http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 10 (22): 4177-4179, 2007
ISSN 1028-8880

Chemical Composition and Antibacterial Activity of *Cochlospermum planchoni* Hook.f. ex Planch Essential Oil from Burkina Faso

[1]Lassina Ouattara, [2]Jean Koudou, [1]Louis C.E. Obame, [1]Damintoti S. Karou,
[1]Alfred Traore and [3]Jean Marie Bessière
[1]Centre de Recherche en Sciences Biologiques, Alimentaires et Nutritionnelles,
Laboratoire de Microbiologie et de Biotechnologie (CRSBAN),
Université de Ouagadougou 03 BP7131 Ouagadougou Burkina Faso
[2]Centre de Recherche en Pharmacopée et Médecine Traditionnelle (CERPHAMETRA),
Université de Bangui, BP 1450 Bangui République Centrafricaine
[3]Laboratoire de Phytochimie, Ecole Nationale Supérieure de Chimie de Montpellier,
8 rue de l'Ecole Normale, 34296 Montpellier Cedex 05 France

Abstract: The water distilled oil obtained from rhizomes of *Cochlospermum planchonii* Hook.f.ex Planch (Apocynaceae) from Burkina Faso was examined by GC and GC/MS. *Cochlospermum planchonii* oil presents a particular chemical composition with a high rate of oxygenated components with predominance of ketones and esters (86.4%). The essential oil was tested against twelve strains of bacteria using a broth microdilution method. The results suggest that *Cochlospermum planchonii* essential oil has significant bactericidal activity.

Key words: *Cochlospermum planchonii*, Apocynaceae, essential oil, antibacterial activity

INTRODUCTION

Cochlospermum planchonii Hook.f.ex Planch (Apocynaceae) is a West Africa species up to 0.5 and 1.5 m and growing from guinean region to Cameroon. In some African countries, it is a medicinal plant that rhizomes and leaves are used to treat many diseases: malaria, hepatitis, diabetes, infertility, touch, trypanosomiasis (Kone *et al*., 2002; Benoit-Vical *et al*., 2003; Anthony *et al*., 2005; Atawodi, 2005; Igoli *et al*., 2005; Pousset, 2006) and certain infections treated by traditional healers as diarrhoea, sexual transmissible infections (personal communication). Few studies concerning the chemical constituents were found (Adde-Mensah *et al*., 1985; Benoit-Vical *et al*., 1999). As far as our literature survey could as certain, rhizomes essential oil analysis and antibacterial properties of the plant have not previously been published. In this study we report volatile components and antibacterial activity of *Cochlospermum planchonii* (*Co.p*).

MATERIALS AND METHODS

Plant material: Samples of *Cochlospermum planchonii* Hook.f. Planch were collected in the rainy season (August, 2006) near the classed forest of Institute de Recherche en Biologie et Ecologie Tropicale de Saponé, 26 km south of Ouagadougou, Burkina Faso. Voucher specimens were kept in the herbarium of CRSBAN, University of Ouagadougou.

Extraction and analyses: The freshly comminuted rhizomes were subjected to hydrodistillation for 4 h with a clavenger-type apparatus. The essential oil was collected and dried, after decantation, over anhydrous sodium sulphate, then analysed by GC and GC/MS.

GC analyses were performed on a fused silica capillary column (30 m×0.25 mm×0.15 μm) coated with DB-1. The oven temperature was programmed from 60-220°C at 3°C min^{-1}; helium was used as a carrier gas at a flow rate of 1 mL min^{-1}.

GC/MS analyses were carried out on a Hewlett-Packard capillary GC-quadrupole MS system (model 5890) fitted with a fused silica column coated with DB-1 (25 m×0.23 mm) and using the same GC parameters. Helium was used as a carrier gas at a flow rate of 0.9 mL min^{-1}.

The volatile components were identified by comparison of their retention indices and their experimental mass spectra with those of reference compounds, further confirmation was done by referring to retention indices data generated from a series of alkanes: C_9-C_{30} (Adams, 2001; Jennings and Shibamoto, 1980) (Table 1).

Corresponding Author: Jean Koudou, [1]Centre de Recherche en Pharmacopée et Médecine Traditionnelle (CERPHAMETRA), Université de Bangui, BP 1450 Bangui République Centrafricaine,
[2]01 BP 134 Ouagadougou 01 Burkina Faso Fax: +226 50 36 85 73

Bacterial strains: The micro organisms used were:

Reference bacterial strains: *Bacillus cereus* LMG13569, *Enterococcus faecalis* CIP103907, *Escherichia coli* CIP NCTC11609, *Listeria innocua* LMG1135668, *Salmonella enterica* CIP105150, *Shigella dysenteria* CIP5451, *Staphylococcus aureus* ATCC9244.

Hospital bacterial strains: *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogenes*. They were kindly provided by the St. Camille Hospital of Ouagadougou, Burkina Faso.

Determination of the strains sensitivity: The tests were performed using Miller Hinton medium for bacteria strains using disk diffusion method following the National Committee for Clinical Laboratory Standards methods (Kiehlbauch Julia *et al*., 2000).

