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# Chemical profile of the leaves of *phymatodes scolopendria* (giant polypody)

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**ABSTRACT**

The leaves of phymatodes scolopendria was analysed for proximate, mineral, toxicant and phytochemical compositions. The proximate analysis showed that these leaves contained 20.40± 0.34% moisture, 14.00 ± 0.12% ash, 4.60 ± 46% crude lipid, 8.80 ± 0.10% crude fibre, 12.60 ± 0.20% crude protein, 68.80 ± 0.32% available carbohydrate and energy value of 366.8 ± 0.12 kcal/100g. Mineral composition revealed that some of the essential metals, such as zinc (23.34 ± 0.14mg/100g) and manganese (55.36 ± 0.54mg/100g) were high in concentrations and, the non-essential and toxic metals such as lead and cobalt were in trace amounts while; mercury (0.003 ± 0.11mg/100g) was very low. The toxicant composition of the leaves of phymatdoes scolopendria were relatively low especially phytic (1.34 ± 0.21mg/100g), and hydrocyanic acids (1.40 ± 0.12mg/100g). The results obtained from the phytochemical analysis revealed the presence of cardiac glycosides, tannins, flavonoids, polyphenols and reducing sugars in both water and petroleum ether extracts. The results obtained in this study have provided information on the nutritive value and its potential in ethno medicine applications.

## INTRODUCTION

In Nigeria, many indigenous plant leaves species are used for food and medicine. A great number of these leaves are traditionally noted for their medicinal properties (Enwere, 1998). Plant leaves can be good source of nutrients as well as drugs. Medicinal plants constitute effective natural products that have been used traditionally for the treatment of ailments of both microbial and non-microbial origins and also provide a source for the development of novel drugs (Ngasi, 2006). Plant extracts provide health coverage for over 80% of the world's population especially in developing countries (Okwu, 2001).

There are considerable information on the nutrient composition of most known cultivated plants (Ejoh, et al., 2007 and Okeke et al., 2011). However information regarding nutrient composition of lesser known leaves appear to be scanty (Osabor et al., 2010). Chemical analysis carried out on these lesser known leaves shows that they contain appreciable levels of bioactive compounds, minerals, vitamins, protein, energy and certain hormone precursors (Cho, et al., 2004).

*Phymatodes scolopendria* is commonly known in English as giant polypody. The plant is a widely creeping and crawling rhizome, occurring from Australia and extending beyond Asia. It occurs mostly in dune forest and dune scrub near sea levels (Swan, 2000). Phymatodes scolopendria grows in woods, ravines and rocky crevices, though most of them grow, on trunk/branches of trees and Marshes (Enwere, 1998). It is best cultivated outdoors in light shade but it also tolerates direct rays from sunlight available most part of the day (Achiewa and Ariena, 1995). The leaves extract has hypoglycaemic properties and is used for the treatment of diabetic symptoms. In the east of Madagascar, infusion of the leaves has been taken orally for the treatment of respiratory disorders and in ethno medicine for the treatment of epilepsy (Achinewu and Aniena, 1995). The leaves of the young plant are chewed by some people as a hunger suppressant, while the mature leaves are used for the treatment of skin sores (Sofoword, 1984). The present study was therefore, designed to evaluate proximate, anti-nutritional, mineral and phytochemical compositions of phymatodes scolopendria obtained from Ikom, Cross River State with a view to assessing its nutrient composition and medicinal potentials.

## MATERIALS AND METHODS

**Sample collection**.

Fresh, tender leaves of phymatodes scolopendira were collected from Okoroba farm plantation in Ikom Local Government Area of Cross River State Nigeria. Samples were identified by a taxonomist in the Botany Unit, Department of Biological Science, University of Calabar. The leaves were separated from the stalks, washed and sun dried for three days and ground into power using a Kenwood blender, sieved and stored in a desiccator until required for analysis.

**Apparatus and reagents**

A pye- Unican atomic absorption spectrophotometer with acetylene flame was used to analysis for calcium, magnesium, iron, manganese, nickel copper, zinc and phosphorus. As described by A. O. A. C. (1990).

