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Full Length Research Paper

Evaluation of productive performance of 51 different peanut cocoon strains of Iran silkworm *Bombyx mori* (Lepidoptera: Bombycidae) germplasm

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In our study, 51 peanut strains of Iran silkworm germplasm were evaluated for 36 economically important traits and for the feasibility of using these strains for breeding programs. After hatching of eggs, neonates were brushed and reared up separately on fresh leaves of mulberry (*Morus alba*). Newly hatched larvae of all strains were reared for experiment. Individual egg laying were prepared for each strain before rearing and each individual egg laying consisted of about 500 eggs taken from one disease free laying and decreased to 250 larvae at the beginning of the 4th instar.

Key words: Cocoon, *Bombyx mori*, yield, gene bank, evaluation.

INTRODUCTION

The silkworm is the larva or caterpillar of the domesticated silkmoth, *Bombyx mori*. It is an important economic insect since it is the producer of silk. A silkworm's preferred food is white mulberry leaves. It is entirely dependent on humans for its reproduction and no longer occurs naturally in the wild (Grimaldi and Engel, 2005). Sericulture has been practiced for at least 5,000 years in China. It was domesticated from the wild silkmoth *Bombyx mandarina* which has a range from Northern India to Northern China, Korea, Japan and far Eastern Russia. It derives from Chinese rather than Japanese or Korean stock. The domesticated and wild species can still breed and so hybridize together (Grimaldi and Engel, 2005). Silk production has increased steadily over the years, with a production of 125,000 metric tons of silk in 2006 - 2007 (Deccan, 2007; Zanatta et al., 2009).

Sericulture is supported by the silkworm gene resource diversity. Sericulture advancement are largely based on the silkworm variety improvement and breeding of new silkworm variety based on the material supply of rich silkworm germplasm resource (Sohn, 2003; Duncan, 1951).

In addition to maintenance, systematic study of resource material is also very important, not only for classification and characterization of varieties but also for the selection of promising parents to initiate various breeding programmes (Rao et al., 2006).

Iran Silkworm Research Center (ISRC) maintains a silkworm germplasm bank that includes 51 peanut cocoon strains, of which little are known of the genetic contents. In order to maintain these genetic resources, the classification and characterization of these strains is very important. In our study, all 51 peanut strains were evaluated for all 36 economically important traits and for the feasibility of using these strains for breeding programs.

MATERIALS AND METHODS

This study was conducted in Islamic Azad University, Ghaemshahr Branch, Iran and Iran Silkworm Research Center (ISRC) from December 2008 till December 2009. Fifty one silkworm strains were used in the present study. These strains included 107-K, 119-K, 113-K, 105, 31, 51, 103, BH-2, B2-09, 1003-4, 1003-5, 1005, M2-6-

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Abbreviations: ISRC, Iran silkworm research center; **EI,** evaluation index.

22-2, M2-6-18(109), M-1-2(5), M2-6-22(107), M2-6-18.3, 307-300-2, 202A-204B, I 20, 101433-9-5, 101433-1-4, 101433-6-6, 1126 (111), 113 (2029), 151 (103×M-1-1), Xihang 2.3, Xihang 3.3, 153 (Xihang-1), 5118×10133-2-2, 5118×10133-3-3, Black-White, 101×F6, F6×101, Kinshu, M-1-1×31, 31×M-1-1, M-1-1×103, 103 Poly Marking, Shaki, 101, T1-J, T5-M, 236, 1524, 1433-15, 1433-9, 7409, N19, White Larvae- Yellow Cocoon and Black Larvae-White Cocoon.

All silkworm germplasm rearing steps including egg, larvae, pupae and moth cycles were conducted at Iran Silkworm Research Center (ISRC) before this study as annual and routine germplasm conservation program. The silkworm rearing technique included single batch rearing system. Feeding and other conditions of larval rearing were conducted following standard procedure (ESCAP, 1993) and all germplasm strains were reared under standards protocols in all rearing steps. After hatching from eggs, neonates were brushed and reared up separately on fresh leaves of mulberry (*Morus alba*). One-day-old 1st instar larvae from all strains were reared for experiment. Individual laying were prepared for each strain before rearing and each individual laying consisted of about 500 eggs taken from one disease free laying and decreased to 250 larvae at the beginning of the 4th instar. The silkworm eggs were incubated in the controlled environment chamber. When there were 95% of eggs having little black dots on the surface of eggs, they were shaded with black gobo to prevent the light beams for about 48 h in order to make the larvae emerge from the eggs at one time. After most have been hatched, the silkworm larvae were fed on leaves of mulberry. Brushing was done carefully. The batches of 500 silkworm larvae were reared. The young larvae (1st - 3rd instars) were reared at 27 - 28℃ with 85 - 90% relative humidity and the late age larvae (4th and 5th instars) were maintained at 24 - 26℃ with a relative humidity of 70 - 80%. The larvae were fed mulberry leaves three times a day.

Rice straw was used as cocoon mountage for cocoon spinning in each replication separately. After cocoon spinning development (seven days after starting of cocoon spinning), produced cocoons are harvested and sorted based on form, thickness and clarity to four classes including, good, middle, double and low cocoons. The calculated ratio of each class cocoons was done for each replication separately. Furthermore, disease percentage of pupae in these cocoon classes was estimated for each replication separately. Health or disease of total obtained pupae was investigated and calculated ratio of each class cocoon disease for each replication was done separately. Cocoon weight of good and double cocoons was also recorded. It must be stated that all records were conducted after 8 days of cocoon spinning.

Studied quantitative characteristics included number of total produced cocoons, number of good produced cocoons, number of alive good produced cocoons, number of died good produced cocoons, number of middle produced cocoons, number of alive middle produced cocoons, number of died middle produced cocoons, number of low produced cocoons, number of alive low produced cocoons, number of died low produced cocoons, number of double produced cocoons, number of alive pupae in double cocoons, number of died pupae in double cocoons, pupae vitality percentage (%), cocoon weight (g), shell cocoon weight (g), shell cocoon percentage (%), male cocoon weight (g), male shell cocoon weight (g), male shell cocoon percentage (%), female cocoon weight (g), female shell cocoon weight (g), female shell cocoon percentage (%), good cocoon weight of 250 larvae (g), middle cocoon weight of 250 larvae (g), middle cocoon weight (g), low cocoon weight of 250 larvae (g), low cocoon weight (g), double cocoon weight of 250 larvae (g), double cocoon weight (g), total cocoon weight of 250 larvae (g), total cocoon weight of 10000 4th instar larvae (g), cocoon number per liter, cocoon weight per liter (g), male pupae weight (g) and female pupae weight (g). For the statistical analysis, the data were transformed if necessary and then analyzed using one-way analysis of variance (ANOVA) and the means were grouped using Duncan's multiple range tests by means of statistical analysis system (SAS) package using the general linear model (GLM) procedure. Therefore, results were expressed as means ± standard deviation (SAS, 1997; Duncan, 1951).

Also, evaluation index value and sub-ordinate function value were calculated for nutritional indices. Evaluation index value (EI) for silkworm strains performance were calculated by using the following formula (Mano et al., 1993; Rao et al., 2006)

$$EI = [(A-B)/C] \times 0 + 50$$

Where, A is mean of the particular trait in a strain, B is overall mean of particular trait in all strains, C is standard deviation of a trait in all strains and 50 is constant.

Sub-ordinate function is calculated by utilizing the following formula (Gower, 1971) and (Rao et al., 2006)

$$X_u = (X_i - X_{min})/(X_{max} - X_{min})$$

Where, X_u is sub-ordinate function, X_i is measurement of trait of tested strain, X_{min} is minimum value of the trait among all the tested strains and X_{max} is maximum value of the trait among all the tested strains.

The evaluation index (Table 2) and sub-ordinate function values (Table 3) for all the traits were calculated separately and average index value was obtained. Then studied silkworm strains are ranked based on average of evaluation index method and sub-ordinate function method (Table 4).

RESULTS AND DISCUSSION

Obtained results are summarized in Tables 1 - 4. From the obtained results, it is clear that different strains of silkworm, *B. mori* showed different performance based on productive characters recorded. The analysis of variance regarding to studied traits, showed that different strains had significant difference for traits ($p < 0.01$).

From the results, the number of total produced cocoons of the 1433-15 (230.330), BH-2 (225.000), T1-J (223.670), 151 [103×M-1-1] (220.670) and 153 [Xihang-1] (219.500) strains significantly remained at upper level than other ones, respectively, (Table 1). The number of good produced cocoons in M-1-1×103 (205.000), 1433-15 (189.670), T1-J (186.000), 113 [2029] (182.000) and 101×F6 (181.330) strains was in high level in comparison with other strains significantly (Table 1). The number of alive good produced cocoons remained significantly at upper level in the 113 [2029] (172.000), M-1-1×103 (170.000), BH-2 (166.330), 1433-15 (165.330) and 202A-204B (162.670) strains increased in comparison with other ones significantly (Table 1).

The obtained results showed that the number of died good produced cocoons of the T1-J (55.333), 1003-4 (43.667), 1003-5 (37.000), 1005 (36.333) and 5118×10133-2-2 (33.667) strains remained significantly at upper level than other strains, respectively, (Table 1). The number of middle produced cocoons in 1003-4 (77.333), 31×M-1-1 (60.667), Xihang 3.3 (57.000), Kinshu (50.000) and T1-J (46.000) strains increased in comparison with other strains significantly (Table 1). Number of alive middle produced cocoons significantly

Table 1. Mean (± standard deviation) performance of cocoon traits in studied silkworm pure lines of gene bank.

Traits Pure Lines	Number of Total Produced Cocoons	Number of Good produced Cocoons	Number of Alive Good Produced Cocoons	Number of Died Good Produced Cocoons	Number of Middle Produced Cocoons	Number of Alive Middle Produced Cocoons	Number of Died Middle Produced Cocoons	Number of Low Produced Cocoons	Number of Alive Low Produced Cocoons	Number of Died Low Produced Cocoons	Number of Double Produced Cocoons	Number of Alive Pupae in Double Cocoons
107-K	185.000^{bc} ± 0.00	138.000^{d-f}±16.82	129.000^{ef}±14.17	9.000^{i-m}±2.64	39.333^{a-e}±11.93	29.667^{c-l}±10.69	9.667^{b-e}±2.30	4.667^{b}±2.08	0.000^{b}±0.00	4.667^{b}±2.08	3.000^{ij}±0.00	3.000^{i-l}±1.00
119-K	216.000^{bc} ± 0.00	133.000^{e-h}±13.52	130.333^{ef}±13.20	2.667^{l-m}±1.52	77.333^{a}±5.50	68.667^{a}±8.50	8.667^{b-g}±3.05	3.000^{b}±1.73	0.000^{b}±0.00	3.000^{b}±1.73	0.333^{jk}±0.57	5.000^{mh}±3.00
113-K	206.333^{c} ± 2.30	161.667^{a-f}±4.61	157.000^{a-d}±5.19	4.666^{klm}±0.57	40.667^{a-e}±4.16	37.000^{b-h}±4.58	3.667^{g-l}±2.51	2.000^{b}±1.00	0.000^{b}±0.00	2.000^{b}±1.00	2.000^{ij}±0.00	4.000^{mh}±0.00
105	196.667^{abc} ± 13.86	140.000^{d-h}±7.81	127.000^{ef}±14.00	13.000^{g-m}±6.24	46.00^{b-e}±9.53	35.000^{b-h}±5.29	11.000^{bc}±4.35	6.000^{b}±3.60	0.000^{b}±0.00	6.000^{b}±3.60	4.667^{g-i}±1.52	7.667^{ghi}±3.51
31	196.667^{abc} ± 2.00	146.000^{b-h}±10.14	137.333^{ef}±13.05	8.667^{i-m}±3.21	46.000^{b-e}±4.58	37.667^{b-f}±1.52	8.333^{b-h}±4.35	3.000^{b}±1.00	0.000^{b}±0.00	3.000^{b}±1.00	1.667^{ij}±2.08	2.333^{ljk}±3.21
51	205.333^{abc} ± 3.00	132.333^{e-h}±16.28	121.667^{b-f}±11.59	10.660^{h-m}±6.02	60.667^{b}±10.96	44.333^{bc}±10.11	16.333^{a}±2.08	7.000^{b}±1.73	0.000^{b}±0.00	7.000^{b}±1.73	5.333^{ij}±1.52	6.667^{ghi}±1.52
103	213.333^{bc} ± 11.93	162.000^{a-f}±19.28	149.667^{a-e}±14.57	12.333^{g-m}±4.93	43.000^{b-g}±18.19	37.667^{b-f}±17.09	5.333^{d-l}±2.30	6.667^{b}±2.33	0.000^{b}±0.00	6.667^{b}±2.30	1.667^{ij}±0.57	2.000^{ljk}±0.00
BH-2	225.000^{abc} ± 10.15	173.000^{a-e}±26.66	166.333^{ab}±27.22	6.667^{i-m}±0.57	43.000^{b-g}±18.19	40.667^{bcd}±16.28	2.333^{lj}±2.51	2.333^{b}±2.30	0.000^{b}±0.00	2.333^{b}±2.30	6.667^{a-e}±2.88	12.333^{cd}±4.04
B2-09	219.000^{a} ± 0.00	148.333^{b-h}±6.65	145.667^{a-f}±7.09	2.667^{l-m}±0.57	57.000^{bc}±7.00	50.667^{b}±6.65	6.333^{c-k}±1.52	6.333^{b}±2.30	0.000^{b}±0.00	6.333^{b}±2.30	7.333^{a-e}±4.72	12.667^{cde}± 9.07
1003-4	195.333^{abc} ± 5.77	153.333^{b-f}±14.22	109.667^{d-f}±9.07	43.667^{b}±7.63	30.000^{d-i}±5.00	22.000^{d-l}±7.00	8.000^{b-i}±2.00	6.667^{b}±3.21	0.000^{b}±0.00	6.667^{b}±3.21	5.333^{ghi}±2.08	7.333^{ghi}±3.51
1003-5	198.333^{abc} ± 11.84	166.667^{a-f}±14.01	129.667^{a-f}±9.07	37.000^{bc}±5.19	23.000^{g-i}±2.00	18.000^{g-l}±1.73	5.333^{d-l}±0.57	4.667^{b}±1.52	0.000^{b}±0.00	4.667^{b}±1.52	4.000^{ij}±2.64	5.333^{mh}±2.51
1005	187.000^{abc} ± 15.17	148.333^{a-f}±10.59	112.000^{c-f}±6.00	36.333^{bc}±4.72	22.667^{g-i}±4.16	17.333^{i-l}±2.88	5.333^{d-l}±1.52	5.333^{b}±2.88	0.000^{b}±0.00	5.333^{b}±2.88	10.667^{ab}±3.51	14.000^{cd}±3.00
M2-6-22-2	198.333^{abc} ± 12.20	152.000^{b-h}±24.87	141.333^{a-f}±21.00	10.667^{h-m}±6.02	36.000^{d-i}±1.00	33.000^{b-h}±17.32	3.000^{h-l}±4.35	6.667^{b}±2.08	0.000^{b}±0.00	6.667^{b}±2.08	3.667^{ij}±2.08	6.333^{ghi}±3.21
M2-6-18(109)	194.333^{abc} ± 6.35	175.667^{abc}±43.50	121.000^{b-f}±21.00	6.000^{i-m}±5.19	50.000^{bcd}± 14.00	39.667^{b-e}±12.05	10.333^{bcd}± 2.30	7.667^{b}±2.51	0.333^{c}±0.57	7.667^{b}±2.51	9.667^{a-d}±1.52	13.000^{edc}± 3.60
M-1-2(5)	195.333^{abc} ± 5.77	166.667^{a-f}±15.63	151.000^{a-e}±14.52	22.667^{d-h}±5.50	22.665^{ghi}± 5.55	21.667^{e-l}±4.72	1.000^{l}±1.00	5.333^{b}±4.16	0.333^{c}±0.57	5.333^{b}±4.16	4.333^{ij}±2.50	6.333^{ghi}±3.51
M2-6-22(107)	195.333^{abc} ± 5.77	154.667^{b-f}±11.37	144.667^{a-f}±14.52	10.000^{i-m}±8.54	32.333^{d-i}±16.19	30.333^{b-l}±14.57	2.000^{kl}±2.00	7.333^{b}±6.11	0.000^{b}±0.00	7.333^{b}±6.11	4.833^{ghi}±2.84	7.333^{ghi}±2.51
M2-6-18.3	198.333^{abc} ± 11.84	149.000^{b-h}±14.93	137.667^{a-f}±10.01	11.333^{h-m}±10.20	32.000^{d-i}±15.62	28.000^{c-l}±15.62	4.000^{f-l}±0.00	10.667^{ab}±6.51	0.333^{c}±0.57	10.667^{ab}±6.50	5.333^{ij}±2.08	7.667^{ghi}±2.51
307-300-2	187.000^{abc} ± 15.17	168.333^{a-f}±0.57	155.333^{a-d}±7.09	13.000^{g-m}±7.54	22.000^{a}±1.73	18.667^{g-l}±4.04	3.330^{h-l}±2.88	3.00^{b}±2.00	0.333^{c}±0.57	3.000^{b}±2.00	1.000^{ij}±1.00	1.000^{ljk}±1.00

