

Effects of certain environmental factors on population fluctuations of *Aphis gossypii* in cucumber fields at Assiut Governorate

Ibrahim,I.L.¹; AbdEl-Ghaffar.M.M.²;Abdel-fftah.O.A.³and Khttab.H.M.⁴

1,2 -Plant Protection. Dept. Fac. Agric. AL-Azhar univ. Cairo.

3,4 - Plant Protection. Dept. Fac. Agric. AL-Azhar univ . Assuit .

Corresponding author: hanymohammed@yahoo.com

Abstract

Field experiments were conducted in the farm of Agriculture faculty, AL-Azhar university at Assiut governorate throughout two successive seasons 2014 and 2015 to survey the insects associated with cucumber crop (*Cucumis sativus* .L). Results indicated existence of 10 insect species related to 9 families of 6 orders. The important Insect pests recored on cucumber were Leafhoppers ,*Empousca spp* ,thrips *Thrips tabaci* (Lind.), the melon aphids *Aphis gossypii* (Glover) , the tomato whitefly, *Bemisia. tabaci* , the cucurbit fruit flies, *Dacus ciliates* and cucurbit leaf fly (leaf-miner) *Liriomyza bryoniae* (Kalt.),. However the common associated natural enemies inhabiting cucumber field were, *Coccinella septempunctata* L.; *Chrysopela carnea* (Steph),. *Orius spp* and *C. undecimpuctata* . The effects of certain environmental factors (maximum temperature , minimum temperature, relative humidity) and *C. undecimpuctata* and numbers on the population fluctuation of *A. gossypii* were studied .Results indicated that *C. undecimpuctata* had significant correlation with population of aphid during the two seasons 2014 and 2015. The previous environmental factors were responsible for about 51.75% & 91.62% of the variability in the populations of aphid in summer and Nili plantation at 2014 respectively , while they were responsible for about 78.08% & 94.65% respectively in 2015.

Key Words: survey the insects *Empousca spp* ,thrips effects of certain environmental

Introduction

Cucumber, *Cucumis sativus* L. is one the most important economic vegetables crop cultivated in Egypt and many countries of the world. The cultivated area with this crop increased during the last two decades especially in new reclaimed regions in both open and protected plantation. Throughout the growing season, cucumber plants are suffering from severe infestation with different phytophagous insect pests such as the aphids, *Aphis gossypii* (Glover.) and the tomato whitefly, *Bemisia tabaci* (Genn.) , which considered the most common and dangerous insect pests of cucumber plants. In case of heavy infestation, these pests are causing serious damage to plants, leading to great reduction in the final yield Hanafy (2004). Cucurbitaceous plants are subjected also to be attacked by several major insect pests which cause severe damage directly or indirectly to the crop production (Gameel, 2004; Gallab *et al.*, 2011; and Gameel, 2012). Aphids play an important role in transmission of viral diseases and produce honeydew Kasperovich (2002). Therefore, the purpose of this work aimed to study the effect of certain environmental factors on the population dynamics of *Aphis gossypii* infesting Summer and Nili cucumber plantations.

Materials and Methods

The experiments were conducted in the farm of Agriculture Faculty AL-Azhar University at Assiut Governorate throughout two successive summer and

Nili cultivations during 2014 and 2015. An area of about 1 Carat was sown with cucumber seeds (*Cucumis sativus*), varieys (*Beit alpha*) on March, 15th and August, 15th for Summer and Nili seasons respectively during 2014 and 2015 .

The experimental area was about 168 m² divided into 4 equal plots area each (7×6 m²). Normal agricultural practices were followed except using chemical control. Sampling started after two weeks from planting date and continued to the harvesting time.

*Methods of survey:

*Three methods were used to survey the insects on cucumber:

1. Direct count:

In this method, three plants were selected randomly representing the four plot corners and plot center at weekly intervals. and three leaves from each of the three level of each plant were chosen and examined.

