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Original Research Paper

Influence on the Overall Performance of the Mulberry Silkworm, *Bombyx mori* L. CSR-19 Cocoon Reared with V1 Mulberry Leaves Irrigated by Different Proportions of Spent Wash

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ABSTRACT

CSR-19 silkworm reared with V1 variety of mulberry plants irrigated by raw water, 50% pretreated spent wash (PTSW) and 33% PTSW. The different parameters such as raw silk (%), filament length (m), reelability (%), denier and shell ratio were determined at the maturity of cocoons. It was found that the parameters were better in cocoon irrigated with 33% PTSW compared to 50% PTSW and raw water irrigation. This concludes that the mulberry plants irrigated with 33% PTSW are enriched with more nutrients for the potential growth of mulberry plants which results in the potential cocoons.

INTRODUCTION

The silkworm, *Bombyx mori* L. is a typical monophagous insect and mulberry (*Morus* spp.) leaf is its sole food. Man has immensely benefited from the silk produced by silkworms and subsequently researchers have always been trying to unveil the factors that can be manipulated to the benefit of the silkworm rearers. Sericulture is an age-old land-based practice in India with high employment potential and economic benefits to agrarian families. No doubt, India is the second largest producer of mulberry silk next only to China. Plants are the richest source of organic chemicals on earth and phytochemicals have been reported to influence the life and behaviour of different insects. Various extracts of medicinal plants have been tested by supplementation in the silkworm *Bombyx mori* and were seen to influence the body weight, silk gland weight and the silk thread length in *Bombyx mori* (Murugan et al. 1998). Dietary supplementation of the leaf, flower and pod extracts of *Moringa oleifera* and chitosan solution (Bin Li et al. 2010) elicited varied responses in the final instar larvae of *Bombyx mori*. Nutrition plays an important role in improving the growth and development of *B. mori* (Kanafi et al. 2007). Alagumalai et al. (1991) observed fortification of mulberry leaves with the flour of black gram and red gram to improve the larval growth and cocoon characteristics in *B. mori*. Similarly, the growth of silkworm larvae improved significantly upon feeding them with mulberry leaves supplemented with different nutrients. The quantity and the quality of dietary protein has long been considered to be important in the growth of the silkworm. Higher growth rate as well as weight gain can be observed in higher protein utilized group and the relative growth rate varied among the different breeds of the silkworm (Magadum et al. 1996) and were influenced by the season (Isaiarasu & Suriabraman 1999). The difference in the relative growth rate of *Aloe vera* tonic supplemented larvae from the control observed in the present study indicates that the *Aloe vera* supplementation results in higher protein utilization. Murugan et al. (1998) noticed a strong correlation between the growth of silkworm and the silk production in the silkworm after the treatment with plant extracts and attributed the growth promoting effect of the plant extracts to the stimulation of biochemical processes leading to protein synthesis. The economic characters of the silk cocoon were reported to improve by feeding the silkworm with mulberry leaves treated with amino acids. The cocoon weight increased when the silkworm larvae were fed with blood meal fortified mulberry leaves (Matsura 1994). Chamudeswari & Radhakrishnaiah (1994) reported the increase of cocoon weight, when the silkworm larvae were fed with zinc and nickel fortified mulberry leaves. Majumdar & Medda (1995)

reported the supplementation of tyrosine to enhance the cocoon weight due to the increased synthesis of DNA, RNA and proteins in silk gland. The weight and the size of cocoon shell ratio and fibroin content of the shell increased with the supplementation of the amino acid and glycine (Isaiarasu & Ganga 2000). It was reported that administration of JH analogue, Methaprene, to fifth instar larvae of *B. mori* through hypodermic injection increased the shell weight by 16 percent over the control. Improvement in economic characters of silkworm was also noticed with folic acid administration. The silkworm larvae fed on mulberry leaves treated with *Coffea arabica* leaf extracts at 1:25 concentration recorded significantly higher growth.

Diluted spent wash increases the uptake of nutrients, height, growth and yield of leafy vegetables (Chandraju et al. 2007, Basvaraju & Chandraju 2008) and yields of condiments (Chandraju & Chidan Kumar 2009), yields of some root vegetables in untreated and spent wash treated soil (Chidan Kumar et al. 2009), yields of top vegetables (creepers) (Chidan Kumar et al. 2009), yields of tuber/root medicinal plants (Nagendra Swamy et al. 2010), yields of leafy medicinal plants (Nagendraswamy et al. 2010), yields of leafy medicinal plants in normal and spent wash treated soil (Chandraju et al. 2010). However, no information is available on the yields of cocoon parameters of silkworms CSR-19, reared using V1 mulberry leaves cultivated by irrigation with distillery spent wash. Therefore, the present investigation was carried out to study the influence of V1 mulberry leaves cultivated by irrigating with different proportions of spent wash on the cocoon parameters of silkworms CSR-19, reared using V1 mulberry leaves.

