OCCURRENCE OF SPONTANEOUS LARVAL MUTANT IN THE POLYVOLTINE SILKWORM, *BOMBYX MORI* L.

K. L. Rajanna*, Ravindra Singh* and T. Jayappa*

* Silkworm Seed Technology Laboratory, Kodathi, Bangalore-560035, INDIA. E-mail: sstlbng@yahoo.com

[Rajanna, K. L., Ravindra Singh & Jayappa, T. 2012. Occurrence of spontaneous larval mutant in the polyvoltine silkworm, *Bombyx mori* L.. Munis Entomology & Zoology, 7 (1): 502-505**]**

ABSTRACT: A recessive mutation was found during the course of basic stock maintenance in December 2009. Some spontaneous marked mutant larvae (0.20%) were observed in a polyvoltine silkworm race “Pure Mysore” of the mulberry silkworm, *Bombyx mori* L. The mutant larvae were dark brown body color and characterized by prominent crescent and star spots when compared to normal cream-white larvae. The performance of mutant larvae was inferior to the normal and the comparative performance of mutant x CSR2 and normal x CSR2 has also been discussed.

KEY WORDS: *Bombyx mori* L.*,* Mutant larvae, Performance, Pure Mysore.

The polyvoltine silkworm race Pure Mysore (PM) plays a vital role in the production of PM x CSR2 hybrid, a ruling hybrid in southern India contributing maximum silk production. Systematic maintenance and multiplication of Pure Mysore breed is followed at different levels both at the Research Institutes and Basic Seed Farms. However, certain spontaneous mutant larvae/pupae have been observed in Pure Mysore such as black striped pupal wing, (Yamamoto et al., 1984), oily larval mutant (Rama Mohana Rao et al., 1989). Majority of the mutants are caused due to chromosomal aberrations (Tazima, 1964). It has been reported that generally mutants are inferior to the normal in several characters such as fecundity, hatching, larval weight, effective rate of rearing, cocoon weight, cocoon shell weight and cocoon shell percentage with an exception to oily larval mutant (Rama Mohan Rao et al, 1989). In this paper, the characters of mutant larvae, comparative performance of mutant and normal and their hybrids are presented.

MATERIALS AND METHODS

During the course of basic stock maintenance of Pure Mysore, some spontaneous larvae (0.20%) were observed in December, 2009.The mutant larval characters are very conspicuous and the mutant larvae can be easily separated from the normal batch. These larvae were separated and stabilized following line breeding and directional selection. Presently, the line is breeding true and characterized by light yellow non-diapausing eggs, prominent crescent and star spots on second and fifth abdominal segments, respectively. The mutant line was designated as “Pure Mysore Mutant” [PM (M)]. Photographs of PM (M) and normal Pure Mysore (PM) have been depicted in Figure 1. Both mutant and normal Pure Mysore were used for this study and maintained up to ten generations (Jan-Feb’2010 to Jul-Aug’2011) by following standard rearing technique (Krishnaswami, 1978). Data were collected for nine characters viz., fecundity, hatchability, larval span, larval weight, effective rate of rearing(ERR) by No., ERR by weight, cocoon weight, cocoon shell weight and cocoon shell percentage. During 6th, 7th and 8th generation, the mutant and normal Pure

Mysore were crossed with bivoltine breed CSR2 and prepared the cross breed eggs of PM (M) x CSR2 and PM x CSR2. These hybrids were reared thrice and their performance was assessed with respect to important rearing and reeling parameters.

RESULTS AND DISCUSSION

Generation-wise performance of PM (M) and normal Pure Mysore for nine characters has been presented in Table 1. The performance of mutant was inferior to normal with respect to all important rearing characters. In all the generations, the characters of the mutant strain were consistent; hence it is breeding true. The reduction noticed in the mutant was 16% in fecundity, 0.70% in hatching,11% each in larval weight and ERR by No., 27% in ERR by Wt, 20% in cocoon weight, 23% in cocoon shell weight and 4% in cocoon shell percentage.

When the mutant individuals were crossed with CSR2 breed, it is observed that neither larval colour nor larval markings were appeared in F1 i e., PM (M) x CSR2 and its reciprocal cross indicating the recessive character of the mutant. It is evident from the Table 2 that the mean values of the rearing parameters also revealed reduction even with hybrid involving the mutant to the tune of 15% in fecundity, 1% in hatching, 6% in larval weight, 0.20% in ERR by No., 6% each in ERR by weight, and cocoon weight and 7% in cocoon shell weight.

