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Phytochemical Evaluation and Antimicrobial Studies of the Root Bark Extracts of *Ficus sycomorus* Linn

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Abstract The root bark of *Ficus sycomorus* Linn collected from Northbank, Makurdi, Nigeria, was extracted, sequentially, using hexane, ethyl acetate and methanol. Extracts were subjected to phytochemical and antimicrobial tests. Antimicrobial screening was carried out and the ethyl acetate extracts of the root bark was found to be the most active. Phytochemical screening of the hexane root bark extract was devoid of all secondary metabolites tested. Studies on the methanol and ethyl acetate extracts of the root bark of *Ficus sycomorus* revealed the presence of the following metabolites (carbohydrates, anthraquinones, saponins, steroids and triterpenes, tannins, alkaloids, cardiac glycosides and flavonoids). Antimicrobial screening of the root bark extracts revealed the extracts to be inhibitory and microbicidal against *Methicillin-Resistant Staphylococcus aureus* (MRSA), *Staphylococcus aureus*, *Streptococcus pyogenes*, *Micrococcus pneumoniae*, *Escherichia coli*, *Campylobacter jejuni*, *Helicobacter pylori*, *Pseudomonas aeruginosa*, *Enterobacter spp*, *Nitrosomonas sp*., with the Minimum Inhibitory Concentration (MIC) values for the extracts ranging from 0.25 – 0.5 mg/mL, while the Minimum Bactericidal Concentration (MBC) values for the extracts ranged from 0.5-2 mg/mL. The antimicrobial nature of the plant extracts and medicinal character of compounds isolated from this plant lends credence to folkloric medicinal applications of *Ficus sycomorus*.

Keywords *Ficus sycomorus*, Phytochemical screening, Antibacterial Studies, Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC)

Introduction

Ficus sycomorus, called the sycamore fig or the fig – mulberry (because the leaves resemble those of mulberry), sycamore or sycomore, is a fig species that has been cultivated since ancient times [1]. The term sycamore, spelled with an 'A' has been used for a variety of plants and is widely used in England to refer to the Great Maple Acer pseudoplatanus. For clarity, this species of fig is usually exclusively referred to as "sycomore" with an 'O' rather than an 'A' as the second vowel) [2].

Plants have been used by man as a source of food, shelter, clothing, medicine and cosmetics [3]. In addition, all plants produce and accumulate many chemical substances from their first day of life as part of their normal metabolic activities [4].

The biologically active constituents of medicinal, commercial and poisonous plants have been studied throughout the development of organic chemistry. Many of these compounds are secondary metabolites. It has been estimated

that over 40% of medicines [5] have their origins in these natural products. Phytochemical surveys can reveal natural products that are "markers" for botanical and evolutionary relationship [6]. Herbal medicine plays a very important role in the healthcare system of the developing world [7]. According to World Health Organization (WHO), 80% of the population of developing countries depend on traditional or herbal medicine for their primary healthcare [8].

From history, medicinal plants are the principal sources of drugs used today for the cure and prevention of many diseases [9]. Herbal medicines are mostly compounded from plants. The clinical success of quinine and quinidine isolated from the Cinchona tree bark and artemisinin from Artemisia maritime (wormwood) in the treatment of malaria have rekindled interest in medicinal plants as potential sources of novel drugs [10-11]. Hence, plants are screened for bioactive agents and by isolating such agents, enhance the confirmation of physiological activity of a medicinal plant. This research work was aimed at carrying out an evaluation of the plant (*Ficus sycomorus*) and its chemical constituents in order to isolate the phytochemicals that are present in it and to ascertain the antimicrobial activities of both the crude extracts and pure isolated compounds.