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While sodium and potassium where determined by flame photometer (Galler Kamp) as described by Vogel (1962). Emarck concentrated volumetric solutions were used as standard metallic ions solution for the calibrations. All reagents used were of analytical grade and the water used was double distilled.

**Proximate analysis**

Recommended methods of the Association of Official Analytical Chemists (AOAC, 1990) were employed in the analysis of moisture, fat, dietary fiber, and ash contents. The nitrogen content obtained was converted to protein content by using a conversion factor of 6.25. Three replicates of the sample were analyzed. Total carbohydrate was calculated by difference (*i.e.*, 100 minus sum of percentages of ash, lipid and protein). One of the methods specified by FDA (Food and Drug Administration) was employed. This uses the general factors of 4, 4, and 9 calories per gram of protein, total carbohydrate, and total fat, respectively, to calculate the calorie content of food.

**Toxicant analysis**

Hydrocyanic acid (HCN) was estimated by the alkaline titration method of (A.O.A.C. 1975), Oxalate was determined by the method of (Dye, 1956) while phytic acid was extracted using 3% trichloroacetic acid. The extracts were prepared according to the method described by wheeler and Ferrel (1977). The absorbance was read at 480nm while phytic acid was calculated by employing the method of saturdi and Suckle (1985). On the bases that six atoms of phosphorus are contained in one molecule of phytic acid giving 1:3.55 phosphorus: phytic acid molecule ratio (phytic acid = $C_6 H_8 O_{24} P_6$).

**Mineral elements analysis** The mineral elements were determined by first wet-ashing of the samples (A.O.A.C. 1990). Sodium and potassium were determined by flame photometer (Galler Kamp). Calcium, Manganese, magnesium, nickel copper, zinc, iron and phosphorus were determined by atomic absorption spectrophotometer (type-Unican).

## RESULTS

The results of proximate composition of the leaves of phymatodes scolopendria, is illustrated in Table 1. These include those of moisture, ash, crude fibre (CF), protein, crude fat and carbohydrates, with values of 20.46±0.34%, 14.00± 0.12%, 8.80 ± 0.10%, 12.60 ± 0.22%, 4.60 ± 0.46% and 68.80±0.32% respectively. Table 2 presents the levels of evaluated toxicants in the leaves of phymatodes scolopendria with values of 1.34 ± 0.21, 1.40± 0.12 and 26.30± 0.11mg/100g for phytic acid, hydrocyanic acid and soluble oxalates respectively. The levels of phytic acids and hydrocyanic acids were very low while that of soluble oxalate was relatively high in the samples analysed.

The mineral elements composition of P. Scolopendria leaves ranged from 0.003± 0.11 to 450.02 ± 0.20 mg/100g, with mercury having the least value while sodium was observed to have the highest value (Table 3).

The results of phytorchemical screening (Table 4) revealed the presence of cardiac glycosides, tannins, flavonoids, polyhenols and reducing sugars while alkaloids, saponins, phlobatannins, anthranoids and anthraquinones were completely absent in both aqueous and petroleum ether extract of phymatodes Scolopendria leaves studied.

**Table 1.** Results of proximately composition (%) of phymatodes scolopendria leaves

| Parameters | % composition |
|---|---|
| Moisture | 20.40 ± 0.34 |
| Ash | 14.00 ± 0.12 |
| Crude lipid | 4.60 ± 0.46 |
| Crude fibre | 8.80 ± 0.10 |
| Crude protein | 12.60 ± 0.22 |
| Carbohydrate | 68.80 ± 0.32 |
| Calorie (Kcal) | 366.8 ± 0.12 |

The data are mean value ± standard deviation (S D) of triplicate determinations.

**Table 2.** Toxicant compositions (mg/100g) of phymatodes scolopendria leaves.

| S/N | Toxicant | Composition (mg/100g) |
|---|---|---|
| 1. | Phytic acid | 1.34 ± 0.21 |
| 2. | Hydrocyanic Acid (HCN) | 1.40 ± 0.12 |
| 3. | Soluble Oxalate | 26.30 ± 0.11 |

The data are mean value ±S.D of triplicate determinations.

