

**Original Research Article****Proximate, Vitamin and Anatomical Studies on *Gomphrena celosioides*****ABSTRACT**

Proximate, vitamin and anatomical studies were carried out on various parts of *Gomphrena celosioides* using standard methods. Analysis of variance (ANOVA) was employed for data analysis. Moisture, ash and crude fiber were highest in the stem ( $64.20\pm 0.14$ ,  $8.26\pm 0.00$  and  $18.66\pm 0.01$ ) respectively. Total protein and fat contents were highest in the leaf ( $0.44\pm 0.00$  and  $0.52\pm 0.00$ ) respectively while carbohydrate was highest in the root ( $33.21\pm 0.63$ ). The leaf contained the highest percentage of the Vitamins ( $1.96\pm 0.01$ ) and ( $1.68\pm 0.01$ ) for vitamin A and vitamin C respectively. Anatomical result revealed similar features in their epidermis and cortex and differences in their arrangement and distribution of vascular bundles. 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, 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

36 Taiwan and Thailand and “common” in Australia, India, Zimbabwe and South  
37 Africa.

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

46 Anatomy of plants revealed the internal organization of the cells organelles, tissues  
47 and their function. The size, shape and arrangement of most cells in the epidermis,  
48 sclerenchyma etc. have aided the studying the wood formation in plant (Eames *et*  
49 *al.*, 1947)

50 *G. celosioides* is a plant with highly medicinal and ornamental values. However no  
51 comprehensive work has been done on the areas of its proximate, anatomy and  
52 vitamin studies, hence the need for the present study. The aims of the study were to  
53 ascertain if the plant parts could be used as edible parts (nutritional) and its  
54 anatomical characteristics for use in taxonomic purposes.

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## 56 **2. MATERIALS AND METHODS**

### 57 **2.1 Area of Study**

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

### 60 **2.2 Collection and identification of plant materials**

61 The plant materials used in this work were collected between April - June from  
62 Akpo town in Aguata Local Government Area of Anambra State. The plant was  
63 identified by a taxonomist of Botany Department, Nnamdi Azikiwe University,  
64 Awka. The voucher specimens were deposited in the herbarium of Nnamdi  
65 Azikiwe University, Awka.

### 66 **2.3 Sample Preparation**

67 The samples were collected and packed in sample envelopes and were oven dried at  
68 65<sup>0</sup>C for 4 hrs. The samples were ground into a powder. The powdered samples  
69 were kept in an air tight container until required for use.

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## 72 **2.4 Proximate, mineral and vitamin studies**

73 Proximate (carbohydrate, ash, crude protein, crude fat, crude fibre and moisture),  
74 and vitamins (vitamin A and C) contents were carried out to ascertain the nutrient  
75 compositions present in the plant extracts. These were done using the standard  
76 methods described by (AOAC, 1990; Kirk and Sawyer, 1998 and Onwuka, 2005).

## 77 **2.5 Anatomical study**

78 Anatomical study was carried out at the Anatomy Laboratory of the Department of  
79 Plant Science and Biotechnology, University of Nigeria, Nsukka using Reichert  
80 sledge microtome. Transverse sections were made from middle part of fully grown  
81 leaves, midpoint of petiole, centre of an internode of young and mature stem and  
82 mature root. This was done using standard procedure as described by (Anon  
83 (1968, Ilodibia, 2015). Photomicrographs of the specimens were taken with Zeiss  
84 light microscope with MC'35 Camera for 53mm film.

## 85 **2.6 Statistical analysis**

86 Results were presented in mean  $\pm$  standard deviation and were subjected to  
87 analysis of variance (ANOVA) using Duncans Multiple Range Test (DMRT) at  
88 5% probability to separate the treatments. Differences in mean value were  
89 considered significant at  $p < .05$ .

## 90 **3. RESULTS AND DISCUSSION**

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

92 The result showed that nutrients were presents in all part of the *Gomphrena*  
93 *celosioides* investigated but in varied amount (Table1-2). Moisture, ash and crude  
94 fiber were highest in the stem ( $64.20 \pm 0.14$ ,  $8.26 \pm 0.00$  and  $18.66 \pm 0.01$ )  
95 respectively. Total protein and fat contents were highest in the leaf ( $0.44 \pm 0.00$  and  
96  $0.52 \pm 0.00$ ) respectively while carbohydrate was highest in the root ( $33.21 \pm 0.63$ )  
97 (Table 1). The result has indicated that these parts are a good source of nutrients  
98 when compared to some other vegetables. Proteins are used for building and  
99 repairing of body tissue, regulation of body processes and formation of enzymes  
100 and hormone. Ash content of any given food material is a measure of food quality  
101 and identity, it represent the foodstuff that is carbon free as a result of burning  
102 away of organic portion (Isong and Essien, 1996). It has proved helpful in  
103 establishing and maintaining acid-alkaline balance of the blood system (Ilodibia *et*  
104 *al.*, 2014). The higher fiber content in the stem showed that they can help in  
105 keeping the digestive system healthy and functioning properly. Fiber aids and  
106 speeds up the excretion of waste and toxins from the body, preventing them from

107 sitting in the intestine or bowel for too long, which could cause a build-up and lead  
 108 to several diseases (Isong and Essien, 1996). Higher moisture content of the stem  
 109 showed that it will be less preferred to leaf and root in processed food products.  
 110 Dorman *et al.* 2000 and Ilodibia *et al.* 2014 have reported that high moisture  
 111 increases spoilage and enzymatic deterioration in food products.

