

## Natural Host Rearing and some Biological Aspects of the Leopard Moth *Zeuzera pyrina* L. (Lepidoptera: Cossidae) on Poplar Trees (*Populus* Sp.) (Malpighiales salicaceae) in Egypt

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### ABSTRACT

The leopard moth *Zeuzera pyrina* (Lepidoptera: Cossidae) became a destructive polyphagous pest to some wood, fruit and ornamental trees. Larvae of *Z. pyrina* were reared on poplar (*Populus* sp.) branches. Number of larvae and pupae completed their development, percentage of pupation, larval and pupal durations, rate of moth emergence, mating, oviposition, longevity, incubation period and percentage of hatchability were studied in poplar branches under mean laboratory conditions. The pre-oviposition period was only one day, the incubation period averaged 10.9 days (16 – 14 days), approximated total life cycles were 300.8 (274 - 324 days on natural host when reared on poplar. The relatively long period of larval period of infestation (248 – 289 days with an average of 271.6 days) impose the need of urgent integrated control.

### INTRODUCTION

In Egypt, poplar trees (*Populus* sp.), (Malpighiales: Salicaceae) is widely spread in the newly reclaimed lands especially Behera governorate, as well as valley lands specially Kafr el-Sheikh, Gharbia and Giza governorates and considered one of the most important wood fortune (Abdel Dayem, 1992). Poplars plantations may lower wind speeds over the area, and provide localized shelter, especially for lambs, reducing the risk of hypothermia and death in lambs and protect against soil erosion as well (Gregory 1995). *Zeuzera pyrina* L. (Lepidoptera: Cossidae) is a serious polyphagous pest attacking several wood trees such as poplar and casuarina, fruit trees especially apple, pear, pomegranate, olive, fig, pecan, as well as some ornamental tree (Tadros and Abd-Allah, 1987). Larvae bore destructive tunnels inside the tree branches and stems, consume large amount of wood, causing weakness, reducing the wood production, and finally death of trees. Infested poplar trees are renewable source of *Z. pyrina* infestation to fruit and other wood trees in fruit orchards. *Z. pyrina* was reared on several fruit tree branches such as Mokhtar (1978), Tadros, and Abd-Allah (1987) on olive, Tadros, *et al.*, (2003) on apple, pear, pomegranate, olive and artificial medium diet, El-Assal, *et al.*, (2009) on fig. Moreover, Abdel Moaty (2001) in Egypt and Moore and Navon, 1966, Navon, 1977 in Israel, Garcia and Haro, 1989 in Spain and Tsourgianni, 1995 in Greece) reared *Z. pyrina* on artificial medium diet. Mansour and Tadros (2001) monitored *Z. pyrina* on poplar trees during three successive years (2003, 2004 and 2005) in two ecologically different localities the old valley lands (El-Saff, Giza governorate) and new reclaimed lands (Nobaria, Behera governorate). *Z. pyrina* was reared on several fruit trees (El-Sherif, *et al.* (1985) in apple, pear and olive, Mesbah, *et al.* (1994) in apple, pomegranate, pear, guava, pecan and olive and Tadros, *et al.* (2007) on pear. Abdel Moaty (2019), conducted similar trials for rearing *Z. pyrina* on Casuarina trees (*Casuarina* sp.).

The rearing of phytophagous insects is advantageous in studying insect pathogens, plant resistant factors, effect of insecticides and study of radiation on fertility and growth. In an attempt to contribute to such a gap in the knowledge, the present biological aspects 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 *Z. pyrina* in poplar trees.

### MATERIALS AND METHODS

During winter (2016 / 2017), branches infested with *Z. pyrina* were transferred from poplar trees at the newly reclaimed lands in Noubaria district, Behera governorate to the laboratory at Dokki, Cairo governorate. Infested branches were dissected and the pre-pupae and pupae were collected while older larvae were left in their tunnels inside the infested branches until pupation. Pupae were wrapped in toilet paper, fixed in place, kept in small specimen tubes (1 × 4 cm) and placed into another larger ones (2 × 7.5 cm) lined with blotting paper to give moths a grasp when struggling during their emergence from pupal exuvia. Pupae, then, were kept in an incubator at 25 °C and 55% relative humidity (Mokhtar, 1978).

