

## Demography of Sunn Pest (*Eurygaster integriceps* Puton) in Iran [Hemiptera: Scutelleridae]

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### Abstract

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The life history and demography of Sunn Pest, *Eurygaster integriceps* Puton, were studied under laboratory conditions of 25±0.5°C, 70±5% RH and 16:8 (L:D). Development from egg to adult averaged 41 days for males and females with a survival rate of 60%. First mating occurred 8.55 (± 0.98) days after the start of the experiment and repeated several times during the reproductive life. Egg laying started on the 12th (± 0.73) day after the beginning of experiment. Demographic parameters were: fecundity, gross (289.11) and net (127.12) eggs/female, hatchability, 75% (gross) and 85% (net). Net reproductive rate ( $R_0$ ) was 34.3 female offspring/female and generation time (T) was 19.2 days.

**Keywords:** Developmental times, *Eurygaster integriceps* Puton, life history, reproduction, Sunn Pest, survival.

### Introduction

Sunn Pest, *Eurygaster integriceps* Puton, is a significant pest of wheat and barley throughout West and Central Asia. It has caused major concern for more than 70 years (12). In Iran, 1.25 million ha of wheat must be sprayed with pesticides each year to control this insect (4). Some of the earliest studies on the biology and ecology of this insect were conducted in Iran, Syria and Turkey in the early part of the 20<sup>th</sup> century (2, 3, 15). Research on Sunn Pest biology was also done in Russia (13), Bulgaria (14) and in the steppe zone of the Ukraine (20).

Daily activity of Sunn Pest and feeding behaviour have been reported by Banks *et al.* (5); the feeding of adults on different diets by Brown (7) and the ecology of overwintering areas by Brown (8). A description of the life history of Sunn Pest is given by Paulian and Popov (19) and Mohaghegh (18).

An extensive search of the literature failed to locate information with a life table of this species. The purpose of the research reported herein was to study the life history of Sunn Pest and conduct demographic analyses of this insect.

### Materials and Methods

In January 2001, approximately 2000 pairs of Sunn Pest were collected from an overwintering site of the insect at Gharah-Aghaj Mountain located 30 km east of Varamin City. These insects were used to start a laboratory culture at Varamin Sunn Pest Research Center. The insects were sexed and separated into groups of 100 to 250 pairs and then placed in plastic cages (0.07 m long x 0.07 m wide x 0.07 m high) at a constant temperature of 25±0.5°C and RH of 70±5%. A 16:8 (LD) photoperiod was established and the Sunn Pest were furnished water and wheat seed (var. Mahdavi) for food. Following mating females were allowed to oviposit for 1 hr. on paper. They were then removed and the eggs used for life history trials.

To determine the development of immatures, 160 egg masses were transferred to small plastic cages (0.002 m long x 0.002 m wide x 0.002 m high) containing a single piece of filter paper. Water was furnished by including in each cage a small test tube with water and a cotton wick. Daily we added

fresh wet wheat seeds to each cage. The cages were held at the same conditions as above. Developmental times were determined by checking experimental containers at 12 h. intervals until all individuals reached adulthood.

### Demography

A random selection of twenty pairs of virgin Sunn Pest were weighed to ensure equal sized individuals then separated into single pairs. Each pair was placed in a plastic container (as above) for determining the survival of each sex (recorded daily). Fecundity data were obtained by placing a narrow piece of paper in the cage for oviposition and recording the numbers of eggs laid/day. Counts were taken between 11 and 12 am. Each day newly laid eggs were removed and transferred to a new plastic container to record growth. Analyses of life table statistics were done according to the procedures of Carey (9).

### Results and Discussion

To our knowledge, this is the first life table study conducted on *E. integriceps* in Iran.

### Immature stages

Data analyses indicated the duration of the various developmental stages of Sunn Pest (Table 1). The average duration of the egg stage was 6.15 days. Nymphal developmental times ranged from 3.82 days for instar 1 to 10.58 days for instar 5. The complete life cycle took about 41 days. There was no significant difference between development times for males and females in this laboratory study. These results are similar to those in biological studies reported by Khalistovsky (17), Mohaghegh (18), Paulian and Popov (19) and Taranukha (21).

