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Effect of different bed disinfectants on life-cycle of double hybrid mulberry silkworm (*Bombyx mori* L.)

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Abstract
The significantly lowest pupal duration (10.07 days), highest moth emergence (96.5 per cent) and fecundity (565.94 eggs) were recorded in the use of bed disinfectant Vijetha @ 5g/ sq. ft. The lowest larval duration (22.03 days) and highest hatching per cent (96.31 per cent) also recorded in the use of bed disinfectant Vijetha @ 5g/ sq. ft. The significantly highest larval duration (24.43 days), pupal duration (11.65 days) and significantly lower moth emergence (85.95 per cent), hatching percentage (84.84 per cent) recorded in the untreated control. The lowest fecundity (439.17 eggs) were recorded in the untreated control.

Keywords: life cycle, bivoltine silkworm, bed disinfectants

Introduction
Silkworms are susceptible to a number of diseases caused by different infectious organisms (Doreswamy *et al*., 2004) [3]. The cocoon loss due to diseases in India is estimated to be about 15-20 kg per unit of 100 disease free layings which accounts for about 30 per cent of total loss (Selvakumar *et al*., 2002) [8]. Once the pathogen invades the silkworm, it is difficult to curb the pathogen. Hence, prevention of any disease is rather essential than attempting to control or cure. The pathogens including the virus can be prevented by cultural methods, physical and chemical agents. The bed disinfectants are those substances which are applied on rearing bed to prevent contamination, further spread and multiplication of diseases causing germs.
To curb the diseases in silkworm rearing, different bed disinfectants and disinfection methods are evolved. Use of bed disinfectants gains a lot of importance in successful cocoon crop production. The present study was undertaken to know the effect of different bed disinfectants on life-cycle of double hybrid mulberry silkworm (*Bombyx mori* L.).

Material and Methods
The present investigation was undertaken during October-November, 2015. The experiment was conducted in rearing house at Department of Agricultural Entomology, College of Agriculture, Latur. The experiment was conducted in a Randomized block design with seven treatments and three replications. Each treatment consisted of 100 silkworms. Disease free layings of bivoltine double hybrid mulberry silkworm (*Bombyx mori* L.) race (CSR_2 X CSR_{27}) X (CSR_6 X CSR_{26}) were used to feed on the leaves of mulberry variety V_1 in the present investigation with the following treatments.

T_1 -Application of bed disinfectant Vijetha @ 5g/sq ft. ½ hour before resuming feeding after each moulting.
T_2 -Application of bed disinfectant Ankush @ 4g/sq ft. ½ hour before resuming feeding after each moulting.
T_3 -Application of bed disinfectant Vijetha supplement @ 5g/sq ft. ½ hour before resuming feeding after each moulting.
T_4 -Application of bed disinfectant Labex @ 4g/sq ft. ½ hour before resuming each moulting.
T_5 -Application of bed disinfectant Sericillin @ 4g/sq ft. ½ hour before resuming feeding after each moulting.
T_6 -Application of bed disinfectant Amruth powder in water @ 20g/litre. ½ hour before resuming feeding after each moulting.
T_7 -Untreated control.

Rearing method

The disease free layings of bivoltine double hybrids mulberry silkworm (*Bombyx mori* L.) race (CSR_2 X CSR_{27}) (CSR_6 X CSR_{26}) were kept for hatching in laboratory. After the hatching of the eggs the chawki worms were brushed as per the treatments they were separated into rearing tray in three replications as per the treatment. The mulberry leaves as per the treatments were chopped and sprinkled over the worms. The bed was made in a uniform size as per space required to the worms. The improved technology of silkworm rearing described by Krishnaswami (1978) [6] was followed in the present investigation. The food, spacing and cleaning were done as per the stage of worms and their requirement. The equal quantity of food on the basis of weight was given to the larvae for feeding. The chopped mulberry leaves were fed to the larvae at 6, 10, 16 and 21 hours in a day. The size of the chopped leaves was regulated according to condition and size of the worm. During moulting period the worms were not fed with any food and they were not disturbed. The bed disinfectants were applied as per treatment ½ hour before resuming feeding after each moult. The feed was given after half an hour and after each moulting bed cleaning was done by removing waste material from tray with the help cleaning nets. The quantity of food was increased as per the growth of the silkworm.

