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*Full Length Research Paper*

# Life table parameters of the dubas bug, *Ommatissus lybicus* (Hem: Tropiduchidae) at three constant temperatures

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**The dubas bug, *Ommatissus lybicus* Bergevin (Hemiptera: Tropiduchidae) is one of the major pests of date palm in Bam region, Iran. In this study, life table parameters of *O. lybicus* were studied at 25, 30 and 35°C. The experiments were conducted in a leaf cage at 60 ± 5% RH and a photoperiod of 16:8 (L: D) h. The survival rate ($l_x$) of individuals developed to adults from the initial cohort stages was estimated 0.78, 0.84 and 0.43 at 25, 30 and 35°C, respectively. The longest and shortest life expectancy ($e_x$) of the pest was 91.9 and 62.5 days at 25 and 35°C, respectively at the beginning of life. These results indicate that 30°C could be the optimum temperature for the biological activities of *O. lybicus*.**

**Key words:** *Ommatissus lybicus*, Bam, life table, temperature.

## INTRODUCTION

Dubas bug, *Ommatissus lybicus* Bergevin is an important pest of date palm in Bam region, Iran (Payandeh et al. 2010). It is active on leaflets and fruiting bunches at different stages of date palm tree growth (Bitaw and Ben Saad, 1990). During heavy infestations, honeydew dripped from palms most of the day and the upper side of old leaves and fruit are covered with the honeydew and dust (Klein and Venezian, 1985). The spread of the insect to such locations has apparently been by transport of offshoots with eggs (Howard et al., 2001). This sucking insect causes great damage to the trees and reduces the quantity and quality of the dates (Mokhtar and Nabhani, 2010). The eggs are laid on all the green parts of the palm except the fruits, with the majority on the leaflets, especially the upper surface (Hussain, 1963).

There is considerable interest in alternative management tactics, which might be applied in wide area on more restricted basis (Naseri et al., 2009). Population parameters are important in measurement of population growth capacity of species under response to selected conditions and as bioclimatic indices in assessing the potential of a pest population growth in a new area (Southwood and Henderson, 2000). Life table is an appropriate tool to study the dynamics of animal populations, especially arthropods, because this tool can provide very important demographic parameters (Maia et al., 2000). Demographic studies have several applications: Analyzing population stability and structure, estimating extinction probabilities, predicting life history evolution, predicting outbreak in pest species and examining the dynamics of colonizing or invading species (Vargas et al., 1997; Haghani et al., 2006). Demographic information may also be useful in constructing population models (Carey, 1993) and understanding interactions with other insect pests and natural enemies (Omer et al., 1992).

The cohort life table gives the most comprehensive description of the survivorship, development and reproduction of population that are fundamental factors in both theoretical and applied population ecology (Taghizadeh et al., 2008). In this study, the effect of temperature on the development of the immature stages of *O. lybicus* was studied in the laboratory by rearing them at nine constant temperatures, ranging from 15 to 35°C (Mokhtar and Nabhani, 2010). Effect of temperature and host plants on the bionomics of the leafhopper, *Empoasca*

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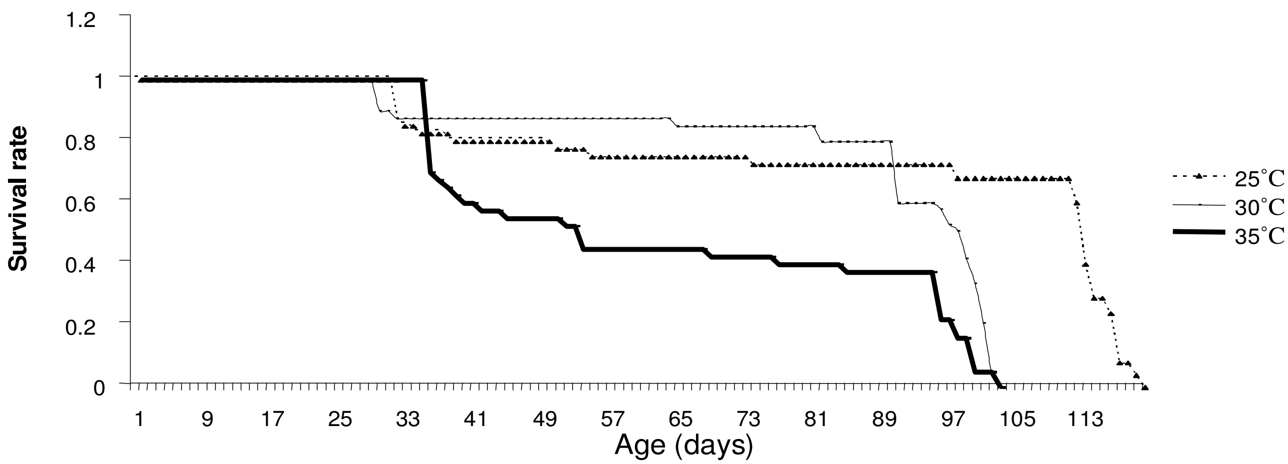


