

**ECOLOGICAL STUDIES ON THE MANGO SCALE INSECT,
AULACASPIS TUBERCULARIS (NEWSTEAD) (HOMOPTERA:
DIASPIDIDAE) INFESTING MANGO TREES UNDER FIELD
CONDITIONS AT QUALUBIA GOVERNORATE**

FAYZA A. KWAIZ

Plant Protection Res. Inst., ARC, Dokki, Giza

(Manuscript received 27 May 2008)

Abstract

The research work was conducted during two successive years 2005 and 2006 on the seasonal abundance and some ecological aspects of the mango scale insect, *Aulacaspis tubercularis* infesting mango trees at Qualubia Governorate .

The obtained results denoted that this insect had three peaks which occurred during March, June and November through each of the two studied years while the lowest population was registered in mid. July Also, data clearly showed that *A. tubercularis* had four overlapping annual generations during the two studied years. Statistical analysis showed that the climate factors affected the activity of *A. tubercularis*. Results proved that there were positive correlation between temperature (Min. & Mix.) and all annual generations through the two studied years except the third one. The data proved a negative correlation between R.H % and all insect generations except the second one in the first year.

It is advisable to apply pesticides from mid July till the end of August as summer spraying which was more suitable for, controlling *A. tubercularis* infesting mango trees .

INTRODUCTION

Mango, *Mangifera indica* (L.) is consider as one of the most popular fruits in Egypt. The mango is the third major crop after citrus and grape. There are several species of the scale insects are attacking mango trees .

Among these pests, the mango scale insect, *Aulacaspis tubercularis* (Newstead) (Homoptera: Coccoidea : Diaspididae) which causing severe damages to the leaves represented in yellowish leaves and defoliated vegetative growth .

Although the mango scale insect does not cause internal fruit damage, its cosmetic effect on the fruit skin results in a significant decrease in the ratio of the exportable fruit. Also, it is believed that most species of armored scale insects release phytotoxic substances (Mc Clure 1990). The present investigation aimed to study some ecological aspects of the mango scale insect, *Aulacaspis tubercularis* on mango trees at Qualubia governorate during two successive years (2005-2006) to achieve to the proper time for successful control under field conditions.

MATERIALS AND METHODS

Ecological studies on the mango scale insect, *Aulacaspis tubercularis* (Newstead) was carried out for two successive years from January 2005 till the end of December 2006 at Qualubia Governorate .

Mango orchard was about 3 feddans with aged about 40 years with about 8-12 meter high. No chemical control was carried out before and throughout the period of the investigation and all trees received the same agricultural practices.

Successive fortnightly samples of 30 leaves from three mango trees replicated three times (nine trees). Samples were taken and kept in a paper bags in order to transfer them to the laboratory for examination. Samples were examined carefully by the aid of stereomicroscope binocular. All the living immature stages, adult females and gravid females of *A. tubercularis* were sorted and counted separately .

- The rate of increase in the population was calculated by (Bodenheimer 1951) :

$$\frac{\text{Average count during the month}}{\text{Average count during the preceding one}}$$

- Number of annual generations for *A. tubercularis* was estimated from changes in the mean half monthly nymphal stages counts throughout two successive years (2005-2006). Data were worked out according to Jacob's formula (1977) and graphically illustrated on semiganssion paper for estimating number and duration of generations .
- Simple correlation (r) was calculated to assess the effect of main weather factors (daily Min.temp., daily. Max. temp., and daily relative humidity) on *A. tubercularis* generations .

RESULTS AND DISCUSSION

1- Seasonal fluctuations of the mango scale insect, *Aulacaspis tubercularis* population

Data represented in tables (1,2) which graphically illustrated in Figs (1) revealed that *A. tubercularis* had 3 peaks of abundance through each of the two studied years .

In the first year of study, (2005) the population of insect showed 3 peaks which occurred during mid March (77.90 individuals/leaf), early June (105.2 individuals /leaf) and early November (76.20 individuals/leaf).

In the second studied year of investigation (2006) the three peaks were recorded in mid March (60.4 individuals /leaf), mid June (157.20 individuals /leaf) and early November (85.30 individuals /leaf) .

