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EFFECT OF DIFFERENT PROBIOTICS ON THE EFFICIENCY OF FOOD CONVERSION IN SILKWORMS

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ABSTRACT

Nutrition plays an important role in improving the growth and development of silkworm *Bombyx mori*. Silk production is mainly dependent on larval growth and nutritive value of mulberry leaves. The purpose of this study is to investigate the impact of application of various food probiotics on *b*nutritional efficiency of Silk work *Bombyx mori*. Previous studies showed some promising results in increasing cocoon quality parameters with certain microorganisms such as *Spirulina* and *Saccharomyces cerevisiae* etc. Experiments were carried out to determine the feed efficacy of silkworm *Bombyx mori* (V instar larvae) fed mulberry (*Morus alba*) leaves and four different probiotics such as Blue green algae *Spirulina*, Yeast *Saccharomyces cerevisiae*, *Lactobacillus acidophilus* and *Lactobacillus supergenes*. Physiological parameters like food consumption (FC), food utilization (FU), Coefficient of food utilization, Food consumption index (FCI) were calculated. Data was collected and subjected to the statistical analysis. The results showed that blue green algae *Spirulina* and *Saccharomyces cerevisiae* had better efficiency of food conversion when compared to *Lactobacillus acidophilus* and *Lactobacillus supergenes*.

KEYWORDS : Sericulture, Probiotics, Spirulina, Yeast, lactobacillus, Food utilization, FCE

Silkworm, *Bombyx mori* L. is monophagus. It eats only mulberry only due to the presence of a chemical Morin (Tribhuwan, et al., 1989). Nutrition is an important growth regulating factor in silkworm. It has been reported that the vitamins of B-complex group and certain essential sugars, proteins, amino acids, minerals etc. are responsible for the proper growth and development of the silkworm, *Bombyx mori* (Horie and Ito, 1963: Horie et al.,1966: Sengupta et al., 1972 and Faruki, 1998).

The growth and development of larva, and subsequent cocoon production are greatly influenced by nutritional quality of mulberry leaves. Efforts are made to study the effect of fortification of nutrient supplements such as proteins, carbohydrates, amino acids, vitamins, sterols, hormones, antibiotics etc. for better performance and get higher yield, quantity and quality of cocoons (Sannappa, 2002). The most important aspect of sericulture is quality and quantity of the mulberry leaves fed during rearing (Koul, 1989: Chenthilnayaki et al., 2004: Balasundaram et al., 2008). Silkworms exclusively feed continuously during five instars of larval period to spin cocoon. The silkworm larvae are attracted by three stimulants in mulberry leaves viz., the attractant, biting factor and swallowing factor (Hamamura and Naito, 1961). Leaf consumption directly affects the silk producing capacity of the silkworm (Muthukrishnan et al., 1978). Sumioka et al., 1982 have observed that the leaf consumption influenced the body weight which in turn influences the silk output. In the present investigation an attempt is made to study the effect of four different probiotics such as, Blue green algae *Spirulina,* Yeast *Saccharomyces cerevisiae*, *Lactobacillus acidophilus* and *Lactobacillus supergenes* on the food consumption and efficiency of food consumption in silkworm *Bombyx mori.*

MATERIALS AND METHODS

Rearing

Rearing of silk worms were conducted at Moshe Farms at S.C. colony, Kaligiri village of Kaligiri Mandal of Sri Potti Sriramulu Nellore district during the year 2013-2014.The silkworm belonging to cross breed (NB_4D_2)of *Bombyx mori* (L) have been reared in Farm ($28^{o} \pm 2^{o}$C, 80 to 85% RH) by following rack method described by Krishnaswamy (1978).

Material

Variety mulberry leaves (*Moras alba*) were used for the present experimentation. Blue green alga (*Spirulina*) was procured from the Department of Biotechnology, D.R.W. College, Gudur and the yeast was purchased in local bakery. Standard culture of *Lactobacillus acidophilus* and *Lactobacillus supergenes* procured from National Collection of Industrial Micro-organisms (NCIM 2083), National Chemical Laboratory, Pune was cultured in MRS broth medium. The broth culture of *L. acidophilus* and *Lactobacillus* supergenes (10^{6} cfu/ml) was used for this experiment.

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Treatments

Four different feed additives (probiotics) like *Spirulina,* Yeast (*Saccharomyces ciriviceae*), *Lactobacillus acidophilus* and *Lactobacillus* sporogens were selected for the present study. 300ppm of each feed additive were prepared by disperse the feed additive in clean UV irradiated tap water. Freshly harvested mulberry leaves were soaked. Healthy and uninjured II instar larvae were selected for experiment and they were divided in to five batches. First batch of silk worms were fed with Mulberry leaves and treated as control. Second batch of Silk worms were with *Spirulina* 300ppm third batch with Yeast, Fourth batch with *Lactobacillus acidophilus*, and fifth batch with *Lactobacillus supergenes.*

Feed Utilization Experiment

The quantity of mulberry leaf offered to the entire groups was similar and *Bombyx mori* larvae were fed five times a day. The left over mulberry leaves and litter were weighed daily and recorded. Similarly, initial and final weights of the V instar larvae were recorded in control group and other probiotics treated groups. Fresh leaves were cut into two halves; one half was used to determine the initial water content. Dry weight of amount of leaf consumed, fecal matter and larval weights were recorded in 5^{th} instar. Based on these weights, the physiological parameters like food consumption (FC), food utilization (FU), approximate digestibility (AD), consumption index (CI) and coefficient of food utilization (CFU) were calculated (Arsenev and Bromlei, 1957).

