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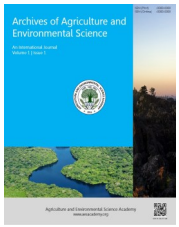

ORIGINAL RESEARCH ARTICLE

Morphological and nutritional assessment of leaf, stem and root of *Zanthoxylum macrophylla* (Rutaceae)

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ABSTRACT

Morphological and nutritional studies were carried out on various parts (leaf, stem, root and petiole) of *Zanthoxylum macrophylla* to determine its taxonomical and nutrient data with regards to morphological and nutritional characters using standard methods. Analysis of variance (ANOVA) was employed in data analyses. Result revealed among other features, the habit of the plant to be tree with prickle stem, imparipinnately compound and reticulate leaves. The various parts contained all the investigated nutrients but in varied quantities. Moisture and fibre were highest in the leaf, (9.40%±0.009) and (14.55%±0.016) of *Z. macrophylla* respectively. Fat and ash were highest in the stem (10.75%±0.125 and 5.10±0.010) of *Z. macrophylla* respectively. Both (the stem and the leaf *Z. macrophylla*) have equal amount of protein (5.95±0.007 and 5.95±0.001) respectively. Results have indicated that these parts of *Z. macrophylla* are rich in nutrient and could be extracted for the manufacture of food supplements and drugs. The obtained data could be used to enhance proper taxonomic characterisation and identification of the species *Z. macrophylla*.

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INTRODUCTION

Zanthoxylum is a genus of flowering plant in the family *Rutaceae*. The family Rutaceae is of great economic importance in warm temperate and sub-tropical climate for its numerous edible fruits of the citrus family, such as the orange, lemon, calamansi, lime, kumquat, mandarin and grape fruit (Singh and Chadha, 1993).

Zanthoxylum comprises about 549 species distributed worldwide mainly in tropical and temperate regions (GBIF, 2010). This genus includes trees and shrubs, usually dioecious. They are economically important because of their alimentary, industrial and medicinal applications (Chase *et al*., 1999; Seidemann, 2005). The *genus* is a rich source of various chemicals such as alkaloids, amides, flavonoids, sterols and terpenes etc. There are about 35 species in West Africa including *Zanthoxylum macrophylla*.

Zanthoxylum macrophylla commonly called lime prickly-ash, wild lime, and columa is a species of flowering plant that despite its name is not actually in the citrus genus with real limes and other fruits but it is close cousin in the larger citrus family. The trunks, branches, branchlets, leaf stalks and inflorescence axes are covered by prickles or what is described as spines (Waterman, 1986). It is well known for its varied uses in trado- medical practice, the root, root-bark and other parts of the plant are used in treating dental diseases, elephantiasis, sexual impotence, gonorrhoea, malaria, dysmenorrhoea, abdominal pain and bio-pesticide for stored food protection (Udo, 2011). Information is available on the vegetative and floral characteristics of *Zanthoxylum macrophylla* but the nutritional investigations of all the parts are lacking or rather scanty (Singh and Chadha, 1993). Accordinginly, the problem and focus of the research is to evaluate the forms and features of different plant organs and the nutritional composition of its various parts. Therefore, the present investigation was carried out to study the morphological and nutritional assessment of leaf, stem and root of *Zanthoxylum macrophylla* (Rutaceae).

MATERIALS AND METHODS

Study area: The nutrient analysis of *Zanthoxylum macrophylla* was carried out at the Anatomy Laboratory, Department of Plant Science and Biotechnology University of Nigeria, Nsukka and Springboard Laboratory Awka.

Collection and identification of plants materials: The plant materials of *Z. macrophylla* used in this work were collected between April-August 2016 from Mbulu- Owo, Nkanu East Local Government Area Enugu State. The *Z. macrophylla* species was authenticated at Department of Botany, Nnamdi Azikiwe University, Awka where the voucher specimen was deposited.

Morphological studies: Observations on vegetative characteristics of *Z. macrophylla* were studied using samples collected from mature tree of *Z. macrophylla*. For the leaves, 3rd-4th leaves from the tip were used; meter rule was used to measure the length.

Proximate analysis

Preparation of plant samples: The leaf, root and stem of the plant was collected, washed, sliced to reduce its surface area, spread on a stainless tray and allowed to dry at room temperature for 8days, it was then taken to the mill, packed in an air tight container and labelled.

