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Review Article

CRITICAL REVIEW ON COMPARATIVE ANTIMICROBIAL ACTIVITIES OF HERBAL DRUGS

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ABSTRACT

India has about 4.5 million plant species and among them, huge variety of plants has been reported to possess medicinal properties against human diseases. Although traditional medicinal healers have used medicinal plants for treatment of ailments for years, there has always been a lingering question in scientific circles about their therapeutic efficacy. As a consequence, the pharmacological activity of many medicinal plants has been studied, even though the vast majority of medicinal plants remain to be studied for their phytochemical components and pharmacological effects. Many researchers have carried out their research for antimicrobial activities of different extracts of certain plants. So, purpose of this review is to enlighten every new researcher. Present study is therefore an attempt for review on some of the medicinal plants and common weeds.

INTRODUCTION

Many medicinal plants are the main and rich source of different activities especially antimicrobial activity. Plants have been used in many countries medicinally and as a source of many potent and powerful drugs [1] .It has been estimated that 25% of drugs are directly or indirectly of plant origin. In the recent years different pharmaceutical companies spent lots of money and time in development of natural products extracted from plant, to produce potent low cost and with lesser side effects drugs that are easily affordable to the population [2] Medicinal plants produce a variety of compounds having very important as microbial agent and have therapeutic properties. In recent years, antimicrobial activities of plants are being increasingly reported from different countries of the world. It is concluded that plant extracts showing target sites other that those used by antibiotics will be active against drug resistant microbial pathogens. Very little information is still available on such activity of medicinal plants [3]

Considering the potentiality of plants as a source of drugs with reference to antimicrobial agents, a systematic attempt is made to help new researchers in research regarding anti-microbial activity of plant drugs.

Comparitive Antimicrobial Activity on Hemidesmus indicus (roots), *Eclipta alba* (fruits), *Coscinium fenestratum* (stems), *Curcubito pepo* (seeds), *Tephrosia purpurea* (roots), *Mentha piperita* (leaves), *Pongamia pinnata* (seeds), *Symplocos racemosa* (barks), *Euphorbia hirta (*roots), *Tinospora cordyfolia* (roots), *Thespesia populnea* (roots), and *Jasminum officinale* (flowers).[4]

Extraction carried out with*:* Ethanol.

Reported Activity*:* Antimicrobial effect against acne inducing bacteria.

Method: Disc diffusion and broth dilution methods.

Test Strains*: Propionibacterium acnes* and *Staphylococcus epidermidis.*

Reported Result: The extract was reported to inhibit the growth of *Propionibacterium acnes*. Among those the extract of *Hemidesmus indicus, Coscinium fenestratum, Tephrosia purpurea, Euphorbia hirta, Symplocos racemosa, Curcubito pepo* and *Eclipta alba* was found to exhibit strong inhibitory effects. Based on a broth dilution method, the *Coscinium fenestratum* extract showed the maximum antimicrobial effect. The MIC values were the same (0.049 mg/ml) for both bacterial species and the MBC values were found to be 0.049 and 0.165 mg/ml against *Propionibacterium acnes* and *Staphylococcus epidermidis*, respectively. In bio autography assay, the *Coscinium fenestratum* extract produced very strong inhibition zones against *Propionibacterium acnes*. Phytochemical screening of *Coscinium fenestratum* revealed

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the presence of alkaloids that could be reason for these activities. The recorded data indicated that *Coscinium fenestratum* had a great inhibitory effect on *Propionibacterium acnes* and *Staphylococcus epidermidis.*

Comparative Antimicrobial Activity on *Albizia lebbeck*, *Cleistanthus collinus*, *Emblica officinalis* (*Phyllanthus emblica* L.), *Eucalyptus deglupta* (*Eucalyptus tereticornis*), *Eupatorium* odoratum (Chromolaena *odorata*), *Oxalis corniculata*, *Hevea brasiliensis* and *Lantana camara*.[5]

Extraction carried out with - Benzene, water and acetone
Reported Activity - Antimicrobial.

