STONE FRUIT TREE PESTS: (5) MONITORING THE MAJOR APRICOT TREE BORERS IN EGYPT

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(Manuscript received 19 February 2006)

Abstract

Population fluctuation of dominant and economically important boring insect pests: *Ptosima undecimmaculata* (Coleoptera: Buprestidae), *Chlorophorus varius, Macrotoma palmata* (Col.: Cerambycidae), and *Scolytus amygdali* (Col.: Scolytidae) attacking apricot trees were monitored at Behera governorate during the two successive years 2000 and 2001.

P. undecimmaculata prevailed from late April to late October. Summer recorded the maximum flight (1.07-1.21 beetles), followed by spring (0.56-0.57 beetle), then autumn (0.01 beetle) /tree, and stopped during winter. The total numbers per year were 1.73-1.88 beetles/tree. It had two broods and the beetles activity averaged 6.5 months.

C. varius appeared from late April to late October. Summer recorded the maximum flight (3.38-4.02 beetles), followed by spring (2.27-2.91 beetles), then autumn (0.10-0.15 beetle) /tree, and stopped during winter. The total numbers per year were 6.23-7.08 beetles/tree. It had one brood and the beetles activity lasted 6.5 months.

M. palmate activity started from late June to October. Summer recorded the maximum flight (0.45-1.61 beetles), followed by spring and autumn (0.02-0.05 beetle) /tree, and stopped during winter. The total number of beetles per year averaged 1.57-1.68 beetles/tree. It had one brood and there were 4–4.5 months of beetles' activity.

S. amygdali prevailed from late February/early March to late December. Spring and summer recorded high flight (337.4-357.8 and 310.0-439.3 beetles). Autumn harboured less beetles (183.9-214.6 beetles), and winter was the least (20.0-20.8 beetles) /tree. The total numbers per year were 882.6-1001 beetles/tree. It had three broods and there were 10.5–11 months of beetles' activity.

Effect of weather factors on the borers activity was mostly positively significant with day maximum, day minimum, and day mean temperatures but negatively and insignificantly with day mean relative humidity. Infestation was almost doubled during only one year, thus needed urgent integrated control.

INTRODUCTION

Frequent field observations allover the governorates of Egypt (research series no. 2) indicated that the major stem boring insect pests in apricot (*Prunus armeniaca*)

orchards at both old valley lands and new reclaimed desert lands were the following four Coleopterous species *Ptosima undecimmaculata* (Buprestidae), *Chlorophorus varius*, *Macrotoma palmate* (Cerambycidae), and *Scolytus amygdale* (Scolytidae).

Successful integrated pest control depends largely on monitoring studies especially the sesonal fluctuation in the target pest population, the progress of infestation, the seasonal cycle, and the effect of the main weather factors on the target pest. However, the literature in this respect is lacking allover the world and there were some scattered researches in Egypt (Tadros and Abd-Allah, 1987, Kinawy *et al.*, 1992, Tadros *et al.*, 1993, Batt, 1999, and Shehata *et al.*, 2001).

In an attempt to contribute to such a gap in the knowledge, the present comparative ecological survey studies are aimed. The broad objective of investigation is to add new information that may help in planning of rather effective "Integrated Control Programs" for the management of tree borers in apricot orchards.

MATERIALS AND METHODS

1. Population fluctuation of apricot tree boring insect pests:

1.1. Seasonal abundance:

Apricot orchards (about 3 feddans with trees approximately more than 7 years old) located at El-Noubaria, west Delta, Behera governorate were subjected to monitoring studies of the four target boring insects. Monitoring studies were carried out during two successive years extending from early January, 2000 until late December, 2001. No chemical treatments were applied in the selected areas throughout population fluctuation studies.

In case of *P. undecimmaculata, C. varius,* and *M. palmata,* a paint marker using a brush canceled the old exit holes on 100 infested trees randomly distributed in the orchard. In case of *S. amygdali,* a paint marker pin canceled the old exit and entrance holes on 10 infested trees (25 cm long branches at the 4 cardinals of each tree) randomly distributed in the orchard.

From January 1st, 2000 until December 31, 2001, the new exit holes - indicating emergence of beetles of every tree borer's species were counted at half-monthly intervals on the 15th and last day of every month. However, from January 1st weekly counting was carried out to verified the precise starting dates of beetles emergence, thenafter half-monthly counting was applied. To avoid repeated counting new exit holes were immediately canceled with a spray / pin paint marker after counting.

1.2. Progress of infestation:

Data of the seasonal abundance were accumulated from January 1st, 2000 until December 31, 2001 for each half-monthly interval. The total number of beetles

represented the accumulated number for the two years together. to smooth the frequency distribution curve, data were smoothed according to the following formula:

{(2 x the actual number) + the previous number + the following number} / 4

The presented figures indicated the periods of the seasonal cycles of beetles activity and inactivity. Progress of infestation also indicated the rate of increase in each borer infestation year after another.

2. Effect of weather factors on the activity of apricot tree borers:

Four main weather factors, the day maximum temperature (DMxT), day minimum temperature (DMnT), day mean temperature (DMT) and day mean relative humidity (DMRH) were considered. Necessary weather data were obtained from the Central Laboratory of Climate and Meteorology, ARC, MOA, Giza.

Population data of the four boring insect pests taken into account (*P. undecimmaculata, C. varius,* and *M. palmata,* and *S. amygdali*) and the meteorological data, both at half-monthly intervals, were presented.

The relationship between the four weather factors and every target insect during the activity season was investigated for two successive years extending from January 2000 until December 2001 in the apricot orchards.

To determine the direct effect of each weather factor on each insect species activity, population counts were plotted against the corresponding weather data. The simple correlation coefficients "r" for the relationship between each weather factor and each insect specie population was then worked out.

