Life History Parameters of Carmine Spider Mite *Tetranychus Cinnabarinus* Boisd. (Acari: Tetranychidae) on *Solanum Melongena* Linn.

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Abstract: Life-history parameters of *Tetranychus cinnabarinus* Boisd. were investigated at 30±2°C and a photoperiod of 13L-11D. The total developmental periods were 11.1 days for the females and 10.5 days for the males. The intrinsic rate of natural increase (r_m), the net reproductive rate (R_o) and the mean generation time (T) were 0.225, 32.20 and 16.95, respectively and the finite rate of increase (λ) was 1.252.

Key words: Developmental period, adult longevity, fecundity, *Tetranychus cinnabarinus*, *Solanum melongena.*

Introduction

The carmine spider mite, *Tetranychus cinnabarinus* Boisd., is a common and serious pest of Egg-plant *Solanum melongena* Linn. The mite is distributed in different areas of the world [1,3]. It infests more than 120 host plants of economic value including cottons, strawberries, ornamental plants, tomatoes, deciduous fruits and other vegetables [8,4]. The egg plant is an all season favorite vegetable in Bangladesh. But, *T. cinnabarinus* mite attacks mainly the mature and old leaves of the egg plants and causes a great deal of yield loss every year through sucking cell sap and damaging chlorophyll of the host plant. Any investigation on the life history of this mite is not known from Bangladesh.

The present study deals with the life-history parameters related to the population increase of *T. cinnabarinus* on egg-plant.

Materials and Methods

Adult females of *T. cinnabarinus* were collected from the egg-plants growing in the field of Rajshahi University campus on April 12, 2003. The mites were reared on dises of the fresh leaves (ca.16cm^2) of the same host plants. The discs were placed on water-soaked cotton pad in petridishes of 9 cm. diameter at 30±2°C temperature and 13L-11D photoperiod. Thus, a stock culture was maintained in the laboratory. An investigation was performed to record the developmental stages and the ovipositon by the females.

Twenty five females and ten males from a stock culture were introduced to a leaf disc and allowed to lay eggs for a twelve hour period. After hatching larvae were singly reared on a fresh leaf disc (Ca. 4cm^2) placing on the leaf portion lower surface up. These leaves were

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checked daily and the developmental stages were recorded. After the emergence of a female deutonymph, one adult male was supplied on to the leaf disc for mating and then removed 24 hour after the emergence of the female. The number of eggs laid by the female was recorded daily.

To examine the sex ratio and the different parameters of life history, one teleochrysalis female and one male were placed on a leaf disc, and the female was allowed to oviposit for six days after the preoviposition period. The eggs obtained from each female (n=22) were cultured to examine hatchability and the sex ratio of the emergent mites at maturity.

The parameter was estimated from the life fecundity table according to the equation [5].

$$\sum e^{-r} m^{x} 1_{x} m_{x} = 1$$

The parameters, R_o, T and λ were calculated using the following formula:

$$R_o = \sum l_x m_x,\ T = \sum x l_x m_x / \sum l_x m_x \text{ and } \lambda = e^{rm}$$

Results

The total developmental periods form egg to adult are 11.09 days for the females and 10.54 days for the males (Table 1) and the difference between the sexes was not significant ('t' test, $p>0.05$). The egg stage occupied 27.86% of the entire developmental period in the female and 27.79% in the male. The percentage of the quiescent period was 22% in the female and 24.6% in the male.

The average durations of preoviposition, oviposition and postoviposition, as well as the fecundity and the rate of reproduction of *T. cinnabarinus,* are given in Table 2 and 3. The hatchability of eggs laid during the first 6-day period of oviposition was 93.4%. The proportion of females in the population was 81.25%.

Figure 1 shows the age specific survival rate (1x, proportion of females alive at age x), oviposition rate (m_x, m_x=proportion of females x age-specific oviposition) nad $l_x m_x$ curves. The daily egg production reached a peak (6.09 eggs/ female/day) on the 15th day and then gradually decreased. The Survival of the females began to decrease from the 15th day onwards. Most of the females died within one or two days after the end of oviposition.

The net reproductive rate (R_o), Intrinsic rate of natural increase (r_m in day^{-1}), mean generation time (T, in days) and finite rate of increase (λ) are given in Table 4.

Discussion

The life history parameters of *T. viennensis Zacher* on deciduous were studied [2]; the values of R_o, r_m, T and λ at 25±1^{o}C and 15L-9D were 32.32, 0.172, 22.14 and 1.118 respectively. The life history parameters of a *T. viennensis* population on cherry plum in Poland was also investigated and the values of R_o, r_m, T and λ at 25^{o}C and 17L-7D were 36.0, 0.136, 26.8 and 1.144 respectively [13]. Where as in the present study the value of R_o, r_m, T and λ are 33.20, 0.225, 16.95 and 1.252 respectively was found in the life history of *T. Cinnabarinus* on *S. melongena*.