Overnight broth cultures of each strain were prepared in nutriment Broth (Diagnostic Pasteur, France). The final concentration of each inoculum was got making dilution of each strain in NaCl 9% solution. The turbidity of each innoculum was compared with McFarland 0.5 solution. The final concentration of each innoculum (approximatively 5.10^5 cfu mL^{-1}) was confirmed by viable count on Plate Count Agar (Merck, Germany). Three microliter of essential oil was put on every disk (8 mm diameter).

Positive and negative growth controls were performed for every test. The plates were incubated aerobically at 30 or 37°C for 24 h. The bacterial sensitivity to the essential oil was assessed by measuring the diameter of inhibition zone. The inhibition zones were compared with that of tetracyclin (BIO-RAD Marnes-la coquette-France) and ticarcillin (BIO-RAD Marnes-la coquette-France).

Determination of antibacterial activity of *Co.p.* essential oil: A broth microdilution method was used to determine the Minimum Inhibitory Concentration (MIC) and the Minimum Bactericidal Concentration (MBC) (Bassole *et al*., 2003). All tests were performed in Mueller-Hinton Broth (Becton Dickinson, USA).

RESULTS AND DISCUSSION

Chemical analyses: The yield of the essential oil of the fresh rhizomes was 0.12% (w/w). Its chemical composition was particular (Table 1). It exhibited a high rate of oxygenated components with predominance of ketones and esters (86.4%). The major constituents were: tetradecan-3-one (30.6%), tetradecen-3-one (15.3%), tetradecylacetate (15.0%), dodecylacetate (12.4%). The oil was characterized by the absence of monoterpenes and contained three minor sesquiterpenes: β-elemene (6.0%), β-selinene (1.9%), α-selinene (3.8%).

Table 1: Chemical composition of the essential oil of *Cochlospermum planchonii* Hook

Retention indices	Components[a]	Percentage
1380	β-Elemene	6.0
1482	β-Selinene	1.9
1488	α-Selinene	3.8
1495	Tridecan-2-one	7.8
1498	Undecyl acetate	0.3
1505	7-diepi-α-selinene	1.8
1576	Tetradecen-3-one	15.3
1585	Tetradecan-3-one	30.6
1588	Ethyl dodecanoate	0.6
1597	Dodecyl acetate	12.4
1698	Pentadecan-2-one	1.0
1738	Methyl tetradecanoate	0.4
1778	Hexadecan-3-one	2.0
1796	Tetradecyl acetate	15.0
1997	Hexadecyl acetate	1.0

[a]Retention indices on DB-1 column

Table 2: Diameter of inhibition zone (mm) of bacterial growth

Reference strains	Origin	*Co.p.*	Te[b]	Ti[b]
Bacillus cereus LMG13569	LMG	19	20	50
Enterococcus faecalis CIP103907	CIP	22	21	30
Escherichia coli CIP NCTC11602	CIP	33	22	8
Listeria innocua LMG1135668	LMG	30	21	50
Salmonella enterica CIP105150	CIP	33	22	50
Shigella dysenteria CIP5451	CIP	30	22	31
Staphylococcus aureus ATCC9244	ATCC	25	18	48
Staphylococcus camorum LMG13567	LMG	9	20.33	nd[c]
Hospital strains				
Enterococcus faecalis	Foeca	27	20	28
Pseudomonas aeruginosa	Vaginal liquid	25	nd[c]	nd[c]
Staphylococcus aureus	Vaginal liquid	25	21	27.66
Streptococcus pyogenes	Vaginal liquid	41	20	24.66

Each value represents mean of three different observations; [b]Te: Tetracycline; Ti: Ticracilline, [c]nd: Not determined

Antibacterial activity of essential oil: The results showed that almost of bacterial strains were sensitive to *Co.p.* (Table 2). Only *Staphylococcus camorum* LMG13567 was not sensible to *Co.p.* (zone of inhibition 9 mm). The best sensitivity to essential oil was, respectively obtained on *Streptococcus pyogenes* (41 mm), *Escherichia coli* CIP NCTC11602 (33 mm), *Salmonella enterica* CIP105150 (33 mm) and *Listeria innocua* LMG1135668 (30 mm). The other strains had sensitivities between 22-27 mm. Following the results in Table 2, the different strains were more sensitive to *Co.p.* than tetracycline. The most important information was that essential oil of *Co.p.* exhibited more activity on *E. coli* CIP NCTC11602 (33 mm) and *S. pyogenes* (41 mm) than tetracyclin (*E. coli* CIP NCTC11602, 22 mm; *S. pyogenes* 20 mm) and ticarcillin (*E. coli* CIP NCTC11602 , 8 mm; *S. pyogenes* 24.66 mm).

The MICs, MBCs of the *Cochlospermum planchonii* essential oil for the micro-organisms tested were consigned in Table 3.

