

LIFE TABLE OF *Nabis pseudoferus* REM. (HEMIPTERA: NABIDAE) FEEDING ON *Spodoptera littoralis* BOISD. (LEPIDOPTERA: NOCTUIDAE) UNDER LABORATORY CONDITIONS

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ABSTRACT

The purpose of this investigation was to determine some biological parameters of the predator, *Nabis pseudoferus* Rem. (Hemiptera: Nabidae), feeding on the Egyptian cotton leaf worm *Spodoptera littoralis* Bois. (Lepidoptera: Noctuidae). Experiments were conducted in a climatic chamber at 25 ± 1 °C and 60 ± 5 % RH under 16:8 light:dark photoperiod. *N. pseudoferus* feeding on *S. littoralis* individuals being on cotton seedlings kept in cages (12x8x7 cm) was used for the experiments. Mortality rate was 33.33% and females laid an average of 50.92 eggs during their life time. From the constructed life table, the following parameters were obtained: the intrinsic rate of increase (r_m , 0.079 females/female/day), net reproduction rate (R_0 , 31.00 females/female), mean generation time (T_0 , 43.246 days), gross reproductive rates (GRR, 37.992), doubling time (T_2 , 8.729) and the finite rate (λ) of *N. pseudoferus* (1.083), respectively.

KEY WORDS:

Nabis pseudoferus, *Spodoptera littoralis*, life table, cotton

1 INTRODUCTION

Cotton is one of the important crops in Turkey and the major one for Çukurova region. In this region, there are a lot of serious pests causing high losses in yield each year [1]. Since insecticides did not show long lasting effects in pest control and often destroy the natural balance, biological control was considered to be the only reliable technique in managing these pests. One of the important pests is the cotton leaf worm *Spodoptera littoralis* (Boisd). *S. littoralis* is spread beyond Hatay, Adana, İçel and Antalya provinces of Mediterranean region and Muğla province of Egean region [2]. Species of Nabidae (Hemiptera)

feed on *Helicoverpa armigera* Hübner, *Heliothis peltigera* Schiff., *S. littoralis* and *S. exigua* (Hübner) [3-17]. *N. pseudoferus* belonging to this family has been reported to be a common species in Mediterranean and Aegean regions of Turkey and is one of the important predators of *S. littoralis* [18].

N. pseudoferus was reported on cotton in Turkey [19, 20] but no detailed study has been done. Thus, this study was aimed to determine some biological parameters of *N. pseudoferus* feeding on the prey *S. littoralis* under laboratory conditions.

2 MATERIALS AND METHODS

The stocks of *S. littoralis* and *N. pseudoferus* used in this research were obtained from cotton (*Gossypium hirsutum* L., cv. Çukurova 1518) fields in Çukurova region. In the laboratory, the prey was cultured on cotton, and *N. pseudoferus* was reared on *S. littoralis*.

The gravid predator females were placed in a cage (12x8x7 cm) with *S. littoralis* as food on cotton seedlings to allow them to lay eggs. Then, females were removed from the cages, with each cage having one egg. The cages were observed three times per day until adult stage in order to determine the incubation period of the eggs, duration of immature stages, and mortality rates. Fecundity of *N. pseudoferus* was determined by keeping a female and a male one-day-old adult in the same cage with unlimited food of *S. littoralis* in 1st – 2nd larval stage. Thirteen replicates were set up. The duration of oviposition and postoviposition periods, longevity and the number of eggs laid per cage were recorded by daily observations until all adults died.

The number of female offspring per female was calculated by dividing the number of eggs per cage by the number of females. The data obtained from daily observations were used to construct the life table [21-28]. All parameters were calculated by Remstat3 program [29]. All experiments were carried out in a climatic chamber at 25 ± 1 °C and 60 ± 5 % RH under 16:8 light:dark photoperiod.

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3 RESULTS AND DISCUSSION

3.1 Developmental time and female longevity

The developmental time of eggs, immature stages, and the duration of various periods for adult females are given in Table 1.

TABLE 1 - Duration of various biological periods, eggs, nymph (N1-N5) and adult *N. pseudoferus* (days \pm SE).

Life Stages	Average	Minimum	Maximum
Egg	12.85 \pm 0.23	11.00	14.00
N1	3.18 \pm 0.17	2.00	7.00
N2	2.64 \pm 0.15	1.08	4.54
N3	2.72 \pm 0.09	2.00	3.66
N4	2.82 \pm 0.17	1.00	4.29
N5	6.43 \pm 0.15	5.00	7.62
Total immature	30.93 \pm 0.34	27.00	34.28
Adult	20.06 \pm 2.44	6.50	46.83
Oviposition	25.31 \pm 4.17	8.00	53.00
Postoviposition	30.62 \pm 8.20	1.00	75.00
Total	50.83 \pm 2.46	37.21	79.08

The average duration of incubation was 12.85 days, five nymph stages remained at an average of 3.18, 2.64, 2.72, 2.82 and 6.43 days, respectively. The mean total developmental time from egg to adult was 30.93 days. The adult females lived 50.83 days (average), with a range of 37.21 to 79.08 days. The ovipositional time averaged 25.31 days and postovipositional time was 30.62 days (Table 1). Females laid an average of 50.92 eggs during their life times. Sex ratio was calculated as 57.4% (female/male).