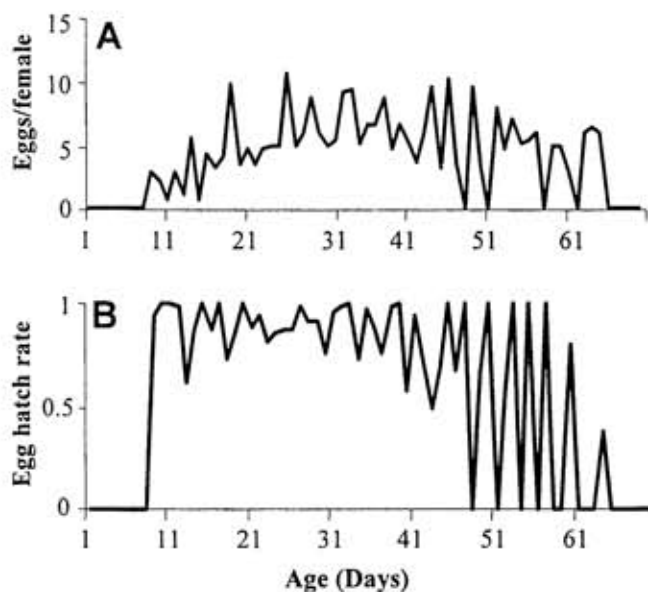
Overall survival of Sunn Pest was 60% which is similar to that reported by Mohaghegh (18) who used 25°C and 55% RH but considerably higher than that reported by Khalistovsky (17), who found survival was 14.6-41% at 28°C.

### Adult life history patterns

Sunn Pest began mating 8.55 ( $\pm 0.98$ ) days after collection from the mountain overwintering site. The collections were made on January 10, 2000. Males and females mated multiple times during their reproductive lives. Adults began laying eggs 12 ( $\pm 0.73$ ) days after the beginning of the experiment. Day to day variability in egg production and hatch was high over the duration of the experiment (Fig. 1A and B). Egg production in one female began 8 days after mating. Egg production per female was variable during the last 25 days of the insect's life. This pattern was probably due partly to the low numbers of surviving females and their age. Egg hatch was high for the first 40 days but fell after this time and also became variable. Results indicated that no females died the first 9 days while about 5% of males did. After 30 days 50% of the original male and female cohort was alive. Thereafter, mortality increased steadily (Fig. 2).

**Table 1.** Mean development time and percent survival of immature stages and adults of Sunn Pest held under laboratory conditions.

Stage	Developmental time (days) Mean ( $\pm$ SE)	Percent survival
Egg	6.15 ( $\pm 0.015$ )	9.6940
Nymph1	3.82 ( $\pm 0.020$ )	7.3760
Nymph2	6.35 ( $\pm 0.028$ )	12.0139
Nymph3	7.01 ( $\pm 0.042$ )	9.0830
Nymph4	7.40 ( $\pm 0.047$ )	1.8341
Nymph5	10.58 ( $\pm 0.052$ )	0.0873
Female	41.56 ( $\pm 0.130$ )	
Male	41.02 ( $\pm 0.140$ )	



**Figure 1.** Sunn Pest oviposition (A) and egg hatch (B) rates of individuals held at 25°C in the laboratory.

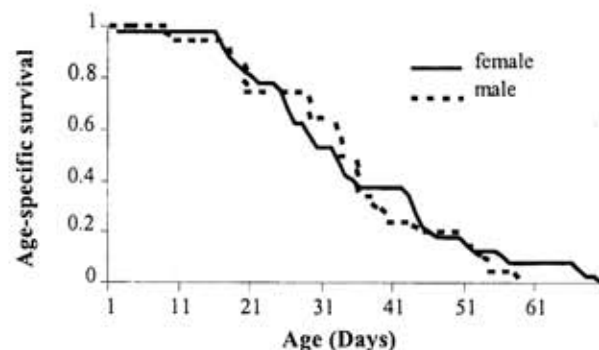
A summary of statistics of adult life history traits is given in Table 2. Several aspects of these statistics merit comment.

First, the life expectancy of females was shorter in this study (35 days) than in others. Javahery (16) and Mohaghegh (18) found that adult females lived an average of 50.1 (at 20-

28.5°C and 75% RH) and 60 days (at 25°C and 55.5% RH) respectively. Their results were about 30-40% longer than the life expectancy we found.

