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ECOLOGICAL STUDIES ON THE SCALE INSECT PULVINARIA PSIDII (MASK) INFESTING COFFEE TREES (COFFEA ARABICA) AT QALUOIYA GOVERNORATE, EGYPT.

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ABSTRACT

Ecological aspects of *Pulvinaria psidii* attacking coffee trees (*Coffeae arabica*) in Qaluobiya Governorate in Egypt was studied during the two successive season of 2000 / 2001 and 2001 / 2002 .

The obtained results denoted all stages of *P. psidii* succeeded to settled on coffee trees and expoded all over the year.

Also, data gathered during first year of study for population density was detected four distinct peaks and three annual peaks. In the second year. Also, ecological data showed that :

- During the first and second years *P. psidii* had three overlapping generations .
- Also, results proved that there were positive correlation between maximum temperature and 1st & 3rd generation while there was a negative correlation with the 2nd generation .
- Minimum temperature had positive correlation with 1st generation but it appeared negative correlation with the 3rd generation. The data proved a negative correlation between R.H. % with all annual generations except second generation of the first year .

INTRODUCTION

Coffee considered from the most and oldest popular drink in world. Many commercial coffee cultivars grown success fully in different resplendent country as Barasil-Souza, (2000) ; Elyamen ; India-Reddy, (1997) ; Mexic-Jimenez (1997), Uganda-Kucel, (1997) ; Cuba-Martinez, (1995) ; and Kenya-Padi, (1997). But Egypt has shrink role in coffee cultivation because coffee considered cosmopolitan crop. Recently with progress apprehension, Egypt took avowal for necessitated agricultural expansion, so coffee cultivars was inserted from about sixteen years at Qaluobiya governorate as a initiative step to extend coffee cultivation through expedient Egyptian governorates *P. psidii* was first recognized by Fernald (1903) who indicated that plum, coffee and citrus infested by this insect. Through examination of fruitful coffee it could be definite highly infestation by *Plavinaria psidii* (Mask) with collateral infestation by *Icerya seychellarum* (mealy bug) but *P. psidii* considered the major pest on the coffee growing area .

It causes direct damage by sucking the plant Juice from the leaves produceding dryness in leaves and branches. Further more excrete honey dew that stimulates sooty mould. The presence of sooty mould on contaminated leaves interferes with the photosynthesis of plant. Also coffee fruits which coated by ovisaces and sooty mould have reduced / size and liquor quantity, these lead to lag it in markets.

Ecological study considered a key to put successful planning of IPC programs under field condition. But ecological study of *P. psidii* on coffee i.s

poorly known in Egypt. So this paper presents first review of ecological study of *P. psidii* on coffee at Qaluobiya governorate, Egypt .

MATERIALS AND METHODS

Standard ecological programme for *pulvinaria psdii* (Mask)was followed throughout two successive years from November 2000 till end of October 2002 field studies were under taken in binary orchard from coffee (coffea arabica) and mango plants. Coffee orchard consists of fruitful trees with about 16 years old locat in El-Kanater research station at Qaluobiya governorat and the area of this coffee orchard was about 2 feddans. No chemical control of coffee trees has never been applied in this orchard during the two years of investigation and it comply to all agricultural processes .

- Sampling

It taken twice monthly from early November 2000 till the end of October 2002. Sample unit was represented by 15 infested twigs (3 replicates x 5 branches). The selected branches must be approximately have 10 leaves Yielded enough scale insect to ensure areprentative sample (De villier 1973) .

- Examination and assessment

The selected branches were examined with a thin needle under laboratory condition by stereo microscope. All the living immature stages, adult females and gravid females of *P. psidii* were counted separately .

The data were pooled together, then the mean number of alive individuals per twig was taken as the population index .

- The rate of increasing in the population

Densities was calculated by preceding one (Bodenheimer 1951).