Data in tables (1 , 2) indicated that the highest peak of *A. tubercularis* population was recorded during June through the two years of investigation, in which the weather factors recorded 33.45 , 32.46 °C for D. Max. Temp., 19.32 , 19.30 °C for N. Mini Temp., and 63.94% , 53.36 % for D.M.R.H .

On the other hand, the lowest population were recorded in January, mid July and mid December with mean total population (25.6 , 20.50 individuals /leaf), (10.4 , 28.60 individuals /leaf) and (25.90 , 22.40 individuals /leaf) through the two years of investigation, respectively.

The lowest peak of *A. tubercularis* was recorded in mid July this may be due to the high temperature prevailing at that time.

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Table 1. Seasonal abundance of different stages of *Aulacaspis tubercularis* (Newstead) in relation to the climatic factors during 2005 season on mango trees at Qualubia Governorate .

Sampling dates		No. of Pre-ad./leaf .	No. of adult females /leaf .	No. of Gravid females /leaf .	Total population	Quotient increase	D.MX. T. °C	N. min.T. °C	D.M. RH %
Jan.	1st	5.00	5.50	16.90	27.40	0.00	20.34	8.49	61.90
	15th	3.90	1.80	19.90	25.60	0.93	18.47	7.27	59.33
Feb.	1st	3.80	3.70	23.70	31.20	1.22	19.55	8.05	56.02
	15th	4.10	5.80	31.50	41.40	1.32	18.83	10.85	60.34
March	1st	8.20	6.20	29.10	43.50	1.39	22.36	11.29	56.76
	15th	5.60	10.60	61.70	77.90	1.79	24.76	11.61	49.54
April	1st	4.00	7.60	37.00	48.60	0.62	22.18	15.17	54.25
	15th	4.30	4.40	21.10	29.80	0.62	27.68	15.57	52.50
May	1st	10.40	9.10	23.50	43.00	1.44	29.34	13.93	53.90
	15th	10.60	16.00	37.00	63.60	1.47	27.14	18.26	49.47
June	1st	16.00	16.40	72.80	105.20	1.71	33.45	19.32	63.94
	15th	19.30	17.40	11.60	48.30	0.41	32.55	20.68	47.40
July	1st	21.00	20.00	4.90	45.90	1.02	32.89	22.68	48.93
	15th	3.90	4.70	1.80	10.40	0.23	35.60	23.10	66.14
August	1st	5.10	7.80	7.80	20.70	1.99	36.21	25.40	58.19
	15th	6.90	10.90	13.70	31.50	1.52	36.49	24.30	63.61
Sept.	1st	10.20	19.60	17.40	47.20	1.50	33.45	19.85	63.75
	15th	13.40	28.20	21.20	62.80	1.33	30.29	19.19	52.49
Oct.	1st	10.20	29.00	26.50	65.70	1.05	30.98	18.17	45.75
	15th	12.60	29.20	29.80	71.60	1.08	28.63	15.23	46.00
Nov.	1st	20.80	32.30	23.10	76.20	1.15	24.93	14.40	59.71
	15th	9.20	35.40	18.40	63.00	0.82	19.50	12.05	54.56
Dec.	1st	6.10	8.30	17.30	31.70	0.50	19.29	10.84	59.94
	15th	4.70	6.20	15.00	25.90	0.82	14.31	6.70	56.23

Table 2. Seasonal abundance of different stages of *Aualcaspis tubercularis* (Newstead) in relation to the climatic factors during 2006 on mango trees at Qualubia Governorate .

