International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 2087-2090

Received: 26-03-2019
Accepted: 28-04-2019

DK Hadimani
Department of Sericulture, College of Agriculture, Bheemarayanagudi, UAS Raichur, Karnataka, India

J Ashoka
Department of Agricultural Entomology, UAS, Raichur, Karnataka, India

A Ravikumar
Farm Superintendent, Agricultural Reasrch Station. Hagari, Karnataka, India

Shyamrao Kulkarni
Department of Agronomy, College of Agriculture, Bheemarayanagudi, Karnataka, India

B Arunkumar
Department of Genetics & Plant Breeding, College of Agriculture, Bheemarayanagudi, Karnataka, India

DG Satihal
Farm Superintendent, Agricultural Reasrch Station, Bheemarayanagudi, Karnataka, India

Correspondence
DK Hadimani
Department of Sericulture, College of Agriculture, Bheemarayanagudi, UAS Raichur, Karnataka, India

Investigation on biochemical constituents of different mulberry genotypes under drip irrigation

DK Hadimani, J Ashoka, A Ravikumar, Shyamrao Kulkarni, B Arunkumar and DG Satihal

Abstract
Quality of mulberry leaves plays an important role in growth, development and cocoon yield of silkworm *Bombyx mori* L., besides biotic, abiotic factors and technology adoption. It is a fact that different genotypes perform differently in varied condition that in turn influence on the quality of cocoon production. To know the performance of mulberry genotypes with respect to biochemical composition, a field experiment was conducted in North Eastern dry zone of Karnataka, involving eighteen mulberry genotypes *viz*., TG, English Black, MR2, V-1, S-54, OPH-1, S-36, M-5, Viswa (DD), TR-8, RFS-175, BR-8, S-1635, Vishala, *Morus multicaulis*, TR-10, Mysore Local and S-41 under drip irrigation during 2014-15 at Agriculture Research Station, Bheemarayanagudi. The data were analyzed for bio-chemical constituents like total soluble proteins, carbohydrates, starch, chlorophyll and total soluble sugars. Among the different leaf constituents, total soluble proteins, carbohydrates, starch and total soluble sugars were found significantly higher in V-1 mulberry leaves followed by S-36 and Vishala mulberry leaves. However, these bio-chemical constituents were recorded lower in TG mulberry leaves. While the chlorophyll – a, b and total chlorophyll contents were recorded significantly higher in V-1 mulberry leaves followed by S-36 and M-5 mulberry leaves. Whereas the minimum chlorophyll - a, chlorophyll – b and total chlorophyll content was noticed in TG mulberry leaves. Thus from the present study, it is concluded that V-1 mulberry genotype grown under drip irrigation is the best among the eighteen mulberry genotypes followed by S-36 and M-5 in respect of considered biochemical constituents.

Keywords: Mulberry, genotypes, biochemical constituents, drip irrigation

Introduction
Silkworm *Bombyx mori* L. growth, development and cocoon yield are mainly influenced by nutritional quality of mulberry leaf used as feed. Nutritive value of mulberry (*Morus* spp.) leaf is a key factor besides biotic, abiotic factors and technology adoption for better management of silkworm rearing. It is a fact that leaf quality differs among mulberry genotypes which in turn responsible for the difference in silkworm rearing performances. Among the various factors influencing silkworm growth and leaf quality plays a major role. Quality of mulberry leaf was highly influenced by genotypes, cultivation practices, preservation techniques, age and position of leaf and moisture content. Higher moisture content of mulberry leaves has a direct effect on growth and development of silkworm larvae by favouring the ingestion, digestion and assimilation of nutrients. Mulberry leaves containing more water, total sugar and soluble carbohydrate and less mineral are best relished by silkworms. Nutritive requirement of silkworm larvae vary with the maturity of leaves fed. Chawki silkworms required leaves of high moisture content as it is easy to digest and late age silkworms required mature leaves with less moisture content as late age silkworms have the strength to digest mature leaves. On the other hand too much mature leaves do not contain sufficient bio-chemicals and moisture content is not suitable to silkworm larvae.

