

POPULATION DENSITY OF THE BEET FLY, *Pegomia mixta* VILL AND THE BEET WEEVIL, *Lixus junci* BOHR ON SUGARBEET VARIETIES AND THEIR ASSOCIATED WEEDS AND STUDY THE SUSCEPTIBILITY OF CERTAIN SUGARBEET VARIETIES TO THESE INSECTS AT FAYOUM GOVERNORATE

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ABSTRACT

Population density of the beet fly, *Pegomia mixta* Vill and the beet weevil, *Lixus junci* Bohr were studied on the chard and the dock weeds growing normally in sugarbeet fields at Fayoum Governorate during the growing seasons of sugarbeet crops 2001/2002 and 2002/2003. In general, the highest peaks of abundance of *P. mixta* eggs and larvae was occurred on the chard weed during the period extended from 6th of Feb. to 27th of Apr. and from 8th of Mar. to 27th of Apr. in the 1st season; from 23rd of Dec. to 3rd of Mar., respectively. The counts of the eggs and larvae showed that infestation of *P. mixta* vill occurred firstly on the chard weeds then transmitted to sugarbeet plants. As for the eggs and larvae stages of the beet weevil *L. junci*, the highest peaks of abundance was occurred on the dock weeds during the period extended from 18th of Mar. to 7th of Apr. and from 18th of Mar. to 17th of May in the 1st season, respectively. Also in the 2nd season the total number of eggs and larvae was high during the period from 13th of Mar. to 2nd of May and from 23rd of Mar. to 22nd of May, respectively. Results indicated that the weed acts as a suitable alternative host and direct source of *P. mixta* and *L. junci* infestation to sugarbeet plants. So, clean cultivation and removal of the chard and the dock weeds could be minimized the population density of *P. mixta* and *L. junci* on sugarbeet plants.

Sugarbeet variety Betapoly 4 infested with highest numbers of *P. mixta*, while Gitane variety received the least numbers in the 1st season 2001/2002. Also, kawsa 12 variety harbored the highest numbers of *P. mixta* in the 2nd season 2002/2003. The highest numbers of *L. junci* occurred on Betaboly 4 variety during the two seasons 2001/2002 and 2002/2003.

Also, there was no effect of the total numbers of predator, *Chrysopa carnæ* and true spider on the total number of *P. mixta* eggs.

INTRODUCTION

Sugarbeet (*Beta vulgaris* L.) provides about 40% of the world sugar production and represents the 2nd source of sugar production in Egypt. During the last few years, infestation of sugarbeet crop with numerous insects were noticed in different regions of Egypt including Fayoum Governorate, which feed on these plants causing economic damage and resulting in yield reduction (Abo-Aiana 1991, Bennewicz 1995, Campell of Hutchison 1995, Bassyouny 1998, and Ei-Gendi 2003).

Also, these insects live on the weeds as alternative hosts to the principal host. Some insects take the weed as a shelter during the adverse

environmental conditions, and they transmit to the cultivated crops and cause serious damage (Bosch 1987, Aly 1988 and Tothova *et al.* 2003).

Therefore, the present work aimed to:

- (1) Study the population density of the different immature stages eggs and larvae of *P. mixta* and *L. junci* on two types of weeds, the chard weed *Beta vulgaris* var. *cicla* L. and the dock weed *Rumex dentatus* L. (Fam. Chenopodiaceae), associated with sugarbeet plants at Fayoum Governorate. The infestation size of the pest in the two tested hosts can help in the following integrated pest management program.
- (2) Also, study the relative susceptibility of four sugarbeet varieties to infestation with two economic insects, *P. mixta* and *L. junci* in sugarbeet fields.
- (3) Study the natural enemies (spider and *Chrysopela carnea*) associated with *P. mixta* eggs.

MATERIAL AND METHODS

About ¼ feddan of sugarbeet plants (Gitane variety) was planted in the farm of the Faculty of Agriculture at Fayoum to evaluate the population density of the different immature stages eggs and larvae of *P. mixta* and *L. junci* in sugarbeet plants and two types of weeds, the chard weed *B. vulgaris* var. *cicla* and the dock weed *R. dentatus*, during two successive seasons (2001/2002 and 2002/2003).

