ECOLOGICAL STUDIES ON SUGAR BEET INSECTS AT KAFR EL- SHEIKH GOVERNORATE, EGYPT

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Abstract

Some ecological studies on sugar beet insect pests were conducted at Kafr El-Sheikh Governorate during 2004/2005 and 2005/2006 seasons. In the first season, the insect pests as well as their associated natural enemies were surveyed. The effect of three planting dates and the relative susceptibility of three sugar beet cultivars on the relative abundance of the main insect pests infestation (*Pegomya mixta*, *Cassida vittata* and *Scrobipalp ocellatella*) were determined. While during the second season, the effect of different infestation levels of *Pegomya mixta* on different sugar beet yield components was estimated. Results revealed that early plantation in September was the most suitable planting date to avoid insects infestation. Results also indicated that the infestation of *P. mixta* caused significant decrease in different sugar beet yield components.

INTRODUCTION

The sugar beet is native to the Mediterranean area, where it was cultivated as far back as about 2000 to 1500 years B.C. The sugar beet roots used to contain not more than 8 to 10% sugar since 160 years ago. Now, the best of current varieties have a high sugar content, some as much as 18 to 20 %, and even more.

In Egypt sugar beet cultivation spread rapidly in the provinces of Lower Egypt (Kafr Sheikh, Dakahlia, Behera and Fayoum). The cultivated area with this crop increased from 17.000 to 140.000 feddans in the period from 1982 to 2004 (cited from Delta Sugar Company). The four Egyptian sugar factories produce more than one million ton of sugar, this production represent about 26% of all sugar production in Egypt.

Under Egyptian ecosystem, sugar beet plants are subjected to be attacked by numerous insect pests during its different growth stages, so many authors are attracted to study these insects, Mesbah *et al.*,(1985), El-Khouly, (1992), Aly *et al.*, (1993a&b), Ebieda (1997), El-Zoghbey (1999), Abdel-Raheem (2000), Helal (2004) and El-Khouly (2006).

The present work outlined to study: survey of the insect pests attack sugar beet as well as their associated natural enemies, the population dynamics and seasonal fluctuations of certain insect pests, effect of three planting dates and the

relative susceptibility of three sugar beet cultivars on abundance of main insect pests infestation. The effect of different infestation levels of *Pegomya mixta* on different sugar beet yield components was studied.

MATERIALS AND METHODS

A survey of insect fauna on sugar beet plants, effect of planting dates and susceptibility sugar beet varieties to certain insect pests infestations were studied during 2004-2005 season at Sakha Research Station,, Kafr El-Sheikh Governorate. An area of about ½ feddan was chosen and divided into three equal blocks, each was also divided into nine equal plots, each was measured 42 m^2. All regular agricultural practices were undertaken with no chemical control during the experimental period.

To study the effect of planting dates, three times were chosen, early on September, 25, moderate on October, 16 and lately on November, 5, 2004.

As for susceptibility of sugar beet varieties, three popular varieties were chosen, *Carola*, *Oscar Boley* and *Pleno*.

Regular weekly interval were made to estimate seasonal fluctuation in the population densities of sap sucking insects and their associated natural enemies. Direct counts, by using 10x hand lens, on 270 leaves (30 leaves/ varieties/ planting dates) were recorded. To identify these insects, samples preserved in 70% ethyle alcohol were transferred to the laboratory.

To estimate the seasonal fluctuations in the population densities of the chewing insects and their associated natural enemies, a number of random leaves (according to each insect infestation) was also taken from each variety and kept in polyethylene bags and transferred to the laboratory.

To determine the impact of *Pegomya mixta* at different levels of infestation on different sugar beet yield components, an experiment was conducted under field conditions at the same station in 2005/2006 season. *Oscar Boley* variety was cultivated in the second week of October, 2005 and harvested at the end of April, 2006. Just before harvest, infested plants were labeled under five degrees of *P. mixta* infestation, no infestation (control), 10 to 20 mine/plant, 21 to 30 mine/plant, 31 to 40 mine/plant and more than 40 mine/plant. Samples of 25 plants were taken from each level to determine the weight of roots and leaves, sucrose and sucrose quality percentages. The qualitative components were analyzed by the sugar factory at El-Hamoul district, Kafr El-Sheikh Governorate.

