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## Studies on varietal performance of mulberry on growth and development of silk worm (*Bombyx mori* L.)

**Umesh Prasad Sai, RKS Tomar, AK Awasthi, V Nirmalkar, NK Chaure and Archana Kerketta**

### Abstract

The experiment was conducted in the Entomology Laboratory of Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (Chhattisgarh), during September-October, 2021 in Completely Randomized Design with nine treatments and three replications. Larvae of Silkworm hybrid MYX × CSR<sub>2</sub> were fed on mulberry varieties CMY-1, C-2038, CPP-1, S-1635, CPP-1, V-1, S-13, K-2, and mixture of all varieties leaf. Observations on the dimensions of different instars of silkworm *Bombyx mori* L. were recorded. Mulberry variety S-1635 was recorded as best variety for growth and development of silkworm during final instars with maximum larval length (68.83 mm), larvae breadth (9.93 mm) and larval weight (3.20 g). Variety V-1 was also observed promising so far growth and development of silkworm larvae is concerned, while minimum larval length, breadth and weight was observed when larvae fed on mixture of all varieties.

**Keywords:** Mulberry, Silk worm, *Bombyx mori* L.

### Introduction

"Natural Silk" a dry salivary secretion is produced when a fully grown silkworm larva spins its cocoon for pupation. It's known as the "Golden Fiber" or "Golden Queen" of textiles, and it's revered all over the world for its lustrous sheen. Its products are delightfully light, soft but sturdy, silky, and universally praised by leading fashion designers across the world for their elegance, colour dyeing affinity, thermal tolerance, and water absorbency. Silk as a weavable fiber was first discovered by the Chinese emperor Xi Ling Shi in 2,640 B.C., and Chinese kept its culture and weaving secrets for 2,500 years. (Gangopadhyay, 2008) [6].

Sericulture is the science of rearing of silkworms and production of silk. Silk is the most elegant textile in the world with natural sheen, light weight, soft touch, glamour, and highly durable. The total raw silk production in the country during 2020-21 was 33,739 MT, which was 5.8% lesser than the production achieved during the previous year 2019-20. India is the second largest producer of silk in the world. Among the four varieties of silk produced in 2020-21, Mulberry accounted for 70.72% (23,860 MT), Tasar 8.02% (2,705 MT), Eri 20.55% (6,935 MT) and Muga 0.71% (239 MT) of the total raw silk production of 33,739 MT. (CSB 2021) [4].

Successful qualitative and quantitative cocoon production is influenced by a no. of factors such as mulberry leaf (38.2 percent), climate (37.0 percent), silkworm breed (4.2 percent), rearing procedures (9.3 percent), silkworm seed (3.1 percent), and other factors (8.2 percent). (Miyashita, 1986). On the bases of above facts, the nutritional value of the leaves fed to silkworms has a significant impact and plays an important role on silkworm growth and development such as larval length, breadth and weight which are influenced by the nutritional status of the leaves supplied to silkworms. Because of the quicker metabolic activity, the worms can mature earlier due to the balanced nutritional quality of the leaves (Sudhakara *et al.*, 2017). Silkworm larvae of a young age like wet, succulent, and nutritive leaves, ideally the top ones, which allow the young larvae to increase the amount of food they consume. (Yokoyama, 1974) [13].

Mulberry varieties are important as they differs in their nutritional value responsible for growth and development of silkworm larva. Mulberry leaves are succulent for silkworms due to their high water content (Anonymous 1975; Machii & Katagiri 1991). Water has a significant impact on the quality of leaves used as silkworm feeding, and there is a close link between the silkworm's ingestion and digestion of leaves and the most crucial variables for

successful silkworm rearing (Ullal & Narasimhanna 1981). Silkworm larvae in the first and second instar, in particular, require more water in leaves to thrive. As a result, they require soft, succulent tender leaves that are high in water and protein. 3rd instar larvae, on the other hand, require dark green leaves, which contain less water than tender leaves. For healthy growth and development of silk glands for higher silk production, the 4th and 5th instar larvae require mature leaves with higher protein and carbohydrate content (Quader 1987) [10].

The early instars of silkworms (I, II, III) are known to consume 10-15% of the food consumed by the silkworm in its larval stage, whereas the late instars (IV and V) feed the bulk of food consumed by the silkworm in its larval stage 80-90% (Krishnaswami *et al.*, 1973) [7].

