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## Effect of different species of mulberry plant on development and growth of mulberry silk worm (*Bombyx mori* Linn.) under natural conditions

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### Abstract

To study the different parameters of the *Bombyx mori* four host viz S-146, S-1635, V-1 and TR-10 and one alternate host plants under natural conditions highest percent mortality of 13.2 species recorded at early stage larvae on V-1. Generation survival fraction revealed that S-146 was most preferred host plant. Life table studies, viz. stage specific and survival of *B. mori* on the four species of mulberry plants (*Morus alba*) i.e, S-1635, S-146, V-1 and TR-10 under natural condition indicate that the insect preferred all the four hosts species but S-146 was favored, suitable food for the development and shows the lowest mortality of *Bombyx mori*.

**Keywords:** *Bombyx mori*, mulberry plants, life table

### Introduction

The silk production and silk industry was originated first rank hold and in China, where the art and source of silk production was kept as secret for more than 2000 years. The silk production in other countries of the world became possible when the art and technology of silk production were smuggled by monks.

Feeding for 2 percent urea and potassium nitrate foliar sprayed leaves of mulberry to the silkworm (*Bombyx mori* L. race Nistari) and NB<sub>4</sub>D<sub>2</sub> x KA significantly influenced the larval weight, length, dry cocoon weight, length and weight of silk filament. The larvae of the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> instars of silkworm were nourished with the feeding of foliar sprayed leaves with 1 percent and 2 percent of urea and potassium nitrate, one day before the harvesting of mulberry (*Morus alba*) leaves. In 2 percent urea foliar sprayed leaves feed larvae, the weight and length of silk filament of Nistari and NB<sub>4</sub> D<sub>2</sub> x KA were about 1.25 and 1.18, times, 1.3 and 1.12 times greater than the control respectively. There was no significant effect of feeding of 1 percent urea and potassium nitrate foliar sprayed of mulberry leaves. In multivoltine race the highest weight length and girth of fifth instar larvae, dry cocoon weight, length and weight of silk filament were observed by feed of 2 percent potassium nitrate sprayed leaves (Singh *et al.* 2005).

On V-1 the mortality fraction was highest at early instar larvae stage, similarly on the other three species the maximum value for mortality fraction was recorded on the same late larval stage. However, the total generation mortality was interestingly 9.6 on V-1 and followed by 8.19, 5.49 and 3.96 on S-1635, TR-10 and S-146.

### Materials and Methods

The studies on various aspects of mulberry sericulture were conducted under laboratory condition in the Sericulture Research, Demonstration and Training Unit lab, Department of Entomology, College of Agriculture, S.V.P. University of Agriculture & Technology, Modipuram, Meerut (U.P.) during 2012.

### Stage specific life table

Data on stage specific survival for eggs, larvae, pupae and adults were recorded from the age specific survival & mortality life-table.

The data obtained from each table was used for computing various life parameters as given below:

### Apparent mortality

This is measured mortality and gives the information on number dying as percentage of number entering that stage and was calculated by using the formula.

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$$\text{Apparent mortality} = lx+1(x+1)/2$$

### Stage specific survival fraction ( $S_x$ )

Data obtained on apparent mortality was used for the calculation of the stage specific survival fraction ( $S_x$ ) of each stage by using equation.

$$S_x \text{ of particular stage} = [\text{lx of subsequent stage}] / [\text{lx of particular stage}]$$

### Generation survival fractions ( $S_G$ )

This parameter was calculated by the following equation.

$$S_G = S_E \cdot S_L \cdot S_P$$

Where;

$S_E$  =  $S_x$  of egg stage

$S_L$  =  $S_x$  of larval stage.

$S_P$  =  $S_x$  of pupal stage.

### Mortality survival ratio (M.S.R.)

It is the increase in population that would have occurred if the mortality in the stage, in question had not occurred and was calculated as follows.

$$\text{M.S.R. of particular stage} = [\text{mortality in particular stage}] / [\text{lx of subsequent stage}]$$

### Indispensable mortality (IM)

This type of mortality would not have occurred unless the factor (S) causing it, was not allowed to operate, while, the subsequent mortality factors operate. The equation is;

IM = Number of adults emerged x M.S.R. of particular stage.

