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Munemanik RM
Department of Agricultural Entomology, Vasantrao Naik Marthwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Latpate CB
Department of Agricultural Entomology, Vasantrao Naik Marthwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Sable GS
Department of Agricultural Entomology, Vasantrao Naik Marthwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Correspondence
Munemanik RM
Department of Agricultural Entomology, Vasantrao Naik Marthwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Study of the rearing performance of single and double hybrids of silkworm (*Bombyx mori* L.) under Marathwada condition

Munemanik RM, Latpate CB and Sable GS

Abstract
The experiment was conducted at Sericulture Research Unit, V.N.M.K.V, Parbhani, during 2016, in randomized block design with nine treatments and three replications. The variety V-1 was utilized. The bivoltine hybrids *viz*., $CSR_2 \times CSR_4$, $CSR_2 \times CSR_5$, $CSR_{16} \times CSR_{17}$, $CSR_{50} \times CSR_{51}$, $CSR_3 \times CSR_6$, $CSR_{12} \times CSR_6$, $CSR_{18} \times CSR_{19}$, $(CSR_{50} \times CSR_{52}) \times (CSR_{51} \times CSR_{53})$ and $(CSR_2 \times CSR_{27}) \times (CSR_6 \times CSR_{26})$ was utilized as treatment. Among the different hybrids reared, the bivoltine double hybrid $(CSR_2 \times CSR_{27}) \times (CSR_6 \times CSR_{26})$ performed better for economic characters *viz*., hatching per cent (93.27 per cent), larval duration (22.68 days), weight of ten mature larvae (44.04 g), single cocoon weight (1.82 g), shell weight (0.388 g), shell ratio (21.34 per cent), filament length (999.33 m), filament weight (0.308 g), cocoon yield/10000 larvae brushed (18.84 kg) and low disease incidence (3.51 per cent) over rest of treatments.

Keywords: Bivoltine single, double hybrids, *Bombyx mori* L., cocoon uniformity, economic traits

Introduction
Sericulture is the science that deals with the production of silk by rearing of silkworm. Silk is called the queen of textiles due to its glittering luster, softness, elegance, durability and tensile properties and is discovered in China between 2600 and 2700 BC. Mulberry plant is the first choice of mulberry silkworms. It was believed that mulberry plant is native of India or China particularly from the lower slopes of Himalayas. Mulberry leaves form the basic food material for mulberry silkworm. These leaves can also be used as fodder for cattle which increase the milk production in cattle by 10 %. However, feeding an artificial diet also possible for silkworm.

Silkworm larva prefers to consume the leaves that contain high moisture and less dry matter (Benchamin and Jolly, 1986) [1]. Water content of leaf plays a significant role on food utilization and growth in phytophagous insects (Periaswamy, 1994). The quality of mulberry leaves varies significantly with factor such as soil fertility, agronomical practices, planting system and environmental condition (Bongale *et al.* 1991) [2]. In spite of this, the qualities of mulberry leaf also vary with age, leaf position and variety of the same species. As the nutritive requirement of the larvae vary with the age of maturity varies according to the physical characters of the leaves supplied to the silkworm.

Materials and methods
The present investigation was undertaken to study the economic traits, disease incidence and quality parameters of new mulberry silkworm (*Bombyx mori* L.) hybrids and their evaluation for rearing under Marathwada condition. The rearing was undertaken at rearing house of Sericulture Research Unit, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The disease free laying's of bivoltine single and double hybrids $CSR_2 \times CSR_4$, $CSR_2 \times CSR_5$, $CSR_{16} \times CSR_{17}$, $CSR_{50} \times CSR_{51}$, $CSR_3 \times CSR_6$, $CSR_{12} \times CSR_6$, $CSR_{18} \times CSR_{19}$, $(CSR_{52} \times CSR_{50}) \times (CSR_{51} \times CSR_{53})$ and $(CSR_2 \times CSR_{27}) \times (CSR_6 \times CSR_{26})$ utilized as treatment.

The newly hatched larvae were fed with chopped pieces of fresh mulberry leaves. The leaves were chopped into small pieces of 0.5 cm and sprinkled over the newly hatched worms for their feeding. The feeding was given four times in a day. The rearing trays were cleaned daily as per recommended times.

After full development, the ripe worms were identified, as they looked translucent with creamy colour. The ripe worms ceased to eat, crawled towards periphery of the trays and tried to spin the cocoons, were handpicked and put on the Chandrika. The worms spun the cocoons within 48 to 72 hours. The pupae remained inside the cocoons till emergence. The harvesting of the cocoon was carried out on the fifth day of release of worms on netrika. Randomly selected ten cocoons of each treatment were used for recording cocoon parameters.

