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Screening of some Cameroonian Medicinal Plants against Bacterial and Yeasts involved in Gastrointestinal Disorders

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Abstract

The present study was designated to evaluated the antimicrobial activities of methanol and ethyl acetate extracts of Carcia arereh, Nelsonia canescens, Ficus thonningu, Bryophillum pinnatum, Cyclosorus striatus, Euphorbia cordifolia, Euphorbia hirta, Erygium foetidum and Mimosa pudica. The selected plants species are used as traditional folk medicine in Cameroon for the treatment of various diseases. Thiazolyl blue tetrazolium bromide colorimetric assay was used to evaluate the antimicrobial activity against 16 microbial species. Preliminary phytochemical screening of plant sample was also carried out. Alkaloids and anthraquinones were the most frequent secondary metabolite in the tested plant extracts. The MIC values obtained ranging from 32 to >1024 μg/ml and 128 to >1024 μg/m respectively for bacterial and yeast strains tested. Methanol extract of Ficus thonningu leaves shows the best antibacterial activity with MIC values of 32 μg/ml against Echerichia coli. The lowest MIC values obtained against yeasts strains was 128 µg/ml. This lowest MIC values was obtained with Erynguim foetidum (AE) Euphorbia hirta (EA and MeOH) and Carcia arereh (MeOH) against 12.5 (1/8), 25 (2/8) and 25% of the yeasts tested strains

The results might explain the ethnobotanical use of the studied species for the treatment of gastrointestinal infections and afflictions of the skin.

Keywords: medicinal plants, antimicrobial activity, infected diseases

1. Introduction

Infectious diseases including bacterial infections continue to be a serious health problem worldwide. Therapy with synthetic tropical applications have most side effects and cannot be afforded by the people due to import cost of the drug. Because of the side effects and the resistance that pathogenic microorganisms build against antibiotics, much recent attention has been paid to extracts and biologically active compounds isolated from plant species used in herbaI medicine (Kokoska et al., 2002; Nostro et al., 2000).

Herbal medicines are the synthesis of therapeutic experiences from generations of traditional healers, and in many countries, the plant drugs are still in use in its traditional way and modern health care systems for treatment of different disorder and to improve the health. It has been estimated that between 60-90% of the populations of developing countries use traditional and botanical medicines almost exclusively and consider them to be a normal part of primary healthcare (WHO, 2002).Consumers are increasingly interested in complementary and alternative medicines, including herbal medicine, as they perceive these forms of healing as being both safe and effective (Gangoue et al., 2004). This trend in use of alternative and complementary healthcare has prompted scientists to investigate the various biological activities of medicinal plants, because they contain many bioactive compounds that can be of interest in therapeutic and also because of their low toxicity. Plant based antimicrobials represent a vast untapped source for medicines and, further exploration of plant antirnicrobials needs to occur.

The present study was conducted to investigate antimicrobial properties of 20 extracts from nine medicinal plants against 16 human pathogenic bacteria and yeast implicated in respiratory, gastrointestinal and systemic infection. The selected plants species are use as traditional medicine in Cameroon for the treatment of various diseases such

as Treatment of gastrointestinal Disorders, afflictions of the skin and mucous membranes, respiratory system disorders, parasitic infections, gastric ulcer, hypertension, headache, earache, asthma, arthritis, snake bites, scorpion stings and epilepsy. The ethnobotanical data on the use of these plants and the selection of the plant part to be tested where complemented with a biographic review (Adjanohoun et al., 1996).

2. Materials and Methods

2.1 Plant Material

Nine Cameroonian medicinal plants were used in this study. The selected plants materiel used were collected in different region of Cameroon. The plants were identified at the National herbarium (Yaoundé, Cameroon) where voucher specimens were deposited under the reference numbers (Table 1).