**Figure 1.** Age-specific survival rate ( $l_x$ ) of *Ommatissus lybicus* at three constant temperatures.

*decipiens* Paoli was studied by Raupach et al. (2002). Furthermore, our finding may be extremely valuable for future development of Integrated Pest Management (IPM) programs against *O. lybicus*.

## MATERIALS AND METHODS

### Leafhoppers' colony

*O. lybicus* adults were collected originally from date palms in the Bam region, Iran. They were replaced with date palm leaves in laboratory in leaf-cages and reared at a temperature of 30: 23°C (day- night), 60 ± 5% RH and a photoperiod of 16:8h (L: D).

### Experimental conditions

*O. lybicus* eggs of nearly equal (cohort) were selected to start the experiments. For this purpose, 100 adults leafhoppers from the colony were placed for 24 h in a plastic cage (length, 1 m) containing two one palm leaf. After 24 h, adults were removed and 40 eggs for each temperature reared in plastic leaf cages on palm leaflet. These eggs of the same age were used to begin the experiments. Cohorts of 40 eggs were individually placed on individual leaf cages and observations were recorded daily for the mortality/survival of nymphs in the same instars and adult emergence. After emerging of adults, a pair of female and male *O. lybicus* was introduced into each transparent leaf-cage, as explained earlier. When females began laying eggs, the number of eggs laid per female was recorded every day. The experiments were continued up to the death of the last female *O. lybicus*.

### Calculation of life-table statistics

Tow important life parameters (survivorship and life expectancy) were calculated by the following formulas (Carey, 1993):

$$l_x = \frac{N_x}{N_0}$$ and

$$e_x = \frac{T_x}{l_x}$$

Where, x is the unit of age; $l_x$ is the age-specific survival rate or the fraction of individuals of the initial cohort alive at age x, $N_x$ is the number at age x; $N_0$ is the starting number of individuals in the cohort; $e_x$ is the life expectancy at age x; $T_x$ is the number of time units lived by the cohort from age x until all individuals die; $T_x = \sum_{x=0}^{\omega} L_x$ and $L_x$ is the fraction of individuals alive during the interval between x and x+1.

## RESULTS

Age-specific survival rate ($l_x$) of *O. lybicus* on three constant are shown in Figure 1. The highest and lowest survivorship of post embryonic was observed at 30 and 35°C, respectively. The survival rate of individuals developed to adults from the initial cohort stages was estimated 0.78, 0.84 and 0.43 at 25, 30 and 35°C, respectively. The results of the present study indicated that the death of last female (maximum age) on mentioned temperatures occurred in the age of 121, 101 and 103 days, respectively (Figure 1). Age specific mortality of *O. lybicus* at three constant temperatures was alternative. High temperature (35°C) had the highest impact on the mortality rate ($q_x$) of adults and late nymph instars than on early nymph instars (Figure 2). The highest mortality at 25 and 30°C was observed in 4 days (0.16) and 2 days (0.17) from the late days of females and for 35°C was observed in early female, respectively.

