Proximate Composition, Vitamin and Anatomical Studies on *Gomphrena celosioides*

[1*]C.V. Ilodibia, [1]F. U. Ewere, [2]E. E. Akachukwu, [2]R. N. Adimonyemma, , [2]N. A. Igboabuchi and [1]N. F. Okeke

[1]Department of Botany, Nnamdi Azikiwe University, P. M. B 5025, Awka, Anambra State, Nigeria

[2]Department of Biology, Nwafor Orizu College of Education Nsugbe, Anambra State, Nigeria

[*] Chinyereokafor206@yahoo.com

ABSTRACT

Gomphrena celosioides is an ornamental plant with highly medicinal values. Available information on its anatomical studies is scanty while proximate composition and vitamins investigations are lacking. This study therefore focused on proximate composition, vitamin and anatomical evaluation of its various parts *using* standard methods. Analysis of variance (ANOVA) was employed for data analysis. Moisture, ash and crude fiber were highest in the stem (64.20±0.14, 8.26±0.00 and 18.66±0.01) respectively. Total protein and fat contents were highest in the leaf (0.44±0.00 and 0.52±0.00) respectively while carbohydrate was highest in the root (33.21±0.63). The study on vitamins showed that vitamins A and C contents were highest in leaf (1.96±0.01) and (1.68±0.01) respectively and lowest in root (1.57±0.02) and (1.47±0.01) respectively. Anatomical result revealed similar features in their epidermis and cortex and differences in their vascular bundles arrangement. This work has demonstrated that the plant is highly nutritious. Apart from its use as an ornamental, the parts could be used as food to supplement our daily nutrient needs. Also the anatomical result is an additional aid to the taxonomic characterization of the plant.

Keywords: Anatomical, proximate composition, vitamin and *Gomphrena celosioides*

1. INTRODUCTION

The use of plants as medicine has contributed greatly to the modern development of paramedical drugs. Scientist all over the world have been interested in knowing the chemical constituents present in most of these plants, and that has led to many research works on plants.
Gomphrena celosioides is an herbaceous annual or perennial belonging to the family Amaranthaceae and a cosmopolitan pioneer plant of disturbed areas, and one of 51 species in the genus (Auld and Medd, 1992). It *is* a hairy, decumbent plant of about 20cm high with woody tap root and reproducing from seeds. The stem is slender, weak, contracted at the nodes, the upper portion beset with white pilose hairs. It grows along roadsides, river banks, rail way and on fallow land, occasionally invades pastures. It is well distributed in South America, Asia, East and West Africa. Its presence in Ghana and Nigeria is recently recorded (Onocha, *et al*., 2005).

G. celosioides is a common and often troublesome weed of crops over a very wide range of the tropics and subtropics. Holm *et al*. (1979) classified it as "serious" in Taiwan and Thailand and "common" in Australia, India, Zimbabwe and South Africa.

Several studies have been conducted to examine the potentials of *G. celosioides*. Oladele and Daodu (1988) studied the stem anatomical indices and recommended it as a vegetation plant in a decertified area while Onocha *et al*. (2005) reported on the phytochemical and biological activities of the plant extracts. *G. celosioides* is prevalently used among the rural people of West Africa to treat a wide variety of ailments. It is used in ethno medical practice in Nigeria for treatment of various skin diseases, worm infections and infectious diseases (Onocha *et al*., 2005). In South America, the plant is used as an abortifacient (Burkill, 1984).

Anatomy of plants revealed the internal organization of the cells organelles, tissues and their function. The size, shape and arrangement of most cells in the epidermis, sclerenchyma etc. have aided the studying the wood formation in plant (Eames *et al.,* 1947)
G. celosioides is a species with great medicinal and ornamental values. However no comprehensive work has been done especially in the area of nutrition, hence the need for the present study. The objective of this study was to evaluate different parts of *G. celosioides* for nutritional content of which when found in high concentration would present them as their possible sources, as well as their suitability as edible plants parts and to determine detailed anatomical characteristics for use in taxonomic purposes.

2. MATERIALS AND METHODS

2.1Area of Study

The experiments were carried out at the different laboratories of Plant Science and Biotechnology Department, University of Nigeria, Nsukka.

2.2Collection and identification of plant materials

The plant materials used in this work were collected between April - June from Akpo town in Aguata Local Government Area of Anambra State. The plant was identified by a taxonomist of Botany Department, Nnamdi Azikiwe University, Awka. The voucher specimens were deposited in the herbarium of Nnamdi Azikiwe University, Awka with the accession No. NAUH 285.

