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Research Article

Determination of the Elemental content and Comparison of their concentrations in the Stem, Fruit and Leaf of *Detarium microcarpum Guill* and *Perr* Plant Samples from Nyibango – Ganye, Adamawa state, Nigeria

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Abstract

The fresh plant parts (stem bark, fruits and leaves) of *Detarium microcarpum* of *Caesalpinoideae* were collected from Nyibango – Ganye, Ganye Local Government Area of Adamawa State, Nigeria. These plant parts were air dried to constant weight and ten (10) grams each were burnt to ash in the furnace and digested. The presence and concentrations of chromium (Cr), manganese (Mn), magnesium (Mg), iron (Fe), copper (Cu), cobalt (Co), arsenic (As), nickel (Ni), lead (Pb), zinc (Zn) and cadmium (Cd) were determined, using Atomic Absorption Spectrometry (AAS). All the elements analyzed for were observed present in all the plant parts at various concentration levels, and the stem bark showed the lowest concentration of all the elements studied, while fruit had the highest concentrations of them respectively. The low concentration of the elements in the stem bark, especially of lead (Pb) at 0.43, 2.43 and 1.88 μgg^{-1} for stem bark, fruit and leaves shows that the consumption of the plant parts of this widely used medicinal herb, especially its fruit and stem bark has no health risk.

Keywords: elemental Content, Presence, Concentration, *Detarium microcarpum.*

INTRODUCTION

Medicinal plants, the wealth of all nations, used to fight against human and animal ailments is a thing that its importance cannot be over emphasized, even in the most developed nations of the world. Chitme *et al.,* 2003; Enzo, 2006; Reuben *et al.,* 2008, have reported that they have been used as the primary source of medicine in many rural areas of the world. They have been reported to be an important source of chemical compounds (Rizk and AL – Nowaihi, 1989).

Trace elements play an important role in health and disease. Macro – nutrients such as sodium, potassium and calcium regulate the fluid balance of the body and thereby influence the cardiac output and changes in their level result in hypertension (Karppanem, 1991; Sacks *et al.,* 1995). These mineral elements, most of which are present in medicinal plants have been known to have health benefits, and their deficiency and toxicity could cause some health hazards (U. S Food and Drug Administration, 1999). Their toxicity concentration in medicinal plants is of major concern. There is thus, the need to analyze medicinal plant parts that are used for medicinal purposes as they are usually administered

mostly by oral means to treat several human ailments. Therefore, this research is aimed at analyzing for the presence and concentration levels of some of these mineral elements, least their concentration levels exceeds the world health organization standards in medicinal herbs.

Detarium microcarpum Guill and *Perr*, synonym: *Detarium senegalence* Gmel, English name Tallo tree belong to the family *Caesalpinoideae* and tribe of *Detarieae*, related to *Copastera* (Arbonnier, 2004; Kouyate and van Damme, 2008. It is known as *Kwakuragwahiu* and *Taura* in Kilba and Hausa languages (Reuben and Jada, 2013). *D. microcarpum Guill* and *Perr* is a medicinal herb used widely in folk – low medicine with wide application in treatment of many human ailments throughout its distribution area, therefore, it deserves scientific research attention to know the concentration levels of some of these elements in its parts, especially those who's high concentration could cause a heath challenge (hazard) to its users.

MATERIALS AND METHODS

Sample Collection and Identification

Fresh samples of (leaves, stem and fruit) of *Detarium microcarpum Guill* and *Perr* were obtained from Nyibango, Ganye Local Gavernment Area of Adamawa State, Nigeria in July 2012 at longitude 8^{o} $31^{/}$ $15^{//}$ N and latitude 12^{o} $7^{/}$ $44^{//}$ E. the plant materials were authenticated by Peter Mnama and Patrick Boni of the departments of Basic Sciences and Forestry Technology of Adamawa State College of Agriculture Ganye, Nigeria. A voucher specimen with No. 072012L1F2 were deposited in the department of Forestry Technology of Adamawa State College of Agriculture Ganye, Nigeria. About 100g each of the leaves, fruits, and stem bark were collected for the research and thorough gabling of the stem bark was done to remove extraneous matter and adulterants to produce clean materials for the research.

