ANTIBACTERIAL ACTIVITIES AND PHYTOCHEMICAL SCREENING OF *RICINUS COMMUNIS* (CASTOR OIL PLANT) AND *CALOTROPIS PROCERA* (APPLE OF SODOM) CRUDE EXTRACTS AGAINST SELECTED CLINICAL ISOLATES

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ABSTRACT

Plants with medicinal properties are of great importance as a result of their pharmacological effects, and they might be natural composite sources that can act as new anti-infectious agents. The antibacterial efficacy of *Calotropis procera* and *Ricinus communis* were investigated for their effects on some selected clinical isolates using Agar well diffusion method, Minimum inhibitory concentration (MIC), Minimum bactericidal concentration (MBC), and phytochemical screening (qualitative and quantitative) and all were carried out using standard methods and procedures. The acetone and aqueous extracts of the plants inhibited the isolates, for the acetone extract, *E. coli* had the highest zone of inhibition 15.50 ± 0.50 mm at 500 mg/ml concentration while extract of *Ricinus communis* had the lowest antibacterial activity against *P. aeruginosa* with a diameter of zone of inhibition 4.00 ± 0.50 mm at 100 mg/ml and a diameter of zone of inhibition 4.50 ± 0.50 mm at 200 mg/ml for *Calotropis procera*. For aqueous extract, extract of *Ricinus communis* had the highest antibacterial activity against *E. coli* with a diameter of zone of inhibition 15.00 ± 0.50 mm at 500 mg/ml concentration while extract of *Calotropis procera* had the highest antibacterial activity against *E. coli* with a diameter of zone of inhibition 14.00 ± 1.00 mm at 500 mg/ml concentration. The qualitative phytochemical screening of the extract confirmed the presence of some secondary plant metabolites such as saponin, terpenoids, cardiac glycosides, tannins, flavonoids, alkaloids, and glycosides. The results showed the effectiveness of both aqueous and acetone extracts of the medicinal plant, the effect of the medicinal plant is also justification for their common use in African traditional medicine and is known to be a potential source of different drug products for the cure of various ailments.

Keywords: Antibacterial activity, *Calotropis procera*, Clinical Isolates, Phytochemical screening, *Ricinus communis*

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INTRODUCTION

Numerous plants with medicinal properties are ingenious to mankind by nature, and numerous amounts of modern drugs have been produced on a large scale from these naturally known medicinal plants [1]. Different researches for compounds with antimicrobial activity have gained a significant increase in recent times; this is ascribable to the growing worldwide concern about the alarming rate of microorganisms resistant to antibiotics [2]. The need for various plants with medicinal properties for different use is consistently increasing, which leads to a developing interest in the use of various medicinal plants such as *Ricinus communis* (Castor oil plant) and *Calotropis procera* (Apple of Sodom).

Ricinus communis (Euphorbiaceae), which is commonly known as castor oil plant, is a soft wooden small tree developed throughout the tropics and warm temperate regions. This plant is known to be indigenous to the southeastern Mediterranean Basin, Eastern Africa, and India, it is also widespread throughout the tropical regions and is widely used as an ornamental plant [3]. *R. communis* has been reported to display various antimicrobial activities and has been used in the cure for different ailments [4]. *Calotropis procera* (Apple of Sodom) is a plant commonly dispersed throughout the tropics of Asia, Africa, and the Middle East. The plant is generally well-known owing to the abundance of latex in its green parts which is easily collected when the plant is injured [5]. Various reports from different literature have indicated many therapeutic activities of *C. procera* some of which include analgesic, anti-inflammatory, anti-diabetic, cytotoxic, anti-cancerous, and hepatoprotective effects [6].

Considering the treatment of antibiotic-resistant bacteria as a major problem, a vast number of plants with medicinal properties have been accepted as a useful source of natural antimicrobial compounds and as an alternative with the capacity to develop an effective treatment for these problematic bacterial infections. There is a dire need to find an alternative way of treating infectious diseases using

