Int. J. Indust. Entomol. Vol. 5, No. 2, 2002, pp. 175~182

International Journal of *Industrial Entomology*

Studies on the Comparative Performance of Victory-1, S-36 and Kanva-2 Mulberry Genotypes and their Impact on Silkworm Rearing under Telangana Conditions of Andhra Pradesh.

P. Venkataramana*, T. V. S. Srinivasa Rao, P. Sreenivasulu Reddy, N. Suryanarayana[1], Vineet Kumar[2] and A. Sarkar[2]

C. S. R. T. I. Research Extension Centre, Central Silk Board, Vikarabad - 501 101, India.
[1]Regional Sericultural Research Station, Anantapur - 515 001, India.
[2]Central Sericultural Research and Training Institute, Mysore - 570 008, India.

(Received 25 August 2002; Accepted 7 October 2002)

A new high yielding mulberry genotype, Victory-1 (V-1) was recommended to the field for irrigated areas by Central Sericultural Research and Training Institute (CSRTI), Mysore during 1996 - 1997. As K-2 and S-36 mulberry genotypes are already in the field, a study on the comparative performance of V-1, S-36 and K-2 varieties, in terms of leaf yield, yield attributes, leaf moisture and moisture retaining capacity and their impact on silkworm rearing was carried out under Telangana conditions of Andhra Pradesh during 1999 - 2001. Among the three genotypes the leaf yield was found to be significantly ($P < 0.01$) higher in V-1 (64,130 kg/ha/yr) followed by S-36 (44,064 kg/ha/yr) and K-2 (22,990 kg/ha/yr). The maximum leaf moisture was also observed in V-1 (71.84%) compared to S-36 (66.86%) and K-2 (64%). The moisture retaining ability was more in V-1 (70.17%) followed by S-36 (66.20%) and K-2 (60.08%). The yield attributes were found to be significantly ($P < 0.01$) enhanced in V-1 over S-36 and K-2. Silkworm rearing results (bioassay) indicated a significant ($P < 0.01$) reduction in larval duration and improvement in larval weight, effective rate of rearing by number and weight, single cocoon and shell weights and shell ratio in the silkworm lots fed on V-1 variety followed by S-36 and K-2. Hence, in this study, V-1 was found to be superior among the three varieties studied.

*To whom correspondence should be addressed.
C. S. R. T. I. Research Extension Centre, Central Silk Board, Vikarabad - 501 101, India. Tel: (08416) 53466; Fax: (08416) 53109; E-mail: vramana42@rediffmail.com

Key words: Mulberry genotypes, Growth attributes, Leaf quality, Bivoltine silkworm, Cocoon characters

Introduction

Leaf yield is the prime character to be considered for the selection and propagation of any new mulberry genotype. The productivity and profitability of production of cocoons depends not only on the maximization of leaf yield but also on the quantity of mulberry per unit area, which even varies from variety to variety of species (Krishnaswami *et al.*, 1971). Also, the quality of mulberry leaves greatly affects the economy of sericultural industry (Das *et al.*, 1983). In accordance with the need for concerted efforts towards developing the high yielding varieties Central Sericultural Research and Training Institute (CSRTI), Mysore recommended Kanva-2 (K-2) variety during 1968 and S-36 variety during 1984 for irrigated areas (Sastry, 1984). However, with continuous efforts, the CSRTI has also developed a superior high yielding variety V-1 (Victory-1) which was found to be suitable for cultivation in irrigated areas of South India with the yielding potentiality of 70 Metric tones (MT)/ha/yr and was released during 1996 - 1997 for its cultivation in farmers' field (Sarkar *et al.*, 2000). Since many farmers in Telangana region raised the K-2, S-36 and V-1 plantations, at this juncture, it is necessary to study the leaf yield potential of these varieties and its impact on cocoon crop production for its effective propagation in the fields. Hence, the present study was carried out to analyse the comparative performance of V-1, S-36 and K-2 mulberry genotypes and its impact on silkworm rearing under Telangana conditions of Andhra Pradesh.

