

SURVEILLANCE STUDIES ON SOME PARASITOIDS ATTACKING THE SOFT SCALE INSECT, *Pulvinaria psidii* MASK INFESTING GUAVA TREES.

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ABSTRACT

The present experiments were carried out in the farm of Agricultural Research Center, Faculty of Agriculture, Mansoura University on guava trees during the two successive years 2001 and 2002 at Mansoura district. This study aimed to give some ecological information about the dominant primary parasitoids attacking the soft scale insect, *Pulvinaria psidii* Mask on guava trees.

The obtained results revealed that there were five primary parasitoids belonging to three Families (Aphelinidae, Encyrtidae, and Eulophidae) attacking *P. psidii* nymphs and adults. These primary parasitoids were identified as; *Encarsia citrina* Craw, *Diversinervus elegans* Silv., *Metaphycus flavus* How., *Microterys flavus* How. and *Tetrastichus ceroplastae* Gir. The most dominant species one was *D. elegans* as it formed 44.75% of the total catch in 2001 and 52.46% in 2002. The lowest species was *Microterys flavus* (9.47 and 9.10%) in 2001 and 2002. Two peaks of parasitism were recorded in the first year of study for *E. citrina* attacking *P. psidii* nymphs. These peaks were found in the end of January (4.9%) and in the end of August (6.2%), while during the second year, the highest density of *E. citrina* was recorded, in the end of January, in the first week of July, in the end of August and in the second week of November. Highly significant positive correlation were found between numbers of *P. psidii* nymphs versus *E. citrina* ($r = 0.568$ and 0.689 in 2001 and 2002. On the other hand, five peaks of parasitism on *P. psidii* adults were recorded during the two years of study. The parasitism showed highly significant correlation with *P. psidii* adults in 2001 and 2002 as 'r' values were 0.776 and 0.766. Based on simple linear regression between the number of *P. psidii* adults and the percentage of parasitism, there were positive strong relationship during the two years of study.

INTRODUCTION

Guava, *Psidium guajava*, L. is one of the important fruits in Egypt. Guava orchards are infested by some species of injurious soft and armoured scale insects. The insects are *Pulvinaria psidii* Mask.; *Saissetia coffeae* Walk; *Ceroplastes floridensis* Comst; *Coccus hesperidum* L.; *Hemiberlesia lataniae* Sign. and *Aonidiella aurantii* Mask (Salama and Salem, 1970; El-Minshawy et al., 1971 and 1974; Hill, 1975; El-Shouny, 1987 and El-Agamy, 1994). Among the insect pests; *P. psidii* and *H. lataniae* are the most serious soft scale insects infesting guava trees in Alexandria area (El-Minshawy et al., 1971 and 1974). These scale insects are attacked by numerous parasitoid insect species (DeBach and Argyriou, 1967; Moursi, 1974; Hafez, 1984; Eider et al., 1998; El-Agamy, 1994; Logan and Thomson, 2002; Matadha et al., 2003 and Ghahhari et al., 2004).

The purpose of the present study was to give some ecological information concerning the dominant primary parasitoid insect species attacking *P. psidii* on guava orchards as biological control agents.

MATERIAL AND METHODS

This study was carried out at guava orchard (about one feddan) located at Mansoura district for the two successive years (2001 and 2002). Guava trees (variety Baladi) were about ten years old, no insecticides were applied in the orchard for the two years of investigation. Five trees of the same age and size were chosen at random at the same orchard. Twenty five guava leaves were collected from each tree and thus, 125 leaves were picked bi-weekly. Obtained leaves were kept inside polyethylene bags, and translocated to the laboratory of Economic Entomology Department, Faculty of Agriculture, Mansoura University for examination. Alive nymphs and adults of the scale insect namely *P. psidii* except the first nymphal instar (crawlers) were counted on both surfaces of guava leaves using a stereo-microscope.