It derives all the essential nutrients from the mulberry leaf for its growth and development. The silkworm is a kind of very efficient bio-reactor for protein synthesis just like yeast in fermentation industry. Therefore, the nutrition of the silkworm is of due importance not only for the maintenance of its life but also for both seed and silk production. Hence, the silkworm should be fed with good quality mulberry leaves in optimum quantity for the successful cocoon production. The various factors responsible for successful cocoon harvest are mulberry leaf (38.20%), climate (37.00%), rearing techniques (9.30%), silkworm race (4.20%),

silkworm seed (3.10%) and other factors (8.20%) (Miyashita, 1986). Thus, the mulberry leaf quality plays a predominant role in healthy growth of silkworm. Keeping in view, the importance of nutritional value of mulberry leaves, present study aims to evaluate better performing mulberry genotypes through quantitative estimation of biochemical parameters and identify the well suited mulberry variety to different agro climatic conditions.

Material and Methods

The field experiment was conducted at Agricultural Research Station Bheemarayanagudi under University of Agricultural Sciences Raichur (Karnataka State) during 2014-15. The investigation was initiated in an established mulberry garden having eighteen mulberry genotypes *viz*., TG, English Black, MR2, V-1, S-54, OPH-1, S-36, M-5, Viswa (DD), TR-8, RFS175, BR-8, S-1635, Vishala, *Morus multicaulis*, TR-10, Mysore Local and S-41 under drip irrigation. The experiment was laidout in randomized complete clock design (RCBD) in two replications with a spacing of 3′ X 3′. The bio-chemical constituents of different mulberry genotypes on total soluble protein (%), carbohydrates (%), starch (%), total soluble sugars (%), chlorophyll-a (mg/g), chlorophyll-b (mg/g) and total chlorophyll-a (mg/g) 60 days after pruning (DAP) were recorded. The collected leaf samples were dried in an oven at 70°C until constant weight was obtained. The total soluble protein was estimated as per procedure of Lowry *et al*. (1951) [9], carbohydrate as per Dubios *et al*. (1956) [7], starch as per Mc Cready *et al.* (1960) [10], chlorophyll as per Hiscox and Israelestam (1979) and total soluble sugar was estimated by Calorimetric method *i.e.*, Phenolsulphuric acid method (Dubios *et al*., 1956) [7]. The experimental data on leaf qualitative parameters were statistically analyzed with simple CRD (Cochron and Cox, 2000) [5].

Results and Discussion

The leaf qualitative parameters pertaining to eighteen mulberry genotypes *viz*., TG, English Black, MR2, V-1, S-54, OPH-1, S-36, M-5, Viswa (DD), TR-8, RFS175, BR-8, S-1635, Vishala, *Morus multicaulis*, TR-10, Mysore Local and S-41 are presented in Table 1 and 2.

Total soluble protein (%)

The total soluble protein content among the mulberry genotypes differed significantly and being found highest in V-1 mulberry leaves (24.13%) followed by S-36 (23.98%) and Vishal (22.54%). However minimum soluble protein content of 20.18 per cent was recorded in TG mulberry leaves (Table 1). The variations in the protein content of the leaves of different genotypes and stages might be due to activities of enzymes like peroxidase and superoxide dismutase. The present findings are also in harmony with Ramachandra *et al.* (2008) [12] who reported that significantly higher soluble protein content was recorded in V-1 genotype compared to all other genotypes. Similarly, Bose and Bindroo (2001) [2] reported that Chak majra variety had highest water soluble protein, crude protein and total free amino acids compared to other genotypes.

Carbohydrates (%)

Among mulberry genotypes, V-1 mulberry leaves recorded higher carbohydrate percentage (24.12 %) followed by S-36 (23.36 %) and Vishala (22.87 %).whereas minimum of 19.84 per cent was registered in TG mulberry leaves (Table 1). Chakravorty *et al*. (2006) [3] who reported that TR 10 variety showed best results for carbohydrate content along with other biochemical contents like crude proteins, total free amino acids, crude fibre, total chlorophyll, lipid and ß-sterols compared to other genotypes.

