Chemistry Research Journal, 2020, 5(2):174-184

Available online www.chemrj.org

Research Article

ISSN: 2455-8990
CODEN(USA): CRJHA5

Phytochemical Screening and Antibacterial Studies of the Stem Bark Extracts of *Ficus sycomorus*

Agbidye, I.G.[1], Gimba, C.E.[2], Igbum, O.G.[1], Agbidye, B.N.[3], Iortyom, S.D.[4]

[1]Department of Chemistry, Benue State University, Makurdi-Nigeria
[2]Department of Chemistry, Ahmadu Bello University, Zaria-Nigeria
[3]Department of Biological Sciences, Benue State University, Makurdi-Nigeria
[4]Department of Chemistry, University of Liberia, Monrovia
Email: isaacagbidye@gmail.com Phone: +2347031361638

Abstract The stem bark of *Ficus sycomorus* Linn., collected from North bank, 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 stem bark was found to be the most active. Phytochemical investigation of hexane stem bark extract revealed the presence of steroids and terpenes. Studies on the methanol and ethyl acetate extracts of the stem 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 stem 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

Plants have been used by man as a source of food, shelter, clothing, medicine and cosmetics [1]. In addition, all plants produce and accumulate many chemical substances from their first day of life as part of their normal metabolic activities [2]. 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 [3] have their origins in these natural products. Phytochemical surveys can reveal natural products that are "markers" for botanical and evolutionary relationship [4]. Herbal medicine plays a very important role in the healthcare system of the developing world [5]. According to

World Health Organization (WHO), 80% of the population of developing countries depend on traditional or herbal medicine for their primary healthcare [6].

From history, medicinal plants are the principal sources of drugs used today for the cure and prevention of many diseases [7]. 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 [8-9]. 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 stem 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 stem bark (SB) 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* (stem 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.

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 [10-12].

Test for Carbohydrates

Molisch's test (General test for carbohydrates)

To aqueous extract (2 mL) in a test tube three drops of Molisch's reagent were added followed by another three drops of concentrated sulphuric acid down the side of the test tube and was allowed to form a lower layer. A purple to violet coloured interface indicates the presence of carbohydrates. The mixture, when shaken gently and allowed to stand for two minutes, followed by dilution with water (5 mL) produced a dull violet precipitate which indicates the presence of carbohydrates [11, 12].

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 [10].

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 [10].

Test for Steroids and Terpenoids

Salkowski's Test for Steroids

The extract (0.5 g) was dissolved in chloroform and concentrated sulphuric acid (2mL) was carefully added down the side of the test tube to form a lower layer. A reddish brown colour which was observed at the interface indicated the presence of steroidal ring [10].

Test for Tannins

Ferric chloride test

The extract (0.2 g) was stirred with water (5 mL) and filtered. To the filtrate (2 mL) in a test tube, two drops of 0.1% ferric chloride solution were added. A green precipitate was observed which indicated the presence of condensed tannins, while a blue precipitate showed the presence of hydrolysable tannins [11].

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 [13], 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 [14].

Test for Flavonoids

Shinoda's test: The extract (0.2 g) was diluted with ethanol. Some pieces of magnesium filing were added followed by five drops of concentrated hydrochloric acid. A pink colour was observed which indicated the presence of flavonoids.

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, Enterobacter sp, 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 [15]. 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 [15]. 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 [16, 17].

Results

Results obtained from this research work are presented in table 1-7

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

Constituents	Hexane	Ethyl acetate	Methanol	Ethyl acetate v/v
Carbohydrates				
Fehling's solution	-	-	+	+
Anthraquinones				
Free anthraquinones	-	+	+	+
Anthraquinone glycosides	-	-	-	-
Saponins				
Frothing test	-	-	+	-
Steroids and Triterpenes				
Liebermann- Burchard's test	-	+	+	+
Salkowski test	+	+	+	-
Tannins				
Lead acetate test	-	-	+	+
$FeCl_3$ 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 Resistant Staphylococcus aureus	S	R	R	S	R
Staphylococcus aureus	S	S	S	S	S
Streptococcus pyogenes	S	S	S	S	R
Micrococcus sp	S	S	R	S	S
Staphylococcus epidermidis	S	R	R	S	S
Crynebacterium ulcerans	R	S	R	S	R
Propionibacterium acnes	R	R	R	R	R
Streptococcus pneumonia	S	S	S	S	S
Escherichia coli	R	R	S	S	S
Campylobacter jejuni	S	S	R	R	R
Helicobacter pylori	R	R	S	S	S
Pseudomonas aeruginosa	R	S	R	R	S
Enterobacter sp	R	S	S	S	S
Nitrosomonas sp	S	S	R	R	R

