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PHYTOCHEMICAL SCREENING AND ANTIMICROBIAL ACTIVITY OF *STERCULIA SETIGERA* LEAVES

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ABSTRACT

The plant Sterculia setigera (family: Sterculiaceae) is known by different indigenous cultural communities in Nigeria. It is a savannah tree, widespread in savannah areas of tropical Africa. The aim of this research is to carry out the phytochemical screening and antimicrobial activity of the leaf of sterculia setigera. The leaves of stercullia setigera was extracted with 70% methanol. The *Phytochemical screening of the extract showed the presence of alkaloids, cardiac glycosides, saponins, phtobatannins, steroids, starch, resins. The Agar well diffusion method was used for the antimicrobial activity. The crude extract showed visible inhibitory effect when compared to the positive control. The crude extract of the leaves of stercullia setigera has zone of inhibitions of; 26 mm, 18 mm, 12 mm, 10 mm, for Staphylococcus aureus at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentrations, 20 mm, 16 mm, 12 mm, 08mm, for Pseudomonas aeruginosa at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentrations, 22 mm, 18.5 mm, 14.2 mm, 7.5 mm, for Escherichia coli at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentrations and 23 mm, 20 mm, 16 mm, 10 mm, for Candida albican at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentrations respectively. The mean zone of inhibition showed that stercullia setigera leaves exhibited activities against the test organisms. It was in this study that E. coli and S. aureus was more susceptible to the plant extracts compared to P. aeruginosa. The present study therefore offers a scientific basis for the traditional use of plant Sterculia setigera for the treatment of Mycobacterium tuberculosis, malaria, jaundice, measles, syphilis and leprosy. The evaluation of phytochemical and antibacterial screening of Sterculia setigera concluded that methanolic extract contain saponins, phtobatannins, resins, cardiac glycosides, alkaloids, steroids, starch. These constituents could be responsible for the inhibition of the test organism. The present study therefore offers a scientific justification for the traditional use of plant Sterculia setigera for the treatment of Mycobacterium tuberculosis, malaria, jaundice, measles, syphilis and leprosy. Further studies are necessary in order to clarify the properties of Sterculia setigera leaves to obtain information enough to provide validation for its medicinal use.*

MAIN PAPER STARTS HERE…

INTRODUCTION

The plant, *Sterculia setigera* (family: *Sterculiaceae*) is known by different indigenous cultural communities in Nigeria: Hausa-"Kukuki", Fulani-"bo'boli", Yoruba-"Ose-awere", Nupe- ''Kokongiga'', Idoma- ''Ompla, Tiv- ''Kume-ndul'' [1].

It is a savannah tree, widespread in savannah areas of tropical Africa. The seeds are with yellow aril and the tree is found in open savannah wood-lands, often characterized by stony hills [2].

This plant is used in traditional medicine by various indigenous communities. For instance, the Yourba people of Nigeria use a black soap prepared from black powder obtained from burnt mixture of the fruits and seeds in dermatosis. In Sudan, dried bark water extract is used for jaundice and dried stem bark for treating wounds. Stem bark decoction is used to treat diarrhea [2] by the Igedes, its bark as a mixture is macerated and used against dysentery by some tribes in central Nigeria [3].

The study on Anti-TB Activity of Stercullia setigera del., leaves (Sterculliaceae) Folkloric claims on antibacterial activity of *S.*

setigera were investigated *in-vitro* on a micro-scale using the Alamar Blue Assay. Three of four successive solvent extractions of the plant leaves extracts inhibited the growth of a virulent strain of *Mycobacterium tuberculosis*, H37Rv (ATCC27294) in the concentrations tested (1-128 µg/ml). The minimum inhibitory concentration (MIC) determined for the hexane, dichloromethane and ethyl acetate extracts were 84 µg/ml, 62 µg/ml and 128 µg/ml respectively [4].