Starch (%)

Maximum starch content was recorded in V-1 mulberry leaves (12.54%) followed by S-36 (12.11%) and Vishala mulberry leaves. However, minimum starch content was found in TG (9.60%) mulberry leaves (Table 1). These findings are comparable with those of Sinha *et al.* (2003) [13], who reported that S1635 recorded as best variety followed by SV1 and JRH in respect of the biochemical constituents.

Total soluble sugar (%)

V-1 mulberry leaves recorded maximum total soluble sugar content (14.02 %) followed by S-36 (13.01 %) and Vishala (12.87%) mulberry leaves. While it was minimum in TG (10.08%) mulberry leaves (Table 1). These observations are comparable to the results of Bose and Bindroo (2001) [2], who reported that Chinese variety which has higher sugars, starch and total carbohydrate contents compared to other genotypes.

Chlorophyll (mg/g)

The chlorophyll – a, chlorophyll – b and total chlorophyll contents were recorded significantly higher in V-1 mulberry leaves (1.556 mg/g, 0.731 mg/g and 2.278 mg/g) followed by S-36 (1.520 mg/g, 0.504 mg/g and 2.024 mg/g) and M-5 (1.515 mg/g, 0.471 mg/g and 2.018 mg/g mulberry leaves. Whereas the least chlorophyll – a, chlorophyll – b and total chlorophyll contents was recorded in TG (1.210 mg/g, 0.321 mg/g and 1.535 mg/g) mulberry leaves (Table 2). These findings are in harmony with Tangamani and Vivekananda (1984) who observed that higher chlorophyll ‘a’ and ‘b’ contents in both MR2 (0.903 and 0.488 mg/g) and Japanese genotypes (0.861 and 0.473 mg/g).

Thus from the present study, it is concluded that V1 mulberry variety grown with drip irrigation is the best among the eighteen mulberry genotypes followed by S-36 and M-5 in respect of considered biochemical constituents. Apart from the chemical constituents, various morphological, physiological and biochemical characters of the plant will have influence on the quality of the leaves. Hence, bio-assay studies should be done for the better understanding the quality of mulberry leaves.

Table 1: Biochemical parameters of mulberry genotypes

Sl. No.	Mulberry Genotypes	Total soluble protein (%)	Carbohydrates (%)	Starch (%)	Total soluble sugar (%)
1	TG	20.18	19.84	9.60	10.08
2	English Black	22.17	21.98	11.25	11.87
3	MR-2	21.16	21.58	10.57	11.51
4	V-1	24.13	24.12	12.54	14.02
5	S-54	22.54	21.71	12.01	11.47
6	OPH-1	21.48	22.97	11.61	12.02
7	S-36	23.98	23.36	12.11	13.01
8	M-5	22.85	22.84	11.84	12.14
9	Viswa (DD)	22.01	21.46	9.54	10.18
10	TR-8	21.61	22.65	9.80	10.14
11	RFS-175	20.78	20.45	9.87	11.22
12	BR-8	21.22	21.54	10.41	11.98
13	S-1635	21.85	21.82	10.21	11.03
14	Vishala	22.54	22.87	12.15	12.87
15	*Morus multicaulis*	21.85	22.45	10.59	11.07
16	TR-10	22.04	22.45	9.62	11.11
17	Mysore local	20.89	20.98	9.84.	10.10
18	S-41	21.24	21.45	11.12	12.03
F - test		*	*	*	*
S.Em ±		0.610	0.571	0.127	0.177
CD at 5 %		1.810	1.657	0.501	0.498