Table 3: Minimum inhibitory concentration, minimum bactericidal concentration data (%v/v) obtained by microdilution method

Reference strains	Origin	MIC	MBC
Bacillus cereus LMG13569	LMG	0.25	0.5
Enterococcus faecalis CIP103907	CIP	0.50	0.5
Escherichia coli CIP NCTC11602	CIP	0.25	0.5
Listeria innocua LMG1135668	LMG	0.25	0.5
Salmonella enterica CIP105150	CIP	1.00	2.0
Shigella dysenteria CIP5451	CIP	0.50	8.0
Staphylococcus aureus ATCC9244	ATCC	1.00	4.0
Staphylococcus camorum LMG13567	LMG	8.00	>8.0
Hospital strains			
Enterococcus faecalis	Foeca	4.00	>8.0
Pseudomonas aeruginosa	Vaginal Liquid	1.00	8.0
Staphylococcus aureus	Vaginal Liquid	8.00	>8.0
Streptococcus pyogenes	Vaginal	0.25	0.5

Each value represents mean of three different observations

The essential oil failed to inhibit *Staphylococcus camorum* LMG 13567 and the *Staphylococcus aureus* obtained from hospital at the highest concentration (8%). *Bacillus cereus*, *Escherichia coli*, *Listeria innocua*, *Streptococcus pyogenes* were inhibited at the lowest MIC of 0.25%. The results of MBC demonstrated a bactericidal effect. The essential oil was bactericidal for *Bacillus cereus*, *Enterococcus faecalis*, *Escherichia coli*, *Listeria innocua* (reference strains), *Streptococcus pyogenes* (hospital strain). The most resistant strains with highest MBC (8% or more) were *Shigella dysenteria* and *Staphylococcus camorum* for reference strains and *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* for hospital strains. For *Enterococcus faecalis* and *Staphylococcus aureus*, strains isolated from hospital were found to be more resistant than reference strains to the essential oil action. Considering MICs and MBCs, no significant difference could be observed between Gram-negative and Gram-positive bacteria.

This study shows *in vitro* high and low antibacterial activities of the rhizomes essential oil of *Cochlospermum planchonii*. It was bactericidal for most of the reference strains and some hospital strains tested. These results indicate that the plant could be used as a potential remedy against diarrhoea and some sexual infections particularly in aromatherapy.

REFERENCES

Adams, R.P., 2001. Identification of Essential oils Components by Gas Chromatography-Quadrupole Mass Spectrometry. Allured Publishing Corp., Card Stream, Illinois, USA.

Adde-Mensah, R. Waibel and H. Achenbach, 1985. Novel long-chain triacylbenzenes from *Cochlospermum planchonii* constituents of West African medicinal plants. Liebigs Anna. Chem. XVI, 1284-1288.

Anthony, J.P., L. Fyfe and H. Smith, 2005. Plant active components, a resource for antiparasitic agents. Trends Parasitol., 21: 462-468.

Atawodi Sunday, E., 2005. Comparative *in vitro* trypanocidal activities of petroleum, chloroform, methanol and aqueous extracts of some Nigerian savannah plants. Afr. J. Biotechnol., 4: 177-182.

Bassole, I.H.N., A.S. Ouattara, R. Nebie, C.A.T. Ouattara, Z.I. Kabore and S.A. Traore, 2003. Chemical composition and antibacterial activities of essential oils of *Lippia chevalieri* and *Lippia multiflora* from Burkina Faso. Phytochemistry, 62: 209-212.

Benoit-Vical, F., A. Valentin, M. Mallie, J.M. Bastide and J.M. Bessiere, 1999. *In vitro* antimalarial activity and citotoxicity of *Cochlospermum tinctorium* and *Cochlospermum planchonii* leaf extracts and essential oils. Planta Medica, 65: 378-381.

Benoit-Vical, F., A. Valentin, B. Da, Z. Dakuyo, L. Descamps and M. Mallie, 2003. Ndribala (*Cochlospermum planchonii*) versus chloroquine for treatment of uncomplicated *Plasmodium falciparum* malaria. J. Ethnopharmacol., 89: 111-114.

Igoli, J.O., O.G. Ogaji, T.A. Tor-Anyiin and N.R. Igoli, 2005. Traditional medicine practice amongst the IGEDE people of Nigeria. Part II. Afr. J. Traditional Complementary Alter. Med., 2: 134-152.

Jennings, W. and T. Shibamoto, 1980. Qualitative Analysis of Flavor and Fragrance Volatiles by Glass Capillary Gas Chromatography. Academic Press, Inc., New York.

Kiehlbauch Julia, A., G.E. Hannett, M. Salfinger, W. Archinal, C. Monserrat and C. Carlin, 2000. Use of the national committee for clinical Laboratory standards guidelines for disk diffusion susceptibility testing in New York State Laboratories. J. Clin. Microbiol., 38: 3341-3348.

Kone, M.W., K.K. Atindehou, H. Tere and D. Traore, 2002. Some medicinal plants used in traditional pediatrics in the region of Ferkessédougou. Bioterre. Revue Internationale des Sciences de la Vie et de la Terre, Numéro Spécial, pp: 30-36.

Pousset, J.L., 2006. Place of traditional medicines in Africa. Médecine Tropicale, 66: 606-609.