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Short Communication

Variability and correlation analysis for the nutritional indices in polyvoltine silkworm (*Bombyx mori* L.) germplasm

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Breeds of mulberry silkworm (*Bombyx mori* L.) differ in their nutritional parameters depending on the silkworm variety, environmental effect upon the physiology of silkworm and quantum of feed given [1]. The nutritional requirement and food consumption has a direct impact on larval weight, cocoon weight, amount of silk production and on reproductive traits. The tropical races ingest and digest less amount of food compare to that of temperate ones [2]. The studies on nutritional indices may be useful in screening out nutritionally efficient breeds of silkworm. The leaf-cocoon and leaf-shell ratio have a close relationship with the amount of food ingested and digested [3]. Hence the present investigation has been under taken to study the variability and relationship among the total ingesta, ingestion to cocoon ratio and shell ratio in fifth age silkworm larvae of fifty-five polyvoltine silkworm germplasm stocks to find out the nutritionally efficient parental lines for further improvement in yield potential and silk productivity.

The experiment was conducted during favourable season (February-March 2000) in completely randomised block design with two replications of 100 fifth instar larvae of each silkworm breeds by providing *ad libitum* S1 mulberry leaves. The missing larvae were replaced daily from buffer stock maintained parallely. The amount of food ingested was calculated on dry weight basis as per Waldbauer [4]. The data on the total ingesta (g)V age larva (Tot.ing.g/Vlar.), ratio of ingestion to cocoon (ICR), ratio of ingestion to shell (ISR), single cocoon weight (g) (CWT) and single shell weight (g) (SWT) were determined by following the method adopted by Magadum *et al.* [2]. The data were subjected to ANOVA and correlation analysis for all the five parameters using the computer packages developed by INDOSTAT Service Pvt. Ltd., Hyderabad, India. Further, the data were subjected to Evaluation Index (EI) method [5] and assigned overall rank based on the cumulative superiority for the traits. Evaluation Index value for the breeds was arrived at by the following formula: Evaluation Index (EI) = A-B/C × 10 + 50. Where, A = Mean of the particular trait, B = Overall mean of the particular trait, C = Standard deviation, 10 = Standard, 50 = Constant. The breeds that score index value above 50 are considered to have greater economic value.

The mean performance and variation among the fifty-five multivoltine silkworm germplasm for all the five selected parameters are presented in Table 1. The variability in feeding indices of silkworm breeds indicates, on an average 5.897g of food ingesta is required to produce one gram of cocoon while 37.503g of food ingesta is required to produce one gram of shell. The results also indicated that the ingestion to cocoon ratio (ICR), ranged from 3.790g (WAI-1) to 10.836g (Pure Mysore), similarly the ingestion to shell ratio ranged from 21.690g (LMP) to 78.873g (Pure Mysore). The average ingestion efficiency was recorded 6.105g per fifth instar larva, which was maximum in MY1 (9.321 g) and minimum in LMP (3.579g).

The correlation coefficient of different nutritional parameters shows relationship between ingestion and other parameters (Table 2). The results revealed a significant positive correlation between total ingesta to ICR (r = 0.803) and shell ratio ISR (r = 0.749). However, non-significant but positive correlation between total ingesta to single-cocoon weight (r = 0.158) and single-shell weight (r = 0.066) were also recorded. Highly positive and significant correlation between ingestion to cocoon ratio and ingestion to shell ratio (r = 0.949) were also observed. The results corroborate with the earlier observation [3]. But a high negative significant correlation between ingestion to cocoon ratio and ingestion to shell ratio was encountered by Magadum *et al.* [2]. The results also revealed a significant negative correlation between ICR to single cocoon weight (r = 0.442) and single-shell weight (r = 0.438); and between ISR to single cocoon weight (t = 0.449) and single shell weight (r = 0.578). The nutritional indices were analysed to score the index values based

Table 1. Name of breeds and mean performance for feeding indices in polyvoltine silkworm