Sampling started three weeks after plantation on 1st week of December. Sampling technique was carried by taking (every ten days) 20 leaves from sugarbeet and 20 plants from each weed and kept in polyester bags and were examined in laboratory. The relationship between the population fluctuation of insect species and the weather factors was calculated by applying the simple correlation (Snedecor 1956).

Also, four varieties of sugarbeet namely Ito, Kwsa 12, Gitane and Betapoly 4 were chosen to evaluate their relative susceptibility to infestation with two insects; the beet fly *P. mixta* Vill and the beet weevil *L. junci* Bohr. during two successive seasons (2001/2002 and 2002/2003). To achieve this evaluation, ¼ feddan was used in the farm of the Faculty of Agriculture at Fayoum Governorate. This area was divided into 4 sections (21 m² each). Every section was cultivated with sugarbeet variety. Each section was divided into four divisions (replicates). Sampling started three weeks after date of plantation (Nov. 14). Sampling technique was carried by taking 40 leaves from each variety every ten days, kept in polyester bage and were examined in the laboratory. The data obtained were statistically analyzed by using F. test and L.S.D. value was carried out Snedecor and Cochran 1980.

Survey of *P. mixta* eggs and the associated of the natural enemies were made during the two seasons 2001/2002 and 2002/2003 at regular interval of 10 days.

RESULTS AND DISCUSSION

1- Population density of the beet fly *P. mixta*.

As shown in Table (1) in the first season the period of deposited eggs on chard weeds extended from 8th of Dec. 2001 to 7th of May 2002. The number of eggs were fluctuated with up and down, the highest number of

eggs was 334 egg/20 plants on mid Apr. and the lowest number was 1 egg/20 plants on 7th of Jan. Three peaks on chard weeds were recorded 41, 180 and 334 eggs/20 plants in the last week of Feb., the 1st week of Apr. and mid Apr., respectively. While the deposited eggs on sugarbeet plants were started from late of Jan. with 7 eggs/20 leaves and continued little to mid Feb. After that the deposited eggs increased during the period extended from late Feb. to mid Apr. The highly numbers of eggs were 56, 60 and 73 eggs/20 leaves on 26th of Feb., 28th of Mar. and 7th of Apr., respectively. However, from the above data it was appeared that the deposited eggs on chard were higher than the deposited eggs on sugarbeet plants. Also, the period of deposited eggs continued longer on the chard weed than on sugarbeet plants. The total number of eggs on the chard weed was 795 eggs/total samples during the 1st season while it was 280 eggs/total samples on sugarbeet during the same season.

On the other hand, larval numbers (26 larvae/20 plants) were recorded in 8th of December 2001, on chard weeds. Four peaks of larvae 36, 22, 53 and 70 larvae/ sample were recorded in 18th of Dec., 6th of Feb., 8th of Mar. and 27th of Apr., respectively. While it was one peak recorded on sugarbeet plants in 28th of Mar. (181 larvae/20 leaves) Table (1).

Table (1): Seasonal abundance of *P. mixta* eggs and larvae on different host plants during the first season 2001/2002 at Fayoum Governorate.

Sampling date	Eggs			Larvae		
	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves
Dec. 8	32	0	0	26	0	0
18	2	0	0	36	0	0
28	20	0	0	12	0	0
Jan. 7	1	0	0	2	0	0
17	8	0	0	1	0	0
27	3	0	7	2	0	0
Feb. 6	17	0	9	22	0	8
16	5	0	3	0	0	3
26	41	0	56	6	0	50
Mar. 8	15	0	26	53	0	145
18	37	0	42	43	0	165
28	40	0	60	34	0	181
Apr. 7	180	0	73	46	0	140
17	334	0	4	59	0	13
27	56	0	0	70	0	16
May 7	4	0	0	3	0	0
17	0	0	0	0	0	0
27	0	0	0	0	0	0
Total	795	0	280	415	0	751

