

Antimicrobial activity of the essential oil of *Sida cordifolia* L.

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RESUMO: “Atividade antimicrobiana do óleo essencial de *Sida cordifolia* L.”. A análise da atividade antimicrobiana do óleo essencial de *Sida cordifolia* foi avaliada com quatro diferentes cepas de bactérias e nove de fungos. O óleo essencial foi testado “in natura” 100 % e diluído de 32 até 2 %. Os microrganismos, bactérias e fungos, foram semeados em ágar Muller-Hinton e Sabouraud dextrose, respectivamente. *S. cordifolia* mostrou atividade inibitória contra os microrganismos testados com eficácia de 80 %. Quando testado contra *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Candida guilliermondii* e *Trichosporon inkin* o óleo essencial mostrou um melhor desempenho.

Unitermos: *Sida cordifolia*, Malvaceae, atividade antimicrobiana, óleo essencial.

ABSTRACT: The analysis of the antimicrobial activity of the essential oil of *Sida cordifolia* was evaluated with four different strains of bacteria and nine fungi. The essential oil was tested “in natura” (100 %) and diluted from 32 until 2 %. The microorganisms, bacteria and fungi, were spread in agar Muller-Hinton and Sabouraud dextrose, respectively. *S. cordifolia* showed inhibitory activity against the microorganisms tested with efficacy of 80 %. When tested against *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Candida guilliermondii* and *Trichosporon inkin* the essential oil showed the best performance.

Keywords: *Sida cordifolia*, Malvaceae, antimicrobial activity, essential oil.

INTRODUCTION

In the world of medicinal plants the aromatic plants constitute a prominent group mainly by the essential oils found in leaves, stems bark, resins, flowers, fruit bark and other parts.

The resistance of the bacteria to the innumerable antimicrobial agents constitutes one of the great challenges in the treatment of infections, conditioning to the necessity of searching and finding new sources of substances with antimicrobial properties to be used in the combat of microorganisms (Recio et al., 1989).

The Malvaceae family comprises about 120 genera and 1700 to 2000 species. The genus *Sida* is the third most diversified one of this complex family having 170 to 250 species around the world (Fuentes, 1993).

Sida cordifolia L. (Malvaceae) is a species with widespread distribution occurring in the tropical regions of the world mainly in America. In Brazil it is a common species found from north to south and is used as medicinal. In the Northeast region *S. cordifolia* is popularly known as “malva-branca” and is used in folk medicine for the

treatment of rheumatisms, inflammations, asthma and in nasal congestions (Silveira et al., 2003).

The aqueous extract of the leaves of *S. cordifolia* showed anti-inflammatory activity (Falcão et al., 2005) and the acetone extract of the roots inhibited the angiotensin converting enzymes (Barbosa-Filho et al., 2006). Phytochemical studies with this plant leaves have revealed the presence of quinolizidine alkaloids, such as vasicine, vasicinone and vasicinol (Ghosal et al., 1975). Pharmacological studies conducted in our laboratory identified the cardiovascular activity of the alkaloid vasicine by Silveira et al. (2003). In this work the antimicrobial activity of the essential oil of *S. cordifolia* against some bacteria and pathogenic fungi is reported.

MATERIAL AND METHODS

Botanical material

The plant was collected in December 2004, near the city of Santa Rita, State of Paraíba, Brazil, a coastal area around the Atlantic Forest. The voucher samples

Table 1. Halos diameter average (mm) of the evaluation of the MIC of the essential oil of *Sida cordifolia* against bacteria and fungi, in solid medium.

Microorganisms	Essential oil (%)						Control		
	100	32	16	8	4	2	Microorganisms	Ketoconazole 50 µg/mL	Chloramphenicol 30 µg/mL
<i>S. aureus</i> ATCC 25923	17	13	12	8	0	0	+	-	22
<i>S. epidermidis</i> ATCC 12228	16	12	10	7	0	0	+	-	16
<i>M. luteus</i> ATCC 9341	12	10	7	0	0	0	+	-	20
<i>P. aeruginosa</i> ATCC 27853	0	0	0	0	0	0	+	-	10
<i>C. albicans</i> ATCC 90028	14	13	12	0	0	0	+	10	-
<i>C. guilliermondii</i> LM 28	20	15	12	10	7	0	+	12	-
<i>C. krusei</i> LM 07	12	10	8	0	0	0	+	0	-
<i>C. stellatoidea</i> LM 96	0	0	0	0	0	0	+	14	-
<i>C. tropicalis</i> LM 25	14	10	7	0	0	0	+	12	-
<i>T. inkin</i> LM 267	24	22	16	12	8	0	+	0	-
<i>T. rubrum</i> LM 105	0	0	0	0	0	0	+	10	-
<i>T. mentagrophytes</i> LM 103	12	10	0	0	0	0	+	12	-
<i>Penicillium</i> FCF 281	0	0	0	0	0	0	+	0	-

(*Agra et Góis 6243*) were deposited in the Herbarium Prof. Lauro Pires Xavier (JPB) and in the reference collection of the Laboratório de Tecnologia Farmacêutica of the Universidade Federal da Paraíba, Brazil.