RESULTS AND DISCUSSION

1. Population Fluctuation of *Ptosima undecimmaculata*:

1.1. Seasonal abundance:

Tables (1&5) and Figure (1) showed the seasonal abundance of *P. undecimmaculata* during 2000 and 2001 seasons of beetle's activity. Beetle's emergence prevailed during the period from late April to late October in apricot orchards at Behera governorate during both years of investigation.

Beetles started to emerge during the 2nd half of April (0.01 beetles/tree) in 2000 and the 2nd half of April (0.02 beetles/tree) in 2001. Two flight peaks were recorded in 2000 during the 1st half of June (0.21 beetles/tree) and the 2nd half of August (0.29 beetles/tree), but in 2001 during the 2nd half of June (0.27 beetles/tree), and the 1st half of August (0.31 beetles/tree). Emergence of beetles was ceased during the 2nd half of October (0.03 beetles/tree) in 2000, and during the 2nd half of October (0.02 beetles/tree) in 2001.

It was concluded that the maximum beetles' flight (1.07 and 1.21 beetles/tree in 2000 and 2001 seasons, respectively) was in summer months (July-September).

Spring months (April-June) recorded the respective numbers 0.56 and 0.57 beetles / tree. Autumn months (October-December) showed the least beetle activity (0.01 beetles/tree). Beetles activity was stopped during winter months (January-March). Moreover, the total numbers of beetles emerged during the whole year were 1.73 and 1.88 beetles/tree in 2000 and 2001 seasons, respectively. The respective means were 0.07 and 0.08 beetles/tree / half month.

Smoothed data in Table (1) and Figure (1) emphasized that *P. undecimmaculata* had two broods of beetles' activity prevailed from the 2nd half of April to the 1st half of October or from the 2nd half of April to the 1st half of December and from the 1st half of May to the 1st half of November or from the 1st half of May to the 1st half of November 2000 or 2001, respectively.

1.2. Progress of infestation:

The cumulative numbers (seasonal cycle) of emerged beetles (Figure, 1) was 6.5 months of beetles activity followed by 5.5 months of beetles inactivity. Infestation was almost doubled during only one year (from 1.73 beetles in 2000 to 3.61 beetles in 2001/tree/year). This serious parameter imposed urgent need of controlling the pest.

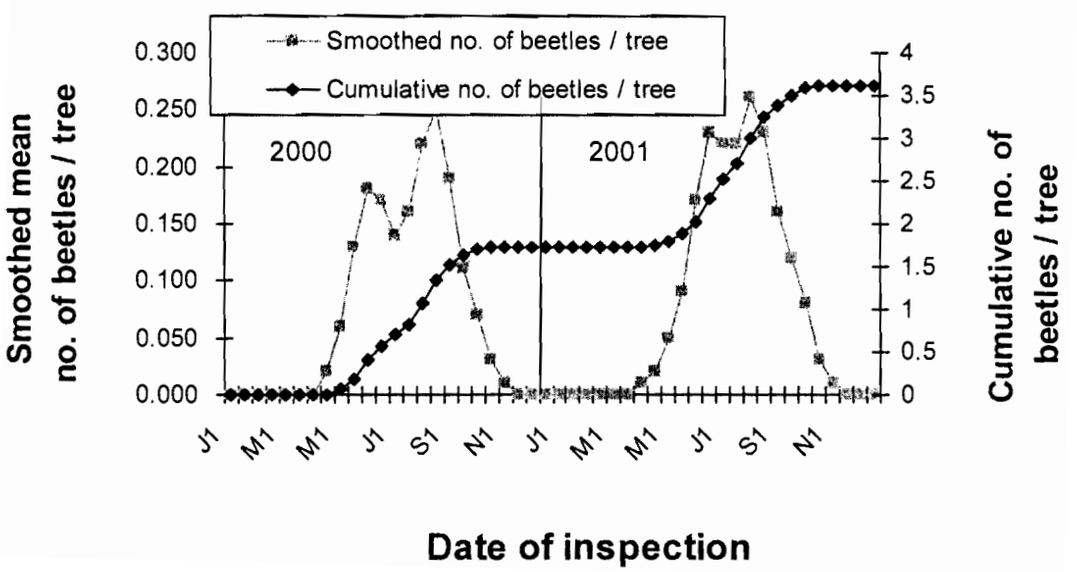
1.3. Effect of temperature and relative humidity on beetles activity:

Statistical analysis in Table (6) revealed that the fluctuation in *P. undecimmaculata* beetles population was highly significant and positively correlated with the temperature in the two years of study whether DMxT ("r" from 0.7657 to 0.7846) or DMnT ("r" from 0.8455 to 0.8533) or DMT ("r" from 0.7828 to 0.8276). On the contrary, the effect of DMRH on beetles' population was insignificant and negative in 2000 where "r": - 0.1006 but significant and positive in 2001 ("r": 0.4049).

Table 1. Mean number of *P. undecimmaculata* beetles in apricot orchards at Behera governorate during 2000 and 2001 seasons.