Sampling dats		No. of Pre-ad./leaf .	No. of adult females /leaf .	No. of Gravid females /leaf .	Total population	Quotient increase	D.MX.T. °C	N. min.T.°C	D.M. RH %
Jan.	1st	4.80	3.30	12.40	20.50	0.00	19.67	9.71	64.87
	15th	4.50	2.90	15.00	22.40	1.22	19.78	9.79	62.65
Feb.	1st	4.10	3.90	30.90	38.90	1.54	18.55	8.29	65.89
	15th	5.20	6.20	29.70	41.10	1.06	21.62	8.29	56.40
March	1st	9.20	7.10	30.10	46.40	1.06	23.31	8.71	51.18
	15th	12.20	12.00	36.20	60.40	1.30	20.64	11.70	55.93
April	1st	8.60	8.60	33.70	50.90	0.84	23.30	8.08	52.95
	15th	14.30	15.30	29.50	59.10	1.12	27.63	9.78	53.61
May	1st	18.00	22.00	24.40	64.40	1.09	26.19	13.83	53.11
	15th	20.60	32.80	54.00	107.40	1.67	31.72	15.68	50.40
June	1st	20.80	31.10	60.70	112.60	1.05	31.29	17.57	51.59
	15th	26.00	38.40	92.80	157.20	1.40	32.46	19.30	53.36
July	1st	26.40	69.40	37.40	133.20	0.85	33.52	22.45	52.26
	15th	8.20	15.70	4.70	28.60	0.21	33.09	20.59	56.40
Augus	1st	9.40	11.80	10.80	32.00	1.11	33.59	21.93	58.15
	15th	11.10	15.10	18.20	44.40	1.39	33.23	22.19	59.22
Sept.	1st	10.80	18.20	19.00	48.00	1.08	32.44	21.71	60.90
	15th	14.50	29.30	22.30	66.10	1.38	33.14	20.47	58.68
Oct.	1st	18.00	30.40	28.10	76.50	1.08	32.23	19.57	56.47
	15th	12.90	31.20	30.30	74.40	1.04	25.67	17.49	55.36
Nov.	1st	23.70	32.10	29.50	85.30	1.15	22.78	15.43	57.82
	15th	21.00	25.10	15.10	61.20	0.72	25.19	12.62	58.02
Dec.	1st	9.70	10.70	12.30	32.70	0.53	20.25	12.57	60.22
	15th	5.20	2.90	14.30	22.40	0.68	22.25	13.25	59.50

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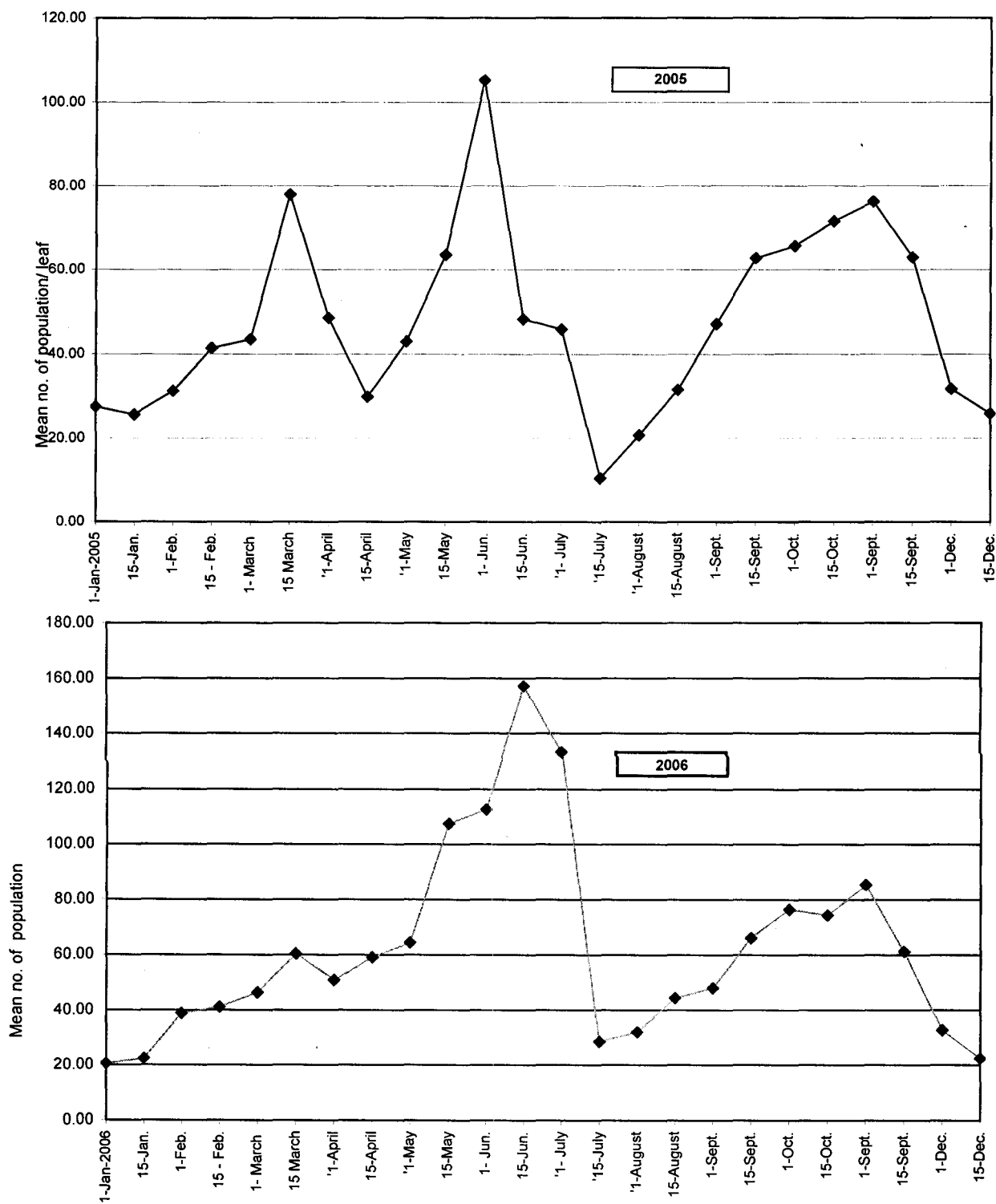