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

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

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

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

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

Plant part	Vitamin A	Vitamin C
Stem	1.84. $\pm$ 0.01 <sup>b</sup>	1.55 $\pm$ 0.03 <sup>b</sup>
Leaf	1.96 $\pm$ 0.01 <sup>a</sup>	1.68 $\pm$ 0.01 <sup>a</sup>
Root	1.57 $\pm$ 0.02 <sup>c</sup>	1.47 $\pm$ 0.01 <sup>c</sup>
P-value	**	**

133 Results are mean  $\pm$ SD \*Columns followed by the same letter are not significantly  
 134 different, significant difference exist at \*\* $p < .05$

### 135 ANATOMICAL STUDIES

136 Transverse section of *Gomphrena celosioides* leaf had uniseriate epidermis with  
 137 cut trichomes followed by 5 layers of parenchyma cells. It had three vascular  
 138 bundles at the midrib and the other vascular bundles seen were those of the veins  
 139 (Plate 1).

140 The transverse section of *Gomphrena celosioides* petiole was crescent shaped and  
 141 showed uniseriate epidermis followed by 2-3 pinkish layers of collenchyma cells.  
 142 It had three vascular bundles very close to the upper part (Plates 2).

143 *Gomphrena celosioides* primary stem showed presence of uniseriate epidermis,  
 144 followed by 2 layers of collenchyma, 4 layers of parenchyma and a layer of  
 145 endodermis on which the vascular bundles were cojointly arranged. There was also  
 146 presence of wide pith filled with parenchymatous cells (Plate 3).

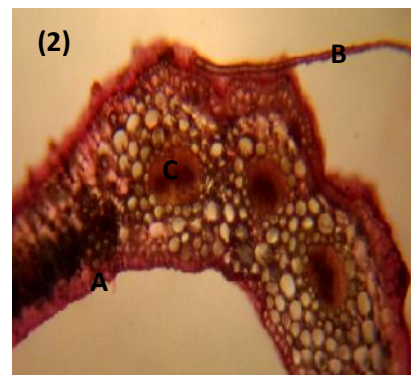
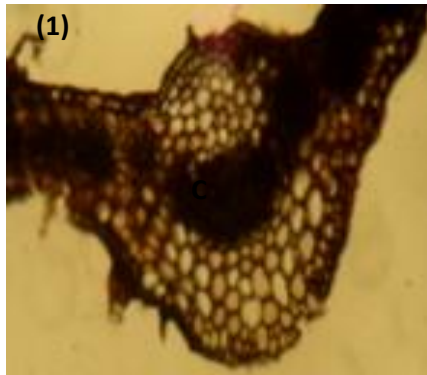
147 *Gomphrena celosioides* secondary stem showed uniseriate epidermis, 2  
 148 layers of collenchyma cells, and 3 layers of parenchyma cells followed by  
 149 endodermis on which vascular bundles were arranged. It has wider pith filled with  
 150 parenchyma cells (Plate 4). Transverse section of the root of *Gomphrena*  
 151 *celosioides* showed uniseriate epidermis, followed by a medium sized cortex and  
 152 also a cojoint vascular bundles. There were medullary vascular bundles in the pith  
 153 (Plate 5). The result has revealed similar epidermis and cortex and some  
 154 dissimilarity in the arrangement and distribution of vascular bundle among the  
 155 various parts. The result is in line with the work of plant anatomist Carlquist 1961  
 156 who stated that the similarities and differences in features confirms their  
 157 physiological functions as plant organs.

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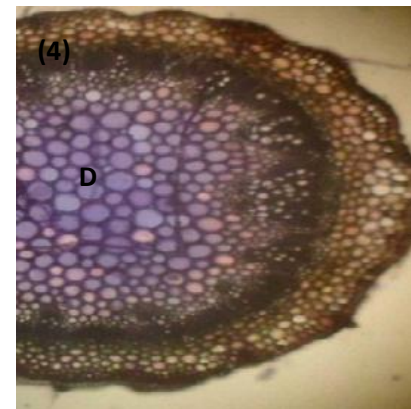
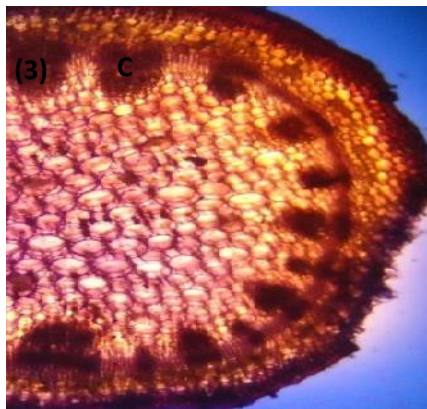
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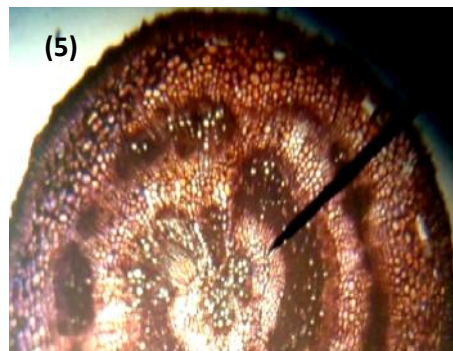
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168 **Plate 1- 5: T/S of leaf, petiole, primary and secondary stem and root**  
169 **respectively of *Gomphrena celosioides* (X40) A-D: epidermis, trichome,**  
170 **vascular bundle and pith respectively**

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194 **Fig 1:** *Gomphrena celosioides* in its natural habitat.  
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197 **4. CONCLUSION**

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