2.2. Sample Extraction

Each plant sample was washed, air dried and finely ground into a fine powder. The obtained powder (200 g) was soaked in either methanol (MeOH; 1l) or ethyl acetate (AE; 1l) for 48 h at room temperature and were homogenized regularly. The plant mixture was then filtered through Whatman $n^0 1$ paper and concentrated under reduced pressure using a rotary evaporator. The extracts were collected and dried in an oven at 40 °C for complete evaporation of the extraction solvent. The performance of each extraction was evaluated in relation to the mass of dry plant starting material. All extracts were then kept at 4 °C until further use.

2.3 Preliminary Phytochemical Screening

Preliminary analysis of chemical constituents such as alkaloids, anthocyanines, flavonoids, saponins, tannins, anthraquinones, polyphenols, sterols and/or triterpenes, and steroids was carried out. These constituents were identified by characteristic colour changes using standard procedures previously described (AOAC, 2005). Each test was qualitatively expressed as negative (−) or positive (+) signs.

2.3.1 Test for Alkaloids (Meyer Reagent)

Fifty milligrams of the tested compound was heated in 10 ml of 2% H 2 SO 4 for 2 min and filtered. To 1 ml of the filtrate, a few drops of the Meyer Reagent was added. The presence of alkaloids was indicated by the obtaining of a white precipitation or turbidity.

2.3.2 Test of Flavonoids

Fifty milligrams of the tested compound was introduced in 5 ml of methanol. To it was added some magnesium chip and concentrated hydrochloric acid drop wise. The presence of flavonoids was indicated by the appearance of a violet or brick red coloration with effervescence.

2.3.3 Test for Saponins

Fifty milligrams of the tested compound was added to 5 ml of distilled water. After homogenization, the mixture was boiled in 5 min, cooled and filtrated. 5 ml of the filtrate was vigorously agitated for 10 to 30 s. The presence of saponins was indicated by the appearance of foam which persists within 15 min.

2.3.4 Test for Tanins

Fifty milligrams of the tested compound was added in 5 ml of distiller water. After mixing, the mixture was boiled for 5 min, cooled and filtrated. 5 ml of 2% NaCl was added to 10 ml of the filtrate and then filtered. The presence of tannins was indicated by the formation of a precipitate after the addition of 1% gelatin to the filtrate.

2.3.5 Test of Anthraquinones

Fifty milligrams of the tested compound was diluted in 2 ml of chloroform, homogenized and filtered. Next, 1 ml of 10% NaOH was added to 1 ml of the filtrate. The presence of anthraquinone was indicated by the appearance of a red coloration.

2.3.6 Test of Phenols and Polyphenols

Fifty milligrams of the tested compound was dissolved in 15 ml distilled water, headed in a water bath for 15 min then cooled and filtered. To 2 ml of the filtrate was added drop wise 1 ml of 1% $FeCl_3$ and 1 ml of 1% $K_3Fe(CN)_6$. The presence of polyphenols and phenols was indicated by the apparition of a blue and green precipitate respectively.