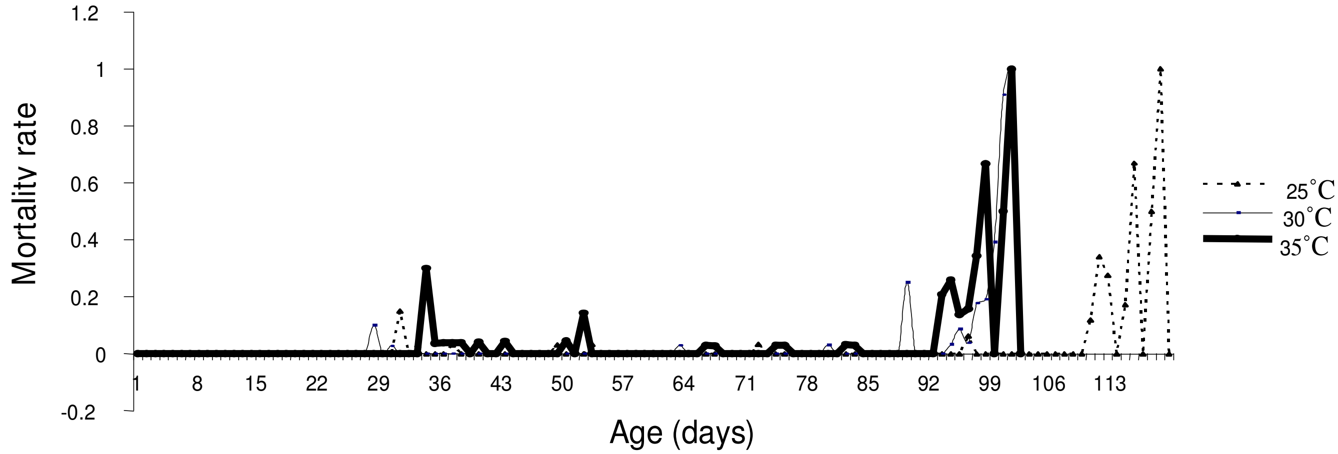


**Figure 2.** Mortality rate ( $q_x$ ) of *Ommatissus lybicus* at three constant temperatures.

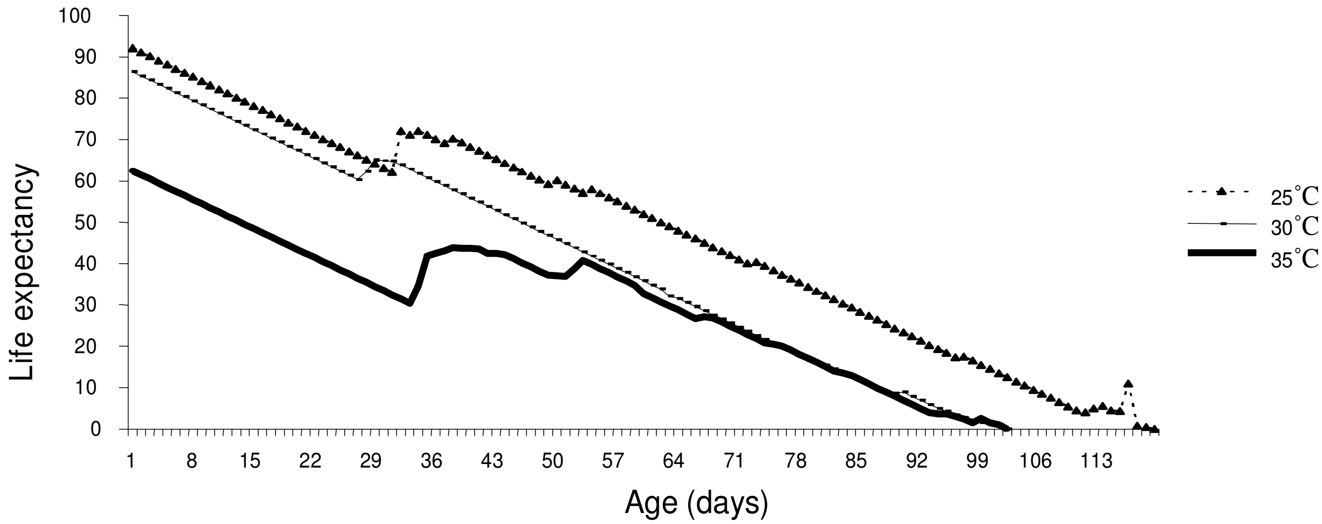


**Figure 3.** Life expectancy ( $e_x$ ) of *Ommatissus lybicus* at three constant temperatures.

The longest and shortest life expectancy of the pest was 91.9 and 62.5 days at 25 and 35°C, respectively at the beginning of life (Figure 3). Life expectancy of *O. lybicus* was estimated at 41.5, 13.7 and 15.4 days on these temperatures (the same order mentioned earlier), respectively at the first day of adult appearance, which revealed maximum and minimum rate of this parameter at 25 and 35°C, respectively. The laying of eggs beginning for the first female at these temperatures occurred in the age of 89, 78 and 93 days, respectively. The highest daily fecundity ( $m_x$ ) of the early adults from the nymph reared at these temperatures was 2.93, 4.14 and 1.05 females / female /day, respectively. The daily fecundity of the date palm was zero in 41, 32 and 17th days at 25, 30 and 35°C, respectively (Figure 4).

