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Evaluation of antibacterial activity of some medicinal plants used in the treatment of sexually transmitted infections (STI) in Guinean traditional medicine

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Abstract: Microbial infections such as sexually transmitted infections are very common in Guinea. Due to the high cost of conventional medicines, the pharmacopeia along with the traditional medicine remains the main medical resources for most of the Guinean populations. An ethnobotanical survey of some medicinal plants used in the traditional treatment of sexual infectious diseases in the district of Kankan led to the inventory of 33 plant species belonging to 17 families. All of the tested extracts were inactive against *Salmonella typhimurium*. Except the extracts of *Spondias mombin* and *Markhamia tomentosa* and *Anogeissus leiocarpus* which showed the highest antibacterial (62, 5 µg/ml) effect against *Bacillus cereus* and/or *Klebsiella pneumoniae* and *Staphylococcus aureus*, all the other extracts exhibited a narrow spectrum of antibacterial activity. This study supports partly the traditional claims of these plants as a remedy to infectious diseases.

Keywords: Guinean Traditional Medicine, Medicinal Plants, Sexually Transmitted Infections, Anti-Bacterial Activity

1. Introduction

According to the World Health Organization [1], 80% of the world population lives in the developing countries and 80% of them use a traditional medicine to meet most of their needs in primary care Health. This means that about 3.2 million people around the world use plant extracts as drugs. It is also estimated that 25 to 50% of the 2500 flowering plants have been used at one time or another for medical purposes. Then, the goals of studying African medicinal plants is to provide a scientific basis to their therapeutic and/or side effects which would contribute to the improvement of the access of the population to primary health care and allow them a savings of foreign exchange. On the other hand, undoubtedly some plants can offer better prospects for the discovery of new pharmaceuticals in general and anti-infective agent in

particular. It is in this context that the present study was undertaken.

2. Materials and Methods

2.1. Materials

The samples were harvested in the district of Kankan during an ethnobotanical survey conducted from May to September 2010.

2.1.1. Selection of Drugs

During our investigations the plant material of our study was selected taking into account the following criteria:

- membership in several pharmacopoeias;
- frequent use in the community;
- notoriety of the practioner
- indication against sexual diseases;

2.1.2. Bacteria

For the realization of this screening a battery of six species of bacteria obtained from the American Type Culture Collection available at the Laboratory of Microbiology and Hygiene of Antwerp Department of Pharmaceutical Sciences of the University (UIA) Belgium has been used it. These are:

- *Bacillus cereus* ATCC 14579 ;
- *Escherichia coli* ATCC 8739 ;
- *Klebsiella pneumoniae* ATCC 13883 ;
- *Pseudomonas aeruginosa* ATCC 15442 ;
- Staphylococcus aureus ATCC 6538 ;
- *Salmonella typhimurium*.

These bacteria represent widely groups of bacteria pathogenic to humans given their physico-chemical characteristics and cover different modes of resistance. All are easily manipulated and they do not possess the special requirements in terms of environment and culture condition.

Microorganisms are maintained on nutrient agar (Gibco) and preserved at 4°C; their purity is regularly control by a biochemical identification test (API galleries Bio Merieux).

2.1.3. Preparation of Extracts

The samples were harvested and dried in the shade and Deeper powder methanol at the temperature of the laboratory. The extract was evaporated under vacuum in a Buchi Rotavapor at a temperature of about 40°C. All operations suspending excerpts are performed aseptically under a laminar flow hood; this combined precaution has a disinfectant effect of the extraction solvent (aqueous MeOH 80%) and the antimicrobial activity of DMSO proved by (Ansel et al 1969 ensures sterility extracts tested.

2.1.4. Preparation of Inoculum and Diluted Extracts

From a culture on agar nutrient senior 24 hours we have levied a colony seeded and two (2) ml of broth-based tryptic digests of soy (TSB) prepared beforehand in a test tube. New cultures in TSB were incubated at 37 Â° C for 24 hours they were homogenized and diluted each once in the TSB thus obtaining an inoculum of about 105 Colony Forming Unit (CFU) ready to be used antibacterial activity of extracts MeOH plants. Extracts for their part were dissolved in dimethyl sulfoxide the (DMSO) and people brought their concentration 2 mg / ml with distilled water ultra-pure. This stock solution we performed a serial dilution to achieve dilutions whose concentrations: 1000 µg / ml; 500µg/ml; 250 g/ml; 125 µg/ml and 62, 5 µg/ml.

