

Phytochemical Investigation And Antimicrobial Properties

This book covers interesting research topics and the use of natural resources for medical treatments in some severe diseases. The most important message is to have native foods which contain high amount of active compounds that can be used as a medicinal plant. Most pharmaceutical drugs were discovered from plants, and still ongoing research will have to predict such new active compounds as anti-diseases. I do believe this book will add significant knowledge to medical societies as well as can be used for postgraduate students.

Phytochemical investigation of leaves of *Brownlowia tersa*, a Shurb from Sundarbans (the largest Mangrove Forest of the World); indicated the presence of Reducing Sugars, Glycosides, Saponins, Tannins & Flavonoids types of compounds. The extract was assessed using brine shrimp lethality as an indicator of toxicity & showed significant level of toxicity (LC50=10ug/ml & LC90=86ug/ml). The antibacterial activity of the extract was investigated, using disc diffusion method which showed antimicrobial activity against some gm(+) & gm(-) bacteria such as *Staphylococcus epidermidis*, *Vibrio cholerae*, *Streptococcus agalactiae*, *Shigella sonnei*, *Streptococcus pyogenes*, *Staphylococcus saprophyticus*, *Staphylococcus aureus* at the dose of 500ug/disc. Plant Drug Analysis has proven an invaluable and unique aid for all those involved with drug production and analysis, including pharmacists, chemical and pharmaceutical researchers and technicians, drug importers and exporters, governmental chemical control agencies, and health authorities. From the reviews of the German Edition: "The reviewer would like to recommend this excellent book to all chromatographers, as he considers it highly relevant to the solution of numerous problems. Its main purpose is the demonstration of thin-layer chromatograms of the usual commercial drugs as an aid in testing for identity and purity. ... 165 colour plates, each showing 6 chromatograms and all of superb quality photographs ..." (Journal of Chromatography)

Medicinal plants have played an important role in drug discovery, with many pharmaceutical products originating from plants. Isolation and characterization of antibacterial compounds is still relevant today because of continuing development of resistance of bacteria to antibiotics. The aim of the study was to evaluate the antibacterial activity of leaf extracts of nine tree species (*Acalypha sonderiana*, *Androstachys johnsonii*, *Dracaena mannii*, *Drypetes natalensis*, *Funtumia africana*, *Necepsia casteneifolia*, *Oncinotus tenuiloba*, *Turraea floribunda*, and *Xylia torreana*) selected from the Phytomedicine Programme Database based on good antimicrobial activities. The next step was to select the most active plant species and to isolate and characterize the antibacterial compounds. A serial microplate dilution method was used to determine the minimal inhibitory concentration and bioautography was used to determine the number of antibacterial compounds in the extract and their Rf values. Four nosocomial infection pathogens (*Escherichia coli*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*) were used as test organisms. Extracts of all the plant species were active with average MIC values ranging from 0.13 to 2.0 mg/ml against the four bacteria. MIC values as low as 0.08 mg/ml was obtained with *F. africana* and *O. tenuiloba* extracts against *S. aureus*. In bioautography seven of the nine leaf extracts had activity with clear zones of inhibition on bioautograms against the red background. *F. africana* was active against all four bacteria while *O. tenuiloba* had selective activity against *P. aeruginosa* with clear bands on the bioautogram. *F. africana* was chosen for further investigation because (a) it had good antibacterial activity against the four tested bacteria with MIC value as low as 0.08 mg/ml, (b) there were several active compounds against all the tested bacteria based on bioautography, (c) it is common in nature, and (d) as far as our literature survey could ascertain there was no published information on the antimicrobial activity of this plant species. The bulk powdered leaves of *F. africana* were extracted with acetone. The acetone extract was fractionated into five fractions (hexane, chloroform, butanol, H₂O and 30% H₂O in methanol) using solvent-solvent fractionation, to group the phytochemicals based on their polarity. Hexane and chloroform fractions were the most active with MIC values as low as 0.02 mg/ml for the chloroform fraction. One of the traditional uses of *F. africana* is to treat burns. As a result, the crude extract and its five fractions were also tested for anti-inflammatory activity using both the COX-1 and COX-2 assays. The crude extract and the hexane and chloroform fraction had moderate activity against both cyclooxygenase 1 and 2. The chloroform fraction was more active than the crude extract (59.7 ± 1.4%) with an inhibition of 68.2 ± 6.6%. Because there was no activity in the aqueous extracts and traditional healers usually use water as extractant, the pain relief experiences traditionally must be due to another anti-inflammatory mechanism. One antibacterial compound was isolated from the hexane fraction using column chromatography with silica gel as the stationary phase and a hexane ethyl acetate gradient as the mobile phase from low to high polarity. The isolated compound was identified as methyl ursolate using nuclear magnetic resonance (NMR) and mass spectrometry. Methyl ursolate has been isolated from a number of plant species. However, this is the first report on the isolation from *Funtumia* genus and the first report of its antimicrobial activity. Previous phytochemical investigation from the stem bark of *F. africana* led to the isolation of steroidal alkaloids of the conanine group. Methyl ursolate had a low activity with MIC values of >250 ug/ml against the four tested bacteria, but had better activity against five fungal (*Candida albicans*, *Cryptococcus neomeforms*, *Fusarium oxysporum*, *Penicillium janthinellium*, and *Rhizoctonia solani*) species with an MIC value of 63 ug/ml against *F. oxysporum*. The chloroform fraction had excellent activity with an MIC of 20 ug/ml and may be developed to become a useful complex drug. The more than one hundred fold lower activity of the isolated methyl ursolate compared to the activity of the chloroform fraction from which it was isolated, provides strong evidence of synergism. This may be good model system for studying synergism in antimicrobial preparations.

