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Determination of Chemical Components of *Memecylon umbellaltum* Burm. - A Medicinal Plant, Karnataka, India

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Abstract: *Memecylon umbellatum* Burm. has been being used not only for treatment of diseases but also for other uses since time immemorial. The different parts of the plant have been used for the preparation of the herbal products which are used orally or for external applications. The leaves of the *M. umbellatum* which have been collected from Koppa and Bannerghatta are subjected for analysis of proximates, micro, macro and toxic elemental composition. The young and mature leaves are separately analyzed. The study reveals that moisture, carbohydrate and crude protein content are the dominant factors in both the young and mature leaf samples. Whereas, crude fat was followed by ash and crude fiber in both young and mature leaf samples of Koppa and in case of Bannerghatta samples crude fat was followed by crude fiber and ash. However, the young leaves are more nutrient than that of mature in both the cases. Among the macronutrients K was dominant which is followed by Ca, Mg, Na and P in both young and mature leaves of Koppa whereas in case of Bannerghatta samples K was followed by Ca, Mg, P and Na, in young leaves but in mature leaves Ca was followed by K, Mg, Na and P in their concentrations. The Fe was highest among the micronutrients of both young and mature leaves of Koppa and Bannerghatta samples. Fe was followed by Mn, Cu and Zn in case of Koppa samples whereas Fe was followed by Mn, Zn and Cu in young leaves and Fe was followed by Mn, Cu and Zn in mature leaves sample of Bannerghatta. There was a significant variation of Cu among the different leaf samples of Koppa and Bannerghatta samples. The Pb content of the young leaves of Koppa is higher than that of Bannerghatta samples and mature leaves of Bannerghatta samples recorded high values of Pb than that of Koppa samples. Between the 2 toxic elements Pb was higher than that of Cd and the mature leaves of both Koppa and Bannerghatta samples recorded lowest concentration of Cd. The results were subjected for statistical analysis.

Key words: Proximate analysis, elemental composition (macro, micro and toxic), medicinal plants of Karnataka, India, *Memecylon umbellatum* Burm.

INTRODUCTION

Memecylon umbellatum Burm. belongs to the family Melastomaceae is a small handsome tree, the local name is Adachare and the English name is Iron-wood tree. The infusion of leaves is used in the treatment of gonorrhoea and leucorrhoea (Nadakarni, 1976; Kirtikar and Basu, 1991). The paste of leaves is used in the treatment of herpes (Maruthi *et al.*, 2000). The decoction of the roots is used for the treatment of menorrhagia and the preparation from the bark for the treatment of bruises (Nadakarni, 1976). The seeds are used to cure cough and sedative (Balakrishna Gowda, 2004). The leaf powder is used for the treatment of diabetes (Ayyanar *et al.*, 2008). It has hypoglycemic effect in normal and alloxan diabetic mice (Amalraj and Ignacimuthu, 1998). Ram Rastogi and Mehrotra (1991) isolated and characterized the umbellactone -β-amyrin, sitosterol, its glycoside, olenalic and ursolic acids. The first and foremost important use of this tree is the protection of hilly slopes, from which other trees have been removed. The ripe berries of Anjan are edible, are eaten in time of famine and they are quite safe. The leaves have for long been employed in India in the dyeing industry to dye wool, silk and even grass mats can be nicely dyed. The leaves used in conjunction with myrobalans give a deep red colour and when used with tin mordant yield a yellow colour if no mordant is used, they produce light brown colour (http://rajbhavankolkata.gov.in/pdf/occasional%20paper5.pdf). In the present study, an attempt has been made to determine the proximates (ash, moisture, crude fat, crude fiber, crude protein and carbohydrate), nutritive value, macro, micro and toxic elemental composition of young and mature leaves of *M. umbellatum* of different regions of Karnataka.