2.1.5. Antibacterial Test

For this screening we used the method described by dilution [2]. A volume of 0.1 ml of inoculum is prepared in each well of a column of a microtiter plate of 96-well Falcon right column by a bacterium. An equal volume of extract is added to the inoculum in each well of the plate line dilution by line making sure mixture well. Two witnesses tests are included in the test the wells of the last column containing 0.1 ml of TSB instead of the inoculum and serve as control of the sterility of the extract while in the last line of the dilution.

Two witnesses tests are included in the test the wells of the last column containing 0.1 ml of TSB instead of the inoculum and serve as control of the sterility of the extract is replaced by the broth and it allows to check the growth of bacteria corresponding plates each has a different extracts are incubated at 37° C in a humidified box for a period of 24 hours. After the incubation period the series of mixed-bacterium extract are compared to the witness when inhibition of the growth of the bacteria occurred the contents of that cup is a volume of 0.05 ml mixture is levied and a subculture is made by dispersion on nutrient agar in petri dish under the conditions of the test.

3. Results

The results of the evaluation of the antibacterial activity of the methalonic plant extracts are shown in Table 1.

Table 1. *Antibacterial activity (minimum inhibitory concentrations (µg/ml) of methanol extracts of Guinean medicinal plants traditionally used in the treatment of sexual transmitted diseases.*

Family	Botanical names	Vernacular names	Part used	Bacteria					
				B. cereus	E. coli	K. pneumoniae	P. aeruginosa	S. typhimurium	S. aureus
Asteraceae	Acanthospermum hispidum DC	Bullè baali (P)	leaf	1000	>1000	>1000	>1000	>1000	>1000
	Vernonia colorata (Wild) Drake	Bantara buruurè (P)	leaf	500	>1000	>1000	>1000	>1000	500
Anacardiaceae	Spondias mombin L.	Gboi (G) Ninkon (M) Tyalè badhi (P)	leaf	62.5	>1000	>1000	>1000	>1000	>1000

