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MONITORING THE SEASONAL FLIGHT ACTIVITY OF STEM BORER MOTHS TO DETERMINE THE PROPER TIME FOR RELEASE *TRICHOGRAMMA* PARASITOID AT SUGARCANE FIELDS IN UPPER EGYPT

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ABSTRACT

The seasonal flight activity of both sugarcane stem borer moths *Sesamia cretica* Led. (Noctuidae: Lepidoptera) and *Chilo agamemnon* Bles. (Pyralidae: Lepidoptera) were monitored with Robinson light trap for two successive years 2005/2006 & 2006/ 2007 at El-Mattana Agricultural Research Station, Qena Governorate, to determine the proper time for releasing the egg-parasitoid, *Trichogramma evanescens* West. for biological control program to the two mentioned borers without any application with chemical pesticides. The obtained results showed that, the moths of the greater sugarcane stem borer, *S. cretica* had a main period of seasonal activity extended from spring to early summer (April to June) and had another four small peaks of seasonal activity at sugarcane fields occurred in April, June, July, and October. The small sugarcane stem borer moth, *C. agamemnon* had two main periods of seasonal activity at sugarcane fields. The first period extended from spring to early summer (March to June) and the moths probably recorded two broods during this period, whereas the second period was relatively smaller and occurred during July. Results of statistical analysis showed that, the combined effect of the three main weather factors (mean of min. & max. temperatures and %R.H.) two weeks earlier were responsible on the changes in the seasonal flight activity of *S. cretica* moths for 51.6% and 66.7% explained variance for the 1st and 2nd year, respectively. Also, these factors were responsible on the changes in the seasonal flight activity of *C. agamemnon* moths for 57.7% and 44.1% explained variance for 1st and 2nd year, respectively. So, it could be recommended that, the egg-parasitoid, *Trichogramma evanescens* releasing program must be started at mid- April for autumn and spring plantations, while for the next ratoons after two months from harvest and continued biweekly intervals to the end of June.

INTRODUCTION

Sugarcane stem borers are common insect pests in sugarcane fields in Upper Egypt. Sugarcane stem borers were recorded in Egypt, by many authors such as **Willcocks & Bahgat (1925); Hassanein (1956); Atreis (1966); Ezzat & Atreis (1967); Isa & Awadallah (1972); Kera and El-Sherif (1974a & 1974b) and Abu-Dooh (1988)**. The greater sugarcane borer, *Sesamia cretica* Led. (Noctuidae: Lepidoptera) infests sugar cane plants in early season causing the dead hearts for the infested plants, while the small sugar cane borer, *Chilo agamemnon* Bles. (Pyralidae: Lepidoptera) infests the sugarcane during the late stages of plant growth. **Allam, *et al* (2006)** showed that the infestation of sugarcane plants cultivar "G.T.54-9" with *C. agamemnon* affected qualitatively and decreased Brix values, sugar juice percentage, extracted sugar recovery and sugar purity as well as increase pH, reducing sugar, ash and dextran contents increased with increasing pest infestation.

Li, (1994) reported that egg parasitoid of genus *Trichogramma* are the most commonly used group from natural enemies in inundative biological control. He added that over 32 millions ha. of agriculture and forest were treated annually with *Trichogramma* to control different insect pests.

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They are relatively easy to culture, kill the host eggs before the larvae hatch and with this crop damage is prevented.

The present work was conducted to study the seasonal flight activity of sugarcane stem borer moths in sugarcane fields by using Robinson light trap to determine the proper time for release the egg-parasitoid, *Trichogramma evanescens* West. within the biological control program of sugarcane stem borers.