Table 1. Contd

202A-204B	$198.333^{abc} \pm 12.20$	$166.667^{a-f} \pm 12.34$	$162.667^{ab} \pm 13.50$	$4.000^{i-m} \pm 3.00$	$33.000^{d-i} \pm 6.24$	$30.000^{b-l} \pm 7.21$	$3.000^{h-l} \pm 1.00$	$4.333^{b} \pm 3.23$	$0.667^{ab} \pm 0.15$	$4.333^{b} \pm 3.21$	$2.000^{ij} \pm 1.73$	$4.000^{mh} \pm 3.46$
I 20	$194.333^{abc} \pm 6.35$	$140.667^{d-h} \pm 19.75$	$139.333^{a-f} \pm 21.19$	$1.333^{m} \pm 1.52$	$42.667^{b-h} \pm 5.03$	$39.000^{b-e} \pm 6.24$	$3.667^{g-l} \pm 3.78$	$4.667^{b} \pm 5.03$	$0.000^{b} \pm 0.00$	$4.667^{b} \pm 5.03$	$1.667^{jk} \pm 0.57$	$2.667^{i-l} \pm 1.52$
101433-9-5	$199.000^{bc} \pm 11.01$	$169.000^{a-f} \pm 15.00$	$160.000^{ab} \pm 13.11$	$9.000^{i-m} \pm 2.64$	$40.000^{c-h} \pm 7.81$	$36.000^{b-j} \pm 7.21$	$4.000^{f-l} \pm 1.73$	$8.000^{b} \pm 3.60$	$0.000^{b} \pm 0.00$	$8.000^{b} \pm 3.60$	$1.000^{j} \pm 1.00$	$2.000^{ljk} \pm 2.00$
101433-1-4	$200.000^{bc} \pm 8.66$	$171.667^{a-f} \pm 17.01$	$160.333^{ab} \pm 13.65$	$11.333^{h-m} \pm 4.50$	$40.667^{b-i} \pm 10.06$	$35.000^{b-j} \pm 9.00$	$5.667^{d-l} \pm 1.52$	$3.667^{b} \pm 2.50$	$0.000^{b} \pm 0.00$	$3.667^{b} \pm 2.51$	$3.000^{ij} \pm 1.73$	$5.000^{mh} \pm 3.60$
101433-6-6	$197.000^{abc} \pm 4.72$	$169.000^{a-f} \pm 14.17$	$151.000^{a-e} \pm 12.00$	$18.000^{e-j} \pm 4.58$	$43.333^{b-f} \pm 3.78$	$40.333^{bcd} \pm 6.35$	$3.000^{i-l} \pm 2.64$	$6.000^{b} \pm 4.00$	$0.000^{b} \pm 0.00$	$6.000^{b} \pm 4.00$	$1.000^{ij} \pm 1.00$	$2.000^{ljk} \pm 3.60$
1126 (111)	$194.333^{abc} \pm 0.00$	$173.667^{a-e} \pm 11.15$	$155.000^{a-d} \pm 7.80$	$18.667^{e-i} \pm 4.04$	$33.000^{d-i} \pm 8.66$	$24.000^{b-k} \pm 8.66$	$9.000^{b-f} \pm 0.00$	$4.000^{b} \pm 4.00$	$0.000^{b} \pm 0.00$	$4.000^{b} \pm 4.00$	$2.000^{ij} \pm 1.00$	$2.667^{i-l} \pm 1.15$
113 (2029)	$206.000^{bc} \pm 14.43$	$182.000^{b-c} \pm 20.80$	$172.000^{a} \pm 17.05$	$10.000^{i-m} \pm 5.56$	$21.667^{hi} \pm 3.05$	$16.667^{jkl} \pm 3.78$	$5.000^{e-l} \pm 1.73$	$3.333^{b} \pm 2.08$	$0.000^{b} \pm 0.00$	$3.333^{b} \pm 2.08$	$1.333^{ij} \pm 1.52$	$2.000^{ljk} \pm 2.00$
151 (103×M-1-1)	$189.66^{bc} \pm 7.50$	$170.666^{ef} \pm 9.45$	$161.667^{ab} \pm 10.21$	$9.000^{i-m} \pm 3.60$	$37.333^{c-i} \pm 4.04$	$33.000^{b-k} \pm 3.46$	$4.333^{f-l} \pm 1.52$	$3.667^{b} \pm 3.05$	$0.000^{b} \pm 0.00$	$3.667^{b} \pm 3.05$	$9.000^{a-d} \pm 1.73$	$17.000^{abc} \pm 2.64$
Xihang 2.3	$218.000^{abc} \pm 6.92$	$166.333^{ef} \pm 6.65$	$156.333^{bc} \pm 10.21$	$10.000^{i-m} \pm 6.08$	$41.000^{b-h} \pm 14.73$	$37.000^{b-h} \pm 14.73$	$4.000^{f-l} \pm 0.00$	$3.000^{b} \pm 2.64$	$0.000^{b} \pm 0.00$	$3.000^{b} \pm 2.64$	$1.333^{jk} \pm 1.52$	$2.333^{ljk} \pm 2.51$
Xihang 3.3	$219.000^{abc} \pm 5.77$	$104.000^{h} \pm 90.50$	$152.500^{f} \pm 10.21$	$3.500^{l-m} \pm 2.08$	$29.000^{e-i} \pm 14.73$	$38.500^{b-e} \pm 23.64$	$3.333^{h-l} \pm 2.51$	$10.000^{b} \pm 7.93$	$0.500^{ab} \pm 0.57$	$10.000^{b} \pm 7.93$	$1.500^{ij} \pm 0.57$	$2.500^{ljk} \pm 1.00$
153 (Xihang-1)	$219.333^{abc} \pm 14.04$	$179.333^{a-e} \pm 12.72$	$169.333^{a-b} \pm 12.72$	$10.000^{g-m} \pm 0.00$	$39.000^{e-i} \pm 13.43$	$34.333^{b-k} \pm 13.43$	$4.667^{e-l} \pm 0.00$	$1.333^{b} \pm 1.41$	$0.000^{b} \pm 0.00$	$1.333^{b} \pm 1.41$	$2.000^{ij} \pm 0.00$	$3.667^{mh} \pm 0.70$
5118×10133-2-2	$212.667^{bc} \pm 3.21$	$163.667^{ef} \pm 34.42$	$130.000^{ef} \pm 10.21$	$33.667^{bcd} \pm 22.36$	$27.000^{f-i} \pm 6.08$	$18.667^{g-l} \pm 12.05$	$8.333^{b-h} \pm 6.65$	$18.000^{a} \pm 2.55$	$0.000^{b} \pm 0.00$	$25.350^{a} \pm 0.18$	$2.667^{ij} \pm 4.61$	$5.000^{mh} \pm 8.66$
5118×10133-3-3	$208.333^{bc} \pm 3.05$	$139.667^{d-h} \pm 14.43$	$122.000^{b-f} \pm 16.46$	$17.667^{e-j} \pm 2.08$	$22.333^{g-i} \pm 6.11$	$17.333^{i-l} \pm 5.85$	$5.000^{e-l} \pm 1.00$	$8.333^{b} \pm 2.30$	$0.000^{b} \pm 0.00$	$8.333^{b} \pm 2.30$	$1.000^{ij} \pm 1.00$	$1.667^{i-l} \pm 2.08$
Black-White	$220.667^{bc} \pm 9.23$	$177.000^{a-e} \pm 18.35$	$159.000^{a-d} \pm 14.17$	$18.000^{e-j} \pm 4.35$	$28.333^{f-i} \pm 4.61$	$23.223^{b-k} \pm 5.01$	$4.667^{e-l} \pm 1.52$	$4.667^{b} \pm 2.88$	$0.000^{b} \pm 0.00$	$4.667^{b} \pm 2.88$	$2.667^{ij} \pm 2.08$	$4.000^{mh} \pm 4.61$
101×F6	$211.667^{bc} \pm 19.85$	$139.667^{d-h} \pm 11.54$	$127.000^{a-f} \pm 14.17$	$12.667^{g-m} \pm 1.52$	$34.667^{d-i} \pm 7.37$	$24.333^{b-k} \pm 8.73$	$10.333^{bcd} \pm 1.52$	$7.333^{b} \pm 4.50$	$0.000^{b} \pm 0.00$	$7.333^{b} \pm 4.50$	$0.000^{k} \pm 0.00$	$0.000^{m} \pm 0.00$
F6×101	$210.500^{d} \pm 26.73$	$181.333^{bc} \pm 20.00$	$155.333^{a-d} \pm 31.02$	$26.000^{c-f} \pm 11.13$	$26.000^{f-i} \pm 12.48$	$17.667^{h-l} \pm 6.65$	$8.333^{b-h} \pm 5.85$	$5.000^{b} \pm 3.00$	$0.000^{b} \pm 0.00$	$5.000^{b} \pm 3.00$	$0.333^{jk} \pm 0.57$	$0.667^{l-m} \pm 1.15$
Kinshu	$235.000^{bc} \pm 4.24$	$152.000^{b-f} \pm 13.22$	$137.000^{ef} \pm 14.10$	$15.000^{f-l} \pm 3.00$	$28.667^{abc} \pm 8.38$	$17.000^{i-l} \pm 7.00$	$11.667^{b} \pm 1.52$	$4.000^{b} \pm 1.00$	$0.000^{b} \pm 0.00$	$4.00^{b} \pm 1.00$	$0.333^{jk} \pm 0.57$	$0.667^{l-m} \pm 1.15$
M-1-1×31	$211.333^{bc} \pm 5.19$	$137.333^{d-f} \pm 35.34$	$119.333^{b-f} \pm 43.36$	$18.000^{e-j} \pm 8.18$	$41.000^{d-i} \pm 1.00$	$34.000^{b-k} \pm 2.64$	$7.000^{b-k} \pm 1.73$	$3.000^{b} \pm 2.64$	$0.000^{b} \pm 0.00$	$3.000^{b} \pm 2.64$	$5.333^{ij} \pm 1.52$	$9.667^{gh} \pm 2.51$
31×M-1-1	$171.333^{abc} \pm 7.54$	$153.667^{b-f} \pm 12.85$	$144.000^{a-d} \pm 10.14$	$9.667^{i-m} \pm 6.35$	$29.333^{d-i} \pm 2.51$	$23.667^{b-k} \pm 3.21$	$5.667^{d-l} \pm 2.31$	$2.667^{b} \pm 1.15$	$0.000^{b} \pm 0.00$	$2.667^{b} \pm 1.15$	$2.667^{ij} \pm 1.52$	$4.667^{mh} \pm 0.57$
M-1-1×103	$212.667^{abc} \pm 7.54$	$205.000^{a} \pm 27.78$	$170.000^{a} \pm 11.53$	$12.000^{g-m} \pm 3.00$	$22.333^{g-i} \pm 2.51$	$14.333^{kl} \pm 3.05$	$7.333^{b-j} \pm 4.04$	$2.000^{b} \pm 1.00$	$0.000^{b} \pm 0.00$	$2.000^{b} \pm 1.00$	$2.667^{ij} \pm 2.88$	$5.000^{mh} \pm 5.19$

Table 1. Contd

103 Poly Marking	181.667^{abc} ± 0.00	121.667^{gh}± 38.79	105.660^{ef}± 38.08	16.000^{f-jk}±1.73	26.000^{f-i}±6.24	22.333^{d-l}±5.50	3.667^{g-l}±2.08	5.333^{b}±5.85	0.000^{b}±0.00	5.333^{b}±5.85	12.000^{a}±2.00	20.000^{ab}±5.56
Shaki	212.667^{bc} ± 3.78	167.333^{ef}± 28.29	159.667^{ab}± 26.53	7.667^{i-m}±5.68	33.000^{d-i}±18.08	27.000^{c-l}±15.52	6.000^{c-l}±3.60	4.000^{b}±3.00	0.000^{b}±0.00	4.000^{b}±3.00	10.667^{ab}±3.51	17.000^{abc}±5.29
101	185.000^{abc} ± 1.00	151.667^{b-f}±39.51	127.333^{ef}± 47.75	24.333^{d-g}±8.62	21.667^{hi}±3.78	18.000^{g-l}±3.60	3.667^{g-l}±0.57	7.667^{b}±1.52	0.000^{b}±0.00	7.667^{b}±1.52	0.333^{jk}±0.57	0.667^{l-m}±1.15
T1-J	186.667^{bc} ± 5.19	186.000^{abc} ±19.97	130.667^{a-f}±25.02	55.333^{a}±6.35	28.667^{abc}± 3.51	20.333^{e-l}±2.08	8.333^{b-h}±2.30	8.333^{b}±4.72	0.000^{b}±0.00	8.333^{b}±4.72	0.667^{jk}±1.15	1.000^{ljk}±1.73
T5-M	188.333^{abc} ± 8.54	168.667^{ef}± 10.01	161.000^{ab}± 13.22	7.667^{i-m}±5.50	39.333^{c-h}±4.72	33.000^{b-k}±4.35	6.333^{c-k}±1.52	7.000^{b}±1.00	0.000^{b}±0.00	7.000^{b}±1.00	1.667^{ij}±0.57	2.667^{i-l}±0.57
236	212.333^{abc} ± 2.51	161.333^{a-f}±26.38	153.000^{bc}± 26.96	8.333^{i-m}±5.03	42.667^{b-h}±14.57	37.333^{b-g}±14.01	5.333^{d-l}±0.57	8.000^{b}±3.60	0.000^{b}±0.00	8.000^{b}±3.60	1.000^{jk}±1.00	1.333^{ljk}±1.52
1524	186.000^{abc}±5.50	157.667^{b-f}±8.02	128.333^{a-f}±5.13	29.333^{cde}± 8.50	21.000^{i}±3.00	13.000^{l}±3.60	8.000^{b-i}±2.64	7.333^{b}±3.21	0.000^{b}±0.00	7.333^{b}±3.21	1.330^{jk}±1.52	1.667^{ljk}±2.08
1433-15	215.000^{bc}±0.00	189.667^{ab}± 22.03	165.333^{ab}± 33.56	24.333^{d-g}±11.93	34.333^{d-i}±13.27	26.333^{c-l}±11.71	8.000^{b-i}±2.64	6.333^{b}±3.78	0.000^{b}±0.00	6.333^{b}±3.78	0.000^{k}±0.00	0.000^{m}±0.00
1433-9	181.333^{abc}±1.73	178.000^{a-e}±2.00	154.000^{a-d}±2.64	24.000^{d-g}±4.58	30.667^{d-i}±4.50	20.333^{e-l}±2.88	10.333^{bcd}± 2.30	6.667^{b}±1.52	0.000^{b}±0.00	6.667^{b}±1.52	3.333^{ij}±0.57	4.333^{mh}±1.52
7409	223.667^{abc}±0.00	124.333^{f-h}±15.04	119.667^{b-f}±15.04	4.667^{klm}±2.30	40.000^{c-h}±7.93	35.667^{b-h}±8.30	4.333^{f-l}±1.15	6.000^{b}±3.46	0.000^{b}±0.00	6.000^{b}±3.46	12.667^{a}±3.78	22.333^{a}±4.50
N19	216.667^{bc}±9.81	160.000^{ef}± 12.48	156.333^{a-d}±10.69	3.667^{klm}±2.88	38.000^{c-h}±7.93	37.000^{b-h}±8.71	1.000^{l}±0.00	2.000^{b}±1.00	0.000^{b}±0.00	2.000^{b}±1.00	4.667^{ghi}±2.08	9.000^{ghi}±3.60
White Larvae-Yellow Cocoon	213.000^{bc}±12.70	138.333^{d-f}±11.37	130.000^{a-f}±8.18	8.333^{i-m}±3.21	37.000^{c-i}± 6.55	33.000^{b-k}±6.55	4.000^{f-l}±0.00	2.667^{b}±2.08	1.000^{a}±0.73	2.667^{b}±2.08	9.000^{a-d}±3.00	14.667^{cd}±3.51
Black Larvae-White Cocoon	187.333^{abc}±8.14	143.667^{b-h}±8.08	138.333^{a-f}±11.59	5.333^{jk}±3.51	41.333^{b-h}±12.34	38.333^{b-e}±6.55	3.000^{h-l}±2.00	5.000^{b}±1.73	0.000^{b}±0.00	5.000^{b}±1.73	1.333^{jk}±1.15	2.333^{ljk}±2.08
107-K	3.000^{c-f}±3.60	86.100^{a-f}±3.53	1.600^{j-u}±0.00	0.337^{cd}±0.01	21.033^{a-f}±0.51	1.430^{bc}±0.04	0.331^{b-e}±0.02	23.100^{ef}±1.05	1.760^{b}±0.01	0.343^{c}±0.00	19.500^{b-f}±0.17	217.560^{ef}± 26.18
119-K	0.333^{f}±0.57	93.300^{abc}± 2.38	1.967^{b}±0.10	0.377^{bcd}±0.01	19.167^{b-g}±0.05	1.737^{bc}±0.00	0.367^{b-e}±0.00	21.167^{ef}±0.83	2.190^{b}±0.09	0.386^{c}±0.01	17.633^{d-f}±0.05	261.843^{ef}± 30.49
113-K	0.000^{f}±0.00	95.000^{a}±1.47	1.437^{stu}±0.00	0.283^{cd}±0.01	19.733^{b-g}±0.66	1.277^{bc}±0.00	0.271^{de}±0.01	21.233^{ef}±0.60	1.500^{b}±0.21	0.288^{c}±0.02	19.267^{b-f}±1.06	228.373^{ef}± 13.54
105	1.667^{c-f}±0.57	80.500^{a-g}±13.48	1.723^{b-m}±0.00	0.400^{bc}±0.01	23.167^{abc}± 0.70	1.563^{bc}±0.06	0.397^{b}±0.02	25.400^{bc}±0.60	1.870^{b}±0.03	0.402^{bc}±0.01	21.467^{abc}± 0.70	242.200^{ef}± 18.94
31	1.000^{ef}± 1.00	89.300^{a-d}±3.90	1.753^{b-k}±0.00	0.401^{bc}±0.03	22.867^{a-f}±0.75	1.587^{bc}±0.12	0.399^{b}±0.03	25.233^{cde}±0.60	1.917^{b}±0.11	0.403^{c}±0.03	21.033^{b-f}±0.90	256.133^{ef}± 30.70
51	4.000^{bc}± 2.64	82.067^{a-g}±2.68	1.700^{e-p}±0.00	0.370^{bcd}±0.01	22.300^{a-f}±0.81	1.523^{bc}±0.09	0.380^{db}±0.02	24.967^{ef}±1.70	1.873^{ab}±0.02	0.378^{c}±0.01	20.133^{b-f}±0.37	228.053^{ef}± 22.64
103	1.333^{d-f}±1.15	88.067^{a-e}±3.49	1.567^{d-o}±0.00	0.329^{cd}±0.00	$21.033^{a–f}$±0.20	1.387^{bc}±0.06	0.321^{b-e}±0.01	23.167^{ef}±0.51	1.747^{b}±0.08	0.339^{c}±0.01	19.267^{b-f}±0.20	238.347^{ef}± 16.44

Table 1. Contd.