Family	Botanical names	Vernacular names	Part used	Bacteria					
				B. cereus	E. coli	K. pneumoniae	P. aeruginosa	S. typhimurium	S. aureus
Annonaceae	Mangifera sp.	Mango tyewddhè (P)	Stem-bark	500	>1000	>1000	>1000	>1000	>1000
	Annona senegalensis Pers.	Mangokunkouri (S) Sunsuningbè (M) Dukummè (P)	leaf	1000	>1000	>1000	>1000	>1000	>1000
	Uvaria chamae P. Beauv.	Boylè nembu (P) Frignan (M)	leaf	250	>1000	>1000	>1000	>1000	>1000
Bignoniaceae	Markhamia tomentosa K.Schum.	Kafa waandu (P)	leaf	62.5	>1000	>1000	>1000	>1000	250
Cesalpiniaceae	Detarium senegalensis J. F. Gmel	Booto bourou	leaf	500	>1000	>1000	>1000	>1000	>1000
	Cassia alata L	Kotambalen	Stem-bark	500	>1000	>1000	>1000	>1000	1000
	Tamarindus indica L	Tombin (M) Dyabbhè (P) Tombinnyi (P)	fruit	500	500	500	500	>1000	250
	Afzelia africana Sm.	Lènkè (M)	leaf	500	>1000	>1000	>1000	>1000	1000
	Dialium guineense Willd.	Mökè (S) Kofina (M)	leaf	500	>1000	>1000	>1000	>1000	>1000
	Piliostigma thonningii (Sch.) Miln.-Redh.	Barkè (P) Nyaman (M) Yorokoe (S)	leaf	250	>1000	>1000	>1000	>1000	500
Combretaceae	Anogeissus leiocarpus (DC.) G. et Perr.	Krèkètè (M) Kerkete (P) ou pendekou	leaf stem-bark	500 125	>1000	>1000 125	>1000	>1000	>1000 125
	Terminalia macroptera G. et Perr.	Warsa (M) Booribillel	Stem-bark	1000	>1000	500	>1000	>1000	1000
Dipterocarpaceae	Monotes kerstingii Gilg.	Gbèrègbèrè (M) Louga (P)	leaf	500	>1000	>1000	>1000	>1000	500
Euphorbiaceae	Alchornea cordifolia (S. et Th.) Mull. Arg.	Pèlennaa (G) Koyiran M) Garkasaki (P) Bolonta (S)	leaf	500	>1000	>1000	>1000	>1000	500
	Phyllanthus discoideus (Baill.) Mull. Arg.	Bakonko (M) Keeri (P)	leaf stem-bark	500 >1000	>1000 >1000	>1000 500	>1000 >1000	>1000 >1000	>1000 >1000
	Jatropha curcasL.	Baanin (M) Kiidi (P)	leaf	250	>1000	>1000	>1000	>1000	>1000
Fabaceae	Pterocarpus erinaceus Poir	Bani bhalè	Stem-bark	1000	>1000	>1000	>1000	>1000	>1000
	Pericopsis laxiflora (Benth. Ex Bak) Van Meeuwen	Kulokulo (P)	Stem-bark	1000	>1000	>1000	>1000	>1000	>1000
	Pterocarpus santalinoides L'Herm	Djegoun (M) Kambè (S)	leaf	1000	>1000	>1000	>1000	>1000	>1000
	Erythrina senegalensis DC	Mbootyolla (P)	leaf stem-bark	1000 1000	>1000 1000	>1000	>1000 1000	>1000	>1000 1000
Laurauraceae	Persea americana Mill.	Piya (P)	seed	500	>1000	>1000	>1000	>1000	>1000
Logoniaceae	Strychnos spinosa Lam.	Kunnèkunè (M) Gundegulen (P) Kundekunde (S)	leaf	1000	>1000	>1000	>1000	>1000	1000
Lythtraceae	Lawsonia inermis L.	Diabé (M) Lali (S)	leaf	500	>1000	250	>1000	>1000	500
Mimosaseae	Parkia biglobosa (Get Perr.) Benth.	Nèdè (M) Nètè (P)	Stem-bark	1000	>1000	>1000	>1000	>1000	>1000
	Dichrostachys glomerata (Forsk.) Chiov.	Gboro woni (M) Bulle bete (P) Santè (S)	leaf	1000	>1000	>1000	>1000	>1000	1000

Family	Botanical names	Vernacular names	Part used	Bacteria					
				B. cereus	E. coli	K. pneumoniae	P. aeruginosa	S. typhimurium	S. aureus
	Mimosa pudica L.	Fidanimaloyala (M)	Whole plant	250	>1000	>1000	>1000	>1000	500
Ochnaceae	Lophira lanceolata Van Tiegh	Malanga (P) Maangbèsè (M) Menègbèsè (S)	root	1000	>1000	>1000	>1000	>1000	>1000
Rubiaceae	Morinda geminata DC.	Wanda ou Ngarba (P)	root	500	>1000	>1000	>1000	>1000	1000
Rutaceae	Fagara xanthoxyloides Lam.	Wo (M) Bullè barkelen (P)	leaf	>1000	>1000	500	>1000	>1000	>1000
Solanaceae	Physalis angulata L.	Tentöla (M), Kindi (S), Subazulagui (T)	leaf	250	>1000	>1000	>1000	>1000	1000

Legend: Vernacular names: G= Guerzé ; M = Maninka ; P = Pular ; S = Susu ; T = Toma

Among the tested bacteria, *Bacillus cereus* was the most sensitive: the leave extracts of *Spondias mombin* and *Markhamia tomentosa* showed the strongest inhibition of its growth with a minimum inhibitory concentration of 62.5 µg/ml, followed by the stem-bark extract of *Anogeissus leiocarpus* (MIC: 125 µg/ml), the leave extracts of *Uvaria chamae, Piliostigma thonningii, Jatropha curcas* or *Physalis angulata* and the whole plant of *Mimosa pudica* (MIC: 250 µg/ml). At a concentration of 500 µg/ml, 13/35 (%) plant extracts were active while 12/35 (%) indicated an inhibition of *B. cereus* at CMI of 1000 µg/ml.