The periods of five nymphal stages of *N. pseudoferus* feeding on *Tetranychus cinnabarinus* Boisduval (Acari: Tetranychidae) and *Aphis gossypii* Glow. (Hemiptera: Aphididae) were 3.90 \pm 0.12, 2.98 \pm 0.12, 2.53 \pm 0.12, 3.62 \pm 0.18, 8.58 \pm 0.77 and 5.27 \pm 1.09, 4.12 \pm 0.50, 6.06 \pm 1.17, 6.48 \pm 0.84, 5.81 \pm 1.52 days, respectively [30, 31]. Results of the present study showed that *S. littoralis* is a suitable food for nymph and adult stages of *N. pseudoferus*. Previous studies using *T. cinnabarinus* and *A. gossypii* as food had similar findings for nymph stages of the predator, while they reported that adults could not grow well on the preys [30, 31], possibly because preys are smaller and move more rapid than *S. littoralis*.

In consequence, it can be mentioned that *S. littoralis* is more suitable for the predator. Studies on 3 Nabis species (*N. americanoferus*, *N. roseipennis* and *N. rufusculus*) feeding on eggs of the Tobacco budworm *Heliothis virescens* revealed developmental times for egg, nymphal stage and total development period of 10.0, 12.8, 11.6; 19.7, 24.0, 29.0; 29.6, 38.8, and 40.5 days at 24 °C, respectively, and 7.3, 10.1, 9.5; 16.8, 21.0, 21.9; 24.0, 30.7, and 31.3 days at 27 °C, respectively [31].

Compared to these research results on other species at 27 °C, in contrast to this research at 25 °C, the test results are very similar.

N. roseipennis (feeding on the larvae of the Tobacco budworm *Heliothis virescens*) laid an average of 52 eggs during life time [32]. The reported number of laid eggs is very similar to the results of this study.

Life table and the parameters calculated for *N. pseudoferus* are given in Table 2.

TABLE 2 - Life table parameters of *Nabis pseudoferus*.

Intrinsic rate of increase, r_m	0.079 ♀/♀/day
Net reproductive rate, R_0	31.000 ♀/♀/generation
Mean generation time, T_0	43.246 days
Gross reproductive rate, GRR	37.992
Doubling time, T_2	8.729
Finite rate of increase, λ	1.083

Survivorship curve (l_x), age-specific fecundity rate (m_x) and reproduction value curve (V_x) are shown in Fig. 1.

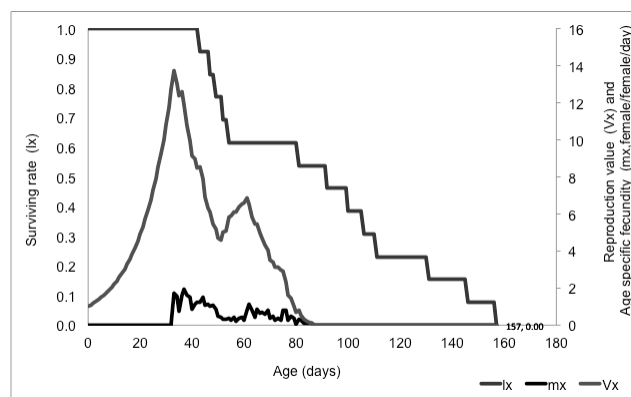


FIGURE 1 - Survivorship curve (l_x), age-specific fecundity rate (m_x) and reproduction value V_x of *Nabis pseudoferus*.

Survivorship curve revealed that mortality rate of *N. pseudoferus* was zero up to 42 days, and then, survival rate started to decrease reaching zero by the 157th day. The m_x value (age-specific fecundity rate) started to increase by the 33th day, reached a peak by the 37th day, declined gradually showing fluctuations, and then reached zero on the 87th day. The m_x curve indicated that *N. pseudoferus* females deposited most of their eggs by the half of their oviposition period. *N. pseudoferus* is a promising candidate as a biological control agent against *Tuta absoluta* [33]. This predator can be used as an biological control agent in greenhouses within the framework IPM programs.

ACKNOWLEDGEMENTS

We are grateful to Dr. Daniel Pohl at Süleyman Demirel University in Isparta, Turkey for editing the English version of this manuscript. This work was carried out with financial support of Süleyman Demirel University Scientific Research Projects Organization (Project number: 543).

The authors have declared no conflict of interest.

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Received: January 11, 2013

Accepted: April 08, 2013

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