Table 1. Information on the studied medicinal plants

Species (family) Voucher specimen number	Plants parts tested, collection locality	Traditional uses	Bioactivity on the crude extract
Carcia arereh (Caesalpiniaceae) N° 39931/HNC	Leaves, North region	Treatment of parasitic infections, diarrhoea, dysentery, malaria, dermatitis, and skin infections (Kochar et al., 1981; Abo et al., 1998)	Anti-trypanosomiasis (Saidu et al., 2013) Antimicrobial properties (De N, et al., 2009) Antioxidant (Kouitcheu et al, 2015)
Nelsonia canescens (Acanthaceae) N° 39542/ HNC	Leaves, Baleveng, West region	Treatment of pain, chickenpox, constipation and gastric ulcer (Owoyele et al., 2006)	Analgesic and anti-inflammatory activities (Owoyele et al, 2005). anti-ulcerogenic potentials of the leaf extract of the plant using aspirin as necrotising agents (Owoyele et al, 2005).
Ficus thonningu (Moraceae) N° 37417 HNC	Leaves, Stem bark Dschang , West region	Use for treating a number of disease conditions which include diarrhoea, urinary tract infections, diabetes mellitus, gonorrhoea, respiratory infections, and mental illnesses (Dangarembizi et al.., 2013).	pharmacological studies have demonstrated the anti-inflammatory, analgesic, anthelmintic, antioxidant, cardioprotective, hypotensive and hypoglycaemic effects (Dangarembizi et al.., 2013) .
Bryophillum pinnatum (Crassulaceae) N° 33394 HNC	Leaves, Dschang , West region	Treatment of haemostatic and wound (Kouitcheu et al., 2016).	Antiulcer, antihypertensive, tocolytic, antidiabetic, anti-inflammatory and analgesic (Raymond et al., 2010). Other reported properties include antitumour, sedative and muscle relaxant effects (Raymond et al., 2010). It may also be effective in the treatment of leishmaniasis (Raymond et al., 2010). Antioxidant and anti-*Helicobacter pylori* (Kouitcheu et al., 2016)
Cyclosorus striatus (Thelypteridaceae) N°40262 HNC	Whole plant, Dschang , West region	Other uses are as food (Camus et al., 1991), medicinal (Dnayeshira and Ravinda, 2011)	Ecological indicators (Chhaya et al., 2013). Soil binders improving soil fertility (James and Shelley, 2011). Phytoremediation (Kate, 2004; Oloyede et al., 2012)
Euphorbia cordifolia (Euphorbaceae) N° 20635 SRF Cam	Whole plant, Dschang , West region	Powdered leaves are used to treat diarrhea, wounds, sores,cuts and applied topically as anti-inflammatory agents (Ansah et al., 2009).	Antibacterial, spasmolytic, anti-inflammatory, hepatoprotective, antidiarrhoeal, antioxidant (Ansah et al., 2009).
Euphorbia hirta (Euphorbaceae) N°14288/SRF Cam	Whole plant, Dschang , West region	It is used traditionally for female disorders, respiratory ailments (cough, coryza, bronchitis, and asthma), worm infestations in children, dysentery, jaundice, pimples, gonorrhea, digestive problems, and tumors (Sunil et al., 2010).	anti-inflammatory, antifungal, anti- bacterial, antidiarrheal, sedative, anxiolytic, analgesic, antipyretic, antioxidant, antiasthmatic, antitumor, antimalarial, larvicidal, diuretic, and increases electrolytes (Sunil et al., 2010).
Erygium foetidum (Apiaceae) N°42131 HNC	Kumba, South-West région - Cameroon Stems and leaves	Treatment of fevers, chills, vomiting, burns, hypertension, headache, earache, stomachache, asthma, arthritis, snake bites, scorpion stings, diarrhea, malaria and epilepsy (Ramcharan, 1999; Paul et al., 2011).	Anthelmintic, anti-inflammatory, analgesic, anti-convulsant, anti-clastogenic, anti-carcinogenic, anti-diabetic and anti-bacterial (Lingaraju et al., 2016; S´aenz, et al., 1997; Simon and Singh, 1986; Singh et al., 2014). Anti-*Helicobacter pylori* (kouitcheu et al, 2016).
Mimosa pudica (Mimosaceae) N°54548 HNC	Whole plant	The herb has been used traditionally for ages, in the treatment of urogenital disorders, piles, dysentery, sinus, and also applied on wounds (Hafsa et al., 2012).	It majorly possesses antivenom, antifertility, anticonvulsant, antidepressant, aphrodisiac hypoglycemic diuretic, Wound healing activity (Hafsa et al., 2012).

2.3.7 Test of Triterpenes and Sterols (Liebermann- Burchard Test)

Fifty milligrams of the tested compound was dissolved in 2 ml of chloroform and next some drops of acetic anhydride added to the mixture and 1 ml of concentrated H_2SO_4. The presence of triterpenes was revealed by the apparition of violet-red coloration and sterols by a blue greenish coloration.