Race Name	Tot.ing.g/V lar.			ICR			ISR			CWT			SWT		
	Mean	±	SE	Mean	±	SE	Mean	±	SE	Mean	±	SE	Mean	±	SE
Pure Mysore	8.62	±	0.14	10.83	±	0.38	78.8	±	6.96	0.79	±	0.01	0.11	±	0.00
Sarupat	7.12	±	0.18	7.21	±	0.01	46.0	±	1.25	0.98	±	0.02	0.15	±	0.00
Moria	7.39	±	0.01	6.62	±	0.17	42.0	±	1.73	1.11	±	0.02	0.17	±	0.00
T. N. White	5.62	±	0.02	5.65	±	0.47	33.6	±	3.20	1.00	±	0.08	0.16	±	0.01
C. nichi	5.31	±	0.10	5.99	±	0.00	47.2	±	0.04	0.88	±	0.01	0.11	±	0.00
Hosa Mysore	5.13	±	0.05	4.13	±	0.18	24.5	±	0.74	1.24	±	0.04	0.20	±	0.00
Mysore Princes	5.40	±	0.28	5.04	±	0.08	28.9	±	1.25	1.07	±	0.03	0.18	±	0.00
Kolar Gold	5.15	±	0.17	4.74	±	0.41	28.3	±	2.23	1.09	±	0.05	0.18	±	0.00
Kollegal Jawan	4.91	±	0.17	4.58	±	0.31	28.0	±	1.77	1.07	±	0.03	0.17	±	0.00
MY1	9.32	±	1.39	8.29	±	1.15	56.6	±	5.48	1.12	±	0.01	0. 16	±	0.00
P2DI	6.85	±	0.05	6.25	±	0.37	35.8	±	1.57	1.10	±	0.07	0.19	±	0.01
Rong Daizo	8.47	±	0.21	7.52	±	0.01	51.1	±	0.43	1.10	±	0.02	0.16	±	0.00
Guangnong Plain	5.56	±	0.51	6.49	±	0.58	42.5	±	4.00	0.80	±	0.00	0.13	±	0.00
OS-616	7.26	±	0.04	6.72	±	0.11	49.8	±	2.30	1.00	±	0.01	0.14	±	0.00
Raj	5.79	±	0.04	5.62	±	0.26	35.4	±	0.70	1.03	±	0.05	0.16	±	0.00
G	4.67	±	0.02	4.35	±	0.15	26.1	±	1.00	1.07	±	0.04	0.17	±	0.00
Nistari	5.73	±	0.02	5.48	±	0.06	33.0	±	1.71	1.04	±	0.01	0.17	±	0.00
Nistari (M)	5.73	±	0.00	6.14	±	0.48	42.0	±	1.41	0.93	±	0.07	0.13	±	0.00
Nistari (P)	5.04	±	0.30	4.79	±	0.02	31.2	±	0.27	1.05	±	0.05	0.16	±	0.01
CB5	4.84	±	0.24	4.13	±	0.01	26.6	±	0.58	1.17	±	0.06	0.18	±	0.00
KW2	7.14	±	0.04	8.08	±	0.16	46.8	±	1.09	0.88	±	0.01	0.15	±	0.00
M2	5.28	±	0.14	5.53	±	0.09	34.9	±	0.03	0.95	±	0.01	0.15	±	0.00
A23	6.24	±	0.48	5.36	±	0.15	35.5	±	0.78	1.16	±	0.05	0.17	±	0.00
A25	6.20	±	0.89	7.64	±	2.22	43.7	±	10.81	0.84	±	0.10	0.14	±	0.01
Oval	6.29	±	0.77	7.73	±	2.49	44.7	±	12.36	0.87	±	0.18	0.14	±	0.02
O	7.55	±	0.09	6.36	±	0.22	40.7	±	2.26	1.18	±	0.02	0.13	±	0.00
M83(c)	5.69	±	0.07	5.21	±	0.12	36.0	±	0.11	1.09	±	0.03	0.15	±	0.00
B	5.79	±	0.22	5.42	±	0.10	35.1	±	0.18	0.18	±	0.02	0.02	±	0.00
A14DY	6.20	±	0.48	5.40	±	0.36	29.4	±	1.90	1.14	±	0.01	0.21	±	0.00
A4E	6.61	±	0.06	5.73	±	0.02	32.7	±	0.58	1.15	±	0.00	0.20	±	0.00
PA12	6.91	±	0.05	4.96	±	0.07	31.8	±	0.74	1.39	±	0.00	0.21	±	0.00
AP12	5.12	±	0.19	5.13	±	0.05	34.1	±	0.39	0.99	±	0.02	0.15	±	0.00
A13	7.02	±	0.22	5.34	±	0.22	27.2	±	2.13	1.31	±	0.01	0.25	±	0.01
PMX	4.59	±	0.17	4.23	±	0.03	25.9	±	0.05	1.08	±	0.03	0.17	±	0.00
PMS2	5.60	±	1.10	5.49	±	0.94	34.9	±	6.21	1.01	±	0.02	0.16	±	0.00
MU-1	5.72	±	1.13	5.77	±	0.95	37.4	±	7.37	0.99	±	0.03	0.15	±	0.00
MU-11	6.28	±	0.13	6.45	±	0.30	37.3	±	1.72	0.97	±	0.06	0.16	±	0.01
WAI-1	3.79	±	0.00	3.79	±	0.02	25.2	±	0.10	1.00	±	0.00	0.15	±	0.00
WAI-4	4.13	±	0.09	4.58	±	0.09	28.7	±	0.80	0.90	±	0.00	0.14	±	0.00
MY23	4.34	±	0.15	4.64	±	0.30	29.1	±	1.45	0.93	±	0.00	0.02	±	0.14
MWI3	5.69	±	0.47	5.06	±	0.49	31.0	±	6.67	1.12	±	0.01	0.18	±	0.00
MHMP(Y)	6.78	±	0.21	5.41	±	0.04	34.2	±	0.71	1.20	±	0.02	0.19	±	0.01
P4D3	6.66	±	0.72	4.97	±	0.56	28.8	±	3.81	1.30	±	0.00	0.23	±	0.00
Nistid (Y)	6.49	±	0.19	6.99	±	0.34	45.5	±	2.20	0.90	±	0.01	0.14	±	0.00
NK4	7.87	±	0.31	8.00	±	0.30	48.6	±	2.14	0.97	±	0.00	0.16	±	0.00
Cambodg	6.59	±	0.23	6.18	±	0.12	41.6	±	0.71	1.06	±	0.01	0.15	±	0.00
Daizo	8.27	±	0.19	8.60	±	0.00	57.1	±	1.18	0.95	±	0.02	0.14	±	0.00
LMP	3.57	±	0.07	3.80	±	0.14	11.6	±	1.08	0.93	±	0.01	0.16	±	0.00
DMR	6.04	±	0.02	6.52	±	0.06	38.5	±	0.07	0.92	±	0.00	0.15	±	0.00
LMO	5.46	±	0.16	5.59	±	0.36	34.2	±	1.09	0.98	±	0.03	0.16	±	0.00
MYI(SL)	6.17	±	0.26	5.60	±	0.18	35.6	±	1.84	1.10	±	0.01	0.17	±	0.00
PM(SL)	7.20	±	0.02	5.90	±	0.03	35.1	±	2.44	1.22	±	0.01	0.20	±	0.00
BL23	6.00	±	0.03	5.53	±	0.03	37.9	±	0.25	1.08	±	0.00	0.15	±	0.00
BL24	5.95	±	0.10	5.46	±	0.25	37.0	±	2.91	1.09	±	0.03	0.16	±	0.00
MU303	6.02	±	0.09	5.28	±	0.17	38.2	±	2.48	1.13	±	0.01	0.15	±	0.00
CD 5%	1.10			1.59			9.2			0.12			0.02		
ANOVA (F-value)	9.14**			5.71**			9.38**			8.16**			13.43**		

