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ECOLOGICAL STUDIES ON SUNT BORER, *Macrotoma palmata* Fab. (COLEOPTERA: CERAMBYCIDAE) INFESTING MANGO ORCHARDS IN EGYPT

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ABSTRACT

Population fluctuation of one of the economically important insect borer *Macrotoma palmata* Fab. (Coleoptera: Cerambycidae) attacking mango trees were monitored at Ismailia Governorate during two successive years (2009 and 2010).

Beetles of M. palmata Fab. started their activity season from the 1st / 2nd half of June to 2nd half of October or 1st half of November. Summer months recorded the maximum beetles' flight (1.26-1.43 beetles), followed by autumn (0.18-0.26 beetle) and spring (0.04-0.06 beetle) / tree, and stopped during winter. The total number of beetles per year averaged 1.56-1.67 beetles / tree. *M. palmata* had only one brood and there were 4.5-5.5 months of beetles' activity.

Effect of weather factors on the borer 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 continuous integrated control.

INTRODUCTION

Frequent field observations allover the Governorates of Egypt (Tadros *et al.*,2013) indicated that the major stem boring insect pests in mango (*Mangifera indica*) orchards at both old Delta valley lands and new reclaimed desert lands were the following coleopterous species: *Macrotoma palmata* Fab., *Chlorophorus varius* Mull., *Pseudocastalia aegyptiaca* Gmlein, *Batocera rufomaculata* DeGeer, *Stromatium vulvum* Villers., *Ptosima undecimmaculata* Herbst., *Belionota scutellaris* Fab., *Chrysobothris dorsata* F., *Anthaxia angustipennis* Klug., *Niphona picticornis* Muls., *Scolytus amygdale* Guer., *Xylotrechus antilope* Sch. , *Hypothenemus eruditus* Westwood, *Xyleborus similis* Ferrai, *Xyleborinus saxeseni* Ratz., *Mesites cunipes* Boheman, *Rhyncolus cylindricus* Boheman, *Lyctus africanus* lesne, *Gastrallus striatus* Zouf., *Tropiderinus munieri* Bedel, *Bostrychopsis reichei* Mars., *Dinoderus bifoveolatus* Woll., *D. minutus* Fab., *Enneadesmus obtusedentatus* Lesne, *E. trispinosa* Olivier, *E. forficula* Frm., *Phonapate frontalis* fahr., *Sinoxylon sudanicum* Lesne.

Successful integrated pest control depends largely on monitoring studies especially the sesonal fluctuation of 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 (Mostafa, 1977; El-Sebay, 1984 ; Kinawy *et al.*, 1993; Tadros *et al.*, 1993; Batt, 1999; Shehata *et al.*, 2001;Tadros *et al.*,2006 and Tadros *et al.*,2007).

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 help in planning of rather effective "Integrated Control Programs" for the management of tree borers in mango orchards.

MATERIALS AND METHODS

1. Population fluctuation of *M. palmata* in mango orchards:

1.1. Seasonal abundance:

Mango orchard (about 5 feddans with trees more than 20 years old) located at El-Tall Kabeer, east Delta, Ismailia Governorate were subjected to monitoring studies of the target boring insect. Monitoring studies were carried out during two successive years extending from early January, 2009 until late December, 2010. No chemical treatments were applied in the selected areas throughoutthe period of population fluctuation studies. A paint marker using a brush was used to cancel the old exit holes on 100 randomly distributed infested trees with *M. palmata*.

From January 1st, 2009 until December 31, 2010, the new exit holes - indicating emergency of beetles of *M. palmata* beetles were counted at half-monthly intervals on the 15th and last day of every month. To avoid repeated counting new exit holes were immediately canceled with a spray marker after counting.

1.2. Progress of infestation:

Data of the seasonal abundance were accumulated from January 1st, 2009 until December 31, 2010 for each half-monthly interval. The total number of beetles represented the accumulated number for the two years together were summed. To smooth down the frequency distribution curve, data were calculated 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 the borer infestation year after another.

2. Effect of weather factors on the activity of mango 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.

The relationship between the four weather factors and the target borer during the activity season was investigated during the two successive years extending from January 2009 until December 2010 in the mango orchard.

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

RESULTS AND DISCUSSION

1. Population Fluctuation of *Macrotoma palmata*:

1.1. Seasonal abundance:

Table (1) and Figure (1) showed that beetle's emergence prevailed during the period from the 1st / 2nd half of June to 2nd half of October or 1st half of November in mango orchards during 2009 and 2010.

Beetles started to emerge during the 1st half of June (0.01 beetle / tree) in 2009 and the 2nd half of June (0.06 beetle / tree) in 2010. Two flight peaks were recorded in 2009 and 2010. The first peak was observed during 2nd half of August 2009 (0.29 beetle / tree) but during the 2nd half of July 2010 (0.21 beetle / tree). The second peak was noticed during 2nd half of September 2009 (0.35 beetle / tree) and during the 1st half of September 2010 (0.42 beetle / tree). Emergence of beetles was ceased during the1st half of November 2009 (0.02 beetle / tree), and during, but during the 2nd half of October 2010 (0.07 beetle / tree).