Collected specimens were kept in paper bags and transferred to the laboratory for identification. Specimens of unknown species were kept in glass vials containing 75% ethyl alcohol, for later identification.

2. Sweeping net:

Twenty five double sweeps (50 net strokes) in five replicates, were taken weekly from the four corners and the center of each plot. The collected insects were

transferred to the laboratory in paper bags for later identification and counting.

3. Yellow sticky traps:

Yellow sticky card-boards measuring 15×20 cm vertically fixed to white stalks were distributed at a rate of 5 trap / plot. Traps were located just or slightly above the tops of the plants and replaced with new ones every week.

Minimum, and maximum temperature and relative humidity were obtained from the meteorological records of Central Laboratory for Agriculture Climate, Agriculture Research Center at Dokki (preventative Assiut Governorate).

Both weather factors and the numbers of *C. undecimpunctat* . were statistically analysed with numbers of *A. gossypii* to obtain the effect of environmental factors on the population fluctuation of aphids .

Statistical analysis:

The statistical analysis (simple correlation and partial regression) of the obtained data was performed by using SAS program (SAS Institute, 1988).

Results and Discussion

Table 1. Taxonomic list of insects on cucumber plants during 2014 and 2015 seasons at Assiut Governorate .

Order	Family	Scientific Name	Status
Hemiptera	Cicadellidae	<i>Empoasca</i> spp.	Pest
	Anthocoridae	<i>Orius</i> spp	Predator
Homoptera	Aphididae	<i>Aphis gossypii</i>	Pest
	Aleyrodidae	<i>Bemisia tabaci</i> (Genn.)	
Diptera	Agromyzidae	<i>Liriomyza bryoniae</i>	Pest
	Tephritidae	<i>Dacus ciliates</i>	Pest
Thysanoptera	Thripidae	<i>Thrips tabaci</i>	Pest
Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i>	Predator
		<i>Coccinella undecimpunctata</i>	Predator
Neuroptera	Chrysopidae	<i>Chrysoperla carnea</i> Steph	Predator

**Population fluctuations of *A. gossypii* and *C. undecimpunctata* on cucumber plants.

1- Season 2014

A- Summer plantation .

Data illustrated in Fig. (1) show that infestation of *Aphis gossypii* on cucumber started after 15 days from sowing date ; 29th March by 15 individuals /45 leaves. Aphids population increased gradually weekly to reach its peak (710 adult /45 leaves) after 50 days after sowing date on 3rd May. After that the insect population decreased gradually to reach the lowest level (8 adult /45 leaves) at mid of June . Meanwhile, data indicated also that population of *A. gossypii* was obviously higher on young plants (3-6 weeks) than on older plants of the cucumber. This result indicated that young fresh plants showed higher biological activities with turgid fully nourished cells than older cucumber plants and was

* Insects associated with cucumber crop:

Table. (1) contains a taxonomic list of insect pests and associated natural enemies inhabiting cucumber fields in Assuit during 2014 and 2015 seasons. Data revealed the presence of 10 insect species related to 9 families belonging to 6 orders. Data also indicate that, 6 insect species of them were pests; the tomato whitefly *B. tabaci*, the melon aphid *A.gossypii* Glover , Leafhoppers *Empoasca* spp., the cucurbit fruit flies, *D. ciliates*, the cucurbit leaf fly (leaf miner); *Liriomyza bryoniae* (Kalt.), and *Thrips tabaci* Lindeman. The other four species were common predators; *Chrysoperla carnea* Steph. , *Coccinella septempunctata* L., *C. undecimpunctata* and *Orius* spp .those insects are recorded as common pests infesting cucurbit plants in many parts of the world (Kamel et al., 2000; Gameel and Sayed, 2008 , Younes et al., 2010. and Gameel 2013). The obtained results are in agreement with those of El-Maghraby et al., 1994 , Ali, 1995 , and Bachatly and Sedrak, 1997 who reported that, each of *C.undecimpunctata*, *Ch. Carnea* and *S. corolla* were the most common predator species associated with the cucurbit insect pests.

more suitable for the reproduction of the insect pest. These results were in agreement with Hafiz and Abou-El-Hagag. (1997), Whitney (1999) , Habashi et al. (2007), and Griffen (2007).