Data in Table (2) indicated that *P. mixta* female laid the eggs during the second season on chard weed (2 eggs/20 plants) on 3rd of December 2002 before four weeks of initial egg infestation on sugarbeet. Two peaks on chard weed were recorded (16 and 14 eggs/20 plants) on 23rd of Dec. and

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22nd of Jan., respectively. While one peak was recorded 106 eggs/20 leaves of sugarbeet plant on 13th of Mar. However, the total number of eggs which laied on sugarbeet plants was higher than the total number of eggs on chard weed and the egg population on chard weed was absent after the 1st week of Mar. while it was absent on sugarbeet after the end of Apr.

On the other hand, larvae of *P. mixta* appeared early on chard weed with 7 larvae/20 plants on 3rd of Dec. while on sugarbeet leaves, infestation started four weeks after the time of appearance on chard weed. Three peaks of larvae infestation were recorded on chard with 32, 25 and 19 larvae/20 plants in 23rd of Dec., 22nd of Jan. and 3rd of Mar., respectively. One peak 286 larvae/20 leaves of sugarbeet plants was recorded in the 2nd week of Mar.

Generally, the 1st growing season was longer than the 2nd season. However, the beet fly *P. mixta* emerged early and deposited eggs on the chard weed before sugarbeet plants. The infestation began on the chard weed, 1-2 months before sugarbeet plants. The total number of immature stages of *P. mixta* was higher in the 1st season than in the 2nd season.

It could be concluded that, the chard weed was a suitable alternative host plants and acted as source of *P. mixta* infestation after hibernation period. So, it is great importance that clean cultivation of sugarbeet and removal of chard weed in sugarbeet fields can help in minimizing the beet fly infestation in an IPM program. These results are in agreement with these of Bosch, 1987; Aly 1988 and Tohova *et al.*, 2003.

Table (2): Seasonal abundance of *P. mixta* eggs and larvae on different host plants during the second season 2002/2003 at Fayoum Governorate.

Sampling date	Eggs			Larvae		
	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves
Dec. 3	2	0	0	7	0	0
13	0	0	0	4	0	0
23	16	0	0	32	0	0
Jan. 2	2	0	0	0	0	0
12	4	0	1	14	0	3
22	14	0	10	25	0	16
Feb. 1	5	0	4	3	0	12
11	0	0	14	18	0	41
21	2	0	31	11	0	57
Mar. 3	4	0	52	19	0	114
13	0	0	106	0	0	286
23	0	0	39	0	0	225
Apr. 2	0	0	37	0	0	126
12	0	0	25	0	0	70
22	0	0	9	0	0	8
May 2	0	0	0	0	0	0
12	0	0	0	0	0	2
22	0	0	0	0	0	0
Total	49	0	328	133	0	960

2. Population density of the beet weevil *L.junci*

Data obtained in Table (3) revealed that *L. junci* female laied eggs during the first season on the chard (3 eggs/20 plants) in 8th of Mar. The eggs

were laid on the dock weed and sugarbeet plants (15 eggs/20 plants) and (one egg/20 leaves) in 18th of Mar. and 28th of Mar., respectively. On the other hand the highest number of eggs was laid on the dock weed and sugarbeet plants (97 eggs/20 plants and 11 eggs/20 leaves) in 7th of Apr. and 17th of May, respectively. However, the beet weevil preferred to lay the eggs on the dock weed.

As for larvae began to appear on chard weed (6 larvae/20 plants) in 8th of Mar., then the larvae were appeared on the dock weed and sugarbeet on 18th of Mar. (12 larvae/20 plants and 15 larvae/20 leaves) respectively. The larvae continued appeared on the sugarbeet and dock weed during the period extended from 18th of Mar. till 27th of Apr. and from 18th of Mar. till 17th of May, respectively. The total number of larvae during this period was 136 larvae on the dock weed and 71 larvae on sugarbeet. So these weeds considered the prefer host for the beet weevil, *L. junci*.

