



Phytochemical Screening and Antibacterial/ Antifungi Activities of Root and Shoot Extracts of *Euphorbia hirta* (Asthma Weed)

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Authors' contributions

This work was carried out in collaboration among all authors. Authors LAA, MON and PNA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author JCN managed the analyses of the study. Authors JNA and IOO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Medicinal plants, also called herbal medicine, have been used in traditional medicine practices since prehistoric times. The phytochemical screening of root and shoot extracts of *Euphorbia hirta* plant commonly known as asthma weed was evaluated using soxhlet and aqueous extract as a solvent to determine the active components. Maceration method was used in extracting the active properties/component. Phytochemical screening of root and shoot extracts revealed presences of saponins, anthranoid anthroquinone, phenol, alkaloid, tannins, phylobatannins and cardiac glycoside. Antibacterial screening of clinical isolates of *Staphylococcus aureus*, *Salmonella typhi*, *Escherichia coli* and *Streptococcus pyogenes*, using disk diffusion method, showed that in both the aqueous root and shoot extract *Streptococcus pyogenes* has the highest zone of inhibition of 120 mg with 12mm while least is *Escherichia coli* that had no inhibition at all. The aqueous extract the root and shoot were more active than the soxhlet solution. Using the aqueous shoot extracts,

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Streptococcus at 120 mg with 12mm zone of inhibition of *Staphylococcus* at 90 mg with 9mm. While in the aqueous root extract, *Staphylococcus aureus* at 100 mg with 10mm, *Streptococcus pyogenes* at 90 mg with 9m and *Salmonella typhi* at 80mm with 8mm. Antifungal screening with clinical isolate of *Candida albicans* had highest zone of inhibition 130 mg with 13mm at root aqueous extract while *penicillium* spp, *Aspergillus*, spp and *Microsporium* spp showed no zones of inhibition at both root and shoot extracts. The results obtained suggested that *Euphorbia hirta* plant can be used in the treatment of ailments caused by the test microorganisms, with particular attention being paid to its aqueous extract.

Keywords: Phytochemical; antibacterial; antifungal; extracts; *Euphorbia hirta*.

1. INTRODUCTION

To date, plants continue to be a major source of commercially consumed drugs. Even most synthetic drugs have their origin from natural plant products [1]. There is an increasing demand for medicinal plants and plant products as alternative to orthodox medicines especially in developing countries [2]. The use of plants and their natural products in Nigeria as either extract or infusion is a widespread practice in the treatment and management of diseases [3]. [4] and [5] reported that about 163 species of plants were used as wound healing plants in Indian systems of medicine. *Euphorbia hirta* (sometimes called asthma-plant) is a pantropical weed, possibly native to India. It is a hairy herb that grows in open grasslands, roadsides and pathways.

It is widely used as a medicinal herb in most places. *Euphorbia* species have been used in the treatment of wounds in India ethnomedicine [6]. In Nigeria extracts or exudates of the plant are used as ear drops and in the treatment of boils, sore and promoting wound healing [7]. *Euphorbia hirta* extract have been shown to have antidiarrhoeic activity, analgesic, antipyretic and anti-inflammatory property [8], Antibacterial effect against dysentery causing *Shigella* sp. [9,10] and showed activity against intestinal motility [11]. *Euphorbia hirta* extract have also been shown to increase urine output and electrolytes in rats. *Euphorbia hyssopifolia* produces latex which constitutes a health hazard to humans and livestock [12]. It is known to contain substances which are inhibitory to seed germination and seedling growth as well as bacteria. Direct contact of the irritant latex with the eye can cause blindness. The toxic latex of *Euphorbia hyssopifolia* has a diuretic effect and purgative action [13]. It has medicinal effect for inflammation of the respiratory tract and also is said to induce bronchial relaxation in asthma. The juice is said to remove warts and the leaves

can be boiled with *Phyllanthus niruri* to make tea for the treatment of gonorrhoea [14]. Hepatotoxicity effect of *Euphorbia hyssopifolia* has also been reported [15]. The largest genus of family *Euphorbiaceae*, is *euphorbia* with about 600 species. It is characterized by the presence of white milky latex which is more or less toxic. Lattices of *Euphorbia hirta*, *Euphorbia maey*, *Euphorbia trinagaris* and possible sources of rubber [13]. The abundance of plants on the earth's surface has led to an increasing interest in the investigation of different extracts obtained from traditional plants, as potential source of new antimicrobial agents [16].