Fig. 1 . Seasonal abundance of total population of *Aulacaspis tubercularis* total population infesting mango trees in two studied seasons 2005 and 2006 at Qualubia Governorate .

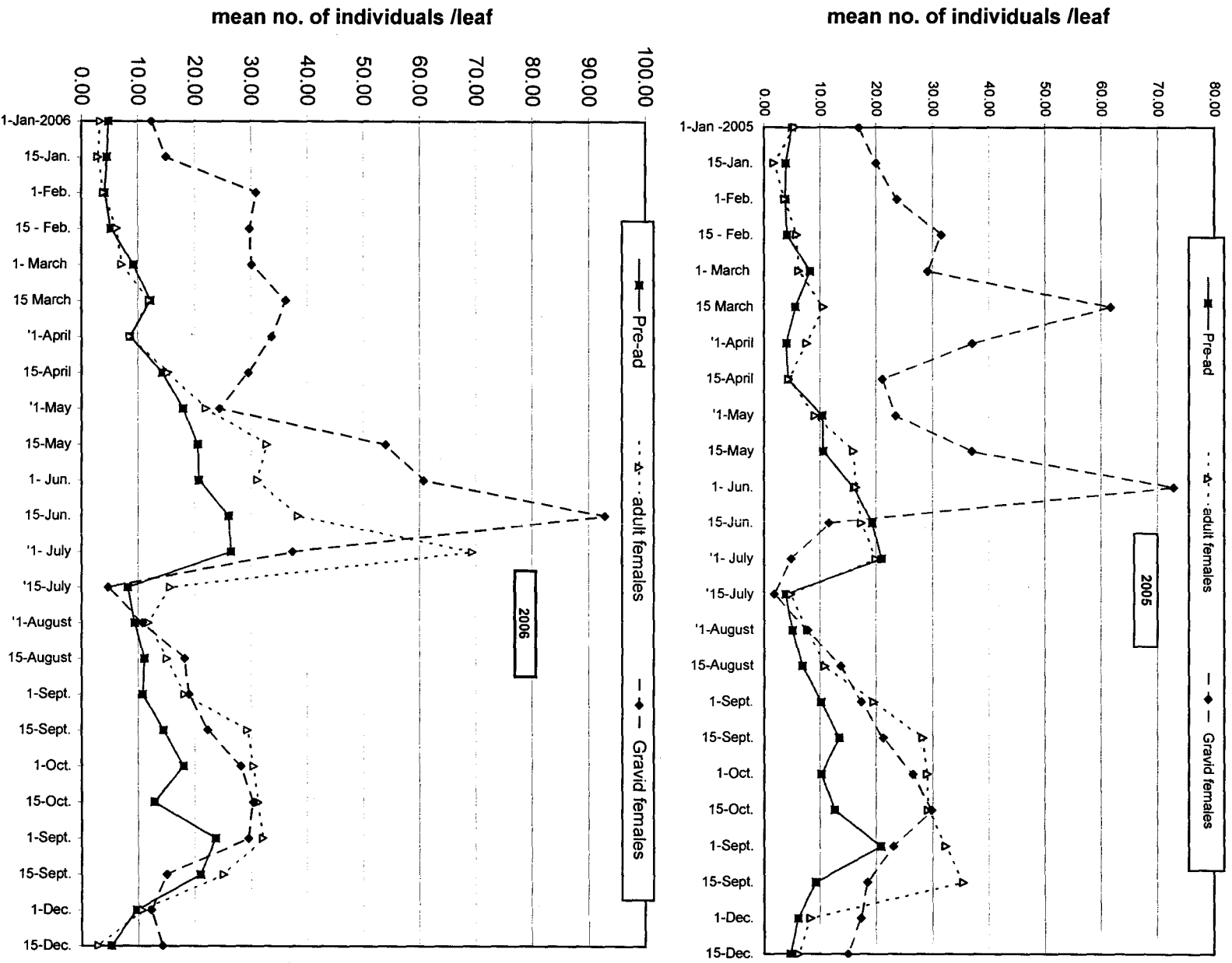


Fig. 2. Seasonal abundance of different stages of *Aulacaspis tubercularis* different stages infesting Mango trees in two studied seasons 2005 and 2006 at Qualubia Governorate .

2- Seasonal fluctuations of the pre-adult stages

Data in tables (1,2) and Fig (2) clearly showed that *A. tubercularis* pre-adults during each of 2005-2006 recorded 3 peaks, (in mid March , 1st July and 1st November) the highest peak was in 1st of July (21.00 individuals /leaf) in the first year and 26.40 individuals/leaf in the second one.

On the other hand, the lowest pre-adult population recorded in first of February with (3.80 individuals /leaf) in the first year (2005) and 4.10 individuals /leaf) during the second one (2006).

3- Seasonal fluctuations of the adults females

Data in tables (1,2) and fig (2) cleared that the population of the adult females through the two studied years had the same trend .

Females population had three peaks recoded in 15th March, 1st July and 1st November whereas, they showed the lowest population in mid January with 1.80 insect/leaf in the first year and 2.90 individuals/leaf in the second one .

4- Seasonal fluctuation of the gravid females

Data in the same tables clearly showed that *A. tubercularis* gravid females had three peaks through each of the two years. The highest peaks were observed in 15th March and 1st June with 61.70 and 72.80 individuals /leaf), respectively in the first year .

However, the highest peaks were recorded in 15th March and 15th June with 36.20 and 92.80 individuals /leaf), respectively, in the 2nd year. The smallest peak was recorded in 15th October with 29.80 individuals/leaf in the first year and with 30.30 individuals /leaf in the second one.