Materials and Methods

A field study was conducted during 1999 - 2001 at six different villages *viz.*, 1) Yalala (V1), 2) Durgamcheruvu (V2), 3) Buranthapalli (V3), 4) Pullmamidi (V4), 5) Kothapalli (V5) in Ranga Reddy district and 6) Sanga Reddy (V6) in Medak district which were randomly selected, and are true replica of the other sericultural villages of Telangana region in Andhra Pradesh. The distance among the villages is about from 50 to 100 kilometers. There is no significant variation in weather conditions. In each village, three different varieties of mulberry gardens such as Kanva-2 (K-2), S-36 and Victory-1 (V-1) under 60 x 60 cm spacing were randomly selected. Each variety of garden measures 0.5 acre area. After establishment, these gardens were maintained by the farmers as per the package of practices recommended by Krishnaswami (1986a). The farm yard manure (FYM) was incorporated in soils as basal dose at the rate of 20 MT/ha/yr in two splits and chemical fertilizers were applied at the rate of 300: 120: 120 kg N, P and K/ha/yr in five crops.The chemical nitrogen fertilizer was applied in five equal splits in all five crops, while phosphorus and potassium were applied in two equal splits in first and third crops. After 65 - 70 days growth of each crop ten plants were selected randomly from each variety of garden with four replications and observed for the height of the plant, height of the shoots, number of shoots per plant, number of leaves per plant, weight of leaves per plant, leaf moisture content, moisture retaining capacity and leaf yield. The total leaf yield was assessed by harvesting the leaves from all the plants available in the net plot area of 10 x 10 m and converted to yield per hectare. A total ten crops were harvested for two years.

All the leaves on healthy shoots of these plants were harvested in respective gardens of the villages at 9 A. M. and 4 P. M. and used for the recording the leaf moisture content and the moisture retaining capacity of leaves, 6 hours after harvest, were determined by the method suggested by Jolly and Dandin (1986). The meteorological data of the region is presented in Table 1. A total ten crops were taken (five each during 1999 - 2000 and 2000 - 2001) and the pooled data for ten crops was statistically analysed (Snedecor and Cochran, 1967). Simultaneously, silkworm rearing trails were conducted for 10 crops using popular bivoltine pure race, NB_4D_2, as these villages were demarcated for bivoltine seed area. The rearings were carried out as per the improved technology of silkworm rearing (Krishnaswami, 1986b). Three replications were maintained with 300 larvae each per genotype. Leaves from respective gardens of each genotype were used for feeding the silkworms till spinning. Larval duration, larval weight, effective rate of rearing (ERR) by number and weight, single cocoon weight, single shell wieght and shell ratio were recorded and statistically analysed (Snedecor and Cochran, 1967).

Results

The meteorological data of the Telangana region are presented in Table 1. The performance of three mulberry genotypes in six different villages is presented in Table 2 – 5.

Table 1. Monthly mean meteorological data of Telangana region of Andhra Pradesh (1999 – 2001)

Months	Temperature (°C)			Relative Humidity (%)		Rainfall (mm)	Rainy days	Sunshine hrs/day	Wind Speed (km/hr)	Evaporation (24 hrs)
	Maximum	Minimum	Mean	Maximum	Minimum					
January	32.7	24.1	28.4	80	52	69.4	6	6.8	8.0	6.3
February	30.7	23.3	27.0	86	63	183.5	13	5.4	18.6	4.8
March	29.3	22.9	26.1	88	69	157.0	10	4.3	5.2	3.1
April	30.2	22.8	26.5	87	63	55.5	8	5.4	4.5	4.0
May	31.1	20.8	26.0	87	51	68.6	4	7.9	2.4	3.7
June	30.4	15.1	22.8	81	35	0	0	9.3	2.1	3.7
July	28.3	11.3	19.1	84	34	0	0	9.4	1.5	3.1
August	30.2	12.8	21.5	84	30	0	0	8.7	1.9	3.6
September	31.5	18.0	24.7	84	44	25.2	2	8.5	3.0	4.4
October	35.4	18.3	26.9	70	41	1.0	0	10.4	2.4	6.7
November	39.4	23.1	31.2	61	36	12.4	2	9.9	3.1	6.2
December	36.9	24.9	30.9	62	37	66.8	4	10.1	4.7	8.0
Average	32.18	20.0	26.00	79.50	46.25	639.4*	49*	8.01	4.78	4.8

*Total. (Source: Annual reports for 1999 – 2000 & 2000 – 2001 of Agricultural Research Institute, Rajendranagar, Hyderabad).

Height of plant

Among the villages the average height of the plants of different mulberry genotypes ranged from 114 cm in K-2 to 188 cm in V-1 (Table 2). Among the villages the maximum mean height of the plant was recorded in V-1 genotype (170.34 cm) followed by S-36 (144.25 cm) and K-2 (115.84 cm). The influence of different villages in enhancing the height of the plants of different genotypes was in the order. V-1 genotype: V5 (188 cm) > V2 (184 cm) > V4 (168 cm) > V1 (162 cm) > V3 and V6 (160 cm). S-36 genotype: V2 and V5 (155 cm) > V3 (145 cm) > V1 and V4 (140 cm) > V6 (130.5 cm). K-2 genotype: V2 and V5 (118 cm) > V4 (116 cm) > V1 (115 cm) > V3 and V6 (114 cm).

