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# Phytotherapeutic potentials and biochemical study of *Nypa fructicans* (Wurmb)

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**Abstract**

The phytochemical evaluation in order to elucidate the phytotherapeutic potentials of *Nypa fructicans* (Nypa palm) using ethanolic extracts of the leaf, stem, root and fruit revealed the presence of tannins, flavonoids, saponins, terpenes, anthraquinones, alkaloids, cardiac and cyanogenic glycosides in each of the plants component part. The individual proximate composition contents of the respective plant parts are low except in carbohydrate and calorific values, while the mineral elements concentrations were high and significant ($P < 0.01$) in calcium, phosphorus, potassium, sodium, nitrogen, iron and magnesium. The anti-nutritive toxic compounds showed that the hydrocyanide and soluble oxalate contents are significantly ($P > 0.01$) lower than those of the phytic acid and tannins. The mean toxicant level of the leaf (73.77 $\pm$ 1.2/100mg) which makes it unacceptable as a ruminant feed is higher than those of the stem (53.11 $\pm$ 1.03mg/100g), root (45.56, 0.9mg/100g) and the fruit (54. 48 $\pm$ 0.92mg/100g). The results of this study call for further research study on the pharmacological potentials of the plant.

*Keywords*: *Nypa fructicans;* Phytochemical screening; Biochemical evaluation.

## Introduction

*Nypa fructicans* commonly called *Nypa* palm (Palmae) is an alien plant introduced into Nigeria from Singapore by the colonial administrators in order to checkmate the ravages of coastal erosion in the sea shores of Calabar and Oron in 1906 and 1912 respectively (Keay, 1953). The plant, locally called "Aya Mbakara" in Ibibio language and "Eyop Inyang" by the Efiks is a mangrove colonizing species and salt water tolerant. The plant possesses conspicuous features like extensive fibrous root system called rhizomes, branchless shoot, leaf and fruits. The stem is usually short, prostrate branched and buried in the mud. The shoot terminates with a crown of pinnate leaves and a terminal spadex inflorescence occurring within the axis of current leaves. The flowers are bright yellow in colour. The fruit is spherical and consists of a pericarp with thin fibrous epicarp with spongy mesocarp and stony endocarp. The ovoid seed possesses a sugary jelly-like endosperm.

Lugo and Citron (1975) and Mercer and Hamilton (1984) enumerated the economic importance of Nypa palm, but not in respect to its medicinal value. Reports by Woodwell

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(1970), Ukpong (1995) and Ubom (2005) portrayed the plant as a nuisance as it has negative effect on the dynamics of biodiversity sharing the same aqua-ecosystem with it. The present study was primarily aimed at elucidating the phytochemical constituents of the ethanolic extracts of the leaf, root, stem, and fruits with the view of bringing out its biotherapeutic potentials to literature. Secondly this study examines its nutritive potentials for livestock feed production.

## Experimental

*Plant material.* The plant materials (leaves, stem, root and fruit) of Nypa palm were collected from the shores of Oron river in Mbo Local Government Area of Akwa Ibom State. The samples were cut into smaller pieces and dried in the sun for 7 days and later respectively milled into powder form using pestle and mortar. The milled samples were stored in different air-tight containers after sieving through a 2mm mesh filter from which the required quantities were removed for extraction.

*Extraction.* Two hundred grams of the milled samples were separately macerated with 500ml of 80% ethanol and left for 72 hours with intermittent shaking for effective extraction. Each sample extract was separately filtered using Whatman No. 1 filter paper. Each extract was concentrated using rotary evaporator to a gelatinous residue.

*Phytochemical screening.* Basic Phytochemical al screening of the plant parts was carried out using the methods of Trease and Evans (1989) and Sofowora (1993).

*Proximate composition analysis.* The proximate composition analyses of the samples were determined according to the standard methods as recommended by the Association of Official Analytical Chemists (AOAC, 1975).