The maximum beetles' flight (1.26 and 1.43 beetles / tree in 2009 and 2010, respectively) was in summer. Autumn recorded the respective numbers 0.26 and 0.18 beetle / tree. Spring showed the respective least beetle activity (0.04 and 0.06 beetle / tree). Beetles activity was stopped during winter. Moreover, the total numbers of beetles emerged during the whole year were 1.56 and 1.67 beetles / tree in 2009 and 2010, respectively. The respective grand means per month were 0.12 and 0.14 beetles/tree/half month.

Smoothed data in Figure (1) emphasized that beetles' activity of *M. palmata* had only one brood prevailed from 1st half of June to the 2nd half of November in both years of study, 2009 and 2010. The peak of the brood was estimated during the 1st half of September

1.2. Progress of infestation:

The seasonal cycle of emerged beetles (Table, 1 and Figure, 1) was 4.5–5.5 months of beetles' activity followed by 1.5-7.5 months of beetles inactivity. Infestation was almost doubled during only one year (from 1.56 beetles in 2009 to 3.23 beetles in 2010 / tree / year), thus, imposes urgent control of the pest year after another.

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

Statistical analysis in Table (2) revealed that the population fluctuation of *M. palmata* beetles was highly significant and positively correlated with the DMxT ("r" from 0.7234 to 0.7502) and DMT ("r" from 0.7076 to 0.7108), but the DMnT ("r": from 0.6053 to 0.6211) in both 2009 and 2010. On the other hand, the effect of DMRH much varied on the fluctuation in the beetles' population showing insignificant and positively correlation ("r": 0.3977) in 2009, but insignificant and negatively correlation ("r": - 0.0731) in 2010.

Table 1: Mean number of *M. palmata* beetles in mango orchards at Ismailia Governorate during the two successive years, 2009 and 2010 .

Date of Inspection		Mean no. of beetles \ tree					
		2009 season			2010 season		
		Actual	Smoothed	Cumulative	Actual	Smoothed	Cumulative
Jan.	1-15	0.00	0.00	0.00	0.00	0.00	1.56
	16-31	0.00	0.00	0.00	0.00	0.00	1.56
Feb.	1-15	0.00	0.00	0.00	0.00	0.00	1.56
	16-29	0.00	0.00	0.00	0.00	0.00	1.56
Mar	1-15	0.00	0.00	0.00	0.00	0.00	1.56
	16-31	0.00	0.00	0.00	0.00	0.00	1.56
Winter		**0.00**			**0.00**		
Apr.	1-15	0.00	0.00	0.00	0.00	0.00	1.56
	16-30	0.00	0.00	0.00	0.00	0.00	1.56
May	1-15	0.00	0.00	0.00	0.00	0.00	1.56
	16-31	0.00	0.00	0.00	0.00	0.00	1.56
Jun.	1-15	0.01	**0.01**	0.01	0.00	**0.01**	1.56
	16-31	0.03	0.04	0.04	0.06	0.05	1.62
Spring		**0.04**			**0.06**		
Jul.	1-15	0.07	0.07	0.11	0.08	0.11	1.70
	16-31	0.11	0.12	0.22	0.21	0.17	1.91
Aug.	1-15	0.18	0.19	0.40	0.19	0.23	2.10
	16-31	0.29	0.26	0.69	0.33	0.32	2.43
Sep.	1-15	0.26	**0.29**	0.95	0.42	**0.34**	2.85
	16-30	0.35	0.28	1.30	0.20	0.23	3.05
Summer		**1.26**			**1.43**		
Oct.	1-15	0.16	0.19	1.46	0.11	0.12	3.16
	16-31	0.08	0.09	1.54	0.07	0.06	3.23
Nov.	1-15	0.02	**0.03**	1.56	0.00	**0.02**	3.23
	16-30	0.00	0.00	1.56	0.00	0.00	3.23
Dec.	1-15	0.00	0.00	1.56	0.00	0.00	3.23
	16-31	0.00	0.00	1.56	0.00	0.00	3.23
Autumn		**0.26**			**0.18**		
Total/ tree/ year		**1.56**		**1.56**	**1.67**		**3.23**
Mean/ tree/ Month		**0.12**			**0.14**		

Figure 1: Mean numbers of M. *palmata* beetles in mango or[illegible]g 2009 and 2010

