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Phytochemical Constituents and Antimicrobial Activity of Aqueous Extract of Cymbopogancitratus

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Abstract:
Aqueous extraction from Cymbopogancitratus whole plant is commonly used as infusion (herbal tea) for the treatment of various ailments. Information on its phytochemical composition and therapeutic uses is however scanty in literature. In this study, the phytochemistry and antimicrobial activity of aqueous extract of Cymbopogancitratuswhole plant was evaluated. The screening for its phytochemical contentand subsequent quantification of the extract from water of Cymbopogancitratusshowedit to containsaponins (18.10%), alkaloids (10.5%), steroids (8.18%), flavonoids (2.74%) and phenols (0.4%).The aqueous extract of Cymbopogancitratusinhibited a broad range of pathogens (B. cereus, S. typhi, S. aureus, E. coli 0157, Shigella species, A. flavus, C. albicans, A. fumigatus, T. rubrum and E. floccosum).A range of 6.00 mm to 24 .00 mm was recorded as its zone of inhibition with highest inhibitory effect on S. typhi (11.00mm) at a concentration of 125mg/ml. The constituent phytochemicals may account for varied ethnobotanical uses of the plant in folk medicine of Nigeria. It is also considered that Cymbopogancitratuscould be a very rich source of antimicrobial formulation if properly harnessed and processed.

Keywords: *Cymbopogancitratus, aqueous extract, phytochemicals, antimicrobial activity.*

1. Introduction

A large contribution to the wellbeing and health of human has been recorded from medicines derived from plants (Avijgan et al., 2010). World Health Organization 2001 statistics showed a large percentage of the world populace depending on medicines from plant. This figure is precisely 80%. There has been a low records of adverse effects of herbal remedy usage compared to synthetic drugs where in developing countries where their usage is popular. This includes Nigeria (Iniaghe*et al.*, 2009). Resistance to current available synthetic drugs is becoming a concern to public health. This has given rise to researches for new drugs of plant origin. Bioactive phytochemical contents that gives rise to physiological and pharmacological effects is the main determining factor of a plants medicinal value (Pascual*et al*., 2002; Akinmoladun*et al*., 2007).

Cymbopogancitratus, commonly called Lemon grass grows in a pattern that is reed-like, possesses firm foot thin stalk alongside a bulb that is small at the bottom. Its color are diverse from very light green which is more popular to pale yellow. It has a characteristic pleasantly assertive lemon taste aroma. This plant is used in so many ways such as whole in simmering, sliced or skewer. Lemon grass belongs to the family Poaceae and kingdom Plantae, a very large genus of the family including about 500 described species (Sprengel*et al*, 1815). It is not grown on commercial scale in Nigeria.

The oils obtained from *Cymbopogancitratus* have been shown to inhibit the activity of some pathogenic bacteria and fungi (Smith,N.M., 2002).Methanol extract of *Cymbopogancitratus* leaves also showed activity on Fungi, Gram positive and negative Bacteria. It can therefore be referred to as having broad spectrum activity (Hamza, 2009). The local populace of Nigeria make infusion (herbal tea) from the aqueous extract of *Cymbopogancitratus* and use it orally for the treatment of various ailments diarrhea, malaria, etc.

Information on the phytochemical constituents and extract gotten through infusion using water for therapeutic purpose of *Cymbopogancitratus* whole plant is however not readily available in the literature. This research was therefore done to ascertain the activity on microbes and phytochemical content in the extract gotten from aqueous extraction of *Cymbopogancitratus* whole plant. This will substantiate its use in Nigeria's folk medicine.

2. Materials and Methods

2.1. Plant Material

Cymbopogancitratus was harvested from a settlement in Mkar, Gboko Local Government Area, Benue State, Nigeria. The whole plant was used in this study.Identification of this plant was done in The Botany Department,University of Agriculture,Makurdi,Benue State, Nigeria. The plant material was air dried for one week. It was ground to powder using an electric blender. Powdered samples were examined at the Biochemistry and Microbiology division of National Veterinary research institute (NVRI) Vom, Plateau State, Nigeria.

2.2. Phytochemical Screening

Qualitative evaluation were done using chemical test on the samples following standard procedure for identification of the content as reported by Harbone in 1973; Trease and Evans in 1989 and Sofowora in 1993. The quantification of the detected phytochemicals was carried out as described for saponins (Brunner, 1984), flavonoids, steroids,terpenes, phenolics (El-Olemy*et al*., 1984) and alkaloids (Henry, 1973).