BH-2	1.000^{ef}±1.73	94.633^{ab}±2.12	1.760^{m-u}±0.00	0.352^{de}±0.04	19.967^{ef}±0.45	1.566^{bc}±0.17	0.344^{b-e}±0.04	21.867^{ef}±0.36	1.947^{a}±0.23	0.359^{c}±0.04	18.433^{d-f}±0.20	310.747^{ab}±61.04
B2-09	2.000^{c-f}±1.73	93.600^{abc}±2.72	1.760^{b-j}±0.00	0.380^{bcd}±0.01	22.033^{a-f}±0.45	1.547^{bc}±0.02	0.364^{b-e}±0.02	24.200^{ef}±0.40	1.910^{b}±0.05	0.387^{c}±0.01	20.267^{b-f}±0.41	251.090^{ef}±12.52
1003-4	3.333^{c-f}±3.21	69.500^{fgh}±5.08	1.730^{b-m}±0.00	0.374^{bcd}±0.00	23.067^{a-d}±0.45	1.457^{bc}±0.02	0.357^{b-e}±0.00	24.467^{a-f}0.40	1.783^{b}±0.05	0.392^{c}±0.00	21.967^{abc}±0.28	232.743^{ef}±25.81
1003-5	2.667^{c-f}±2.88	75.633^{ef}±1.18	1.623^{h-u}±0.00	0.416^{cd}±0.01	23.600^{abc}±0.26	1.573^{bc}±0.00	0.394^{b}±0.01	25.033^{a-f}±0.70	1.943^{b}±0.12	0.436^{bc}±0.01	22.467^{ab}±0.90	279.043^{ef}±34.83
1005	7.333^{a}±4.04	73.233^{ef}±2.04	1.757^{b-k}±0.00	0.361^{cd}±0.02	22.667^{a-f}±0.26	1.387^{bc}±0.01	0.355^{b-e}±0.02	25.600^{abc}±1.94	1.799 ^{b}±0.05	0.367^{c}±0.03	20.400^{a-g}±1.37	233.997^{ef}±14.90
M2-6-22-2	1.333^{d-f}±0.57	89.433^{a-d}±0.70	1.590^{l-u}±0.00	0.379^{cd}±0.02	22.900^{a-e}±0.45	1.480^{bc}±0.10	0.374^{b-e}±0.03	25.267^{a-e}±0.66	1.843^{b}±0.13	0.383^{c}±0.02	20.800^{a-f}±0.60	252.060^{ef}±57.30
M2-6-18(109)	6.667^{ab}±3.05	85.200^{ef}±1.53	11.653^{a}±0.00	0.332^{cd}±0.01	20.467^{b-g}±0.51	1.490^{bc}±0.05	0.333^{b-e}±0.01	22.300^{b-h}±0.55	1.757^{b}±0.09	0.331^{c}±0.01	18.867^{b-h}±0.51	201.580^{gh}±15.72
M-1-2(5)	2.333^{c-f}±1.52	88.200^{cde}±0.26	1.623^{h-u}±0.00	0.393^{bcd}±0.02	22.967^{a-e}±1.27	1.517^{bc}±0.04	0.360^{b-e}±0.00	23.767^{a-g}±0.23	1.900^{b}±0.09	0.425^{bc}±0.04	22.400^{ab}±2.25	281.497^{ef}±18.77
M2-6-22(107)	4.667^{abc}±3.21	88.933^{a-d}±6.60	1.710^{e-p}±0.00	0.409^{bc}±0.02	22.767^{a-e}±0.37	1.637^{bc}±0.06	0.403^{b}±0.01	24.633^{a-f}±0.65	1.957^{b}±0.11	0.414^{bc}±0.02	21.133^{a-f}±0.20	266.090^{ef}±25.32
M2-6-18.3	3.000^{c-f}±2.64	85.733^{ef}±7.04	1.793^{b-g}±0.00	0.383^{bcd}±0.01	22.100^{a-f}±0.78	1.523^{bc}±0.03	0.372^{b-e}±0.01	24.400 $^{a-g}$±0.72	1.857^{b}±0.04	0.377^{c}±0.02	20.300^{a-g}±0.81	247.450^{ef}±35.53
307-300-2	1.000^{ef}±1.00	89.600^{a-d}±4.07	1.693^{e-p}±0.00	0.323^{b-e}±0.01	17.833^{hi}±0.30	1.620^{bc}±0.05	0.313^{b-e}±0.01	19.333^{h-i}±0.73	1.993^{b}±0.07	0.663^{a}±0.56	17.500^{ghf}±1.30	302.330^{abc}±21.19
202A-204B	0.000^{f}±0.00	94.800^{ab}±2.95	1.803^{b-f}±0.00	0.260^{e}±0.00	14.567^{i}±0.15	1.643^{bc}±0.04	0.261^{e}±0.00	15.867^{i}±0.45	1.930^{b}±0.03	0.260^{c}±0.00	13.433^{j}±0.05	294.560^{bc}±17.87
I 20	0.667^{ef}±0.57	94.600^{ab}±1.01	1.783^{b-l}±0.00	0.318^{c-d}±0.02	16.200^{ij}±1.51	1.800^{b}±0.07	0.301^{b-e}±0.01	16.733^{i}±0.70	2.117^{b}±0.02	0.334^{c}±0.04	15.760^{hij}±2.21	275.427^{ef}±43.39
101433-9-5	0.000^{f}±0.00	90.400^{a-d}±0.51	1.960^{bc}±0.00	0.388^{c-d}±0.00	22.900^{a-e}±0.52	1.530^{bc}±0.03	0.383^{bcd}±0.00	25.033^{a-f}±0.41	1.850^{b}±0.06	0.394^{c}±0.00	21.300^{a-d}±0.69	280.633^{bc}±20.28
101433-1-4	1.000^{ef}±1.00	90.233^{a-d}±0.64	1.693^{e-p}±0.00	0.400^{bc}±0.01	22.367^{ef}±0.55	1.537^{bc}±0.06	0.387^{b}±0.01	24.200^{a-g}±0.55	1.973^{b}±0.07	0.401^{bc}±0.02	20.333^{a-g}±1.40	300.890^{abc}±22.13
101433-6-6	0.000^{f}±0.00	88.433^{a-e}±2.05	1.787^{b-h}±0.00	0.381^{bcd}±0.00	23.333^{a-d}±0.60	2.483^{a}±1.74	0.376^{bcd}±0.01	25.333^{a-e}±0.64	1.780^{b}±0.01	0.386^{c}±0.00	21.700^{abc}±0.50	262.230^{ef}±21.93
1126 (111)	1.333^{de}±1.15	84.800^{ef}±1.41	1.633^{g-t}±0.00	0.426^{b}±0.01	24.267^{ab}±0.90	1.547^{bc}±0.05	0.402^{b}±0.01	26.000^{abc}±0.43	1.963^{b}±0.04	0.450^{bc}±0.03	22.867^{a}±1.62	300.930^{abc}±10.04
113 (2029)	0.667^{ef}±1.15	91.033^{a-d}±3.32	1.757^{b-k}±0.00	0.389^{bcd}±0.02	23.167^{a-d}±0.60	1.493^{bc}±0.06	0.374^{b-e}±0.02	25.033^{a-f}±0.70	1.863^{b}±0.13	0.403^{bc}±0.03	21.600^{abc}±0.51	310.390^{ab}±25.43
151 (103×M-1-1)	1.333^{de}±0.57	92.167^{abc}±2.92	1.677^{e-p}±0.00	0.360^{b-e}±0.01	20.200^{b-g}±0.34	1.603^{bc}±0.00	0.350^{b-e}±0.00	21.833^{c-h}±0.45	1.953^{b}±0.02	0.368^{c}±0.00	18.800^{b-h}±0.30	306.930^{ef}±19.54
Xihang 2.3	0.333^{f}±0.57	91.900^{a-d}±1.50	1.780^{b-l}±0.00	0.368^{b-e}±0.01	21.500^{a-g} ±0.98	1.503^{bc}±0.03	0.356^{b-e}±0.02	23.667^{a-g}±0.98	1.917^{b}±0.04	0.380^{c}±0.01	19.817^{a-f}±1.07	275.583^{bc}±14.79

Table 1. Contd

Xihang 3.3	0.500^{ef}±0.57	25.061^{h}±52.20	1.710^{e-p}±0.00	0.579^{a}±0.01	21.950^{ef}±12.09	1.480^{bc}±0.27	0.355^{a}±0.37	24.000^{i}±13.27	1.875^{b}±0.50	0.383^{ab}±0.35	20.400^{ij}±11.20	260.795^{h}±15.90
153 (Xihang-1)	0.333^{f}±0.70	91.400^{a-d}±0.00	1.680^{b-e}±0.00	0.413^{b}±0.00	22.333^{a-e}±1.06	1.643^{bc}±0.27	0.393^{b}±0.00	23.967^{a-f}±1.20	2.060^{b}±0.03	0.432^{bc}±0.00	21.000^{abc}±0.80	331.247^{ab}±22.52
5118×101 33-2-2	0.333^{f}±0.57	70.000^{f}±25.26	1.657^{e-q}±0.00	0.38^{cbd}±0.03	23.133^{a-d}±1.35	1.550^{bc}±0.09	0.393^{b}±0.01	25.400^{a-d}±2.19	1.760^{b}±0.34	0.370^{c}±0.07	21.033^{a-f}±0.87	261.243^{ef}±11.28
5118×101 33-3-3	0.333^{f}±0.57	81.567^{a-g}±3.53	1.400^{u}±0.00	0.319^{c-d}±0.00	22.700^{a-f}±0.34	1.244^{c}±0.02	0.310^{b-e}±0.00	24.967^{a-f}±0.40	1.557^{b}±0.04	0.329^{c}±0.01	21.133^{a-f}±0.30	197.687^{gh}±27.90
Black-White	0.667^{ef}±1.15	87.067^{ef}±3.53	1.660^{e-q}±0.00	0.363^{b-e}±0.00	21.867^{a-f}±0.28	1.493^{bc}±0.05	0.355^{b-e}±0.01	23.800^{a-g}±0.17	1.820^{b}±0.06	0.370^{c}±0.00	20.367^{a-g}±0.47	325.167^{a}±19.17
101×F6	0.000^{f}±0.00	83.067^{a-g}±4.88	1.570^{m-u}±0.00	0.321^{c-d}±0.00	21.733^{a-f}±0.51	1.420^{bc}±0.04	0.335^{b-e}±0.00	23.600^{a-g}±0.69	1.717^{b}±0.02	0.346^{c}±0.00	20.167^{a-f}±0.30	215.400^{ef}±11.12
F6×101	0.000^{f}±0.00	81.333^{a-g}±9.55	1.613^{j-u}±0.00	0.347^{j-u}±0.00	20.467^{b-g}±0.40	1.440^{bc}±0.03	0.319^{b-e}±0.01	22.133^{b-h}±0.49	1.780^{b}±0.04	0.342^{c}±0.01	19.233^{a-h}±0.45	288.117^{cde}±35.05
Kinshu	0.000^{f}±0.00	83.500^{a-g}±2.26	1.643^{e-s}±0.00	0.337^{cd}±0.01	21.733^{a-f}±0.90	1.453^{bc}±0.11	0.335^{b-e}±0.00	23.433^{a-g}±1.60	1.650^{b}±0.07	0.333^{c}±0.02	20.167^{a-f}±0.70	232.497^{ef}±27.18
M-1-1×31	1.000^{ef}±1.00	84.200^{a-g}±5.63	1.713^{d-o}±0.00	0.343^{cd}±0.00	20.033^{b-g}±0.50	1.500^{bc}±0.03	0.330^{b-e}±0.00	21.967^{c-h}±0.50	1.927^{b}±0.04	0.356^{c}±0.00	18.500^{c-h}±0.40	234.360^{ef}±73.21
31×M-1-1	1.333^{d-f}±1.52	89.867^{a-d}±1.59	1.683^{e-p}±0.00	0.361^{b-e}±0.01	21.467^{a-g}±0.25	1.523^{bc}±0.07	0.357^{b-e}±0.01	23.467^{a-g}±0.15	1.843^{b}±0.08	0.364^{c}±0.01	19.800^{a-f}±0.50	256.800^{ef}±22.71
M-1-1×103	0.333^{f}±0.57	88.633^{a-d}±3.54	1.470^{q-u}±0.00	0.313^{c-d}±0.00	21.300^{a-g}±0.43	1.287^{cb}±0.02	0.293^{b-e}±0.00	22.800^{ef}±0.62	1.670^{b}±0.07	0.332^{c}±0.01	19.833^{a-f}±0.35	275.330^{ef}±13.77
103 Poly Marking	4.333^{bcd}±1.52	82.800^{a-g}±4.91	1.527^{p-u}±0.00	0.321^{c-d}±0.02	21.000^{a-g}±0.52	1.380^{bc}±0.09	0.316^{b-e}±0.02	22.867^{ef}±0.47	1.663^{b}±0.07	0.323^{c}±0.02	19.400^{a-f}±0.62	175.140^{h}±50.31
Shaki	4.330^{bcd}±2.30	90.200^{abc}±2.19	1.550^{o-u}±0.00	0.297^{cde}±0.06	19.000^{ef}±1.49	1.357^{bc}±0.19	0.276^{cde}±0.07	20.900^{d-h}±1.64	1.747^{b}±0.21	0.308^{c}±0.06	17.567^{c-h}±1.32	263.970^{ef}±75.68
101	0.000^{f}±0.00	78.867^{ef}±9.53	1.560^{n-u}±0.00	0.348^{b-e}±0.00	22.300^{a-f}±0.30	1.447^{bc}±0.05	0.343^{b-e}±0.00	23.700^{ef}±0.52	1.663^{b}±0.07	0.352^{c}±0.01	21.133^{a-f}±0.15	234.070^{ef}±63.60
T1-J	0.333^{f}±0.57	67.433^{gh}±5.77	1.713^{c-o}±0.00	0.376^{bcd}±0.00	19.833^{b-g}±2.40	1.470^{bc}±0.05	0.363^{b-e}±0.00	24.767^{a-f}±0.61	8.353^{a}±10.60	0.389^{c}±0.01	16.900^{gh}±3.55	302.707^{ef}±28.42
T5-M	0.667^{ef}±0.57	90.033^{a-d}±2.17	1.717^{c-o}±0.00	0.360^{b-e}±0.01	20.967^{a-g}±0.40	1.547^{bc}±0.00	0.357^{b-e}±0.01	23.067^{a-h}±0.70	1.887^{b}±0.08	0.363^{c}±0.01	19.233^{a-h}±0.20	290.720^{cde}±21.55
236	0.667^{ef}±0.57	89.000^{a-d}±4.01	1.620^{i-u}±0.00	0.348^{b-e}±0.00	21.500^{a-g}±0.43	1.437^{bc}±0.08	0.336^{b-e}±0.01	23.400^{a-g}±0.90	1.797^{b}±0.07	0.360^{c}±0.01	20.067^{a-f}±0.15	271.487^{ef}±43.59
1524	1.000^{ef}±1.00	75.900^{ef}±4.90	1.637^{f-t}±0.00	0.398^{cb}±0.01	24.000^{a}±0.80	1.497^{bc}±0.03	0.392^{b}±0.01	26.233^{a-b}±0.30	1.770^{b}±0.06	0.403^{bc}±0.02	22.800^{a}±1.11	253.727^{ef}±15.40
1433-15	0.000^{f}±0.00	83.133^{ef}±7.63	1.653^{e-q}±0.00	0.363^{b-e}±0.02	22.233^{a-f}±0.11	1.503^{bc}±0.05	0.365^{b-e}±0.02	24.267^{a-g}±0.83	1.793^{b}±0.06	0.380^{c}±0.01	21.200^{a-e}±0.17	300.010^{bc}±55.06
1433-9	2.333^{c-f}±0.57	80.470^{ef}±2.07	1.670^{e-q}±0.00	0.372^{b-e}±0.01	22.300^{a-f}±0.20	1.603^{bc}±0.15	0.357^{b-e}±0.01	23.800^{a-g}±0.40	1.837^{b}±0.06	0.387^{c}±0.00	21.100^{b-f}±0.50	295.290^{bc}±7.79

Table 1. Contd.

7409	3.000^{c-f}±3.60	90.733^{a-d}±0.89	1.467^{r-u}±0.00	0.300^{cde}±0.01	20.433^{d-g}±0.32	1.307^{bc}±0.01	0.293^{b-e}±0.00	22.400^{b-h}±0.10	1.623^{b}±0.07	0.305^{c}±0.02	18.733^{b-h}±0.75	178.053^{gh}±24.49
N19	0.333^{f}±0.57	96.667^{a}±1.44	1.593^{k-u}±0.00	0.338^{b-e}±0.00	21.200^{a-g}±0.40	1.410^{bc}±0.05	0.329^{b-e}±0.00	23.333^{a-h}±0.32	1.773^{b}±0.01	0.347^{c}±0.00	19.533^{a-f}±0.49	251.907^{ef}±18.81
Black Larvae-White Cocoon	5.000^{b}±1.73	92.900^{abc}±1.05	1.657^{tu}±0.00	0.351^{b-e}±0.01	24.567^{a}±0.15	1.267^{bc}±0.02	0.338^{b-e}±0.00	26.700^{a}±0.10	1.593^{b}±0.09	0.363^{c}±0.01	22.800^{a}±0.40	217.560^{ef}±26.18
107-K	56.077^{fgh}±19.65	1.413^{i-m}±0.17	7.263^{b}±4.20	1.510^{ab}±0.24	9.567^{g-k}±6.27	3.167^{a-e}±0.19	263.417^{hij}±23.39	12058.000^{b-g}±1064.51	128.667^{abc}±10.01	204.613^{a-f}±11.52	1.099^{d-k}±0.02	1.417^{f-m}±0.00
119-K	143.660^{a}±6.46	1.857^{ab}±0.05	4.437^{b}±1.02	1.657^{abc}±0.46	10.180^{f-k}±0.09	3.677^{ab}±0.18	419.943^{a}±21.31	12415.333^{a-g}±4781.98	121.333^{a-f}±4.61	237.503^{ab}±10.14	1.369^{d-k}±0.00	1.804^{ab}±0.07
113-K	52.097^{fgh}±7.47	1.300^{m}±0.08	2.830^{b}±1.09	1.500^{abc}±0.20	5.293^{g-k}±0.37	2.647^{a-f}±0.18	271.213^{g-j}±50.64	11217.000^{efg}±421.23	124.000^{a-e}±6.55	174.760^{d-h}±1.68	1.006^{d-k}±0.00	1.213^{m}±0.18
105	78.103^{cd}±16.99	1.703^{a-f}±0.00	11.197^{b}±6.40	1.880^{abc}±0.03	15.413^{d-i}±0.04	3.267^{abc}±0.11	346.853^{a-h}±9.02	12804.677^{a-g}±1294.21	108.333^{b-g}±2.08	187.443^{d-g}±4.62	1.166^{d-k}±0.04	1.469^{d-k}±0.01
31	73.523^{cd}±4.49	1.607^{a-l}±0.18	5.683^{b}±2.17	1.870^{abc}±0.28	6.100^{g-k}±7.81	2.373^{a-f}±2.06	341.440^{a-h}±39.23	13034.000^{a-g}±1456.66	107.333^{c-g}±10.01	184.227^{d-g}±6.43	1.188^{d-k}±0.00	1.513^{d-k}±0.09
51	101.313^{b}±20.90	1.667^{a-i}±0.11	11.073^{b}±2.38	1.620^{abc}±0.33	18.193^{ab}±4.43	3.440^{abc}±0.14	340.663^{a-h}±22.04	11684.000^{c-g}±1456.66	103.667^{d-g}±11.06	180.550^{d-g}±15.61	1.143^{d-k}±0.08	1.499^{d-k}±0.01
103	63.820^{fgh}±27.28	1.480^{e-m}±0.05	12.083^{b}±4.55	1.807^{ab}±0.18	4.283^{g-k}±1.00	2.667^{ef}±0.40	318.540^{b-j}±11.67	11280.667^{efg}±810.55	129.667^{abc}±3.78	131.393^{h-i}±113.80	1.065^{d-k}±0.05	1.411^{f-m}±0.06
BH-2	72.127^{cd}±28.62	1.700^{a-f}±0.05	3.697^{b}±2.73	1.897^{abc}±0.67	23.427^{b-f}±11.50	3.467^{abc}±0.32	419.567^{a}±30.31	14420.667^{a-e}±2592.00	105.333^{d-g}±19.29	187.647^{d-g}±8.47	1.222^{d-k}±0.12	1.588^{d-g}±0.18
B2-09	92.270^{bc}±11.44	1.633^{a-k}±0.05	12.723^{b}±5.53	2.020^{abc}±0.36	24.177^{b-e}±16.37	3.250^{a-d}±0.25	380.267^{abc}±19.83	12146.000^{b-g}±735.00	97.333^{g}±3.05	169.570^{e-h}±5.60	1.172^{d-k}±0.01	1.523^{d-k}±0.03
1003-4	42.230^{fgh}±0.83	1.420^{i-m}±0.23	13.060^{b}±7.15	1.867^{abc}±0.25	13.467^{e-k}±0.80	2.590^{a-f}±0.87	301.500^{d-j}±36.54	12250.333^{b-g}±857.00	122.000^{a-f}±5.56	174.643^{d-h}±38.33	1.100^{i-n}±0.02	1.392^{f-m}±0.04
1003-5	37.893^{fgh}±3.28	1.667^{a-i}±0.05	8.600^{b}±2.22	1.897^{abc}±0.17	13.873^{e-k}±0.55	3.490^{abc}±0.32	339.410^{a-h}±40.23	14425.667^{a-e}±940.00	124.333^{cde}±1.52	210.600^{a-f}±9.79	1.179^{d-j}±0.00	1.507^{d-k}±0.11
1005	33.763^{i-l}±5.89	1.500^{d-m}±0.00	9.837^{b}±8.46	1.767^{ab}±0.30	32.750^{ab}±7.45	3.133^{a-f}±0.35	307.013^{d-j}±17.47	13510.000^{a-g}±392.00	120.000^{a-g}±1.73	191.097^{a-g}±3.47	1.032^{l-o}±0.03	1.430^{e-m}±0.02
M2-6-22-2	55.473^{fgh}±30.44	1.567^{d-l}±0.05	12.733^{b}±3.64	1.900^{abc}±0.10	11.687^{e-k}±9.12	3.120^{a-f}±1.36	331.920^{a-h}±24.61	11399.333^{d-g}±628.00	115.000^{ef}±5.00	187.707^{d-g}±7.56	1.106^{h-n}±0.05	1.460^{d-k}±0.10
M2-6-18(109)	77.170^{cd}±20.13	1.580^{d-l}±0.13	12.920^{b}±5.37	1.600^{abc}±0.30	29.433^{abc}±8.99	3.000^{a-f}±0.55	321.103^{b-j}±6.79	11317.667^{efg}±1179.00	111.667^{b-g}±3.21	180.770^{d-g}±4.56	1.158^{d-k}±0.04	1.425^{f-m}±0.08
M-1-2(5)	36.333^{fgh}±8.44	1.600^{b-l}±0.00	9.523^{b}±8.46	1.723^{ab}±0.26	13.917^{e-k}±7.33	3.300^{abc}±0.34	341.197^{a-h}±14.57	14531.000^{a-e}±312.00	115.000^{ef}±4.58	199.163^{a-f}±3.93	1.156^{d-k}±0.03	1.465^{d-k}±0.11
M2-6-22(107)	57.763^{fgh}±30.80	1.767^{a-d}±0.05	13.970^{b}±11.60	1.867^{ab}±0.15	18.323^{ab}±6.05	3.267^{abc}±0.28	356.147^{a-f}±27.37	13826.333^{a-g}±1484.00	103.667^{d-g}±5.50	183.323^{d-g}±1.45	1.234^{cde}±0.05	1.510^{d-k}±0.14
M2-6-18.3	51.673^{fgh}±25.70	1.623^{a-k}±0.02	19.463^{b}±14.03	1.763^{ab}±0.20	17.727^{c-h}±7.42	3.267^{abc}±0.11	336.313^{a-i}±45.01	13108.333^{a-g}±575.00	117.667^{a-g}±7.37	196.350^{a-f}±2.74	1.152^{d-k}±0.02	1.480^{d-k}±0.03

