SHORTLISTING OF PROMISING SILKWORM BREEDS AND HYBRIDS OF THE SILKWORM, *BOMBYX MORI* L.

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**ABSTRACT:** Identification of promising silkworm breeds and hybrids was carried out utilizing various statistical tools viz, multiple traits evaluation indices, subordinate function indices, combining ability and hybrid vigour. Out of six multivoltine silkworm breeds, AGL$_5$ was found promising exhibiting maximum values based on its performance, multiple traits evaluation indices, subordinate function indices and general combining ability exhibiting maximum values for seven characters viz., cocoon yield/10,000 larvae by weight, cocoon weight, cocoon shell weight, filament length, reelability, raw silk percentage and neatness followed by AGL$_3$ which exhibited higher values for three characters viz., fecundity, cocoon shell percentage and raw silk percentage. Data revealed distinct superiority of two multivoltine × bivoltine hybrids viz., AGL$_3$ × CSR$_2$ and AGL$_5$ × CSR$_2$. AGL$_5$ × CSR$_2$ recorded maximum values for cocoon yield/10,000 larvae by weight and cocoon weight analyzed through all the statistical tools whereas maximum values were obtained for cocoon shell percentage, reelability and neatness. AGL$_3$ × CSR$_2$ exhibited comparatively higher values for cocoon yield/10,000 larvae by weight, cocoon weight and cocoon shell weight analyzed through all the methods except special combining ability (SCA).

**KEY WORDS:** *Bombyx mori*, Hybrid vigour, Combining ability, Multiple traits evaluation indices, Performance, Silkworm breed and hybrids, Subordinate function indices.

Selection of promising silkworm breeds and hybrids based on cumulative effect of several characters is important in silkworm breeding (Narayanaswamy et al., 2002). Several attempts have been made to select silkworm breeds / hybrids on the basis of multiple traits evaluation indices (Vidyunmala et al., 1998; Kariappa & Rajan, 2005; Gangopadhay et al., 2006; Choudhary & Singh, 2006a), multiple traits evaluation and subordinate function indices (Babu et al., 2002; Rao et al., 2006; Nirupama et al., 2008) and through analysis of combining ability and hybrid vigour (Datta et al., 2001; Choudhary & Singh, 2006b; Singh et al., 2000, 2001, 2010). The present study has been undertaken to identify promising multivoltine breeds and multivoltine × bivoltine hybrids based on the performance as well as through different statistical methods like multiple traits evaluation indices method of Mano et al. (1993), subordinate function indices method of Gower (1971), analysis of combining ability method of Kempthorne (1957) and hybrid vigour.

**MATERIALS AND METHODS**

Six multivoltine silkworm breeds namely, AGL$_1$, AGL$_2$, AGL$_3$, AGL$_4$, AGL$_5$ and PM and thirty six multivoltine × bivoltine hybrids were utilized in this study. Rearing of both silkworm breeds along with hybrids was conducted with three replications in each and 300 larvae were retained after III moult. Data were recorded for ten economic characters namely, fecundity, pupation rate, yield/10,000 larvae by weight, cocoon weight, cocoon shell weight, cocoon shell percentage, filament length, reelability, raw silk percentage and neatness. Data were analyzed based on the performance, multiple traits evaluation index method, subordinate function index method, combining ability and hybrid vigour.
RESULTS AND DISCUSSION

Performance of multivoltine breeds along with multiple traits index values, subordinate function index values and general combining ability values have been given in Table 1. Promising multivoltine × bivoltine hybrids along with hybrid vigour and various evaluation indices for different characters have been given in Table 2. Among six multivoltine breeds, AGL_5 exhibited maximum values on the basis of performance, multiple evaluation index, subordinate function index and general combining ability for seven characters viz., cocoon yield/10,000 larvae by weight, cocoon weight, cocoon shell weight, filament length, reelability, raw silk percentage and neatness. AGL_3 exhibited for three characters viz., fecundity, cocoon shell percentage and raw silk percentage. Among thirty six multivoltine × bivoltine hybrids, two hybrids viz., AGL_3 × CSR_2 and AGL_5 × CSR_2 were found promising. AGL_5 × CSR_2 exhibited maximum values for cocoon yield/10,000 larvae by weight and cocoon weight analyzed through all the methods whereas maximum values were obtained for cocoon shell percentage, reelability and neatness. AGL_3 × CSR_2 exhibited comparatively higher values for cocoon yield/10,000 larvae by weight, cocoon weight and cocoon shell weight analyzed through all the methods except special combining ability (SCA).