2.3.8 Test of Steroids

Fifty milligrams of the tested compound was dissolved in 3 ml of chloroform, agitated intermittently for 2 hours and filtered. 1 ml of the filtrate was deposited on a porcelain plate. After evaporation, a drop of sulfuric acid was added, stirred and the color noted. To another portion of the filtrate was added a drop of acetic anhydride and the color noted. The reaction was positive if the same color was obtained for both sulfuric acid and acetic anhydride.

2.3.9 Test for Anthocyanins

To 50 mg of the tested compound was added 15 ml of a concentrated HCl, the mixture was boiled. The presence of anthocyanins was indicated by the variation of coloration from orange red to orange blue during boiling.

2.4 Antimicrobial Assays

2.4.1 Chemicals for Antimicrobial Assay

Ciprofloxacine (zoflox, ciprofloxacin 750mg, Odypharm), amoxicillin ((Sigma-Aldrich, St. Quentin Fallavier, France) and nystatin (500000 UI, Novadina Pharmaceutical Ltd, London, United Kingdom) were used as reference antibiotics. Thiazolyl blue tetrazolium bromide (TBTB, Sigma-Aldrich) was used as microbial growth indicator (Gomez-Flores et al., 1995; Sankar et al., 2008).

2.4.2 Microbial Strains and Culture Media

The microorganisms used in this study included eight bacterial strains ; *Staphylococcus aureus* ATCC25922 *Enterococcus faecalis* ATCC10541, *Escherichia coli* ATCC11775, *Pseudomonas aeruginosa* ATCC27853, *Salmonella typhi* ATCC6539, *Klebsiella pneumonia* ATCC251388, two clinical isolates *(Proteus mirabilis* and *Shigella flexneri)* and eight fungal strains among which seven *candida* species (*Candida albicans* CPC2091, *Candida glabrata* CIPA35, *Candida tropicalis* ATCC750*, Candida guilliermondi, Candida krusei* ATCC6258, *Candida lusitaneae* ATCC200950, *Candida parapsilosis* ATCC22019) and *Cryptococcus neoformans* IP95026 obtained from the Pasteur Institute (IP, Paris-France). Mueller Hinton Agar (MHA, Conda, Madrid, Spain) and Sabouraud Dextrose Agar (SDA, Liofilchem and Conda), were used for the activation of the tested bacterial and yeast strains respectively while Mueller Hinton broth (MHB, Conda, Madrid, Spain) and Sabouraud dextrose broth (SDB, Liofilchem and Conda) were used for susceptibility assay. All the medium were prepare following the manufacturer recommendations.

2.4.3 TBTB Colorimetric Assay for MIC Value Determination

Minimum Inhibitory Concentrations (MICs) were determined by broth micro dilution method previously described by Kuete et al., 2008 with slight modifications. The test samples were first of all dissolved in dimethylsulfoxide and/or Tween 80 (1% (v/v). The solution obtained was then added to MHB for bacteria or SDB for yeasts to give a final concentration of 2048 µg/ml. This was serially diluted two fold in 96-wells microplate. A volume of 100 µl of inoculums ($2x10^5$ CFU/ml for the yeasts and $2x10^6$ CFU for bacteria) was added in each well (96-wells microplate) for final concentrations varying from 0.25 to 1024 µg/ml. The negative control well consisted of 100 µl of appropriate medium (MHB or SDB) with DMSO or Tween 80 (1% v/v) and 100 µl of the standard inoculums. The plates were covered with the sterile lid, then agitated to mix the contents of the wells using a plate shaker and incubated at 37°C for 24 h (for bacteria) or at 25^0C for 48 h (for yeasts). The assay was repeated thrice. The MICs of samples were determined by adding 50µl of a 0.2 mg/ml thiazolyl blue tetrazolium bromide (TBTB, Sigma-Aldrich) solution followed by incubation at 35°C for 30 min. the TBTB is reduced by viable bacterial dehydrogenases into formazan, a violated blue dye (Gomez-Flores et al., 1995; Sankar et al., 2008). MICs were defined as the lowest sample concentrations that prevented this color change, thus indicating a complete inhibition of microbial growth.

