ESTIMATION OF EVALUATION INDEX VALUES IN DIFFERENT LOCAL AND IMPORTED HYBRIDS OF SILKWORM, *BOMBYX MORI* L.

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ABSTRACT

Forty two of silkworms, *Bombyx mori* L. hybrids were evaluated by using Evaluation Index Methods. Including thirty seven of local hybrids and five hybrids imported from different countries during Spring 2006. Hybrids of CXH, DXF, FXA, FXD and GXK acquired best values of Evaluation Index for all traits except for fifth instar duration. So that, these local hybrids can be used instead of the imported hybrids.

INTRODUCTION

The power of hybrids and phenomenal contribution of hybrid vigour to silkworm improvement. However, unlike in many plant species like rice where highly inbred lines are used for commercial exploitation, in the silkworm, only the hybrids of highly inbred lines or of different breeds are used (Yokoyama, 1979; Gamo and Hirabayashi, 1983 and Krishnaswami *et al.,* 1964). Heterosis or hybrid vigour is the phenomenon in which the crosses of two different varieties or lines produce a hybrid that is superior in growth, size, yield or general vigour (Falconer, 1981).

The present study an attempt to evaluate some local and imported silkworm hybrids using Evaluation Index method.

MATERIAL AND METHODS

Ten local races of silkworm *Bombyx mori* L. namely EchP, DchP, NoviP, NoviM, DjP, DjM, EjP, EjM, 380 and SA105P were used for hybridization. These races were coded as A, B, C, D, E, F, G, H, I and K, respectively. These races were obtained from Sericulture Research Department-Giza- Egypt.

Hybridization between local races were made by using male of race D was mated with E, F, H, I and K. Female of A, B, E, G, H and I were crossed with male of race K. C male was mated with B, D, E, F, H and G females. Male of race B

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crossed with A, C, I and K females. Also, male of F mated with females of B, D, E and H. G male crossed with E, F, and K. H male was mated with females of A, C, F. and K. Male of race I was crossed with H and K. Male of race A was mated with females of B and F. So, thirty seven of single local hybrids were obtained.

Also, evaluation is including five F_1 hybrids imported from different countries during Spring 2006. These hybrids are HQIX.XJIUF and HBBX.DT which imported from China and coded as China 1 and China 2, respectively. Hybrids of $C_1X.X_2$ and Bp35X M_2 which imported from Bulgaria and coded as Bulgaria 1 and Bulgaria 2. And Japon X Cin imported from Turkey and coded as Turkey. So, the investigation is including forty two hybrids.

Silkworm rearing was carried out according to Krishnaswami 1978. Three replicates from each hybrid were reared during Spring season of 2006 (April- May) under the laboratory normal conditions at 22.79°C and 75.34 % RH. Three hundred larvae were retained after third moult per each replicate. Data were accrued for nine economic traits namely cocoon weight (CW), cocoon shell weight (CSW), pupal weight (PW), cocoon shell ratio (CSR), silk productivity (SP), fifth instar duration (FID), total larval duration (LD), pupation ratio (PR) and double cocoon percentage (DCP). The weights of cocoon, cocoon shell and pupa were recorded by gram, while cocoon shell ratio, pupation ratio and double cocoon as percentage, fifth instar duration and total larval duration recoded by day and silk productivity were recorded by centigram/day.

Cocoon shell ratio for each entry was calculated according to Tanaka (1964) as follows:

Silk productivity was estimated by using formula of Chattopadhyay *et al.*, (1995).

$$Cocoon\ shell\ ratio\ (\%) = \frac{cocoon\ shell\ weight}{fresh\ cocoon\ weight} x100$$

$$Silk\ productivity\ (cg/day) = \frac{Cocoon\ shell\ weight\ (cg)}{fifth\ instar\ duration\ (day)}$$

Where cg: Centigram

Double cocoon percentage and pupation ratio were calculated according to the following formulae of Lea (1996):

$$Double\ cocoon\ percentage\ (\%) = \frac{Number\ of\ pupae\ made\ double\ cocoon}{Total\ number\ of\ pupae\ harvested}$$

$$Pupation\ ratio\ (\%) = \frac{Number\ of\ health\ pupae}{Corrected\ basic\ number\ of\ examined}$$

Evaluation index were calculated by using the following formula according to Mano *et al.*, (1992):

$$Evaluation\ index\ (EI) = \frac{(A-B)}{C} X10 + 50$$

Where:

A= Value obtain for a particular trait of the particular hybrid.