## DISCUSSION

Information on how temperature can influence the life cycle of a given insect pest is essential to develop effective integrated pest management (IPM) strategies (Frel et al., 2003). Morgan et al. (2001) have declared that in developing forecasting models, it is necessary to investigate the bionomics of indigenous populations, in order to avoid erroneous data resulting from adaptation to disparate climatic conditions.

The present research demonstrated significant differences of the life table parameters of the dubas bug among the three temperatures tested. Moreover, at 35°C, most of the biological activities of the dubas bug were disrupted and dramatically reduced developmental time, survival and fecundity. In this temperature, early females after 1

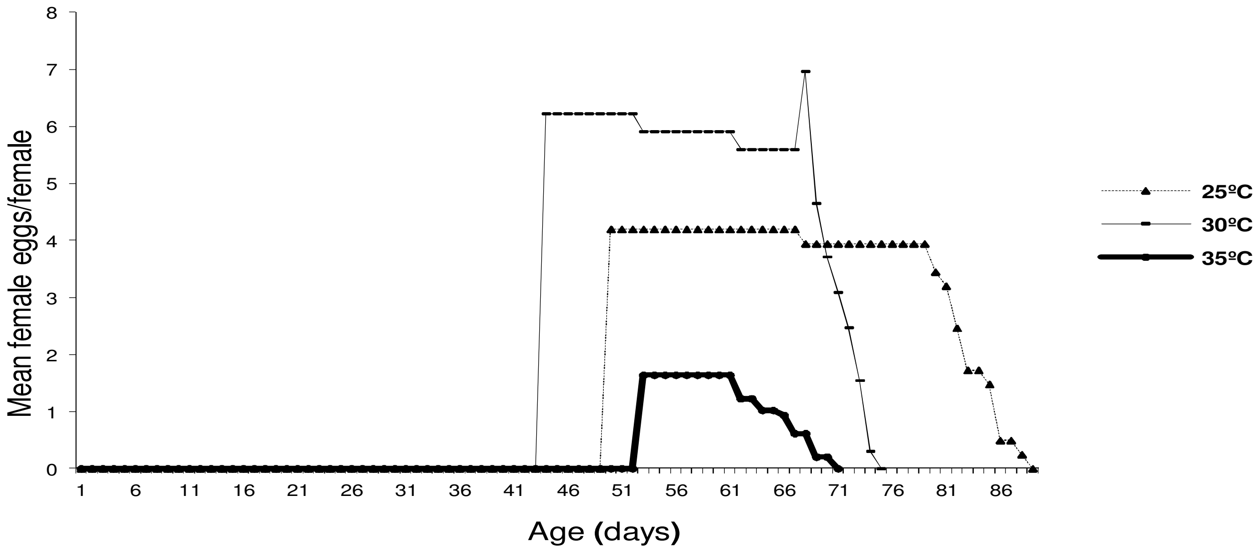


**Figure 4.** Age specific fecundity ( $m_x$ ) of *Ommatissus lybicus* at three constant temperatures (age expressed from the onset of the egg stage).

to 5 days died. Survival of *O. lybicus* was more affected by high (35°C) than by low temperatures (25°C). The highest survivorship obtained in our study was at 30°C, the same as for *Rhopalosiphum padi* L. (Dean, 1974). The survival rate of individuals developed into adults from the initial cohort stage was 0.71 to 0.89% at 30 and 35°C, respectively. Survival rate of *Cicadulina bipunctata* (Melicher) (Homoptera: Cicadellidae) reared on corn was 50% at 25.3°C (Tokuda et al., 2004). The life expectancy of *O. lybicus* at different temperature varied from 10 to 28.7 days at first days of adult appearance, which revealed highest and lowest rates of this parameter at 25 and 30°C, respectively. The results of Maya- Hernandez et al. (2000) indicated that life expectancy of *Empoasca kraemeri* Ross and Moore adult on five bean genotypes including DOR- 40, BAT- 1636, BAT- 58 -2 and *Negro Jamapa* was 19.04, 21.29, 22.29, 21.17 and 22.2 days, respectively.

Therefore, based on life table parameters observed, it can be concluded that 30°C could be optimum temperature for the biological activities of *O. lybicus*. Hence, it may be useful to consider a wide range of constant temperatures for evaluation of life table parameters of *O. lybicus* and assessment of biological control agents in integrated pest management (IPM) program of date palm. However, more attention should be devoted to semi-field and field experiments to obtain more applicable results under field conditions.