Date of inspection		Mean no. of beetles \ tree					
		2000 season			2001 season		
		Actual	Smoothed	Cumulative	Actual	Smoothed	Cumulative
Jan.	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-31	0.00	0.00	0.00	0.00	0.00	1.73
Feb.	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-29	0.00	0.00	0.00	0.00	0.00	1.73
Mar	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-31	0.00	0.00	0.00	0.00	0.04	1.73
Winter		0.00			0.00		
Apr.	1-15	0.00	0.00	0.00	0.00	0.01	1.73
	16-30	0.01	0.02	0.01	0.02	0.02	1.75
May	1-15	0.05	0.06	0.06	0.04	0.05	1.79
	16-31	0.13	0.13	0.19	0.09	0.09	1.88
Jun.	1-15	0.21	0.18	0.40	0.15	0.17	2.03
	16-31	0.16	0.17	0.56	0.27	0.23	2.30
Spring		0.56			0.57		
Jul.	1-15	0.14	0.14	0.70	0.22	0.22	2.52
	16-31	0.12	0.16	0.82	0.18	0.22	2.70
Aug.	1-15	0.24	0.22	1.06	0.31	0.26	3.01
	16-31	0.29	0.25	1.35	0.24	0.23	3.25
Sep.	1-15	0.18	0.19	1.53	0.13	0.16	3.38
	16-30	0.10	0.11	1.63	0.13	0.12	3.51
Summer		1.07			1.21		
Oct.	1-15	0.07	0.07	1.70	0.08	0.08	3.59
	16-31	0.03	0.03	1.73	0.02	0.03	3.61
Nov.	1-15	0.00	0.01	1.73	0.00	0.01	3.61
	16-30	0.00	0.00	1.73	0.00	0.00	3.61
Dec.	1-15	0.00	0.00	1.73	0.00	0.00	3.61
	16-31	0.00	0.00	1.73	0.00	0.00	3.61
Autumn		0.10			0.10		
Grand Total		1.73		1.73	1.88		3.61
Grand Mean		0.07			0.08		

Figure 1: Mean numbers of *P. undecimmaculata* beetles in apricot orchards at Behera governorate during 2000 and 2001.



2. Population fluctuation of *Chlorophorus varius*:

2.1. Seasonal abundance:

Tables (2 & 5) and Figure (2) showed that beetle's emergence prevailed during the period from late April to late October on apricot during 2000 and 2001.

Beetles started to emerge during the 2nd half of April (0.12 beetles/tree) in 2000 and the 1st half of April (0.16 beetles/tree) in 2001. Two flight peaks were recorded in 2000 during 1st half of June (1.54 beetles/tree) and the 1st half of August (1.19 beetles/tree), but in 2001 during the the 1st half of June (1.16 beetles/tree) and the 2nd half of July (2.03 beetles/tree). Emergence of beetles was ceased during the 2nd half of October (0.04 beetles/tree) in 2000, and during 2nd half of October (0.06 beetles/tree) in 2001.

The maximum beetles' flight (3.38 and 4.02 beetles/tree in 2000 and 2001, respectively) was in summer. Spring recorded the respective numbers 2.27 and 2.91 beetles/tree. Autumn showed the respective least beetle activity (0.10 and 0.15 beetles/tree). Beetles activity was stopped during winter. Moreover, the total numbers of beetles emerged during the whole year were 6.23 and 7.08 beetles/ tree in 2000 and 2001, respectively. The respective means were 0.26 and 0.30 beetles/ tree/half month.

Smoothed data emphasized that *C. varius* had one broods of beetles' activity prevailed from 1st half of April to the 1st half of October in both 2000 and 2001.

2.2. Progress of infestation:

The seasonal cycle of emerged beetles (Figure, 1) was 6.5 months of beetles activity followed by 5.5 months of beetles inactivity. Infestation was almost doubled during only one year (from 6.23 beetles in 2000 to 13.41 beetles in 2001/tree/year). This is also serious parameter imposed urgent need of controlling the pest yearly.

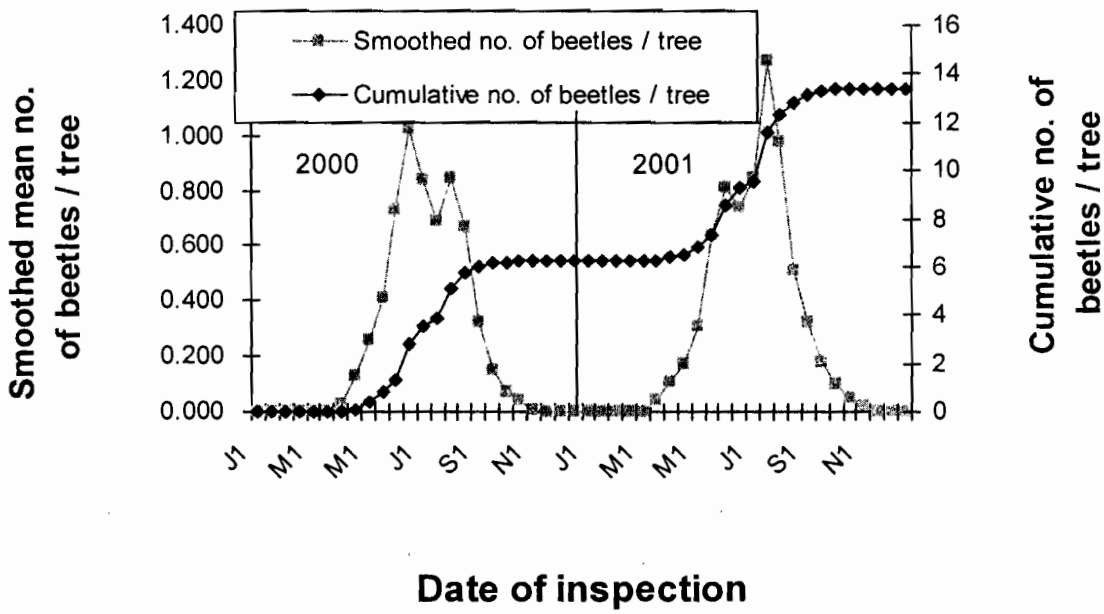
2.3. Effect of temperature and relative humidity on beetles activity:

Statistical analysis in Table (6) revealed that the fluctuation in *C. varius* beetles population was highly significant and positive correlated with the DMxT ("r" = from 0.5932 to 0.6176) and DMT ("r" = from 0.5587 to 0.6282) in both 2000 and 2001, but only in 2000 with DMnT ("r" = 0.6597). In 2001, the fluctuation in the beetles' population was insignificant and positive correlated with the DMnT ("r" = 0.3434). However, DMRH showed insignificant and negative correlation ("r" = - 0.1483) in 2000 but insignificant and positive correlation ("r" = 0.2138) in 2001.

