Scholars Academic Journal of Biosciences (SAJB) **ISSN 2321-6883 (Online)**
Sch. Acad. J. Biosci., 2014; 2(10): 663-670 **ISSN 2347-9515 (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com **DOI:** 10.36347/sajb.2014.v02i10.001

Research Article

Triphytochemistry and *in vitro* antibacterial activity of root extracts *Cochlospermum planchonii* Hook f. ex. Planch (Cochlospermaceae) on multireristant strains.

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Abstract: *Cochlospermum planchonii* is a food, medicinal and dye plant known in Ivory Coast under the common name "Kpôlorgô" in Sénoufo. It is widely used in traditional medicine in areas of sub-Saharan savannahs Ivorian and West African. The aim of our study was to evaluate the antibacterial four root extracts of this plant obtained by the method of successive solvent extraction with increasing polarity: dichloromethane, ethyl acetate, ethanol 96%, and water. It is performed on three reference strains including *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853 and six resistant clinical strains including *Staphylococcus aureus* methicillin-R (MRSA), *Pseudomonas aeruginosa* imipenem-Intermediate, *Escherichia coli* (ESBL), *Salmonella Typhi* (ESBL) *Klebsiella pneumoniae* (ESBL) and *Enterobacter cloacae* (ESBL).The method of wells in the agar was used to test the sensitivity of bacterial strains while the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were determined by the method of broth dilution. The dichloromethane and aqueous extracts did not give significant inhibition diameters. As against, the ethanolic and acétatic extracts gave inhibition diameters between 8 and 21 mm on the strains tested. Furthermore, the latter showed bactericidal power on all these tested strains and especially on *S. aureus* methicillin-R, *Pseudomonas aeruginosa* Imp-I, *S tyhi* (ESBL) with MIC and MBC ranging from 6.25 and 50 mg / mL. The phytochemical analysis of root extracts *Cochlospermum planchonii* showed the presence of polyphenols, flavonoids, tannins, alkaloids, sterols and carotenoids and polyterpenes. The sensitivity of the bacteria tested justifies the use of this plant in traditional community to combat diseases in which the tested bacteria are involved including infections associated with cough and diarrhea.
Keywords: *Cochlospermum planchonii*, Triphytochemistry, Antibacterial activity, Multireristant strains.

INTRODUCTION

During recent decades, the spread of multirésistant bacteria to antibiotics in the world has had a detrimental impact on the health of the population [18]. Multi-drug resistance puts modern medicine in a therapeutic impasse. It concerns both the bacteria causing community-acquired infections as nosocomial infections [36]. These multiresistant bacteria can also come from biologic product patients who underwent first-line antibiotic misuse and often inappropriate [5]. Among all these multireristant bacteria, methicillin-resistant *Staphylococcus aureus* (MRSA) and producing enterobacteria beta-lactamases extended spectrum (ESBL) greatest concern because of their pathogenicity [33]. This situation has worsened with the advent of HIV / AIDS which causes various opportunistic infections due to deficiency of the immune system. With the emergence and re-emergence of certain diseases due to the resistance of some microorganisms, the use of natural products, including medicinal plants as potential sources of new molecules is fully justified.

Cochlospermum planchonii, savannah shrub of sub-Saharan West Africa is traditionally used in Ivory Coast against diarrhea, cough, malaria and rinderpest [4, 27, 28]. Some countries in West Africa used it to treat malaria, fever, jaundice, jaundice, intestinal pain and stomach, worms, infertility, invoices and hepatobiliary disorders [2, 3, 16, 24, 14, 29].

In addition, some scientific studies have demonstrated its effectiveness against diarrhea [22], stomach disorders, typhoid fever, urinary tract infections [34], malaria [11, 12], trypanosomiasis [8, 9]; Hepatitis 6], diabetes [37], hyperglycemia [7, 30], infertility [1] and against certain bacteria from the leaves and the essential oil of the roots of the plant [25, 31]. In the present work, we determined the chemical component of four roots extracts *Cochlospermum planchonii* which may have antibacterial activity on some multireristant strains.

