IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 19, Issue 3 Ser. 2 (May. – June. 2024), PP 05-10
www.Iosrjournals.Org

Comprehensive Phytochemical Profiling Of Ficus Thonningii

Udechukwu Chidozie Dennis, Muoka Rufina Ogechukwu,
Ozor Anthonia Ukamaka
Department Of Biology, Alex Ekwueme Federal University Ndufu Alike, Ebonyi State.
Department Of Science Laboratory Technology, Federal Polytechnic, Oko, Anambra State.

Abstract
The study aimed to qualitatively determine the presence and concentration of various phytochemicals in different parts (roots, stem, and leaves) of Ficus thonningii. *Phytochemical screening revealed a diverse presence of bioactive compounds across all tested plant parts. Alkaloids were consistently present in low quantities throughout the roots, stem, and leaves. Saponins were found in moderate quantities in the roots and in low quantities in both the stem and leaves. Quinones exhibited the highest concentration in the roots (excess quantity), while the stem showed low quantities and the leaves moderate quantities. Tannins were abundant in the roots and present in moderate quantities in the stem and leaves. Phenols showed moderate presence in roots and leaves, with low quantities in the stem. Steroids were found in low quantities in roots and leaves, but in moderate quantities in the stem. Flavonoids were abundantly present in roots and moderately present in both stem and leaves. Cardiac glycosides were moderately present in roots and leaves, but in low quantities in the stem. Reducing sugars were absent in all parts of the plant. Oxalates were present in moderate quantities in roots and leaves, and in excess quantity in the stem. This phytochemical profiling indicates that* Ficus thonningii *contains a rich variety of bioactive compounds, which may contribute to its medicinal properties and warrant further pharmacological studies.*

Date of Submission: 09-06-2024 Date of Acceptance: 19-06-2024

I. Introduction

About 75-90 % of the world population still relies on plants and plant extracts as a source of primary health care (Sani and Aliyu, 2011). All thanks to mother earth and nature which has provided mankind with a reservoir of remedies to cure diseases of different types. Plants use in traditional medicine, also called phytomedicine are plant-derived medicines that contain chemicals, more usually, mixtures of chemical compounds that act individually or in combination on the human body to prevent disorders and to restore or maintain health (Aref *et al*.,2010). This widespread use of plant derived extracts in disease management has led to an interest in the identification and characterisation of the active compounds which give the extracts their therapeutic potential. (Adekanbi *et al.,* 2014). *Ficus thonningii* is one of these plants that have been employed by botanists for the treatment of several acute and chronic diseases. Nature's signature evolved from the time of Galen and Discorides, it is on the view that plant's part resembling part of human body can be used to cure the disease affecting that human part.

Ficus thonningii, commonly known as Thonning's fig, is a species widely distributed across Africa and renowned for its extensive use in traditional medicine. The various parts of the plant, including roots, stems, and leaves, have been employed to treat numerous ailments such as infections, wounds, and gastrointestinal disorders (Akah et al., 2009). The therapeutic potential of *Ficus thonningii* is largely attributed to its rich phytochemical composition, which includes alkaloids, saponins, tannins, phenols, flavonoids, and other bioactive compounds (Olowokudejo et al., 2008).

Phytochemicals are naturally occurring chemical compounds in plants, responsible for their color, flavor, and disease resistance (Harborne, 1998). These compounds play a crucial role in plant defense mechanisms and have been found to exhibit a wide range of biological activities beneficial to human health, including antioxidant, anti-inflammatory, antimicrobial, and anticancer properties (Dai & Mumper, 2010). The qualitative determination of phytochemicals in different parts of plants helps in understanding their potential medicinal value and can guide further pharmacological studies.

Previous studies have demonstrated the presence of various phytochemicals in different parts of *Ficus thonningii*. For instance, Okoli et al. (2007) reported the presence of alkaloids, flavonoids, and tannins in the leaves of the plant, which contribute to its antimicrobial and antioxidant activities. Similarly, Adedapo *et al.*

(2009) identified significant amounts of saponins and phenolic compounds in the roots and stems, supporting their use in traditional medicine for treating inflammatory conditions.