Figure 1. *Zanthoxylum macrophylla tree in its natural habitat. Location (Mbulu-owo Nkanu East L.G.A Enugu state).*

Figure 2. *Zanthoxylum macrophylla leaf morphology.*

Figure 3. *Zanthoxylum macrophylla stem.*

Materials/chemicals used: The following materials were used for the proximate analysis: Dessicator, muffle furnace, spectrometer, silica dish, kjeldahl flask, funnel, soxhlet apparatus, thimble, electric oven, grinder, retort stand, cotton wool, beakers, weighing balance, petri dish, platinum crucible, filter paper. The chemicals used include petroleum ether, Tetraoxosulphate (vi) acid, Boric acid indicator solution, Sodium hydroxide, hydrochloric acid. Proximate composition (ash content, protein content, fat content, crude fibre and moisture content) was carried out using the standard methods described by Association of Official Analytical Chemist (AOAC, 2005).

Statistical analysis: Results were presented in mean ± standard deviation and were subjected to analysis of variance (ANOVA) using Duncans Multiple Range Test (DMRT) at 5% probability to separate the treatments. Differences in mean value were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

Results of morphological and nutritional assessment of *Z. macrophylla* are presented in Table 1 and Figures 1-3.

Morphological studies: Observations on the morphology of *Zanthoxylum macrophylla* plant (Figs 1, 2 and 3) showed the habit to be an erect tree, perennial, with hard and woody stem covered with prickles and grey to brown in colour. The leaves of *Z. macrophylla* are imparipinnately compound arranged alternatively, 3.0 – 7.0cm wide and 6.4 – 94cm long; simple, glabrous, ovate to elliptical in shape, deep green in colour, have entire margins; venation is reticulate, lamina is auriculate, apices obtuse and base swollen. The observations above tally with an earlier study by (Nacoulma, 1996; Arbonnier, 2004) except in those features they did not study.

Proximate composition: Percentage proximate composition of the leaf, stem and root of *Z. macrophylla*. Result showed that the nutrients were present in all the parts of *Z. macrophylla* investigated but in varied quantities (Table 1). Moisture and fibre content were highest in the leaf (9.40±0.009%) and (14.55±0.016%) of *Z. macrophylla*, respectively, the leaf and the stem contained equal amount of protein (5.95±0.001%) and (5.95±0.007%) of *Z. macrophylla*, respectively (Table 1). Fat and ash content were highest in the stem (10.55±0.001 %) and (5.10±0.010 %) of *Z. macrophylla*, respectively while the root has highest composition of carbohydrate (65.05±0.016 %). Analysis of variance showed a significant difference in all the proximate composition assayed between the leaf, stem and root of *Z. macrophylla* ($p<0.05$). The result indicated that *Z. macrophylla* has some nutritional potential that can be exploited in diet. The result has shown the stem to be a better source of fat and ash, the root a better source of carbohydrate and the leaf of *Z. macrophylla* a better source of moisture and fibre. These nutrients provide energy for work and warmth, provide materials for growth and repairs of worn out tissues, aid excretion and keep the organism healthy so that it can fight against diseases (Ilodibia and Igboabuchi, 2017). The result is in line with the work of Ilodibia *et al*. (2016a, b, c and 2017) who reported similar

Table 1. Percent proximate composition of leaf, stem and root of *Z. macrophylla* (%).

Plant parts	Fat	Moisture	Ash	Fibre	protein	CHO
Leaf	10.55±0.001[b]	9.40±0.009[c]	3.70±0.014[a]	14.55±0.016[c]	5.95±0.001[b]	53.40±0.010[a]
Stem	10.75±0.125[c]	5.65±0.012[a]	5.10±0.010[c]	14.05±0.005[b]	5.95±0.007[b]	58.55±0.004[b]
Root	6.90±0.011[a]	7.05±0.002[b]	4.60±0.008[b]	12.20±0.011[a]	4.20±0.013[a]	5.05±0.016[c]

Results are in mean± standard deviation. Columns followed by the same letter are not significantly different at $P<0.05$ level of significance.

results among the various parts of *Celosia argentea*, *Gomphrena celosioides*, *Vitex chrysocarpa* and *Talinum triangulare*.

Conclusions

Results have indicated that these parts viz., root, stem and leaf of *Z. macrophylla* are rich in nutrient and could be extracted for the manufacture of food supplements and drugs. The obtained data could be used to enhance proper taxonomic characterisation and identification of the species *Z. macrophylla*.

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