Data in Table (4) and indicated that the beet weevil prefer to lay the eggs during the second season on the dock weed and this start from 3rd of Mar. to 12th of May with total number 215/total samples while it laid 4 eggs/20 leaves only in 12th of May on sugarbeet. Also, the beet weevil laid about (43 eggs/samples) during the period from 3rd of Mar. to 23rd of Mar. on the chard weed. On the other hand, the larvae appeared on sugarbeet (2 larvae/20 leaves) on 22nd of Apr. and continued to 22nd of May with total number 27 larvae. While infestation started early on the dock and chard weed. Two peaks were recorded on the dock and chard weed and their counts were 36 and 62 larvae/20 plants in 23rd of Mar. and 12th of Apr., respectively. On the chard weed one peak occurred (37 larvae/20 plants) in 23rd of March.

Table (3): Seasonal abundance of *L. junci* eggs and larvae on different host plants during the first season 2001/2002 at Fayoum Governorate.

Sampling date	Eggs			Larvae		
	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves
Dec. 8	0	0	0	0	0	0
18	0	0	0	0	0	0
28	0	0	0	0	0	0
Jan. 7	0	0	0	0	0	0
17	0	0	0	0	0	0
27	0	0	0	0	0	0
Feb. 6	0	0	0	0	0	0
16	0	0	0	0	0	0
26	0	0	0	0	0	0
Mar. 8	3	0	0	6	0	0
18	0	15	0	0	12	5
28	0	36	1	0	27	10
Apr. 7	0	97	0	0	34	4
17	0	2	2	0	17	9
27	0	4	0	0	16	9
May 7	0	0	6	0	21	10
17	0	0	11	0	9	24
27	0	0	0	0	0	0
Total	3	154	20	6	136	71

Table (4): Seasonal abundance of *L. junci* eggs and larvae on different host plants during the second season 2002/2003 at Fayoum Governorate.

Sampling date	Eggs			Larvae		
	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves	Chard/20 plants	Dock/20 plants	Sugarbeet/20 leaves
Dec. 3	0	0	0	0	0	0
13	0	0	0	0	0	0
23	0	0	0	0	0	0
Jan. 2	0	0	0	0	0	0
12	0	0	0	0	0	0
22	0	0	0	0	0	0
Feb. 1	0	0	0	0	0	0
11	0	0	0	0	0	0
21	0	0	0	0	0	0
Mar. 3	2	9	0	0	2	0
13	15	35	0	25	1	0
23	23	20	0	37	36	0
Apr. 2	3	53	0	20	34	0
12	0	37	0	21	62	0
22	0	32	0	12	57	2
May 2	0	25	0	0	51	3
12	0	4	4	0	51	18
22	0	0	0	0	39	4
Total	43	215	4	115	333	27

3: Influence of temperature and relative humidity :

As shown in Table (5) the effect of max. temp. on the population density of the beet fly *P. mixta* eggs on the chard weed was significant (0.497*), also the effect of min. temp. (0.540*); while it was insignificant for RH % (0.439). The effect of max., min. temp. and RH% was insignificant on population density of larvae of *P. mixta* during the 1st season. While in the second season, the effect of max. temp. on the eggs and larvae of *P. mixta* on the chard weed was significant (-0.512*) and highly significant (-0.620**), respectively. Also, the effect of RH% on the eggs and larvae on the same weed was significant (0.547* and 0.509*), respectively.

Table (5): Correlation between *P. mixta* and *L. junci* population (number of eggs and larvae) and major weather factors during two seasons 2001/2002 and 2002/2003.