The observations were recorded on hatching percentage, larval duration, 10 mature larvae weight, single cocoon weight, single shell weight, shell ratio, filament length, disease incidence and cocoon yield/10000 larvae brushed, Disease incidence (%) were recorded and analyzed as suggested by Panse and Sukhatme (1985) [5] and the results were interpreted. The data thus collected were statistically analysed and the results were recorded.

Results and Discussion

Investigation pertaining to the "Study of the rearing performance of single and double hybrids of silkworm (*Bombyx mori* L.) Under Marathwada condition" was carried out at 'Sericulture research unit', Department of Agril. Entomology, College of Agriculture, V.N.M.K.V, Parbhani, during 2016-17.

The hatching percentage of eggs was recorded in the range of (83.72 to 93.27 per cent). The highest hatching per cent of 93.27 per cent was recorded in double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) over the rest of hybrids followed by ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (93.08 per cent), $CSR_{16} \times CSR_{17}$ (92.83 per cent) and $CSR_3 \times CSR_6$ (92.25 per cent) which were at par with each other. Only two hybrids *viz*., $CSR_{12} \times CSR_6$ (90.06 per cent) and $CSR_{18} \times CSR_{19}$ (83.72 per cent) recorded low hatching percentage than the control treatment. Chavan (2010) [3] observed that hatching in bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (93.27 per cent).

The bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) had shown the shortest larval duration (22.68 days) and found significantly superior over ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (23.27 days), $CSR_{18} \times CSR_{19}$ (23.28 days), $CSR_{16} \times CSR_{17}$ (23.42 days), CSR_{12} x CSR_6 (23.42 days), $CSR_3 \times CSR_6$ (23.44 days) and $CSR_2 \times CSR_5$ (23.55 days), whereas $CSR_{50} \times CSR_{51}$ had shown longest larval duration (23.99 days). Suradkar *et al.* (2016) [7] reported that larval duration of double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) had shown larval duration (22.06 days) silkworm reared on variety V-1.

The performance for larval weight of bivoltine hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (44.04 g) followed by CSR_{16} x CSR_{17} (43.91 g) was observed significantly superior over rest of tested hybrids. Whereas ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (42.69 g) found at par with ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (44.04 g). The lowest ten matured larval weight was recorded in $CSR_{50} \times CSR_{51}$ (33.37 g). Chavan (2010) [3] recorded that maximum larval weight was recorded in ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (43.88 g) over the rest of hybrids.

The highest significant cocoon weight was recorded by ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (1.82 g) followed by $CSR_{12} \times CSR_6$ (1.79 g) ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (1.78 g), $CSR_{16} \times CSR_{17}$ (1.77 g). The lowest single cocoon weight was recorded by the hybrid $CSR_{50} \times CSR_{51}$ (1.75 g). Gowda (2014) [4] reported the cocoon weight of double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) 2.04 g.

The significantly maximum shell weight was recorded by bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (0.388 g) followed by ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (0.374 g), which are at par with each other. Whereas the minimum shell weight was recorded by the hybrid $CSR_{50} \times CSR_{51}$ (0.340 g). The three bivoltine hybrids *viz*., $CSR_{18} \times CSR_{19}$ (0.366 g) and $CSR_{12} \times CSR_6$ (0.364 g) showed at par with each other results then the control treatment $CSR_2 \times CSR_4$ (0.357 g). Gowda (2014) [4] reported the shell weight of double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) 0.472 g.

Table 1: Rearing performance of mulberry silkworm hybrids

S. No	Treatment	Growth parameters			
		Hatching (%)	Larval duration (days)	Weight of 10 mature larvae (g)	Disease incidence (%)
1	$CSR_2 \times CSR_4$ (C)	90.60	23.77	40.68	4.32
2	$CSR_2 \times CSR_5$	92.02	23.55	38.83	4.16
3	$CSR_{16} \times CSR_{17}$	92.83	23.42	43.91	3.80
4	$CSR_{50} \times CSR_{51}$	92.21	23.99	33.37	4.79
5	$CSR_3 \times CSR_6$	92.95	23.44	39.33	4.05
6	$CSR_{12} \times CSR_6$	90.06	23.42	38.17	4.00
7	$CSR_{18} \times CSR_{19}$	83.72	23.28	33.68	4.33
8	($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$)	93.08	23.27	42.69	3.74
9	($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$)	93.27	22.09	44.04	3.51
	SE+	1.03	0.34	0.74	0.27
	CD at 5%	3.10	1.03	2.21	0.80