Leaves having insect species were separated from each other, and classified into two portions with adult scale insects, and portions with nymphs. Then, they were introduced into emergence wood boxes (50 x 20 x 20 cm) to collect the emerging parasitoids. Internally, each cage was divided into two sections, each provided with eight glass tubes inserted in rounded holes. The ventilation in the cages was achieved by holes covered with gauze textile in the back side of the cages. Two neon electric lamp (40 cm long and 60 W) were placed externally in front of the two internal sections of each cage. By the emergence time of the parasitoid species, the adults were attracted to light and then entered the tubes where they could be easily collected. The emerging parasitoids were monitored and collected by substituting the tubes having the parasitoids by new ones. Guava leaves also were replaced by new leaves having alive scale insects. The trapped parasitoids were mounted using Hoyer's medium and identified by the help of the Biological Control Research Department, Plant Protection Research Institute, Giza, Egypt. Daily records of temperature and relative humidity during the two years of study were obtained from the Meteorological Station, Ministry of Defence at Shawa Air Base Station (about 5 km from Mansoura).

Total number of the primary parasitoids attacking the two soft scale insects were subjected to one way analysis of variance (ANOVA), and the means separated using Duncan's Multiple Range Test (Costat, 1990). The correlation coefficient between weather parameters and the numbers of the primary parasitoids attacking the soft scale insect was computed. In addition, the simple linear regression between total numbers of primary parasitoids and total numbers of *P. psidii* during the two years of study was also fulfilled.

RESULTS AND DISCUSSION

I. Survey of parasitoids attacking the soft scale insect *Pulvinaria psidii* on guava trees:

Five hymenopterous parasitoids pertaining to three families; Aphelinidae, Encyrtidae and Eulophidae were surveyed. These parasitoids were collected from either nymphal or adult stage, or from the both stages. Of these one aphelinid species namely, *E. citrina* was recorded parasitizing on *P. psidii* nymphs. Table (1) shows the number of the four parasitoids

attacking *P. psidii* adult females and their percentages to the total catch on guava trees during the two years of study. These species were *D. elegans*, *M. flavus*, *M. flavus* and *T. ceroplastae*. The most dominant species was *D. elegans*. It formed 44.75% of the total catch in 2001 and 52.46% in 2002. The lowest density was recorded for *M. flavus* (9.47 and 9.10%) in 2001 and 2002, respectively.

Table (1): Numbers of the four primary parasitoid species attacking *P. psidii* adults and their percentages to the total catch on guava trees during the two years of study at Mansoura district.

Parasitoid species	2001		2002	
	Total numbers	% to total catch	Total numbers	% to total catch
1. Encyrtoridae:				
<i>Diversinervus elegans</i> Silv.	345	44.75	438	52.46
<i>Metaphycus flavus</i> How.	204	26.46	173	20.72
<i>Microterys flavus</i> How.	73	9.47	76	9.109
2. Eulophidae:				
<i>Tetrastichus ceroplastae</i>	149	19.32	148	17.72
Total	771	100	835	100

II. Seasonal abundance of *E. citrina* parasitoids attacking *P. psidii* nymphs on guava trees:

Data in Figs. (1 and 2) show the seasonal abundance and percentage of parasitism of *E. citrina* during the two successive years of 2001 and 2002.

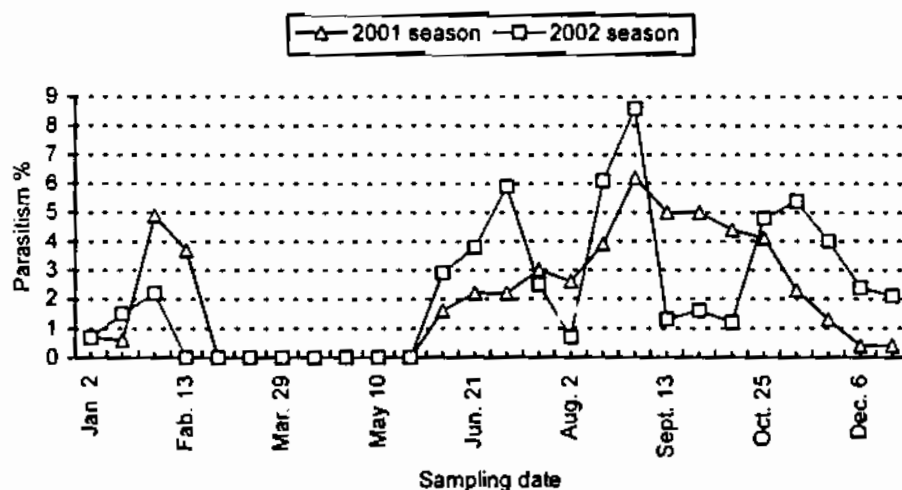


Fig.1. Parasitoid numbers of *E. citrina* attacking *P. psidii* nymphs during the two year of study at Mansoura district