Table 1. Contd.

307-300-2	$38.480^{fgh}\pm5.04$	$1.733^{a-e}\pm0.15$	$2.923^{b}\pm1.89$	$1.202^{bc}\pm0.66$	$2.983^{ijk}\pm3.57$	$1.833^{a-g}\pm1.75$	$346.717^{a}\pm15.12$	$15642.333^{a}\pm1151.00$	$130.667^{ab}\pm6.65$	$238.200^{a}\pm11.18$	$1.307^{b-c}\pm0.03$	$1.664^{b-e}\pm0.03$
202A-204B	$54.267^{fgh}\pm9.76$	$1.633^{a-k}\pm0.05$	$6.647^{b}\pm4.31$	$1.567^{abc}\pm0.15$	$7.210^{g-k}\pm5.94$	$3.693^{ab}\pm1.80$	$363.977^{a-f}\pm17.88$	$14525.000^{a-e}\pm518.00$	$129.667^{abc}\pm6.80$	$233.147^{abc}\pm6.64$	$1.383^{b}\pm0.03$	$1.670^{bcd}\pm0.06$
I 20	$78.407^{cd}\pm11.20$	$1.830^{abc}\pm0.10$	$7.557^{b}\pm9.37$	$0.967^{c}\pm0.87$	$6.327^{g-k}\pm2.20$	$3.797^{ab}\pm0.33$	$367.717^{a-e}\pm39.46$	$14666.000^{a-d}\pm1102.00$	$112.333^{b-g}\pm3.51$	$220.007^{a-d}\pm5.92$	$1.499^{a}\pm0.06$	$1.783^{abc}\pm0.06$
101433-9-5	$64.687^{fgh}\pm17.28$	$1.603^{a-l}\pm0.12$	$13.623^{b}\pm5.86$	$1.733^{ab}\pm0.05$	$3.153^{ijk}\pm3.11$	$2.117^{a-f}\pm2.04$	$362.097^{a-f}\pm23.14$	$12956.333^{ef}\pm345.00$	$126.000^{a-d}\pm5.56$	$211.853^{a-f}\pm10.31$	$1.147^{d-k}\pm0.03$	$1.456^{d-k}\pm0.06$
101433-1-4	$68.537^{c-h}\pm16.22$	$1.687^{a-h}\pm0.03$	$6.950^{b}\pm4.67$	$1.943^{abc}\pm0.13$	$9.520^{g-k}\pm4.58$	$3.240^{a-d}\pm0.20$	$385.89^{abc}\pm14.35$	$13971.667^{a-g}\pm658.00$	$117.000^{a-g}\pm6.08$	$207.137^{a-f}\pm9.41$	$1.209^{c-h}\pm0.02$	$1.547^{d-i}\pm0.11$
101433-6-6	$64.880^{fgh}\pm8.15$	$1.493^{e-m}\pm0.05$	$10.747^{b}\pm6.80$	$1.780^{ba}\pm0.21$	$3.520^{h-k}\pm3.48$	$2.357^{a-f}\pm2.00$	$341.357^{a-h}\pm40.29$	$12072.000^{b-g}\pm159.00$	$126.333^{a-d}\pm3.05$	$196.533^{a-f}\pm6.64$	$1.107^{gn}\pm0.03$	$1.394^{f-m}\pm0.02$
1126 (111)	$54.037^{fgh}\pm13.22$	$1.643^{a-k}\pm0.11$	$7.053^{b}\pm1.79$	$1.953^{abc}\pm0.57$	$6.830^{g-k}\pm3.06$	$3.483^{abc}\pm0.19$	$369.820^{a-e}\pm6.14$	$14355.000^{a-f}\pm272.00$	$119.000^{a-g}\pm2.64$	$205.173^{a-f}\pm6.96$	$1.144^{d-k}\pm0.02$	$1.514^{d-k}\pm0.04$
113 (2029)	$28.930^{f-l}\pm2.33$	$1.353^{l-m}\pm0.21$	$5.610^{b}\pm3.22$	$1.760^{ab}\pm0.27$	$4.313^{g-k}\pm4.60$	$2.277^{a-f}\pm0.18$	$349.250^{a-h}\pm27.63$	$15041.000^{ab}\pm1256.00$	$110.000^{b-g}\pm3.60$	$195.680^{a-f}\pm4.43$	$1.120^{f-m}\pm0.03$	$1.460^{d-k}\pm0.02$
151 (103×M-1-1)	$64.517^{fgh}\pm6.29$	$1.733^{a-e}\pm0.04$	$3.083^{b}\pm2.52$	$1.750^{ab}\pm0.25$	$33.670^{ab}\pm4.41$	$3.917^{a}\pm0.87$	$411.773^{ab}\pm7.92$	$14829.667^{abc}\pm718.00$	$114.000^{a-g}\pm1.73$	$202.637^{a-f}\pm8.15$	$1.253^{c-d}\pm0.02$	$1.586^{d-g}\pm0.02$
Xihang 2.3	$67.477^{c-h}\pm24.64$	$1.640^{a-k}\pm0.04$	$5.067^{b}\pm4.97$	$1.533^{abc}\pm0.37$	$4.307^{g-k}\pm4.83$	$2.187^{a-f}\pm0.62$	$352.433^{a-f}\pm37.13$	$13160.333^{a-g}\pm424.00$	$109.000^{b-g}\pm3.60$	$184.307^{d-g}\pm5.98$	$1.147^{d-k}\pm0.02$	$1.537^{d-g}\pm0.03$
Xihang 3.3	$68.720^{fgh}\pm43.05$	$1.595^{b-l}\pm0.34$	$15.975^{b}\pm13.58$	$1.515^{abc}\pm0.32$	$3.765^{ijk}\pm2.33$	$2.400^{a-g}\pm2.22$	$349.255^{k}\pm202.30$	$8340.000^{h}\pm7230.00$	$72.333^{h}\pm61.78$	$121.750^{i}\pm10.71$	$1.125^{i-o}\pm0.02$	$1.493^{i-m}\pm0.02$
153 (Xihang-1)	$66.743^{c-h}\pm23.34$	$1.710^{a-f}\pm0.01$	$2.117^{b}\pm2.43$	$1.027^{abc}\pm0.12$	$7.467^{gh}\pm1.26$	$3.730^{ab}\pm1.46$	$407.573^{ab}\pm2.89$	$15152.333^{a-e}\pm1076.00$	$106.333^{c-g}\pm6.36$	$198.037^{a-f}\pm9.35$	$1.250^{c-f}\pm0.05$	$1.628^{d-f}\pm0.04$
5118×10133-2-2	$51.023^{fgh}\pm15.76$	$1.867^{a}\pm0.24$	$38.930^{a}\pm55.10$	$1.423^{abc}\pm0.23$	$10.387^{f-jk}\pm17.99$	$1.300^{efg}\pm0.32$	$335.157^{a-i}\pm99.71$	$12373.667^{a-g}\pm4604.00$	$107.333^{c-g}\pm6.42$	$185.350^{d-g}\pm24.29$	$1.157^{d-k}\pm0.03$	$1.390^{f-m}\pm0.02$
5118×10133-3-3	$30.440^{c}\pm10.17$	$1.350^{l-m}\pm0.13$	$14.407^{b}\pm4.62$	$1.653^{abc}\pm0.25$	$2.583^{ijk}\pm2.78$	$1.663^{b-g}\pm0.00$	$245.117^{j}\pm36.03$	$11587.333^{c-g}\pm570.96$	$114.333^{ef}\pm6.02$	$163.117^{f-i}\pm6.58$	$0.933^{p}\pm0.04$	$1.228^{m}\pm0.03$
Black-White	$45.423^{fgh}\pm8.47$	$1.600^{a-l}\pm0.06$	$8.140^{b}\pm5.12$	$1.740^{ab}\pm0.17$	$8.940^{gh}\pm7.22$	$3.360^{abc}\pm1.84$	$387.67^{abc}\pm28.09$	$15611.333^{a}\pm2272.00$	$114.000^{ef}\pm3.46$	$194.853^{a-f}\pm7.67$	$1.138^{e-l}\pm0.02$	$1.450^{e-k}\pm0.05$
101×F6	$51.087^{fgh}\pm12.26$	$1.470^{e-m}\pm0.08$	$12.913^{b}\pm3.80$	$1.737^{ab}\pm0.06$	$0.000^{k}\pm0.00$	$0.000^{g}\pm0.00$	$279.423^{e-j}\pm0.00$	$11878.000^{b-g}\pm442.00$	$110.333^{b-g}\pm7.23$	$171.227^{d-h}\pm5.81$	$1.085^{i-o}\pm0.03$	$1.370^{g-m}\pm0.01$
F6×101	$37.257^{fgh}\pm15.49$	$1.463^{klm}\pm0.09$	$7.990^{b}\pm8.28$	$1.683^{abc}\pm0.42$	$1.067^{jk}\pm1.84$	$1.067^{d-g}\pm1.84$	$334.437^{a-i}\pm17.18$	$13556.667^{a-g}\pm1396.00$	$116.333^{a-g}\pm3.51$	$188.943^{b-g}\pm2.55$	$1.121^{f-l}\pm0.03$	$1.438^{f-m}\pm0.03$
Kinshu	$40.700^{fgh}\pm10.44$	$1.433^{i-m}\pm0.05$	$6.573^{b}\pm3.87$	$1.637^{ab}\pm0.24$	$0.960^{jk}\pm1.66$	$0.960^{g-f}\pm1.66$	$280.730^{e-j}\pm40.54$	$12606.333^{a-g}\pm429.00$	$121.333^{ef}\pm3.05$	$186.467^{d-g}\pm6.65$	$1.112^{g-m}\pm0.03$	$1.317^{j-m}\pm0.04$
M-1-1×31	$68.287^{c-h}\pm2.66$	$1.663^{a-j}\pm0.04$	$4.743^{b}\pm2.49$	$1.527^{abc}\pm0.12$	$17.693^{c-h}\pm4.56$	$3.3400^{abc}\pm0.16$	$325.087^{a-j}\pm77.04$	$12993.333^{a-g}\pm1065.00$	$120.000^{a-g}\pm14.17$	$205.933^{a-f}\pm23.57$	$1.170^{d-k}\pm0.05$	$1.577^{d-f}\pm0.04$
31×M-1-1	$48.667^{fgh}\pm3.94$	$1.660^{a-j}\pm0.02$	$4.620^{b}\pm4.56$	$1.703^{ab}\pm0.23$	$9.720^{f-jk}\pm3.13$	$3.247^{a-d}\pm0.12$	$316.807^{b-j}\pm13.15$	$13940.333^{a-g}\pm548.00$	$119.667^{a-g}\pm4.16$	$200.130^{a-f}\pm5.91$	$1.166^{d-k}\pm0.02$	$1.479^{d-k}\pm0.06$

Table 1. Contd.

M-1-1×103	31.327^{fgh}±8.89	1.410^{i-m}±0.06	3.277^{b}±2.35	1.677^{abc}±0.15	8.147^{ab}±8.39	3.200^{a-e}±0.20	318.080^{b-j}±20.70	13274.000^{a-g}±357.00	126.333^{a-d}±3.21	190.630^{a-g}±3.15	0.993^{nop}±0.03	1.338^{h-m}±0.06
103 Poly Marking	35.833^{fgh}±8.27	1.39^{klm}±0.01	8.827^{b}±2.15	1.890^{abc}±0.54	35.507^{gh}±5.42	2.963^{a-f}±0.14	255.307^{i-j}±68.33	11990.667^{ef}± 821.00	99.333^{fg}±1.15	143.070^{g-l}±2.64	1.064^{k-o}±0.04	1.341^{h-m}±0.04
Shaki	24.987^{n}±19.16	1.443^{i-m}±0.22	6.010^{b}±4.61	1.477^{abc}±0.05	33.297^{ab}±13.11	3.077^{a-f}±0.22	348.593^{a-h}±64.23	13066.000^{a-g}±3005.00	120.333^{ef}±10.59	187.263^{d-g}±10.13	1.071^{j-o}±0.03	1.438^{e-l}±0.02
101	31.773^{h-k}±7.18	1.460^{klm}±0.14	12.250^{b}±2.22	1.603^{abc}±0.08	1.020^{jk}±1.76	1.020^{efg}±1.76	279.113^{e-j}±71.16	12874.000^{ef}±771.00	121.000^{ef}±7.93	188.630^{b-g}±6.75	1.104^{h-n}±0.02	1.312^{klm}±0.05
T1-J	51.707^{fgh}±12.61	1.827^{abc}±0.42	14.983^{b}±8.83	1.763^{ab}±0.10	1.943^{ijk}±3.36	0.973^{g-f}±1.68	371.340^{a-d}±40.67	13581.667^{a-g}±600.00	135.667^{a}±6.02	219.243^{a-e}±20.85	1.107^{h-n}±0.02	1.964^{a}±0.39
T5-M	60.250^{fgh}±7.76	1.547^{d-m}±0.09	10.973^{b}±0.38	1.587^{abc}±0.18	5.170^{g-k}±1.84	3.097^{a-f}±0.11	367.113^{a-e}±29.04	13553.000^{a-g}±565.00	111.000^{b-g}±7.54	190.700^{a-g}±8.57	1.190^{d-i}±0.03	1.524^{d-k}±0.06
236	65.403^{fgh}±21.60	1.537^{d-m}±0.03	13.323^{b}±7.09	1.600^{abc}±0.23	3.207^{ijk}±3.08	2.180^{ef}±1.89	353.42^{a-f}±17.00	12792.333^{a-g}±1483.00	103.000^{efg}±1.00	174.470^{d-h}±3.22	1.101^{h-n}±0.03	1.436^{e-l}±0.06
1524	32.297^{lj}±3.88	1.543^{d-m}±0.04	13.513^{b}±6.43	1.827^{ab}±0.10	4.140^{g-k}±4.69	2.087^{ef}±1.80	303.677^{d-j}±9.39	13672.000^{a-g}±581.00	110.333^{b-g}±2.08	179.227^{d-g}±6.20	1.104^{h-n}±0.03	1.367^{g-m}±0.06
1433-15	51.573^{fgh}±18.50	1.52^{d-m}±0.08	9.903^{b}±5.40	1.700^{ab}±0.40	0.000^{k}±0.00	0.000^{g}±0.00	361.487^{a-f}±0.00	13015.333^{a-g}±2215.00	109.667^{b-g}±8.50	171.943^{d-h}±2.94	1.165^{d-k}±0.02	1.413^{f-m}±0.05
1433-9	50.407^{f-h}±6.57	1.64^{a-k}±0.03	12.903^{b}±3.11	1.953^{abc}±0.30	11.390^{e-k}±2.33	3.410^{abc}±0.21	369.990^{a-e}±16.14	13813.667^{a-g}±93.00	117.333^{a-g}±2.51	197.237^{a-f}±4.73	1.146^{d-k}±0.05	1.449^{e-k}±0.06
7409	56.007^{f-h}±7.88	1.413^{i-m}±0.10	8.703^{b}±5.60	1.417^{abc}±0.08	37.680^{a}±10.81	2.983^{a-f}±0.08	264.677^{h-j}±63.44	11044.667^{fgh}±244.00	126.000^{a-d}±4.58	183.590^{d-g}±11.20	1.014^{m-p}±0.02	1.319^{j-m}±0.05
N19	55.150^{fgh}±9.32	1.457^{i-m}±0.06	2.580^{b}±1.80	14.877^{d-}±7.17	3.170^{a-e}±0.22	3.170^{a-e}±0.22	325.047^{a-j}±13.88	12735.000^{a-g}±767.00	196.917^{a-f}±3.42	196.917^{a-f}±3.42	1.081^{i-o}±0.02	1.427^{f-m}±0.02
White Larvae-Yellow Cocoon	61.283^{fgh}±13.89	1.647^{a-k}±0.11	4.603^{b}±3.26	27.670^{a-} 16.20	3.020^{a-f}±1.04	3.020^{a-f}±1.04	329.530^{a-i}±54.05	13436.000^{a-g}±247.00	184.363^{d-g}±18.40	184.363^{d-g}±18.40	1.215^{c-g}±0.05	1.553^{d-h}±0.05
Black Larvae-White Cocoon	56.487^{f-h}±12.67	1.387^{klm}±0.09	7.207^{b}±2.50	3.630^{h-k}±3.14	1.817^{g}±1.57	1.817^{a-g}±1.57	274.793^{f-j}±6.38	11008.667^{gh}±1228.00	170.777^{d-h}±7.28	170.777^{d-h}±7.28	0.928^{p}±0.03	1.230^{l-m}±0.07

Means in each column followed by the same letters are not significantly different at $\alpha = 0.01$.

remained at upper level in the 119- K (68.667), B2-09 (40.667), 51 (40.333), BH-2 (39.667) and 101433-6-6 (39.000) strains increased in comparison with other strains significantly (Table 1).