Height of shoot

Among the villages the average height of the shoot of different genotypes was ranged from 84 to 158 cm. Among the villages this character was maximum in V-1 genotype (140.17 cm) followed by S-36 (114 cm) and the minimum in K-2 (86.47 cm). The effect of different villages in improving the shoot height of different genotypes was in the order. V-1 genotype: V5 (158 cm) > V2 (155 cm) > V4 (135 cm) > V6 (133 cm) > V1 and V3 (130 cm).

No. of branches/plant

Among the villages the number of branches per plant of different genotypes ranged from 5 to 12. Among the villages, the maximum mean value of number of branches per plant was registered in V-1 genotype (9.67) followed by S-36 (7.34) and K-2 (5.84) being the least. The influence of different villages in enhancing the number of branches per plant in different genotypes was in the order (Table 3). V-1 genotype: V5 (12) > V4 (11) > V6 (10) > VI (9) > V2 and V3 (8). S-36 genotype: V4 and V5 (8) > V1, V2, V3 and V6 (7). K-2 genoype: V5 (7) > V1, V2 and V4 (6) > V3 and V6 (5).

Table 2. Height of plant and height of shoot of mulberry genotypes in six different villages (average of 10 crops)

Villages	Height of Plant (cm)			Average height of shoots (cm)		
	K-2	S-36	V-1	K-2	S-36	V-1
V1	115.00	140.00	162.00	87.84	110.00	130.00
V2	118.00	155.00	184.00	89.00	125.00	155.00
V3	114.00	145.00	160.00	84.00	115.00	130.00
V4	116.00	140.00	168.00	86.00	108.00	135.00
V5	118.00	155.00	188.00	88.00	125.00	158.00
V6	114.00	130.50	160.00	84.00	101.00	133.00
Mean	115.84	144.25	170.34	86.47	114.00	140.17
CD at 5 %						
Varieties	-	-	1.94	-	-	1.78
Villages	-	-	2.75	-	-	2.52
Villages × Varieties	-	-	4.76	-	-	2.52

Table 3. No. of branches per plant and No. of leaves per plant of mulberry genotypes in six different villages (average of 10 crops)

Villages	No. of branches per plant			No. of leaves per plant		
	K-2	S-36	V-1	K-2	S-36	V-1
V1	6.00	7.00	9.00	63.00	92.00	123.00
V2	6.00	7.00	8.00	72.00	98.00	138.00
V3	5.00	7.00	8.00	75.00	95.00	142.00
V4	6.00	8.00	11.00	64.00	95.00	120.00
V5	7.00	8.00	12.00	75.00	102.00	142.00
V6	5.00	7.00	10.00	65.00	95.00	125.00
Mean	5.84	7.34	9.67	69.00	96.17	131.67
CD at 5 %						
Varieties	-	-	0.55	-	-	1.81
Villages	-	-	0.77	-	-	2.57
Villages × Varieties	-	-	1.34	-	-	4.44

No. of leaves/plant

The number of leaves per plant of different genotypes among the villages, ranged from 63 to 142. The maximum mean values of number of leaves per plant was recorded in V-1 genotype (131.67) followed by S-36 (96.17) and K-2 (66.00). The impact of different villages in yielding of no. of leaves/plant of different genotypes was in the order. V-1 genotype: V3 and V5 (142) > V2 (138) > V6 (125) > V1 (123) > V4 (120). S-36 genotype: V5 (102) > V2 (98) > V3, V4 and V6 (95) > V1 (92). K-2 genotype: V3 and V5 (75) > V2 (72) > V6 (65) > V4 (64) > V1 (63).

Weight of leaves/plant

Among the villages the average values of the weight of leaves/plant of different varieties ranged from 0.350 to 1.200 kg. The maximum mean weight of leaves/plant, among the villages, was recorded in V-1 genotype (1.060 kg) followed by S-36 (0.742 kg) and K-2 (0.380 kg). The influence of different villages in improving the weight of leaves/plant of different varieties was in the order (Table 5). V-1 genotype: V3 and V5 (1.200 kg) > V2 (1.100 kg) > V4 (0.960 kg) > V1 and V6 (0.950 kg). S-36 genotype: V5 (0.858 kg) > V3 0.800 kg) > V2 (0.700 kg) > V4 (0.730 kg) > V1 (0.660 kg) > V6 (0.700 kg).