Key: A = Hexane Extract (Stem Bark) S = Sensitive R = Resistant

B = Ethyl acetate Extract (Stem Bark)

C = Methanol Extract (Stem 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 Resistant Staphylococcus aureus	24	0	0	35	0
Staphylococcus aureus	28	29	23	37	35
Streptococcus pyogenes	23	28	25	32	0
Micrococcus sp	28	26	0	37	35
Staphylococcus epidermidis	29	0	0	35	32
Corynebacterium ulcerans	0	24	0	32	0
Propionibacterium acnes	0	0	0	0	0
Streptococcus pneumonia	25	21	27	37	30
Escherichia coli	0	0	24	35	38
Campylobacter jejuni	27	24	0	0	0
Helicobacter pylori	0	0	23	30	32
Pseudomonas aeruginosa	0	24	0	0	35
Enterobacter sp	0	24	24	31	30
Nitrosomonas sp	24	22	0	0	0

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

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

Test Organism	A					B				
	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*	-	-	0*	+	++					
Staphylococcus aureus	-	-	-	0*	+	-	-	-	0*	+
Streptococcus pyogenes	-	-	0*	+	++	-	-	-	0*	+
Micrococcus sp	-	-	-	0*	+	-	-	0*	+	++
Staphylococcus epidermidis	-	-	-	0*	+					
Corynebacterium ulcerans						-	-	0*	+	++
Propionibacterium acnes										
Streptococcus pneumonia	-	-	0*	+	++	-	-	0*	+	++
Escherichia coli										
Campylobacter jejuni	-	-	-	0*	+	-	-	0*	+	++
Helicobacter pylori										
Pseudomonas aeruginosa						-	-	0*	+	++
Enterobacter sp						-	-	0*	+	++
Nitrosomonas sp	-	-	0*	+	++	-	-	0*	+	++

Key: A = Hexane Extract (Stem bark)
B = Ethyl Acetate Extract (Stem bark)
- No turbidity (no growth)
0* MIC
+ Turbid (light growth) ++ Moderate Turbidity

Table 5: Minimum inhibitory concentration of the extract C of *Ficus sycomorus* Linn against the test microorganisms

Test Organism	C				
	2 mg/mL	1 mg/mL	0.5 mg/mL	0.25 mg/mL	0.12 mg/mL
Methicillin Resistant *Staphylococcus aureus*	-	-	-	-	-
Staphylococcus aureus	-	-	0*	+	++
Streptococcus pyogenes	-	-	0*	+	++
Micrococcus sp	-	-	-	-	-
Staphylococcus epidermidis	-	-	-	-	-
Corynebacterium ulcerans	-	-	-	-	-
Propionibacterium acnes	-	-	-	-	-
Streptococcus pneumonia	-	-	-	0*	+
Escherichia coli	-	-	0*	+	++
Campylobacter jejuni	-	-	-	-	-
Helicobacter pylori	-	-	0*	+	++
Pseudomonas aeruginosa	-	-	-	-	-
Enterobacter sp	-	-	0*	+	++
Nitrosomonas sp					

Key: C = Methanol Extract (Stem bark); - No turbidity (no growth); 0* MICs
+ Turbid (light growth) ++ Moderate Turbidity

Table 6: Minimum bactericidal concentration of the extracts (A and B) of *Ficus sycomorus* Linn against the test microorganisms

