INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
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www.vmsindia.org

Performance of Some Hybrid Races of Silkworm, *Bombyx mori* L. During Different Seasons In Nagpur Region

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ABSTRACT:
A popular multivoltine x bivoltine (PM x CSR2) and bivoltine x bivoltine (CSR4 x CSR2 and CSR2 x CSR4) silkworm hybrids were reared on mulberry Kanva 2/M5 during rainy, winter and summer seasons. The seasonal effects on rearing performance and economic parameters have been studied. The results indicated that productivity of silkworm was influenced by rearing season and PM x CSR2 race produced better yield in different season as compared to CSR4 x CSR2 and CSR2 x CSR4 races. The cocoon weight 1.69 ± 0.018g, shell weight 0.285 ± 0.002g, shell ratio 17.67±0.017% obtained in PM x CSR2 during winter season whereas CSR4 x CSR2 produced cocoon weight 1.67 ± 0.014g, shell weight 0.273 ± 0.03g, and shell ratio 17.14 ± 0.023%. In CSR2 x CSR4 cocoon weight was 1.61 ± 0.032g with shell weight of 0.259 ± 0.07g giving shell ratio of 16.83 ± 0.036% during winter season. The silk filament was also longer 791.86 ±6.39m in PM x CSR2 race as compared to the other two hybrids. The present study indicate that the PM x CSR2 race gives better production in rainy, winter, and summer season as compared to the other two hybrids of silkworm in Nagpur region.

Key words: Bombyx mori, Silkworm races, different season, Kanva 2/M5.

INTRODUCTION:

The silkworm, *Bombyx mori* L. is an economically important domesticated insect used for the luxuriant silk production. Though India occupies the second position in mulberry silk production, its productivity and quality did not match to that of China, the leading silk producing country. The main reason for this situation, obviously, is the prevailing tropical climatic condition in India. Among the environmental factors, temperature and humidity are reported to be the most important ones, affecting the growth and development of silkworm. The main important factor for improvement in sericulture is agro-climatic condition prevail in the region where sericulture is being practiced. Environment plays a major role in the mulberry leaf production, an essential food source of the mulberry silkworm for production of cocoon crop (Sharma *et al.,* 1995). Change in temperature affects the growth and survival of an organism (Hoffman, 1984). Silkworm being a poikilothermic animal cannot regulate its temperature and is susceptible to various kinds of disease, such as nuclear polyhydrosis, pebrine, muscardine and flacherie, (Prasad, 1999). Keeping this in view the present study was undertaken to know the rearing performance of multi-bivoltine and bivoltine-bivoltine hybrids using kanva 2/M5 mulberry variety during different season in vidharba region.

MATERIAL AND METHODS:

The disease free eggs laying (Dfls) of the silkworm, *Bombyx mori* races PM x CSR2, CSR4 x CSR2, CSR2 x CSR4 were obtained from National Silkworm Seed Organization (NSSO) Central Silk Board, Bangalore. The hatched larvae were brushed and reared separately as per the standard rearing technique described by Dandin *et al.,* (2003) on fresh mulberry leaves Kanva2/M5. The rearing was undertaken during summer, rainy and winter season under control condition at Center for sericulture and Biological Pest Management Research (CSBR), RTM Nagpur University, Nagpur. The rearing of I, II and III instars larvae was done in chowki while IV and V instars larvae was done in a wooden tray placed on rearing stand by providing entire mulberry leaves. About 400 larvae of each silkworm races were reared separately in which PM x CSR2 treated as control. The larvae were fed 4 times in a day till spinning during all the three seasons. When the mature larvae looked creamish or translucent they were picked and placed on chandrika (mountages) for spinning. The spun cocoons were harvested on the IV day of initiation of spinning. Male and female pupa separated and kept separately in a box, till the emergence of adult moth. The emerged male and female moths were allowed to mate. After mating the females were separated, allowed to urinate and placed on a brown paper card covered with cellule for egg laying and fecundity were recorded. During the rearing, developmental period, duration of cycle, economic parameters and fecundity during three seasons were recorded and compared.