This work was borne out of the fact that certain bacterium are resistant to synthetic drug and thus the need to explore plant species for antimicrobial agents that will inhibit the growth of drug resistant bacteria. Hence, the study was undertaken to explore the Phytochemical Screening and Antibacterial activities of root and shoot extracts of *Euphorbia hirta* (Asthma Weed).

2. MATERIALS AND METHODS

2.1 Collection of Samples

The shoot and root of the *Euphorbia hirta* plant was collected from Federal University of Technology Owerri and Identified by a Botanist Dr. Duru from Biological Science Department with herbarium voucher number BIO/SOBS/0908. The sample was then air-dried and ground into powder using sterile manual grinder. This was stored in air-tight glass containers protected from light and heat until required for analysis.

2.2 Preparation of Plant Material and Test Organisms

The fresh root and shoot of *Euphorbia hirta* plant was collected and properly washed and rinsed in sterile water. It was air dried at room

temperature for two weeks and three days. The dried roots and shoots were pulverized using mechanical grinder machine and was stored in air tight container for further use.

The clinical isolates of *Escherichia coli*, *Staphylococcus aureus*, *Salmonella* spp., *Streptococcus pyogenes*, *Candida albicans*, *Aspergillus* spp, *Penicillium* spp, and *Microsporium* spp. were collected from the Microbiology Department of Federal Medical Centre, Owerri and identified. The identified isolates were then sub-cultured on sterile Nutrient agar and Sabouraud Dextrose agar slants (in the case of the *Candida albicans*, *Penicillium* spp, *Aspergillus* spp. and *Microsporium* spp. The microbial culture were diluted with peptone water until the final suspension that contained 1.0×10^8 cfu/ml of *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, *Streptococcus pyogenes*, *Microsporium* spp and *Candida albicans* were obtained according to the method of [17]. The cell densities obtained were in accordance with 0.5 McFarland's standard and used in all the investigations. The McFarland's standard was prepared by adding 0.1 ml of 1% BaCl₂ into 9.9 ml of 1% Sulphuric acid.

2.3 Extraction of the Plant Materials

Hot water extraction and soxhlet extraction with ethanol (99%) as described in [18] was adopted for this study. Twenty grams (10 g) of the ground samples of shoot and root of the *Euphorbia hirta* plant was weighed into 100ml of water and heated. It was stirred intermittently for 30 minutes and allowed to boil. After boiling, it was filtered using Whatman filter paper (No. 1). For the soxhlet extraction, 10 g of the ground sample was stuffed in a thimble and placed in the extraction chamber of the soxhlet extractor. Thereafter the Liebig condenser containing the water in-let and outlet hoses was fitted into the extraction chamber which was then placed into a flat bottom flask containing 100 ml of ethanol. The apparatus was set up on a heating mantle and then the mantle was connected to the mains. After the extraction, the ethanol was recovered from the mixture of ethanol and the extract using simple evaporation techniques. The soxhlet extract was used in all the investigations.

2.4 Phytochemical Screening

Freshly prepared ground samples were chemically tested for the presence of chemical constituents using a standard procedure [19],

water and soxhlet extracts were commonly used. The root and shoot extracts (both soxhlet and aqueous extract) were screened for their phytochemical basis using the standard method of [20]. The phytochemical components analyzed were alkaloids, saponins, tannins, phenol. Saponins, Anthranoid, anthroquinone, phenol, alkaloid, tannins, phylobatannins and cardiac glycoside.

2.4.1 Test for saponins

Ten millilitres (10 ml) of distilled water was added to two millilitres (2 ml) of eh of the extracts in a test tube and shaken vigorously [21]. Persistent frothing even after heating was an indication of the presence of saponins.

