ANTIMICROBIAL ACTIVITY OF ESSENTIAL OILS OF *PHYSALIS ANGULATA*. L

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Abstract

The need for a reduction in drug resistance led to the investigation of *Argemone Mexicana L.* as an agent against *Bacillus subtilis, Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans, Candida stellatoidea and Candida torulopsis,* using well diffusion and minimum inhibitory concentrations methods. The sensitivity of *Bacillus Subtilis, Klebsiella pneumoniae, Pseudomonas aeruginosa and Staphylococcus aureus* to the essential oils of both the aerial and root parts were determined. *Pseudomonas aeruginosa* was resistant to the essential oil from both the aerial and root part of the plant. *C. torulopsis, C. stellatoidea and C. albicans* were susceptible to the essential oils from the aerial and root part of the plant. The minimum inhibitory concentrations ranging between 3.75mg/ml and 4.0mg/ml were recorded for *Bacillus subtilis, Klebsiella pneumoniae* by the aerial and the root extracts, but *P. aeruginosa* and *S. aureus* were not susceptible to the aerial and root extracts. The observed inhibition of selected bacteria and fungi by oils of *Physalis angulata* makes it a promising antimicrobial agent. This study justifies its uses for treatment of sores, cuts, intestinal and digestive problems and some skin-diseases often reported in folkloric medicine.

Key words: *Physalis angulata L*, essential oils, antimicrobial, antifungi

Introduction

Physalis angulata L is an annual, herbaceous plant which belongs to Solanaceae family. It is known by different names, including camapu; cutleaf groundcherry; wild tomato, mullaca, winter cherry etc. In Southwest Nigeria, it's known as Koropo. Its biologica properties include antimycobacterial, anticancerous, antitumorous, anticoagulant, hypotensive, immunostimulant etc (Pietro et al, 2000; Januário et al.,2002). The Plant prefers moist drained sandy loamy soil with full sun or partial shade; it is renowned as an effective stimulant for the immune system. The juice is used in the treatment of earache, jaundice, fever, bladder diseases etc The fruit and other aerial parts are used in the treatment of boils, sores, cuts, constipation, intestinal and digestive problems (Sultan et al., 2008; Van Valkenburg and Bunyapraphatsara, 2002), and used as an antimutagenic, anticoagulant, antispasmodic, antileucemis agents (Freitas et al., 2006). *In vivo* antitumour activity was demonstrated in mice (Chiang et al., 1992; Magalhães et al, 2006), while it is used in treatment of hepatitis, diabetes, asthma, and malaria. It also possesses anticarcinogenic properties (Wen-Tsong et al., 2006).

Physalis angulata L is one of the plants frequently used in the treatment of gonorrhea (Armando et al., 2000). Root aqueous extract of *physalis angulata* exhibited *in-vivo* antinociceptive activity (Bastos et al 2006). Methanol extracts of *physalis angulata* exhibited antiperidontic property (Jae-Seok et al 2002), anti-inflammatory and immunomodulatory activities, Bastos et al., 2008). The fruit of *Physalis angulata* inhibited *S. aureus* ATCC 29213, *S. aureus* ATCC 25923, *S. aureus* ATCC 6538P and *N gonorrhoea* ATCC 49226 (Melissa et al.*;* 2005). The objectives of this study was to determine the effectiveness of the antibacterial activities of the essential oils of *Physalis angulata L* against *Candida* species*(C. stellatoidea, C. albicans and C. torulopsis*) and some selected bacteria species (*B. subtilis, P. aeruginosa, K. pneumoniae and S. aureus)*

Materials and Methods

Aerial and root parts of *Physalis angulata* (voucher No. FHI108789) were collected from Sagamu in May, 2007 and was authenticated at the plant Science Department of Olabisi Onabanjo University, Ago-Iwoye. Nigeria.

Essential oil isolation

Air-dried plant material (100 g) was hydrodistilled for 3 hrs using a Clevenger type apparatus. The oil was dried over anhydrous sodium sulfate and was kept in a sealed vial at 4^0C until analysis and tests.

Antimicrobial assays

The modified method of Muñoz-Mingarro et al. (2003) was used for the bioassay. The bacterial growth inhibition assays were performed using cultures of *Klebsiella pneumonia, Bacillus subtilis, Staphylococcus aureus* (ATCC 24213), and *Pseudomonas aeruginosa* (ATCC 9027) and the yeast *Candida albicans* (ATCC 10231), *C. stellatoidea,* and *C. torulopsis*. Bacteria strains were maintained on Mueller-Hinton broth and the yeast on Sabourand's dextrose agar. The diluted extract suspension was homogenized and the screening was then performed according to the liquid dilution method.

