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Nutritional analysis of mulberry leaves

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Abstract: *The quality and quantity of Mulberry leaf, the sole food source of silkworm Bombyx mori L. plays a major role in sericulture industry. Carbohydrates, Proteins and Lipids are the major plant metabolites which influence quality and quantity of leaf yield. Phenols are responsible for plant defense mechanism and synthesis of various metabolites. Analysis of mulberry leaf helps in identification of mulberry leaf quality there by selection for silkworm feeding. Hence, a preliminary study was conducted to analyze mulberry leaves for important metabolites like carbohydrates, proteins, phenols and chlorophyll. For this study three popular mulberry varieties were selected for analysis they are Kanva-2 which is most popular and improved variety, S36 variety which is best suitable for young age silkworm rearing and V1 which is high yielding and popular variety .In this study it was identified that V1 is rich carbohydrates and chlorophyll content followed by S36 and kanva2 variety.*

Keywords: *Mulberry, silkworm, leaf quality.*

I. Introduction

India is the second largest producer of silk after China. Mulberry is an important crop plant in sericulture, and its foliage is the exclusive food of domesticated silkworm Bombyx mori L., which produces the natural silk used in textile industries. To a great extent, increasing the production of raw silk depends on higher yield and quality in mulberry leaves. Leaf yield in mulberry is a polygenic character influenced by several quantitative characters (Vijayan *et al*., 1997) and is the cumulative consequence of various physiological and biochemical processes. The common species found in India are, *Morus alba, Morus indica Linn, Morus atropurpurea roxb, Morus nigra, Morus serrata* and *Morus laevigata.* Young leaves which have attained full size are best suited for feeding silkworm larvae (Koul *et al.,* 1994). The composition of leaves varies with variety, degree of maturity and the type of soil in which the plants are grown. The food value of mulberry leaf for silkworm larvae is attributed to the presence of 3 stimulant factors *viz.* an attractant, a biting factor and a swallowing factor (David *et al.,* 1970). Mulberry leaves are sometimes eaten as vegetable. They are also useful as cattle fodder. They are nutritious and palatable, and are stated to improve milk yield when fed to dairy animals.

Carbohydrates, proteins lipids are the major plant metabolites which influence quality and quantity of leaf yield. Plant phenolics are generally involved in defense against ultraviolet radiation or aggression by pathogens, parasites and predators, as well as contributing to plants colors. They are ubiquitous in all plant organs. Phenolics are widespread constituents of plant foods (fruits, vegetables, cereals, olive, legumes, chocolate, *etc.*) and beverages (tea, coffee, beer, wine, *etc.*), and partially responsible for the overall organoleptic properties of plant foods (Jin and Rassell, 2010).

Since plant metabolites play a major role in quality and quantity of crop produce, nutritional analysis of mulberry ,the sole food source of silkworm Bombyx mori L , helps in assessing the quality and quantity of leaf produced. Hence, a preliminary study was conducted to analyze mulberry leaves for important metabolites like carbohydrates, proteins, phenols and chlorophyll. For this study three popular mulberry varieties were selected for analysis, they are 1).Kanva 2 – the most popular and improved variety, 2) S36 variety - best suitable for young age silkworm rearing and 3) V1variety –the high yielding variety.

II. Materials and Methods:

This study was conducted in the department of Sericulture, Sri Padmavati Mahila University, Tirupati. Fresh mulberry leaf at the rate of 10 leaves from each variety randomly was collected from healthy mulberry garden. Three varieties namely Kanva2, S36 and V1 were selected for the study.

The various parameters studied are 1.Total chlorophyll content, 2.Total carbohydrate content and 3.Total phenol content.

Total Carbohydrate estimation by Anthrone method:

The total carbohydrate was estimated by anthrone method (Hedge and Hofreiter, 1962. Standard graph was plotted by plotiing the concentrations of the standard in the *X*-axis versus absorbance on the *Y*-axis. From the graph the amount of carbohydrate present in the sample was calculated.

Amount of carbohydrate present in 100mg of the sample

$$= \frac{\text{mg of glucose}}{\text{Volume of test sample}}$$

Total Chlorophyll estimation:

The chlorophyll content in leaves was estimated by the method of Arnon (1949).The amount of amount of chlorophyll present in the extract was calculated using the following formula and noted in mg /gram weight of tissue.

$$\text{mg chlorophyll a/g tissue} = 12.7\ (A_{663})\text{-}2.69\ (A_{645}) \times \frac{V}{1000 \times W}$$

$$\text{mg chlorophyll b/g tissue} = 22.9\ (A_{645})\text{-}4.68\ (A_{663}) \times \frac{V}{1000 \times W}$$

and

$$\text{mg total chlorophyll/g tissue} = 20.2\ (A_{645})\text{-}8.02\ (A_{663}) \times \frac{V}{1000 \times W}$$

where A=absorbance at specific wavelengths,
V=final volume of chlorophyll extract in 80% acetone
and W=fresh weight of tissue extracted.

Total Phenols estimation:

Total phenol content was estimated using Folin-cio calteau method.

From the standard curve find out the calculation of phenols in the test sample and express as mg phenols/100mg material.