Materials and Methods

Sample Collection

Fresh root bark of *Ficus sycomorus* Linn were collected from North Bank area of Makurdi Town, Benue State, Nigeria, in the month of June, 2015. The sample was identified by Mr. Namadi Sunusi, a Botanist, in the Department of Biological Sciences, Ahmadu Bello University, Zaria and a voucher specimen of *Ficus sycomorus*, voucher Number: 1466, was deposited in the Herbarium Section, Ahmadu Bello University, Zaria.

Sample preparation

The root bark (RB) of *Ficus sycomorus* was air-dried for three weeks in a well-ventilated room and powdered into fine powder using a wooden mortar and pestle. The sample was stored in clean and dry polythene bags prior to extraction. The essence of pounding into fine powder was to reduce the particle size and increase the surface area for effective extraction of the constituents.

Extraction

The samples of *Ficus sycomorus* (root bark) was weighed (2 Kg) and subjected to solvent extraction (maceration). The solvents used to carry out the extraction in order of increasing polarity include; n-Hexane, Ethyl acetate, methanol and water. The extracts were concentrated by distillation. The crude samples were exposed for some time to allow evaporation of the solvent to dryness. The crude extracts were then labelled, closed and kept in a refrigerator for phytochemical screenings.

Chemicals and reagents

The following chemicals and solvents were used for this work: hexane, ethyl acetate, chloroform, methanol, hydrochloric acid, sulphuric acid, magnesium turnings, ferric chloride, lead sub-acetate, Dragendorff's reagent, Mayer's reagent, Wagner's reagent, Iodine and potassium mercuric iodide. All chemicals and reagents used were of analytical grade. All solvents were of analytical grade and re-distilled before use.

Phytochemical Screening

Phytochemical tests were carried out on the plant extracts to identify secondary metabolites present in them such as carbohydrates, alkaloids, flavonoids, saponins, tannins, anthraquinones, cardiac glycosides and steroids/terpenes using standard procedures [12]–[14].

Test for carbohydrates

Fehling's solution Test for free Reducing Sugars: About 5 mL of a mixture (1:1) of Fehling's solutions A and B was added to the extract which was dissolved in water and the mixture was boiled on a water bath for 5 minutes. A brick-red precipitate was observed which indicated the presence of reducing sugars.

Test for anthraquinone glycosides

Benzene (10 mL) was added to the extract (0.2 g) and was shaken for 5 minutes. Ammonia (5 mL, 10%) solution was added and shaken. The presence of a pink colour was observed in the ammoniacal (lower layer) phase which indicated the presence of free anthraquinones.

For anthraquinone glycosides, the extract (0.2 g) was boiled with dilute sulphuric acid (10 mL) and filtered while hot. Filtrate was shaken with benzene (5 mL), the benzene layer separated and to it, ammonia solution (3 mL, 10 %) was added and the mixture was shaken. The layers were then allowed to separate. A pink colour was observed in the lower layer showed the presence of anthraquinone glycosides [12].

Test for saponin glycosides

Frothing test: The extract (0.2 g) was shaken with water (5 mL) in a test tube for 30 seconds. A persistent froth for 15 minutes indicated the presence of saponins [12].

Test for steroids and terpenoids

Liebermann –Burchard's test: The extract (0.5 g) was dissolved in chloroform (2 mL) and filtered into a clean, dry test tube. Acetic anhydride (2 mL) was added to the filtrate and shaken. Few drops of concentrated sulphuric acid were added carefully down the side of the tube to form a lower layer. A brownish-red or violet ring at the zone of contact of the two liquids and the upper layer turning green denoted the presence of sterols and terpenes.

Test for tannins

Lead subacetate test: To the aqueous extract (1 mL), three drops of lead subacetate solution were added. A coloured precipitate was observed which indicated the presence of tannins [13].

Test for alkaloids

General test: An extract (0.2 g) was stirred with 1% hydrochloric acid (5 mL) on a water bath. To the filtrate (1 mL) was added, 2-3 drops of the following reagents were added:

Wagner's reagent (solution of iodine in potassium iodide), Mayer's reagent (potassium mercuric iodide solution) and Dragendorff's reagent (potassium bismuth iodide solution).