MATERIALS AND METHODS

Plant material

Some fresh plant roots *Cochlospermum planchonii* were harvested in September 2012 in the north of Côte d'Ivoire precisely near the village of Kapissorivogo, located at about 3 km from the city of Ferkessédougou. After harvesting, the plant was identified by Professor Ake-Assi Laurent of the National Center Floristic (CNF) from the University of Cocody Felix Houphouet-Boigny where one specimen is deposited under the number 14643 of Cochlospermaceae's family.

Microorganisms

Bacterial media used in this study consists of six resistant strains namely *Escherichia coli* producing beta-lactamase (ESBL), *Salmonella typhi* (ESBL), *Kblebsiella pneumoniae* (ESBL), *Enterobacter cloacae* (ESBL); Methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa* imipenem-Intermediate isolated from pathological products and three reference strains which were *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923), *Pseudomonas aeruginosa* (ATCC 27853). These bacterial organisms are from the strain bank Unit Antibiotics Natural Substances and Monitoring Microorganisms for Anti-Infective (ASSURMI) of the Department of Bacteriology and Virology of the Pasteur Institute in Ivory Coast (IPCI).

Preparation of plant extracts

Cochlospermum planchonii roots are harvested, cleaned, cut, dried out of the sun for two weeks and made into powder using a grinder IKAMAG kind. The preparation of the plant extracts was performed by the method of successive extraction increasing polarity solvents described by Diallo and *al*., [19]. We used successively four solvents: dichloromethane, ethyl acetate, ethanol 96 % and water. Two hundred and fifty grams (250g) of plant powder is soaked in 2 L of dichloromethane for 24 h under a magnetic stirrer type IKAMAG-RCT. The homogenate obtained is filtered successively with a clean cloth, twice on cotton wool and once on the Whatman paper n°2. The dichloromethane filtrate was distilled under vacuum on a rotary evaporator Heidolph -type temperature of 40 ° C to give the Dichloromethane Extract (EDCm). Then the same operation is repeated successively dried at room temperature with marc respectively 2 L of ethyl acetate, 2 L of 96 % ethanol and 2 L of distilled water in this order giving Acetatic Extract (EACe), 96% Ethanol Extract (EEth 96 %) and Aqueous Extract (EAq). The organic solutions were evaporated previous extracts respectively at 43 ° C and 45 ° C. While the aqueous solution is deshydrated using a type P SELECTA oven at 50 ° C. Yields are calculated in each extraction. (Table1)

Preparation of bacterial inoculum

Two isolated colonies from each bacterial culture for 18 hours were homogenized in 10 mL of Muller-Hinton broth and incubated for 3 hours at 37°C for preculture. A levy of 0.1 mL of the preculture broth was diluted in a tube containing 10 mL of Mueller-Hinton (MH). This bacterial suspension was made consisting of 10^0 dilution of bacterial inoculum so as to obtain a bacterial load estimated to 10^6 Unit Format colonies per milliliter (CFU / mL).

Preparation of extracts concentration ranges

A range of concentration of each extract was prepared with a series of ten vice tubes through the method of double dilution an in medium liquid. This range of concentration is 200 mg / mL to 0.39 mg / mL numbered T1 to T10. For this, 10 mL of a mixture solution of DMSO / sterile distilled water (V / V) were placed in the tubes T1 and 5mL in all the other tubes. Two grams (2g) of each extract were dissolved in the tubes T1 to obtain a concentration of 200 mg / mL. A 5mL volume of the tubes T1 was transferred into the tubes T2 and then homogenized. This operation was repeated until T10 tubes where 5 mL of T10 tubes are rejected. All tubes are kept refrigerated at 4 °C.