In case of *C. undecimpunctata* the adult population started to appear in low numbers at the beginning of April(8 adult / 45 leaves) after 15 days sowing date, then increased to reach the highest level(131 adult / 45 leaves) at 17th may . It is obvious that increasing of *C. undecimpunctata* numbers follows the increasing in aphid population by 2 week .After that the insect population fluctuated , then decreased gradually to reach a lower level (24 adult /45 leaves) by the end of the season at 14th June .

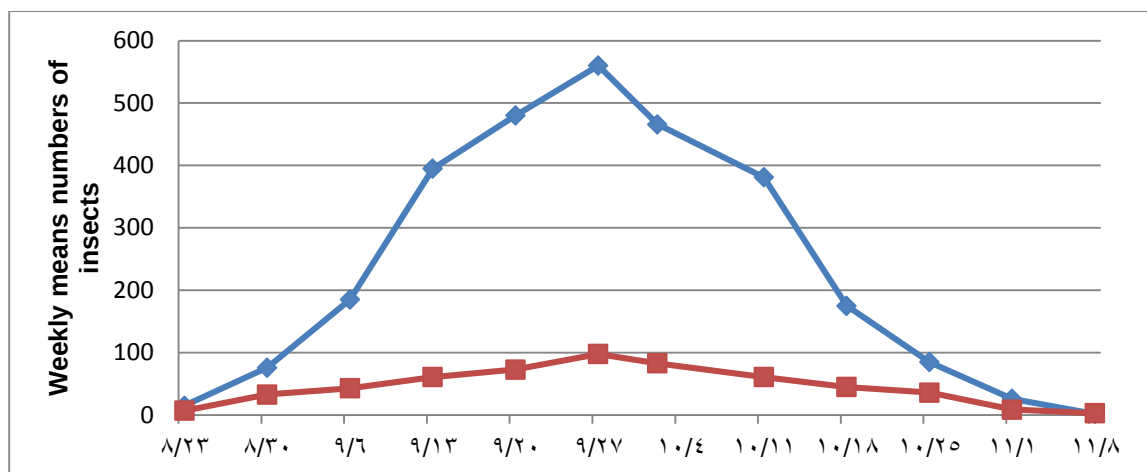


Fig.(1) Weekly numbers of *Aphis gossypii* and *Coccinella undecimpunctata* on cucumber plants during summer plantation , 2014.

B- Nili plantation

Data in Fig. (2) showed that infestation of *Aphis gossypii* on cucumber started at 15 days after sowing date on 23th August (12 aphid /45 leaves). It increased to reach its maximum level (705 aphids /45 leaves) after 50 days sowing on 27th September .After that the insect population fluctuated and decreased gradually to reach a lower level (4 aphids /45 leaves) at 11th November after 90 days from sowing .date also, as recorded in summer plation, young and fresh cucumber leaves more suitable for aphids. These results are in agreement with **El- Sayed (1978)**,

Dibble (1980), **Nazato (1988)**, **Steenis et al., (1995)** ,**Hanafy (2004)** , and **El-Lakwah et al (2011)** who stated that aphid population reached its maximum by the end of October in Qalyubia governorate .

As shown in Fig .(2) , *C. undecimpunctata* adult started to appear on cucumber in relatively low numbers at the beginning of August(9 adult / 45 leaves) . then , its population increased to reach a high level(105 adult / 45 leaves) on 27th september . After that the insect population fluctuated then decreased gradually to reach a lowest level (3 adult /45 leaves) on 11th November .