The aim of this study is to comprehensively profile the phytochemical constituents of the roots, stems, and leaves of *Ficus thonningii*. By qualitatively determining the presence and concentration of these compounds, this research seeks to provide a deeper understanding of the plant's medicinal properties and its potential for developing novel therapeutic agents.

II. Materials And Methods

Sample Collection

Fresh roots, stems and leaves of *Ficus thonningii* were collected from a farm land in Ugwuto village Nsude town in Udi Local Government Area of Enugu State. The samples were taken to the Phytochemistry Department of the National Arbor Viruses and Vectors Research Centre, Enugu, Enugu State, Nigeria

Preparation of Plant Extracts

The collected plant materials (roots, stems, and leaves) were washed with distilled water, air-dried in the shade for two weeks, and then ground into a fine powder using a mechanical grinder. Each powdered plant part (50 g) was subjected to successive extraction with solvents of increasing polarity (petroleum ether, chloroform, ethyl acetate, methanol, and water) using a Soxhlet extractor for 8 hours per solvent . The extracts were concentrated using a rotary evaporator at 40°C and stored at 4°C until further analysis.

Phytochemical Screening

Phytochemical screening of the extracts was conducted using standard qualitative methods to identify the presence of various secondary metabolites.

Alkaloids

Dragendorff's reagent and Mayer's reagent were used for the detection of alkaloids. A positive test was indicated by the formation of an orange-red precipitate (Dragendorff's) or a white precipitate (Mayer's).

Saponins

The froth test was employed to detect saponins. Persistent froth formation for at least 10 minutes after shaking the extract in distilled water indicated the presence of saponins.

Quinone

About 1ml of the plant crude extract was added with 0.1 molar of acidified hydrochloric acid. After blue black or iodine color were observed which indicated the presence of quinone. Also, 2ml of the plant crude extract was added with solution of distilled water and boiled in water bath. After 15 minutes, it was neutralize with potassium hydroxide and Fehling solution. A brick red precipitate was observed which indicated the presence of glycoside.

Tannins

Ferric chloride test was used to detect tannins. A blue-black or greenish-black coloration indicated the presence of tannins when the extract was mixed with 5% ferric chloride solution

Phenolic Compounds

The Folin-Ciocalteu reagent method was employed for the qualitative and quantitative determination of total phenolic content. The presence of phenolic compounds was indicated by the development of a blue color after reacting the extract with the reagent.

Steroid

Exactly 5 drops of sulphuric acid was added to 1ml of the plant crude extract. Red- dark color was observed which indicated the presence of steroid

Flavonoids

The presence of flavonoids was confirmed by the formation of a yellow coloration when the extract was treated with a few drops of concentrated hydrochloric acid and magnesium ribbon (Shinoda test).

Glycoside

The method described by Ajayi (2018) was utilized to determine the cyanogenic glycoside content in the plant extract. Plant samples were weighed into a 250 cm^3 round bottom flask, and approximately 200 cm^3 of

distilled water was added to 1 g of each dry wood powder sample. The mixture was left to stand for 2 hours to allow autolysis to occur. Full distillation was then performed in a 250 cm^3 conical flask containing 20 cm^3 of 2.5% NaOH (sodium hydroxide) along with an antifoaming agent (tannic acid). The distillate, containing cyanogenic glycoside, was combined with 8 cm^3 of 6 M NH4OH (ammonium hydroxide) and 2 cm^3 of 5% KI (potassium iodide). The resulting mixture was titrated with 0.02 M $AgNO_3$ (silver nitrate) using a microburette against a black background, and the end point was indicated by continuous turbidity. The cyanogenic glycoside content in the sample was then calculated as follows:

Mg = titre value cm^3× 1.08 × extract value

Wg = aliquot volume cm^3 × sample weight

Reducing sugar

The reducing sugar content (RSC) was assessed using the 3, 5-dinitrosalicylic acid (DNSA) method, following the modified procedure outlined by Krivorotova and Sereikaite (2014). To prepare the DNSA reagent, 1 g of DNSA and 30 g of sodium-potassium tartaric acid were dissolved in 80 mL of 0.5 N NaOH at 45°C. After the reagents were fully dissolved, the solution was cooled to room temperature and diluted to a final volume of 100 mL with distilled water. For the RSC measurement, 2 mL of DNSA reagent was added to a test tube containing 1 mL of the plant extract (1 mg/mL), and the mixture was heated at 95°C for 5 minutes. Upon cooling, 7 mL of distilled water was added to the solution, and its absorbance was measured at 540 nm using a UV-VIS spectrophotometer (Shimadzu UV-1800). The reducing sugar content was calculated using a calibration curve of standard D-glucose (200-1000 mg/L), and the results were expressed in mg D-glucose equivalent (GE) per gram of dry extract weight.

Oxalate content

Determination of oxalate content was carried out using the method reported by Ejikeme (2002). Exactly 20 cm^3 of 0.3 M HCl in each wood powder sample (2.50 g) was extracted three (3) times by warming at a temperature of 50°C for 1 hour with constant stirring using a magnetic stirrer. For oxalate estimation, 1.0 cm^3 of 5 M ammonium hydroxide was added to 5.0 cm^3 of extract to ensure alkalinity. Addition of 2 drops of phenolphthalein indicator, 3 drops of glacial acetic acid, and 1.0 cm^3 of 5% calcium chloride to make the mixture acidic before standing for 3 hours was followed by centrifugation at 3000 rpm for 15 minutes. After discarding the supernatant, the precipitate was washed three times using hot water by mixing thoroughly each time centrifugation. Then, to each tube, 2.0 cm^3 of 3 M tetraoxosulphate (VI) acid was added and the precipitate dissolved by warming in a water bath at 70°C. Freshly prepared 0.01 M potassium permanganate ($KMnO_4$) was titrated against the content of each tube at room temperature until the first pink colour appears throughout the solution. The solution was allowed to stand until it returned colourless, after which it was warmed on an electric hot plate at 70°C for 3 minutes, and retitrated again until a pink colour appears and persists for at least 30 seconds.Titration reaction of oxalate in sample was calculated as

$C_2O^2_4 + 8H + MnO_4 = 2CO_2 + 4H_2O + Mn$

Ratio of reacting ion = 1:1 $M1V1 = M_2V_2$

M1= molarity of KMn04

M2= molarity of extract oxalic

V1= volume of extract (oxalate)

V2= volume of KMn04

Molecular weight of $CaCO_3$

Weight of oxalate in titrant 2 $cm^3 = \frac{Xg \times 2}{1000} = Y$

100 cm^3 of oxalate extract will contain $= \frac{Y \times 100g}{2.5} = W$

% Oxalate composition g/100g $= \frac{w \times 100}{2.5}$

Statistical Analysis

All experiments were performed in triplicate, and data were expressed as mean ± standard deviation (SD). Statistical analysis was conducted using [software, e.g., SPSS, version X.0]. Differences between means were evaluated by one-way ANOVA followed by Tukey's post hoc test. A p-value of < 0.05 was considered statistically significant.

III. Results

The results obtained from the qualitative phytochemical analysis have been summarized in Table **1.** From the results, it was observed that there was either presence or absence of the different phytochemicals analysed.

From the results obtained in **Table 1 below**, it can be revealed that the different parts of the *Ficus thonningii* plant (root, stem, and leave) has phytochemicals in either low, moderate or excess quantities. The + sign represents presence of phytochemicals while the – sign represents absence. Reducing sugars where absent (-) in the plant analysed. Quinones, tannins, and flavonoids were present in the roots excess quantity (+++), saponins, phenols, cardiac glycosides and oxalates were in moderate quantity (++) while alkaloids and steroids were in low quantities (+). For the stem, only oxalate was found to be in excess, while other phytochemicals were either in low or moderate quantity. For the leaves, oxalates, cardiac glycoside, and phenol where in excess quantity (+++), quinones, tannins and flavonoids where in moderate quantity (++) while saponins and steroids where found to be low (+). 1.045mg/g of oxalates was obtained from the roots of *Ficus thonningii*, 2.903 and 2.730 mg/g of oxalates were obtained from the stem and leaves of the plant respectively. Cyanogenic glycosides were present in 0.81, 0.634 and 0.915mg/g in the root, stem and leaves of *Ficus thonningii.*