In the first year, this species parasitized *P. psidii* nymphs from January till the mid of February (0.7-4.9% parasitism), and then completely disappeared from last week of February till the last week of May. It appeared parasitizing *P. psidii* nymphs from the first week of June through December. Two peaks of parasitism were recorded, in the end of January (4.9%) and in the end of August (6.2%). In the second year of study four peaks of parasitism were detected. The first (2.2%) was in the end of January, the second was 5.9% in the first week of July, the third (8.6%) was in the end of August and the fourth (5.4%) was in second week of November. Highly significant positive correlations were found between numbers of *P. psidii* nymphs versus numbers of *E. citrina* ($r = 0.568$ and 0.689 in 2001 and 2002) (Table 2).

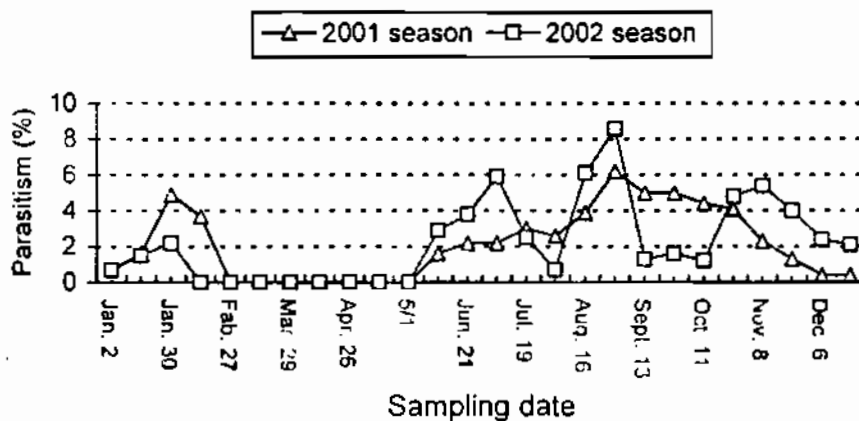


Fig.2. Parasitism percentages of *E. citrina* attacking *P. psidii* nymphs during the two years of study at Mansoura district

Table (2): Correlation coefficient (r) between the numbers of *P. psidii* versus the numbers of the five parasitoids.

Variables	Correlation coefficient (r value)	
	2001	2002
<i>P. psidii</i> x <i>E. citrina</i>	0.568	0.689
<i>P. psidii</i> x Total parasitoids	0.776	0.766

The regression equations between the total number of *P. psidii* nymphs and the number of the parasitoid *E. citrina* indicated that there were a highly positive relationship between the total number of *P. psidii* nymphs and number of the parasitoid *E. citrina*.

III. Seasonal abundance of the primary parasitoids attacking *P. psidii* adult:

Figs. (3, 4, 5 and 6) clearly showed that the relationship between adult females of *P. psidii* and their parasitoids on guava trees during the two considered years. Three peaks of *P. psidii* adults were recorded in 2001. The

first peak was recorded in the second week of February, the second one was observed in the third week of July, while the third peak was recorded in the first week of December. It could be concluded that five peaks of parasitism (46.15, 36.00, 26.19; 30.31, and 27.61%) were recorded in the first year of study. The first peak was found in last week of April, the second one was recorded in the first week of June, the third peak was observed in first week of August, the fourth peak was found in the third week of November, while the fifth peak was recorded in the third week of December.

In the second year of study, there were three peaks of *P. psidii* adults. These peaks were found in the second week of February, in the first week of August, and in the first week of December, respectively. It can be noted that five peaks of parasitism (45.23, 33.56, 22.82, 29.48 and 26.23%) were recorded. These peaks were found in last week of April, in the first week of June, in the third week of July, in the last week of November and in the third week of December, respectively (Tables 5). The parasitism showed highly significant correlation with *P. psidii* adults in 2001 and 2002 as "r" values were 0.776 and 0.766 (Table 2).

Based on simple linear regression between the number of *P. psidii* adults and the percentages of parasitism there were strongly positive relationship during the two years of study. The regression equations were: $Y = 2.48033 + 0.12270 x$ in the first year and $Y = 2.5220 + 0.14103 x$ in the second year of investigation. The values of R^2 were 0.6085 and 0.5884 during the two years, respectively.