The fastest growing demographic in both developed and developing societies around the world, the elderly bring unique medical and financial health-care burdens. In response to this phenomenon, a large and growing body of research is directed toward the science of healthy aging. A substantial amount of observational data points to the consumption of a plant-based diet as a factor in lowering the risk of multiple chronic degenerative age-related diseases. The 6th International Phytochemical Conference, Phytochemicals: Aging and Health, focused on the particular concerns of nutrition in the aging population, as well as new aspects of research methodology, real-world applications, and updates or expansions of previously introduced topics. Drawn from the illustrious panel of scientists and researchers who spoke at the conference, *Phytochemicals: Aging and Health* begins by highlighting the prevailing theories on aging, including dietary manipulation and the role of phytochemical medicinals or supplements in health. Contributions present state-of-the-art methodologies for polyphenolic analysis, bioavailability, and metabolism—crucial tools that answer pressing questions such as “are there age related changes in flavonoid bioavailability?” The following chapters provide research results on botanicals and inflammation, green tea formulations and skin health, and the effects of phytochemicals on vision, brain function, and cardiovascular disease. The book concludes with forward-looking discussions on

applying nutrient–gene interaction research findings to individual dietary recommendations, along with the step-by-step process to commercialize botanical products for allergy relief. Continuing to introduce the highest-quality, groundbreaking research, *Phytochemicals: Aging and Health* provides pragmatic information for food companies, supplement manufacturers, and researchers interested in developing functional foods and nutraceuticals for the aging population.

Caesalpinia pulcherrima flowers have excellent antibacterial property. The present study aims to evaluate the antibacterial property *Caesalpinia pulcherrima* flower extract against clinically isolated eye infection causing *Staphylococcus aureus*. The (MIC) minimum inhibitory concentration and (MBC) minimum bactericidal concentration was found to be 200 µg/ml and 400 µg/ml. Antioxidant activity, spectroscopic and phytochemical analysis of the extract was also studied. This study concludes that *Caesalpinia pulcherrima* can be used as a potential natural remedy to treat eye infection.

Medicinal plants are the focus of intense study, in particular whether their traditional uses are supported by real pharmacological effects, or merely based on folklore. *Piper capense* L.f. (Piperaceae) is used traditionally for the treatment of infectious diseases, and has the potential to be a source of novel antimicrobial compound(s). Crude solvent extracts (water, methanol, hexane and acetone) and sequentially extracted subfractions of the root-bark of *P. capense* were prepared, of which the hexane-soluble subfraction MsAsHs was identified as the most promising antimicrobial subfraction. Phytochemical analyses of the various extracts and subfractions using TLC with numerous mobile phases and compound selective visualising reagents revealed the presence of quinones in all of the crude solvent extracts. Alkaloids, lipids/sterols/steroids, phenolic compounds and amino acids/peptides were detected in select subfractions. Gradient reverse phase HPLC analyses using 0.1% formic acid and methanol indicated three major peaks in MsAsHs. IR spectroscopy indicated that carbonyl and hydroxyl functional groups, and aromatic characteristics were present in the major compound present in MsAsHs. Further analysis using targeted LC-MS Q-TOF and quadrupole LC-MS/MS analyses indicated an empirical formula of C₁₁H₈O₃. This formula was confirmed for the isolated compound by GC-MS (HP5-MS column) that identified the compound as 5-hydroxy-2-methyl-1,4-naphthoquinone (C₁₁H₈O₃ MW: 188.18) with 98% certainty using the database. Although 5-hydroxy-2-methyl-1,4-naphthoquinone (also known as plumbagin) is well-known, this is the first time that the presence of this compound is reported in the *Piper* genus. Antimicrobial activities of *P. capense* root-bark extracts and the subfractions were determined against Gram-negative and Gram-positive bacteria and a yeast strain using the disk diffusion and broth micro-dilution assays. Antimicrobial activity was observed against Gram-positive bacteria, Gramnegative bacteria as well as a yeast strain, indicating broad spectrum activity. The antimicrobial activities of the crude solvent extracts decreased in the order: acetone > methanol > hexane > water. The MsAsHs subfraction demonstrated the highest antimicrobial activity with an MIC of 29 µg/ml against both *Staphylococcus aureus* (ATCC 12600) and *Candida albicans* (ATCC 10231). HPLC eluents of this subfraction that were collected in a drop-wise fashion onto silica TLC plates and assayed by bioautography, indicated that the major compound eluting at 13.6 minutes accounted for most of the antimicrobial activity. Antioxidant activity was observed for the crude water extract, crude methanol extract, crude acetone extract, MsAsAs subfraction as well as the MsAsHs subfraction. Cytotoxicity against mammalian cells in culture was observed for the crude methanol extract, crude acetone extract, crude hexane extract and the MsAsHs subfraction when determined using C2C12 cells as well as resting and PHA stimulated lymphocytes. Stability testing of the MsAsHs subfraction revealed that the antimicrobial compounds found in this subfraction appear to be stable up to 30 days at both 25°C and 40°C when assayed against *S. aureus*. However, when assayed against *C. albicans*, there was an increase in antifungal activity from 29 µg/ml to