MATERIALS AND METHODS

Robinson light trap **(Robinson & Robinson, 1950)** was used to monitor the seasonal activity of the sugarcane stem borer moths for two successive years (16/4/ 2005 to 20/4/2007) at El-Mattana Agricultural Research Station, Qena Governorate, Upper Egypt. The light trap was kept in the sugarcane plants at suitable height (from 1/2 to 3 meter), the height of the trap increased with the growth of sugarcane plants. The trap operated daily from sun set to sun rise. The trapped moths were collected, identified and counted at weekly intervals. The actual data of catched moths/week for the two sugarcane stem borers in both studied years were smoothed (two week running mean).

The Meteorological data were obtained from the nearest Meteorological Station at Kous, Qena Governorate (about 30 Km to the North of experimental station). The daily records means of minimum & maximum temperatures as well as daily mean % relative humidity (R.H. %) were recalculated as weekly means. The effects of these factors on the activity periods of both sugarcane stem borer moths were estimated by application of C-multiplier formula **(Fisher, 1950)** the partial regressions and the simultaneous effect of these factors, "means of two weeks earlier", on the variability within the catched moths/week.

RESULTS AND DISCUSSION

A- Seasonal flight activity of *S. cretica* moths

Data of weekly catches of *S. cretica* moths attracted to Robinson light trap at sugarcane field in El-Mattana Agricultural Research Station, Qena Governorate during two successive years (2005/ 2006 and 2006/2007) were graphically illustrated in **(Fig. 1 A&B)**. The obtained results revealed that the seasonal flight activity of the moths were more abundant during the 1st year than the 2nd one. The annual means were 14.5 & 9.6 moths/week, respectively.

During the first year, the moths were attracted with few numbers during first week of April, 2005 (10 moths/week). Afterwards the moth population increased gradually throughout the successive weeks and recorded a maximum peak on the second week of May, 2005 (203 moths/week). The moth population was fluctuated with few numbers during the following weeks till the end of the year. During this period the weekly moth catches recorded another four small peaks of seasonal activity on the 3rd week of June, 4th week of July, 1st week of October, 2005 and the 1st week of March, 2006, where the weekly catches represented by 34, 45, 16 and 17 moth/week, respectively.

During the second year, the seasonal flight activity of the same moths followed the same trend. The moths recorded its maximum peak of seasonal flight activity also on the 3rd week of May, 2006 (102 moths/week). Afterwards, the weekly catches were decreased in the following weeks and also recorded four small peaks of seasonal flight activity on the 3rd week of June, 4th week of July, 1st week of October, 2006 and the 2nd week of April, 2007, where the weekly mean number of insect catches represented by 19, 24, 16 and 12 moths/week in average, respectively.

From these results it could be stated that the *S. cretica* had main period of seasonal flight activity at sugarcane fields under Upper Egypt conditions. This period extended from spring to early summer (April to June) and moth activity probably recorded two broods throughout this period. Also, this species had another three small peaks of seasonal activity at sugarcane fields and probably it attacks another hosts especially maize from July to November. During winter months, (December to March) the larvae were found to hibernate inside the stalks of its hosts.

These results are in agreement with these obtained by **El-Saadany & Hosny (1974)** they stated that the first moth of *S. cretica* attracted to light trap in late February at maize fields in Giza region. **Kira & El-Sherif (1974 b)** reported that *S. cretica* had two annual generations at sugarcane fields in Abu-Qurqas, Minia Governorate. They depended on counts of egg-masses, whereas, they recorded three annual generations depending on larvae counts. **Farag *et al* (1992)** recorded two periods of seasonal activity of *S. cretica* on maize plants in Menoufia Governorate. The first period occurred between May and late June and the second one occurred on first week of August. **Moyal *et al* (2002)** stated that population density of *S. cretica* on maize plants recorded two main periods of