The resultant cocoons of PM (M) x CSR2 and PM x CSR2 were subjected for reeling test and collected the data for six characters namely, average filament length, non breakable filament length, filament size, renditta, reelability and waste on silk weight and presented in Table 3. The reduction observed in important reeling parameters of mutant was 7.2% in average filament length (AFL), 4% in average non-breakable filament length (NBFL), -0.37% in filament size and -2.20% in renditta. In case of both filament size (denier) and renditta, negative trend measures quality of the silk. However, increased reelability (3%) was recorded in case of PM (M) x CSR2.

Genetical studies on spontaneous mutants in the mulberry silkworm, *Bombyx mori* L. like polyphagous mutant strains Si and Brd with regard to dominant feeding habit (Tazima, 1994), “non-moulting k” mutant with retarded growth (Banno et al., 1995), sex linked “non-moulting nm-s” (Banno et al., 1997), a recessive translucent-15 mutant with moderately translucent or oily larval skin (Kawaguchi et al., 1997), a mutant expressing extra legs and wings at adult stage (Hirokawa, 1998) have been carried out.

In the present study, the mutant PM (M) was found recessive in nature as no mutant larvae were observed when crossed with another bivoltine silkworm breed CSR2. In F1 hybrid involved one spontaneous larval mutant with reddish brown larvae at hatching pure Mysore chocolate and one polyvoltine breed MW1 with normal dark brown larvae, all the larvae were dark brown in colour indicating the recessive nature of the mutant (Ravindra Singh, et al., 1992). The findings of this study can be useful to the silkworm breeders who are involved in maintenance of the basic stocks. As the several characters of mutant and its hybrid have shown deterioration, this type of mutant should be eliminated from the stock to avoid greater affect on the important breed characters during basic stock maintenance and also to avoid reduction in economic characters in the cross breed combination.

LITERATURE CITED

Banno, Y., Kawaguchi. Y., Koga, K. & Doira, H. 1995. Genetical studies on the "non-moulting K" mutant in the silkworm, *Bombyx mori.* J. Seric. Sci. Japan, 64: 219-223.

Banno, Y., Goto, H., Yasuoka, M., Nakamura, T., Kawaguchi, Y. & Doira, H. 1997. Genetic studies on the sex-linked non-moulting mutation, mm-s, of *Bombyx mori* J. Seric. Sci. Japan, 66: 351-354.

Hirokawa, M. 1998. Genetic analysis of a new mutant expressing extra-legs and extra-wings at the adult stage in the silkworm, *Bombyx mori* J. Seri. Sci. Japan, 67: 1-7.

Kawaguchi, Y., Yamada, H, Banno, Y., Koga, K. & Doira, H. 1997. Genetic analysis of the 'translucent – 15" mutant in *Bombyx mori.* J. Seric. Sci. Japan, 66: 113-115.

Krishnaswami, S. 1978. New technology of silkworm rearing Bull No.2, CSRTI, Mysore. pp, 23.

Rama Mohana Rao, P., Vijayaraghavan, K., Ravindra Singh & Premalatha, V. 1989. A note on the spontaneous oily larval mutant in silkworm *Bombyx mori* L.. Current Science, 58: 1155-1157.

Ravindra Singh, Vijayaraghavan, K., Premalatha, V., Rama Mohana Rao, P., Sengupta, K. & Viswanatha Kannantha. 1992. Hybrid vigour in F1, F2 and backcrosses in silkworm *Bombyx mori* L.. Mysore. J. agri.Sci, 26: 76-81.

Tazima, Y. 1964. Mutation and radiation mutagenesis in: The genetics of the silkworm, Logos press / Academic Press, London. pp. 176-195.

Tazima, Y. 1994. Genetic analysis of polyphagous mutant strains of the silkworm, *Bombyx mori* L.. Sericologia, 34: 601-617.

Yamamoto, T. 1984. Studies on the mutant "black-striped pupal wing" sensitive to temperature in *Bombyx mori.* J. Seri. Sci. Jpn, 53: 501-505.

NORMAL **MUTANT**

Figure 1. Normal and mutant larvae of silkworm.

Table 1. Performance of mutant PM (M) and normal Pure Mysore.