plants that possess medicinal properties and their extracts which are in abundance in our environment so that these plants can serve as a source of novel drugs for the cure of these ailments [7]. Various microorganisms are known to have caused different infections and have contributed to the prevalence of various diseases. The emergence of multidrug-resistant bacteria such as *Staphylococcus aureus, Escherichia coli* and *Klebsiella pneumonia* has increased rapidly. This has caused an increase in morbidity and mortality rates [8]. Therefore, the study of some plant extracts as a natural source of antimicrobials may lead to natural antimicrobials that will have the potential to hinder the growth of *Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae,* and *Escherichia coli* and also serve as a source of remedy in the treatment of diseases caused by these organisms. Such natural antimicrobials may also serve as an alternative to conventional drugs. Pathogenic microorganisms are known to be one of the main causes of high mortality in the world, where over 10 million people are estimated to die annually from severe diseases caused by these pathogens [9, 10]. The selection of the microorganisms for antibacterial analysis in this present study was based on their known pathogenic effects in both humans and animals. Hence, the purpose of this present study was to determine the antibacterial activity and the phytochemical constituents of the crude extract of *Ricinus communis* and *Calotropis procera* leave against four selected clinical isolates viz; *Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Escherichia coli.*

MATERIALS AND METHODS

Collection and identification of plant materials

The plant materials (Leaves) used for this research work, *Ricinus communis* and *Calotropis procera* were obtained in Ilorin, Kwara State, and the taxonomic authentication of the plant was carried out at the Department of Plant Biology (Herbarium section), University of Ilorin, Kwara State. The leaves were given voucher numbers: UILH/001/2020/1299 for *Ricinus communis* and UILH/002/2020/1001 for *Calotropis procera.*

Collection and maintenance of clinical isolates

The four clinical isolates used for the antibacterial efficacy test were *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*, and *Klebsiella pneumoniae.* They were obtained from the University of Ilorin Teaching Hospital (Medical Microbiology and Parasitology Department) and were transported to the Microbiology laboratory at the Department of Biosciences and Biotechnology, Faculty of Pure and Applied Sciences, Kwara State University, Malete, Kwara State where the research work was carried out. The isolates were kept on a nutrient agar slant in a McCartney bottle and refrigerated at 4^0C before use. The isolates were confirmed and further sub-culturing was carried out to make the isolates viable. The four isolates (*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*, and *Klebsiella pneumonia)* were sub-cultured into Nutrient broth at 37^0C to ensure they are at their exponential phase of growth prior to carrying out the antibacterial analysis.

Sample preparations

The plant samples,*Ricinus communis* and *Calotropis procera* (leaves) were rinsed with distilled water, and dried at 28 ± 2^0C for 2 weeks, and were grinded into a fine powder using mortar and pestle. The resulting powders were kept in a moisture-free, airtight container under 28 ± 2^0C before use.

Preparation of acetone extracts

One hundred and fifty (150 g) of each powdered leaves was added into 300 ml of 70% acetone in a 1000 ml conical flask. The flask was covered with cotton wool and then wrapped with aluminum foil and shaken vigorously at intervals of 5 hours for 48 hours at 28 ± 2^0C. After 48 hours, the crude extracts were filtered using a muslin cloth and finally filtered with Whatman no 1 filter paper. The filtrate was evaporated to dryness using a water bath at 45 ^{0}C. The dried extract was stored in an airtight sample bottle and kept in a refrigerator until it was required for use.

Preparation of aqueous extracts

One hundred and fifty (150 g) of each powdered leaves were added to 300 ml of distilled water into a 1000 ml conical flask. The flask was covered with cotton wool and then wrapped with aluminum foil and shaken vigorously at an interval of 5 hours for 48 hours at 28 ± 2^0C. After 48 hours, the crude extracts were filtered using a muslin cloth and finally with Whatman no. 1 filter paper. The filtrate was evaporated to dryness using a water bath at 50^0C. The dried extract was stored in an airtight sample bottle kept in a refrigerator until it was required for use.

Qualitative phytochemical screening of *Ricinus communis* and *Calotropis procera* (Acetone and Aqueous extracts)

The phytochemical constituents were carried out as reported [11] and phytochemicals determined were Tannins, Saponins, Alkaloids, Anthraquinone, Phenol, Cardiac Glycosides, Flavonoids, and Alkaloids

Reconstitution of the extracts

Each extract (acetone and aqueous) was reconstituted for the antibacterial screening. A well sterilized calibrated Pasteur pipette was used to introduce various concentrations; 100 mg/ml, 200 mg/ml, 300 mg/ml, and 400mg/ml of each extracts from their stock solutions of (500 mg/ml) into the wells bored on the surface of the culture. Each plate was allowed to

stand for one hour at 28 ± 2^0C to enable the diffusion of the substances. The plates were incubated at 37^0C for 24 hrs.

Identification of clinical isolates
The organisms were subjected to Gram Staining and various biochemical tests such as Catalase test, Indole test, Methyl red test, Coagulase test, Motility test, and Oxidase test to ascertain the true identity of the clinical isolates.