Note: *Significant at 5%

Table 2: Leaf chlorophyll content of mulberry genotypes

Sl. No.	Mulberry Genotypes	Chlorophyll- a (mg / g)	Chlorophyll – b (mg / g)	Total chlorophyll (mg / g)
1	TG	1.210	0.321	1.535
2	English Black	1.386	0.451	1.837
3	MR-2	1.510	0.401	1.901
4	V-1	1.556	0.731	2.278
5	S-54	1.512	0.409	1.922
6	OPH-1	1.501	0.500	2.024
7	S-36	1.520	0.504	2.021
8	M-5	1.515	0.471	2.018
9	Viswa (DD)	1.201	0.317	1.525
10	TR-8	1.302	0.471	1.864
11	RFS-175	1.325	0.438	1.720
12	BR-8	1.298	0.327	1.601
13	S-1635	1.210	0.326	1.536
14	Vishala	1.478	0.347	1.821
15	*Morus multicaulis*	1.254	0.410	1.652
16	TR-10	1.351	0.452	1.654
17	Mysore local	1.212	0.358	1.552
18	S-41	1.379	0.327	1.711
F - test		*	*	*
SEm ±		0.031	0.023	0.032
CD at 5 %		0.073	0.045	0.095

Note: * Significant at 5%

References

1. Abdullaev AK, Aliev MO, Gusejnova PA, Mammudbekova NI. Chemical analysis of fodder qualities of the leaves of promising mulberry genotypes in the conditions of the Karabah area. Azerb. SSR Elmler. Akad. Heberler. Biol. Elmer. Ser. 1966; 1:36-43.
2. Bose PC, Bindroo BB. A comparative biochemical study of seven promising mulberry (*Morus alba* L.) genotypes under rainfed conditions of sub-tropical region. Indian Journal of Sericulture. 2001; 40:171-173.
3. Chakravorty R, Neog K, Sinha USP, Goswami BC, Hazarika LK. Comparative study on the nutritive value of thirteen mulberry genotypes at different maturity stages. Indian Journal of Agricultural Chemistry. 2006; 34(1):1-11.
4. Chinnaswamy KP, Gajanana GN, Arunakumar YS, Bhagyaraj DJ, Seenappa K. Sustainable Rainfed Sericulture. Swiss Agency for Development Co-operation (SDC) India, Seri Programme Unit Bengaluru, 2006, 171.
5. Cochron and Cox. Experimental Design-Procedures for the Behavioural Sciences, Cole Publishing Company, 2000, 319-380.
6. Dandin SB, Giridhar K. Hand Book of Sericulture Technologies. Central Silk Board. 2010, 427.
7. Dubios SM, Giller KA, Hamilton JK, Lehros PA, Smith F. A colorimetric method of estimation of sugars and related substances, Analytical Chemisrty, 1956; 28:350-356.

8. Hiscox JD, Israelstam GF. A method for the extraction of chlorophyll from leaf tissue without maceration. Canadian Journal of Botany, 1979; 57:1332-1334.
9. Lowry OH, Rosebrough N, Farr A, Randall R. Protein measurement with Folin phenol reagent, Journal of Biological Chemistry, 1951; 193:265-275.
10. Mc cready RM, Guggole J, Silveria V, Owens HS. Determination of starch and amylase in vegetables. Application to Peas. Analytical Chemistry, 1960; 29:1156-1158.
11. Miyashita Y. A report on mulberry cultivation and training methods suitable to bivoltine rearing in Karnataka, 1986, 1-7.
12. Ramachandra YL, Padmalatha RAIS, Sudeep HV, Sujan Ganapathy PS, Kavitha BT, Krishna Murthi NB. Evaluation of leaf quality at different growth stages and maturity levels of selected mulberry genotypes. Environment and Ecology, 2008; 26(1A):272-276.
13. Sinha USP, Neog K, Rajkhowa, Chakravorty R. Variations in biochemical constituents in relation to maturity of leaves among seven mulberry genotypes. Sericologia, 2003; 43(2):251-257.
14. Tangamani R, Vivekananda M. Physiological studies and leaf nutrient analysis in the evaluation of best mulberry variety. Sericologia, 1984; 24:317-324.