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SHORT NOTE

A COMPARATIVE QUALITATIVE ANALYSIS OF SOME VARIETIES OF MULBERRY (*Morus* spp.)

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The sustainability of sericulture industry depends on the growth of silkworm which, in turn, depends on the leaf quality of mulberry on which the silkworms feed. To meet the feed demands of silkworm, it is essential to evolve high yielding mulberry varieties possessing high quality nutritive leaves as well as the ability to grow under varied agro-climatic conditions throughout the year. Silkworm is a monophagous insect, therefore the carbohydrate and protein contents in mulberry foliage play vital role in quality silk production. Young silkworms require succulent leaves for easy ingestion, while late-age silkworms can feed on mature leaves as they have the strength to cut and ingest the hard leaves which usually possess less proteins and water (Srichaikul *et al.*, 2011). The availability of moisture content in leaves enhances the feeding efficiency of silkworm larvae which, in turn, increases the growth rate (Sastry *et al.*, 1988). Hence, nutritional value and palatability serve as a better criterion to assess the superiority of one type of leaf over the other. The chemical composition of mulberry leaves varies with genotype and the application of manures and fertilizers. Mulberry leaf quality is highly influenced by the nature of varieties, age, leaf position, leaf harvest, preservation techniques, etc. (Horie,1978). The varieties vary in their leaf nutritional quality especially with respect to carbohydrate, proteins, moisture, chlorophyll contents, etc. (Das and Sikadar,1970). The present study was aimed to evaluate the relative moisture content, carbohydrates, protein and chlorophyll contents in six mulberry varieties grown in under tropical conditions.

The present study was conducted in the Department of Biosciences and Sericulture, SPMVV, Tirupati (India). Fresh mulberry leaves of different mulberry varieties namely S13, RFS135, Tr 10, M5, Vishala, and G2 were collected from the mulberry garden of the department in polyethene bags and stored under in ambient conditions and analyzed for moisture content, carbohydrate, protein and chlorophyll contents. The analysis was conducted on five randomly selected plants of each genotype in each replication. The fresh leaves of a shoot from top to bottom of three different plants from each variety were collected in a polyethene bag. Fresh leaf weight was noted immediately after collection. Three replications were taken from each genotype. The pre-weighed leaf samples were dried in a hot air oven at 60^{o}C for 48 h till a constant weight was achieved. The moisture content was calculated by using the following formulae (Vijayan *et al.*, 1997):

$$\text{Leaf moisture content (\%)} = \frac{[\text{Fresh weight of leaves} - \text{Dry weight of leaves}]\ x\ 100}{\text{Fresh weight of leaves}}$$

The carbohydrates content in leaves was estimated by Anthrone method (Hedge and Hofreiter, 1962) and protein content by Lowry's method (Lowry *et al.*, 1951). The total chlorophyll content was measured by acetone method (Arnon, 1949). The observations were recorded from five randomly selected plants for each genotype, in each replication. The data was analyzed by analysis of variance and variability among the genotypes compared (Gomez and Gomes, 1984).

The production of quality cocoons depends on the timely supply of quality mulberry leaves to the silkworm. Therefore, it is necessary to analyze the quality parameters of mulberry such as leaf moisture percentage, carbohydrate, proteins and chlorophyll contents. The results revealed that the quality parameters in mulberry leaves varied with the genotype (Table 1). Maximum moisture content was found in cv. 'TR 10' (80.4%), followed by 'G2' (79.2%); whereas lowest moisture content was observed in cv. 'S13' (64.6%). Succulent quality leaf is one of the important factors that influences the healthy growth of the silkworm and subsequently successful cocoon crop. Apart from environmental factors, leaf anatomical parameters like stomata size, frequency of stomata, thickness of cuticle and leaf thickness also influences the moisture content of the leaf and its retention capacity. Ghosh *et al.* (2006) and Adolkar *et al.* (2007) evaluated some improved mulberry varieties grown under irrigated conditions and reported that moisture content significantly varied among the varieties. Kaushal *et al.* (2018) also reported high moisture content in tender leaves, followed by medium and coarse leaves. Young worms require tender and succulent leaves as compared to older silk worms. The leaves of triploid mulberry varieties have significantly high moisture (Murthy, 2013).

