدلات ٣٥٫٢٧ ، ٥٨٫٢٩%.

ب-**دودة الذره الأوروبية:** عند إطلاق الطفيل مبكرا (٥ مارس) إنخفضت نسب الإصابة بالحشرة بمعدل ٣١٫٢٨ ، ٦١٫٥٠% لكل من معدلات ٣٠٠٠٠٠ ، ٦٠٠٠٠٠ طفيل/فدان على التوالى· بينما كانت القيم المناظرة لخفض أعداد اليرقات هى ٣٠٫٤٣ ، ٥٢٫١٧% ، بينما تسبب إطلاق الطفيل فى ٥ أبريل فى زيادة كفاءته فى تقليل الإصابات بالحشرة حيث بلغ الخفض فى نسب الإصابة ٣٢٫٤٨ ، ٦٩٫٠١% عند إطلاق ٣٠ ألف ، ٦٠ ألف طفيل/للفدان على التوالى وقد بلغت القيم المناظرة لخفض تعداد اليرقات ٣١٫٩١ ، ٧٢٫٣٤%.

٢- **تأثير المعاملة بالممرضات الحشرية فى تقليل أعداد حشرات بنجر السكر:** أدت المعاملة بالمبيدات الحيوية البكتيرية *Bacillus thuringiensis* (Dipel 2x) والفطرية *Beauveria bassiana* (Biofly) إلى تقليل تعداد آفات بنجر السكر الحشرية· فقد تسبب المبيد البكتيرى دايبل 2x فى تقليل الآفات الحشرية الآتية بالمعدلات المذكورة· خنفساء البنجر (٢٧٫٢٨ ، ١٩٫٠١%) ، فراشة البنجر (٢٨٫٦٦ ، ٢٧٫١٠%) ، ذبابة البنجر (١٥٫٨٢-٣٨٫٤٢%) خلال موسمى ١٩٩٩/٩٨ ، ٢٠٠٠/٩٩ على الترتيب· أما المبيد الحيوى الفطرى Biofly فقد قلل الإصابات كما يلى: خنفساء البنجر (٢٤٫٤٢ ، ٢٩٫٦٥%) ، فراشة البنجر (٢٦٫٤٣-٣٩٫٤٢%) ، ذبابة البنجر (٦٫٥٣ ، ٣٥٫٥٣%) خلال موسمى ١٩٩٩/٩٨ ، ٢٠٠٠/٩٩ على الترتيب·