MATERIALS AND METHODS

Plant collection: The leaves were collected from Bannerghatta and Koppa, Karnataka, India (Map). The mature and young leaves were collected separately. The plant was identified and classified by using taxonomic literature (Flora of British India (Hooker, 1894). Flora of Presidency of Madras (Gamble, 1928), Flora of

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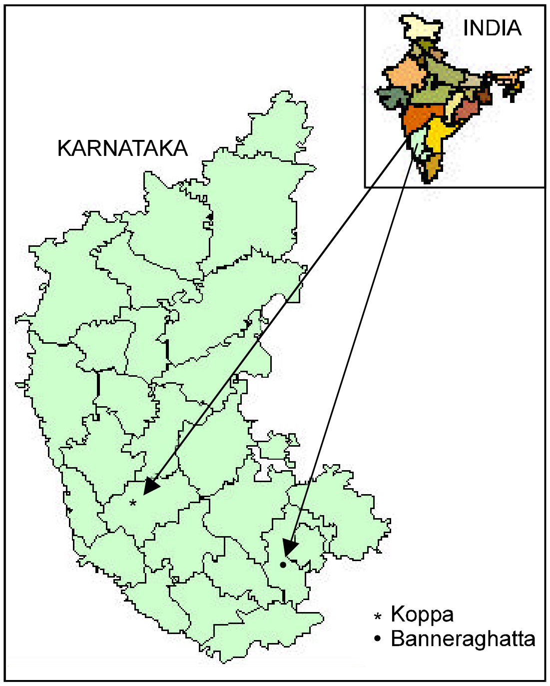

Map: Showing the study area

Davanagere District (Manjunath *et al.*, 2002), Flora of Bangalore District (Ramaswamy and Razi, 1973), Flora of Chikmagalore District (Yoganarasimhan *et al.*, 1982), Compendium of Indian Medicinal plants (Ram Rastogi and Mehrotra, 1991), Flora of Presidency of Bombay (Theodore Cooke, 1903), The Forest Trees of Travancore (Bourdillon, 1908), Flora of South Indian Hill Stations (Fyson, 1932), Flora of Coorg (Kodagu) (Keshava Murthy and Yoganarasimhan, 1990), Flora of Hassan District (Cecil Saldanha and Dan Nicolson 1976). The voucher specimens are deposited as herbarium in the Department of Applied Botany, Kuvempu University.

Sample preparation: The collected leaves were first washed thoroughly 2-3 times with running tap water and once with sterile water and in alcohol to remove the dust particles, then they are shade dried, powdered and stored in airtight bottles for further investigation.

Proximate analysis: The proximate analysis (moisture, ash, crude fat, crude fiber, crude proteins and carbohydrates) and nutritive values of both the samples were determined and calculated by following the methods of Indrayan *et al.* (2005). All the proximate values were reported in percentage and the nutritive values were expressed in cal/100 g.

Elemental analysis: The macro (P, K, Na, Ca and Mg), micro (Fe, Cu, Zn and Mn) and heavy metals (Pb and Cd) were analyzed by using atomic absorption spectrophotometer and flame photometer by following the procedures of Gali *et al.* (1999) in Central Coffee Research Institute, Balehonnur, Karantaka, India. The results were expressed in percent and ppm for macro, micro and heavy metals respectively.

Statistical analysis: Each experiment was repeated for three times. The results were represented with their means, standard deviation and standard error. The correlation matrix has been calculated.

RESULTS AND DISCUSSION

Proximate analysis: The result of proximate analysis shows variant concentration/proportions of biochemicals and other contents (Table 1). The percentage of moisture content was high in both mature and young leaf samples of Bannerghatta and Koppa. In case of percent of ash content, it was highest in both young and mature samples of Koppa while Bannerghatta sample had comparatively lesser composition. The percent of crude fat was more in young leaf sample of Bannerghatta and mature sample of Koppa. The crude fiber percent was more or less similar in both the samples of Bannerghatta and Koppa. The crude protein percent was highest in Bannerghatta samples than that of Koppa samples. The percentage value of carbohydrate was more in Koppa samples than Bannerghatta samples (Fig. 1). The results revealed that the young leaf samples of both Bannerghatta and Koppa had highest nutritive values when compared to mature leaf samples (Fig. 2).

Among the proximates, mature leaves of Bannerghatta recorded highest percentage of moisture, crude fiber and crude proteins, whereas, mature leaves of Koppa recorded highest percentage of ash and young leaves of Bannerghatta recorded highest percentage of crude fat. The nutritive values ranged between 174.33±0.629 and 218.83±1.010 cal/100g of mature leaves of Bannerghatta and young leaves of Koppa respectively (Fig. 2). When the results are subjected for correlation matrix and it is found that the carbohydrate is negatively significantly correlated with moisture and nutritive value is positively significantly correlated with carbohydrate (Table 2).

