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Rice Bran Extract Enriched Mulberry Leaves (*Morus Alba* L.) For The Improvement Of Silkworm (*Bombyx Mori* L) Growth, Cocoon And Silk Production.

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Abstract

Mulberry leaves are considered as an effective food for silkworm growth. The present research was conducted to study the growth performance of the 4th and 5th stages of silkworm (*Bombyx mori* L), which were fed with MR-2 variety mulberry leaves fortified with rice bran extract. This supplementary diet was increased the growth of late age silkworms. The 4th stage of silkworm fed with MR-2 variety mulberry leaves fortified with 2.0 % concentration rice bran extract showed an increased average larval weight (0.89 ± 0.27 g) than the average larval weight in the control group (0.82 ± 0.27 g). The 5th stage of silkworm fed with MR-2 variety mulberry leaves fortified with high concentration rice bran extract (1.0 %) showed an increased average larval weight (4.89 ± 0.32 g) than the average larval weight in the control group (4.41 ± 0.15 g). A significant difference was observed in parameters such as average larval weight, specific growth rate, weight gain, leaf supplied, leaf waste, and silkworm larval excreta at different concentrations of the rice bran fed group of silkworms in the control group fed silkworms.

Keywords: MR 2 variety, rice bran extract, late age silkworms.

1. INTRODUCTION

The most commercially important silkworms are known as mulberry silkworm (*Bombyx mori* L.). and they are utilized for silk production (Kumar and Arunachalam, 2009). The silkworm larvae are monophagous, eating only the leaves of mulberry plants, thus fresh and nutritious quality of mulberry leaves play a vital role in maintenance of silkworm, cocoon development and silk quality (Ashok Kumar *et al.*, 2009). Enhancing mulberry leaves with supplemental nutrients and feeding them to silkworms is a beneficial modern technique for increasing the economic worth of cocoons (Kumararaj *et al*, 1972). The nutritional structure of the larval stage has a considerable influence on the condition of the subsequent stages of larva, pupae, and silk fibre (Aftab Ahmed *et al.*, 1998; Rahmathulla *et al.*, 2002). Although mulberry leaves provide a complete diet for silkworms, several shortages may emerge for a variety of reasons. Supplementing extra nutrients with mulberry

leaves results in to larger output since the creation of superior quality and quantity of silk is mostly determined by the larva's nutritional status and health (Murugan *et al.*, 1998).

The significance of studies on the effect of various fortification agents in silkworm nutrition can be assessed using the principle of cooperating supplements. Supplementary nutrients, when added to normal food, boost its nutritional value and make it more helpful. In recent years, multiple attempts have been undertaken to fortify leaves with various beneficial nutrients like as carbohydrates, proteins, and amino acids, hormones, chemicals, and salts, as well as nutritional combinations, in order to increase the cocoon quality. Previous studies have investigated the influence of feed supplements on silkworm growth and silk yield. However, research into the synergistic impact of a combination of supplemental nutrients is limited. As a result, the current study aims to investigate the influence of feed supplement rice bran on the biological and commercial characteristics of cocoon and silk filament.

2. MATERIALS AND METHODS

The fourth instar larvae of the mulberry silkworm *Bombyx mori* L. were chosen for the purpose of this research. The commercial cross breed race CSR 2 x CSR 4 was selected for the current study. The late age silkworm larvae were received from a farmer practicing sericulture at the Assistant Directorate of Sericulture in Nannagaram, Tenkasi district, Tamil Nadu. The silkworm larvae were safely transferred to the laboratory. The worms were acclimatised to the rearing conditions; thus, the fourth instar larva was retained within the rearing chamber. Fresh, healthy mulberry leaves of the MR-2 species of *Morus alba* L. (M R 2 -variety) were obtained from the mulberry farm during the morning hours. They were preserved in a laboratory under cool conditions, using moist gunny bags to keep them as fresh. The rice bran extract was taken and mixed with sugar at different proportions i.e., 5 gm rice bran extract + 0.5 gm sugar + 1litre hot water, 10 gm rice bran extract + 1 gm sugar + 1 litre hot water, 15 gm rice bran extract + 1.5 gm sugar + 1 litre hot water, 20 gm rice bran extract + 2 gm sugar + 1 litre hot water, 25 gm rice bran extract + 2.5 gm sugar + 1 litre hot water. Then it was filtered by using cotton cloth and after proper cooling, it was sprayed on MR 2- variety mulberry leaves and fed to silkworm larvae.

