FIELD AND LABORATORY OBSERVATIONS ON SOME TREE BORERS AND THEIR HOSTS IN NORTH SINAI GOVERNORATE, EGYPT.

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Abstract

The present investigation showed some field and laboratory observations on the borers infesting economic fruit and wood trees in North Sinai Governorate. Studies revealed that the survival of *Capnodis carbonaria* beetles, differed during different months, the longest survival was 48.8 days during December, while the shortest one was 12.5days during July. Monthly relative percentage of deposited eggs/female were 7.5, 12.5, 27.5, 22.5, 19.5 and 11.1% during May to October, respectively. *Batocera rufomaculata,* infested mango trees also. The activity period of this pest was observed from April until November. The beetles were able to attack fig, mango, sycamore and apple with relative percentages of deposited eggs 21.3, 31.7, 40.2 and 6.8 % on previous hosts, respectively. However, peach, pear, mulberry and acacia were not suitable to infestation. The seasonal emergence of *Xystrocera globosa* beetles were abundant during different seasons. The emergence percentages were 9.8 % , 41.1% , 37.3 % and 11.8 % for winter, spring, summer and autumn, respectively. Two peaks of emergence were observed during May and September. Monthly relative percentages of developmental stages of *Steraspis squamosa* within tamarisk trees showed that the immature larvae and beetles were abundant within the host throughout the whole year, the full grown larvae and pre-pupae were observed from February to November, while the pupae were found during March to December. Beetles had quiescence period within trees during winter and early spring months. The weather factors revealed positive significant effect on population of fullgrown larvae, pre-pupae and pupae, while the effect was negative significant on adults population within trees.

INTRODUCTION

There are very little information available to specific status of borers occurring in North Sinai Governorate. The wide spread of fruit and wood trees, prevailing environmental conditions, location to neighboring states and natural isolation of North

Sinai from Nile valley helped in the spread of certain borers which not existant in Nile valley as fig root borer and peach root borer. The following fruit and wood borers were surveyed in North Sinai Governorate : *A.kneuckeri* Oben, *A. stupida* Mars., *A. angustipennis* Klug., *Capnodis carbonaria* Klug., *Paracmaeodera elevata* Klug, *Ptychomus polita* Klug., *Psiloptera mimosa* Klug and *Steraspis squamosa* Klug (Col.: Buprestidae); *Batocera rufomaculata,* De Geer, *Chlorophorus varius* Mull., *Dichostatus subocellatus* Far., *Niphona picticornis* Muls., *Hesperophanes griseus* F., *Senichro fasciata* Steph., *Phoracantha semipunctata* F. and *Xystrocera globosa* Oliv. (Col.: Cerambycidae); *Hypoborus ficus* Eric., *Phloeotribus scarabaeoides* Bern and *Scolytus amygdali* Guer.(Col.: Scolytidae) ; *Phonapate frontalis* Fahr., *Bostrychoplites zickeli* Mars., *Enneadesmus obtusedentatus* Lesne., *E. trispinosus* Oliv. and Sinoxylon sudanicum Lesne. (Col.: Bostrychidae); *Rhynchophorus ferrugineus* Oliv. (Col.: Curculionidae); *Tropiderinus munieri* Bedel (Col.: Anthribidae); *Gastrillus steriatus* Zouf. (Col.: Anobiidae) *Lyctus impressus* Lom. and *Lyctus spp* (Col.:Lyctidae) and *Zeuzera pyrina* L. (Lep.: Cossidae).

Little workers surveyed certain borers on some host plants in North Sinai Governorate (Willcocks, 1924; Bodenheimer, 1929; Alfeiri, 1976; Fadl, 1984 and 1990; El-Said, 1987; Batt and Girgis 1996; Batt *et al.* 1996; Batt 1999a; Okil, 2001; Batt, 2002).

The objective of this work is to throw a light on some borers and their host plants in North Sinai with some field and laboratory observations.

MATERIALS AND METHODS

During 2000 and 2001, monthly visits were made to different localities of North Sinai Governorate to collect data on different species of fruit and wood trees and borers attacking them. Infested trees were examined externally and internally. Confused samples were transferred to laboratory for identification. Filed and laboratory observations on hosts and different borers were made and the current studies were carried out.