On the other hands, the lowest gravid females was achieved in July through the two years of study .

5- Number and duration of *Aulacaspis tubercularis* generations on mango trees

Data in table (3,4) and Fig (3,4) showed that four annual generations were recorded through each of the two studied years (2005 & 2006). They happened as follows :-

- First generation. extended for 3 months started from 1st of January till the end of March through the two years of study .

- Second generation. Also, elapsed 3 months, beginning from 1st of April till the end of June in the first year 2005, but it started from 1st of April till mid of July (3.5 months) in the second year, 2006 .
- Third generation started from 1st of July till mid of October (3.5 months) in the first year but it started from mid of July till mid of October (3 months) in the second one .
- Fourth generation was the shortest generation where it started from mid of October till end of December extended for 2.5 month through: two years of experiments .

The results disagreed with those obtained by Radwan (2003) who reported that *Aulacaspis tubercularis* had 3 generations on mango trees at Beni-Sweif governorate.

This prolonged durations caused further overlapping between generations. This is in agreement with Labuschagne *et al.* (1995) and Radwan (2003).

Table 3. Simple correlation between three tested climatic factors and the annual generations of *Aulacaspis tubercularis* on Mango trees in Qualubia Governorate during (2005) .

Generation	durations	"r"		
		D.Mx. T	N.Min.T	R.H.%
1- First generation (1 st of Jan-last of Mar.) .	3months	0.868 *	0.798	- 0.862 *
2- Second generation (1 st of April-last of June)	3 months	0.457	0.533	0.672
3- Third generation (1 st of July-mid of Oct.)	3½ months	-0.906**	- 0.845*	- 0.741
4- Fourth generation (mid of Oct.-last of Dec.)	2½ months	0.837	0.904*	- 0.358

r: Correlation coefficient value.