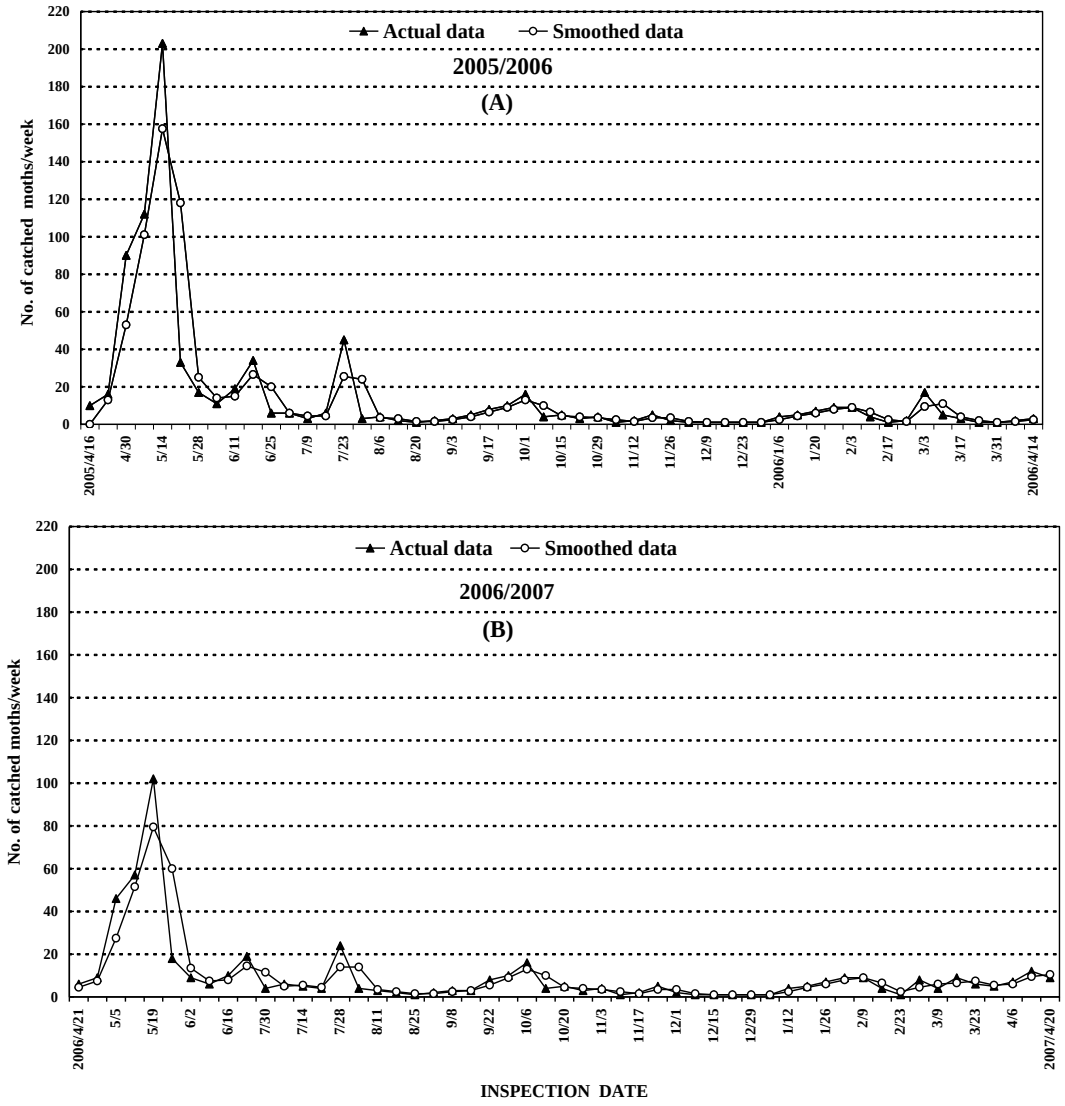

Fig. 1. Weekly catches of *S. cretica* moths attracted to Robinson light trap at sugarcane field at El-Mattana Agricultural Research Station in Qena Governorate with smoothed data (two week running mean) during A: 2005-2006 & B: 2006-2007

seasonal activity, the first period occurred on April and the second one occurred on September/ October.

