Journal of Applied Biology & Biotechnology Vol. 2 (02), pp. 012-015, March-April, 2014
Available online at http://www.jabonline.in
DOI: 10.7324/JABB.2014.2203

Efficacy of sodium hypochlorite in controlling viral and bacterial diseases in muga silkworm, *Antheraea assamensis* Helfer.

N. Ibotombi Singh, Dulal Goswami, Mushtaq Ahmed and K. Giridhar

Central Muga Eri Research and Training Institute Lahdoigarh, Jorhat-785700, Assam, India.

ARTICLE INFO

Article history:
Received on: 18/01/2014
Revised on: 13/02/2014
Accepted on: 05/04/2014
Available online: 27/04/2014

Key words:
Antheraea assamensis Helfer, sodium hypochlorite, virosis, bacteriosis .

ABSTRACT

The incidence of the viral and bacterial diseases *viz.* flacherie and grasserie caused large mortality to the muga silkworm, *Antheraea assamensis* Helfer thereby affected the cocoon silk production. It was observed that the application of 0.01 % of NaOCl to the silkworms at larval instars, reduced the mortality due to bacterial and viral diseases quite significantly ($P < 0.1$ & $P < 0.05$) as compared to the control without affecting the quality of cocoons during different seasons at the different locations. The values of Effective Rate of Rearing (E.R.R. %) in the treated lots was significantly higher ($P < 0.1$ & $P < 0.05$) than that of control in all the crop seasons at the different locations. The results of the present study deduced that the application of 0.01 % of Sodium hypochlorite during the rearing of muga silkworm, *Antheraea assamensis* Helfer can effectively control the larval mortality due to bacterial and viral diseases thereby enhance the cocoon production.

1. INTRODUCTION

The muga silkworm *Antheraea assamensis* Helfer is a holometabolus sericigenous insect endemic to North East region of India only. This silkworm produces the unique golden colour silk which is more durable and has high demand in the global market. This silkworm is polyphagous in nature and feeds on a wide range of host plants [1]. Among the food plants, 'som' *Persea bombycina* Kost and 'soalu' *Litsea monopetala* Juss, are the two major primary food plants. Out of these two primary food plants 'soalu' *Litsea monopetala* Juss is semi-deciduous in nature while the other is evergreen. The muga silkworm is multivoltine in nature and is generally reared six crops in a year. Annually, India produces about 126 tons of muga raw silk. Due to outdoor nature of rearing muga silk worms are exposed to various rigors of changing environment of the varied topography of the region and thus the silkworm is prone to various diseases leading to heavy loss in production [2, 3]. Outbreak of various diseases viz., pebrine, flacherie, muscurdine and grasserie are the major constrains encountered in muga industry. Out of these diseases, flacherie and grasserie caused by virus and bacteria occurred mostly in every season and thereby causing death of considerable number of larvae which ultimately affects the cocoon silk production. The pathogens primarily infect the alimentary tract of the silk worm, but high infection may affect blood cells,hypodermis and fat bodies too. Even after providing quality foliage and suitable environmental conditions during the rearing, in every crop about 14-40% crop loss normally occurred due to incidence of such diseases [4]. Disinfection and maintenance of hygienic condition during rearing are essential factors for preventing occurrence of diseases. Various disinfectants namely, formalin [5], bleaching powder [6, 7], Calcium hydroxide [8] and Chlorine dioxide [9] have been effectively used to minimize disease incidences. Besides, different antibiotics *viz.* Triazoles, Triadime, Streptomycine sulphate, Gentamycine, Cloxacillin, Kanamycine, Chloram-phenicol, Tetracycline and Aureofungin were used for control of diseases in mulberry silkworm, *Bombyx mori* [10,11,12,13]. Sodium hypochlorite as egg surface sterilant was also reported in *B. mori* [14]. The efficacy of Sodium hypochlorite in controlling mortality due to bacterial and viral diseases has been reported in *Antheraea mylitta* [15]. Considering the effectiveness of Sodium hypochlorite as disinfectant and control of certain diseases in seri-culture, the present study was taken up to observe the efficacy of this chemical against viral and bacterial diseases in *A. assamensis* Helfer.

