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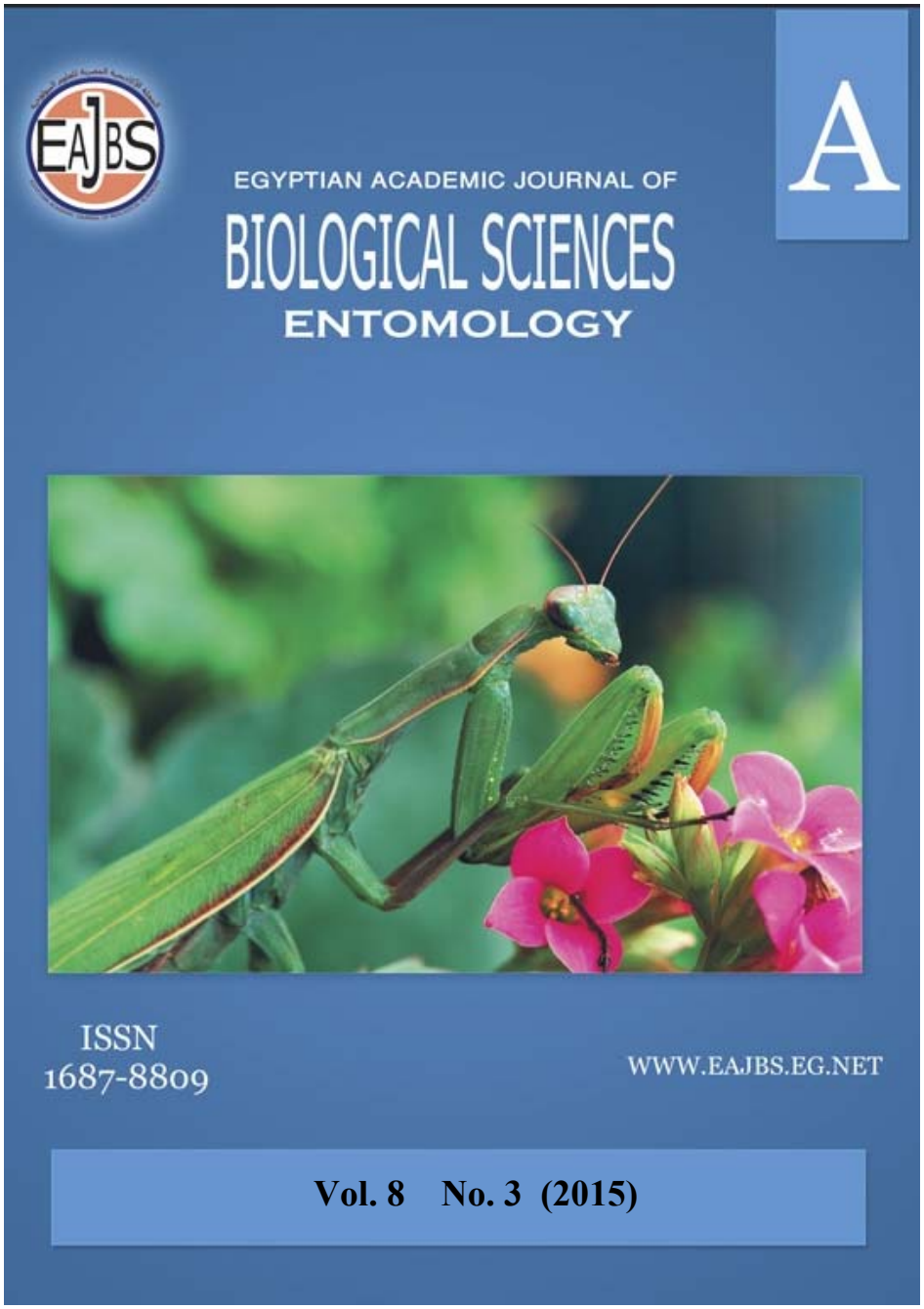

