



**BIOLOGICAL ASPECTS AND LIFE TABLE PARAMETERS OF THE
EGGPLANT STEM BORER, *Euzophera osseatella* Treit.
(Lep.: Pyralidae)**

[76]

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ABSTRACT

Biological aspects and life table parameters of the eggplant stem borer, *Euzophera osseatella* Treit. (Lep.: Pyralidae) were studied under laboratory conditions at 27°C and 65% R.H. The egg, larval and pupal stages of *E. osseatella* lasted 5.8, 33.2 and 12.9 days, respectively. The mortality percentage in the corresponding stages reached 14, 37 and 13%, respectively. The sex ratio in *E. osseatella* was in favour of females (1:1.1). The preoviposition, oviposition and postoviposition periods of the pest averaged 1.8, 3.1 and 1.2 days, respectively. The daily and total numbers of eggs/female of *E. osseatella* were 46.6 and 147.2, respectively. The male and female of the insect lived 4.4 and 6.2 days, respectively.

The mean generation time (T) of *E. osseatella* averaged 54.22 days. The net reproductive rate (R_0), the intrinsic rate of increase (r_m) and the finite rate of increase ($\exp.r_m/\lambda$) in the pest were 28.09, 0.062 and 1.063, respectively. The generation doubling time (Dt) of *E. osseatella* reached 14.01 days. The fecundity curve (M_x) of *E. osseatella* showed three peaks of 14.14, 20.14 and 12.32 female progeny/female/day at the female age (X) of 50.5, 61.5 and 63.5 days, respectively. The survival curve (Lx) of the insect revealed that most death of females occurred after an extended oviposition period to compensate failure of most immature stages to reach maturity (64%).

Key words: *Euzophera osseatella*, biological aspects, life table parameters

INTRODUCTION

E. osseatella is an economically important pest infesting some species and varieties of Solanaceae plants in several continents (Cameron, 1963; Rivnay, 1966; Ferial, 1969 and Berlinger, 1986). In Egypt, host plants of this pest include eggplant, potato, pepper, tomato, kangaroo apple and black nightshade (Ferial, 1969; Harakly, 1974; Shaheen, 1979; Moftah, 1985 and Oda, 2012). Eggplant varieties showed highly significant differences in their susceptibility to *E. osseatella* infestation (Ferial, 1969). The Romy variety was highly infested, followed by varieties of Baladi Black and Baladi White.

E. osseatella larvae feed on pithy and woody portions in stems and branches of host plants, as well as internal tissues in potato tubers in the field. The larvae cause holes in stems, branches and tubers (Cameron, 1963 and Harakly, 1965). Infested plants are weakened with easily breakable stems and reduced yields. Microorganisms develop in larval tunnels causing rots, which finally kill plants (Rivnay, 1966). *E. osseatella* infestation on eggplant began two months after transplanting and increased progressively to 70 and 90% one and three months later, respectively (Ferial, 1969). *E. osseatella* is found all the year round, but it obviously decreases in winter (Harakly, 1965). The larvae hibernate during winter inside stems of host plants.

Several authors studied biological aspects of *E. osseatella*, but they never dealt with life table parameters (Harakly, 1965; Rivnay, 1966; Hamad, 1968 and Ferial, 1969). Therefore, the pre-

sent work aimed to estimate life table parameters of this pest reared on potato tubers under laboratory conditions.

MATERIALS AND METHODS

1. Rearing of *E. osseatella*

Samples of Romy eggplant stems infested with *E. osseatella* were collected from Damanhur region in El-Beheira Governorate during 2017. They were placed in wooden cages and left until emergence of moths. The emerged males and females of the pest were put in glass chimneys adjusted on glass dishes and covered with cloth secured with rubber bands. Each glass chimney was offered a cotton piece moistened with 10% sugar solution for feeding moths, as well as potato tubers and cloth strips to serve as oviposition sites. Potato tubers and cloth strips carrying *E. osseatella* eggs were taken and placed in glass jars covered with cloth secured with rubber bands until the hatching. Newly hatched larvae bore into potato tubers, feed on internal tissues and pupate in silken cocoons until emergence of moths. Infested potato tubers were replaced with newly sound ones, when it was necessary.

2. Biology of *E. osseatella*

To study biological aspects of *E. osseatella*, 100 fertilized eggs were taken from the culture, divided into 10 replicates of 10 eggs each and put in glass jars provided with potato tubers. *E. osseatella* eggs laid on cloth strips were better than those deposited on potato tubers, because they were easily separated into comparatively few numbers. They were daily examined under a stereomicroscope to record the hatching rate and incubation period. The neonate larvae enter potato tubers, bore tunnels and pupate outside or inside them depending on the larval feeding extent, which affects the condition of tubers. Fourth and fifth instar larvae of *E. osseatella* often emerged from decomposed potato tubers to pupate outside. Therefore, the former were transferred to new potato tubers to complete their feeding. However, the latter were transferred to new glass jars supplied with small pieces of cloth to facilitate the cocoon spinning until emergence of moths. Larval and pupal mortalities, as well as larval and pupal periods were daily recorded. The pest larvae sometimes remained in coherent potato tubers to pupate inside them leading to a great difficulty to follow up

larval and pupal stages. So, potato tubers were periodically opened to determine the insect development and record the previous data.