Activity period from-to	Immature stage	Weather factors			Activity period from-to	Immature stage	Weather factors					
		Temp. c°		R.H%			Temp. c°		R.H%			
		Max.	Min.				Max.	Min.				
1st season				1st season								
<i>P. Mixta</i> on chard				<i>L. Junci</i> on dock								
18/12/2001	Eggs	0.497*	0.540*	0.439	18/3/2002	Eggs	0.558	0.508	0.698			
17/5/2002	Larvae	0.452	0.387	0.342	17/5/2002	Larvae	0.479	0.369	0.579			
2nd season				2nd season								
13/11/2002	Eggs	-0.512*	-0.136	0.547*	3/3/2003	Eggs	0.210	0.126	0.308			
13/3/2003	Larvae	-0.620**	0.358	0.509*	22/5/2003	Larvae	0.764**	0.671**	-0.730**			
				2nd season								
				<i>L. Junci</i> on chard								
				3/3/2003				Eggs		0.159	0.245	-0.070
				22/5/2003				Larvae		0.140	-0.062	-0.158

Also, the effect of max. & min. temperature and RH % on the eggs and larvae of the beet weevil *L. junci* on the dock weed was insignificant during the first season while in the second season, the effect of max. temp. on the larvae of the beet weevil on the dock weed was highly significant (0.764** and 0.671**), respectively, also the effect of RH % on the larvae on the same weed was highly significant (-0.730**).

The effect of max. & min. temp. and RH% on the eggs and larvae of the beet fly *P. mixta* on the chard weed was significant during the second season.

4- Relative susceptibility of four sugarbeet varieties to *P. mixta* Infestation:

Data presented in Table (6) showed that in the 1st season of 2001/2002, Beta poly 4 variety was more susceptible than the other three varieties kwsa, 12, Ito and Gitane to *P. mixta* infestations, with average numbers 126.1, 115.4, 115 and 113.7 for both eggs & larvae /40 leaves, respectively. The statistical analysis of the data indicated that there was no significant differences in susceptibility between these four varieties.

In the 2nd season 2002/2003, the data presented in Table (6) cleared that, Kwsa 12 variety was more susceptible than Gitane, Betapoly 4 and Ito varieties to *P. mixta* infestation with average numbers 123.3, 116.8, 103.6 and 100.3 individuals /40 leaves, respectively. The statistical analysis of the data indicated a significant differences in susceptibility between these four varieties. El-Sherif *et al.*, (1993) mentioned that there was a high rates of infestation with *Pegomia hyoscyami* Penz on both sugarbeet varieties (Palyrave and Kawe mono). Solouma (1989) reported that all sugarbeet varieties were liable to infestation with *P. mixta*, also Sayed (2001) indicated that Raspoly of sugarbeet variety was more susceptible to infestation with *P. mixta* than Samba, Pamela and Farida varieties.

Table (6): Mean numbers of the sugar beet fly *P. mixta* eggs and larvae on the different sugar beet varieties during the two successive seasons at Fayoum Governorate.

Sugarbeet varieties	Season	Season
	2001/02	2002/03
Ito	115	100.3 ^a
Kwsa (12)	115.44	123.3 ^{ab}
Gitane	113.78	116.8 ^{bc}
Betapoly 4	126.11	103.6 ^c
F. test	0.342	4.041
L.S.D.	-	15.6

5- Relative susceptibility of four sugarbeet varieties to *L. junci* Infestation:

As shown in Table (7) in the first season of 2001/2002, Betapoly 4 variety was more susceptible than Gitane, kwsa 12 and Ito varieties to *L. junci* infestation with average numbers 12.3, 11.4, 9.0 and 7.8 eggs and larvae/40 leaves, respectively. The statistical analysis of the data indicated no significant differences in susceptibility between these four varieties, (Table 7).