Sample collection and preparation

Fresh samples of the plant material (leaves of *Sterculia setigera*) were collected at Sabon kaura Road behind Abubakar Tafawa Balewa University Bauchi, Nigeria. The plant was identified at the botany laboratory in the Department of Biological Sciences, ATBU Bauchi. The freshly collected leaves of *Sterculia setigera* were spread to air dry at room temperature for two weeks. After drying, the leaves were pounded with the laboratory mortar and pestle and were stored in a clean container for further analysis.

Extraction of the leaf extracts

The sample (30g) was weighed and was subjected to maceration extraction method with 30% water and 70% methanol for 48 hours. The extracts were filtered and the filtrates were evaporated for the qualitative analysis.

Antibacterial Analysis

The test organisms used in this study include Escherichia coli, staphylococcus aureus, candida albicans and pseudomonas aeruginosa. The plates were incubated at 37 °C for 24 hours. After incubation the plates were checked for pure confluent growth and the diameter of the zones of inhibition of growth were measured to the nearest millimeter ruler [5].

The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) was done according to the method described by [6].

Phytochemical Screening of the Extracts:

Test for Saponins

Frothing Foam Test: The method described by [7] 1 ml solution extract was diluted with distilled water to 20 ml and shaken. If foam produced persists for ten to fifteen minutes it indicates the presence of saponins.

Test for starch (Fehling's test)

Iodine crystals (0.1 g) and 0.1 g of potassium iodide will be weighed using analytical weighing balance and 5 ml of distilled water will be measured with the aid of 10 ml measuring cylinder, the iodide crystals and potassium iodide will be dissolved into distilled water and 2 ml of the crude extract will be added. The formation of blue-black color, indicates the presence of starch [8].

Test for steroids

The extract was dissolved in 2ml of chloroform and 1 ml of acetic anhydride solution, followed by the two drops of concentrated sulfuric acid was added along the side of the test tube and left standing. The formation of pink color, indicates the presence of steroid [7].

Test for alkaloids

The presence of alkaloids in the crude extract was detected using Mayer's and Wagner's test as descrided by [9].

Hydrochloric acid 5 ml of 2 M was added to 0.5 g of the crude extract and warmed in boiling water bath, the solution will be filtered and will be distinctly separated into two (2) test tubes, and used for the below test:

Mayer's Reagent:

The test solution was mixed with little amount of Mayer's reagent and 1 ml of the filtrate. Formation of yellow precipitate indicates the presence of alkaloids.

Wagner's Reagent:

The test solution was mixed with little amount of Wagner's reagent and 1 ml of the filtrate. Formation of reddish-brown precipitate indicates the presence of alkaloids.

Test for cardiac glycosides

Keller-Killian test [10] was employed for the detection of Cardiac Glycoside which to the solution of the extract in 2 ml glacial acetic acid, few drops of ferric chloride and 1 ml concentrated sulfuric acid was gently pour through the wall of the test tube and observed for a brown ring colouration at the junction of two layers and a bluish green color at the upper layer. This is an indication of positive result.

Test for phtobatannins

Crude extract 0.5 ml was transferred into test tube, the boiled in 1% Hydrochloric acid, using water bath. The formation of red precipitate indicates the presence of phtobatannins [11].

Test for resin

To the solution of the extract, shake thoroughly. The formation of turbidity indicates the presence of resins [8].

RESULTS AND DISCUSSION

The leaves of Sterculia setigeria was extracted with 70% methanol using the merceration extraction method for 48 hours. The crude extract was obtained by evaporating the solvent to dryness. Table 1 below shows the physical properties and % yield of the crude extract.