Standardization of the inoculum
The organisms were standardized using Mcfarland standard which is equivalent to 1.5 x10^8 cfu /ml [12]. The prepared standard was matched against bacterial suspensions in turbidity, to standardize them.

Antibacterial activity
The antibacterial activities of the crude extracts were determined using agar well diffusion method [13]. Fresh cultures were used and inocula were standardized as earlier explained. These bacterial cultures were standardized to 0.5 McFarland turbidity using saline solution. About one milliliter of each of the standardized inoculum from each clinical isolate was dispensed unto Mueller-Hinton agar. A sterile cork borer of 6 mm was employed to make six wells in the Mueller-Hinton agar and each well was sealed at the bottom with molten Mueller-Hinton agar to avoid seepage of the extract. About 0.5 ml of each concentration (100mg/ml, 200mg/ml, 300mg/ml, 400mg/ml, and 500mg/ml) of the extracts was added to corresponding labeled, distilled water and acetone were employed as negative control and Streptomycin was employed as the positive control. The experiment was carried out in duplicates. All plates were incubated at 37 ^{0}C for 24 hours inside an incubator. The Clear zones on all sides of the wells were noted and measured in millimeters [13].

Determination of Minimum Inhibitory Concentration (MIC)
The Minimum Inhibitory Concentration (MIC) of each extract was determined using the broth dilution technique. Based on the results from the antimicrobial sensitivity, a three-fold double dilution of each extracts was prepared. About 0.5 ml of various concentrations; 60, 70, 80, 90, 160, 170, 180, and 190 mg/ml of each extract was prepared and introduced into each test tube containing 9 ml of the nutrient broth. The test tube without extract served as the negative control. About 0.5 ml of the standardized inoculum for each test organism was inserted into each test tube containing broth and extract, and the tubes were incubated at 37 °C for 24 hours after which they were observed for growth. This was carried out by checking for turbidity after incubation. The least concentration of the extract that did not show any visible growth in the broth was recorded as the MIC. The MIC of both extracts was determined for each test organism [14].

Minimum Bactericidal Concentration (MBC)
About 1 ml of broth was taken from each tube with no visible growth in the MIC assay and was sub-cultured on a newly prepared nutrient agar plate, the plates were incubated at 37^0C for 24 hours. The MBC was seen as the minimum concentration of the extract that did not exhibit any growth on the plates [14].

Statistical analysis
The statistical analysis of the data obtained from the antimicrobial activities was carried out using a statistical package for social science (SPSS 25.0). Data were presented as mean ± standard error (SE). The difference between the control and treated samples of acetone and aqueous extract of *Ricinus communis* and *Calotropis procera* leaves was determined by one-way analysis of variance (ANOVA) test (Bonferroni multiple comparison tests). $P<0.05$ was regarded as statistically significant.

RESULTS

The qualitative phytochemical screening of acetone and aqueous extracts of *Ricinus communis* and *Calotropis procera* showed the presence of saponin, flavonoids, tannins, alkaloids, anthraquinone, and glycosides (Table 1). The quantitative analysis of phytochemical constituents of *Ricinus communis* leaf revealed that the percentage yield of flavonoids is 0.25%, alkaloids 2.0 %, tannin 1.20%, saponin 2.0%, and cardiac glycosides 3.83% while *Calotropis procera* leaf revealed that the percentage yield of flavonoids is 0.21%, alkaloids 1.0%, tannin 0.8%, saponin 1.0%, and cardiac glycosides to be 3.15% (Table 2).

According to Table 3, the acetone extract of both *Ricinus communis* and *Calotropis procera* had the highest antibacterial activity against *E. coli* with a diameter of zone of inhibition 15.50 ± 0.50 mm at 500 mg/ml concentration while the acetone extract of *Ricinus communis* had the lowest antibacterial activity against *P. aeruginosa* with a diameter of zone of inhibition 4.00 ± 0.50 mm at 100 mg/ml, and a diameter of zone of inhibition 4.50 ± 0.50 mm at 100 mg/ml for *Calotropis procera*.

