

Identification of some productive bivoltine hybrids of mulberry silkworm, *Bombyx mori*, L. through rearing under rain fed sericulture of North eastern region of India.

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Abstract

Three mulberry silkworm breed viz. CSR46 x CSR47(EIV60.7208), CSR2 x CSR4(EIV57.0620) and SLD4 x SLD8(EIV55.9030) has been identified as the most promising breed for commercial exploitation under agroclimatic 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 $24\pm3^{\circ}\text{C}$ and $25\pm5^{\circ}\text{C}$ and $79\pm2\%$ 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: bivoltine hybrids, *Bombyx mori* mulberry silkworm, promising, rearing.

1. Introduction

Silk production involves mulberry cultivation and silkworm rearing which are essentially akin to agriculture, particularly mulberry cultivation is land and water based and influenced by soil, climate and other edaphic factors; whereas silkworm rearing is almost exclusively dependant on the mulberry leaf production and its quality and silkworm rearing also profoundly influenced by the climate and hence there is a demand for region and season specific silkworm races. (Thangvalu, 1999) In India, the silkworm hybrids which has been exploited for commercial silk production are either multivoltine x multivoltine, multivoltine x bivoltine or bivoltine x bivoltine combination. Identification of different season

specific silkworm hybrids for Kashmir condition were carried out and three specific hybrids were identified (Quadir et al., 1997). Several promising multi x bi and bi x bi silkworm hybrids were identified by Subba Rao et al., 1989; Das et al., 1994; Rao et al 1989 for west Bengal condition.

Considering the climatic condition of NE Region (temp. ranges from 5°C to 38°C and relative humidity ranges from 38% to 98% with a annual precipitation ranges from 1000 mm to 11500 mm.) it has become need of the time to identify bivoltine commercial hybrid with high qualitative & quantitative characters for rearing under rainfed condition. In the present study a comparative performance of new bivoltine breeds i.e SLD4 x

SLD8 , Dun17 x Dun 18 , CSR2 x CSR4 , APS105 x APS 126 , APS45 x APS12 and CSR46 x CSR47 were studied for its quantitative and qualitative characters were studied for spring commercial seasons .

2.Materials and Methods

Seven Bivoltine silkworm breeds viz. SLD4 x SLD8 (mark larvae , white , oval in shape, slightly constricted in the middle cocoon) , Dun17 x Dun 18 (mark larvae , white , slightly constricted in the middle, medium size cocoon) , CSR2 x CSR4 (Plain larvae, white, robust oval cocoons) , APS105 x APS126 (Plain larvae, white, oval small cocoons) , APS45 x APS12(Plain larvae, white, oval cocoons) CSR46 x CSR47 (Plain larvae, white, robust oval cocoons) , were utilized for study on the hybrid.

2.1.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 under taking assessment with respect to finalized characters for statistical analysis

2.2 The study was carried out at room temperature condition ($25\pm 2^{\circ}\text{C}$ and 75-80 % RH). 2.2. 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 .

2.3.The observation were recorded on sixteen various silk contributing parameters of economic importance such as fecundity , hatching percentage , yield/10,000 larvae by number , yield /10,000 larvae by weight ,yield/100dfls., cocoon weight ,shell weight, and cocoon shell percentage ,filament length, filament weight , filament size, Reelability, Raw silk (%),Boil-off,neatness, following the standard rearing technology as suggested by Krishnaswami (1978).2.4. 25 females (♀) and 25 males (♂) cocoons taken randomly from each replication for assessing cocoon weight , shell weight and shell percentage .

2.4.The remaining good cocoons (replication wise) have been weighted (for green cocoon weight) stifled in / accordance with the apporved / recommend scheduled temperatures and have been sent for reeling assessment .

2.5.The hybrid performance and reeling characters have been statistical analysed .

2.6 The Two years rearing data were pooled season wise and evaluated by using Evaluation index was calculated as per Mano et al.(1993) shown below:

$$\text{Evaluation Index of a trait} = \frac{(A - B) \times 10 \div 50}{C}$$

A = Value obtained for a particular trait

B = Mean value of the trait of all treatment

C = Standard deviation

10 = Standard unit

50 = Fixed value

For Spring Season

3. Results and Discussion

The performances of Bi x Bi hybrids i.e SLD4 x SLD8 , Dun17 x Dun 18 , CSR2 x CSR4 , APS105 x APS 126 , APS45 x APS126 and CSR46 x CSR47 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 below :

Fecundity : The analysed data revealed that fecundity of Bi x Bi hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 432.5 (Dun17 x Dun 18) to 497.85 (CSR46 x CSR47).Among the six hybrids highest evaluation index value was observed in the hybrid CSR46 x CSR47 (EIV 60.90428) followed by CSR2 x CSR4 (EIV 60.00) and SLD4 x SLD8 (EIV 55.58888)

Hatchability : The analysed data revealed that fecundity of Bi x Bi hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 51.4% (Dun17 x Dun 18) to 94.91 % (CSR2 x CSR4) . Hatching percentage was observed highest in CSR2 x CSR4 (EIV 58.71585) followed by CSR46 x CSR47 (EIV 58.04918)

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 3068 (APS45 x APS126) to 5391 (APS105 x APS 126) reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. Among the six hybrids highest evaluation index value was observed in the hybrid APS105 x APS 126 (E IV 60. 50109) followed by SLD4 x SLD8 (EIV 56.60311) and CSR2 x CSR4 (EIV 56. 52489) .