Field observation showed that the emergence of *C. carbonaria* beetles (peach root borer) continued during the whole year (Girgis and Batt, 1998) and the beetles were abundant on peach trees throughout different months. Therefore, the survival of these beetles was estimated. Beetles were collected during the 4th week of each month from a peach orchard located at Rafah district. Beetles were put in wire cages (40x40x40cm) with some fresh peach leaved shoots. Daily observations were carried out, dead beetles were counted and removed, thus, the survivals were estimated. Field observations were also conducted on *Scolytus amygdali* , *Senichro fasciata* and *Chlorophorus varius*.

The beetles ability of the fig root borer,*B. rufomaculata,* to attack the different hosts were determined. Five groups of host plants, each contained two fresh cuttings(each 40x6cm) of fig, mango sycamore, apple, peach pear, mulberry and acacia cuttings were used. Each group was introduced into plastic container with five

couples of newly emerged beetles. Daily examination was carried out until all females died. The differentiation between hosts based on the number of deposited eggs and ability of larvae to grow inside each host.

Monthly relative percentage of developmental stages of *S. squamosa* within tamarisk branches during 2000 were studied. Ten infested branches were cut monthly and the number of different stages within branches were counted, the relative percentages during different months were accounted and the effect of weather factors on monthly abundance of different developmental stages were estimated.

The seasonal abundance of *X. globosa* during 2001 was studied. Twenty infested acacia trees with *X. globosa* were chosen at the end of December 2000 and old exit holes were marked. The new emergence holes during different seasons of 2001 were counted and time of population peaks was determined.

RESULTS AND DISCUSSION

The common and economically important trees in North Sinai Governorate were peach, olive, fig, mango, date palm, tamarisk and acacia. These trees were attacked by the following several borers in North Sinai Governorate.

1. Peach tree borers

a. ***Capnodis carbonaria* Klug.** (Col.:Buprestidae)

C. carbonaria is a common pest on peach trees only in North Sinai and infests the roots and trunk ca., 80 cm above the ground. Field observation indicated that some beetles were found on plum and castor oil trees. Beetles were found also with high density on almond trees which were planted inside peach orchards during the defoliating period of peach leaves. Larvae, pupae, and adults were found in the infested roots inside tunnels under cortexes of deep and lateral roots which may reached 2cm. diameter and appeared with delicated walls and filled with compacted frass.

Under laboratory conditions, the survival of beetles was varied during different months, Table,1. The longest survival was 48.84 $\pm$ 10.61 (range, 25- 68) days, recorded during December, at mean temp. of 19.1ºC and 62.9 % R.H., while the shortest one was 12.54 $\pm$ 4.60 (range, 4-20) days, recorded during July at mean temp of 31.4ºC and 61.5 % R.H. Statistical analysis showed significant negative correlation between monthly temperature and survival of beetles ($r = -0.76$ and $b = -2.21$), while insignificant correlation was obtained between relative humidity and beetles survival. The monthly relative percentages of deposited eggs / female were 7.5, 12.5, 27.5, 22.5, 19.5 and 11.1 % during May, June, July, August, September and October, respectively.

b- ***Scolytus amygdali* Guer.** (Col.:Scolytidae)

S. amygdali was also a common pest on peach trees. It attacked the trunk and branches of trees. The rarity of rainfall in this region caused severe infestation and subsequently death of trees.

C. carbonaria and *S. amygdali* considered as limiting factors in peach cultivated area in North Sinai Governorate.

Table 1. Survival of *C. carbonaria* beetles under laboratory conditions during different months.

Date of collected beetles	Survival period		Mean lab. cond.	
	Range	M. ± S.d	Temp°C	R.H %
Jan.	20 – 53	37.79 ± 10.17	18.2	64.5
Feb.	18 – 38	29.98 ± 5.11	20.5	60.2
Mar.	15 – 27	20.55 ± 4.27	22.6	57.3
Apr.	9 – 21	15.20 ± 4.12	24.9	58.9
May	12 – 19	15.18 ± 3.45	27.8	53.8
Jun.	10 –17	14.48 ± 2.38	30.2	51.4
Jul.	4 – 20	12.54 ± 4.60	31.4	61.5
Aug.	6 –19	14.24 ± 2.90	30.8	65.3
Sep.	5 –20	17.01 ± 2.24	28.4	68.1
Oct.	29 – 42	32.89 ± 4.39	25.6	63.5
Nov.	28 – 52	43.98 ± 8.51	23.1	61.1
Dec.	25 – 68	48.84 ± 10.61	19.1	62.9

