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PROXIMATE ANALYSIS OF NIGERIAN *CROTON GRATISSIMUS, CROTON LOBATUS, CROTON MEMBRANACEUS* AND *CROTON PENDULIFLORUS*

***[1]Adamu, T., [1]Atanda, H. A., [1]Al-Adams B. K., [1]Nwaokoro, S. C., [1,2]Isyaka, M. S. and [3]Abdullahi M. A.**

[1]Department of Chemistry, University of Abuja, Abuja, Nigeria.
[2]Department of Chemical Sciences, North-Eastern University, Gombe State - Nigeria.
[3]Federal University of Health Sciences, Azare, Bauchi State, Nigeria.

*Corresponding authors' email: adamutalatu7@gmail.com Phone: +2348081219301

ABSTRACT

With about 1300 species of herbs, shrubs, trees, and lianas, Croton (*Euphorbiaceae*) is one of the largest genera of flowering plants. It is an important component of secondary vegetation in the tropics and subtropics of the world and has ecological significance. The growing consumer interest in ingredients originating from natural sources has led to a recent surge in the demand for natural extracts in the food, cosmetics, and pharmaceutical industries. Determining the proximate analysis of Croton gratissimus, lobatus, memebranaceus, and penduliflorus stembarks is the aim of this work. The proximate analysis was carried out using AOAC standard procedures in order to assess the moisture contents, dry matters, crude proteins, ash contents, carbohydrates, fat contents and fiber contents of the stated plant materials. The findings showed that there was a significant amount of dry matter, fiber and carbohydrates at 82.52%, 32.48% and 38.63% respectively in the stem bark of Croton gratissimus. Croton lobatus showed the highest amount of protein and fat content at 17.83% and 4.71% respectively while Croton lobatus and penduliflorus contains the same amount of moisture at 24.53%. Findings of the study showed that the stembarks of the plants possess high nutritional value.

Keywords: Ethnomedicinal uses, Proximate analysis, *Croton, Croton gratissimus, Croton lobatus, Croton membranaceus, Croton penduliflorus*

INTRODUCTION

Man has relied on natural products for survival since the dawn of humanity. From consuming fruits and vegetables to employing trees and animal pelts for trade, everything is interrelated. Plants provide humans with food, medicine, shelter, and a host of other necessities. The stems, leaves, flowers, fruit seeds, and roots of humans can provide food (Amaechi, 2009). The application of traditional medicine knowledge over centuries resulted in a body of understanding about the therapeutic qualities of herbs that served as the foundation for modern medicine (Ojinnaka, 1998). Approximately 75% of the world's population uses plant extracts for medicinal purposes (Gahbe *et al.,* 2006). African traditional healers have traditionally relied on medicinal plants as an endless supply of treatment for a wide range of serious illnesses (Segla *et al.,* 2022).

Growing consumer interest in items produced from natural sources has led to a notable growth in demand for natural extracts in the food, cosmetics, and pharmaceutical industries. It is also commonly known that spices and essential oils have numerous health-promoting qualities (Briskin, 2000). Their importance for contemporary astrological, alchemical, and divination challenges, as well as for diets, medicine, and daily life at home, cannot be overstated (Ojo *et al.,* 2018). The compositions of protein, fat, and carbohydrates vary throughout plants, and these constituents are essential for the production of food and feed. They take on greater significance when one considers their functions within the human body (Ojo *et al.,* 2018).

With about 1300 species of herbs, shrubs, trees, and lianas, Croton (Euphorbiaceae) is one of the largest genera of flowering plants. It is an important component of secondary vegetation in the tropics and subtropics of the world and has ecological significance (Webster, 1993; Govaerts *et al.,* 2000). In Africa, South Asia, and Latin America, croton species have long been utilized as remedies for a wide range of illnesses, infections, and digestive issues (Wu and Zhao, 2004; Xu *et al.,* 2018; Mahmoud *et al.,* 2020). Also referred to as lavender fever berry or lavender croton, Croton gratissimus is a plant. Angola, Benin, Botswana, Burkina, Cameroon, Cape Provinces, Chad, Ethiopia, Gambia, Ghana, Guinea, Ivory Coast, Kenya, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, Sierra Leone, Sudan, Uganda, Zambia, and Zimbabwe are among the countries where it can be found (Burkil, 1985).