*Determination of mineral elements.* Determination of K, Na, Ca, P, Fe, Mg, Zn and Cu concentrations in the sample parts were estimated using the methods of AOAC (1975).

*Determination of toxic antinutritive compounds.* The total oxalate and soluble oxalate contents of the samples were determined by the method of Dye (1956), while the tannin content was by the method of Burns (1971). The hydrocyanic and phytic acid levels were obtained by AOAC methods of (1975).

## Results

The ethanolic extracts of the leaf, stem and root of *N. fructicans* produced positive chemical reactions for tannins, saponins, anthraquinones, flavonoids, alkaloids, terpenes, cardiac and cyanogenic glycosides. The fruit extract showed similar indications except that anthraquinone was absent (Table 1). The proximate composition of the plant component parts are shown in Table 2. The results show that the leaf contains the highest protein content of $12.25 \pm 0.23\%$ and the root at least ($0.88 \pm 0.46\%$). The carbohydrate contents in all the component parts are significantly ($P < 0.05$) higher than all other proximate composition content. The calorific values are also high.

Table 3 reveals that copper is absent in the root sample but present in the leaf, stem and fruit. It further shows that the concentration of the mineral elements in the *N. fructicans* parts varied from one component part to another. The toxic antinutritive composition and contents of the plant parts indicate high levels of hydrocyanide, oxalate, tannins and phytic acid (Table 4). The highest concentration of hydrocyanide was found in the stem with $30.12 \pm 1.13$mg/100g and the leaf possessing the highest oxalate content of $88.00 \pm$

2.03mg/100g. The highest amount of tannins was also found in the leaf with the stem exhibiting highest level of phytic acid.

## Discussion

The presence of toxic constituents in the leaf, stem, root and fruit samples of *N. fructicans* is indicative of profound physiological properties attributed to the plant for destabilizing the dynamic equilibrium of other biodiversity sharing the same eco-habitat with it. Similarly the elucidation of phytotherapeutic chemical constituents in the plant component parts makes the plant a potential raw material for pharmaceutical industry.

**Table 1:** Qualitative phytochemical screening of leaf, stem, root and fruit of *Nypa fructicans*

| Compound class | Test | Inferences | | | |
|---|---|---|---|---|---|
| | | Leaf | Stem | Root | Fruit |
| Tannins | Ferric chloride test | +++ | +++ | +++ | +++ |
| | Bromine water test | +++ | +++ | +++ | +++ |
| Saponins | Frothing test | +++ | +++ | +++ | +++ |
| | Lieberman's test | +++ | +++ | + | - |
| Flavonoids | Shinoda's test | +++ | +++ | +++ | ++ |
| | Salkowski test | +++ | +++ | +++ | +++ |
| Anthraquinones | Borntrager's test | +++ | +++ | ++ | ++ |
| Cyanogenic glycosides | | +++ | - | + | +++ |
| Terpenes | | +++ | +++ | ++ | ++ |
| Alkaloids | Dragendorff's test | - | - | - | - |
| | Mayer's test | - | - | - | - |
| | Picric test | +++ | +++ | +++ | +++ |

+++ = Highly present; ++ = Moderately present; + = Slightly present; - = Absent

**Table 2:** Proximate composition and content of leaf, stem, root and fruit of *Nypa fructicans*

| Test | Content (%) | | | |
|---|---|---|---|---|
| | Leaf | Stem | Root | Fruit |
| Moisture | 50.19 ± 0.33 | 63.51 ± 0.54 | 29.19 ± 0.94 | 19.35 ± 0.25 |
| Crude protein | 12.25± 0.23 | 3.50 ± 1.01 | 0.88 ± 0.46 | 5.25± 0.76 |
| Lipid | 7.00 ± 1.03 | 5.50 ± 0.86 | 20.00 ± 0.23 | 6.00 ± 0.36 |
| Crude fibre | 10.00 ± 1.03 | 5.50 ± 0.68 | 20.00 ± 0.95 | 14.00 ± 1.02 |
| Ash | 3.00 ± 0.43 | 2.00 ± 0.78 | 9.00 ± 0.56 | 1.00 ± 0.85 |
| Carbohydrate | 67.75 ± 0.98 | 71.00 ± .06 | 67.62 ± 1.08 | 73.75 ± 1.48 |
| Caloric value (kCal) | 383.00± 0.98 | 347.50 ± 1.50 | 296.50 ± 1.32 | 370.00 ± 1.24 |

