

Pharmacy and Drug Development

Research Article

Phytochemicals Analysis of Water Yam Leaf (*Dioscorea Alata*)

Orodu, Victor Enearepuadoh^{1*}, and Hart, Divine Tamunonengiofori¹

¹Faculty of Science, Department of Chemical Sciences, Niger Delta University, Wilberforce Island, P.M.B 071, Bayelsa State, Nigeria

***Corresponding Author:** Orodu, Victor Enearepuadoh, Faculty of Science, Department of Chemical Sciences, Niger Delta University, Wilberforce Island, P.M.B 071, Bayelsa State, Nigeria

Received Date: 23 June 2025; **Accepted Date:** 24 July 2025; **Published Date:** 28 July 2025

Copyright: © 2025 Orodu, Victor Enearepuadoh, this is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

This research takes a closer look at the chemical makeup of *Dioscorea alata* (water yam) leaves, using a technique called Gas Chromatography-Mass Spectrometry (GC-MS). While water yam is mostly known and cultivated for its edible tubers, its leaves are often overlooked, even though they hold important medicinal and nutritional value. This study, revealed nineteen bioactive compounds, which were grouped into categories such as fatty acids and esters, terpenoids and sterols, vitamins and phenols, and aromatic esters. The identified compounds and their relative abundance are: 4-(Prop-2-enoyloxy)octane (3.33%), Neophytadiene (3.89%), Tetradecanoic acid (1.10%), Dodeca-1,6-dien-12-ol, 6,10-dimethyl- (1.11%), Hexadecanoic acid, ethyl ester (5.47%), n-Hexadecanoic acid (29.13%), Phytol (5.42%), Octadecanoic acid, ethyl ester (2.77%), Linoleic acid ethyl ester (1.70%), 9-Octadecenoic acid (Oleic acid) (15.99%), 9,12-Octadecadienoic acid (Linoleic acid) (6.14%), 9,12,15-Octadecatrienoic acid (α -Linolenic acid) (5.27%), Tridecenyl tiglate (1.25%), Squalene (6.97%), Vitamin E (α -Tocopherol) (3.09%), β -Sitosterol (3.03%), Cycloergost-24(28)-en-3-ol, 4,14-dimethyl- (1.21%), Cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate (1.33%), and Stigmast-4-en-3-one (1.82%). n-hexadecanoic acid (palmitic acid), made up over 29% of the extract. It's widely recognized for its ability to reduce inflammation and act as an antioxidant. Other key compounds like oleic acid, linoleic acid, α -linolenic acid, phytol, squalene, β -sitosterol, and vitamin E also appeared in meaningful amounts, each offering valuable health benefits, from supporting heart health and boosting the immune system to protecting the skin and fighting off microbes. The results showed that water yam leaves are more than just agricultural waste, they're a powerful source of natural compounds with real health potential.

Keywords: *Disocorea alata*, Phytochemicals, Leaves, Medicinal

Introduction

Plants are crucial for human health and well-being. Currently, over 80% of the world's population relies on plants as herbal remedies for various ailments and health challenges [1]. Plants used as remedies for health challenges contain bioactive compounds called phytochemicals, which occur naturally in the leaves, roots, and stems of plants. These phytochemicals help the plants fight against foreign bodies, preventing and protecting them from various diseases. In humans, phytochemicals trigger defense mechanisms that shield and fortify the body against a variety of diseases. Phytochemicals consist of primary and secondary constituents. The primary

constituents include chlorophyll, proteins, sugars, and amino acids, while the secondary constituents include alkaloids, flavonoids, phlorotannins, and more [2]. The secondary constituents have been proven to be vital for human health and well-being. For example, alkaloids can be used as a powerful anesthetic and are crucial in treating serious disorders such as heart failure, cancer, malaria, and diabetes. Flavonoids exhibit numerous beneficial properties including anti-microbial, anti-allergic, anti-tumor, and anti-inflammatory activities [3]. Tannins function as a coagulant aid and also demonstrate antioxidant and anti-fungal activity [1,4].



Figure1: *Dioscorea alata* (White Water Yam)

Dioscorea alata, commonly known as the water yam which belongs to the Dioscoreaceae family, is a species of yam native to Southeast Asia and widely cultivated in tropical and subtropical regions. It is valued for its large, starchy tubers, which are rich in carbohydrates, vitamins, and minerals, and play a crucial role in food security in many cultures. In Nigeria, water yam (*Dioscorea alata*) is typically planted between March and May, coinciding with the beginning of the rainy season, which ensures adequate water for growth. The growing season extends from June to September, during which the yams develop underground while the vines flourish above ground. Harvesting usually takes place between October and December, aligning with the dry season when farmers dig up the matured tubers. After harvesting, water yams are stored and consumed throughout the dry season, which runs from January to March, until the next planting season begins. While this general cycle is consistent across yam-producing areas, specific timing may vary slightly by region.

Culinary uses of *Dioscorea alata* are diverse; the tubers can be boiled, baked, roasted, or fried. In Nigeria, for instance, water yam is prepared locally as pottage called “Ikokore” by the “Ijebus” in Ogun State, or “Ojojo” (Water yam balls/Yam fritters) by the south-west part of Nigeria. Beyond nutrition, *Dioscorea alata* also holds cultural importance, often featuring in traditional rituals and celebrations such as the “New Yam Festival” within the Bayelsan, making it a vital crop for sustainable agriculture and food systems. *Dioscorea alata* leaf has high botanical and nutritional significance. Giant yam plants are vines with very long leafy tendrils growing from the tuber, which develop distinctive heart-shaped leaves.



Figure2: *Dioscorea alata* Leaves

Botanically, the leaves of *Dioscorea alata* also bear importance, where photosynthesis is needed to create energy for

tuber formation. The wide area of the leaves makes them excellent light catchers, providing photosynthate to be stored in tuber tissue. Leaves are alternately arranged along the vine, so more leaves have exposure to light with less mutual shading. Nutritionally, the leaves of *Dioscorea alata* are noteworthy. They are rich in vitamins and minerals, including vitamin C, vitamin A, calcium, and iron. These nutritional properties make the leaves a valuable, though often overlooked, component of the plant. In various cultures, the leaves are utilized as a leafy green vegetable, either cooked or consumed in salads. Their high nutrient content, particularly the presence of antioxidants such as flavonoids and phenolic compounds, enhances their dietary significance (Adejumo & Olaoye, 2017). In addition to their nutritional benefits, *Dioscorea alata* leaves have been studied for their medicinal properties. Research indicates that the leaves exhibit antimicrobial and anti-inflammatory activities, which can be attributed to their bioactive compounds [5]. These properties underscore the potential of *Dioscorea alata* leaves in traditional medicine and contemporary health applications. Overall, while *Dioscorea alata* is primarily cultivated for its tubers, its leaves also contribute valuable nutritional and medicinal benefits, warranting greater attention and utilization in both culinary and health contexts. Although Water yam is a common agricultural by-produce, there is little or no information about the efficiency and potential effect of the leaves.