The results also showed that the number of died middle produced cocoons of the 51 (16.333), Kinshu (11.667), 105 (11.000), 101×F6 (10.333) and 1433-9 (10.333) strains significantly remained at upper level than other ones, respectively, (Table 1). The number of low produced cocoons in 5118×10133-2-2 (18.000), M2-6-18.3 (10.667), 5118×10133-3-3 (8.333), T1-J (8.333) and 101433-9-5 (8.000) strains increased in comparison with other ones significantly (Table 1). The number of alive low produced cocoons significantly remained at upper level in the White Larvae-Yellow Cocoon (1.000), 202A-204B (0.666), Xihang 3.3 (0.666), M2-6-18.3 (0.333) and M-1-2[5] (0.333) strains increased in comparison with others significantly (Table 1).

In addition, the number of died low produced

Table 2. Evaluation index values for cocoon traits in studied silkworm pure lines of gene bank.

Traits Pure Lines	Number of Total Produced Cocoons	Number of Good Produced Cocoons	Number of Alive Good Produced Cocoons	Number of Died Good Produced Cocoons	Number of Middle Produced Cocoons	Number of Alive Middle Produced Cocoons	Number of Died Middle Produced Cocoons	Number of Low Produced Cocoons	Number of Alive Low Produced Cocoons	Number of Died Low Produced Cocoons	Number of Double Produced Cocoons	Number of Alive Pupae in Double Cocoons
107-K	39.116	40.239	42.099	48.301	54.892	49.693	43.243	48.503	46.782	48.503	46.964	45.761
119-K	57.367	37.920	42.844	88.583	109.276	97.772	43.880	58.190	46.782	58.190	74.227	48.726
113-K	51.676	51.212	57.759	64.017	56.801	58.733	52.268	71.785	46.782	71.785	48.669	47.243
105	45.985	41.166	40.980	43.113	64.433	56.267	42.606	44.677	46.782	44.677	45.749	52.680
31	45.985	43.948	46.759	48.911	64.433	59.555	44.146	58.190	46.782	58.190	49.690	44.772
51	51.087	37.611	37.997	45.707	85.424	67.773	41.014	42.723	46.782	42.723	45.484	51.197
103	55.797	51.367	53.657	43.723	60.140	59.555	47.756	43.293	46.782	43.293	49.690	44.278
BH-2	62.666	56.467	62.979	54.251	60.140	63.254	60.550	66.005	46.782	66.005	45.096	59.597
B2-09	59.133	45.030	51.420	88.583	80.176	75.582	46.163	43.944	46.782	43.944	44.953	60.092
1003-4	45.199	47.348	31.286	34.873	41.535	40.241	44.411	43.293	46.782	43.293	45.484	52.184
1003-5	46.966	53.531	42.472	35.483	31.516	35.310	47.756	48.503	46.782	48.503	46.117	49.219
1005	40.293	45.030	32.591	35.636	31.040	34.488	47.756	46.386	46.782	46.386	44.524	62.068
M2-6-22-2	46.966	46.730	48.996	45.707	50.122	53.802	55.453	43.293	46.782	43.293	46.352	50.702
M2-6-18(109)	44.611	57.704	37.624	56.845	70.158	62.021	42.925	41.665	62.401	41.665	44.616	60.586
M-1-2(5)	47.358	53.531	54.403	38.077	31.040	39.830	90.863	46.386	62.401	46.386	45.923	50.702
M2-6-22(107)	47.947	47.967	50.861	46.622	44.874	50.514	64.319	42.153	46.782	42.153	45.678	52.184
M2-6-18.3	46.181	45.339	46.946	44.791	44.397	47.638	51.047	38.734	62.401	38.734	45.484	52.680
307-300-2	44.611	54.303	56.826	43.113	30.085	36.132	53.702	58.190	62.401	58.190	53.775	42.796
202A-204B	51.480	53.531	60.928	69.510	45.828	50.103	55.453	49.887	78.067	49.887	48.669	47.243
I 20	41.864	41.475	47.878	145.803	59.663	61.199	52.268	48.503	46.782	48.503	49.690	45.267
101433-9-5	58.545	54.612	59.437	48.301	55.846	57.500	51.047	41.258	46.782	41.258	53.775	44.278
101433-1-4	59.133	55.849	59.623	44.791	56.801	56.267	47.119	53.306	46.782	53.306	46.964	48.726
101433-6-6	59.329	54.612	54.403	39.908	60.616	62.842	55.453	44.677	46.782	44.677	53.775	44.278
1126 (111)	55.405	56.776	56.640	39.603	45.828	42.707	43.668	51.433	46.782	51.433	48.669	45.267
113 (2029)	52.853	60.640	66.148	46.622	29.609	33.667	48.393	55.504	46.782	55.504	51.222	44.278
151 (103×M-1-1)	60.115	55.385	60.369	48.301	52.029	53.802	50.039	53.306	46.782	53.306	44.697	66.516
Xihang 2.3	54.816	53.376	57.386	46.622	57.277	58.733	51.047	58.190	46.782	58.190	51.222	44.772
Xihang 3.3	54.129	48.585	55.242	75.003	60.140	60.582	49.561	39.222	70.234	39.222	50.375	45.019
153 (Xihang-1)	68.553	59.403	64.656	46.622	54.415	55.445	49.136	92.137	46.782	92.137	48.669	46.750
5118×10133-2-2	54.619	52.140	42.658	35.941	37.241	36.132	44.146	35.641	46.782	35.641	47.393	48.726
Black-White	55.405	58.322	58.877	39.908	39.149	41.749	49.136	48.503	46.782	48.503	47.393	48.232
101×F6	37.154	41.012	40.980	43.418	48.214	43.117	42.925	42.153	46.782	42.153	43.564	41.313
101×F6	55.405	60.331	56.826	37.162	35.810	34.899	44.146	47.363	46.782	47.363	74.227	42.302

Table 2 Cont.

Kinshu	39.116	46.730	46.573	41.587	39.627	34.077	42.341	51.433	46.782	51.433	74.227	42.302
M-1-1×31	40.097	39.929	36.692	39.908	57.277	55.035	45.367	58.190	46.782	58.190	45.484	55.645
31×M-1-1	41.078	47.503	50.488	47.080	40.580	42.296	47.119	61.609	46.782	61.609	47.393	48.232
M-1-1×103	55.208	71.304	65.029	44.028	30.562	30.789	44.995	71.785	46.782	71.785	47.393	48.726
103 Poly Marking	39.705	32.666	29.049	40.976	35.810	40.652	52.268	46.386	46.782	46.386	44.412	70.964
Shaki	56.778	53.839	59.250	51.200	45.828	46.405	46.641	51.433	46.782	51.433	44.524	66.516
101	36.957	46.576	41.166	37.620	29.609	35.310	52.268	41.665	46.782	41.665	74.227	42.302
T1-J	61.881	62.495	43.031	34.110	39.627	38.186	44.146	40.851	46.782	40.851	58.870	42.796
T5-M	57.760	54.458	59.996	51.200	54.892	53.802	46.163	42.723	46.782	42.723	49.690	45.267
236	55.601	51.057	55.522	49.674	59.663	59.143	47.756	41.258	46.782	41.258	53.775	43.289
1524	40.489	49.358	41.726	36.551	28.654	29.146	44.411	42.153	46.782	42.153	51.222	43.784
1433-15	65.806	64.195	62.419	37.620	47.736	45.583	44.411	43.944	46.782	43.944	43.564	41.313
1433-9	58.937	58.785	56.081	37.772	42.489	38.186	42.925	43.293	46.782	43.293	46.627	47.737
7409	37.938	33.902	36.879	64.017	55.846	57.090	50.039	44.677	46.782	44.677	44.371	74.422
N19	50.695	50.439	57.386	73.020	52.984	58.733	90.863	71.785	46.782	71.785	45.749	54.656
White Larvae- Yellow Cocoon	40.293	40.393	42.658	49.674	51.553	53.802	51.047	61.609	93.686	61.609	44.697	63.057
Black Larvae-White Cocoon	42.844	42.866	47.319	60.050	57.754	60.376	55.453	47.363	46.782	47.363	51.222	44.772
107-K	44.468	48.861	53.902	49.072	47.004	41.386	44.226	47.964	48.587	38.520	47.019	39.519
119-K	66.344	47.221	59.625	49.088	34.351	72.824	56.124	35.393	51.634	55.083	34.915	50.366
113-K	41.740	46.033	58.411	49.049	38.189	25.718	24.394	35.822	46.745	17.335	45.508	42.167
105	46.656	52.435	49.912	49.097	61.474	55.006	66.040	62.921	49.367	61.246	59.771	45.554
31	49.933	45.287	54.379	49.098	59.440	57.464	66.701	61.835	49.700	61.631	56.958	48.967
51	43.788	53.181	51.994	49.089	55.595	50.910	60.421	60.105	49.388	52.001	51.123	42.089
103	47.885	45.140	52.514	49.068	47.004	36.982	40.920	48.400	48.495	36.979	45.508	44.610
BH-2	49.933	55.115	57.066	49.078	39.776	55.313	48.522	39.945	49.912	44.683	40.101	62.344
B2-09	45.837	56.456	59.885	49.090	53.785	53.367	55.133	55.117	49.650	55.468	51.992	47.732
1003-4	44.198	53.775	25.287	49.087	60.796	44.151	52.819	56.854	48.750	57.394	63.013	43.238
1003-5	44.812	50.501	33.438	49.104	64.410	56.030	65.048	60.535	49.884	74.342	66.255	54.578
1005	42.854	67.477	32.440	49.081	58.083	36.982	52.158	64.222	48.849	47.764	52.854	43.545
M2-6-22-2	47.885	50.054	53.294	49.089	59.663	46.506	58.438	62.056	49.175	53.927	55.447	47.969
M2-6-18(109)	42.969	63.903	56.330	49.069	43.166	47.530	44.556	42.761	48.566	33.898	42.915	35.605
M-1-2(5)	45.255	51.689	49.957	49.095	60.118	50.295	53.811	52.302	49.579	70.105	65.820	55.179
M2-6-22-2	47.885	50.054	53.294	49.089	59.663	46.506	58.438	62.056	49.175	53.927	55.447	47.969
M2-6-18(109)	42.969	63.903	56.330	49.069	43.166	47.530	44.556	42.761	48.566	33.898	42.915	35.605
M-1-2(5)	45.255	51.689	49.957	49.095	60.118	50.295	53.811	52.302	49.579	70.105	65.820	55.179
M2-6-22(107)	43.493	55.115	54.032	49.101	58.762	62.584	68.023	57.933	49.983	65.868	57.606	51.406

Table 2 Cont.

M2-6-18.3	44.468	54.222	52.688	49.090	54.239	50.910	57.777	56.418	49.275	51.616	52.206	46.840
307-300-2	49.933	43.947	52.211	49.065	25.306	60.843	38.276	23.466	50.238	161.780	34.053	60.282
202A-204B	41.740	46.328	59.061	49.040	3.160	63.198	21.089	0.926	49.792	6.549	7.686	58.379
I 20	54.022	45.586	60.882	49.064	14.233	79.276	34.310	6.558	51.117	35.053	22.817	53.693
101433-9-5	41.740	43.799	55.332	49.092	59.663	51.626	61.413	60.535	49.225	58.164	58.689	54.968
101433-1-4	49.933	47.820	53.772	49.097	56.049	52.343	62.735	55.117	50.097	60.861	52.419	59.930
101433-6-6	41.740	43.500	48.396	49.090	62.599	149.219	59.099	62.486	48.729	55.083	61.282	50.460
1126 (111)	47.885	45.881	48.352	49.108	68.933	53.367	67.693	66.823	50.026	79.735	68.848	59.940
113 (2029)	54.022	44.541	55.245	49.093	61.474	47.837	58.438	60.535	49.317	61.631	60.634	62.258
151 (103×M-1-1)	47.885	60.029	55.375	49.081	41.356	59.102	50.506	39.724	49.955	48.150	42.481	61.409
Xihang 2.3	66.344	44.394	54.509	49.084	50.170	48.861	52.489	51.651	49.700	52.772	49.074	53.731
Xihang 3.3	58.126	44.840	59.429	49.085	53.222	46.506	52.158	53.817	49.402	53.927	52.854	50.109
153 (Xihang-1)	66.344	45.734	54.812	49.103	55.819	63.198	64.718	53.602	50.713	72.802	56.744	67.365
5118×10133-2-2	66.344	46.927	23.206	49.090	61.243	53.675	64.718	62.921	48.587	48.920	56.958	50.219
5118×10133-3-3	66.344	44.394	45.490	49.064	58.307	22.236	37.285	60.105	47.149	33.127	57.606	34.651
Black-White	54.022	47.521	49.132	49.082	52.659	47.837	52.158	52.516	49.012	48.920	52.640	65.876
101×F6	41.740	41.713	50.303	95.979	51.750	40.362	45.548	51.215	48.283	39.675	51.343	38.990
101×F6	41.740	42.459	42.803	49.076	43.166	42.410	40.259	41.675	48.729	38.135	45.288	56.801
Kinshu	41.740	42.459	49.306	49.072	51.750	43.741	45.548	50.129	47.808	34.668	51.343	43.178
M-1-1×31	49.933	55.115	43.279	49.074	40.223	48.554	43.895	40.596	49.771	43.527	40.536	43.635
31×M-1-1	47.885	48.115	54.205	49.081	49.947	50.910	52.819	50.351	49.175	46.609	48.964	49.130
M-1-1×103	66.344	47.074	51.430	49.062	48.814	26.742	31.666	46.013	47.949	34.283	49.178	53.669
103 Poly Marking	43.633	75.518	43.799	49.065	46.780	36.266	39.268	46.449	47.900	30.816	46.371	29.129
Shaki	43.633	63.903	56.286	49.055	33.219	33.910	26.047	33.657	48.495	25.038	34.487	50.886
101	41.740	42.459	38.901	49.076	55.595	43.127	48.192	51.866	47.900	41.987	57.606	43.563
T1-J	66.344	42.906	22.988	49.088	38.867	45.482	54.802	58.805	95.306	56.239	30.163	60.375
T5-M	54.022	45.140	56.243	49.081	46.556	53.367	52.819	47.749	49.487	46.224	45.288	57.439
236	54.022	43.799	55.332	49.076	50.170	42.103	45.878	49.915	48.849	45.068	50.695	52.728
1524	49.933	44.988	38.206	49.097	69.380	48.247	64.387	68.339	48.658	61.631	68.413	48.378
1433-15	41.740	41.713	43.453	49.082	55.141	48.861	55.463	55.553	48.821	52.772	58.040	59.714
1433-9	45.255	48.562	44.710	49.086	55.595	59.102	52.819	52.516	49.133	55.468	57.392	58.558
7409	44.468	72.985	57.283	49.056	42.935	28.790	31.666	43.412	47.616	23.883	42.046	29.842
N19	66.344	51.689	59.322	49.072	48.136	39.338	43.565	49.479	48.679	40.061	47.233	47.932
White Larvae- Yellow Cocoon	44.198	62.857	54.509	49.064	30.961	50.910	36.624	29.540	49.438	32.357	33.404	44.029
Black Larvae-White Cocoon	66.344	44.840	57.283	49.077	70.967	24.694	46.539	71.376	47.404	46.224	68.413	37.048
107-K	49.645	38.106	48.941	59.476	48.178	54.378	32.353	39.854	65.010	58.721	43.926	46.195

Table 2 Cont.

119-K	120.451	70.127	59.068	48.670	48.687	58.857	70.053	43.293	56.324	79.475	79.457	71.871
113-K	46.427	29.956	73.967	60.407	44.633	49.812	34.230	31.758	59.483	39.883	31.688	32.660
105	67.452	59.021	43.237	35.257	53.028	55.257	52.449	47.041	40.927	47.886	52.743	49.645
31	63.749	52.097	53.364	35.815	45.302	47.406	51.145	49.249	39.743	45.857	55.638	52.564
51	86.216	56.424	43.354	51.092	55.334	56.776	50.958	36.254	35.401	43.537	49.716	51.635
103	55.905	42.938	42.539	39.169	43.795	49.988	45.629	32.371	66.195	12.518	39.452	45.797
BH-2	62.620	58.804	64.306	34.325	59.676	57.013	69.963	62.597	37.374	48.015	60.112	57.540
B2-09	78.905	53.972	42.073	28.363	60.298	55.107	60.497	40.701	27.899	36.608	53.532	53.228
1003-4	38.450	38.611	41.840	36.002	51.414	49.312	41.525	41.705	57.114	39.809	44.058	44.536
1003-5	34.944	56.424	46.380	34.325	51.751	57.215	50.656	62.645	59.877	62.499	54.454	52.166
1005	31.605	44.380	44.750	41.591	67.410	54.080	42.853	53.831	54.745	50.192	35.109	47.057
M2-6-22-2	49.156	49.212	42.073	34.139	49.937	53.966	48.852	33.513	48.823	48.053	44.847	49.048
M2-6-18(109)	66.697	50.150	41.840	52.583	64.659	52.912	46.247	32.727	44.876	43.676	51.690	46.726
M-1-2(5)	33.683	51.592	45.100	44.199	51.787	55.546	51.087	63.659	48.823	55.282	51.427	49.379
M2-6-22(107)	51.008	63.636	41.258	36.002	55.442	55.257	54.687	56.876	35.401	45.287	61.691	52.365
M2-6-18.3	46.084	53.251	38.814	41.777	54.948	55.257	49.910	49.964	51.982	53.507	50.901	50.375
307-300-2	35.419	61.184	72.687	91.147	42.717	42.665	52.416	74.357	67.379	79.914	71.298	62.582
202A-204B	48.181	53.972	50.338	55.005	46.223	58.997	56.573	63.601	66.195	76.726	81.299	62.980
I 20	67.697	68.180	48.243	128.780	45.491	59.910	57.474	64.958	45.665	68.434	96.564	70.477
101433-9-5	56.605	51.809	41.375	43.640	42.858	45.158	56.121	48.501	61.852	63.289	50.243	48.782
101433-1-4	59.718	57.867	49.639	32.089	48.139	55.019	61.853	58.275	51.192	60.313	58.401	54.820
101433-6-6	56.761	43.875	43.703	40.846	43.162	47.266	51.125	39.989	62.246	53.622	44.979	44.669
1126 (111)	47.996	54.693	49.407	31.530	45.908	57.153	57.981	61.965	53.561	59.074	49.848	52.630
113 (2029)	27.698	33.779	53.597	41.963	43.820	46.563	53.026	68.568	42.901	53.084	46.689	49.048
151 (103×M-1-1)	56.468	61.184	70.592	42.522	68.174	60.964	68.085	66.534	47.639	57.474	64.192	57.407
Xihang 2.3	58.861	54.477	55.809	57.613	43.815	45.773	53.793	50.465	41.717	45.908	50.243	54.156
Xihang 3.3	59.866	51.232	40.211	59.103	43.365	47.643	53.027	44.200	40.533	44.625	47.347	51.237
153 (Xihang-1)	58.268	59.525	87.819	117.602	46.436	59.322	67.074	69.640	38.558	54.571	63.797	60.194
5118×10133-2-2	45.559	70.848	35.904	67.114	48.859	37.984	49.632	42.892	39.743	46.566	51.558	44.404
5118×10133-3-3	28.919	33.779	40.909	48.857	42.385	41.172	27.945	35.323	48.033	32.537	22.081	33.656
Black-White	41.032	51.592	47.195	43.268	47.658	56.073	62.280	74.058	47.639	52.562	49.058	48.384
101×F6	45.611	42.217	41.840	43.454	40.242	26.569	36.208	38.121	43.296	37.654	42.084	43.143
101×F6	34.430	41.712	47.428	46.807	41.127	35.938	49.458	54.280	50.402	48.833	46.821	47.588
Kinshu	37.213	39.548	50.571	49.974	41.038	34.999	36.523	45.132	56.324	47.270	45.637	39.560
M-1-1×31	59.516	56.136	57.438	58.172	54.920	55.898	47.206	48.857	54.745	59.554	53.269	56.346
31×M-1-1	43.654	55.919	58.020	45.503	48.305	55.081	45.212	57.973	54.351	55.892	52.743	50.308
M-1-1×103	29.636	37.889	68.380	47.180	47.000	54.668	45.519	51.559	62.246	49.897	29.977	40.954

Table 2 Cont.