The presence of a precipitate with above reagents indicated presence of alkaloids [14], that is: Wagner's reagent gave a light brown precipitate; Mayer's reagent gave a creamy white precipitate, while Dragendorff's reagent gave an orange yellow precipitate.

Test for cardiac glycosides

The extract (1.0 g) was dissolved in water. Lead subacetate solution (1 mL) was added and filtered. Filtrate was divided into two for the following tests:-

Keller-Killiani test (for Deoxysugars): To the first portion of filtrate was added chloroform, the chloroform layer (lower) was separated and evaporated to dryness on water bath. The residue was dissolved in 3.5 % ferric chloride (3mL) solution in glacial acetic acid. The mixture was allowed to stand for a minute before it was transferred to a test tube. Concentrated sulphuric acid (1.5 mL) was added down the side of the test tube form a lower layer on standing, the presence of a brown colour at the junction of the two liquids and a pale green colour in the upper layer indicated the presence of cardiac glycosides [17].

Test for flavonoids

Ferric chloride test: The extract (0.1 g) was boiled with water and filtered. To the filtrate (2 mL), 2 drops of 10% ferric chloride solution were added. A green colour indicated the presence of phenolic nucleus.

Antimicrobial Screening

Test organisms

Bacteria that were used for antimicrobial assay are: Methicillin Resistant *Staphylococcus Aureus* (MRSA), *Staphylococcus aureus, Streptococcus pyogenes,* Micrococcus sp, *Staphylococcus epidermidis, Corynebacterium ulcerans, Propionibacterium acnes, Streptococcus pneumoniae, Escherichia coli, Campylobacter jejuni, Helicobacter pylori, Pseudomonas aeruginosa, Enterobactersp, Nitrosomonas sp.* These were obtained from the Department of Microbiology, Ahmadu Bello University Teaching Hospital, Zaria. All the microorganisms were checked for purity and maintained in slants of agar.

Cultivation and standardization of test organisms

A loopfull of test organisms was taken from the agar slant and subcultured into test tubes containing sterile nutrient agar for bacteria. The test tubes were then incubated for 48 hours at 37°C. The broth culture was standardized using sterile normal saline to obtain a density of 10^6cfu/mL for bacteria.

Antimicrobial profile (Sensitivity test)

The extract (0.02 g) was weighed and dissolved in of DMSO (10 mL) to obtain a concentration of 2 mg/mL. This was the initial concentration of the extract used in checking the activities of the extracts from the plate.

Antimicrobial screening was carried out using agar diffusion method as described by [16]. Mueller Hinton agar was the medium that was used for the growth of the bacteria. All the media were prepared according to the manufacturer's instructions, sterilized at 121°C for 15 minutes and poured into sterile Petri dishes. The plates were allowed to cool and solidify. Diffusion method was used for the screening of the extracts. Sterilized Mueller Hinton agar was seeded with 0.1 mL of standard inoculums of the test bacteria. The inoculums were then evenly spread over the surface of the media using a sterile swab. A sterile standard cork borer of 6 mm in diameters was used to cut a well at the centre of each inoculated medium. About 0.1 mL of solution of extract of 2 mg/mL of concentration was then introduced into the well in the medium. Incubation for bacteria was at 37°C for 24 hours. Each plate was then observed for zone of inhibition of groth, which was measured with a transparent ruler and the result were recorded in millimetres (mm).

