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Short Communication

Genetic variability and selection index of some quantitative traits of bivoltine silkworm (*Bombyx mori* L.) genotypes

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Genetic variation among genotypes and relation between major yield contributing traits are of vital importance in the breeding programme that aim to produce improved genotype [1]. The present investigation has been undertaken to estimate the genetic variability of some important economic characters of bivoltine silkworm genotypes and their evaluation based on selection index for use in the breeding programme. A total of 59 bivoltine silkworm germplasm stocks (Thirty genotypes of spin peanut shape cocoons, sixteen genotypes of spin oval shape cocoons, eleven genotypes of spin elliptical shape cocoons, and two genotypes of spin spindle shape cocoons) maintained at Central Sericultural Research and Training Institute, Berhampore, were reared during two favourable seasons *viz.*, March-April, Nov-Dec (2001 to 2003) in completely randomized design (CRD). During rearing, the important quantitative traits having commercial value such as, fecundity, larval period (days), pupation rate (%), cocoon yield/10,000 larvae (wt), cocoon weight (g), shell weight (g), cocoon shell ratio (%), filament length (m) and denier were recorded. The data were subjected to analysis of variance, estimation of genotypic and phenotypic coefficients of variation (GCV %, PCV %), heritability (h^2 in broad sense) and genetic advancement. The selection index for ranking the genotypes was done following smith [2], based on the criterion I and II (Table 1).

The mean performance of fifty-nine bivoltine silkworm genotypes and their ranking (based on selection index) are presented in Table 1. Analysis of variance revealed highly significant differences among the genotypes for all the traits studied. The mean, range, phenotypic and genotypic variability and genetic advance of different traits are presented in Table 2. The maximum PCV% (15.94) and GCV% (14.84) and heritability (86.67%) were observed in shell weight, followed by filament length (15.70, 15.02, and 91.42 respectively). This indicates that the selection based on these characters will be highly effective for improvement. The characters like, fecundity, cocoon weight and larval period showed low GCV % (8.86, 8.31 and 2.38, respectively) and low heritability (64.76, 73.61 and 50.91%, respectively) demonstrating maximum environmental influence. The characters with low values of heritability are of little importance in selection strategies because here most variations are non-transmissible. Characters with high heritability as well as high genetic advance indicating possible operation of additive gene action and hence respond better to simple phenotypic selection than those having low heritability and low genetic advance [3].

The differences between the phenotypic and genotypic variance was observed more for fecundity, larval period and pupation rate (%). The phenotypic coefficients of variation for the characters were higher than the genotypic coefficients of variation, which may due to higher degree of interaction of the genotypes with the environment. Minimum difference of phenotypic and genotypic variance was observed for cocoon weight, shell weight, filament length and denier indicating less environmental effect.

A selection index is used when the breeder simultaneously selects many desirable economic traits to improve it in a desired direction [1, 4]. In this study we ranked the genotypes giving different weightage to different traits (Table 1) considering their heritability and correlation existing between the traits. The results showed among the fifty nine genotypes, D3 was ranked first followed by YS3, MC4 (E), SK3, MC4 (O), SF19, D6 (P), NB18, O4, O1 and so on. Of the first ten top ranked genotypes, three genotype spin peanut shape cocoons (Japanese type), three genotypes spin elliptical shape cocoons and four genotypes spin oval shape cocoons (Chinese type). These genotypes can be used in conventional breeding programme for evolving superior bivoltine silkworm breeds suitable for tropical climatic conditions.