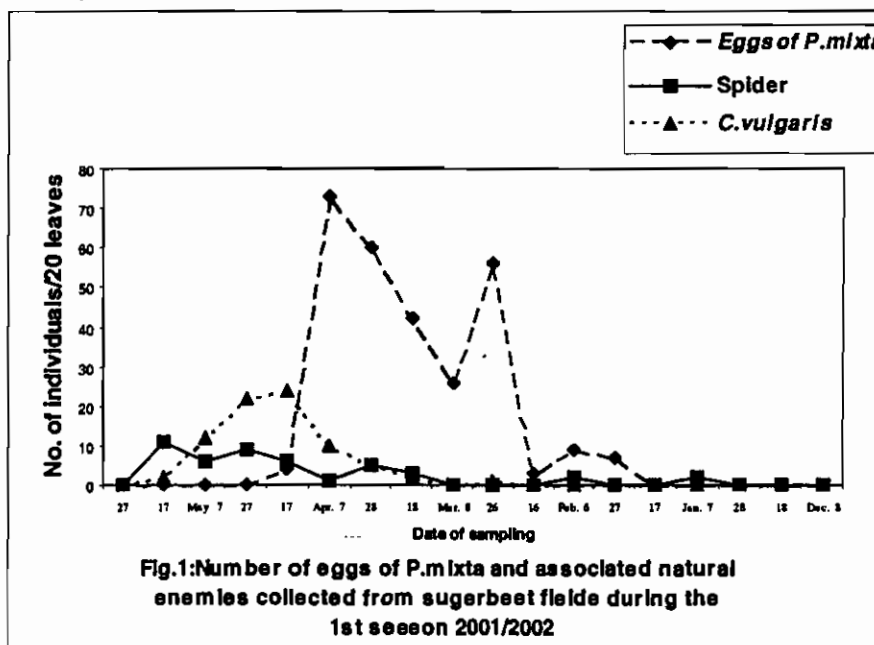
In the 2nd season of 2002/2003, the data presented in Table (7) showed that, the same variety Betapoly 4 was more susceptible to infestation with *L. junci* than Ito, Kwsa 12 and Gitane varieties. The analysis of variances indicated that there were no significant differences between these varieties. Sayed (2001) indicated the same results.

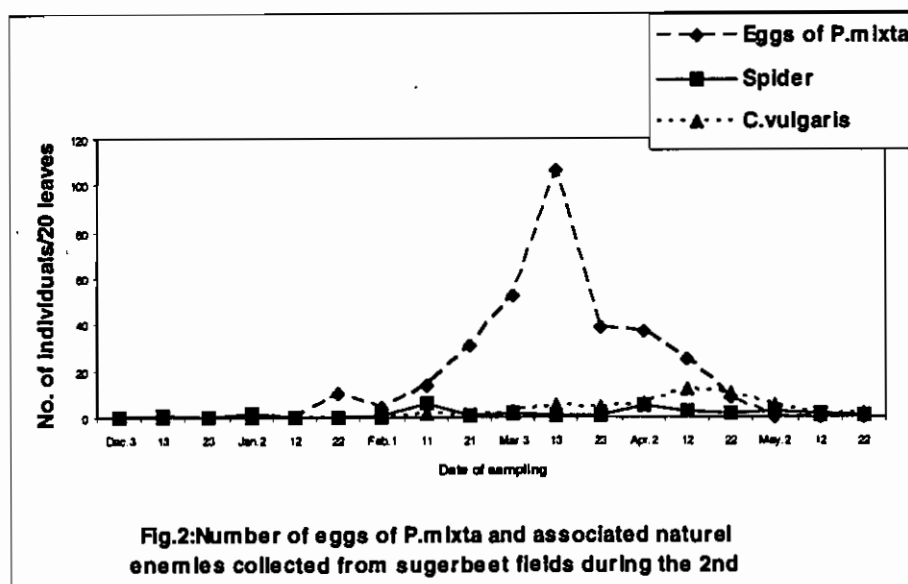
Table (7): Mean numbers of the sugar beet weevil *L.junci* eggs and larvae on the different sugar beet varieties during the two successive seasons at Fayoum Governorate.

Sugarbeet varieties	Season	Season
	2001/02	2002/03
Ito	7.8	8.7
Kwsa (12)	9.0	5.2
Gitane	11.4	4.5
Betapoly 4	12.3	9.5
F. test	1.294	2.14
L.S.D.	-	-

6- Natural enemies associated with *P. mixta* eggs:

As shown in Figs. (1 & 2), the population density of predators (Spiders and *C. carae*) per 20 leaves on sugarbeet plants during the 1st season 2001/2002 began low numbers 2 individuals of spider in Feb. 6 and one individual of *C. carae* in Feb 26. then the numbers of both predators increased during the period extended from 18th of Mar. to 17th of May with a peak (9 individuals/20 leaves) for spiders and (24 individuals/20 leaves) for *C. carae*).





