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Antimicrobial Activity of *Rhus coriaria* L. Leaf Extract

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The antibacterial activity of *Rhus coriaria* leaf methanol extract was assayed against Gram-positive and Gram-negative bacteria; antimycotic activity was assayed against some *Candida* species. MICs were determined by a broth microdilution assay in microlitre plates using Mueller–Hinton medium. MBCs were determined by plating 0.01 mL samples from clear 1 mL tubes onto agar plates. © 1998 John Wiley & Sons, Ltd.

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INTRODUCTION

We report the preliminary results of antibacterial and antimycotic activities of *Rhus coriaria* L. leaf extract.

Rhus coriaria L. (Anacardiaceae) found on the coast, in the hedges and in the woods of the mediterranean region, is an evergreen shrub or sapling up to 4 m tall. Numerous drugs obtained from different species of *Rhus* genus for their medicinal properties are included in the Pharmacopoeias of various countries (Imbesi, 1964).

Among these drugs, *Rhus coriaria* leaves, which contain tannins, flavonoids and an essential oil (El Sissi *et al.*, 1966; Van Loo *et al.*, 1988; Kuruku *et al.*, 1993) are used for their astringent properties, and we decided to examine them for antimicrobial activity.

MATERIALS AND METHODS

Plant material. Leaves of *Rhus coriaria* L. were collected in the neighbourhood of Messina in March 1996.

A voucher specimen of the plant was deposited in the herbarium of the Pharmaco-Biological Department of the University of Messina (Italy).

The fresh material was immediately lyophilized and powdered.

Preparation of extract. The methanol extract of *Rhus coriaria* L. was assayed. For the preparation of methanol extract exhaustive extraction of 10 g of *Rhus coriaria* L. leaves was carried out at 60°C in a water bath using methanol as solvent.

The mixture was filtered and the organic solvent removed under vacuum, dissolved in DMSO and diluted to 250 000 mg/L in volumetric flasks.

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Microorganisms. A total of 27 fresh clinical isolates identified by conventional procedures (National Committee for Clinical Laboratory Standards, 1995) and ATCC standard strains were used (Table 1).

Minimum inhibitory concentration (MIC). MICs were determined by a broth microdilution assay in microtitre

Table 1. MICs and MBCs (mg/L) of *Rhus coriaria* L. leaf extracts against 27 strains of standard and clinically isolated microorganisms

Standard strains	MIC	MBC
Escherichia coli ATCC 25922	312	625
Escherichia coli ATCC 30213	156	312
Pseudomonas aeruginosa NCTC 10662	625	1250
Staphylococcus aureus ATCC 29213	156	312
Enterococcus faecalis ATCC 29212	156	312
Bacillus subtilis ATCC 6603	78	156
Candida albicans ATCC 3183	625	1250
Clinical strains		
Escherichia coli 66	625	625
Escherichia coli 61	625	1250
Escherichia coli 64	312	312
Escherichia coli 71	312	625
Pseudomonas aeruginosa 052	312	625
Pseudomonas aeruginosa 020	625	625
Klebsiella pneumoniae 62	312	625
Klebsiella pneumoniae 006	312	625
Klebsiella pneumoniae 028	312	625
Klebsiella pneumoniae 017	625	625
Klebsiella pneumoniae 100	312	312
Enterobacter cloacae 02	312	625
Enterobacter cloacae 201	312	625
Enterobacter agglomerans 021	625	625
Enterobacter agglomerans 010	312	625
Enterobacter agglomerans 099	312	625
Citrobacter freundii 081	312	625
Staphylococcus aureus 16	156	312
Staphylococcus aureus 22	312	312
Staphylococcus aureus 050	156	312

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plates according to the NCCLS reference methods (National Committee for Clinical Laboratory Standards, 1995; Murray *et al.*, 1995) using Mueller–Hinton broth at pH 7.3.

A total of 12 concentrations were performed from 25 000 to 12.25 mg/L.

A suspension of microorganism (1 μL) was added to each well containing the drug and to the control well without drug. The final concentration of each microorganism in each well was 5×10^5 CFU/mL.

The present investigation was carried out using 6 bacterial and 1 mycotic standard strains and 20 clinical isolates of Gram-positive and Gram-negative bacteria.

The MIC is defined as the lowest concentration of drug that inhibits the visible growth after 18–24 h.

Minimum bactericidal concentration (MBC). MBCs were determined by plating 0.01 mL samples from clear 1 mL tubes onto plant extract-free agar plates.

The MBC was the concentration at which there was a 99.9% reduction of the original inoculum (Amsterdam, 1991).

RESULTS AND DISCUSSION

The results of the antimicrobial activity (MICs and MBCs) of *Rhus coriaria* L. leaf extract against the microorganisms tested are shown in Table 1.

The inhibitory action of this plant extract was high against both Gram-negative and Gram-positive bacteria.

Regarding Gram-negative bacteria, *Rhus coriaria* L. leaf methanol extract was most active against *Escherichia coli* ATCC 30213 (MIC = 156 mg/L); for all other Gram-negative strains MIC values ranged from 312 mg/L to 625 mg/L.

The extract also showed very good activity against Gram-positive microorganisms inhibiting *Bacillus subtilis* strain at 78 mg/L and *Staphylococcus aureus* strains (both standard and clinical isolates) at 156 and 312 mg/L. *Escherichia faecalis* was also inhibited at 156 mg/L. *Candida albicans* ATCC 3183 was susceptible at 625 mg/L.

The significant antimicrobial activity of *Rhus coriaria* L. leaf methanol extract was evidenced by MBCs results.

In all cases, MBC values are generally the same or twice the MIC values for all microorganisms.

The present study has shown that *Rhus coriaria* L. leaf extract is active against both Gram-negative and Gram-positive bacteria.

The extract has excellent bactericidal activity with MBCs being equal to twice the MICs.

The results suggest further investigations into the antimicrobial activity of *Rhus coriaria* L. leaf extract, in particular against *Staphylococcus aureus* and enteric Gram-positive and Gram-negative bacteria (which were frequently resistant to drugs commonly used in therapy) should be carried out.

REFERENCES

Amsterdam, D. (1991). Susceptibility testing of antimicrobials in liquid media. In, *Antibiotics in Laboratory Medicine*, 3rd edn, pp. 53–105. Williams and Wilkins; Baltimore.

El Sissi, H. I., Saleh, N. A. M., and Abdel Waid, M. S. (1966). The tannins of *Rhus coriaria* and *Mangifera indica*. *Planta Med.* **14**, 222–231.

Imbesi, A. (1964). *Index Plantarum quae in omnium populorum pharmacopoeis sunt adhuc receptae.* Messina, pg. 594.

Kuruku, S., Koyuncu, M., Guvenc, A., Baser, K. H. C., and Ozek, T. (1993). The essential oils of *Rhus coriaria* L. *J. Essent. Oil Res.* **5**, 481–486.

Murray, P. R., Baron, E. J., Pfaller, M. A., Tenover, F. C., and Yolken, R. H. (1995). *Manual of Clinical Microbiology*, Ed VI, American Society for Microbiology, Washington.

National Committee for Clinical Laboratory Standards (NCCLS) (1992). *Performance Standard for Antimicrobial Susceptibility Testing*. Villanova, PA.

Van Loo, P., De Bruyn, A., and Verzele, M. (1988). On the liquid chromatography and identification of the flavonoids, present in the 'sumach tannic acid' extracted from *Rhus coriaria*. *Chromatographia* **25**, 15–20.