B= Mean value of the particular trait of all the considered hybrids.

C= Standard deviation (n-1) of a particular trait of all the considered hybrids.

10 = standard unit, 50 = Fixed value

In order to judge superiority of hybrid genotypes impartially, a common evaluation index is necessary to be adopted giving equal emphasis to all the commercial economic traits. The average of evaluation index value fixed to select a hybrid genotype is over 50. Only the hybrids with an evaluation index value higher than 50 have been considered of great economic importance.

RESULTS AND DISCUSSION

The averages of performance of forty two hybrids are found in Table 1. Data reveal that, hybrid of Bulgaria 1 acquired higher value of weights of cocoon, cocoon shell and pupa also, cocoon shell ratio among the imported hybrids.

KXD hybrid earned higher values of mean performance of weights of cocoon and cocoon shell also, for cocoon shell ratio and silk productivity characters among the local and the imported hybrids.

Hybrids of CXH, DXF, FXA, FXD and GXK acquired best values of Evaluation Index for all traits except for fifth instar duration. Also, the previous hybrids earned best values of the average of Evaluation Index (Table, 2).

From the previous results, it could be concluded that, hybrids of CXH, DXF, FXA, FXD and GXK can be used instead of the imported hybrids. Similar findings were reported by Babu *et al.*, (2002) who evaluated eighteen new bivoltine silkworm *Bombyx mori* L. hybrids by using evaluation index method. The results indicated that one hybrid combination being the best among the 18 hybrids.

TABLE (I)

Performance of some local and imported hybrids of silkworm, *Bombyx mori* L.

	CW	CSW	PW	CSR	FID	SP	LD	DCP	PR
AxB	1.241	0.257	0.988	21.063	9.000	2.860	35.000	5.294	93.664
AxH	1.281	0.264	1.018	20.775	9.000	2.939	43.000	3.030	95.652
AXK	1.392	0.292	1.092	21.200	9.000	3.248	35.000	0.000	29.167
BxA	1.098	0.253	0.828	23.347	9.000	2.807	35.000	10.204	97.030
BxC	0.978	0.183	1.014	18.921	9.000	2.037	35.000	9.551	99.441
BxF	1.001	0.221	0.778	22.398	8.000	2.765	34.792	3.306	92.366
BxK	1.059	0.204	0.859	19.471	9.000	2.270	36.000	5.607	89.916
CXB	0.974	0.235	0.786	24.245	9.000	2.607	34.792	4.545	72.131
CXE	1.239	0.249	0.989	20.327	9.000	2.767	35.000	3.077	95.588
CXH	1.271	0.309	0.974	27.538	9.000	3.435	35.000	3.200	98.425
DxC	0.901	0.173	0.736	19.208	9.000	1.918	37.792	0.000	70.423
DXE	1.161	0.255	0.903	22.354	9.000	2.838	35.000	2.273	95.652
DxF	1.270	0.283	0.989	22.586	9.000	3.148	35.000	2.740	98.649
ExD	1.077	0.258	0.856	24.446	8.000	3.230	34.792	0.000	98.030
EXF	1.224	0.236	0.969	19.500	8.000	2.947	35.000	1.237	88.828
EXG	1.381	0.295	1.108	21.621	9.000	3.280	36.000	5.430	91.322
EXK	1.289	0.299	1.046	23.400	9.000	3.326	34.792	12.075	92.982
FxA	1.271	0.279	1.006	22.083	9.000	3.099	35.000	4.317	100.000
FxC	0.982	0.189	0.790	19.359	9.000	2.098	35.000	1.724	97.890
FxD	1.249	0.296	0.960	23.451	9.000	3.294	35.000	3.822	98.125
FXG	1.373	0.285	1.100	20.994	9.000	3.171	35.000	2.976	95.455
FxH	1.003	0.184	0.813	18.461	8.000	2.301	36.792	2.963	97.826
GXC	1.215	0.242	1.143	20.205	9.000	2.685	35.000	5.405	98.813
GXK	1.240	0.279	1.011	22.739	9.000	3.098	35.000	0.000	98.649
HXC	1.352	0.284	1.066	21.077	9.000	3.157	35.000	4.681	95.723
HxD	1.106	0.243	0.856	22.014	8.000	3.043	36.000	0.000	98.824
HXF	1.205	0.244	0.986	20.464	8.000	3.052	35.000	6.452	96.875
HX I	1.181	0.229	0.914	19.990	9.000	2.549	35.000	2.128	99.471
HXK	0.763	0.148	0.613	19.314	10.000	1.478	36.000	0.000	83.721
IXB	1.280	0.289	0.995	22.921	9.000	3.211	35.000	15.068	97.333
IXD	1.186	0.271	0.920	23.102	10.000	2.713	35.000	1.835	90.083
IXK	1.142	0.244	0.903	21.566	9.000	2.707	35.000	3.544	96.107
KXB	1.212	0.258	0.955	21.573	9.000	2.872	35.000	4.225	95.946
KXD	1.460	0.315	0.964	25.274	9.000	3.497	35.000	2.727	88.710
KXG	1.136	0.231	0.899	20.492	9.000	2.564	35.000	10.619	96.996
KXH	1.052	0.201	0.850	19.325	8.000	2.511	33.792	9.217	91.176
KXI	1.331	0.291	1.022	22.413	9.000	3.229	35.000	0.000	78.125
China 1	0.933	0.200	0.739	21.850	11.000	1.817	41.000	11.905	87.958
China 2	0.947	0.214	0.742	22.903	9.000	2.380	39.000	6.742	79.821
Bulgaria 1	1.252	0.257	0.991	20.662	9.000	2.851	38.000	2.312	77.232
Bulgaria 2	1.332	0.297	1.017	22.518	11.000	2.699	42.000	2.817	74.737
Turkey	1.195	0.244	0.949	20.690	9.000	2.706	39.000	8.451	86.850
Average	1.172	0.250	0.932	21.615	8.976	2.791	35.918	4.417	90.517
SD	0.154	0.040	0.117	1.874	0.643	0.460	2.044	3.743	12.551

