



## Studies of some economic traits of multi × bivoltine hybrids of mulberry silkworm, *Bombyx mori*, L, through rearing under rain fed condition for commercial exploitation in the agro climatic condition of Assam, India

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### Abstract

One mulberry silkworm breed viz. PM × CSR2 (EIV 53.01) has been identified as the most promising breed for commercial exploitation amongst four multi × bi hybrids namely MC1 × BC4, MC4 × BC4, N × NB4D2 and PM × CSR2 evaluated under agro climatic condition of North Eastern region of India. In India, in recent times, the Evaluation index method for a particular trait or character is widely used by the silkworm breeders and a cumulative score of all the characters ranks the hybrids based on higher score. The sum of index values with regard to all the characters allotted to an hybrid indicates the hybrid's worth. During the present study, by employing the Evaluation index method six bivoltine hybrids were evaluated based on their performance at 24±3°C and 25±5°C and 79±2 % relative humidity. The hybrids were ranked as per the cumulative score and the value of a particular trait in a particular hybrid were compared with the ranking.

**Keywords :** Multi × Bi hybrids, *Bombyx-mori* mulberry silkworm, promising, rearing.

### 1. Introduction

India is the only country in the world which can commercially produce all the four known varieties of natural silk viz. Mulberry (*Bombyx-mori* L), Tassar (*Antheraea mylitta*), Eri (*Philosamia ricini*) and muga (*Antheraea assamensis*). Since mid-1970's, sericulture has progressed fast in developing countries.

Mulberry silkworm is reared in all over the North Eastern region of India. The present practice of Assam is to import dfls from outside agencies for commercial rearing due to lack of recommended hybrids. So, farmers of Assam are losing the remunerative from commercial crop rearing during commercial seasons.

Considering the climatic condition of NE Region it has become need of the time to identify multi x bivoltine commercial hybrid with high qualitative & quantitative characters for rearing as per suitability of the Assam Climatic condition

The promising multi x bi hybrid and bi x bi hybrids/combinations with better survival and economic character to maximize silk production in North Eastern Region. Productive hybrids for commercial rearing will contribute the substantial increase in silk production. By enhancing the quality as well as quantity of raw silk, we can upgrade the economic condition of rural mass because in the NE Region more than 3.0 lakhs families are engaged in sericulture with a total of

55,819 hectares of land. So, to increase the productivity of mulberry silk in this region, we have to identify promising multi × bi hybrid.

In the present study, four multi × bi hybrids namely MC1 × BC4, MC4 × BC4, N × NB4D2 and PM × CSR2 were evaluated for some important economic traits from commercial point of view to identify the most promising hybrids. Data on 15 economically important traits were analyzed using evaluation index method of Mano *et al.* (1993)

## 2. Materials and methods

Four multivoltine × bivoltine breeds MC1 × BC4 (mark larvae, white, slender elongated cocoon), MC4 × BC4 mark larvae, deep yellow, robust elongated cocoon), N × NB4D2 (mark larvae, deep yellow, slender elongated cocoon) and PM × CSR2 (Plain larvae, light yellow, robust oval cocoons) were utilized for the present study on the hybrid.

- (a) During the process about 4000 silkworm (*Bombyx-mori* L.) larvae have been brushed for each hybrid and after III moult exactly 2500 larvae should be retained and divided into five replications consisting 500 larvae of each batch to facilitate undertaking assessment with respect to finalized characters for statistical analysis. The study was carried out at room temperature condition ( $25 \pm 2^\circ\text{C}$  and 75-80 % RH).
- (b) The observation were recorded on fifteen various silk contributing parameters of economic importance such as fecundity, hatching percentage, yield/10,000 larvae by number, yield /10,000 larvae by weight, cocoon weight, shell weight, and cocoon shell percentage, Yield/100 dfls., filament length, filament weight, filament size, Reelability, Raw silk (%), neatness, boil-off following the standard rearing technology as suggested by Krishnaswami (1978).
- (c) Evaluation index was calculated as per Mano *et al.*, (1992). The index score in different score in different characters or traits thus denotes the performance of a hybrid combinations with relatively higher index value were considered to have greater economic value.