* Correlation is significant at the 0.05 Level .

Table 4. Simple correlation between three tested climatic factors and the annual generation of *Aulacaspis tubercularis* on Mango trees in Qualubia Governorate during (2006) .

Generation	Durations	"r"		
		D.Mx. T	N.Min.T	R.H.%
1- First generation (1 st of Jan-last of Mar.) .	3 months	0.513	0.085	- 0.718
2- Second generation (1 st of April-mid of July)	3½ months	0.899**	0.896**	- 0.0242
3- Third generation (mid of July-mid of Oct.)	3 months	- 0.641	- 0.644	- 0.058
4- Fourth generation (mid of Oct.-last of Dec.)	2½ months	0.602	0.688	- 0.770

r: Correlation coefficient value.

* Correlation is significant at the 0.05 Level .

6- The relation between climatic factors and *A. tubercularis* generations on the mango trees :-

(A) Effect of the maximum temperature on the different generations

1- The first generation : There was a positive correlation between maximum temperature and this generation during the two studied years, the correlation was significant in the first year but it was insignificant in the second one (tables 3 & 4).

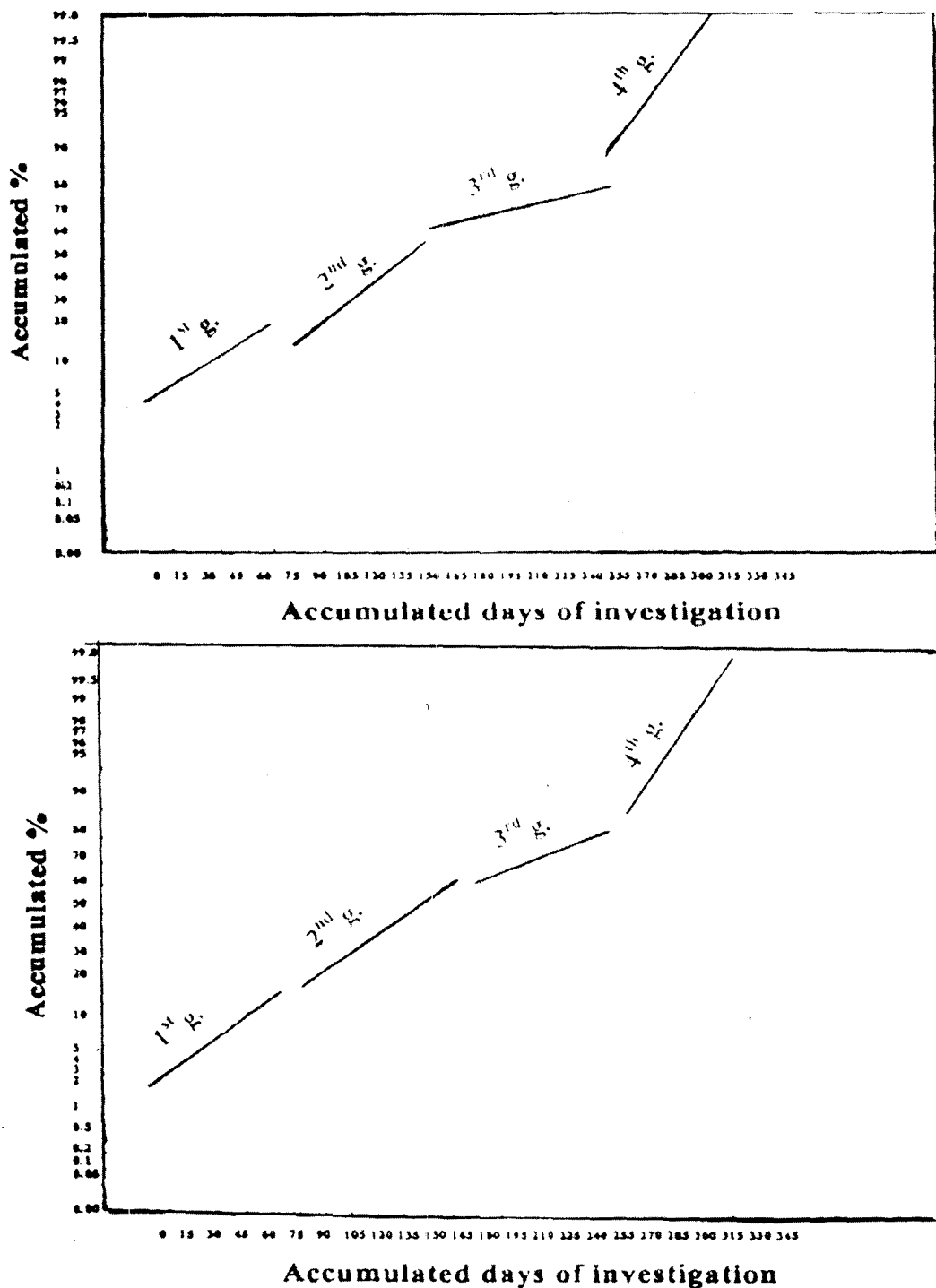


Fig . 3. Annual generations (g.) of *Aulacaspis tubercularis* on mango trees during (2005-2006) according to Jacob's method .

- 2- The second generation :** There was a positive correlation between maximum temperature and the second generation in the two studied years. The correlation was insignificant in the first year but it was highly significant during the second one.
- 3- The third generation :** The correlation between maximum temperature and the third generation was negative during the two years of investigation but its effect was highly significant during the first year .
- 4- The fourth generation :** The effect Max. temperature was positive and insignificant through the two years of study .

(B) Effect of the minimum temperature on the different generations :-

- 1- The first generation :** There was a positive and insignificant correlation between Min. temperature and the first generation during the two years of study Tables (3&4).
- 2- The second generation :** The correlation between Min. temperature and the second generation was positive during the two years. The correlation was insignificant in the first year but it was highly significant in the second one Tables (3&4).
