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COMPARATIVE EFFICACY OF DISINFECTANTS IN MANAGEMENT OF VIROSIS AND BACTERIOSIS IN TASAR CULTURE

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ABSTRACT

The field experiment was conducted to study the comparative efficacy of disinfectants in management of virosis and bacteriosis diseases infecting tasar silkworm. The experimental results revealed a significant difference among and between the treatments for virosis and bacteriosis incidence. It was observed that 0.01 % Sodium hypochlorite + 9:1 lime bleaching mixture treated plots showed minimum virosis (2.13 to 2.80 %) and bacteriosis (1.05 to 1.73 %) than other disinfectant treated plots. Whereas, untreated plots showed maximum incidence of virosis (29.45 to 40.15 %) and bacteriosis (11.73 to 14.15 %). The efficacy of disinfectants was in the order of 0.01 % Sodium hypochlorite + 9:1 lime bleaching mixture > 0.01 % Sodium hyphochlorite > 1.0 % Jeevan Sudha > 2 % formalin > 0.05 % Calcium hydroxide > 9:1 lime bleaching mixture. The cocoon yield, cocoon weight, shell weight and ERR (%) significantly differed among the treatments and disinfectant treated plots yielded higher number cocoons than untreated control. Maximum mean cocoon yield of 66.33 to 78.33 per dfls was observed in 0.01 % Sodium hypochlorite + 9:1 lime bleaching mixture treated plots, Whereas, minimum mean cocoon yield of 13.33 to 25.00 per disease free layings (dfls) was recorded in untreated plots. The application of disinfectants during rearing period reduced the viral and bacterial disease incidence and enhanced the effective rate of rearing (ERR %) followed by cocoon production.

Keywords: Disinfectants, diseases, efficacy, management, cocoon yield

Introduction

India is the second largest silk production country next to China and produces five distinct silk namely, Mulberry (*Bombyx mori*), Eri (*Samia ricini*), Muga (*Antheraea assamensis*), Tropical Tasar (*Antheraea mylitta*) and Temperate tasar (*Antheraea pernyi*). Tropical tasar silkworm is wild in nature and produces from *Terminalia arjuna*, *T. tomentosa* and *Shorea robusta* by rural tribes of Jharkhand, Chhattisgarh, Bihar, Odisha, Madhya Pradesh, Uttar Pradesh, West Bengal, Andhra Pradesh, Telengana and Maharashtra (Jolly *et al*., 1974; Singh *et al*., 2014). Since, Tasar silkworm rearing is outdoor in nature exposes to wide variety of stresses namely., abiotic (temperature, humidity, rainfall and wind), biotic (insect pest, birds, animals and diseases) and causes huge economic losses to silkworm industry (Singh *et al*., 1992; Kumar, 2003). Pebrine, bacteriosis, virosis and muscardine are major diseases infected by tasar silkworm caused by *Nosema mylitta*, various type of bacteria (*Bacillus sp*, *Micrococcus sp*, *Serratia marcesens*, *Proteus vulgaris* and *Pseudomonas sp*), AmCPV and *Penicililium citrinum* and *Penicilium variotii* (Fungus). Yield losses causes by pebrine, bacteriosis, virosis and muscardine were 20-25 %, 10-15 %, 25-30 % and 2-5 %, respectively, as on whole tasar silkworm diseases causes 40 % losses (Sahay, 2000). Tasar silkworm diseases can be reduced or prevented by certain

chemical disinfectants namely., slaked lime, formalin (Kagawa, 1980), Calcium hydroxide (Ishiwata and Zhou, 1988), Benomyl, NaoH, Sodium hypochlorite, labex (9:1 lime to bleaching powder) (Kobayashi *et al*., 1968; Ananthalakshmi *et al*., 1995), Jeevan sudha, Leaf surface Microbes (LSM), Tasar Keet Oushad (TKO) and Jeevan suraksha (Singh *et al*., 2008; Sahay *et al*., 2008; Roy *et al*., 2009; Singh *et al*., 2010; Madhusudan *et al*., 2013). However, information on comparative efficacy of disinfectants in management of tasar silkworm diseases was meager. Hence, present study was conducted to study the comparative efficacy of disinfectants in management of tasar silkworm diseases namely, virosis, bacteriosis and cocoon characteristics.