- Number and annual generations :

Number and annual generations for *P. psidii* was estimated from data obtained throughout two successive years 2000-2002 by using the changes in the half-monthly counts of immature stages (the nymphs) according to the formula proposed by Jacob (1977) .

RESULTS AND DISCUSSION

(a) Seasonal fluctuation of *P. psidii* population :

Collected data which monitored in Tables (1 & 2) and elucidate in Fig. (2 & 4) recorded the total population through the two successive years (2000-2002), They demonstrative the permanency of *Pulvinaria psidii* around the year on coffee trees at Qaluobiya Governorate.

- During the first year of study (2000/2001) questionnaire data of population fluctuation avered four peaks were registrated during mid of Nov. (74 insects / leaf), mid of Feb. (56 insects / leaf), mid of Jun. (88 insects / leaf) and continuous increase period during Oct. month (123 insects / leaf & 130 insects / leaf) .

- During the second year of study (2001/2002) it can be behold 3 annual population peaks, were demonstrated during mid of Nov. (78 insects / leaf), mid of Jan. (84 insects / leaf) and continuous increased period start from first of Sep. till the end of Oct. (211.7, 232, 245 and 270 insects / leaf, respectively) .
- Also, the data in Tables (1 & 2) published below up in *P. psidii* population in mid of Oct. through the two years at temperature average of 27.85°C and 56 % R.H. % during the first year and at a temperature average 28.45 °C and 42.5 % R.H. during the second year . while distinat shrivel population density was recorded in 1st of May at temperature average 25.1 °C and 54.5 % R.H. through the first year and in first of August with 40.75 °C and 60.5 % R.H. during the second year .

(b) Seasonal fluctuation of immature stages of *P. psidii* on coffee :

The data of first year of study Table (1) and Fig. (1) explained that population of immature stages was vacillate from first of Nov. till the end of May, then distinct up rise (first apex) occurred during Jun, followed with sharply diminution from first July to mid of August, then the second and up most apexes was registrated during Oct, 2001. The data of the second year of study which tabulated in Table (2) and illustrated in Fig. (3) took the same trend of the first year but the mono chief apex was registrated during September, 2002 .

(c) Seasonal fluctuation of *P. psidii* adult females :

The results given in Tables (1 & 2) and illustrated in Figs (1 & 3) explicate behaviour of adult stage in first year which was imitate that during the second year of study. They show equinoctial increasing from the first of Nov. till the end of Jan, then the abundance of mature females was oppressed until Sep, then engendered emission of the culminate apex during Oct. month .

(d) Seasonal fluctuation of ovipositional females :

Regarding to the number of ovipositing females which collected in Table (1) and delineate in Fig. (1) denote the presence of four definitive peaks during the first year (2000/2001) of study these peaks were appropriately at Nov., Feb., Jun. And Oct. months, respectively. Data in Table (2) which delineate in Fig. (2) exhibit three sequent moderate elevation during the second year of study (2001/2002) these elevation were elongated through Nov., Jan. and Oct. months, respectively. The most probable explanation for the increase in population of different stages during the mid of Oct., the harmonic correlation between the insect body temperature and the surrounding air temperature. When this suitable difference elicit, resulted in spell of higher population density. This agree with Bodenheimer (1951) he reported that the suitable difference between the body temperature of the red scale and the surrounding air temperature was 13.4°C when leaves were in sun and was 6.3 on shade leaves .

Table (1) : Seasonal occurrence of *Pulvinaria psidii* (Mask) different stages inrelation to climatic factors throughout 2000/2001 on coffee trees at Qaluobiya Governorate.