2.4.2 Test for anthranoid

The method of [20] was adopted for this test. Two millilitre (2 ml) of each of the extracts, five millilitres (5 ml) of 0.5M Potassium Hydroxide was added and mixed properly. Then 6 drops of acetic acid was added followed by 2ml of toluene. To the upper layer formed, 2ml of 0.5M Potassium Hydroxide was added. A change in colour of the mixture was an indication of a positive test while no colour change was an indication of a negative test.

2.4.3 Test for anthroquinone

Two millilitres (2 ml) of each of the extracts, 5 ml of 10% ammonia was added and shaken vigorously. 2 ml of benzene was thereafter added. A colour change was an indication of a positive test while none was an indication of a negative test [20].

2.4.4 Test for phenol

The method of [19] was employed. 5 ml of each of the extracts was mixed with 8 ml of distilled water in a test tube and 6 ml of Ferric chloride was added to the mixture. A colour change to light brown was an indication of a positive test while none indicates a negative test.

2.4.5 Test for alkaloid

Two millilitre (2 ml) of each of the extracts, 5 ml of 1% aqueous Hydrochloric acid was added and placed in a water bath for 3 minutes and thereafter 3 drops of Mayer's reagent was added [21]. A white precipitate was an indication of a positive test while none indicates a negative test.

2.4.6 Test for tannins

The method of [21] was employed. One millilitre (1 ml) of each of the extracts, 2 ml of 1% ferric chloride was added. A colour change was an indication of a negative test while none was an indication of a negative test.

2.5 Test for Phylobatannins

Two millilitres (2 ml) of each of the extracts, 1% aqueous hydrochloric acid was added and boiled. The presence of white precipitate was an indication of a positive test while none was an indication of a negative test [21].

2.6 Test for Cardiac Glycoside

The Salkowski test was employed in this test. One millilitre (1 ml) of the extracts, 2 ml of chloroform was added and then 2 ml of concentrated tetraoxosulphate (vi) acid was added to form a lower layer. A reddish brown colour at the inter phase was an indication of a positive test while none was an indication of a negative test.

2.7 Enumeration of Microbial Population

The characterization and identification of bacteria and fungi isolates were based on the colony morphology, (catalase test, oxidase and coagulase test) and standard biochemical test as described by [22,23,24,25].

2.8 Characterization of Microbial Isolates

2.8.1 Biochemical test

Although the presumptive identification of colonies were made using their morphological character and color standard, other series of test were done in order to characterize and identify the bacterial isolates, in these test, only fresh cultures bacterial between 18-24 hrs were used, these tests were highly limited selection of test and of general usefulness in the characterization and identification of bacteria [26]. The isolates were characterized based on the following tests.

2.8.2 Catalase test

This test is done or carried out as described by [27] to detect the enzyme, catalase. This enzyme is responsible for protecting bacteria from hydrogen peroxide accumulation, which occurs

during aerobic metabolism, if hydrogen peroxide accumulates it becomes toxic to organism, catalase breaks down hydrogen peroxide down into water and oxygen.

2.9 Method

Two drops of 3 percent hydrogen peroxide (May and baker) was placed on a clean free grease slide. The bacteria isolates was collected using a sterile wire loop and placed on a slide containing hydrogen peroxide. Production of bubbles shows that the test is positive while lack of bubbles shows that the test is negative.

2.9.1 Oxidase test

This test is based on detecting the production of the enzyme cytochrome oxidase by gram negative bacteria.

2.10 Method

Two to three drops of oxidase test reagent was dropped on a clean free grease filterpaper. Bacteria isolates was used to smear on the filter paper containing the reagent. An evident purple color changes within 30 sec to 1 min shows or indicate a positive result, it is important that there is a purple color change within 1 min to avoid false negative and false positive.

2.10.1 Coagulase test

This was carried out as outlined by [28]. It is a test used in differentiating of *Staphylococcus aureus* from coagulase-negative *staphylococci*. *Staphylococcus aureus* produces two forms of coagulase [bound coagulase and free coagulase]. A drop of plasma was mixed with the suspension and then observed for clumping within 10 secs. Clumping indicates coagulase positive results.

