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(RESEARCH ARTICLE)

Phytochemical profiling of aqueous extract of Nypa palm (Nypa fructican wurmb) using Gas Chromatography-Mass Spectrometry (GC-MS)

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Abstract

Objective *Nypa fructicans* is an invasive plant belonging to the family Arecaceae and grows along tidal streams in brackish swamps. Its invasive nature has been linked to the presence of phytochemicals present in the plant. In this study, the leaves of *Nypa fructicans* commonly called Nypa palm were subjected to phytochemical screening using Gas Chromatography-Mass spectrometry (GC-MS).

Methodology: Aqueous extract of *Nypa fructicans* was analysed using Gas chromatography equipped with mass spectrometry.

Results: The results from the GC-MS showed that the aqueous extracts of *Nypa fructicans* contains bioactive compounds. The major constituents are Beta-sitosterol (22.18%), Acetic acid dichloro (6.23%), 2-Etoxy carbonyl-3-methyl-4-azafluorenone, 2-flurenyimine (5.55%).

Keywords: Phytochemicals; Nypa fructicans; Gas chromatography-Mass spectrometry; Bioactive; Aqueous extract

1. Introduction

Nypa fructicans belongs to the family Arecaceae and grows along tidal streams in brackish swamps. *Nypa fructicans* is a mangrove plant that thrives in specific ecosystems, favoring temperatures between 20 and 35°C and receiving around 1,000 mm of evenly distributed rainfall each month. The genus Nypa and subfamily Nypoideae are monotypic, with *Nypa fructicans* as their only representative [1]. This plant is typically found along beaches and rivers flowing into the Indian and Pacific Oceans, extending from India to the Pacific Islands. *Nypa fructicans* is native to areas such as China, South Asia, Southeast Asia, Australia, and several Pacific Islands. It has also been introduced to places like Cameroon, Guyana, Nigeria. While it typically grows in stands, it can also mix with other mangrove species in some regions. The Nypa palm is well-adapted to coastal mangrove areas with moderate salinity but does not tolerate pure seawater well, preferring brackish waters near river mouths [2]. The Nypa palm is a versatile species known for its various uses and benefits, especially in coastal regions of the tropics and subtropics. This plant has various local names depending on the area, such as poothada in the Andaman Islands, rola, ki-bano, and tacannapoon in Australia, golpata and nipa palm in Bangladesh, dani in Myanmar, ayangmbakara, uwaknjojo, and ude in Nigeria, and attap palm in Singapore [3].

Its invasive nature has been linked to the presence of phytochemicals like phenolic compounds [4] mentioned that the extracts of *N. fructicans* contains phenolic and flavonoids compounds. *Nypa fructicans* contains flavoinoids, tannins,

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phenol, hydroquinone, diterpenes, steroids and saponins [5]. *Nypa fructicans* roots contains alkaloids, steroids, triterpenoids, flavonoids and tannins [6]. These compounds may confer strong alleloparthic effects influencing the physiological, Biological processes of neighboring cultivated plants [7].

2. Materials and methods

2.1. Collection and identification of plant materials.

Fresh leaves of *Nypa fructicans* were harvested from the riverside of Ekede in Andoni Local Government, Rivers state ad was authenticated by a taxonomist. Dr Wisdom Barade (WNB85) in the Department of Science Laboratory Technology at Kenule Beeson Saro-Wiwa polytecnics, Bori, Rivers state. The voucher number (KAPT/2023/321) was obtained from Kenule Beeson Saro-Wiwa Polytechnic Bori, Herbarium.

2.2. Preparation of Aqueous Extract

The fresh leaves of Nypa palm (*Nypa fructicans*) were thoroughly washed with clean tap water 2-3 times and then dried at room temperature for one month. The air dried sample was pulverized and stored in an air-tight container at room temperature. 100g of the pulverized sample was mixed with 500ml of distilled water in a conical flask. This was covered and shaken and then left to stand for 24 hours. The solution was filtered using muslin cloth and then whatman number 1 filter paper. The filtrate was evaporated to dryness using a rotary evaporator (model type 349/2, corning Ltd). The extract was stored at 4^0C for further analysis.

2.3. Phytochemical studies using Gas Chromatography-Mass Spectrometry (GC-MS).

The GC-MS was performed on a Themo Scientific Co, Thermo GC-THRACE Ultra Ver. 5.0, thermo MS DSQ 11. Experimental conditions of GC-MS include; BS-MS dimension: 30 Mts, ID: 0.25 MM, Film thickness: 0.25μm. The flow rate of the mobile phase was set at 1.0Ml/min (carrier gas: helium). In the gas chromatography, the oven temperature was initially 40^0C and raised to 150^0C at 10^0C/min. The temperature was raised again 230^0C/min at the rate of 20^0C which was held for 8 minutes. The injector pot temperature remained constant at 280^0C and detector temperature was 250^0C. The crude extract (1g) was reconstituted in 1mL of methanol. Then, 2μl of the extract was injected into the pot and vaporized down the column with helium as the carrier gas at the flow rate of 1Ml/min and the result were compared to Wiley Special Library Search Program. Interpretation of the mass spectrum of the constituents of the extract was carried out in comparison with the database of the National Institute of Standard and Technology (NIST).

3. Results and discussion

In this study, the analysis of *Nypa fructicans* extract using Gas Chromatography-Mass Spectrometry (GC-MS) revealed the presence of natural bioactive components. The major constituents are Beta-sitosterol (22.18%) Acetic acid dichloro (6.23%), 2 Etoxy carbonyl-3-methyl-4-azofluorenone, 2-flurenylimine (5.55%), 9, 12, 15-octadecatrienoic acid (3.65%), Tridecanoic acid (6.74%), Benzo-1, 3, 2-oxatthiaborale 2-ethyl (5.53%). The results identified multiple classes of phytoconstituents in *Nypa fructicans* leaves including steroids, flavonoids, quinones, alkaloids and phenols. These compounds were present in varying quantities which shows a complex chemical composition within the leaves of *Nypa fructicans*. A study by [8] reported that the salycyclic acid and Beta-sitosterol present in *Nypa fructicans* could reduce the salt stress experienced by *Nypa fructicans* in the environment by increasing the activity of antioxidant systems. This is in support of the allelopathic nature of the plant. [9], noted that, chemical composition including phenolic acids and flavonoid found in *Nypa fructicans* can be used commercially in the food and pharmaceutical industries.

Most of the natural antioxidants have antibacterial activities [10]. *Nypa fructicans* has excellent antibacterial and antifungal activity against vibrio species [11]. Polyisoprenoid compounds found from *Nypa fructicans* showed anticancer activity in vitro. They could reduce cell proliferation and induce apoptosis in colon cancer cells.

The advantage of using *Nypa fructicans* as the main raw material for the bio ethanol is that *Nypa fructicans* is not a main food source, so it will not compete with other food needs. The part used as raw material is the juice so that it does not damage its ecology.

4. Conclusion

This study revealed that *Nypa fructicans* contains bioactive compounds which can be used in different areas of human needs like the pharmaceutical and cosmetic industries. The presence of allelochemicals in the leaf of *Nypa fructicans* could be channelled into the production of bioherbicides.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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