Food Consumption (FC) was calculated by following formula

FC = Dry weight of leaves offered Dry weight of residual leaves after eating

Food Utilization (FU) was calculated by following formula

FU = Dry Weight of food consumed Weight of fecal matter

Coefficient of food utilization was calculated by 100X (food Utilized/ food Consumed)

Food Consumption Index (FCI) was calculated by following formula

Where E/TA

E = Dry weight of food eaten,

T = Duration of Experimental period

A = Mean dry weight of animal during experimental period.

Co-efficient of Food Utilization (CFU) was calculated by following formula

Statistical analysis

The data were subjected to statistical analysis of variance for identifying significant differences among the treatments using standard method.

RESULTS

The data regarding the use of cocoon characters and silk quality was presented in Table.

Table: Effect of different probiotics on the efficiency of Food Conversion in silkworms

S.No.	Parameter	Control	*Spirulina* treatment	Yeast treatment	*Lactobacillus acidophilus* Treatment	*Lactobacillus sporogens* treatment
1	Food consumption	48.10	52.70+9.56	47.90-1.98	47.10-0.42	46.60-2.08
2	Fecal matter	3.60	2.70-28.5	4.50+23.5	4.80+33.3	5.10+41.66
3	Food utilization	44.50	44.90+0.89	43.40+2.47	42.302.53	41.50-1.89
4	Coefficient of food utilization	92.52	93.35+2.55	90.612.08	89.81-0.88	89.060.84
5	Mean dry weight of larve	1.16	1.2021.55	1.150.86	1.10-5.17	1.10-5.17
6	Larval duration (Days)	6.50	6.007.69	6.254.17	7.00+12	7.00+1.06
7	Food conversion efficiency	6.38	7.32+14.74	6.66+8.95	6.128.21	6.05-0.84

(values are mean of 100 larve. + /- indicate percent increase or decrease over control)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	8	295.2705	36.90881	1515.9
Column 2	8	309.6728	38.7091	1627.372
Column 3	8	291.0752	36.3844	1444.444
Column 4	8	288.0347	36.00434	1411.307
Column 5	8	285.4635	35.68294	1383.192

ANOVA

Source of Variation	SS	*df*	MS	F	P - value	F crit
Between Groups	45.52666	4	11.38166	0.007709	0.999876	2.641465
Within Groups	51675.51	35	1476.443			
Total	51721.03	39				

DISCUSSION

The digestive system is home to many types of bacteria. They help keep the intestines healthy and assist in digesting food. They are also believed to help the immune system. These friendly organisms also help fight bacteria. In probiotics therapy, live microbial feed supplements are improving the intestinal microbial balance of host. These non-pathogenic bacteria play a key role in enhancing resistance to colonization by exogenous potentially pathogenic organism. Many bacterial strains have been evaluated for ability to normalize the properties of abnormal native micro flora and reinforce various aspects of intestinal defense. Pathogen growth in the intestines. Probiotics can stabilize the structure in the intestinal barrier and maintain rigidity in the tight junctions between epithelial cells. Probiotics can also stimulate the body's innate defense mechanisms, as with the increased production of the antimicrobial peptide defenses in the intestines.

Lactobacillus plantarum in vitro model demonstrated its ability to prevent adherence of a pathogenic strain, as well as increased the expression of protective proteins. Colonized probiotics ferment dietary fiber, and in doing so can induce pH and other chemical changes in the intestinal lumen (cavity) that also affect the inhibition of pathogen growth. Additionally, short-chain fatty acids are released as a byproduct of bacterial fermentation display anti-inflammatory properties in the epithelial (intestinal lining) cells.

Various live microorganism (probiotics) have been demonstrated to modify the composition of the micro flora, restore the microbial balance and therefore have the potential to provide health benefits when normal intestinal flora is disturbed due to diarrhea, food toxification etc. Probiotics prevent infections due to competition for binding sites and available substrates, lowering lumina. PH, production of 'bactericins' and production of other antibacterial substances enhancement of intestinal motility and up gradation of genes mediating innate immunity.

CONCLUSION

Fortification of mulberry leaves by using supplementary nutrient and feeding to the silkworms is a useful modern technique to increase efficiency of digestive system. Fortification of food with certain vitamins successfully tried as a prophylactic measure in silkworm (Ito and Niminura, 1966).The present investigation concluded that two probiotics namely *Spirulina* and Yeast significantly promotes the coefficient of utilization of food and food conversion efficiency and ultimately enhance cocoon characters (Venkataraman et al 2013, Masthan et al. 2011a, Masthan et al 2011b) and silk quality, when compared to *lactobacillus acidophilus* and *Lactobacillus supergenes.*

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