In the 2nd season (2002/2003), few numbers of spider began to appear from 13th of Dec. (one individual/20 leaves) then increased slowly and reached (6 individuals/20 leaves) on 11th of Feb. and continued to 22nd of May. while the *C. carnea* appeared during the period extended from 11th of Feb. to 22nd of May with highest numbers (12 individuals / 20 leaves) on 12th of Apr. as for statistical analysis during the two seasons (2001/2002 and 2002/2003), the simple correlation values of the number of the two predators the spiders and *C. carnea* were insignificant on the number of *P. mixta* eggs.

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كثافة تعداد حشرتي ذبابة البنجر *Pegomia mixta* Vill وسوسة البنجر *Lixus junci* Bohr على بنجر السكر والحشائش المصاحبة له ودراسة لحساسية أصناف البنجر للإصابة بهاتين الحشرتين في محافظة الفيوم

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تمت دراسة كثافة تعداد حشرتي ذبابة البنجر *Pegomia mixta* ، وسوسة البنجر *Lixus junci* على حشائش السلق والحميض التي تنمو طبيعياً في حقول بنجر السكر في محافظة الفيوم أثناء موسم نمو محصول البنجر خلال موسمين متتاليين هما ٢٠٠٢/٢٠٠١، ٢٠٠٣/٢٠٠٢. وبصفة عامة كان أعلى تعداد لذبابة البنجر على السلق خلال الفترة ما بين ٦ فبراير إلى ٢٧ أبريل بالنسبة للبيض، ٨ مارس - ٢٧ أبريل لليرقات خلال الموسم الأول ٢٠٠٢/٢٠٠١، ومن ٢٣ ديسمبر - ٢٢ يناير بالنسبة للبيض، من ٢٣ ديسمبر إلى ٣ مارس بالنسبة لليرقات خلال الموسم الثاني ٢٠٠٣/٢٠٠٢. وقد ظهر أن الإصابة بطوري البيض واليرقات لذبابة البنجر تحدث في الحقل على نباتات السلق أولاً ثم تنتقل إلى نباتات بنجر السكر. أما بالنسبة لطور البيض واليرقات لسوسة البنجر فوجد أن أعلى تعداد لهما كان على حشائش الحميض خلال الفترات من ٢٨ مارس - ٧ أبريل، ١٥ مارس - ١٧ مايو في الموسم الأول ٢٠٠٢/٢٠٠١. أما في الموسم الثاني فكان خلال الفترات من ١٣ مارس - ٢ مايو، ٢٣ مارس إلى ٢٢ مايو على التوالي. وقد وجد أن الحشائش تعتبر المائل البديل والمصدر المباشر لتعداد ذبابة البنجر وسوسة البنجر على نباتات بنجر السكر ولذلك فإن نظافة الزراعات وإزالة الحشائش من حقول بنجر السكر يمكن أن يقلل الإصابة بهاتين الحشرتين.

كذلك تمت دراسة حساسية أربع أصناف من بنجر السكر للإصابة بذبابة البنجر وسوسة البنجر خلال موسمي الدراسة ٢٠٠٢/٢٠٠١، ٢٠٠٢، ٢٠٠٣ وتبين من النتائج أن الصنف 4 Betapoly يستقبل أعلى تعداد من الحشرة بينما الصنف Gitane يستقبل أقل تعداد من هذه الحشرة وذلك خلال الموسم الأول ٢٠٠٢/٢٠٠١.

بينما وجد أن الصنف 12 Kwass يستقبل أعلى تعداد من ذبابة البنجر خلال الموسم الثاني من الدراسة ٢٠٠٣/٢٠٠٢. أيضاً وجد أن الصنف 4 Betapoly يستقبل أعلى تعداد من سوسة البنجر خلال موسمي الدراسة. كذلك وجد أن المقترسات من العناكب وأسد المن *Chrysopela carnae* كانت مصاحبة لبيض ذبابة البنجر خلال فترة الدراسة وكان تأثيرها على تعداد البيض غير معنوي.