This study aimed at conducting a comprehensive phytochemical analysis of ethanolic extract of *Dioscorea alata* (water yam) leaves, quantify the identified phytochemicals to assess their relative abundance and evaluate their potential health benefits, with a particular focus on their anti-inflammatory properties and compare the efficacy of leaf extracts against conventional anti-inflammatory drugs in treating inflammatory diseases, potentially offering a natural alternative for such conditions.

Aerial yam (*Dioscorea bulbifera*) is a native plant primarily cultivated for food by a small number of people. This fast-growing plant demonstrates adaptability to various environmental conditions. Traditional uses of aerial yam include its application in treating ailments such as diarrhea, dysentery, and cholera, and it has been observed to be used by rural diabetes patients as well.



Figure3: *Dioscorea bulbifera*

In a recent study, the phytochemical composition of aerial yam was meticulously analyzed. Plant bulbils were sourced

from local farmers in the Ohafia Local Government Area of Abia State and subsequently cultivated in a greenhouse. The leaves of the plant collected were washed with water to remove debris and air dried at room temperature. The dried leaves samples were ground into powder using mortar and pestle. The extract was prepared by adding 10g of the powdered leaf sample into a conical flask and adding 100ml of distilled water into the conical flask and leaving it for 24 hours, after which, it was filtered to have the aqueous extract. The same procedure was repeated but with ethanol to have the ethanol extract. These were properly labeled. The leaf samples were subjected to phytochemical screening, resulting in vital insights [2]. It was found that out of the ten phytochemicals screened, including alkaloids, glycosides, saponins, tannins, flavonoids, and polyphenols were present, while phlorotannins, anthraquinones, and hydroxymethyl anthraquinones, were absent. Given its declining population in the Niger Delta region of Nigeria, it is imperative to take steps to prevent the endangered status of *Dioscorea bulbifera*. This plant not only serves as a source of energy food but also embodies significant potential in terms of its rich phytochemical content, which could greatly benefit human health. Cultivating and preserving this plant is crucial for both ecological conservation and potential medical application [1].

In the study of Scent leaf and Bitter leaf, research was conducted to analyze the compounds present in the leaves of Scent Leaf (*Ocimum gratissimum*) and Bitter Leaf (*Vernonia amygdalina*) through phytochemical screening [6]. The results revealed the presence of alkaloids, flavonoids, steroids, tannins, and carotenoids. The most effective solvents for extraction for both plants were hot water, followed by cold water, although they were unable to extract flavonoids from bitter leaf extracts [7]. The washed bitter leaf extracts contained more alkaloids than the extracts made from the unwashed leaves, although the differences were not significant (washed bitter leaf- 7.32% from hot water and 6.83% from cold water, unwashed bitter leaf- 6.12% from hot water and 5.32% from cold water) [6].

The ethanolic extracts of the bitter leaf were able to extract flavonoids, while hot water was also effective in extracting flavonoids from the scent leaf. Carotenoids were found in the extracts of both plants, although the quantities were not significantly different [7]. The study indicated that bitter leaf and scent leaf contain similar antimicrobial compounds, but bitter leaf contains a larger quantity. It can be concluded that the different extraction solvents have varying abilities to extract these compounds and the quantities that each solvent extract have been determined [6]. *Moringa oleifera* is a tree native to tropical and subtropical regions of South India and is used in traditional medicine. This study aimed to identify the phytochemicals present in *Moringa oleifera* leaf extracts [8]. *Moringa oleifera* has shown its therapeutic potential against several human pathologies; dyslipidemia, hypertension, asthma, diabetes, infection, rheumatoid arthritis, cancer, and

wound healing [9].

Younis, Khan, Zahoor, and Faisal researched that taking too much N-acetyl-para-aminophenol commonly known as acetaminophen (APAP) can cause serious damage to the liver. However, giving a treatment with *Moringa oleifera* before the damage happens helped protect the liver by restoring normal liver function and balancing certain proteins in the blood. In the group treated with *Moringa oleifera*, some harmful genes (MAPK-8, TRAF-4, and TRAF-6) were less active compared to rats with liver damage from acetaminophen. *Moringa oleifera* leaves help prevent liver cell death and repair damaged liver cells. The extract from *Moringa oleifera* leaves could be a low-cost, natural option for treating liver damage, especially in long-term diseases [9].

In the year 2019, research was carried out by Jelita et al to find out the phytochemicals content contained in Curry leaves (*Murraya Koenigii*) [10]. This research found that there were alkaloid, flavonoid, saponin, phenolic, and tannin compounds in the ethanol extract of curry leaves. Also, this research was taken up again in the year 2023, and it was found that curry leaf extract contained 23.73% alkaloids, 1.24% flavonoids, 8.74% saponins, 4.4% phenolics, and 5.2% tannins [11]. The curry plant (*Murraya koenigii* (L.) Spreng) is said to belong to the Rutaceae family. This plant originates from India and Sri Lanka and thrives in tropical climates. The curry plant is typical of India, Sri Lanka, and various regions in Southeast Asia, such as Indonesia.

Curry leaf extract as a producer of bioactivity has been widely known and reported in developed countries and is known to be active as an antitumor, antioxidant, antimutagen, anti-inflammatory, antidiabetic, antidiarrheal, stimulant, and antibacterial [11]. *Jatropha tanjorensis*, also known as the "Hospital is Too Far" leaf, is a flowering plant in the spurge family Euphorbiaceae. It is native to Central America and has naturalized in some tropical and subtropical countries such as India, Nigeria, and Canada [12]. *Jatropha tanjorensis* is a 6m high shrub with spreading branches. It has smooth gray bark that releases white latex when cut. The leaves are arranged alternately, crowded at the top, and have a 3-5 lobed outline, with a length of 6-40cm and petioles 3-8cm long [13]. A research was conducted and proven that *Jatropha tanjorensis* has a significant anticancer, hepatoprotective, and pesticidal property [12]. It was also discovered that the stem sap of the *Jatropha tanjorensis* stops bleeding and itching of cuts and scratches. The root is decocted as a mouthwash to treat bleeding gums, toothache, eczema, ringworm, scabies, dysentery, and venereal diseases [14]. The leaf extract is used as a blood tonic with the claim that it increases blood volume. It can also be used as a substitute for lettuce in salad preparation, among other important uses reported by many authors [15]. The residents of Alagoinha, Pernambuco, and Northeast Brazil utilize the latex from *Jatropha tanjorensis* for external application. It has been claimed that consuming the latex, diluted with water, can treat snake poisoning [16].

Materials and Methods

Materials

The materials used for the phytochemical analysis of water yam leaf include Water Yam Leaves, distilled water, ethanol, conical flasks, beakers, cotton wool, funnel, reagent bottles, hand grinder, and water bath. Ethanol was used as a solvent for the extraction of sample agents

Methods

Sample Preparation

Water yam leaves were harvested and washed in clean water to remove dirt. After washing, they were air-dried at room temperature and ground using a hand grinder. It is then weighed in a weighing balance to give a mass of 140 g.