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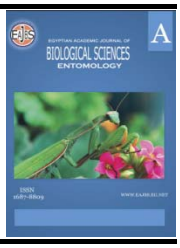

Ecological Aspects of Pear Psyllid, *Cacopsylla pyricola* (Hemiptera: Psyllidae), and Its Associated Natural Enemies, as A new Pest on Pear Trees in Egypt

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ABSTRACT

Pear psyllid, *Cacopsylla pyricola* (Foerster) (Hemiptera: Psylloidea) was recorded as a new pest on pear trees in Ismailiya Governorate, Egypt (Ahmed, 2007). The infestation of the pest causes leaves yellowish, local lesions due to toxic saliva, defoliation, loss in plant vigour and shrinking of fruits then dropping in premature stage. The nymphs and adults excrete large amounts of honeydew which encourage the growth of sooty mould and the infested leaves acquire the dirty black appearance that effect on the photosynthesis. The seasonal activity of *C. pyricola*was studied on pear trees during two successive years,2013 &2014 in Ismailiya Governorate. The obtained results showed that, the adults have two forms, the first one is winter form whereas, spends winter season in diapause and the other one is summer form which responsible much of damages. The pear psyllid, *C. pyricola*has two overlapping generations per year, the first generation occurred from early February to mid-June, peaked in early May with duration about 4.5 months; the second generation started from mid June to early November, peaked in early September with duration about 4.5 months. The duration of generation affected significantly with the tested weather factors (mean temperatures and % RH). The combined effect of the tested factors on the population activity ranged 70.5&73.5% in the 1stgeneration of activity and 66.8& 65.2% in the 2nd one for both years, respectively.

INTRODUCTION

Pear tree, *Pyrus communis* L. is one of the most famous deciduous of family Rosaceae. Pear trees are attacked by many agricultural pests, scale insects, such as *Parlatoria oleae*and *Lepidosaphes ulmi*, mites, such as *Tetranychus urticae*, apple stem borer, *Zuzera pyrina* and fruit fly, *Ceratitis capitata*which are considered as a main pest on pear trees. At least seventeen species of psylla have been recorded on *Pyrus* sp. in different parts of the world (Burckhardt and Hodkinson, 1986 and Burckhardt, 2010). In the last decade, a pear psyllid, *C. pyricola*was observed with high population density on pear leaf and fruits in North Sinai and Ismailiya Governorates causing damages, premature leaf defoliation and fruit dropping, resulting in substantial losses in yield. Adult and nymphs of pear psyllid excrete large quantities of honeydew which in turn results in downgrading of the fruit at harvest (Burts, 1970). The damage may be exacerbated by a sooty mould fungus that colonizes honeydew and also marks fruit; at high densities, the fungus may

additionally cause a reduction in photosynthesis.

These symptoms have collectively been termed psylla shock, and are caused by a toxin in the saliva of feeding nymphs. Symptoms of the injury can be similar in appearance to those associated with pear decline disease (Beers *et al.*, 1993).

The present study is the first work carried out to study the ecological aspects (the seasonal activity, number and duration of generations, and survey the natural enemies associated with the pest on pear tree as well effect of main weather factors on the insect activity) of the pear psyllid, *C. pyricola*in Egypt under field conditions.

