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SILKWORM INDEX (SI): AN EVALUATOR OF MULBERRY GENOTYPES

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Abstract: *The paper presents a new concept of silkworm index (SI) for evaluation of mulberry varieties on the basis of their feeding quality. SI has four important components including, body weight gain in the V instar, food intake in the V instar, cocoon shell weight and the time taken to complete the V instar. The results of SI have been compared with already known parameter including PCSW, ECP and PECS. The SI has an advantage over other evaluation methodologies for having short evaluation time (V instar only) and inclusion of time as a factor for determination of index.*
Keywords*: Silkworm, Mulberry, Evaluation, Silkworm Index, SI*

Introduction: Silkworm (*Bombyx mori* L.) is an obligate feeder of mulberry (*Morus* spp.) leaves. The silk cocoon output is directly correlated with the quality and quantity of mulberry. This fact besides the chemical analysis is the best tool for evaluation of mulberry variety. Silkworm bioassay is already applied for evaluation of mulberry variety. Different parameters have been evaluated including, leaf digestibility, moulting test, efficiency of cocoon production (ECP), production efficiency of cocoon shell (PECS), percentage of cocoon shell weight (PCSW), evaluation index etc. [1-6]. However, most of these methods are cumbersome involving longer studies. In most of the methodologies only silkworm characters or cocoon characters are considered oblivious of the time duration, which is the major input at commercial level rearing where longer rearing period means higher labour and leaf inputs affecting the profitability. In this background, the present study proposes a new index for evaluation of mulberry varieties including larval weight and period, food ingested and digested and also the time taken during the last in star.

Materials and Methods

The present study was undertaken at Division of Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Udheywalla, Jammu. Six mulberry varieties Tr-10, $BC_2$59, C-763, S-36, China white and Chak majra were used for feeding the worms of hybrid $NB_4D_2 \times SH_6$. Silkworms were reared on a mixed diet up to IV moult. Post IV moult worms were separated in sets of 100 each and fed with known quantity of specific mulberry variety leaf. Food ingestion and digestion were determined [7]. Worm weight was recorded at the beginning of feeding and also at fully developed stage to determine the weight gain. Ripe worms were put for Seri position and cocoon harvested. Cocoon weight and cocoon shell weight were determined gravimetrically. Time taken to complete the in star was calculated from first feed of V age to last feed when worms were ripe for Seri position.

The above mentioned data was utilized to calculate the silkworm index (SI) as per new equation:

SI = [{A x C/ B} / T] 100

Where, A = Body weight gain (g) in V age
B = Food intake (g) in V age
C = Cocoon shell weight (g)
T = Time (hrs) taken to complete the V age

SI, thus calculated was compared with other indices for evaluation.

Results and Discussion

Silkworms reared on six different feeds showed variation in larval and cocoon characters. The body weight gain in V instar (Table 1) fluctuated from 3.44 g in variety Tr-10 to 4.11 g in $BC_2$59. The average weight gain was 3.82 g. Larval period showed a variation of only 3 h in between the varieties being 196 in Tr-10, $BC_2$59 and China white. Average food intake was 12.92 g with highest intake (13.18 g) in Tr-10 and least (12.75 g) in Chak majra. Food digestion also varied from 6.51 g (Chak majra) to 7.68 g (S-36) with an overall average of 7.32 g.

Table 1: Food dynamics during V age in silkworms

Mulberry variety	Weight gained (g)	Larval period (Hrs)	Food intake (g)	Food digested (g)
Tr-10	3.44	196	13.18	7.57
$BC_2$59	4.10	196	12.81	7.37
C-763	3.91	199	12.82	7.44
S-36	3.79	199	13.12	7.68
China white	3.86	196	12.85	7.39
Chak majra	3.83	199	12.75	6.51

Cocoon characters and food conversion also showed variation from variety to variety (Table 2). Best cocoon weight (2.06 g) was observed in variety Tr-10 and least weight (1.82 g) in variety S-36. Overall average cocoon weight stood at 1.94 g. Average cocoon shell weight was 0.356 g fluctuating from 0.320 g (Tr-10, Chak majra) to 0.380 g (C-763). Average ECD was 52.35, highest (55.83) in Chak majra and lowest (45.44) in Tr-10. ECI also fluctuated from 26.10 (Tr-10) to 32.08 ($BC_2$59) with an average of 29.60.

Table 2: Cocoon characters and food conversion in silkworms

Mulberry variety	Cocoon weight (g)	Cocoon shell weight(g)	Conversion of ingested food (ECI)	Conversion of digested food (ECD)
Tr-10	2.06	0.37	26.10	45.44
$BC_2$59	2.01	0.35	32.08	55.76
C-763	1.99	0.38	30.49	52.55
S-36	1.82	0.35	28.88	49.34
China white	1.97	0.37	30.03	52.23
Chak majra	1.83	0.32	30.03	58.83

From these characters silkworm index (SI) was calculated and compared with PCSW, ECP and PECS (Table 3). PCSW and ECP differed widely from PECS and SI, which showed similar trend among the varieties studied. Highest values for PCSW, ECP, PECS and SI were in varieties S-36 (19.23), Chak majra (0.281), C-763 (2.96) and C-763 (4.63) respectively. The values of SI were however double than PECS. This indicates widening of spectrum for evaluation of mulberry genotypes. The advantage of SI over other indices is the consideration of time period taken in completing the V instar. This has direct bearing on commercial rearing as longer rearing means more labour inputs and leaf reducing the comparative profit. Also reported that fifth age period is an indicator of superiority of mulberry variety [8]. Less consumption of mulberry leaves results in the reduced cocoon cost as observed on the feeding of polyploid varieties to silkworm in comparison to diploid varieties [9]. Concluded that reduced larval span reduces the food intake indication superiority of a particular variety [4].

Table 3: Comparison of Silkworm Index (SI) with PCSW, ECP and PECS

Mulberry variety	Percentage of cocoon shell weight (PCSW)	Efficiency of cocoon production (ECP)	Production efficiency of cocoon shell (PECS)	Silkworm index (SI)
Tr-10	17.96	0.272	2.80	4.22
$BC_2$59	17.41	0.272	2.73	4.36
C-763	19.09	0.267	2.96	4.63
S-36	19.23	0.236	2.66	4.18
China white	18.78	0.266	2.87	4.29
Chak majra	17.48	0.281	2.50	4.02

Conclusion: In the local agro climate and sericulture practices, single rearing is being conducted in a year on wild plantation or plants raised on wasteland. Leaf shortages are frequent during the last age. Prolongation of rearing due to the mulberry variety would further add to the leaf shortfall. The SI would help in identifying the varieties, which lead to shorter larval period eliminating the threat of leaf shortage. On the basis of these comparisons it can be safely concluded that the new concept of SI is highly

suitable for bioassay of mulberry variation vis-à-vis silkworm larvae.

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