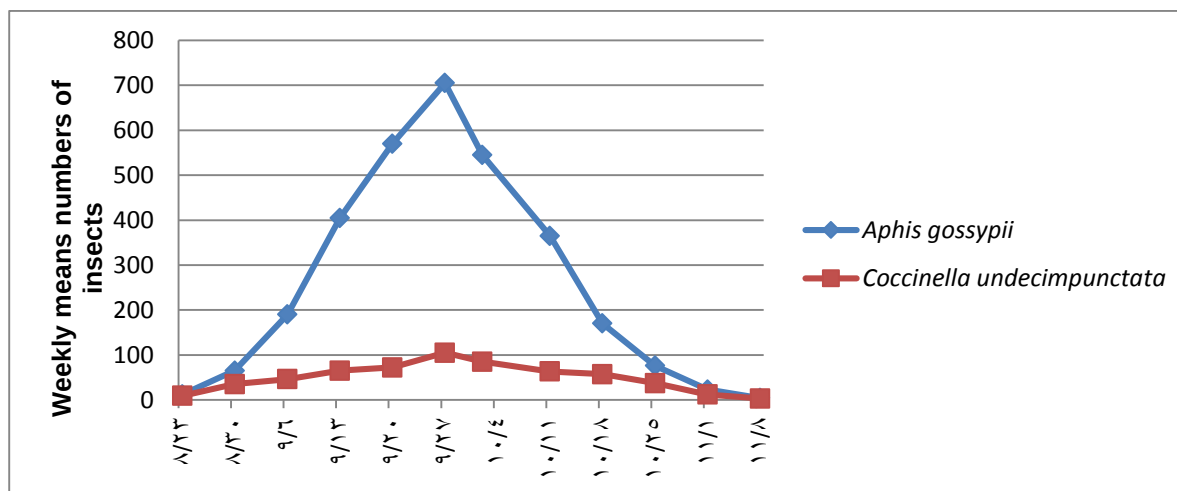


Fig.(2) Weekly numbers of *Aphis gossypii* and *Coccinella undecimpunctata* on cucumber plants during Nili plantation 2014.

2- Season 2015

A- Summer plantation

As shown in Fig. (3) the aphids infestation level showed the same trend of the previous season .The infestation of *Aphis gossypii* on cucumber started at 15 days after sowing date on 29th March (21 aphids /45 leaves). It increased to reach its maximum level (700 aphids /45 leaves) 50 days after sowing on 3rd May. After that the insect population fluctuated and decreased gradually to reach a lowest level (8 aphids

/45 leaves) on 14th June after 90 days from sowing date .

In respect to the *C. undecimpunctata* , its population started to appear in low number at the beginning of April(9 adult / 45 leaves) following the appearance of the aphids then the beetles increased in numbers to reach a high level(101 adult / 45 leaves) on 17th may . After that the insect population fluctuated then declined gradually to reach a lower level (12 adult /45 leaves) on 14th June.