Table 2. Correlation coefficient of the feeding indices of polyvoltine silkworm breeds

S.No.	Variables	ICR	ISR	CWT	SWT
1.	Tot.ing. g/V lar.	0.803**	0.749**	0.158NS	0.06NS
2.	ICR		0.949**	-0.442**	-0.438**
3.	ISR			-0.449**	-0.578**
4.	CWT				0.874**

Significance at 1%; NS = Non-significance

Table 3. Evaluation index (EI) values of feeding indices for selected best races

Sl. No.	Race name	Tot.ing.g/ V lar.	ICR	ISR	CWT	SWT	Average
1	MYI	71.3	87.1	92.2	29.6	28.4	63.7
2	Pure Mysore	58.6	60.0	58.9	44.6	45.1	61.7
3	Rong Daizo	60.9	55.6	54.9	54.8	53.0	60.2
4	A13	46.0	48.4	46.3	45.7	50.0	59.6
5	Daizo	43.3	50.9	60.1	36.6	29.1	58.6
6	PA12	41.8	37.0	37.1	65.0	65.3	57.9
7	O	44.1	43.8	41.6	51.4	57.1	57.3
8	P4D3	42.0	41.5	41.0	52.9	55.2	57.1
9	PM(SL)	40.0	40.3	40.7	51.7	52.6	56.9
10	NK4	77.1	68.2	69.7	55.2	48.1	56.9
11	Moria	56.3	52.8	48.5	53.7	59.0	55.8
12	MHMP(Y)	69.9	62.4	64.1	55.6	48.9	55.3
13	OS-616	45.4	54.7	55.3	34.2	36.2	54.5
14	P2DI	59.8	56.3	62.7	52.0	41.8	54.1
15	A4E	47.4	48.1	48.2	48.3	48.1	53.8
16	Sarupat	37.9	38.7	38.7	51.5	54.1	53.5
17	KW2	46.9	47.1	46.4	49.2	50.7	53.1
18	A14DY	46.8	52.0	54.8	40.7	38.1	52.5
19	Cambodg	41.1	41.9	43.9	49.8	47.4	51.6
20	A23	39.4	37.0	39.3	59.4	54.9	51.4
21	MYI(SL)	58.8	66.5	59.7	36.5	44.0	50.5
22	Oval	43.1	47.5	47.7	42.0	43.0	50.2
23	Nistid(Y)	51.2	46.2	48.2	58.6	52.6	50.1
24	MU-11	50.9	63.2	56.6	33.7	41.4	50.0
25	MU303	51.6	63.9	57.6	35.5	42.2	49.8

on Mano's evaluation index (EI) method [5] and assigned overall rank based on cumulative superiority of the traits. Breeds that score index value above 50 are considered to have greater economic value (Table 3). The highest EI values obtained for first 10 silkworm races *viz.*, MY1, Pure Mysore, Rong Daizo, A13, Daizo, PA12, 0, P4D3, PM(SL) and NK4 are suggested to be used as a parental line for evolving nutritionally efficient breeds of silkworm.

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