Studies on the performance of some silkworm, *Bombyx mori* L, hybrids during summer season in Kashmir

Shabir A Bhat, Malik Farooq IL Khan and KA Sahaf

Abstract

Eight newly evolved silkworm, *Bombyx mori* L, hybrids were evaluated for their performance in eight metric traits viz., fecundity, hatching, larval weight, yield per 10,000 larvae by number and by weight, single cocoon weight, single shell weight and shell ratio (%). The data generated were analyzed statistically and subjected to multiple trait evaluation index. Four hybrids viz., SK28 × SBNP1, SK6 × SBNP1, NB-D2 × SHs and SK6 × SBNP1, exhibited better performance during summer season.

Keywords: *Bombyx mori*, evaluation, hybrid, silkworm, summer and trait

Introduction

Kashmir is the temperate sericulture belt bestowed with climate suited for production of bivoltine silk of international standard. Though there is scope for taking two to three crops per year on a large scale, but mainly one major crop is taken commercially during spring whereas during summer 10-15 percent farmers take up sericulture\[^{[17]}\]. Production is below the production potential in both seasons especially during summer. Attempts have been made to popularize the second silkworm rearing on a commercial scale\[^{[8,11]}\] but the non-availability of season specific hybrids, shortage of quality mulberry leaf, disease prevalence etc come in way of the achieving the targets. Although a good number of silkworm breeds / hybrids have been developed for rearing during the spring season under Kashmir climatic conditions\[^{[23,7,10,12]}\] yet limited work has been carried out for evolution / identification of silkworm hybrids for summer season under Kashmir climatic conditions\[^{[16]}\]. The present study is an attempt towards identification of silkworm hybrids suitable for rearing during summer season in Kashmir. Identification and rearing of summer specific silkworm hybrids will ensure cocoon crop stability and generate more income to sericultural farmers. The introduction of multiple cocoon crop will make sericulture viable and sustainable in the region.

Material and Methods

Eight silkworm crosses viz., SK28 × SBNP1, SK6 × SBNP1, SK6 × SBNP1, SH6 × KA, SH6 × NB2, NB-D2 × KA, NB-D2 × SHs and SH6 × NB-D2 were prepared and the disease free layings of these crosses were reared at the Temperate Sericulture Research Institute (TSRI), Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Mirgund. The experiment was laid down in a Completely Randomized Design (CRD) with three replications of 300 larvae following the standard rearing procedure\[^{[1]}\]. The data for eight metric traits viz., number of eggs/ laying, hatching percentage, ten mature larval weight, yield per 10,000 larvae by number and by weight, single cocoon weight, single shell weight and shell ratio were recorded, analyzed statistically and also subjected to Multiple Trait Evaluation Index (EI)\[^{[14]}\] to identify with top ranking hybrids for exploitation in the field during summer under Kashmir climatic conditions.

Evaluation and Index

Evaluation index value (EI) for silkworm hybrid performance was calculated by using the following formula

\[
\text{Evaluation index} = \frac{A - B}{C} \times 10 + 50
\]

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Where,
A= Value obtained for a particular trait of particular hybrid combination
B= Mean value of particular trait of all the hybrid combinations
C= Standard Deviation
10= Standard Unit
50= Fixed Value
The average index value fixed for the selection of a combination is >50. The hybrid combinations with the relatively higher value of >50 were only considered to have greater economic value.