- (d) Matured silkworms were mounted on bamboo mountages and cocoons were harvested on 7th day after mounting. After harvest, rate of perfect pupation of each cocoon have been checked verified & recorded.
- (e) 25 females (♀) and 25 males (♂) cocoons taken randomly from each replication for assessing cocoon weight, shell weight and shell percentage.
- (f) The remaining good cocoons (replication-wise) have been weighted (for green cocoon weight) stifled in / accordance with the approved/recommend scheduled temperatures and have been sent for reeling assessment.
- (g) The hybrid performance and reeling characters have been sent for statistical analysis.

## 3. Result and discussion

The performances of Multi × Bi hybrids i.e MC1 × BC4, MC4 × BC4, N × NB4D2, PM × CSR2 during spring season at different temperature levels i.e.,  $24 \pm 3^\circ\text{C}$  and  $25 \pm 5^\circ\text{C}$  with constant humidity of  $79 \pm 2\%$  is given in Table-1 & Figure-1 to 4.

**Fecundity :** The analysed data revealed that fecundity of Multi × Bi hybrids reared at  $25 \pm 5^\circ\text{C}$  and  $79 \pm 2\%$  ranged from 297.0 (N × NB4D2) to 354.55 (MC4 × B C4) (Table 1). Among the four hybrids highest evaluation index value was observed in the hybrid MC4 × BC4 (EIV 60.5448) followed by PM X CSR2 (EIV 59.20078) and MC1 × BC4 (EIV 42.06628 )

**Hatchability :** The analysed data revealed that fecundity of Multii × Bi hybrids reared at  $25 \pm 5^\circ\text{C}$  and  $79 \pm 2\%$  ranged from 67.59% (N × NB4D2) to 77.48 % (PM × CSR2). Hatching percentage was observed highest in PM × CSR2 (EIV 66.04396) followed by MC1 × BC4 (EIV 49.57418).

**Effective rate of rearing (ERR/No.) :** The economic output of mulberry silkworm rearing as reflected by effective rate of rearing in number (ERR) ranged from 3787.335 (MC1 × BC4) to 6455.33 (PM × CSR2) reared at  $25 \pm 5^\circ\text{C}$  and  $79 \pm 2\%$ . Among the four hybrids highest evaluation

index value was observed in the hybrid PM × CSR2 (E IV 63. 00388) followed by N × NB4D2 (EIV 53.04915) and MC4 × BC4 (EIV 48.77783).

**Cocoon yield/10,000 larvae by weight :** The cocoon yield by weight ranged from 4.985 kg (MC1 × BC4 ) to 8.46 kg (PM × CSR2) at 25±5°C and 79±2%. Significant difference in cocoon yield among the four Multi × Bi hybrids was noticed in PM × CSR2 (EIV 61.09105) followed by N × NB4D2 (EIV 53.63422) and MC4 × BC4 (EIV51.48744).

**Single cocoon weight :** cocoon weight among hybrids reared at 25±5°C and 79±2% ranged from 1.198 (MC1 × BC4) to 1.4465 g (PM × CSR2). Significant difference in single cocoon weight among the four Multi × Bi hybrids was noticed in PM × CSR2 (EIV 52.88542) followed by (MC4 × BC4) (EIV 46.79167) and N × NB4D2 (EIV 45.41667).

**Shell weight :** The shell weight ranged from 0.1905 (N × NB4D2) to 0.227 g (PM × CSR2 ) at 25±5°C and 79±2%. Significant difference in shell weight for all the hybrids was recorded in PM × CSR2 (EIV 54.63964) followed by (MC1 × BC4) (EIV 50.0), MC4 × BC4 (EIV 49.14414) and N × NB4D2 (N × NB4D2 (EIV 48.06306).

**Shell percentage :** The analyzed data revealed that shell ratio among the four Multi x Bi hybrids reared at 25±5°C and 79±2% ranged from 15.78 % ( PM × CSR2) to 16.605 % (MC1 × BC4). Significant difference was observed among four Multi × Bi hybrids in MC1 × BC4 (EIV 67.17325) followed by MC4 × BC4 (EIV 45.59271) and N × NB4D4D2 (EIV 45.13678).

**Yield :** Cocoon yield was calculated per 10,000 larvae brushed and expressed in terms of yield / 100 dfls ( kg). The cocoon yield among the four Multi × Bi hybrids reared at 25±5°C and 79±2% ranged from 7.45 (N × NB4D2) to 33.84 kg (Table 2). (PM × CSR2). Significant difference was observed among the four Multi × Bi hybrids in PM X CSR2 (EIV 61.26221) followed by MC4 × BC4 (EIV 56. 38285) and MC1 × BC4 (EIV 47.40379).