B- Seasonal flight activity of *C. agamemnon* moths

Data of weekly catches of *C. agamemnon* moths attracted to the light trap at sugarcane fields in El-Mattana Agricultural Research Station, Qena Governorate during the two successive years (2005/2006 & 2006/2007) are graphically illustrated in **(Fig. 2 A&B)**. These results denoted that moths were more active during 2005/2006 than 2006/2007. The annual means were 9 & 5.7 moths/week respectively. Also, moths of *C. agamemnon* were less active than moths of *S. cretica*. During the first year, the weekly catches of *C. agamemnon* moths began with relatively large numbers 43 moths/week on 16 April, 2005.

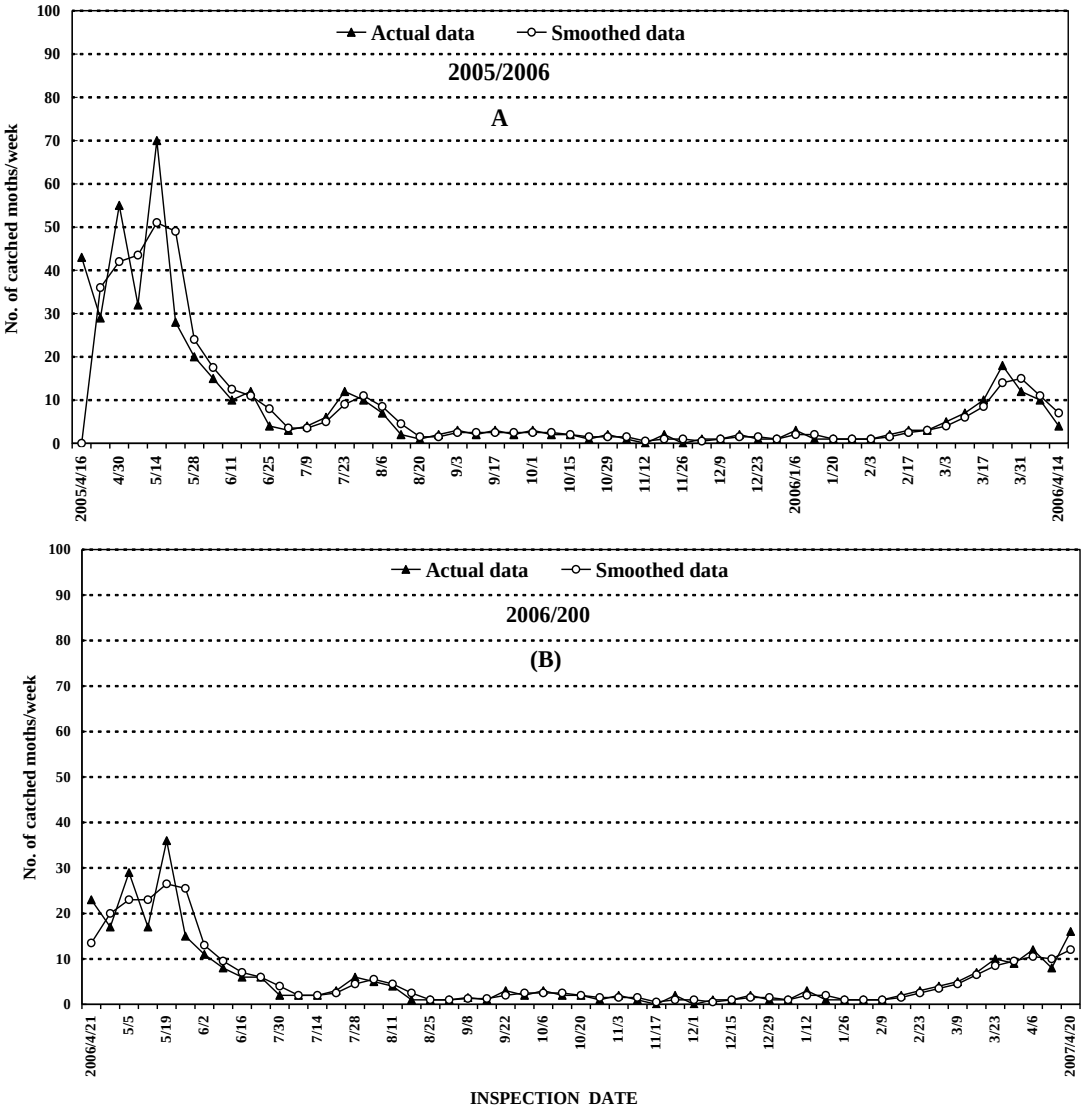

Fig. 2. Weekly mean number of *C. agamemnon* moths\ catches attracted to Robinson light trap in sugarcane field at El-Mattana Agricultural Research Station, Qena Governorate with smoothed data (two week running mean) during A: 2005-2006 & B: 2006-2007

After-wards, the weekly catches fluctuated during the successive following weeks and recorded its maximum activity on 14 May, 2005 (70 moths/week), then the number of moths decreased during the successive weeks. Two small peaks were recorded on 23 July, 2005 and 24 March, 2006 when the weekly catches were 12 &18 moths/week, respectively.

During the second year, the seasonal activity of *C. agamemnon* followed the same trend but with less numbers than first year. The weekly moth catches recorded three peaks of seasonal flight activity on 19 May, 28 July, 2006 and 6 April, 2007, the weekly mean number of insect catches were 36, 6 and 12 moths/week, respectively.

From the above mentioned results it could be concluded that the *C. agamemnon* moth had two main periods of seasonal flight activity in sugar-cane fields. The first period extended from the spring to early summer (March to June). The moths probably recorded two broods during this period. The second period was relatively smaller during July probably the moths attacked other host plants especially maize.

During winter months, the moth activity reached its minimum activity, probably due to that the larvae hibernate during this season. These results are in harmony with those obtained by **Hanna & Atreis (1969)** who stated that *C. aga-memnon* had two annual generations in sugarcane