Method - Agar well diffusion method.

Test Strains- *Escherichia coli* (MDR), *Staphylococcus aureus* (MDR), *Klebsiella pneumoniae, Bacillus cereus, Vibrio cholerae* and *Candida albicans*.

Reported Result- The extracts of *Albizia lebbeck*, *Cleistanthus collinus, Emblica officinalis*, *Eucalyptus deglupta*, *Eupatorium odoratum*, *Oxalis corniculata* and *Hevea brasiliensis* were showed highest zone of inhibition (>11mm) against *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Bacillus cereus*, *Vibrio cholerae* and *Candida albicans*. The *Lantana camara* showed 11-13mm of zone of inhibition against *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Bacillus cereus*, *Vibrio cholerae* and *Candida albicans*. The extract of *Butea frondosais*, *Melastoma malabathricum*, *Terminalia arjuna*, and *Lycopodium japonicum* were reported to show moderate activity against all the tested strains. The plants like *Adina cordifolia*, *Asparagus racemosus*, *Aegle marmelos*, *Cassia tora*, *Dillenia pentagyna*, *Valeriana wallichii* showed little activity (5 to 8mm) against all pathogenic microorganisms. *Ocimum basilicum* were reported to show moderate antibacterial activity (05mm–08mm) but it exhibited higher antifungal activity (12 mm). It was also observed during the research that the antimicrobial substances are extracted in more quantity from plant cell in organic solvent like in acetone and benzene as compared to water. It was also revealed that all aqueous, benzene and acetone extracts of herbal plants (leaves) were active against the locally isolated human pathogens like *Escherichia coli* (MDR), *Klebsiella pneumoniae*, *Staphylococcus aureus* (MDR), *Bacillus cereus*, *Vibrio cholerae*, and *Candida albicans*. The extracts of eight plants like *Albizia lebbeck*, *Cleistanthus collinus, Emblica officinalis*, *Eucalyptus deglupta*, *Eupatorium odoratum*, *Oxalis corniculata*, *Hevea brasiliensis*, and *Lantana camara* showed maximum and promising antimicrobial activity against multi-drug resistant clinically isolated test strains in comparison to other twelve herbal plants. The MIC values of herbal plant extracts were found to exhibit significant at 0.35- 0.80 mg / ml. Among the tested herbal plants, *Albizia lebbeck*, *Cleistanthus collinus*, *Emblica officinalis*, *Eucalyptus deglupta*, *Eupatorium odoratum*, *Oxalis corniculata* and *Hevea brasiliensis* were observed to show the lowest MIC values of 0.35mg/ml-0.60 mg/ml. Acetone extracts of *Emblica officinalis*, *Eucalyptus deglupta*, *Oxalis corniculata* and *Hevea brasiliensis* were reported to be best against test strains.

Comparaitive Antimicrobial Activity on *Acacia nilotica, Sida cordifolia, Tinospora cordifolia, Withania somnifer* and *Ziziphus mauritiana* .[6]

Part used*:* Leaf, roots and bark

Extraction carried out with: Methanol.

Reported Activity: Antibacterial and Antifungal
Method: Disc diffusion method.

Test Strains*: Bacillus subtilis, Escherichia coli*, *Pseudomonas fluorescens, Staphylococcus aureus* and *Xanthomonas axonopodis*.

