Macronutrient and Trace Element Content of Calyx and Bud of *Bombax buonopozense (P. Beav)*

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Abstract

Consumption of plants and vegetables as food items usually constitutes a means of supplementing for some essential elements that are part of the chemical components of the plants, in biosystems. The bud and calyx of Bombax buonopozense (P. Beav) plant used as food particularly in Nigeria were therefore analyzed for their elemental content using spectrophotometric methodology. Dry weight values of 820±0.4 mg/100g and 1320±0.2 mg/100g for K, and 130 ± 0.4 mg/100g and 100 mg/100g for Mg, were obtained for the bud and calyx of the bombax plant. Phosphorus level was about 70 mg/100g, while only Fe among the trace heavy elements studied showed an appreciable value of 6.6 mg/100g ash weight in the calyx sample. Zn followed with a value of 1.84 mg/100g; while Co had the lowest values in both plant parts. The calyx recorded the higher elemental concentration factors for the trace heavy elements compared to the bud sample. Zinc had the highest value of 19 followed by Cu (3.2) and then Co (2.2). This in general reflects the ease at which these elements were absorbed from the soil by the plant roots and transferred to these parts of the bombax plant. Bombax buonopozense (P. beav) has been shown here to have appreciably high elemental levels in the calyx and bud and could thus serve as good supplements for especially the micronutrients, and some trace elements when consumed as food.

Introduction

Schroeder (1973) states that essential elements may include those elements necessary for special purposes that provide perfect health but without which life can still exist at an unhealthy level. Elements that are necessary for biological functions and general well being of biosystems are thus considered to be essential (Schroeder, 1973; Underwood, 1977). Some of these elements are present in plants along with many other chemical compounds some of which are of medicinal importance to man. Consumption of some of these plants as food exposes man and animals to these compounds with an attendant hazard in some cases and benefits in other cases. *Bombax buonopozense* (*P. beav*) is found mostly in the Northern and middle areas of Nigeria.

In Traditional Medicine, the decoctions of the bark, leaves and flowers are employed for their emollient properties. Notably, a decoction of the young leaves in warm bath is used for febrile patients especially in children. An extract of the pounded bark is taken by women to increase lactation, and if drunk or rubbed on the head is said to cure dizziness (Dalziel *et al* 1937). As food, the calyx of the mucilaginous flower is utilized as a sauce in some parts of Africa. In Nigeria in particular, the powdered calyx is used for thickening of soup. Proximate analysis of the calyx of this plant has been carried out (Ochigbo, 1996). The macronutrient and some trace elemental content of the edible parts of the bombax plant is investigated here. Possible level of element uptake when the bud and calyx of *Bombax buonopozense* (P. Beav) are consumed as food is thus highlighted in this study.

Materials and Methods

Sample, sampling and sample preparation: The bud and calyx from the bombax plant were collected in the early months of 2002 in Jos, Nigeria, as the early part of the year is usually the flowering season of this plant. The flowers were removed and identified by Professor S.W.H. Husaini, of the Department of Botany University of Jos. The calices and buds were then removed and air-dried.

Determination of the ash content of *Bombax buonopozense:* The moisture, dry matter and ash contents of the bud and calyx samples of the bombax plant were determined following standard methods reported elsewhere (AOAC, 1984; Rodajevic and Bashkin, 1999).

Determination of the elemental content of the bombax samples: The metals in this study were determined by atomic absorption spectrometry as reported in AOAC (1984) and Ramirez-Munoz (1969). Atomic absorption spectrophotometer, Pye UNICAM SP 969 model, was used for the analysis. A portion, 0.5g, of each of the ashed bud and calyx samples was placed into 100 ml beakers, 30 ml 2M HCl were added and heated at 90°C over a hot plate for 1h. The solutions were cooled and filtered into 100 ml volumetric flasks. The residues were rinsed with distilled water and transferred into the volumetric flasks, and were then made up to the mark with distilled water. Elemental contents of the samples were determined at appropriate lamp current and wavelengths for each element by standard calibration method.

Phosphorus was determined by UV spectrometry using Pye SP 6 UV spectrometer at wavelength of 470 nm. The vanado-molybdo phosphoric acid method using potassium dihydrogen phosphate as the standard as reported in Ademoroti (1996) was used. Sulphur was determined by gravimetric method as SO_4 – S as reported in Vogel, (2000)

Results and Discussion

Respective ash contents of the bud and calyx samples of the bombax plant were found to be 6.1 and 6.7%, which reflects the level of mineral content of these plant parts. The moisture and dry matter contents were determined as 10.7% and 89.3% for the bud, and 20% and 80% for the calyx sample. The macronutrient and trace element contents of these samples are shown in Table 1.