RESULTS AND DISCUSSION

I- Survey of the insect fauna:

Identification procedures for the surveyed insects during 2004-2005 showed two main groups. The first is sap sucking insect pests included five species, *Aphis gossypii* Glover and *Myzus persicae* (Sulz) (Hemiptera: Aphididae), *Empoasca decipiens* Paoli (Hemiptera: Jassidae), *Nezara viridula* (Linnaeus) (Hemiptera: Pentatomidae) and *Thrips tabaci* (Lindeman) (Thysanoptera: Thripidae). These insects were associated with five predators, *Syrphus corollae* Fabricius (Diptera: Syrphidae), *Coccinella undecimpunctata* L. (Coleoptera: Coccinellidae), *Paedierus alfierii* Koch (Coleoptera: Staphylinidae), *Orius* spp. (Hemiptera: Anthocoridae) and *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae)(fig. 1 & 2).

The second group is chewing insect pests included 3 species, Sugar beet leaf miner, *Pegomya mixta* Vill. (Diptera: Anthomyiidae), the Tortoise beetle, *Cassida vittata* (Vill.) (Coleoptera: Chrysomelidae) and the Sugar beet moth, *Scrobipalp ocellatella* Boyd (Lepidoptera: Gelechidae). The parasitoids of these insect pests were *Opius nitidulator* Nees (Hymenoptera: Braconidae) on larvae and pupae of *P. mixta*, *Agathis* sp. (Hymenoptera: Braconidae) on larvae and pupae of *S. ocellatella*, *Monothochaeta nigra* Blood and Kryger (Hymenoptera: Trichogramatiidae) on eggs of *C. vittata.*

II. The Population dynamics:

1. Sap-sucking insects and their associated natural enemies:

Weekly direct examination of leaves during the period from 2, March to 25, May, 2005 indicated that, the Jassid species, *E. decipiens* was the most dominant with a seasonal mean number of 113.9 insect/leaf. The other species were found in a few numbers, 9.2, 2.8 and 1.2 insect/leaf for thrips, aphids and green bug species, respectively, Fig. (1). The associated five predator species showed that, *C. carnae* was the most dominant with a seasonal mean number of 19.0 individuals/leaf (14.2 eggs & 4.8 adults) while the other four predators were found in a small numbers, 6.9, 4.9, 3.3 and 0.1 insect/leaf for *P. alfierii*, *C. undeciumpunctata*, *Orius* spp. and *S. corollae*, respectively, Fig. (2).

From the above results, it could be concluded that, the sap-sucking insects were not dangerous to sugar beet plants, may be due to the role of their natural enemies which keeps the population of these insects around their equilibrium position in this region.

2. Chewing insects and their associated parasitoids:

a. The Sugar beet leaf miner, *P. mixta* Vill.:

Weekly mean numbers of leaf mines were taken from 270 random leaves (30 leaves/ variety/ plantation date). Results in Table (1) showed that, regardless of plantation date, the seasonal mean number of mines was 3.8/leaf. The population density of this pest fluctuated throughout the successive counts and recorded two peaks, the first was in early March while the second was in the first week of April,2005, recorded 4.3 mine/leaf, for each .

The *Opius nitidulator* parasitoid was recorded on both *P. mixta* larvae and pupae during the period from the last week of February (19.4% parasitism) to the end of March, 2005 (2.8% parasitism), Table,1. These results are in agreement with those obtained by El-Agamy *et al.* (1994 a & c) and El-Zoghbey, (1999).

b. The Tortoise beetle, *C. vittata* (Vill.):

Seasonal fluctuations of the tortoise beetle were carried out by weekly numbers of leaf pores/ cm^2/leaf taken from a sample consisted of 270 random leaves (30 leaves/ variety/ plantation date). Results in Table (2) showed that, the infestation appeared in the last week of March and extended to the second week of May, 2005. The seasonal mean number of pores was 4.3 /cm^2/leaf. The population density of this insect recorded three peaks during the activity period, in last week of March (2.0 pores/cm^2/leaf), mid April (3.4 pores/cm^2/leaf), and mid May (17.0 pore/cm^2/leaf) .

The parasitoid *M. nigra*. was counted on eggs of *C. vittata*. during the period from the last week of March to the second week of May. Parasitism ranged between zero% in the first week of April, to 19.5% in the first week of May, 2005 (Table,2). These results are in agreement with those obtained by El-Agamy *et al.* (1994 b&c), Youssef, (1994), Awadalla, (1996) and El-Zoghbey (1999).

c. The sugar beet moth, *S. ocellatella* Boyd:

Seasonal fluctuations in the infestation by this insect were carried out weekly through numbers of larvae directly were counted on 90 random plants (10/ variety/ plantation date). Results in Table (3) showed that, the infestation appeared in the second week of March later than the other two chewing pests and extended to 13, April, 4, May and 11, May, 2005, for the three plantation dates, respectively. The seasonal mean number of larvae was 54 /10 plants. The larval population density recorded two peaks during the activity period, in mid April with of 63.7 larvae /10 plants and in early May with 92 larvae/10 plants.