Table 1: Qualitative Determination of Phytochemicals of *Ficus thonningii*

Constituent tested/ Parameters	Roots	Stem	Leaves
Alkaloids	+	+	+
Saponins	++	+	+
Quinones	+++	+	++
Tannin	+++	++	++
Phenol	++	+	+++
Steroids	+	++	+
Flavonoids	+++	++	++
Cardiac Glycoside	++	+	+++
Reducing sugars	-	-	-
Oxalates	++	+++	+++

Key + = Present in Low quantity
++ = Present in Moderate quantity
+++= Present in Excess quantity
- = Absent

IV. Discussion

This work examined the relationship between the phytochemicals present in the leaves, stems and roots of *Ficus thonningii* and it was found that it was capable of curing skin related disease. The research has truly proven the treatment of pus using herbs (*F. thonningii*) as the best alternative as it has no side effect to human health. Therefore, the doctrine of nature's signature using the leaves, stem and roots in treating pus related skin disease was verified to be true using laboratory practical evidence. Correct identification and quality assurance of the starting materials is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy (Kiran *et al*. 2011).

The transverse section of *F. thonningii* stem bark revealed some prominent features like cork cells, prismatic calcium oxalate crystals, sclereids, parenchymatous cells, medullary rays and fibres. These features were similar to those observed in *F. virens* (Sunday *et al.,* 2015). The prismatic calcium oxalate crystals, rectangular cork cells, sclereids and parenchyma cells were common among the two species (*F. thonningii* and *F. virens*). Phellogen, cork layers and fibres have also been reported in stem bark of *F. hispida* (Singh *et al*., 2012). Quantitave analysis on stem bark of *F. thonningii* were found to have oxalate, tannins, cyanogenic glycosides, flavonoids. Similarly, *F. abutilifolia*was reported to contain starch, tannins, mucilages and calcium oxalate crystals (Ukwubile, 2010).

Phytochemicals are naturally occurring; biologically active, non-nutritive chemical compounds found in plants and act as a natural defense system against various pests. Various phytochemicals have been known to possess medicinal properties and hence widely used in Nigerian systems of traditional medicine. In this study, various phytochemicals like saponins, alkaloids, tannins, flavonoids, steroid/triterpenes, glycoside were detected in the stem bark of *F. thonningii* indicating their potential medicinal uses. Previous studies on the phytochemistry of *F. thonningii* have also reported the presence of these phytochemicals (Ndukwe *et al*., 2007) Different phytochemicals have been found to possess a wide range of activities, which may help in protection against chronic diseases. For example; saponins, flavonoids, tannins and alkaloids have been reported with hypoglycemic and anti- inflammatory activities (Hay *et al*., 2012). The presences of phenolic co mpounds which are known to have antibacterial activity were revealed in the plant. This therefore, supports the use of the plant in the traditional treatment of cutaneous infections, venereal diseases, and dysentery (Thakare *et al.,* 2010). Reports show that saponins possess hypocholesterolemic and antidiabetic properties.

The presence of these compounds supports the traditional use of the plant in treatment of antimicrobial infections. Thin layer chromatographic analysis is a simple and cheap method for detection of plant active constituents due to its good selectivity and sensitivity of detection providing convincing results (Singh *et al.,*

2012), hence considered a reliable technique for qualitative phytochemical screening of plant active constituents. Phenolic compounds such as tannins and flavonoids possess diverse biological properties such as anti-inflammatory, antibacterial, antiulcer and anti-oxidant activities (Sen and Batra, 2012). In this study, phenolic compounds, quinones, steroids/triterpenes and flavonoids were observed to be the most abundant bioactive constituents in the *F. thonningii* plant (root, stem and leave).