Materials and Methods

The experiment was conducted at departmental rearing farm, Basic Seed Multiplication and Training Centre, BTSSO, CSB, Salaiya, Lohrajhor, Madhupur, Jharkhand (Lattitude-24.26° N, Longitude-86.64° E and 748 ft above mean sea level (MSL)) with Randomized Block Design with seven treatment and three replication during 2019-20 and 2020-21. The chemical disinfectant (Sodium hypochlorite, Calcium hydroxide, lime, bleaching, formalin and Jeevan sudha) required for experimental purpose was obtained from Scientific corporation, Deoghar, Jharkhand and Biosafe hygiene, Ranchi. The test insect required for the experiment was utilized from own sources and released 25 dfls per replication in plot size of 20 m × 20 m. The rearing was performed during first Daba Bivoltine (July-Aug) and Second Daba Bivoltine (Sep-Dec) for both the year. The disinfectants chemicals such as 9:1 lime bleaching powder mixture dusted over larval body and rearing sites. Whereas, liquid based disinfectants such as Sodium hypochlorite, formalin, Calcium hydroxide and Jeevan sudha applied over larval body as well as foliage before transfer of worms to one foliage to another foliage during every instar. Moreover, disinfectants applied two times for fourth and fifth instar larvae. Virosis and bacteriosis infected larvae were collected periodically and counted throughout the rearing period and cocoon yield, cocoon weight, shell weight data recorded after harvest of cocoons. The percentage of virosis, bacteriosis, shell ratio and effective rate of rearing (ERR) was calculated by using formula given below (Mahfuz and Ahsan, 2004; Singh *et al*., 2014),

$$\% \text{ disease} = \frac{\text{Number of diseased larvae observed}}{\text{Number of healthy larvae observed}} \times 100$$

$$\text{Shell ratio } \% = \frac{\text{Shell weight (g)}}{\text{cocoon weight (g)}} \times 100$$

$$\text{Effective rate of rearing (ERR) } \% = \frac{\text{Total number of cocoons harvested}}{\text{Total number of worms brushed}} \times 100$$

Statistical Analysis

The count data obtained from experimental observation were converted to percentage data and analyzed using IBM SPSS statistics 20 software package after doing arc sine transformation. Means were separated using least significance difference (LSD).

Results and Discussion

The experimental results of comparative efficacy of disinfectant treated plots during first Daba bivoltine tasar silkworm rearing 2019-20 and 2020-21 revealed that virosis (%), bacteriosis (%), cocoon yield, cocoon weight (g), shell weight (g) and ERR (%) recorded in the range of 02.33 to 33.50, 1.05 to 12.25, 13.33 to 66.33, 08.83 to 10.35, 01.12 to 1.42 and 6.67 to 33.17, respectively. Minimum disease incidence was observed in T_5-9:1 lime bleaching powder dusting + 0.01 % Sodium hypochlorite treated plots which was recorded 02.33% and 02.13 % virosis, 01.45 % and 01.05 % bacteriosis. Whereas, T_7-untreated plots showed maximum disease incidence which was recorded 33.50% and 29.45 % virosis, 12.25 % and 11.73 % bacteriosis. The efficacy of T_1- 0.01 %- Sodium hypochlorite alone showed 04.17 % and 03.65 % virosis, 01.95 % and 1.88 % bacteriosis which is more or less on par with T_5. The treatments like T_5, T_1, T_6 effectively reduced the disease incidence when compared to other treatments and control (Table 1).

Table.1. Efficacy of disinfectant in management of virosis and bacteriosis during first crop Daba Bi-voltine 2019-20 & 2020-21

Treatments	Virosis (%)		Bacteriosis (%)		Cocoon yield/dfls		Cocoon weight (g)		Shell weight (g)		ERR (%)	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T1- 0.01 % sodium hyphochlorite @ 2.5 ml/lit	4.17	3.65	1.95	1.88	55.67	54.44	10.22	10.30	1.28	1.30	27.83	27.67
T2- 0.50 % Calcium hydroxide	7.87	6.53	4.53	4.22	46.00	45.67	10.23	10.23	1.27	1.29	23.00	22.17
T3- 9:1 Lime: bleaching	17.52	16.73	9.20	8.75	37.00	36.33	9.93	9.83	1.25	1.27	18.50	17.83
T4- 2 % formalin	8.15	8.02	5.00	4.45	44.67	42.44	10.31	10.41	1.28	1.25	22.33	22.17
T5- 9:1 Lime: Bleaching + 0.01 % Sodium hyphochlorite	2.33	2.13	1.45	1.05	66.33	66.00	10.35	10.32	1.42	1.39	33.17	32.17
T6- 1 % Jeevan Sudha	5.10	4.60	3.05	2.73	51.67	50.33	10.09	10.18	1.37	1.30	25.83	25.00
T7- Control	33.50	29.45	12.25	11.73	13.33	15.67	9.60	8.83	1.15	1.12	6.67	6.83
Standard Error	**0.60**	**0.36**	**0.15**	**0.14**	**1.44**	**1.42**	**0.11**	**10.31**	**0.02**	**0.04**	**0.72**	**0.71**
CD (5 %)	**1.84**	**1.11**	**0.47**	**0.43**	**4.46**	**4.42**	**0.34**	**0.25**	**0.07**	**0.10**	**2.23**	**2.20**