The ground plant leaves are placed in a dark bottle and soaked in 800 mL of ethanol solvent for 24-72 hours with occasional shaking. This process is known as Maceration.

After 72 hours of soaking, the soaked plant is filtered using a ball of cotton wool in a funnel. The filtered solvent extract is then left to dry in a water bath (50°C).

The extracted sample is then scraped out and put in a GC-MS Machine for analysis, where all phytochemicals and chemical compounds are identified.

Gas Chromatography and Mass Spectrometry

GC-MS Agilent Technologies 7890A GC system. Gas chro-

matogram coupled with the Agilent Technologies 5975C MSD mass spectrometer featuring a triple-axis detector, equipped with an Agilent Technologies GC-MS capillary column HP-5MS (30 m × 0.25 mm ID × 0.25 µm) composed of 5% diphenyl and 95% dimethyl polysiloxane. An electron ionization system with an ionizing energy of 70 eV was used. Helium gas (99.99%) served as the carrier gas at a constant flow rate of 1 mL/min, and an injection volume of 1 µL was employed with a split ratio of 50:1. The injector temperature was set at 50 °C, and the ion source temperature was at 250 °C. The relative percentage of each component was calculated by comparing its average peak area to the total area. The GC-MS Mass Hunter software was used for spectrum and chromatogram analysis.

Result and Discussion

The result of the research on phytochemicals in water yam leaf (*Dioscorea alata*) is presented here as shown in Figure 4 below.

Here are the compounds detected in the water yam leaf sample that are classified as phytochemicals, grouped by their general phytochemical class:

Fatty acids and fatty acid Esters, Terpenes and sterols, Vitamins and phenols, and Esters. This is elaborated in table 1 shown below.

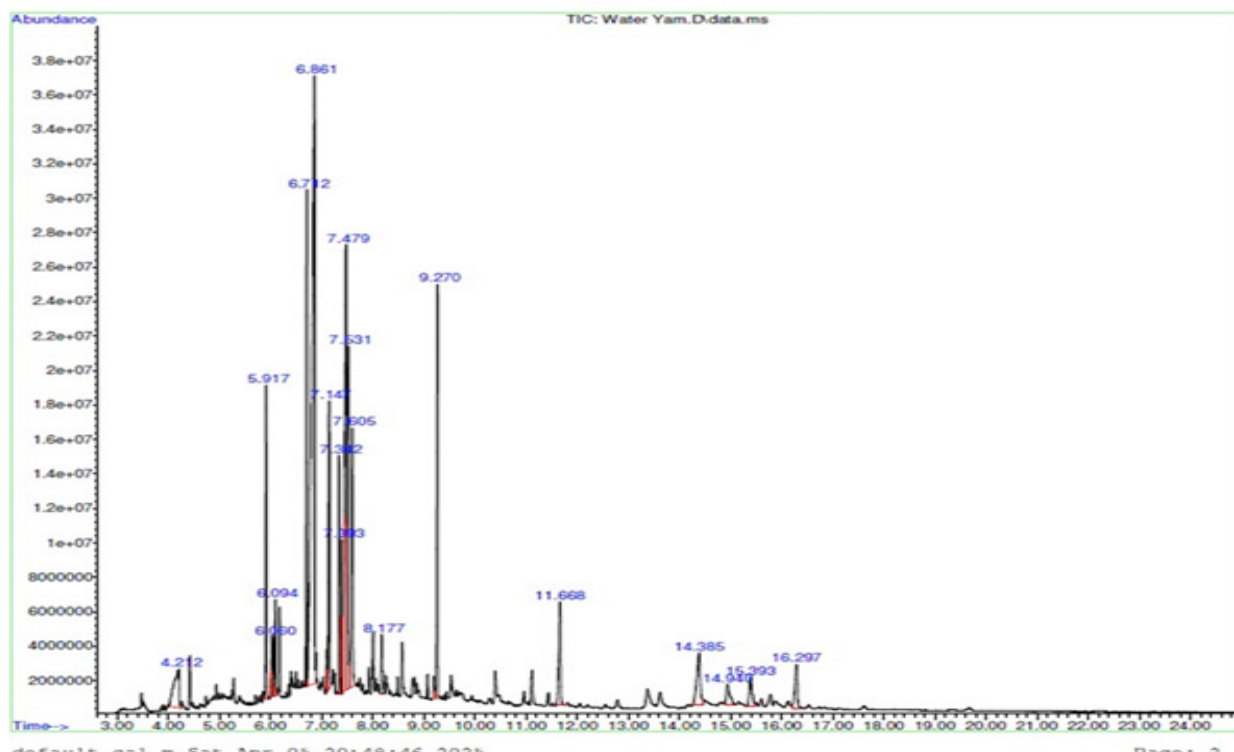


Figure4: Chromatogram of the component

Peak	Phytochemical Class	Compound	RT	%	Biological Activity / Relevance
1	Fatty Acids & Esters	n-Hexadecanoic acid (Palmitic acid)	6.861	29.13	Anti-inflammatory, antioxidant
2	Fatty Acids & Esters	Tetradecanoic acid (Myristic acid)	6.060	1.1	Lipid metabolism, flavoring agent
3	Fatty Acids & Esters	9-Octadecenoic acid (Oleic acid)	7.479	15.99	Heart health, anti-inflammatory
4	Fatty Acids & Esters	9,12-Octadecadienoic acid (Linoleic acid)	7.531	6.14	Essential fatty acid, skin health
5	Fatty Acids & Esters	9,12,15-Octadecatrienoic acid (α -Linolenic acid)	7.605	5.27	Omega-3 fatty acid, anti-inflammatory
6	Fatty Acids & Esters	Hexadecanoic acid, ethyl ester (Ethyl palmitate)	6.712	5.47	Emollient, bioactive ester
7	Fatty Acids & Esters	Ethyl Octadecanoate	7.342	2.77	Soothing agent, cosmetic use
8	Fatty Acids & Esters	Linoleic acid ethyl ester	7.393	1.7	Nutraceutical, lipid metabolism
9	Terpenoids	Phytol	7.147	5.42	Vitamin K1 & E precursor, anti-microbial
10	Terpenoids	Neophytadiene	5.917	3.89	Anti-inflammatory, antimicrobial
11	Terpenoids	Squalene	9.270	6.97	Antioxidant, skin-protective
12	Terpenoids	Dodeca-1,6-dien-12-ol, 6,10-dimethyl-	6.094	1.11	Aromatic, terpene derivative
13	Terpenoids	Trideceny l tiglate, 2E-	8.177	1.25	Found in essential oils, aromatic
14	Sterols & Steroids	β -Sitosterol (γ -Sitosterol)	14.385	3.03	Cholesterol-lowering, anti-inflammatory
15	Sterols & Steroids	Stigmast-4-en-3-one	16.297	1.82	Plant sterone, anti-inflammatory
16	Sterols & Steroids	Cycloergost-24(28)-en-3-ol derivatives	14.940	1.33	Structural sterol, cell membrane function
17	Phenolics & Vitamins	Vitamin E (α -Tocopherol)	11.668	3.09	Antioxidant, skin and immune health
18	Other Plant Derivatives	4-(Prop-2-enoyloxy) octane	4.212	3.33	Fatty ester, possible plant lipid derivative

Table1: Phytochemical compounds of Water yam leaf (*Dioscorea alata*)

Fatty Acids and Fatty Acid Esters

These phytochemicals, which are commonly lipid-based, contribute to energy storage, membrane structure, and bio-activity.