2.11 Antimicrobial Susceptibility Testing of the *Euphorbia hirta* Plant Extracts

The disc technique as described by [29] was adopted for this study to evaluate the antibacterial activity of the extracts. 0.2 ml aliquot of each of the extract was dropped on sterile filter paper discs of 6 millimetres in diameter and allowed to get absorbed before they were placed into the prepared nutrient agar plates and Sabouraud dextrose agar inoculated with each of the test organisms (bacteria on nutrient agar, fungi on Sabouraud dextrose agar) and appropriately labelled. Discs impregnated with

Chloramphenicol for bacteria and Nystatin for fungi was used as control in each case. The nutrient agar plates and Sabouraud dextrose agar plates were then incubated at 37°C for 24 hours and 25°C for 48 hours respectively. The zones of inhibition were measured with a meter rule.

2.12 Tests for Minimum Inhibitory Concentrations (Mic) of the Root and Shoot Extracts

For the MIC test, the plant extracts were concentrated by evaporation and one millilitre (1 ml) of each of the extracts was added into four millilitres (4 ml) of peptone water; this gives 250 mg/ml. Also, 0.8 g of the same extract was placed in 4 ml of peptone water to obtain the concentration of 200 mg/ml. Thereafter, two fold serial dilutions was carried out from the 200 mg/ml concentration by transferring 2 ml of the 200 mg/ml concentration to 2 ml of peptone water contained in a test tube and homogenized properly. This procedure of transferring 2 ml of the tube to 2 ml of peptone water contained in the subsequent tubes was continued until the eighth tube. The following concentrations were thereafter obtained: 250 mg/ml, 200 mg/ml, 100 mg/ml, 50 mg/ml, 25 mg/ml, 12.5 mg/ml, 6.25 mg/ml and 3.125 mg/ml. Having obtained the different concentrations and dilutions, three drops of overnight broth cultures of the test organisms were inoculated into the dilutions in each case of the test organisms (Akujobi et al., 2004). The tubes were then incubated at 37°C for 24 hours. The lowest concentration of each of the extracts in each case of the hot water and soxhlet extracts that inhibited the growth of the test organisms were recorded as the MIC.

2.13 Test for the Bactericidal/Fungicidal Concentration of the Extract

Tubes showing no visible growth from the MIC test were sub cultured onto sterile Nutrient agar plates and Sabouraud dextrose agar plates and incubated at 37°C for 24 hours and 25°C for 48 hours respectively. The lowest concentration of the extracts yielding no growth was recorded as the Minimum Bactericidal/Fungicidal Concentration as the case may be.

3. RESULTS AND DISCUSSION

3.1 Antimicrobial Sensitivity Testing of Aqueous and Soxhlet Extract of the Plant *Euphorbia hirta*

Table 2 shows the presences of saponins, anthranoid, alkaloid, tannins, phylobatannins and cardiac glycoside in both root and shoot extract. Anthroquinone in raq extract was absence but presence in rsox, ssox and saq, phenol was presence in both rsox, ssox and saq but absence in raq extract and cardiac glycoside was presence in ssox and saq but absence in rsox and raq extract.

From the result, it shows that root and shoot extract are very rich in phytochemical screening.

The result of the zone diameter of inhibition of *Escherichia coli* was recorded by checking the diameter of the clearance area from one end across the disc to the other end of millimetre. As can be seen in Table 3, *Salmonella typhi* at 80 mg the inhibition zone is 8mm for the root aqueous extract and no inhibition at root soxhlet, shoot equeous extract, and soxhles shoot extract. *Escherichia coli* has no zone of inhibition

Table 1. Phytochemicals present in root and shoot extracts of *Euphorbia hirta*

Phytochemicals	Root extracts		Shoot extracts	
	Sox.	Aq.	Sox.	Aq.
Saponins	+	+	+	+
Anthranoid	+	+	+	+
Anthroquinone	+	-	+	+
Phenol	+	-	+	+
Alkaloid	+	+	+	+
Tannins	+	+	+	+
Phylobatannins	+	+	+	+
Cardiac glycoside	-	-	+	+