Test Organism	A					B				
	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)	-	0*	+	++	+++	-	-	-	-	-
Staphylococcus aureus	-	-	0*	+	++	-	-	0*	+	++
Streptococcus pyogenes	0*	+	++	+++	++++	-	-	0*	+	++
Micrococcus sp	-	-	0*	+	++	-	0*	+	++	+++
Staphylococcus epidermidis	-	-	0*	+	++	-	-	-	-	-
Corynebacterium ulcerans	-	-	-	-	-	-	0*	+	++	+++
Propionibacterium acnes	-	-	-	-	-	-		-	-	-
Streptococcus pneumonia	-	0*	+	++	+++	0*	+	++	+++	++++
Escherichia coli	-	-	-	-	-	-	-	-	-	-
Campylobacter jejuni	-	0*	+	++	+++	-	0*	+	++	+++
Helicobacter pylori	-	-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	-	-	-	-	-	-	0*	+	++	+++
Enterobacter sp	-	-	-	-	-	-	0*	+	++	+++
Nitrosomonas sp	-	0*	+	++	+++	0*	+	++	+++	+++

Key: A = Hexane Extract (Stem bark); B = Ethyl Acetate Extract (Stem bark)
- No colony growth; 0* MBC
+ Scanty colonies growth; ++ Moderate colonies growth; +++ Heavy colonies growth

Table 7: Minimum Bactericidal Concentration of the extracts C of *Ficus sycomorus* Linn against the microorganisms

Test Organism	**C**				
	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	-	-	-	-	-
Staphylococcus epidermidis	-	-	-	-	-
Corynebacterium ulcerans	-	-	-	-	-
Propionibacterium acnes	-	-	-	-	-
Streptococcus pneumonia	-	-	0*	+	++
Escherichia coli	-	0*	+	++	+++
Campylobacter jejuni	-	-	-	-	-
Helicobacter pylori	-	0*	+	++	+++
Pseudomonas aeruginosa	-	-	-	-	-
Enterobacter sp	-	0*	+	++	+++
Nitrosomonas sp	-	-	-	-	-

Key: C = Methanol Extract (Stem bark); - No colony growth; 0* Minimum Bactericidal Concentration (MBC)
+ Scanty colonies growth; ++ Moderate colonies growth;
+++ Heavy colonies growth; ++++ = very heavy colonies growth

Discussion

Phytochemical screening of the stem 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 [18 - 20].

Antimicrobial activities of the stem and 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, Corynebacterium ulcerans, Propionibacterium acnes, Streptococcus pneumoniae, Escherichia coli, Campylobacter jejuni, Helicobacter pylori, Pseudomonas aeruginosa, Enterobacter sp,* 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, *Crynebacteri umulcerans*, 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. The ethyl acetate extract (stem bark, B) had the greatest sensitivity on nine (9) microorganisms namely; *Staphylococcus aureus, Streptococcus pyogenes, Micrococcus sp, Crynebacterium ulcerans, Streptococcus pneumonia, Campylobacter jejuni, Pseudomonas auruginosa, Enterobacter sp* and *Nitrosomonas sp*. 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 result (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 stem 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 stem bark extracts against the following microorganisms; 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, 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.

References

[1]. Gurib-Fakim, A.(2006). Medicinal plants: Traditions of yesterday and drugs of tomorrow, *Mol. Aspects Med.*, 27(1), 1–93.

[2]. Husain, S. Z., Malik, R. N., Javaid, M. and Bibi, S. (2008). Ethonobotanical properties and uses of medicinal plants of Morgah Biodiversity Park, Rawalpindi, *Pakistan J. Bot.*, 40(5), 1897–1911.

[3]. Muthaura, C. N., Keriko, J. M., Derese, S., Yenesew, A. and Rukunga, G. M. (2011). Experimental Parasitology Investigation of some medicinal plants traditionally used for treatment of malaria in Kenya as potential sources of antimalarial drugs, *Exp. Parasitol.*, 127(3), 609–626.

[4]. Omotayo, F. O. and Borokini, T. I. (2012). Comparative phytochemical and ethnomedicinal survey of selected medicinal plants in Nigeria, *Sci. Res. Essays*, 7(9), 989–999.