After the moth emergence, the total number of *E. osseatella* moths was counted and the sex ratio was estimated. Each pair of moths was studied as it was mentioned above. Preoviposition, oviposition and postoviposition periods, as well as the longevity of males and females were calculated. Daily and total number of eggs laid / female of *E. osseatella* were also recorded.

3. Life table of *E. osseatella*

To estimate life table parameters of *E. osseatella*, the duration of immature stages, mortality rate, sex ratio, total number of deposited eggs / female and number of alive females were utilized. Life table parameters were calculated according to **Birch (1948)** by using the basic computer program (**Abou-Setta et al 1986**).

RESULTS AND DISCUSSION

1. Biological aspects of *E. osseatella*

The egg, larva, pupa and total development of *E. osseatella* lasted 5.8, 33.2, 12.9 and 51.4 days at 27 °C and 65% R.H., respectively (**Table 1**). The mortality percentage in the egg, larva, pupa and total immature stages of the pest reached 14, 37, 13 and 64 %, respectively. The sex ratio in *E. osseatella* was in favour of females (1:1.1).

The preoviposition, oviposition and postoviposition periods of *E. osseatella* averaged 1.8, 3.1 and 1.2 days, respectively (Table 2). The daily and total numbers of eggs / female of the pest were 46.6 and 147.2, respectively. The male and female of *E. osseatella* lived 4.4 and 6.2 days, respectively.

2. Life table parameters of *E. osseatella*:

The mean generation time (T) of *E. osseatella* averaged 54.22 days (**Table 3**). The net reproductive rate (R_0) is the net increase rate of the pest population, which equals 28.09. The intrinsic rate of increase (r_m) means the real increase rate of *E. osseatella* population and equiponderates 0.062. The finite rate of increase ($\exp.r_m / \lambda$) expresses the multiplicative increase rate in a time unit of the insect population and equals 1.063. The generation doubling time (Dt) of *E. osseatella* reached 14.01 days.

The fecundity curve (M_x) of *E. osseatella* showed three peaks of 14.14, 20.14 and 12.32 female progeny / female / day at the female age (X) of 50.5, 61.5 and 63.5 days, respectively (Fig. 1). The survival curve (L_x) of the insect revealed that most death of females occurred after an extended oviposition period to compensate failure of most immature stages to reach maturity (64%).

Similar biological trends were reported by Harakly (1965) who found that the sex ratio in *E.*

osseatella was in favour of females (55.5%). The fertilized female laid up to 292 eggs at 27°C. Rivnay (1966) clarified that the egg, larval and pupal stages of *E. osseatella* lasted 6.0, 26.9 and 12.6 days, respectively at 27°C. The preoviposition and oviposition periods of the pest took 3.2 and 1-6 days, respectively at 26°C. The female laid 1-300 eggs. Ferial (1969) stated that the mated female of *E. osseatella* laid 158.3 eggs at 26.3°C.

Table 1. Duration and mortality of *E. osseatella* immature stages reared on potato tubers and sex ratio of emerged moths at 27±2°C and 65±5 % R.H.

Egg stage		Larval stage		Pupal stage		Immature stages		N. of emerged moths			Sex ratio ♂:♀
Incubation period (days)	% Mortality	Larval period (days)	% Mortality	Pupal period (days)	% Mortality	Total period (days)	% Mortality	Total	Male	Female	
5.8±0.6 (5-6)	14	33.2±2.0 (25-40)	37	12.9±1.9 (5-19)	13	51.4±0.9 (44-63)	64	36	17	19	1:1.1

Table 2. Oviposition, fecundity and longevity of *E. osseatella* moths fed on 10% sugar solution at 27±2°C and 65±5 % R.H.