Keys: + = Presence- = Absence, Raq. = Root aqueous extract, Rsox = Root soxhlet extract, Ssox = Shoot soxhlet extract, Saq= Soxhlet aqueous extract

Table 2. Diameter of inhibition of bacteria growth by root and shoot extract of *Euphorbia hirta*

Test organisms	Zone Diameter of inhibition			Concentration (mg)	Zone diameter of inhibition	
	Concentration (mg)	Root extracts Aq. (mm)	Root extract Sox.		Shoot extracts Aq. (mm)	Shoot extract Sox. (mm)
<i>Salmonella typhi</i>	80	8	Nill	-	Nill	Nill
<i>Escherichia coli</i>	-	Nill	Nill		Nill	Nill
<i>Staphylococcus aureus</i>	100	10	Nill	90	9	Nill
<i>Streptococcus pyogenes</i>	90	9	Nill	120	12	Nill

Keys: Nill means no zone of inhibition. Aq. = aqueous extract, Sox. = soxhlet extract

Table 3. Diameters of inhibition zone recorded on the fungal using soxhlet and aqueous extract

Test organisms	Zone Diameter of inhibition(mm)			
	Root extracts Aq. (mm)	Root extract Sox.	Shoot extracts Aq. (mm)	Shoot extract Sox. (mm)
<i>Penicillium spp.</i>	Nill	Nill	Nill	Nill
<i>Candida albicans</i>	13	Nill	Nill	Nill
<i>Microsporium spp.</i>	Nill	Nill	Nill	Nill
<i>Aspergillus spp</i>	Nill	Nill	Nill	Nill

Table 4. Control with commercial disk for bacteria

Microorganisms	Chloramphenicol control (mm)
<i>Staphylococcus aureus</i>	19
<i>E. coli</i>	18
<i>Streptococcus pyogenes</i>	20
<i>Salmonella</i>	11

Table 5. Antibiotic used as control

Microorganisms	Nystatin control (mm)
<i>Candida albicans spp</i>	20
<i>Aspergillus spp</i>	Nill
<i>Penicillium spp</i>	23
<i>Microsporium spp</i>	16

in both root soxhlet, root aqueous, shoot soxhlet and shoot aqueous. *Staphylococcus aureus* at 100 mg the inhibition zone is 10mm at root aqueous extract, no zone of inhibition at root soxhlet extract, 9mm at shoot aqueous extract and no zone of inhibition in shoot aqueous extract. *Streptococcus pyogenes* at 90 mg has an inhibition zone of 9mm at root aqueous extract, no zone of inhibition in root soxhlet extract, 12mm at shoot aqueous extract, and no inhibition zone at shoot soxhlet extract.

Table 4 shows that the result of *candida albican* has 130 mg, the inhibition zone is 13mm at root

aqueous extract there was not zone of inhibition at both root soxhlet, extract, shoot aqueous extract and shoot soxhlet extract. Finally both *Microsporium spp.*, *Aspergillus spp* and *Penicillium spp* has no inhibition in both root and shoot extract.

This result shows that *candida albican* has the highest zone of inhibition at root aqueous extract than order organisms. *Streptococcus pyogenes* has the highest zone of inhibition than *Staphylococcus aureus*, *E. Coli* and *Salmonella typhi*.

As seen in Table 5, Chloramphenicol showed 11mm inhibition on *Salmonella typhi*, 18mm inhibition on *E. Coli*, 19mm inhibition on *Staphylococcus aureus* and 20mm inhibition on *Streptococcus pyogene*. The result shows that *Streptococcus pyogenes* has the highest control inhibition and *salmonella* has the lowest control inhibition.