	Generation	Fecun-dity (No.)	Hatching (%)	Larval span (h)	Larval Wt.(g)	ERR No.	ERR Wt. (Kg)	Cocoon Wt. (g)	Cocoon shell Wt. (g)	Cocoon shell (%)
Mutant PM (M)	Jan-Feb'10	383	98.69	672	21.037	7333	6.333	0.763	0.109	14.30
	Mar-Apr'10	386	78.46	552	18.307	8766	6.666	0.832	0.096	11.54
	May-Jun'10	321	93.83	600	21.037	8756	8.750	1.082	0.151	13.95
	Jul-Aug,10	445	94.74	600	22.268	7400	6.000	0.948	0.142	14.98
	Sept-Oct'10	453	90.92	600	20.153	7133	6.903	0.981	0.134	13.66
	Nov-Dec '10	402	90.10	696	21.308	9866	9.333	1.014	0.145	14.23
	Jan-Feb '11	473	89.38	696	23.215	8400	7.140	0.870	0.131	15.05
	Mar-Apr'11	413	90.75	576	23.372	9666	7.833	0.894	0.124	13.81
	May-Jun'11	367	93.25	624	21.678	8333	7.000	0.953	0.142	14.90
	Jul-Aug,11	452	89.25	624	18.285	7800	6.000	0.882	0.128	14.51
	Mean	**410**	**90.94**	**624**	**21.066**	**8345**	**7.196**	**0.922**	**0.130**	**14.09**
	SD	**47**	**5.27**	**49**	**1.764**	**948**	**1.126**	**0.093**	**0.017**	**1.02**
Normal PM	Jan-Feb'10	374	98.40	648	24.153	9933	11.333	1.070	0.156	14.58
	Mar-Apr'10	474	88.44	552	23.291	9666	9.500	0.995	0.137	13.77
	May-Jun'10	427	92.13	600	23.203	9866	11.000	1.173	0.179	15.26
	Jul-Aug,10	552	92.74	600	24.723	9850	11.000	1.156	0.175	15.14
	Sept-Oct'10	567	91.92	600	24.523	9000	7.333	1.343	0.176	13.10
	Nov-Dec '10	498	91.38	696	25.596	9900	10.667	1.223	0.189	15.45
	Jan-Feb '11	524	91.59	744	21.396	9500	9.833	1.118	0.176	15.74
	Mar-Apr'11	464	92.06	576	26.341	9733	11.166	1.216	0.181	14.88
	May-Jun'11	501	90.43	600	21.706	9024	8.960	1.099	0.170	15.47
	Jul-Aug,11	526	86.79	600	21.788	7366	8.167	1.108	0.157	14.16
	Mean	**491**	**91.59**	**622**	**23.672**	**9384**	**9.896**	**1.150**	**0.170**	**14.76**
	SD	**58**	**3.03**	**58**	**1.695**	**787**	**1.387**	**0.096**	**0.015**	**0.85**

Table 2. Rearing performance of hybrids of mutant PM (M) and normal Pure Mysore.

Crossbreed combination	Generation	Fecun-dity (No.)	Hatch-ing (%)	Larval span (h)	Larval Wt.(g)	ERR No.	ERR Wt. (Kg)	Cocoon Wt. (g)	Cocoon shell Wt. (g)	Cocoon shell (%)
PM(M) x CSR2	Nov-Dec '10	396	90.76	576	42.126	9840	20.000	1.920	0.354	18.44
	Jan-Feb '11	473	89.38	624	33.297	9840	16.400	1.645	0.339	20.60
	Mar-Apr'11	438	90.31	552	45.575	9920	17.800	1.745	0.312	17.88
	Mean	**436**	**90.15**	**584**	**40.33**	**9867**	**18.067**	**1.770**	**0.335**	**18.97**
	SD	**39**	**0.70**	**37**	**6.33**	**46**	**1.815**	**0.139**	**0.021**	**1.44**
PM x CSR2	Nov-Dec '10	501	93.53	576	44.160	9880	19.000	1.884	0.346	18.37
	Jan-Feb '11	542	91.62	672	42.218	9880	19.200	2.000	0.419	20.95
	Mar-Apr'11	503	88.54	552	41.756	9900	19.200	1.776	0.324	18.24
	Mean	**515**	**91.23**	**600**	**42.71**	**9887**	**19.133**	**1.887**	**0.363**	**19.19**
	SD	**23**	**2.52**	**63**	**1.28**	**12**	**0.115**	**0.112**	**0.050**	**1.53**

Table 3.Reeling performance of hybrids of mutant PM (M) and normal Pure Mysore.

Crossbreed combination	Generation	AFL (m)	NBFL (m)	Filament size(d)	Renditta	Reelability (%)	Waste on silk wt (%)
PM(M) x CSR2	Nov-Dec '10	828	759	2.97	7.70	91.65	19.05
	Jan-Feb '11	794	668	2.52	7.60	83.00	30.00
	Mar-Apr'11	735	668	2.62	8.30	90.00	28.60
	Mean	**786**	**698**	**2.70**	**7.87**	**88.22**	**25.88**
	SD	**47**	**53**	**0.24**	**0.38**	**4.59**	**5.96**
PM x CSR2	Nov-Dec '10	729	627	3.02	8.00	86.25	22.11
	Jan-Feb '11	1004	827	2.50	7.30	80.00	30.70
	Mar-Apr'11	808	738	2.56	7.80	89.00	25.00
	Mean	**847**	**731**	**2.69**	**7.70**	**85.08**	**25.94**
	SD	**142**	**100**	**0.28**	**0.36**	**4.61**	**4.37**