Table 2. Mean number of *C. varius* beetles in apricot orchards at Behera governorate during 2000 and 2001 seasons.

Date of inspection		Mean no. of beetles \ tree					
		2000 season			2001 season		
		Actual	Smoothed	Cumulative	Actual	Smoothed	Cumulative
Jan.	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-31	0.00	0.00	0.00	0.00	0.00	1.73
Feb.	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-29	0.00	0.00	0.00	0.00	0.00	1.73
Mar	1-15	0.00	0.00	0.00	0.00	0.00	1.73
	16-31	0.00	0.00	0.00	0.00	0.04	1.73
Winter		0.00			0.00		
Apr.	1-15	0.00	0.03	0.00	0.16	0.11	6.39
	16-30	0.12	0.13	0.12	0.12	0.17	6.51
May	1-15	0.26	0.26	0.38	0.27	0.31	6.78
	16-31	0.41	0.41	0.79	0.56	0.64	7.34
Jun.	1-15	1.54	0.73	1.33	1.16	0.91	8.50
	16-31	0.42	1.03	2.75	0.74	0.74	9.24
Spring		2.27			2.91		
Jul.	1-15	0.76	0.84	3.51	0.31	0.85	9.55
	16-31	0.42	0.69	3.93	2.03	1.27	11.58
Aug.	1-15	1.19	0.85	5.12	0.69	0.98	12.27
	16-31	0.61	0.67	5.73	0.52	0.51	12.79
Sep.	1-15	0.28	0.32	6.01	0.30	0.32	13.09
	16-30	0.12	0.15	6.13	0.17	0.18	13.26
Summer		3.38			4.02		
Oct.	1-15	0.06	0.07	6.19	0.09	0.10	13.35
	16-31	0.04	0.04	6.23	0.06	0.05	13.41
Nov.	1-15	0.00	0.01	6.23	0.00	0.02	13.14
	16-30	0.00	0.00	6.23	0.00	0.00	13.14
Dec.	1-15	0.00	0.00	6.23	0.00	0.00	13.14
	16-31	0.00	0.00	6.23	0.00	0.00	13.14
Autumn		0.10			0.15		
Grand Total		6.23		6.23	7.08		13.41
Grand Mean		0.26			0.30		

Figure 2: Mean numbers of *C. varius* beetles in apricot orchards at Behera governorate during 2000 and 2001.



3. Population Fluctuation of *Macrotoma palmata*:

3.1. Seasonal abundance:

Tables (3 & 5) and Figure (3) showed that beetle's emergence prevailed during the period from late June to October in apricot orchards during 2000 and 2001.

Beetles started to emerge during the 2nd half of June (0.05 beetles/tree) in 2000 and the the 2nd half of June (0.02 beetles/tree) in 2001. Only one flight peaks were recorded in 2000 during 1st half of September (0.39, but in 2001 during the the 2nd half of August (0.45 beetles/tree). Emergence of beetles was ceased during the 2nd half of October (0.01 beetles/tree) in 2000, and during 1st half of October (0.05 beetles / tree) in 2001.

The maximum beetles' flight (0.45 and 1.61 beetles/tree in 2000 and 2001, respectively) was in summer. Spring recorded the respective numbers 0.05 and 0.02 beetles/tree. Autumn showed the respective least beetle activity (0.07 and 0.05 beetles /tree). Beetles activity was stopped during winter. Moreover, the total numbers of beetles emerged during the whole year were 1.57 and 1.68 beetles/tree in 2000 and 2001, respectively. The respective means were 0.07 beetles/tree/half month.

Smoothed data in Figure (3) emphasized that *M. palmata* had only one brood of beetles' activity prevailed from 1st half of June to the 2nd half of October in 2000 and from the 2nd half of June to the 2nd of October in 2001.

3.2. Progress of infestation:

The seasonal cycle of emerged beetles (Figure, 3) was 4–4.5 months of beetles' activity followed by 7.5-8 months of beetles inactivity. Infestation was almost doubled during only one year (from 1.57 beetles in 2000 to 3.25 beetles in 2001/tree/year), thus, need urgent control of the pest year after another.

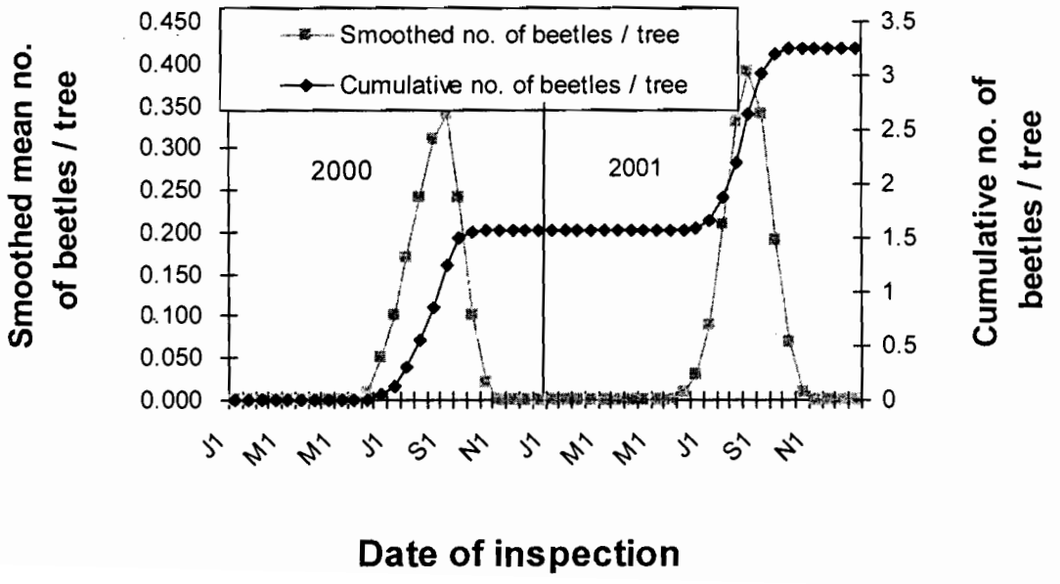
3.1. Effect of temperature and relative humidity on beetles activity:

Statistical analysis in Table (6) revealed that the fluctuation in beetles population was highly significant and positively correlated with the DMxT ("r" from 0.6722 to 0.6892) and DMT ("r" from 0.6183 to 0.6808) in both 2000 and 2001, but only in 2001 with DMnT ("r": 0.5878). In 2000, the fluctuation in the beetles' population was insignificant and positive correlated with the DMnT ("r": 0.3303). However, the effect of DMRH much varied on the fluctuation in the beetles' population showing significant and positively correlation ("r": 0.4524) in 2001 but insignificant and negatively correlation ("r": - 0.0001) in 2000.

Table 3. Mean number of *M. palmata* beetles in apricot orchards at Behera governorate during 2000 and 2001 seasons.

Date of inspection		Mean no. of beetles \ tree					
		2000 season			2001 season		
		Actual	Smoothed	Cumulative	Actual	Smoothed	Cumulative
Jan.	1-15	0.00	0.00	0.00	0.00	0.00	1.57
	16-31	0.00	0.00	0.00	0.00	0.00	1.57
Feb.	1-15	0.00	0.00	0.00	0.00	0.00	1.57
	16-29	0.00	0.00	0.00	0.00	0.00	1.57
Mar	1-15	0.00	0.00	0.00	0.00	0.00	1.57
	16-31	0.00	0.00	0.00	0.00	0.00	1.57
Winter		0.00			0.00		
Apr.	1-15	0.00	0.00	0.00	0.00	0.00	1.57
	16-30	0.00	0.00	0.00	0.00	0.00	1.57
May	1-15	0.00	0.00	0.00	0.00	0.00	1.57
	16-31	0.00	0.00	0.00	0.00	0.00	1.57
Jun.	1-15	0.00	0.01	0.00	0.00	0.01	1.57
	16-31	0.05	0.05	0.05	0.02	0.03	1.59
Spring		0.05			0.02		
Jul.	1-15	0.08	0.10	0.13	0.07	0.09	1.66
	16-31	0.18	0.17	0.31	0.21	0.21	1.87
Aug.	1-15	0.24	0.24	0.55	0.33	0.33	2.20
	16-31	0.31	0.31	0.86	0.45	0.39	2.65
Sep.	1-15	0.39	0.34	1.25	0.36	0.34	3.01
	16-30	0.25	0.24	1.50	0.19	0.19	3.20
Summer		0.45			1.61		
Oct.	1-15	0.06	0.10	1.56	0.05	0.07	3.25
	16-31	0.01	0.02	1.57	0.00	0.01	3.25
Nov.	1-15	0.00	0.00	1.57	0.00	0.00	3.25
	16-30	0.00	0.00	1.57	0.00	0.00	3.25
Dec.	1-15	0.00	0.00	1.57	0.00	0.00	3.25
	16-31	0.00	0.00	1.57	0.00	0.00	3.25
Autumn		0.07			0.05		
Grand Total		1.57		1.57	1.68		3.25
Grand Mean		0.07			0.07		

Figure 3: Mean numbers of *M. palmata* beetles in apricot orchards at Behera governorate during 2000 and 2001.



4. Population Fluctuation of *Scolytus amygdali*:

4.1. Seasonal abundance:

Tables (4) and (5) and Figure (4) showed that beetle's emergence prevailed during the period from late February/early March to late December.

Beetles started to emerge during the 1st half of March (4.2 beetles/tree) in 2000 and the 2nd half of February (1.6 beetles/tree) in 2001. Four flight peaks were recorded in 2000 during the 2nd half of April (97.0 beetles/tree), 2nd half of June (107.9 beetles/tree), 1st half of September (155.8 beetles/tree) and the 1st half of November (82.4 beetles/tree), and in 2001 during the 1st half of April (89.3 beetles/tree), the 1st half of June (86.6 beetles/tree), the 2nd half of September (82.8 beetles/tree), the 2nd half of November (61.5 beetles/tree). Emergence of beetles was ceased during the 2nd half of December (5.3 beetles/tree) in 2000, and (4.5 beetles/tree) in 2001.

Spring recorded high beetles' flight (357.8 and 337.4 beetles/tree in 2000 and 2001, respectively). Summer was also high as the respective numbers/tree were 439.3 and 310.0 beetles/tree. Autumn showed less beetle activity, as the respective numbers were 183.9 and 214.6 beetles/tree. The least beetle's activity was during winter as the respective numbers were 20.0 and 20.8 beetles/tree. Moreover, the total numbers of beetles emerged during the whole year were 1001 and 882.6 beetles/tree in 2000 and 2001, respectively. The respective means were 41.7 and 36.8 beetles/tree/half month.

Smoothed data in Figure (4) emphasized that *S. amygdali* had three broods of beetles' activity prevailed from the 2nd half of February to the 1st half of June, 2nd half of April to the 2nd half of August, and from the 2nd half of July to the 2nd half of December 2000 and from the 1st half of March to the 1st half of August, 2nd half of March to the 1st half of September, and from the 1st half of August to the 2nd half of December 2001, respectively.