fields at Abu-Qurqas, Minia Governorate. The first generation occurred between July and early September and the second generation occurred between mid-September and late November. **El-Saadany and Hosny (1974)** reported that the first moth of *C. agamemnon* attracted to light traps between mid-March and May at maize fields in Giza region. **Kira and El-Sherif (1974a)** recorded three annual generations of *C. agamemnon* at sugarcane fields in Minia Governorate. The first generation occurred during the1st week of June; the 2nd at late August and the 3rd one in October.

From the forementioned discussion it could be stated that, the egg-parasitoid *Trichogramma evanescens* releasing program must be started during the mid-April for spring and autumn plantations; while for next ratoon after two months from harvest and continued biweekly intervals to the end of June to control the sugarcane stem borers throughout the biological control program of sugarcane stem borer.

C. Effect of main weather factors on seasonal activity of sugarcane stem borers moths

The effects of the three main weather factors (means of maximum and minimum temperatures and % relative humidity) two weeks earlier on the activity of moths of *S. cretica* and *C. agamemnon* were investigated. That was carried out during the main period of seasonal flight activity for both insect species (April - June) during the two tested years. Statistical analysis procedure was carried out by applying C-multiplier formula **(Fisher, 1950).**

1- The greater sugarcane stem borer, *S. cretica* moths

Results of statistical analysis are given in **Tables (1 & 2)**. The obtained results revealed that, the single effect of the three tested factors had negative insignificant effect on the weekly catches of moths during 1st year; whereas in the 2nd year both mean minimum temperature and mean %R.H. had negative insignificant effects, while mean maximum temperature had positive insignificant effect. Also, results revealed that the combined effects of the three main weather factors were responsible on the changes in the seasonal activity of *S. cretica* moths for 51.6% and 66.7% explained variance for the 1st and 2nd year, respectively. The variance ratio was insignificant during the 1st year (F= 2.13) and significant during 2nd year (F= 4.0) under probability of 0.05.