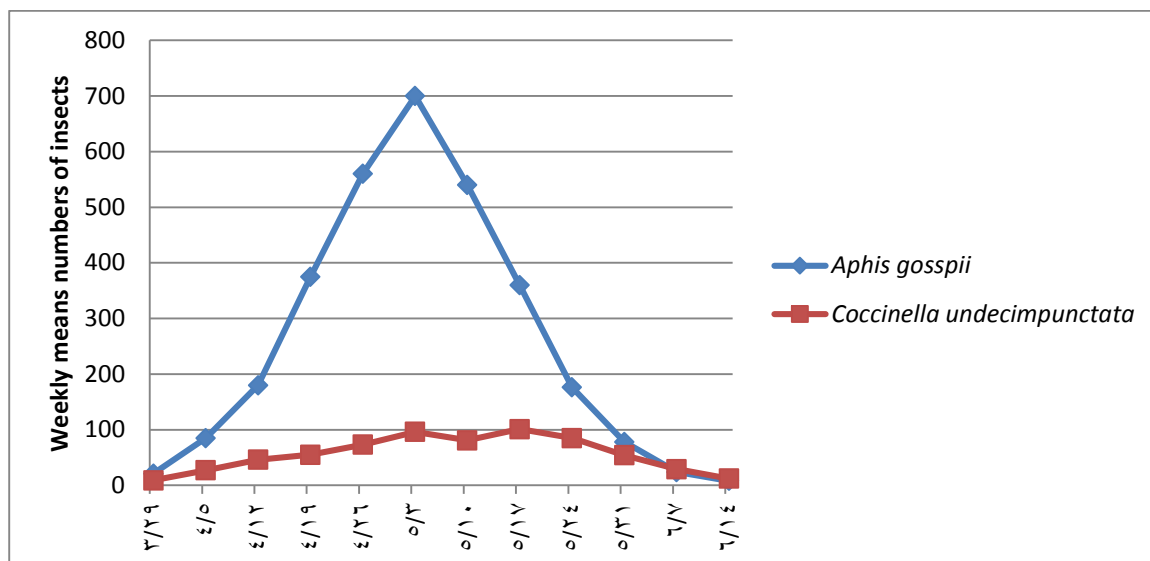


Fig. (3) Weekly numbers of *Aphis gossypii* and *Coccinella undecimpunctata* on cucumber plants during summer plantation , 2015.

B- Nili plantation

Data illustrated in Fig. (4) Showed that infestation of *Aphis gossypii* started on the plants after 15 days after sowing on 23th August (15 aphids /45 leaves). It increased to reach its maximum level (560 aphids /45 leaves) at 50 days after sowing on 27th September. After that the insect population decreased gradually to reach a lowest level (2 aphids /45 leaves) on 11th November after 90 days from sowing date .

However, *C. undecimpunctata* individuals started to appear on the plants in relatively low numbers at the beginning of August (7 adult / 45 leaves) then it increased to reach its high level(98 adult / 45 leaves) on 27th September . After that the insect population decreased gradually to reach a lower level (3 adult /45 leaves) on 11th November .

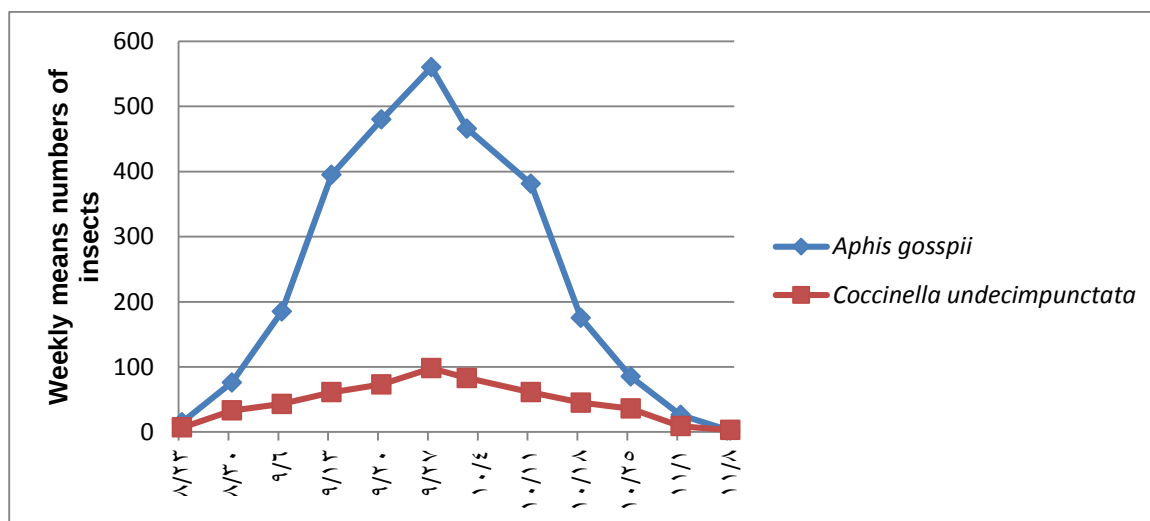


Fig. (4) Weekly numbers of *Aphis gossypii* and *Coccinella undecimpunctata* on cucumber plants during Nili plantation 2015.