Table 1: Results for the Crude Extraction of Stercullia setigera leaves

Extract weight	% yield	solvent used	plant part	color
Crude extract 1. 1 g	3.66 %	70% methanol	leaves	green

Weight of sample: 30 g
Residue: 23.0 g
Key: (g) = gram
% = percentage

Table 2: Phytochemical Constituents of Sterculia setigera Leaves

S/N	Secondary Metabolites	Test/Reagent	Result
1.	Alkaloid	Mayer's	+
		Wagner's	+
2.	Saponins	Distilled water	+
3.	Steroid	Chloroform	+
4.	Cardiac Glycoside	Glacial acetic acid	+
5.	Resin	Distilled water	+
6.	Starch	Felhing's solution	+
7.	phtobatannins	Hydrochloric acid	+

Key: Present = (+), Precipitate = ppt

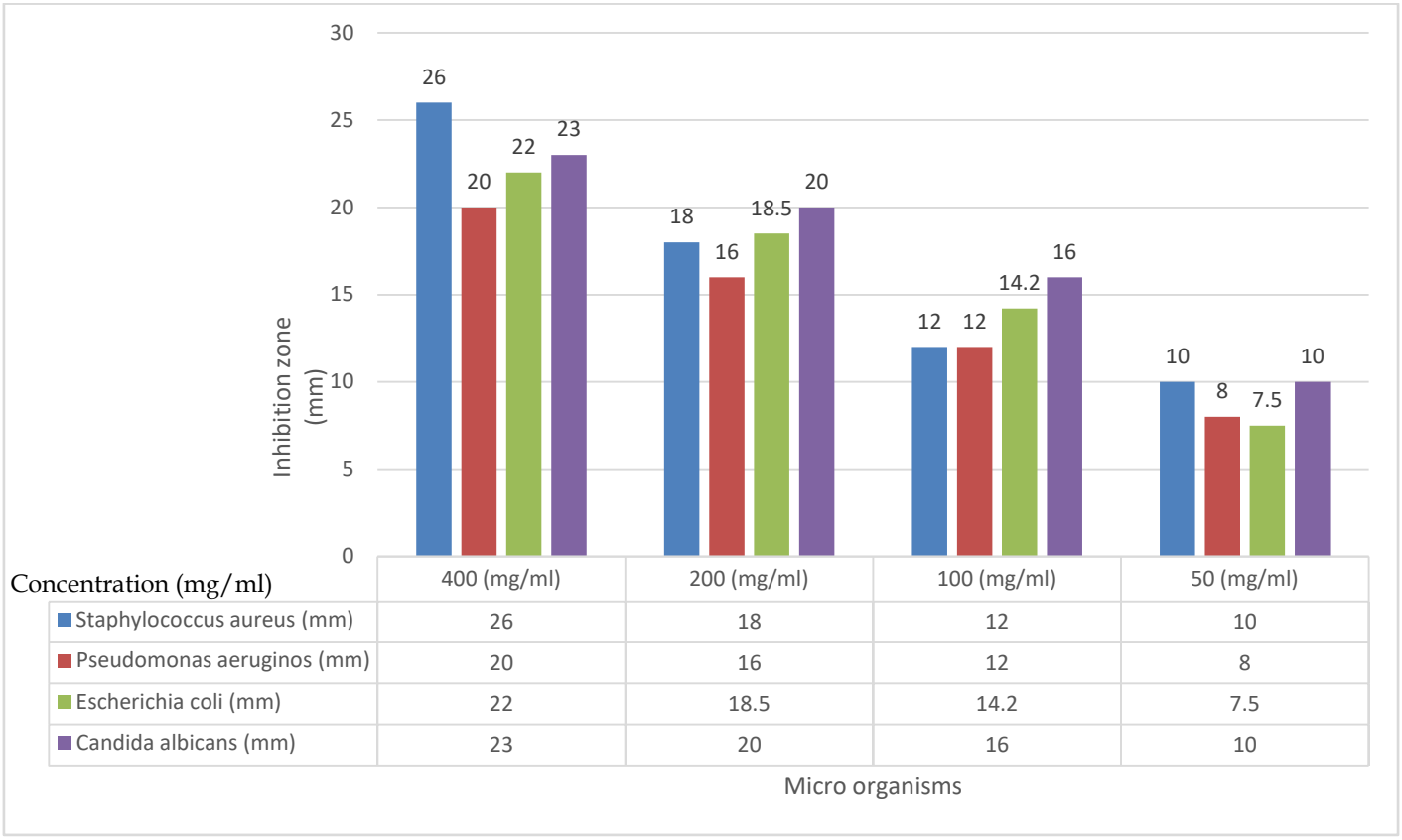

Figure 1: Chat Representing Mean Zone of Inhibitions of Crude Extract Stercullia setigera Leaves Against Different Organisms.