Table 1. Mean performance of bivoltine silkworm genotypes and their ranking based on selection index

Breed	Fecundity (No)	Larval period (days)	Pupation rate (%)	Cocoon yield/ 10000 larvae wt (kg)	Cocoon weight (g)	Shell weight (g)	Cocoon shell ratio (%)	Filament length (m)	Denier	Selection index	Rank
D3	464	24.17	80.07	12.16	1.46	0.30	20.50	917	2.5	254	1
YS3	544	25.25	75.25	11.59	1.53	0.28	18.00	892	2.4	346	2
MC4(E)	538	26.38	83.74	11.89	1.48	0.28	18.83	938	2.1	351	3
SK3	471	25.38	80.61	10.62	1.36	0.28	20.44	968	2.2	355	4
MC4(O)	502	24.54	85.08	11.43	1.37	0.25	18.69	884	2.0	372	5
SF-19	523	26.63	87.51	12.77	1.49	0.27	18.33	828	2.2	408	6
D6(P)	513	25.00	66.01	9.58	1.49	0.28	18.91	927	2.5	408	7
NB18	507	27.67	70.90	10.30	1.58	0.34	21.10	963	2.6	434	8
O4	592	27.04	66.17	9.53	1.45	0.30	20.84	948	2.3	446	9
01	460	25.21	89.90	11.14	1.25	0.24	19.64	864	2.3	461	10
KPG-A	470	25.63	69.00	9.68	1.43	0.28	19.41	864	2.5	474	11
MC3	419	24.33	87.07	11.04	1.31	0.25	18.82	844	2.2	474	12
MJ2	555	25.88	74.12	10.18	1.45	0.26	18.01	778	2.7	507	13
KPG-7	553	26.33	58.35	9.26	1.56	0.31	19.36	821	2.4	508	14
LG	500	26.13	82.77	11.26	1.44	0.25	17.58	774	2.6	514	15
D6(M)	444	25.13	64.39	9.39	1.46	0.27	18.92	833	2.5	525	16
BHR-3	465	24.38	74.17	10.21	1.46	0.25	17.20	712	2.3	545	17
YA(W)	467	24.50	74.86	9.41	1.38	0.26	18.63	714	2.2	546	18
BL1	467	25.75	86.56	11.19	1.34	0.24	17.74	772	2.3	549	19
O2	439	25.13	79.28	9.38	1.31	0.24	18.47	857	2.3	555	20
CSR-4	421	25.04	51.29	8.49	1.45	0.29	20.05	1024	2.8	587	21
BG(W)	450	24.38	77.10	9.98	1.31	0.24	17.86	741	2.4	590	22
CCI	519	26.33	64.10	8.58	1.37	0.27	19.67	819	2.5	592	23
KS(MD)	478	25.38	68.92	9.58	1.42	0.25	17.78	742	2.5	593	24
KS(MO)	505	24.29	79.22	9.74	1.25	0.23	18.55	716	2.0	596	25
MJ1	427	24.71	83.95	10.18	1.24	0.22	17.95	812	2.4	615	26
SK7	390	23.79	85.95	9.59	1.16	0.23	20.03	812	2.1	616	27
D7	411	24.67	70.13	8.89	1.29	0.25	19.49	823	2.7	618	28
D4	430	25.38	70.42	9.49	1.37	0.25	18.22	829	2.8	619	29
KPG-2	432	25.17	76.97	10.13	1.38	0.25	17.77	690	2.4	625	30
P5	450	25.33	74.18	9.66	1.33	0.24	17.92	752	2.3	628	31
JD6	473	25.33	75.98	10.25	1.31	0.23	17.28	739	2.3	639	32
YP(C)	455	24.54	74.49	8.90	1.29	0.24	18.56	702	2.6	650	33
CSR-2	426	25.17	52.34	7.11	1.39	0.29	20.59	1015	2.9	653	34
MCI	447	24.17	79.72	8.85	1.16	0.22	18.90	797	2.1	669	35
SH6	459	25.63	62.15	8.35	1.39	0.25	17.93	818	2.3	673	36
03	481	25.21	57.99	7.55	1.33	0.25	18.55	890	2.5	681	37
YP(E)	370	24.58	80.73	9.90	1.25	0.23	18.38	758	2.1	698	38
KPG-B	458	25.96	65.71	8.67	1.30	0.24	18.26	831	2.5	698	39
CSR-18	458	25.04	56.04	6.47	1.38	0.27	19.87	806	2.4	703	40
KPG-11	426	24.71	79.19	9.64	1.20	0.21	17.45	820	1.9	717	41
BHR-2	474	24.92	67.61	8.84	1.35	0.23	16.89	693	2.4	722	42
KPG-6	440	25.50	67.70	8.93	1.32	0.23	17.64	755	2.1	728	43
SKI	456	23.71	63.78	7.72	1.31	0.23	17.45	753	2.3	730	44
MC2	411	25.46	85.97	9.48	1.14	0.22	19.43	755	2.0	739	45
SK4IV	417	23.50	80.58	8.58	1.14	0.23	20.10	643	2.4	746	46
CSR-19	449	24.63	50.73	6.47	1.36	0.28	20.42	771	2.6	748	47
SK6	392	25.00	76.26	8.29	1.17	0.23	19.26	768	2.4	778	48
YB	408	25.63	86.65	9.59	1.22	0.22	17.66	710	1.9	785	49
D5	398	25.38	67.20	8.68	1.30	0.23	17.74	748	2.5	787	50
NB4D2	416	27.00	72.67	9.09	1.23	0.23	18.61	841	2.3	789	51
BHR-1	466	25.00	72.99	8.24	1.19	0.20	16.83	792	2.4	811	52
CP(N)	453	24.00	87.48	8.91	1.09	0.19	17.73	678	2.4	817	54
SK4	426	24.96	86.13	9.17	1.15	0.20	17.73	721	1.9	812	53
CSR-5	431	24.17	49.14	5.67	1.19	0.25	20.57	837	2.6	892	55
SK4III	389	24.71	79.56	8.13	1.10	0.21	19.04	680	2.3	892	56
Chinese (G)	379	24.08	46.65	6.14	1.27	0.19	14.98	506	2.2	1384	57
Boropolu (C)	360	25.58	70.68	6.72	1.05	0.11	10.33	356	2.0	2046	58
Boropolu (B)	348	25.04	72.32	7.31	1.04	0.09	9.45	362	1.9	2102	59
Mean	454	25.14	72.99	9.29	1.32	0.24	18.34	786	2.34		
SD	49.5	0.83	10.73	1.46	0.13	0.03	1.96	122	0.23		
Criterion 1	3	-3	3	3	3	3	3	3	0		
Criterion 2	7	6	8	8	9	10	9	10	5		
Anova											
MSS	14931	4.24	7028742	13.17	0.098	0.009	23.51	91468	0.33		
F-value	2.83**	2.03**	2.87**	2.15**	3.79**	6.86**	12.90**	11.66**	2.93**		
Error	5260	2.08	2445534	6.10	0.02	0.001	1.82	7842	0.11		