.2.3Sample Preparation

The samples were collected and packed in sample envelops and were oven dried at 65^0C for 4 hrs. The samples were ground into a powder. The powered samples were kept in an air tight container until required for use.

2.4Proximate and vitamin studies

Materials used: The following materials were used in the proximate analylsis: Dessicator, muffle furnace, spectrometer, silica dish, kjeldahl flask, funnel, soxhlet apparatus, filter paper, thimble, electric oven, grinder, retort stand, test tube and test tube rack, crucible, weighing balance, petri dish. The chemicals used include: Tetrahydrosulphate (vi) acid, Boric acid indicator solution, Sodium hydroxide, Hydrochloric acid, Petroleum ether, Potassium hydroxide, Acetone, Phenolphthaline indicator, Ammonia, Dithezone solution, Carbon tetrachloride, Hydroquinoline, Phenonthroline, Vanado Molybidic acid, Selenium oxide.

Proximate (carbohydrate, ash, crude protein, crude fat, crude fibre and moisture), and vitamins (vitamin A and C) contents were carried out to ascertain the nutrient compositions present in the plant extracts. Moisture content, total ash and protein were determined according to the method of AOAC (1990). Crude fat and carbohydrate were determined using the method of James (1995) while crude fibre was done by solvent extraction gravimetric method described by Kirk and Sawyer (1998). Vitamins were done following the method of Onwuka (2005).

2.5Anatomical study

The following materials were used for the anatomical study: Photomicroscope, a staining jar, a wash bottle, a sledge microtome, a beaker, Carmel's hair brush, Zeiss light microscope with the serial No. 4F8662206, MC'35 Camera for 53mm film. The reagents and stains were 97% alcohol, absolute alcohol, 50/50 alcohol, /xylene, xylene, safranin, fast green and Canada balsam as mountant

Anatomical study was carried out at the Anatomy Laboratory of the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka using Reichert sledge microtome. Transverse sections were made from middle part of fully grown leaves, midpoint of petiole, centre of an internode of young and mature stem and mature root. This was done using standard procedure as described by (Anon (1968, Ilodibia, 2015). Photomicrographs of the specimens were taken with Zeiss light microscope with MC'35 Camera for 53mm film.

2.6Statistical 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 $p < .05$.

3. RESULTS AND DISCUSSION

The results of the study were shown in Figure 1, Tables 1- 2 and Plates 1 – 5

The result showed that nutrients were presents in all part of the *Gomphrena celosioides* investigated but in varied amount (Table1-2). Moisture, ash and crude fiber were highest in the stem (64.20±0.14, 8.26±0.00 and 18.66±0.01) respectively. Total protein and fat contents were highest in the leaf (0.44±0.00 and 0.52±0.00) respectively while carbohydrate was highest in the root (33.21±0.63) (Table 1). The result has indicated that these parts are a good source of nutrients which could be exploited in diet. Proteins are used for building and repairing of body tissue, regulation of body processes and formation of enzymes and hormone. Ash content of any given food material is a measure of food quality and identity, it represent the foodstuff that is carbon free as a result of burning away of organic portion (Isong and Essien, 1996). It has proved helpful in establishing and maintaining acid-alkaline balance of the blood system (Ilodibia *et al*., 2014). The higher fiber content in the stem showed that they can help in keeping the digestive system healthy and functioning properly. Fiber aids and speeds up the excretion of

waste and toxins from the body, preventing them from sitting in the intestine or bowel for too long, which could cause a build-up or azotaemia. Higher moisture content of the stem showed that it will be less preferred to leaf and root in processed food products. Dorman *et al*. 2000 and Ilodibia *et al*. 2014 have reported that high moisture increases spoilage and enzymatic deterioration in food products.

Table 1: Mean proximate composition of the leaf, stem and root of *Gomphrena celosioides* (%)

Plant part	Moisture	Ash	Crude Fibre	Total protein	Fat content	Carbohydrate
Stem	64.20±0.14^{c}	8.26±0.00^{c}	18.66±0.01^{b}	0.27±0.01^{b}	0.44±0.00^{b}	8.18±0.15
Leaf	58.60±0.14^{b}	7.65±0.00^{b}	17.67±0.03^{b}	0.44±0.00^{c}	0.52±0.00^{c}	15.13±0.17^{b}
Root	50.35±0.00^{a}	5.34±0.00^{a}	10.53±0.06^{a}	0.22±0.01^{a}	0.37±0.02^{a}	33.21±0.63^{c}
P-value	**	**	**	**	**	**

Same letters in a column are not significantly different at p< .05

Result in table 2 showed that the leaf contained the highest percentage of the vitamins investigated (1.96±0.01) and (1.68±0.01) for vitamin A and vitamin C respectively (Table 2). This implies that the leaf will serve as a better source of vitamin A and C than the root and stem. Analysis of variance showed a significant difference in the compositions of vitamin A and vitamin C between the stem, root and leaf (P< .05). The result has shown that these parts are rich in vitamins A and C. Vitamin A enhances vision while vitamin C activates the cell functions. Vitamin C is a powerful antioxidant. It favours the absorption of iron in the intestine, protects against infections. It neutralizes blood toxins and intervenes in the healing of wounds (Isong and Essien, 1996).