103 Poly Marking	33.279	36.447	46.031	34.698	69.698	52.587	30.399	39.206	30.268	19.887	39.320	41.153
Shaki	24.510	40.269	52.200	62.270	67.864	53.588	52.868	49.557	55.140	47.773	40.241	47.588
101	29.996	41.495	42.422	52.396	41.088	35.526	36.133	47.709	55.930	48.635	44.584	39.229
T1-J	46.112	67.964	40.676	41.777	41.854	35.113	58.347	54.521	73.301	67.952	44.979	82.486
T5-M	53.018	47.770	43.470	53.514	44.531	53.764	57.329	54.245	44.086	49.942	55.901	53.294
236	57.184	47.049	41.608	52.583	42.902	45.712	54.031	46.922	34.611	39.700	44.189	47.455
1524	30.420	47.481	41.491	38.051	43.676	44.895	42.050	55.390	43.296	42.702	44.584	42.878
1433-15	46.004	45.823	44.634	45.689	40.242	26.569	55.974	49.069	42.507	38.106	52.611	45.930
1433-9	45.061	54.982	41.957	31.530	49.691	56.512	58.022	56.754	51.587	54.066	50.111	48.318
7409	49.588	38.106	46.264	67.673	71.500	52.763	32.656	30.099	61.852	45.455	32.740	39.693
N19	48.895	41.279	78.042	56.868	52.583	54.405	47.197	46.371	59.483	53.865	41.557	46.858
White Larvae- Yellow Cocoon	53.854	54.982	58.137	42.709	63.196	53.088	48.277	53.118	39.743	45.943	59.191	55.218
Black Larvae-White Cocoon	49.976	36.231	49.057	64.879	43.253	42.524	35.093	29.753	51.982	37.370	21.423	33.788

cocoons of the 5118×10133-2-2 (18.000), M2-6-18.3 (10.667), 5118×10133-3-3 (8.333), T1-J (8.333) and 101433-9-5 (8.000) strains significantly remained at upper level than other strains, respectively, (Table 1). The number of double produced cocoons in 7409 (12.667), 103 Poly Marking (12.000), Shaki (10.667), 153[Xihang-1] (10.667) and M2-6-18[109] (9.667) strains increased significantly in comparison with other strains (Table 1). The number of alive pupae in double cocoons significantly remained at upper level in the 7409 (22.333), 103 Poly Marking (20.000), 151 [103×M-1-1] (17.000), Shaki (17.000) and White Larvae- Yellow Cocoon (14.667) strains increased in comparison with other ones significantly (Table 1). The number of died pupae in double cocoons in 1005 (7.333), M2-6-18[109] (6.667), M2-6-22[107] (4.667), 103 Poly Marking (4.333) and Shaki (4.333) strains increased in comparison with other ones significantly (Table 1). Pupae vitality percentage (%) significantly remained at upper level in the N19 (96.667 %), 51 (3.728%) 113-K (95.000%), 202A-204B (94.800%) and I 20 (94.600%) strains increased in comparison with others significantly (Table 1).

Furthermore, the cocoon weight (gr) of the M2-6-18(109 gr) (11.653 gr), 119-K (1.967 gr), 101433-9-5 (1.960 gr), 202A-204B (1.803 gr) and 101433-6-6 (1.787 gr) strains significantly remained at upper level than the others, respectively, (Table 1). The shell cocoon weight (gr) in Xihang 3.3 (0.579 gr), 1126 [111] (0.426 gr), 153 [Xihang-1] (0.418 gr), 1003-5 (0.416 gr) and M2-6-22[107] (0.408 gr) strains increased in comparison with others significantly (Table 1). Shell cocoon percentage (%) significantly remained at upper level in the Black Larvae-White Cocoon (24.567%), 1524 (24.333%), 1126 [111] (24.267%), 1003-5 (23.600%) and 101433-6-6 (23.333%) strains increased in comparison with others significantly (Table 1).

From the obtained results, the male cocoon weight (gr) of the 101433-6-6 (2.483 gr), I 20 (1.800 gr), 119-K (1.736 gr), 202A-204B (1.643 gr) and M2-6-22[107] (1.636 gr) strains increased in comparison with others significantly (Table 1). The male shell cocoon weight (gr) in Xihang 3.3 (0.570 gr), M2-6-22[107] (0.403 gr), 1126 [111] (0.402 gr), 31 (0.399 gr) and 105 (0.397 gr) strains increased in comparison with others significantly (Table 1). The male shell cocoon percentage (%) in, Black Larvae-White Cocoon (26.700%), 1524 (26.233%), 1126 (111) (26.000%), 1003-5 (25.600%), 1005 (25.600) and strains increased in comparison with others significantly (Table 1). Female shell cocoon weight (gr) remained significantly at upper level in the T1-J (8.353 gr), 119-K (2.190 gr), I 20 (2.117 gr), 153 [Xihang-1] (2.045 gr) and 307-300-2 (1.993 gr) strains increased in comparison with other ones significantly (Table 1).

The results also showed that the female cocoon weight (gr) of the 307-300-2 (0.662 gr), Xihang 3.3

Table 3. Sub-ordinate function values for cocoon traits in studied silkworm pure lines of gene bank

Traits Pure Lines	Number of Total Produced Cocoons	Number of Good Produce d Cocoons	Number of Alive Good Produced Cocoons	Number of Died Good Produced Cocoons	Number of Middle Produced Cocoons	Number of Alive Middle Produced Cocoons	Number of Died Middle Produced Cocoons	Number of Low Produced Cocoons	Number of Alive Low Produced Cocoons	Number of Died Low Produced Cocoons	Number of Double Produced Cocoons	Number of Alive Pupae in Double Cocoons
107-K	0.215	0.196	0.352	0.127	0.325	0.299	0.045	0.228	0.000	0.228	0.111	0.134
119-K	0.702	0.136	0.372	0.488	1.000	1.000	0.058	0.399	0.000	0.399	1.000	0.224
113-K	0.550	0.480	0.774	0.268	0.349	0.431	0.226	0.640	0.000	0.640	0.167	0.179
105	0.398	0.220	0.322	0.081	0.444	0.395	0.032	0.160	0.000	0.160	0.071	0.343
31	0.398	0.292	0.477	0.133	0.444	0.443	0.063	0.399	0.000	0.399	0.200	0.104
51	0.534	0.128	0.241	0.104	0.704	0.563	0.000	0.125	0.000	0.125	0.063	0.299
103	0.660	0.484	0.663	0.086	0.391	0.443	0.135	0.135	0.000	0.135	0.200	0.090
BH-2	0.843	0.616	0.915	0.180	0.391	0.497	0.392	0.537	0.000	0.537	0.050	0.552
B2-09	0.749	0.320	0.603	0.488	0.639	0.677	0.103	0.147	0.000	0.147	0.045	0.567
1003-4	0.377	0.380	0.060	0.007	0.160	0.162	0.068	0.135	0.000	0.135	0.063	0.328
1003-5	0.424	0.540	0.362	0.012	0.036	0.090	0.135	0.228	0.000	0.228	0.083	0.239
1005	0.246	0.320	0.095	0.014	0.030	0.078	0.135	0.190	0.000	0.190	0.031	0.627
M2-6-22-2	0.424	0.364	0.538	0.104	0.266	0.359	0.290	0.135	0.000	0.135	0.091	0.284
M2-6-18(109)	0.361	0.648	0.231	0.204	0.515	0.479	0.038	0.107	0.333	0.107	0.034	0.582
M-1-2(5)	0.435	0.540	0.683	0.036	0.030	0.156	1.000	0.190	0.333	0.190	0.077	0.284
M2-6-22(107)	0.450	0.396	0.588	0.112	0.201	0.311	0.468	0.115	0.000	0.115	0.069	0.328
M2-6-18.3	0.403	0.328	0.482	0.096	0.195	0.269	0.201	0.055	0.333	0.055	0.063	0.343
307-300-2	0.361	0.560	0.749	0.081	0.018	0.102	0.255	0.399	0.333	0.399	0.333	0.045
202A-204B	0.545	0.540	0.859	0.317	0.213	0.305	0.290	0.252	0.667	0.252	0.167	0.179
I 20	0.288	0.228	0.508	1.000	0.385	0.467	0.226	0.228	0.000	0.228	0.200	0.119
101433-9-5	0.733	0.568	0.819	0.127	0.337	0.413	0.201	0.099	0.000	0.099	0.333	0.090
101433-1-4	0.749	0.600	0.824	0.096	0.349	0.395	0.122	0.313	0.000	0.313	0.111	0.224
101433-6-6	0.754	0.568	0.683	0.052	0.396	0.491	0.290	0.160	0.000	0.160	0.333	0.090
1126 (111)	0.649	0.624	0.744	0.049	0.213	0.198	0.053	0.280	0.000	0.280	0.167	0.119
113 (2029)	0.581	0.724	1.000	0.112	0.012	0.066	0.148	0.352	0.000	0.352	0.250	0.090
151 (103×M-1-1)	0.775	0.588	0.844	0.127	0.290	0.359	0.181	0.313	0.000	0.313	0.037	0.761
Xihang 2.3	0.634	0.536	0.764	0.112	0.355	0.431	0.201	0.399	0.000	0.399	0.250	0.104
Xihang 3.3	0.615	0.412	0.706	0.366	0.391	0.458	0.171	0.063	0.500	0.063	0.222	0.112
153 (Xihang-1)	1.000	0.692	0.960	0.112	0.320	0.383	0.163	1.000	0.000	1.000	0.167	0.164
5118×10133-2-2	0.628	0.504	0.367	0.016	0.107	0.102	0.063	0.000	0.000	0.000	0.125	0.224
5118×10133-3-3	0.000	0.216	0.246	0.053	0.024	0.078	0.148	0.092	0.000	0.092	0.333	0.075
Black-White	0.649	0.664	0.804	0.052	0.130	0.184	0.163	0.228	0.000	0.228	0.125	0.209
101×F6	0.162	0.216	0.322	0.083	0.243	0.204	0.038	0.115	0.000	0.115	0.000	0.000

Table 3 Contd.

F6×101	0.649	0.716	0.749	0.027	0.089	0.084	0.063	0.207	0.000	0.207	1.000	0.030
Kinshu	0.215	0.364	0.472	0.067	0.136	0.072	0.027	0.280	0.000	0.280	1.000	0.030
M-1-1×31	0.241	0.188	0.206	0.052	0.355	0.377	0.087	0.399	0.000	0.399	0.063	0.433
31×M-1-1	0.267	0.384	0.578	0.116	0.148	0.192	0.122	0.460	0.000	0.460	0.125	0.209
M-1-1×103	0.644	1.000	0.970	0.089	0.024	0.024	0.080	0.640	0.000	0.640	0.125	0.224
103 Poly Marking	0.230	0.000	0.000	0.061	0.089	0.168	0.226	0.190	0.000	0.190	0.028	0.896
Shaki	0.686	0.548	0.814	0.153	0.213	0.251	0.113	0.280	0.000	0.280	0.031	0.761
101	0.157	0.360	0.327	0.031	0.012	0.090	0.226	0.107	0.000	0.107	1.000	0.030
T1-J	0.822	0.772	0.377	0.000	0.136	0.132	0.063	0.092	0.000	0.092	0.499	0.045
T5-M	0.712	0.564	0.834	0.153	0.325	0.359	0.103	0.125	0.000	0.125	0.200	0.119
236	0.654	0.476	0.714	0.139	0.385	0.437	0.135	0.099	0.000	0.099	0.333	0.060
1524	0.251	0.432	0.342	0.022	0.000	0.000	0.068	0.115	0.000	0.115	0.250	0.075
1433-15	0.927	0.816	0.899	0.031	0.237	0.240	0.068	0.147	0.000	0.147	0.000	0.000
1433-9	0.743	0.676	0.729	0.033	0.172	0.132	0.038	0.135	0.000	0.135	0.100	0.194
7409	0.183	0.032	0.211	0.268	0.337	0.407	0.181	0.160	0.000	0.160	0.026	1.000
N19	0.524	0.460	0.764	0.348	0.302	0.431	1.000	0.640	0.000	0.640	0.071	0.403
White Larvae- Yellow Cocoon	0.246	0.200	0.367	0.139	0.284	0.359	0.201	0.460	1.000	0.460	0.037	0.657
Black Larvae-White Cocoon	0.314	0.264	0.492	0.232	0.361	0.455	0.290	0.207	0.000	0.207	0.250	0.104
107-K	0.111	0.211	0.816	0.001	0.647	0.004	0.493	0.668	0.038	0.206	0.643	0.272
119-K	1.000	0.163	0.967	0.001	0.460	0.011	0.746	0.489	0.101	0.313	0.445	0.555
113-K	0.000	0.128	0.935	0.000	0.517	0.001	0.070	0.495	0.000	0.069	0.618	0.341
105	0.200	0.317	0.711	0.001	0.860	0.007	0.958	0.880	0.054	0.352	0.852	0.430
31	0.333	0.106	0.828	0.001	0.830	0.008	0.972	0.865	0.061	0.355	0.806	0.519
51	0.083	0.339	0.765	0.001	0.773	0.006	0.838	0.840	0.054	0.293	0.710	0.339
103	0.250	0.101	0.779	0.001	0.647	0.003	0.423	0.674	0.036	0.196	0.618	0.405
BH-2	0.333	0.396	0.899	0.001	0.540	1.000	0.585	0.554	0.065	0.246	0.530	0.869
B2-09	0.167	0.436	0.974	0.001	0.747	0.007	0.725	0.769	0.060	0.315	0.724	0.487
1003-4	0.100	0.357	0.061	0.001	0.850	0.005	0.676	0.794	0.041	0.328	0.905	0.369
1003-5	0.125	0.260	0.276	0.001	0.903	0.007	0.937	0.846	0.065	0.437	0.958	0.666
1005	0.045	0.762	0.249	0.001	0.810	0.003	0.662	0.898	0.043	0.266	0.738	0.377
M2-6-22-2	0.250	0.247	0.800	0.001	0.833	0.005	0.796	0.868	0.050	0.305	0.781	0.493
M2-6-18(109)	0.050	0.656	0.880	0.001	0.590	0.005	0.500	0.594	0.038	0.176	0.576	0.169
M-1-2(5)	0.143	0.295	0.712	0.001	0.840	0.006	0.697	0.729	0.058	0.409	0.950	0.681
M2-6-22(107)	0.071	0.396	0.819	0.001	0.820	0.009	1.000	0.809	0.067	0.382	0.816	0.583
M2-6-18.3	0.111	0.370	0.784	0.001	0.753	0.006	0.782	0.788	0.052	0.290	0.728	0.463

Table 3 Contd.

307-300-2	0.333	0.066	0.771	0.001	0.327	0.008	0.366	0.320	0.072	1.000	0.431	0.815
202A-204B	0.000	0.137	0.952	0.000	0.000	0.009	0.000	0.000	0.063	0.000	0.000	0.765
I 20	0.499	0.115	1.000	0.001	0.163	0.012	0.282	0.080	0.090	0.184	0.247	0.642
101433-9-5	0.000	0.062	0.854	0.001	0.833	0.006	0.859	0.846	0.051	0.333	0.834	0.676
101433-1-4	0.333	0.181	0.812	0.001	0.780	0.006	0.887	0.769	0.069	0.350	0.731	0.806
101433-6-6	0.000	0.053	0.670	0.001	0.877	0.027	0.810	0.874	0.041	0.313	0.876	0.558
1126 (111)	0.250	0.123	0.669	0.001	0.970	0.007	0.993	0.935	0.068	0.471	1.000	0.806
113 (2029)	0.499	0.084	0.851	0.001	0.860	0.005	0.796	0.846	0.053	0.355	0.866	0.866
151 (103×M-1-1)	0.250	0.542	0.855	0.001	0.563	0.008	0.627	0.551	0.066	0.268	0.569	0.844
Xihang 2.3	1.000	0.079	0.832	0.001	0.693	0.006	0.669	0.720	0.061	0.298	0.677	0.643
Xihang 3.3	0.666	0.093	0.962	0.001	0.738	0.005	0.662	0.751	0.055	0.305	0.738	0.549
153 (Xihang-1)	1.000	0.119	0.840	0.001	0.777	0.009	0.930	0.748	0.082	0.427	0.802	1.000
5118×10133-2-2	1.000	0.154	0.006	0.001	0.857	0.007	0.930	0.880	0.038	0.273	0.806	0.552
5118×10133-3-3	1.000	0.079	0.594	0.001	0.813	0.000	0.345	0.840	0.008	0.171	0.816	0.144
Black-White	0.499	0.172	0.690	0.001	0.730	0.005	0.662	0.732	0.047	0.273	0.735	0.961
101×F6	0.000	0.000	0.721	1.000	0.717	0.004	0.521	0.714	0.032	0.213	0.714	0.258
F6×101	0.000	0.022	0.523	0.001	0.590	0.004	0.408	0.578	0.041	0.203	0.615	0.724
Kinshu	0.000	0.022	0.695	0.001	0.717	0.005	0.521	0.698	0.022	0.181	0.714	0.367
M-1-1×31	0.333	0.396	0.535	0.001	0.547	0.006	0.486	0.563	0.062	0.238	0.537	0.379
31×M-1-1	0.250	0.189	0.824	0.001	0.690	0.006	0.676	0.702	0.050	0.258	0.675	0.523
M-1-1×103	1.000	0.159	0.751	0.000	0.673	0.001	0.225	0.640	0.025	0.179	0.678	0.642
103 Poly Marking	0.077	1.000	0.549	0.001	0.643	0.003	0.387	0.646	0.024	0.156	0.632	0.000
Shaki	0.077	0.656	0.879	0.000	0.443	0.003	0.106	0.465	0.036	0.119	0.438	0.569
101	0.000	0.022	0.420	0.001	0.773	0.004	0.577	0.723	0.024	0.228	0.816	0.377
T1-J	1.000	0.035	0.000	0.001	0.527	0.005	0.718	0.822	1.000	0.320	0.368	0.817
T5-M	0.499	0.101	0.878	0.001	0.640	0.007	0.676	0.665	0.056	0.256	0.615	0.740
236	0.499	0.062	0.854	0.001	0.693	0.004	0.528	0.695	0.043	0.248	0.703	0.617
1524	0.333	0.097	0.402	0.001	0.977	0.006	0.923	0.957	0.039	0.355	0.993	0.503
1433-15	0.000	0.000	0.540	0.001	0.767	0.006	0.732	0.775	0.043	0.298	0.823	0.800
1433-9	0.143	0.203	0.573	0.001	0.773	0.008	0.676	0.732	0.049	0.315	0.813	0.770
7409	0.111	0.925	0.905	0.000	0.587	0.001	0.225	0.603	0.018	0.112	0.562	0.019
N19	1.000	0.295	0.959	0.001	0.663	0.004	0.479	0.689	0.040	0.216	0.647	0.492
White Larvae- Yellow Cocoon	0.100	0.625	0.832	0.001	0.410	0.006	0.331	0.406	0.055	0.166	0.421	0.390
Black Larvae-White Cocoon	1.000	0.093	0.905	0.001	1.000	0.001	0.542	1.000	0.014	0.256	0.993	0.207
107-K	0.111	0.211	0.816	0.001	0.647	0.004	0.493	0.668	0.038	0.206	0.643	0.272

Table 3 Contd.