Cocoon yield/10,000 larvae by weight : The cocoon yield by weight ranged from 4.00 kg (APS45 x APS126) to 8.62 kg (SLD4 x SLD8) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. Significant difference in cocoon yield among the six Bi x Bi hybrids was noticed in SLD4 x SLD8 (EIV 62.03947) followed by CSR2 x CSR4 (EIV 58.45395) and CSR46 x CSR47 (EIV 49.93421) .

Single cocoon weight : cocoon weight among hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 1.52 (Dun17 x Dun 18) to 1.729 g (SLD4 x SLD8) . Significant difference in single cocoon weight among

the six Bi x Bi hybrids was noticed in SLD4 x SLD8 (EIV 67.28571) followed by (Dun17 x Dun 18) (EIV 62.57).

Shell weight : The shell weight ranged from 0.2995 (APS105 x APS 126) to 0.3985 g (SLD4 x SLD8) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. at $25\pm 5^{\circ}\text{C}$ and $79\pm 2^{\circ}\text{C}$. Significant difference in shell weight for all the hybrids was recorded in SLD4 x SLD8 (EIV 65.78791) followed by (CSR46 x CSR47) (EIV 51.07239) and APS45 x APS126 (EIV 51.37027).

Shell percentage : The analyzed data revealed that shell ratio among the six Bi x Bi hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 19.595 % (APS105 x APS 126) to 22.97 % (SLD4 x SLD8) . Significant difference was observed among the six Bi x Bi hybrids in APS45 x APS126 (EIV 70.581605) followed by SLD4 x SLD8 (EIV 59.8512173) .

Yield : Cocoon yield was calculated per 10,000 larvae brushed and expressed in terms of yield/ 100 dfls (kg). The cocoon yield among the six Bi x Bi hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 16 (APS45 x APS12) to 34.48 kg. (SLD4 x SLD8) . Significant difference was observed among the six Bi x Bi hybrids in SLD4 x SLD8 (EIV 65.91)

Filament length : The trait filament length ranged from 660 (APS45 x APS126) to 816 m (CSR46 x CSR47) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. Significant difference was observed among the six Bi x Bi hybrids in CSR46 x CSR47 (EIV 60.2653) followed by SLD4 x SLD8 (EIV 57.45165) and CSR2 x CSR4 (EIV 53.59422) .

Filament weight : The trait filament weight ranged from 20.255 (APS45 x APS12) to 26.925 cg (CSR2 x CSR4) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. Significant difference

was observed among the six Bi x Bi hybrids in CSR2 x CSR4 (EIV 61.30515) followed by CSR46 x CSR47 (EIV 60.97426) and Dun17 x Dun 18 (EIV 54.05331)

Filament size : The trait filament size ranged from 2.53 (APS45 x APS12) to 3.11d (CSR2 x CSR4) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$. Significant difference was observed among the six Bi x Bi hybrids in by CSR46 x CSR47 (EIV 68 .18721) followed by CSR2 x CSR4 (EIV 64.61187) .

Reelability : The reelability of the hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 82.855 (APS45 x APS12) to 85.11% (Dun17 x Dun 18) . Significant difference was observed among the six Bi x Bi hybrids in Dun17 x Dun 18 (EIV 66.79487) followed by SLD4 x SLD8 (EIV 58.782057) .

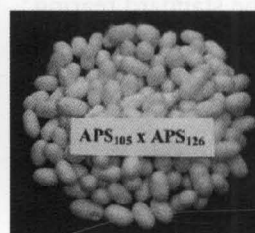
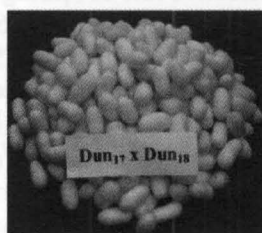
Raw silk percentage : The raw silk percentage of the hybrids reared at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$ ranged from 29.715 (APS45 x APS12) to 35.88% (CSR46 x CSR47). Significant difference was observed among the six Bi x Bi hybrids in CSR2 x CSR4 (EIV 61.10879) followed by CSR46 x CSR47 (EIV 61.04603) .