Raw mulberry leaves were fed to control group of 100 silkworm larvae and similarly each 100 group of silkworm larvae were fed to different concentration of rice bran extract. Similarly, 5th stage silkworm larvae were fed with raw leaves and rice bran extract fortified diet with above concentrations. The mature larvae were mounted in plastic collapsible mountages separately as per feed group, and the cocoons were harvested on the sixth day, and cocoon parameters assessed as per standard procedure (Kumar *et al.*,1994); (Shankar *et al.*, 1994). A single cocoon weight, shell weight, shell ratio, weight gain, feed conversion ratio specific growth rate growth index and effective rearing rate (ERR) by number and weight were calculated as per the formula given below.

- $$\text{Cocoon weight} = \frac{\text{Weight of cocoons (g)}}{\text{Number of cocoons taken}}$$

- $$\text{Shell weight} = \frac{\text{Shell weight of cocoon (g)}}{\text{Number of cocoons taken}}$$

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

- Weight gain of silkworm = Initial weight - Final weight

- $$\text{Feed conversion ratio} = \frac{\text{Feed intake}}{\text{Weight gain}}$$

- $$\text{Specific growth rate of silkworm (SGR)} = \frac{100 \times (\ln \text{final weight} - \ln \text{initial weight})}{\text{Total days}}$$

$$\text{Growth index} = \frac{\text{Final weight of the larvae (g)} - \text{Initial weight of the larvae (g)}}{\text{Initial weight of the larvae (g)}}$$

3. RESULT AND DISCUSSION

3.1. Growth performance of 4th stage silkworm larvae fed with rice bran fortified mulberry leaf, MR - 2 variety

The nutrient rich mulberry leaves were very important for growth of silkworm larvae (Kanafi *et al*., 2007). As per the results obtained in the present study, fortification of mulberry leaves with rice bran extract improved the larval growth, cocoon characters and silk quality in *Bombyx mori* L. The previous studies indicated that growth of silkworm larvae significantly improved by feeding them with mulberry leaves fortified with different combination of nutrient (Sarker, 1993). In the present study, the 4th instar silkworm larvae showed reduced larval duration in rice bran extract fed group than the control and all larvae were alive up to the completion of 4th stage and larval weight was increased to 0.88 ± 0.29 g, 0.98 ± 0.37 g and 0.89 ± 0.27 g respectively in 1.0 %, 1.5 %, and 2.0 % rice bran extract fed group than the control (0.82 ± 0.27 g) and the remaining concentration of rice bran extract fed group were showed decreased specific growth rate. The feed conversion ratio was decreased in 1.0 % rice bran extract fed group (2.63) than the control (2.94) and the larval weight was gained in 1 % rice bran diet administered silkworm larvae (19 g) than the control group (17 g). Similarly, the specific growth rate (SGR) was increased in 1.0 % rice bran extract fed group (7.39 %) than the control (4.93 %). During the entire 4th instar larval duration, 50 g of leaves supplied to both the control and rice bran extract fed groups and the leaves waste was increased in all the rice bran extract fed groups of silkworms than the control and the larval excreta was reduced in rice bran diet fed group than the control (Table 1).

Table 1. Growth performance of 4th stage silkworm larvae fed with mulberry leaf MR 2 variety fortified with rice bran extract.

S.No.	Parameters	Control	Concentration of rice bran extract (%)			
			0.5	1.0	1.5	2.0
1	Number of silkworm alive	100	100	100	100	100
2	Number of silkworm dead	0	0	0	0	0
3	Larval duration (Hours)	84	80	79	82	82
4	Average larval weight (g)	0.82 ± 0.27	0.76 ± 0.19	0.88 ± 0.29	0.98 ± 0.37	0.89 ± 0.27
5	Specific growth rate (%)	4.93	4.69	7.39	5.95	5.88
6	Feed conversion ratio	2.94	4.54	2.63	2.77	3.12
7	Weight gain (g)	17	11	19	18	16
8	Leaf supplied (g)	50	50	50	50	50
9	Leaf waste (g)	19	20	16	18	18
10	Silkworm larval excreta (g)	10.6	8.0	6.9	7.0	7.2