Fungal- *Aspergillus flavus, Dreschlera turcica* and *Fusarium verticillioides.*

Reported Result- The methanolic leaf extracts of *Acacia nilotica, Sida cordifolia, Tinospora cordifolia,* Withania *somnifer* and *Ziziphus mauritiana* retain significant antibacterial activity against *Bacillus subtilis, Escherichia coli*, *Pseudomonas fluorescens, Staphylococcus aureus* and *Xanthomonas axonopodis* pv. *malvacearum* and antifungal activity against *Aspergillus flavus, Dreschlera turcica* and *Fusarium verticillioides* when compared to root/ bark extracts. Maximum antibacterial activity was reported for *A. Nilotica* and *S. cordifolia* leaf extract against *B. subtilis*. *and Z. mauritiana* leaf extract against *X. a.* pv. *malvacearum.* For root and leaf extract of *S. cordifolia* significant activity was reported against all the test bacteria*. A. nilotica* bark and leaf extract were found to have significant antifungal activity against *A. flavus, Ziziphus mauritiana and For Tinospora cordifolia* significant antifungal activity recorded against *D. turcica.* The methanol extract of *Sida cordifolia* was reported to possess maximum and promising antifungal activity against *F. Verticillioides.*

Comparative Antimicrobial Activity on *Acalypha indica, Adhatoda vasica, Allium cepa*, *Allium sativum* and *Aloe vera*.[7]

Part used*:* Leaves, bulb, clove and gel respectively.

Extraction carried out with: Aqueous extract.

Reported Activity*:* Antituberoculosis.

Method*:* Lowenstein Jensen (L-J) medium and colorimetric BacT/ALERT 3D system.

Test Strains: *M. tuberculosis*, *M. fortuitum.*

Reported Result: Extracts of all the five plants *A. indica, A. vasica, A. cepa*, *A. sativum* and *A. vera* were reported to exhibit anti-tuberculosis activity in L-J medium. The proportion of inhibition of these plants extract in respect mentioned above was recorded as 95, 32, 37, 72, 32 per cent, respectively for MDR isolate DKU-156 and 68, 86, 79, 72, 85 per cent, respectively for another MDR isolate JAL-1236, while for sensitive *M. tuberculosis* H37Rv, inhibition was found to be 68, 70, 35, 63 and 41 per cent, at 4 per cent v/v concentration in L-J medium. No result of inhibition against rapid grower *M. fortuitum* was reported. In BacT/ALERT also, extracts of these plants showed significant inhibition against *M. tuberculosis*.

Antimicrobial Activity on *Mikania glomerata, (Psidium guajava)*, *Syzygium aromaticum*, *Allium sativum*, *Cymbopogon citratus*, *Zingiber officinale*, *Baccharis trimera*, and *Mentha piperita* .[8]

***Extraction carried out with**:* 70% methanol.

***Reported Activity**:* Antibacterial (Synergistic activity on 8 plant extracts)

***Test Strains**: Staphylococcus aureus* strains.

***Method**:* Disc Diffusion method.

***Reported Result**:* Characteristics, MIC 90% (mg/ml) against 32 *S. aureus* strains, and one-fourth the MIC 90% values was reported in the synergism assays for the plants and their respective extracts. Anti *S. aureus* activity was verified for all the plants. *S. aromatic* showed the highest activity, followed by *P.guajava*; the lowest activity was recorded for *Cymbopogon citratus*. The MIC 90% range was 0.36 mg/ml for *Syzygium aromaticum* and 17.84 mg/ml for *C. citratus* and thery observed the differences in the antimicrobial activity of plants tested, due to phytochemical properties and differences among species. The antimicrobial activities of *C. citratus*, *B. trimera,* and *Z. afficinale*, have not been relatively high. Synergism assays were carried out for these plants and the synergism rate of *C. citratus* was found to be as high as that of *S. aromaticum.* The antimicrobial mechanisms of the drugs used here were variable and the protein synthesis inhibitors were those that presented strongest synergistic effect together with folic acid and bacterial cell wall synthesis inhibitors. Among the protein synthesis inhibitors, tetracycline was reported to show synergism with all the extracts, followed by chloramphenicol and netilmicin.

***Antimicrobial Activity on** Arnebia nobilis, Garcinia indica, Boehavia diffusa, Solanum albicaule, Vitex negundu, Bunium persicum, Acacia concinna* and *Albizia lebbeck.*[9]

***Extraction carried out with**:* Ethanol

***Reported Activity**:* Antibacterial

Method: Well diffusion method.