Sampling Date		Mean no. of pre-ad./ leaf	Mean no. of ad. fem. / leaf	Mean no. of oviposition fem./ leaf	Mean no. of total pop.	Quotient increase	D.Max. T. °C	N.Nin. T. °C	Mean T. °C	D.M. R.H. %
Nov. 2000	1st	26	13.4	33.4	72.8	-	31	14.2	22.6	56.5
	15th	25	14	35	74	1.02	37	10.4	23.7	53
Dec.	1st	11.6	10	10.4	32	0.43	26	8.8	17.4	56.5
	15th	12	11	12	35	1.09	28.2	8.6	18.4	55.5
Jan. 2001	1st	7	12	12.8	31.8	0.9	30.3	6	18.15	58
	15th	8	13	14	35	1.1	24.8	5.6	15.2	53
Feb.	1st	2	0.6	48.6	51.2	1.5	20.2	3.4	11 8	62
	15th	5	1	50	56	1.1	28.8	5	16.9	63.5
Mar.	1st	14.2	1.2	2	17.4	0.3	23.8	6.6	15.2	66.5
	15th	15	2	1.9	18.9	1.09	27.2	7.6	17.4	60.5
Apr.	1st	16.75	0.5	2.5	19.75	1.04	35.7	8.8	22.25	58
	15th	17.2	0.8	3	21	1.1	32	10	21	61
May	1st	10	1.7	4	15.7	0.75	37	13.2	25.1	54.5
	15th	12	2.1	6	20.4	1.28	41	13.2	27.1	59.5
Jun.	1st	48.3	2.3	32.7	83.3	4.14	39.4	18.8	29.1	55.5
	15th	50	3	35	88	1.1	39.4	18.4	28.9	54.5
Jul.	1st	9	0	12.7	21.7	0.25	41.4	18.7	30	57.5
	15th	12	1	13	26	1.2	41.4	18.8	30.1	58
Aug.	1st	11	6.5	4.5	22	0.85	38	22	30	61
	15th	12	7.1	5.1	24.2	1.1	38.2	22	30.1	61
Sep.	1st	48.3	1	5.3	54.6	2.26	40	20	30	48
	15th	50.2	2	6	58.2	1.1	40	21	30.5	48
Oct.	1st	60	38	25	123	2.1	41.8	20.4	31.1	52
	15th	63	40	27	130	1.1	36.5	19.2	27.85	56

Table (2) : Seasonal occurrence of *Pulvinaria psidii* (Mask) different stages inrelation to climatic factors throughout 2001/2002 on coffee trees at Qaluobiya Governorate.

Sampling Date		Mean no. of pre-ad./ leaf	Mean no. of ad. fem. / leaf	Mean no. of oviposition fem./ leaf	Mean no. of total pop.	Quotient increase	D.Max. T. °C	N.Nin. T. °C	Mean T. °C	D.M.R.H. %
Nov. 2001	1st	23.3	16.7	32.7	72.7	0	29	12.2	20.6	56.5
	15th	25.2	18.1	34.7	78	1.1	35	8	21.5	54
Dec.	1st	23.3	9.3	26.7	59.3	0.76	24.2	8.6	16.4	56.5
	15th	24.3	11.3	28.8	64.4	1.1	22	8.8	15.4	55.5
Jan. 2002	1st	11.6	18	53	82.6	1.3	28.3	6	17.15	60
	15th/	12	17	55	84	1.02	22.8	5.6	14.2	56.5
Feb.	1st	1	1	29.4	31.4	0.37	20.6	5	12.8	57.5
	15th	2	1	30.1	33.1	1.1	25.5	8.5	17	53
Mar.	1st	22.8	0	0	22.8	0.69	23.8	7	15.4	66.5
	15th	24	1	1	26	1.14	26.2	8.6	17.4	60.5
Apr.	1st	38.7	1	1	40.7	1.57	37	9.6	23,3	55.5
	15th	39	2	1.1	42.1	1.03	31.2	10.8	21	59
May	1st	17.5	1	16.5	35	0.83	37.2	13.2	25.2	54.5
	15th	18	1.1	17	36.1	1.03	41	13.2	27.1	59.5
Jun.	1st	14	3.5	18.5	36	0.99	39	17.7	28.35	52
	15th	15.1	5	20	40.1	1.1	38	21	29.5	54
Jul.	1st	11	6.5	4.5	22	0.55	35	22	28.5	57.5
	15th	12	7.8	5	24.8	1.13	41.9	23.8	40.9	58
Aug.	1st	11	6	4	21	0.85	39	21	40.75	60.5
	15th	11.8	7	5	23.8	1.1	39	21	40.75	60.5
Sep.	1st	133.3	66.7	11.7	211.7	8.9	41	21.1	34	47
	15th	150	70	12	232	1.1	41	20.8	33.9	47
Oct.	1st	110	100	35	245	1.06	30.6	14.8	36.4	58
	15th	120	110	40	270	1.1	34	14.4	28.45	42.5