Neatness : Neatness did not show much variation in the breeds . It ranged from 91.5

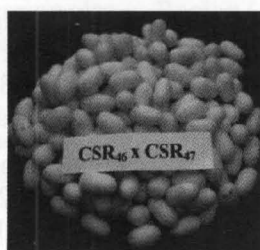
(SLD4 x SLD8, Dun17 x Dun 18) to 92.5 (, CSR2 x CSR4 , APS105 x APS 126 , APS45 x APS126 and CSR46 x CSR47) at $25\pm 5^{\circ}\text{C}$ and $79\pm 2\%$, respectively.

Boil –off loss : It ranged from 26.65 (CSR46 x CSR47) to 29.26 (CSR2 x CSR4) .

Significant difference was observed among the six Bi x Bi hybrids in CSR2 x CSR4 (EIV 62. 07) followed by Dun17 x Dun 18 (EIV 53. 67) .



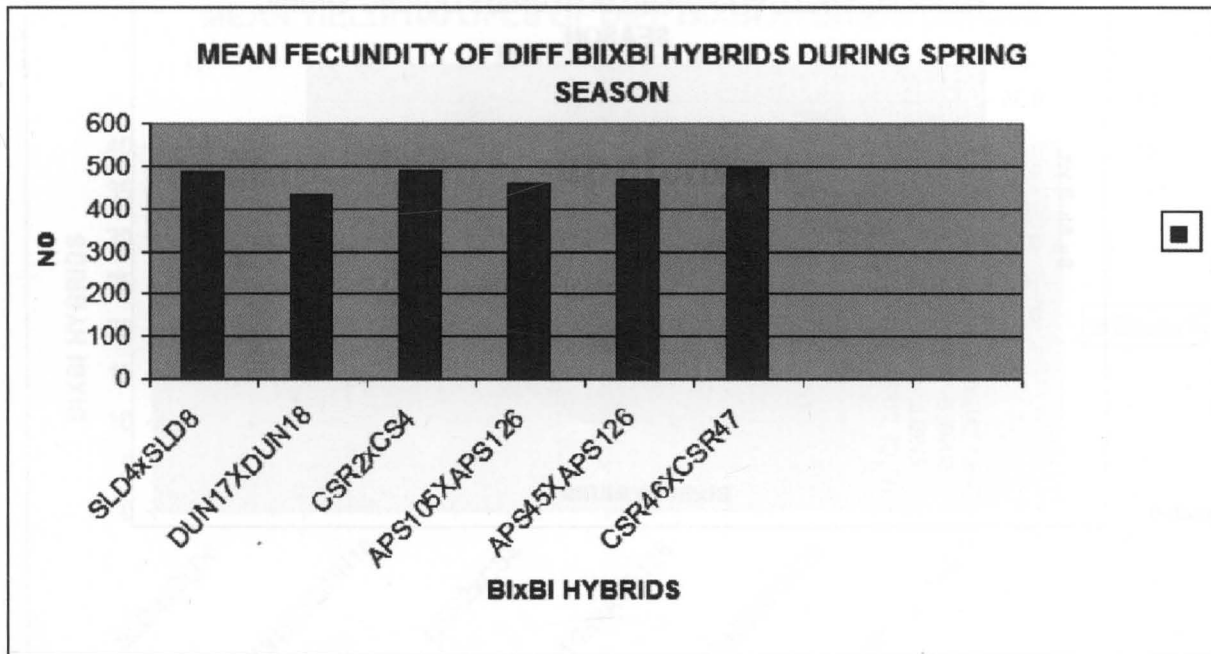
PHOTOGRAPHS OF BI X BI HYBRIDS



Photographs shows some BI X BI hybrid cocoons

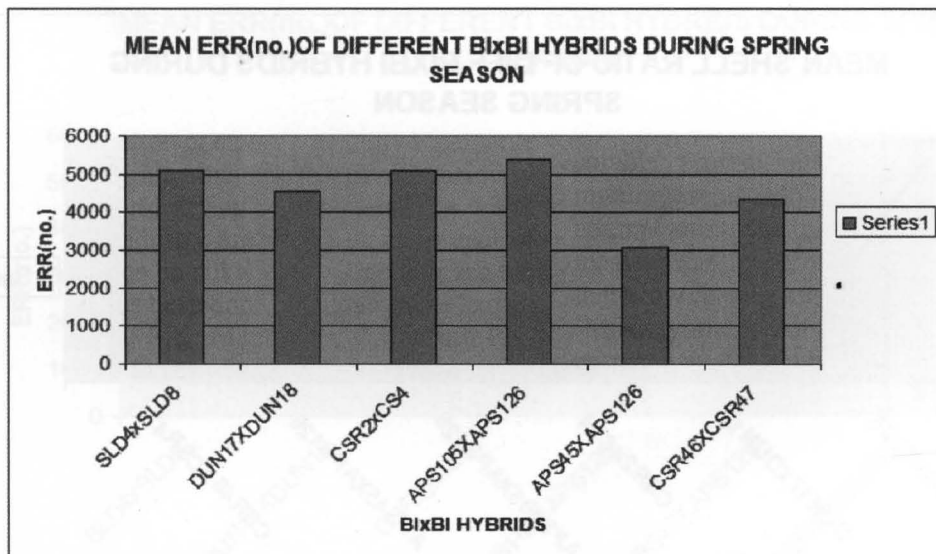
TAB.1(a) MEAN FECUNDITY OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON 20006-07

| | | | | | |
|-----------|-------------|----------|---------------|--------------|-------------|
| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
| 485.8 | 432.5 | 490.75 | 461.15 | 470.753 | 497.85 |