Ocimum species has been used as a traditional remedy for various ailments such as arthritis, bronchitis, cold, conjunctivitis, diarrhea, dysentery, and flatulence, as well as for healing wounds and lowering blood glucose level. These are characterized by variations in their morphology such as the shape, size and pigmentation of leaves, which cause differences in chemical composition and affect the commercial value of this genus. This book describes phytochemical investigations of *Ocimum* species using LC-MS/MS instruments to study qualitative and quantitative variations of phytochemicals in different *Ocimum* species. Features: Collection of Ayurvedic features and scientific analytical and pharmacological evidence of most important medicinal plants of genus *Ocimum*. Chemical signatures for the identification of *Ocimum* species. Easy-to-use analytical procedure for quality control of plants of *Ocimum* species and its herbal products.

Summary report published as technical document with reference number: WHO/HSE/PED/AIP/2014.2.

Medicinal Plants of East Africa is a revised edition of the book first published in 1976 on herbal remedies and the traditional medical practice of East Africa. The book covers the rich diversity of plants found in Kenya, Tanzania and Uganda, from sea to alpine plants. East Africa also has a rich ethnic diversity and a large number of herbalists whose traditional knowledge and practices are also covered in the book. Over 1500 species are described and for the first time over 200 of these herbs have been illustrated. Also included are maps detailing where the herbs were collected and an ethnographic map detailing the tribes of each herbalist whose knowledge is contained in the book. John Kokwaro is an Eminent Professor of Botany and a research specialist on herbal remedies at the University of Nairobi.

Mentha (also known as mint, from Greek *míntha* (Palaeolexicon) is a genus of plants in the family Lamiaceae (mint family) (Harley et al., 2004). The species are not clearly distinct and estimates of the number of species varies (Bunsawat et al., 2004).

Hybridization between some of the species occurs naturally. Many other hybrids, as well as numerous cultivars, are known in cultivation. The genus has a subcosmopolitan distribution across Europe, Africa, Asia, Australia, and North America (Brickell et al., 1997). Mints are aromatic, almost exclusively perennial, rarely annual, herbs. They have wide-spreading underground and overground stolons and erect, square (Rose, Francis, 1981) branched stems. The leaves are arranged in opposite pairs, from oblong to lanceolate, often downy, and with aserrated margin. Leaf colors range from dark green and gray - green to purple, blue, and sometimes pale yellow. The flowers are white to purple and produced in false whorls called verticillasters.

Doctoral Thesis / Dissertation from the year 2012 in the subject Chemistry - Analytical Chemistry, grade: 3, Kachchh University (Department of Chemistry), course: MSc, language: English, abstract: *Moringa oleifera*, an important medicinal plant is one of the most widely cultivated species of the family Moringaceae. It is highly valued from time immemorial because of its vast medicinal properties. The present study provides all necessary information regarding of four parts such as flower, leaves, seed and pulp of moringa like biochemical, phytochemical, mineral, antibacterial activity and its nutritional value. The benefits of essential nutrients and minerals for maintaining good health were also highlighted in this study. The results of proximate analysis of *Moringa oleifera* revealed that the protein (9.37%), carbohydrate (7.33%), ascorbic acid (2.10%) and total soluble sugar (0.73%) were highest in flower as compared to leaves, seed and pulp. While free amino acid (9.84%) was found to be higher in seed, total phenol (0.29%)