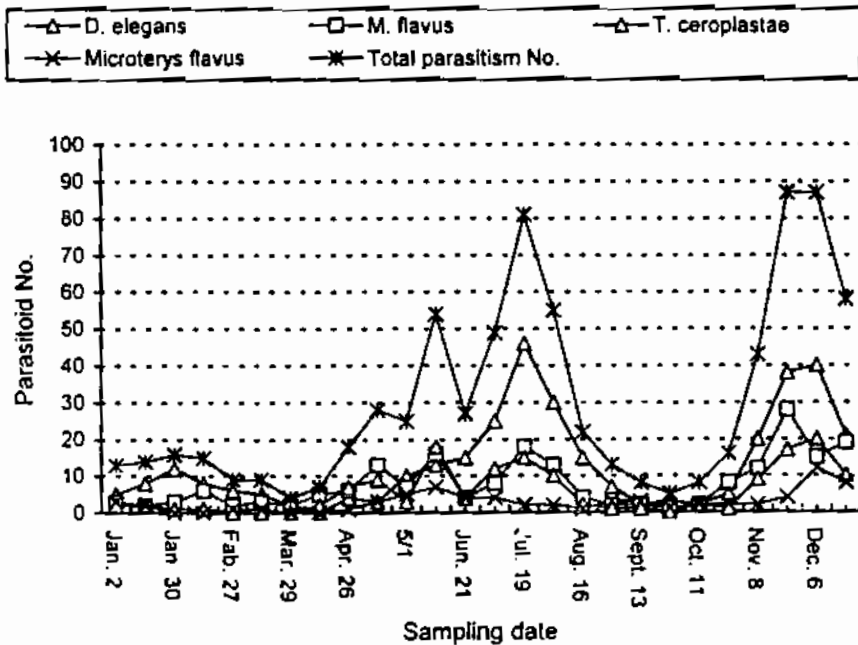


Fig.3. Parasitoid numbers of four hymenopterous parasitoids attacking *P. psidii* nymphs during 2001 season at Mansoura district.

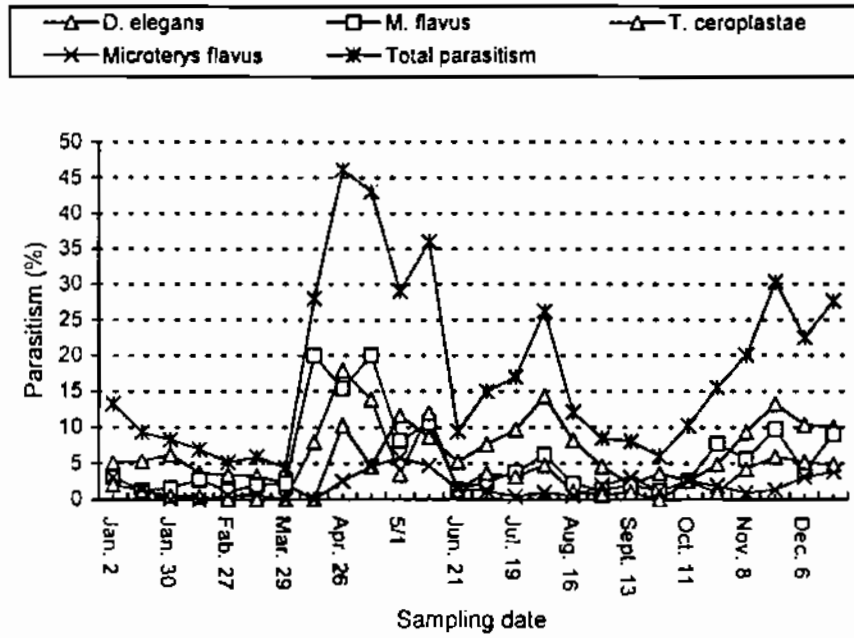


Fig.4. Parasitism percentages of four hymenopterous parasitoids attacking *P. psidii* nymphs during 2001 season at Mansoura district