Leaf moisture percentage

The average values of leaf moisture percentage, among the villages, in different mulberry genotypes ranged from 61 to 73%. Among the villages, the maximum mean value of leaf moisture was recorded in V-1 genotype (71.84%) followed by S-36 (66.86%) and K-2 (63.0%). The effect of different villages in enhancing the leaf moisture percentage of different varieties was in the order. V-1 genotype: V3, V4 and V5 (73%) > V2 (72%) > V1 and V6 (70%). S-36 genotype: V3 and V5 (70%) > V2 and V4 (68%) > V6 (63%) > V1 (62.20%). K-2 genotype: V2 and

Table 4. Weight of leaves per plant and leaf yield of mulberry genotypes in six different villages (average of 10 crops)

Villages	Weight of leaves per plant (kg)			Leaf Yield (kg/ha/yr)		
	K-2	S-36	V-1	K-2	S-36	V-1
V1	0.350	0.660	0.950	21175	38724	57475
V2	0.380	0.700	1.100	22990	42345	66550
V3	0.350	0.800	1.200	21175	42350	72600
V4	0.400	0.730	0.960	24200	44165	58080
V5	0.420	0.858	1.200	25410	51425	72600
V6	0.380	0.700	0.950	22990	45375	57475
Mean	0.380	0.742	1.060	22990	44064	64130
CD at 5 %						
Varieties	-	-	0.545	-	-	1036.67
Villages	-	-	0.771	-	-	1466.08
Villages × Varieties	-	-	1.335	-	-	2539.33

Table 5. Leaf moisture content and moisture retaining capacity of mulberry genotypes in six different villages (average of 10 crops)

Villages	Leaf moisture content (%)			Moisture retaining capacity		
	K-2	S-36	V-1	K-2	S-36	V-1
V1	61.00	62.20	70.00	58.00	61.00	68.00
V2	65.50	68.00	72.00	58.00	67.00	70.00
V3	64.00	70.00	73.00	62.00	69.00	71.00
V4	65.00	68.00	73.00	63.00	67.00	71.00
V5	65.50	70.00	73.00	61.50	69.15	71.00
V6	63.00	63.00	70.00	58.00	61.00	70.00
Mean	64.00	66.86	71.84	60.08	65.69	70.17
CD at 5 %						
Varieties	-	-	1.57	-	-	3.64
Villages	-	-	1.11	-	-	2.57
Villages × Varieties	-	-	NS	-	-	NS

V5 (65.50%) > V4 (65%) > V3 (64%) > V6 (63%) > V1 (61%).

Moisture retaining capacity

Among the villages, the values of moisture retaining capacity of leaves of different varieties ranged from 58 to 71%. Among the villages, the maximum mean value of moisture retaining capacity of leaves was recorded in V-1 genotype (70.17%) followed by S-36 (65.20%) and K-2 (60.08%). The effect of different villages in retaining of leaf moisture of different varities was in the order. V1 genotype: V3, V4 and V5 (71.00%) > V2 and V6 (70%) > V1 (68%). S36 genotype: V5 (69.15%) > V3 (69%) > V2 and V4 (67%) > V1 and V6 (61%). K2 genotype: V4 (63%) > V3 (62%) > V5 (61.5%) > V1, V2 and V6 (58%).

Leaf yield

The range of leaf yield of different mulberry genotypes, among the villages, was from 21,175 to 72,600 kg/ha/yr. The maximum average leaf yield was recorded, among the villages, in V-1 genotype (64,130 kg/ha/yr) followed by S-36 (44,064 kg/ha/yr) and minimum in K-2 (22,990 kg/ha/yr). The impact of different villages in leaf yielding of different varieties was in the order. V-1 genotype: V3 and V5 (72,600 kg/ha/yr) > V2 (66,550 kg/ha/yr) > V4 (58,080 kg/ha/yr) V1 and V6 (67,475 kg/ha/yr). S-36 genotype: V5 > V6 > V4 > V3 > V2 > V1. K-2 Genotype: V5 > V4 > V2 and V6 > V1 and V3. The effect of different mulberry genotypes on the rearing performance of bivoltine pure race (NB4D2) is presented in Table 6.

Larval weight

The weight of 10 larvae fed with the leaves of different mulberry genotypes recorded highest in V-1 genotype (52.00 g) followed by S-36 (43.50 g) and K2 (42.15 g). The effect of V-1 genotype in increasing the larval weight (52.00 g) was highly significant ($P < 0.01$), when compared to K2 (42.15 g) and S-36 (43.15 g). The variations in larval weight of silkworms fed on K-2 and S-36 was insignificant.

Larval duration

The larval duration recorded for different mulberry genotypes ranged from 26.02 to 26.99 days. The minimum larval duration was recorded with V-1 genotype (26.02 days) followed by S-36 (26.52 days) and the maximum larval duration (26.99 days) was recorded with K-2.Variations for this character was highly significant ($P < 0.01$) among the genotypes.