3. Results and Discussion

The results of the qualitative phytochemical analysis showed that each of the tested plant extract contains at least 3 classes of secondary metabolites (Table 2). Alkaloids and anthraquinones were the most frequent secondary metabolites in the tested plant extracts.

Table 2. Preliminary phytochemical screening

Species	Solv	Alc	Anthr	Antho	Flav	Phen	Sapo	Tan	Trit	Ster
Carcia arereh	Me	+	+	+	+	+	+	+	+	-
	AE	+	+	+	+	+	+	+	-	-
Bryophyllum pinnatum	Me	+	+	-	-	+	-	+	-	+
Nelsonia canescens	Me	+	+	-	-	-	-	-	-	+
Nelsonia canescens	AE	+	+	-	-	-	-	-	-	+
Euphorbia hirta	AE	+	+	-	-	-	-	-	-	+
	Me	+	+	-	-	-	-	-	-	+
Ficus thonningu **(Leaves)**	AE	+	+	-	-	-	-	-	-	+
Ficus thonningu **(Stem bark)**	ME	+	+	-	-	+	-	+	-	-
Cyclosorus striatus	ME	-	-	-	-	-	-	-	-	+
	AE	+	+	-	-	-	-	-	-	+
Erynguim foetidum	ME	+	+	-	-	-	-	-	-	+
	AE	+	+	-	+	-	-	-	-	+
Euphorbia cordifolia	ME	+	+	-	-	+	-	+	+	+
Mimosa pudica	AE	+	+	-	-	+	-	+	-	+

Solvent of extraction **(Solv),** Methanol **(MeOH),** Ethyl acetate **(AE)**

Alkaloids **(Alc)**, Anthocyanines **(Antho)**, Flavonoids **(Flav)**, Saponins **(Sapo)**, Tannins **(Tan)**, Anthraquinones **(Anthr)**, Polyphenols **(Phen)**, Sterols and/or Triterpenes **(Trit)**, Steroids **(Ster).**

The antimicrobial activity of each extract against microorganisms examined in the present study and their potency were quantitatively assessed by the determination of MIC values. The MIC value obtained using the broth microdilution method is given in Table 3 and 4.

Table 3. The MIC values of the plant material extracts against the bacterial strain tested using microdilution assay

Species	Solv	Bacterial strains (MIC µg/ml)							
		KP	***SF***	***ST***	***PA***	***EF***	***EC***	***SA***	***PM***
Carcia arereh	Me	256	256	128	128	256	128	256	128
	EA	128	128	256	256	128	256	512	256
Nelsonia canescens	Me	>1024	512	>1024	256	1024	256	>1024	>1024
	EA	>1024	256	>1024	>1024	64	>1024	>1024	>1024
Ficus thonningu **(leaves)**	Me	1024	256	>1024	512	256	32	>1024	1024
	EA	512	1024	>1024	1024	>1024	512	>1024	1024
Ficus thonningu **(stem**	Me	256	1024	>1024	256	1024	256	>1024	512
bark)	AE	>1024	>1024	1024	>1024	1024	>1024	>1024	>1024
Bryophyllum pinnatum	Me	512	256	512	256	512	1024	256	256
	EA	128	128	256	128	128	256	128	128
Cyclosorus striatus	Me	256	128	256	128	128	256	256	128
	EA	256	512	256	512	256	256	128	512
Euphorbia cordifolia	Me	512	512	512	512	256	512	256	256
	EA	512	512	512	512	512	256	512	1024
Euphorbia hirta	Me	256	256	512	256	256	128	256	128
	EA	128	256	256	256	128	256	128	256
Erynguim foetidum	Me	256	1024	1024	512	256	256		
	EA	512	512	512	1024	1024	1024	512	256
Mimosa pudica	Me	1024	1024	512	512	512		512	
	EA	128	256	128	128	256	128	128	256
Ciprofloxacine		0.5	0.032	0.5	0.5	0.125	0.032	0.25	0.25
Amoxicilline		16	32	16	128	8	8	8	8