### K-values

It is the key factor which is primarily represented for increase or decrease in number from one generation to another and was computed as the difference between the successive values for "log  $l_x$ ", The total generation mortality was calculated by adding the k-values of different development stages of the insect which is designated/Indicated as "K" (Varley and Gradwell, 1970; Southwood, (1978).

$$K = k_0 + k_1 + k_2 + k_3$$

Where  $k_0$ ,  $k_1$ ,  $k_2$  and  $k_3$  are the k-values at egg, larval, prepupal and pupal stages, respectively.

### Result and Discussion

The data revealed (Table: 1-4) that the highest apparent mortality of 20.0%, at egg stage, was on TR-10 followed by 18% on V-1, 16% on S-146 and 15% on S-1635. As far as the mortality at early larval stage was concerned, it was highest on V-1 (18.29), followed by 16.67% on S-146, 16.47% on S-1653 and 16.25% on TR-10. The apparent mortality of the last instar larvae produced maximum value of 14.92% on V-1 followed by 11.26% on S-1635 while it was 8.95% on TR-10 and 5.17% on S-146. The pre-pupal and pupal stage did not exhibit any of apparent mortality.

The highest (1.00) survival fraction of pre-pupal and pupal stage was recorded on all species of mulberry plant. The highest value of 0.85 at egg stage was recorded on S-1635 with the lowest 0.80 on TR-10. As far as early instar larval stage was concerned, S-1635, S-146 and TR-10 exhibited the

highest value 0.83, against the lowest 0.81 on V-1. At late instar larval stage, TR-10 received the highest value 0.98 against 0.85 on V-1. The generation survival fraction ( $S_G$ ) computed is given as below:

$$S-146: S_G = 0.84 (0.83 + 0.94) 1 \times 1 = 1.4868$$

$$S-1635: S_G = 0.85 (0.83 + 0.88) 1 \times 1 = 1.4535$$

$$V-1: S_G = 0.82 (0.81 + 0.85) 1 \times 1 = 1.3612$$

$$TR-10: S_G = 0.80 (0.83 + 0.98) 1 \times 1 = 1.4480$$

The data revealed that the highest MSR was recorded at early instar larval on all the four species of mulberry plant. it was 0.22 on V-1, 0.21 on S-146, 0.19 on S-1635 and TR-10, While, the lowest value 0.00 was encountered on pre-pupal and pupal stage on all species of mulberry plants.

Early larval stage of *Bombyx mori* race Nistari. Exhibited highest values as compared to other stages. The values so obtained at above mentioned stage were, 13.86, 12.54, 11.59 and 6.93 on S-146, V-1, TR-10 and S-1635, respectively. The minimum value of 0.00 was recorded both at pre-pupal and pupal stages on all species of mulberry plants.

The maximum 'k' values of 0.09 on V-1, 0.08 on S-146, S-1635 and TR-10 was recorded at early instar larval stage. However, the maximum (0.00) was encountered at pre-pupal and pupal stage on all the four species of mulberry plants. Total generation mortality 'K' was also computed and it was interesting to note that four species of mulberry plants, and the highest 'k' value was 0.24 on V-1 followed by 20.0 on S-1635, 0.178 on TR-10 and the lowest value was 0.170 on S-146.

The data obtained from stage specific life table exhibited that among all the species of mulberry plants, the highest apparent mortality (20.0%) at the egg stage was recorded on TR-10, while the lowest (15.0%) on S-1635. It was notice the apparent mortality was recorded at early instar larvae stage on all the four species of mulberry plants with no mortality at all at prepupal and pupal stage on all the four species of mulberry plants. As far as the survival fraction was concerned it was lowest at early inster larval stage and highest both the pre-pupal and pupal stages. However, there was the slight variation in the value obtained at different development stages.

The mortality survival ratio showed it maximum value at early instar larval stages and minimum in pre-pupal and pupal stage in all cases. In case of indispensable mortality it followed the same trend as in case of mortality survival ratio.