It is separated into two categories: Croton gratissimus var. sub gratissimus and gratissimus var. gratissimus. The distinction between the two is that sub gratissimus bears stellate hairs on the upper surface of its leaves, whereas gratissimus lacks any hairs at all (Ndhala *et al.,* 2013). It is use as source of medicine, food flavoring and essential oil (Tropical Plants Database, 2024). Although the plant is believed to be toxic, it is an important stock food in Namibia (Dlamini, 2005). The fruits and bark are aromatic and are used as spice in food (Burkil, 1985). They are also used as flavor in tea (Tropical Plants Database, 2024). Originally from Senegal, Croton lobatus L. has since expanded to Ethiopia and Eritrea. It is also found in the Arabian Peninsula, South America, and the Caribbean. Crude extracts from its stem and roots have good anti-plasmodia activity (Weniger *et al*. 2004).

Many ailments, including as paralysis, epilepsy, convulsions, spasms, rheumatic pain, cutaneous and subcutaneous parasite infection, ulcers, sores, migraines, and ulcerative colitis, can be treated topically with the leaves. Odukoya *et al.* (2012) claimed that the leaves are often boiled in water and the resulting decoction is ingested to mend nonhealing wounds. The plant is said to be a favorite diet of birds in northern Ghana (Burkil, 1985).

Croton membranaceus Mull. Arg. (*Euphorbiaceae*) is an undershrub or herb that grows in West Africa, distributed in Cote d'Ivoire, Ghana and Nigeria and Niger. The root bark of the plant is ethnomedicinally used in Ghana to treat benign

prostatic hyperplasia or urinary retention caused by enlarged prostate, and for the treatment of measles (Adesogan, 1981). In Nigeria, it is used for the treatment of stomach pain or diarrhea (Adesogan, 1981). Furthermore, the leaves of *Croton membranaceus* are used to aromatize tobacco and as an aromatic bitter and a tonic, which improves digestion (Bayor *et al.*, 2009).

There are also anecdotal claims that states that the essential oil of the bark is used to treat Diarrhea, cough, fever, Flatulence and Nausea (Bayor *et al.*, 2009). A medium-sized ornamental tree that is utilized for medicine and lumber locally is called Croton penduliflorus Hutch. It can be found in Eastern Sierra Leone, Eastern Nigeria, and the Central African Republic of Gabon (Schlmelzer and Gurib-fakim, 2008). The seeds are roasted, crushed, and combined with Nigerian cassava meal to induce purging (Azuzu *et al.*, 1989). The study's goals are to ascertain the proximate and mineral composition of these plants, even though these plant parts are usually ground and eaten with food. There is little to no information available on the nutritional value of the leaves and seeds of this plant, which is used both medicinally and as an ornamental houseplant.

MATERIALS AND METHODS

Sample Collection and Preparation

Fresh stem bark of *Croton gratissimus, Lobatus, membranaceus and Penduliflorus* were collected from the northern part of Nigeria in Zaria, Kaduna State in January, 2023 and identified by a botanist at the Department of Botany, Ahmadu Bello University, Zaria, Kaduna State, Nigeria. The collected samples were stored in polythene bags and were transported to chemistry research laboratory University of Abuja, Nigeria.

Sample Preparation and Treatment

After being divided into smaller pieces, the samples were allowed to air dry for 28 days. Using a laboratory pestle and mortar, the air-dried materials were ground into a powder. The plant samples were then sieved using a laboratory sieve and kept in a tightly sealed polythene bag for additional examination (Fredrick *et al.*, 2023).

Proximate Analysis Procedure

At the Department of Chemistry, Faculty of Science, University of Abuja, the proximate analysis of the powdered plant materials for percentage composition of protein, fat, fiber, ash, carbohydrate, and dry matter was conducted using the techniques described in AOAC (2005).

Moisture Content (%)

The metallic dishes were weighed after being chilled in a desiccator and dried for 20 minutes at 80 ºC. Plant samples weighing 5 g were put into the dishes and weighed after that. After achieving a consistent weight by drying the dishes containing the samples in an oven at 80 °C for 24 hours, they were promptly moved to a desiccator to cool. It was promptly weighed with as little exposure to the atmosphere as possible after cooling. The moisture content of a plant sample is determined by its weight loss while drying (AOAC, 2005).

Where:

W_1 = Initial weight of empty crucible

W_2 = Weight of crucible + food before drying

W_3 = Final weight of crucible + food after drying.

% Total solid (dry matter) =100 - % moisture

Protein Content (%)

K_2SO_4, CuSO4, concentrated NaOH (40 %) and concentrated H_2SO_4 were used to breakdown the plant material. A micro-Kjeldahl distillation apparatus was filled with 5 milliliters of the digested sample, and excess concentrated NaOH was added to the mixture to make it intensely alkaline. In a different titrating flask, ammonia was distilled into 5 milliliters of boric acid indicator. Over 45 milliliters of the distillates were gathered. 0.01 M HCl was used for titrations, and light green was the end point (AOAC, 2005).

$$\%\ Nitrogen\ (N) = \frac{V_S V_B \times N\ acid \times 0.01401 \times 100}{W}$$

V_S =vol. (ml) of acid required to titrate sample

V_B =vol. (ml) of acid required to titrate blank

N acid = Normality of acid (0.1 N)

W = weight of sample in grams

Each food type has its percentage nitrogen. The common factor used for most food and food mixture is 6.2.5

% protein = % N X F

where F = conversion factor = 100/ (% N in food protein).