was higher in leaves and reducing sugar (0.43%) higher in pulp of the moringa. The result of qualitative analysis of amino acid represented that lysine, glycine, threonine, valine, Isoleucine, tryptophan, alanine and cystein were present in moringa. The flower also contained higher amounts of crude fibre (0.23%) as well as moisture (90.56%), while fat (15.53%) content was found higher in seed. The dry matter (30.40%) and total ash (2.12%) content were higher in leaves. The ash content represented minerals in different amounts. The higher amount of potassium was found in flower (50.9%), seed (40.7%) and pulp (77.00%). Leaves contained higher amount of Calcium (57.18%). However Aluminum (10.00%) and Magnesium (6.07%) were found only in leaves. The result of heavy metal (zinc, lead and cadmium) and analysis represented that flower, leaves, seed and pulp have zinc (Zn), lead (Pb) and cadmium (Cd) found in lower amount then permissible limit for human body. The results of phytochemical analysis showed that terpenoids and steroids were present in all parts of moringa. Alkaloids present only in seed. Flavonoid was present in flower and seed, saponins was present in leaves, and tannin was present in leaves and seed. The result of antibacterial activity of different types of sample (flower, leaves. seed and pulp) of moringa showed that salmonella typhii was effectively inhibited to all the extracts studied. But Escherichia coli were not inhibited by any extract. Methanolic extract of flower, leaves, seed and pulp were highly sensitive against the salmonella typhii bacteria

The Handbook of Arabian Medicinal Plants is the first illustrated reference on the uses of plants in the Arabian Peninsula. It documents and preserves the existing knowledge in a region where social patterns are rapidly changing. The book emphasizes the need for preserving social and cultural patterns and examines the close relationship between those patterns and nature. This excellent source identifies more than 250 species of plants and describes their medicinal uses. Biochemical information and references are also included for each species.

Scientific Study from the year 2016 in the subject Biology - Micro- and Molecular Biology, grade: 1.5, Mar Augusthinose College, language: English, abstract: Citrus, one of the major genes of Rutaceae family and most economically important fruit tree and widely cultivated throughout the country. The Citrus have high nutritional value and medicinal value. Honey and lemon-honey are traditional remedies in the Middle East and China and for many centuries and have been used in the treatment and prevention of the common cold and various upper respiratory tract infections. Three types of honey were collected; 'Cheruthen'-produced by bees belongs to the Trigona irridipennis species; Vanthen'- produced by bees belongs to the Apis indica species; 'Kattutthen'- produced by bees belongs to the Apis dorsata species. The antibacterial activities of honey samples and lime juice were tested against Bacillus, Klebsiella, E.coli, Staphylococcus and Micrococcus. The result showed that the samples have different antimicrobial activity. Antimicrobial activity of Cheruthen against Klebsiella species showed a zone of inhibition of 10.1 ± 0.73 mm, when 100 μ l of Cheruthen is applied. When 200 μ l of Cheruthen is applied the zone of inhibition was 30.1 ± 0.23 mm. Antimicrobial activity of Cheruthen against E.coli showed a zone of inhibition of 10.1 ± 0.13 mm, when 100 μ l of cheruthen is applied. When 200 μ l of cheruthen is applied the zone of inhibition was 30.2 ± 0.23 mm. Also the phytochemical examination of lime juice and honey samples showed that different types of phytochemical substances are present in both lime juice and different types of honey samples. Further studies are required to reveal the role of each phytochemical and its contribution to the antimicrobial properties of the samples included in this study.

Phytochemicals from medicinal plants are receiving ever greater attention in the scientific literature, in medicine, and in the world economy in general. For example, the global value of plant-derived pharmaceuticals will reach \$500 billion in the year 2000 in the OECD countries. In the developing countries, over-the-counter remedies and "ethical phytomedicines," which are standardized toxicologically and clinically defined crude drugs, are seen as a promising low cost alternatives in primary health care. The field also has benefited greatly in recent years from the interaction of the study of traditional ethnobotanical knowledge and the application of modern phytochemical analysis and biological activity studies to medicinal plants. The papers on this topic assembled in the present volume were presented at the annual meeting of the Phytochemical Society of North America, held in Mexico City, August 15-19, 1994. This meeting location was chosen at the time of entry of Mexico into the North American Free Trade Agreement as another way to celebrate the closer ties between Mexico, the United States, and Canada. The meeting site was the historic Calinda Geneve Hotel in Mexico City, a most appropriate site to host a group of phytochemists, since it was the address of Russel Marker. Marker lived at the hotel, and his famous papers on steroidal saponins from Dioscorea composita, which launched the birth control pill, bear the address of the hotel.

Scientific Study from the year 2016 in the subject Agrarian Studies, grade: 1.5, Mar Augusthinose College, language: English, abstract: This study aims at the attributes of the Annona reticulata and its medical and biological value. Annona reticulata belongs to the family Annonaceae, commonly known as honey apple. Qualitative phytochemical analysis of chloroform and water extracts of Annona reticulata fruit, leaf and stem bark was conducted in order to detect the presence of various secondary metabolites using standard procedures. The results of phytochemical screening indicated the presence of secondary metabolites such as tannins, betacyanins, carbohydrates, alkaloids, terpenoids, phenols, quinines, saponins, cardiac glycosides etc. Also the comparative antimicrobial activity of chloroform and water extracts of fruit, leaf and stem bark of Annona reticulata was evaluated against four bacterial species namely, Escherichia coli, Pseudomonas aeruginosa, Serratia marcescens and Micrococcus luteus and two fungal species namely Candida albicans and Rhizopus. Agar well diffusion method and disc diffusion method were selected to check the antimicrobial activities of the extracts. The study revealed that the chloroform extracts of leaf, stem bark and fruit of Annona reticulata has activity against the bacterial strains and fungal strains. Whereas, the water extracts of leaf, fruit and stem bark of Annona reticulata has more activity towards the fungal species. The findings of this study have identified that Annona reticulata extracts acts as a promising source of antimicrobial agent which could be useful in the modern medicine.