***Test Strains**:* Pure culture of all test organisms, namely *Pseudomonas aeruginosa, Staphylococcus aureus positive, Escherichia coli, Staphylococcus aureus negative* and fungi *Candida albicans.*

***Result reported**:* The antimicrobial activity of the crude extracts of selected plants *viz. A. nobilils, G. indica, B. diffusa, S. albicaule, V. nigundu, B.persicum, A. concinna* and *A. lebbeck* was reported to show good antimicrobial activity against selected test bacterial strains.

***Combined Anti Microbial Study on** Clerodendron inerme, Eupatorium triplinerve, Lantana camera, Parthenium hysterophorus, Solanum xanthocarpum and Dathura stromonium.*[10]

Parts used: leaf

Extraction carried out with: ether & water.

Reported Activity: Antibacterial, Antifungal.

***Method**:* Zone of inhibition checked in potato agar plate for in vitro study and blotter method for in vivo study.
***Test Strains**: Staphylococcus aureus, Klebsiella pneumoniae, E.coli, Bacillus subtilis,* and major seed-borne fungi *Aspergillus niger, Aspergillus awamori*.

Result Reported: Extracts of *Dathura stromonium* were effective against all the four bacteria (inhibition zone of 1.9, 2.0, 1.6, 1.7 cm). Extracts of *Lantana camera* and *Dathura stromonium* reduced the incidence of seed-borne fungi tested and increased seed germination when compared with the untreated control. *Dathura stromonium* extract was reported to be the most effective while *Clerodendron inerme* and *Eupatorium triplinerve* extracts were the least. Among the plant extracts tested *Dathura stromonium* showed the antibacterial activity against all the four bacteria. Extracts of *Parthanium hysterophorus, Solanum xanthocarpum and Lantana camera* were effective against one or two bacteria. The extracts of *Parthanium hysterophorus, Solanum xanthocarpum, Dathua stromonium and Lantana camera* showed antifungal activity against both fungi used. *Solanum xanthocarpum, Dathua stromonium* and *Lantana camera* extracts were most effective against the fungi used. Extracts of *Dathua stromonium and Lantana camera* were reported to show significant inhibition of fungal growth on the seeds (in vivo) and in the seeds treated with these two extracts, the germination was also more than the control. *Datura stromonium* was found to be more effective against the microorganisms among the plant extracts used in the study.

***Combined Study on Plants -** Bidens pilosa*, *Bixa orellana* , *Cecropia peltata* , *Cinchona officinalis* , *Gliricidia sepium*, *Jacaranda mimosifolia*, *Justicia secunda, Piper pulchrum*, *P. paniculata* and *Spilanthes Americana*.[11]

***Parts used**:* whole plant parts.

***Extraction carried out with**:* Ethanol, Water and Hexane.

Reported Activity: Antibacterial.

***Test Strains**: Staphylococcus aureus, Streptococcus* β *hemolític*, *Bacillus cereus*, *Pseudomonas aeruginosa*, and *Escherichia coli*, and one yeast *Candida albicans*.

***Result Reported**:* The water extracts of *Bidens pilosa* L., *Jacaranda mimosifolia* D.Don, and *Piper pulchrum* was reported to show a higher activity against *Bacillus cereus* and *Escherichia coli* than gentamycin sulfate. Similarly, the ethanol extracts of all species were active against *Staphylococcus aureus* except for *Justicia secunda*. Furthermore, *Bixa orellana*, *Justicia secunda* and *Piper pulchrum* presented the lowest MICs against *Escherichia coli* (0.8, 0.6 and 0.6 µg/ml, respectively) compared to gentamycin sulfate (0.9 8g/ml). Likewise, *Justicia secunda* and *Piper pulchrum* showed an analogous MIC against *Candida albicans* (0.5 and 0.6 µg/ml, respectively) compared to nystatin (0.6 µg/ml). *Bixa orellana* , exhibited a better MIC against *Bacillus cereus* (0.2 µg/ml) than gentamycin sulfate (0.5 µg/ml).

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