MATERIALS AND METHODS

Disease free layings (dfls) of Muga Silkworm *Antheraea assamensis* Helfer were obtained from the Silkworm Improvement Division, Central Muga Eri Research & Training Institute, Jorhat, Assam (India).The rearing was conducted in outdoor on the foliages of som, *Persea bombycina* Kost. and Soalu,*Litsea monopetala* Juss

* *Corresponding Author*
Email: ibotombisingh@yahoo.co.in

at two separate locations viz. Germplasm Conservation Centre (GCC), Chenijan, Assam and Farm No. 03, Central Muga Eri Research & Training Institute, Lahdoigarh, Assam (India) for three seasons viz. Aherua (June-July), Jarua (January-February) and Chatua (February-March) during 2011 and 2012. During these seasons, higher mortality of worms usually occurred due to incidence of viral and bacterial diseases. Four different concentrations of NaOCl solution viz. 0.001 %, 0.01 %, 0.05 % and 0.1 % were sprayed with the help of the foot sprayer on the foliages once before 2-3 days of rearing, then once each at 2^{nd}, 3^{rd} and 4^{th} instars and twice at 5^{th} instars on the body of the larvae along with the foliages during the rearing. The silkworm larvae were fed with the treated leaves. The concentrations 0.1% and 0.05 % were found to be corrosive to the leaves while 0.001 % was not so effective against the control of diseases. The concentration 0.01 % was found to be more effective in controlling the bacterial and viral diseases and more safe to the leaves. Therefore, 0.01 % of NaOCl was sprayed on the body of the larvae and foliages during the rearing. Each treatment comprised of 4 replications with 500 worms in each replication which were hatched on the same day. The experiment was conducted in a completely randomised design in two different locations for two consecutive years. In the control lot also same numbers of replications with same number of worms were maintained and only distilled water was sprayed on them. Data of mortality of worms due to diseases, effective rate of rearing (ERR %), cocoon weight and shell weight were recorded.

Effective Rate of Rearing (ERR %) was calculated as follows;

$$\text{ERR \%} = \frac{\text{Number of larvae reared}}{\text{Number of Cocoons formed}} \times 100$$

The recorded data were analyzed statistically and significant differences of the treatment means were compared by using the statistical package SSP (Version 1.0.0.0.).

RESULTS AND DISCUSSION

Among the different concentrations of NaOCl viz., 0.01 %, 0.05% and 0.1 %, the first concentration (0.01%) was found more effective in controlling the mortality due to bacterial and viral diseases (Table I). However, the last two concentrations have shown corrosive action to the leaves and the treated larvae at these concentrations produce low quality cocoons. The larvae treated with concentration of 0.001 % do not show much reduction of mortality as compared to the control. Therefore, 0.01 % of NaOCl was selected for multilocational testing of its efficacy in controlling the mortality due to bacterial and viral diseases in the golden Indian muga silkworm, *Antheraea assamensis* Helfer since it did not show any adverse effect on the quality of the cocoons.

It was observed that when 0.01 % of NaOCl was applied to the silkworms, the mortality due to bacterial and viral diseases reduced quite significantly ($P < 0.1$ & $P < 0$ .05) as compared to the control without affecting the quality of cocoons during different seasons at the different locations (Table II and III). During Jarua Crop (December-January), the mortality in the NaOCl treated lots at GCC, Chenijan were recorded as 12.50 % during 2011 and 8.55 % during 2012 while at farm No. 3, the mortality during this season were recorded as 10.23 % during 2011 and 10.25 % during 2012 which were significantly lower as compared to the control lots. Significant difference on the quality of cocoon and cocoon shell were not observed between treated and control lots as shown in Table II and III. Larval mortality due to Flacherie disease accounts for major crop loss in muga culture. The larval mortality due to Flacherie during Jarua crop was recorded as high as 92. 66 % [16]. During Chatua Crop (February-March), the mortality in the treated lots were recorded as 8.54 % during 2011 and 9.75 % during 2012 at GCC, Chenijan while it was recorded as 5.62 % and 5.55 % respectively at Farm No. 3, Lahdoigarh which were significantly ($P < 0.1$ & $P < 0$ .05) lower as compared to the control lots. It is evident from Table II & III that there was no adverse effect on the quality of cocoon and cocoon shell due to the treatment as compared to the control. Similarly, during Aherua Crop (June-July), the mortality in the treated lots were significantly($P < 0.1$ & $P < 0$ .05) reduced to 4.82 % against 24.64 % of control during 2011 and 12.44 % against 30.22 % of control during 2012 at GCC, Chenijan while at Farm No. 3, mortality was recorded as 4.52 % against 30.88 % of control and 7.83 % against 34.82 % in control respectively during the two years showing significant ($P < 0.1$ & $P < 0$ .05) reduction of the mortality after the application of NaOCl solution. The values of E.R.R. % in the treated lots were significantly ($P < 0.1$ & $P < 0$ .05) higher than that of control in all the crop seasons and years at the different locations (Table-II & III). As evident from Table-II & III, the E.R.R. during crop seasons ranged from 50.52 % to 64.87 % in the treated lots at the different locations while in the control lots, it ranged from 38.62 % to 47.34 % which indicated the efficacy of NaOCl solution in increasing the survivability in muga silkworms. Sodium hypochlorite acts as a leave surface disinfectant. Sodium hypochlorite is effective against bacteria, viruses and fungi and it disinfects the same way as chlorine does. When sodium hypochlorite dissolves in water, two substances viz. hypochlorous (HOCl) and the less active hypochlorite ion (OCl^-) are formed, which play a role for oxidation and disinfection. The bactericidal and virucidal effect of active chlorine and NaOCl has been reported in the larvae of cabbage looper [14] and *Bombyx mori* [17]. The application of NaOCl (0.05-0.5 %) was found to effectively reduce the viability and infectivity of *Bacillus thuringiensis*, *Beauvaria bassiana* and nuclear polyhedrosis virus (NPV) in cabbage looper [18]. It has been observed that the bactericidal and virucidal action of NaOCl is mainly caused by the release of hypochlorous acid (HOCl). The hypochlorite ion OCl^- may be a contributing factor since alkaline hypochlorite solutions show some antibacterial potency. The application of NaOCl disrupted the normal protoplasmic balance in the living cell which eventually caused the death of the pathogens and reduced the mortality of the host silkworm. From the present study it is deduced that the application of 0.01 % of Sodium hypochlorite during the rearing of muga silkworm, *Antheraea assamensis* Helfer can effectively control the mortality due to bacterial and viral diseases thereby will enhance the cocoon production.

