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Phytochemical and Proximate Studies of Various Parts of *Commelina benghalensis* L. and *Commelina diffusa* Burm. f.

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Abstract

Commelina benghalensis L. and *C. diffusa* Burm. f. are members of the genus, *Commelina* that belong to the family, Commelinaceae. The chemical and nutritional values of parts of *C. benghalensis and C. diffusa* were determined and compared. Standard analytical methods were used for the analyses of phytochemical and proximate constituents of the leaf, stem and root of these plants. The significance of the findings was evaluated using Duncan's multiple range test. Highest alkaloid and flavonoid contents were detected in the leaf (2.94±0.00%) and stem (1.74±0.02%) of *C. diffusa* respectively. Saponin, moisture and fibre levels were highest in the root (1.73±0.01%), leaf (11.53±0.08%) and stem (18.53±0.08%) of *C. benghalensis* respectively. Highest quantity of anthraquinones was found in the stem (2.40±0.00%) of *C. diffusa*. In addition, high concentration of hydrogen cyanide was present in the leaves of *C. benghalensis* (3.78±0.02 mg/kg) and *C. diffusa* (2.86±0.06 mg/kg). *Commelina benghalensis* and *C. diffusa* are rich in phytochemicals and nutrients; hence, utilization of these two species of *Commelina* as food and drug is suggested. However, there is need to process the plant parts before administration, due to presence of high level of hydrogen cyanide.

Keywords

Commelina, Plant-based Drugs, Alkaloids, Flavonoids, Hydrogen Cyanide

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1. Introduction

Commelina is a genus of the family, Commelinaceae. It is regarded as the largest genus of the family [1]. They are annual or perennial herbs. *Commelina benghalensis* L., commonly known as wandering Jew or tropical spiderwort is a weed of cultivated, waste and roadsides while *C. diffusa* Burm. f., commonly known as spread dayflower is a weed of field crops, often found under shades, on lawns and waste areas [2]. Moreover, they are both pan-tropical weeds.

Plants are nature's panacea and cure for all ills from time immemorial. Folk medicine uses whole plants as well as different parts for treatment of different human afflictions. Its practice mainly depends on comparatively cheap and easily locally accessible plants, as well as the ancestral knowledge of the utility of the plants. Hence, it is applicable worldwide and is the predominant health care delivery system in Africa. Moreover, the availability and level of phytochemicals in plants denote their curative potentials. Humans derive a greater health benefit from phytochemicals when compared with macronutrients and micronutrients [3].

Commelina species are used in Nigerian traditional medicine. The whole plant of *Commelina* spp is taken as infusion in water for infertility in women, to initiate foetal movement, as tonic for children, for treatment of urine retention in infants,

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and as a good luck charm [4]. However, the particular species was not specified. Therefore, the objectives of this work were to investigate and compare the chemical and nutritional values of *C. benghalensis and C. diffusa* parts.

2. Materials and Methods

2.1. Collection of Plant Materials

The leaves, stems and roots of mature *C. benghalensis* and *C. diffusa* were collected in June beside Faculty of Law and Science Village, Nnamdi Azikiwe University Awka, Nigeria respectively. The plants were authenticated by Dr C. A. Ezeabara, a plant taxonomist in Department of Botany of the same institution, where the voucher specimens were deposited.

2.2. Preparation of Samples

The leaves, stems and roots of the plants were washed under running water and were oven dried at 55°C for five days and later ground to powder form. The powdered samples were stored in an air tight container prior to analyses.

2.3. Qualitative Phytochemical Analysis

The qualitative phytochemical tests were carried out using ethanol extract. The dry milled samples were soaked in the solvent (ethanol) overnight and filtered with filter paper to obtain pure solution. After that, it was heated to one quarter volume of flask. Presence of alkaloids, anthraquinones, flavonoids, hydrogen cyanide, phenols, saponins, sterols, tannins and terpenoids were determined using the standard methods of Beckett and Stenlake [5].

2.4. Proximate Analysis

Carbohydrate, crude fibre, moisture and crude protein contents were determined by the calculated difference as the nitrogen free extractive (NFE), Weende, gravimetric and Kjeldahl digestion methods respectively [6]. Crude fat (ether extract) was determined by extracting known amount of moisture-free sample with fat petroleum ether in soxhlet ether extraction apparatus [7], while total ash left after ignition of a decarbonized material in a muffle furnace at 550–600°C for 2 hrs was estimated [8].

2.5. Statistical Analysis

The data was statistically analyzed using One-Way-Anova (F-Test). Duncan's Multiple Range Test was then used to measure the test of significance, and the values were expressed as mean ± standard error of triplicate determinations.