In the traditional system of medicine, the plant is being used as diuretic and anthelmintic, antidiabetic, expectorant and in the treatment of lithiasis. The plant is used for arresting haemorrhage during pregnancy, burn healing, as an anti-inflammatory, headache, skin diseases to dissolve kidney and gall bladder stones. Bacterial pathogens have evolved numerous defence mechanism against antimicrobial agents hence resistance to old and newly produced drugs is on the rise. The phenomenon of antibiotic resistance exhibited by the pathogenic minor has led to the need for screening of several medicinal plants for their potential antimicrobial activity. In the present study various extracts Aerva lanata were tested against pathogens of UTI & RTI (Staphylococcus aureus, Pseudomonas sp, E. coli, Klebsiella sp.) Among the organism tested Staphylococcus aureus, E. coli showed the maximum clear zone with Aqueous extract followed by the Pseudomonas sp, Klebsiella sp, phytochemical analysis revealed the presence of sterols, saponins, glycosides phenols and resins. The phytochemicals were separated by paper chromatography and identification based on Rf values. Antioxidant array was also carried out and found to possess antioxidant

potential. This study will aim the clinician to prescribe adequate treatment for urinary tract and respiratory tract infections. The leaves of *Nerium oleander* have excellent antibacterial property. The present study aims to evaluate the cosmetic activity of *Nerium oleander* leaf extract against clinically isolated pimple causing *Staphylococcus aureus*. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) was found that dilution factor 200, and 300 respectively. Phytochemical analysis of the extract was also studied. This study concludes that *Nerium oleander* be used as a potential natural remedy to treat pimples.

Honey Analysis - New Advances and Challenges discusses advances in honey research. Topics include the physicochemical characteristics of honey from stingless bees, the therapeutic properties of honey, melissopalynological analysis as an indicator of the botanical and geographical origin of honey, and methods for authenticating honey. Written by experts in the field, this book provides readers with an indispensable source of information, assisting them in future investigations of honey and beekeeping. Research Paper from the year 2013 in the subject Chemistry - Bio-chemistry, grade: none, Madonna University Elele, Nigeria, course: Pharmaceutical and Medicinal Chemistry, language: English, abstract: The in vitro antimicrobial activity of crude methanol and aqueous extracts of the seeds of *Bucholzia coriacea* were investigated. The extracts exhibited antimicrobial activities against *Escherichia coli*, *Klebsiella pneumoniae*, *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, *Bacillus cereus* and *Pseudomonas aeruginosa*. The minimum inhibitory concentration (MIC) of the ethanol extract was between 0.50 – 6.00 mg/ml-1 while the minimum bactericidal concentration ranged from 2.0 – 10.0. The methanol and water extracts exhibited antifungal activity against *Candida albicans* and *Aspergillus niger* with zones of inhibition of 7.50 and 2.80mm for *Candida albicans*; and 6.0 and 2.0 for *Aspergillus niger*. Phytochemical screening revealed the presence of tannins, saponins, terpenoids, cardiac glycosides and alkaloids in the ethanolic and water extracts. The ability of the ethanol extract of *Bucholzia coriacea* seeds to inhibit the growth of bacteria and fungi is an indication of its broad spectrum antimicrobial potential which justifies its utilization in traditional medicine in treatment of infections.

This book focuses on the usage and application of plant- and animal-based food products with significant functional properties and health benefits as well as their development into processed food. Many chapters in this book contain overviews on superfood and functional food from South America. Details on the functional properties of apiculture products are also included herein. Additionally, an area that is not widely discussed in academia - pet food with functional properties - is also covered. It is hoped that this book will serve as a source of knowledge and information to make better choices in food consumption and alterations to dietary patterns. It is also recommended for readers to take a look at a related book, *Superfood and Functional Food - The Development of Superfoods and Their Roles as Medicine*.

In the present study, three Libyan medicinal plants *Juniperus phoenicea*, *Pistacia lentiscus* and *Cupressus sempervirens* were investigated for their chemical constituents. Studies were conducted to determine the active chemical constituents of alcoholic extracts by way of phytochemistry and to evaluate its in vitro antimicrobial activity, using the disc diffusion technique as described by the National Committee of Clinical Laboratory Standard (1993). The alcoholic extracts of all plants produced a dose dependent zone of inhibition in all the organisms tested (*Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumoniae*). Due to their medicinal value and relative abundance, it was decided to investigate the flavonoids from these plants. The present investigation has led to the isolation of five flavonoids from an ethanol extract prepared from the leaves, barks and roots of these plants by preparative thin-layer chromatography technique. Their structures were determined through a combination of spectrometric techniques including IR, UV, 1D and 2D NMR and high-resolution electrospray mass spectrometry.