## Materials and Method

The experiment entitled “Studies on varietal performance of mulberry on growth and development of silk worm (*Bombyx mori* L.)” was conducted in the Laboratory of Entomology, Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (Chhattisgarh), during September-October, 2021 in Completely Randomized Design with nine treatments and three replications. 25 larvae of silkworm hybrid MYX × CSR<sub>2</sub> were reared on eight cultivars of mulberry *i.e.* CMY-1, C-2038, CPP-1, S-1635, CPP-1, V-1, S-13, K-2 and mixture of all varieties. The fresh mulberry leaves of above eight varieties were obtained in required quantity was collected from state sericulture farm, Ramtala, Bilaspur.

The black boxing was done for uniform development of embryo. The subsequent day, in morning at 9am to 10am eggs were exposed to bright light for about 1 to 2 hours to get synchronized hatching. The leaves were chopped into small pieces of 0.5 cm. and sprinkled over the newly hatched worms for their feeding. The feeding was given four times in a day, at 6am, 11am, 5pm, and 10pm. The rearing trays were cleaned daily.

During its larval stage, the silkworm molts four times. There are five instars in a silkworm's life cycle. During molting feeding were not given. Molting takes 20 to 30 hours to finish. Worms during molting are more prone to disease infection and to manage illnesses, a bed disinfectant Vijeta @ 200 gm/5 DFLs were dusted after each molt and feeding was provided an hour afterwards. After that, the bed was cleaned.

The mature worms were translucent and creamy in colour. The ripe worms stopped eating, crept to the trays' edges, and attempted to spin cocoons by raising their head upward. They were picked gently by hand and placed on chandrika for spinning the cocoon.

The observations on larval dimensions *viz.*, length, breadth, and weight of larvae were taken in each instars.

## Result and Discussion

### 1. Larval length

Length of 10 larvae feeding on each variety of mulberry was taken and mean was calculated as per standard statistical procedure. Table 1. Showed the results of the silkworm larvae length at various developmental stages fed on various mulberry varieties. No significant difference were observed on average length of silkworm larvae feeding with different varieties of mulberry during I<sup>st</sup> and II<sup>nd</sup> instar which varied from 08.74-08.97 mm and 12.10-12.50 mm, respectively.

Significant differences in length of silkworm larvae feeding with different mulberry varieties during III<sup>rd</sup>, IV<sup>th</sup> and V<sup>th</sup> instar were recorded. Mulberry variety S-1635 was the best performer as far as larval length is concerned (24.63mm-III instar, 41.70 mm-IV instar and 68.83 mm-V instar) and proved to be significantly superior over rest of the varieties except CPP-1(24.50 mm) during III instar, V-1(40.90 mm) during IV instar and V-1(68.63mm) and CPB-1(68.13 mm) during V<sup>th</sup> instar. The poor performance was showed by the treatment mixture of leaves of all varieties with lowest 24.07, 39.63 and 65.53mm larval length during III<sup>rd</sup>, IV<sup>th</sup> and V<sup>th</sup> instar, respectively. Mulberry variety V-1 was found next best.

The findings of Kaur *et al.*, (2020) are in accordance with present findings as variety M-5 was recorded with maximum length 58.5 mm of final instars larvae and followed by variety S-1635 (57.6 mm) while in present findings variety S-1635 was recorded with maximum length.

### 2. Larval breadth

Larval breadths of different instars fed with different mulberry varieties were taken and found that there was no significant difference in the larval breadths of first and second instar. Significant difference was observed during III, IV and V instar larval breadth (Table 2). The maximum larval breadth 04.50mm in III, 06.87mm in IV and 09.93mm in V instar were recorded in larvae fed with mulberry variety S-1635 which is significantly superior over other varieties during III instar, while during IV instar, the mulberry variety was at par with varieties V-1(06.86mm), CPB-1(06.69 mm), C-2038(06.64 mm) and CPP-1(06.57 mm) and during final instar variety S-1635 was followed by CPB-1(09.73mm), V-1(09.70mm) and C-2038(09.70mm). The varieties K-2, S-13, CMY-1 and mixture of all varieties were recorded with less larval breadth and lowest were observed in mixture of all varieties in all instars.

Findings of Kumar *et al.*, (2014) [9] are in accordance with present findings as maximum larval width was recorded in variety TR-10 (3.47 mm), S-1635 (6.49 mm) and BR-2 (9.75 mm) respectively. In present findings on larval width variety S-1635 was recorded with highest, however Variety TR-10 is not included in present work.

