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Influence of Feeding Sequences and Feeding Methods of Mulberry Varieties on Cocoon and Egg Productivity of Pure Silkworm (*Bombyx mori* L.) Breeds

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ABSTRACT. *The leaves of three mulberry varieties, Mysore Local, M_5 and S_{54} were given as sole feed for the entire larval period and as feeding sequences, one during early instars and another during late age to Pure Mysore, NB_4D_2 and NB_{18} silkworm breeds. The leaves were supplied by shoot or chopped feeding methods. Feeding of S_{54} variety leaves to early instars (1st and 3rd instars) and Mysore Local to late age (4th and 5th instars) produced higher mature larval weight, Effective Rate of Rearing (ERR), cocoon weight, shell weight, cocoon yield and number of eggs. This was followed by feeding of M_5 variety to early instars and Mysore Local to late age worms. Among the sole feedings, both cocoon yield and number of eggs were high in larvae fed on S_{54} and did not differ among the silkworm breeds reared on M_5 and Mysore Local varieties.*

Shoot feeding method resulted in higher larval weights, Effective Rate of Rearing, cocoon weight, shell weight and number of eggs than chopped feeding method. Shoot feeding of S_{54} mulberry variety to early instars and Mysore Local to late instars was considered as the best feeding sequence and method for cocoon yield. Feeding of M_5 variety to early instars and Mysore Local to late instars was found to be most suitable for egg yield followed by Mysore Local plus S_{54} feeding sequence.

INTRODUCTION

Sericulture is an integral part of Indian agriculture, as India is the second largest country producing silk in the world. Karnataka is the premier state in the country contributing a major share to the total production. Mulberry is the only food plant for the silkworm (*Bombyx mori* L.). With the advancement of research and technology, several new lines of mulberry have been evolved, besides improvement in silkworm breeds, rearing technology, cocoon processing and reeling. It is known that mulberry varieties differ nutritionally due to many factors. Accordingly, the productivity in terms of

cocoon and egg yield also vary. In Karnataka the farmers who used to sustain with native mulberry variety (Mysore Local) are using improved mulberry varieties (M_5, S_{54}, S_{13}) to harvest better leaf yields. Therefore, farmers are now growing more than one variety. However, they are not aware of timing of feeding of different varieties, the best sequence of feeding and the best method of feeding to attain higher productivity. There is no literature available on these aspect which is considered a crucial field problem. A study was undertaken to find out the best feeding sequence and method for higher cocoon and egg productivity of pure silkworm breeds in sericulture.

MATERIALS AND METHODS

The leaves of three mulberry varieties namely; Mysore Local, M_5 and S_{54} grown under irrigated conditions in row systems were fed to three pure silkworm breeds (Pure Mysore, NB_4D_2 and NB_{18}) as a sole feed during chawki (early instars) to late instars and in combinations, one during early instars and another in the late instars, as follows:

1. Mysore Local throughout the larval period
2. M_5 throughout the larval period
3. S_{54} throughout the larval period
4. S_{54} to early stage and M_5 to the later stage
5. M_5 to early stage and S_{54} to later stage
6. Mysore Local to early stage and M_5 to later stage
7. M_5 to early stage and Mysore Local to later stage
8. Mysore Local to early stage and S_{54} to later stage
9. S_{54} to early stage and Mysore Local to later stage

There were three sole feedings *i.e.*, feeding of one mulberry variety throughout the larval period and six feeding sequences *i.e.*, feeding of one variety during early stage and another variety during later stage. Each treatment was replicated thrice and reared with one disease free laying (DFL) for each treatment using the three breeds separately.

The rearing experiment was conducted as a Completely Randomized Design (CRD) . The data obtained for mature larval weight, shell weight, cocoon yield and number of eggs were tabulated, computed and analyzed statistically.

Mature larval weight

Mature larval weight (g) was recorded at 50% maturity of worms by selecting 100 larvae from each replicate of each treatment.

Effective rate of rearing (ERR)

The effective rate of rearing (ERR) was calculated based on number of worms brushed to the number of cocoons formed and expressed as a percentage.

Cocoon and Pupal weight

Twenty cocoons randomly selected from each replicate were weighed to determine cocoon weight. Subsequently cocoons were cut open, weights of pupae and shells were recorded.