**Table 3**. Mineral elements compositions of phymatodes scolopendria leaves

| **Minerals** | **Composition (mg/100g)** |
|---|---|
| Potassium (K) | 7.80 ±0.11 |
| Sodium (Na) | 450.02 ± 0.20 |
| Calcium (Ca) | 14.534 ± 0.36 |
| Zinc (Zn) | 23.34 ± 0.14 |
| Lead (Ph) | Trace |
| Cobalt (Co) | Trace |
| Manganese (Mn) | 55.36 ± 0.55 |
| Magnesium (Mg) | 36.72 ± 054 |
| Mercury (Hg) | 0.003 ± 0.11 |
| Nickel (Ni) | 6.44 ± 0.32 |
| Phosphorus (P) | 32.66 ± 0.41 |
| Copper (Cu) | 2.98 ± 0.12 |
| Iron (Fe) | 3.07± 0.10 |

Data are mean value ± S.D of triplicate determinations.

**Table 4.** Phytochemcial screening of phymatodes scolopendria leaves

| **S/N** | **Phytochemicals** | **Petroleum ether extract** | **Water extract** |
|---|---|---|---|
| 1. | Akaloids | - | - |
| 2. | Cardiac glycosides | - | ++ |
| 3. | Saponins | - | |
| 4. | Tannins | - | + |
| 5. | Flavonoids | - | + |
| 6. | Polyphenols | ++ | ++ |
| 7. | Phlobatannins | - | - |
| 8. | Anthraquinones | - | - |
| 9. | Anthranoids | - | - |
| 10. | Reducing sugars | ++ | ++ |

Key: ++ = present in excess quantity

+ = present in moderate quantity

**-** = Absent

## DISCUSSION

This study was designed to investigate the potential of the leaves of phymatodes scolopendria for nutritional utilization and physiological importance. The moisture content, of phymatodes scolopendria leaves (fresh) as presented in table1 (20.40± 0.34%DM) is significantly lower than the 51.06 ± 0.05% reported by Gafar et al., (2011) for the leaves of Hairy Indigo (Indigofera astragalina). Moisture content of food is usually used as a measure of stability and susceptibility of microbial contamination.

The result of the ash content is represented in table 1. The ash content of 14.06 ±0.12%DM is a reflection of its mineral elements. The value obtained is high when compared to 8.17 ±0.58%DM reported for indegofera astragalina leaves (Gafar et al., 2011) while lower than 18.00% for balsam apple leaves reported by Hassan and Umar, 2006).

The result of the lipid content is lower than 5.00 ±0.50% reported by Gafar et al., (2011) for indigofera astrogalina leaves. Fat aids in storing energy in the body. A diet providing 1-2% of its calories of energy as fat is said to be sufficient to human being as excess lipid consumption is implicated in certain cardiovascular disorder (Champ, 2002). The result of the protein content of phymatodes scolopendria leaves is presented in table 1. The obtained results show that it contains 12.60 ± 0.22%DM Protein. The result is lower than 24.85% in sweet potatoes leaves and piper guineeses and talinum trangulare with values of 29.78% and 31.00% respectively (Akindanunsi and Salawu, 2005).

The daily protein requirement for children and adult is 23-26g and 45 -56g respectively (NRC, 1974). Proteins are essential for building and maintenance of body cells. Food proteins function primarily in the provision of amino acids, for the production and maintenance of body proteins (including enzymes) as well as a supplementary energy source. The crude fibre content of 8.80 ± 0.10%DM is low compared to 29.00% in balsam apple leaves reported by Hassan and Umar, 2006) crude fibre plays a useful role in providing roughage that aids digestion and reduces the accumulation of carcinogens in the body. Fibre in nutrition also aid in the reduction of cholesterol levels, risk of coronary heart attack, breast cancer and hypertension (Ganong, 2003).

The carbohydrate content of the leaves is low 68.80 ± 0.32% compared to 82.8% in corchorus tridens leaves reported by Asibey-Berko and Tagie (1999), but higher than 73.45 ± 0.11% for the leaves of Diplazium Summatt reported by Osabor et al (2010). Carbohydrates are good source of energy, they are energy giving food, when carbohydrate is sufficient in food, it prevents the unnecessary usage of protein and allows it to be used for body building processes.