N-Hexadecanoic ACD

N-Hexadecanoic acid (Palmitic acid) is a fatty acid and ester identified in the Water Yam leaf extract. It is associated with the following biological activities: anti-inflammatory and antioxidant properties. It is found as a major component in Water Yam leaf (29.13% area). It is a saturated fatty acid with both anti-inflammatory and antioxidant properties. Functional group: carboxylic acid (-COOH).

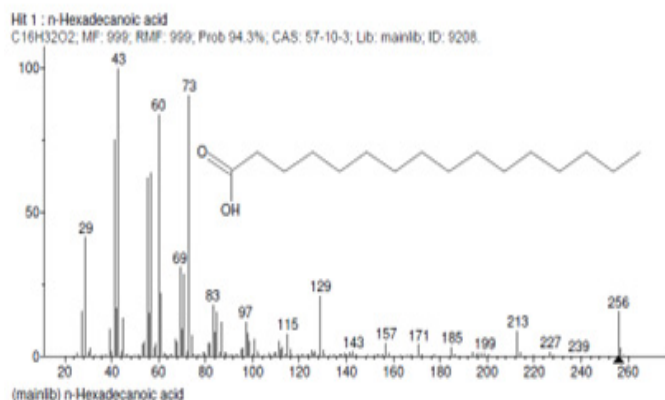


Figure5: n-Hexadecanoic acid

Tetradecanoic Acid

Tetradecanoic acid (Myristic acid) is a fatty acid and ester identified in the Water Yam leaf extract. It is associated with the following biological activities: lipid metabolism and flavoring agent. Detected in moderate amounts, it is a saturated fatty acid involved in lipid metabolism and energy storage. Functional group: carboxylic acid ($-\text{COOH}$).

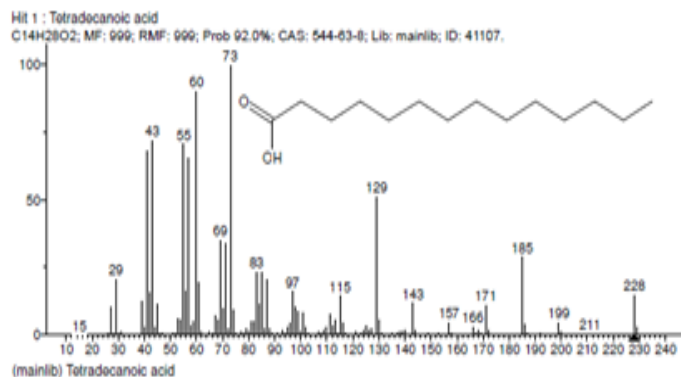


Figure6: Tetradecanoic acid

9-Octadecenoic Acid

9-Octadecenoic acid (Oleic acid) is a fatty acid and ester identified in the Water Yam leaf extract. It is associated with the following biological activities: heart health and anti-inflammatory effects. This unsaturated fatty acid is known for its cardiovascular benefits. Its functional groups include a carboxylic acid ($-\text{COOH}$) and an alkene ($\text{C}=\text{C}$).

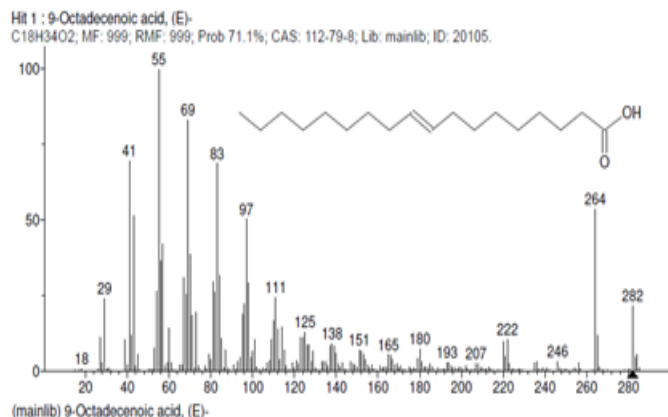


Figure7: 9-Octadecenoic acid

9, 12-Octadecadienoic Acid

9,12-Octadecadienoic acid, commonly known as linoleic acid, is a fatty acid and ester found in the extract of Water Yam leaves. It is linked to essential biological functions, particularly in maintaining skin health. This essential fatty acid plays an important role in skin care. Its structure includes a carboxylic acid group ($-\text{COOH}$) and two alkene groups ($\text{C}=\text{C}$).

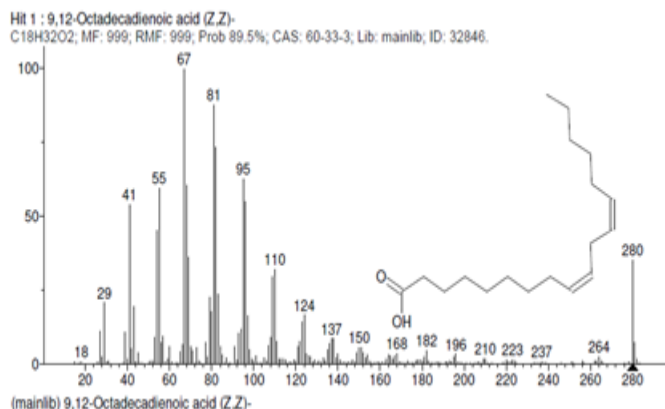


Figure8: 9, 12-Octadecadienoic acid

9, 12, 15-Octadecatrienoic Acid

9,12,15-Octadecatrienoic acid, commonly known as α -Linolenic acid, is a fatty acid and ester found in the extract of Water Yam leaves. It is linked to several biological activities, including being an Omega-3 fatty acid that offers cardiovascular and anti-inflammatory benefits. Its functional groups consist of a carboxylic acid ($-\text{COOH}$) and three alkenes ($\text{C}=\text{C}$).

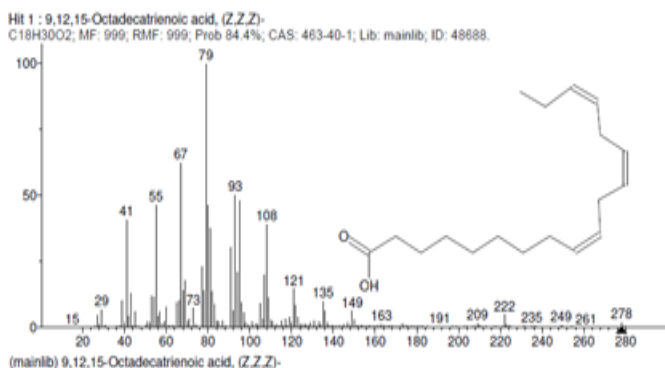


Figure9: 9, 12 15-Octadecatrienoic acid

Hexadecanoic Acid, Ethyl Ester

Hexadecanoic acid, ethyl ester, commonly known as ethyl palmitate, is a fatty acid and ester found in the extract of water yam leaves. This compound is associated with various biological activities, including emollient properties and being a bioactive ester. It is the ester form of palmitic acid and is believed to function as an emollient. The functional groups present in ethyl palmitate include an ester ($\text{R}-\text{CO}-\text{OR}'$) and an alkyl chain.

