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 v*iz.,* 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; Gangopadhyay 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.

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

Characters	Based on performance	Based on Evaluation Index values	Based on Subordinate Function Index values	Based on General Combining Ability
Fecundity	AGL_6 (516) AGL_3 (495)	AGL_5 (62.22) AGL_3 (57.41)	AGL_5 (1.003) AGL_3 (0.794)	AGL_5 (46.033) AGL_6 (20.300)
Pupation rate	AGL_6 (92.50) AGL_3 (91.18)	AGL_5 (64.29) AGL_3 (55.57)	AGL_5 (1.001) AGL_3 (0.645)	AGL_6 (1.453) -
Cocoon yield/10,000 larvae by wt	AGL_6 (11.111) AGL_3 (10.511)	AGL_5(67.09) AGL_3 (48.56)	AGL_6 (1.000) -	AGL_6 (0.584) AGL_6 (0.475)
Cocoon weight	AGL_6 (1.271) AGL_3 (1.189)	AGL_5 (66.69) AGL_3 (51.39)	AGL_5 (1.000) AGL_3 (0.885)	AGL_5(0.046) AGL_6 (0.031)
Cocoon shell weight	AGL_6 (0.225) AGL_3 (0.193)	AGL_5 (67.18) AGL_3 (48.18)	AGL_6 (1.000) -	AGL_6 (0.017) AGL_5 (0.015)
Cocoon shell %	AGL_6 (17.70) AGL_3 (16.91)	AGL_5 (65.31) AGL_3 (54.54)	AGL_5 (1.001) AGL_3 (0.568)	AGL_6 (0.524) AGL_6 (0.505)
Filament length (m)	AGL_6 (555) AGL_3 (526)	AGL_5 (63.85) AGL_3 (56.36)	AGL_6 (1.000) AGL_3 (0.674)	AGL_6 (30.033) -
Reelability (%)	AGL_6 (84) AGL_3 (82)	AGL_5(62.30) AGL_3 (58.91)	AGL_5 (0.974) AGL_3 (0.821)	AGL_5 (1.358) -
Raw silk %	AGL_6 (12.9) AGL_3 (12.8)	AGL_5 (60.93) AGL_3 (58.58)	AGL_5 (1.077) AGL_3 (0.974)	AGL_5 (0.696) AGL_6 (0.402)
Neatness	AGL_6 (90) AGL_3 (90)	AGL_5 (60.43) AGL_3 (60.43)	AGL_6 (0.889) AGL_3 (0.889)	AGL_6 (1.189) AGL_6 (1.122)

Table 2. Identification of multivoltine × bivoltine hybrids based on various statistical analyses.