TAB.1 (b) MEAN ERR.(by no.) OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON

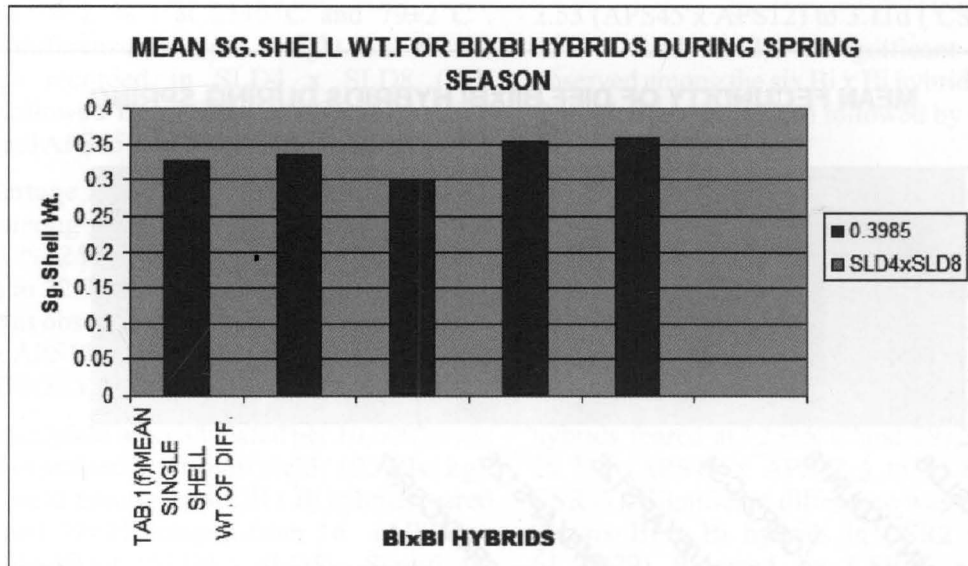
| | | | | | |
|-----------|-------------|----------|---------------|--------------|-------------|
| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
| 5092 | 4556 | 5086 | 5391 | 3068 | 4320 |



TAB.1 (c) MEAN SINGLE SHELL WT.OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON

| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
|-----------|-------------|----------|---------------|--------------|-------------|
| 0.3985 | 0.3265 | 0.3355 | 0.2995 | 0.3545 | 0.3585 |

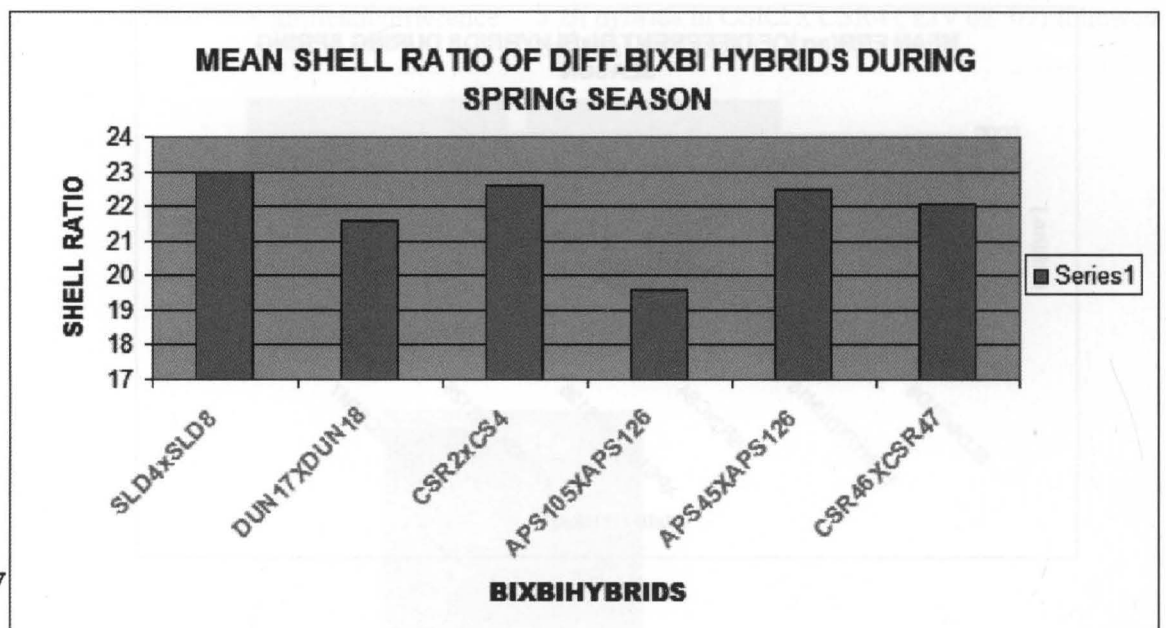
graph-6



TAB.1 (d) MEAN SHELL RATIO OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON

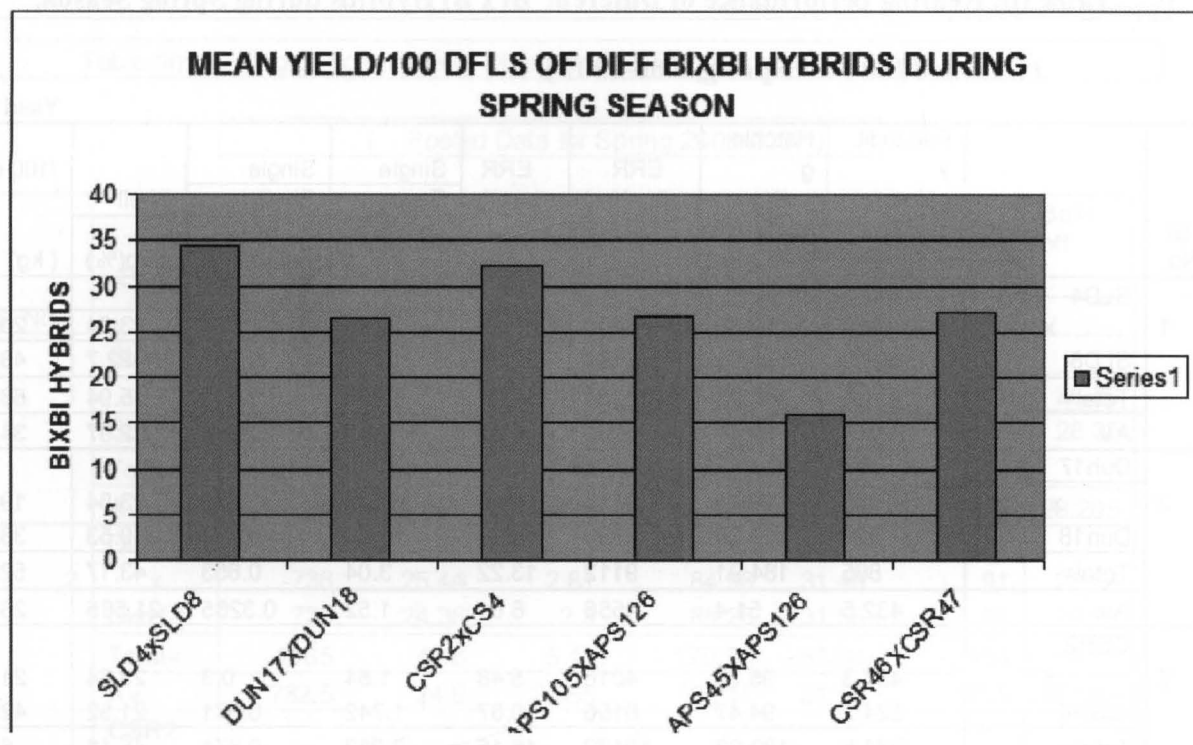
| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
|-----------|-------------|----------|---------------|--------------|-------------|
| 22.97 | 21.585 | 22.58 | 19.595 | 22.49 | 22.045 |

Graph -7



TAB.1(e) MEAN YIELD/100 dfls OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON

| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
|-----------|-------------|----------|---------------|--------------|-------------|
| 34.48 | 26.44 | 32.3 | 26.56 | 16 | 27.08 |



TAB.1(f) MEAN ERR(by no.) OF DIFF. BI X BI HYBRIDS DURING SPRING SEASON

| SLD4xSLD8 | DUN17XDUN18 | CSR2xCS4 | APS105XAPS126 | APS45XAPS126 | CSR46XCSR47 |
|-----------|-------------|----------|---------------|--------------|-------------|
| 5092 | 4556 | 5086 | 5391 | 3068 | 4320 |