Table 4. Mean number of *S. amygdali* beetles in apricot orchards at Behera governorate during 2000 and 2001 seasons.

Date of inspection		Mean no. of beetles \ tree					
		2000 season			2001 season		
		Actual	Smoothed	Cumulative	Actual	Smoothed	Cumulative
Jan.	1-15	0.00	0.00	0.00	0.00	0.00	1001
	16-31	0.00	0.00	0.00	0.00	0.00	1001
Feb.	1-15	0.00	0.00	0.00	0.00	0.40	1001
	16-29	0.00	1.1	0.00	1.6	2.6	1002.6
Mar	1-15	4.20	6.1	4.2	7.3	7.0	1009.9
	16-31	15.8	20.8	20.0	11.9	30.1	1021.8
Winter		20.0			20.8		
Apr.	1-15	47.2	47.3	67.2	89.3	61.7	1111.1
	16-30	79.0	58.0	146.2	56.2	61.7	1167.3
May	1-15	26.9	41.4	173.1	45.0	46.1	1212.3
	16-31	32.7	39.1	205.8	38.2	42.1	1250.5
Jun.	1-15	64.1	67.2	269.9	46.8	48.4	1297.3
	16-31	107.9	82.8	377.8	61.9	64.3	1359.2
Spring		357.8			337.4		
Jul.	1-15	51.1	59.6	428.9	86.6	72.5	1445.8
	16-31	28.3	38.3	457.2	54.7	54.6	1500.5
Aug.	1-15	45.6	41.8	502.2	22.2	29.6	1522.7
	16-31	47.5	74.1	550.3	19.1	26.3	1541.8
Sep.	1-15	155.8	117.5	706.1	44.6	47.8	1586.4
	16-30	111.0	63.0	817.1	82.8	69.8	1669.2
Summer		439.3			310.0		
Oct.	1-15	47.4	57.6	864.5	69.1	68.9	1738.3
	16-31	24.7	44.8	889.2	54.4	49.4	1792.7
Nov.	1-15	82.4	51.0	971.6	19.7	38.8	1812.4
	16-30	14.6	30.3	986.2	61.5	37.0	1873.9
Dec.	1-15	9.5	9.7	995.7	5.4	19.2	1879.3
	16-31	5.3	5.0	1001	4.5	3.6	1883.8
Autumn		183.9			214.6		
Grand Total		1001		1001	882.6		1883.8
Grand Mean		41.7			36.8		

Figure 4: Mean numbers of *S. amygdali* beetles in apricot orchards at Behera governorate during 2000 and 2001.

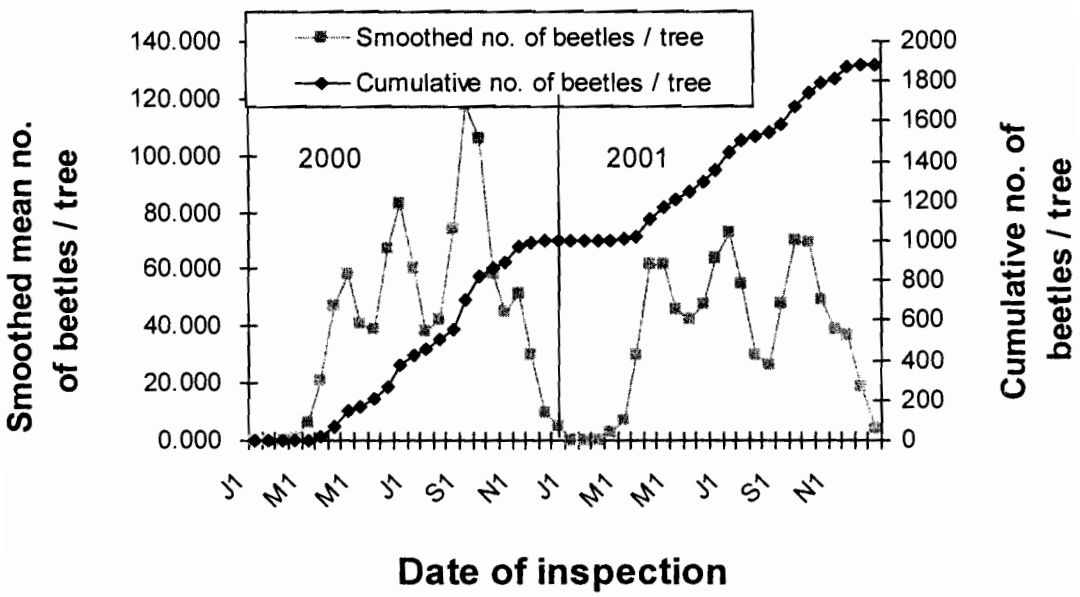


Table 5. Commencement, peak, last date, and broods of *P. undecimmaculata*, *C. varius*, *M. palmata*, and *S. amygdali* beetles in apricot orchards at Behera governorate, during 2000 and 2001 seasons.