Effective rate of rearing (ERR) by number and weight

The effective rate of rearing by number with different genotypes varied from 8128 to 9485. The maximum ERR by number (9485) was recorded with V-1 genotype followed by S-36 (8820) and K-2 (8128). The variation in this character between V-1 and K-2 was significant at 5% level, whereas it was highly significant ($P < 0.01$) between V-1 and S-36. ERR by weight among the genotypes studied was varied from 15.27 to 20.58 kg. The maximum ERR by weight was recorded with V-1 (20.58 kg) followed by S-36 (17.46 kg) and K-2 (15.27 kg). The variations in this character were highly significant ($P < 0.01$) among the genotypes.

Single cocoon weight

The single cocoon weight varied from 1.79 to 2.17 g among the genotypes. It was maximum with V-1 genotype (2.17 g) followed by S-36 (1.98 g) and minimum with K-2 (1.79 g). The variations for this character were significant among the genotypes. The variety V-1 showed significant ($P < 0.01$) effect in increasing the single cocoon weight (2.17 g) compared to K2 (1.79 g). Further, the variation between S-36 and K-2 was significant at 5% level.

Single shell weight

The range of variations in single shell weight was from

Table 6. Rearing performance (NB4D2 on three mulberry genotypes at farmers level (average of 10 crops)

Treatment	Genotypes			CD at 5%	CD at 1%
	K-2	S-36	V-1		
Larval duration (days)	26.99	26.52	26.02	0.370	0.538
Weight of 10 larvae (g)	42.15	43.50	52.00	1.580	2.290
ERR. by no. (for 10,000 larvae brushed)	8128	8820	9485	651	948
ERR by weight (kg) for 10,000 larvae brushed	15.27	17.46	20.58	1.23	1.62
Single cocoon weight (g)	1.790	1.980	2.170	0.113	0.350
Single shell weight (g)	0.305	0.360	0.412	0.027	0.035
Mean shell ratio (%)	17.04	18.18	18.99	NS	NS

NS: Not significant.

0.305 to 0.412 g. The shell weight was maximum with V-1 (0.412 g) followed by S-36 (0.360 g) and K-2 (0.305 g). The variations in this character were highly significant ($P < 0.01$) among the genotypes tested.

Shell percentage

The range of the values of shell percentage was from 17.04 to 18.99%. The shell ratio was maximum with V-1 (18.99%) followed by S-36 (18.18%) and K-2 (17.04%). The variations in this character among the genotypes studied were insignificant.

Discussion

Among the three test mulberry genotypes the maximum average leaf yield was recorded in V-1 mulberry genotype (64,130 kg/ha/yr) followed by S-36 (44,064 kg/ha/yr) and K2 (22,990 kg/ha/yr) may be mainly due to their increased number of shoots and leaves per plant, length of shoots, leaf weight per plant and leaf moisture (Table 2 – 5). Many investigators have reported the increased leaf production is resulted due to more number of long and heavy shoots (Sarkar *et al.*, 1983; Tojyo, 1985; Sarkar *et al.*, 2000). This investigation shows the maximum number of shoots per plant, more number of leaves per plant with more weight could share major contributions towards the significant increase in leaf yield per unit area.

Leaf yield variation among the three mulberry genotypes examined in this investigation was highly significant and this genetic variability is in confirmity with the results of earlier studies (Anonymous, 1970; Dandin *et al.*, 1983; Susheelamma *et al.*, 1990; Cheluvachari, 1994; Sujathamma *et al.*, 1998). The reason could be attributed to the polygenic base of the genotype and new recombination of heterozygous nature as these have been derived by cross pollination (Fotadar, 1995). In addition to the varietal variation, a significant difference in leaf yield, yield attributes and leaf moisture content and moisture retaining percentage were observed among the seasons and regions (Villages). These results are in confirmity with the studies of Das and Vijayaraghavan (1990) and Sujathamma *et al.* (1998).

Nutritional status of mulberry leaves, which influence the economic characters of silkworm crop depends on the levels of leaf moisture content, moisture retaining capacity and nutrients. Leaf moisture is an indispensable element for mulberry plants and body of silkworms and at the same time, it takes a charge for transportation of nutrients in the body of plants and animals. Hence, the moisture content in the leaves may serve as one of the best criteria in estimating their quality. The effect of high moisture content of leaves on their palatability by silkworm was greatly stressed by many scientists (Yokayama, 1963; Waldbauer, 1968; Kasiviswanathan *et al.*, 1973; Paul *et al.*, 1992). Udea and Suzuki (1967) and Paul *et al.* (1992) reported in their studies that availability of moisture content in the leaves enhances the feeding efficiency of the silkworm larvae, which in turn increases the growth rate. In this present investigation the highest moisture content was recorded in V-1 genotype (71.84%) followed by S-36 (66.86%) and K-2 being the least (64.0%), which are in confirmity with the results of earlier studies (Das and Vijayaraghavan, 1990; Sarkar *et al.*, 2000).