MATERIALS AND METHODS

Mulberry plant selected for the present study was V1 variety. The land was ploughed repeatedly (3 to 4 times) to loosen the soil and all gravel, stones and weed were removed to get the fine soil. The ridges and furrows were made at a distance of 1.0 m, sets were planted at a distance of 0.6 m (set to set) along the row and irrigated (by applying 5-10cm^3/cm^2) with raw water (RW), 50% and 33% pretreated spent wash (PTSW) at the dosage of once in fortnight and rest of the period with raw water (depending upon the climatic condition), without the application of any external fertilizer (either organic or inorganic). Harvesting of the leaves was done by plucking individual leaf during cooling hours of the day, which were 50-60 days old. These fresh leaves were used to rear silkworms.

Disease free laying of the silkworm were obtained and raised on fresh mulberry leaves as per the new technology for silkworm rearing (Dandin et al. 2000). After third moult, the larvae were acclimatized to the laboratory conditions by rearing them during the fourth instar in plastic trays of size 26 × 20 × 6 cm. During this period, they were fed four times a day. Sufficient ventilation was ensured to the larvae by placing the trays one above the other crosswise. Coolant gel bags were used to bring down the temperature and wet synthetic foam pads were used to enhance the relative humidity near the larval bed within the optimum level. A thermo-hygrometer was used to record the temperature and relative humidity near the larval bed. Fresh and healthy leaves of V1variety of mulberry were used in the present study. The leaves were harvested daily from the mulberry garden during the early hours of the day and stored cool to maintain its freshness until use using wet gunny cloth in a wooden chamber. Disinfection was carried out prior to the commencement of silkworm rearing as a precautionary measure against pathogens, which may remain in the rearing room and are likely to infect the silkworm. For this, the rearing room was disinfected by spraying 2% formalin solution 3 days prior to the commencement of rearing. The rearing materials such as trays and mountages were washed with chloralk solution. Dettol solution was used to wash the hands before and after handling the worms during the time of rearing. A bed disinfectant powder prepared by grinding lime powder, paraformaldehyde and benzoic acid in 97:2:1 ratio was dusted mildly on the worms daily after bed cleaning. Dead larvae if any, during the course of rearing were immediately removed and discarded properly. The larvae in both the control and experimental trays were reared with equal quantities of leaves. The temperature and relative humidity were maintained at about 26 ± 2°C and around 70 ± 10 per cent respectively. Several parameters were studied to assess the growth and the cocoon characteristics of *B. mori*. The mature larvae of the experimental sets were isolated and mounted on separate plastic mountage (Netrika). They were left undisturbed for four days to spin the cocoon. The cocoon were harvested. Then cocoons were collected after harvest and cleaned by removing litter. Trials were conducted thrice, cocoon parameters, such as raw silk percentage, filament length, reelability, denier and shell ratio were determined, recorded by taking the average values. These quantitative parameters were measured by the procedures given by Sonwalkar (1993).

RESULTS AND DISCUSSION

The cocoon parameters were very high reared using V1 variety mulberry plant leaves cultivated by 33% SW irrigation, and moderate in 50%, while comparatively poor in RW (Table 1). In our previous studies we also found that 33% SW irrigation favours the growth, yield and nutrients of plants. This could be due to the maximum absorption of

Table 1: Parameters of CSR-19 cocoon reared with mulberry leaves at different spent wash irrigation.

Cocoon parameters	Irrigation Medium		
	RW	50% PTSW	33% PTSW
Raw silk (%)	18.00 ± 0.019	20.66 ± 0.009	23.62 ± 0.010
Filament length (m)	772.00 ± 0.008	860.33 ± 0.010	959.34 ± 0.007
Reelability (%)	81.93 ± 0.011	83.50 ± 0.008	85.33 ± 0.010
Denier	2.61 ± 0.012	2.68 ± 0.009	2.78 ± 0.011
Shell ratio	20.77 ± 0.013	21.6 ± 0.006	22.59 ± 0.008

NPK by the plants at 33% dilution. In the case of 50% SW irrigation the yields were low.

Enrichment of nutrients in V1 mulberry leaves cultivated with 33% spent wash resulted in healthy growth of silkworms containing comparatively high proportion of natural protein fibre secreted by silkworms in the form a thread, fibroin-inner core comprising 75% of silk, sericin-outer gum comprising 25% of silk.

CONCLUSION

It was observed that the parameters of cocoons produced by rearing the silk worms using V1 variety of mulberry leaves cultivated by irrigation in 33% PTSW were maximum and moderate in 50% PTSW and minimum in RW irrigation. It concludes that in 33% PTSW irrigation the plants are able to absorb maximum amounts of nutrients (NPK) both from the soil and the spent wash resulting in high yield and enhance the nutrients in plants leaves which in turn influence the better growth of silkworms containing higher proportion of silk proteins, yields spinning of long silk threads in cocoons resulting in increased weight of cocoons, minimizes the cost of cultivation, and increase the parameter values of cocoons resulting in high silk production. This can elevate the economy of the farmers, since cultivation of mulberry is made without using fertilizer.