The parasitoid *Agathis* sp. was found attacking both larvae and pupae of *S. ocellatella* during the period from the last week of March to the second week of May. Percentages of parasitism fluctuated between 6.3 in the second week of April to 80 in the last week of March, 2005 (Table,3). These results are in agreement with those obtained by Abd-El-Ghany (1994) and El-Agamy *et al.* (1994 a & c).

III. Planting dates in relation to the insect infestation:

The effect of the three tested planting dates (last week of September, half of October and first week of November) on sugar beet infestation by the surveyed chewing insect pests was studied during 2004/2005 season. Results in Tables (1, 2 and 3), pointed to that, the relative abundance of these pests increased with the delaying of planting date. *C. vittata* infestation increased significantly as 2.4, 12.1 and 18.3 pores/cm^2/leaf for the early, moderate and late planting dates, respectively, Table (2). Also, the early planting date was effective since decreased the infestation by both *P. mixta* and *S. ocellatella* to 8.0 mines/leaf and 5.7 larvae/ 10 plants compared with 1.5 mines/leaf and 13.7-14.7 larvae/10 plants in the other late dates, respectively. These results revealed clearly that, September plantation is better for sowing sugar beet at Kafr El-Sheikh Governorate. and these are in agreement with those obtained by Youssef (1986), Awadaila, *et al.* (1992), Aly *et al.* (1993b), Talha (2001) and Helal (2004).

IV. Susceptibility of cultivars to the infestation:

Results illustrated in Tables (1, 2 & 3) indicated insignificant differences among susceptibilities of the three cultivars to the infestation by *P. mixta* and *C. vittata*. On the other hand, highly significant differences were detected among susceptibilities of the cultivars to the infestation by *S. ocellatella,* the variety *Pleno* was severly infested, 24.1 larvae/10 plants. On the contrary, *Carola* cultivar was the most tolerant, 11.8 larvae/10 plants. These results are in agreement with those obtained by Abo-Saied (1987) and Metwally *et al.* (1987),.

V. *P. mixta* infestation and sugar beet yield:

Results in Table (4) showed the effect of *P. mixta* infestation levels on different sugar beet yield components during 2005-2006 season. Statistical analysis revealed that, while there are significant negative relationships among these levels and each of root weight (r= -0.872), leaves weight (r= -0.728) and Sucrose quality percentage (r= -0.757), while the relation was also negative but insignificant in case of sucrose percentage (r= -0.449). From these results it could be noticed that, the infestation of *P. mixta* caused a significant decrease in the different sugar beet components except that of sucrose percentage. These results are in agreement with those obtained by Helal (2004).

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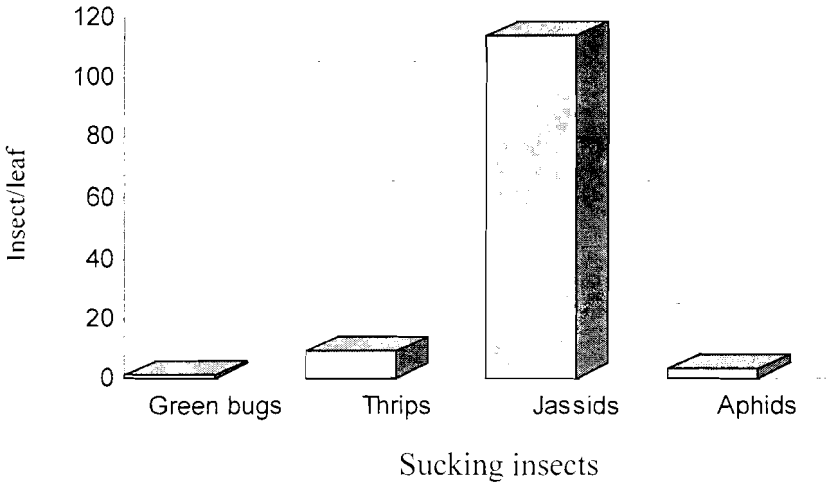

Fig. 1. Seasonal mean numbers of the sap-sucking insects.

