Short communication

Antimycobacterial activity of some trees used in South African traditional medicine

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Abstract

Seventy eight extracts obtained from 10 trees used in South African traditional medicine were investigated for antimycobacterial activity using the broth microdilution method. The extracts (dichloromethane, ethyl acetate and ethanol) were tested against Mycobacterium aurum A+. Of the plant extracts investigated, 30% showed activity against M. aurum at a concentration ranging from 1.5 to 0.195 mg ml\(^{-1}\). At these concentrations the ethyl acetate and ethanolic extracts of the leaf, bark and roots of Acacia nilotica and Combretum kraussii inhibited growth of the organism. Dichloromethane extracts (with some exceptions) did not show activity against M. aurum at the highest concentration (25 mg ml\(^{-1}\)) tested in this study.

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Tuberculosis (TB) has reemerged in recent years as a serious public health problem worldwide. The disease spreads more easily in overcrowded settings and in conditions of malnutrition and poverty (Pereira et al., 2005). Despite highly effective drugs, morbidity and mortality due to Mycobacterium tuberculosis are still increasing (Ballell et al., 2005). This has been linked to co-infection with the human immunodeficiency virus (HIV) and to the emergence of strains resistant to available therapies (Chung et al., 1995; Ballell et al., 2005). In South Africa, TB is the most commonly notified disease and the fifth largest cause of death among the black population where one in ten cases of TB is resistant to treatment in some parts of the country (Lall and Meyer, 1999).

The search for biologically active agents based on traditionally used plants is still relevant as medicinal plants have the potential to provide pharmacologically active natural products with compounds that act on novel molecular targets. New chemical entities with novel mechanism of action may possess activity against the multi-drug resistant pathogens (Clements et al., 2002; Ballell et al., 2005; Pereira et al., 2005).

Southern Africa is one of the richest centers of plant diversity in the world (Arnold and de Wet, 1993). Many of these plants have been used for several centuries in traditional medicine for the prevention and treatment of ailments including microbial diseases (Watt and Breyer-Brandwijk, 1962; Iwu, 1993; Hutchings et al., 1996; Eldeen et al., 2005).

Work done in our laboratory on the biological activity of trees used in South African traditional medicine showed that some plant extracts had interesting antibacterial activities against both Gram-positive and Gram-negative bacteria (Eldeen et al., 2005). Based on these results, a further investigation screening specifically for antituberculosis activity was carried out in this study. Due to the slow growth rate and the highly infectious nature of M. tuberculosis, a strain of the rapidly growing, non-pathogenic Mycobacterium aurum A+ was used. Inhibition of M. aurum A+ growth is highly predictive of activity against M. tuberculosis (Chung et al., 1995).

Tree species screened in this study were selected based on their uses in South African traditional medicine (Table 1). Plant material (leaves, roots, bark) was collected from the National...
Botanical Garden Pietermaritzburg and the Botanical Gardens of the University of KwaZulu-Natal Pietermaritzburg. Voucher specimens were deposited in the Natal Herbarium, University of KwaZulu-Natal (Table 1). The collected materials were dried in an oven at 50 °C, powdered and extracted using dichloromethane, ethyl acetate and ethanol (10 ml/g) sequentially by sonication for 1 h. The extracts were filtered using Whatman No.1 filter paper and dried under a fan at room temperature.

Middlebrook 7H10 agar base (ref 453982) and Middlebrook 7H9 broth base (ref 454012) were used. The supplement OADC (oleic acid + albumin + dextrose + catalase) (Remel, USA) was added (10%) to both agar and broth media. A stock culture of M. aurum A+ was obtained from the Microbiology Laboratory, Division of Pharmacology, University of Cape Town. The bacteria was first isolated from human sputum in France in 1965 (Tsukamura, 1966). The organism (stock number CIP 1965) was deposited in the Natal Herbarium, University of KwaZulu-Natal Pietermaritzburg. Voucher specimens and traditional uses are also included.

Minimum inhibitory concentration (MIC) of ciprofloxacin (standard drug) against M. aurum A+ was 1.8 μg ml⁻¹. na = not active at the highest concentration tested (25 mg ml⁻¹).
diluted culture was added to every well of the microtitre plate excluding the wells of the first column that served as the medium control. The plates were loosely sealed in plastic bags to prevent dryness and incubated at 37 °C for 72 h. After incubation, 40 μl of 0.4 mg ml⁻¹ solution of p-iodonitrotetrazolium salt (INT) was added to each well of the plate. The plates were left sealed in plastic packets overnight 37 °C. The lowest concentration containing no indication of red colour as a result of INT was deemed to be the MIC.

Plant materials were extracted sequentially in order to ensure extraction of a wide range of polar and non-polar compounds using dichloromethane, ethyl acetate and ethanol. The minimum inhibitory concentrations (MIC) of the plant extracts against *M. aurum* A+ as determined using the broth micro-dilution method are shown in Table 1. Of the 78 plant extracts tested, 30% inhibited growth of *M. aurum* A+ at a concentration ranging from 1.5 to 0.195 mg ml⁻¹ (Table 1). All ethyl acetate and ethanolic extracts (leaf, bark and roots) of *Acacia nilotica* and *Combretum kraussii* showed strong activity against the organism. These findings are in agreement with previous reports of antимycобacterium activity of extracts from *Acacia* and *Combretum* species (Lall and Meyer, 1999). Extracts from different plant parts of both *Combretum* and *Acacia* species also possessed broad spectrum antimicrobial activity against both Gram-positive and Gram-negative bacteria (Iwu, 1993; Eldeen et al., 2005). Several bioactive compounds are present in *Combretum* and *Acacia* species. The isomeric flavonoids vitexin and saponaretin, catechins and the alkaloids combretacin occur in a wide range of polar and non-polar compounds extracted from the ethanolic extracts (with some exceptions). The highest concentration tested (25 mg ml⁻¹) solution of INT was added to each well of the plate. The microtitre plates were left sealed in plastic packets overnight 37 °C. The results of INT were verified in part the traditional use of some of the tested plants as traditional remedies against TB.

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**References**