The calorific value of phymatodes scolopendrai leaves is 366.8 ± 0.12 Kcal/100g on dry weight though adequate but low compared to 578.87Kcal/100g DM reported by Gafar et al., (2011) for L. astragalina leaves. This is expected because of the low carbohydrate value of 68.80 ± 0.32%DM. Phymatodes scolopendria leaves can serve as a good source of energy for the body system. The result of the toxicant compositions is presented in table 2. The phytic acid levels was 1.34 ± 0.21mg/100g, on the basis of the present study the phytic acid value is low. High concentration of phytic acids in food causes adverse effect on digestibility (Nwokolo and Braggs 1977).

The hydrocyanic acid (HCN) contentswas found to be 1.40 ± 0.12mg/100g, which is far below 36mg/100gDM considered to be lethal to man. The soluble oxalate was moderately high but lower than the 28.20 ± 0.11mg/100gDM reported by Osabor et al (2010) for D. Summatti leaves. The levels may not likely pose any toxicity problem to man since it is below the tolerance level of 2.5g oxalate (Manro and Bassir, 1969). Phytic acid, hydrocyanic acid and soluble oxalate in foods are toxicity factors which are known to affect the complete absorption of many minerals in the body (Igboh et al., 2009).

The results of mineral element compositions (table 3) clearly revealed that phymetodes scolopendria leaves constitutes a rich source of mineral elements although the bioavailability of these elements must be established. The mineral elements compositions showed high levels in sodium, manganese, magnesium, phosphorus and zinc and low levels in Iron, copper, Nickel, Calcium, mercury, lead and cobalt. This values obtained from this study compared favourably well with values obtained in the literature, (Mahammed et al., 2011 and Ezeike et al., 2011). The high levels of the essential elements is desirable as long as they are within allowed limits. Knowledge of the concentration levels of these elements (heavy metals) in food is of significant scientific interest because some of these metals (e.g. Co, Ca, Zn, Mn, Fe, Mg) though essential to human health can be toxic depending on their concentration and specification (e.g. Cr (III) is essential while Cr (VI) is toxic. Other metals such as Hg, Pb, Cd, As which have no known biological functions, do exhibit toxicological effects, even at trace concentrations (Iwegbue, 2008). Heavy metals are very harmful because of their non-biodegradable nature, long biological half lives, potential to accumulate in different body parts and their solubility in water. The main threat of heavy metals to human health is associated with exposure to lead, cadmium, mercury and arsenic (Lars, 2003). Excessive intake of these toxic metals can lead to several diseases such as organ failure, cancer and retarded mental development, most especially in children and foetus in pregnant women. Even the so called essential metals can cause symptoms of toxicity at higher concentrations (e.g. Cu, Cr and Zn), (Abou-Arab *et al*., 1996).

The phytochemical screening of the leaves extracts of phymatoes scolopendria showed the presence of cardiac glycosides, tannins, flavonoids. Polyphenols and reducing sugars (table 4). Ikewuchu et al., (2009) investigated the phytochemical compositions of the leaves of Tridax procumbens linn which showed the presence of alkaloids, flavonoids, saponins and tannins. Osabor et al (2010) also reported the presence of alkaloids, flavonoids, saponins, cardiac glycoside and phlobatannins in the leaves of D. Summatti.

Okeke et al., (2011) investigated the phytochemical compositions in the leaves of cassi alata plant which showed presence of alkaloids, flavonoids, saponins, tannins, phenols and glycosides.

## CONCLUSION

The nutrient composition of Phymatodes scolopendria leaves was found to compare favourably with that of other ferns documented thus making it a source of nutrients. Anti nutrients presents were within permisable limits therefore posing no potential threats to health. Phytochemical screening showed the presence of cardiac glycosides, tannins, flavonoids, polyhenols and reducing sugars. It was equally observed to contain mineral elements below toxic levels while the presence of bioactive compounds justifies its use in the treatment of respiratory disorder and epilepsy.

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