The leaf moisture plays a vital role as because the leaves with high moisture remain afresh and acceptable to silkworms for longer period. In general, high moisture retaining capacity (MRC) is related to the initial moisture content in the leaves. Hesketh *et al.* (1985) reported the thickness of leaves and the ratio of palisade to spongy parenchyma are found to be related to moisture conservation and net assimilation rate which contribute to the quality of leaves. Stomatal size and frequency also play a major role in moisture retention in leaves, transpiration rate and CO_2 exchange rate (Miskin *et al.*, 1972; Susheelamma and Jolly, 1986).

It was observed that the higher leaf yield was recorded in rainy season followed by winter and summer. High soil moisture and atmospheric humidity favour the high leaf yield of good quality. Hence, rainy and winter seasons are considered for high productivity and good quality of leaf in the tropical regions having with a little temperature during winter season. Shablovskaya and Kafian (1967) reported in his studies that the biological (bioassay) method is the best way to evaluate a good quality mulberry variety. It is also felt that the performance of silkworm, *Bombyx mori* L. is known to very much depending on the varieties of mulberry used as food source, thereby implying that certain varieties are comparatively better for optimum growth and development of worms (Nataraju *et al.*, 1981). Several reports are available on the evaluation of mulberry varieties through bioassay (Krishnaswami *et al.*, 1970; Nataraju *et al.*, 1981; Thangamani and Vivekananda, 1984; Pillai and Jolly, 1985; Narayana Prakash *et al.*, 1985; Susheelamma *et al.*, 1989; Das and Vijayaraghavan, 1990; Giridhar and Sivarami Reddy, 1991; Machii and Katagiri, 1990; Saratchandra *et al.*, 1992; Sarkar *et al.*, 2000).

Several investigations are available on the positive correlations between leaf quality and silkworm growth. Krishnaswami *et al.* (1970) found a significance difference for ERR and weight of larvae when fed on different varieties. Samokhvalova *et al.* (1972) suggested that food quality greatly influences the larval growth, cocoon

weight and silk yield. Narayana Prakash *et al.* (1985) opined that the leaf quality is a conducive factor for reduction of larval span, improvement in larval weight, cocoon weight, ERR by number and weight, shell weight and shell ratio. Susheelamma *et al.* (1989) reported the significant influence of certain varieties on all the economic characters of cocoons. Das and Vijayaraghavan (1990) and Sarkar *et al.* (2000) have also reported significant influence of different mulberry genotypes on larval and cocoon characters of silkworm, *B. mori* L. Thus, the higher content of moisture in the leaves appears to be the conducive factor for reduction of larval duration, improvement in shell weight and shell ratio as evident from the Table 6.

Interestingly in the present study the variety K-2 gave significantly better rearing results in terms of ERR, larval weight, larval duration and cocoon characters on par with S-36, though its leaf moisture content was less than S-36. This shows that the moisture content of leaf alone is not responsible to improve the overall economic characters of silkworm. However, over all better rearing results yielded by the varieties like S-36 and V-1 as revealed in the present study would be due to their better nutritional quality besides their higher moisture content over that of K-2. Scriber (1978) reported that the decrease in water content of food affects nitrogen utilization efficiency and leads to poor growth and development of consumer insect. Toshio and Arai (1963), Radha *et al.* (1978) and Pillai (1979) opined that feeding quality of mulberry leaf depends upon the variety, leaf moisture and nutrients available in the leaf. Yoshitake (1961) also reported that silkworms have the capacity to recover from poor nutrition and hence cocoon crop does not necessarily reflect the nutritive value of leaf.

The overall study revealed that the variety V-1 showed better performance in respect of leaf yield, yield attributing characters, leaf moisture content and moisture retaining capacity over that of S-36 and K-2 in all the villages. Further, through bioassay also it proved its cumulative effect in improving the larval growth, ERR and cocoon characters compared to that of S-36 and K-2 genotypes. These results are also in conformity with the findings of earlier reports. Sarkar *et al.* (2000) have recorded the highest leaf yield (71.92 MT/ha/yr) in V-1 genotype compared to S-36 (46.20 MT/ha/yr) and the silkworm rearing results in laboratory conditions revealed that the silkworm batches fed with V-1 genotype got reduced the larval duration (23.00 days), and gained in larval weight (51.98 g), ERR by number (9544 g) and weight (20.32 kg), single cocoon weight (2.22 g), single shell weight (0.427 g) and shell ratio (19.21%) when compared with the rearing performance of S-36 (Larval duration - 23.34 days; larval weight - 47.74 g; ERR by number - 8272; ERR by weight - 15.62 g; single cocoon weight - 1.951 g; single shell weight - 0.374 g and shell ratio - 19.17%). Hence, the variety V-1 can be popularized among the sericulturists of Telangana region of Andhra Pradesh and in the other states of South India having the similar meteorological conditions for the successful cocoon crop production.