While there are many books available on methods of organic and biochemical analysis, the majority are either primarily concerned with the application of a particular technique (e.g. paper chromatography) or have been written for an audience of chemists or for biochemists working mainly with animal tissues. Thus, no simple guide to modern methods of plant analysis exists and the purpose of the present volume is to fill this gap. It is primarily intended for students in the plant sciences, who have a botanical or a general biological background. It should also be of value to students in biochemistry, pharmacognosy, food science and 'natural products' organic chemistry. Most books on chromatography, while admirably covering the needs of research workers, tend to overwhelm the student with long lists of solvent systems and spray reagents that can be applied to each class of organic constituent. The intention here is to simplify the situation by listing only a few specially recommended techniques that have wide currency in phytochemical laboratories. Sufficient details are provided to allow the student to use the techniques for themselves and most sections contain some introductory practical experiments which can be used in classwork.

Remedial aspects of plants are owing to existence of secondary metabolites that act as armaments to shield plant body besides trepidation organisms. It was conjecture that *Parthenium hysterophorus* has persuasive antibacterial and antifungal activity so present study was conducted to resolute antibacterial, antifungal activity and preface phytochemical screening of this plant. Subject plant engrossed in three solvents i.e. methanol, ethanol and water after converting in powder form in order to prepared plant organic extracts. Antibacterial activity was determined by using agar well diffusion assay against twelve bacterial strains *Escherichia coli* 1, *Escherichia coli* 2, *Escherichia coli* 3, *Neisseria gonorrhoeae*, *Streptococcus pyogenes*, *Enterobacter aerogenes*, *Shigella sonnei*, *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus aureus* 1, *Staphylococcus aureus* 2 and *Klebsiella pneumoniae*. A very novel parameter was also applied which involved the effect of time on the doses of extract to inhibit bacterial growth to determine plant crude drug efficacy.

The essential peel oil of *Citrus limetta* var. *Mitha* (Sweet lime) extracted by steam distillation was assessed for chemical constituents and antimicrobial activity. Gas chromatographic analysis identified 17 constituents among which Limonene (95.98 %) was found as major component followed by camphene (1.79 %), while the remaining terpenes were less than 1%. The results of antimicrobial activity of essential oil tested by disc diffusion method, against different against bacteria and fungi showed that it exhibited maximum zone of inhibition against *Bacillus cereus* (31.0mm) and *Bacillus subtilis* (29mm) followed by *Staphylococcus aureus* (25.3mm), whereas the minimum zone of inhibition was shown by *Fusarium oxysporum* (11mm) after 48 hours of incubation at their respective temperature (37°C for bacteria and 25°C for fungi). The inhibition zones, measured after 48 hours and 96 hours, showed that it was active against all tested bacteria and fungi. The results of our study showed that essential oil of *Citrus limetta* var. *Mitha* peel can be an effective medicine against different pathogenic microbes.

Medicinal plants have bioactive compounds which are used for various human disease and also an important role in wound healing. The present study is to investigate about the Antimicrobial, phytochemical and antioxidant activity of *Eupatorium triplinerve* Vahl. The extracts are studied against human wound and burn pathogenic bacterial strains. *E. coli*, *Klebsiella* species,

Pseudomonas species, *Staphylococcus aureus*, *Enterobacter* species. From the phytochemical study it shows the presence of steroids, glycosides, tannins, phenols, saponins and flavonoids. Plant extract compounds were separated by thin layer chromatography and identification based on R_f values. The presence of vitamin C and an important role of antioxidants. "*Erigeron annuus* (L.) Pers. (fleabane) is one of the most valuable plants in the genus, used in Chinese folk medicine to treat indigestion, malaria, enteritis, hepatitis and hematuria increasingly since the 1970s. However it is not an indigenous species in China and has not been officially recorded in the Chinese Pharmacopeia. Very little research has been published on its biological activity and no activity against MRSA has been reported. In this research, whole plant material was collected in Shanghai, China and its chemical composition, antibacterial activity, DNA gyrase inhibitory activity and mutagenicity assessment were evaluated on isolated compounds and extracts." -- Abstract, page i.