(e) Number and duration of *P. psidii* (Mask) generation on coffee trees :

The obvious data presented by Jacob (1977) in Figs (5 & 6), exhibit three annual generations under local conditions at El- Kanater through the two years (2000-2001) and (2001-2002) .

- First generation lasted about 151 days , it's engender at first of Nov. and it's abduce at last of March.
- The second generation denoted at first of April until mid of August , it prolongated about 137 days .
- The third generation permanency about 77 days, it's emission started from mid of August till the last of Oct .
- From the obvious results it must be referred that, the first and second generations took long period than the third generation (autumn generation) this differ in the trend of the three generations was due to unfavourable climatic condition which limiting the activity of this pest during generation period . Although the third generation has the shortest period (77 days) during the first and the second year but it collateral with highly insect population (390 and 982.5 insect) through the first and the second years, respectively .
- So, it could be deduct that the climatic condition through autumn has an effective role on activity of *P. psidii* (Mask) .

(F)Effect of climatic factors on the *P. psidii* generations on coffee trees:-

(A) Effect of the maximum temperature on :-

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

2- **The second generation:** The correlation between maximum temperature and the second generation was negative during the two years of study , also, it's effect was highly significant during the first year only .

3- **The third generation :** There was positive correlation between maximum temperature and the third generation in the two years of investigation .

(B) Effect of the minimum temperature on :-

1- **The first generation :** As shown in Tables (3 & 4) the effect of min. temperature through the two years of study was positive and significance.

2-**The second generation :** Effect of min temperature on the second generation showed nigative highly significant during the first year but it took counteractive effect due to second year of study .

3-**The third generation :** The effect of min . temperature on the third generation took the same trend during the two years study, it has negative correlation and insignificant effect .

Table (3): The correlation between three tested climatic factors on the annual generation of *P. psidii* on coffee trees (*Coffea arabica* L.) in El-Kanater- Qaluobiya Governorate during (2000-2001).

Generation	D.Mx. Temp.	N.Min.T.	R.H.%
1-First generation from (1st of Nov. – last of Mar.) (151 days)	0.427	0.751*	-0.344
2-Second generation from (1st of April-mid of Aug) (137 days)	-0.834 **	-0.892**	0.313
3-Third generation from (mid of Aug. – last of Oct.) (77 days)	0.284	-0.662	-0.888*

* Correlation is significant at the 0.05 level.

Table (4): The correlation between three tested climatic factors on the annual generation of *P. psidii* on coffee trees (*Coffea arabica* L.) in El-Kanater- Qaluobia Governorate durin (2001-2002).

Generation	D.Mx. Temp.	N.Min.T.	R.H.%
1-First generation from (1st of Nov. – last of Mar.) (151 days)	0.721	0.711*	-0.030
2-Second generation from (1st of April-mid of Aug.) (137 days)	-0.490	0.154	-0.721*
3-Third generation from (mid of Aug. – last of Oct.) (77 days)	0.072	-0.674	-0.619

* Correlation is significant at the 0.05 level.

(C) Effect of R . H . % :

As shown in Tables (3 & 4) which deduced that the correlation between three annual generations and relative humidity was negative except 2nd generation in the first year. Also general effect of R.H on the annual generations of *P. psidii* on coffee was insignificant except 3rd generation in the first year and 2nd generation in the second year of study .