V. Conclusion

The qualitative phytochemical analysis of *Ficus thonningii* reveals a diverse and rich profile of bioactive compounds across its roots, stem, and leaves, indicating significant therapeutic potential. Each part of the plant contains a unique combination of phytochemicals, suggesting varied medicinal uses. The roots are particularly rich in quinones, tannins, and flavonoids, indicating strong antibacterial, antifungal, and antioxidant properties. The presence of moderate levels of saponins, phenols, cardiac glycosides, and oxalates further enhances their therapeutic value, making the roots a potent part of the plant for medicinal applications, especially in anti-inflammatory and cardiovascular treatments. The stem shows a moderate presence of tannins, steroids, flavonoids, and high levels of oxalates. This suggests that the stem could be useful in treatments requiring anti-inflammatory and cholesterol-lowering effects, but caution is advised due to the high oxalate content, which could contribute to kidney stone formation. The leaves are notably high in phenols and cardiac glycosides, with moderate to high levels of quinones, tannins, and flavonoids. This combination suggests that the leaves have strong antioxidant and heart-protective properties, making them suitable for combating oxidative stress and managing heart conditions.

The absence of reducing sugars in all parts of the plant indicates that *Ficus thonningii* does not contribute to dietary sugars, which is beneficial for individuals managing blood sugar levels. The varied and rich phytochemical composition across different parts of the plant highlights its potential as a versatile and valuable resource for natural remedies and pharmaceutical applications. Further research and extraction of these compounds could lead to the development of new medications and treatments derived from *Ficus thonningii*.