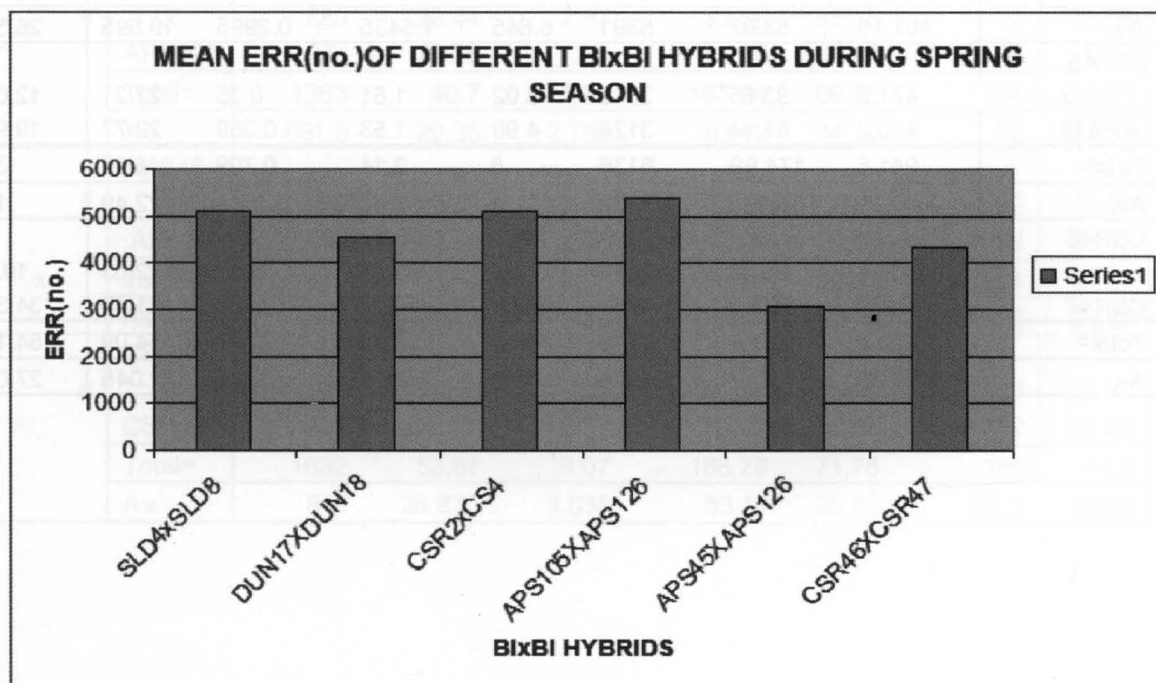


Table (i): Rearing performance of Different Bi x Bi Hybrids during Spring Season.**(Pooled Data for Spring,2006-2007)**

| SI No. | | Fecundity (Nos.) | Hatching (%) | ERR (by No.) | ERR by wt. (g) | Single | Single | Shell ratio(%) | Yield /100 dfls (kg) |
|--------|-----------------------|-----------------------|-------------------|-----------------|------------------------|--------------------|----------------------|-------------------|------------------------------|
| | | | | | | Cocoon | Shell | | |
| | | | | | | weight(g) (g) | weight(cg) (cg) | | |
| 1 | SLD4 x SLD8 | 439 532.6 | 89.65 95.26 | 3400 6784 | 5.16 12.08 | 1.68 1.779 | 0.4 0.397 | 23.24 22.7 | 20.64 48.32 |
| | Total= | 971.6 | 184.91 | 10184 | 17.24 | 3.459 | 0.797 | 45.94 | 68.96 |
| | Av. | 485.8 | 92.46 | 5092 | 8.62 | 1.7295 | 0.3985 | 22.97 | 34.48 |
| | Dun17 | | | | | | | | |
| 2 | x Dun18 | 436 429 | 90.44 12.36 | 3812 5300 | 4.96 8.26 | 1.48 1.56 | 0.35 0.303 | 23.64 19.53 | 19.84 33.04 |
| | Total= | 865 | 184.91 | 9112 | 13.22 | 3.04 | 0.653 | 43.17 | 52.88 |
| | Av. | 432.5 | 51.4 | 4556 | 6.61 | 1.52 | 0.3265 | 21.585 | 26.44 |
| | Dun17 | | | | | | | | |
| 3 | CSR2 x CSR4 | 457.3 524.2 | 95.36 94.47 | 4016 6156 | 5.48 10.67 | 1.54 1.742 | 0.3 0.371 | 23.64 21.52 | 21.92 42.68 |
| | Total= | 981.5 | 189.83 | 10172 | 16.15 | 3.282 | 0.671 | 45.16 | 64.6 |
| | Av. | 490.75 | 94.915 | 5086 | 8.075 | 1.641 | 0.3355 | 22.58 | 32.3 |
| | Dun17 | | | | | | | | |
| 4 | APS105 x APS126 | 447.9 474.4 | 87.48 20.26 | 5692 5090 | 6.03 7.26 | 1.66 1.427 | 0.32 0.279 | 19.48 19.71 | 24.08 29.04 |
| | Total= | 922.3 | 107.74 | 10782 | 13.29 | 3.087 | 0.599 | 39.19 | 53.12 |
| | Av. | 461.15 | 53.87 | 5391 | 6.645 | 1.5435 | 0.2995 | 19.595 | 26.56 |
| | Dun17 | | | | | | | | |
| 5 | APS45 x APS12 | 471.3 470.2 | 93.85 81.14 | 3012 3124 | 3.02 4.98 | 1.61 1.53 | 0.35 0.359 | 22.21 22.77 | 12.08 19.92 |
| | Total= | 941.5 | 174.99 | 6136 | 8 | 3.14 | 0.709 | 44.98 | 32 |
| | Av. | 470.75 | 87.495 | 3068 | 4 | 1.57 | 0.3545 | 22.49 | 16 |
| | Dun17 | | | | | | | | |
| 6 | CSR46 x CSR47 | 468.7 527 | 93.85 93.55 | 3656 4984 | 4.95 8.59 | 1.56 1.729 | 0.35 0.367 | 22.63 21.46 | 19.8 34.36 |
| | Total= | 995.7 | 187.4 | 8640 | 13.54 | 3.289 | 0.717 | 44.09 | 54.16 |
| | Av. | 497.85 | 93.7 | 4320 | 6.77 | 1.6445 | 0.3585 | 22.045 | 27.08 |
| | Dun17 | | | | | | | | |

