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SUGAR BEET PLANT STAND IN AUGUST CULTIVATION AS INFLUENCED BY COTTON LEAFWORM INFESTATION AND ROLE OF ARTHROPOD PREDATORS IN INSECT MANAGEMENT

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ABSTRACT

Field experiments were conducted at sugar beet fields at four districts (Kafr El-Sheikh, Qualleen, El-Riad and El-Hamoul) of Kafr El-Sheikh Governorate during three successive seasons, 2007/08, 2008/09 and 2009/10 seasons. The experiments aimed to monitor population fluctuations of cotton leafworm larvae on sugar beet planted on August 1st as first cultivation. The reductions in plant stand due to *Spodoptera littoralis* Boisd attacks were computed, and the correlations between this insect pest and each of predators and some weather factors were calculated. The highest population density of *S. littoralis* larvae was found during September and October with densities of 81.00 – 113.25, 95.00 – 126.25 and 119.25 – 18350 larvae/10 sugar beet plants in 2007/08, 2008/09 and 2009/10 sugar beet seasons, respectively. The high infestation by cotton leafworm synchronized with high temperature prevailing in September and October as compared with those prevailing in November and December. The coccinellid, true spiders and *Chrysoperla carnea* Steph. populations were high during September. The plant stand was heavily reduced due to *S. littoralis* attacks with values ranging between 93.67 and 94.52% at the four districts. Correlation coefficient values were highly significant between *S. littoralis* larval population and each of coccinellid and *C. carnea* populations.

INTRODCUTION

Sugar beet, *Beta vulgaris* L. is an important industrial crop that produces about one quarter of the world's sugar in temperate climates, where sugarcane can not grown (Draycott 2006).

This crop is subject to infestations of several insect pests resulting in yield losses of about 10-20% (Ferry *et al* 2006). Sugar beet is planted in Egypt in four cultivations, beginning from August up to November. Since the first cultivation is planted as early as August, where temperature is high, the cotton leafworm is the most dangerous insect pest attacking this crop. Severe infestations of *S. littoralis* for sugar beet may inforce the growers to re-plant the crop, which results in late-sowing and losses in crop seeds.

In a laboratory study, Mesbah (1984) estimated the leaf area of sugar beet consumed by the entire larval stage of *S. littoralis* as 239.26 cm^2/larva. This consumption of leaf area was evaluated by Afifi and Mesbah (1990) as about 21% of total sugar beet leaf area, most of which were consumed by fifth and sixth *S. littoralis* larval instars. The consumed area of sugar beet leaf was assessed by Bassyouny (1998) as about 151 cm^2/cotton leafworm larva.

El-Gendi *et al* (2006) showed, in a laboratory study, that entire larval stage of *S. littoralis* consumed about 114 cm^2 of sugar beet leaves. The damage of *S. littoralis* in the first sugar beet cultivation was also indicated as high by Bazazo (2005 & 2010) and Bahgat (2010).

The highest population density of *S. littoralis* was recorded in September plantation followed by that of October plantation and then by November one (Abo-Saied Ahmed,1987 Shalaby, 2001).

This investigation was conducted to reveal the population fluctuations of *S. littoralis* infestation on sugar beet plants sown early in August (first cultivation). The reduction in plant stand, due to insect infestation, at four districts of Kafr El-Sheikh Governorate was estimated. Also, the dominant predators associated with *S. littoralis* were surveyed, and correlation coefficient values were computed between the insect pest and each of predators and some weather factors.

MATERIALS AND METHODS

1. Experimental field:

Experiments have been performed at four districts of Kafr El-Shiekh Governorate; Kafr El-Sheikh, Qualleen, El-Riad and El-Hamoul during three sugar beet successive seasons; 2007/08, 2008/09 and 2009/10. The experimental area was prepared, and sown with Pleno sugar beet cultivar on first of August every season. This date of sowing was selected to mimic the infestation of cotton leafworm, *S. littoralis* occurs in sugar beet fields sown on early August, when the temperature is high. All recommended cultural practices were applied along the growing seasons without insecticide applications.