References

Anonymous (1970) Collection and maintenance of germplasm for the purpose of important varieties of mulberry. Annual Report, Central Sericultural Research and Training Institute, Mysore, pp. 40-54.

Cheluvachari, C. (1994) Studies on leaf quality evaluation of a few selected mulberry varieties. Ph. D. Thesis, Bangalore University, Bangalore, India.

Dandin, S. B., M. S. Jolly, B. N. Susheelamma, R. S. Mallikarjunappa and C. R. Sastry (1983) Evaluation and utilization of existing genetic variability in mulberry. National Seminar on Silk Research and Development, Bangalore, March 10-13, p. 2.

Das, P. K., K. Vijayaraghavan and M. S. Jolly (1983) Preliminary observation on the effect of feeding with washed and dusty mulberry leaves on the performance of four races of silkworm, *Bombyx mori* (L.). National Seminar on Silk Research and Development, March 10-13 Bangalore (Abstract), pp. 114.

Das, P. K. and K. Vijayaraghavan (1990) Studies on the effect of different mulberry varieties and season on the larval development and cocoon characters of silkworm *Bombyx mori* L. *Indian J. Seric.* **29**, 44-53.

Fotadar, R. K. (1995) Evaluation and utilization of variability in mulberry gene pool under temperature conditions. Ph. D. Thesis, Bangalore University, Bangalore, India.

Giridhar, K. and N. Sivarami Reddy (1991) Effective rate of rearing in bivoltive silkworm (*Bombyx mori* L.) breeds on different mulberry (*Morus* spp.) varieties. *Indian J. Seric.* **30**, 88-90.

Hesketh, J. D., J. T. Wolley and D. B. Peters (1985) Physiology of genotypic differences in photosynthetic rate. Proceedings, World Soybean Research Conference-III, West View Press, Boulder Co.

Jolly, M. S. and S. B. Dandin (1986) Collection, conservation, and evaluation of mulberry (*Morus* spp) germplasm. Central Sericultural Research and Training Institute, Mysore, pp. 1-10.

Kasiviswanathan, K. S. Krishnaswami and C. V. Venkataramu (1973) Effect of storage on the moisture content of mulberry leaves. *Indian J. Seric.* **12**, 13-21.

Krishnaswami, S. (1986a) Mulberry cultivation in South India. Central Silk Board, Bangalore, India. pp. 19.

Krishnaswami, S. (1986b) New technology of silkworm rear-

ing. Central Silk Board, Bangalore, Indian pp. 23.

Krishnaswami, S., S. Kumararaj, K. Vijayaraghavan and K. Kasiviswanathan (1971) Silkworm feeding trials for evaluating the quality of mulberry leaves as influenced by variety, spacing and nitrogen fertilization. *Indian J. Seric.* **10**, 79-89.

Krishnaswami, S., M. K. R. Noamani and M. Ahsan (1970) Studies on the quality of mulberry leaves and silkworm cocoon crop production. Part I. Quality differences due to varieties. *Indian J. Seric.* **9**, 1-10.

Machii, H. and K. Katagiri (1990) Varietal differences in food value of mulberry leaves with special reference to production efficiency of cocoon shell. *J. Seric. Sci. Jpn.* **59**, 34-48.

Miskin, K. E., D. C. Rasumsson and B. N. Mass (1972) Inheritance and physiological effects of stomatal frequency in barley. *Crop Sci.* **12**, 780-783.

Nataraju, B., Murthuza Baig, R. Raju, S. Krishnaswami and M. V. Samson (1981) Feeding trials with different varieties of mulberry in relation of cocoon crop performance and incidence of loss due to disease; in Proceedings of sericulture symposium and seminar. Muthu Krishna, T. S. and S. R. Sree Rangaswamy (eds.), pp. 43-50, Tamil Nadu Agricultural University, India.

Narayana Prakash, R., K. Periswamy and S. Radhakrishna (1985) Effect of dietary water content on food utilization and silk production in *Bombyx mori* L. (Lepidoptera: Bombycidae). *Indian J. Seric.* **24**, 12-17.

Paul, D. C., G. Subba Rao and D. C. Deb (1992) Impact of dietary moisture on nutritional indices and growth of *Bombyx mori* and concomitant larval duration. *J. Insect Physiol.* **38**, 229.