Ethyl Octadecanoic

Octadecanoic acid, also known as ethyl stearate, is a fatty acid ester found in the extract of the Water Yam leaf. It is recognized for its soothing properties and is commonly used in cosmetics for this purpose. Its functional group is an ester ($\text{R}-\text{CO}-\text{OR}'$).

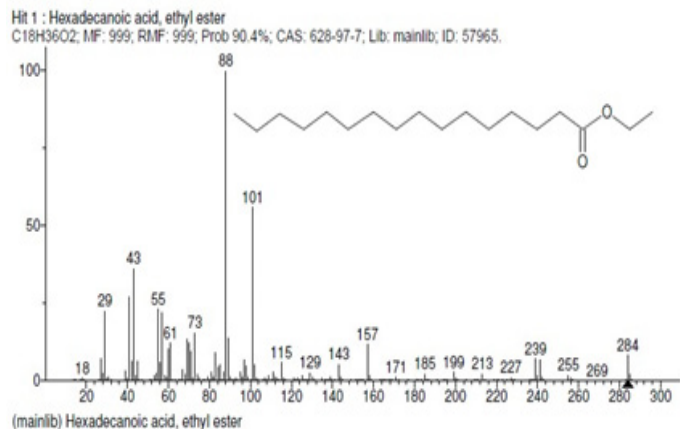


Figure10: Hexadecanoic acid

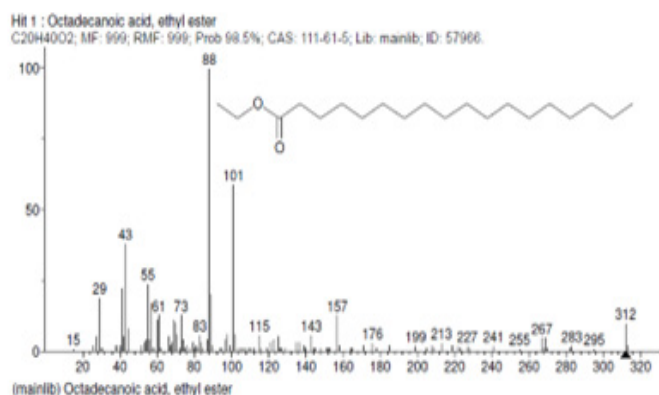


Figure11: Ethyl octadecanoate

Linoleic Acid Ethyl Ester

Linoleic acid ethyl ester is a fatty acid and ester identified in the Water Yam leaf extract. It is associated with the following biological activity: Nutraceutical, lipid metabolism. Esterified essential fatty acids are involved in anti-inflammatory activity. The functional group found is an ester (R-CO-OR').

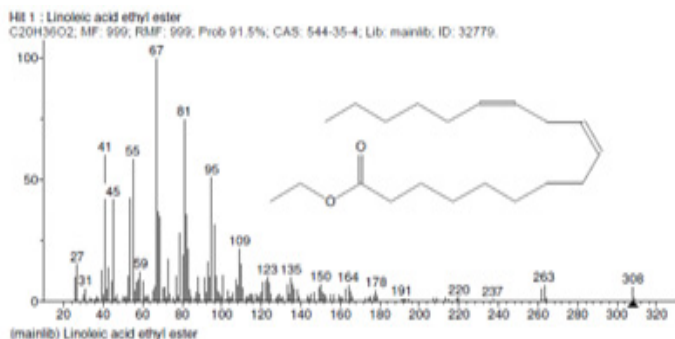


Figure12: Linoleic acid, ethyl ester

Terpenes and Sterols

In plants, terpenes and sterols are diverse compounds with significant roles in various biological processes, including

defense, signaling, and development. Terpenes, also known as isoprenoids, are a large group of natural products that contribute to fragrance, taste, and color in plants. Sterols, on the other hand, are a class of lipids that serve as essential components of cell membranes and play roles in signaling and stress responses.

Phytol

Phytol is a terpenoid found in the extract of Water Yam leaves. It is associated with biological activities such as being a precursor to vitamins K1 and E, as well as having antimicrobial properties. Phytol is a diterpene alcohol that serves as a precursor to vitamins E and K. Its functional group is an alcohol (-OH).

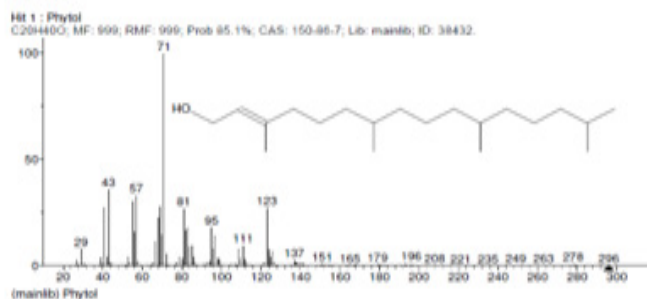


Figure13: Phytol

Neophytadiene

Neophytadiene is a terpene identified in the extract of Water Yam leaves. It is associated with anti-inflammatory and antimicrobial activities. This diterpene exhibits notable antimicrobial properties and contains an alkene functional group (C=C).

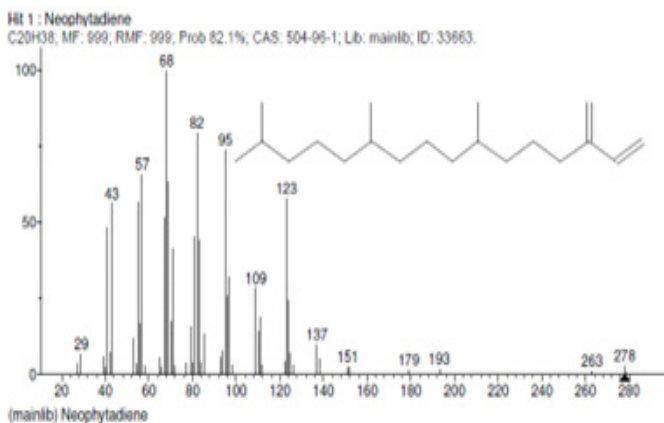


Figure14: Neophytadiene

Squalene

Squalene is a terpenoids identified in the Water Yam leaf extract. It is associated with the following biological activity: Antioxidant, skin-protective. Triterpene with antioxidant and skin benefits. Functional group: alkenes (C=C).