Soon after emergence, moths were released in pairs (one male and one female) in small cylindrical wire gauze cage (10 cm diameter and 15 cm high) lined with rough paper to provide a suitable site for egg-laying, top and bottom were covered with Petri dishes. Eggs were daily collected and kept in an incubator at 25 °C and 55% relative humidity until hatching.

After hatching, larvae were introduced into fresh cuttings of poplar trees (about 1 cm diameter and 20 cm length) sterilized with 0.25% formaldehyde tap water, soaked from the two ends with wax and kept in glass jar, (5 liters) containing moistened sand. Enclosed larvae were shifted into new thicker fresh cuttings as needed (about 3 week intervals during winter months and 5 weeks during summer months) until completion of their development (in prepupal stage). The larva, pupa, adult (mating, oviposition and longevity), eggs stage and the total life cycle were studied under mean laboratory conditions of 26.2 ± 1 °C and 60 ± 2% R.H.

Analysis of variance (F test), T-test, and Duncan Multiple Range Test (SAS) methods were used according to Snedecor and Cochran (1990).

### RESULTS AND DISCUSSION

During the period from May, 2017 until July, 2018; *Z. Pyrina* was reared on its natural host of poplar branches under mean laboratory conditions (26.2 ± 1 °C and 60 ± 2% R.H.).

#### 1. Larval and pupal stages:

Newly hatched larvae started boring their tunnels under the bark. Data presented in Table (1) showed that 35% of larvae could complete their development and

pupated in poplar branches. The same Table also showed that the larval duration 248 – 289 average of  $271.6 \pm 7.48$  days) was noticed when reared on poplar branches.

The pupal duration (Table, 1) was recorded from larvae reared on poplar branches 16 – 20 days, with an average of  $18.3 \pm 1.31$  days) to reach adult stage.

**2. Adult stage:**

Pupae reared on poplar branches that completed their development and emerged successfully were 35% (Table, 1).

The rate of emergence was 93.4% in pupae reared on poplar branches (Table, 1).

Coitus lasted 19 – 42 (mean of  $29.21 \pm 10.32$ ) minutes for moths reared on poplar branches (Table, 2).

Eggs were laid in small chains of 5 – 18 eggs each or in masses of 39 – 124 eggs. Fertile eggs were laid (pre-oviposition period) after mating mostly the next day.

Oviposition period lasted 4 to 7 days with an average of 5.2 days. Females died at the last day of oviposition or one day after oviposition period (post-oviposition period).

Fertile females reared on poplar branches laid 513 – 1228 eggs with an average 795 eggs. The number of eggs remained in the ovaries after death of females were 59 (38 - 137) eggs. Thus, the fecundity approximated 854 eggs. The respective pre-oviposition period was 1 days, while the oviposition period was 5.2 (4 - 7) days. The post-oviposition period was 0.4 (0 - 1) days (Table, 2).

Females *Z. pyrina* reared on poplar branches lived 5 – 7 days with an average of 6.1 days. The respective longevity of males lived for 5.4 (3 - 6) days (Table, 2).

**Table 1. Effect of poplar natural host plant on larval and pupal durations of *Z. pyrina* reared under laboratory conditions.**

No. of larvae used		100
No. of larvae pupated		35
% pupation		35
Larval duration (in days)	Average	$271.6 \pm 7.48$
	Rang	248 – 289
No. of pupae completed their development		28
Pupal duration (in days)	Average	$18.3 \pm 1.31$
	Range	16 – 20
% moth emergence		93.4

Means with the same letter are not significantly different (P < 0.05) using Duncan's Multiple Range Test (SAS).

