

Study of Life Table Parameters for Bird Cherry-Oat Aphid, *Rhopalosiphum padi* (Linnaeus), Reared on Wheat Plants

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ABSTRACT

The study were conducted on life table parameters for bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus) (Hom., Aphididae), on wheat seedlings at 15, 20 and 25°C constant temperatures. The survival rates were 77.2, 77.7 and, 62.5% at 25, 20 and 15°C, respectively. Time to 50% mortality (days) decreased gradually to 33.5, 30.5 and 17.5 by temperature increase from 15, 20 to 25°C, respectively. The longest mean generation time (T) (28.66 days) was recorded at 15°C. This duration decreased gradually (17.10 and 12.24 days) by the increase of temperature from 20 to 25°C, respectively. Highest net reproductive rate (R_0) as 41.56 was recorded at 20°C then decreased gradually to 31.375 and 27.36364 at 15 and 25°C, respectively. The rate of Intrinsic increase (r_m), recorded as 0.270 at 25°C, followed by 0.218 at 20°C and the lowest as 0.120 at 15°C. Rate of finite increase (exp. r_m) followed the same sequence of (r_m). It was recorded as 1.310, 1.243 and 1.128 at 25, 20 and 15°C, respectively. The highest population doubling time (PDT) reached (5.765 days) at 15°C. This value was lower (3.180 days) at 20°C followed by (2.564 days) at 25°C, respectively.

Keywords: *Rhopalosiphum padi*, life table parameters, constant temperature.

INTRODUCTION

Rhopalosiphum padi (Linnaeus), is a polyphagous species with a worldwide distribution (Blackman and Eastop, 2000 and Taheri *et al.*, 2010). Its abundance in cereal crops varies greatly between years (Leather *et al.* 1989 and Legrand and Barbosa 2000). The severe damage caused in producing cereals countries (Mallott and Davy 1978), the excretion of sticky film can arise on surface of plants, and that can reduce photosynthesis and support the sooty mold growth (Blackman and Eastop, 2000). Also, *R. padi* may infect plants with harmful viruses (Borer *et al.*, 2009).

The life tables require tools of powerful for understanding and analyzing this impact which presented an external factor upon biological parameters and increase of rate for population density of insect (Soufbaif *et al.*, 2010). The biology of *R. padi*, were studied by (Descamps and Chopra, 2011), they concluded that life table parameters could serve as a basis to develop control.

Moreover, Hasan and Ansari, 2010 reported that, the associated strategy to controlling any insect population need in general comprehensive and in-depth study of parameters on the life table on tested pest.

The survival rates of the cereal aphid, *R. padi* decreased with the increase of temperature and the fecundity reached its maximum at 20 °C (Dean, 1974). Whereas, Abdel-Rahman *et al.* 2002, found that, optimum temperature for *R. padi* rearing was 24°C.

This present study clarifies the different constant temperatures effects on life table parameters of *R. padi* reared on wheat plants.

MATERIALS AND METHODS

The bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus) were collected from the wheat plants field which reared on wheat seedlings under three different constant temperatures *i. e.*, 15, 20 and 25oC and R.H. 65±10% on wheat seedlings with using new technique of the Punctured Ependorf Tube Technique (PETT) as described by El-Fatih, 2014.

The newly-born progenies from field-collected mothers were gently transferred separately using a fine

hair brush to filter paper discs placed inside clean Petri-dishes containing wheat seedlings germinated in PETT and were monitored daily until death.

Data obtained of life table study were analyzed following Birch 1948, using of Life 48 Basic Computer Program Abou-Setta *et al.* 1986. Sex ratio was considered as one (all progeny developed to females).

RESULTS AND DISCUSSION

- Life table parameters of *Rhopalosiphum padi*:

The obtained life table parameters were presented in Table (1). Expected female/female/day (M_x) and daily survival rates (L_x) were illustrated in Fig. (1).

As shown in Table (1), Survival rates were 77.2, 77.7 and, 62.5% at 25, 20 and 15°C, respectively. Time to 50% mortality (days) decreased gradually to 33.5, 30.5 and 17.5 days by temperature increased from 15, 20 to 25°C, respectively in this field of study. El-Gantiry *et al.* (1999), found a negative relation with temperature. El-Heneidy *et al.* (2004) observed 100% and 85% survival rate of both *R. padi* and *Schizphis graminum*, respectively on barley plants.

The longest mean generation time (T) (28.66 days) was recorded at 15oC. This duration decreased gradually to 17.10 and 12.24 days by the increase of temperature from 20 to 25oC, respectively.

Table 1. The three different constant temperatures effects on the life table parameters of *R. padi*.

Parameter	Values obtained		
	Degree of temperature °C		
	15	20	25
Survival rate to maturity%	62.5	77.7	77.2
Time to 50% mortality (days)	33.5	30.5	17.5
Mean generation time (T) (days)	28.66	17.10	12.241
Net reproductive rate (R_0)	31.38	41.56	27.36
Intrinsic rate of increase (r_m)	0.120	0.218	0.270
Finite rate of increase (exp r_m)	1.128	1.243	1.310
Generation doubling time (days)*	5.77	3.180	2.56

(*) = $\ln 2 / r_m$

Highest net reproductive rate (R_0) as 41.56 was recorded at 20oC then decreased gradually to 31.38 and 27.36 at 15 and 25oC, respectively. These results disagree

with those recorded by Abdel-Rahman (1997), who reported that the highest R_o value (35.09) for *S. graminum* at 24 °C, while it was 11.7 for *R. padi* (El-

Fatih, 2000). On the contrary, this value was very low (0.37 and 0.19) for *R. padi* and *S. graminum*, respectively on barley plants (El-Heneidy *et al.*, 2004).