**Effects of environmental factors on the population fluctuations of *A.gossypii* infesting cucumbers ,:

An experiment was carried out to verify the influence of certain environmental factors, temperatures , relative humidity and numbers of aphid ophagous , *C. undecimpunctata* on the fluctuation of aphid population .

Season , 2014 :

As shown in table (2) , there is a positive relation between the aphid population and each of maximum and ,minimum temperatures and the numbers of *C. undecimpunctata* , the correlation was significant in case of *C. undecimpunctata* , but it was insignificant with both max . and min. temperatures during both plantations (Summer and Nili). The

correlation coefficient (r) between aphid population and *C. undecimpunctata* population were ,0.677 and 0.943 during Summer and Nili plantations , respectively .however , simple correlation between aphid population and relative humidity was negative and insignificant , during Summer and Nili plantations (table 2).

The partial regression analysis proved a significant effect in case of *C. undecimpunctata* during both plantations $b = 4.66, 7.81$.

The three previously mentioned environmental factors were responsible for about approximately 51.75% and 91.62 % of the variability in aphid population on cucumber during Summer and Nili plantations of 2014 ,respectively . (table 2).

Table 2. Simple correlation, partial regression and explained variance values between environmental factors and *Aphis gossypii* population on cucumber plants during Summer and Nili plantation , 2014 .

plantation	Factors	Simple correlation		Partial regression				
		r	p	b	p	F	P	Ev %
Summer	R .H	-0.192	0.548	-5.961	0.750	1.88	0.2193	51.75
	Min .temp.	0.110	0.732	-31.945	0.561			
	Max .temp.	0.170	0.597	15.785	0.788			
	<i>C.undecimpunctata</i>	0.677	0.015	4.665	0.035			
Nili	R.H	-0.325	0.302	13.936	0.328	19.14	0.0007	91.62
	Min .temp.	0.332	0.290	10.492	0.677			
	Max .temp.	0.223	0.484	-4.433	0.867			
	<i>C.undecimpunctata</i>	0.943	0.0001	7.818	0.0002			

r: Simple correlation value.

P: Probability level .

b: Partial regression coefficient value .

E.v.: Explained variance.

Season 2015

Simple correlation values given in table (3) showed a negative and insignificant relation between aphid population and each of max . , mini temperature and relative humidity prevailing during Summer plantation 2015 . While, during Nili plantation , simple correlation between aphid numbers and each of max. and mini. temperatures were positive and insignificant . However , relative humidity had a negative and significant effect on the aphid population fluctuation ($r = -0.620$).

In both plantations a positive and highly significant relation was recorded between aphid population and *C. undecimpunctata* population .

Simple correlation coefficients were 0.757 and 0.964 in Summer and Nili plantations respectively . Also , the partial regression proved a positive significant values in respect to the relation between the pest population and its predator numbers .

Data presented in the same table proved that , the three ecological factors were responsible for about 78.08% and 94.65% of variability in aphid population during Summer and Nili plantation, respectively (table 3) , **However, El-Lakwah et al . (2011)** reported that mean temperature and plant age had significant effect on the population dynamics of *Aphis gossypii* ,while the relative humidity had no significant effect .

Table 3. Simple correlation , partial regression and explained variance values between environmental factors and *Aphis gossypii* population on cucumber plants during Summer and Nili plantation , 2015 .

Plantation	Factors	Simple correlation		Partial regression		F	p	Ev %
		r	P	b	P			
Summer	R . H	-0.384	0.242	0.101	0.994	5.34	0.035	78.08
	Min .temp.	-0.184	0.586	-59.097	0.184			
	Max .temp.	-0.114	0.737	27.436	0.411			
	<i>C . undecimpunctata</i>	0.757	0.006	7.051	0.006			
Nili	R .H	-0.620	0.031	3.838	0.497	30.95	0.0002	94.65
	Min .temp.	0.571	0.052	28.410	0.246			
	Max .temp.	0.531	0.075	-16.005	0.389			
	<i>C.undecimpunctata</i>	0.964	0.0001	6.735	0.0001			

r: Simple correlation value.