**Filament length :** The trait filament length ranged from 456 ( PM × CSR2 ) to 571 m (MC4 × BC4) (Table 3) at 25±5°C and 79±2%. Significant difference was observed among the four Multi × Bi hybrids in MC4 × BC4 (EIV 61.57974) followed by MC1 × BC4 (EIV 58. 28469) and N × NB4D2 (EIV 40.209).

**Filament weight :** The trait filament weight ranged from 13.285 (MC4 × BC4) to 14.78cg (PM × CSR2) at 25±5°C and 79±2%. Significant difference was observed among the four Multi × Bi hybrids in PM × CSR2 (EIV 65.99297) followed by N × NB4D2 (EIV 50.87873), MC1 × BC4 (43.84886) and MC4 × BC4 (EIV 39.7188).

**Filament size :** The trait filament size ranged from 1.925d (PM × CSR2) to 2.825d (N × NB4D2) at 25±5°C and 79±2%. Significant difference was observed among the multi × Bi hybrids in N × NB4D2 (EIV 66.43258) followed by MC1 × BC4 (EIV 49.57865) and MC4 × BC4 (EIV 42.69663).

**Reelability :** The reelability of the hybrids reared at 25±5°C and 79±2% ranged from 70.515 (N × NB4D2) to 82.945% (MC4 × BC4). Significant difference was observed among the four Multi × Bi hybrids in MC4 × BC4 (60.82057) followed by PM × CSR2 (EIV 54.92341), MC1 × BC4 (EIV 53.0744) and N × NB4D2 (EIV 33.62144).

**Raw silk percentage :** The raw silk percentage of the hybrids reared at 25±5°C and 79±2% ranged from 20.005 (MC4 × BC4) to 26.035% (N × NB4D2). Significant difference was observed among the four Multi × Bi hybrids in N × NB4D2 (EIV 62.78802) followed by PM × CSR2 (EIV53.73272), MC1 × BC4 (EIV 49.86175) and MC4 × BC4 (EIV 35.0).

**Neatness :** Neatness show much variation in the breeds . It ranged from 82.5 (PM × CSR2) to 89.5 (MC4 × BC4). Significant difference was observed among the four Multi × Bi hybrids in MC4 × BC4 (57.49117) followed by N × NB4D2 (EIV 55.72438), MC1 × BC4 (EIV 53.9576) and PM × CSR2 (EIV32.75618) at 25±5°C and 79±2% respectively.

**Boil-off loss :** It ranged from 27.25 (MC4 × BC4) to 28.49 (MC1 × BC4). Significant difference was observed among the four Multi × Bi hybrids in MC1 × BC4 (61.25) followed by N × NB4D2 (EIV 56.97917), PM × CSR2 (EIV 46. 45833) and MC4 × BC4 (EIV35.41667) at 25±5°C and 79±2% respectively.

Among all, PM × CSR2 in general showed better EI value in desirable direction for fifteen major rearing and reeling traits. Similar trend was also observed with respect to mean performance of crosses by Benchamin *et al.*, (1988), Tayade (1987), Kumaresan *et al.*, (2000) with respect to cocoon quality and productivity parameters under South Indian conditions.