Solvent of extraction **(Solv),** Methanol **(MeOH),** Ethyl acetate **(AE)**

Staphylococcus aureus ***(SA***) *Enterococcus faecalis* (***EF)***, *Escherichia coli* (***EC)***, *Pseudomonas aeruginosa* (***PA)***, *Salmonella typhi* (***ST)***, *Klebsiella pneumonia* (***KP)***, *Proteus mirabilis* (***PM),*** *Shigella flexneri* ***(SF)***

Table 4. The MIC values of the plant material extracts against the yeast strains tested using microdilution assay

Species	Solv	Yeast strains (MIC µg/ml)							
		CA	***CK***	***CT***	***CN***	***CG***	***CP***	***CGL***	***CL***
Carcia arereh	Me	256	1024	256	128	512	512	128	1024
	AE	512	512	>1024	1024	1024	256	512	256
Nelsonia canescens	Me	1024	>1024	>1024	1024	>1024	1024	1024	1024
	AE	1024	>1024	>1024	>1024	>1024	1024	1024	1024
Ficus thonningu **(leaves)**	Me	>1024	>1024	>1024	>1024	>1024	>1024	>1024	512
	AE	>1024	512	>1024	>1024	>1024	>1024	>1024	1024
Ficus thonningu **(stem**	Me	1024	>1024	>1024	>1024	>1024	>1024	>1024	>1024
bark)	AE	>1024	>1024	>1024	>1024	>1024	>1024	>1024	>1024
Bryophyllum Pinnatum	Me	>1024	>1024	1024	>1024	>1024	>1024	1024	>1024
	EA	>1024	>1024	1024	>1024	>1024	>1024	>1024	>1024
Cyclosorus Striatus	Me	>1024	>1024	>1024	>1024	>1024	>1024	1024	>1024
	EA	>1024	>1024	>1024	>1024	>1024	>1024	256	>1024
Euphorbia cordifolia	Me	>1024	512	>1024	>1024	>1024	>1024	>1024	>1024
	EA	>1024	>1024	>1024	>1024	>1024	>1024	>1024	>1024
Euphorbia Hirta	Me	>1024	512	128	>1024	128	>1024	>1024	512
	EA	>1024	>1024	256	>1024	128	>1024	>1024	128
Erynguim foetidum	Me	>1024	>1024	>1024	>1024	>1024	1024	>1024	>1024
	EA	>1024	1024	>1024	>1024	>1024	128	>1024	>1024
Mimosa Pudica	Me	>1024	>1024	>1024	>1024	>1024	1024	>1024	>1024
	EA	>1024	>1024	>1024	>1024	>1024	1024	>1024	>1024
Nystatine		0.125	1	0.062	0.062	0.062	0.031	0.031	0.062

Solvent of extraction **(Solv),** Methanol **(MeOH),** Ethyl acetate **(AE)**

Candida albicans (***CA)***, *Candida glabrata* (***CGL)***, *Candida tropicalis* (***CT)***, *Candida guilliermondi* ***(CG),*** *Candida krusei* (***CK)***, *Candida lusitaneae* (***CL)***, *Candida parapsilosis* (***CP)***, *Cryptococcus neoformans* ***(CN)***

