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Herbal Medicine-The Review

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ABSTRACT
Twenty two medicinal plants selected through a literature survey in Mozambique were investigated using the agar diffusion method for their antibacterial activity. Five Gram-positive and five Gram-negative bacterial species were used. Acetone extract of Lippia javanica showed inhibitory activity against Gram-positive bacteria, at a concentration of 0.125 mg/ml. The minimal inhibitory concentrations (MIC) of six other plant extracts were found to be 0.5 mg/ ml. Only extracts of Adenia gummifera and Momordica balsamina were found to have activity against Gram-negative bacteria at a concentration of 5.0 mg/ ml. Acetone extracts of ten plants species used for respiratory diseases were also tested against Mycobacterium tuberculosis using the BACTEC radiometric method. Four extracts showed activity against M. tuberculosis at 0.5 mg/ml.

I. INTRODUCTION

Herbal medicine has a long history in the treatment of several kinds of disease (Holm et al., 1998). Their use for the treatment of disease has been practised by man for many years and is still being widely practised even today (Kokwaro, 1993). For many years, people have developed a store of empirical information concerning the therapeutic values of local plants before orthodox medical practice appeared. Through periods of trial, error, and success, these herbalists and their apprentices have accumulated a large body of knowledge about medicinal plants. According to Iwu et al. (1999) the first generation of plant drugs were usually simple botanicals employed in more or less their crude form. Several effective medicines used in their natural state were selected as therapeutic agents based on empirical study of their application by traditional societies from different parts of the world.

Following the industrial revolution, a second generation of plant drugs emerged based on scientific processing of the plant extracts to isolate ″their active constituents″. Plant materials remain an important component in combating serious diseases in the world; for the therapeutic approach to several pathologies. Interest in medicinal plants has been overwhelming in the recent times especially as an important source of medication/health care. Currently, the global market for medicinal plants has been estimated to be around US $62 billion and the demand is growing rapidly (Indian Council of Medical Research, 2003). It is globally recognised that medicinal plants play a significant role in providing health benefits to human beings. The World Health Organization (2000) has estimated that 80 % of the inhabitants of the world rely mainly on traditional medicines for their primary health care needs, and it may be presumed that a major part of traditional healing involves the use of plant extracts or their active principles**.**

Infectious diseases account for approximately one-half of all deaths in tropical countries (Iwu, 1999). Medicinal plants have been traditionally used for different kinds of ailments including infectious diseases. Plants are rich in a wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which have been found in vitro to have antimicrobial properties. Historically, plants have provided a good source of anti-infective agents. The isoquinoline alkaloid, emetine, obtained from the underground part of Cephaelis ipecuanha, and related species, have been used for many years as an amoebicidal drug for the treatment of abscesses due to the spread of Escherichia histolytica infections. Quinine, an alkaloid that occurs naturally in the bark of the Cinchona tree, is another important drug of plant origin with a long history of usage against malaria. The higher plants have made important contributions in areas beyond anti-infective, such as cancer therapies. Scientists from divergent fields are investigating plants with an intention to discover valuable phytochemicals. Laboratories all over the world have found literally

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thousands of phytochemicals which have inhibitory effects on all types of microorganisms in vitro (Cown, 1999).

1.2 The value of plants used in ethnomedicine for drug discovery

Medicinal plants provide a rich source of raw materials for primary health care in Africa and other parts of the developing world. According to Fabricant & Farnsworth (2001) the goals of using plants as sources of therapeutic agents are: 1) to isolate bioactive compounds for direct use as drugs; 2) to produce bioactive compounds of novel or known structures as lead compounds for semi synthesis to produce patentable entities of higher activity and/ or lower toxicity**;** 3) to use agents as pharmacologic tools; 4) to use the whole plant or part of it as a herbal remedy. Notable examples were quinine from Cinchona pubescens, reserpine from Rauvolfia serpentine and taxol from Taxus spp. Various other plant based drugs are listed in Table 1.1. The sequence for development of pharmaceuticals usually begins with the identification of active lead molecules, detailed biological assays, and the formulation of dosage forms. This is followed by several phases of clinical studies designed to establish safety, efficacy and the pharmacokinetic profile of the new drug (Iwu et al., 1999).

During the last few decades, there has been a resurgence of interest in plants as source of medicines and of novel molecules for use in the elucidation of physiological/biochemical phenomena. There is the worldwide green revolution, which is reflected in the belief that herbal remedies are safer and less damaging to the human body than synthetic drugs. Furthermore, underlying this upsurge of interest in plants is the fact that many important drugs in use today were derived from plants or from starting molecules of plant origin: digoxin/digitoxin, the vinca alkaloids, reserpine and tubocurarine are some important examples (Iwu et al., 1999).