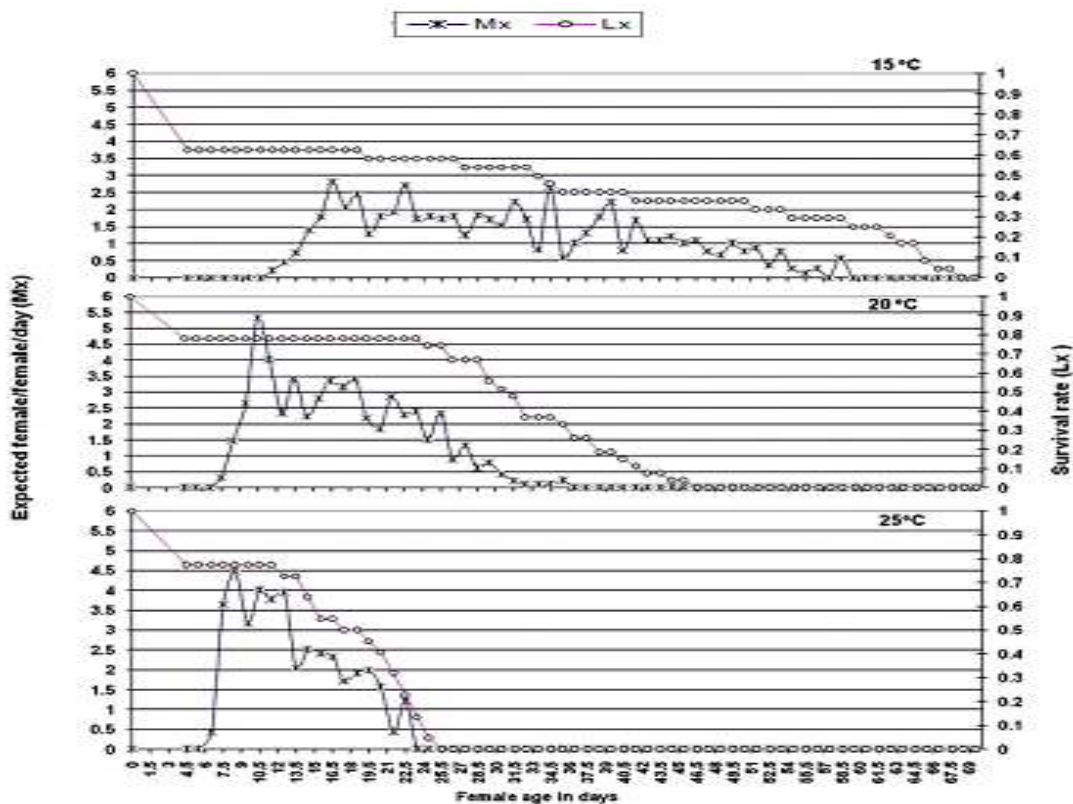


Fig. 1. Natality and survivorship of *R. padi* on wheat seedlings at three different constant temperatures.

Rate of intrinsic increase (r_m) was recorded as 0.270 at 25°C, followed by 0.218 at 20°C and lowest as 0.120 at 15°C. Rate of finite of increase (exp. r_m) followed the same sequence of (r_m). It was recorded as 1.310, 1.243 and 1.128 at 25, 20 and 15°C, respectively. Abdel-Rahman *et al.* 2002, indicated that the population of *R. padi* had a capacity to multiply about 1.19 or 1.31 times per female per day, according to temperature. Also, El-Gantiry *et al.* 1999, mentioned that the (r_m) per day and the exp. r_m for *S. graminum* were greater as temperature increased, while El-Heneidy *et al.* 2004, found different values for *R. padi* and *S. graminum*, respectively.

The highest population doubling time (PDT) reached (5.77 days) at 15°C. This value was lower (3.180 days) at 20°C followed by (2.56 days) at 25°C, respectively. Kuo *et al.*, 2006, reported that *R. maidis* probably are the better for adapted in population spread in warm regions to wider range of high temperatures.

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قياسات جداول الحياة لمن الشوفان المربي على نباتات القمح

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تم دراسة جداول الحياة لحشرة من الشوفان تحت ظروف المعمل على بادرات القمح على ثلاث درجات حرارة ثابتة هي ١٥، ٢٠ و ٢٥ م. سجلت أعلى قيمة (٤١.٥٦) لصافي معدل التوالد (R_0) لمن الشوفان على درجة حرارة ٢٠م، ثم انخفضت هذه القيمة إلى ٣١.٣٨ عند درجة الحرارة ١٥م في حين وصلت إلى ٢٧.٣٦ عند ٢٥م. سجلت أعلى قيمة (٠.٢٧٠) لمعدل الزيادة (r_m) على درجة حرارة ٢٥ م ثم انخفضت هذه القيمة بانخفاض درجات الحرارة حيث كانت (٠.٢١٨) عند ٢٠م و(٠.١٢٠) عند ١٥م، كما انخفضت قيم معدل الزيادة المطلق بانخفاض درجات الحرارة أيضا حيث سجلت ١.٣١٠، ١.٢٤ و ١.١٣ عند ٢٥ و ٢٠ و ١٥م. وبالنسبة للوقت اللازم لتضاعف الجيل (PDT) كان أطول مدة عند درجات الحرارة المنخفضة حيث وصل إلى ٥.٧٧ يوم عند ١٥م، بينما قصرت هذه المدة مع ارتفاع درجة الحرارة حيث وصلت إلى ٣.١٨٠ و ٢.٥٦ يوما عند درجتي الحرارة ٢٠ و ٢٥م على الترتيب.