Plant species showed different anti-microbial activity each other with MIC values ranging from 32 to >1024 µg/ml and 128 to >1024 µg/m respectively for bacterial and yeast strains tested. Methanol extract of *Ficus thonningu* leaves shows the best antibacterial activity with MIC values of 32 µg/ml against *Echerichia coli* , following by ethyl acetate extract of *Nelsonia canescens* against *Enterococcus feacalis* with MIC value of 64 µg/ml. It appears that extracts from *Mimosa pudica* (AE), *Euphorbia hirta (*AE*)*, *Cycloorus striatus* (MeOH), *Bryophyllum pinnatum* (AE), and *Carcia arereh* (MeOH) inhibited the growth of all the eight tested bacterial strains within a concentration range from 128 to 256 µg/mL. The most susceptible bacterium was *E. coli* following by *Enterococcus feacalis* with a susceptibility of 65 (13/20) and 60% (12/20) respectively of the tested plant extract. Moreover, the lowest MIC values (32 and 64 µg/mL) was obtained against these bacterial strains. *Salmonella typhi* was the most resistant bacterium tested since only 35% (7/20) of extract evaluated here had showed an inhibitory activity against it.

Plant sample were more active against bacterial stains than fungal one. Indeed, the lowest MIC values obtained against yeasts strains was 128 µg/ml while it was 32 µg/ml against bacteria strains. This lowest MIC values was obtained with *Erynguim foetidum* (AE) *Euphorbia hirta* (EA and MeOH) and *Carcia arereh* (MeOH) against 12.5 (1/8) , 25 (2/8) and 25% of the tested yeasts strains. Moreover, MIC values of 256 µg/ml were also recorded with *Euphorbia hirta* (EA) and *Carcia arereh* (AE and MeOH) against 12.5 and 25% of the evaluated yeast. So, these two plant extracts; *Euphorbia hirta* (EA) and *Carcia arereh* (MeOH) show the best antifungal activity. The most sensitive yeast was *Candida guilliermondi***,** following by *Candida tropicalis, Cryptococcus neoformans, Candida parapsilosis, Candida glabrata and Candida lusitaneae* with a susceptibility of 10 (2/20) and 5(1/20)% respectively of the tested plant extract. *Candida albicans* and *Candida krusei* were the most resistant yeast tested since none of extract evaluated here had showed any inhibitory activity against them.

It was considered that if the extracts displayed an MIC less than 100 µg/ml, the antimicrobial activity was good ; from 100 to 500 µg/ml the antimicrobial activity was moderate; from 500 to 1000 µg/ml the antimicrobial activity was weak; over 1000 µg/ml, the extract was considered inactive (Fabiola et al., 2002). Our results shown that most of the extract presented a moderate activity against the pathogenic bacteria and yeasts tested.

Methanol extract of *Ficus thonningu* leaves presented a good activity against *Echerichia coli*, following by ethyl acetate extract of *Nelsonia canescens* against *Enterococcus feacalis. Salmonella typhi CA and CK* were the most resistant strains tested. This differences in susceptibility between the bacterial strains against antimicrobial substances in plants extract may be explained by the differences in cell wall composition and/or inheritance genes on plasmids that can be easily be transferred among bacterial strains (Karaman et al., 2003).

The results of the qualitative phytochemical analysis showed that alkaloids and anthraquinones are the most frequent secondary metabolite in the tested plant extracts.The presence of these chemical compounds in extracts may explain some of their antimicrobial actions since antimicrobial actions of most of these phytochemical substances have been documented (Kouitcheu et al., 2011). However, the antimicrobial activities demonstrated by the extract could be due to the presence of other antimicrobial substances not covered by the screening.

4. Conclusion

The results in the present work indicate that some of the plant species assayed possess antimicrobial properties and justify the use of these plants in folk medicine for the treatment of various infected diseases. At present, our group is concerned with the fractionation and the isolation of pure compounds and the elucidation of their structures in order to better evaluate their pharmacological activity in vitro and in vivo.

Competing interests

The authors declare that they have no competing interests.

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