Determination of growth inhibition zones

The method of holes punch in the MH agar described by Konan et *al.*, [26] has been accepted. Each pit or holes of 6 mm diameter was filled with 80 µL of extract concentrations of 200 and 100 mg / mL, taking care to separate two holes of at least 20 mm. A negative control wells was performed for each bacterial strain with 80 µL of the mixture of DMSO / sterile distilled water solution (V / V). After a pre-release of 45 minutes at laboratory temperature to 16 ° C, all the Petri dishes were incubated in an incubator at 37 ° C for 18-24h. Meanwhile, Ceftriaxone (CRO 30µg) for Enterobacteriaceae and oxacillin (OX 5µg) for staphylococci were used as positive controls. After incubation, the activities of the extracts were assessed by measurement of a growth inhibition area around the wells using a caliper. According to Ponce et *al*., [32], a strain is called insensitive or resistant, sensitive and very sensitive if the diameters of inhibition are respectively less than 8 mm, between 9 and 14 mm and between 15 and 19 mm.

Determination of Minimum Inhibitory Concentration (MIC)

The macro dilution method in liquid medium described by Dosso and Faye-Kette, [21]was used to determine these antimicrobials parameters. Thus, in a series of 10 hemolysis tubes numbered C1 to C10 for each extract was introduced 1 mL of the bacterial inoculum. Then 1 mL of each extract concentration well known by the range of prepared concentration was added in the same tubes. This distribution of plant extract is made so that 1 ml of plant extract of 200 mg / mL was transferred in the tube C1, that of 100 mg / mL in the tube so C2 to C9 tube receive 1mL plant extract of 0.78 mg / mL. C10 has been tube, received instead of plant extract, 1 mL of DMSO / Sterile distilled water (V / V), was used as a control. This distribution of plant extract concentration is well known in each tube already containing 1 mL of inoculum reduced the concentration of plant extract in medium at its half. Tube and the concentration of C1 increased from 200 mg / mL to 100 mg / mL. 100 mg / mL to 50 mg / mL for C2 so on until a concentration of 0.39 mg / mL for T9. This experiment was performed identically for each sample tested. The first nine (9) tubes (C1 to C9) are called "experimental tubes" and the last tube (C10) is rated "growth control tube or TC." The loaded tubes were incubated at 37 ° C for 24 h. The MIC is the concentration of the first tube where it finds no trouble visible to the naked eye.

Determination of Minimum Bactericidal Concentration (MBC)

From the MIC, the lowest concentration that leaves no more than 0.01% survival of bacteria suspended starting 24 hours corresponds to the CMB. It is determined by plating by a streak on Mueller-Hinton agar by streaking 5 cm using a loop, beginning with the first and incubated undisturbed at 37 ° C for 24 h tube.

Antibacterial activity of the extracts tested

The antibacterial effect of different extracts tested was considered bactericidal or bacteriostatic depending on the MBC / MIC ratio. According Berche et *al*., [13], when this ratio is greater than 4, the extract has bacteriostatic and bactericidal, if the ratio is less than or equal to 4.

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Phytochemical screening

Phytochemical tests for tannins, polyphenols, flavonoids, alkaloids, sterols, polyterpenes, saponins and carotenoids were conducted according to the methods described by Touré et *al.*, [35].

Test for sterols and polyterpenes (reaction LIEBERMANN)

After evaporation to dryness 5mL of each solution in a capsule on a sand bath without charring, the residue was dissolved in hot acetic anhydride and 1 mL in a test tube, we poured cautiously with 0.5 mL of concentrated sulfuric acid along the tube wall to the solution. The applications to the interphase of a purple or purple ring, turning blue to green, indicate a positive reaction.

Test for alkaloids (reactions Dragendorff and Bouchardat)

Six milliliters of plant extract were evaporated. The residue was taken up in six milliliters of alcohol at 60 ° and the alcoholic solution thus obtained was divided into two test tubes.

In the first tube was added two drops of Dragendorff reagent. The appearance of a precipitate or an orange color indicated the presence of alkaloids.

In the second tube was added two drops of reagent Bouchardat. The appearance of a reddish brown color indicated a positive reaction to the presence of alkaloids.

Test for polyphenols

Two milliliter of extract was added a drop of alcoholic solution of ferric chloride at 2%. The appearance of a dark green or lighter or darker blue color indicated the presence of polyphenolic derivatives.