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## REFERENCES

Bitaw A, Ben Saad A (1990). Survey of data palm trees insect pests in Libya. Arab J. Plant Protect. 8: 72-76.

Carey JR (1993). Applied demography for biologists with special emphasis on insects. Oxford University Press UK.

Dean GJ (1974). Effect of temperature on the cereal aphids Metopolophium dirhodum (WIK), Rhopalosiphum padi (L.) and Macrosiphum avenae (F.) (Hem.: Aphididae). Bull. Entomol. Res. 63: 401- 409.

Frel A, Gu H, Cardona C, Dorn S (2003). Antixenosis and antibiosis of common beans to Thrips palmi. J. Econ. Entomol. 93: 577- 584.

Haghani M, Fathipour Y, Talebi AA, Baniameri V (2006). Comparative demography of Liriomza sativae Blanchard (Diptera: Agromyzidae) on cucumber at seven constant temperatures. J. Insect Sci. 13: 477-483.

Howard FW, Moore D, Giblin-Davis RM (2001). Insects on palms. CABI Publishing, New York, USA.

Hussain AA (1963). Biology and control of the dubas bug, Ommatissus binotatus lybicus de Berg. (Homoptera: Tropiduchidae) infesting date palms in Iraq. Bull. Entomol. Res. 53: 737-745.

Klein M, Venezian A (1985). The dubas date Tropiduchid, Ommatissus binotatus lybicus, threat to date palms in Israel . J. Phytoparasitica. 13: 95-101.

Maia AHN, Luiz AJB, Campanhola C (2000). Statistical influence on associated fertility life table parameters using jackknife technique computational aspects. J. Eco. Entomol. 93: 511-518.

Maya–Hernandez V, Vera–Graziano J, Garza–Garcia R (2000). Empoasca kraemeri Ross and Moore ( Homoptera: Cicadellidae) population parameters in common bean genotypes. Agrociencia. 34: 60-610.

Mokhtar AM, Nabhani SSA (2010). Temperature-dependent development of dubas bug, Ommatissus lybicus (Hemiptera: Tropiduchidae), an endemic pest of date palm, Phoenix dactylifera. Eur. J. Entomol. 107(4): 681-685.

Morgan D, Walters KFA, Aegerter JN (2001). Effect of temperature and cultivar on pea aphid, Acyrthosiphon pisum (Hemiptera: Aphididae) life history. Bull. Entomol. Res. 91: 47-52.

Naseri B, Fathipour Y, Moharramipour S, Hosseininaveh V (2009). Comparative life history and fecundity of Helicoverpa armigera (Lepidoptera: Noctuidae) on different soybean varieties. J. Entomol. Sci. 12: 51- 58.

Omer AD, Johnson MW, Tabashinik BE (1996). Demography of the leafminer parasitoid Ganaspidium utilis Beardsley (Hymenoptera: Eucoilidae) at different temperatures. Biol. Control. 6: 29-43.

Payandeh A, Kamali K, Fathipour Y (2010). Population structure and seasonal activity of Ommatissus lybicus in Bam region of Iran. Mun. Ent. Zool. 5(2): 726-733.

Raupach K, Borgemeister C, Hommes M, Poehling H, Setamou M (2002). Effect of temperature and host plants on the bionomics of Empoasca decipiens (Hom.: Cicadellidae). Crop Prot. 21: 113-119.

Southwood TRE, Henderson PA (2000). Ecological Methods. Third edition, Blackwell Science, Oxford.

Taghizadeh R, Fathipour Y, Kamali K (2008). Influence of temperature on life table parameters of Stethorus gilvifrons (Mulsant) (Coleoptera: Coccinellidae) fed on Tetranychius urticae Koch. J. Appl. Entomol. 132: 638-645.

Tokuda M, Matsumura M (2004). Effect of temperature on the development and reproduction of maize organ leafhopper Cicadulina bipunctata (Melichar ) (Homoptera: Cicadellidae). J. Appl. Entomol. Zool. 40: 213-220.

Vargas RI, Walsh WA, Kanehisa DT, Jang EB, Armstrong JW (1997). Demography of four Hawaiian fruit flies (Diptera: Tephritidae) reared at five constant temperatures. Annal. Entomol. Soci. Amer. 90: 162-168.