Results and Discussion
The results on eight metric traits are presented in table 1. Highest fecundity (622) was recorded in NB4 × KA and found significantly superior to other hybrids. Maximum hatching percentage (97.37) was recorded in SH6 × NB4D2 significantly superior to SK30 × SBNP1 (86.82) but at par with other hybrids. Weight of ten mature larvae was recorded (40.30g) in NB4 × KA which was significantly superior to SK6 × SBNP1 (34.30), SH6 × NB4D2 (31.59), and SH6 × KA (24.04) but was at par with SK30 × SBNP1 (39.78), SK30 × SBNP1 (39.01), SH6 × NB4 (37.23), NB4 × KA (40.30) and NB4D2 × SH6 (37.79). Highest yield per 10,000 larvae by number was obtained in SK6 × SBNP1 (8050) and lowest in SH6 × NB4 (5666), however the yield per 10,000 larvae by weight (Kg) was highest in SK28 × SBNP1 (15.00) and lowest (8.50) in SH6 × KA. Single cocoon weight was recorded in the range of 1.45 to 1.63g being highest in SK28 × SBNP1 followed by NB4D2 × SH6 and SK30 × SBNP1 with values of 1.61 and 1.59, respectively. Highest single cocoon shell weight of 0.35g was recorded in SK30 × SBNP1 followed by SK28 × SBNP1 and SK30 × SBNP1 with value of 0.34 and 0.33g respectively. The highest shell ratio percentage (21.61) was recorded in SK30 × SBNP1 followed by SK6 × SBNP1 (21.47) and SK6 × SBNP1 (21.25). The data in respect of important commercial characters viz., number of eggs / laying, hatching percentage, larval weight, yield per 10,000 larvae by number and by weight, cocoon weight, shell weight and shell ratio were subjected to multiple trait evaluation index (EI) as per Mano et al. (1993) and is presented in table 2. On the basis of evaluation index only four silkworm hybrids viz., SK28 × SBNP1 (57.66), SK6 × SBNP1 (55.15), NB4D2 × SH6 (53.29), and SK30 × SBNP1 (52.25) scored values greater than 50 (Table 2 and Fig.1).

The manifestation of heterosis described in terms of superiority through F1 hybrid performance over the parental performance is well established in biological kingdom. It is well documented that parental stock undergo some deterioration in performance due to continuous inbreeding therefore, evolution of new breeds / hybrid is must so that week and low yielding breeds are replaced with new productive ones. Fusion of new gene combinations by genetic manipulation is one of the powerful tools in improving the commercial traits of plants and animals. As per available literature manifestation of heterosis in silkworm has been demonstrated by many breeders [2, 7, 9, 8, 21, 13, 6]. The F1 hybrids are robust, productive, tolerant to biotic and abiotic stress [5] and can be reared easily by adopting appropriate rearing technology [3]. The high levels of production and productivity is mainly attributed to use of highly productive silkworm hybrids for commercial cocoon production. In earlier studies silk productivity was regarded to be one of the important characteristics for evaluation of silkworm hybrid / breeds [24, 20] but cocoon yield being a complex trait is contributed by more than 21-components traits [22]. Hence the identification of new and productive hybrids call for consideration of the cumulative effects of all the component traits on cocoon silk yield so multiple trait evaluation index method developed by [14] has been utilized for short-listing silkworm breeds / hybrids by various breeders [17, 18, 10, 12, 15]. In this method equal weight-age is given to yield components and has been employed in the present investigation as well. Based on the values obtained for eight metric traits, only four top ranking hybrids viz., SK28 × SBNP1 (57.660), SK6 × SBNP1 (55.15), NB4D2 × SH6 (53.29), and SK30 × SBNP1 (52.25) were identified / short listed based on higher index value (>50). These short listed hybrids are recommended for rearing during summer season to boost the cocoon production in the region.

Table 1: Performance of silkworm hybrids with respect to rearing parameters.