Test for flavonoids

For this research, two milliliter of the extract was evaporated to dryness in a porcelain dish on a sand bath. The residue was taken after cooling in five milliliter hydrochloric alcohol half. The successive addition of three magnesium shavings and three drops of isoamylic alcohol showed an intense pink or violet in the presence of flavonoids[17].

Test for saponosides

A volume of two milliliters of each extract was evaporated and taken up in five milliliters of water. After vigorous stirring, the foaming of more than one centimeter, stable and persistent high for 30 minutes indicated the presence of saponins.

Test for catechol or condensed tannins (reaction Stiasny)

A volume of five milliliter of each extract was evaporated and an amount of 10 ml of a reagent solution Stiasny was added to the residue. This mixture was placed in a water bath at 80 ° C for 30 minutes and was cooled to room temperature. Positive feedback had resulted in the formation of large flakes brown clear or dirty precipitates.

Test for Gallic tannins

The above solution was saturated and one or two drops of alcoholic solution of iron chloride to 2 % have been added. The positive response has led to the appearance of blue-black coloration characteristic intense tannins Gallic.

Test for carotenoids

After evaporation to dryness of 5 ml of the extract was added 2 to 3 drops of a saturated antimony trichloride in chloroform solution. It grows in the presence of a carotenoids blue coloration thereafter becoming red.

RESULTS AND DISCUSSION

Table 1 shows the extraction yields of different solvents used. Dichloromethane extract has the highest yield with 11.40%, followed by the aqueous extract with 6.96% of the extract then acetatic extract with 5.05% and finally the ethanolic extract with 4.48%. These yields depend on the extracting power of the solvent and the content of chemical compounds. Tables 3 and 4 shows the values of the diameters of the zones of inhibition of growth of bacteria tested. With the exception of the aqueous extract and the dichloromethane extract, it seems that the ethanol and Acetatic extracts has a well-defined activity on the growth of all organisms studied. The inhibition diameters are between 10 and 21 mm for the ethanol extract and between 10 to 19 mm for the Acetatic extract. These diameters are comparable to those obtained by Konan and *al*., [26] on clinical isolates of producing beta-lactam with total extracts of *Terminalia glaucescens* Planch Ex Benth used in the treatment of various infections.

However, only *Staphylococcus aureus* ATCC is sensitive with the dichloromethane extract and the aqueous extract at 200 mg / mL. This could be explained by the presence of flavonoids, essential oils and triterpenes. According Franchomme and Pénoël et *al*. [23], *Staphylococcus aureus* is sensitive in touch essential oils rich in phenols and monoterpénols. Because the effect of terpenoids on isolated bacterial membranes suggests that their activity depends of lipophilic properties, terpen constituents, and the nature of the functional groups, their solubility in aqueous phase and the stereochemistry of the molecule[20]. These results have been demonstrated by Ouattara and *al*.,[31] which have shown that the sensitivity of certain bacterial strains in the presence of the essential oil of the roots of the same plant.

According Ponce and *al*., [32], a sample is considered as active if it induced inhibition area high or equal to 10 mm. Thus, against the tested seeds to 200 mg / mL, the 96 % ethanolic extracts and Acetatic are proved active on all the strains investigated. However at 100 mg / mL, the strains of *Enterobacter cloacae* (ESBL), *Klebsiella pneumoniae* (ESBL) and *Escherichia coli* (ESBL) are resistant with zone inferior to 10 mm inhibition.

The 96% ethanolic and acetatic extracts were more active compared to aqueous, dichloromethane extracts and antibiotics namely ceftriaxone (30 µg) and oxacillin (5 µg) for which the inhibition zones observed are less than or comparable to the diameters of inhibition zones of our extracts.

The values of the antibacterial parameters (MIC and MBC) and those of the MBC / MIC ratios determined are given in Table 5. According to the analysis of these results that MIC values are consistent with those of the diameters of inhibition zones growth. Indeed, the extracts having a larger diameter induces inhibition exhibited smaller MIC values on the corresponding bacterial strains.