After the full development the full grown worms were released on collapsible mountages for spinning cocoons. The harvesting of cocoon was made on fifth day of release of worms on the mountages as per the treatments. Three lots of randomly selected 10 cocoons from each treatments and replications were collected for recording observations. The first lot was used for recording cocoon weight and shell weight. The second lot was used for determining the single filament length and the third lot was used to observe emergence of moths as seed cocoons.

Method of recording observations

1. Larval duration (days)

The total larval period was measured by recording period from the date of hatching to the onset of spinning.

2. Pupal duration (days)

The total pupal period was measured by recording the period from spinning to the date of emergence of moth.

3. Moth emergence (Per cent)

The observations on the number of moth emerged from cocoon were recorded and it was expressed in percentage.

$$\text{Moth emergence (\%)} = \frac{\text{No. of moth emerged}}{\text{Total no. of cocoons}} \times 100$$

4. Fecundity

The fecundity of each race was computed by taking number of eggs laid by female of each race after mating.

5. Hatching percentage

Empty whitish egg shells were counted immediately after brushing, which indicates the emergence of larvae. The late born larvae, unhatched and unfertilized eggs also counted and computed.

Results and Discussion

Effect of different bed disinfectants on larval duration of double hybrid mulberry silkworm (*Bombyx mori* L.) (Days).

The data on effect of different bed disinfectants on the larval duration of double hybrid mulberry silkworm (*Bombyx mori* L.) are presented in Table-1. The data (Table-1) revealed that the lowest larval duration (22.03 days) was recorded in application of bed disinfectants Vijetha at the rate 5g per sq.ft. ½ hour before resuming feeding after each moult which was at par with treatment application of bed disinfectants Labex at the rate 4g per sq.ft. ½ hour before resuming feeding after each moult (22.86 days). The significantly highest larval duration was recorded in untreated control (24.43 days). The literature on the effect of disinfectant Vijetha and Labex on larval duration is not found however, Anonymous (1979) reported that the minimum larval duration of silkworm recorded in 0.05 per cent bleaching powder (20.15 days) and maximum in untreated control (31.0 days). Jawale and Tayade (1987) [4] found that the shortest larval duration was recorded in cleaned leaves with cotton (24.41 days) and in turmeric powder treatment. Swathi *et al*. (2014) [9] observed the least larval duration of silkworm *B. mori* L. was observed in daily application of hydrated lime powder at the rate of 5g per sq ft + application of bundh powder after every moult (25.23 and 25.22 days, respectively) in both first and second rearing.

Table 1: Effect of different bed disinfectants on the life cycle of double hybrid mulberry silkworm (*Bombyx mori* L.).

Treatment. No.	Treatment detail	Mean larval duration (days)	Mean pupal duration (days)	Mean moth emergence (%)	Mean fecundity	Mean hatching (%)
T_1	Application of bed disinfectant Vijetha @ 5g/sq ft. ½ hour before resuming feeding after each moulting.	22.03	10.07	96.53 (79.27)*	565.94	96.31 (78.94)*
T_2	Application of bed disinfectant Ankush @ 4g/sq ft. ½ hour before resuming feeding after each moulting.	23.01	10.73	93.34 (75.17)	513.49	90.73 (72.41)
T_3	Application of bed disinfectant Vijetha supplement @ 5g/sq ft. ½ hour before resuming feeding after each moulting.	23.48	10.54	90.80 (72.36)	518.97	89.09 (70.74)
T_4	Application of bed disinfectant Labex @ 4g/sq ft. ½ hour before resuming feeding after each moulting.	22.86	10.86	91.02 (72.56)	494.39	91.44 (73.10)
T_5	Application of bed disinfectant Sericillin @ 4g/sq ft. ½ hour before resuming feeding after each moulting.	23.16	10.97	92.81 (74.58)	492.57	92.32 (74.06)
T_6	Application of bed disinfectant Amruth powder in water @ 20g/litre. ½ hour before resuming feeding after each moulting.	22.94	10.82	89.99 (71.66)	502.24	90.12 (71.78)
T_7	Untreated control.	24.43	11.65	85.95 (68.00)	439.17	84.84 (67.08)
	S.E. ±	0.279	0.130	0.974	8.370	1.220