2. Population fluctuations of cotton leafworm, and associated predators:

Sampling started one month after sowing and continued till one month before harvest. At 10-day intervals, the plants were visually examined in the field and occurring *S. littoralis* larvae were counted per 10 sugar beet plants. Also, adults of coccinellids and *C. carnea*, and spiderlings and adults of true spiders were counted. The sampling continued at 10-day intervals.

3. Reduction in sugar beet plant stand caused by cotton leafworm:

At the four districts, sugar beet was sown by the first of August in an area of about 1/2 feddan. This area was divided into two sections (1/4 feddan each) and every sections was divided into plots (42 m^2 each), and the plants in each plot was adjusted 300 plants to count 30,000 plants/feddan as a recommended stand. The first part (1/4 feddan) was completely protected from insect infestations using the insecticide; Selecron 750 ml/feddan every 20 days beginning from first of September till mid-December. The second area was left to natural insect infestation (without insecticide). The number of insect larvae was recorded every 10 days as previously mentioned. One month before harvest, the numbers of plants/plot were recorded in both treated and untreated parts and the reduction percentages in plant stand in untreated areas were calculated.

RESULTS AND DISCUSSION

1. Population fluctuations of cotton leafworm, *S. littoralis*:

As shown in Table (1) the sugar beet plants of August plantation were greatly attacked by cotton leafworm which caused great damage. The highest population density of the cotton leafworm larvae was found in September and October which recorded numbers of insect larvae ranging 81.00-113.25, 95.00-126.25 and 119.25-183.50 larvae/10 sugar beet plants in 2007/08, 2008/09 and 2009/10 seasons, respectively. The population density of the insect larvae gradually decreased as the age of the sugar beet progressed. The last examination conducted on December, 20th witnessed the lowest larval density; 0.25, 1.25 and 6.50 larvae/10 sugar beet plants in the three seasons, respectively. Data revealed that the high infestation of sugar beet plants resulting from *S. littoralis* synchronized with high temperature prevailing in September and October (ranging between 23.60 and 26.30 °C). Decline in temperature during November and December (16.50-22.70 °C) was accompanied by low larval population.

Table (1): Population fluctuations of *Spodoptera littoralis* larvae in sugar beet fields as effected by weather factors during three successive seasons at Kafr El-Sheikh region.

Sampling date		*S. littoralis* Av. No. /10 sugar beet plants				Weather factors (Av.)	
		2007/08	2008/09	2009/10	Mean	Temp. ºC	RH %
Sept.	1	98.25	124.00	169.50	130.58	26.10	65.80
	10	81.00	125.00	183.50	129.83	26.30	62.80
	20	113.00	95.50	178.50	129.00	26.00	61.00
Oct.	1	113.25	126.25	173.00	137.50	24.90	60.50
	10	92.50	97.00	121.00	103.50	23.60	63.40
	20	88.50	102.75	119.25	103.35	25.80	62.80
Nov.	1	77.00	81.25	94.75	84.33	22.70	65.30
	10	62.00	66.00	47.75	58.58	19.20	63.40
	20	30.00	59.25	17.00	35.41	18.20	64.90
Dec.	1	4.00	35.00	8.75	15.91	17.60	64.50
	10	0.50	4.25	6.50	3.75	16.50	65.60
	20	0.25	1.25	7.50	3.00	16.50	63.30

As shown in Table (2) coccinellid (different species) population, as an average of thee seasons, was relatively high during September and October, with a peak of 23.16 coccinellids on 20 September. Then, the population density declined, but exhibited another peak of 15.00 coccinellids/10 plants on November 20th.

Table (2): Population fluctuations of predators in sugar beet fields and its effected with weather factors during three successive seasons at Kafr El-Sheikh region.

