SEASONAL FLUCTUATION OF *ZEUZERA PYRINA*
POPULATION ON APPLE, POMEGRANATE, PEAR,
GUAVA, PECAN AND OLIVE TREES
IN ALEXANDRIA GOVERNORATE

H.A. MESBAH, [1] A.W. TADROS [2] AND W.A. SHEHATA [2]

1 . Faculty of Agriculture (Saba Pasha), Alexandria University, Alexandria, Egypt.
2 . Plant Protection Research Institute , Agricultural Research Centre, Dokki, Egypt.

Abstract

The leopard moth, *Zeuzera pyrina* L. (Lepidotera : Cossidae) is a serious polyphagous pest attacking fruit, wood and ornamental trees in Egypt and in many other countries in the world. Seasonal fluctuation of the population was monitored on six host plants (apple, pomegranate, pear, guava, pecan and olive) in Alexandria governorate during two successive years (1988 and 1989). Moths started to emerge during late April or early May until July and continued to October and December according to the host. An assessment of occurence and abundance of annual broods was approximated. Appropriate insecticidal application was determined for each host. The seasonal calender of *Z. pyrina* stages was constructed in pear orchards.

INTRODUCTION

The bionomics of *Z. pyrina* was studied on apple and olive trees by Mokhtar (1977) and Tadros and Abd-Allah (1987), respectively. Larvae bore their tunnels mainly in the heartwood of the stem and branches, causing serious damage to the trees , and the pest most probably undergoes only one generation per year.

Abd El-Kader and Zaklama (1961), El-Defrawi *et al.* (1967), Mokhtar (1977), El - Sherif *et al.* (1985) and Ismail *et al.* (1988) monitored *Z. pyrina* on appple, pear

and olive trees in mid - Egypt. Ecological studies on the six fruit hosts except pear in the north of Egypt are rare and rather incomplete.

The aim of the present study was to monitor *Z. pyrina* on its magjor six hosts in Alexandria governorate in an attempt to design a more successful control programme in the future.

MATERIALS AND METHODS

A. Seasonal aboundace

The seasonal fluctuation in *Z. pyrina* population was esimated in apple, pomegranate , pear , guava, pecan and olive orchards in Alexandria governorate during 1988 and 1989 seasons.

The pupal skins protruding from the infested trees which indicate moth emergence , were the criterion for the assessment of the fluctuation in population density of *Z. pyrina*. Ten randomly distributed trees of about 15 - 20 years old were subjected to study in each fruit orchard. In December 1987, the old pupal skins were removed from all selected trees. Starting from January 1988 and until December 1989, counts of new pupal skins were practiced twice a month. On each inspection date , the counted pupal skins were removed to avoid double counting . Detailed behaviour of emergence as well as peaks of moths were recorded for each host.

B. Progress of infestation

For each host, data of the seasonal abundance were cumulated monthly during the two years of study.

C. Effect of hygrothermic conditions

The effect of the day - maximum temperature (DMxT) , day - mnimum temperature (DMnT) and daily - mean relative humidity (DMRH) on the rate of *Z. pyrina* moths emerging from the six hosts was studied throughout the two successive years 1988 and 1989 .

The direct effect (Simple correlation, r), the precise effect (partial regression, p.reg.), analysis of variance (F) and explained variance (E.V.) of the weather factors on the rate of moth emerggence were calculated according to the "C-

multipliers" formula described by Fisher (1950).

D. Seasonal calender of *Z. Pyrina* in pear orchards

During the two successive years 1988 and 1989, half - monthly inspections were carried out on 50 pear trees infested with *Z. pyrina* in Maamoura, Alexandria governorate to determine the periods of occurrence of the different stages.

Periods of moth flight with their peaks were estimated by counting the newly pupal skins. Egg occurrence coincided with the life- span of moths (4-7 days) . Larval occurrence was recognized by the active holes, characterized by the sawdust and excrements ejected from the entrance holes of the larval tunnels. During winter months, larval, as well as pupal existence were recognized by taking them out from their tunnels by a wire.

RESULTS AND DISCUSSION

A. Seasonal abundance

The mean number of pupal skins/tree (mean number of emerged moths) on the six fruit tree species in Alexandria during 1988 and 1989 is illustrated in Fig. 1. Moreover, Table 1 describes the beginning and the end of normal moth emergence.