The carbohydrate content in leaves ranged from 0.28 to 0.45 mg g^{-1} with highest content in cv. 'Vishala' and lowest in cv. 'RFS 135'. The protein content in leaves varied from 150.0 to 486.6 mg g^{-1} with highest content in cv.'Vishala' and lowest in cv. 'M5'. Triploid mulberry variety showed better performance than diploids in protein and carbohydrate (Mustafaev 1970; Krishnaswami *et al.*, 1971) also observed wide variation in nutritional content in different varieties of same species. Leaf biochemical analysis showed that total protein and total carbohydrate content are more in triploids (Mustafev, 1970; Bongale *et al.*, 1997). Proteins are important for silkworm larvae as it utilizes leaf nitrogen for growth, development and silk protein synthesis (Horie, 1978). The nutritional constitution of mulberry leaves has great impact on the silkworm crop which, in turn, depends upon the moisture, total protein, total carbohydrates and total minerals of mulberry leaves. Investigation in relation of nutritional status of mulberry leaves and growth of silkworm larvae clearly showed that accumulation of proteins in leaves mainly depends on the concentration of carbohydrates in the leaves (Ohnuma*et al.*, 1997).

Table 1: Moisture, carbohydrate, protein and chlorophyll contents in some mulberry varieties

Mulberry varieties	Moisture content (%)	Carbohydrate content (mg g^{-1} leaf)	Protein content (mg g^{-1} leaf)	Chlorophyll content (mg g^{-1} leaf)
S13	64.3 ± 1.08	0.30 ± 0.00	269.0 ± 1.00	2.19 ± 0.05
TR10	84.0 ± 1.76	0.37 ± 0.01	173.3 ± 1.15	1.67 ± 0.00
M5	78.4 ± 1.02	0.31± 0.01	150.0 ± 1.00	1.64 ± 0.01
G2	79.3 ± 0.80	0.34 ± 0.00	443.6 ± 1.15	1.79 ± 0.05
RFS 135	79.2 ± 0.90	0.28 ± 0.00	248.6 ± 1.15	1.64 ± 0.00
Vishala	78.5 ± 1.15	0.45 ± 0.01	486.6 ± 0.57	1.83 ± 0.01

Each value represents the average of 3 replicates (n = 3); mean ± standard deviation (SD)

Maximum larval growth was noticed when silkworm were fed with 3-4% of mulberry leaves in 1st and 4-5% leaves 2nd instars. Manjula and Vijaya (2015) have reported that high carbohydrate content in mulberry resulted in healthy rearing of silkworms. In present study, cv. 'Vishala' and TR 10' are triploids varieties. We observed that triploids varieties were superior over diploid varieties as they exhibited improved qualities with respect to morphological and biochemical parameters. The analysis revealed the superiority of triploids over diploid variety. The nutritive content of leaves varies with the variety, degree of maturity and soil type in which the plants are grown (Ghosh *et al.*, 2006). Bongale *et al.* (1997) showed decrease in leaf protein and increase in carbohydrate content with leaf maturity.

The photosynthetic pigment in leaves ranged from 1.64 to 2.19 mg g^{-1} leaf, with maximum chlorophyll content in mulberry variety 'S13' and minimum in 'RFS 135'. As S13 is drought tolerant variety, it showed superior photosynthetic rate compared to other variety. Higher level of leaf chlorophyll indicates the high photosynthetic efficiency of the genotype. Chlorophyll is an important biochemical attribute of plants which usually serves as an indicator of plant's photosynthetic capacity and health status (Srichaikul *et al.*, 2011). High content of chlorophyll a and b is advantageous for greater photosynthetic activities (Manjula and Vijaya, 2015).

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