Table (ii): Reeling performance of Different Bi x Bi Hybrids during Spring Season.

(Pooled Data for Spring,2006-2007)

| Sl No. | Breed | Filament Length (M) | Filament Weigth (cg) | Filament size(D) | Reelability (%) | Raw | Neatness | Boil-off |
|--------|--------|---------------------|----------------------|------------------|-----------------|----------|----------|----------|
| | | | | | | silk (%) | (%) | |
| 1 | SLD4 | | | | | | | |
| | x | 779 | 23.98 | 2.77 | 82.63 | 32.07 | 91 | 28.06 |
| | SLD8 | 791 | 23.73 | 2.7 | 86.34 | 31.16 | 92 | 28.35 |
| | Total= | 1570 | 47.71 | 5.47 | 168.97 | 63.23 | 183 | |
| | Av. | 785 | 23.855 | 2.735 | 84.485 | 31.615 | 91.5 | 28.205 |
| 2 | Dun17 | | | | | | | |
| | x | 736 | 25.44 | 2.81 | 84.96 | 31.48 | 91 | 28.64 |
| | Dun18 | 729 | 24.36 | 2.3 | 85.26 | 31.56 | 92 | 28.53 |
| | Total= | 1465 | 49.8 | 5.11 | 170.22 | 63.04 | 183 | 57.17 |
| | Av. | 732.5 | 24.9 | 2.555 | 85.11 | 31.52 | 91.5 | 28.585 |
| 3 | CSR2 | | | | | | | |
| | x | 745 | 26.08 | 3.15 | 83.05 | 35.94 | 92 | 29.51 |
| | CSR4 | 740 | 27.77 | 3.11 | 83.81 | 35.85 | 92 | 29.01 |
| | Total= | 1485 | 53.85 | 3.11 | 166.86 | 71.79 | 184 | 58.52 |
| | Av. | 742.5 | 26.925 | 3.11 | 83.43 | 35.895 | 92 | 29.26 |
| 4 | APS105 | | | | | | | |
| | x | 689 | 20.44 | 2.67 | 83.38 | 35.16 | 92 | 28.06 |
| | APS126 | 674 | 20.26 | 2.9 | 84.26 | 34.42 | 92 | 28.71 |
| | Total= | 1363 | 40.7 | 5.57 | 167.64 | 69.58 | 184 | 56.77 |
| | Av. | 681.5 | 20.35 | 2.785 | 83.82 | 34.79 | 92 | 28.385 |
| 5 | APS45 | | | | | | | |
| | x | 650 | 20.37 | 2.82 | 82.73 | 29.9 | 92 | 28.57 |
| | APS12 | 670 | 20.14 | 2.24 | 82.98 | 29.53 | 92 | 28.77 |
| | Total= | 1320 | 40.51 | 5.06 | 165.71 | 59.43 | 184 | 57.34 |
| x | Av. | 660 | 20.255 | 2.53 | 82.855 | 29.715 | 92 | 28.67 |
| 6 | CSR46 | | | | | | | |
| | x | 801 | 27.59 | 3.1 | 82.95 | 36.5 | 93 | 26.78 |
| | CSR47 | 831 | 26.08 | 2.97 | 83.33 | 35.26 | 92 | 26.52 |
| | Total= | 1632 | 53.67 | 6.07 | 166.28 | 71.76 | 185 | 53.3 |
| | Av. | 816 | 26.835 | 3.035 | 83.14 | 35.88 | 92.5 | 26.65 |

Table (iii):Ranking For Spring Specific Hybrids.