Determination of minimum inhibitory concentration (MIC)

Minimum inhibitory concentration (MIC) was carried out on extracts that showed growth inhibitory activity on the test organisms. This was done using broth dilution method [17]. Mueller Hinton broth was prepared according to the manufacturer's instructions. The broth (10 mL) was dispensed into test tubes, separated and were sterilized at 121°C for 15 minutes and allowed to cool. Mc-Farland turbidity standard scale number 0.5 was prepared to give a turbid solution. Normal saline was prepared and used to make a turbid suspension of the microbes. About 10 mL was dispensed into test tubes and the test microbes inoculated and incubated for 6hr at 37°C. Dilution of microorganisms in normal saline was continuously done until the turbidity (1.5×10^6cfu/mL) matched that of the Mc-Farland scale by visual comparison. Two fold serial dilution of extract in sterile broth was done to obtain concentrations of 2 mg/mL, 1 mg/mL, 0.5 mg/mL, 0.25 mg/mL and 0.125 mg/mL. The initial concentration was obtained by dissolving 0.02 g of the extract in 10mL of the sterile broth. Having obtained different concentrations of extracts in broth, 0.1 mL of standard inoculums of the microbes was inoculated into the different concentrations. Incubation for bacteria was carried out at 37°C for 24hr. The test tube was then observed for turbidity. The lowest concentration of extract in the broth which showed no turbidity was recorded as the minimum inhibitory concentration (MIC).

Determination of minimum bactericidal concentration (MBC)

The MBC was carried out to determine whether the test microbes were killed or only their growths were inhibited. Mueller Hinton agar was prepared according to the manufacturer's instruction, sterilized at 121°C for 15 minutes and poured into sterile petri-dishes. The plates were allowed to cool and solidify. The contents of the MIC in serial dilution were then sub-cultured on to the prepared plates and plates were then incubated at 37°C for 24 hours for

bacteria, after which the plates were observed for colony growths. The MBC was determined from the plates with the lowest concentration of extracts without colony growth. Results were recorded after 24 hours [18-19].

Results

Table 1: Phytochemical screening of the root bark extract of *Ficus sycomorus* Linn

Constituents	Hexane	Ethyl acetate	Methanol	Ethyl acetate v/v
Carbohydrates				
Fehling's test	-	-	+	+
Anthraquinones				
Free Anthraquinones	-	-	+	-
Saponins				
Frothing Test	-	-	+	-
Tannins				
Lead Acetate Test	-	-	+	+
Ferric Chloride Test	-	-	+	-
Alkaloids				
Mayer's Test	-	-		-
Wagner's Test	-	-	+	-
Dragendorff's test	-	-	-	-
Cardiac Glycosides				
Keller-Killiani test	-	+	+	+
Flavonoids				
Sodium hydroxide test	-	-	-	-
$FeCl_3$ test	-	-	-	-
Shinoda's test	-	-	+	-

Key: - = negative; + = positive

Table 2: Antimicrobial activities of A, B and C extracts of *Ficus sycomorus* Linn and control against the test microorganisms

Test organism	A	B	C	Sparfloxacin	Ciprofloxacin
Methicillin Resitant Staphylococcus aureus	S	R	R	S	R
Staphylococcus aureus	S	R	S	S	S
Streptococcus pyogenes	S	S	R	S	R
Micrococcus sp	S	S	S	S	S
Staphylococcus epidermidis	R	S	S	S	S
Crynebacteri umulcerans	S	S	R	S	R
Propionibacterium acnes	R	R	S	R	R
Streptococcus pneumonia	R	S	S	S	S
Escherichia coli	R	R	R	S	S
Campylobacter jejuni	S	R	S	R	R
Helicobacter pylori	R	R	R	S	S
Pseudomonas aeruginosa	R	S	R	R	S
Enterobactersp	S	S	R	S	S
Nitrosomonassp	S	S	S	R	R

KEY: A = Hexane Extract (Root Bark) S = Sensitive R = Resistant
B = Ethyl acetate (Root Bark)
C = Methanol Extract (Root Bark)

Table 3: Zone of inhibition (mm) of A, B and C extracts of *Ficus sycomorus* Linn and control against the test microorganisms