RESULTS AND DISCUSSION

Feeding sequences

The rearing rate of the silkworms breeds in different treatment combinations as reflected in terms of mature larval weight, effective rate of rearing, pupal weight, cocoon weight, shell weight, cocoon yield and number of eggs are presented in the Table 1.

The mature larval weight was significantly high (308.909 g) with S_{54} + Mysore Local feeding sequence followed by M_5 + Mysore Local (308.227 g) feeding sequence. Among the sole feedings S_{54} produced heavier larvae, though not significant with that of other feeding sequences. This finding is supported by the earlier results of Prabhakara *et al.* (1994) who reared chawki worms on S_{54} mulberry variety.

The effective rate of rearing was also high (86.00%) in S_{54} + Mysore Local feeding sequence followed by M_5 + Mysore Local (84.35%). Further, sole feeding of S_{54} resulted in a better effective rate of rearing (78.40%) than M_5 (Kanva-2). Thangamani and Vivekanandhan (1984) concluded that S_{54} was superior variety to Kanva-2 as reflected by high effective rate of rearing.

Table 1. Influence of feeding sequences and feeding methods on rearing and grainage parameters of pure silk worm (*Bombyx mori* L.) breeds.

Treatments		Mature larval weight (g)	ERR %	Cocoon weight (g)	Shell weight (g)	Pupal weight (g)	Cocoon yield (g/DFL)	Egg yield (Nos)
Feeding Sequences :	Mysore Local	299.749	76.260	1.514	0.290	1.219	333.950	502.090
	M_5	303.696	77.700	1.522	0.288	1.225	341.190	494.680
	S_{54}	304.702	78.400	1.531	0.292	1.230	343.820	506.120
	$S_{54} + M_5$	303.147	80.160	1.526	0.292	1.227	351.800	445.160
	$M_5 + S_{54}$	304.498	78.970	1.533	0.288	1.227	346.990	488.030
	Mysore Local + M_5	297.939	83.850	1.524	0.292	1.173	365.330	490.280
	M_5 + Mysore Local	308.227	84.340	1.551	0.307	1.242	368.820	522.740
	Mysore Local + S_{54}	307.975	84.040	1.545	0.299	1.237	365.300	514.940
	S_{54} + Mysore Local	308.909	86.000	1.556	0.324	1.240	380.890	506.200
	S.E. ±	0.498	0.735	0.001	0.008	0.020	3.746	1.530
	C.D. (5%)	1.361	2.082	0.004	0.022	0.057	10.615	4.336
Silkworm breeds :	NB_4D_2	381.561	78.010	1.824	0.383	1.439	396.640	530.960
	NB_{18}	383.046	77.580	1.831	0.383	1.440	400.590	541.340
	Pure Mysore	152.118	87.650	0.946	0.126	0.816	268.790	417.850
	S.E. ±	0.277	0.424	0.001	0.005	0.009	2.163	0.883
	C.D. (5%)	7.862	1.202	0.002	0.013	0.027	6.129	2.503
Feeding method :	Shoot feeding method	305.246	83.660	1.542	0.302	1.235	367.020	503.120
	Chopped feeding method	305.237	78.490	1.525	0.292	1.228	343.660	490.310
	S.E. ±	0.226	0.346	0.001	0.004	0.012	1.766	0.721
	C.D. (5%)	6.419	0.981	0.002	0.010	0.003	5.004	2.040

In the present investigation the effective rate of rearing was at a peak even with feeding sequences.

Higher cocoon weight (1.556 g), shell weight (0.324 g) and cocoon yield (380.89 g) were recorded in S_{54} + Mysore Local feeding sequence followed by M_5 + Mysore Local (368.82 g). Among the sole feedings, S_{54} produced higher cocoon yield, pupal weight, cocoon weight, shell weight, than M_5 and Mysore Local. These findings are in accordance with the work of Tayade and Jawale (1984) who recorded higher cocoon yields of S_{54} than M_5. Further, Tayade *et al.* (1986) reported that S_{54} was superior for improving economic traits of cocoon than Kanva-2 and Mysore Local mulberry varieties.

