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Research Article

Preliminary Studies on the Evaluation of Phytochemistry and Proximate Composition of *Dicksonia Antarctica* (Labill)

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Abstract: Phytochemical screening and proximate analysis were carried out on the stem, leaves and roots of *Dicksonia antarctica* (Labill) using standard procedures. The preliminary screening revealed the presence of some important phytochemical compounds like alkaloid, saponins, flavonoids, glycosides, and steroids. Alkaloid was the most prominent and occurred mostly in leaves (46%) and roots (23.6%) while tannin was relatively low in all the samples with the root, having the least content (0.60%). The proximate analysis showed that the plant was rich in plant constituents and most of them were shown to be high in the leaves except carbohydrate which occurred very high in the root (57.15%). Highest moisture content (55.7%) was observed in the leaves while the roots recorded the least value (25.6%).
Keywords: Evaluation, Phytochemistry, Dicksonia, Proximate, Composition.

INTRODUCTION

Dicksonia antarctica, commonly known as soft tree fern, is slow growing, hardy plant in the family Dicksoniaceace. It is an evergreen fern growing from 4m to 9m at a slow rate. Fern species live in a wide variety of habitats, from remote mountain elevations to dry desert rock surfaces, to bodies of water or in open fields [1, 2].

Although ferns are not as important economically as seed plants, but they have considerable importance. Some ferns are used for food, including the fiddleheads (*Dipbaium esculentum)* and others such as mosquito ferns are used as biological fertilizer in rice paddies of Southeastern Asia with their ability to fix nitrogen from air into compounds that can be used by other plants [3, 4]. Ferns have been studied and found to be useful in the removal of metal s especially arsenic, from the soil [5]. Ferns are known to be used as vermifuge, in florist trade as well as model plants for teaching and research [6].

The chemical constituents of plants which are used as drugs may occur in the form of primary metabolites such as amino acid or in the form of secondary metabolites like alkaloids, flavonoids, steroids etc [7]. The primary benefits of using plant derived medicine are that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and affordable treatment [8].These active components of plants can be identified by phytochemical analysis [9]. Specific phytochemicals such as flavonoids, are widely distributed in plants, having many functions which include producing yellow and red blue pigmentation in flowers and protection from attack by microbes and insects [10].

MATERIALS AND METHODS

The plant sample of *Dicksonia antarctica* was collected from the Botanical Garden of Nnamdi Azikiwe University, Awka. The plant material was authenticated by Mr. AO Ozioko, a consultant taxonomist with the International Center for Ethnomedicine and Drug Development (InterCEDD) Nsukka Nigeria. The voucher specimen of the plant studied is deposited in the herbarium of the Department of Botany, NnamdiAzikiwe University, Awka.

Preparation of Plant Extract

The stem, leaves and roots of *Dicksonia antarctica* were washed thoroughly in water, chopped into tiny pieces then dried in an air-circulating oven in the laboratory at 45^{o}C for 2hours. The dried sample was pulverized using automated blender. The pulverized sample was dissolved in 100ml

of 70% ethanol and left to stand for 24hours using the batch method of extraction. The sample was filtered with No.42 Whatman filter paper. Standardization was accomplished by evaporating to dryness using rotary evaporator at 40^{o}C.

Phytochemical Analysis

The powdered extracts were subjected to both qualitative and quantitative phytochemical analysis using standard methods as described by [11].

Proximate Analysis

Proximate analysis on the extracts of the stem, leaves and roots of *Dicksonia Antarctica* was carried out using the methods of AOAC, [12, 13]**.**

The proximate composition of the sample was determined using the AOAC official methods [12, 14]. Thermal drying method was used in the determination of moisture content of the samples [15]. Moisture was determined by the loss in weight of samples dried in a 105^{0}C oven. The percentage moisture content was calculated by computing the loss in weight on drying as a fraction of the initial weight of sample used and multiplied by 100.

$$MC\,(\%) = \frac{W_o}{W_i}\ X\,100$$

Where,

W_o = loss in weight (g) on drying and

W_i = initial weight of sample(g)

The ash content was determined using the ignition method by burning the sample in a muffle furnace at 600^{0}C for 2 hr. The percentage ash Content was calculated using the formula:

$$Ash\,(\%) = \frac{M_a}{M_s}\ X\,100$$

Where,

M_a = Mass of ash (g)

And M_s = Mass of sample used (g)

Determination of crude protein was done by determining the total organic nitrogen, using the macro-Kjeldhal method. This involved digestion, distillation and titration. The technique determined the amino nitrogen of the sample, after which the total organic nitrogen was then, calculated using the formula:

$$\%\,TON = \frac{TV \times NE \times TV_d}{Ms \times V_d}$$

Where,

TV = Titer value,

NE = mg nitrogen equivalent to molarity of acid,

TV_d= total volume to which digest was diluted,

M_s= mass of sample (g) and

V_d= volume of digest distilled.

Determination of crude fat content of the sample was done using Soxhlet type of the direct solvent extraction method. Crude fat represents total fat in most samples. At the end of the extraction, the solvent was evaporated and the flask dried in the oven (at 60^{0}C). The flask was then cooled and reweighed. The percentage crude fat (Lipid) was calculated using the formula:

$$CL\,(\%) = \frac{M_{ex}}{M_g}\ X\,100$$

Where,

M_{ex} = mass of extract (g) and

M_s = mass of sample used (g).