Simple correlation with temp. = - 0.67 (significant)
Simple correlation with R.H. = 0.31 (insignificant)

C. ***Senichro fasciata*** **Steph.** (Col.:Cerambycidae).

The beetle is elongated, slender, 7.5-12mm. long and 1-2 mm. width and dark brown with two light brown spots on each elytron; the first is large at the base (about 1-2 mm.long), the other at the apex (about 0.5 –1mm.long). Beetles emerged from peach branches during the summer months with high abundance at mid June.

d. ***Chlorophorus varius*** **Mull.** (Col.: Cerambycidae)

Beetle emerged from trunk and branches of peach trees.

2. Fig and mango tree borers

a. *Batocera rufomaculata* De Geer (Col.: Cerambycidae)

The pest infested the roots of fig trees only in North Sinai Governoratre (Batt et al 1996). Field observation indicated that beetles were observed on branches of fig trees during the period from April until the 4th week of November 2000. However, beetles activity was recorded during the period from the 1st half of May until late October.

Larval infestation started at crown region above ground surface then the larvae bore in the trunk to the root system. Larval infestation was concentrated in trunks and

main branches of mango trees until 3m.height, the infested branches become dry and trees died afterwards.

Laboratory observation on beetles ability to attack different hosts indicated that beetles made grooves on incisions to lay eggs in all tested hosts, namely: fig, mango, sycamore, apple, peach, pear, mulberry and acacia. Eggs were only laid in fig ,mango, sycamore and apple cuttings. The respective percentages of deposited eggs were 21.3, 31.7, 40.2 and 6.8 %. The hatching larvae were found easily grown inside the four hosts.

b. *Niphona picticornis* Muls. (Col.: Cerambycidae).

N. picticornis was recorded as one of the borers infesting mango trees in Nile valley, Egypt (Batt, 1999b). This borer also infests mango trees in North Sinai Governorate. Field observation revealed that the larvae were found inside the terminal shoots and twigs of mango trees and bored to base of limbs which become dry and minimizing tree growth. This pest was collected also from branches of fig trees. Eggs were put under the bark, the larvae were found throughout the year, some larvae transferred to pupae and beetles during one year, while the others may need longer period. This pest overwintered in larval and adult stages. Batt (1999a), revealed that *N. picticornis* had one generation yearly on fig trees and the adults were abundant within host throughout the period from September to May. Haggag (2000) mentioned that this pest had one generation yearly on mulberry trees.

C. *Hesperophanes griseus* F. (Col.: Cerambycidae).

H. griseus was found in terminal small branches of fig trees. Larvae were observed in the center of branches, the infestation caused the dryness and death of infested branches.

d. *Hypoborus ficus* Eric (Col.: Scolytidae).

The cut fig trees or infested by *B. rufomaculata* had extensive infestation.

e. *Chlorophorus varius* Mull (Col.: Cerambycidae).

Beetles of this pest emerged from collected branches of infested fig and mango trees.

3. Olive tree borers

Two main pests markedly affected olive trees in North Sinai Governorate, i.e.

a. *Phloeotribus scarabaeoides* Bern. (Col.: Scolytidae).

Field observation indicated that the percentage of *Ph. scarabaeoides* infestation differed in different districts, showing about 0-6 % at Rafah, 0-35 % at El-Sheikh Zowied, 0-80% at El-Arish and 0-3 % at El-Hasana districts. Worthwhile observation clarified that there were differences between the status of infestation in the orchards which depend upon rainfull and the others which regularly irrigated. In unirrigated orchards, olive trees were heavily infested and gradually increased to include the whole orchard, while in irrigated one, the infestation appeared only in weakened trees and wounded or broken branches.

b. ***Zeuzera pyrina*** **Lense.** (Lep. : Cossidae).

Nowadays the infestation by *Z. pyrina* started to quickly conquer olive orchards so much so that the rate of infestation in some orchards reached 11-18 emergence holes/m. of infested branch. Complaints increased of olive planters from this dangerous pest specially that it infested apple and pear trees which their cultivated area increased gradually year after another.

4. Date palm tree borers

a. *Phonapate frontalis* Fahr. (Col.: Bostrychidae).

