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NOTE

Chemical Analysis of a Fodder Tree Leaves (*Terminalia tomentosa*)

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Protein, crude protein, ether extract, crude fibre, ash, insoluble silica, carbohydrate, sugars, reducing sugars, minerals, trace elements and amino acids were found in the leaves of the plant.

Key Words: *Terminalia tomentosa*, **Protein, Carbohydrate, Amino acids.**

Terminalia tomentosa[1] (synonym *T. coriacea* Wight and Arn), belongs to Combretaceae family. It is a large deciduous tree, grows in moist soil and it sheds leaves; generally they are lopped for fodder. The fodder tree leaves were collected from Kotdwara (foot-hill of Garhwal Himalaya) tri-monthly and analyzed chemically for nutritive value. Protein was analyzed by micro-Kjeldahl procedure[2]. Plant material was defatted with solvent ether and was macerated with 5 mL absolute alcohol (80%). The extract was filtered and four volumes of acetone were added to it. After keeping it in an upright position two layers appeared separately. The upper layer was used for the analysis of free amino acids[3, 4]. Qualitative and quantitative estimations of free amino acids were done by paper chromatography and spectrophotometer method[5, 6]. The solvent systems used for the development of chromatogram[7] were *n*-butanol-acetic acid-water (4 : 1 : 1) (v/v) and *n*-butanol-acetic acid-pyridine-water[8] (15 : 3 : 10 : 12). Developed and dried chromatograms were sprayed with 0.1% solution of ninhydrin. The concentration of eluted complex was determined by spectrophotometer at 570 nm. Estimation was carried out by comparing the colour intensity of the unknown with that of the known (standard) and thus concentration was determined. Carbohydrates[9] are first hydrolyzed into simple sugar using dilute hydrochloric acid. In hot acidic medium, glucose is dehydrated to hydroxymethyl furfural. This compound forms with anthrone a green coloured product with an absorption maximum at 630 nm. The complete extraction of sugars from plant materials without solubilizing polysaccharides and proteins and dissolving other interfering substances was accomplished by 80% ethanol[10]. Extraction was performed by means of a soxhlet. The sugar solution was then heated in a water bath and centrifuged. The sugar solution gave blue-green colour with anthrone reagent. Its intensity was determined by spectrophotometer at 760 nm. Benedict's quantitative reagent method was used for the estimation of reducing sugars[11]. Analysis of minerals was done by following the methods described by Misra[12]. Iron content was determined by using 2,2′-dipyridyl reagent, copper by cupron reagent, manganese by formaldoxime reagent and zinc by quinaldinic acid. Vitamin A was determined by antimony trichloride reagent[13] and vitamin C was determined by using 2,4-dinitrophenyl hydrazine (DNPH) reagent[9].

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From Table-1, it is found that the amounts of crude protein (19.33%), ether extract (5.07%), crude fibre (15.90%), insoluble silica (2.43%), calcium (3.78%), phosphorus (1.07%), potassium (1.65%) and reducing sugars were high in the month of March in comparison to other months. Magnesium, iron and non-reducing sugars were high in December, while ash carbohydrates and sugar contents were more in December and September, respectively. Concentration of copper was same for nine months and then decreased in winter months, while the amounts of manganese and zinc remained constant for six months and then decreased from September and December, respectively. Vitamins A and C were also detected in the leaves of the fodder plant with fluctuations in concentration. The lowest values of crude protein, ether extract, crude fibre, ash, silica, calcium, phosphorus, potassium, copper, zinc, reducing sugars and vitamin A were found in the month of December. Thus, it was concluded that the plant can be exploited as a fodder in the month of March followed by September.