Among the components of nutritive value, the moderate values of protein suggests that its contribution to the formation of hormones and other metabolite which are required for the growth and development of plants and Mau *et al.* (1999) emphasized the contribution of low level of proteins to the formation of hormones which controls a variety of body functions such as growth, repair and maintenance of body proteins. According to Michael and David (2002), the ash content is useful in grading the plant material based on their mineral composition. However the leaf samples of *M. umbellatum* record low concentration of ash. Further the crude fat and carbohydrate content indicate the

Table 1: Average values of proximates [(moisture, ash, crude fat, crude fiber, crude protein and carbohydrate (in %) and nutritive values (in cal/100gm)] of *Memecylon umbellatum*

Place	Samples	Moisture	Ash	Crude fat	Crude fiber	Crude protein	Carbohydrate	Nutritive value
Koppa	Mature leaves	54.333±0.577	4.333±0.289	6.333±0.629	4.000±0.500	11.820±0.437	23.18±1.707	197.00±2.250
	Young leaves	47.667±0.289	3.667±0.289	4.833±0.144	2.667±0.289	13.087±0.343	30.75±0.497	218.83±1.010
Bannerghatta	Mature leaves	60.333±0.289	2.333±0.289	5.000±0.250	4.333±0.289	20.767±0.363	11.57±0.830	174.33±0.629
	Young leaves	56.667±0.289	1.333±0.289	7.000±0.500	2.667±0.289	13.627±0.430	21.37±0.529	203.00±3.905

±shows mean and standard error

Table 2: Correlation matrix of proximate parameters

	Moisture	Ash	Fat	Fiber	Protein	Carbohydrate	Nutritive value
Moisture	1						
Ash	-0.570	1					
Fat	0.268	-0.335	1				
Fiber	0.623	0.258	-0.216	1			
Protein	0.689	-0.439	-0.480	0.555	1		
Carbohydrate	-0.966*	0.483	-0.011	-0.720	-0.838	1	
Nutritive value	-0.915	0.272	0.073	-0.859	-0.806	0.974*	1

*Correlation is significant at the 0.05 level (2-tailed)

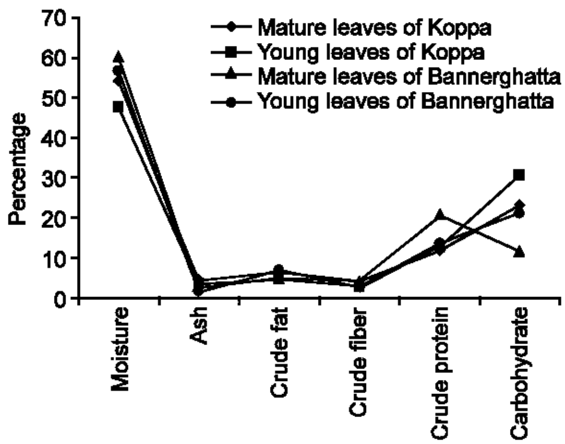

Fig. 1: Average values of components of nutritive value

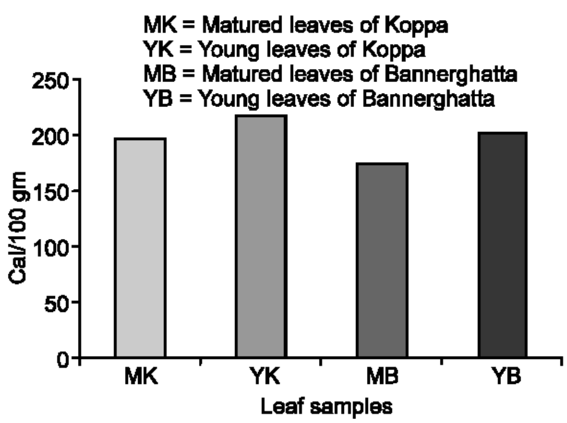

Fig. 2: Average values of nutritive value of Koppa and Bannerghatta

storage and transport of metabolic fuel and energy sources (Alli Smith, 2009). Indrayan *et al.* (2005) included leaves of *Artocarpus heterophyllus*, a medicinal plant based on their nutritive value and high sodium content under fodder. The nutritive value of leaves of *M. umbellatum* is higher than that of *Artocarpus heterophyllus*.