MATERIAL AND METHODS

The present work was carried out in Ismailiya Governorate for two successive years, 2013 & 2014 on ten pear trees variety "Bartlett" grafted on betulifolia root stock cultivated in a private orchard. The selected pear trees were similar in age, size, height and vigor growth which received the normal agricultural practices without any control measures for any pest during the period of investigation. Adult female, specimens from samples were prepared and mounted on slides by using Hoyer's media for confirmation of the pest's identity. Fortnightly samples were taken for two complete seasons (2013 & 2014). The samples (100 leaves) were picked up at random from all directions with a rate of 10 leaves/tree kept in special paper bags and transferred to the laboratory for inspection. Samples were investigated by using stereomicroscope. The total number of alive nymphs, adult females were sorted and counted separately. The mean number of alive individuals per 10 leaves was taken as the population index. Number and duration of annual generations under field conditions were determined by integration of the population curves in these figures. Distribution of *C. pyricola* population on pear tree was determined. Each leaf was stored in a well-ventilated emergence glass tube and monitored daily for parasitoid emergence. Predators were recorded in these field and transferred to the laboratory for further examination. The Meteorological data were obtained from Ismailiya Meteorological Station and the half monthly means of temperature and the percentages of relative humidity were estimated. The statistical analysis of data was carried out with computer (SAS Institute, 1989).

RESULTS AND DISCUSSION

Seasonal fluctuation of the nymphal population

Data illustrated in Figs. (1&2) showed the seasonal fluctuation of the nymphal population in both years, 2013 &2014. In the first year, the obtained data showed two peaks for the nymphal population the first peak occurred in early March, (275 nymphs /10 leaves) under the field condition 28°C&54% R.H., the second peak was occurred in early September, (109 nymph /10 leaves), at 38° C &65 % R.H. On the other hand in the second year, 2014, the first peak was in early May, (235 nymphs /10 leaves) under the field condition 27° C &59 % R.H., the second peak was occurred in early September (129 nymph /10 leaves), at 38°C & 50 % R.H. The obtained results showed that, the nymphal population peaked two times per year and the highest peak occurred in early summer while, the lowest peak was in late summer season. It could be concluded that, the changes in weather factors affected on the nymphal activity and the highest activity of *C. Pyricola* occurred in summer season in both of years.

Seasonal fluctuation of adult females

The population of adult females Figs. (1, 2 & 3) were varied and lower

compared with the nymphal population in the two years, 2013 &2014.

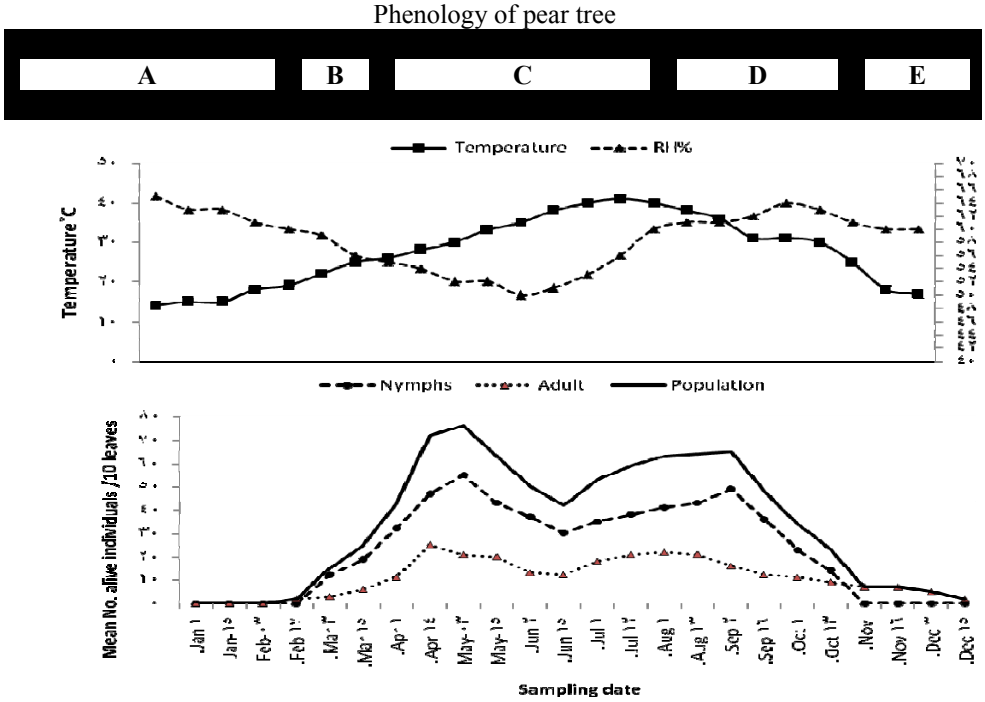

Fig. 1: Seasonal fluctuations of *C. pyricola*on pear trees with corresponding means of main climatic factors and phenology of pear treeinIsmailiya Governorate during 2013.