Extraction of the essential oil

Fresh leaves of *S. cordifolia* (1000 g) were cut into pieces, and subjected to steam distillation in a Clevenger-type apparatus (Matos et al., 1999). The essential oil obtained (0.06 % w/w) had yellow color and characteristic odor and was dried over anhydrous sodium sulfate and filtered. The oil was kept in amber bottle flask and maintained in temperature lower than 4°C.

Microorganisms

For the bioassays 4 bacteria and 9 fungi were used: *Staphylococcus aureus* (ATCC 25923), *Staphylococcus epidermidis* (ATCC 12228), *Micrococcus luteus* (ATCC 9341), *Pseudomonas aeruginosa* (ATCC 27853), *Candida albicans* (ATCC 90028), *Candida guilliermondii* (LM 28), *Candida krusei* (LM 07), *Candida stellatoidea* (LM 96), *Candida tropicalis* (LM 25), *Trichosporon inkin* (LM 267), *Trichophyton rubrum* (LM 105), *Trichophyton mentagrophytes* (LM 103) and *Penicillium* (FCF 281).

Culture media

The assays for the antimicrobial activities were carried out in agar Muller-Hinton (Merck) and agar Sabouraud dextrose – ASD (Difco) for bacteria and fungi,

respectively.

Assays of antimicrobial activities

The essential oil was tested “in natura” (100 %) and in dilutions from 32 until 2 %, according to Allegrini et al. (1973). For this purpose, 1.2 mL of the oil, 0.04 mL of Tween 80 (Sigma Chemical) and sterile distilled water enough to complete 5 mL were placed in sterile glass tubes, 70 x 10 mm (32% dilution). The resultant emulsion was homogenized in agitator Vortex (FANEM) for five minutes. The serial dilutions were made in proportion of two. Beginning at the first tube, 2.5 mL were transferred to a second one, which contained 2.5 mL of sterile distilled water following by agitation and homogenization. This process was successively repeated until the sixth dilution, corresponding to 2 %. The tests performed to evaluate the antibacterial and antifungal activity of the volatile oil were carried out by the method of diffusion in solid media (Bawer et al., 1996; Cleland; Squires, 1991). 1 mL of suspension of each microorganism, previously prepared, was deposited in dischargeable and sterile Petri dishes (15 x 90 mm), to which were previously added 20 mL of ASD with slow homogenization. Cavities were made with sterile glass cannulas with 6 mm in diameter in the solid culture media and were inoculated with 50 µL of each dilution of the tested oil. The controls were made for each microorganism with the standard antimicrobial chloramphenicol at 30 µg/mL for bacteria, and ketoconazole at 50 µg/mL for fungi. The assay system was incubated at 37 °C, during 24 – 48 hours for bacteria and leveduriform fungi; and at room temperature

in a period of 10 – 14 days for the filamentous fungi. Each assay was carried out in duplicate and the results were expressed by arithmetic media of the halos of inhibition obtained. The biological activity of the oil was considered positive when the media of the inhibition of the halos were equal or superior to 10 mm in diameter.

RESULTS AND DISCUSSION

The antimicrobial activity results of the oil against the bacteria and fungi can be seen in Table 1.

The essential oil of *S. cordifolia* was able to inhibit the growth of three of the four strains of bacteria tested. However, it was more effective against *Staphylococcus aureus* e *S. epidermidis*, up to the dilution of 8 % with inhibition halos of an average of 12 mm in diameter.

Among the fungi strains tested, seven were sensitive to the oil of *S. cordifolia*, representing 70 % of the tested strains. Concerning the leveduriform fungi, *C. guilliermondii* and *Trichosporon inkin* were the most sensitive ones to the oil up to the dilution of 8 %, with inhibition halos of an average of 13 mm in diameter. Being only *C. stellatoidea* resistant to the essential oil. Regarding *Candida albicans*, *C. krusei*, *C. tropicalis*, they were sensitive to the oil at the concentration of 16%, with inhibition halos of an average of 10 mm in diameter.

Among the filamentous fungi tested, the oil at the concentration of 32 %, inhibited the growth of only *T. mentagrophytes*, with inhibition halos of an average of 10 mm in diameter.

This study led to the conclusion that the antimicrobial activity of the essential oil of *Sida cordifolia* was satisfactory against the bacteria and fungi tested. These results are important as a preparation for further research with this same material. However, this essential oil needs to have adequate toxicological studies carried out in order to verify the possibility of its use in the fight against the microorganisms tested.

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