This pest was a common borer to standing and fronds date palm trees in North Sinai. Vigorous trees were resistive to beetle's attack, where many of attacking beetles die by gum secretion which fill the entrance tunnels. Observation showed that fronds were served as fences around various orchards and some buildings, these fronds were heavily infested by this borer and became renewable source of new infestation to date palm trees and other hosts. Beetles were attracted to light traps.

***b. Rhynchophorus ferrugineus* Oliv.** (Col.: Curculionidae).

The red palm weevil, *R. ferrugineus* is the serious and most destructive pest to palm trees. Although varietal and numerous efforts were made to stop diffusion of this pest, the infestation appeared during October 2000 at 6th of October village (Bir El-Abd district) then at Al-Mesaeid and Al-Arish (Al-Arish district). Field observation showed that the infestations were observed on different heights of palm trunk, however, most infestations were noticed on the lower part of about 2m. and few were apical. The infestation resulted in exudation of odorous brown liquid secretion at the site of attack. Larvae bore tunnels in all directions, but the most run with the inner fibers of palm and upward. Different developmental stages (larvae, cocoons of pupae and weevils) were abundant in infested trees throughout the whole year inside the

palm and / or cavities in internal side of frond base. Entrance holes of newly larvae can easily be seen on external side of frond base. All varieties, ages and stages of palm trees were liable to infestation with this pest. Batt and Girgis (1996) surveyed the borers attacking the date palm trees in Egypt and found this pest in Skarkyia, Ismailyia and Qalyobyia Governorates.

5. Acacia tree borers

Acacia trees are extensively distributed on the different roadsides and consider as fences on margins of different fields in North Sinai Governorate. Infestation with borers led to quick death of these trees as well as reduced the quality of wood.

a. *Xystrocera globosa* Oliv.(Col.:Cerambycidae).

X. globosa is a common pest to lebbek and acacia trees in Egypt. Infestation could be recognized by stick fluids on the bark at places of hatching larvae, these places may be cracked and take blackish colour. When one of trunk sides was infested, the branches of the same infested side showed dry, as infestation progress the tree die. At removing the bark above infested part, the different developmental stages (larval tunnels and pupal chambers) can be easily seen. The observation indicated that the infestation translocated from infested tree to neighboring healthy trees gradually.

Beetles were abundant during the different seasons of year. The maximum percentage of emergence (41.06%) recorded during spring followed by summer (35.14%) and autumn (11.84%), while the minimum percentage (9.82%) found during winter.

Two emergence peaks were observed, the first was during May at emergence percentage of 40.49% from spring population, while the second was during September with 35.14% emergence from summer population. Statistical analysis showed that highly significant correlations were found between population emergence of *X. globosa* and each of min.temp.($r = 0.84$), max.temp.($r = 0.77$) and R.H. % ($r = 0.80$), Table 2. Beeson and Bahatia (1939), in India, showed that *X. globosa* emerge allover the year, but mainly in May to June and September.

b. **other borers of acacia trees**

Other borers also emerged from collected branches of acacia trees were: *A. kneuckeri* obenberger, *A. stupida* Mars., *A. angustipennis* Klug., *Paracmaeodera elevata* Klug, and *Ptychomus polita* Klug.(Buprestidae); *Senichro fasciata* Steph.,

Chlorophorus varius Mull. and *Dichostatus subocellatus* Fairm. (Cerambycidae) and *Lyctus impressus* Lom.(Lyctidae)

6. Tamarisk tree borers

a. *Steraspis squamosa* Klug.(Col.:Buprestidae).

Tamarisk trees are widely distributed in North Sinai Governorate. Many of these trees were heavily infested by tamarisk Jewel beetle, *S. squamosa*. Female beetles laid their large eggs externally on the branches and trunk of trees. Eggs are (average 6.6 x 4.7mm) sub-oval / sub-ovate, swelling from upside and adhered to the bark from down side. Some eggs were parasited by Chalicid parasite (discribed by Willcocks, 1924). At removing the shell of some eggs, it could be observed 4 or more of parasited larvae inside each egg. The parasitized eggs were empty with 1-2 emergence holes of adult parasites on each egg shell. The parasite overwintered in larval or adult stage. up to 9 parasitoid adults were inhabited a single Steraspis egg. At Al-Rwafaa dam region, the bark of some infested branches appeared moist with hony secretions above the larval tunnels, that were attractive to the common Egyptian wasp (Hornet), *Vespa orientalis* L., which eat away the bark down to the wood and the larvae were exposured. Therefore, these hornets may consider as a biotic agents.

