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Determination of Nutritive Contents (Protein and Carbohydrate) of Popular Mulberry Varieties

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ABSTRACT: Proteins and carbohydrates are the main nutritive components in mulberry leaves. The present study was undertaken to analyse the protein and carbohydrate content in the leaves of popular mulberry varieties (Goshoerami, Koksu-21 and Ichinose) at three different stages (tender, medium and coarse). In general, decreasing trend in terms of total protein and carbohydrate content was recorded from tender to coarse textured leaves of all three varieties. The leaf extract of Goshoerami (tender) and Koksu-21 (tender) recorded the highest protein and carbohydrate content to the tone of 28.93 and 18.68% respectively. Among the varieties, Goshoerami recorded highest protein content of 25.24%, whereas highest carbohydrate content (16.91%) was found in Koksu-21 mulberry variety.

Keywords: Silkworm, Mulberry leaves, Protein and Carbohydrate.

INTRODUCTION

Mulberry plants are fast growing and found in varied climatic conditions. It is mainly used to feed the silkworms for the production of silk. Presence of good amount of bioactive constituents makes it choice of plant for various pharmaceutical and nutraceutical studies. Mulberry plant is also appreciated for the source of mulberry fruit, which is good in taste and have various health benefits. Fruits can be consumed fresh, fried or in the form of juices, squashes etc. Silkworm larval growth, development and cocoon production is directly proportional to the nutritional and biochemical quality of mulberry leaves (Krishnaswami, 1978). Any deficiency in the quality of leaf causes changes in the metabolic activity of silkworm larvae (Ito, 1972). Protein and carbohydrate are prime components of nutrition in leaf and their quantities greatly influence the growth of silkworm. Mulberry leaf quality also depends on the age, variety and leaf position within same species (Narayanswamy *et al*., 1996). Present study was undertaken for quantitative analysis of protein and carbohydrate composition of mulberry leaves (tender, medium and coarse) of three mulberry varieties (Goshoerami, Ichinose and Koksu-21) grown under temperate climatic conditions of Kashmir.

MATERIALS AND METHODS

Present study was conducted at College of Temperate Sericulture, SKUAST-K, Mirgund, Jammu and Kashmir. Leaf samples comprising of equal proportion of tender, medium and coarse from three mulberry varieties viz., Goshoerami, Ichinose and Koksu-21 were taken in early morning during the spring 2021.

Processing of leaf samples. The collected leaf samples were first washed with running tap water, followed by distilled water, to decontaminate leaves from dust and other impurities. The samples were air dried on filter papers and then oven dried at 60-65^{o}C (Chapman, 1964) till constant weight was obtained. After drying, samples were crushed with the help of mortar pestle, followed by sieving and stored in envelops for further use.

Experimental Material. Ethanol (analytical grade), Folin- Ciocalteu reagent (FCR), Anthrone reagent, Sulphuric acid (H_2SO4), Trichloroacetic acid (TCA), Standard glucose, Alkaline copper reagent (Sodium potassium tartrate ($KNaC_4H_4O_6.4H_2O$), Copper sulphate ($CuSO_4$), Sodium hydroxide (NaOH),Sodium carbonate (Na_2Co_3),Bovine serum albumin (BSA), Hydrochloric acid (HCL), Distilled water and Mulberry leaf (tender, medium & coarse) of three popular varieties viz., Goshoerami, Ichinose and Koksu-21.

Estimation of total protein content. Total protein content was measured by colorimetric method described by Lowry *et al.*, 1951. 50mg of dry leaf from each sample was homogenized in 80% ethanol using mortar pestle. Homogenates were centrifuged at 5000rpm for 20 minutes. Supernatants were discarded and residues suspended in 10ml of 10% TCA (Trichloroacetic acid) for 30 minutes. The mixtures were centrifuged at 5000rpm for 10 min and the supernatants discarded. Pellets were washed with 5% TCA and protein precipitates (pellets) were dissolved in 1N NaOH and kept in hot water bath for 30 minutes. The samples were diluted 10 times with distilled water. 1ml was taken as protein sample followed by the addition of 5ml of alkaline copper reagent and allowed to stand for 10 minutes. 0.5ml of 50% FCR reagent was added rapidly and mixed. FCR added mixtures are kept at room temperature for 30 minutes and optical density was taken at 750nm.

Estimation of total carbohydrate content. Carbohydrate content in leaf samples was estimated by Thimmaiah 1999, using the anthrone reagent with slight modification. 0.1g of dry leaf samples were taken in test tubes and added with 5ml of 0.5N HCL. Tubes were kept for 3 hours in hot boiling water bath and cooled at room temperature. Dry sodium carbonate was added to neutralize samples till effervescence ended. Volume of tubes were made 10ml with distilled water and 0.05ml from each sample tubes was taken for analysis. Volume of sample tubes was made up to 1ml with distilled water followed by addition of 4ml anthrone reagent. Tubes were kept in boiling water for 8 minutes, cooled rapidly and absorbance of green to dark green colour was read at 630nm.