Sample Preparation

The vegetable (leaves), clean and crushed (using wooden pestle and mortar) stem bark and pulp of the fruit (scraped using clean knife) were air dried at room temperature for seven days. Portions of these were taken again and dried in an oven at 80^{o}C for 72houres to a constant weight. The dry samples were digested by weighing 0.5g of the oven – dried, ground and sieve (< 1mm) into an acid – washed porcelain crucible and placed in a muffle furnace for four (4) hours at 500^{o}C. The crucibles were removed from the furnace and cooled. 10ml each of distilled water (H_2O), concentrated trioxinitrate (v), until their volume reduced to about 5ml as the heating continued. The beakers were removed from the hot plate and cooled. On cooling, another 10ml of $2MHNO_3$ and 30ml of distilled water were added, swirled and filtered into a 100ml volumetric flask and made up to the mark with distilled water Elemental Analysis (Radojevic, 1999)

The resulting solution from the parchloric acid digestion was used for the elemental analysis using flame atomic absorption Spectrometry (FAAS) with SPG Unicam model at appropriate wave length, temperature and lamp – current for the elements for the determination of Cr, Mn, Mg, Fe, Cu, Co, As, Ni,Pb, Zn and Cd respectively.

RESULT AND DISCUSSION

Figures 1 to 3 show the mean concentration of the elemental content in the stem bark, fruit and leaf of *Detarium microcarpum Guill* and *Perr* of *Caesalpinoideae* family and the tribe of *Detarieae* of plant. From the result of the study, all the metals studied were found present in all the plant parts at various concentration levels. The concentration of the metals ranged between 0.04 to 0.73 μgg^{-1} in the stem bark (Figure 1), 0.34 to 5.22 μgg^{-1} in fruit (Figure 2) and 0.43 to 4.32 μgg^{-1} in leaf (Figure 3) respectively. The result of the study also reveals that the metal concentrations in the stem bark plant sample are in the following order: Cd > Fe > Pb > Zn > Mn > Co > Cr, Mg and Ni > As > Cu, while in the fruit it is Ni > Cr > Zn > Pb > Mg > Fe > Cu > Mn > Co > Cd > As, and in the leaf, the order is:

Ni > Cr > Zn > Pb > Mg > Fe > Cu > Mn > Co > Cd > As respectively.

Note that nickel (Ni) appears highest in the fruits and leaf (6.44 and 4.32 μgg^{-1}), while lead (Pb) for both these plant parts ranked position four (4)(1.54 and 1.43 μgg^{-1}). Cadmium (Cd) ranked first in the stem bark, 0.73 μgg^{-1} and lead (Pb) the third 0.43 μgg^{-1}.

The result of the study also reveals that the fruit is richer of all the plant parts for all the elements investigated, followed by the leaf, then the stem bark, except for cadmium(Cd) in which the stem had the highest concentration 0.73 μgg^{-1}followed by fruit 0.54 μgg^{-1}, then leaf 0.43 μgg^{-1}. Santamaria *et al*. (1999) carried out similar study and stated that

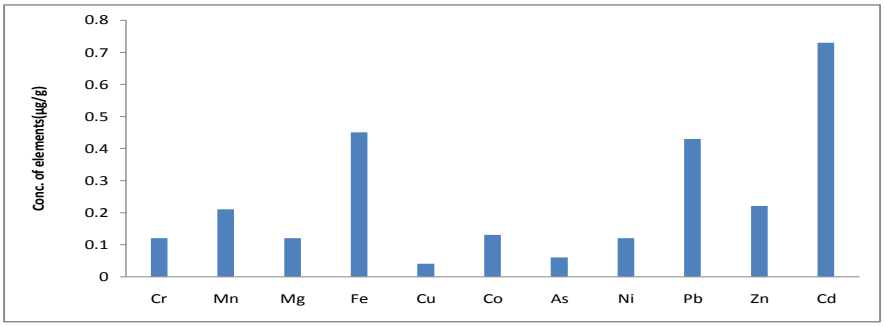

Figure 1. Mean elemental concentration (µg/g) in the steam of *Detarium microcarpum* plant

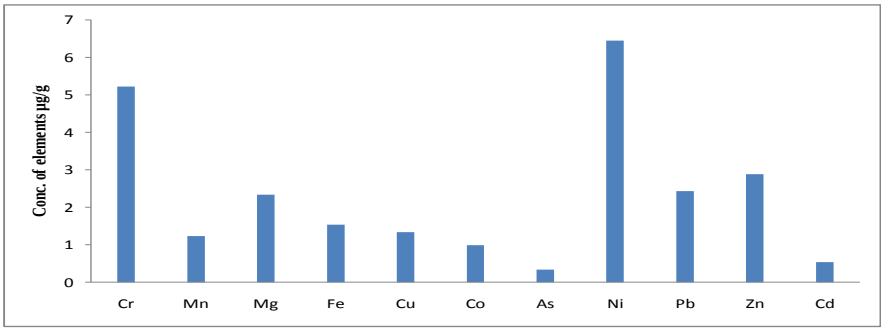

Figure 2. Mean elemental concentration (µg/g) in the fruits of *Detarium microcarpum* plant