	C.D. at 5%	0.861	0.402	3.000	25.790	3.758
	C.V. (%)	2.091	2.090	1.843	2.877	2.329

(*figures are in parentheses are arc sign transformed values)

Effect of different bed disinfectants on the pupal duration of double hybrid mulberry silkworm (*Bombyx mori* L.) (Days)

The data on the effect of different bed disinfectants on the pupal duration of double hybrid mulberry silkworm (*Bombyx mori* L.) are presented in Table-1. The treatment T_1 i.e. application of bed disinfectant Vijetha at the rate 5g per sq. ft. ½ hour before resuming feeding after each moulting recorded significantly lowest pupal duration (10.07 days). The untreated control recorded significantly higher pupal duration (11.65 days). Jadhav (1990) [5] reported that the shortest pupal period was observed in combination of kaolin + benzoic acid + bleaching powder (11.90 days) followed by lime (12.00 days) over control (12.48 days).

Effect of different bed disinfectants on the moth emergence of double hybrid mulberry silkworm (*Bombyx mori* L.) (Per cent)

The data pertaining to the effect of different bed disinfectants on the moth emergence of double hybrid mulberry silkworm (*Bombyx mori* L.) are presented in Table-1. The data (Table-1) revealed that significantly higher moth emergence of double hybrid mulberry silkworms (96.53 per cent) was recorded in treatment T_1 i.e. application of bed disinfectant Vijetha at the rate 5g per sq.ft. ½ hour before resuming feeding after each moulting and significantly lowest moth emergence (85.95 per cent) was recorded in treatment T_7 i.e. untreated control. The literature pertaining to effect of bed disinfectants on the moth emergence of double hybrid mulberry silkworm (*B. mori* L.) was not available so results could not be discussed.

Effect of different bed disinfectants on the fecundity of double hybrid silkworm (*Bombyx mori* L.)

The data on the effect of different bed disinfectants on fecundity of double hybrid mulberry silkworm (*Bombyx mori* L.) are presented in Table-1. The data on fecundity (Table-1) are statistically significant. The maximum fecundity of double hybrid mulberry silkworm (565.94 eggs) was recorded in T_1 i.e. application of bed disinfectant Vijetha at the rate 5g per sq.ft. ½ hour before resuming feeding after each moulting. Whereas, the lowest fecundity (439.17 eggs) were recorded in treatment T_7 i.e. untreated control. The effect of bed disinfectants Vijetha on fecundity of double hybrid mulberry silkworm could not be discussed for want of literature however, Jadhav (1990) [5] reported highest fecundity (504 eggs) in lime + paraformaldehyde treatment followed by lime (482 eggs) and formalin (462 eggs).

Effect of different bed disinfectants on the hatching percentage of double hybrid mulberry silkworm (*Bombyx mori* L.)

The data on the effect of different bed disinfectants on the hatching percentage of double hybrid mulberry silkworm (*Bombyx mori* L.) are presented in Table-1. The data (Table-1) revealed that the highest hatching percentage (96.31 per cent) was recorded in treatment T_1 i.e. application of bed disinfectant Vijetha at the rate 5g per sq.ft. ½ hour before resuming feeding after each moulting and it was at par with treatment T_3 i.e. application of bed disinfectant Vijetha supplement at the rate 5g per sq.ft. ½ hour before resuming feeding after each moulting (89.09 per cent). The significantly lowest hatching percentage was recorded in the treatment T_7 i.e. untreated control (84.84 per cent). Samson *et al*. (1987) [7] reported that the batch treated with formalin (1 per cent) gave highest hatching (98.04 per cent) when compared to untreated control (87.04 per cent). Venkataramana *et al*. (2002) [10] reported bed disinfectants, Vijetha and Resham Jyothi significantly improved effective rate of rearing. Vijetha was found to be very effective in improving ERR by number in line with the results obtained in the present investigation.

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