Test organism	A	B	C	Sparfloxacin	Ciprofloxacin
Methicillin Resitant Staphylococcus aureus	26	0	0	35	0
Staphylococcus aureus	24	0	24	37	35
Streptococcus pyogenes	22	29	0	32	0
Micrococcus sp	25	26	29	37	35
Staphylococcus epidermidis	0	28	29	35	32
Corynebacteri umulcerans	24	29	0	32	0
Propionibacterium acnes	0	0	25	0	0
Streptococcus pneumonia	0	26	28	37	30
Escherichia coli	0	0	0	35	38
Campylobacter jejuni	24	0	23	0	0
Helicobacter pylori	0	0	0	30	32
Pseudomonas aeruginosa	0	27	0	0	35
Enterobactersp	26	28	0	31	30
Nitrosomonassp	23	26	26	0	0

Key: A = Hexane Extract (Root Bark) Control = Sparfloxacin and Ciprofloxacin
B = Ethyl acetate (Root Bark)
C = Methanol Extract (Root Bark)

Table 4: Minimum inhibitory concentration of the extracts (A) of *Ficus sycomorus* Linn against the test microorganisms

Test Organism	A				
	2 mg/mL	1 mg/mL	0.5 mg/mL	0.25 mg/mL	0.12 mg/mL
Methicillin Resistant *Staphylococcus aureus*	-	-	0*	+	++
Staphylococcus aureus	-	-	0*	+	++
Streptococcus pyogenes	-	-	0*	+	++
Micrococcus sp	-	-	0*	+	++
Staphylococcus epidermidis	-	-	-	-	-
Corynebacteri umulcerans	-	-	0*	+	++
Propionibacterium acnes	-	-	-	-	-
Streptococcus pneumonia	-	-	-	-	-
Escherichia coli	-	-	-	-	-
Campylobacter jejuni	-	-	0*	+	++
Helicobacter pylori	-	-	-	-	-
Pseudomonas aeruginosa	-	-	-	-	-
Enterobactersp	-	-	0*	+	++
Nitrosomonassp	-	-	0*	+	++

Key: A = Hexane Extract
- No turbidity (no growth)
0* MICs
+ Turbid (light growth) ++ Moderate Turbidity

Table 5: Minimum inhibitory concentration of the extracts (B and C) of *Ficus sycomorus* Linn against the test microorganisms

Test Organism	**B**					**C**				
	2 mg/mL	**1 mg/mL**	**0.5 mg/mL**	**0.25 mg/mL**	**0.12 mg/mL**	**2 mg/Ml**	**1 mg/mL**	**0.5 mg/Ml**	**0.25 mg/mL**	**0.12 mg/Ml**
Methicillin Resistant *Staphylococcus aureus* (MRSA)	-	-	-	-	-	-	-	-	-	-
Staphylococcus aureus	-	-	-	-	-	-	-	0*	+	++
Streptococcus pyogenes	-	-	-	0*	+					
Micrococcus sp	-	-	0*	+	++	-	-	-	0*	+
Staphylococcus epidermidis	-	-	-	0*	+	-	-	-	0*	+
Corynebacteri umulcerans	-	-	-	0*	+	-	-	-	-	-
Propionibacterium acnes	-	-	-	-	-	-	-	0*	+	++
Streptococcus pneumonia	-	-	0*	+	++	-	-	-	0*	+
Escherichia coli										
Campylobacter jejuni	-	-	-	-	-	-	-	0*	+	++
Helicobacter pylori	-	-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	-	-	-	0*	+	-	-	-	-	-
Enterobactersp	-	-	-	0*	+					
Nitrosomonassp	-	-	0*	+	++	-	-	0*	+	++

Key: B = Ethyl Acetate Extract; C = Methanol Extract; - = No turbidity (no growth); 0* = MIC
+ = Turbid (light growth); ++ = moderate turbidity

Table 6: Minimum Bactericidal Concentration of the extracts (A) of *Ficus sycomorus* Linn against the microorganisms