The observation also showed that the infested branches that were examined during winter months contained on larvae and beetles, therefore the monthly relative percentages of developmental stages of *S.squamosa* within tamarisk branches during the different months of year 2000, were studied to reveal the behaviour, seasonal abundance and effect of weather factors on different stages transformations within tamarisk tree. Data in Table 3 showed that immature larvae were abundant during January, February, June, September, October and December (range,40-43%), while low abundance was recorded during March (29 %) and April (28 %). The fullgrown larvae were abundant from February to November, with maximum percentage of abundance (18%) during May followed by September (15%) and July (14%), while the minimum was (2%) during November. The prepupae were also abundant during the period from February to November, with maximum percentage of abundance during October (18%) followed by November (17%) and April (16%), while the min was (3%) during February and March.

Table 2. Emergence percentage and population peaks of *Xystrocera globosa* beetles during different seasons of 2001 at North Sinai Governorate.

Season	Emergence percentage	Population peaks		Mean weather factors		
		Time	Emergence %	Temp.°C		R.H. (%)
				Min.	Max.	
Winter (Jan.-Mar.)	9.82	-	-	9.8	20	73.3
Spring (Apr.-Jun.)	41.06	May	40.49	17.3	26.9	76.7
Summer (Jul. –Sep.)	37.28	Sep.	35.14	22	31.6	81
Autumn (Oct. – Dec.)	11.84	-	-	14.2	25.5	74.3
	r			0.84	0.77	0.80

The pupae were abundant from March to December, high abundance was during July (23%) and August (22%), while the low abundance was during December (3%) and March (9%). The beetles were abundant within tamarisk branches throughout the year. There were two periods of beetles abundance, the first was high during December to April (range,42-58%), the second was low during May to November (range,17 –30%), this period was encountered the observed activity period of beetles in nature. These results indicated also that the beetles have quiescence period within tree during winter months and some spring. Haggag *et al.* (1996) mentioned that under laboratory conditions of 30.7°C and 61% R.H., beetles stayed in pupal chamber for 10-15 days before emergence .

Statistical analysis, Table 4, showed insignificant correlation between the studied weather factors and population of immature larvae, while full grown larvae showed significant positive correlation with ,min.temp.,max.temp. and R.H. Insignificant correlation was found between min.temp. and population of prepupa, while significant positive correlation was noticed between population of prepupa and each max.temp. and R.H. The population of pupae showed highly significant positive correlation with min.temp., max.temp. and R.H. The population of adults revealed highly negative correlation with min.temp., max.temp. and R.H.

b. ***Phonapate frontalis*** **Fahr** (Col.: Bostrychidae)
This pest infested both standing and cut tamarisk trees. Beetles attacked cut trees extensively in mid May, while the activity period was observed during the period from May to October.

c. Tarfa beetle, ***Psiloptera mimosa*** **Klug.** (Col.:Buprestidae).
Beetles were collected from tarfa shurbs at Al-Rwafaa Dam region with other unknown species of family Buprestidae.

7. Other fruit and wood tree borers

Observation on other trees spreading in different regions of North Sinai revealed the existence of 12 other species of fruit and wood trees i.e, almond, apple, citrus, grapevine, pear, plum, apricot, eucalyptus, sycamore, mulberry, nabk and poinciana trees. These trees were liable to infestation with some borers such as, *Scolytus amygdali* Guer., *Chlorophorus varius* Mull., *Enneadesmus obtusedentatus* Lesne., *Enneadesmus trispinosus* Oliv., *Anthaxia angustipennis* Klug., *Lyctus spp., Phoracantha semipunctata, Sinoxylon sudanicum* Lesne, *Bostrychoplites zickeli* Mars, *Tropiderinus munieri* Bedel., *Gastrillus steriatus* Zouf. and the subterranean termite , *Psammotermis* sp.

Table 3. Monthly relative percentages of developmental stages of *Steraspis squamosa* within tamarisk branches at North Sinai Governorate during 2000.