TABLE (II)

Evaluation Index values of some local and imported hybrids of silkworm, *Bombyx mori* L.

	CWI	CSW	PW	CSR	FID	SP	LD	DCP	PR	average
AxB	54.459	51.930	54.810	47.055	50.370	51.506	45.510	52.344	52.507	51.166
AxH	57.111	53.683	57.380	45.515	50.370	53.219	84.652	46.296	54.091	55.813
AXK	64.328	60.555	63.753	47.783	50.370	59.936	45.510	38.201	1.120	47.951
BxA	45.166	50.764	41.068	59.241	50.370	50.365	45.510	65.461	55.189	51.459
BxC	37.352	33.634	57.046	35.623	50.370	33.622	45.510	63.715	57.110	45.998
BxF	38.834	42.990	36.819	54.178	34.829	49.444	44.492	47.032	51.474	44.455
BxK	42.612	38.822	43.737	38.559	50.370	38.693	50.403	53.181	49.521	45.100
CXB	37.122	46.314	37.477	64.034	50.370	46.016	44.492	50.344	35.351	45.724
CXE	54.328	49.865	54.901	43.128	50.370	49.487	45.510	46.421	54.040	49.783
CXH	56.427	64.719	53.586	81.605	50.370	64.006	45.510	46.750	56.301	57.697
DxC	32.349	30.983	33.195	37.153	50.370	31.031	59.170	38.201	33.990	38.494
DXE	49.290	51.451	47.526	53.945	50.370	51.038	45.510	44.273	54.091	49.721
DxF	56.356	58.340	54.880	55.181	50.370	57.771	45.510	45.520	56.479	53.379
ExD	43.814	52.172	43.541	65.106	34.829	59.541	44.492	38.201	55.986	48.631
EXF	53.369	46.592	53.182	38.713	34.829	53.406	45.510	41.506	48.654	46.196
EXG	63.598	61.268	65.099	50.032	50.370	60.633	50.403	52.707	50.642	56.083
EXK	57.606	62.306	59.785	59.523	50.370	61.647	44.492	70.460	51.964	57.573
FxA	56.411	57.237	56.392	52.499	50.370	56.692	45.510	49.733	57.555	53.600
FxC	37.640	34.988	37.829	37.961	50.370	34.946	45.510	42.807	55.875	41.992
FxD	55.028	61.585	52.410	59.797	50.370	60.943	45.510	48.411	56.062	54.457
FXG	63.091	58.847	64.372	46.686	50.370	58.266	45.510	46.152	53.934	54.136
FxH	38.964	33.819	39.833	33.167	34.829	39.360	54.278	46.117	55.823	41.799
GXC	52.765	48.048	68.098	42.472	50.370	47.711	45.510	52.641	56.610	51.581
GXK	54.409	57.221	56.814	55.998	50.370	56.677	45.510	38.201	56.479	52.409
HXC	61.694	58.530	61.540	47.126	50.370	57.956	45.510	50.706	54.148	54.176
HxD	45.679	48.491	43.520	52.126	34.829	55.493	50.403	38.201	56.618	47.262
HXF	52.163	48.671	54.607	43.856	34.829	55.691	45.510	55.436	55.066	49.537
HX I	50.603	45.007	48.462	41.327	50.370	44.739	45.510	43.885	57.134	47.448
HXK	23.342	24.854	22.648	37.723	65.911	21.471	50.403	38.201	44.585	36.571
IXB	56.987	59.728	55.458	56.967	50.370	59.128	45.510	78.456	55.431	57.559
IXD	50.902	55.364	48.996	57.934	65.911	48.310	45.510	43.103	49.654	51.743
IXK	48.011	48.531	47.495	49.735	50.370	48.183	45.510	47.670	54.454	48.884
KXB	52.561	52.204	52.002	49.776	50.370	51.773	45.510	49.489	54.325	50.890
KXD	68.728	66.096	52.777	69.524	50.370	65.352	45.510	45.487	48.560	56.934
KXG	47.644	45.348	47.229	44.004	50.370	45.072	45.510	66.571	55.162	49.657
KXH	42.155	37.968	42.987	37.777	34.829	43.922	39.599	62.823	50.525	43.621
KXI	60.328	60.146	57.724	54.256	50.370	59.536	45.510	38.201	40.127	51.800
China 1	34.411	37.706	33.453	51.250	81.452	28.829	74.867	70.004	47.961	51.104
China 2	35.310	41.268	33.762	56.871	50.370	41.084	65.081	56.211	41.478	46.826
Bulgaria 1	55.176	51.744	55.031	44.911	50.370	51.323	60.188	44.378	39.416	50.282
Bulgaria 2	60.389	61.700	57.310	54.818	81.452	48.018	79.759	45.726	37.427	58.511
Turkey	51.489	48.511	51.463	45.066	50.370	48.164	65.081	60.777	47.079	52.000

