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THE RELATION BETWEEN DAILY TEMPERATURE, AND THE POPULATION OF *BEMISIA TABACI* (GENN.) ON TOMATO PLANTATION

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Abstract

Efficiency of degree-day of temperature on the activity of *Bemisia tabaci* (Genn.) was worked out, in the present study, over two tomato growing seasons (Nili plantations of 1996 and 1997). Results of this study infer that the degree-day model and the population of *B.tabaci* (Genn.) adults are highly correlated, and therefore, the degree-day model index (Heat units) could be taken as an indication on *B.tabaci* (Genn.) abundance on the tomato fields. The simple regression value (b) indicate that for every 0.5-0.6^{o}C increasing in the degree-days, on an average, there is a 1% infestation in the population density of *B.tabaci* adults and so on. Such results are very important for managing this pest.

INTRODUCTION

In India, Trehan (1944) reported that high temperature was found to favour rapid multiplication of whitefly. Avidov (1956) in Israel stated that the rate of reproduction in *Bemisia tabaci* (Genn.) was greater when the temperature was high.

In Egypt, El-Sayed (1981) mentioned that the total developmental time from egg to adult in *B.tabaci* ranged from 65.1 days at 14.9^{o}C to 16.6 days at 30^{o}C.

Zalom *et al.* (1985) in USA, estimated the threshold of temperature at 10.0^{o}C (lower) and 32.2^{o}C (upper) when linear regression was used to determine the least coefficient of variation of mean *B.tabaci* generation times calculated from a combination of possible threshold.

Colkesen and Sekerogly (1987) in Turkey, observed the development of each stage of *B.tabaci* (Genn.) on cotton seedling at 16.8, 21.3 and 25^{o}C. They found that, the total development times from egg to adult were 86.0, 36.0 and 24.2 days, respectively. Regression analyses indicated that there was a linear employed in this study.

Verma *et al.* (1990) in India, studied the effect of temperature on development

of *B.tabaci* in the field on green gram (*Phaseolus radiatus = Vigna radiata*). Optimum development of eggs occurred between 23 and 30°C, while optimum adult development occurred between 20 and 30°C. The accumulated day-degrees above a threshold of 10°C required for adult development were 303.28 - 336.80 day-degrees. There were 16-17 generations annually in the field, with 307.20-356.65 day-degrees being required per generation.

In Egypt, tomato at Nili plantation suffered from infestation by *B.tabaci.* Therefore, our study was conducted to throw light on the relation between degree-days and the population density of *B.tabaci* (Genn.) in Giza Governorate.

MATERIALS AND METHODS

The role of temperature summations attempts to find an index for the heat energy required to complete a given a stage or entire life cycle. So, temperature data could be transformed into heat units and serve as a useful tool for studying insect populations and predicating appearance of *B. tabaci* in the field.

The relation between degree-day models of temperature and infestation level of *B.tabaci* were studied at three days interval. Complete randomized samples of 100 leaves from 100 tomato plant (castle Rock variety) were examined. Testing period was carried out from 1st July till 25th December of 1996 and 1997, Nili plantation, in Giza Governorate. The population density of *B.tabaci* adult was determined early in the morning. The degree-day models of temperature (heat units) were recorded for three days interaral coincident to tomato sampling dates. Degree-day models of temperatue were calculated from the daily maximum and minimum temperature (°C) with developmental threshold (zero of development) of 10°C as referred by Verma *et al* (1990). Hereinafter, formula which was used for computing heat units according to Richmond *et al* (1983):

$$\frac{\text{Maximum temp.} + \text{Minimum temp.}}{2} - \text{Zero of development temperature.}$$

RESULTS AND DISCUSSION

Table 1 shows the degree-day model of temperature along with the coincident of mean number of *Bemisia tabaci* / leaf during the period elapsed from 1st July till 25th December of the two successive season 1996 and 1997. By eliminating the

Table 1. Degree-days and corresponding mean number of *B.tabaci* adult per leaf in Nili tomato plantation in Giza Governorate during two successive seasons of 1996 and 1997.

Inspection day		Nili tomatoes of 1996 season		Nili tomatoes of 1997 season	
		Degree-days (Heat units)	Mean no.of *B.tabaci* adults/leaf	Degree-days (Heat units)	Mean no.of *B.tabaci* adults/leaf
July,	1	14.2	9.6	13.1	8.0
	4	14.8	11.0	13.3	10.3
	7	15.4	13.0	14.0	12.6
	10	15.6	16.5	14.6	14.0
	13	16.3	19.6	14.3	15.6
	16	16.1	20.4	14.3	16.3
	19	15.8	20.2	14.6	19.3
	22	16.3	20.6	15.3	20.3
	25	16.5	21.5	15.0	21.6
	28	15.9	22.2	15.6	22.0
	31	16.8	23.3	16.5	21.6
August,	3	17.2	25.6	17.3	24.0
	6	16.0	27.0	15.1	26.3
	9	16.4	28.0	17.6	26.0
	12	15.3	28.6	16.2	26.6
	15	16.2	28.3	15.0	27.3
	18	16.0	29.0	15.3	28.6
	21	15.8	29.3	14.6	28.3
	24	15.5	29.6	15.3	29.0
	27	15.3	31.0	14.0	29.6
	30	13.9	31.3	14.6	31.6
September,	2	14.1	32.0	13.0	31.6
	5	14.6	35.3	13.5	34.6
	8	14.2	35.0	13.0	35.3
	11	13.8	36.6	13.2	36.0
	14	13.1	38.3	13.6	37.6
	17	13.6	39.0	13.3	38.3
	20	13.2	38.6	13.6	38.0
	23	13.6	38.3	12.0	38.6
	26	13.3	39.0	12.3	38.0
	29	12.8	38.6	11.0	39.2
October,	2	12.5	38.3	10.6	38.3
	5	12.1	36.0	10.4	36.3
	8	12.6	37.3	10.6	38.0
	11	12.2	38.6	10.3	38.6
	14	12.9	39.0	9.6	39.3
	17	12.6	38.3	9.3	38.0
	20	10.8	36.0	8.6	37.6
	23	9.20	37.3	7.3	36.0
	26	8.40	34.6	6.6	35.3
	29	7.60	32.6	6.3	34.3