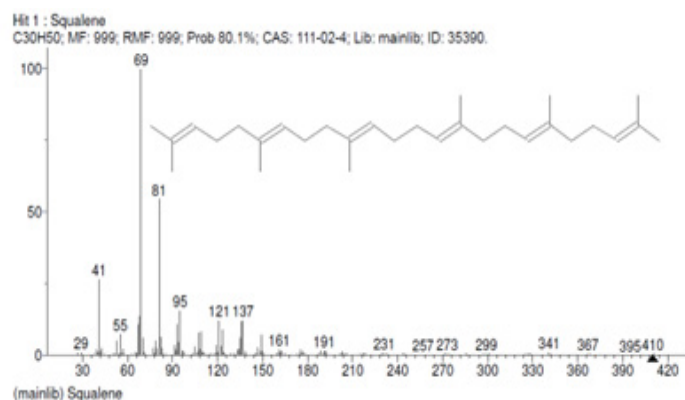


Figure15: Squalene

β-Sitosterol

β-Sitosterol is a sterol and steroid found in the leaf extract of Water Yam. It is linked to cholesterol-lowering and anti-inflammatory activities. This plant sterol has cholesterol-lowering effects and contains a hydroxyl functional group (O-H).

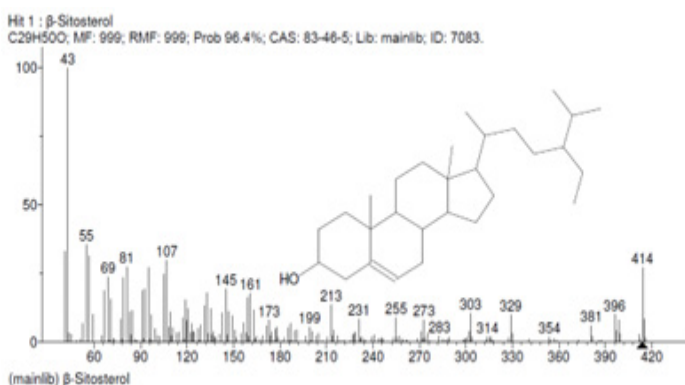


Figure16: β-Sitosterol

Stigmast-4-en-3-One

Stigmast-4-en-3-one is a sterol and steroid found in the extract of Water Yam leaves. It is known for its biological activity as a plant sterone with anti-inflammatory properties. This compound is a steroidal ketone containing functional groups such as a ketone and an alkene.

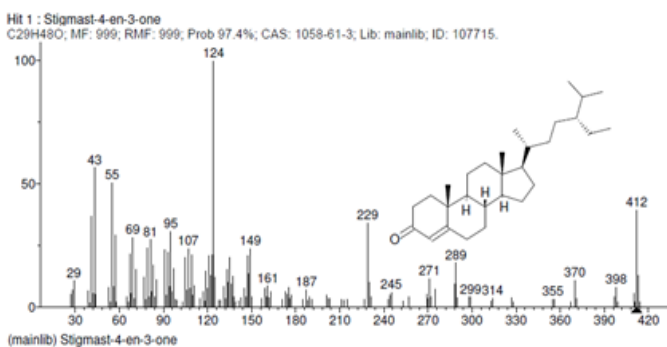


Figure17: Stigmast-4-en-3-one

Cylcoergost-24(28)-En-3-Ol

Cycloergost-24(28)-en-3-ol are derivative of a sterol and steroids identified in the Water Yam leaf extract. It is associated with the following biological activity: Structural sterol, cell membrane function. Steroidal alcohol derivatives with cell membrane function. Functional groups: alcohol, alkene.

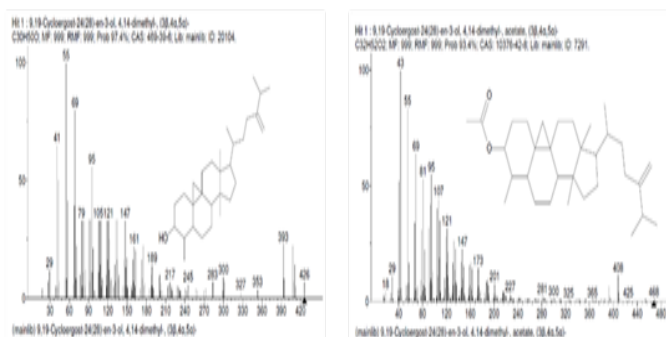


Figure18: Cycloergost-24(28)-en-3-ol

Vitamins and Phenols

In plants, both vitamin E and phenolic compounds play crucial roles as antioxidants, protecting against oxidative stress and contributing to plant health. Vitamin E, particularly α-tocopherol, is a lipid-soluble antioxidant that helps protect plant cells from lipid peroxidation. These are potent antioxidants and essential for human nutrition.

Vitamin E

Vitamin E (α-Tocopherol) is a phenolic vitamin found in the Water Yam leaf extract. It is linked to several biological activities, including antioxidant properties, skin health, and immune support. Antioxidant vitamins are vital for overall health. The functional groups present in Vitamin E are phenolic OH and chromanol.

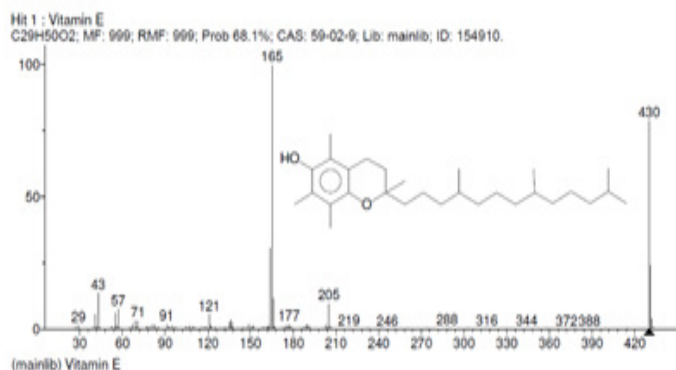


Figure19: Vitamin E

Esters

Esters are commonly found in plants and play a crucial role in their natural fragrances and flavors. They are produced through a process called esterification, which occurs in spe-

cialized plant cells called plastids.

4-(Prop-2-Enoyloxy) Octane

4-(Prop-2-enoyloxy) octane is another plant derivative identified in the Water Yam leaf extract. It is associated with the following biological activities: fatty ester and a possible plant lipid derivative. It relates to lipid metabolism and contains the functional groups of ester and alkene.

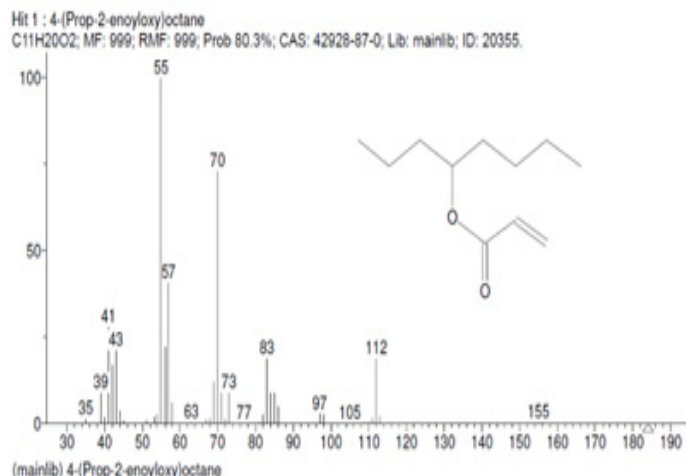


Figure20: 4-(Prop-2-enoyloxy) Octane

Dodeca-1, 6-Dien-12-Ol, 6,10-Dimethyl-

Dodeca-1,6-dien-12-ol, 6,10-dimethyl- is a terpene identified in the Water Yam leaf extract. It is associated with the following biological activities: aromatic and terpene derivatives. This terpene alcohol contributes to the aroma and contains the functional groups: alcohol and alkene.