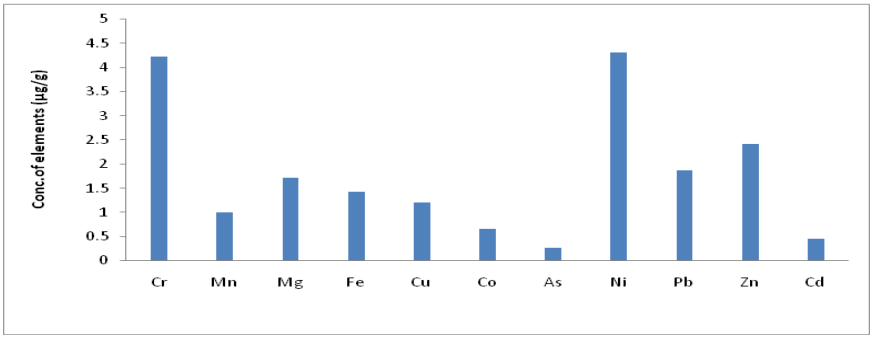

Figure 3. Mean Elemental concentrations (µg/g) in the Leaf of *Detarium microcarpum* Plant

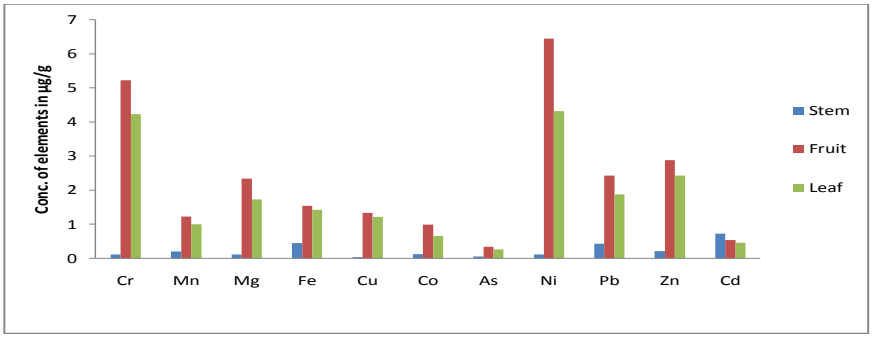

Figure 4. Comparison of the Elemental content Concentration in the Plant Parts of *Detarium microcarpu Guill* and *Perr*

the order of leaf > stem > root > tuber > bulb > fruit > seed was observed. However, the result of this study did not agree with the above as the pattern observed is: fruit > leaf > stem.

Figure 4 shows the comparison of the concentrations of the metallic elements in all the plant parts studied. This reveals that the stem has the least concentration of all the elements studied, followed by the leaf, and the fruit shows the highest concentration for all the elements, except for the cadmium in which the stem appears highest, followed by fruit, then the leaf. It also reveals that of all the elements studied, nickel (Ni), appears highest in the fruit and leaf (6.44 and 4.32 μgg^{-1}), followed by chromium (Cr) in the same plant parts (5.22, 4.23 μgg^{-1}). Lead (Pb) the most deadly heavy metallic element is observed to be highest in the fruit, 2.43μgg^{-1}, followed by in the leaf 1.88 μgg^{-1} and least in the stem bark, 0.43 μgg^{-1}. Therefore, considering the low concentration of this deadly element in this plant part that is highly used as medicinal remedy in folk – low for many human ailments (stem bark) and the fruit which is widely consumed throughout its distribution area, the consumption of any of these plant parts has no health risk. This is because WHO (1998), prescribed limit for Pb contents in herbal medicines is 10 μgg^{-1}

The element which appears least in concentration in all the plant parts is Arsenic (As) 0.06, 0.27 and 0.34 μgg^{-1} for stem, leaf and fruit respectively. However, the concentration of copper (Cu) 0.04 μgg^{-1} is the least of all as is observed in the stem bark.

CONCLUSION

The low concentrations observed of the metals from this research on the *Detarium microcarpum* plant parts (stem, fruit and leaves), especially of lead, as low as 0.43, 2.43 and 1.88 μgg^{-1} for stem, fruit and leaves respectively provides credence for the wide folkloric use of the stem bark of this plant as well as the consumption of the fruit, as this research rules out the fear from heavy metals poison, especially of lead. Some of these elements whose presence like iron that is reported to be necessary in red blood cell formation, chromium which aids glucose metabolism and regulates blood sugar, and copper being one of the factors in hemoglobin(FDA/CFSAN,1999) further gives credibility to the use of this medicinal plant herb folkloric - ally. However, research is dynamic the authors still encourage further studies on the parts of this plant to reconfirm these ones studied and more of the essential elements which have not been captured in this research.

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