PRELIMINARY ANALYSIS OF FIELD POPULATION OF BLACK CUTWORM, *AGROTIS IPSILON* (HUFN) AND SOME MEASUREMENTS FOR ITS FIELD LIFE TABLE IN EGYPT

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Abstract

A method to forecast the beginnings of damage by the black cutworm, *Agrotis ipsilon* (Hufn) to maize, cotton, clover, faba beans and vegetables was detected through 1993-1996 in Abu-homos District, Behaira Governorate. Life table parameters which were calculated to fit the accuracy of the method. As it appears the first and third generations have a moderate values of (r_m), and the second generation has a low (r_m) values. The (R_o) also decreased in the second generation and increased on the third one to be like the first one. These parameters are more sensitive to the change in developmental time, survival rates and fecundity than other life history components, which should be taken into consideration when a successful plans are to be proposed for management and control programs of this pest.

Introduction

The black cutworm, *Agrotis ipsilon* (Hufn), BCW, is an among the worst pests that farmers and gardeners have to cope with in most countries in the world. It is a cosmopolitan known to attack at least 49 species of cultivated plants (Odiya 1975, Rings *et al*. 1974, Rings *et al.* 1975). In Egypt BCW attack maize, faba beans, wheat, cotton, soya beans, tomatoes, potato, cantaloupe, cucumber and many others of vegetables. Larvae cause damage by severing seedlings or chewing into stalks, roots, bulbs, and tubers. The larvae are specially damaging to maize throughout Lower Egypt Region (north Nile Delta) during May and June. The insect has several generations per year, the number of generations regulated by weather.

The complete life history of insect is not known lower Egypt region. The damage occurs has been unpredictable. Consequently, damage in fields frequently has remained undetected until extensive stand reduction has occurred. Based on surveys of BCW adult moths, an early warning system to alert farmers when to begin watching their fields for BCW could save area from being replanted annually through the timely application of an emergency rescue insecticide treatment. Levine *et al*. (1982) suggest that early capture of males in sex pheromone traps could serve as a reference point to donate the start of egg laying in central corn belt and that a BCW phonology model (Toester *et al.* 1982) could be used to predict the occurrence of damaging larval instar. Indeed, they present a BCW development model and suggest that the beginning of BCW damage in the field. The reproductive behavior of BCW has been studied extensively under laboratory conditions, (Amin 1994). A model using daily minimum and maximum air temperature was used to predict the occurrence of BCW, (Amin *et al*. 1994).

This work is an attempt detect the field generations of BCW, the beginning of damage in the field, and the effect of crop rotation on life history throughout three successive years in Abu-Homes Distract, Behaira Governorate, Lower Egypt.

Materials and Methods

The experiments were conducted throughout three successive years, 1993-1996 at Abu-Homos District, Behaira Governorate, 160 km, north Cairo, Delta Region. A modified Robinson type light trap equipped with 160-watt mercury vapor lamp, with sodium cyanide inside a partially opened glass jar was used. The trap was sites adjacent to experimental plots of annual crops, which were grown through the year. Crop rotation in tested field for 3 years (1993-1996) is shown in Table (1). Trap catches were identified, daily, and BCW moths were counted sexed. Crop's rotation was recorded. Captured moths was used to determine the growth rate (r_m) Pearl method (1930). Captured moths used also to fit the logistic equation: $\log_e (K - N) / N = a - r_m t$ where N = population size, t= time, r_m = innate capacity for increase and K = upper asymptote or maximal value of N. The slope of this line is a proximate estimate of the innate capacity for increase (r_m), and the *y* intercept is an estimate of "a". Luckman *et al*. formula (1976) using daily minimum and maximum air temperature was adopted to compute centigrade degree-days (CDDs) as a frist step in forecasting the occurrence peaks and generation duration. Net reproductive rate (R_o), generation time (Gt.), and finite rate of population increase ($F_{r.}$) also were described according to Birch (1948) formula :

$$r_m = \log e\, R_o / T, \quad \text{and} \quad F_{r.} = e^{rm}$$

Results and Discussion

Seasonal fluctuations:

Fig. (1) represents the population fluctuations of BCW moths during 1993/1994 along with the standing crop in the experimental area. From it, three distinct generations were detected; first started at October 6 th and ended at December 15 th; second from December 20 th to April 29 th, and the third from April 29 th to June 13 th. The same results were recognized for the other two years. These three generations for 1994/1995 (Fig. 2 a) are: first (5/10 - 4/12), second (5/12 - 14/4) and the third (19/4 - 6/8). whereas these for 95/96 (Fig. 2 b) are : first (September 26 th to

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November 15 th), second (November 15 th to March 24 th and third (March 29 th to May 28 th).

These data revealed that the, first brood, after the summer disappearance, occurs in October, although it may start with very few numbers in early September. This always the smallest brood at all tested years. The second brood, is presumably the outcome of the first, and is much bigger than it. It occurs from October to December. This is the most trouble-some generation as it may seriously injure winter crops. From about the mid of January to about middle of March, there are very few catches of moths, since the insect being mostly in the pupal stage, which is prolonged owing to the cold climate. The total duration of winter brood is about 3-4 months that is quite expected. The next brood that occurs in march and April is the biggest of them all. The fourth brood appears in June.