2.3. Preparation of Innocular

The stock culture from the Microbiology Laboratory, National Veterinary Research Institute, Vom, Nigeria was the source of all pathogens used in this study. Resuscitation of the organisms was done in buffered peptone broth. They were subsequently sub-cultured into plates made from potatoes dextrose agar and nutrient agar for Fungi and Bacteria respectively. Incubation for 5 days at 25^{o}c and 24 hours at 37^{o}c was done for Fungi and Bacteria respectively. This was done to ascertain the viability of every isolate.

2.4. Test for Antimicrobial Activity

Using a method of diffusion decribed by Ebi and Ofoefulu in 1997, the test organism sensitivity to the aqueous extract of *Cymbopogancitratus* was tested. This procedure was carried out using molten nutrient agar and potatoes dextrose agar of 20ml in volume. They were inoculated broth culture containing the test organism in sterile dishes. 0.2ml of this was used. To ensure a distribution of the organisms in a uniform way. There was slow swirling of the petri dish. Solidification was done by allowing plates stand for some time. With the help of a sterile Pasteur pipette, 8.0mm diameter of dish cups were made. For proper diffusion of extract into media, the plates were kept for a duration of 30 minutes. This was done at room temperature. In an inverted position, incubation of petri dishes containing media, extract and pathogens were done for 24 hours at 37^{o}c and 25^{o}c for 5 days respectively for Bacteria and Fungi. Measuring and recording of inhibition zones in millimeter was then done.

2.5. Minimum Inhibitory Concentration (MIC) Test

Baron and Finegold 1990 description of agar dilution method was adopted in this study. The MIC was determined with their described way.Nutrient agar and potatoes dextrose agar were prepared to manufacturer's specification. After sterilization, the media were dispensed into sterile Petri dishes to allow solidification. Using sterile swap sticks, the pathogens were introduced into the bored holes. The Petri dishes were then placed in an inverted way in the incubator at 37^{o}C for 24 hours and 25^{o}C for 5 days respectively for bacteria and fungi.Measuring and recording of zones of inhibition in millimeters was done.

3. Results

Phytochemicals	**Quantity (%)**
Saponins	18.10
Alkaloids	10.50
Terpenes	Not detected
Steroid	8.18
Flavonoids	2.74
Phenols	0.40

Table 1: Phytochemical components of aqueous extract of Cymbopogancitratus

Organism	Zones of diameter (mm)/ concentration of extract (mg/ml)			
	1000	500	250	125
B. cereus	24 ± 4	20 ± 4	18 ± 0	10 ± 0
S. typhi	26 ± 1	22 ± 0	15 ± 1	11 ± 0
S. aureus	24 ± 1	17 ± 1	12 ± 0	8 ± 1
E. coli 0157	19 ± 0	13 ± 1	10 ± 0	6 ± 0
Shigella species	17 ± 0	10 ± 0	7 ± 0	0
A. flavus	20 ± 0	11 ± 0	0	0
C. albicans	10 ± 0	6 ± 0	0	0
A. fumigatus	18 ± 0	11 ± 0	8 ± 0	0
T. rubrum	9 ± 0	6 ± 0	0	0
E. floccosum	12 ± 0	10 ± 0	0	0

Table 2: Antimicrobial action of aqueous extract of Cymbopogancitratusagainst a broad range of organisms

Organism	Concentration (mg/ml)						MIC
	100	50	25	12.5	6.25	3.125	
B. cereus	-	-	-	-	+	+	12.5
S. typhi	-	-	-	-	+	+	12.5
S. aureus	-	-	+	+	+	+	50
E. coli 0157	-	-	+	+	+	+	50
Shigella species	-	+	+	+	+	+	100
A. flavus	-	+	+	+	+	+	100
C. albicans	+	+	+	+	+	+	0
A. fumigatus	+	+	+	+	+	+	0
T. rubrum	+	+	+	+	+	+	0
E. floccosum	+	+	+	+	+	+	0

Table 3: The minimum inhibitory concentration of aqueous extract of Cymbopogancitratusagainst a broad range of organisms
Key: Visible turbidity (+); No visible turbidity (-)

Saponins (18.10%), alkaloids (10.5%), steroids (8.18%), flavonoids (2.74%) and phenols (0.4%) was present with terpenes absent in the phytochemical analysis as shown in table 1. The aqueous extract of *Cymbopogancitratus* inhibited a broad range of pathogens (*B. cereus, S. typhi, S. aureus, E. coli 0157, Shigella species, A. flavus, C. albicans, A. fumigatus, T. rubrum* and *E. floccosum*;Table 2). A range from 6.00 mm to 24 .00 mm was recorded as the zone of inhibition with the highest inhibitory effect on *S. typhi* (11.00 mm) at a concentration of 125mg/ml (Table 3).