III. Results:

Table: 1 describes the amount of primary metabolites of Mulberry leaf. The carbohydrates is maximum (4.63) in V1, second one (4.49) is S36 and minimum (4.0) is Kanva-2. The maximum (2.95) total phenolic compounds present in V1, second one (2.72) is S36 and minimum (2.49) percentage is Kanva-2. Considering the chlorophyll content V1 has the maximum (1.85) chlorophyll-a content, second one (1.48) is S36 and minimum (1.22) is Kanva-2. Chlorophyll-b is maximum in V1 (0.37) second one is S36 (0.27) and minimum chlorophyll present in Kanva-2 (0.23).

Table 1: Primary metabolites of Mulberry

S. No.	Mulberry varieties	Carbohydrates	Phenols	Chlorophylls		
				a	b	Total
1.	V1	4.63	2.95	1.85	0.37	2.22
2.	S36	4.49	2.72	1.48	0.27	1.75
3.	Kanva-2	4.0	2.49	1.22	0.23	1.45

Figure 1: Carbohydrates present in mulberry varieties

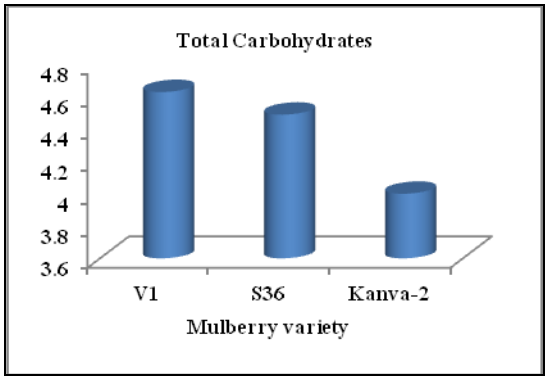


Figure 2: Total Phenols present in mulberry varieties

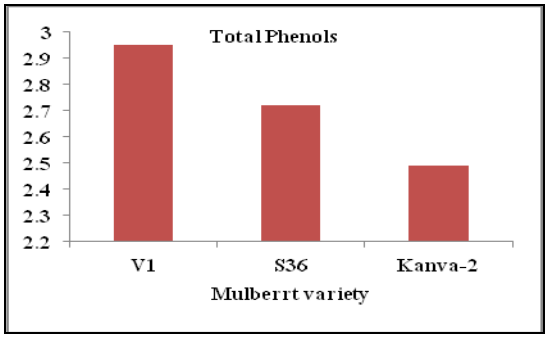
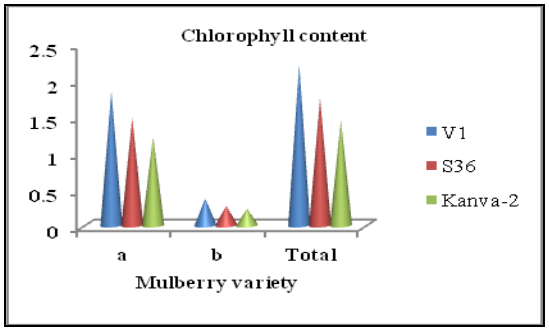


Figure 3: Chlorophyll present in mulberry varieties



IV. Conclusion

The silk cocoon yield mainly depends on silk worm rearing management and the quality of mulberry leaves. If silkworm rearing and cocoon production are to be a success, it is very necessary that mulberry leaf to be fed to the silkworms is very nutritive and fresh. The cultivation of mulberry for raising silkworm cocoon crops mainly aims not only at increased production of leaves per unit area but also leaves of suitable quality for the maximum utilization of the leaf crop produced. It has been fairly well recognized that both chemical composition and nutritive value of the leaves as reflected in the silkworm cocoon crop differ considerable from variety to variety, season to season or according to growth and maturity of the leaves, manure application, irrigation and so on. Despite considerable amount of researches carried out by various workers on this problem of quality of leaves, there seem to considerable contradictions and it has not been possible to make any positive recommendations as to the mulberry cultivation practice to be followed for the production of suitable type of leaves. Narayanan *et al.*, (1966) and Sidhu *et al.*, (1969) have reported about the quality differences in leaves due to variety, irrigation and manuring. Mulberry improvement is also aimed at bringing qualitative improvement of leaves and a survey of the available literature reveals that extensive studies have been carried out on the varietal response, effect of agronomical inputs, seasons and related aspects on biochemical composition of leaves. Matsumara *et al.*, (1955), Tangamani and vivekanandan (1984), Lie and Sano (1984), Fotadar *et al.*, (1989) and chaluvachari and Bongale (1995) discussed the importance of quality of mulberry leaves used as feed for silkworm. High quantity of chlorophyll 'a' and 'b' is advantageous since they are the most important pigment in photosynthesis. Carbohydrates of the mulberry leaves are synthesized by the photosynthetic action of the leaves. Carbohydrates particularly the sugar content in mulberry leaves in closely related to the health of the silkworm. Mulberry leaves with high sugar content fields good results of rearing. Moreover by adding sugar artificially to the feed, the occurrence of flacherie was reported to have greatly reduced. (Kichisaburo minamizawa, 1970). Importance of the nutritive care for young age silkworms and its influence on cocoon crop performances have been widely accepted (Yokoyma, 1965, Krishnaswami *et al.* 1970; Chaluvachari 1995).

V. References

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