Now if even a portion of this big brood was to lie eggs on the spot one would expect another brood some five weeks later or, so, but there are numerous indications of unfavorable conditions. This brood is dangerous for damaging maize and cotton seedlings planted in this period.

Life table parameters:

Data in Table (3) demonstrates the life table parameters of BCW in different generations in all tested years. As it appears from the table first generation has a moderate value of (r_m), second generation has a low (r_m) values and third one has similar to the first one. The (R_o) also decreased in the second generation and increased in the third one to be like the first one. This phenomena could be explained that, the fewer numbers of insect occurred in first generation need to build up a big population an vise versa for the third one.

The obtained results are in full agreement with the findings of many authors; Bishara (1932), Sherrod *et al*. (1979), Kaster and Showers (1984), Toster *et al*. (1983) , Kaster *et al*. (1989) and Amin *et al*. (1994).

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Table (1): Crop rotation in tested field, Abu-Homos District, Behaira Governorate,(1993-1996)

Crop sequence	1993-1994	1994-1995	1995-1996
1	Clover	Maize	Faba beans
2	Maize	Clover	Maize
3	Faba beans	Cotton	Clover

Table (2): Relationship between the monthly BCW captured moths and crop rotation, Abu-Homos District, Behaira Governorate (1993-1996).

Months	1993-1994		1994-1995		1995-1996	
	Moths	Crops	Moths	Crops	Moths	Crops
September	158	Clover	487	Maize	204	Cotton
October	316	Clover	515	Faba beans	486	Clover
November	1430	Clover	2220	Faba beans	748	Clover
December	2671	Clover	3419	Faba beans	1522	Clover
January	2225	Clover	1533	Faba beans	1330	Clover
February	968	Clover	1042	Faba beans	1612	Clover
March	32139	Clover	2090	Faba beans	2317	Clover
April	6041	Clover	1124	Cotton	145	Clover
May	1133	Maize	2004	Cotton	26	Maize
June	363	Maize	141	Cotton	5	Maize
July	7	Maize	11	Cotton	0	Maize
August	21	Maize	8	Cotton	0	Maize

Table (3): Life table parameters of BCW for the different field generations, Abu-Homos, Behaira Governorate (1993-1995).

Parameters	1993			1994			1995		
Generations	G1	G2	G3	G1	G2	G3	G1	G2	G3
Starting date	10/6	12/15	4/29	10/6	12/4	4/19	9/26	11/15	3/29
Ending date	12/15	4/29	6/13	12/4	4/14	6/8	11/15	3/24	5/28
r_m	0.068	0.030	0.062	0.088	0.029	0.089	0.067	0.0375	0.099
T	75	135	45	58	130	50	55	130	65
R_o	168.8	58.43	16.86	172.8	43.43	87.26	40.33	132.48	152
F_r	1.07	1.03	1.063	1.091	1.029	1.093	1.069	1.038	1.104

r_m = innate capacity for increase
R_o = net reproductive rate
T = generation time
F_r = finite rate of population increase

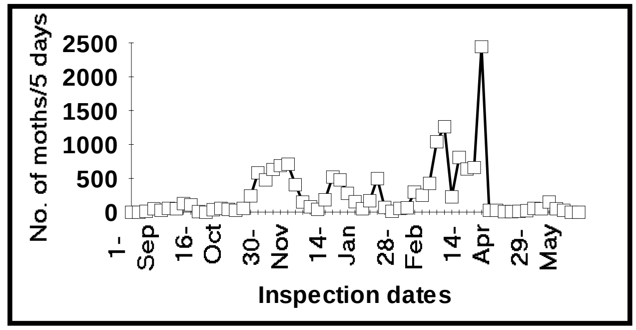
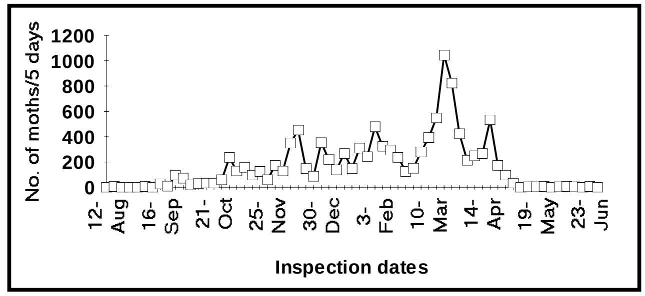


Fig. (1): Fluctution in the population density of BCW through (1993/1994), Abou-Homos, Behaira.



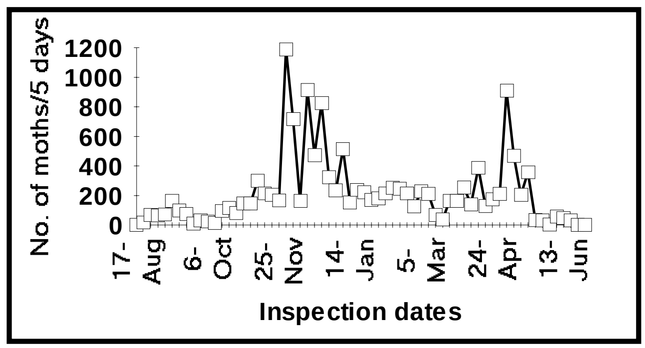


Fig. (2): Fluctution in the popuulation density of BCW through (1994/1995 &1995/1996), Abou-Homos, Behaira.