The 'k' value obtained at the different development stages were of different magnitude. The summation of all the 'K' values in all the cases revealed that the total generation mortality was maximum 0.25 on TR-10 followed by 0.24, 0.20 and 0.17 on V-1, S-1635 and S-146,

Attempt have also been made in the pest of construct ecological life-table so that they can be used as tools in the study of insects population dynamics. This was held good by Harcourt (1969) that such type of table recorded a series of sequential measurements indicating population change throughout the life-cycle of species in its natural environment. The findings of Bilapate *et al.* (1992) on *Helicoverpa armigera*, Ray and Bains (1983) [3] on *Tryporyza nivella*, Sharma and Bhalla (1992) [4] on *Metasyphus corolla* and Rizvi and pathak (1998) on *Spodoptera obliqua* also support our findings.

**Table 1:** Stage Specific life table of *Bombyx mori* Linneaus race Nistari on S-1635 variety of mulberry plants.

Stage X	No. of surviving at the beginning of the stage(lx)	No. of dying in each stage(dx)	Apparent mortality (100qx)	Survival Fraction (Sx)	Mortality/ Survival Ratio (MSR)	Indispensable Mortality (IM)	log lx	K-values
EGG	100	15	15.00	0.85	0.18	11.34	2.00	0.07
Early-Instar Larvae	85	14	16.47	0.83	0.19	6.93	1.93	0.08
Late- Instar Larvae	71	8	11.26	0.88	0.13	8.19	1.85	0.05
Pre-Pupa	63	0	0.00	1.00	0.00	0.00	1.79	0.00
Pupa	63	0	0.00	1.00	0.00	0.00	1.79	0.00
Adult	63	0	0.00	0.00	0.00	0.00	1.79	0.00

**Table 2:** Stage Specific life table of *Bombyx mori* Linneaus race Nistari on S-146 variety of mulberry plants.

Stage (X)	No. of surviving at the beginning of the stage (lx)	No. of dying in each stage(dx)	Apparent mortality (100qx)	Survival Fraction (Sx)	Mortality/ Survival Ratio (MSR)	Indispensable Mortality (IM)	log lx	K-values
Egg	100	16	16.00	0.84	0.19	12.54	2.00	0.07
Early-Instar larvae	84	14	16.67	0.83	0.21	13.86	1.92	0.08
Late-Instar Larvae	70	4	5.17	0.94	0.06	3.96	1.84	0.02
Pre-Pupa	66	0	0.00	1.00	0.00	0.00	1.81	0.00
Pupa	66	0	0.00	1.00	0.00	0.00	1.81	0.00
Adult	66	0	0.00	0.00	0.00	0.00	1.81	0.00

**Table 3:** Stage Specific life table of *Bombyx mori* Linneaus race Nistari on V-1 variety of mulberry plants

Stage (X)	No. of surviving of the stage (lx)	No. of dying in each stage (dx)	Apparent mortality (100qx)	Survival Fraction (Sx)	Mortality/ Survival Ratio (MSR)	Indispensable Mortality (IM)	log lx	K-Values
EGG	100	18	18.00	0.82	0.22	12.54	2.00	0.08
Early-Instar Larvae	82	15	18.29	0.81	0.22	12.54	1.95	0.09
Late- Instar Larvae	67	10	14.92	0.85	0.17	9.69	1.82	0.07
Pre-Pupa	57	0	0.00	1.00	0.00	0.00	1.75	0.00
Pupa	57	0	0.00	1.00	0.00	0.00	1.75	0.00
Adult	57	0	0.00	0.00	0.00	0.00	1.75	0.00

**Table 4:** Stage Specific life table of *Bombyx mori* Linneaus race Nistari on TR-10 variety of mulberry plants.

Stage (X)	No. of surviving at the beginning of the stage (lx)	No. of dying in each stage (dx)	Apparent mortality (100qx)	Survival Fraction (Sx)	Mortality/ Survival Ratio (MSR)	Indispensable Mortality (IM)	log lx	K-values
EGG	100	20	20.00	0.80	0.25	15.25	2.00	0.09
Early- instar larvae	80	13	16.25	0.83	0.19	11.59	1.90	0.08
Late- instar larvae	67	6	8.95	0.98	0.09	5.49	1.82	0.008
Pre-Pupa	61	0	0.00	1.00	0.00	0.00	1.78	0.00
Pupa	61	0	0.00	1.00	0.00	0.00	1.78	0.00
Adult	61	0	0.00	0.00	0.00	0.00	1.78	0.00

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