Ovipositional periods (days)			N. of eggs/female		Longevity(days)	
Pre-oviposition	Oviposition	Post-oviposition	Daily	Total	Female	Male
1.8±0.8 (1.0-3.0)	3.1±1.1 (1.5-5.3)	1.2±0.8 (0.5-3.0)	46.6±6.6 (2-157)	147.2±9.2 (24-337)	6.2±1.2 (3-9)	4.4±1.2 (3-8)

On the other hand, Harakly (1965) found that the egg, larval, pupal and adult stages of *E. osseatella* lasted 7, 14-15, 20.6 and 3-4 days, respectively at 28°C. Rivnay (1966) indicated that the mortality of *E. osseatella* eggs reached 27 and 57% at 19 and 30°C, respectively. Adults survived 7-10 days. Ferial (1969) stated that the egg, larval and pupal stages of *E. osseatella* required 3-13, 24-159 and 9-39 days, respectively at 26.3°C. The preoviposition and oviposition periods of the pest averaged 0.6 and 6.0 days, respectively. The male and female lived 1-12 and 2-15 days, respectively

Table 3. Life table parameters of *E. osseatella* females fed on 10% sugar solution at 27±2°C and 65±5 % R.H.

Parameter	Value
Mean generation time (T) (days)	54.22
Net reproductive rate (R_o)	28.09
Intrinsic rate of increase (r_m)	0.062
Finite rate of increase (exp. r_m / λ)	1.063
Generation doubling time (Dt)(days)	14.01

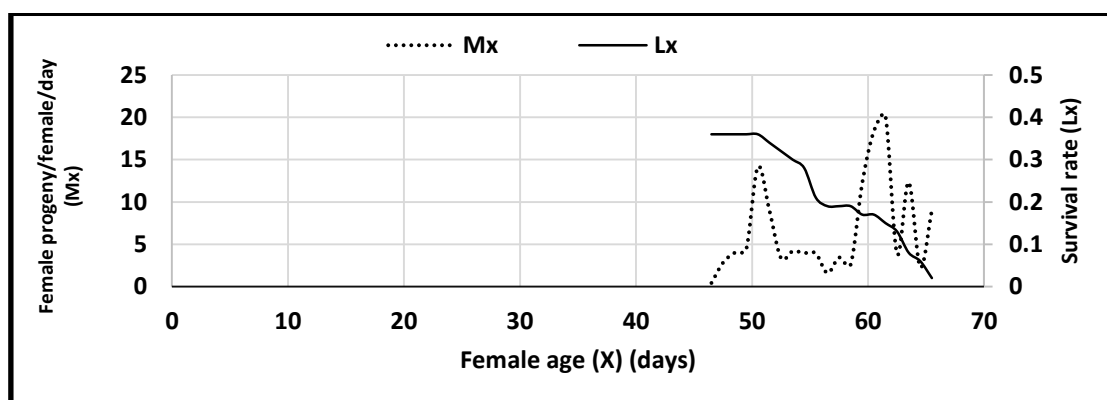


Fig. 1. Age-specific fecundity rate (Mx) and age specific survival rate (Lx) of *E. osseatella* females fed on 10% sugar solution at $27\pm 2^{\circ}\text{C}$ and $65\pm 5\%$ R.H.

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النواحي الحيوية ومعايير جدول حياة حفار ساق الباذنجان (رتبة الحشرات حرشفية الأجنحة: فصيلة بيراليدى)

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الموجز

بلغ متوسط مدة الجيل لحفار ساق الباذنجان 54.22 يوما. كان معدل التزايد ومعدل التزايد الحقيقى ومعدل التزايد المتضاعف فى وحدة الزمن لمجموع الآفة 28.09، 0.062، 1.063 على التوالي. وصلت مدة تضاعف جيل الحشرة 14.01 يوما. أوضح منحى الخصوبة لحفار ساق الباذنجان ثلاث ذروات 14.14، 20.14، 12.32 ذرية أنثى / أنثى / يوم عند عمر الأنثى الفعلى 50.5، 61.5، 63.5 يوما على الترتيب. بين منحى الحياة للحشرة أن معظم موت الإناث حدث بعد فترة وضع بيض ممتدة لتعويض فشل معظم البيض فى الوصول إلى الأطوار غير البالغة النضج (64%).

الكلمات الدالة: حفار ساق الباذنجان، النواحي الحيوية، معايير جدول الحياة.

تم دراسة النواحي الحيوية ومعايير جدول حياة حفار ساق الباذنجان (رتبة الحشرات حرشفية الأجنحة: فصيلة بيراليدى) تحت الظروف المعملية عند درجة حرارة 27م° ورطوبة نسبية 65%. إستغرق طور البيضة واليرقة والعذراء لحفار ساق الباذنجان 5.8، 33.2، 12.9 يوما على التوالي. وصلت نسبة الموت فى الأطوار المقابلة 14، 37، 13 % على الترتيب. كانت النسبة الجنسية فى الحشرة فى صالح الإناث (1): (1.1). بلغت فترات ما قبل وضع البيض ووضع البيض وما بعد وضع البيض فى الآفة 1.8، 3.1، 1.2 يوما على التوالي. كانت أعداد البيض اليومية والكلية لأنثى الحشرة 46.6، 147.2 بيضة على الترتيب. عاش ذكر وأنثى الحشرة 4.4، 6.2 يوما على التوالي.