References

[1] Harborne, J.B. (1998). Phytochemical Methods: A Guide To Modern Techniques Of Plant Analysis. Chapman And Hall, London.
[2] Trease, G.E., & Evans, W.C. (2002). Pharmacognosy. Saunders Publishers, London.
[3] Sofowora, A. (1993). Medicinal Plants And Traditional Medicine In Africa. Spectrum Books Ltd., Ibadan, Nigeria.
[4] Kokate, C.K. (1994). Practical Pharmacognosy. Vallabh Prakashan, New Delhi.
[5] Edeoga, H.O., Okwu, D.E., & Mbaebie, B.O. (2005). Phytochemical Constituents Of Some Nigerian Medicinal Plants. African Journal Of Biotechnology, 4(7), 685-688.
[6] Khandelwal, K.R. (2008). Practical Pharmacognosy: Techniques And Experiments. Nirali Prakashan, Pune.
[7] Wagner, H., & Bladt, S. (1996). Plant Drug Analysis: A Thin Layer Chromatography Atlas. Springer-Verlag, Berlin.
[8] Singleton, V.L., Orthofer, R., & Lamuela-Raventos, R.M. (1999). Analysis Of Total Phenols And Other Oxidation Substrates And Antioxidants By Means Of Folin-Ciocalteu Reagent. Methods In Enzymology, 299, 152-178.
[9] Pourmorad, F., Hosseinimehr, S.J., & Shahabimajd, N. (2006). Antioxidant Activity, Phenol And Flavonoid Contents Of Some Selected Iranian Medicinal Plants. African Journal Of Biotechnology, 5(11), 1142-1145.
[10] Chang, C., Yang, M., Wen, H., & Chern, J. (2002). Estimation Of Total Flavonoid Content In Propolis By Two Complementary Colorimetric Methods. Journal Of Food And Drug Analysis, 10, 178-182.
[11] Ibm Corp. (2020). Ibm Spss Statistics For Windows, Version 27.0. Armonk, Ny: Ibm Corp.
[12] Adedapo, A. A., Mogbojuri, O. M., & Emikpe, B. O. (2009). Safety Evaluations Of The Aqueous Extract Of The Leaves Of Moringa Oleifera In Rats. Journal Of Medicinal Plants Research, 3(8), 586-591.
[13] Akah, P. A., Okoli, C. O., & Ndu, O. O. (2009). Experimental Methods In Medicinal Plant Research. Basic Principles And Techniques. 1st Ed. Nigeria: Universities Press.
[14] Dai, J., & Mumper, R. J. (2010). Plant Phenolics: Extraction, Analysis And Their Antioxidant And Anticancer Properties. Molecules, 15(10), 7313-7352.
[15] Harborne, J. B. (1998). Phytochemical Methods A Guide To Modern Techniques Of Plant Analysis. Springer Science & Business Media.
[16] Ajayi, A.O. (2018). Antimicrobial Nature And Use Of Some Medicinal Plants In Nigeria. African Journal Of Biotechnology 7, 595-599.
[17] Okoli, C. O., Akah, P. A., & Okoli, A. S. (2007). Potentials Of Leaves Of Aspilia Africana (Compositae) In Wound Care: An Experimental Evaluation. Bmc Complementary And Alternative Medicine, 7, 24.
[18] Olowokudejo, J. D., Kadiri, A. B., & Travih, V. A. (2008). An Ethnobotanical Survey Of Herbal Markets And Medicinal Plants In Lagos State Of Nigeria. Ethnobotanical Leaflets, 2008(1), 116.
[19] Adekanbi, J., Olatokun, M.W. And Ajiferuke, I. (2014), Preserving Traditional Medical Knowledge Through Modes Of Transmission: A Post-Positivist Enquiry, South African Journal Of Information Management, 16(1): 1-5
[20] Sani, H. D. And Aliyu, B.S. (2011), A Survey Of Major Ethno Medicinal Plants Of Kano North, Nigeria, Their Knowledge And Uses By Traditional Healers, Bayero Journal Of Pure And Applied Sciences, 4(2): 28 – 34.
[21] Aref, H. L., Salah, K. B. H., Chaumont, J. P., Fekih, A. W., Aouni M. And Sa'id K. (2010). In Vitro Antimicrobial Activity Of Four Ficuscarica Latex Fractions Against Resistant Humanpathogens (Antimicrobial Activity Of Ficuscarica Latex), Pakistan Journal Of Pharmaceutical Science, 23(1): 53-58.
[22] Krivorotova T., & Sereikaite J. (2014). Determination Of Fructan Exohydrolase Activity In The Crude Extracts Of Plants. Electronic Journal Of Biotechnology; 17(6):329–333. Doi: 10.1016/J.Ejbt.2014.09.005.
[23] Ndukwe, I.G., Bello, A.I., Habila, J.D. And John, C. (2007). Phytochemical And Antimicrobial Screening Of The Crude Petroleum Spirit And Methanol Extracts Of The Stem Bark, Leaves And Roots Of Ficusthonningii (Blume). African Journal Of Biotechnology 16: 2645-2649.

[24] Ukwubile, C.A. (2010). Pharmacognostic, Antibacterial And Toxicity Investigations Of Ficusabutlilifoliamiq. (Moraceae): International Journal Of Biological Sciences, 2(8): 98-111.
[25] Thakare, V.N., Suralkar, A.A., Deshpande, A.D. And Naik, S.R. (2010). Stem Bark Extraction Of Ficusbengalensis Linn For Anti-Inflammatory And Analgesic Activity In Animal Models. Indian Journal Of Experimental Biology, 48:39 – 45.
[26] Sunday, A., Mary, K.O. And Joshua, K. (2015). Ethnomedicinal Survey Of Medicinal Plants Used For The Treatment Of Diabetes Mellitus In Ekiti South Senatorial District, Nigeria, European Journal Of Botany, Plant Science And Phytology, 2: 1 – 5.
[27] Singh, Y., Kumar, S., Kumawat, B.K, Upadhayay, A. And Verma, H.K. (2012). Pharmacognostic Investigations On The Stem Bark Of Ficushispida, World Journal Of Pharmacy And Pharmaceutical Sciences, 1(1) : 336-346.
[28] Kiran, Y.K., Mira, A.K., Ghulam, M.S. And Imran, H. (2011). Ethnomedicinal Use Of Genus Ficus L. In Pakistan. Journal Of Science And Technology 1:2, Issue 2.