Table 1. Cont.'d

Inspection day	Nili tomatoes of 1996 season		Nili tomatoes of 1997 season	
	Degree-days (Heat units)	Mean no.of *B.tabaci* adults/leaf	Degree-days (Heat units)	Mean no.of *B.tabaci* adults/leaf
November, 1	7.4	31.3	6.0	31.0
4	7.4	29.0	5.0	29.6
7	6.9	28.3	5.6	29.0
10	6.5	26.6	5.2	27.6
13	5.6	26.0	5.3	26.0
16	4.9	26.3	4.8	26.6
19	4.5	27.0	4.6	26.0
22	3.2	26.3	3.3	25.6
25	3.0	25.6	3.3	25.0
28	2.5	23.6	2.6	22.6
December, 1	1.8	22.3	1.3	22.0
4	0.6	21.6	0.6	22.3
7	0.8	21.0	0.3	20.6
10	1.0	20.6	1.0	20.3
13	0.6	20.0	0.6	20.6
16	0.6	20.3	1.3	21.0
29	0.3	20.6	0.3	20.3
22	0.6	19.0	0.0	20.0
25	0.3	18.3	0.6	19.3

zero of development of 10°C, first record of degree-day model was 14.2 and 13.1°C on 1st July of 1996 and 1997, respectively. Then degree-day model began to increase gradually through July and Agust, where the highest degree-day model was recorded on 15th Aug. 1996 and 9th Aug. 1997 having 16.0°C and 16.2°C, respectively. Whatever, it began to draw slowly through Sep. and Oct of 1996 and 1997 and followed by a fast decreasing through Nov. and Dec. of the two successive studying seasons, recording 0..3 and 0.6°C at 1996 and 1997, respectively.

Meanwhile, the mean number of *B.tabaci* adults/leaf was coincident with the degree-day model of tmperature records during the two studying seasons. In the first inspection, it was 9.6 and 8.0 adults/leaf during 1996 and 1997, respectively. Then, insect population began to increase gradually through Jul. and Aug. to reach its maximum density during the period from mid of Sept. to mid of Oct. Population of *B.tabaci* adult was still high through the second half of Oct. till the end of Nov. of the two successive studying seasons. During the rest period, population decrease sharply to reach 18.3 and 19.3 adults/leaf at the end of Dec. of 1996 and 1997, respectively.

To verify the relationship between the population of Bemisia tabaci (Genn.) and corresponding degree-day model, Table 1, the simple correlation coefficient was taking variable of the 2-year means of *Bemisia tabaci* population.

The following table gives the calculated correlation values:

Season	r	b
1996	+0.993*	+0.536
1997	+0.989*	+0.612

* Highly significant at 1% level of probability.

The values infer that the population of *B.tabaci* adults and degree-days model are highly correlated, and therefore, the degree-days model could be taken as an indication of *B.tabaci* adults population in tomato field. The simple regression values (b) indicate that for every increasing of 0.536°C in the degree-days on an average, there is a 1% in the population density of *B.tabaci* adults on tomato plants and so on.

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درجات الحرارة اليومية وعلاقتها بتعداد الذبابة البيضاء على الطماطم فى العروة النيلية

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درس تاثير درجة الحرارة اليومية المكتسبة (الوحدات الحرارية) على نشاط حشرة ذبابة القطن والطماطم البيضاء فى محصول الطماطم فى العروة النيلية لمدة عامين متتاليين (عامى ١٩٩٦، ١٩٩٧) فى محافظة الجيزة . وأشارات نتائج هذة الدراسة الى أن تعداد حشرة ذبابة القطن والطماطم البيضاء مرتبط ارتباطا وثيقا بدرجات الحرارة اليومية .

وتبين من نتائج تطبيق معامل الإرتباط البسيط أن كل زيادة مقدارها ٠,٥ - ٠,٦ م يقابلها زيادة ١ ٪ فى تعداد ذبابة القطن والطماطم البيضاء على محصول الطماطم. وهذه النتائج قد يكون لها أهمية فى إستراتيجية مكافحة هذه الافة .