Minimum inhibitory concentration (MIC) was determined by incorporating various amounts (1–200 mg/ml) of reconstituted extract solution into the medium. The MIC was interpreted as the lowest concentration of the extracts that did not permit any visible growth when compared with that of the control.

Results and Discussion

The antimicrobial activity of *Physalis angulata L* at different concentrations was determined by agar well diffusion method. A total of 7 microoganisms that consisted of four bacterial and three fungi were tested. Standard antibiotics (Ampicillin and Ketoconazole)) were used as positive control and 75% methanol as negative control. The essential oil obtained from hydrodistillation of both the leaves, stem and root parts of *Physalis angulata L* 1.5%[(w/w) was based on the dry weight of the plant]

Table 1: Antibacterial activity of the essential oil of the aerial part of *Physalis angulata L*

Microorganism	Essential oil (10ul/ml)		Ampicillin (10 ug/ml)
	IZ (mm)	MIC (mg/ml)	IZ (mm)
B.subtilis	14.0±0.2	4.0±0.1	22.1±0.1
P.aeruginosa	na	na	13.0±0.2
K.pneumoniae	10.0±0.2	4.0±0.2	24.0±0.2
S. aureus	na	na	23.0±0.3

IZ, inhibition zone including diameter of Well (6 mm); MIC, minimum inhibitory concentration; na, not active;

Table 2: Antibacterial activity of the essential oil of the root part of *Physalis angulata L*

Microorganism	Essential oil (10ul/ml)		Ampicillin (10 ug/ml)
	IZ (mm)	MIC (mg/ml)	IZ (mm)
B.subtilis	na	na	22.1±0.1
P.aeruginosa	na	na	20.1±0.1
K.pneumoniae	10.0±0.2	4.0±0.2	24.0±0.2
S. aureus	na	na	21.0±0.3

IZ, inhibition zone including diameter of Well (6 mm); MIC, minimum inhibitory concentration; na, not active;

Table 3: Antifungi activity of the essential oil of the aerial part of *Physalis angulata L*

Microorganism	Essential oil (10ul/ml)		Ketoconazole (10 ug/ml)
	IZ (mm)	MIC (mg/ml)	IZ (mm)
C. albicans	10.0±0.1	4.0±0.1	15.0±0.2
C. stellatoidea	11.0±0.2	3.75±0.1	12.0±0.3
C. torulopsis	16.0±0.3	4.0±0.2	13.0±0.2

IZ, inhibition zone including diameter of Well (6 mm); MIC, minimum inhibitory concentration; na, not active;

Table 4: Antifungi activity of the essential oil of the root part of *Physalis angulata*

Microorganism	Essential oil (10ul/ml)		Ketoconazole (10 ug/ml)
	IZ (mm)	MIC (mg/ml)	IZ (mm)
C. albicans	8.0±0.2	4.0±0.1	11.0±0.1
C. stellatoidea	10.0±0.1	3.75±0.1	14.0±0.2
C. torulopsis	12.0±0.2	4.0±0.2	10.0±0.3

IZ, inhibition zone including diameter of Well (6 mm); MIC, minimum inhibitory concentration; na, not active;

The results are presented in Tables 1-4. As shown in Table 1 the result obtained from the well diffusion method followed by the measurement of the MIC values showed that *B. subtilis* and *K. pneumoniae* were sensitive with the lowest MIC values of 4.0mg/ml in the presence of essential oils isolated from aerial parts of *Physalis angulata.* But *P. aeruginosa* (ATCC 9027) and *S. aureus* (ATCC 24213) were resistant to the essential oil isolated from aerial part of *Physalis angulata.* The oils from the aerial parts were active against B. subtilis, K. pneumoniae while P. aeruginosa and S. aureus were resistant. However, K. pneumoniae was sensitive to the oils from the root while the others were resistant (Table 2). All the fungi tested were sensitive to the oil isolates from the aerial and root parts (Tables 3 and 4). However, the aerial parts were more active.The efficacy of the oil extract of *Physalis angulata L* on *Candida albicans, Candida stellatoidea, Candida torulopsis, Klebsiella pnuemoniae, Bacillus subtilis, Staphylococcus aureus and Pseudomonas aeruginosa* confirmed its usefulness in treament of boils, sores, cuts, constipation and intestinal and digestive problems (Van Valkenburg and Bunyapraphatsara, 2002; Sultan et al., 2008).

The activity shown against of *Candida albicans, Candida stellatoidea and Candida torulopsis,* which are resistant to many antibiotics justifies that further investigation should be conducted on its anti-infective properties.

In conclusion, *Physalis angulata L* oil extract has both antifungi and antibacterial properties, although its antifungi activities are higher. These activities are more concentrated in the aerial parts than in any other part of the plant.

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