

ANTIMICROBIAL EVALUATION OF METHANOLIC EXTRACT OF *COLLIANDRA SURINAMENSIS* ON SOME PATHOGENIC ORGANISMS

EMMANUEL E. I. IRABOR¹, ABIODUN FALODUN^{2*}, OSAHON OBASUYI³,
CHUKWUDI O. OFOEGBU¹, SAMUEL O. ABIODUN¹ and KINGSLEY UMUJEYAN¹

¹Department of Chemistry, Faculty of Physical Sciences and Departments of ²Pharmaceutical Chemistry and
³Pharmaceutical Microbiology, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

Abstract: The crude extract of *Colliandra surinamensis* is used in traditional medicine for the treatment of some diseases/infections. The crude extract obtained from the flower of *Colliandra surinamensis* was found to have antimicrobial activity against some Gram positive organisms such as *Staphylococcus aureus*, *Bacillus subtilis* and *Streptococcus* species. The performance of the extract against the bacteria isolates was favorably comparable with established commercial antibacterial agents.

Keywords: *Colliandra surinamensis*, antimicrobial activity, pathogenic organisms

The World Health Organization (WHO) supports the use of medicinal plants provided it is proven to be efficacious and safe (1). The organization also acknowledges the role of herbal preparation in primary health care. In line with this, developed and developing countries have adopted the use of herbal preparation as complimentary or alternative medicine.

Consequently, the scientific search for new drugs from natural products remains a serious task for scientists worldwide (1). It is an accepted fact that a large segment of the population in tropical countries rely on traditional medicines for their health needs. It is also known that many of these ethno-medicines have given up drugs to modern medical practice. The practices are well established and regulated in China, India and Europe. This has led to a systematic scientific evaluation of these herbs giving rise to new medicines. However, such structure and regulated use is still absent in many of the African countries despite the use of these herbs by the local population (2).

In Nigeria, almost all plants are medicinal and the application of medicinal plants especially in traditional medicine is currently well acknowledged and established as a viable profession (3). An extraction of bioactive compounds from medicinal plants permits the demonstration of their physiological activity. It also facilitates pharmacological studies leading to synthesis of a more potent drugs with reduced toxicity (4-6). Furthermore, the active com-

ponents of herbal remedies have the advantage of being combined with many other substances that appear to be inactive. However, these complementary components give the plant as a whole a safety and efficiency much superior to that of its isolated and pure active components (7).

Colliandra surinamensis is a large multi-trunked, low branching, evergreen shrub with silky leaflets which appears glossy copper when turning to a dark metallic green; commonly referred to as prick powder-puff. It belongs to the family *Leguminosae*. It is a spreading tree with a height of about 4 – 6 m and spreads out at about 3 – 4 m. It has a fine texture foliage, which is oblong shaped and of boned, parallel, pinnate venation. The flower is pink colored with pleasant fragrant (8).

The investigation into the antimicrobial activity of the flower extract of this plant arises as a result of the observation of its stability during long period of storage.

EXPERIMENTAL

Materials and Methods

Extraction

The fresh flowers of *Colliandra surinamensis* were collected, air dried and crushed with aid of a mechanical grinder. The powdered plant material (1.306 kg) was extracted exhaustively with methanol by maceration process and the crude

*Correspondence: e-mail: faloabi25@yahoo.com, phone: +2348032396550

extract was obtained after evaporation to dryness with a rotary evaporator attached to a vacuum pump. The concentrated extract (277.73 g) obtained was stored in a refrigerator (-4°C) until use.

Antimicrobial evaluation

Clinical isolates of *Staphylococcus aureus*, *Bacillus subtilis*, *Streptococcus* spp, *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes* and *Candida albicans* were all supplied by the Department of Pharmaceutical Microbiology, University of Benin, Benin City.

The agar-well diffusion method was used to determine the antimicrobial activity (9-11).

Inocula of test organism obtained from source were prepared by growing each pure isolate in nutrient broth (Oxford CM31) for 18 h at 37°C. The overnight broth culture was matched with Macfarland turbidity standard to give approximately 10⁸ cfu/mL, 0.2 mL was then used to seed a molten nutrient agar medium which has been allowed to cool to 45°C to obtain approximately 10⁶ cfu/mL. This was poured in sterile Petri-dishes and used for analysis.

The extract was tested at 100 mg/mL concentration. This was delivered into wells (8 mm in diameter) bored into the surface of the already seeded nutrient agar plate. Commercial antibiotics containing Amoxicillin (25 mg) and ciprofloxacin (5 mg) (Silva Hills Pharmaceuticals) were used in parallel in the agar-well diffusion method. *Staphylococcus aureus* (NCTC 10788) was set up along with the test organism as a check on the effect of media and inherent sensitivity of isolate on zone of inhibition produced by the antibacterial substance. The fungal isolate (*Candida albicans*) was treated in slightly different manner. It was first grown on Sabouraud dextrose broth (Oxoid CM41) and assayed using Sabouraud dextrose agar. The plates were incubated at 37°C for 24 h while the fungi were incubated at 25°C for 48 h. After incubation, the zones of inhibition were recorded in millimeters (mm).