Studies have been carried out to select silkworm breeds / hybrids through multiple traits evaluation index method (Gangopadhyay et al., 2006; Choudhary & Singh, 2006a), subordinate function index method (Babu et al., 2002; Rao et al., 2006; Lakshmi & Chandrashekharaiah, 2007; Nirupama et al., 2008) and through analysis of combining ability and hybrid vigour (Datta et al., 2001; Choudhary & Singh, 2006b; Singh et al., 2000, 2001, 2010). The identified breeds AGL_3 and AGL_5 may be further utilized in future breeding programmes for the development of superior multivoltine silkworm breeds. The promising multivoltine × bivoltine hybrids AGL_3 × CSR_2 may be exploited for commercial exploitation.

LITERATURE CITED


**Table 1. Identification of multivoltine silkworm breeds based on various statistical analyses.**

<table>
<thead>
<tr>
<th>Characters</th>
<th>Based on performance</th>
<th>Based on Evaluation Index values</th>
<th>Based on Subordinate Function Index values</th>
<th>Based on General Combining Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feecundy</td>
<td>AGL (516)</td>
<td>AGL (62.22)</td>
<td>AGL (1.003)</td>
<td>AGL (46.033)</td>
</tr>
<tr>
<td>Pupation rate</td>
<td>AGL (92.50)</td>
<td>AGL (64.29)</td>
<td>AGL (1.001)</td>
<td>AGL (20.030)</td>
</tr>
<tr>
<td>Cocoon yield/10,000 larvae by wt</td>
<td>AGL (11.111)</td>
<td>AGL (57.09)</td>
<td>AGL (1.000)</td>
<td>AGL (1.453)</td>
</tr>
<tr>
<td>Cocoon weight</td>
<td>AGL (1.271)</td>
<td>AGL (56.69)</td>
<td>AGL (1.000)</td>
<td>AGL (0.504)</td>
</tr>
<tr>
<td>Cocoon shell weight</td>
<td>AGL (0.223)</td>
<td>AGL (57.18)</td>
<td>AGL (1.000)</td>
<td>AGL (0.475)</td>
</tr>
<tr>
<td>Cocoon shell %</td>
<td>AGL (17.70)</td>
<td>AGL (55.31)</td>
<td>AGL (1.000)</td>
<td>AGL (0.464)</td>
</tr>
<tr>
<td>Filament length (m)</td>
<td>AGL (5.55)</td>
<td>AGL (59.85)</td>
<td>AGL (1.000)</td>
<td>AGL (0.524)</td>
</tr>
<tr>
<td>Reelability (%)</td>
<td>AGL (0.84)</td>
<td>AGL (62.30)</td>
<td>AGL (1.000)</td>
<td>AGL (0.505)</td>
</tr>
<tr>
<td>Raw silk %</td>
<td>AGL (12.9)</td>
<td>AGL (60.93)</td>
<td>AGL (1.077)</td>
<td>AGL (30.033)</td>
</tr>
<tr>
<td>Neatness</td>
<td>AGL (90)</td>
<td>AGL (60.43)</td>
<td>AGL (1.358)</td>
<td>AGL (1.152)</td>
</tr>
</tbody>
</table>
Table 2. Identification of multivoltine × bivoltine hybrids based on various statistical analyses.