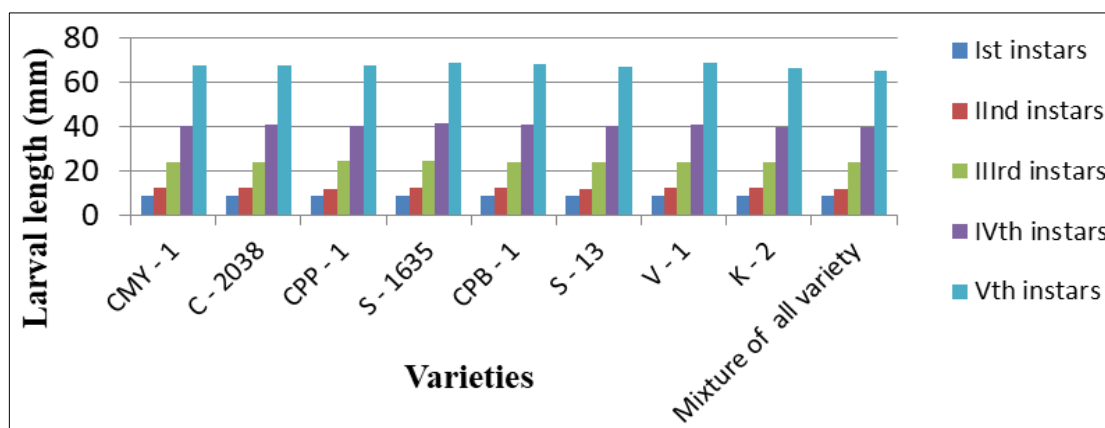
### 3. Larval weight

The mean larval weight of silkworm in different developmental stages under different treatments of mulberry varieties feeding is shown in Table 3. Larval weights during two early instars showed no significant difference; whereas significant differences in weight of later stages larvae were observed. Most of the varieties of mulberry were found at par with V-1 (0.376 g) except variety CMY-1 and mixture of all varieties so far larval weight is concerned at III instar stage. At IV instar stage, maximum (1.154 g) larval weight was observed in Variety S-1635 closely followed by V-1 (1.152 g), CPP-1 (1.151g), S-13 (1.151g) and CPB-1. Larval weight of last instar was observed maximum 3.199g in variety S-1635 and found at par with V-1 (3.137 g) and CPB-1 (3.136 g). Minimum 2.844 g larval weight was recorded in mixture of all varieties.

The present findings on larval weight are in agreement with findings of Kumar *et al.*, (2014) [9] and Lalfelpui *et al.*, (2014) [9] who had also reported variety S-1635 as best variety with highest larval weight during fifth instars.

**Table 1:** The performance of different varieties of mulberry on the larval length

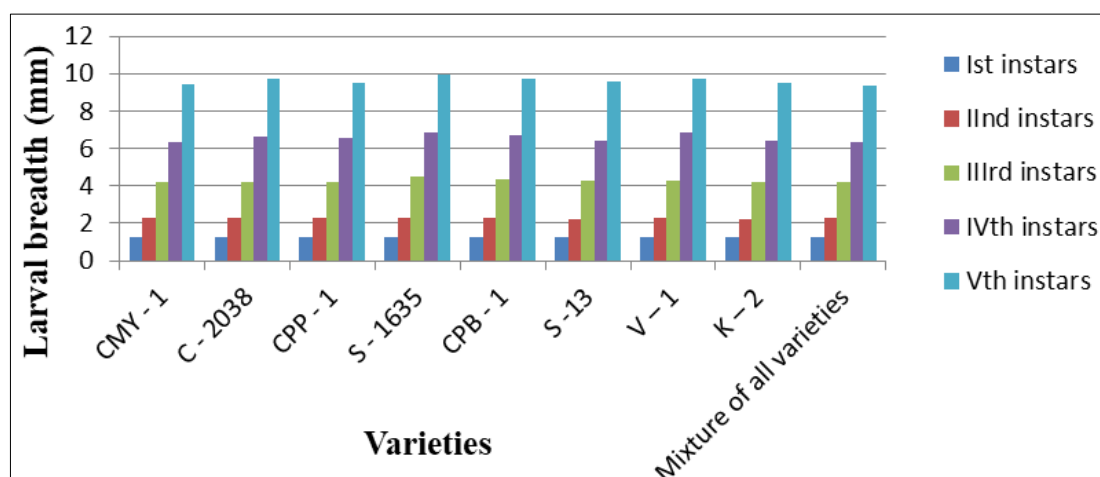
S.N.	Mulberry variety	Mean length (mm)				
		I <sup>st</sup> instars	II <sup>nd</sup> instars	III <sup>rd</sup> instars	IV <sup>th</sup> instars	V <sup>th</sup> instars
1	CMY - 1	8.97	12.33	24.21	40.53	67.50
	C - 2038	8.81	12.27	24.25	40.70	67.79
2	CPP - 1	8.90	12.20	24.50	40.20	67.50
3	S - 1635	8.77	12.47	24.63	41.70	68.83
4	CPB - 1	8.77	12.37	24.26	40.83	68.13
6	S - 13	8.74	12.10	24.14	40.10	67.03
7	V - 1	8.74	12.50	24.27	40.90	68.63
8	K - 2	8.78	12.27	24.12	39.83	66.43
9	Mixture of all variety	8.81	12.17	24.07	39.63	65.53
-	SEm ±	0.0497	0.0903	0.1090	0.2895	0.3021
-	CD at 5%	NS	NS	0.3238	0.8602	0.8976