4. Discussion

In this study, we demonstrated that aqueous extract of *Cymbopogancitratus* contains the phytoconstituents saponins, alkaloids, steroids, flavonoids and phenols. It also possesses antimicrobial activity over a broad range of pathogens.

Significant therapeutic functions in the body are recognized to be carried out by phytochemicals.The therapeutic uses of plants and their products in traditional medicine, including antimicrobial activity against various pathogenic microorganisms depend on the presence of phytochemicals in them (Edeoga et al., 2005; Bishnu et al., 2009; Ettebong and Nwafor, 2009). Essential roles in medicine has been recorded to be played by Saponins. They are known to serve as emulsifying agent and expectorant (Edeoga et al., 2009), inhibition of *Staphylococcus aureus* (Soetan K.O et al., 2006) and having antifungal properties (Osuagwu et al., 2007).

Development control in living system and some metabolic role in living system have been shown from previous studies as some roles played by alkaloids (Edeoga and Eriata, 2001). In steroidal drugs manufacture, this phytochemical is utilized as starting material. They also function in animal as a protective. Thus, steroidal alkaloids are used as medicine (Maxwell et al., 1995; Stevens et al., 1992). Another vital property of isolated alkaloids from plants that are pure alongside their derivatives that are synthetic is their anspasmodic, antibacterial and analgesic potential. This leads to them being used as basic medicinal agent (Ogukwe, et al., 2004).

Estrogen, a type of steroids are implicated in disease reduction such as neurodegenerative, coronary heart, etc. in both young and healthy women that are no longer menstruating. This was recorded by Perrella et al., in 2003. Tannins show cytotoxic, astringent andantimicrobial properties at low concentrations as suggested by Zhu et al., in 1997; Ijeh et al., in 2004.

Defensive effects, serving as antioxidant etc. are known to be carried out by flavonoids (Kim et al., 1994; Okwu, 2004). Okwu and Omodamiro in 2005, reported a kind of flavonoid known as Isoflavones, are phytoestrogen, which efficiently control levels of estrogen in human. Frequency of cancer, cardiac diseases, hyperlipidemias and other long-lasting diseases are reduced by a form of flavonoid identified as anthocyanin (De Pascual-Teresa and Sanchez-Ballesta, 2008).

Singh and Sawhney, in a 1988 study showed plants phenolic compounds to be potentially lethal to the survival of pathogens. Other studies also demonstrate that compounds with phenolic content conduct strong antioxidant activity and extensive pharmacologic actions. These comprises platelet aggregation inhibition action, anti-carcinogenic action, etc. as reported by Rein et al. in 2000 and

Rice – Evans et al. in 1996.

Arshad et al., Kamba and Hassan reported both in 2010 while Koche et al. reported in 2011 that other plant leaves have been described for their varied antimicrobial activities. Presence of bioactive substances like alkaloids, flavonoids, phenols saponins, steroids and tannins in their leavesis thought to give extracts the ability to hinder development of different organisms (Bishnu et al., 2009; Iniaghe et al, 2009; Omoyeni and Aluko, 2010). From the result of this study, there is an observed relationship between the extract strength and inhibition rate in the growth of the microbes. There was a corresponding increase in the rate of rendering the pathogens ineffective as the concentration of the extracts upsurges. This trend was also recorded by other researchers (Valarmathy et al 2010; Subban et al., 2011).

This study showed that making infusion from this plant as it is been done by the locals in many parts of Nigeria is actually medicinal on a broad range of pathogens.

In conclusion, the constituent phytochemicals may account for the antimicrobial activity and other ethnobotanical uses of aqueous extract of *Cymbopogancitratus* whole plant in folk medicine of Nigeria. It is also considered that *Cymbopogancitratus* could be a very rich source of antimicrobial formulation if properly harnessed and processed.

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