Statement	Insect borer	Year	
		2000	2001
Flight Commence -ment	*P. undecimmaculata*	4th week of Apr.	3rd week of Apr.
	C. varius	3rd week of Apr.	2nd week of Apr.
	M. palmata	3rd week of Jun.	4th week of Jun.
	S. amygdali	1st week of Mar.	4th week of Feb.
Peaks	*P. undecimmaculata*	1st half of Jun. 2nd half of Aug.	2nd half of Jun. 1st half of Aug.
	C. varius	1st half of Jun. 1st half of Aug.	1st half of Jun. 2nd half of Jul.
	M. palmata	1st half of Sep.	2nd half of Aug.
	S. amygdali	2nd half of Apr. 2nd half of Jun. 1st half of Sep. 1st half of Nov.	1st half of Apr. 1st half of Jul. 2nd half of Sep. 2nd half of Nov.
Last flight	*P. undecimmaculata*	2nd half of Oct.	2nd half of Oct.
	C. varius	2nd half of Oct.	2nd half of Oct.
	M. palmata	2nd half of Oct.	1st half of Oct.
	S. amygdali	2nd half of Dec.	2nd half of Dec.
Broods	*P. undecimmaculata*	2nd half of Apr. to 1st half of Oct. 1st half of May to 1st half of Nov.	2nd half of Apr. to 1st half of Dec. 1st half of May to 1st half of Nov.
	C. varius	1st half of Apr. to 1st half of Oct.	1st half of Apr. to 1st half of Oct.
	M. palmata	1st half of Jun. to 2nd half of Oct.	2nd half of Jun. to 2nd of Oct.
	S. amygdali	2nd half of Feb. to 1st half of Jun. 2nd half of Apr. to 2nd half of Aug. 2nd half of Jul. to 2nd half of Dec.	1st half of Mar. to 1st half of Aug. 2nd half of Mar. to 1st half of Sep. 1st half of Aug. to 2nd half of Dec.

4.2 Progress of infestation:

The seasonal cycle of emerged beetles (Figure, 4) was 10.5–11 months of beetles activity followed by 1.5–2 months of beetles inactivity. Infestation was almost doubled during only one year (from 1001 beetles in 2000 to 1883.8 beetles in 2001/ tree/year). This imposed urgent need of controlling the pest year after another.

4.3 Effect of temperature and relative humidity on beetles activity:

Statistical analysis in Table (6) showed that the fluctuation in *S. amygdali* beetles population was highly significant and positively correlated with the temperature in the two years of study. The simple correlation "r" with the DMT ranged from 0.5914 to 0.6907, the DMnT ranged from 0.5755 to 0.6646, and the DMxT ranged from 0.5833 to 0.7073. On the contrary, the effect of the DMRH was insignificant and negative ("r" ranged from - 0.2932 in 2000 to -0.0400 in 2001).

DISCUSSION AND CONCLUSION

Monitoring studies (especially the sesonal fluctuation of insect pest population, progress of infestation, seasonal cycle, and effect of the main weather factors on the target pests) are essential in planning successful and effective "Integrated Control Programs" for the management of boring insect pests.

Survey studies (Tadros *et al.*, 2006) indicated that dominant and economically important boring insect pests in apricot orchards are *Ptosima undecimmaculata, Chlorophorus varius, Macrotoma palmata,* and *Scolytus amygdali.*and 310.0 beetles/tree. Autumn showed less beetle activity, as the respective numbers were 183.9 and 214.6 beetles/tree. The least beetle's activity was during winter as the respective numbers were 20.0 and 20.8 beetles/tree. Moreover, the total numbers of beetles emerged during the whole year were 1001 and 882.6 beetles/tree in 2000 and 2001, respectively. The respective means were 41.7 and 36.8 beetles/tree/half month.

Smoothed data in Figure (4) emphasized that *S. amygdali* had three broods of beetles' activity prevailed from the 2nd half of February to the 1st half of June, 2nd half of April to the 2nd half of August, and from the 2nd half of July to the 2nd half of December 2000 and from the 1st half of March to the 1st half of August, 2nd half of March to the 1st half of September, and from the 1st half of August to the 2nd half of December 2001, respectively.

Table 6. Simple correlation "r" and regression "b" coefficients between the mean numbers of *P. undecimmaculata*, *C. varius*, *M. palmata*, and *S. amygdali* beetles in apricot orchards and the corresponding day maximum (DMxT), day mean (DMT), day minimum temperatures (DMnT) and day mean relative humidity (DMRH) during 2000 and 2001

Insect Borer	*P. undecimmaculata*		*C. varius*		*M. palmata*		*S. amygdali*	
Year	2000	2001	2000	2001	2000	2001	2000	2001
Simple correlation "r"								
DMxT	0.766**	0.785**	0.593**	0.618**	0.330	0.588**	0.707**	0.583**
DMT	0.783**	0.828**	0.628**	0.559**	0.681**	0.618**	0.691**	0.591**
DMnT	0.853**	0.846**	0.660**	0.343	0.672**	0.689**	0.665**	0.576**
DMRH	-0.101	0.405*	-0.148	0.214	-0.001	0.452*	-0.293	-0.040
Simple regression "b"								
DMxT	45.00**	45.586**	8.145**	7.056**	12.792	24.025**	0.094**	0.109**
DMT	45.86**	43.486**	7.923**	6.464**	26.577**	30.766**	0.086**	0.106**
DMnT	45.92**	44.474**	7.877**	0.346	27.622**	27.300**	0.079**	0.103**
DMRH	-3.78	9.3468*	-1.838	1.443	-0.003	10.695*	-0.036	-0.004

**: Significant at 0.01 levels (Highly significant)

*: Significant at 0.05 levels (Significant)

In apricot orchards beetles activity started from late February/early March for *S. amygdali* to late April for *P. undecimmaculata* and *C. varius*, whereas *M. palmata* beetles started from late June. Emergence was stopped by the end of October, but extended to late December for *S. amygdali.* The activity seasons were summer and spring, but summer only for *M. palmata*, and *S. amygdali* activity extended to autumn. Owing to the adverse weather factors and feeding habits, winter season showed inactivity of all beetles species. The activity season extended from 4 to 11 months according to the borer species. There were 1 to 4 broods of peak borer activity. Infestation was almost doubled during only one year, thus needed urgent integrated control. Larvae however, are existed all the year round inside the wood tunnels, but larval duration are prolonged in winted without diapause.

Generally, there were positive and significant effects of major weather factors: day maximum, day minimum, and day mean temperatures on the borers' activity, but this effect was mostly negative and insignificantly with day mean relative humidity.