P: probability level.

b:Partial regression coefficient value.

E.v: Explained variance.

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تأثير بعض العوامل البيئية على التذبذب العددي لحشرة المن على نبات الخيار في محافظة اسيوط

ابراهيم لبيب ابراهيم¹, محمد عبد الغفار محمود¹, اسامة عبد الفتاح². هاني محمد محمد²

1- قسم وقاية النبات - كلية الزراعة - جامعة الازهر بالقاهرة

2- قسم وقاية النبات - كلية الزراعة - جامعة الازهر فرع اسيوط

يعتبر الخيار من اهم محاصيل العائلة القرعية ذات العائد الاقتصادي حيث يزرع في الحقل المفتوح وفي الصوب البلاستيكية والتي ازدادت مساحته الزراعية في السنوات الاخيرة وذلك من اجل الاستهلاك المحلي والتصدير
يصاب الخيار بالعديد من الافات الحشرية مثل الذبابة البيضاء والتريس والمن وصانعات الانفاق وذبابة ثمار القرعيات والتي تسبب خسائر تؤثر على جودة وكمية المحصول .

اجريت التجربة بمزرعة كلية الزراعة - جامعة الازهر - فرع اسيوط وذلك في عروتين صيفيه و ميعاها 15 مارس ونيليه و ميعاها 15 اغسطس لمدة موسمين 2014 و 2015 وقسمت الى 4 مكررات مساحة كل مكررة 6×7 م² .

تم عمل حصر للافات و الاعداء الحيوية المصاحبة لها على محصول الخيار واوضحت النتائج المتحصل عليها الى وجود 10 انواع حشرية تنتمي الى 9 فصائل تتبع 6 رتب حشرية . تم رصد 6 افات حشرية هي من القطن والذبابة البيضاء والجاسيد والتريس وصانعات الانفاق وذبابة ثمار القرعيات و 4 انواع من الاعداء الحيوية هي ابو العيد ذو السبع نقاط وابو العيد ذو الاحدى عشرة نقطة وبقة الاوريس واسد المن .
تم دراسة التذبذب العددي لحشرة المن وجد انها تبلغ ذروتها في شهرى مارس وابريل للعروة الصيفية وشهرى اغسطس وسبتمبر للعروة النيلية وكذلك ابو العيد في شهر ابريل للعروة الصيفية وشهر اغسطس للعروة النيلية .

وتم دراسة اثر بعض العوامل البيئية كالحرارة والرطوبة واعداد المفترس ابو العيد ذو الاحدى عشر نقطة على تذبذبات اعداد حشرة المن واطهرت نتائج العروة الصيفية والنيلية للموسم الاول 2014 بان هناك ارتباط موجب لعامل الحرارة سواء الصغرى او العظمى بينما كان هناك ارتباط سالب لعامل الرطوبة . بينما كان هناك ارتباط معنوى موجب بين اعداد المن وابى العيد .

بينما نتائج الموسم الثانى 2015 بالنسبة للعروة الصيفية كان هناك ارتباط سالب لكل عوامل البيئة من حرارة ورطوبة اما فى العروة النيلية لنفس الموسم اظهرت ارتباط موجب لعامل الحرارة الصغرى والعظمى وارتباط سالب لعامل الرطوبة . بينما كان هناك ارتباط معنوى بين اعداد المن وابى العيد .

وكانت هذه العوامل مسئولة عن 51,75% و 91,62% نسبة التغير فى اعداد حشرة المن فى العروة الصيفية والعروة النيلية للموسم الاول .
بينما فى الموسم الثانى كانت مسئولة عن 78,08% و 94,65% نسبة التغير فى اعداد حشرة المن فى العروة الصيفية والنيلية على التوالي .