| Breeds | Fecundity (Nos.) | Mean value | (a)- (b)=d | d2 | Evaluation Index Value | Rank |
|----------------------------|----------------------|---------------|---------------|----------------|------------------------------|-------|
| (1) SLD4 x SLD8 | (a) 485.8 | (b) 473.13 | 12.67 | d2 160.5289 | EI 55.58888 | (III) |
| (2) Dun17 x Dun18 | 432.5 | 473.13 | -40.63 | 1650.797 | 32.07764 | |
| (3) CSR2 X CSR4 | 490.75 | 473.13 | 22.67 | 513.9289 | 60 | (II) |
| (4) APS105X APS126 | 461.15 | 473.13 | -11.98 | 143.5204 | 44.71548 | |
| (5) APS45 X APS12 | 470.753 | 473.1 | -2.347 | 5.508409 | 48.96471 | |
| (6)CSR46 X CSR47 | 497.85 | 473.13 | 24.72 | 611.0784 | 60.90428 | (I) |

$$\Sigma d^2 = 3085.362$$

$$\Sigma d^2/n \quad \text{where} \\ 514.227$$

$$\sqrt{514.227} \\ 22.67657$$

Table (iv): Evaluation index of six Bi x Bi Hybrids of Bombyx- mori L in (Spring Season)☒

| | BRE ED | EI value for Fecun dity | EI value for Hat% | EI value for ERR(No) | EI value for ERR(WT.) | EI value for S.C.wt . (g) | EI value for S.s.wt . (g) | EI value for SR% | EI value for Yield/1 00 dfls. | EI value for Filame nt Length (M) | EI value for Filam ent Wt. |
|---|-------------------------------|-------------------------------------|-------------------------------|-----------------------------------|------------------------------------|---------------------------------------|---------------------------------------|---------------------------------|--|---|---|
| 1 | SLD 4 x SLD 8 | (a) EI 55.58 888 | (b) EI 57.36 612 | © EI 56.60 311 | (d) EI 62.039 | (e) EI 67.28 571 | (f) EI 65.78 791 | (g) EI 59.851 2173 | (h) EI 65.914 8864 | (I) EI 57.451 646 | (j) EI 50.01 838 |
| 2 | Dun1 7 x Dun1 8 | 32.07 764 | 36.02 732 | 49.61 542 | 48.882 | 62.57 143 | 50.56 598 | 52.637 5113 | 56.123 3179 | 52.686 586 | 54.05 331 |
| 3 | CSR 2 x CSR 4 | 60 | 58.71 585 | 56.52 489 | 58.454 | 54.71 429 | 50.29 789 | 56.334 5356 | 62.932 5665 | 53.594 217 | 61.30 515 |
| 4 | APS 105 x APS 126 | 44.71 548 | 36.28 415 | 60.50 109 | 49.046 | 59.21 429 | 51.37 027 | 70.581 605 | 58.574 185 | 29.905 062 | 37.13 235 |
| 5 | APS 45 x APS 12 | 48.96 471 | 54.66 12 | 30.21 675 | 31.645 | 55.42 857 | 50.26 81 | 55.522 9937 | 55.946 0462 | 46.106 265 | 36.80 147 |
| 6 | CSR 46 x CSR 47 | 60.90 428 | 58.04 918 | 46.53 875 | 49.934 | 55.14 286 | 51.07 239 | 51.510 3697 | 56.863 2023 | 60.265 3 | 60.97 426 |

Contd.

| El value for Filament Size (D) | El value for Reelabilit y (%) | El value for Raw silk | El value for Neatnes s (%) | El value for Boil-off | CUMULA - TIVE El | Av. | Rank |
|---|---|-------------------------------|--|-------------------------------|---------------------------|----------|-------|
| (k) El 47.4885 8 | (L) El 58.78205 | (m) El 43.2008 4 | (n) El 49.22495 | (o) El 48.9414 7 | 838.5452 | 55.90302 | (III) |
| 39.2694 1 | 66.79487 | 42.8033 5 | 50 | 53.6737 2 | 747.7814 | 49.8521 | |
| 64.6118 7 | 45.25641 | 61.1087 9 | 50 | 62.0797 | 855.9301 | 57.06201 | (II) |
| 49.7716 9 | 49.74359 | 56.4853 6 | 50 | 48.8169 4 | 752.1421 | 50.14281 | |
| 38.1278 5 | 37.88462 | 35.2510 5 | 50 | 45.2677 5 | 672.0921 | 44.80614 | |
| 61.1872 1 | 41.53846 | 61.0460 3 | 50 | 29.5765 9 | 910.8131 | 60.72088 | (I) |

4. Conclusion

Analysis of the growth and economic traits of cocoon revealed that three mulberry silkworm breed viz. CSR46 x CSR47(EIV60.7208), CSR2 x CSR4(EIV57.0620)and SLD4 x SLD8(EIV 55.9030)are the most promising for commercial exploitation in agroclimatic condition of North eastern region of India.

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