REFERENCES

BABU, M. R.; L. H. CHANDRASHEKHARAIAH and J. PRASAD (2002): Multiple trait evaluation of bivoltine hybrids of silkworm *Bombyx mori* L. *(Int. J. Indust. Entomol., 5 (1): 37-43).*

CHATTOPADHYAY, S.; S. K. DAS; G. C. ROY; S. K. SEN and S. S. SINHA (1995): Heterosis analysis on silk productivity of three-way crosses in *Bombyx mori* L..*(Sericologia, 35 (3): 549-551).*

FALCONER, S. D (1981): Introduction to quantitative genetics.*(Longman Scientific and Technical. London. Third ED.438p).*

GAMO, T. and T.HIRABAYASHI (1983): Genetic analysis of growth rate. pupation rate and some quantitative characters by diallel cross in silkworm, *Bombyx mori. (Japan J. Breed., 33, 178-190).*

KRISHNSWAMI, S. (1978): New technology of silkworm rearing. CSR & TI *(Bull.no.2, Central Silk Board, 1-23).*

KRISHNASWAMI, S.; M. S. JOLLY and S. SUBBA RAO (1964): Diallel analysis of quantitative characters in multivoltine races of silkworm. *(Indian J. Genet., 24,213-222)*

LEA, H. Z. (1996): Basic Principles And Practical Techniques of Silkworm Breeding. *(Department of biology, Kangwon National univ., Chun chon, Korea).*

MANO, Y.; S. N. KUMAR; H. K. BASAVARAJA; N. M. REDDY and R. K. DATTA (1992): An index for combined trait selection for silk yield improvement in *Bombyx mori* L. *(Mulb. Seric. Res. Mysore. 10: 12).*

TANAKA, Y. (1964):" Sericology" *(Central silk Board, Bombay. 95-B Meghdoot, Marine Drive PP. 216 – 20).*

YOKOYAMA, T. (1979): Silkworm selection and hybridization. *(Genetics in Relation to Insect Management. Worked papers, Rockefeller Foundation, 71-83).*