This is the case of the 96% ethanolic extract on the strain of *Staphylococcus aureus* methicillin-R with a MIC = 12.50 mg / mL to 16 mm zone of inhibition, on the strain of *P. aeruginosa* IMIP -I to MIC = 25 mg / mL for 15 mm or the case of the Acetatic extract on *Staphylococcus aureus* ATCC with MIC = 6.25 mg / mL for 21 mm for and *Salmonella typhi* ESBL with MIC = 25 mg / mL to 13 mm. Furthermore, it should be noted that on *Staphylococcus aureus* methicillin-R, the inhibitory effect of the ethanolic extract and that of the Acetatic extract are equivalent with MIC = 6.25 mg / mL to 16 mm inhibition diameter.

Overall, the greatest sensitivity is observed in the presence of Acetatic and ethanolic extracts against strains of *S. aureus, S. typhi* and *P. aeruginosa* as well as sensitive and resistant than producing beta-lactamas. Our results compared to those of Isah and *al*., [25] support the activities of ethanolic and Acetatic extracts of *C. planchonii* Hook f. ex. Planch. Because according to the author, the methanol extract of leaves of *C. planchonii* (Nigerian species) on *S.aureus, S. typhi* and *P. aeruginosa* have respectively inhibition diameters of the order of 22, 25 and 19 mm to the concentration of 80 mg / mL.

Moreover, we have to remark that the antimicrobial activities of the secondary metabolites of the plants depend on many factors including the origin of the extracts, the extraction methods, the solvent nature, the concentration of the active compound, the nature of the applicator tests as well as tested strains [15].

Whereas, the CMB / MIC ratio was determined bactericidal or bacteriostatic power of different extracts. According Berche and *al.*, [13], when this ratio is less than or equal to 4, the extract has a bactericidal and bacteriostatic, when this ratio is greater than 4. Thus, we can say that with the exception of the aqueous and dichloromethane extract for which power could be determined up to 100 mg / mL, the other two extracts exerted bactericidal effects against all bacterial strains tested.

The antibacterial activities are explained by the observed results of the phytochemical analysis extracts studied (Table 2) which showed the presence of

compounds such as polyphenols, flavonoids, tannins, alkaloids, sterols-polyterpenes and carotenoids. The antimicrobial activity of most of these compounds including flavonoids, tannins, alkaloids and terpenes present in the majority of acetatic and ethanolic extracts was already demonstrated by several researchers [38]. According Ybert [38], the tannins help to fight against infections.

A high concentration of these compounds was detected in ethanolic and Acetatic extracts justifying so the most important activities of these extracts compared to aqueous and dichloromethane extracts. From this result, it can be deduced that, unlike water and dichloromethane, ethyl acetate and ethanol are solvents that provide a better extraction of compounds with anti-microbial properties like those identified in the corresponding previews.

This statement could also justify the fact that the aqueous extracts and dichloromethane had no bactericidal effect on strains tested up to 100 mg / mL because for this concentration; these solvents could not really extract and concentrate the active ingredients of the plant.

Furthermore, the sensitivity of these pathogenic strains to the *Cochlospermum planchonii* extract studied is of great importance, because these strains are highly resistant to antibiotics used in clinical practice. In addition, the concentrations to which these extracts remain active lead us to affirm that this plant could be used against various infections including diarrhea and cough.

Table 1: Full capacity of extraction

Extract	weight (g)	capacity(%) with regard to initial of powder	Colors and Aspects
EDcm	28.40	11.40	Orange (oiled)
EAce	12.70	05.05	Yellow (oiled)
EEth 96%	11.20	04.48	Brown (a bit sticky)
EAq	17.40	06.96	black

Table 2: Phytochemical analysis of *Cochlospermum planchonii* roots extracts

EXTRACTS	Alcal. D	Alcal. M	Anth.	Carot	Flavo.	Poly.	Quin.	Sapo.	Tanins Gal	Tanins Cat	Sterol and Polyterp.
EDcm	+	-	-	++	++	++	-	-	+	+	+++
EAce	+	-	-	+++	+++	+++	-	-	++	++	+++
EEth 96%	++	+	-	+	+	+++	-	+	+++	+	++
EAq	+	++	-	+	+	+	-	+++	+	+	+

- : Absence +: Presence ++ means + + +: abundant.