Although literature is lacking concerning such studies, yet in Egypt, there were some scattered researches in this respect. The previous results are somewhat in agreement with Kinawy *et al.* (1992) who surveyed *Ptosima undecimmaculata* in apricot orchards from the 1st week of March until the last week of September, with three population peaks. Also, Batt (1999) studied the seasonal fluctuation of *Ptosima undecimmaculata* population in apricot orchards at Alexandria and Giza Governorate during 1987 to 1989. Emergence of started from April/May until October. Adult activity affected by temperature and R. H. The seasonal fluctuation of *M. palmata* population

was monitored by Tadros *et al.* (1993) in apricot orchards at Alexandria and Giza from 1987 to 1989. Emergence of started during June and continued until October. Temperature and R. H. influenced the development of *M. palmata*. Moreover, Shehata *et al.* (2001) stated that adult beetles of *M. palmata* emerged during June and continued until September and October. In addition, Tadros and Abd-Allah (1987) found that *S. amygdali* beetles were active in apricot orchards from February to December.

Literature from abroad concerning these four boring pests is lacking.

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آفات أشجار الفاكهة ذات النواة الحجرية: (٥) تتبع تعداد أهم حفارات أشجار المشمش في مصر

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تم تتبع نشاط أهم حفارات أشجار الفاكهة السائدة ذات الأهمية الاقتصادية التي تهاجم أشجار المشمش وهي حفار ساق البرقوق وحفار ساق الخوخ ذو القرون الطويلة، وحفار ساق السنط، وخنافس قلف الحلويات في محافظة البحيرة علي مدار عامين متتاليين (٢٠٠٠، و ٢٠٠١).

١. **حفار ساق البرقوق *P. undecimmaculata***: يبدأ النشاط الموسمي للحفار من أواخر أبريل إلى أواخر أكتوبر. سجلت شهور الصيف أعلى نشاط للحشرات (١,٠٧-١,٢١ حشرة)، يليها الربيع (٠,٥٦-٠,٥٧ حشرة). ثم الخريف (٠,٠١ حشرة) وتوقف النشاط خلال الشتاء. بلغ إجمالي عدد الحشرات التي خرجت من الشجرة خلال العام ١,٧٣-١,٨٨ حشرة. وللحفار حضنتان من النشاط خلال العام. وهناك دورة من نشاط الحشرات لمدة ٦,٥ شهر. وقد تضاعفت الإصابة بالحفار خلال عام واحد (من ١,٧٣ إلى ٣,٦١ حشرة).

٢. **حفار ساق الخوخ ذو القرون الطويلة *C. varius***: يبدأ النشاط الموسمي للحفار من أواخر أبريل إلى أواخر أكتوبر. سجلت شهور الصيف أعلى نشاط للحشرات (٣,٣٨-٤,٠٢ حشرة)، يليها الربيع (٢,٢٧-٢,٩١ حشرة). ثم الخريف (٠,١٠-٠,١٥ حشرة). وتوقف النشاط خلال الشتاء. بلغ إجمالي عدد الحشرات التي خرجت من الشجرة خلال العام ٦,٢٣-٧,٠٨ حشرة. وللحفار حضنة واحدة من النشاط خلال العام. وهناك دورة من نشاط الحشرات لمدة ٦,٥ شهر. تضاعفت الإصابة بالحفار خلال عام واحد (من ٦,٢٣ إلى ١٣,٤١ حشرة).

٣. **حفار ساق السنط *M. palmate***: يبدأ النشاط الموسمي للحفار من أواخر يونيو إلى أكتوبر. سجلت شهور الصيف أعلى نشاط للحشرات (٠,٠,٤٥-١,٦١ حشرة)، يليها الربيع والخريف (٠,٠٢-٠,٠٥ حشرة). وقد توقف النشاط خلال الشتاء. بلغ إجمالي عداد الحشرات التي خرجت من الشجرة خلال العام ١,٥٧-١,٦٨ حشرة. وللحفار حضنة واحدة من النشاط خلال العام. وهناك دورة من نشاط الحشرات لمدة ٤-٤,٥ شهر. وقد تضاعفت الإصابة بالحفار خلال عام واحد (من ١,٥٧ إلى ٣,٢٥ حشرة).

٤. **خنافس قلف الحلويات *S. amygdali***: يبدأ النشاط الموسمي للخنافس من أواخر فبراير/أوائل مارس إلى أواخر ديسمبر. سجلت شهور الربيع والصيف أعلى نشاط للحشرات (٣٣٧,٤-٣٥٧,٨ و ٣١٠,٠-٤٣٩,٣ حشرة، علي التوالي)، وانخفض في الخريف (١٨٣,٩-٢١٤,٦ حشرة)، في حين قل النشاط كثيرا في الشتاء (٢٠,٠-٢٠,٨ حشرة). بلغ إجمالي تعداد الحشرات التي خرجت من الشجرة خلال العام ٨٨٢,٦-١٠٠١ حشرة. وللحفار ثلاث حضنات من النشاط خلال العام. وهناك دورة من نشاط الحشرات لمدة ١٠,٥-١١ شهر. وقد تضاعفت الإصابة

بالحفار خلال عام واحد (من ١٠٠١ إلى ١٨٨٣,٨ حشرة).

٥. تلاحظ أن تأثير العوامل الجوية علي نشاط الحفارات موجب ومعنوي في معظم الأحوال مع درجات الحرارة الصغري والمتوسطة والعظمي، ولكنها سالبة وغير معنوية مع متوسط الرطوبة النسبية.

٦. في جميع الأحوال تضاعفت الإصابة بالحفارات الأربعة خلال عام واحد مما يستوجب المكافحة المستمرة.