RESULT AND DISCUSSION:

The data were recorded during the three different seasons; it was observed that in rainy season larvae of PM x CSR2 showed higher larval weight as compared to CSR4 x CSR2 and CSR2 x CSR4 races. The initial weight of 3rd instars in PM x CSR2 was 0.22 ± 0.001g and finally reached to 2.93 ± 0.038g in late V instar, where as CSR4 x CSR2 and CSR2 x CSR4 race the increase was from 0.026 ± 0.001g and 0.024 ± 0.001g to 2.83 ± 0.036g and 2.72 ± 0.039g respectively during fifth instar. The similar trend in larval weight was also recorded during winter and summer cycle (Table 1).

The life cycle completed in 847 ± 1.4 hrs by PM x CSR2, 873 ± 1.4 hrs and 907 ± 2.33 hrs in CSR4 x CSR2, CSR2 x CSR4, and the shortest life cycle was during rainy season whereas larvae took longer duration to completion its life cycle in winter (Table 2). The result of the present study indicated that the effect of temperature, humidity on the developmental period of different silkworm races, it was noticed that the larval developmental period was reduced in summer cycle.

Effect of feeding the leaves of different mulberry (*Morus species*) varieties on the larval growth, cocoon yield and other economic characters has been reported by the number of investigators (Krishnaswami *et al.,* 1970)

Among the biotic factors, temperature plays a major role on growth and productivity of silkworm as the silkworm is poikilothermic (Benchamin 1986). Several reports are available on the evaluation of mulberry varieties directly through silkworm rearing performance (Krishnaswami *et al.,* 1970).

Seasonal variation had pronounced effect on cocoon weight. Better cocoon weight was obtained during favorable season i.e. rainy and winter and poor being in summer. In rainy season the cocoon weight of PM x CSR2 was 1.59 ± 0.019 g, where as in CSR4 x CSR2 it was 1.49 ± 0.006 g and in CSR2 x CSR4 it was 1.47 ± 0.005 g. During winter the cocoon weight was 1.69 ± 0.018g in PMxCSR2, 1.67 ± 0.014g in CSR4 x CSR2 and 1.61 ± 0.0032g in CSR2 x CSR4. During summer season PMxCSR2 has 1.54 ± 0.014g in CSR4 x CSR2, CSR2 x CSR4 it was 1.42 ± 0.04g and 1.41 ± 0.05g respectively (Table 2). The quality of the mulberry leaves and the rearing environment are the utmost importance for obtaining good cocoon crop of silkworm (Shimizu, 1959).

During rainy and winter shell weight increased as compared to summer season. During rainy season the shell weight was 0.271 ± 0.002g in PM x CSR2, whereas 0.248 ± 0.005g in CSR4 x CSR2 and 0.237 ± 0.001g in CSR2 x CSR4.The similar trend was observed during winter and summer season in all the races of silkworm (Table 2).

Environmental factors especially, temperature and relative humidity play very important role in the life cycle of silkworm. In India, indigenous races are well adapted to fluctuating tropical climatic conditions characterized by high temperature but they are poor in productivity. The high temperature and low humidity has greater effect on larval development and cocoon parameter

The high shell ratio was observed in all the silkworm races during winter, and the shell ratio ranged between 17.67 ± 0.017 % to 17.14 ± 0.023 % and 16.83 ± 0.036 % in PM x CSR2, CSR4 x CSR2 and CSR2 x CSR4 which was higher as compared to rainy and summer season in all the three races. Suresh Kumar *et al.* (2003) reported the deleterious effect of high temperature and humidity on the growth, cocoon shape and size of many of the pure races, single hybrid and double hybrids.

When single cocoon reeled on Approuvet, it was observed that the larvae of PM x CSR2, gave higher filament length, 697.09 ± 13.76m in rainy, 791.86 ± 6.39.0 m in winter and 690.82 ± 10.9 m in summer followed by CSR4 x CSR2 and CSR2 x CSR4 races. The filament weight and denier were also noticed higher in PM x CSR2 during winter as compared to rainy and summer season followed by CSR4 x CSR2 and CSR2 x CSR4. The PM x CSR2 race performed better in all seasons as compared to CSR4 x CSR2 and CSR2 x CSR4 races.

The variation in the length of silk filament depends mainly on the uniformity of the cocoons used and which in turn will ultimately determine the uniformity and quality of the silk reeled. (Nakada, 1994) observed significant variation in various economic characters of silkworm due to mulberry varieties, silkworm races and also seasons.