Tables 4 shows that the aqueous extract of *Ricinus communis* had the highest antibacterial activity against *E. coli* with a diameter of zone of inhibition 15.00 ± 0.50 mm at 500 mg/ml concentration while aqueous extract of *Calotropis procera* had the highest antibacterial activity against *E. coli* with a diameter of zone of inhibition 14.00 ± 1.00 mm at 500 mg/ml concentration. The aqueous extract of *Ricinus communis* had the lowest antibacterial activity against *P. aeruginosa* with a diameter of zone of inhibition 4.5 ± 0.50 mm at 200 mg/ml and a diameter of zone of inhibition 5.00 ± 1.00

mm at 200 mg/ml against *K. pneumonia* for *Calotropis procera.*

Table 1: Qualitative phytochemical screening of *Ricinus communis and Calotropis procera* extracts phytochemicals

	R. communis		***C. procera***	
	Acetone	**Aqueous**	**Acetone**	**Aqueous**
Tannin	+	+	+	+
Saponin	-	+	+	+
Flavonoid	+	+	+	-
Alkaloid	+	-	+	+
Glycoside	+	+	-	-
Anthraquinone	+	+	-	+
Phenol	-	-	-	-
Terpenoid	-	-	-	-

KEY: (-) Absent, (+) Present

Table 2: Quantitative phytochemical screening of *Ricinus communis and Calotropis procera* leaves in percentage (%)

	Phytochemicals (%)				
Plant samples	**Flavonoid**	**Alkaloid**	**Tannin**	**Saponin**	**Glycoside**
R. communis	0.25 ±0.05	2.00±0.00	1.20±0.08	2.00±0.00	3.83±0.02
C. procera	0.21±0.01	1.00±0.00	0.80± 0.02	1.00±0.00	3.15±0.05

Values are means of two replicates ±SEM of quantitative phytochemicals of *Ricinus communis* and *Calotropis procera.*

Table 3: Antibacterial activities of acetone extracts of *Ricinus communis* and *Calotropis procera* leaves against selected clinical isolates

Clinical Isolates/ Diameter of zones of inhibition (mm)/Conc. of Extract											
	Ricinus communis					***Calotropis procera***					
(mg/ ml)	***E. coli***	***S. aureus***	***K. pneumonia***	***P. aeruginosa***	**Streptomycin**	**(mg/ ml)**	***E. coli***	***S. aureus***	***K. pneumonia***	***P. aeruginosa***	**Streptomycin**
100	7.00±1.0^{b}	10.80±0.0^{c}	6.00±0.5^{b}	4.00±0.5^{a}	10.50±0.5^{c}	100	8.50±0.5^{b}	7.50±0.5^{b}	_____	4.50±0.5^{a}	10.80±0.2^{c}
200	9.00±0.0^{b}	11.00±0.5^{c}	8.50±0.5^{b}	5.50±1.5^{a}	12.00±0.0^{c}	200	10.00±0.0^{c}	8.50±0.5^{b}	5.00±0.0^{a}	6.00±0.0^{a}	11.50±0.5^{c}
300	12.50±0.5^{c}	12.00±0.5^{c}	10.00±0.0^{b}	8.00±0.5^{a}	12.90±0.1^{c}	300	12.00±1.0^{c}	11.00±0.0^{b}	6.50±0.5^{a}	6.50±0.5^{a}	12.50±0.5^{c}
400	14.00±0.0^{c}	13.50±0.5^{b}	11.00±0.5^{b}	8.50±0.5^{a}	13.50±0.5^{c}	400	14.50±0.5^{c}	13.00±1.0^{b}	8.00±0.0^{a}	9.00±1.0^{a}	13.00±0.5^{b}
500	15.50±0.5^{c}	14.00±0.0^{c}	12.50±0.5^{b}	11.50±0.5^{a}	16.00±0.0^{c}	500	15.50±0.5^{c}	14.50±0.5^{b}	10.50±0.5^{a}	10.50±0.5^{a}	14.50±0.5^{b}

KEY: (-) = No Zone of Inhibition

Values are means of two replicates ±SEM of zone of inhibition. Values with different superscripts on the same row are statistically different at P<0

Table 4: Antibacterial activities of aqueous extract of *Ricinus communis* and *Calotropis procera* leaves against selected clinical isolates

