

# Qualitative Analysis of Phytochemicals from the Stem of *Ficus vogelii*

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## Abstract

The plant *Ficus vogelii* commonly known as West African rubber tree, belongs to the family of Moraceae; it is a member of the fig genus found mostly in the Guinea savannah vegetation belt of West and Central Africa. The phytochemicals from the stem of *Ficus vogelii*, a plant species with ethnomedicinal importance in West Africa, were qualitatively analysed in this work. The aim of the study was to identify and characterize the bioactive compounds present in *Ficus vogelii*, which could potentially contribute to its therapeutic effects. Fresh stems of *Ficus vogelii* were collected from a natural habitat in Enugu State, Nigeria, and subjected to air drying followed by cold extraction using methanol, ethyl acetate, and water as solvents. The extracts were then tested for the presence of various phytochemicals using standard qualitative tests. The results of the phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, tannins, glycosides, terpenoids, and phenols in the stem extracts of *Ficus vogelii*. Each phytochemical was present in varying quantities across the different solvent extracts, with methanol showing the highest extraction efficiency for most compounds. Nonetheless, the findings of this study underscore the potential of *Ficus vogelii* as a valuable source of natural products for pharmaceutical and medicinal purposes.

**Keywords:** *Ficus vogelii*, Phytochemicals, Qualitative analysis, Bioactive, Medicinal purposes.

## INTRODUCTION

According to World Health Organization (2015), medicinal plants would be the best source to obtain variety of drugs. About 80% of individuals from developed countries use traditional medicines, which have compounds derived from medicinal plants efficiency (Arunkumar & Muthuselvam, 2009). However, these plants should be investigated to better understand their properties, safety, and efficiency.

Phytochemicals are biologically active, naturally occurring compounds found in the leaves, stem, bark, roots, and other parts of medicinal plants that have defence mechanisms and protect from various diseases (Kumar *et al.*, 2023). These phytochemicals include both primary (such as chlorophyll, proteins, and common sugars) and secondary (such as terpenoid, alkaloids, and phenols) compounds (Ullah *et al.*, 2020).

Medicinal plants contain some organic bioactive substances e.g. tannins, alkaloids, carbohydrates, terpenoids, steroids, and flavonoids that have definite physiological action on the human body (Edeoga *et al.*, 2005). These compounds are synthesized by primary or secondary metabolism of living organisms and are widely used in the human therapy, veterinary, agriculture, scientific research, and countless other areas (Bennacer *et al.*, 2022). Most important of such compounds are alkaloids, tannins, flavonoids, terpenoids, saponins and phenolic compounds. Pharmacists are interested in these compounds because of their therapeutic performance and low toxicity.

Many herbaceous and medicinal plants contain important phytochemicals and vitamins such as alkaloids, flavonoids, cyanogenic glycosides, saponins, lignin and lignans; also, vitamins C and E, and carotenoid which are utilized both by humans and animals as important components of diets (Edo *et al.*, 2023). These herbaceous plants and species are harmless sources for obtaining natural antioxidants (Ncube *et al.*, 2008).

Rasheem *et al.* (2019) in their study found that there are bioactive compounds- betulinic acid, lupeol, gallic acid in the whole plant of *F. vogelii*, including the leaves, stem bark, and fruits. Edwige *et al.* (2002) conducted a similar study on the leaves of *F. vogelii* and detected some other bioactive compounds such as bergapten,  $\beta$ -sitosterol, and stigmasterol.

This study aimed to conduct a qualitative photochemical analysis of the stem of *Ficus vogelii*, and to potentially identify fresh bioactive compounds such as flavonoids, saponins, tannins, and terpenoids that could have therapeutic potentials which can lead to the development of new drugs. The significance is to broaden our comprehension of the chemical composition of *F. vogelii* and its potential applications in pharmacology, medicine, and conservation biology. The plant *Ficus Vogelii* (commonly known as West African Rubber tree) belongs to the family of Moraceae and it is a member of the fig genus found mostly in the Guinea savannah vegetation belt of West and Central Africa (Ganogpichayagrai & Suksaard, 2020). It is a Large, spreading, briefly deciduous tree, usually starting as a strangler but often freestanding when older. *Ficus Vogelii* is also known for its ethnomedicinal application most especially in the treatment of diabetes, anorexia, and anaemia (Sparg *et al.*, 2004). The plant's well-known medicinal properties, including as its antidiabetic and anti-ulcer properties, are being studied scientifically (Hussain *et al.*, 2011), anti-anaemia and antihepatotoxic potentials (Egbuna & Ifemeje, 2016). It is also called the Giant leave fig tree in English, Áwáyòdò in Hausa, and 'kujung' by the Obudu people of Cross River, Nigeria (Shi *et al.*, 2022).

## MATERIALS AND METHODS

### Sample Collection

Fresh stems of *Ficus Vogelii* were collected from a bush in Ugwuto village, Nsude town in Udi Local Government Area of Enugu State at Latitude 6° 24' 7" N, and Longitude 7° 23' 36" E. The sample was intentionally collected from the wild to ensure it contained no pesticides or herbicides.