**Significant at $P < 0.01$

Table 2. Estimation of different genetic parameters for important quantitative traits of bivoltine silkworm genotypes

	Fecundity (no)	Larval period (days)	Pupation rate (%)	Cocoon yield/10000 larvae (wt) (kg)	Cocoon weight (g)	Shell weight (g)	Cocoon shell ratio (%)	Filament length (m)	Denier
Mean	453	25.14	72.99	9.285	1.319	0.243	18.34	786	2.33
Range	348-592	23.7-27.7	49.1-89.9	6.1-12.8	1.0-1.6	0.09-0.34	9.4-21.1	356-1024	1.9-2.9
Genotypic variance	1611.82	0.360	763868	1.17	0.012	0.0013	3.61	13937	0.036
Phenotypic variance	2488.60	0.707	1171457	2.19	0.0163	0.0015	3.91	15244	0.055
Error variance	876.77	0.35	407589	1.01	0.004	0.00022	0.303	1307	0.018
PCV%	11.01	3.34	14.82	15.94	9.68	15.94	10.78	15.70	10.06
GCV%	8.86	2.38	11.97	11.65	8.31	14.84	10.36	15.02	8.14
Heritability %	64.76	50.91	65.20	53.42	73.61	86.67	92.33	91.42	65.45
Genetic advance (at 5%)	66.55	0.882	1453.85	1.63	0.194	0.069	3.76	232.54	0.316
Genetic advance as % of mean	14.67	3.50	19.91	17.63	14.70	28.58	20.50	29.56	13.62

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