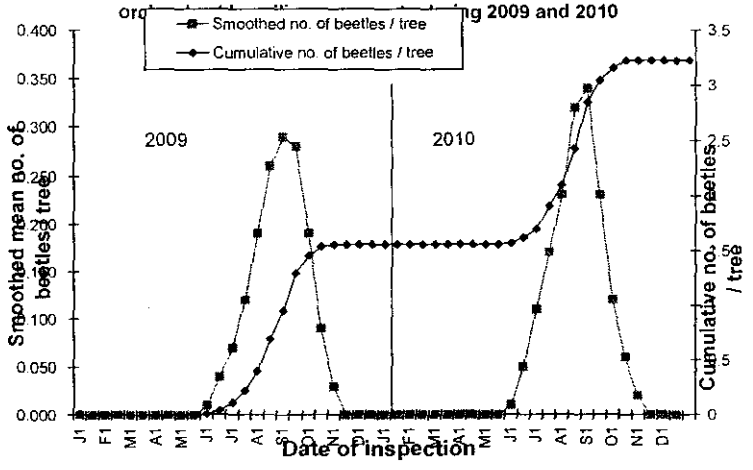

Table 2: Commencement, peak, last dates, and broods of *M. palmata* beetles in mango orchards at Ismailia Governorate, during 2009 and 2010 seasons, as well as simple correlation "r" and Simple regression "b" coefficients between the mean numbers of *M. palmata* beetles in mango orchards and the corresponding day maximum (DMxT), day mean (DMT), day minimum temperatures (DMnT) and day mean relative humidity (DMRH) during 2009 and 2010

Statement	Year	
	2009	2010
Flight Commencement	1st half of June	2nd half of June
Peaks	2nd half of August 2nd half of September	2nd half of July 1st half of September
Last flight	1st half of November	2nd half of October
Broods	1st half of June to 1st half of November	1st half of June to 1st half of November
Simple correlation "r" coefficients		
DMxT	0.7234	0.7502
DMT	0.7076	0.7108
DMnT	0.6211	0.6053
DMRH	0.3977	- 0.0731
Simple regression "b" coefficients		
DMxT	15.639	20.373
DMT	22.739	26.551
DMnT	26.946	24.676
DMRH	0.025	- 5.294

**: Significant at 0.01 levels (Highly significant)
*: Significant at 0.05 levels (Significant)

4. Discussion and conclusion:

Monitoring studies (the sesonal fluctuation of *M. palmata* population, progress of infestation, seasonal cycle, and effect of the main weather factors, mainly temperature and relative humidity on the target pests) are essential in planning successful and effective "Integrated Control Programs" for the management of boring insect pests (El-Sebay, 1984) and (Tadros, *et al.*, 1996).

Survey studies in mango orchards (Tadros *et al.*, 2013) indicated that *M. palmata* is a dominant and economically important boring insect pest in mango orchards as well as other 27 boring insects. Batt (1999) and Tadros *et al.* (2007) also recorded *M. palmata* during their survey on borers attacking deciduous fruit trees.

Literature is lacking concerning such studies on *M. palmata* abroad. However, in Egypt, there were some researches in this respect. The previous results are somewhat in agreement with Tadros *et al.* (1993), (2006) and Shehata *et al.* (2001) who monitored the seasonal fluctuation of *M. palmata* population in stone fruit orchards in Egypt, and stated that emergence started almost around June and continued until September or October and the temperature and R. H. influenced the development of *M. palmata*.

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دراسات ايكولوجية علي حفار ساق السنط *Macrotoma palmata* التي تصيب حدائق المانجو في مصر

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اجريت دراسات بيئية علي نشاط حفار ساق السنط *M. palmata* حيث يعتبر من أهم حفارات أشجار الفاكهة السائدة ذات الأهمية الاقتصادية التي تهاجم أشجار المانجو في محافظة الإسماعيلية علي مدار عامين متتاليين (٢٠٠٩، و ٢٠١٠). يبدأ النشاط الموسمي للحفار من النصف الأول أو النصف الثاني من يونيو إلى النصف الثاني من أكتوبر أو النصف الأول من نوفمبر. سجلت شهور الصيف أعلى نشاط للحشرات (١,٢٦ – ١,٤٣ حشرة / شجرة)، يليها فصلي الخريف (٠,١٨–٠,٢٦ حشرة / شجرة)، ثم الربيع (٠,٠٤–٠,٠٦ حشرة / شجرة)، في حين توقف النشاط خلال فصل الشتاء. بلغ إجمالي تعداد الحشرات التي خرجت من الشجرة خلال العام ١,٥٦–١,٦٧ حشرة / شجرة. وقد سجلت للحفار حضنة واحدة من النشاط خلال العام. وهناك دورة من نشاط الحشرة استمرت لمدة ٤,٥ – ٥,٥ شهر فقط. وقد تضاعفت الإصابة بالحفار خلال عام واحد (من ١,٥٦ إلى ٣,٢٣ حشرة). واوضح التحليل الاحصائي أن تأثير العوامل الجوية علي نشاط الحفارات موجب ومعنوي في معظم الأحوال مع درجات الحرارة الصغري والمتوسطة والعظمي، ولكنها سالبة أو موجبة وغير معنوية مع متوسط الرطوبة النسبية. في جميع الأحوال تضاعفت الإصابة بالحفار خلال عام واحد مما يستوجب اجراء عمليات المكافحة المستمرة.

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