3. Results and Discussion

The results of the quantitative phytochemical and proximate analyses of the leaf, stem and root extracts of *C. benghalensis* and *C. diffusa* were shown in Tables 1 and 2 respectively. The higher levels of alkaloids and flavonoids occurred in the leaf and stem of *C. benghalensis* and *C. diffusa*. Moreover, the highest percentages of alkaloids and flavonoids were detected in the leaf (2.94±0.00) and stem (1.74±0.02) of *C. diffusa* respectively. Alkaloids and flavonoids of plant origin are known for their several pharmacological significances. Administration of warm dried leaves of *C. benghalensis* treated rheumatic pain [9]. This is attributable to the high presence of alkaloids in *C. benghalensis* as well as the painkilling effect of the alkaloids. Flavonoids have anti-inflammatory effect as a result of their characteristic inhibition of reactive oxygen or nitrogen species [10]. This probably explained the traditional use of *C. benghalensis* as an anti-inflammatory medicine in China [11]. Phenol, sterol and terpenoid levels were low in all parts of the two species of *Commelina*. Although they occurred in low concentrations, yet they could interact with other chemical compounds present in the plants for stronger pharmacological effects. High percentages of saponins were detected in all parts of both species, with the highest occurrence in the root of *C. benghalensis* (1.73±0.01) and the lowest in the root of *C. diffusa* (0.95±0.01). Plants rich in saponins are used in treatment of diseases as a result of a wide range of biological activities of saponins. Highest percentages of tannins were detected in the leaf (1.29±0.00) and stem (1.65±0.00) of *C. diffusa* respectively. Moreover, considerable high levels of tannins that were not significantly different were found in the leaf (0.85±0.02%) and stem (0.91±0.01%) of *C. benghalensis* as well as in the root (0.85±0.00%) of *C. diffusa*. In Tanzania, a solution made from pounded leaves of *C. benghalensis* soaked in warm water is used in treating diarrhoea [12]. This medicinal application is probably as a result of tannin content of *C. benghalensis* leaf. Tannins possess antidiarrhoeal quality which is due to their ability to stimulate the reabsorption of water from the intestinal lumen as well as significantly reducing the intestinal transit time and intestinal motility [13, 14]. Moreover, *C. benghalensis* parts are made into a poultice and applied on sores of feet in Southern Nigeria [15]. This medicinal usage of *C. benghalensis* could also be as a result of the presence of tannins, which have wound healing effect. Highest concentrations of anthraquinones were found in the leaf (2.29±0.01%) of *C. benghalensis* and stem (2.40±0.00%) of *C. diffusa*. High quantity of hydrogen cyanide was present in the leaf of *C. benghalensis* (3.78±0.02 mg/kg) and *C. diffusa* (2.86±0.06 mg/kg). The highest concentration which was detected in *C. benghalensis* (3.78±0.02 mg/kg) fell

within the range of values reported in the stem of *Stachytarpheta angustifolia* (3.52+0.03 mg/kg) [16], *S. cayennensis* (3.12+0.036 ml/kg) and *S. indica* (3.18+0.006 ml/kg) [17]. The levels of hydrogen cyanide found in the leaf of the two plants are high and could be considered toxic to human and animal systems. The clinical symptoms of acute cyanide poisoning have been enumerated [18]. They include rapid respiration, drop in blood pressure, rapid pulse, headache, dizziness, vomiting, diarrhoea, mental confusion, stupor and blue discolouration of the skin due to lack of oxygen (cyanosis), twitching and convulsions. Processing of parts of *C. benghalensis* and *C. diffusa* before consumption is hereby suggested.

The percentage moisture ranged from 7.51±0.09 to 8.91±0.01 in the root, 7.73±0.13 to 8.35±0.06 in the stem and 8.68±0.08 to 11.53±0.08 in the leaf of *C. diffusa* and *C. benghalensis* respectively. Hence, the moisture contents of *C. diffusa* and *C. benghalensis* followed the patterns that root<stem<leaf and root>stem<leaf respectively. The ash content was highest in the leaf of the two plants with a larger value in the leaf of *C. diffusa* (13.82±0.02%). The soluble part of ash consists of mineral matter which can be used for preparing mineral extract in the estimation of various minerals [8]. The percentage of fibre was high in all the parts of both species. In addition, the stems of the two species had the highest amount of fibre with the highest level present in *C. benghalensis* (18.53±0.08%). Fibre aids in cleansing of the digestive tract, digestion as well as controlling the absorption of cholesterol [19]. Low quantities of fat were detected in all parts of these species of *Commelina*. The highest levels of fat were found in the leaf with greater amount in *C. diffusa* (3.41±0.01%); while the lowest values were found in the root of both plants. The highest content of protein was detected in the leaf of the two species, with higher level in *C. diffusa* (15.78±0.02%). Percentages of carbohydrate present in *C. benghalensis* ranged from 46.16±0.12 in the leaf to 57.58±0.12 in the root, and from 45.65±0.01 in the leaf to 59.83±0.18 in the root of *C. diffusa*. These findings indicate that these plants are rich in nutrients, hence, are suggested as sources of nourishment.