Table 6. Concentrations of the extracts (mg/ml) of *Euphorbia hirta* Plant

Test organisms	Concentrations of the extracts (mg/ml)			
	MIC (mg/ml)			
	Roots		Shoot	
	Aqueous	Soxhlets	Aqueous	Soxhlet
<i>Salmonella typhi</i>	>250	N.D	N.D	N.D
<i>Escherichia coli</i>	N.D	N.D	N.D	N.D
<i>Staphylococcus aureus</i>	250	N.D	250	N.D
<i>Streptococcus pyogenes</i>	>250	N.D	250	N.D
<i>Candida albicans</i>	>250	N.D	N.D	N.D
<i>Microsporium spp</i>	N.D	N.D	N.D	N.D
<i>Aspergillus flavus</i>	N.D	N.D	N.D	N.D

N.D = Not done (because the raw concentrations did not exhibit antimicrobial activity)
>250 = greater than 250mg/m

Table 7. Minimum bactericidal concentrations (MBCs) of root and shoot extracts of *Euphorbia hirta*

Test organisms	Concentrations of the extracts (mg/ml)			
	MBC (mg/ml)			
	Roots		Shoot	
	Aqueous	Soxhlets	Aqueous	Soxhlet
<i>Salmonella typhi</i>	>250	N.D	N.D	N.D
<i>Escherichia coli</i>	N.D	N.D	N.D	N.D
<i>Staphylococcus aureus</i>	>250	N.D	>250	N.D
<i>Streptococcus pyogenes</i>	>250	N.D	250	N.D
<i>Candida albicans</i>	>250	N.D	N.D	N.D
<i>Microsporium spp</i>	N.D	N.D	N.D	N.D
<i>Aspergillus flavus</i>	N.D	N.D	N.D	N.D

N.D = Not done (because the raw concentrations did not exhibit antimicrobial activity),
>250 = greater than 250 mg/ml

Table 8. Colony microscopy and biochemical characteristics of bacterial isolates used in the work

Colony morphology	Gram reaction	Shape	Catalase	Coagulase	Oxidase	Probable organism
Cream Circular Colonies on Nutrient Agar, pink on MacConkey Agar	-ve	Short rods	+ve	-ve	+ve	<i>Escherichia coli</i>
White tiny Colonies on Nutrient agar	+ve	Cocci	+ve	+ve	-ve	<i>Staphylococcus aureus</i>

Table 6 shows that the highest zone of inhibition 23mm was observed in *Pencillium spp* using nystatin as a control *Candida albicans* has zone of inhibition of 20mm using nystatin and *Microsporium spp* has zone of inhibition 16mm at the use of nystatin, *Aspergillus spp* has no zone of inhibition.

4. DISCUSSION

The result of this study shows that the root and shoot extract of *Euphorbia* plant contain saponins, anthranoid, anthroquinones, phenol, alkaloid, tannins, phylobactaninns and cardiac

glycoside. [21] also reported the presences of these substances in *Euphorbia hirta* plant. The root and shoot of this plant have been reported to be maturant and emollient, used in the treatment of wound and boils. The bark rich in tannins improves digestion and oestrogenic effect. This is in line with the work of [30] who reported that alkaloids are medicinally useful, possessing analgesic antispasmodic and bactericidal effects. The tannins found in this plant was equally reported by [31]. The inhibitory effects noticed from the aqueous root and shoot extracts on the test organisms may be due to the presence of these phytochemical component. Although the

root aqueous extract had limited activity against the bacteria, but a recognizable inhibitory activities were very noticeable in *Streptococcus pyogenes* and *Staphylococcus aureus* and the fungi, *Candida albicans*, marked activity of inhibition against the bacteria *Salmonella typhi*, *Staphylococcus aureus* and *Streptococcus pyogenes* and the fungi, *Candida albicans* was noticed. The none activity recorded in the bacteria *E. coli* and fungi *Aspergillus* spp, *Microsporium* spp and *Penicillium* spp using both soxhlet and aqueous extracts corresponds to the work of [31]. The use of plant extract or their active principles is the major part of traditional therapy, this means that medicinal plants and plants generally are of immense necessity to man. [32] stated that the use of herbs and shrubs in the treatment of disease, both physiological and otherwise, is an important breakthrough in pharmacognosy and is a great contribution to the development of modern pharmatherapeutics in Africa.

This is in line with the works of [33] who reported that antibiotic is not the only antimicrobial agents, the antibacterial and antifungal properties of the soxhlet ethanol and aqueous root and shoot extracts of *Euphorbia hirta* showed that aqueous root extract of 80 mg/ml concentration on *Salmonella typhi* showed inhibition zone of 8mm, no zone of inhibition at root soxhlet, shoot aqueous and soxhlet shoot extract.