<table>
<thead>
<tr>
<th>Character</th>
<th>Based on performance</th>
<th>Based on Evaluation Index value</th>
<th>Based on Subordinate Function Index value</th>
<th>Based on Specific Combining Ability</th>
<th>Based on Hybrid vigour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feecundity</td>
<td>AGL₁ × CSR₅(512)</td>
<td>AGL₁ × CSR₅(67.66)</td>
<td>AGL₁ × CSR₅(1.002)</td>
<td>AGL₁ × CSR₅(45.522)</td>
<td>AGL₁ × CSR₅(12.56)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(506)</td>
<td>AGL₁ × CSR₅(85.50)</td>
<td>AGL₁ × CSR₅(0.850)</td>
<td>AGL₁ × CSR₅(51.122)</td>
<td>AGL₁ × CSR₅(7.34)</td>
</tr>
<tr>
<td>Pupation rate</td>
<td>AGL₁ × CSR₅(97.73)</td>
<td>AGL₁ × CSR₅(66.70)</td>
<td>AGL₁ × CSR₅(1.00)</td>
<td>PM × CSR₅(1.264)</td>
<td>AGL₁ × NB₅D₅(8.51)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(97.60)</td>
<td>AGL₁ × CSR₅(58.62)</td>
<td>AGL₁ × CSR₅(0.906)</td>
<td>PM × CSR₅(3.321)</td>
<td>AGL₁ × NB₅D₅(7.61)</td>
</tr>
<tr>
<td>Cocoon yield / 10,000 larvae by wt</td>
<td>AGL₁ × CSR₅(59.82)</td>
<td>AGL₁ × CSR₅(78.25)</td>
<td>AGL₁ × CSR₅(1.600)</td>
<td>AGL₁ × CSR₅(1.379)</td>
<td>AGL₁ × CSR₅(51.98)</td>
</tr>
<tr>
<td>Cocoon weight</td>
<td>AGL₁ × CSR₅(2.041)</td>
<td>AGL₁ × CSR₅(66.54)</td>
<td>AGL₁ × CSR₅(0.788)</td>
<td>PM × CSR₅(0.717)</td>
<td>AGL₁ × CSR₅(46.63)</td>
</tr>
<tr>
<td>Cocoon shell weight</td>
<td>AGL₁ × CSR₅(0.421)</td>
<td>AGL₁ × CSR₅(78.66)</td>
<td>AGL₁ × CSR₅(1.001)</td>
<td>AGL₁ × CSR₅(0.114)</td>
<td>AGL₁ × CSR₅(39.31)</td>
</tr>
<tr>
<td>Cocoon shell %</td>
<td>AGL₁ × CSR₅(0.421)</td>
<td>AGL₁ × CSR₅(70.84)</td>
<td>AGL₁ × CSR₅(0.773)</td>
<td>AGL₁ × CSR₅(0.053)</td>
<td>AGL₁ × CSR₅(37.67)</td>
</tr>
<tr>
<td>Filament length (cm)</td>
<td>AGL₁ × CSR₅(87.10)</td>
<td>AGL₁ × CSR₅(65.90)</td>
<td>AGL₁ × CSR₅(1.000)</td>
<td>AGL₁ × CSR₅(0.738)</td>
<td>AGL₁ × CSR₅(13.96)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(33.5)</td>
<td>AGL₁ × CSR₅(70.52)</td>
<td>AGL₁ × CSR₅(0.995)</td>
<td>AGL₁ × CSR₅(0.569)</td>
<td>AGL₁ × NB₅D₅(12.12)</td>
</tr>
<tr>
<td>Reelability (%)</td>
<td>AGL₁ × CSR₅(84)</td>
<td>AGL₁ × CSR₅(72.02)</td>
<td>AGL₁ × CSR₅(0.023)</td>
<td>AGL₁ × NB₅D₅(4.500)</td>
<td>AGL₁ × NB₅D₅(10.22)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(82)</td>
<td>AGL₁ × CSR₅(64.79)</td>
<td>AGL₁ × CSR₅(0.861)</td>
<td>AGL₁ × CSR₅(3.367)</td>
<td>AGL₁ × NB₅D₅(8.52)</td>
</tr>
<tr>
<td>Raw silk %</td>
<td>AGL₁ × CSR₅(56.2)</td>
<td>AGL₁ × CSR₅(71.59)</td>
<td>AGL₁ × CSR₅(0.853)</td>
<td>AGL₁ × CSR₅(0.670)</td>
<td>AGL₁ × NB₅D₅(42.79)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(15.2)</td>
<td>AGL₁ × CSR₅(64.06)</td>
<td>AGL₁ × CSR₅(0.990)</td>
<td>AGL₁ × NB₅D₅(0.631)</td>
<td>AGL₁ × NB₅D₅(10.34)</td>
</tr>
<tr>
<td>Nestmass</td>
<td>AGL₁ × CSR₅(91)</td>
<td>AGL₁ × CSR₅(84.18)</td>
<td>AGL₁ × CSR₅(0.943)</td>
<td>AGL₁ × CSR₅(3.589)</td>
<td>AGL₁ × CSR₅(3.51)</td>
</tr>
<tr>
<td></td>
<td>AGL₁ × CSR₅(65)</td>
<td>AGL₁ × CSR₅(60.35)</td>
<td>AGL₁ × CSR₅(0.889)</td>
<td>AGL₁ × NB₅D₅(1.000)</td>
<td>AGL₁ × NB₅D₅(1.31)</td>
</tr>
</tbody>
</table>

Plate I. 1 - Larvae of AGL₅, 2 - Cocoons of AGL₅, 3 - Larvae of AGL₆ and 4 - Cocoons of AGL₆.
Plate II. 1 - Larvae of AGL₁ × CSR₂, 2 - Cocoons of AGL₁ × CSR₂, 3 - Larvae of AGL₅ × CSR₂ and 4 - Cocoons of AGL₅ × CSR₂.