Clinical Isolates/ Diameter of zones of inhibition (mm)/Conc. of Extract											
Ricinus communis						***Calotropis procera***					
(mg/ ml)	***E. coli***	***S. aureus***	***K. pneumonia***	***P. aeruginosa***	**Streptomycin**	**(mg/ ml)**	***E. coli***	***S. aureus***	***K. pneumoniae***	***P. aeruginosa***	**Streptomycin**
100	6.50±0.5^{b}	8.00±0.0c	5.00±0.0^{a}	_____	9.00±0.5^{c}	100	9.00±1.0^{b}	7.00±1.0^{a}	_____	_____	9.50±0.5^{b}
200	9.00±1.0^{b}	8.00±1.0^{b}	5.00±1.0^{a}	4.50±0.5^{a}	11.50±0.5^{c}	200	10.50±0.5^{c}	10.00±1.0^{c}	5.00±1.0^{a}	7.50±0.5^{b}	11.00±0.0^{c}
300	10.00±0.5^{b}	11.00±0.0^{c}	9.50±0.5^{b}	6.50±0.5^{a}	12.00±0.0^{c}	300	11.00±1.0^{c}	9.00±1.0^{b}	9.50±0.5^{b}	8.00±0.5^{a}	12.80±0.2^{c}
400	11.50±0.5^{b}	12.00±0.0^{b}	11.50±0.0^{b}	8.00±0.0^{a}	13.50±0.5^{c}	400	12.00±1.0^{c}	10.50±0.5^{b}	11.50±0.5^{b}	9.50±0.5^{a}	13.00±0.5^{c}
500	15.00±0.5^{c}	13.00±0.5^{b}	14.00±0.5^{b}	10.50±0.5^{a}	15.50±0.5^{c}	500	14.00±1.0^{c}	12.50±0.5^{b}	14.50±0.5^{c}	11.50±0^{a}	15.00±0.0^{c}

KEY: (-) = No Zone of Inhibition

Values are means of two replicates ±SEM of zone of inhibition. Values with different superscripts on the same row are statistically different at P<0

Table 5: Minimum Inhibitory Concentration and Minimum Bactericidal Concentration of the leaves extracts of *Ricinus communis* and *Calotropis procera* against selected clinical isolates

Minimum Inhibitory Concentration (MIC) (mg/ml)					**Minimum Bactericidal Concentration (MBC) (mg/ml)**				
	***R. communis* extract**		***C. procera* extract**			***R. communis* extract**		***C. procera* extract**	
Clinical Isolates	**Acetone**	**Aqueous**	**Acetone**	**Aqueous**	**Clinical Isolates**	**Acetone**	**Aqueous**	**Acetone**	**Aqueous**
S. aureus	60	60	60	70	*S. aureus*	70	80	70	60
E. coli	60	60	60	60	*E. coli*	60	60	70	70
*K.pneumonia*e	70	80	180	170	*K. pneumonia*e	80	-	-	180
P. aeruginosa	80	170	80	160	*P.aeruginosa*	-	180	90	170

KEY: (-) = No MBC

DISCUSSION

The present study shows that the phytochemical components of *C. procera* and *R. communis* are good plants for medicinal purposes. Various phytochemicals have been found to maintain an extensive array of activities, which may be useful in the protection against recurrent disease [15]. Many plants with medicinal properties are known to be likely antimicrobial unrefined drugs as well as a pedigree for the different compounds with antimicrobial activity with likely new modes of action [16]. Various parts of medicinal plants like the leaves, flowers, fruits, roots, and the bark extract, infusion, decoctions, and powders have proven useful in curing a wide range of health-related issues [17]. Owing to the antimicrobial activities of both *C. procera* and *R. communis* extracts, they can be used to effectively cure diseases that could be manifested by the human pathogenic bacteria [14]. The qualitative phytochemical screening of the leaves extract of both *Calotropis procera* and *Ricinus communis* indicates the presence of tannins, saponins, alkaloids, flavonoids, glycoside, and Anthraquinone. This is similar to a result conducted where the phytochemical leaves extract showed the presence of saponin, tanins, alkaloids, flavonoids, glycoside, anthraquinones and glycosides [5, 14, 18, 19]. There is presence of Glycoside in the acetone and aqueous extract of *R. communis* while it was absent in *C. procera* extract, there is also presence of saponin in the aqueous and acetone extract of *C. procera* while there is absence of saponin in the aqueous extract of *R. communis*. Alkaloid is absent in the aqueous extract of *R. communis* and Anthraquinone is also absent in the acetone extract of *C. procera*.