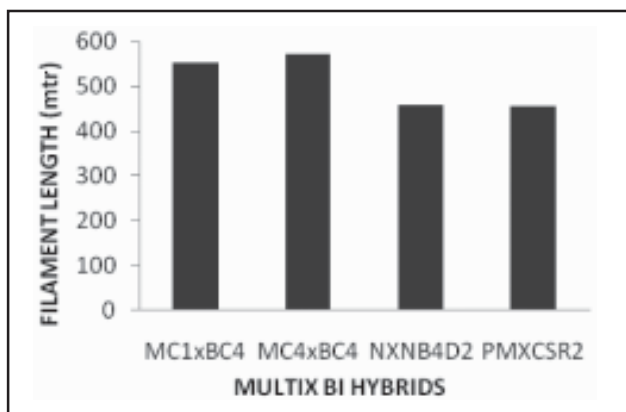


Fig. 1 : Mean filament length (m) of different Multi × Bi Hybrids during spring

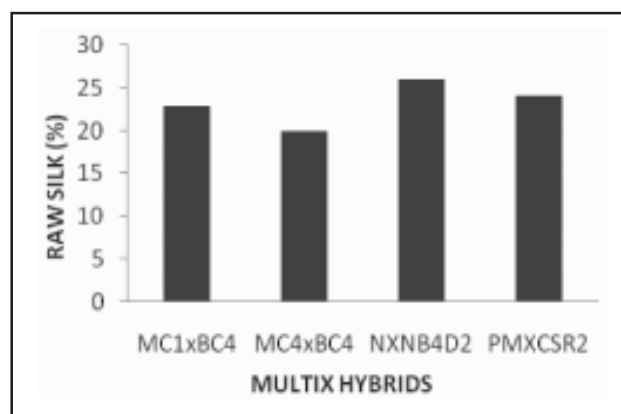


Fig. 2 : Mean Raw silk% of different Multi × Bi Hybrids during spring

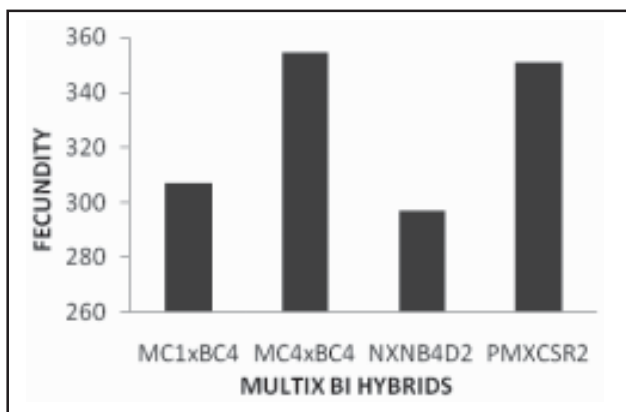


Fig. 3 : Mean Fecundity of different Multi × Bi Hybrids during spring

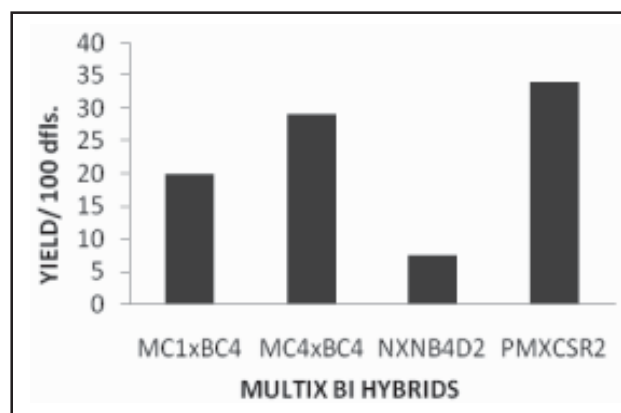


Fig. 4 : Mean yield/100 DFSLs Multi × Bi Hybrids during spring

**Table - 1 :** Evaluation index values of experimental hybrids for 15 quantitative traits under Assam condition

Sl. No.	BREED	Evaluation index values for													Total Evaluation Index	Average	Rank		
		Fecundity	Hat %	ERR (No)	ERR (WT.)	S. C. wt. (g)	S. S. wt. (g)	SR %	Yield / 100	Filament	Filament	Filament	Reability	Raw silk				Neatness	Boil-off
1	MC1 × BC4	42.08	49.58	35.16	33.88	41.56	50	67.17	47.49	58.29	43.86	49.57	53.07	49.86	53.97	61.25	736.617	49.1	(II)
2	MC4 × BC4	60.58	45.56	48.77	51.48	46.79	49.14	45.59	56.38	61.57	39.71	42.69	60.87	35	57.49	35.41	737.048	49.13	(II)
3	N × NB4D2	38.15	38.88	53.04	53.63	45.41	48.06	45.18	34.95	40.29	50.87	66.48	33.64	62.78	55.78	56.97	723.919	48.26	(III)
4	PM × CSR2	59.28	66.09	663.08	61.09	52.88	54.63	42.09	61.26	39.9	65.99	41.26	54.92	53.73	32.78	46.45	795.282	53.01	(I)

$$PM \times CR2 > MC4 \times BC4 = MC4 \times BC4 > N \times NB4d2$$

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