1. On apple trees

Moths started to emerge in Alexandria region during late April or early May, and continued until early November. Peaks were recorded on early May, early June, late July and late August.

2. On pomegranate trees

The commencement date of moth emergence was in late April or early May and continued until November. Peaks were recorded on late June, late July, Late August, September and late October.

3. On pear trees

Moths emerged in pear orchards from early May until late October at the northern part of Egypt with peaks on early June, early July, August and September.

4. On guava trees

Emergence started during late May and continued until late October at the northern part of Egypt, while peaks were on late June, early July, early August and early September.

5. On pecan trees

Moths started to emerge in the northern areas during mid-May and continued until late October or early November . Peaks were observed during late June, early July, August, September and late October.

6. On olive trees

Moths started to emerge from early July and continued until early December. Peaks were found during late July , late August, September, late October and late November in the northern parts of Egypt.

Figure 1 and Table 1 show that *Z. pyrina* moths started to emerge during late April in apple and pomegranate orchards, then in pear, guava and pecan, while in olive orchards, moths emerged during July. Moths ceased to emerged during January, Febuary and March.

From the practical view point, in the northern regions, the best time for insecticidal application to control *Z. pyrina* in apple , pomegranate , pear guava , pecan and olive is early May, early June, late June and late July, respectively.

B. Progress of infestation

The cumulative numbers of *Z. pyrina* pupal skins (moths) per tree on the six considered hosts in Alexandria during 1988 and 1989 are illustrated in Fig. 1. Data indicated that the seasonal cycle consists of an activity season which lasted for about 5.5, 5.5, 5.5-6, 6, 7 and 6.5 - 7.5 months annually in olive , guava, pecan , pear , apple and pomegranate orchards, respectively. The remaining months express the inactive season of moth flight.

In December 1988, the initial numbers of moths emerged from guava, olive,

pecan, pomegranate, apple and pear trees were 6.5 , 9.8, 10.4, 12.8, 15.2 and 16.0 months / tree / year , respectively. One year later, in December 1989, the respective numbers were 12.4, 17.5 , 19.4, 27.1, 27.4 and 29.2 moths/ tree / year showing an increase in rate of infestation of about 1.8 - 2.1 times during one year only.

This double increase in rate of infestation is an important parameter which necessitates the need for urgent control in fruit orchards .

C. Effect of certain weather hygrothermic conditions

Table 2 shows the direct effect (r) , precise effect (P. reg.), analysis of variance (F) and the explained variance (E.V.) of the day-maximum and day - minimum temperatures and the daily mean relative humidity on the rate of Z. pyrina moth emergence in apple pomegranate, pear , guava , pecan and olive orchards in Alexandria during 1988 and 1989.

1. Effect of day -maximum temperature (DMxT)

Data in Table 2 indicate that there are positive and significant direct effects (r) of DMxT on the rate of moth emergence during the two years in the five fruit hosts, while in olive the effect was positive and insignificant. The true effect was insignificant in all fruit hosts.

2. Effect of the day - minimum temperature (DMnT)

Table 2 shows the direct effect (r) of DMnT on the rate of moth emergence which was significantly positive in the five fruit hosts, while it was positive and insignificant in case of olive. The true effect was insignificant in all fruit hosts except in pomegranate and pear during 1989 only.

3. effect of   daily - mean relative humidity (DMRH)