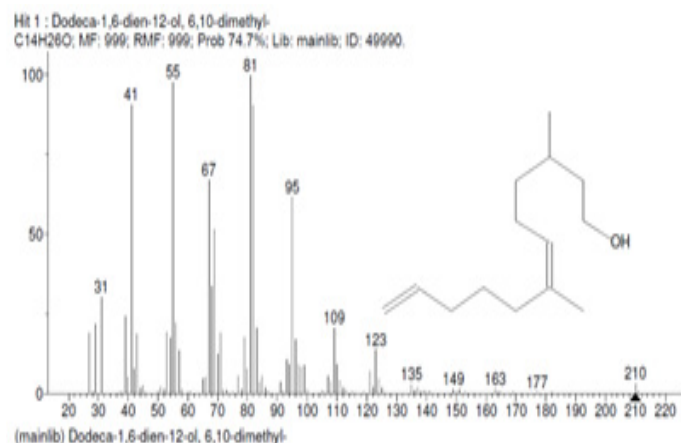


Figure21: Dodeca-1,6-dien-12-ol, 6, 10-dimethyl-

Tridecenyl Tiglate, 2E-

Tridecenyl tiglate, also known as 2E-, is a terpenoid found in the extract of Water Yam leaves. It is associated with biological activities and is present in essential oils, giving them aromatic properties. This compound is an ester that contains functional groups such as ester and alkene.

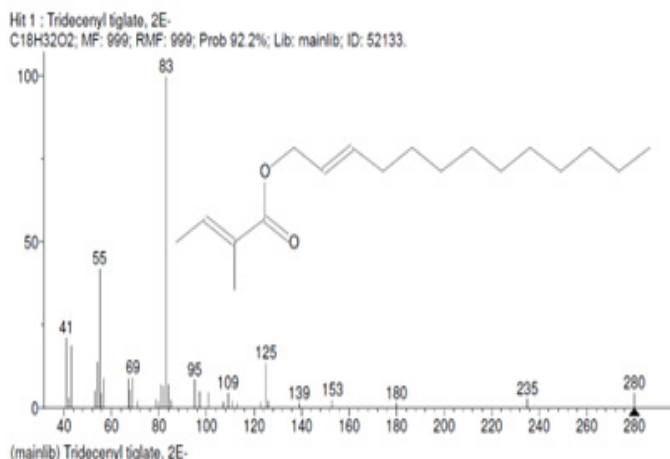


Figure22: Tridecenyl Tiglate, 2E

Summary, Conclusion, Recommendation, and Contribution to Knowledge

Summary

Phytochemicals are natural compounds found in plants that provide essential nutrients and have medicinal properties. They act as defense mechanisms for plants and can enhance human immunity against diseases. Many, including alkaloids, flavonoids, and tannins, offer benefits such as pain relief, antimicrobial effects, and antioxidant activity, aiding in the treatment of serious illnesses like cancer and heart disease. For instance, *Moringa oleifera* and *Jatropha tanjorensis* are known to contain valuable phytochemical compounds.

In this study, I made use of a technique called Gas Chromatography-Mass Spectrometry (GC-MS) to carefully examine the chemical makeup of water yam (*Dioscorea alata*) leaves and found quite an impressive range of natural, health-boosting compounds known as phytochemicals. These compounds were grouped into several key categories: fatty acids and esters, terpenoids and sterols, vitamins and phenols, and plant-based esters.

Among all the fatty acids detected, n-Hexadecanoic acid, more commonly known as palmitic acid, stood out the most. It made up over 29% of the chemical profile and is recognized for its anti-inflammatory and antioxidant effects. Other important fatty acids like oleic acid, linoleic acid, and α -linolenic acid were also present, all of which are known to support heart health and strengthen the immune system. Interestingly, their ester counterparts, such as ethyl palmitate and ethyl stearate, were also found, indicating that the leaf extract has lipid-based biological activity.

The analysis also highlighted a rich presence of terpenoids, including phytol, neophytadiene, and squalene. These natural chemicals are often linked with antimicrobial, antioxidant, and skin-nourishing benefits. Notably, phytol serves as a building block for vitamins E and K. In the sterol group,

compounds like β -sitosterol and stigmast-4-en-3-one were found, which are known to help lower cholesterol and fight inflammation.

Also worth noting was the detection of vitamin E (α -tocopherol), a strong antioxidant that helps protect cells and boost the immune system. Several other ester compounds, such as 4-(Prop-2-enoyloxy) octane and tridecenyl tiglate, were identified. These may enhance the plant's aromatic qualities and add to its therapeutic potential.

In summary, these findings confirm that water yam leaves are a rich source of beneficial phytochemicals, which reinforces their value not just in traditional herbal practices but also in the development of modern natural remedies.

Conclusion

The findings from this study provide compelling evidence that the leaves of *Dioscorea alata* (Water Yam) are a rich source of diverse and biologically significant phytochemicals. Through the application of Gas Chromatography-Mass Spectrometry (GC-MS), a total of nineteen phytochemical compounds were successfully identified and categorized into fatty acids and esters, terpenoids and sterols, vitamins and phenols, and plant-derived esters. Among these, n-Hexadecanoic acid (palmitic acid) was notably the most abundant, constituting 29.13% of the extract, and recognized for its strong anti-inflammatory and antioxidant properties. The presence of unsaturated fatty acids such as oleic acid, linoleic acid, and α -linolenic acid, along with their esterified forms, underscores the plant's potential in promoting cardiovascular health and modulating immune responses. Additionally, terpenoids like phytol, squalene, and neophytadiene, as well as plant sterols such as β -sitosterol and stigmast-4-en-3-one, were observed to play key roles in antimicrobial defense, cholesterol regulation, and skin health. Furthermore, the identification of vitamin E (α -tocopherol) as a major antioxidant and the detection of aromatic esters like tridecenyl tiglate support the multifaceted therapeutic applications of the water yam leaf. Collectively, these phytochemicals exhibit a wide range of biological functions that align with the traditional medicinal uses of *Dioscorea alata* in various cultures. This research validates the medicinal potential of *Dioscorea alata* leaves, not only highlighting their nutritional and pharmacological relevance but also advocating for their further study and incorporation into modern herbal and pharmaceutical formulations.