***Alcalá** : Alcaloide ; **D**: Dragendorff 's ; **M**: Mayer ; **Anth** : Anthocyanin ; **Carot** : Carotenoid ; **Flav** : flavonoids ; **Poly** : polyphenol; **Quin** : quinone ; **sapo** : saponins ; **Tan cat**: catechol tannins ; **Tan gal**: gallic tannins ; **Sterol and polyterp** : sterols and polyterpenes **; EDCm** : Dichloromethane extract **; EACe** : Extract Acetatic **; EEth 96%** : 96% Ethanol Extract, **EAq** : Aqueous Extract*

Table 3: Inhibition diameter (mm) of *Cochlospermum planchonii* roof extract against bacterial strain *at* 200 mg / mL (n=3)

Strains	Vegetable extracts (200 mg / mL) EDCm	EACe	EEth	EAq	T=0,0	Antibiotics CRO	OXA
E. coli ESBL	06 ± 0,0	11 ± 0,9	10 ± 0,9	06 ± 0,0	06 ± 0,0	10	-
S. typhi ESBL	08 ± 0,0	14 ± 0,6	13 ± 0,6	06 ± 0,0	06 ± 0,0	07	-
K. pneumoniae ESBL	06 ± 0,0	10 ± 0,3	11 ± 0,3	06 ± 0,0	06 ± 0,0	06	-
E. cloacae ESBL	06 ± 0,0	11 ± 1,3	10 ± 0,6	06 ± 0,0	06 ± 0,0	07	-
S. aureus Meti-R	09 ± 0,0	16 ± 0,3	16 ± 0,3	06 ± 0,0	06 ± 0,0	-	06
P. aeruginosa IMP-I	06 ± 0,0	15 ± 0,3	14 ± 0,3	06 ± 0,0	06 ± 0,0	15	-
S. aureus ATCC	10 ± 1,0	19 ± 0,3	21 ± 0,3	10 ± 1,3	06 ± 0,0	-	24
E. coli ATCC	06 ± 0,0	15 ± 1,0	12 ± 0,3	06 ± 0,0	06 ± 0,0	30	-
P. aeruginosa ATCC	06 ± 0,0	17 ± 0,6	16 ± 1,9	06 ± 0,0	06 ±0,0	22	-

***T = 0:** Including Control = the diameter of the wells (6mm) with DMSO / water (0.5: 0.5, V/V); **CRO**: Ceftriaxone (30µg), **OXA**: oxacillin (5µg); **Meti-R**: Methicillin -resistant; **IMIP -I**: Intermediate imipenem; **ESBL**: extended spectrum beta-lactamase*

Table 4: Inhibition diameters (mm) of *Cochlospermum planchonii* roof extract against bacterial strain *at* 100 mg / mL (n=3)

Strains		Vegetable extracts (100 mg / mL)				Antibiotics	
	EDCm	**EACe**	**EEth**	**EAq**	**T=0,0**	**CRO**	**OX**
E. coli ESBL	06 ± 0,0	10 ± 0,6	08 ± 0,6	06 ± 0,0	06 ± 0,0	10	-
S. typhi ESBL	06 ± 0,0	12 ± 0,3	11 ± 0,6	06 ± 0,0	06 ± 0,0	07	-
K. pneumoniae ESBL	06 ± 0,0	08 ± 0,3	08 ± 0,9	06 ± 0,0	06 ± 0,0	06	-
E. cloacae ESBL	06 ± 0,0	09 ± 0,6	06 ± 0,3	06 ± 0,0	06 ± 0,0	07	-
S. aureus Meti-R	06 ± 0,0	14 ± 0,6	13 ± 0,3	06 ± 0,0	06 ± 0,0	-	06
P. aeruginosa IMP-I	06 ± 0,0	13 ± 0,3	13 ± 0,6	06 ± 0,0	06 ± 0,0	15	-
S. aureus ATCC	08 ± 0,3	15 ± 0,6	19 ± 0,9	08 ± 0,0	06 ± 0,0	-	24
E. coli ATCC	06 ± 0,0	13 ± 1,3	11 ± 0,3	06 ± 0,0	06 ± 0,0	30	-
P. aeruginosa ATCC	06 ± 0,0	15 ± 1.6	13 ± 0,9	06 ± 0,0	06 ±0,0	22	-