Test Organism	**A**				
	2 mg/mL	**1 mg/mL**	**0.5 mg/mL**	**0.25 mg/mL**	**0.12 mg/mL**
Methicillin Resistant *Staphylococcus aureus* (MRSA)	-	0*	+	++	+++
Staphylococcus aureus	-	0*	+	++	+++
Streptococcus pyogenes	0*	+	++	+++	++++
Micrococcus sp	-	0*	+	++	+++
Staphylococcus epidermidis	-	-	-	-	-
Corynebacteriumulcerans	-	0*	+	++	+++
Propionibacterium acnes	-	-	-	-	-
Streptococcus pneumonia	-	-	-	-	-
Escherichia coli	-	-	-	-	-
Campylobacter jejuni	-	0*	+	++	`+++
Helicobacter pylori	-	-	-	-	-
Pseudomonas aeruginosa	-	-	-	-	-
Enterobactersp	-	0*	+	++	+++
Nitrosomonassp	-	0*	+	++	+++

Key: A = Hexane Extract; - No colony growth; 0* Minimum Bactericidal Concentration (MBC)

\+ Scanty colonies growth; ++ Moderate colonies growth; +++ Heavy colonies growth ++++ = very heavy colonies growth

Table 7: Minimum bactericidal concentration of the extract (B and C) of *Ficus sycomorus* Linn against the test microbes

Test Organism	**B**					**C**				
	2 mg/mL	**1 mg/mL**	**0.5 mg/mL**	**0.25 mg/Ml**	**0.12 mg/mL**	**2 mg/mL**	**1 mg/mL**	**0.5 mg/mL**	**0.25 mg/mL**	**0.12 mg/Ml**
Methicillin Resistant *Staphylococcus aureus*(MRSA)	-	-	-	-	-	-	-	-	-	-
Staphylococcus aureus	-	-	-	-	-	-	0*	+	++	+++
Streptococcus pyogenes	-	-	0*	+	++	-	-	-	-	-
Micrococcus sp	-	0*	+	++	+++	-	-	0*	+	++
Staphylococcus epidermidis	-	-	0*	+	++	-	-	0*	+	++
Corynebacteriumulcerans	-	-	0*	+	++	-	-	-	-	-
Propionibacteriumaenes	-	-	-	-	-	-	0*	+	++	+++
Streptococcus pneumonia	-	0*	+	++	+++	-	-	0*	+	++
Escherichia coli	-	-	-	-	-	-	-	-	-	-
Campylobacter jejuni	-	-	-	-	-	-	0*	+	++	+++
Helicobacter pylori	-	-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	-	-	0*	+	++	-	-	-	-	-
Enterobactersp	-	-	0*	+	++	-	-	-	-	-
Nitrosomonassp	-	0*	+	++	+++	-	-	-	-	-

Key: B = Ethyl acetate Extract; C = Methanol Extract; - = No colony growth; +++ = Heavy colonies growth
0* = Minimum Bactericidal Concentration (MBC); + = Scanty Colonies Growth;
++ = moderate colonies growth

Discussion

Phytochemical screening of the root bark extract of*Ficus sycomorus* revealed the presence of carbohydrates, anthraquinones, saponins, steroids, triterpenes, tannins, alkaloids, cardiac glycosides and flavonoids as seen on Table 1. Almost all the secondary metabolites were obtained from the methanol and ethyl acetate fractions. This indicates that most of these secondary metabolites were polar compounds hence soluble in the polar solvents that facilitated their extraction. Hexane, being a non-polar solvent revealed the presence of steroids and triterpenes. Most of these secondary metabolites have previously been reported as been biologically or pharmacologically active and are largely implicated in the medicinal properties of *Ficus sycomorus* L [20-22].