The direct effect (r) of DMRH on hte rate of moth emergence was positive and significnat in apple, pomegranate, pear (1989), guava (1988) and pecan (1989), negative and signifcant in olive and insignificantly positive in pear (1988) , guava (1989) and pecan (1988). The true effect was insignifcant in all fruit hosts.
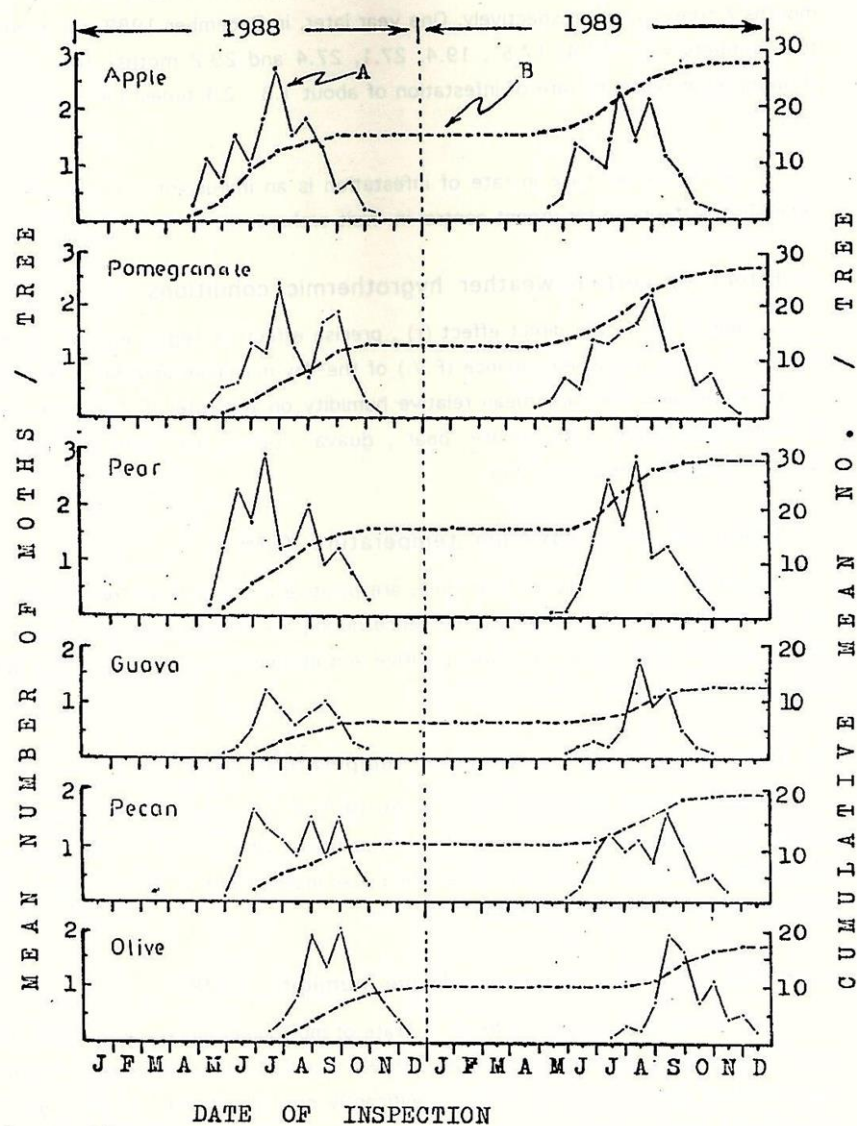
Figure 1. Actual (A) and cumulative (B) mean numbers of *Z. pyrina* moths/ tree in apple , pomegranate, pear guava, pecan and olive orchards in Alexandria governorate during 1988 and 1989.

Table 1. Periods of moth emergence and their peaks on apple, pomegranate, pear, guava , pecan and olive at Alexandria goverrnorate during 1988 and 1989.

Host	Year	First A	Last A	Peak
Apple	1988	Apr. (2)	Nov.. (1)	May (1) , Jun (1) ., Jul, (2) & Aug. (2)
	1989	May (1)	Nov. (1)	Jun (1) , Jul (2) & Aug.(2)
Pomegranate	1988	May (1)	Nov. (1)	June (2) , Jul (2), Sept, (1) Jun (2),
	1989	Apr. (2)	Nov. (2)	July (2), Aug (2), Sept.(2) & Oct.(2)
Pear	1988	May (1)	Oct. (2)	Jun. (1) , July (1) , Aug. (2) & Sept. (2),
	1989	May (1)	Oct. (2)	July (1) , Aug. (1) & Sept. (1)
Guava	1988	May (2)	Oct. (2)	July (1) & Sept. (1)
	1989	May (2)	Oct. (2)	Jun (2) , Aug. (1) & Sept. (1)
Pecan	1988	May (2)	Oct. (2)	Jun (2) , Aug. (2) , Sept. (2)
	1989	May (2)	Nov. (2)	July (1) , Aug . (1), Sept, (1) & Oct. (2)
Olive	1988	Jul. (1)	Dec. (1)	Aug. (2) , Sep. (2) & Oct. (2)
	1989	Jul. (1)	Dec. (1)	July (2) , Sept. (1) , Oct. (2) & Nov.