For centuries medicinal plants have been used all over the world for the treatment and prevention of various ailments, particularly in developing countries where infectious diseases are endemic and modern health facilities and services are inadequate. In recent years the use of and search for drugs derived from plants have been accelerated. Ethnopharmacologists, botanists, microbiologists, and natural-product chemists are trying to discover phytochemicals and leads which could be developed for the treatment of 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. The evaluation of these plants for biological activity is necessary, both to substantiate their use by communities, and also to discover possible new drug or herbal preparations. Twenty five plants selected through ethno-botanical surveys in Mozambique which are used to treat respiratory diseases, wounds, viruses, stomach ailments and etc., were collected and investigated for antimicrobial activity. Acetone extracts of selected plants were tested for antibacterial, antimycobacterial and anti-HIV-1 activity. Antibacterial activity was evaluated using the agar diffusion method. Five Gram positive (*Bacillus cereus*, *Bacillus pumilus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Enterococcus faecalis*) and five Gram negative (*Enterobacter cloacae*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Serratia marcescens*) bacterial species were used in this study. The extracts of each plant were tested at concentrations ranging from 0.125 to 5.0 mg/ml. Most of the plant extracts inhibited the growth of the Gram-positive microorganisms. The minimum inhibitory concentration of eight plants (*Cassia abbreviata*, *Elephantorrhiza elephantina*, *Hemizygia bracteosa*, *Hoslundia opposita*, *Momordica balsamina*, *Rhoicissus tomentosa* and *Salvadora australis*) against Gram-positive bacteria was found to be 0.5 mg/ml. Gram-positive bacteria were found to be susceptible to extracts of *Lippia javanica* at concentration of 0.125 mg/ml. Among the 22 acetone extracts tested, two were found to have activity against Gram-negative bacteria at a concentration of 5.0 mg/ml (*Adenia gummifera* and *Momordica balsamina*). *Rhoicissus revoilli* inhibited *E. cloacae*, a Gram-negative strain, at a concentration of 2.5 mg/ml. To evaluate antimycobacterium activity ten plant species were tested against H37Rv, a drug-sensitive strain of *Mycobacterium tuberculosis* at concentrations ranging from 0.5 to 5.0 mg/ml using BACTEC radiometric method. Four of the plant species tested (*Cassia abbreviata*, *Hemizygia bracteosa*, *Lippia javanica* and *Melia azedarach*) were observed to be active against the H37Rv. (ATCC 27294) strain of TB at a concentration of 0.5 mg/ml which was the lowest concentration used in this study. Seventeen plant species, were screened for anti-HIV bioactivity in order to identify their ability to inhibit the enzymes glycohydrolase (? -glucosidase and? - glucuronidase) and eleven species were further tested against Reverse transcriptase. It was found that 8 plant species (*Cassia abbreviata*, *Elephantorrhiza elephantina*, *Rhoicissus tomentosa*, *Pseudolachnostylis maprouneifolia*, *Lippia javanica*, *Litogyne gariepina*, *Maerua juncea* and *Momordica balsamina*) showed inhibitory effects against? -glucosidase and? -glucuronidase at a concentration of 200? g/ml. The results of the tests revealed that the plant extracts of *Melia azedarach* and *Rhoicissus tomentosa* appeared to be active, showing 49 and 40% inhibition of the enzyme activity respectively. *Lippia javanica* was found to have the best activity exhibiting a minimum inhibitory concentration of 0.125 mg/ml. The extracts also showed positive activity against *Mycobacterium tuberculosis* at concentration of 0.5 mg/ml and HIV-enzyme glycohydrolase was (? -glucosidase and? -glucuronidase) inhibited by 62 % and 73 % respectively. Considering its medicinal use local for HIV and various infections, it was therefore, selected for identifying its bioactive constituents. In the initial screening of plants used in Mozambique *Hoslundia opposita* demonstrated good antitubercular activity. It was therefore, selected to identify its bioactive constituents. A Phytochemical investigation of *L. javanica* led to the isolation of eight compounds, 4-ethyl-nonacosane (1), (E)-2(3)-tagetenone epoxide (2), myrcenone (3), piperitenone (4), apigenin (5), cirsimaritin (6), 6-methoxyluteolin 4'-methyl ether (7), 6-methoxyluteolin and 3',4',7-trimethyl ether (8). Three known compounds, 5,7-dimethoxy-6-methylflavone (9), hoslundiol (10) and euscaphic acid (11) were isolated from *H. opposita*. This is the first report of compounds (1), (2), (5-8) from *L. javanica* and of compound (9) from *H. opposita*. The compounds were tested against *Mycobacterium tuberculosis* and HIV-1 reverse transcriptase for bioactivity. It was found that compounds (2), (4) and (9) inhibited the HIV-1 Reverse transcriptase enzyme by 91%, 53% and 52% respectively at 100? g/ml. Of all the compounds tested against a drug-sensitive strain of *Mycobacterium tuberculosis*, euscaphic acid (11) was found to exhibit a minimum inhibitory concentration of 50? g/ml against this strain. The present study has validated scientifically the traditional use of *L. javanica* and *H. opposita* and a few other Mozambican medicinal plants to some extent.