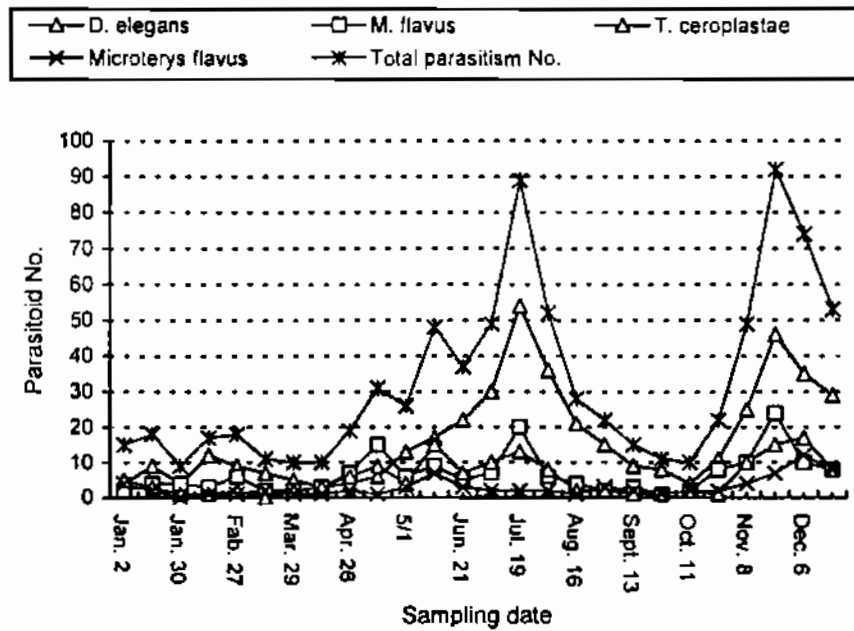


Fig.5. Parasitoid numbers of four hymenopterous parasitoids attacking *P. psidii* nymphs during 2002 season at Mansoura district

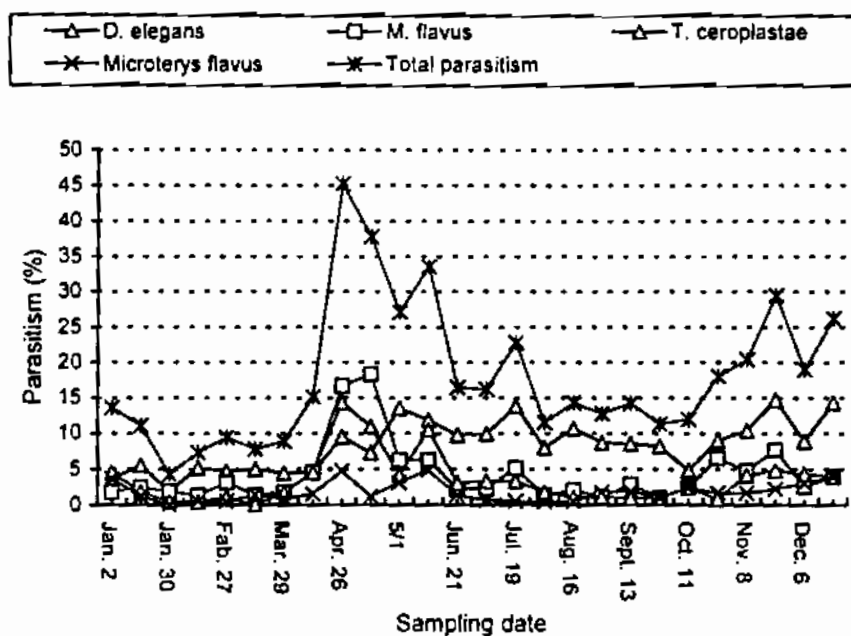


Fig.6. Parasitism percentages of four hymenopterous parasitoids attacking *P. psidii* nymphs during 2002 season at Mansoura district

IV. Effect of temperature and relative humidity on the primary parasitoid species attacking both nymphs and adult of *P. psidii*:

Data in Table (3) showed the correlation coefficients (r) between the total numbers of the five primary parasitoid species attacking both nymphs and adults of *P. psidii* and the average of temperature and the relative humidity. The obtained results revealed that correlations between *E. citrina* and *T. ceroplastae* numbers and average temperature were positively significant during the two years of investigation, while that was positively significant in 2002 for *M. flavus* (Table 3). The effect of relative humidity on these parasitoid species was not significant.