Table 1: Elemental content of the bud calyx of *Bombax buonopozense* (*P. beav*)

Element	Concentration (mg/100g ashed weight)	
	Macronutrient Elements	
	Bud	**Calyx**
Ca	1.10±0.01	4.8±0.8
K	6200.11	1320±0.2
Na	110±±0.1	2.3±0.2
Mg	130±0.4	9700.1
P	60±0.2	70±0.007
S	4.2±0.01	2.3±0.7
	Trace Element	
Fe	1.30±0.05	6.6±0.1
Mn	0.5±0.1	1.5±0.6
Co	0.17±0.18	0.11±0.06
Cr	0.32	0.9±0.03
Cu	0.36±0.06	0.63±0.1
Zn	0.85±0.3	1.84±0.6

Both sample types were observed to have relatively high levels of the macronutrient elements. Particularly so are K and Mg which had respective ash weight values of 620 ± 0.11 and 1320 ± 0.2, and 130 ± 0.4 and 970 ± 0.11 mg/100g, These values are comparable to the values obtained for some medicinal plants used in Traditional medical practice in Nigeria (Ogugbuaja *et al*, 1997). The bombax bud and calyx, which are widely consumed in Nigeria as food plants could therefore constitute good supplements of these macronutrients to the biosystem. The calyx showed higher levels of the trace elements compared to the bud. Fe, in particular, had the highest value showing about five times its value as in the bud. The others, Zn, Mn and then Cr follow with about three times their levels as observed in the bud sample, and were thus noted to be significantly different ($p<0.05$).

Table 2 presents macronutrient element (and S) composition of parts of the bombax plant analyzed compared to the general range and critical concentration range in plants, and also to the range in the soil. It is observed that all the elements determined had values within the range in plants and below their critical concentration range in plants.

Table 2: Concentration of some heavy metals in the bud and calyx of Bombax buonopozense (*P. beav*) sample compared to levels in plants and soil

Element	Concentration, mg kg^{-1}	
	Bud	**Calyx**
Co	1.7	1.10± 0.6
Cr	3.2	9.0± 0.3
Cu	3.6	6.3 ± 1.0
Mn	5.0	15 ± 4
Zn	8.5	19 ± 6
	plants	**In Soil**
Co	0.02-1	0.5 – 65
Cr	0.03 - 14	5-1500
Cu	5-20	2- 250
Mn	20 - 1000	1 – 10000
Zn	1 -400	1-900
	In plants	
Co	15-50	
Cr	5-30	
Cu	20-100	
Mn	300 - 500	
Zn	100- 400	

[S 0.004 ± 0.0001 % 0.002 ± 0.0007 % 0.08 – 0.5%-0.03–4%]
**Concentration above which toxicity is likely (Adapted from Radojevic and Bashkin, 1999); 1. Values here converted to mg/kg from table 1 in mg /100g dry sample*

Elemental levels in plants usually indicate the elemental composition of the particular soil where the plants are grown. In some cases the plants adapt to the soil composition and can thus thrive in metal polluted soils. They may even adapt to become concentrators of particular elements (Harborne 1982). The rocky topography of Jos where the plant samples were obtained should generally contain high levels of the pertinent elements. Hence the recorded values of these elements in bombax plant studied could be traced to this observation.

Trace heavy metal pollutants accumulate in above ground tissues from the soil and transfer these into the food chain, thus constituting one of the environmental concerns of the present day. Apart from the phytotoxicity of many of the metals to the plant they are also harmful to man and animals (Radojevic and Bashkin, 1999). Harmfulness here though should be related to the level of the metals in the environment if above stipulated health values. Thus the elemental concentration factors of the bud and calyx of the bombax plant with the soil values are presented in Table 3.

Table 3: Concentration factor of some Minor Element (and S) in the Bud and Calyx of Bombax plant samples to the level in the soil

Element	Concentration Factor (CF)*	
	Bud	**Calyx**
Co	3.4	2.2
Cr	0.64	1.8
Cu	1.8	3.2
Mn	0.25	0.75
Zn	8.5	19
S	0.14	0.007

**CF = Element Conc. In Bombax sample/Element Min. Range Value in soil (these are generated from Table 2)*

Zinc had the highest concentration factor followed by Cu and then Co. These were not appreciably high in this instance but still indicated the rate at which these elements were absorbed from the soil and transferred to these parts of the bombax plant.

Conclusion: The bud and calyx of the *Bombax buonopozense* (P. Beav) have been shown to contain comparatively high elemental levels. These could thus serve as good supplements for especially the macronutrient elements and some trace heavy elements when consumed as food.

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