The quantitative study of phytochemical components of *C. procera* and *R. communis* revealed that the percentage yield of glycoside was the highest in both extracts while the least percentage yield was observed in flavonoids. The use of acetone and aqueous leaves extract of *R. communis* and *C. procera* had a significant antibacterial effect on the clinical isolates. Both acetone and aqueous solvent used as extractants are polar solvents and it has been documented that, polar solvents exhibit the highest number of bioactive compounds and extract yields are comparatively higher than in non-polar solvent [20]. However, the acetone leaves extract of the plant sample had a greater antibacterial effect [21, 22]. The result of the present study indicated that the acetone leaves extracts were found to have significant antibacterial effects against some of the clinical isolates, except for acetone leaf extract of *C. procera* which showed no zone of inhibition against *Klebsiella pneumonia*e. The result indicates that acetone leaves extract of both *R. communis* and *C. procera* possess antibacterial bioactivities on both grams positive and gram-negative organisms, while the aqueous leaves extract of both *R. communis* and *C. procera* were also found to be very effective against all the clinical isolates except for aqueous extracts of *R. communis* against *Pseudomonas aeruginosa* and aqueous extracts of *C. procera* against *Klebsiella pneumonia* and *Pseudomonas aeruginosa* respectively.

To a certain degree, low activity of *C. procera* and *R. communis* leaves extract against *P. aeruginosa* may be justified by some earlier reports that *Pseudomonas species* exhibited strong resistance against a host of antibiotics including plant extracts [23]. It should be pointed out that though both acetone and aqueous extracts exhibited a various degree of inhibition which indicates that the solvent system plays an important role in the solubility of the bioactive component and influence the antibacterial activity. However, both zones of inhibition for acetone and aqueous were low when compared with standard drug (streptomycin). The highest activity was recorded with streptomycin in both extracts; this is because the drug (streptomycin) is in a pure state and a standard antibiotic. The results revealed that for both acetone and aqueous leaves extract for *R. communis* and *C. procera* showed that the inhibitory effect on *E. coli* was significantly higher, while *Staphylococcus aureus* was slightly higher at ($P<0.05$) than that exhibited by *Klebsiella pneumonia* and *Pseudomonas aeruginosa* at lowest concentrations. Similar research carried out by Shetty *et al*. and Tajamul *et al*. [21, 24] which worked on *R. communis* and *C. procera* where antibacterial activity of *R. communis* and *C. procera* leaves extract was tested against *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Pseudomonas aeruginosa* and the result indicated that the acetone extracts of both *R. communis* and *C. procera* were more effective than the aqueous extracts.

The basic criterion for the determination of antimicrobial agents that possess a potential for antimicrobial is the minimum inhibitory concentration (MIC).The minimum inhibitory concentration (MIC) for both acetone and aqueous leaves extracts of *R. communis* and *C. procera* for *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa* was also carried out as presented in the table above. The Minimum inhibitory concentration (MIC) of *R. communis* extracts inhibits the growth of bacterial pathogens in the lowest concentration when compared to *C. procera* extracts. [14, 22]. The Minimum bactericidal concentration (MBC) against *E. coli* was 60 mg/ml for both the acetone and aqueous extracts of *R. communis* while it was 70 mg/ml for both *C. procera* extracts, the MBC against *S. aureus* for both extracts of *R. communis* ranges from 70 to 80 while it ranges from 60 to 70 for both extracts of *C. procera*, while there was no MBC for the aqueous extract of *R. communis* and acetone extract of *C. procera* against *K. pneumoniae*, and there was no MBC against *P. aeruginosa* for the acetone extract of *R. communis*

CONCLUSION

The present study highlights the antibacterial potentials of both *C. procera* and *R. communis.* Both plants possess the following bioactive constituents; glycosides, saponin, tannins, flavonoids, anthraquinone, and alkaloids which makes them valuable antimicrobials. The antibacterial activities against the selected isolates reveal the broad spectrum and antibacterial properties of different compounds found in the leaves extracts of both *C. procera* and *R. communis*. The expression of antibacterial activities against the selected clinical isolates is an indication that both *C. procera* and *R. communis* possess compounds with antibacterial properties and are a potential source of antibacterial agents which can be employed for the production of drugs to cure several ailments.

AUTHORS' CONTRIBUTIONS

Conceptualization; (A.E., S.K. and R.A.) Data curation; (S.K.) Formal analysis; (R.A.) Investigation; (A.E. and S.K.) Methodology; (A.E., S.K. and R.A.) Project administration; (A.E.) Resources; (S.K.) Software; (S.K. and R.A.) Supervision; (A.E.) Validation; (A.E. and S.K.) Visualization; (A.E., S.K., and R.A.) Writing - original draft; (S.K.) Writing - review and editing; (A.E., S.K. and R.A.). All authors read and approved the final manuscripts.

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