Determination of minimum inhibitory concentration (MIC)

The test tube dilution methods (12, 13) were used in the determination of the minimum inhibitory concentration of the plant extract. Appropriate dilutions of 1.0, 1.5, 3.0, 6.0, 12.0, 15.0, 20.0, 25.0, 50.0, and 100 mg/mL in nutrient broth were made to give a final volume of 1 mL in the tubes. One drop equivalent to 0.02 mL of organisms (prepared as previously described) was added to each test tube. A tube was set up without the extract as a control. The test tubes were incubated at 37°C for 24 h. The min-

imum inhibitory concentration was regarded as the lowest concentration that inhibited visible growth.

RESULTS

Table 1 shows that the extract of *Colliandra surinamensis* possesses antibacterial activity against *Staphylococcus aureus*, *Bacillus subtilis* and *Streptococcus* species, which are all Gram positive organisms. No activity was shown against *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes* and *Candida albicans*.

The minimum inhibitory concentration (MIC) of the *Colliandra surinamensis* is shown in Table 2. It ranges from 1.5 mg/mL for *Staphylococcus aureus* and *Streptococcus* species to 6.0 mg/mL for *Bacillus subtilis*.

Comparative analysis of the activity of extract against some commercially obtained antibiotics is shown in Table 3. The activity of 1.5 mg/mL *Colliandra surinamensis* extract was similar to that produced by 25 µg Amoxicillin against *Streptococcus* species, whereas that of 6.0 mg/mL had a higher activity than Amoxicillin against *Bacillus subtilis*.

Table 1. Antimicrobial activity of *Colliandra Surinamensis* extract.

Organism	Mean zone diameter (mm)*
<i>Staphylococcus aureus</i>	14
<i>Bacillus subtilis</i>	17
<i>Streptococcus</i> species	16
<i>Escherichia coli</i>	-
<i>Pseudomonas aeruginosa</i>	-
<i>Enterobacter aerogenes</i>	-
<i>Candida albicans</i>	-

* Mean of 5 isolates, - = no activity. Zones measuring ≥ 10 mm were acceptable as sensitive

Table 2. Minimum inhibitory concentration (MIC) of *Colliandra Surinamensis* extract.

Organism	Minimum Inhibitory Concentration (MIC) mg/mL
<i>Staphylococcus aureus</i>	1.5
<i>Bacillus subtilis</i>	6.0
<i>Streptococcus</i> species	1.5
<i>Escherichia coli</i>	N.T.
<i>Pseudomonas aeruginosa</i>	N.T.
<i>Enterobacter aerogenes</i>	N.T.
<i>Candida albicans</i>	N.T.

N.T. = Not tested since there was no zone of inhibition

Table 3. Comparison of antimicrobial activity of commercial antibiotics against extract of *Colliandra Surinamensis*.

Organism	Mean zones of inhibition (mm)		
	<i>Colliandra surinamensis</i>	AM (25 µg)	CP (25 µg)
<i>Staphylococcus aureus</i>	14	15	33
<i>Bacillus subtilis</i>	17	14	28
<i>Streptococcus species</i>	16	16	30
<i>Escherichia coli</i>	-	17	24
<i>Pseudomonas aeruginosa</i>	-	-	28
<i>Enterobacter aerogenes</i>	-	20	28
<i>Candida albicans</i>	-	N.T.	N.T.

N.T. = Not tested; AM = Amoxicillin; CP = Ciprofloxacin

DISCUSSION

The fact that the crude extract of *Colliandra surinamensis* produced zones of inhibition against Gram positive organisms such as *Staphylococcus aureus*, *Bacillus subtilis* and *Streptococcus species* indicates the presence of antibacterial activity which confine its use as anti-infective. However, not having it against Gram negative organisms such as *Escherichia coli*, *Enterobacter aerogenes* and *Pseudomonas aeruginosa* indicates its narrow spectrum of activity. This may be due to the presence of hydrophilic substances in the cell wall of the Gram negatives. The extract showed no activity against *Candida albicans* which was the only fungus tested.

The performance of *Colliandra surinamensis* extract against sensitive bacteria isolates did not show differences when compared with established commercial antibiotics prepared with Amoxicillin (Table 3).

This result suggests the need for further studies on this substance to identify, isolate, characterize and elucidate the structure of the active ingredient(s) using some spectroscopic techniques such as nuclear magnetic resonance (NMR), infrared spectrophotometry (IR) and mass spectrometry (MS).

CONCLUSION

The crude extract of *Colliandra surinamensis* demonstrated a significant antibacterial activity against the microorganisms investigated and could therefore be added to the potential list of antibacterial agents. The study also justified the reason for the keeping quality (storage) of the extract.

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