- 3- The third generation :** The effect of Min. temperature through the two years of study was negative and its effect was significant during the first year only. (Tables 3 & 4).
- 4- The fourth generation :** There positive correlation between Min. temperature and this generation during the two studied years the correlation was significant in the first year but it was insignificant in the second one Tables (3&4).

(C) Effect of R.H%

Statistical analysis in tables (3&4) clearly showed that the correlation between the four annual generations and the relative humidity was negative except the 2nd generation during 1st year. The effect of R.H% on annual generation of *A. tubercularis* on mango was insignificant except the 1st generation in the first year .

The climatic factors, particularly temperature, and humidity have the most effect on armored scale insect and play a major role in its population dynamics .

Labuschangne *et al.*, (1995), Hassan (1998), Kwaiz (1999 , 2003) and Radwan (2003), found interrelation between population peaks of the mango scale insect and the highest mean temperature .

It is advisable to apply pesticides for controlling the mango scale insect, *A. tubercularis* that infesting Mango trees from mid July till late August as summer spraying which was more suitable

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دراسات بيئية لحشرة المانجو القشرية التي تصيب أشجار المانجو تحت الظروف الحقلية فى محافظة القليوبية

فايزة أحمد كوايز

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - النقى - الجيزة .

أجريت هذه الدراسات البيئية على حشرة المانجو القشرية التي تصيب أشجار المانجو بمحافظة القليوبية خلال موسمي (٢٠٠٥-٢٠٠٦) .

أظهرت الدراسة : أن للحشرة ثلاثة ذروات للكثافة العددية سنوياً وتم تسجيلها خلال مارس ويونية ونوفمبر وكان أقل تعداد للحشرة خلال شهر يولية وكان لحشرة المانجو القشرية أربعة أجيال متداخلة خلال العام .

وقد أظهر التحليل الإحصائي تأثير العوامل الجوية على نشاط الحشرة حيث وجدت علاقة موجبة بين الحرارة بنوعها (الصغرى - العظمى) وجميع أجيال الحشرة فيما عدا الجيل الثالث خلال سنتي الدراسة. وكانت العلاقة سالبة بين عامل الرطوبة وأجيال الحشرة فيما عدا الجيل الثاني فى السنة الأولى .

ومن خلال هذه الدراسة يمكن التوصل إلى أن أنسب ميعاد لمكافحة حشرة المانجو القشرية هو التوقيت الصيفي الذي يبدأ من منتصف يوليو حتى آخر أغسطس.