Total carbohydrate content of the sample was estimated by 'differences' [9]. In this, the sum of the percentages of all the other proximate components was subtracted from 100 i.e.

Total CHO (%) = 100 – (% moisture + % crude protein + % crude fat + %ash).

RESULTS

The results of the study on proximate and phytochemical contents of the stem, leaves and roots of *Dicksonia Antarctica* are shown in Tables 1 to 3.

Table 1 showed that Tannin, Saponin and Steroid were present in all the samples. Alkaloid was present in leaf and root but absent in the stem. Flavonoid was present in stem and root but absent in leaf. Glycosides were present only in the leaf but absent in stem and root.

The highest value of chemical component was obtained in the leaf, this component was alkaloids (46.6%) and the least tannin (0.60 %) was obtained in the root.

The highest value of proximate composition was carbohydrate (57.15%) obtained from the Root. This was followed by moisture (55.7%) obtained in leaf. The least was Acid insoluble (1.00%) obtained in the stem.

Table- 1: The qualitative content of the various chemical compounds

Sample/constituent	Stem	Leaf	Root
Tannin	+	+	+
Saponin	+	+	+
Flavonoid	+	-	+
Steroid	+	+	+
Glycosides	-	+	-
Alkaloid	-	+	+

+ = present, - = Absent

Table-2:Quantitative phytochemical content of the various parts of the *Dicksonia antarctica.*

Phytochemical (%)	Stem	Leaf	Root
Flavonoid	14.00	-	2.20
Tannin	1.00	0.80	0.60
Saponin	11.80	13.00	18.40
Alkaloid	-	46.60	23.60
Steroid	6.20	11.20	4.00
Glycoside	-	12.40	-

Table-3:Proximate composition of *Dicksonia antarctica*.

Sample/constituent(%)	Stem	Leaf	Root
Protein	3.06	9.19	5.25
Fat	15.50	21.50	6.00
Ash	3.00	9.00	6.00
Carbohydrate	25.34	4.61	57.15
Moisture	53.10	55.70	25.60
Acid insoluble	1.00	3.50	2.00
Water insoluble	2.00	6.00	3.50

DISCUSSION

Plants produce a wide array of chemicals and substances for their growth, maintenance, reproduction and protection. These chemicals naturally produced by the plants are referred to as phytochemicals.

The result of the phytochemical and proximate studies of *Dicksonia antarctica* revealed that Alkaloid, Glycoside, Saponin, Steroid and Flavonoid were present in the stem, leaves and roots. Glycoside was only present in the leaves, and flavoniod was absent in the leaves while alkaloid was absent in the stem. Saponin and steroid were present in all the samples (stem, leaf and root). The result also revealed that alkaloid was the component that had the highest value and was found in the leaves (46.6%) followed by the root (23.6%), but relatively low in the stem. Tannin was the least component in all the samples.

The presence of some of these secondary metabolites such as flavonoid in stem and roots of *Dicksonia actarctica* showed that it has free radicals scavenging ability and anti-oxidant property which might be linked to the anti-diarrhea, anti-dysentery and wound healing properties of this plant as documented from the local use of this plant [16].

The usefulness of these active constituents of plants as the main source of drug has tremendous prospects in the medical profession. Alkaloids are chemical constituent from plants that are used as analgesic because they are capable of relieving pains. They have anti-bacterial [17] and antispasmodic effect, and can be used in manufacture of sedatives [11].

Flavonoids have been shown to protect against hap toxicity, probably by preventing lipid peroxidation [15]. They have also been shown to have astringent and anti-microbial effects and can therefore aid in wound healing [18].

Saponins possess specific physical, chemical and biological activities that make them useful as drugs. Although saponins are cytotoxic and affect the permeability of cell wall, they are beneficial to man by helping in lowering the cholesterol level in the body [19] and also beneficial for the treatment of cancer [20]. It has been reported [21, 22] that phytochemicals , working together with nutrients found in fruits, vegetables and nuts may help slow the aging process and reduce the risk of many diseases, including cancer, heart diseases, stroke, high blood pressure, cataracts, ostioporosis, and urinary tract infections.

Similarly, the result of the proximate analysis revealed that the samples were very rich in moisture content, with the leaves having the highest value (55.7%). The roots and the stem respectively have the highest content of carbohydrate. Fat is the third highest occurring constituent in all the samples while acid insoluble, ash and water insoluble are respectively lowest in all the samples. The highest content of all the constituents occurred in the leaves except carbohydrate which occurred highest (57.15%) in the root.

The presence of carbohydrate, protein, fat, ash and the high moisture content (55.7%) confirmed the nutritional values of *Dicksonia antarctica* and its role in treatment of diseases. The carbohydrate found in the root of the plant is required by the human body for the building of tissues and energy. Carbohydrates are hydrolyzed in the body to yield glucose, which can be utilized immediately, or stored as glycogen in the muscles and liver for future use [23]. Proteins are important in the body for the production of hormones, enzymes and blood plasma transport systems. They are immune boosters and can help in cell division as well as growth [9]. Fats are secondary plant products that yield more energy per gram than carbohydrates. Dietary fats are important not only because of their high energy value, but the fat soluble vitamins and essential fatty acids contained in the fat of natural foods. Fats and oils help to regulate blood pressure [24].

The rich chemical constituent of *Dicksonia antarctica* especially alkaloids and saponin, suggested that the plant has striking potentials in achieving the treatment of certain diseases.

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