A: Dormant phase **B:** Flowering period **C:** Fruit development **D:** Harvest & post harvest **E:** leaf fall.

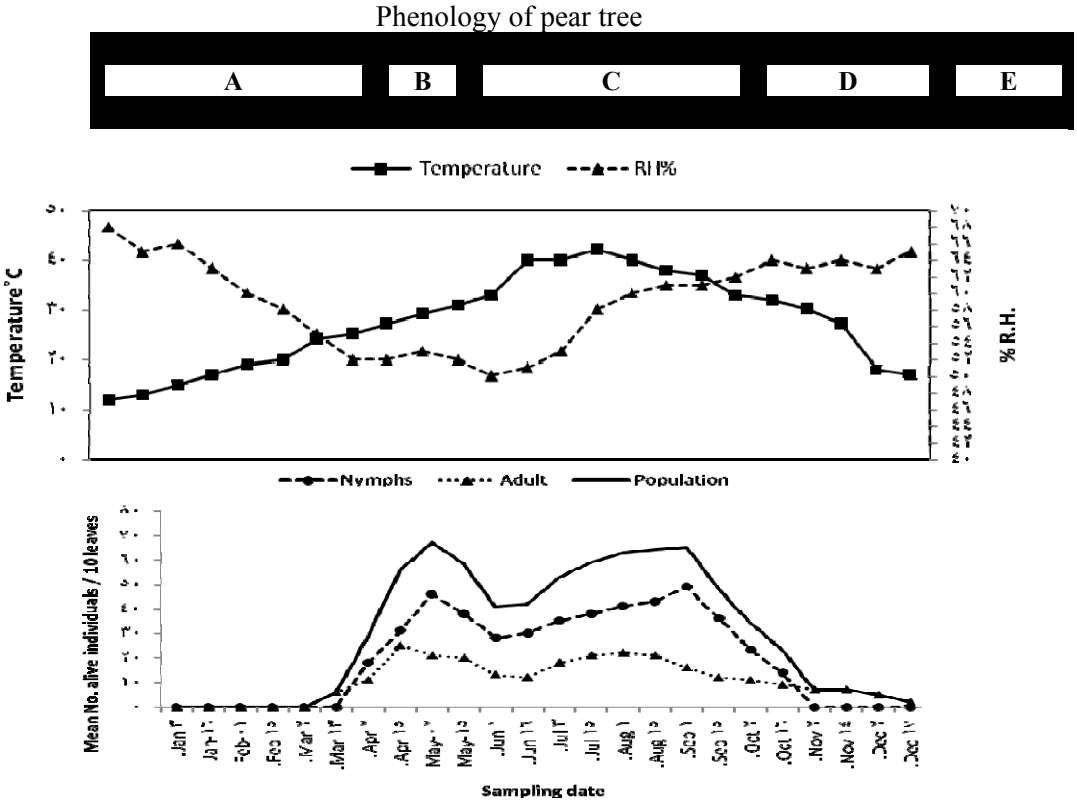

Fig. 2: Seasonal fluctuations of *C. pyricola*on pear trees with corresponding means of main climatic factors and phenology of pear tree in Ismailiya Governorate during 2014.

A: Dormant phase **B:** Flowering period **C:** Fruit development **D:** Harvest & post harvest **E:** leaf fall

Fig. 3: Phenology of pear psyllid, *C. pyricola*on pear trees variety Bartlett in Ismailiya Governorate

The data showed that two small peaks for adult females per year. In the first year, 2013 the first peak occurred in mid April, (113 adult female / 10 leaves) at 26°C &55 % R.H., and the second peak was in early August, (133 adult female/10 leaves) at 41°C & 63% R.H., respectively.