Only the fruit extract of *Tamarindus indica* and the stem-bark of *Erythrina senegalensis* inhibited weakly the growth of *E. coli* at CMI of 500 and 1000 µg/ml, respectively.

The second sensible bacteria was *Staphylococcus aureus* which was inhibited by *Anogeissus leiocarpus* (MIC: 125 µg/ml), *Tamarindus indica, Markhamia tomentosa,* (MIC: 250 µg/ml). A weak effect was recorded with 6/35 (CMI: 500 µg/ml) and 7/35 (CMI: 1000 µg/ml) plant extracts.

Only the stem-bark of *Anogeissus leiocarpus* and the leaf of *Lawsonia inermis* showed the highest activity against *Klebsiella pneumoniae* with CMI of 125 and 250 µg/ml, respectively. 4/35 (%) other samples (the fruit of *Tamarindus indica,* the stem-bark of *Terminalia macroptera,* the stem-bark of *Phyllanthus discoides,* and the leaf of *Fagara xanthoxyloides* were weakly active (CMI: 500 µg/ml).

The inhibition of the growth of *Pseudomonas aeruginosa* was slighlty effective with the fruit of *T. indica* (CMI: 500 µg/ml) and the stem-bark of *E. senegalensis* (CMI: 1000 µg/ml).

None of the tested extracts were active against *Salmonella tiphymorium* (CMI > 1000 µg/ml).

4. Discussion and Conclusion

Among the active extracts, only that of *A. leiocarpus* had a wide antibacterial spectrum against *B. cereus, K. pneumoniae,* and *S. aureus* at the same concentration of 125 µg/ml.

The present results are supported and/or reinforced by previous investigations which have described the antibacterial activity of some of the tested plant species. The leave extract of *Piliostigma thonningii* were active against *Staphylococcus aureus* [3]. The bark extract of *Anogeissus leiocarpus* inhibited the growth of *Staphylococcus aureus, Escherichia coli* [4; 5], *E. coli, S. aureus* at 300µg/ml [6], E. coli, *S. typhi, Shigella sp* [7], *S. aureus, Streptococcus pyogenes, B. subtilis, Salmonella typhi, Escherichia coli, Pseudomonas aeruginosa, Neisseria gonorrhoea* [8]. The leaf extracts of *Spondias mombin* showed an inhibitory effect against *S. pyogenes, S. typhi, E. coli, and S. aureus* [9] while its phenolic acids were shown to have a pronounced antibacterial effect against *B. cereus, S. pyogenes, and Mycobacterium fortuitum* (minimal bactericidal concentration in a concentration range of 3-25 µg/ml) [10]. The leave of *Lawsonia inermis* against *S. aureus* [11], *P.aeruginosa* [12], *B. subtilis, S. epidermidis, E. coli, S.typhi, Klebsiella spp.* and *Shigella* [13], *Staphylococcus epidermidis*, ß-hemolytic streptococci, *P.aeuruginosa* [14], *S. aureus, P. aeruginosa, Streptococcus mutans* [15], *B. cereus, S. aureus, E. coli, K. pneumoniae, P. pseudoalcaligenes* [16].

The founded antibacterial potency of the tested extracts was not significantly pronounced. Moreover, the tested micro-organisms are not quiete involved in STDs. STDs are caused by protozoa and different microorganisms such as bacterial and viral STDs which often give no warning signs or symptoms. This evidence limited the Guinean traditional healers possibilities to make an accurate diagnostic about STDs. Apart from gonorrhoeae, most of the diseases considered as STDs were related to some with evident symptoms like pelvic inflammatory disease, urethritis, infertility etc. Although the tested micro-organisms are not quiete involved in STDs, the present and previous results can support at least partly the traditional use of some of the tested plant species in the treatment of infectious diseases.

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