Elemental composition analysis: The average values of macro, micro, toxic elements are given in the Table 3. The K was dominant which is followed by Ca, Mg, Na and P in the leaf samples of Koppa. However in case of young leaves of Bannerghatta K was followed by Ca, Mg, P and Na and in case of mature leaves Ca was followed by K, Mg, Na and P (Fig. 3). The Fe was the dominant microelement which was followed by Mn, Cu and Zn in case of Koppa samples, where as in case of young leaf of Bannerghatta Fe was followed by Mn, Zn and Cu and in case of mature leaves Fe was followed by Mn, Cu and Zn (Fig. 4). The Pb was the highest toxic element in all the leaf samples of Koppa and Bannerghatta (Fig. 5). The correlation matrix of elemental composition reveals that major macroelements do not show any correlations, however among the microelements Fe shows positively correlation with K and Mg, Zn shows positively correlation with K, Mg and Fe and Mn showed positively correlation with K, Fe and Zn respectively (Table 4).
Among the macronutrients, Ca, P, Mg and N are required for repair of worn out cells, strong bones and teeth in humans, building of RBCs and for body mechanisms (WHO, 1996). Their absence in diet might result in weak, stunted growth and poor bone development (Edeoga *et al.*, 2006). Further, Indrayan *et al.* (2005) said that Na and K take part in ionic balance of the human body and maintain tissue excitability. Because of the solubility of salts, Na plays an important role in the transport of metabolites. The K is of importance as a diuretic. Indrayan *et al.* (2005) also mentioned the role of Ca and Mg and said that Ca constitutes a large proportion of the bone, human blood and extracellular fluid, it is necessary for the normal functioning of cardiac muscles, blood coagulation and milk clotting and the regulation of

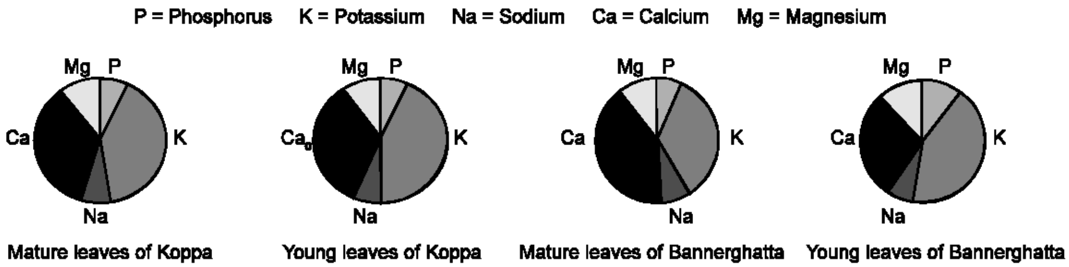

Fig. 3: Macronutrients (in %)

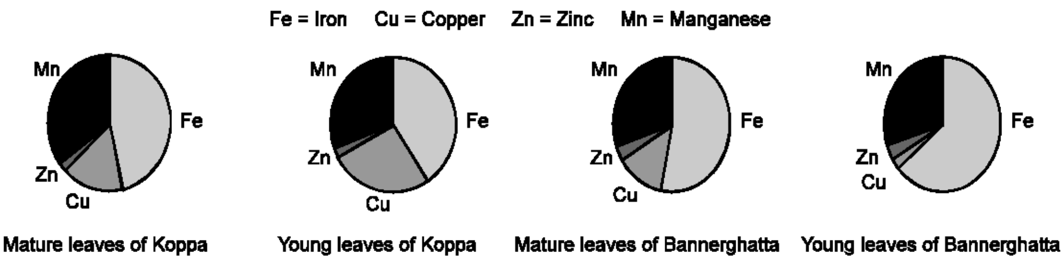

Fig. 4: Micronutrients (in ppm)

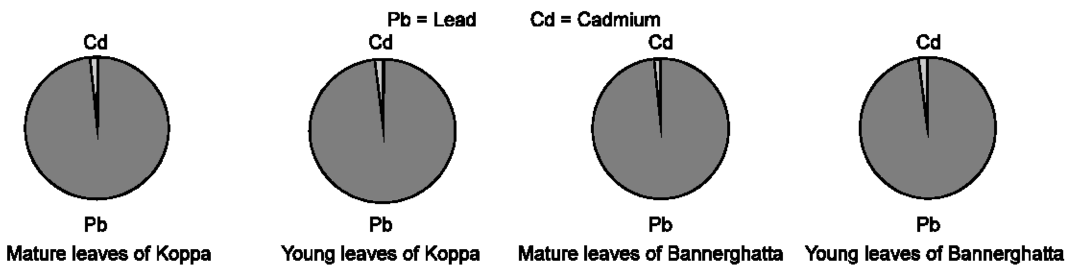

Fig. 5: Heavy metals (in ppm)