Table 2: Rearing performance of mulberry silkworm hybrids

S. No	Treatment	Economic Traits			
		Single cocoon weight (g)	Single shell weight (g)	Shell ratio (%)	Filament length (m)
1	$CSR_2 \times CSR_4$ (C)	1.77	0.357	20.15	975.67
2	$CSR_2 \times CSR_5$	1.75	0.347	19.86	969.33
3	$CSR_{16} \times CSR_{17}$	1.77	0.357	20.14	975.00
4	$CSR_{50} \times CSR_{51}$	1.75	0.340	19.44	938.33
5	$CSR_3 \times CSR_6$	1.77	0.355	20.08	982.33
6	$CSR_{12} \times CSR_6$	1.79	0.364	20.34	956.33
7	$CSR_{18} \times CSR_{19}$	1.76	0.366	20.77	965.00
8	($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$)	1.78	0.374	20.99	987.33
9	($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$)	1.82	0.388	21.34	999.33
	SE+	0.010	0.003	0.18	7.10
	CD at 5%	0.030	0.010	0.55	21.30

The significant maximum shell percentage was recorded ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (21.34 per cent) followed by ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) and (20.99 per cent), $CSR_{18} \times CSR_{19}$ (20.77) whereas, the minimum shell percentage was recorded by hybrid $CSR_{50} \times CSR_{51}$ (19.44 per cent). Chavan (2010) [3] reported the highest shell ratio of bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (19.29 per cent). The present findings are in a confirmative with the result of above worker.

Maximum cocoon yield/10,000 larvae was noticed by ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (18.84 kg) which was significantly superior over the rest of hybrids followed by $CSR_{16} \times CSR_{17}$ (18.49 kg) and $CSR_3 \times CSR_6$ (17.99 kg).The minimum cocoon yield was noticed by $CSR_{50} \times CSR_{51}$ (16.65 kg) followed by ($CSR_{52} \times CSR_{50}$) × ($CSR_{51} \times CSR_{53}$) (17.19 kg). Suresh Kumar *et al*. (2011) [8] reported the highest cocoon yield was observed in double hybrid $CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (18.4 kg). Suradkar *et al*. (2016) [7] recorded the significantly maximum cocoon yield was observed in double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (17.73 kg).

The filament length was recorded significantly superior by ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (999.33 m) over the rest of the hybrids except ($CSR_{52} \times CSR_{50}$) x ($CSR_{51} \times CSR_{53}$) (987.33 m) which was at par with each other. The bivoltine single hybrid $CSR_{50} \times CSR_{51}$ (938.33 m) was observed lowest filament length. Present findings are inconformity with Suresh Kumar *et al*. (2011) [8] in his experiment $CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (1090 m). Suradkar *et al*. (2016) [7] record the significantly maximum filament length was observed in bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (1060 m).

The double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) (3.51 per cent) recorded significantly less disease incidence than all other treatments. The bivoltine hybrid $CSR_{50} \times CSR_{51}$ (4.79 per cent) recorded more disease incidence than all the hybrids tested. In bivoltine double hybrid ($CSR_2 \times CSR_{27}$) × ($CSR_6 \times CSR_{26}$) had shown the disease incidence is 4.87 per cent is recorded by chavan (2010) [3].

References

1. Benchamin KV, Jolly MS. Principles of silkworm rearing in proceeding of seminar on problems and prospects of sericulture. Mahalingam, S. (ed), *Vellore*, India, 1986, 63-108.
2. Bongale U, Chaluvachari DM, Narahari Rao BV. Mulberry leaf quality evaluation and its importance. Indian silk. 1991; 39(8):51-53.
3. Chavan SL. Performance of bivoltine hybrids of silkworm on (*Bombyx mori* L) M.Sc. (Agri.) Thesis, V.N.M.K.V, Parbhani, 2010.
4. Gowda. Study on performance of double cross hybrids of silkworm (*Bombyx mori* L.) in central dry zone of Karnataka, M.Sc (Agri) Thesis, Karnataka, 2014.
5. Panse VG, Sukhatme PV. Satistical methods for Agricultural workers. ICAR, New Delhi, 1985.
6. Periaswamy K. Problems and prospectus of sericulture. Boraith G. lectures on sericulture. 2nd edition PBS publishers and distributors, 1984, 293-307.
7. Suradkar PG, Latpate CB, Tukaram A, Nikam. Feeding effect of different mulberry varieties on silkworm double hybrid (CSR_2 x CSR_{27}) x (CSR_6 x CSR_{26}) of (*Bombyx mori* L.) Dept. of Agricultural Entomology, Vasantrao Naik Marthwada Agriculture University, Parbhani 431402, Maharashtra, India. 2016; 11(III):1723-1725.
8. Suresh Kumar, Harjeet Singh, Saha AK, Bindroo BB. Development of bivoltine double hybrid of the silkworm, (*Bombyx mori* L.) tolerant to high temperature and high humidity conditions of the tropics. Universal J of Environmental Research and Technology. 2011; 1(4):423-434.