Sampling date		Predator Av. No. /10 sugar beet plants											
		Coccinellids (Adults)				True spiders (Spiderling & Adult)				*Chrysoperla carnea*			
		2007/08	2008/09	2009/10	Mean	2007/08	2008/09	2009/10	Mean	2007/08	2008/09	2009/10	Mean
Sept.	**1**	31.00	16.75	9.00	18.91	26.50	24.50	27.75	26.25	10.25	16.00	27.75	18..00
	10	27.50	21.50	10.00	19.66	34.75	17.75	30.50	27.66	6.25	10.75	19.75	12.25
	20	29.25	29.25	11.00	23.16	32.25	22.50	41.00	31.91	8.40	13.25	12.75	11.46
Oct.	**1**	22.75	25.50	7.00	18.41	23.25	32.25	31.25	28.91	7.25	15.25	6.25	9.58
	10	16.25	23.00	8.25	15.83	25.00	35.50	36.00	32.16	10.75	11.75	11.75	7.50
	20	12.75	23.50	10.00	15.41	24.00	33.25	38.50	31.91	6.26	14.00	10.75	10.33
Nov.	**1**	14.00	21.75	10.50	15.41	25.25	35.75	17.00	26.00	4.75	1.00	4.25	3.33
	10	18.75	27.00	11.25	19.00	14.75	19.25	23.00	19.00	16.00	1.75	3.25	7.00
	20	17.25	18.75	9.00	15.00	18.75	39.00	12.00	23.25	4.25	2.25	5.50	4.00
Dec.	**1**	7.75	9.75	9.75	9.08	16.00	20.50	14.00	16.83	2.25	2.75	2.50	2.50
	10	8.75	9.00	13.25	10.33	11.75	26.00	19.75	19.16	2.25	1.50	0.75	1.50
	20	4.50	5.00	29.25	12.91	16.75	40.75	49.75	35.75	1.25	2.50	1.50	1.75

2. Population fluctuations of predators associated with cotton leafworm:

True spider population density was high during September and October, ranging between 27.75 and 41.00 spiderlings and adults/10 sugar beet plants.

Chrysoperla carnea predator was recorded as eggs and larvae. The average of the three seasons was high during September (11.46-18.00 individuals/10 plants) but decreased during December (1.50-2.50 individuals/ 10 plants).

Talha (2001) found that highest spider population in September sugar beet plantation. On the other hand, El-Agamy *et al* (1996) showed that the maximum population of Paederus alfierii and *Chrysoperla carnea* in sugar beet fields in April in September plantation and in May and June in December plantation.

3. Reduction in sugar beet plant stand caused by cotton leafworm:

Sugar beet plants treated with insecticide (Selecron 750 ml/fed. every 20 days) had 6.33, 8.00, 7.70 and 5.32 *S. littoralis* larvae/10 plants at Kafr El-Sheikh, Qualleen, El-Raid and El-Hamoul districts, respectively (Table 3). The corresponding values in the untreated areas were 79.33, 80.67, 78.67 and 73.30. Due to *S. littoralis* infestation, the reductions in plant stand were 94.52, 93.93, 93.67 and 94.37% at Kafr El-Sheikh, Qualleen, El-Riad and El-Hamoul districts, respectively. Overall districts, the stand reduction accounted for 94.12%.

Table (3): Sugar beet plant stand as influenced by cotton leafworm infestation, 2009/10 season.

Location	*S. littorlais*/10 sugar beet plant		No. of plants/fed.		
	Treated	Untreated	Treated	Untreated	Reduction %
Kafr El-Sheikh	6.33	79.33	29,800	1,633	94.52
Quallein	8.00	80.67	29,633	1,800	93.93
El-Riad	7.70	78.67	29,500	1,866	93.67
El-Hamoul	5.33	73.30	29,566	1,666	94.37
Average	**6.84**	**77.99**	**29,62**	**1,74**	**94,12**

4. Correlation coefficient values among *S. littoralis*, predators and weather factors:

Data presented in Table (4) show that correlation coefficient values between number of cotton leafworm larvae and numbers of each of coccinellids, *Chrysoperla carnea* and average temperature were highly significant with "r" values of 0.816, 0.859 and 0.967, respectively. Also, average temperature correlated with highly significant values with coccinellids (0.750) and *Chrysoperla carnea* (0.779), but with insignificant positive value with temperature. Cotton leafworm correlated insignificantly positive with true spiders, and insignificantly negative with relative humidity. In addition, relative humidity exhibited insignificant negative values with each of coccinellids, true spiders and *Chrysoperla carnea*.