Total Ash Content (%)

The plant samples were weighed into a tiny, dry crucible with a known weight of ten grams (10 g). Using a low furnace, the plant samples in the separate crucible were burned. For two hours, the burnt samples were ashed at 550 ^{0}C in a muffle furnace. After being taken out of the furnace, the ash materials were allowed to cool. After that, the materials were weighed in the desiccator (AOAC, 2005).

Where: W_1=weight of empty crucible, W_2=weight of crucible + food before drying and/or ashing, W_3=weight of crucible + ash

Total Fat Contents (%)

By employing petroleum ether (b.p 40–60^{0}C) as a solvent during direct Soxhlet extraction, the % fat content of the plant was ascertained. Plant samples weighing 0.5 g were weighed, divided into individual filter papers, and put into the extractor. The apparatus was positioned on an independent heating mantle. For six hours, the heat source was changed to allow the solvent to slowly boil and reflux multiple times, siphoning out the ether and emptying the extractor's barrel. It was taken out of the filter paper and dried to constant weight in an oven set to 50 ºC. Next, the proportion of fat was computed using the formula below (AOAC, 2005).

Total Carbohydrate Content (%)

The total percentage of plant carbohydrates was calculated by subtracting total protein and organic matter (AOAC, 2005).

RESULTS AND DISCUSSION

Table 1: Proximate Composition of *Croton; gratissimus, lobatus, membranaceus* and *penduliflorus*

***Croton* (Stembark)**	***grattisimus* (%)**	***lobatus* (%)**	***membranaceus* (%)**	***penduliflorus* (%)**
Moisture	17.48	24.53	17.20	24.53
Dry Matter	82.52	13.04	12.80	19.04
Ash Content	4.59	11.61	7.78	10.64
Crude Protein	2.58	17.83	13.76	15.03
Crude Fiber	32.48	15.87	18.99	18.91
Fat Content	4.23	4.71	1.52	1.92
Carbohydrate	38.63	36.94	36.81	17.89

Table 1: reveals the result of the proximate analysis of the stembarks of Nigerian *Croton plants; Croton grattissimus, Croton lobatus, Croton membranaceus and Croton penduliflorus.* The moisture content ranges from 17.20 % for *C. membranaceus* to 24.53 % for *C. lobatus* and *C. penduliflorus*. Moisture content above 8% in plant material is reported to attract insects and at 14 %, prone to grow fungi and bacteria (Njoroge *et al.,* 2021). Dry matter is the measure of the mass of a completely dry substance. Dry matter consists of carbohydrate, protein, fats, vitamins, minerals and antioxidant. The dry matter of the *Croton* plants ranged from 12.80 % in *C. membranaceus* to 82.52 % in *C. gratissimus*. Ash content indicate the amount of minerals and organic matter present in plant. It ranged from 4.59 % in *C. gratissumus* to 11.61 % in *C. lobatus*. The ash presents in *C. lobatus* 11.61 % and *C. penduliflorus* 10.64 % suggested high value of minerals in the samples. The crude protein ranged from 2.58 % in *C. gratissimus* to 17.83 % in *C. lobatus*. Adnan *et al.* 2010 reported that plant material with 23-33 % protein content is rich in protein hence the protein value in this study is considered low compared to other plants. *C. gratissimus* possesses the highest value of fiber at 32.48 % while *C. lobatus* possesses the lowest at 15.87 %. The fat content present in the plant materials ranged from 1.52 % in *C. membranaceus* to 4.23 % in *C. gratissimus*. The carbohydrate presents in the crotons are relatively similar except *C. penduliflorus* which possesses the value of 17.89 % which is still higher when compared to that of *Croton tiglium* with the low yield of carbohydrates of 15.51 % (Shah *et al.,* 2009). Therefore, this plant species could be used as sources of energy.

CONCLUSION

The study's conclusions demonstrated the high nutritional potential of the plants' stembarks, which can supply important vitamins, minerals, and other nutrients including fiber and antioxidants. Studies repeatedly demonstrate that those who consume five or more portions of nutrient-dense food each day are at the lowest risk of developing numerous illnesses, such as heart disease and cancer.

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