Table 1. Quantitative phytochemical composition of leaf, stem and root of *C. benghalensis* and *C. diffusa* (%).

Composition	*C. benghalensis*			*C. diffusa*		
	Leaf	**Stem**	**Root**	**Leaf**	**Stem**	**Root**
Alkaloids	2.74±0.02^{d}	2.82±0.00^{d}	1.65±0.00^{b}	2.94±0.00^{e}	2.61±0.01^{c}	1.48±0.00^{a}
Flavonoids	1.47±0.04^{c}	1.62±0.02^{d}	0.91±0.02^{b}	1.63±0.00^{d}	1.74±0.02^{e}	0.72±0.02^{a}
Phenols	0.25±0.00^{c}	0.20±0.01^{b}	0.15±0.01^{b}	0.18±0.01^{b}	0.09±0.04^{a}	0.25±0.02^{c}
Saponins	1.39±0.01^{c}	1.37±0.02^{c}	1.73±0.01^{e}	1.60±0.00^{d}	1.22±0.02^{b}	0.95±0.01^{a}
Tannins	0.85±0.02^{b}	0.91±0.01^{b}	0.64±0.02^{a}	1.29±0.00^{c}	1.65±0.00^{d}	0.85±0.00^{b}
Sterols	0.16±0.00^{b}	0.26±0.03^{c}	0.14±0.02^{b}	0.09±0.00^{a}	0.19±0.01^{b}	0.25±0.01^{c}
Anthraquinones	2.29±0.01^{d}	1.83±0.01^{c}	0.36±0.00^{a}	0.65±0.00^{b}	2.40±0.00^{e}	1.92±0.00^{c}
Terpenoids	0.68±0.01^{c}	0.56±0.04^{b}	0.22±0.02^{a}	0.74±0.02^{c}	0.61±0.01^{b}	0.23±0.00^{a}
HCN (mg/kg)	3.78±0.02^{f}	0.87±0.03^{c}	0.44±0.02^{a}	2.86±0.06^{e}	1.16±0.00^{d}	0.56±0.02^{b}

HCN: Hydrogen cyanide. Values are mean ± standard error of triplicate determinations. Rows with the same superscripts are not significantly different ($p<0.05$)

Table 2. Proximate composition of the leaf, stem and root of *C. benghalensis* and *C. diffusa* (%).

Composition	*C. benghalensis*			*C. diffusa*		
	Leaf	**Stem**	**Root**	**Leaf**	**Stem**	**Root**
Moisture	11.53±0.08^{f}	8.35 ±0.06^{c}	8.91 ±0.01^{e}	8.68 ±0.08^{d}	7.73 ±0.13^{b}	7.51 ±0.09^{a}
Ash	10.66±0.04^{c}	9.47 ±0.02^{b}	8.93±0.01^{a}	13.82±0.02^{e}	11.67±0.04^{d}	9.47±0.02^{b}
Crude fibre	13.78±0.02^{b}	18.53±0.08^{f}	15.38±0.08^{d}	12.66±0.04^{a}	17.82±0.02^{e}	14.62±0.09^{c}
Crude fat	3.17 ±0.01^{c}	1.91 ±0.01^{a}	2.88 ±0.03^{b}	3.41 ±0.01^{d}	1.85 ±0.00^{a}	2.79 ±0.01^{b}
Protein	14.71±0.01^{d}	5.88+0.04^{a}	6.33 ±0.01^{b}	15.78±0.02^{e}	6.81 ±0.01^{c}	5.79 ±0.01^{a}
Carbohydrate	46.16±0.12^{b}	55.88±0.12^{d}	57.58±0.12^{e}	45.65±0.01^{a}	54.13±0.06^{c}	59.83±0.18^{f}

Data are mean ± standard error of triplicate determinations. Rows with the different superscripts are significantly different ($p>0.05$)

4. Conclusion

Highest levels of saponins, moisture and fibre were present in the root, leaf and stem of *C. benghalensis* respectively. In *C. diffusa*, alkaloids, ash, fat and protein values were highest in the leaf; flavonoids and anthraquinones were highest in the stem; and the highest content of carbohydrate was found in the root. Considerable high nutritive and phytochemical values were found in parts of *C. benghalensis* and *C. diffusa*; with the latter being richer. They are therefore, revealed as species of *Commelina* with huge health benefits.

Conflict of Interest

Authors declared that there was no any conflict of interest.

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