2- The lesser sugarcane stem borer, *C. agamemnon* moths

Results of statistical analysis are given in **Tables (3 & 4)**. These results showed that mean maximum temperature had negative insignificant on the changes in moths' catches during both years. Also mean minimum temperature had negative effect of changes in moths catches, this effect was significant during 1st year only (r = -0.735) and insignificant in the 2nd one, whereas mean percentage of relative humidity had positive insignificant effect during both years.

Table 1. Results of statistical analysis for the effect of the three main weather factors, two weeks earlier on the seasonal flight activity of *S. cretica* moths during the main period of activity at sugarcane plantation in El-Mattana Agricultural Research Station, Qena Governorate during 2005/2006

Factor	Simple correlation and regression values			Partial regression values		ANOVA	
	r	b reg. ± s.e	t value	P. reg. ± s.e	t value	E.V %	F Value
Mean max. temp.	-0.098	-2.0 ± 7.1	0.28	8.8 ± 7.9	1.12		
Mean min. temp.	-0.442	-8.6 ± 6.2	1.39	-2.1 ± 8.7	-2.44*	51.6	2.13
Mean R.H. (%)	-0.125	-0.91 ± 2.6	0.36	-4.5 ± 2.6	-1.74		

Table 2. Results of statistical analysis for the effect of the three main weather factors, two weeks earlier on the seasonal flight activity of *S. cretica* moths during the main period of activity at sugarcane plantation in El-Mattana Agricultural Research Station, Qena Governorate during 2006/2007

Factor	Simple correlation and regression values			Partial regression values		ANOVA	
	r	b reg. ± s.e	t value	P. reg. ± s.e	t value	E.V %	F value
Mean max. temp.	0.101	0.81±2.8	0.29	3.8±1.3	2.84		
Mean min. temp.	-0.023	-0.20 ± 3.02	0.07	-4.1±1.3	-3.10**	66.7	4.0*
Mean R.H. (%)	-0.323	-2.94 ± 3.10	0.96	-2.3±3.2	-0.71		

Table 3. Results of statistical analysis for the effect of the three main weather factors, two weeks earlier on the seasonal flight activity of *C. agamemnon* moths during the main period of activity at sugarcane plantation in El-Mattana Agricultural Research Station, Qena Governorate during 2005/2006

Factor	Simple correlation and regression values			Partial regression values		ANOVA	
	r	b reg. ± s.e	t value	b ± s.e	t value	E.V %	F value
Mean max. temp.	-0.486	-3.06 ± 1.94	1.57	0.04 ± 2.3	0.13		
Mean min. temp.	-0.735*	-4.45 ± 1.45	3.06*	-5.5 ± 2.5	-2.16*	57.7	2.72
Mean R.H. (%)	0.273	0.62 ± 0.77	0.80	-0.05 ± 0.07	-0.72		

Table 4. Results of statistical analysis for the effect of the three main weather factors, two weeks earlier on the seasonal flight activity of *C. agamemnon* moths during the main period of activity at sugarcane plantation in El-Mattana Agricultural Research Station, Qena Governorate during 2006/2007

Factor	Simple correlation and regression values			Partial regression values		ANOVA	
	r	b reg. ± s.e	t value	b ± s.e	t value	E.V %	F value
Mean max. temp.	-0.358	-0.92 ± 0.85	1.08	6.8 ± 5.5	1.24		
Mean min. temp.	-0.437	-1.19 ± 0.87	1.37	-8.8 ± 5.6	-1.58	44.1	1.58
Mean R.H. (%)	0.065	0.19 ± 1.03	0.18	-0.07 ± 1.3	-0.50		

Also, these results showed that the combined effect of the three main weather factors were responsible on the changes in the seasonal activity of *C. agamemnon* moths for 57.7% and 44.1% explained variance for 1st and 2nd year, respectively. The F values were insignificant for both years.

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