Table (4): Correlation coefficient values among *Spodoptera littoralis* larvae, predators and weather factors (combined analysis of 2007/08, 2008/09 and 2009/10 sugar beet seasons).

Item	"r" value over three sugar beet seasons
Cotton leafworm X Coocinellids	0.816**
Cotton leafworm X True spiders	0.428
Cotton leafworm X *Chrysoperla carnea*	0.859**
Cotton leafworm X Av. Temp. ºC	0.976**
Cotton leafworm X Av. RH %	-0.500
Coocinellids X Av. Temp. ºC	0.750**
Coocinellids X Av. RH %	-0.550
True spiders X Av. Temp. ºC	0.477
True spiders X Av. RH %	-0.516
***Chrysoperla carnea* X Av. Temp. ºC**	0.779**
***Chrysoperla carnea* X Av. RH %**	-0.014

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تأثير الإصابة بدودة ورق القطن على الكثافة النباتية لنباتات بنجر السكر المنزرعة فى أغسطس ودور المفترسات فى تنظيم أعداد الآفة

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أجريت هذه الدراسة على محصول بنجر السكر فى أربعة مراكز بمحافظة كفر الشيخ هى كفر السيخ، قلين، الرياض، والحامول خلال مواسم 2007/2008، 2008/2009 و 2009/2010م. استهدفت الدراسة متابعة التغيرات فى تعداد يرقات دودة ورق القطن *Spodoptera littoralis* Boisd. على نباتات البنجر المنزرعة مبكراً فى أول أغسطس كعروة أولى. كما تمت أيضاً دراسة تأثير هذه الإصابة على الكثافة النباتية لنباتات البنجر فى الحقول المصابة بدودة ورق القطن، مع مقارنتها بالكثافة النباتية فى القطع التجريبية التى تمت حمايتها ضد الإصابة بالحشرة باستخدام الرش الدورى بمبيد السيليكرون.

كانت الإصابة بدودة ورق القطن أعلى ما يمكن خلال شهرى سبتمبر وأكتوبر، وكانت كثافة اليرقات على نباتات البنجر كما يلى: 81.00 – 113.25 يرقة/ 10 نباتات فى موسم 2007/2008، 95.00 – 126.25 فى موسم 2008/2009، 119.25 – 183.50 فى موسم 2009/2010. كما تزامنت الإصابة العالية بدودة ورق القطن لنباتات البنجر مع الارتفاع النسبى لدرجة الحرارة خلال شهرى سبتمبر وأكتوبر، مقارنة بالانخفاض النسبى للحرارة خلال شهرى نوفمبر وديسمبر. كما ارتفعت الكثافة العددية لمفترسات أبو العيد coccinellids، والعناكب الحقيقة true spiders وأسد المنّ *Chrysoperla carnea* خلال شهر سبتمبر. ونتيجة الإصابة الشديدة بيرقات دودة ورق القطن فى هذه العروة المبكرة، انخفضت جداً الكثافة النباتية فى جميع المواسم، وتراوحت نسبة الخفض بين 93.67، 94.50% كمتوسط عام للمراكز الأربعة التى جرت فيها الدراسة. كما أوضحت التحاليل الإحصائية وجود ارتباط موجب عالى المعنوية بين تعداد يرقات دودة ورق القطن، وتعداد كل من أنواع أبو العيد وأسد المنّ

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