TABLE-1
CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF *T. TOMENTOSA*

Percentage on dry matter basis	March	June	September	December
Crude protein	19.33	17.65	18.43	15.35
Ether extract	5.07	4.15	4.49	2.75
Crude fiber	15.90	15.32	14.62	13.43
Ash	9.05	10.36	11.27	8.00
SiO_2	2.43	2.02	1.35	1.33
Calcium	3.78	3.08	3.47	2.21
Phosphorus	1.07	1.00	0.94	0.85
Magnesium	1.30	1.77	1.10	1.84
Potassium	1.65	1.42	1.50	1.36
Iron	0.058	0.04	0.038	0.060
Copper	++	++	++	+
Manganese	+++	+++	++	++
Zinc	+	++	++	+
Carbohydrates	32.20	35.52	36.66	33.58
Sugars	3.22	3.48	3.57	3.44
Reducing sugar	1.96	1.88	1.72	1.66
Non reducing sugar	1.26	1.60	1.85	1.78
Vitamin A	++	++	++	+
Vitamin C	+++	++	+++	++

+: In traces, ++: Moderate amount, +++: Good amount.

Table-2 shows amino acid composition of the leaves of *T. tomentosa*. Twelve amino acids in March, thirteen in June and September and fourteen in December were detected and quantitatively reported. Highest concentration of histidine (1.75), arginine (0.85), alanine (1.30), tyrosine (1.60), methionine (0.32), phenylalanine (0.92), isoleucine (0.30) and leucine (0.32) was found in September, followed by cystine (1.75), lysine (0.50) and serine (1.00) in March and glycine (0.90), proline (0.65) and valine (in trace) in the month of December. The quantity of amino acids in the month of June was very poor; it may be due to shedding period of the plant.

TABLE-2
AMINO ACID COMPOSITION OF *T. TOMENTOSA*

Amino acids (mg/100 g) on dry matter basis	March	June	September	December
Cystine	1.75	0.20	0.95	0.66
Histidine	0.75	0.95	1.75	0.35
Lysine	0.50	0.30	+++	0.22
Arginine	0.25	0.50	0.85	0.70
Serine	1.00	0.45	0.18	0.56
Glycine	0.20	0.40	0.80	0.90
Alanine	0.15	0.24	1.30	+++
Proline	+	++	0.24	0.65
Tyrosine	++	0.40	1.60	0.12
Valine	—	—	—	+
Methionine	0.21	0.18	0.32	0.10
Phenylalaine	0.48	0.72	0.90	0.20
Isoleucine	0.26	0.28	0.30	+++
Leucine	—	0.27	0.32	+

—: not detected, +: in traces, ++: moderate amount, +++: good amount.

Conclusion

The fodder tree leaves can provide a range of nutrients required by the animals for maintenance, growth, production and reproduction. The best time to use the plant as a fodder is March followed by September. Besides a good fodder, its bark yields tannin and wood is used for construction work, packing-cases, plywood and tea-chests; therefore it has economic value too. Since the nutritive value of the leaves is good, therefore it can be put in the list of selected indigenous fodder tree species for plantation and propagation.

REFERENCES

1. U. Singh, A.M. Wadhwani and B.M. Johri, Dictionary of Economic Plants in India, ICAR Publication, New Delhi, p. 227.
2. R.B. Bradstreet, Kjeldahl Method of Organic Nitrogen, Academic Press, New York-London (1965).
3. T.M. Hais and K. Mecek, Paper Chromatography, Academic Press, New York (1963).
4. E.A. Bell and A.S.L. Tirimanna, *Biochem. J.*, **97**, 104 (1968).
5. J.G. Heathcoate and R.J. Washington, *Analyst*, **92**, 627 (1967).
6. G.S. Rajwar, V.K. Tiwari, S.K. Gupta, G.S. Rawat and D.N. Joshi, *Phillip. J. Sci.*, **109**, 37 (1980).
7. L.J. Reid, *J. Biochem.*, **183**, 451 (1950).
8. M.P. Dark, J.W. Giffer, D.A. Johnson and V.L. Keying, *J. Am. Chem. Soc.*, **79**, 1395 (1952).
9. S. Sadasivam and A. Manickam, Biochemical Methods, 2nd Edn., New Age International (P) Limited, p.34.
10. Official Methods of Analysis, 10th Edn., Assoc. Office Agr. Chemists, Washington, D.C. (Section 6.075) (1965).
11. D.T. Plumer, An Introduction to Practical Biochemistry, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, p. 114.
12. R. Misra, Ecology Work Book, Oxford & IBH Publishing Co., New Delhi (1968).
13. M.A. Joslyn, Methods in Food Analysis, 2nd Edn., 745, Academic Press, NY, p. 745 (1970).

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