Functions, however, tend to succumb to infections by fungi and viruses, as well as to bacteria which grow predominantly intracellularly (Stanier et al., 1958). The pathogenicity of some of the bacterial species is significant because of their resistance to known antibiotics. The emergence of methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci and multiresistant Gram-negative bacteria has become a serious issue (Rao, 1998). In an earlier study it was found that 36 strains of Bacillus cereus were highly resistant to lincomycin, polymyxin B and penicillin G- cephalosporin (Arribas et al., 1988). Fifty methicillin-resistant strains of S. aureus were isolated at a hospital in Osaka between 1986 and 1990 of which a few were also found to be resistant to streptomycin and kanamycin (Kondo et al., 1991).

Tuberculosis (TB), an airborne lung infection, is becoming an epidemic in some parts of the world. It kills about 1 million children each year and it is estimated that between now and 2020, nearly 1 billion more people will be infected, 200 million people will get sick and 70 million will die from TB if control is not strengthened (World Health Organization, 1997). Moreover, TB has also been recognised as one of the most frequent opportunistic infections in persons suffering from the human immunodeficiency virus (HIV), particularly in Africa. Given the alarming incidence of drug resistance to strains of bacteria, there is a constant need for new and effective therapeutic agents (Bhavnani and Ballow, 2000).

Plants contain numerous biologically active compounds, many of which have been shown to have antimicrobial properties (Cowan, 1999). Ethnobotanical data are useful in the search for new antimicrobial agents and several bioactive compounds have been isolated from medicinal plants (Penna et al., 2001).

In this study 25 medicinal plant species from Mozambique, were investigated for their antimicrobial activity. The plants selected are used for various infections, uberculosis related symptoms such as chest pain, cough, etc. by Mozambicans. The effectiveness of these plants has not been scientifically evaluated. There is a lack of scientific validation and there is no documented evidence of efficacy particularly with reference to their use for antimicrobial complaints.

II. MATERIALS AND METHODS

2.2.1 Plant material

Different parts of the plants, (Table 2.1) were collected in 2002 from the south and central parts of Mozambique (Maputo, Chókwe, Massingir, Manica and Zambezia) Figure 2.1. The plants were identified at the HGWJ Schweickerdt herbarium of the University of Pretoria (PRU) and also at the herbarium of the South Africa National Biodiversity Institute, Pretoria (PRE). Voucher herbarium specimens have been submitted at the herbarium of the University of Pretoria.

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2.2.2 Preparation of plant extracts

Various solvents have been used to extract plant metabolites. In this study acetone solvent was used for plants extraction. Acetone is very useful extractant because dissolve many hydrophilic and lipophylic components, is miscible with water, is volatile and has a low toxicity to the bioassay (Eloff, 1998).

Acetone extracts of each air-dried plant sample were prepared by stirring 50 g of the powdered plant material in 500 ml acetone for 48 hours. The extracts were filtered and concentrated to dryness at reduced pressure.. The resultant residue was later dissolved in acetone to a concentration of 100.0 mg/ ml.

2.2.3 Antibacterial bioassay

Five Gram-positive bacteria, Bacillus cereus (ATCC 11778), B. subtilis (ATCC 6051), B. pumilus (ATCC 7061), Staphylococcus aureus (ATCC 12600), Enterecoccus faecalis (ATCC 292192) and five Gram-negative bacteria, Enterobacter cloacae (ATCC 13047), Escherichia coli (ATCC 11775) Klebsiella pneumoniae (ATCC 13883), Pseudomonas aeruginosa (ATCC 33584) and Serratia marcescens (ATCC 1380) were tested for susceptibility to plant extracts. The bacteria were obtained from the Department of Microbiology and Plant Pathology, University of Pretoria. Each organism was maintained on a nutrient agar slant and was recovered for testing by growing them in fresh nutrient broth (No. 2, Biolab) for 24 hours**.** Before streaking, the culture was diluted to 1:10 with fresh sterile nutrient broth. The minimum inhibitory concentration (MIC) of the extracts was determined using the agar dilution method (Jorgensen et al., 1999). The tested concentrations were 5.0, 2.5, 1.0, 0.5, 0.25, 0.125 and 0.062 mg/ml. Plant extracts were added to 5 ml of nutrient agar medium in Petri dishes and swirled carefully before congealing. The organisms were streaked in radial patterns on agar plates containing plant extracts (Figure 2.2), incubated at 37^{o}C and observed after 24 hrs (Mitscher et al., 1972). Plates containing only nutrient agar and 1% acetone without the plant extracts served as controls. In addition two plates containing streptomycin sulfate at concentrations of 100.0, 50.0 and 10.0 µg/ml served as positive controls. The MIC was regarded as the lowest

III. CONCLUSION

The evaluation of plants used in traditional medicine is necessary. In this investigation, a number of plants exhibited promising activity against a variety of bacteria and Mycobacterium tuberculosis. It is concluded that the demonstration of inhibitory activities of the tested plants revealed their value in traditional medicine and supports the enormous role of medicinal plants in primary health care.

The results corroborate the importance of ethnopharmacological surveys in selection of plants for bioactivity screening. The results obtained represent a worthwhile expressive contribution to the characterization of the antibacterial and antimycobacterial activities of plant extracts of traditional medicine plants from Mozambican flora. Subsequently, bio-guided fractionation will be conducted on plants showing potential activity to identify the active compounds

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