**Table 2. Mating, oviposition, longevity periods and number of eggs laid by female *Z. pyrina* reared on poplar branches under laboratory conditions**

Coitus (in minutes)		$29.21 \pm 10.32$ (19 – 42)
Pre-oviposition period (in days)		1
Oviposition period (in days)		5.2 (4 – 7)
Post-oviposition period (in days)		0.4 (0 – 1)
No. of eggs in ovaries		59 (38 - 137)
Fecundity		854
Longevity (in days)	Female	6.1 (5 – 7)
	Male	5.4 (3 - 6)

**3. The egg stage:**

The obtained results in Table (3) indicated that under mean laboratory conditions  $29 \pm 1$  °C and  $56 \pm 1$  R.H.), the incubation period reached  $10.9 \pm 0.7$  (9 - 14) days for eggs laid by females reared on natural hosts of

poplar branches, respectively. Under the same temperature and R.H., the respective percentage hatchability was 89 (85 – 95%).

**4. Approximated life cycle:**

Data obtained in Table (3) approximated the life cycle of *Z. pyrina* reared on its natural host of poplar branches under mean laboratory conditions of  $26.9 \pm 1$  °C and  $61 \pm 1$  % R.H. The respective durations of total life cycle were 300.8 (274 – 324) days.

**Table 3. The approximated life cycle of *Z. pyrina* reared on poplar branches under laboratory conditions.**

Stages	Duration (in days)
Larva	271.6 (248 – 289)
Pupa	18.3 (16 – 20)
Pre- oviposition	1
Egg	10.9 (9 - 14)
Total life cycle	300.8 (274 – 324)

**Discussion: Hardwood plant species are usually have higher hemicellulose contents than softwoods**

Results of rearing *Z. pyrina* on pear branches was almost disagreed with Mokhtar (1978) in Egypt who recorded 270 – 317 days with an average of 298.6 days for larval duration. He further recorded 9 – 24 for eggs incubation period, 16 – 34 days for pupal duration, 4 – 15 days for adult longevity and 298 – 351 (average, 330.1) days for the total life cycle. Also, results disagree with Abdel Moaty (2019) for rearing *Z. pyrina* on Casuarina branches, those disagreements may be due to the degree of polymerization and crystallinity of cellulose pear and casuarina wood, as it is known that, tree to tree variation in fiber length could be attributed to the inherent potential of individual trees to produce longer or shorter fibers, variation of wood properties may be a limiting factor El-Osta (1982). In Spain Garcia and Haro (1989) also reported 10 – 11 months for the larval duration of *Z. pyrina*.

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### تربية حفار ساق التفاح *Zeuzera pyrina* (رتبة حرشفية الأجنحة: عائلة كوسيدي) علي العائل الطبيعي لأشجار الحور (الفصيلة الصفصافية) في مصر

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الحور من الأشجار الخشبية متساقطة الأوراق من الفصيلة الصفصافية، ذات خشب لين تسهل معالجته، يستعمل في صناعة الأثاث واللوازم الخشبية، كما أنه يستخدم مصدات رياح في حدائق الفاكهة. يعتبر حفار ساق التفاح من الآفات شديدة الخطورة للعديد من أشجار الفاكهة والأشجار الخشبية في مصر. تم تربية يرقات الحفار علي أفرع الحور. درس عدد اليرقات والعذارى التي أكملت نموها، ونسبة التعذر، ومدة طوري اليرقة والعذارى، ومعدل خروج الفراشات، والتلقيح، ووضع البيض، ومدة حياة الحشرات الكاملة، وفترة حضانة البيض، ونسبة الفقس علي العوائل الطبيعية. بلغت فترة ما قبل وضع البيض يوما واحدا فقط، في حين بلغت فترة حضانة البيض ١٦ – ٢٤ يوما، بمتوسط ١٠.٩ أيام. استغرقت دورة الحياة ٣٠٠.٨ يوما (٢٧٤ – ٣٢٤ يوما) عند التربية علي العائل الطبيعي الحور، معظم هذه الفترة كانت لطور اليرقة حيث بلغت ٢٤٨ – ٢٨٩ بمتوسط ٢٧١.٦ يوما، ويستلزم ذلك المكافحة للحد من هذه الإصابة في الحور والعوائل المحيطة بها.