Table.2. Efficacy of disinfectant in management of virosis and bacteriosis during second crop Daba Bi-voltine 2019-20 & 2020-21												
Treatments	**Virosis (%)**		**Bacteriosis (%)**		**Cocoon yield/dfls**		**Cocoon weight (g)**		**Shell weight (g)**		**ERR (%)**	
	2019-20	**2020-21**	**2019-20**	**2020-21**	**2019-20**	**2020-21**	**2019-20**	**2020-21**	**2019-20**	**2020-21**	**2019-20**	**2020-21**
T1- 0.01 % Sodium hyphochlorite @ 2.5 ml/lit	4.87	5.13	2.47	2.32	66.00	65.67	12.08	12.50	1.87	1.85	33.00	33.33
T2- 0.50 % Calcium hydroxide	8.77	12.62	5.13	4.78	49.67	49.67	11.75	11.58	1.80	1.77	24.83	25.50
T3- 9:1 Lime: bleaching	18.10	19.27	10.17	9.77	42.67	42.33	10.97	9.75	1.70	1.55	21.33	21.50
T4- 2 % formalin	8.60	8.30	5.75	5.98	47.00	44.00	10.75	10.83	1.70	1.75	23.50	22.17
T5- 9:1 Lime: Bleaching + 0.01 % Sodium hyphochlorite	2.75	2.80	1.73	1.68	78.33	77.33	12.75	13.00	1.97	1.97	39.17	39.50
T6- 1 % Jeevan Sudha	5.67	6.02	3.55	3.43	54.00	51.33	11.58	12.25	1.80	1.78	27.00	26.50
T7- Control	37.25	40.15	14.17	14.15	25.00	23.00	9.93	9.92	1.38	1.42	12.50	13.17
Standard Error	**0.64**	**0.48**	**0.15**	**0.21**	**1.54**	**1.20**	**0.14**	**0.19**	**0.03**	**0.03**	**0.77**	**0.65**
CD (5 %)	**1.97**	**1.48**	**0.46**	**0.66**	**4.74**	**3.69**	**0.42**	**0.58**	**0.09**	**0.09**	**2.37**	**2.00**

Similarly, during second Daba bivoltine rearing 2019-20 and 2020-21 recorded 02.75 to 40.15 % virosis, 1.68 to 14.17 % bacteriosis, 23.00 to 78.33 cocoons, 09.92 to 12.50 g cocoon weight, 01.38 to 01.87 g shell weight and 12.50 to 39.50 % effective rate of rearing. Minimum disease incidence was recorded in T_5 which is significantly differs from all other treatments which was recorded 02.75 % and 02.80 % virosis, 01.73 % and 01.68 % bacteriosis. Treatments T_1 on with T_6 and treatment T_2 on par with T_4 in disease incidence and cocoon characteristics. Whereas, maximum disease incidence was recorded in T_7- untreated plots which was recorded 37.25 % and 40.15 % virosis, 14.17 % and 14.15 % bacteriosis. Similar, trends was recorded in cocoons parameters such as yield, cocoon weight, shell weight and effective rate of rearing (Table 2).

The disinfectant chemicals such as 0.01 % Sodium hypochlorite alone or in combination with 9:1 lime bleaching mixture, 1.0 % Jeevan sudha, 0.50 % Calcium hydroxide and 2 % Formalin effectively reduced the disease incidence in both the bivoltine crops. Similarly, G.P. Singh *et al.* (2005) reported 0.5 % slaked lime, 2.0 % formalin and 5 % bleaching powder inactivated the AmCPV. Vail *et al.* (1968); Sahay *et al.* (2008) and Singh *et al.* (2014) reported that Sodium hypochlorite (NaoCl) deactivated and reduced the virosis and bacteriosis in Cabbage looper, Mulberry silkworm and Muga Silkworm, respectively. Rao *et al.* (1992) reported effectiveness of lime bleaching powder mixture for reduction of muscardine and grasserie diseases in silkworm. Balavenkasubbaih *et al.* (1994) reported that slaked lime solution deactivated BmCPV in *Bombyx mori* L. Ishiwata and Zhou (1988) reported the efficiency of Calcium hydroxide in deactivation of NPV in *Bombyx mori* L. Several authors reported the mechanism and efficacy of disinfectants in management of silkworm diseases. In present study, we provided comparative efficacy of disinfectants in reduction of virosis and bacterisis incidence at field level.

Conclusion

Sodium hypochlorite (0.01 % @ 2.5 mL/l) alone or in-combination with 9:1 bleaching and lime powder mixture, 1 % Jeevan sudha, 2.0 % formalin and 0.50 % Calcium hydroxide effective in reduction of virosis and bacteriosis disease in tasar culture under field condition. Moreover, dusting of 9:1 lime bleaching powder in rearing site followed by spraying of 0.01 % Sodium hypochlorite on foliage and larval body during larval transfer effectively reduced the disease incidence. However, application of 2.0 % formalin not recommended due to photo-toxicity effect on host plants.

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