119-K	1.000	0.163	0.967	0.001	0.460	0.011	0.746	0.489	0.101	0.313	0.445	0.555
113-K	0.000	0.128	0.935	0.000	0.517	0.001	0.070	0.495	0.000	0.069	0.618	0.341
105	0.200	0.317	0.711	0.001	0.860	0.007	0.958	0.880	0.054	0.352	0.852	0.430
31	0.333	0.106	0.828	0.001	0.830	0.008	0.972	0.865	0.061	0.355	0.806	0.519
51	0.083	0.339	0.765	0.001	0.773	0.006	0.838	0.840	0.054	0.293	0.710	0.339
103	0.250	0.101	0.779	0.001	0.647	0.003	0.423	0.674	0.036	0.196	0.618	0.405
BH-2	0.333	0.396	0.899	0.001	0.540	1.000	0.585	0.554	0.065	0.246	0.530	0.869
B2-09	0.167	0.436	0.974	0.001	0.747	0.007	0.725	0.769	0.060	0.315	0.724	0.487
1003-4	0.100	0.357	0.061	0.001	0.850	0.005	0.676	0.794	0.041	0.328	0.905	0.369
1003-5	0.125	0.260	0.276	0.001	0.903	0.007	0.937	0.846	0.065	0.437	0.958	0.666
1005	0.045	0.762	0.249	0.001	0.810	0.003	0.662	0.898	0.043	0.266	0.738	0.377
M2-6-22-2	0.250	0.247	0.800	0.001	0.833	0.005	0.796	0.868	0.050	0.305	0.781	0.493
M2-6-18(109)	0.050	0.656	0.880	0.001	0.590	0.005	0.500	0.594	0.038	0.176	0.576	0.169
M-1-2(5)	0.143	0.295	0.712	0.001	0.840	0.006	0.697	0.729	0.058	0.409	0.950	0.681
M2-6-22(107)	0.071	0.396	0.819	0.001	0.820	0.009	1.000	0.809	0.067	0.382	0.816	0.583
M2-6-18.3	0.111	0.370	0.784	0.001	0.753	0.006	0.782	0.788	0.052	0.290	0.728	0.463
307-300-2	0.333	0.066	0.771	0.001	0.327	0.008	0.366	0.320	0.072	1.000	0.431	0.815
202A-204B	0.000	0.137	0.952	0.000	0.000	0.009	0.000	0.000	0.063	0.000	0.000	0.765
I 20	0.499	0.115	1.000	0.001	0.163	0.012	0.282	0.080	0.090	0.184	0.247	0.642
101433-9-5	0.000	0.062	0.854	0.001	0.833	0.006	0.859	0.846	0.051	0.333	0.834	0.676
101433-1-4	0.333	0.181	0.812	0.001	0.780	0.006	0.887	0.769	0.069	0.350	0.731	0.806
101433-6-6	0.000	0.053	0.670	0.001	0.877	0.027	0.810	0.874	0.041	0.313	0.876	0.558
1126 (111)	0.250	0.123	0.669	0.001	0.970	0.007	0.993	0.935	0.068	0.471	1.000	0.806
113 (2029)	0.499	0.084	0.851	0.001	0.860	0.005	0.796	0.846	0.053	0.355	0.866	0.866
151 (103×M-1-1)	0.250	0.542	0.855	0.001	0.563	0.008	0.627	0.551	0.066	0.268	0.569	0.844
Xihang 2.3	1.000	0.079	0.832	0.001	0.693	0.006	0.669	0.720	0.061	0.298	0.677	0.643
Xihang 3.3	0.666	0.093	0.962	0.001	0.738	0.005	0.662	0.751	0.055	0.305	0.738	0.549
153 (Xihang-1)	1.000	0.119	0.840	0.001	0.777	0.009	0.930	0.748	0.082	0.427	0.802	1.000
5118×10133-2-2	1.000	0.154	0.006	0.001	0.857	0.007	0.930	0.880	0.038	0.273	0.806	0.552
5118×10133-3-3	1.000	0.079	0.594	0.001	0.813	0.000	0.345	0.840	0.008	0.171	0.816	0.144
Black-White	0.499	0.172	0.690	0.001	0.730	0.005	0.662	0.732	0.047	0.273	0.735	0.961
101×F6	0.000	0.000	0.721	1.000	0.717	0.004	0.521	0.714	0.032	0.213	0.714	0.258
F6×101	0.000	0.022	0.523	0.001	0.590	0.004	0.408	0.578	0.041	0.203	0.615	0.724
Kinshu	0.000	0.022	0.695	0.001	0.717	0.005	0.521	0.698	0.022	0.181	0.714	0.367
M-1-1×31	0.333	0.396	0.535	0.001	0.547	0.006	0.486	0.563	0.062	0.238	0.537	0.379
31×M-1-1	0.250	0.189	0.824	0.001	0.690	0.006	0.676	0.702	0.050	0.258	0.675	0.523
M-1-1×103	1.000	0.159	0.751	0.000	0.673	0.001	0.225	0.640	0.025	0.179	0.678	0.642

Table 3 Contd.

103 Poly Marking	0.077	1.000	0.549	0.001	0.643	0.003	0.387	0.646	0.024	0.156	0.632	0.000
Shaki	0.077	0.656	0.879	0.000	0.443	0.003	0.106	0.465	0.036	0.119	0.438	0.569
101	0.000	0.022	0.420	0.001	0.773	0.004	0.577	0.723	0.024	0.228	0.816	0.377
T1-J	1.000	0.035	0.000	0.001	0.527	0.005	0.718	0.822	1.000	0.320	0.368	0.817
T5-M	0.499	0.101	0.878	0.001	0.640	0.007	0.676	0.665	0.056	0.256	0.615	0.740
236	0.499	0.062	0.854	0.001	0.693	0.004	0.528	0.695	0.043	0.248	0.703	0.617
1524	0.333	0.097	0.402	0.001	0.977	0.006	0.923	0.957	0.039	0.355	0.993	0.503
1433-15	0.000	0.000	0.540	0.001	0.767	0.006	0.732	0.775	0.043	0.298	0.823	0.800
1433-9	0.143	0.203	0.573	0.001	0.773	0.008	0.676	0.732	0.049	0.315	0.813	0.770
7409	0.111	0.925	0.905	0.000	0.587	0.001	0.225	0.603	0.018	0.112	0.562	0.019
N19	1.000	0.295	0.959	0.001	0.663	0.004	0.479	0.689	0.040	0.216	0.647	0.492
White Larvae- Yellow Cocoon	0.100	0.625	0.832	0.001	0.410	0.006	0.331	0.406	0.055	0.166	0.421	0.390
Black Larvae-White Cocoon	1.000	0.093	0.905	0.001	1.000	0.001	0.542	1.000	0.014	0.256	0.993	0.207

(0.588 gr), 1126 [111] (0.449 gr), 153 [Xihang-1] (0.439 gr) and 1003-5 (0.436 gr) strains remained significantly at upper level than others, respectively, (Table 1). The female shell cocoon weight (gr) in 307-300-2 (0.663 gr), 1126 [111] (0.450 gr), 1003-5 (0.436 gr), 153[Xihang-1] (0.432 gr) and M2-6-22[107] (0.414 gr) strains increased in comparison with others significantly (Table 1). Female shell cocoon percentage (%) significantly remained at upper level in the 1126 [111] (22.867%), 1524 (22.800%), Black Larvae-White Cocoon (22.800%), 1003-5 (22.800%) and M-1-2[5] (22.467%) strains increased in comparison with other ones significantly (Table 1).

The good cocoon weight of 250 larvae (gr) of the Black-White (325.17 gr), 153 [Xihang-1] (313.080 gr), 113 [2029] (310.75 gr), 151 [103×M-1-1] (310.40 gr) and T1-J (306.93 gr) strains significantly remained at upper level than others, respectively, (Table 1). The middle cocoon weight of 250 larvae (gr) in 119-K (143.662 gr), 51 (101.310 gr), B2-09 (92.270 gr), I 20 (78.410 gr) and 105 (78.100 gr) strains increased in comparison with others significantly (Table 1). The middle cocoon weight (gr) significantly remained at upper level in the 5118×10133-2-2 (1.866 gr), 119-K (1.856 gr), I 20 (1.830 gr), T1-J (1.826 gr) and M2-6-22[107] (1.766 gr) strains increased in comparison with others significantly (Table 1).

The low cocoon weight of 250 larvae (gr) of the 5118×10133-2-2 (38.930 gr), M2-6-18.3 (19.463 gr), T1-J (14.983 gr), 5118×10133-3-3 (14.407 gr) and M2-6-22[107] (13.970 gr) strains significantly remained at upper level than the other ones, respectively, (Table 1). The low cocoon weight (gr) in B2-09 (2.020 gr), 1126 [111] (1.953 gr), 1433-9 (1.953 gr), 101433-1-4 (1.943 gr) and M2-6-22-2 (1.900 gr) strains increased in comparison with others significantly (Table 1). The double cocoon weight of 250 larvae (gr) significantly remained at upper level in the 7409 (37.680 gr), 103 Poly Marking (35.507 gr), 151 [103×M-1-1] (33.670 gr), Shaki (33.297 gr) and 1005 (32.750 gr) increased in comparison with others significantly (Table 1).

The results further showed that the double cocoon weight (gr) of the 151 [103×M-1-1] (3.916 gr), I 20 (3.796 gr), 153 [Xihang-1] (3.760 gr), 202A-204B (3.693 gr) and 119-K (3.676 gr) strains significantly remained at upper level than other ones, respectively, (Table 1). The total cocoon weight of 250 larvae (gr) in 119-K (419.94 gr), BH-2 (419.57 gr), 151 [103×M-1-1] (411.77 gr), 153 [Xihang-1] (394.19 gr) and Black-White (387.67 gr) strains increased in comparison with others significantly (Table 1). Total cocoon weight of 10000 4th instar larvae (gr) significantly remained at upper level in the 307-300-2 (15642), Black-White (15611), 113 [2029] (15041), 151 [103×M-1-1] (14830) and I 20 (14666) strains increased in comparison with others significantly (Table 1). The cocoon number per liter of the T1-J (135.667), 307-300-2 (130.667), 202A-204B (129.667), 103 (129.667) and 107-K (128.667) strains significantly remained at upper level than other ones, respec-tively, (Table 1). The cocoon weight per liter (gr) in 307-300-2 (238.200 gr), 119-K (237.500 gr), 202A-204B (233.150 gr), I 20 (220.010 gr) and T1-J (219.240 gr) strains increased significantly in comparison with other strains (Table 1). Male pupae weight (gr) significantly remained at upper level in the I20

Table 4. Ranking of studied silkworm germplasm based on average of valuation index method and sub-ordinate function method for cocoon traits

	Evaluation Index Method		Sub-Ordinate Function Method	
	Value	**Rank**	**Value**	**Rank**
107-K	1689.404	39	11.005	44
119-K	2183.059	2	19.738	2
113-K	1684.749	40	11.433	42
105	1832.536	18	13.648	28
31	1864.684	2	14.031	31
51	1831.902	19	13.245	28
103	1659.133	45	11.168	43
BH-2	1967.926	6	17.488	4
B2-09	1910.497	11	15.095	10
1003-4	1639.667	46	10.273	47
1003-5	1824.430	21	13.945	25
1005	1676.896	41	11.838	39
M2-6-22-2	1763.322	32	12.825	34
M2-6-18(109)	1768.871	31	12.926	33
M-1-2(5)	1861.669	16	15.002	12
M2-6-22(107)	1864.870	14	14.662	15
M2-6-18.3	1780.889	30	13.321	29
307-300-2	1997.288	4	15.912	7
202A-204B	1787.626	29	13.976	24
I 20	2017.379	3	15.858	9
101433-9-5	1867.118	13	14.448	16
101433-1-4	1926.167	8	16.087	6
101433-6-6	1925.278	9	14.396	17
1126 (111)	1912.548	10	15.590	9
113 (2029)	1816.983	24	14.326	18
151 (103×M-1-1)	1970.934	5	17.758	3
Xihang 2.3	1873.822	12	15.066	11
Xihang 3.3	1853.181	17	14.173	19
153 (Xihang-1)	2208.466	1	20.920	1
5118×10133-2-2	1730.929	35	12.303	36
5118×10133-3-3	1481.164	51	7.996	51
Black-White	1824.133	22	14.822	14
101×F6	1590.124	49	8.896	50
F6×101	1659.981	44	11.516	38
Kinshu	1630.760	36	10.335	46
M-1-1×31	1788.792	28	13.199	32
31×M-1-1	1801.923	25	13.682	27
M-1-1×103	1745.517	34	14.057	22
103 Poly Marking	1534.018	50	9.352	49
Shaki	1713.116	38	13.292	30
101	1603.300	48	9.755	48
T1-J	1830.069	20	14.914	13
T5-M	1819.733	23	14.082	21
236	1746.359	33	12.539	35
1524	1673.002	43	11.001	45
1433-15	1730.828	36	11.935	37
1433-9	1789.693	27	13.727	26
7409	1673.012	42	11.545	41
N19	1943.127	7	16.720	5
White Larvae- Yellow Cocoon	1799.424	27	14.086	20
Black Larvae-White Cocoon	1729.704	37	11.894	38

(1.499 gr), 202A-204B (1.383 gr), 307-300-2 (1.369 gr), 151 [103×M-1-1] (1.307 gr) and M2-6-22[107] (1.253 gr) increased in comparison with others significantly (Table 1).

The female pupae weight (gr) of the T1-J (1.964 gr), 119-K (1.804 gr), I 20 (1.782 gr), 202A-204B (1.670 gr) and 307-300-2 (1.664 gr) strains significantly remained at upper level than other ones, respectively, (Table 1).

Also, the performance potential of strains were assessed based on different parameters, such as number of total produced cocoons, number of good produced cocoons, number of alive good produced cocoons, number of died good produced cocoons, number of middle produced cocoons, number of alive middle produced cocoons, number of died middle produced cocoons, number of low produced cocoons, number of alive low produced cocoons, number of died low produced cocoons, number of double produced cocoons, number of alive pupae in double cocoons, number of died pupae in double cocoons, pupae vitality percentage, cocoon weight, shell cocoon weight, shell cocoon percentage , male cocoon weight, male shell cocoon weight, male shell cocoon percentage, female cocoon weight, female shell cocoon weight, female shell cocoon percentage, good cocoon weight of 250 larvae, middle cocoon weight of 250 larvae, middle cocoon weight, low cocoon weight of 250 larvae, low cocoon weight, double cocoon weight of 250 larvae, double cocoon weight, total cocoon weight of 250 larvae , total cocoon weight of 10000 4th instar larvae, cocoon number per liter, cocoon weight per liter, male pupae weight and female pupae weight. Recorded characteristics of productive characters using the evaluation index (Tables 2 and 4) and sub-ordinate function (Tables 3 and 4) methods and their details are as follows.

Among germplasm strains, as per the evaluation index method, the strains 153 [Xihang-1] (68.553), 1433-15 (65.806), BH-2 (62.666), T1-J (61.881) and 151[103×M-1-1] (60.115) showed higher evaluation index values for number of total produced cocoons (Table 2). Also, as per the evaluation index method, the strains M-1-1×103 (71.304), 1433-15 (64.195), T1-J (62.495), 113 [2029] (60.64) and 101×F6 (60.331) showed higher evaluation index values for number of good produced cocoons (Table 2). Also, the strains 113 [2029] (66.148), M-1-1×103 (65.029), 153 [Xihang-1] (64.656), BH-2 (62.979) and 1433-15 (62.419) showed higher evaluation index values for number of alive good produced cocoons (Table 2). Meanwhile, the strains I 20 (145.803), 119-K (88.583), B2-09 (88.583), Xihang 3.3 (75.003) and N19 (73.02) showed higher evaluation index values for number of died good produced cocoons (Table 2).

In addition, the strains 119-K (109.276), 51 (85.424), B2-09 (80.176), M2-6-18[109] (70.158) and 105 (64.433) showed higher evaluation index values for number of middle produced cocoons (Table 2) while the strains 119-K (97.772), B2-09 (75.582), 51 (67.773), BH-2 (63.254) and 101433-6-6 (62.842) showed higher evaluation index values for number of alive middle produced cocoons (Table 2).

Furthermore, the strains M-1-2[5] (90.863), N19 (90.863), M2-6-22[107] (64.319), BH-2 (60.55) and M2-6-22-2 (55.453) showed higher evaluation index values for number of died middle produced cocoons (Table 2). The strains 153 [Xihang-1] (92.137), 113-K (71.785), M-1-1×103 (71.785), N19 (71.785) and BH-2 (66.005) showed higher evaluation index values for number of low produced cocoons (Table 2). Also, the strains White Larvae- Yellow Cocoon (93.686), 202A-204B (78.067), Xihang 3.3 (70.234), M2-6-18[109] (62.401) and M-1-2[5] (62.401) showed higher evaluation index values for number of alive low produced cocoons (Table 2). Meanwhile, the strains 153 [Xihang-1] (92.137), 113-K (71.785), M-1-1×103 (71.785), N19 (71.785) and BH-2 (66.005) showed higher evaluation index values for number of died low produced cocoons (Table 2).

The strains 119-K (74.227), 101×F6 (74.227), Kinshu (74.227), 101 (74.227) and T1-J (58.870) showed higher evaluation index values for number of double produced cocoons (Table 2). Also, the strains 7409 (74.422), 103 Poly Marking (70.964), 151 [103×M-1-1] (66.516), Shaki (66.516) and White Larvae- Yellow Cocoon (63.057) showed higher evaluation index values for number of alive pupae in double cocoons (Table 2).