Among the races, PM x CSR2 recorded higher egg laying 598 ± 10.69 during winter season and hatching percent was also higher during summer season in PM x CSR2 as compared to CSR4 x CSR2 and CSR2 x CSR4 irrespective of races and seasons. The larvae of PM x CSR2 took shortest duration during all the three seasons as compared to CSR4 x CSR2 and CSR2 x CSR4 silkworm races.

Among the three hybrid races used for the study during different seasons under the present study indicate that mansoon and winter can be

considered as favorable seasons with respect to temperature and humidity required for rearing of bivoltine hybrids in Nagpur Region. With the rise of temperature, activities of worms were accelerated while they retarded when temperature goes down. Too humid conditions in late worms build up bed humidity and create conditions that favors outbreak of diseases (Ullal and Narasimhama, 1987). High temperature coupled with high humidity during summer makes the condition unfavorable for bivoltine rearing and thereby resulted poor performance. The results of present findings are in accordance with Das and Vijayaraghavan (1990).

Table 1: Rearing performance of three silkworms during different season

Season	Silkworm races	Third instar larval wt (g)	Fifth instars larval wt (g)	Fifth instars larval duration (day/h)	Duration of cycle (day/h)
Rainy	PM x CSR2	0.022±0.001	2.938±0.038	197±1.453	847±1.453
	CSR4 x CSR2	0.026±0.001	2.839±0.036**	202±0.881***	873±1.453***
	CSR2 x CSR4	0.024±0.001	2.729±0.039*	205±0.577***	907±2.333***
Winter	PM x CSR2	0.040±0.001	3.005±0.116	204±50.09	914±1.453
	CSR4 x CSR2	0.040±0.00	2.849±0.026	226±0.666	984±1.764***
	CSR2 x CSR4	0.040±0.00	2.746±0.059	250±1.202	1022±1.732***
Summer	PM x CSR2	0.033±0.001	2.877±0.032	197±0.881	823±1.764
	CSR4 x CSR2	0.026±0.00**	2.723±0.041*	198±32.67	873±2.028***
	CSR2 x CSR4	0.026±0.001**	2.656±0.024**	205±1.202	907±1.732***
*- significant <0.05					

Table 2: Economic character and fecundity of three silkworm races during different season

Season	Races	Cocoon wt (g)	Shell wt (g)	Shell ratio (%)	Filament Length (m)	Filament weight (g)	Denier Scale	Fecundity	Hatching (%)
Rainy	PM x CSR2	1.59±0.019	0.271±0.002	17.30±0.214	697.09±13.76	0.209±0.007	2.70±0.058	554±6.692	91.02±3.136
	CSR4 x CSR2	1.49±0.006**	0.248±0.005**	16.54±0.314	693.59±8.95	0.215±0.010	2.87±0.043**	500±21.73	92.40±2.328
	CSR2 x CSR4	1.47±0.005**	0.237±0.001**	15.98±0.014**	648.71±8.61	0.227±0.008	3.14±0.037**	524±32.99	91.48±1.751
Winter	PM x CSR2	1.69±0.018	0.285±0.002	17.67±0.017	791.86±6.39	0.268±0.011	3.05±0.049	598±10.69	89.86±0.857
	CSR4 x CSR2	1.67± 0.014	0.273±003	17.14±0.023***	734.29±6.98**	0.252±0.011	3.08±0.035**	578±21.40	88.47±1.924
	CSR2 x CSR4	1.61±0.032	0.259±0.007*	16.83±0.036***	718.54±9.56***	0.222±0.005	2.78±0.040**	573±22.15	92.57±1.393
Summer	PM x CSR2	1.54±0.014	0.287±0.002	17.01±0.051	690.82±10.9	0.227±0.004	2.84±0.029	511±11.67	95.45±1.093
	CSR4 x CSR2	1.42±0.04***	0.220±0.005**	15.40±0.136***	690.61±17.5	0.217±0.006	2.82±0.020***	408±10.41**	94.08±0.338
	CSR2 x CSR4	1.41±0.05***	0.216±0.001**	15.11±0.243***	619.71±8.86*	0.169±0.008***	2.49±0.029***	509±10.73	96.14±0.930

*- significant <0.05

CONCLUSION:

The above result obtain concluded that both selection of race and season has pronounced effect on rearing performance of silkworm that ultimately reflected on economic parameters for silk production.

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