While, In the second year 2014, the first peak was in early April, (96 adult female/10 leaflets) at 25° C & 62% R.H. and the second peak was in early August (131 adult female/10 leaves) at 42°C&54% R.H., respectively.

Number and duration of generations

Results obtained in Tables, (1&2) showed that *C. pyricola*had two overlapping generations a year under field conditions. The generations were as following:

During the first year, the first generation started from early February to mid June, peaked in early May, the duration of this generation lasted about 4.5 months with an average of (188.6 mean number of alive individuals/10 leaves) under field condition, 28 °C &54 % R.H.

Table 1: Number and duration of annual generations (nymphs and adults) of *C. pyricola*under fieldconditions on pear trees in Ismailiya Governorate during 2013 & 2014.

Years	Generation	stages	Duration				Density
			From	To	Peak	Duration (month)	
2013	G.1	Nymph	Early Mar.	Mid June	Early May	3.5	275.0
		Adult	Mid Feb.	Mid June.	Mid Apr.	4.0	113.0
	G.2	Nymph	Mid June	Early Nov.	Early Sep.	4.5	109.0
		Adult	Mid June	Mid Oct.	Early Aug.	4.0	133.0
2014	G.1	Nymph	Mid Mar.	Early Jun.	Early May	2.5	235.0
		Adult	Mid Mar.	Early June	Early Apr.	2.5	96.0
	G.2	Nymph	Early June	Mid Oct.	Early Sep.	4.5	279.0
		Adult	Mid Jun.	Early Oct.	Early Aug.	3.5	131.0

Table 2: Number and duration of generations of *C. pyricola*under field conditions on pear trees in Ismailiya Governorate during 2013& 2014.

Years	Generation	Duration of generation				Generation density
		From	To	Peak	Duration (month)	
2013	G.1	Early Feb.	Mid June	Early May	4.5	188.6
	G.2	Mid June	Early Nov.	Early Sep.	4.5	742.0
2014	G.1	Early Mar.	Early June	Early May	3.0	167.0
	G.2	Mid June	Early Nov.	Early Sep.	4.5	740.0

The second generation lasted from mid June to early November, peaked in early September; the duration lasted about 4.5 months with an average of (742.0 mean number of alive individuals/10 leaflets) under the field condition 38° C &65 % R.H. On the other hand in the second year, 2014 the first generation started from early March to early June, peaked in early May, the duration lasted about 3 months with an average of (167 mean number of alive individuals/10 leaflets) under the field condition, 27° C &59 % R.H. The second generation started from mid June to early November, peaked in early September, the duration lasted about 4.5 months with an

average of (740 mean number of alive individuals/10 leaflets) under field condition 38◦C & 50 % R.H.

The afore-mentioned results showed that, the first generation prolonged 4.5 months in first year 2013, with relatively shortened in the second year, 2014. The prolonged period of the first generation in the first year refers to unfavourable climatic conditions in this period. While, the second generation in both years was the same trend.

These results are harmony with those obtained by (Horton *et al*. 1994), Pear psylla spends much of the winter in reproductive diapauses, and the winter form adult overwinters on the pear host plant. Dispersal of winter forms from the orchard begins in mid- to late-September, and peaks during late-October and early-November started coinciding with leaf fall in pear.

Effect of the main climatic factors on the changes in annual generations:

The first generation:

Effect of the mean temperature.

Result obtained in Table (3) showed that a positive and highly significant (r = 0.762**& 0.699**) for the mean temperature. The partial regression coefficient showed insignificant effect (t value = 0.82& 1.12) when the mean relative humidity become around its mean. The obtained results revealed that, the mean temperature within the optimum range of the population activity during the first generation for both years, respectively.