Table 2: Vitamin Composition of the Stem, Leaf and Root of *Gomphrena celosioides* (mg/100g)

Plant part	Vitamin A	Vitamin C
Stem	1.84. ±0.01[b]	1.55±0.03[b]
Leaf	1.96±0.01[a]	1.68±0.01[a]
Root	1.57±0.02[c]	1.47±0.01[c]
P-value	**	**

Results are mean ±SD *Columns followed by the same letter are not significantly different, significant difference exist at **p< .05

ANATOMICAL STUDIES

Transverse section of *Gomphrena celosioides* leaf had uniseriate epidermis with cut trichomes followed by 5 layers of parenchyma cells. It had three vascular bundles at the midrib and the other vascular bundles seen were those of the veins (Plate 1). The transverse section of *Gomphrena celosioides* petiole was crescent shaped and showed uniseriate epidermis followed by 2-3 pinkish layers of collenchyma cells. It had three vascular bundles very close to the upper part (Plates 2). *Gomphrena celosioides* primary stem showed presence of uniseriate epidermis, followed by 2 layers of collenchyma, 4 layers of parenchyma and a layer of endodermis on which the vascular bundles were cojointly arranged. There was also presence of wide pith filled with parenchymatous cells (Plate 3). *Gomphrena celosioides* secondary stem showed uniseriate epidermis, 2 layers of collenchyma cells, and 3 layers of parenchyma cells followed by endodermis on which vascular bundles were arranged. It has wider pith filled with parenchyma cells (Plate 4). Transverse section of the root of *Gomphrena celosioides* showed uniseriate epidermis, followed by a medium sized cortex and also a cojoint vascular bundles. There were medullary vascular bundles in the pith (Plate 5). The result has revealed similar epidermis and cortex and some dissimilarity in the arrangement and distribution of vascular bundle among the various parts. The result is in line with the work of plant anatomist Carlquist 1961 who stated that the similarities and differences in features confirms their physiological functions as plant organs.