In *T. urticae*, the values of R_o reported by several authors vary from 65.0 to 128.9, r_m from 0.219 to 0.292, T from 16.16 to 20.60 and λ from 1.243 to 1.339 at about 25°C [12, 6, 9, 10]. In three species of *Schizotetranychus*, the values of R_o vary from 26.1 to 17.5, r_m from 0.160 to 0.202, T from 16.13 to 20.42 and λ from 1.173 to 1.228 at 25°C [7]. Each value of the parameters in the *T. viennensis* from deciduous oak was considerably lower than that in *T. urticae* from herbs, and was closer to those in *Schizotetranychus* ssp. Moreover, the total number of eggs laid per female and the average number of eggs laid per day by both *T. viennensis* and *Schizotetranychus* ssp. were about half those by *T. urticae* [12, 6, 7].

In present study, the findings about the parameters of *T. cinnabarinus* is somewhat different from those in *T. viennesis* execpt R_o. but in comparison to *T.utricae,* the present result are within the limit range except R_o. The average number of eggs laid per day is closer to those in *T. viennesis*, but considerably lower than that in *T. viennesis*. The above differences may be the result of differential intensities of r_m-selection as well as the temperature variation. Also the unpredictability of ephemeral food resources may impose a strong selective advantage to genes coding for increased reproductive capacity [11].

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Table 1: *The development period (in days) of Tetranychus cinnabarinus at 30±2°C and 13L-11D*

Stage	Female (n=22) (Mean±SE)	Male (n=22) (Mean±SE)
Egg	3.09±0.06	2.93±0.15
Larva	1.23±0.09	1.07±0.07
Protochysalis	0.86±0.07	0.80±0.11
Protonymph	1.95±0.10	1.87±0.13
Deutochrysalis	0.68±0.18	0.87±0.09
Deutonymph	2.41±0.11	2.07±0.15
Teleochrysalis	0.91±0.06	0.93±0.12
Total	11.09±0.00	10.54±0.12

Table 2: *The duration (in days) of various periods of Tetranychus cinnabarinus females at 30±2°C and 13L-11D.*

Period	n	Mean±SE
Preoviposition	22	1.51±0.10
Oviposition	22	9.82±0.19
Prostoviposition	22	1.36±0.11
Total adult longevity	22	12.59±0.12

Table 3: *Fecundity and ovipositonal rate of Tetranychus cinnabarinus at 30±2°C and 13L-11D.*

	n	Mean±SE
Number of eggs laid per female	22	33.18±0.63
Average number of eggs laid per day	22	3.39±0.06

Table 4: *Duration (in days) of various periods of Tetranychus cinnabarinus females at 30±2°C and 13L-11D.*

Parameters			
Ro	r_m	T	λ
33.20	0.225	16.95	1.252

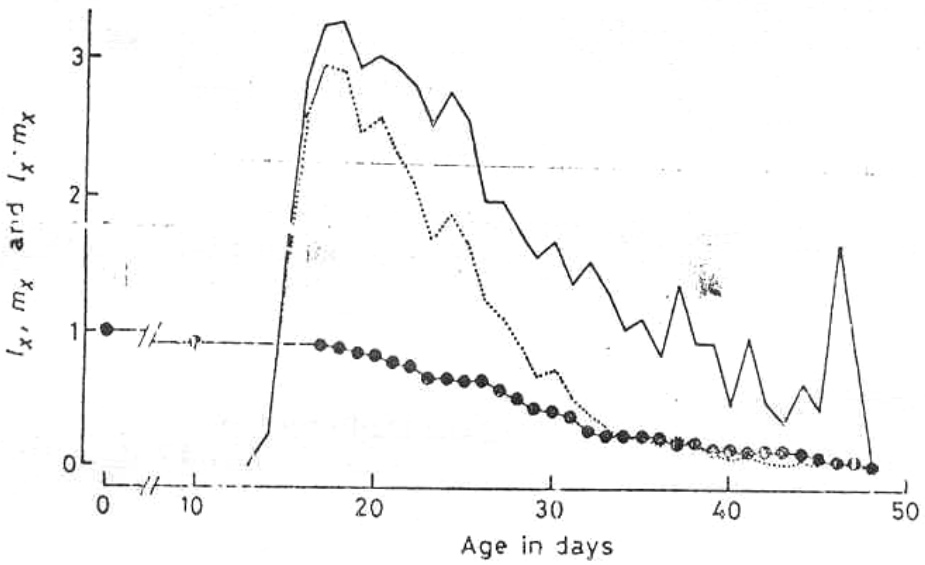

Fig.1*: The age-specific survival rate (l_x), age-specific fecundity rate (m_x) and $l_x m_x$ curves in T. cinnabarinus at 30±2°C and 13L-11D.*

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