Characters	Based on performance	Based on Evaluation Index values	Based on Subordinate Function Index values	Based on Specific Combining Ability	Based on Hybrid vigour
Fecundity	$AGL_3 \times CSR_{12}$(513) $AGL_1 \times CSR_2$ (506)	$AGL_3 \times CSR_{12}$(67.66) $AGL_1 \times CSR_2$(65.50)	$AGL_3 \times CSR_{12}$(1.002) $AGL_1 \times CSR_2$(0.950)	$AGL_1 \times CSR_2$ (45.522) $AGL_5 \times CSR_2$ (31.122)	$AGL_2 \times CSR_4$(12.61) $AGL_2 \times CSR_{12}$ (7.34)
Pupation rate	$AGL_2 \times CSR_2$(97.33) $AGL_4 \times CSR_2$(97.60)	$AGL_2 \times CSR_2$(59.20) $AGL_4 \times CSR_2$(58.62)	$AGL_2 \times CSR_2$(1.00) $AGL_4 \times CSR_2$(0.986)	PM × CSR_2 (3.264) PM × CSR_3 (3.231)	$AGL_2 \times NB_4D_2$ (8.51) $AGL_1 \times NB_4D_2$ (7.61)
Cocoon yield / 10,000 larvae by wt	$AGL_5 \times CSR_2$(19.692) $AGL_3 \times CSR_2$(18.322)	$AGL_5 \times CSR_2$(78.25) $AGL_3 \times CSR_2$(66.84)	$AGL_5 \times CSR_2$(1.000) $AGL_3 \times CSR_2$(0.788)	$AGL_5 \times CSR_2$ (1.379) PM× CSR_3 (0.717)	$AGL_5 \times CSR_2$ (53.90) $AGL_3 \times CSR_2$ (46.63)
Cocoon weight	$AGL_5 \times CSR_2$(2.041) $AGL_3 \times CSR_2$(1.928)	$AGL_5 \times CSR_2$(82.66) $AGL_3 \times CSR_2$(70.84)	$AGL_5 \times CSR_2$(1.001) $AGL_3 \times CSR_2$(0.773)	$AGL_5 \times CSR_2$ (0.134) $AGL_2 \times CSR_{12}$ (0.053)	$AGL_5 \times CSR_2$ (39.31) $AGL_3 \times CSR_2$ (37.67)
Cocoon shell weight	$AGL_5 \times CSR_2$(0.438) $AGL_3 \times CSR_2$(0.412)	$AGL_5 \times CSR_2$(78.44) $AGL_3 \times CSR_2$(70.81)	$AGL_5 \times CSR_2$(0.998) $AGL_3 \times CSR_2$(0.837)	$AGL_4 \times NB_4D_2$ (0.039) $AGL_2 \times CSR_{12}$ (0.024)	$AGL_5 \times CSR_2$ (50.57) $AGL_3 \times CSR_2$ (50.12)
Cocoon shell %	$AGL_5 \times CSR_2$(21.44) $AGL_3 \times CSR_2$(21.38)	$AGL_5 \times CSR_2$(66.90) $AGL_3 \times CSR_2$(66.30)	$AGL_5 \times CSR_2$(1.000) $AGL_3 \times CSR_2$(0.985)	$AGL_2 \times CSR_{12}$ (0.738) $AGL_2 \times CSR_4$ (0.569)	$AGL_2 \times CSR_{12}$ (13.96) $AGL_1 \times NB_4D_2$ (12.12)
Filament length (m)	$AGL_3 \times CSR_2$(870) $AGL_5 \times CSR_2$(885)	$AGL_5 \times CSR_2$(70.53) $AGL_3 \times CSR_2$(68.03)	$AGL_5 \times CSR_2$(0.999) $AGL_3 \times CSR_2$(0.950)	$AGL_2 \times CSR_{12}$ (68.256) $AGL_5 \times NB_4D_2$ (55.989)	PM × CSR_3 (34.69) PM × CSR_2 (31.38)
Reelability (%)	$AGL_5 \times CSR_2$(84) $AGL_3 \times CSR_2$(82)	$AGL_5 \times CSR_2$(72.02) $AGL_3 \times CSR_2$(64.79)	$AGL_5 \times CSR_2$(1.028) $AGL_3 \times CSR_2$(0.861)	$AGL_1 \times NB_4D_2$ (4.500) $AGL_2 \times CSR_4$ (3.367)	$AGL_1 \times NB_4D_2$ (10.22) PM × CSR_2 (8.52)
Raw silk %	$AGL_3 \times CSR_2$(16.2) $AGL_5 \times CSR_2$(15.5)	$AGL_3 \times CSR_2$(71.59) $AGL_{35} \times CSR_2$(64.06)	$AGL_5 \times CSR_2$(0.853) $AGL_3 \times CSR_2$(0.990)	$AGL_5 \times CSR_{12}$ (0.670) $AGL_1 \times NB_4D_2$ (0.631)	$AGL_1 \times NB_4D_2$ (12.79) $AGL_1 \times CSR_{12}$ (10.34)
Neatness	$AGL_5 \times CSR_2$(91) $AGL_3 \times CSR_2$(91)	$AGL_5 \times CSR_2$(64.18) $AGL_2 \times CSR_4$(62.25)	$AGL_5 \times CSR_2$(0.944) $AGL_2 \times CSR_4$(0.889)	$AGL_4 \times CSR_2$ (1.389) $AGL_4 \times NB_4D_2$ (1.000)	$AGL_2 \times CSR_{12}$ (1.51) $AGL_1 \times NB_4D_2$ (1.31)


1


2


3


4

Plate I. 1 - Larvae of AGL_3, 2 - Cocoons of AGL_3, 3 - Larvae of AGL_5 and 4 - Cocoons of AGL_5.

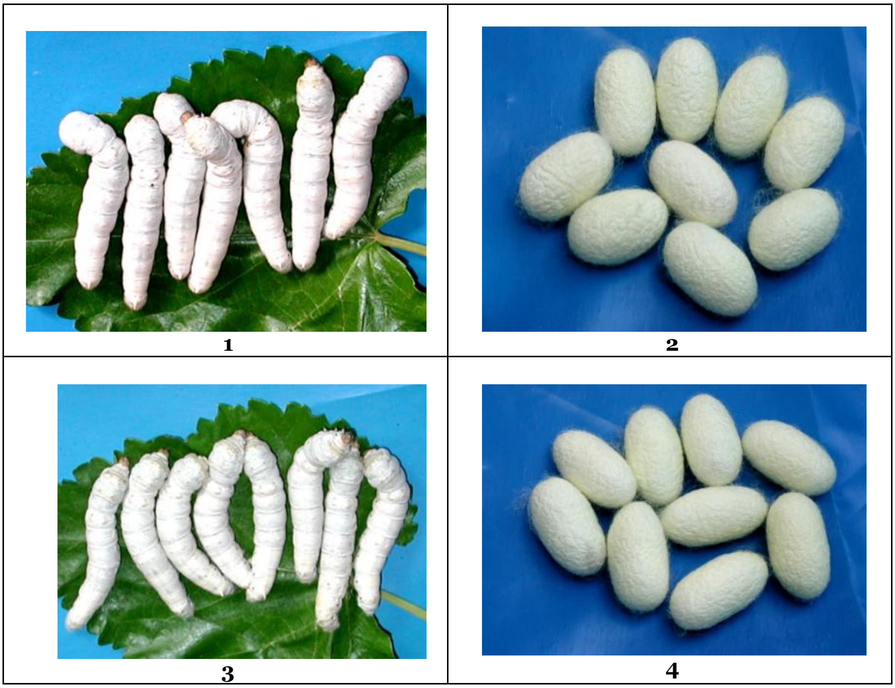

Plate II. 1 - Larvae of $AGL_3 \times CSR_2$, 2 - Cocoons of $AGL_3 \times CSR_2$, 3 - Larvae of $AGL_5 \times CSR_2$ and 4 - Cocoons of $AGL_5 \times CSR_2$.