Still among germplasm strains, as per the evaluation index method, the strains 119-K (66.344), Xihang 2.3 (66.344), 153 [Xihang-1] (66.344), 5118×10133-2-2 (66.344) and 5118×10133-3-3 (66.344) showed higher evaluation index values for number of died pupae in double cocoons (Table 2). The strains 103 Poly Marking (75.518), 7409 (72.985), 1005 (67.477), M2-6-18[109] (63.903) and Shaki (63.903) showed higher evaluation index values for pupae vitality percentage (Table 2). The strains I 20 (60.882), B2-09 (59.885), 119-K (59.625), Xihang 3.3 (59.429) and N19 (59.322) showed higher evaluation index values for cocoon weight (Table 2). While, the strains 101×F6 (95.979), 1126 [111] (49.108), 1003-5 (49.104), 153 [Xihang-1] (49.103) and 49.101

(49.101) showed higher evaluation index values for shell cocoon weight (Table 2).

The strains Black Larvae-White Cocoon (70.967), 1524 (69.380), 1126 [111] (68.933), 1003-5 (64.41) and 101433-6-6 (62.599) showed higher evaluation index values for shell cocoon percentage (Table 2). Also, as per the evaluation index method, the strains 101433-6-6 (149.219), I 20 (79.276), 119-K (72.824), 202A-204B (63.198) and 202A-204B (63.198) showed higher evaluation index values for male cocoon weight (Table 2).

Still on the germplasm strains, the strains M2-6-22[107] (68.023), 1126 [111] (67.693), 31 (66.701), 105 (66.040) and 1003-5 (65.048) showed higher evaluation index values for male shell cocoon weight (Table 2) while the strains Black Larvae-White Cocoon (71.376), 1524 (68.339), 1126 [111] (66.823), 1005 (64.222) and 105 (64.222) showed higher evaluation index values for male shell cocoon percentage (Table 2). The strains T1-J (95.306), 119-K (51.634), I 20 (51.117), 153 [Xihang-1] (50.713) and 307-300-2 (50.238) showed higher evaluation index values for female cocoon weight (Table 2). Meanwhile, as per the evaluation index method, the strains 307-300-2 (161.780), 1126 [111] (79.735), 1003-5 (74.342), 153 [Xihang-1] (72.802) and M-1-2[5] (70.105) showed higher evaluation index values for female shell cocoon weight (Table 2).

Also, the strains 107-K (47.019), 119-K (34.915), 113-K (45.508), 105 (59.771) and 51 (56.958) showed higher evaluation index values for female shell cocoon percentage (Table 2). The strains 153 [Xihang-1] (67.365), Black-White (65.876), (62.344), BH-2 (62.258) and 113 [2029] (61.409) showed higher evaluation index values for good cocoon weight of 250 larvae (Table 2).

Among germplasm strains, as per the evaluation index method, the strains 119-K (120.451), 51 (86.216), B2-09 (78.905), I 20 (67.697) and 105 (67.452) showed higher evaluation index values for middle cocoon weight of 250 larvae (Table 2). Also, as per the evaluation index method, the strains 5118×10133-2-2 (70.848), 119-K (70.127), I 20 (68.18), T1-J (67.964) and M2-6-22[107] (63.636) showed higher evaluation index values for middle cocoon weight (Table 2). Also, as per the evaluation index method, the strains 153 [Xihang-1] (87.819), N19 (78.042), 113-K (73.967), 307-300-2 (72.687) and 151 [103×M-1-1] (70.592) showed higher evaluation index values for low cocoon weight of 250 larvae (Table 2). Meanwhile, as per the evaluation index method, the strains I 20 (128.78), 153 [Xihang-1] (117.602), 307-300-2 (91.147), 7409 (67.673) and 5118×10133-2-2 (67.114) showed higher evaluation index values for low cocoon weight (Table 2).

Among germplasm strains, as per the evaluation index method, the strains 7409 (71.500), 103 Poly Marking (69.698), 151 [103×M-1-1] (68.174), Shaki (67.864) and 1005 (67.410) showed higher evaluation index values for double cocoon weight of 250 larvae (Table 2). Also, as per the evaluation index method, the strains 151 [103×M-1-1] (60.964), I 20 (59.91), 153 [Xihang-1] (59.322), 202A-204B (58.997) and 119-K (58.857) showed higher evaluation index values for double cocoon weight (Table 2).

Among germplasm strains, as per the evaluation index method, the strains 119-K (70.053), BH-2 (69.963), 151 [103×M-1-1] (69.963), 153 [Xihang-1] (69.963) and Black-White (69.963) showed higher evaluation index values for total cocoon weight of 250 larvae (Table 2). Also, as per the evaluation index method, the strains 66.534 (74.357), Black-White (74.058), 153 [Xihang-1] (69.64), 113 [2029] (68.568) and 151 [103×M-1-1] (66.534) showed higher evaluation index values for total cocoon weight of 10000 4th instar larvae (Table 2). Also, as per the evaluation index method, the strains T1-J (73.301), 307-300-2 (67.379), 103 (66.195), 202A-204B (66.195) and 107-K (65.010) showed higher evaluation index values for cocoon number per liter (Table 2). Meanwhile, as per the evaluation index method, the strains 307-300-2 (79.914), 119-K (79.475), 202A-204B (76.726), I 20 (68.434) and T1-J (67.952) showed higher evaluation index values for cocoon weight per liter (Table 2).

Among germplasm strains, as per the evaluation index method, the strains I 20 (96.564), 202A-204B (81.299), 119-K (79.457), 307-300-2 (71.298) and 151 [103×M-1-1] (64.192) showed higher evaluation index values for male pupae weight (Table 2).

Among germplasm strains, as per the evaluation index method, the strains T1-J (82.486), 119-K (71.871), I 20 (70.477), 202A-204B (62.98) and 307-300-2 (62.582) showed higher evaluation index values for male and female pupae weight (Table 2). Totally, 153 [Xihang-1] (2208.466), 119-K (2183.059), I 20 (2017.379), 07-300-2 (1997.288) and 151 [103×M-1-1] (1970.934) showed higher evaluation index values (Table 4).

Among germplasm strains, as per the sub-ordinate function method, the strains 153 [Xihang-1] (1.000), 1433-15 (0.927), BH-2 (0.843), T1-J (0.822) and 151 [103×M-1-1] (0.775) showed higher sub-ordinate function values for number of total produced cocoons (Table 3).

Also, as per the sub-ordinate function method, the strains M-1-1×103 (1.000), 1433-15 (0.816), T1-J (0.772), 113 [2029] (0.724) and 101×F6 (0.716) showed higher sub-ordinate function values for the number of good produced cocoons (Table 3). Also, as per the sub-ordinate function method, the strains 113 [2029] (1.000), M-1-1×103 (0.970), 153 [Xihang-1] (0.960), BH-2 (0.915) and 1433-15 (0.899) showed higher sub-ordinate function values for number of alive good produced cocoons (Table 3). Meanwhile, as per the sub-ordinate function method, the strains I 20 (1.000), 119-K (0.488), B2-09 (0.488), Xihang 3.3 (0.366) and N19 (0.348) showed higher sub-ordinate function values for number of died good produced cocoons (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 119-K (1.000), 51 (0.704), B2-09 (0.639), M2-6-18[109] (0.515) and 105 (0.444) showed higher sub-ordinate function for number of middle produced cocoons (Table 3). Also, as per the sub-ordinate function method, the strains 119-K (1.000), B2-09 (0.677), 51 (0.563), BH-2 (0.497) and 101433-6-6 (0.491) showed higher sub-ordinate function values for number of alive middle produced cocoons (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains M-1-2[5] (1.000), N19 (1.000), M2-6-22[107] (0.468), BH-2 (0.392) and M2-6-22-2 (0.290) showed higher sub-ordinate function values for number of died middle produced cocoons (Table 3). Also, as per the sub-ordinate function method, the strains 153 (Xihang-1) (1.000), 113-K (0.640), 103 Poly Marking (0.640), N19 (0.640) and BH-2 (0.537) showed higher sub-ordinate function values for number of low produced cocoons (Table 3). Also, as per the sub-ordinate function method, the strains White Larvae- Yellow Cocoon (1.000), 202A-204B (0.667), Xihang 3.3 (0.500), M2-6-18[109] (0.333) and M-1-2[5] (0.333) showed higher sub-ordinate function values for number of alive low produced cocoons (Table 3). Meanwhile, as per the sub-ordinate function method, the strains 153 [Xihang-1] (1.000), 113-K (0.640), M-1-1×103 (0.640), N19 (0.640) and BH-2 (0.537) showed higher sub-ordinate function values for number of died low produced cocoons (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 119-K (1.000), 101×F6 (1.000), Kinshu (1.000), 101 (1.000) and T1-J (0.499) showed higher sub-ordinate function values for number of double produced cocoons (Table 3). Also, as per the sub-ordinate function method, the strains 7409 (1.000), 103 Poly Marking (0.896), 151 [103×M-1-1] (0.761), Shaki (0.761) and White Larvae- Yellow Cocoon (0.657) showed higher sub-ordinate function values for number of alive pupae in double cocoons (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 119-K (1.000), Xihang 2.3 (1.000), 153 [Xihang-1] (1.000), 5118×10133-2-2 (1.000) and 5118×10133-3-3 (1.000) showed higher sub-ordinate function values for number of died pupae in double cocoons (Table 3). Also, as per the sub-ordinate function method, the strains 103 Poly Marking (1.000), 7409 (0.925), 1005 (0.762), M2-6-18[109] (0.656) and Shaki (0.656) showed higher sub-ordinate function values for pupae vitality percentage (Table 3). Also, as per the sub-ordinate function method, the strains I 20 (1.000), B2-09 (0.974), 119-K (0.967), Xihang 3.3 (0.962) and N19 (0.959) showed higher sub-ordinate function values for cocoon weight (Table 3). Meanwhile, as per the sub-ordinate function method, the strains 101×F6 (1.000), 107-K (0.001), 119-K (0.001), 105 (0.001) and 31 (0.001) showed higher sub-ordinate function values for shell cocoon weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains Black Larvae-White Cocoon (1.000), 1524 (0.977), 1126 [111] (0.970), 1003-5 (0.903) and 101433-6-6 (0.877) showed higher sub-ordinate function values for shell cocoon percentage (Table 3). Also, as per the sub-ordinate function method, the strains BH-2 (1.000), 119-K (0.027), 119-K (0.011), 31 (0.008) and 105 (0.007) showed higher sub-ordinate function values for male cocoon weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains M2-6-22[107] (1.000), 1126 [111] (0.993), 31 (0.972), 105 (0.958) and 1003-5 (0.937) showed higher sub-ordinate function values for male shell cocoon weight (Table 3). Also, as per the sub-ordinate function method, the strains Black Larvae-White Cocoon (1.000), 1524 (0.957), 1126 [111] (0.935), 1005 (0.898) and 105 (0.880) showed higher sub-ordinate function values for male shell cocoon percentage (Table 3). Also, as per the sub-ordinate function method, the strains T1-J (1.000), 119-K (0.101), I 20 (0.090), 153 [Xihang-1] (0.082) and 307-300-2 (0.072) showed higher sub-ordinate function values for female cocoon weight (Table 3). Meanwhile, as per the sub-ordinate function method, the strains 107-K (0.001), 119-K (0.001), 113-K (0.001), 105 (0.001) and 31 (0.001) showed higher sub-ordinate function values for female shell cocoon weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 1126 [111] (1.000), 1524 (0.993), Black Larvae-White Cocoon (0.993), 1003-5

(0.958) and M-1-2[5] (0.950) showed higher sub-ordinate function values for female shell cocoon percentage (Table 3). Also, as per the sub-ordinate function method, the strains 153 [Xihang-1] (1.000), Black-White (0.961), BH-2 (0.869), 113 [2029] (0.866) and 151 [103×M-1-1] (0.844) showed higher sub-ordinate function values for good cocoon weight of 250 larvae (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 119-K (1.000), 51 (0.643), B2-09 (0.567), I 20 (0.450) and 105 (0.448) showed higher sub-ordinate function values for middle cocoon weight of 250 larvae (Table 3). Also, as per the sub-ordinate function method, the strains 5118×10133-2-2 (1.000), 119-K (0.982), I 20 (0.935), T1-J (0.929) and M2-6-22[107] (0.824) showed higher sub-ordinate function values for middle cocoon weight (Table 3). Also, as per the sub-ordinate function method, the strains 153 [Xihang-1] (1.000), N19 (0.812), 113-K (0.733), 307-300-2 (0.709) and 151 [103×M-1-1] (0.668) showed higher sub-ordinate function values for low cocoon weight of 250 larvae (Table 3). Meanwhile, as per the sub-ordinate function method, the strains I 20 (1.000), 153 [Xihang-1] (0.889), 307-300-2 (0.625), 7409 (0.391) and 5118×10133-2-2 (0.386) showed higher sub-ordinate function values for low cocoon weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 7409 (1.000), 103 Poly Marking (0.942), 151 [103×M-1-1] (0.894), Shaki (0.884) and 1005 (0.869) showed higher sub-ordinate function values for double cocoon weight of 250 larvae (Table 3). Also, as per the sub-ordinate function method, the strains 151 [103×M-1-1] (1.000), I 20 (0.969), 153 [Xihang-1] (0.952), 202A-204B (0.943) and 119-K (0.939) showed higher sub-ordinate function values for double cocoon weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains 119-K (1.000), BH-2 (0.998), 151 [103×M-1-1] (0.953), 153 [Xihang-1] (0.929) and Black-White (0.815) showed higher sub-ordinate function values for total cocoon weight of 250 larvae (Table 3). Also, as per the sub-ordinate function method, the strains 307-300-2 (1.000), Black-White (0.993), 153 [Xihang-1] (0.894), 113 [2029] (0.87) and 151 [103×M-1-1] (0.825) showed higher sub-ordinate function values for total cocoon weight of 10000 4th instar larvae (Table 3). Also, as per the sub-ordinate function method, the strains T1-J (1.000), 307-300-2 (0.870), 103 (0.843), 202A-204B (0.843) and 107-K (0.817) showed higher sub-ordinate function values for cocoon number per liter (Table 3).

Meanwhile, as per the sub-ordinate function method, the strains 307-300-2 (1.000), 119-K (0.993), 202A-204B (0.953), I 20 (0.830) and T1-J (0.823) showed higher sub-ordinate function values for cocoon weight per liter (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains I 20 (1.000), 202A-204B (0.797), 119-K (0.772), 307-300-2 (0.664) and 151 [103×M-1-1] (0.569) showed higher sub-ordinate function values for male pupae weight (Table 3).

Among germplasm strains, as per the sub-ordinate function method, the strains T1-J (1.000), 119-K (0.787), I 20 (0.759), 202A-204B (0.609) and 307-300-2 (0.553) showed higher sub-ordinate function values for female pupae weight (Table 3). Totally, 153 [Xihang-1] (20.920), 119-K (19.738), I 20 (17.758), BH-2 (17.488) and N19 (16.720) showed higher sub-ordinate function values (Table 4).

Analysis of variance indicated significant variation among the silkworm strains for all the economic traits considered for the study (Table 1). Effective utilization of selected germplasm also plays an important role in saving the time of the breeder in the synthesis of new hybrids (Rao et al., 2006). Keeping the need in view, the germplasm strains have been reared consecutively for several generations and their quantitative traits were evaluated using two reliable statistical methods, that is, evaluation index and sub-ordinate function methods to assess the performance of the inbred lines (Rao et al., 2006).

The results corroborate with earlier findings. These results further imply that when an initial choice of parents has to be made to obtain heterosis it is important to ascertain the level of parental divergence (Jolly et al., 1989; Kumaresan et al., 2007). Earlier, many breeders (Ramesh Babu et al., 2001; Rao et al., 2004; Rao et al., 2006) analyzed their breeds by adopting the above methods either individually or together. The strains, which have been selected through these methods could be effectively used in further breeding programmes as potential parents for synthesizing superior polyvoltine silkworm hybrids that are suitable (Rao et al., 2006). Proper choice of suitable parents plays a pivotal role in achieving the targets in scheduled time (Rao et al., 2006).

REFERENCES

Deccan H (2007). Available in silk demand, supply gap 8,000 tonnes.

Available in: http://www.deccanherald.com/Content/Oct262007/state2007102632414.asp DOI:10.1631/jzus.2006.B0215.
Duncan DB (1951). A significance test for differences between ranked treatments in an analysis of variance. Virginia J. Sci. (2): 171-189.
ESCAP (1993). Principle and Techniques of Silkworm Breeding. United Nations, New York.
Gower JC (1971). A general coefficient of similarity and some of its properties. Biometrics, 27: 857-871. DOI: 10.2307/ 2528823
Grimaldi D, Engel MS (2005). Evolution of the Insects. 755 pp. Cambridge, New York, Melbourne: Cambridge University Press. ISBN 0 521 82149 5. http://intranet.unescap.org/publications/detail.asp?id=389http://www.answers.com/topic/sas-systemhttp://www. vacadsci.org/vjsArchives/main.html
Jolly MS, Datta RK, Noamani MKR, Iyengar MNS, Nagaraj CS, Basavaraj HK, Kshamarani G, Ramamohana Rao P (1989). Studies on the genetic divergence in mulberry slkworm *Bombyx mori* L. Sericologia, (29): 545-559.
Kumaresan P, Sinha RK, Raje Urs S (2007). An analysis of genetic variation and divergence in Indian tropical polyvoltine silkworm (*Bombyx mori* L.) genotypes Caspian J. Environ. Sci. 5(1): 11-17.
Mano Y, Nirmal Kumar S, Basavaraja HK, Mal Reddy N, Datta RK (1993). A new method to select promising silkworm breeds/combinations. Indian Silk, (31): 53-59.
Ramesh Babu M, Chandrashekaraiah, Lakshmi H, Prasad J (2001). Silkworm (*Bombyx mori* L.) genetic stocks-an evolutionary analysis. Bull. Ind. Acad. Series, 5: 9-17.
Rao CGP, Chandrashekaraiah, Ramesh C, Ibrahim Basha K, Seshagiri SV, Nagaraju H (2004). Evaluation of polyvoltine hybrids based on silk productivity in silkworm, *Bombyx mori*. Int. J. Ind. Entomol. 8(2): 181-187.
Rao CGP, Seshagiri SV, Ramesh C, Basha Ibrahim K, Nagaraju H, Chandrashekaraiah C (2006). Evaluation of genetic potential of the polyvoltine silkworm (*Bombyx mori* L.) germplasm and identification of parents for breeding programme. Journal of Zhejiang Univsity Science B. 7(3): 215-220. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1419067/ SAS.
SAS/STAT User Guide for personal computers, Cary, NC: SAS institute.
Sohn KW (2003). Conservation Status of Sericulture Germplasm Resources in the World - II. Conservation Status of Silkworm (*Bombyx mori*) Genetic Resources in the World. Food and Agriculture Organization of the United Nations, Rome. http://www.fao.org/DOCREP/005/AD108E/AD108E00.HTM
Zanatta DB, Bravo JP, Barbosa JF, Munhoz REF, Fernandez MA (2009). Evaluation of Economically Important Traits from Sixteen Parental Strains of the Silkworm *Bombyx mori* L (Lepidoptera: Bombycidae). Neotrop. Entomol. 38(3):327-331. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1519-566X2009000300005.