Month	Percentage of abundance					Average of weather factors		
	Larva		Pre-pupa	pupa	Adult	Temp.°C		R.H.%
	Immature	Full-grown				Min.	Max.	
Jan.	42	0	0	0	58	8	17.6	57
Feb.	41	4	3	0	52	7.8	18.6	55
Mar.	29	7	3	9	52	9	19.5	78
Apr.	28	11	16	13	42	12.9	26.3	72
May	37	18	9	16	20	16.6	27.9	77
Jun.	42	6	12	18	22	20.3	29.4	81
Jul.	33	14	13	23	17	21.1	30.6	82
Aug.	37	10	12	22	19	21.9	31.8	82
Sep.	43	15	11	14	17	16.3	29.4	81
Oct.	40	5	18	19	18	10.7	26.9	81
Nov.	35	2	17	16	30	10.2	23.7	72
Dec.	40	0	0	3	57	9.1	20.7	65

Table 4. Simple correlation(r) of relationship between weather factors and population of different developmental stages of *S. squamosa* within tamarisk trees at North Sinai Governorate during 2000.

Stage	Weather factors		
	Min.temp.°C	Max.temp.°C	R.H.%
Immature larva	-0.013	-0.034	-0.241
Full-grown larva	0.666 *	0.699 *	0.616 *
Pre-pupa	0.46	0.717 **	0.650 *
Pupa	0.811 **	0.912 **	0.906 **
Adult	-0.786 **	-0.919 **	-0.824 **

* Significant at level of 0.05 ** Significant at level of 0.0

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ملاحظات حقلية ومعملية على بعض ناخرات الأشجار و عوائلها فى شمال سيناء ، مصر

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معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقى- مصر

يتضمن هذا البحث بعض الملاحظات الحقلية والمعملية على بعض الناخرات التى تصيب أهم أشجار الفاكهة والأشجار الخشبية فى محافظة شمال سيناء . وتشير أهم الدراسات التى أجريت فى هذا العمل الى الآتى:-

١- تختلف مدة بقاء خنفساء جذور الخوخ *C.carbonaria* خلال الأشهر المختلفة وكان متوسط أطول مدة بقاء للخنافس (٤٨,٨ يوم) التى جمعت خلال شهر ديسمبر، بينما كانت أقصر مدة بقاء (١٢,٥ يوم) خلال شهر يوليو وقد وضعت الخنافس البيض فى المعمل خلال الفترة من مايو الى أكتوبر وكانت النسب المئوية النسبية للبيض الموضوع خلال هذه الفترة ٧,٥و ١٢,٥و ٢٢,٥و ١٩,٥و ١١,١% على الترتيب.

٢- وجد أن خنفساء جذور التين *B.rufomaculata* تصيب أشجار المانجو ووجد أن فترة نشاط الخنفساء كانت خلال الفترة من ابريل حتى نوفمبر، كما وجد أن الخنافس لها القدرة على مهاجمة بعض العوائل فى المعمل مثل التين ،المانجو ، الجميز ، التفاح وكانت النسبة المئوية النسبية لوضع البيض فى هذه العوائل ٢١,٣و ٣١,٧و ٤٠،٢ و ٦،٨ % على الترتيب بينما وجد أن الخوخ ،الكمثرى، التوت، الأكاسيا غير مناسبة للإصابة.

٣- الخروج السنوى لحفار ساق اللبخ *X.globosa* على أشجار الأكاسيا يشير أن الخنافس كانت متوفرة طوال فصول السنة المختلفة وبلغت النسب المئوية النسبية ٩,٨ و ٤١،١ و ١١,٨% خلال الشتاء و الربيع و الصيف و الخريف على الترتيب و كما تم تسجيل قمتين للخروج خلال مايو وسبتمبر.

٤- وجد أن الخنافس واليرقات غير تامة النمو لحفار ساق العبل *S.squamosa* تكون متوفرة داخل الأشجار طوال أشهر السنة فى حين توفرت اليرقات التامة النمو خلال الفترة من فبراير الى نوفمبر، بينما لوحظت العذارى فى الفترة من مارس الى ديسمبر . وتدل النتائج أن الخنافس لها فترة سكون داخل العائل خلال أشهر الشتاء وبعض أشهر الربيع. وقد أظهرت عوامل الطقس تأثيرات معنوية موجبة على تعداد كل من اليرقات التامة النمو و ماقبل العذراء والعذراء ، بينما كان التأثير معنويا سالبا على تعداد الحشرات الكاملة داخل العائل.