An Experimental Text Book on Phytochemical Analysis and Antimicrobial Activity of *Mentha Piperita* Onlinegatha

Scientific Study from the year 2016 in the subject Biology - Micro- and Molecular Biology, grade: 1.5, Mar Augusthinose College, language: English, abstract: Citrus, one of the major genes of Rutaceae family and most economically important fruit tree and widely cultivated throughout the country. The Citrus have high nutritional value and medicinal value. Honey and lemon-honey are traditional remedies in the Middle East and China and for many centuries and have been used in the treatment and prevention of the common cold and various upper respiratory tract infections. Three types of honey were collected; 'Cheruthen'-produced by bees belongs to the *Trigona irridipennis* species; 'Vanthen'- produced by bees belongs to the *Apis indica* species; 'Kattutthen'- produced by bees belongs to the *Apis dorsata* species. The antibacterial activities of honey samples and lime juice were tested against *Bacillus*, *Klebsiella*, *E.coli*, *Staphylococcus* and *Micrococcus*. The result showed that the samples have different antimicrobial activity. Antimicrobial activity of Cheruthen against *Klebsiella* species showed a zone of inhibition of 10.1 0.73 mm, when 100 l of Cheruthen is applied. When 200 l of Cheruthen is applied the zone of inhibition was 30.1 0.23 mm. Antimicrobial activity of Cheruthen against *E.coli* showed a zone of inhibition of 10.1 0.13 mm, when 100 l of cheruthen is applied. When 200 l of cheruthen is applied the zone of inhibition was 30.2 0.23 mm. Also the phytochemical examination of lime juice and honey samples showed that different types of phytochemical substances are present in both lime juice and different types of honey samples. Further studies are required to reveal the role of each phytochemical and its contribution to the antimicrobial properties of the samples included in this study.

The outbreak of drug resistant pathogens, the high cost of health care, limited accessibility of the conventional drugs and their side effects are

problems that make the treatment of infectious diseases difficult all over the world. These challenges have led to the search for novel drugs and drug leads that can surpass the quality of the currently available antimicrobial agents. Medicinal plants are considered to be the best candidates for the discovery of new drugs because of their long history of use in the treatment of various ailments in communities. The current study was aimed at investigating the antimicrobial activity, cytotoxic activity and phytochemical composition of the methanol extracts from *Buxus macowanii*, *Polygala myrtifolia*, *Scilla* sp. and *Xanthocercis zambesiaca*. *Staphylococcus aureus*, *Clostridium perfringens*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Escherichia coli*, *Staphylococcus epidermidis*, and the fungal species *Candida albicans* and *Candida tropicalis* were used to evaluate the antimicrobial activity of the selected plant extracts using the broth Microdilution method. All the plants extracts tested showed no activity against all the bacterial and fungal species except *Buxus macowanii*. *Buxus macowanii* inhibited the growth of *Staphylococcus aureus*, *Clostridium perfringens*, *Pseudomonas aeruginosa*, *Staphylococcus epidermidis*, *Candida albicans* and *Candida tropicalis* at the MIC of 2.5 mg/ml while *Enterococcus faecalis* and *Escherichia coli* were inhibited at 1.2 mg/ml. *Buxus macowanii* was selected for further studies because it presented the best antimicrobial properties. Antimicrobial compounds were located using TLC bioautography. Four clear zones possibly flavonoids and alkaloids were detected on the TLC chromatogram. These findings suggest that the antimicrobial activity of *Buxus macowanii* was not attributed to a single compound but to a synergy of compounds. The effect of *Buxus macowanii* on the bacterial cell morphology was also evaluated. Morphological changes such as damage to the cell wall, loss of intracellular contents, incomplete cell division and shrinkage of the cells were observed using Scanning and Transmission Electron Microscopy. Bacterial cells were affected morphologically after treatment with the extracts of *B. macowanii*. In order to evaluate the safety of the extracts used in the study, the Sulforhodamine cytotoxicity assay was carried out using the WI-38 cell line (Normal human fetal lung fibroblast). *P. myrtifolia* was inactive against the WI-38 cell line whereas *B. macowanii* and *X. zambesiaca* were found to be moderately hazardous. *Scilla* extracts were found to be hazardous. These results indicate that caution should be exercised when employing plants like *B. macowanii*, *X. zambesiaca* and *Scilla* sp. for treatment of ailments. The phytochemical screening of *B. macowanii*, *P. myrtifolia*, *Scilla* and *X. zambesiaca* using standard methods, TLC and GCMS revealed compounds that have important health benefits. Bioactive compounds such as flavonoids, alkaloids, terpenes, cardiac glycosides, steroids, saponins and tannins were found in most of the extracts and their presence may explain the medicinal usage of the plants. GCMS also revealed compounds such as neophytadiene that was found in the extracts of *Buxus macowanii*, n-hexadecanoic was also found in the extracts of *scilla* sp and *X. zambesiaca*. 2-methoxy- 4-vinylphenol was found in the extracts of *P. myrtifolia* and *X. zambesiaca*. The results obtained in this study show that *B. macowanii* is a promising source of antimicrobial drugs. Further investigation into the isolation and identification of the bioactive compounds as well as in vivo screening is recommended.

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