Total Protein. The results with respect to total protein content of mulberry leaves are presented Table 1 and Fig. 1. In general, tender leaves of Goshoerami recorded significantly highest (28.93%) total protein content followed by tender leaves of Koksu-21(27.58%) and Ichinose (23.96%). Obtained results coincides with results put forth by Lokesh *et al*., 2012; Murthy *et al*., 2013; Jyothi *et al*., 2016) who reported that the tender leaves of mulberry contain more protein content than medium and coarse textured leaves. High protein content in tender leaves makes it best feed during early stage of larvae where larvae get more nutrition by consuming even less leaf quantity. Protein and carbohydrate content are the major nutritional component in leaf and directly influences the larval growth. Krishnaswami (1978) reported that the constituents like water, total sugars, soluble sugars, proteins, crude fiber and minerals are efficiently consumed by silkworm larvae.

Total carbohydrate. Results of carbohydrate content in mulberry leaves are presented in Table 2 and Fig. 2. Highest carbohydrate content was observed in Koksu-21 tender (18.68), followed by Ichinose tender (16.98%) and Goshoerami tender (14.48%) which declined gradually within increasing growth periods. More photosynthetic products to upper leaves can be related to the higher carbohydrate composition in the tender (upper leaves) than lower leaves and its depletion can be attributed to genotypic character of matured leaves. Current results are in conformity with the results obtained by (Lokesh *et al*., 2012; Murthy *et al.*, 2013) who reported that the tender leaves of mulberry contain more carbohydrate content than medium and coarse textured leaves.

RESULTS AND DISCUSSION

Table 1: Protein content (%)in leaves of different mulberry varieties.

Leaf Stage	Mulberry varieties			
	Goshoerami	Koksu-21	Ichinose	**Mean**
Tender	28.93	27.58	23.96	**26.82**
Medium	25.49	24.58	23.68	**24.58**
Coarse	21.29	20.36	18.87	**20.18**
Mean	**25.24**	**24.17**	**22.17**	

C.D ($p \leq 0.05$)

Varieties = 0.0143

Leaf type = 0.0143

Varieties × leaf type = 0.025

Table 2: Carbohydrate content (%) in leaves of different mulberry varieties.

Leaf Stage	Mulberry varieties			
	Goshoerami	**Koksu-21**	**Ichinose**	**Mean**
Tender	14.48	18.68	16.98	16.713
Medium	13.93	16.25	16.66	15.613
Coarse	12.66	15.8	14.83	14.430
Mean	**13.69**	**16.91**	**16.16**	

C.D ($p \leq 0.05$)

Varieties = 0.1043

Leaf type = 0.1043

Varieties × leaf type = 0.181

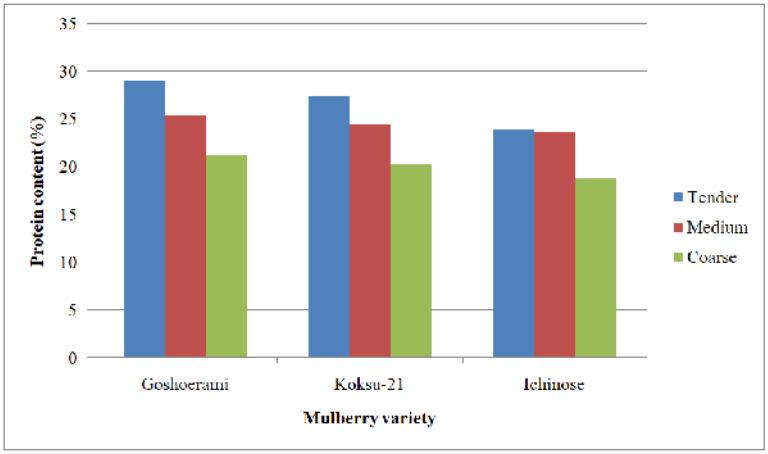

Fig. 1. Graphical representation of total protein content in different leaf varieties of mulberry.

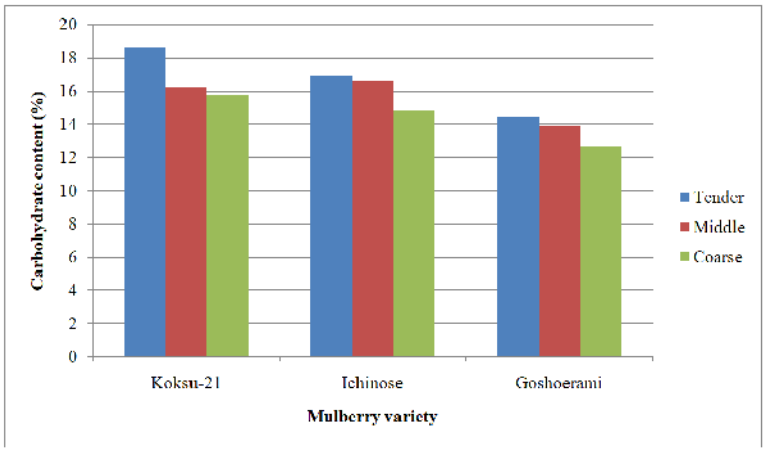

Fig. 2. Graphical representation of carbohydrate content in different leaf varieties of mulberry.

CONCLUSION (Provide)

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Conflict of Interest. None.

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