**Fig. 1.** The performance of different varieties of mulberry on the larval length

**Table 2:** The performance of different varieties of mulberry on the larval breadth

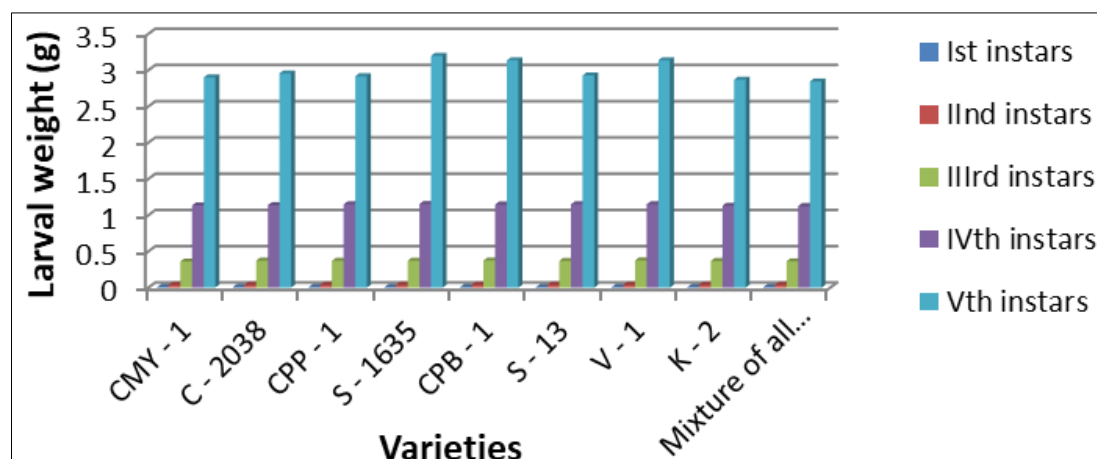
S.N.	Mulberry variety	Mean breadth (mm)				
		I <sup>st</sup> instars	II <sup>nd</sup> instars	III <sup>rd</sup> instars	IV <sup>th</sup> instars	V <sup>th</sup> instars
1	CMY - 1	1.23	2.29	4.23	6.37	9.47
	C - 2038	1.28	2.28	4.23	6.64	9.70
2	CPP - 1	1.24	2.28	4.20	6.57	9.53
3	S - 1635	1.28	2.30	4.50	6.87	9.93
4	CPB - 1	1.28	2.27	4.37	6.69	9.73
6	S - 13	1.24	2.24	4.30	6.44	9.57
7	V - 1	1.27	2.29	4.27	6.86	9.70
8	K - 2	1.27	2.25	4.20	6.41	9.53
9	Mixture of all varieties	1.28	2.26	4.20	6.33	9.33
-	SEm ±	0.0185	0.0199	0.0294	0.1029	0.0903
-	CD at 5%	NS	NS	0.0873	0.3058	0.2679



**Fig 2:** The performance of different varieties of mulberry on the larval breadth.

**Table 3:** The performance of mulberry varieties on weight of silk worm larvae.

S.N.	Mulberry variety	Mean weight(g)				
		I <sup>st</sup> instars	II <sup>nd</sup> instars	III <sup>rd</sup> instars	IV <sup>th</sup> instars	V <sup>th</sup> instars
1	CMY - 1	0.008	0.042	0.361	1.136	2.901
	C - 2038	0.008	0.042	0.374	1.139	2.955
2	CPP - 1	0.008	0.042	0.372	1.151	2.917
3	S - 1635	0.008	0.042	0.372	1.154	3.199
4	CPB - 1	0.008	0.042	0.375	1.148	3.136
6	S - 13	0.008	0.042	0.370	1.151	2.928
7	V - 1	0.008	0.042	0.376	1.152	3.137
8	K - 2	0.008	0.042	0.368	1.130	2.870
9	Mixture of all varieties	0.008	0.042	0.364	1.126	2.844
-	SEm ±	0.0008	0.0003	0.0024	0.0041	0.0337
-	CD 5%	NS	NS	0.0075	0.0122	0.1003

**Fig 3:** The performance of different varieties of mulberry on weight of silk worm.

### Conclusion

The results of the present study indicate that mulberry variety S-1635 was found best performer in relation to different parameters, larval length, larval breadth, and larval weight. Variety V-1 and CPB-1 were recorded next best performers.

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