Table 3: Results of statistical analysis for simple correlation and partial regression to investigate the effects of the main weather factors of the total population of *C. pyricola* on pear trees in Ismailiya Governorate during 2013 & 2014.

Years	Generation	Source of Variance	Simple Correlation " r "	Partial regression		ANOVA	
				b. reg. ± s.e.	T value	"F" value	E.V %
2013	G1	Mean Temp. °C.	0.762**	1.37 ± 0.16	0.82	6.51*	70.5
		Mean % R.H.	0.684	2.46 ± 0.30	0.79		
	G2	Mean Temp. °C.	0.871**	1.53 ± 0.88	1.67	7.58*	66.8
		Mean % R.H.	0.218	2.41 ± 0.52	0.63		
2014	G1	Mean Temp. °C.	0.699*	1.81 ± 0.19	1.12	5.94*	73.4
		Mean % R.H.	0.511	2.10 ± 1.12	0.93		
	G2	Mean Temp. °C.	0.529	1.64 ± 1.20	1.61	6.27*	65.2
		Mean % R.H.	0.732*	2.57 ± 1.77	2.93		

Effect of the percentage of relative humidity.

The mean relative humidity percentages showed that a positive and insignificant relation for percentage of relative humidity in both years, (r = 0.684& 0.511) in both of years, respectively. The partial regression coefficient showed a positive and insignificant effect for this factor on population density (t value = 0.79 &0.93) when the mean temperature become around its mean. The obtained results revealed that, the mean relative humidity around the optimum range of the population density in the first generation in both years, respectively.

The combined effect of the main weather factors.

The combined effect of both mean temperature and percentage of relative humidity showed that significant effect (F value = 6.51&5.94) on the population density in the first generation in both years, respectively. The changes in half monthly counts of the population referred to the effect of the tested weather factors ranged 70.5% &73.4% in both years, respectively.

The second generation:

Effect of the mean temperature.

The mean temperature showed a positive and highly significant relation on the population density (r = 0.871** for the first year and positive insignificant (r = 0.529) in the second one. The partial regression coefficient showed insignificant effect for this factor (t value = 1.67&1.61) in both years, respectively when the mean relative humidity become around its mean. The obtained results revealed that, the mean temperature become around optimum range of the population density in the first year and under the optimum range in the second one, respectively.

Effect of percentage of relative humidity.

The mean relative humidity percentages showed a positive insignificant relation (r = 0.218) in first year and positive and significant (0.732*) on the population density in the second one. The partial regression coefficient showed positive insignificant effect for this factor in both years (t value = 0.63& 2.93) when the mean temperature become around its mean. The obtained results revealed that, the mean relative humidity within the optimum range of the population density in both years, respectively.

The combined effect of the main weather factors.

The combined effect of both of the mean temperature and the relative humidity percentages showed that positive significant effect (F = 7.58&6.27) on the population in both years, respectively. The changes in the half monthly counts of the population referred to the effect of the tested weather factors ranged 66.8. &65.2% in both years, respectively.

Natural enemies associated with *C. pyricola* infesting pear trees.

During a complete season, started from January, until December, 2013 & 2014, three species of predators and one species of the parasitoid were detected to be associated with *C. pyricola* in Ismailiya Governorate.

The obtained results in Table (4) showed that, the natural enemies surveyed associated with pear psylla, *C. pyricola* on pear trees in Ismailiya Governorate during 2013 & 2014. Three species of predators and one species of parasitoid were detected to be associated with *C. pyricola*.

Table 4: Natural enemies associated with pear psyllid, *C. pyricola*recorded on peartrees in Ismailiya Governorate (2013 & 2014).