Antimicrobial activities of the root bark extracts (hexane, ethyl acetate and methanol) was carried out using the following test microbes; Methycillin resistant *Staphylococcus aureus, Staphylococcus aureus, Streptococcus pyogenes, Micrococcus sp, Staphylococcus epedermidis, Corynebacteri umulcerans, Propionibacterium acnes, Streptococcus pneumoniae, Escherichia coli, Campylobacter jejuni, Helicobacter pylori, Pseudomonas aeruginosa, Enterobactersp,* and *Nitrosomonas sp*. The result is shown on Table 2, from this result, five (5) of these extracts were sensitive on four microorganisms namely, *Streptococcus pyogenes*, *Micrococcus sp*, *Nitrosomonas sp* and *Streptococcus pneumonia;* four of the extracts were sensitive on two *microorganisms*, namely; *Campylobacter jejuni* and *Enterobacter sp*. Three of the extracts were sensitive on one microorganism, *Crynebacteriumulcerans*, whereas two of the extracts were sensitive on *Enterobacter sp and* Methicillin Resistant *Staphylococus aureus*, while one of the extracts was sensitive on three microorganisms, which are *Escherichia coli*, *Propionibacterium*

acne and *Helicobacter pylori.* All the extracts were sensitive on at least one of the microbes. This indicates that the plant extracts (A, B and C) could be employed to inhibit the growths of these disease causing microorganisms that have been investigated.

The antimicrobial activities results (Table 2) of the plant extracts A, B and C and Control (Sparfloxacin and Ciprofloxacin) are as shown. Whereas, sparfloxacin is sensitive to 10 of the microorganisms out of 14. The second control, ciprofloxacin is sensitive to 8 of the microorganisms.

Table 3 shows the diameter of the zones of inhibition of the microorganisms by A, B and C extracts of the plant. In all cases where sensitivity is recorded, the diameter of zone of inhibition lies between 21-29 mm. These results compare fairly well with those of the control drugs used in the study which lies between 30-37 mm.

Tables 4 and 5 show that the minimum inhibitory concentration (MIC) of the extracts ranged from 0.25 mg/mL-0.5 mg/mL, implying that they can be used to inhibit the growth of these microbes.

Tables 6 and 7 show the minimum bactericidal concentration (MBC) of the extracts (A, B and C). These values of MBC lie between 0.5mg/mL and 2 mg/mL. These values show that the plant extracts can be used to kill these microbes which are causative agents for various diseases that are treated by herbalists using these extracts. Thus, the extracts could serve as possible drug candidates in treating cases where these organisms are causative agents.

Conclusion

Phytochemical screening of the root bark extracts of *Ficus sycomorus* has revealed that the plant contains carbohydrates, anthraquinones, saponins, steroids and triterpenes, tannins, alkaloids, cardiac glycosides and flavonoids as seen on Table 1. These secondary metabolites possess biological activities which account for the use of the plant in herbal medicine to treat several ailments since the antibacterial screening of the root bark extracts against the following microorganisms; Methicillin Resistant *Staphylococcus Aureus* (MRSA), *Staphylococcus aureus, Streptococcus pyogenes,* Micrococcus sp, *Staphylococcus epidermidis, Corynebacteri umulcerans, Propionibacterium acnes, Streptococcus pneumoniae, Escherichia coli, Campylobacter jejuni, Helicobacter pylori, Pseudomonas aeruginosa, Enterobacter sp, Nitrosomonas sp,* revealed that these plant extracts inhibit or even killed most of the microorganisms investigated. Their biological effectiveness is comparable to the two drugs used as control on the various test microorganisms (see Tables 2-7) which are sparfloxacin and ciprofloxacin.

Recommendations

The following recommendations have been made;

- Antifungal screening for the extracts should be carried out by subsequent investigators
- Toxicity studies of extracts of *F. sycomorus* have not been carried out to the best of our knowledge and should be considered in future work.
- It was realised from this study that several other compounds of interest may be present in the plant and future efforts should be directed towards studying these.
- Herbal formulations can be made from extracts of the plant subject to favourable toxicity studies.

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