Second, both gross and net fecundity for this colony were 289.11 and 127.12 respectively. These results are similar to those reported by Mohaghegh (18) but considerably higher than previously reported findings. Abdollahi (1) who used 10 different varieties of wheat and reared Sunn Pest at 25°C, 70% RH reported averages of 144 to 212 eggs/female, depending upon the wheat variety, and Javahery (16) cited 195.2 eggs/female when reared at 20-28.5°C. There may have been a subtle temperature influence on egg production.

Third, a female living to her maximum life span laid 75% fertile eggs while the average newly eclosed female laid 85% fertile eggs. Thus, a female which lived its maximum life span laid 56% more eggs than did the average individual in its cohort but 10% fewer hatched (Table 2.).



**Figure 2.** Survivorship of adult male and female Sunn Pest held at 25°C in the laboratory.

**Table 2.** Summary statistics for adult female Sunn Pest.

General trait	Parameter	Value
Fecundity	Gross	289.11 eggs
	Net	127.12 "
	Average eggs/day	3.6
	Mean age fecundity schedule	36.9 days
Egg hatch	Gross	75%
	Net	85%
	Mean age hatch schedule	30.8 days
Fertility	Gross	215.7 eggs
	Net	107.4 "
	Average fertile eggs/day	3.1
	Mean age fertility schedule	33.3 days

Fourth, net fertility was 63% less than gross fecundity. Of this percentage 56% was due to adult mortality and 7% due to infertility. Adult mortality played a larger role than did infertility in reducing gross reproduction.

Life history parameters for Sunn Pest are shown in Table 3. Comparing the gross reproduction rate (GRR) and net reproduction rate ( $R_0$ ) indicated that if adults lived to their physiological maximum they would have laid on average a total of 69.8 eggs (=GRR) but because of the mortality effects the average female laid only 34.3 eggs ( $R_0$ ). The generation time (T) was 19.2 days and population

increased daily by 1.2 times the previous day's total number. Every 3.8 days (=DT) the population doubled so that the intrinsic rate of natural increase was 0.184 per female per day. This parameter, as a measure of animal population growth rate, was first applied to insect populations by Birch (6) and has since been used in several studies of phytophagous insects (10, 11).

Table 3. Demographic parameters for female Sunn Pest.

Parameter <sup>1</sup>	Value
GRR	69.8
R <sub>0</sub>	34.3
r <sub>m</sub>	0.184
λ	1.2
T	19.2
DT	3.8

<sup>1</sup> GRR = gross reproductive rate, R<sub>0</sub> = net reproductive rate, r<sub>m</sub> = intrinsic rate of increase, λ = finite rate of increase, T = generation time, DT = doubling time.

The results from this experiment clearly indicate how long to expect adult Sunn Pest collected in Iran and held under laboratory conditions will live. They also give an indication of the number of eggs to expect per female and the hatch rate of these eggs over time. The authors realize that this study was done under controlled conditions and stress that care must be taken when applying this information to actual field conditions.

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### الملخص

أمير-مافي، م ويروس ل. باركر. 2001. مجتمعات السونة (*Eurygaster integriceps* Puton) [Hemiptera: Scutelleridae] في إيران. مجلة وقاية النبات العربية. 19: 135-138.

تمت دراسة تاريخ حياة حشرة السونة (*Eurygaster integriceps* Puton) ومجتمعاتها تحت الظروف المختبرية عند درجة حرارة 25±0.5 °م ورطوبة نسبية 70±5% وفترة ضوئية (16 ساعة ضوء: 8 ساعات ظلام). استغرق التطور من البيضة إلى البالغة 41 يوماً بالمتوسط للذكور والإناث وبنسبة بقاء 60%. وحدث أول تزاوج بعد 8.55±0.98 يوماً من بدء التجربة وتكرر عدة مرات أثناء الحياة التكاثرية للأفة. وبدأت الإناث بوضع البيض في اليوم الثاني عشر (0.73±) من بدء التجربة. وكانت معايير المجتمع: الخصوبة الإجمالية 289.11 والصالية 127.12 بيضة/أنثى، نسبة الفقس الإجمالية 75% والصالية 85%. بلغت سرعة التكاثر الصافية 34.3 وبلغ الوقت الجيلي 19.2 يوماً.

كلمات مفتاحية: زمن التطور، *Eurygaster integriceps*، دورة حياة، التزاوج، السونة، البقاء.

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