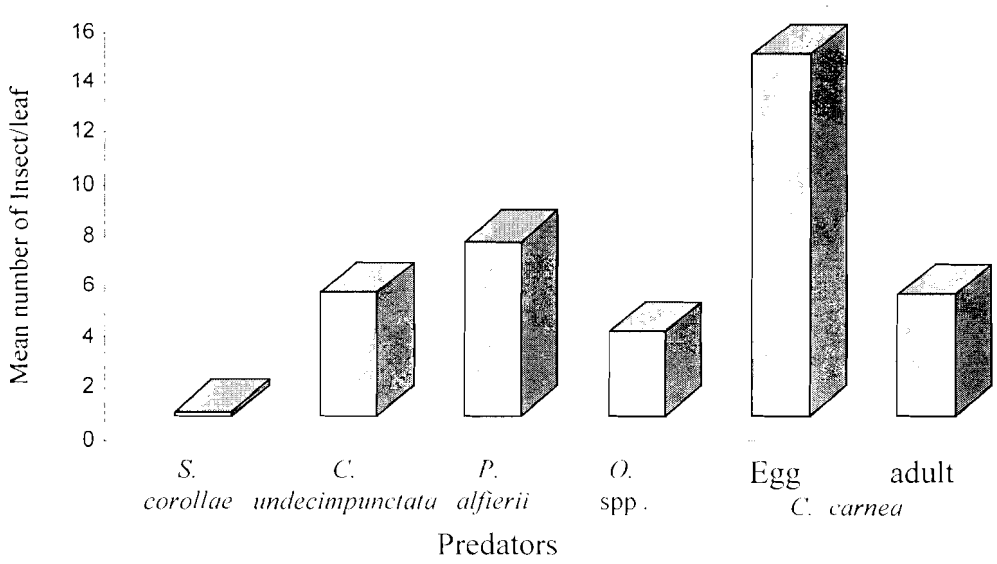

Fig. 2. Seasonal mean numbers of five predators associated with the sap-sucking insects.

Table 1. Weekly mean numbers of *pegomya mixta* mines/leaf of three sugar beet varieties planted at three different dates with the parasitism percentages by *Opius nitidulator*, 2004/2005 season.

Sampling dates	Plantation dates			Total	Varieties			Parasitism %
	Early (25,Sep.)	Moderate (16, Oct.)	Late (5,Nov.)		Carola	Oscar Boley	Pleno	
23, Feb., 2005	1.5	1.1	1.3	3.9	1.5	1.2	1.2	19.4
2, Mar.	1.3	1.1	1.9	4.3	1.2	1.3	1.8	14.3
9, Mar.	0.7	1.3	1.7	3.7	1.1	1.1	1.6	10.5
16, Mar.	0.02	1.5	1.5	3.0	1.0	0.8	1.2	12.2
23, Mar.	0.9	1.8	1.1	3.8	1.2	1.4	1.2	6.5
30, Mar.	1.1	1.4	1.4	3.9	1.2	1.4	1.3	2.8
6, Apr.	0.7	1.9	1.7	4.3	1.5	1.4	1.4	3.7
13, Apr.	0.7	1.8	1.6	4.1	1.4	1.3	1.4	2.9
20, Apr.	0.5	1.4	1.4	3.3	1.1	1.1	1.1	3.1
27, Apr.	0.4	1.8	1.4	3.6	1.4	1.1	1.1	3.0
Total	7.8	15.1	15	37.1	12.6	12.1	13.3	78.4
Mean	0.8	1.5	1.5	3.8	1.3	1.2	1.3	7.84

F value among varieties was 0.51 (insignificant).

F value among dates was 0.18 (insignificant).

Table 2. Weekly mean numbers of *Cassida vittata* pore/cm^2/leaf of three sugar beet varieties each at three different dates with the parasitism percentages by *Monothochaeta nigra*, 2004/2005 season.

Sampling on:	Dates			Total	Varieties			Parasitism %
	Early (25,Sep.)	Moderate (16, Oct.)	Late (5,Nov.)		Carola	Oscar Boley	Pleno	
23, Mar.	0.2	0.2	0.4	0.8	0.4	0.1	0.3	1.0
30, Mar.	0.7	0.9	0.4	2.0	0.6	0.9	0.5	2.8
6, Apr.	0.4	0.6	0.3	1.3	0.5	0.3	0.5	0.0
13, Apr.	1.1	2.0	0.3	3.4	0.9	1.5	1.0	8.6
20, Apr.	0.0	2.2	0.5	2.7	1.5	0.6	0.6	13.8
27, Apr.	0.0	2.4	0.5	2.9	0.8	1.2	0.9	10.
4, May	0.0	2.5	0.2	2.7	1.5	0.7	0.5	19.5
11, May	0.0	1.3	15.7	17.0	7.6	5.5	3.9	16.5
Total	2.4	12.1	18.3	32.8	13.8	10.8	8.2	72.2
Mean	0.3	1.5	2.3	4.1	1.7	1.3	1.0	9.02

F value among varieties was 0.47 (ns).