Discussion

Extraction and phytochemical screening of bioactive agents from medicinal plant permits demonstration of their physiological ac-

tivities. Table 1 shows that the plant extract to be green in color and 1.1 g crude extract was recovered from the 30 g of the sample used for the extraction.

The result of the phytochemical analysis of sterculia setigera leaf showed that, saponins, phtobatannins, resin, starch, steroids, cardiac glycoside, alkaloids are all present in the leaf of the plants (Table 2). The observed phytochemicals in the leaves extracts corresponds to the report of [12]. [5] reported the presents of phtobatannins and alkaloids in the methanol extracts of the stem bark of sterculia setigera. The medicinal activity of the plant maybe related to its chemical constituents for example phytobatannins are plant secondary metabolites well known for their antimicrobial properties and can aid in wound healing and burns [13]. Similarly, [14] revealed the presence of some secondary metabolites but alkaloids and flavonoids were not detected in the report. Also, about 80% of the western pharmaceuticals have their origin in plants [15]. Flavonoids have important dietary significant because being phenolic compound they are strongly antioxidant and this probably explains why Africans eat the young leaf of *Sterculia setigera* as vegetable. Since, they are known to be synthesized by plant and responsible for microbial inhibition in curing ailment and also therapeutic agent for relieving pain.

Figure 2, shows the antibacterial activity of crude extract of leaves of Sterculia setigera with zone of inhibitions of 26 mm, 18 mm, 12 mm, 10 mm on *Staphylococcus aureus* at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentration and 20 mm, 16 mm, 12 mm, 08 mm on *Pseudomonas aeruginosa* at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentration while 22 mm, 18.5 mm, 14.2 mm, 7.5 mm on *Escherichia coli* at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentration and 23 mm, 20 mm, 16 mm, 10 mm on *Candida albicans* at 400 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml concentration. The extract of the plant has shown wide range of activity against various microorganisms. The standard antibiotic Chloramphenicol (250 mg/ml) was used as positive control for the bacteria and Ketoconazole (200 mg/ml) was used for the fungus, while Dimethyl sulfoxide (DMSO) was used as a negative control of both bacteria and fungus. Based on the results obtained, Sterculia setigera leaves have demonstrated varying degree of antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa, Saphylococcus aerues* and Candida albican (fungi). Therefore, this signifies that some bacteria that have not been tested with sterculia setigera leaves extract in this research may also be susceptible to the antibacterial effect of sterculia setigera leaves.

The minimum inhibitory concentration (MIC) to Minimum bactericidal and fungicidal concentration (MBC and MFC) results of stercullia setigera leaf extract is 100 mg/ml to 400 mg/ml (for Escherichia coli), 200 mg/ml to 400 mg/ml (for Staphylococcus aureus and Pseudomonas aeruginosa) and 400 mg/ml to above (for Candida albican) respectively.

These were higher than that reported by [16] about the ethanolic extract of Stercullia setigera leaf. But was Similar to [17] report on the antifungal effect of the bioactive fractions of the leaf of *S. setigera*.

Conclusion

The crude extract of the leaves of stercullia setigera were screened for phytochemical and anti-microbial activity. The result of phytochemical revealed that various secondary metabolites present in the leaves of Stercullia setigera were saponins, phtobatannins, resins, cardiac glycosides, alkaloids, steroids and starch. Stercullia setigera leaves has demonstrated antibacterial properties which could be used for the development of alternative means of therapeutic control of clinical pathogens.

Therefore, there is need for further research to be carried out to determine the toxicity/safety level of the plant extracts, administration as well as to isolate and identify the active compound responsible for the activity.

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