Table. I: Effect of different concentrations of NaOCl on the ERR % of *A. assamensis.*

Concentration	Crop season		
	Jarua (December-January)	Chatua (February-March)	Aherua (June-July)
0.001%	42.60	47.25	55.65
0.01%	**60.40**	**64.65**	**66.55**
0.05%	**60.58**	**62.45**	**65.45**
0.1%	55.64	58.35	54.70
Control	38.52	44.50	52.40

Table. II: Effect of NaOCl Flacheri disease and commercial characters of *A. assamensis* during 2011-12.

Crop/Season	Location	Treatment with NaOCl (0.01 %)	Incidence of disease (%)	ERR %	Cocoon weight (g)	Shell weight (g)
Jarua (Dec-Jan)	GCC Chenijan	Control	46.72	40.22	5.65	0.42
		Treatment	12.50	61.71	6.28	0.45
	Farm No: 03 Lahdoigarh	Control	41.82	42.62	5.53	0.40
		Treatment	10.23	51.75	6.12	0.47
Chatua (Feb-March)	GCC Chenijan	Control	36.75	47.34	6.22	0.52
		Treatment	8.54	56.81	6.85	0.58
	Farm No: 03 Lahdoigarh	Control	37.42	51.87	5.56	0.49
		Treatment	5.62	57.77	6.02	0.52
Aherua (June-July)	GCC Chenijan	Control	24.64	55.52	5.54	0.58
		Treatment	4.82	64.87	6.45	0.62
	Farm No: 03 Lahdoigarh	Control	30.88	54.72	5.8	0.52
		Treatment	4.52	66.82	6.54	0.58
CD at 5%			7.604	7.618	0.362	0.089
1%			11.357	11.372	0.541	0.131

Table. III: Effect of NaOCl Flacheri disease and commercial characters of *A. assamensis* during 2012-13.

Crop/Season	Location	Treatment with NaOCl (0.01 %)	Incidence of disease (%)	ERR %	Cocoon weight (g)	Shell weight (g)
Jarua (Dec-Jan)	GCC Chenijan	Control	36.62	44.62	5.55	0.45
		Treatment	8.55	58.45	6.0	0.42
	Farm No: 03 Lahdoigarh	Control	40.20	42.23	5.06	0.45
		Treatment	10.25	50.52	5.58	0.42
Chatua (Feb-March)	GCC Chenijan	Control	46.52	38.62	5.52	0.49
		Treatment	9.75	52.27	6.02	0.52
	Farm No: 03 Lahdoigarh	Control	23.62	42.33	5.50	0.48
		Treatment	5.55	57.62	5.85	5.0
Aherua (June-July)	GCC Chenijan	Control	30.22	40.56	5.98	0.48
		Treatment	12.44	54.56	6.0	0.45
	Farm No: 03 Lahdoigarh	Control	34.82	45.55	5.58	0.48
		Treatment	7.83	57.23	6.02	0.52
CD at 5%			7.432	3.678	0.305	0.086
1%			11.093	5.491	0.456	0.128