No.	Natural enemy	Species	Family
1	Parasitoid	*Pachyneuron* sp.	Pteromaidae
2	Predators	*Chrysoperla carnea* L.	Chrysopidae
3		*Orius albidipennis* Reut.	Anthocoridae
4		*Anthocoris* sp.	Anthocoridae

The hemipterans were the most abundant predator group. Among the anthocorids, *Anthocoris sp.* and *Orius albidipennis* Reut., their populations were related to the psyllid fluctuations. Other species recorded during the study were the chrysopid, *Chrysoperla carnea* L.(Chrysopidae). The parasitoid belonging to the

order Hymenoptera was the only primary parasitoid. *Pachyneuron sp.* (Pteromalidae), was detected in the surveys.

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ARABIC SUMMARY

المظاهرالأيكولوجية لحشرة سيلد الكمثرى *Cacopsylla pyiola* (Foerster) كآفة جديدة على أشجار الكمثرى فى مصر

عباس سيف النصر يوسف، نادية عبد الله على،شعبان عبد ربه
معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة

سجلت حشرة سيلد الكمثرى (قمل الكمثرى القافز) فى مصر خلال السنوات القليلة الماضية على أشجار الكمثرى بمناطق مختلفة بمحافظات (الأسماعيلية وشمال سيناء) بمصر ، حيث ظهرت بأعداد كبيرة على الأوراق والثمار وتسببت فى مشاكل عديدة وصلت لحد جفاف وموت الأشجار ببعض المناطق، مما أستدعى أجراء دراسات بيئية عاجلة للحد من أنتشارها ووضع برنامج لمكافحتها، أجريت الدراسة الحالية على صنف بارتليت مطعوم على أصل بتشيفوليا وذلك فى محافظة الأسماعيلية لمدة عامين كاملين (يناير 2013– ديسمبر 2014) بهدف دراسة التغيرات فى تعداد الآفة على مدار العام للأطوار الكاملة وغير الكاملة وتحديد مدة الجيل وعدد الأجيال وتأثير العوامل المناخية السائدة بالمنطقة على نشاط الحشرة بغرض وضع أستراتيجية لبرنامج مكافحة متكامل يحد من أنتشارها.

أوضحت نتائج الدراسة وجود جيلين متداخلين على مدار العام ، ففى السنة الأولى بدء الجيل الأول نشاطه من بداية فبراير حتى منتصف يونيو وكانت ذروة النشاط فى بداية مايو و مدة الجيل حوالى 4.5شهر بمتوسط (186.6 حشرة / 10 أوراق) وكان متوسط درجة الحرارة 28 درجة مئوية والرطوبة النسبية 54 % ، بينما بدء الجيل الثانى من منتصف يونيو وأمتد حتى أول نوفمبر وكانت قمة النشاط فى أول سبتمبر ومدة الجيل حوالى 4.5 شهر ومتوسط تعداد الجيل (742 حشرة / 10أوراق)وكان متوسط درجة الحرارة 38 درجة مئوية والرطوبة النسبية 65% ، أما فى السنة الثانية بدأ نشاط الجيل الأول فى أوائل مارس وأمتد إلى أول يونيو ومدة الجيل حوالى 3 شهور ومتوسط التعداد (167 حشرة / 10 أوراق) ومتوسط درجة الحرارة 27 درجة مئوية والرطوبة النسبية 59 %، أما الجيل الثانى من منتصف يونيو حتى أول نوفمبر ومتوسط التعداد (740 حشرة / 10 أوراق) ومتوسط درجات الحرارة 38 درجة مئوية والرطوبة النسبية 50 %. وكان التأثير المشترك لمتوسطات درجات الحرارة والرطوبة النسبية السائدة بالمنطقة متبايناً على نشاط الحوريات والحشرات الكاملة فى كلا الجيلين حيث سجلت فى الجيل الأول 70.5&73.4 % ، وفى الجيل الثانى 66.8&62.2 % خلال سنتين الدراسة على التوالى، تم حصر نوع واحد من الطفيليات وثلاثة أنواع من المفترسات مصاحبة للآفة خلال فترة النشاط.