<table>
<thead>
<tr>
<th>Silkworm Hybrids</th>
<th>Fecundity (No)</th>
<th>Hatching (%)</th>
<th>Larval Weight (g)</th>
<th>Yield / 10000 Larvae By No.</th>
<th>By Wt.</th>
<th>Cocoon Wt. (g)</th>
<th>Shell Wt (g)</th>
<th>Shell ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK28 × SBNP1</td>
<td>571</td>
<td>95.67</td>
<td>39.78</td>
<td>7500</td>
<td>15.00</td>
<td>1.63</td>
<td>0.34</td>
<td>21.25</td>
</tr>
<tr>
<td>SK30 × SBNP1</td>
<td>342</td>
<td>86.82</td>
<td>39.01</td>
<td>7100</td>
<td>13.90</td>
<td>1.59</td>
<td>0.35</td>
<td>21.61</td>
</tr>
<tr>
<td>SK6 × SBNP1</td>
<td>560</td>
<td>97.36</td>
<td>34.30</td>
<td>8050</td>
<td>12.83</td>
<td>1.56</td>
<td>0.33</td>
<td>21.47</td>
</tr>
<tr>
<td>SH6 × KA</td>
<td>553</td>
<td>93.66</td>
<td>24.04</td>
<td>5950</td>
<td>8.50</td>
<td>1.48</td>
<td>0.28</td>
<td>19.27</td>
</tr>
<tr>
<td>SH6 × NB4</td>
<td>570</td>
<td>95.41</td>
<td>37.23</td>
<td>5666</td>
<td>10.21</td>
<td>1.55</td>
<td>0.29</td>
<td>18.89</td>
</tr>
<tr>
<td>NB4 × KA</td>
<td>622</td>
<td>97.06</td>
<td>40.30</td>
<td>7366</td>
<td>10.16</td>
<td>1.45</td>
<td>0.28</td>
<td>19.52</td>
</tr>
<tr>
<td>NB4D2 × SH6</td>
<td>491</td>
<td>95.97</td>
<td>37.79</td>
<td>6650</td>
<td>14.16</td>
<td>1.61</td>
<td>0.33</td>
<td>20.72</td>
</tr>
<tr>
<td>SH6 × NB4D2</td>
<td>503</td>
<td>97.37</td>
<td>31.59</td>
<td>6716</td>
<td>11.66</td>
<td>1.54</td>
<td>0.30</td>
<td>19.43</td>
</tr>
<tr>
<td>CD@5%</td>
<td>10</td>
<td>5.8</td>
<td>4.99</td>
<td>1276</td>
<td>1.66</td>
<td>0.82</td>
<td>0.227</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Table 2: Evaluation index for eight different commercial characters of silkworm hybrids.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Fecundity</th>
<th>Hatching</th>
<th>Larval Weight</th>
<th>Yield/10000 larvae By No.</th>
<th>By Wt.</th>
<th>Cocoon weight</th>
<th>Shell weight</th>
<th>Shell ratio</th>
<th>Mean EI</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK28 × SBNP1</td>
<td>53</td>
<td>51.42</td>
<td>57.34</td>
<td>56.15</td>
<td>62.51</td>
<td>60.35</td>
<td>60.07</td>
<td>56.58</td>
<td>57.66</td>
<td>1</td>
</tr>
<tr>
<td>SK30 × SBNP1</td>
<td>34</td>
<td>34.69</td>
<td>56.01</td>
<td>52.67</td>
<td>57.83</td>
<td>55.70</td>
<td>61.17</td>
<td>59.02</td>
<td>52.25</td>
<td>1</td>
</tr>
<tr>
<td>SK6 × SBNP1</td>
<td>52</td>
<td>54.62</td>
<td>47.92</td>
<td>61.63</td>
<td>53.30</td>
<td>51.51</td>
<td>56.76</td>
<td>58.08</td>
<td>55.15</td>
<td>1</td>
</tr>
<tr>
<td>SH6 × KA</td>
<td>52</td>
<td>47.63</td>
<td>30.32</td>
<td>40.73</td>
<td>43.88</td>
<td>40.34</td>
<td>40.20</td>
<td>43.28</td>
<td>40.52</td>
<td>3</td>
</tr>
<tr>
<td>SH6 × NB4</td>
<td>53</td>
<td>50.93</td>
<td>52.95</td>
<td>73.91</td>
<td>42.18</td>
<td>50.11</td>
<td>42.40</td>
<td>40.68</td>
<td>45.07</td>
<td>3</td>
</tr>
<tr>
<td>NB4 × KA</td>
<td>57</td>
<td>54.05</td>
<td>58.24</td>
<td>54.83</td>
<td>41.96</td>
<td>35.68</td>
<td>39.09</td>
<td>44.96</td>
<td>48.30</td>
<td>2</td>
</tr>
<tr>
<td>NB4D2 × SH6</td>
<td>47</td>
<td>51.99</td>
<td>53.92</td>
<td>47.69</td>
<td>58.97</td>
<td>57.56</td>
<td>55.65</td>
<td>55.04</td>
<td>53.29</td>
<td>1</td>
</tr>
<tr>
<td>SH6 × NB4D2</td>
<td>48</td>
<td>54.63</td>
<td>43.26</td>
<td>48.36</td>
<td>48.34</td>
<td>48.72</td>
<td>44.61</td>
<td>44.31</td>
<td>47.73</td>
<td>2</td>
</tr>
</tbody>
</table>
Fig 1: Graphical representation of mean evaluation index of different economic characters of silkworm hybrids.

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References