3.2. Growth performance of 5th stage silkworm larvae fed mulberry leaf MR 2 variety fortified with rice bran extract

In this present study, during the 5th stage, all the silkworms were alive in the control, but in 1.5 % rice bran fed group, maximum mortality was observed followed by 6 in 0.5 %, 4 in 1.0 % and 3 in 2.0 %. Larval duration was maximum in control group and it was decreased in all the studied concentrations of rice barn extract fed group. The 5th stage silkworm larvae showed the maximum average larval weight (4.89 ± 0.32 g) in 1.0 % concentration of rice bran extract fortified mulberry leaf - MR 2 variety. Minimum average larval weight (4.15 ± 0.35 g) was recorded in 1.5 % concentration than other concentrations. The higher SGR (0.27 %) was recorded in 1.0 % concentration and lower SGR (0.11 %) was recorded in 1.5 % concentration. Maximum weight gains of silkworm larvae (8 g) was recorded at 1.0 % concentration than the control group (Table 2). The larval weight of silkworm has a direct effect with food consumption by silkworm was in agreement with the present findings (Shivakumar, 1995). The physicochemical nature of fortified mulberry leaves showed higher effect in food consumption (Waldbauer, 1968).

Table 2. Growth performance of 5th stage silkworm larvae fed with mulberry leaf MR 2 variety fortified with rice bran extract

S.No.	Parameters	Control	Concentration of rice bran extract (%)			
			0.5	1.0	1.5	2.0
1	Number of silkworm alive	100	94	96	93	97
2	Number of silkworm dead	0	6	4	7	3
3	Larval duration (Hours)	156	152	144	148	151
4	Average larval weight (g)	4.41 ± 0.15	4.73 ± 0.20	4.89 ± 0.32	4.15 ± 0.35	4.36 ± 0.10
5	Specific growth rate (%)	0.17	0.13	0.27	0.11	0.14
6	Feed conversion ratio	50	62.5	31.25	35.71	62.5
5	Weight gain (g)	5	4	8	7	4
6	Leaf supplied (g)	250	250	250	250	250
7	Leaf waste (g)	64	54	40	52	56
8	Silkworm larval excreta (g)	52	58	45	49	53

3.3. Effect of rice bran extract on cocoon and silk quality

All the mulberry leaf fed group of 5th stage silkworms were produced cocoons, but 97 cocoons produced in 2.0 % rice bran extract fortified mulberry leaf fed group followed by 96 in 1. 0%, 94 in 0.5 %, and 93 in 1.5 % respectively. The total number of defective cocoons were 2 each in 0.5 %, 1.0 % and 2.0 % rice bran extract fortified mulberry leaf fed group than the control. The pupal duration was decreased in all the experimental group than the control. The average pupal weight was higher (1.25 g) in 1.0 % concentration and lower (1.05 g) in control group. The higher percentage of shell ratio (0.54 %) was recorded at 1.0 % concentration and the lower shell ratio (0.42 %) was in control group. Similarly, the higher silk filament (1245 m) was recorded in1.0 % concentration and the lower length was (968 m) was recorded in control group. Denier was recorded higher (24) in 1.0 % concentration and lower (20) in control group (Table 3). The quality of cocoon was very much important for the quality and economic value of silk (Venkatesh *et al*., 2014). The nutritional value of mulberry leaves has an important role in the higher production of quality cocoons (Sevarkodiyone and Baskaran, 2003). The mulberry leaves treated with different additives showed increase in quality of cocoons (Sridhar, and Pand Radha, 1986).

Table 3. Effect of rice bran extract on cocoon and silk quality

S. No.	Parameters	Control	Concentration of rice bran extract (%)			
			0.5	1.0	1.5	2.0
1	Total number of cocoons	100	94	96	93	97
2	Total number of defective cocoons	4	2	2	5	2
3	Pupal – duration (hours)	120	114	112	117	119
4	Mean pupal weight (g)	1.05	1.12	1.25	1.09	1.23
5	Shell ratio (%)	0.42	0.51	0.54	0.44	0.46
6	Silk filament length (m)	968	1067	1245	986	970
7	Denier	20	22	24	22	22
8	Silk waste	0.16	0.12	0.11	0.14	0.11

4. CONCLUSION

The results of this present study concluded that the 4th and 5th stages of silkworm fed with mulberry leaves (MR 2) variety fortified with rice bran extract showed an increase in growth parameters. Due to the higher growth parameters of 5th stage silkworm larvae, the cocoon weight, shell weight, and shell ratio were increased, and thus improved the quality of silk.

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