E. coli had no inhibition zone at all root and shoot extract. *Staphylococcus aureus* had 10mm at aqueous root extract no zone of inhibition at soxhlet root extract, 9mm at shoot aqueous extract and none at shoot soxhlet extract *Staphylococcus aureus* had no zone of inhibition. *Streptococcus pyogenes* had 9mm at root aqueous, no zone of inhibition at root soxhlet, 12mm at shoot aqueous and no zone of inhibition at shoot soxhlet extract. This may be as a result of enzyme they have that activated the active ingredient in plant or the phytochemicals may not be enough to inhibit the growth of the organisms.

The results of the Antifungal screening of root and shoot extract of *Euphorbia hirta*, showed that in the root aqueous extract *Candida albicans* at 130 mg/ml was 13mm, no inhibition zone at root soxhlet, shoot aqueous and shoot soxhlet. *Microsporium* spp, *Aspergillus* spp and *Penicillium* spp had no zone at inhibition at all extract. Considering the study of both soxhlet and aqueous extracts of shoot and root.

It is evident from the results that water extract of root and shoot has some significantly high antibacterial activity, suggesting that the active principles in the root and shoot are more soluble in water and that water is the appropriate solvent for the extraction of the bioactive principles present in root and shoot of *Euphorbia hirta*. This is similar to the reports of [34] and [34], but contrary to that of [35]. This is a clear indication that the solvent system plays a significant role in the solubility of the active principles in the plant and influences the antibacterial activities. This can be explained in terms of the polarity of the compound being extracted by each solvent and in addition to their intrinsic bioactivity, their ability to dissolve or diffuse in the media used in the assay. The pathogenic bacteria varied in their susceptibility to the crude plant extracts, This is similar to the observations of [36]. There are several other reports stating that other *Euphorbia* species extracts exhibit antibacterial activities. In their own studies, [26] reported that the acetone and water extracts of *Euphorbia fruticosa* showed significant antibacterial activity as well as the methanol extracts of *Euphorbia macroclada* studied by [29]. Also, [37] reported that crude extracts of *Euphorbia australis* inhibited the growth of *B. cereus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *S. typhi*.

In bacteria, the inhibition zone of the antibiotic used as control are as follows;

Chloramphenicol showed 11mm zone of inhibition for *Salmonella typhi*, *Escherichiac coli* showed 18mm zone of inhibition, *Staphylococcus aureus* showed 19mm zone of inhibition and *streptococcus pyogenes* showed 20mm zone of inhibition.

In fungi, the inhibition zone of the antibiotic used as control is Nystatin;

Nystatin showed no inhibition zone for *Aspergillus* but showed inhibition zone, for *Microsporium* spp 16mm, *candida albicans* 20mm and *penicillium* with the highest zone of inhibition of 23mm.

For root and shoot extracts of *Euphorbia hirta* to have inhibition zone comparable to that of the standard antibiotics, it means that *Euphorbia hirta* has high antibacterial and antifungal properties and this may be due to the presence of the active chemical compounds, tannins, saponins, anthranoid, anthorquinone, phenol, phylobtannins and cardiac glycoside.

5. CONCLUSION

The outcome of this research work has shown that the root and shoot extract of *Euphorbia hirta* possesses antimicrobial activities against certain bacteria. The aqueous extract had more antimicrobial activities against the test organisms than the soxhlet extracts. The test bacteria that were susceptible to the root and shoot extracts of *Euphorbia hirta* were *Salmonella typhi*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Candida albicans*. This shows that the root and shoot extracts of *Euphorbia hirta* can be used in the treatment of diseases caused by these bacteria.

6. RECOMMENDATIONS

From the outcome of this research work, the following are recommended;

- That herbal medicine should be standardized to find solutions to the growing cases of drug resistant pathogens.
- That the extracts of *Euphorbia hirta* be purified and be used in the preparation of drugs against *Candida albicans*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Salmonella typhi*.
- That government should support researches towards exploring plants for the treatment of antimicrobial infections.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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