### Drying and Extraction

The samples were air dried naturally under room temperature to remove its water content while still maintaining its full constituents after drying. The drying process took about 2 weeks. The cold method of extraction also called aqueous extraction was used. Three different containers were labelled A, B and C, containing methanol, ethyl acetate, and water, respectively. 20 g of the samples were soaked in the container for 24 hours after which it was taken to the water bath for concentration. The extracts were then ready for isolation and purification.

### Test for Alkaloids

5 mL of Wagner reagent (iodine in potassium iodide) was added to 5 mL of sample extracts (Hussain *et al.*, 2011). A Reddish-brown coloured precipitate was obtained in all three extracts, confirming the presence of alkaloids.

### Test for Flavonoids

Few drops of sodium hydroxide solution were added to 2 mL of the aqueous solution of the crude extract (Schnarr *et al.*, 2024). The mixture was observed for intense yellow coloration which indicates the presence of flavonoids.

### Test for Saponins

5 mL of distilled water was added to 2 mL of the plant extract and the mixture was shaken vigorously for about 10 minutes. Persistent frothing was taken as preliminary evidence for the presence of saponins. The frothing was then mixed with few drops of olive oil and again shaken vigorously, and the appearance of foam showed the presence of saponins (Kumar *et al.*, 2023).

### Test for Tanin

0.5 mL solution of ferric chloride (a mixture of 5 g of ferric chloride, dissolved in 100 mL of distilled water) was added with 2 mL of the plant crude extract in a test tube (Egbuna & Ifemeje, 2016). A greenish coloration was observed which indicated the presence of tannins.

**Test for Glycoside (Keller-Kilian test):** 1 drop of ferric chloride mixture and 0.5 mL of concentrated Sulphuric acid was added to 5 mL of aqueous plant sample extract (Sundarram & Murthy, 2014). A brown ring formed in between the layers indicating the presence of Cardiac glycosides.

**Test for Terpenoid: (Salkowski test):** 4 mL of chloroform was added to 1 mL of each the extract afterwards, 6 mL of concentrated Sulphuric acid ( $H_2SO_4$ ) was also carefully added to form a layer (Society *et al.*, 2013). The observance of a reddish-brown coloration of the interface confirmed the presence of terpenoids.

**Test for Phenols: (Ferric chloride test):** 1 mL of distilled water was added to 5 mL of alcoholic solution of sample extract, this was followed by few drops of 10% aqueous Ferric chloride ( $FeCl_3$ ) solution (Hussain *et al.*, 2011). A blue colour which indicates the presence of phenols was obtained.

## RESULTS

Table 1 shows which phytochemicals are present in the stem of *Ficus vogelii* either excessively, moderately, slightly, or completely absent.

**Table 1: Qualitative determination of phytochemicals in the stem of *Ficus vogelii***

S/N	phytochemical Tested	Test Applied	Aqueous Extract	Methanol Extract	Ethyl acetate extract
1.	Alkaloid	Wagner test	+	+	+
2.	Flavonoid	Alkaline reagent test	-	++	-
3.	Saponin	Foam test Olive oil test	+	-	-
4.	Tannin	Ferric chloride test	-	+	++
5.	Glycosides	Keller-killian test	+	++	-
6	Terpenoid	Salkowski test	+	-	+
7	Phenol	Ferric chloride test	-	+	-

Key: - Absent, + Slightly present, ++ Moderately present, +++ Strongly present

From the table, Alkaloid was slightly present in all three sample extracts. Flavonoid was moderately present in the methanoic extract but completely absent in both the aqueous and ethyl acetate extracts. Saponin was slightly present in aqueous extract but absent in methanol and ethyl acetate extracts. Tanin was absent in the aqueous extract, slightly present and moderately present in the methanol and ethyl acetate extracts respectively. Glycoside was slightly present in the aqueous extract, moderately present in the methanol extract but was absent in the ethyl acetate extract. Terpenoid was slightly present in the aqueous and ethyl acetate extracts but absent in the methanol extract. Phenol was only slightly present in the methanol extract and absent in the aqueous and ethyl acetate extracts. None of the phytochemicals were strongly present in any of the sample extracts.

## DISCUSSION

The qualitative phytochemical analysis (Table 1) confirmed the presence of secondary metabolites such as terpenoids, phenol, saponin, alkaloids, tannins, glycosides, and flavonoids in the stem of *Ficus vogelii* which is also similar to the results obtained from the research carried out by Uchewa, *et al* (2017). Secondary metabolites such as alkaloids, flavonoids and saponins have been reported to have antimicrobial activities (Tkachenko *et al.*, 2017).

The qualitative determination of phytochemicals in the stem extracts of *Ficus vogelii* provides valuable insights into the chemical composition and potential therapeutic properties of this plant species. Each phytochemical identified plays a specific role in the plant's defence mechanisms and may contribute to its ethnomedicinal uses.