Diversinervus elegans was recorded to attack different species of *Pulvinaria* (Prisner and Hosny, 1940; Moursi, 1974 and Hamed and Hassanein, 1991). The same parasitoid attacked species of *Saissetia* (Prisner and Hosny, 1940; Salama and Salem, 1970; Rosen *et al.*, 1971 and Ragab, 1995). On the other hand, *M. flavus* was found to attack *C. floridensis* (Hafez *et al.*, 1987). In addition, *C. floridensis* was parasitized by *Tetrastichus ceroplastae* (Den-Dov, 1972; El-Agamy, 1994).

Table (3): Correlation coefficient (r) between total numbers of the primary parasitoids attacking both nymphs and adults of *P. psidii* and certain weather factors during the two years of study at Mansoura district.

Variables	Correlation coefficient (r value)	
	2001	2002
1. <i>E. citrina</i> x Av. Temp. x Av. RH %	0.566**	0.601**
2. <i>D. elegans</i> x Av. Temp. x Av. RH %	0.203	0.456
3. <i>M. flavus</i> x Av. Temp. x Av. RH %	0.412	0.302
4. <i>M. flavus</i> x Av. Temp. x Av. RH %	0.210	0.186
5. <i>T. ceroplastae</i> x Av. Temp. x Av. RH %	0.470	0.565**
	0.193	0.120
	0.501**	0.553**
	0.152	0.135

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دراسات حصر على بعض الطفيليات التي تهاجم الحشرة القشرية الرخوة
Pulvinaria psidii MASK والتي تصيب أشجار الجوافة
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أجريت تجارب حقلية في مزرعة كلية الزراعة - جامعة المنصورة على أشجار الجوافة خلال عامين متتاليين هما ٢٠٠١، ٢٠٠٢ وتهدف هذه الدراسة إلى إعطاء معلومات ليكولوجية على بعض الأنواع السائدة من الطفيليات الأولية التي تتطفل على الحشرة القشرية الرخوة *psidii Pulvinaria* على أشجار الجوافة .

وقد أشارت للنتائج المتحصل عليها إلى وجود خمس أنواع من الطفيليات الأولية والتي تتبع ثلاث عائلات هي : (Aphelinidae , Encyrtidae and Eulophidae) والتي تتطفل على حوريات والحشرات الكاملة

وهذه الطفيليات الأولية هي : *Encarsia citrina* Craw , *Diversinervus elegans* Silv , *Metaphycus flavus* How , *Microterys flavus* How and *Tetrastichus ceroplastae* Gir .

وكان أكثر الأنواع السائدة هو النوع *Diversinervus elegans* حيث وصلت النسبة المئوية ٤٥,٤٤ % بالنسبة للتواجد الكلي للطفيليات في عام ٢٠٠١ & ٥٢,٦٤ % في عام ٢٠٠٢ وكان أقل الأنواع شيوعاً هو النوع *Metaphycus flavus* وكانت نسبته ٩,٤٧ % & ٩,١٠ % خلال عامي الدراسة .

أشارت الدراسة إلى وجود ذروتين للنشاط الطفيلي في العمام الأول للدراسة للنوع *Encarsia citrina* Craw والتي تهاجم الحوريات ووجدت هاتين الذروتين في نهاية يناير وكانت ٤,٩ % وفي نهاية أغسطس ٦,٢ % بينما في العام الثاني للدراسة كانت ذروة التعداد لهذا الطفيل خلال نهاية يناير وفي الأسبوع الأول من شهر يوليو وفي نهاية أغسطس وفي الأسبوع الثاني من نوفمبر وكان هناك ارتباط عالي موجب بين أعداد حوريات *Pulvinaria psidii* ، *Encarsia citrina* Craw .

($r = 0.568$ & 0.689) في ٢٠٠١ ، ٢٠٠٢ وعلى الجانب الآخر وجدت خمس ذروات للتطفل على الحشرات الكاملة سجلت خلال عامي الدراسة .
أظهرت الدراسة أن التطفل كان له ارتباط عالي المعنوية مع الحشرات الكاملة خلال عامي الدراسة ($r = 0.776$ & 0.766) ومن جدول تحليل الانحدار بين الحشرات الكاملة ونسبة التطفل فقد أظهرت الدراسة إلى وجود علاقة قوية موجبة خلال عامي الدراسة .