(1) = First half of the month (1-15)
(2) = Second half of the month (16-30).
A = Apearance.

4. The combined effect of the three weather factors

Data of the run analysis of variance (F) for the combined effects of the complex factors (DMxT, DMnT and DMRH) on the rate of moth emergence (Table 2) were significant in the six fruit hosts during the two years except in 1989 on guava and olive. Almost 64-67, 66-85, 49-72, 45-81, 55-64 and 36-63% (with a general range 36 - 85%) of the variability in the rate of moth emergence could be attributed to the changes in the three tested weather factors together in apple, pomegranate, pear, guava, pecan and olive orchards, respectively.

These results clearly indicate that the activity of *Z. pyrina* moths in the different fruit orchards is mostly related to the combined effect of certain weather factors rather than to the single effect of each factor alone.

D. Seasonal calender of *Z. pyrina* in pear orchards

Table 3 shows the seasonal calender of *Z. pyrina* constructed in pear orchards in Alexandria during 1988 and 1989. Under the field hygrothermic conditions, pupation took place frequently during late March or early April and continued until late October. Flight season began druing early May and fluctuated until late October, with peaks during early June, early July, early August and September. Egg deposition always coincided with the moths emergence period. Larvae were found infesting pear trees during the whole year round. Development of larvae was at its peak during summer months, while during winter months, prologation of the larval development was noticed.

Field observations indicated that *Z. pyrina* undergoes its development during the whole year with no detectable hibernation, and the pest seemed to have only one generation annually in pear orchards.

Table 2. Simple correlation (r) , partial regression (P. reg.), analysis of variance (F) and explained variance (E.V.) of DMxT, DMnT and DMRH on the number of emerged beetles of *Z. pyrina* in Alexandria during 1988 and 1989.

Year	DMxT		DMnT		DMRH		F	E. V. (%)
	(r)	P. reg	(r)	P. reg	(r)	P. reg		
Apple:								
1988	+ 0.75**	+ 0.19	+0.79 **	+ 0.15	+0.16*	+0.11	9.9**	64
1989	+ 0.67**	+ 0.24	+ 0.80 **	+ 0.20	+ 0.45*	+0.10	10.1**	67
Pomegranate:								
1988	+ 0.66**	+0.17	+0.78 **	+0.15	+ 0.51*	+0.10	9.1**	65
1989	+ 0.73**	+0.17	+0.88**	+0.17*	+ 0.62**	+0.11	34.6**	85
Pear :								
1988	+ 0.69**	+0.28	+ 0.60*	+0.17	+0.19	+0.04	4.3 *	49
1989	+0.76**	+0.40	+ 0.80**	+0.29*	+0.79**	+0.18	11.5**	72
Guava :								
1988	+ 0.64*	+0.13	+0.83 **	+0.11	+0.70**	+ 0.07	17.5**	81
1989	+ 0.63*	+0.23	+0.65*	+0.15	+0.45	+0.06	3.3	45
Pecan :								
1988	+ 0.61*	+0.16	+0.73**	+0.13	+0.33	+0.04	4.8*	55
1989	+ 0.63*	+0.16	+0.75**	+0.14	+0.57*	+0.08	8.0**	64
Olive :								
1988	+0.43	+0.07	+0.42	+0.05	-0.58*	-0.12	6.9*	63
1989	+0.32	+0.05	+0.25	+0.03	-0.54*	-0.13	2.3	36

* = singinficant at the level of 0.05
** = singifcant at the level of 0.01

Table 3 . Seasonal calendar of Z. pyrina on pear trees during 1988 and 1989 in Alexandria governorate.

1989

DATE		STAGE (markings)	M.W.F. Temp. °C	M.W.F. R.H. %
J	I		12.1	72
J	II		12.5	71
F	I		12.2	69
F	II		14.3	67
M	I		14.4	68
M	II		16.5	65
A	I		19.4	63
A	II	●	21.0	67
M	I	●	21.0	63
M	II	● + ·	23.5	62
J	I	● + ·	23.5	66
J	II	● ⊞ ·	24.1	72
J	I	+ ·	25.9	74
J	II	● ⊞ ·	25.5	73
A	I	● + ·	26.2	72
A	II	● + ·	26.3	73
S	I	● + ·	26.1	71
S	II	● + ·	25.3	69
O	I	● + ·	23.1	67
O	II	● + ·	20.1	69
N	I	● + ·	19.1	72
N	II	+ ·	15.5	70
D	I		14.9	75
D	II		15.3	73