Pillai, S. V. (1979) Growth studies in silkworm *Bombyx mori*, with special reference to its economic characters, Ph. D. Thesis, Kerala University, Trivandrum.

Pillai, S. V. and M. S. Jolly (1985) An evaluation of the quality of the mulberry varieties reared under hill conditions and crop result of *Bombyx mori*. *Indian J. Seric.* **24**, 48-52.

Radha, N. V., S. Lethchoumande, P. Rajeswari and G. Obliswami (1978) Effect of feeding with the leaves of different mulberry varieties on the races of silkworm. All India Symposium on Seri. Sci. UAS, Bangalore (Abstract), pp. 52.

Samokhalova, G. V., N. S. Simonov and V. M. Ionov (1972) Effect of food quality on the biology of *Bombyx mori* L. and the physio-chemical properties of the silk thread. *Vestn. Mask. Univ. Ser. 6 Biol. Pochvovedenie* **27**, 19-24.

Saratchandra, B., L. Rajanna, K. Philomena, C. Paramesha, S. P. Ramesh, T. Jayappa and M. G. Sabitha (1992) An evaluation of elite mulberry varieties for yield and quality through bioassay. *Sericologia* **32**, 127-134.

Sarkar, A., B. C. Das and S. K. Mandal (1983) Growth, yield and feeding value of initial diploid, triploid and tetraploid mulberry. National Seminar on Silk Research and Development, Bangalore, India, March 10-13, pp. 6.

Sarkar, A., S. Jalaja Kumar and R. K. Datta (2000) Gradual improvement of mulberry varieties under irrigated conditions in South India and the tropical program for varietal selection in the tropics, *Sericologia* **40**, 449-461.

Sastry, C. R. (1984) Mulberry varieties, exploitation, and pathology. *Sericologia* **24**, 333-359.

Scriber, J. M. (1978) The effects of larval feeding specialization and plant growth form on the consumption and cultivation of plant biomass and nitrogen. An ecological consideration. *Entomol. Exp. Appl.* **24**, 694-710.

Shablovaskaya, M. I. and A. G. Kafian (1967) Driving a mulberry variety with a high quality leaf. *Silk* **4**, 8-10.

Snedecor, W. G. and G. W. Cochran (1967) In Statistical Methods. Oxford and IBH Publications, India.

Sujathamma, P. and S. B. Dandin (1998) Evaluation of mulberry (*Morus* spp.) genotypes for yield under Rayalaseema conditions of Andhra Pradesh. *Indian J. Seric.* **37**, 133-136.

Susheelamma, B. N. and M. S. Jolly (1986) Evaluation of morpho-physiological parameters associated with drought resistance in mulberry. *Indian J. Serc.* **25**, 6-14.

Susheelamma, B. N. R. G. Geethadevi, M. S. Jolly, S. Jalaja Kumar, K. Giridhar, K. Senugupta and Meera Verma (1989) Effect of different mulberry varieties on silkworm, *Bomby mori* L. *Insect Sci. Appl.* **10**, 359-364.

Susheelamma, B. N., M. S. Jolly, K. Giridhar and K. Senugupta (1990) Evaluation of germplasm genotypes for drought resistance in mulberry. *Sericologia* **30**, 327-341.

Tojyo, I. (1985) Research of polyploidy and its applications in *Morus*, *JARQ* **18**, 222-228.

Thangamani, R. and M. Vivekanandan (1984) Physiological studies and leaf nutrient analysis in the evaluation of best mulberry varieties. *Sericologia* **24**, 317-324.

Toshio, I. and A. Narihiro (1963) Food values of mulberry leaves for the silkworm *Bombyx mori* (L.) determined by means of artificial diets - Relationship between kinds of mulberry leaves and larval growth. *Bull. Seri. Expt. Stn.* **18**, 226-229.

Ueda, S. and K. Suzuki (1967) Studies on the growth of the silkworm, *Bombyx mori* L. I. Chronological changes of the amount of food ingested and digested, food weight and water content of the body, their mutual relationship. *Bull. Seric. Expt. Stn.* **22**, 65-67.

Waldbauer, G. P. (1968) The consumption and utilization of food by insects. *Adv. Insect Physiol.* **5**, 229-288.

Yokayama, T. (1963) 'Sericulture'. *Ann. Rev. Ent.* **8**, 287-298.

Yoshitake, T. (1961) Studies on the effect of nutrition on the moulting in silkworm (*Bombyx mori* L.) II, Analysis of various factors concerning the judgement of nutritional value of mulberry leaf by means of moulting ratio of silkworm fed with leaf concerned. *Bull. Seric. Expt. Stn.* **17**, 53-87.