Each data is mean of triplicate determination ± standard error

**Table 3:** Mineral element content of leaf, stem, root and fruit of *Nypa fructicans*

| Elements (mg/100g) | Content (%) | | | |
|---|---|---|---|---|
| | Leaf | Stem | Root | Fruit |
| Calcium | 6000.00 ± 1.03 | 64000.00 ± 1.24 | 6000.00±1.12 | 4400.00±1.16 |
| Magnesium | 303.15±0.33 | 269.96±0.24 | 102.65±0.67 | 123.87±0.56 |
| Phosphorus | 6000.00±1.32 | 6700.00±1.46 | 7000.00±1.22 | 700.00± 1.14 |
| Potassium | 84000.00±1.38 | 46000.00±1.43 | 1700.00±13.48 | 5000.00±9.28 |
| Sodium | 196000.00±1.38 | 46000.00±1.43 | 7900.00±1.08 | 1400.00±0.78 |
| Nitrogen | 166000.00±16.38 | 56000.00±18.89 | 14000.00±15.96 | 84000.00±10.64 |
| Iron | 3294.30±1.54 | 3669.60±1.16 | 6255.00±1.26 | 4170.00±1.28 |
| Copper | 0.05±0.45 | 0.25±0.26 | 0.00±0.00 | 0.25±0.13 |
| Zinc | 11.00±0.67 | 4.67±0.36 | 9.83±0.59 | 10.50±0.11 |
| Manganese | 7.00±0.76 | 52.00±1.03 | 6.00±0.47 | 3.00±0.34 |

Mean values of triplicate determinations ± standard error

**Table 4:** Anti-nutrient composition and content in the leaf, stem root and fruit of *Nypa fructicans*

| Elements (mg/100g) | Concentration mg/100g | | | |
|---|---|---|---|---|
| | Leaf | Stem | Root | Fruit |
| Hydrocyanide | 21.60±1.43 | 30.20±1.13 | 23.80±1.30 | 15.100±1.11 |
| Total oxalate | 88.00±2.03 | 44.00±1.63 | 102.65±0.67 | 123.87±0.56 |
| Soluble oxalate | 35.20±0.73 | 26.40±0.56 | 17.60±0.43 | 17.60±0.23 |
| Tannin | 149.36±0.33 | 125.35±0.42 | 85.35±0.13 | 122.69±0.38 |
| Phytic acid | 74.68±1.50 | 83.57±1.40 | 56.88±1.26 | 81.79±1.33 |
| Nitrogen | 166000.00±16.38 | 56000.00±18.89 | 14000.00±15.96 | 84000.00±10.64 |
| Mean | 73.77±1.21 | 53.11±1.03 | 45.56±0.44 | 54.48±0.92 |

Mean values of triplicate determinations ± standard error

The low levels of proximate composition components except that of carbohydrate and the high levels of toxicants in the leaf suggest that the plant is unsuitable for consumption by ruminants. The high amounts of phosphorus, potassium and nitrogen could be responsible for the luxuriant growth and widespread of the plant as they are good fertilizer supplements. This therefore calls for the incorporation of the plant debris for organic manure formulation for agricultural crops. The high values of tannins in the plant samples make it a good source of drugs containing tannins. The high concentration of the phytic acid in the plant parts may be responsible for the lethal effect on some of the biodiversity trying to share the same ecosystem with the plant in its habitat.

In conclusion, this study has established the biotherapeutic potentials of the plant as a medicinal herb for further extraction and the leaf is not good forage for ruminants as it contains high levels of toxic compounds.

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