Alkaloids are nitrogen-containing compounds known for their diverse pharmacological activities (Atanasov *et al.*, 2021). While alkaloids were slightly present in all three sample extracts, their presence suggests the potential for *Ficus vogelii* to exhibit alkaloid-related bioactivities such as analgesic, antimicrobial, and anti-inflammatory effects (Ferverza *et al.*, 2019). Further studies are needed to isolate and identify specific alkaloids present in the plant and investigate their pharmacological properties (Atanasov *et al.*, 2021).

Flavonoids are polyphenolic compounds with antioxidant, anti-inflammatory, and anticancer properties (Ajji *et al.*, 2020). The moderate presence of flavonoids in the methanol extract indicates that this solvent fraction may be enriched with these bioactive compounds (Ullah *et al.*, 2020). Flavonoids have been associated with various health benefits, including

cardiovascular protection, immune modulation, and neuroprotection (Aji *et al.*, 2020). The absence of flavonoids in the aqueous and ethyl acetate extracts suggests differences in the phytochemical profiles of different solvent fractions (Atanasov *et al.*, 2021).

Saponins are glycosides with detergent-like properties that can disrupt cell membranes and exhibit various biological activities, including antifungal, antiviral, and anticancer effects (Sparg *et al.*, 2004). It can increase the permeability of the bacterial cells without destroying them. This action might facilitate the entry of antimicrobial agents into the bacterial cells and enhance antimicrobial activity of the agents (Arabski *et al.*, 2012). The presence of saponins in the aqueous extract suggests that these compounds are water-soluble and may contribute to the traditional uses of *Ficus vogelii* in ethnomedicine (Sparg *et al.*, 2004). The absence of saponins in the methanol and ethyl acetate extracts may be due to differences in solvent polarity and extraction efficiency (Atanasov *et al.*, 2021).

Tannins are polyphenolic compounds known for their astringent taste and ability to precipitate proteins (Smeriglio *et al.*, 2017). The presence of tannins in the methanol and ethyl acetate extracts indicates that these solvent fractions may contain compounds with protein-binding properties (Jiménez-Nevárez *et al.*, 2023). Tannins have been traditionally used for their antimicrobial, anti-inflammatory, and antioxidant effects (Smeriglio *et al.*, 2017). The absence of tannins in the aqueous extract suggests differences in the chemical composition of this solvent fraction (Atanasov *et al.*, 2021).

Glycosides are compounds that contain a sugar moiety attached to a non-sugar (aglycone) component (Sparg *et al.*, 2004). The presence of glycosides in the aqueous and methanol extracts suggests that these solvent fractions may contain compounds with cardiovascular and antimicrobial activities (Kebede & Shibeshi, 2022). Glycosides are often found in medicinal plants and have been investigated for their potential therapeutic effects (Atanasov *et al.*, 2021). Terpenoids are a diverse class of compounds with antimicrobial, anti-inflammatory, and anticancer properties (Smeriglio *et al.*, 2017). The presence of terpenoids in the aqueous and ethyl acetate extracts suggests that these solvent fractions may be enriched with volatile compounds that contribute to the characteristic odour of *Ficus vogelii* (Jiang *et al.*, 2016). Terpenoids have been implicated in the plant's defence against pathogens and herbivores and may play a role in its ethnomedicinal uses (Atanasov *et al.*, 2021).

Phenolic compounds are antioxidants that scavenge free radicals and protect cells from oxidative damage (Lobo *et al.*, 2010). The presence of phenols in the methanol extract suggests that this solvent fraction may contain compounds with antioxidant and antimicrobial properties (Smeriglio *et al.*, 2017). Phenols have been studied for their potential therapeutic effects in various diseases, including cancer, cardiovascular disease, and neurodegenerative disorders (Rahman *et al.*, 2021). The absence of phenols in the aqueous and ethyl acetate extracts may be attributed to differences in the solvent's ability to extract these compounds (Shi *et al.*, 2022).

In essence, the presence of these phytochemicals in the stem extracts of *Ficus vogelii* suggests the potential therapeutic properties of this plant species. Further research is warranted to isolate and characterize specific bioactive compounds and evaluate their pharmacological activities.

## CONCLUSION

From the results obtained from the phytochemical analysis conducted during this study, it has detected that the stem of *F. vogelii* contain some bioactive compounds which include flavonoids, tannins, alkaloids, phenol, terpenoids, cardiac glycosides and saponin in different quantities and these bioactive compounds that have documented to contain antibacterial, antifungal, anti-inflammatory, antimicrobial and antioxidant effect. Hence, flavonoids, saponin, tannin, alkaloid and other phenolic compounds detected in the assayed samples are alternative sources for pharmaceutical and medicinal applications. These conclusions are based only on the qualitative phytochemical analysis results, and more research is required to validate the health advantages of *F. Vogelii*.

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