1988

DATE		STAGE (markings)	M.W.F. Temp. °C	M.W.F. R.H. %
J	I		13.9	73
J	II		13.8	67
F	I		13.8	63
F	II		13.4	69
M	I	●	15.1	68
M	II	●	15.1	63
A	I	●	18.7	66
A	II	●	19.2	61
M	I	● + ·	21.2	66
M	II	● + ·	23.4	63
J	I	● ⊞	24.2	64
J	II	● + ·	25.9	68
J	I	● ⊞	27.0	74
J	II	● + ·	26.8	74
A	I	● + ·	27.4	72
A	II	● ⊞	27.2	69
S	I	● + ·	26.7	69
S	II	● + ·	25.8	67
O	I	● + ·	22.9	66
O	II	+ ·	20.3	71
N	I		17.1	66
N	II		15.2	70
D	I		16.3	73
D	II		14.1	75

Legend:

+ Adult
Egg
- Larva

● Pupa
⊞ Adult peak

I The 1 st half of the mongth
II The 2 nd half of the month
* Mean wather factors

REFERENCES

1 . Abd El-Kader, S. and S. Zaklama 1961. The chemical and mechanical control of inner stages of *Z. pyrina*. The 1st Arabic Conf. of Hort. 16th April, 1961.

2 . El - Defrawi, M. E., I. Hanbal and S. M. Hammad 1967. Biology and control of leopard moth on pear trees in U.A.R., Pl. Prot. Bull., F. A. O., 15(4) : 70-76.

3 . El - Sherif, S. I., A. W. Tadros, F. M. L. Afifi and F. F Abd- Allah. 1958. Monitoring *Z. pyrina* L. population in apple , pear and olive orchards. Bull. Fac. Agric., Univ. of Cairo, 36(2) : 1293 - 1304.

4 . Fisher, R. A. 1950. Statistical methods for research workers. Oliver and Boyd Ltd., London.

5 . Ismail, I.I., N.A.Abu-Zeid and F.F. Abd-Allah. 1988. Ecological and behavioural studies on olive tree borers and their parasites, Agric. Res. Rev., 66 (1) : 145 - 152

6 . Mokhtar, A.M. 1977. Studies on the leopard moth, *Z. Pyrina* L. and its control . M.Sc. Thesis, Fac . of Agric., Cairo Univ.

7 . Tadros, A. W. and F. F. Abd- Allah. 1987. Studies on the biology of the leopard moth *Z. pyrina* (Lep., Cossidae) on olive trees in Egypt . Zagazig J. Agric . Res. (under publication).

النشاط الموسمي لحفار ساق التفاح Zeuzera pyrina
على أشجار التفاح، والرومان، والكمثري، والجوافة، والبيكان، والزيتون في محافظة الأسكندرية

حسن علي مصباح ١ ، انطون ولسن تادرس ٢ ، وجيه ايوب شحاته ٢

١ – كلية الزراعه (سابا باشا) ، جامعة الأسكندرية ، الاسكندرية.

٢ – معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي

يعتبر حفار ساق التفاح من الآفات الخطيره التي تهاجم أشجار الفاكهة والزينه والأشجار الخشبيه في مصر وفي العديد من بلدان العالم . درس التذبذب الموسمي في تعداد الحفار علي سته عوائل هي التفاح ، والرمان ، والكمثري ، والجوافه ، والبيكان والزيتون في محافظة الأسكندرية خلال العامين المتتالين ١٩٨٨ ، ١٩٨٩ . بدأ خروج الفراشات خلال أواخر ابريل أو أوائل مايو وحتي يوليو ، واستمر الخروج حتي شهر اكتوبر إلي ديسمبر حسب نوع العائل. ازدادت الاصابه الي الضعف خلال عام واحد . أمكن تحديد فترات تواجد وقمم وانتهاء خروج الفراشات في حدائق الفاكهه المختلفه ، مما يساعد مستقبلا علي تحديد انسب ميعاد لتطبيق برامج المكافحة الكيماويه في كل عائل. هذا وقد انشئ تقويم موسمي لتواجد الأطوار المختلفه للحفار في حدائق الكمثري.