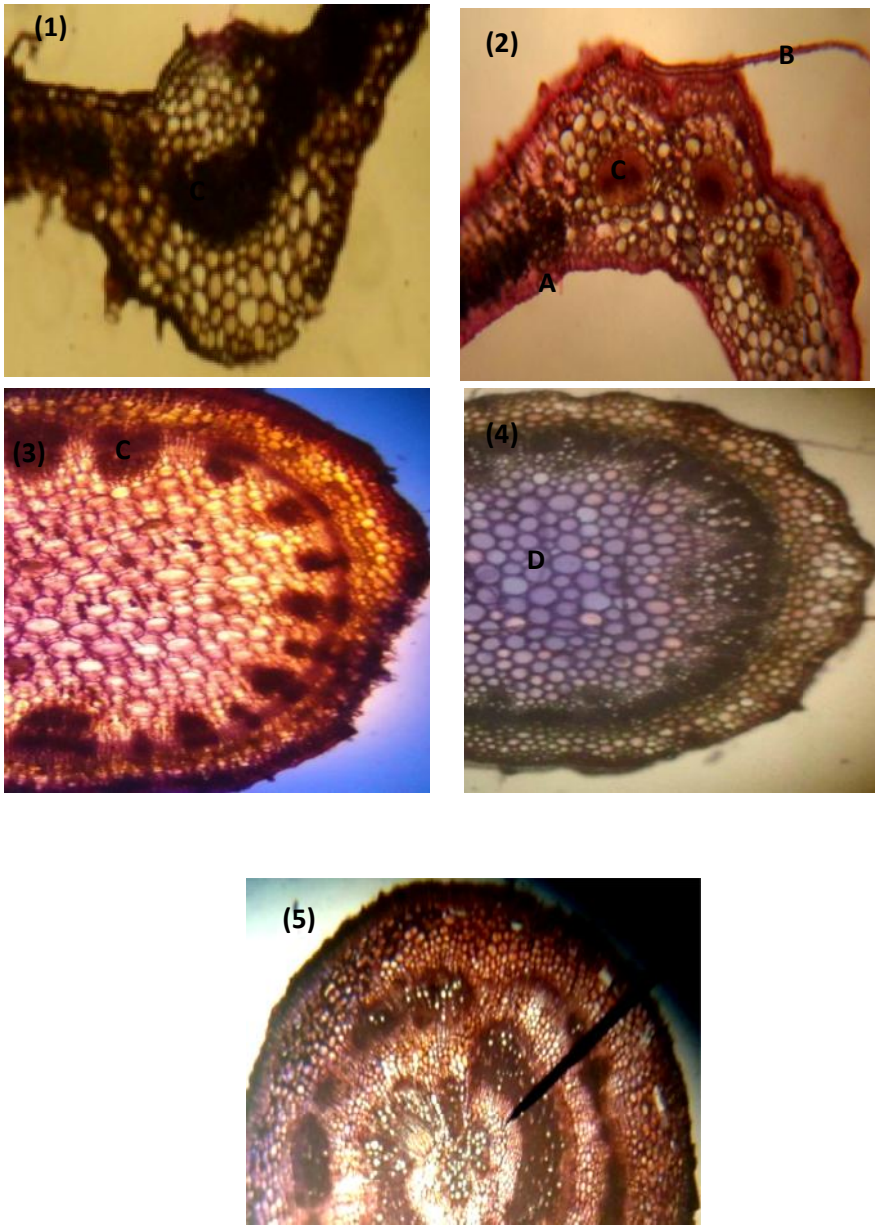

Plate 1- 5: T/S of leaf, petiole, primary and secondary stem and root respectively of *Gomphrena celosioides* (X40) A-D: epidermis, trichome, vascular bundle and pith respectively

Fig 1: *Gomphrena celosioides* in its natural habitat.

4. CONCLUSION

The results of the study revealed that these parts of the *Gomphrena celosioides* investigated are very nutritious and can contribute significantly to the human health requirements. Anatomical study is an additional aid to the plant taxonomic characterization and identification.

REFERENCES

Auld, B. A. and Medd, R.W. (1992). *An illustrated botanical guide to the weeds of Australia*. Inkata Press, Melbourne, 255 *pp*

Anon, J.B. (1968). *The Preparation of Wood for Microscopic Examination.* Forest Products Research Laboratory Leaflet No. 40. Ministry of Technology London, 11pp

AOAC (1990). Official Method of Analytical Chemistry, Washington DC. 235PP

Burkill, H.M. (1984).*The Useful Plants of West Tropical Africa* 1:61; 2:338.Royal Botanical Gardens Kew.

Carlquist, J. (1961). Comparative plant anatomy, *American Journal of Botany, **46:50***-66.

Dorman, H. J.; Fiqueriredo, A. C.; Barroso, J. G. and Deans, S. G.(2000). In vitro evaluation of antioxidant activity of essential oils and their Components, F*lavor Gragr Journal 15*: 12- 16

Eames, A.J. and Mac Daniel L. H. (1947) *An Introduction to plant Anatomy*, Mc-Graw-Hill Book Company, 550pp

Holm, L. G.; Pancho, J.V.; Herberger,J.P, and Plucknett,D.L.(1979*). A Geographical Atlas of World Weeds,* Wiley press, New York, 391 pp

Ilodibia, C. V., Ugwu, R. U., Okeke, C. U., Ezeabara, C. A., Okeke N. F Akachukwu, E. E. and Aziagba, B. O.(2014). Determination of Proximate Composition of various parts of two Dracaena Species, *International Journal of Botany 10*(1) 37-41

Isong, E. U. and Essien I. B.(1990). Nutritional and Nutrient Composition of Tree Varieties of Piper Species Plant. *Food Human Nutrition 49:* 133-137

James, C. S. (1995). Analytical Chemistry of Foods. Chapman and Hall, New York, 53pp

Kirk, H. and Sawyer, R. (1998). *Frait Pearson Chemical Analysis of Food* (8^{th} ed). Longman Scientific and Technical, Edinburgh. 211-212pp.

Oladele, F. A.; and Daodu, I. O. (1988). Stem Anatomical Indices for Suitability of Gomphrena celosioides Mart as a Potential Revegetation Plant. *Nigerian Journal of Botany 1*: 134-130.

Onocha, P.A.; Ajaiyeoba, E.O.; Dosumu, O.O.and Ekundayo, O. (2005). Phytochemical screening and biological activities of Gomphrena celosioides Mart extracts. *Nigerian Society Experiment 5*:59–65.

Onwuka, G.I. (2005). *Food Analysis and Instrumentation; Theory and Practice*. (2nd Edition). Naphthali Prints, Lagos. 250.