[5]. Vardiman, J. W., Thiele, J., Arber, D. A., Brunning, R. D., Borowitz, M. J., Porwit, A., Harris, N. L., Le Beau, M. M., Hellstrom-Lindberg, E., Tefferi, A. And Bloomfield, C. D. (2009). The 2008 revision of the World Health Organization (WHO) classification of myeloid neoplasms and acute leukemia : rationale and important changes, *Blood*, 937–951.

[6]. Powers, B. J., Brown, G., Williams, R. W. and Speers, W.(2015). *Medical eligibility criteria for contraceptive use*, vol. 87(5).

[7]. Sandberg, F., Perera-Ivarsson, P. and El-Seedi, H. R. (2005). A Swedish collection of medicinal plants from Cameroon, *J. Ethnopharmacol.*, 102(3), 336–343.

[8]. Fabiano-Tixier, A. S., Elomri, A., Blanckaert, A., Seguin, E., Petitcolas, E. and Chemat, F. (2011). Rapid and green analytical method for the determination of quinoline alkaloids from *Cinchona succirubra* based on microwave-integrated extraction and leaching (MIEL) prior to high performance liquid

chromatography, *Int. J. Mol. Sci.*, 12(11), 7846–7860.

[9]. Erdemoglu, N., Orhan, I., Kartal, M., Adıgüzel, N. and Bani, B. (2007). Determination of artemisinin in selected Artemisia L. species of Turkey by reversed phase HPLC, *Rec. Nat. Prod.*, vol. 3, 36–43.

[10]. Sofowora, A.(1993). Recent Trends in Research into African Medicinal-Plants, *J. Ethnopharmacol.*, 38(2–3), 209–214.

[11]. Edeoga, H. O., Okwu, D. E. and Mbaebie, B. O. (2005). Phytochemical constituents of some Nigerian medicinal plants," *African J. Biotechnol.*, 4(7), 685–688

[12]. Harris, R. (2003). *Trease and Evans' pharmacognosy*, vol. 13, no. 1. Saunders/Elsevier.

[13]. Tijjani, M. A., Abdurahaman, F. I., Khan, I. Z. and Sandabe, U. K. (2012). The effects of ethanolic extract of *Vitex doniana* stem bark on peripheral and central nervous system of laborotory animals," *J. Appl. Pharm. Sci.*, 2(3), 74–79

[14]. Usman, H., Abdulrahman, F. I. and Ladan, A. A. (2007). Phytochemical and amtimicrobial evaluation of *Tribulus terrestris* L. (Zygophyllaceae) Growing in Nigeria, *Res. J. Biol. Sci.*, 2(3), 244–247.

[15]. Linga Rao, M. and Savithramma, N. (2012). Quantification of primary and secondary metabolites of svensonia hyderobadensis - a rare medicinal plant, *Int. J. Pharm. Pharm. Sci.*, 4(1), 519–521.

[16]. Apak, L.and Olila, D. (2006). The in-vitro antibacterial activity of *Annona senegalensis*, *Securidacca longipendiculata* and *Steganotaenia araliacea* - Ugandan medicinal plants, *Afr. Health Sci.*, 6(1), 31–35.

[17]. Volleková, A., Košt'Álová, D., Kettmann, V. and Tóth, J. (2003). Antifungal activity of *Mahonia aquifolium* extract and its major protoberberine alkaloids, *Phyther. Res.*, 17(7), 834–837.

[18]. Singh, M., Mukhtar, H. and Vashishth, D. (2012). Standardization of Stem Bark of *Ficus Bengalensis.*

[19]. Naquvi, K. Ali, M., J. A. N. P. A. I. (2012). Antidiabetic and cholesterol lowering activities of the stem bark of *Ficus bengalensis* L., *Natural Products An Indian Journal*, 8(8), 328-331.

[20]. Adesina, S. K., Idowu, O., Ogundaini. A. O., Oladimeji, H., Olugbade, T. A., Onawunmi, G. O. and Pais, M. (2000). Antimicrobial constituents of the leaves of *Acalypha wilkesiana* and *Acalypha hispida*, *Phyther. Res.*, 14(5), 371–374.