REFERENCE

1. Choudhury, S.N. Muga Silk Industry, Directorate of Sericulture, Govt. of Assam; 1970.
2. Thangavalu, K., Chakravorty, A.K., Bhagabati, A.K. Hand book of Muga culture. Pp 75-84; 1988.
3. Das, K., Borah, A., and Chakravorty, R. Seasonal incidence of diseases in muga silkworm *Antheraea assamensis* Helfer in different muga growing belts. Proc. The 20th Congress of the International Sericulture Commission. 2005; pp 259-263.
4. Chakravorty, R., Das, R., Neog, K., Das, K., Sahu, M. A diagonostic manual for diseases and pest of muga silkworm and their host plants. Published by CMER&TI, Central Silk Board, Lahdoigarh, and Jorhat, Assam. Pp 1-47; 2007.
5. Kagawa, T. The efficacy of formalin as disinfectant of *Nosema bombycis* spores. J. Seri. Sci. Jpn. 1980: 49(3): 218-222.
6. Kobayashi, H., Sato, F. and Ayuzawa, K. On the disinfecting ability of the mixture of bleaching power and formalin. J. Seric. Sci. Jpn. 1968: 37: 311-318.
7. Ananthalakshmi, K.V.V., Baig, M. and Dutta, R.K. Effect of temperature and duration of treatment on the germicidal activity of selected disinfectants against *Nosema bombycis*. Current technology seminar on seed technology, Silkworm seed technology laboratory, Kodathi, Bangalore, India, Nov17-18, P 45; 1995.
8. Ishiwata, Y. and Zhou, C.Q. 1988. Inactivation by the treatment of nuclear polyhedrosis virus of the silkworm *Bombyx mori* L. with calcium hydroxide solution. J. seri. Jpn. 1988: 57:511-518.
9. Balavenkatasubbaiah, M., Nataraju, B and Dutta, R. K. Efficacy of chlorine dioxide and virkon-s as disinfectants against pathogens of silkworm. *Bombyx mori* L. Current Technology Seminar on Silkworm disease management, Silkworm rearing Technology and Mulberry pathology, October 25-26, Central Sericultural Research and Training, Berhampore, India p.12; 1995.
10. Rai, B. R. and Devaiah, M. C. Effect of antibiotics on the incidence of diseases in silkworm, *Bombyx mori* L.: International Congress on Tropical Sericulture Practices, Bangalore, India; 1988.
11. Baig, M., Nataraju, B., and Samson, M. V. Studies on the effect of antibiotics on rearing performance and loss due to diseases in silkworm, *Bombyx mori*. Indian J. Seric. 1980: 29(1): 54-58.
12. Javare Gowda, B. L. and Zhou, C. Q. In vitro evaluation of antifungal antibiotics against the fungus *Beauveria bassina* (Bals) Vuil, pathogenic to the silkworm, *Bombyx mori* L. In Recent Trends in Sericulture. Jasti Pramoda Kumari (Eds), S. V. University, Tirupati, India; 1988.
13. Sreedhara, V. M., Shree, M.P., Boraiah, G. A. and Fletcher, R. A. Muscardine disease of silkworm controlled by triazoles. Sericologia. 1991:31: 423-426.

14. Vail, P. V., Henneberry, T. J., Krishaba, A. N. and Arakawa, K.Y. Sodium hypochlorite and formalin antiviral agents against nuclear polyhedrosis virus in larvae of the cabbage looper. J. Invertebr. Pathol. 1968: 10: 84-93.
15. Alok Sahay, Ojha, N. G., Kulshrestha V., Singh, G. P., Roy, D.K. and Suryanarayana, N. Application of sodium hypochlorite for controlling virosis and bacteriosis in tasar silkworm, *Antheraea mylitta* D. Sericologia. 2008: 48(1):71-79.
16. Rashmimala Kakoti. Impact of environmental factors on outbreak of Diseases in the muga crops, *Antheraea assama*, Westwood (Lepidoptera: saturniidae), in Kamrup District (Assam). The Bioscan. 2011: 6(1): 103-106.
17. Subha Rao, G., Chandra, A. K. and Bhattacharya, J. Effect of bleaching powder and lime against grasserie and muscardine diseases of silkworm, *Bombyx mori* L. Indian J. Seric. 1992: 31(1): 37-40.
18. Ignoffo, C. M. and Dutki, S. The effect of sodium hypochlorite on the viability and infectivity of *Bacillus* and *Beauveria* spores and cabbage looper nuclear polyhedrosis virus. J. Insect Pathol. 1963: 5, 422-426.

How to cite this article:

N. Ibotombi Singh, Dulal Goswami, Mushtaq Ahmed and K. Giridhar. Efficacy of Sodium Hypochlorite in Controlling Viral and Bacterial Diseases in Muga Silkworm, *Antheraea Assamensis* Helfer. J App Biol Biotech. 2014; 2 (02): 012-015.