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REFERENCES

Alagumalai, K., Hepshyba, C.S.S. and Ramaraj, P. 1991. Bran of pulses as extra nutrient to silkworm. Indian Silk, 30(6): 10-11.

Basavaraju, H.C. and Chandraju, S. 2008. Impact of distillery spent wash on the nutrients of leaves vegetables: An Investigation. Asian J. of Chem., 20(7): 5301-5310.

Bin Li, Ting Su, Xiaoling Chen, Baoping Liu, Bo Zhu, Yuan Fang, Wen Qiu and Guanlin Xie 2010. Effect of chitosan solution on the bacterial septicemia disease of *Bombyx mori* (Lepidoptera: Bombycidae) caused by *Serratia marcescens.* Applied Entomology and Zoology, 45: 145-152.

Chamudeswari, P. and Radhakrishnaiah, K. 1994. Effect of zinc and nickel on the silkworm, *Bombyx mori* L. Sericologia, 34(2): 327-332.

Chandraju, S. and Basavaraju, H.C. 2007. Impact of distillery spent wash on seed germination and growth of leaves vegetables: An investigation. Sugar Journal (SISSTA), 38: 20-50.

Chandraju, S., Nagendra Swamy R., Chidan Kumar, C.S. and Girija Nagendraswamy 2010. Influence of distillery spentwash irrigation on the yields of leafy medicinal plants in normal and spentwash treated soil. Internat. J. Agric. Sci., 7(1): 23-26.

Chidan Kumar, C.S., Chandraju, S. and Nagendra Swamy, R. 2009. Impact of distillery spentwash irrigation on yields of top vegetables (creepers). World Appl. Sci. J., 6(9): 1270-1273.

Chidan Kumar, C.S., Chandraju, S. and Nagendra Swamy, R. 2009. Impact of distillery spentwash irrigation on the yields of some root vegetables in untreated and spentwash treated soil. SISSTA, 40: 233-236.

Chidan Kumar, C.S. and Chandraju, S. 2009. Impact of distillery spentwash irrigation on the yields of some condiments: An investigation. Sugar Tech., 11(3): 303-306.

Dandin, S.B., Jayaswal, J. and Giridhar, K. 2000. Handbook of Sericulture Technologies. Central Silk Board, Bangalore, pp. 259.

Isaiarasu, L. and Ganga, G. 2000. Influence of dietary glycine supplementation on the mulberry silkworm, *Bombyx mori.* ANJAC Journal, 17: 47-53.

Isaiarasu, L. and Suriabraman, S. 1999. Seasonal differences in the biochemical composition of M5 and MR2 varieties grown in Sivakasi and their influence on the growth of the late age larvae of *Bombyx mori.* Journal of Ecobiology, 11(3): 229-231.

Kanafi, R.R., Ebadi, R., Mirhosseini, S.Z., Seidavi, A.R., Zolfaghari, M. and Eteban, K. 2007. A review on nutritive effect of mulberry leaves enrichment with vitamins on economic traits and biological parameters of silkworm, *Bombyx mori* L. Indian Sericulture Journal, 4: 86-91.

Magadum, S.B., Hooli, M.A. and Magadum, V.B. 1996. Effect of the application of juvenile hormone analoguein V instar followed by thyroxin in the pure Mysore Breed of *Bombyx mori*. L. Sericologia, 32 (3): 385-390.

Majumdar, A.C. and Medda, A.K. 1995. Studies on the thyroxin and vitamin B2 induced changes in the cycle of Silkworm *Bombyx mori.* Indian Journal of Physiology and Applied Science, 29: 1-13.

Matsura, Y. 1994. Utilization of blood meal as the source of dietary protein for the silkworm, *Bombyx mori* L. Japan Agriculture Research Quarterly, 28(2): 133-137.

Murugan, K., Jeyabalan, D., Senthikumar, N., Senthilnathan, S. and Sivaprakasam, N. 1998. Growth Promoting effect of plant products on silkworm - A Biotechnological approach. Journal of Scientific and Industrial Research, 57: 740- 745.

Nagendra Swamy, R., Chandraju, S., Girija Nagendraswamy and Chidan Kumar, C.S. 2010. Studies on the impact of irrigation of distillery spentwash on the yields of tuber/root medicinal plants. Biomedical Pharmacology J., 3(2): 99-105.

Nagendra Swamy, R., Chandraju, S., Girija Nagendraswamy and Chidan Kumar, C.S. 2010. Studies on the impact of irrigation of distillery spentwash on the yields of leafy medicinal plants. Nat. Env. Poll. Tech., 9(4): 743-748.

Sonwalker, T.N. 1993. Hand book of Silk Technology. Wiley Eastern Limited, New Delhi, pp.14-25.