Table 3: Average values of elemental composition (macro (in %), micro (in ppm) and heavy metals (in ppm) of *Memecylon umbellatum*

		Macro elements					Micro elements				Trace elements	
Place	Samples	P	K	Na	Ca	Mg	Fe	Cu	Zn	Mn	Pb	Cd
Koppa	Mature	0.167±	1.044±	0.172±	0.901±	0.259±	570.63±	194.85±	29.500±	426.943±	52.923±	0.849±
	leaves	0.013	0.017	0.000	0.062	0.001	1.381	1.874	0.121	2.787	5.808	0.374
	Young	0.169±	1.044±	0.172±	0.835±	0.229±	464.80±	303.89±	25.443±	352.107±	66.420±	1.025±
	leaves	0.014	0.031	0.000	0.036	0.036	1.124	3.638	0.377	2.110	4.151	0.475
Bannerghatta	Mature	0.126±	0.720±	0.143±	0.840±	0.208±	278.78±	67.530±	17.840±	158.040±	68.903±	0.881±
	leaves	0.016	0.012	0.025	0.018	0.016	0.989	5.680	0.234	2.868	16.557	0.486
	Young	0.189±	0.755±	0.115±	0.514±	0.212±	300.29±	10.287±	16.767±	141.280±	55.373±	1.137±
	leaves	0.000	0.010	0.025	0.033	0.007	2.127	0.366	0.338	8.005	9.605	0.577

±shows mean and standard error

Table 4: Correlation matrix of elemental composition

	P	K	Na	Ca	Mg	Fe	Cu	Zn	Mn	Pb	Cd
P	1										
K	0.307	1									
Na	-0.199	0.872	1								
Ca	-0.600	0.567	0.891	1							
Mg	0.246	0.849	0.739	0.561	1						
Fe	0.269	0.950*	0.835	0.598	0.971*	1					
Cu	0.0490	0.907	0.914	0.666	0.591	0.760	1				
Zn	0.142	0.951*	0.902	0.701	0.950*	0.990**	0.808	1			
Mn	0.170	0.968*	0.906	0.685	0.936	0.989*	0.837	0.998**	1		
Pb	-0.697	-0.235	0.128	0.310	-0.568	-0.430	0.193	-0.311	-0.291	1	
Cd	0.707	-0.247	-0.610	-0.875	-0.493	-0.413	-0.245	-0.501	-0.457	-0.115	1

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed) cell permeability and Ca plays an important part in nerve-impulse transmission and in the mechanism of neuromuscular system, whereas, Mg is required for plasma and extracellular fluid and it helps in the maintenance of osmotic equilibrium. It is also a metabolic part of the enzyme and it is evident that when the lack of Mg is associated with abnormal irritability of muscle and convulsions and excess of Mg causes depression of central nervous system.

The role of micronutrients varies, Fe is found in all the samples and it is also an important element in the human body and plays a key role in oxygen and electron transport. Cu involves in Fe metabolism and its deficiency results in fragile bone cortices and spontaneous rupture of major vessels (Obiajunwa *et al.*, 2002). Mills (1981) said that Cu is a component of many enzyme systems such as cytochrome oxidase, lysyl oxidase and ceruloplasmin, an iron-oxidizing enzyme in blood. Zn is a component of many metalloenzymes, including some enzymes which play a central role in nucleic acid metabolism, Zn acts as a membrane stabilizer and stimulator of the immune response (Hambidge, 1978). Wang *et al.* (1996) and Calabrese (1981) said that high levels of essential elements such as Fe, Zn, Ca and Mn influence the retention of toxic elements in animals or human beings. Broyer *et al.* (1972) reported 2-6 mg/l of Pb in some plants, but Javid Hussain *et al.* (2009) reported very less amount of Pb in some plant species of Pakistan.

Conclusion: The proximate components, nutritive values, macro, micro and toxic elements of the leaves of different ages of the two regions of Karnataka, India have been determined. The results revealed that young leaves are more nutritive than mature leaves. The macro, micro and toxic elemental content also varied not only with respect to the regions of the plants where they grow, but also with their ages of the leaves. However, the leaf samples recorded low concentration of elemental components which is confirmed by recording low values of ash content. Though, all the leaf samples contained toxic elements, their values were in lowest concentrations. The study play an important role as the proximates and elemental composition influences the quality and the efficacy of the herbal products.

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