T = 0: *Including Control = the diameter of the wells (6mm) with DMSO / water (0.5: 0.5, V/V);* ***CRO****: Ceftriaxone (30µg),* ***OXA****: oxacillin (5µg);* ***Meti-R****: Methicillin -resistant;* ***IMIP -I****: Intermediate imipenem;* ***ESBL****: extended spectrum beta-lactamase.*

Table5: Antibacterial parameters compared of *Cochlospermum planchonii root extracts* on the growth *in vitro* of tested germs.

Strains		Antibacterial parameters (mg/mL)			
	Extracts	**MIC**	**MBC**	**MBC/MIC**	**Bacterial power**
E. coli BLSE	EDcm	>100	>100	-	-
	EAce	50	50	1	bactericidal
	EEth 96%	50	50	1	bactericidal
	Eaq	>100	>100	-	-
S. typhi BLSE	EDcm	>100	>100	-	-
	EAce	25	25	1	bactericidal
	EEth 96%	25	25	1	bactericidal
	Eaq	>100	>100	-	-
K. pneumoniae BLSE	EDcm	>100	>100	-	-
	EAce	50	50	1	bactericidal
	EEth 96%	50	100	2	bactericidal
	Eaq	>100	>100	-	-
E. cloacae BLSE	EDcm	>100	>100	-	-
	EAce	50	100	2	Bactericide
	EEth 96%	50	100	2	Bactericide
	Eaq	>100	>100	-	-
S. aureus Méti-R	EDcm	>100	>100	-	-
	EAce	12,5	50	4	bactericidal
	EEth 96%	12,5	50	4	bactericidal
	Eaq	>100	>100	-	-
P. aeruginosa IMP-I	EDcm	>100	>100	-	-
	EAce	25	25	1	bactericidal
	EEth 96%	12,5	25	2	bactericidal
	Eaq	>100	>100	-	-
S. aureus ATCC	EDcm	100	100	1	bactericidal
	EAce	6,25	12,5	2	bactericidal
	EEth 96%	6,25	12,5	2	bactericidal
	Eaq	100	>100	-	-
E. coli ATCC	EDcm	>100	>100	-	-
	EAce	25	25	1	bactericidal
	EEth 96%	25	25	1	bactericidal
	Eaq	>100	>100	-	-
P. aeruginosa ATCC	EDcm	>100	>100	-	-
	EAce	6,25	12,5	2	bactericidal
	EEth 96%	12,5	12,5	1	bactericidal
	Eaq	>100	>100	-	-

MIC: Minimum Inhibitory Concentration; **CMB**: Minimum Bactericidal Concentration
EDCm: dichloromethane extract; **EACe**: Extract Acetatic; **EEth 96%**: 96% ethanol extract; **EAq**: Aqueous Extract

CONCLUSION

This work has allowed us to highlight the antibacterial properties of root extracts *C. planchonii* on bacterial resistance, producing beta-lactamase extended-spectrum and reference strains involved in a large number of infectious diseases. The dichloromethane and aqueous extracts did not give bactericidal powers over all strains tested. However, 96% ethanolic and Acetatic extracts were more active on all the tested strains, in particular against strains of *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella typhi*. The tri-phytochemical analysis was used to demonstrate the antibacterial activity of polyphenols especially tannins and flavonoids.

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