F value among plantation dates was 11.6, LSD= 0.52.

F value among varieties and plantation dates was 0.62(ns).

Table 3. Weekly mean numbers of *scrobipale ocellatella* larvae/10 plants of three sugar beet varieties planted at three dates with the parasitism percentages by *Agathis* sp.

Sampling on:	Dates			Total	Varieties			Parasitism
	Early (25,Sep.)	Moderate (16, Oct.)	Late (5,Nov.)		Carola	Oscar Boley	Pleno	%
30, Mar.	3.4	17.3	5.0	25.7	3.7	14.7	7.3	80.0
6, Apr.	7.0	4.3	11.0	22.3	3.7	0.0	18.6	12.4
13, Apr.	29.7	15.0	19.0	63.7	7.0	22.7	34.0	6.30
20, Apr.	0.0	17.7	24.3	42.0	8.0	11.0	23.0	14.3
27, Apr.	0.0	33.0	26.0	59.0	15.5	21.0	22.5	20.8
4, May	0.0	49.7	42.3	92.0	26.0	36.0	30.0	19.4
11, May	0.0	0.0	73.0	73.0	19.0	21.0	33.0	19.5
Total	40.1	137	200.6	377.7	82.9	126.4	168.4	172.7
Mean	5.7	19.6	28.7	54.0	11.8	18.1	24.1	24.67

F value among varieties was 5.76**, LSD= 9.8

F value among plantation dates was 0.53 (ns).

F value among varieties and plantation dates was 1.09(ns).

Table 4. The relationship among *pegomya mixta* infestation levels and sugar beet yield components.

Infestation level (mine/ leaf)	Root weight* (Kg)	Leaves weight* (Kg)	Sucrose (%)	Sucrose quality (%)
Zero (Control)	81.750	63.30	15.70	80.40
10-20	80.700	49.80	15.55	81.90
21-30	73.125	45.10	16.40	81.50
31-40	72.100	48.75	15.95	79.90
More than 40	72.750	46.60	14.70	76.80
Correlation coefficient (r)	.0872*	-0.728*	-0.449	-0.757*
Regression coefficient (b)	-0.23	0.301	0.02	-0.1

* For 25 plants

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دراسات بيئية على بعض الآفات الحشرية والطفيليات المصاحبة لها التي تصيب بنجر السكر في محافظة كفر الشيخ- مصر.

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٢. *معهد بحوث وقاية النباتات – مركز البحوث الزراعية – دقى - جيزة*

أجريت بعض الدراسات البيئية على بعض الآفات الحشرية التي تصيب بنجر السكر في محافظة كفر الشيخ خلال موسمي ٢٠٠٥/٢٠٠٤ و ٢٠٠٦/٢٠٠٥. ففي الموسم الأول اجري حصر شامل للحشرات التي تصيب بنجر السكر مع تتبع نشاطها الموسمي وكذلك الأعداء الطبيعية المصاحبة لها. كما تم دراسة تأثير ثلاثة مواعيد للزراعة (مبكرة- متوسطة- متأخرة وعلاقتها بحساسية ثلاثة أصناف من بنجر السكر للإصابة بذبابة أوراق البنجر (*بيجوميا ميكستا*)، خنفساء البنجر السلحفائية (*كاسيدا فيتاتا*) و فراشة البنجر العنكبوتية (*سكروبيبالبا اوسلاتيلا*). أوضحت النتائج ان موعد الزراعة المبكر (الأسبوع الثاني من سبتمبر) هو الأنسب لتقليل الإصابة بالآفات الثلاثة بصورة واضحة. كما أوضحت النتائج عدم وجود فروق معنوية فى قابلية الأصناف المختبرة للإصابة بكل من ذبابة أوراق البنجر وخنفساء البنجر السلحفائية، و كان الصنف بلينو أكثرها حساسية للإصابة بفراشة البنجر.

في الموسم الثاني ٢٠٠٦/٢٠٠٥ تم دراسة تأثير خمس مستويات للإصابة بذبابة البنجر على كل من وزن الجذور، وزن المجموع الخضري، النسبة المئوية للسكر والنسبة المئوية لجودة السكر أوضحت النتائج وجود علاقة عكسية عالية المعنوية بين الإصابة وكل من الصفات النباتية المذكورة عدا النسبة المئوية للسكر حيث كانت غير معنوية.

وعلى ذلك ننصح بالزراعة المبكرة في النصف الثاني من سبتمبر (عقب المحاصيل الصيفية المبكرة النضج) حيث تكون اقل عرضة للإصابة بالآفات الحشرية المذكورة. ويكون الحصاد كذلك مبكرًا.