The fecundity of silkworm breeds was high (522.74) when reared with M_5 + Mysore Local, feeding sequence followed by Mysore Local + S_{54} (514.94). These two did not differ significantly and were superior over rest of the feeding sequences. However, of the egg productivity S_{54} was high (506.12) followed by Mysore Local (502.09) and least in M_5 (494.68). It was evident that cocoon productivity was greater when silkworms were fed with S_{54} during chawki and Mysore Local during later stage. Egg productivity was more with M_5 + Mysore Local sequence and the same trend was also maintained when they were fed as sole feeding throughout the larval period. This could be attributed to the fact that S_{54} is nutritionally richer than M_5 and Mysore Local mulberry varieties. It is also evident that feeding of Mysore Local either during chawki or during late age with any one of the improved varieties induces higher productivity than feeding of two improved varieties in either of the sequence during entire larval period.

Silkworm breeds

Among the silkworm breeds used for the experiments, the bivoltine breed NB_{18} recorded higher larval weight (382.046 g), cocoon weight (1.831 g), shell weight (0.383 g), pupal weight (1.440 g) and fecundity (541.34) followed by NB_4D_2 breed. This could be attributed to genetic factors of the breeds and also supported by the observations of Jolly *et al.* (1982) who reported that mature larval weight was 325 g in NB_{18}. Udupa (1986) recorded larval weight of 289.00 g in NB_{18} breed.

Feeding methods

Shoot feeding method of mulberry resulted in higher larval weight (305.246 g), effective rate of rearing (83.66%), cocoon weight (1.542 g), pupal weight (1.235 g), shell weight (0.302 g), cocoon yield (367.02 g) and fecundity (503.12) when compared to chopped feeding method. In shoot feeding method leaves could retain moisture for longer period and the worms could feed efficiently with more convenience. Further, the excreta passed by the worms would not come in contact with worms and leaves which created hygienic rearing conditions. The feeding method favoured better ingestion by the worms and resulted in higher rearing parameters. This trend endorses the observation of Chikkavenkateshappa (1987) who reported that all economic characteristic of silkworm are superior with shoot feeding method than chopped feeding method.

CONCLUSIONS

Feeding of S_{54} for chawki and Mysore Local at the late stage is found to be the best for cocoon yield while M_5 + Mysore Local feeding sequence is the best for egg yield in shoot feeding method. Feeding of Mysore Local is important either during early instars or in late age with any one of the, improved varieties. Feeding of two improved varieties in combination *i.e.*, M_5 + S_{54}, or S_{54} + M_5 is not advisable as the productivity is much lower than the combination with Mysore Local both for cocoon yield and egg yield.

The bivoltine, NB_{18} breed performed better than NB_4D_2. Shoot feeding of mulberry throughout the larval period is superior to the chopped feeding method. The silkworm breeds NB_4D_2, NB_{18} and Pure Mysore can be reared by the shoot feeding method with feeding sequence of M_5 + Mysore Local for higher egg yield and S_{54} + Mysore Local for higher cocoon yield. The findings are of value in the Silkworm seed areas of Karnataka.

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REFERENCES

Chikkavenkateshappa, K.M. (1987). Evaluation of different methods of application of feed to mulberry silkworm in relation to the economics of cocoon production. M.Sc. (Agri.) Thesis, UAS, Bangalore, pp. 81.

Jolly, M.S., Benchamin, K.V. and Ratna, Sen. (1982). Studies on the weight relationship among various growth parameters in silkworm. Ann. Rep. (1981-82) CSR and TI Mysore, pp. 108.

Prabhakara, K.M., Reddy, D.N.R. and Narayanaswamy, K.C. (1994). Influence of mulberry varieties and silkworm races on grainage performance and leaf egg ratio. Second National Symposium on Prospects and Problems of Sericulture in India, Vellore, Tamil nadu, Abstract, No. 58.

Tayade, D.S. and Jawale, M.D. (1984). Studies on the comparative performance of silkworm races against different varieties of mulberry and Marthwada condition. Sericologia. 24: 361-364.

Tayade, D.S., Jawale, M.D. and Uncheganokar, P.K. (1986). Evaluation of some improved strains of mulberry by feeding experiments under Marthwada condition. National Seminar on Prospects and Problems of Sericulture in India, Vellore, Tamilnadu, Abstract, No. 133.

Thangamani, R. and Vivekanadha, M. (1984). Physiological studies and leaf nutrient analysis in the evaluation of leaf mulberry variety. Sericologia. 24: 312-324.

Udupa, S.M. (1986). Heterosis in relation to single, three way and double cross Hybirds selected races of silkworm (*Bombyx mori* L.). M.Sc. (Agri.) Thesis, UAS, Bangalore, pp. 127.