Recommendation

Given the impressive variety of health-boosting compounds found in *Dioscorea alata* (water yam) leaves, it's clear that more research should be done to fully understand how these natural substances work in the body. Studies focusing on their medicinal potential and safety would help uncover how they can be used to prevent or treat diseases. With compounds like palmitic acid, oleic acid, squalene, β -sitosterol, and vita-

min E present in high amounts, the leaf extract shows strong potential for use in producing natural supplements and herbal remedies. This study also supports the idea that water yam leaves could have a valuable place in both traditional and modern medicine, thanks to their anti-inflammatory, antioxidant, and antimicrobial qualities. Local communities and herbal medicine practitioners should be encouraged to make better use of this often-overlooked part of the plant. From a farming perspective, these leaves-typically thrown away during harvest-could actually be turned into profitable products, giving farmers and small businesses a new way to earn income. It's also important to spread awareness about the nutritional and healing benefits of water yam leaves. Educating the public and gaining support from the government and research bodies will help unlock the full potential of this useful, natural resource.

Contribution to Knowledge

This research provides a significant addition to the growing body of knowledge on the phytochemical potential of underutilized plant parts, specifically the leaves of *Dioscorea alata* (water yam). While the tubers of water yam are widely recognized and consumed for their nutritional value, the leaves have received comparatively little scientific attention. By applying Gas Chromatography-Mass Spectrometry (GC-MS), this study is among the few that have comprehensively identified and quantified the bioactive compounds present in water yam leaves. The identification of nineteen distinct phytochemicals, including n-Hexadecanoic acid, oleic acid, linoleic acid, α -linolenic acid, phytol, β -sitosterol, and vitamin E, highlights the plant's untapped potential for use in both nutritional and medicinal applications. This research confirms that water yam leaves contain compounds known for their anti-inflammatory, antioxidant, antimicrobial, and cholesterol-lowering properties, thereby laying a scientific foundation for their integration into pharmaceutical, cosmetic, and nutraceutical formulations.

Furthermore, this study emphasizes the economic and environmental value of utilizing agricultural by-products, advocating for the valorization of water yam leaves, which are often discarded as waste. It also encourages further research and public awareness of this affordable and locally available plant resource.

In summary, this work contributes new scientific insights into the chemical profile of *Dioscorea alata* leaves and supports their wider application in health, agriculture, and sustainable development initiatives.

References

1. Kalu, Osuagwu, Agbor, (2019). "International Journal of Scientific and Research Publications, Vol. 9; 2, ISSN 2250-3153

2. Krishnaiah, Duduku, Rosalam Sarbatly, and Awang Bono. "Phytochemical antioxidants for health and medicine: A move towards nature." *Biotechnol Mol Biol Rev* 1, no. 4 (2007): 97-104.
3. Mohammad Asif and Elham Khodadadi (2013). "Medicinal uses and chemistry of flavonoid contents of some common edible plants". *Journal of paramedical Sciences*. 4(3): 119 – 138.
4. Ozacar, Mahmut, and I. Ayhan Sengil. "The use of tannins from Turkish acorns(valonia) in water treatment as a coagulant and coagulant aid." *Turk. J. Eng. Environ. Sci.* 26, no. 3 (2002): 255-263.
5. Thakur, M., & Sharma, D. (2015). "Nutritional Evaluation, Fatty Acid Profile, and Functional Properties of Purple Yam (*Dioscorea alata*) Flour." *Journal of Food Science and Technology*, 52(12), 8114-8121.
6. Oladosu-Ajayi, R. N., H. E. Dienye, C. T. Ajayi, and O. D. Erinle. "Comparative Screening of Phytochemical Compounds in Scent Leaf *Ocimum gratissimum* Linn.(Family: Lamiaceae) and Bitter Leaf *Vernonia amygdalina* Del.(Family: Asteraceae) Extracts." *Advances in Zoology and Botany* 5, no. 4 (2017): 50-54.
7. Erinle, O. D. "Phytochemical Screening of Scent leaf (*Ocimum gratissimum*) and bitter leaf (*Vernonia amygdalina*) extracts." ND Project, FCFFT, New Bussa, Niger State (2012): 1-5.
8. Bagheri, Gholamreza, Miquel Martorell, Karina Ramírez-Alarcón, Bahare Salehi, and Javad Sharifi-Rad. "Phytochemical screening of *Moringa oleifera* leaf extracts and their antimicrobial activities." *Cellular and Molecular Biology* 66, no. 1 (2020): 20-26.
9. Younis, Noor, Muhammad Issa Khan, Tahir Zahoor, and Muhammad Naeem Faisal. "Phytochemical and antioxidant screening of *Moringa oleifera* for its utilization in the management of hepatic injury." *Frontiers in Nutrition* 9 (2022): 1078896.
10. Wirjosentono, Basuki, and Lamek Marpaung. "Phytochemical screening and chemical analysis of ethanol extract of Kari leaves (*Murayya koenigii*) using GC-MS method." In *Journal of Physics: Conference Series*, vol. 1232, no. 1, p. 012012. IOP Publishing, 2019.
11. Arif MAA, Warsito SH, Lamid M, Lokapirnasari WP, Khairuallah AR, Ayuti SR, Sugito, et al (2024). Phytochemical Analysis of Curry Leaf Extract (*Murraya koenigii* L.) as a Potential Animal Feed and Medicinal Ingredient. *Pharmacogn J.* 16(2): 471-477.
12. Anwar, F. (2007). "A food plant with multiple medicinal uses". *Journal of Food Sciences and Nutrition*; 21:17-25.
13. Madubuike, K.G., Yusuf, N.O. and Robinson, E.S. (2015). "Evaluation of the in vitro and in vivo antioxidant potentials of *Jatropha tanjorensis* methanol leaf extract". *Internal J. Pharm. Phytochem. Res.*; 7: 43-51.
14. T. Lockett, Christopher C. Calvert, Louis E. Grivetti, Cassius. "Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, Northeastern Nigeria." *International Journal of food sciences and nutrition* 51, no. 3 (2000): 195-208.
15. Igbinaduwa, Patrick O., Cyril O. Usifoh, and Comfort C. Ugwu. "Phytochemical analysis and toxicological evaluation of the methanolic extract of *Jatropha tanjorensis* leaf." *Journal of Pharmacy & Bioresources* 8, no. 2 (2011): 86-91.
16. de Albuquerque, Ulysses Paulino, Júlio Marcelino Monteiro, Marcelo Alves Ramos, and Elba Lúcia Cavalcanti de Amorim. "Medicinal and magic plants from a public market in northeastern Brazil." *Journal of ethnopharmacology* 110, no. 1 (2007): 76-91.
17. Coursey, D.G. (1967) "Yams. An Account of the Nature, Origins, Cultivation, and Utilization of the Useful Members of the Dioscoreaceae". Longmans, London.
18. Martin, F. W., & Sadik, S. (1977). "Tropical Yams and Their Potential: Part 2. *Dioscorea alata*." USDA Agriculture Handbook.
19. Nwachukwu, C. N. "Nutrient, phytochemical and anti-nutrient evaluation of *Jatropha tanjorensis* leaf (hospital too far)." *Journal of Agriculture and Food Sciences* 16, no. 2 (2018): 36-46.