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منظور لاستراتيجية إنتشار حشرة البلفناريا على أشجار البن العربى المنزرعة فى مصر كبيئة غير تقليدية لزراعتة .

نجوى على حسن

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى

تم إجراء دراسات بيئية على الكثافة العديدة لحشرة البلفناريا الرخوة التى تعتبر الآفة الأساسية التى تهاجم أشجار البن العربى المثمرة المنزرعة فى مصر بمحافظة القليوبية. وتم أخذ عينات نصف شهرية تتمثل كل عينة ب١٥ فرع مصابة تم فحصها وحصر أعداد كل من الأطوار الغير بالغة – الإناث البالغة – الإناث المحملة بأكياس البيض وتمت هذه الدراسة فى الفترة من نوفمبر ٢٠٠٠ إلى أكتوبر ٢٠٠٢ .

وأشارت النتائج إلى تواجد جميع أطوار هذه الآفة على أوراق وأفرع أشجار البن العربى على مدار السنة ومن أهم نتائج السنة الأولى للدراسة وجود أربع ذروات للكثافة العديدة للحشرة سجلت في منتصف نوفمبر – منتصف فبراير – منتصف يونيه وخلال شهر أكتوبر الذي أرتبط بأعلى كثافة عديدة للحشرة .

أما نتائج السنة الثانية للدراسة فكان هناك ثلاث ذروات فقط للكثافة العديدة للحشرة خلال منتصف نوفمبر – منتصف يناير – وفترة متصلة من الإرتفاع ممتدة من بداية سبتمبر إلى نهاية أكتوبر سجلت فيها أعلى كثافة لهذه الآفة .

وأشارت النتائج أيضا إلى وجود فترتى نشاط للحوريات خلال السنة الأولى من الدراسة وسجلت خلال (شهرى) يونية وأكتوبر ولكن فى السنة الثانية تم تسجيل فترة واحدة خلال شهر سبتمبر .

- وبالنسبة للإناث البالغة فقد تواجدت فى صوره متذبذبة بين الإرتفاع والإنخفاض الطفيف ولكن فى السنة الثانية من الدراسة ظهر فترة واحدة من النشاط الملحوظ المحدد فى شهر أكتوبر . كما لوحظ فترة عدم نشاط لهذا الطور تمتد من شهر فبراير إلى شهر أغسطس .
- بالنسبة للإناث المحملة بأكياس البيض فقد كان لها أربع فترات نشاط خلال نوفمبر – فبراير – يونية وأكتوبر وذلك خلال السنة الأولى اما فى السنة الثانية سجل ثلاث فترات نشاط فقط خلال نوفمبر – يونية وأكتوبر .
- أما بالنسبة لعدد الأجيال فقد وجد إن للحشرة ثلاث أجيال متداخلة وكانت مدة الجيل الأول ١٥١ يوم كانت بدايته من أول نوفمبر وأمتد حتى نهاية مارس .
- الجيل الثاني كانت مدته حوالي ١٣٧ يوم وكانت بداية من أول إبريل وأمتد حتى منتصف أغسطس .
- الجيل الثالث وكانت مدته ٧٧ يوم وكانت بدايته من منتصف أغسطس وأمتد حتى نهاية أكتوبر .
- أما بالنسبة لتأثير العوامل المناخية فقد وجد علاقة موجبة بين الحرارة القصوى وكل من الجيل الأول والثالث وكانت هذه العلاقة سالبة مع الجيل الثاني وهذا خلال عامة الدراسة .

وكانت العلاقة بين الحرارة الصغرى والجيل الأول موجبة وسالبة مع الجيل الثانى والثالث وكانت سالبة مع الجيل الثالث فقد فى السنة الثانية .

- وكانت العلاقة بين عامل الرطوبة وأجيال حشرة *P. psidii* علاقة سالبة مع جميع الأجيال فيما عدا الجيل الثاني خلال السنة الأولى للدراسة .