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Research Article

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Antibacterial Activity of Some Selected Indian Medicinal Plant Barks

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Abstract

Barks of six plant barks were screened for potential antibacterial activity. In evaluating antibacterial activity both aqueous and methanolic solvents were used. The plants were *Azardirchata indica* A. Juss, *Terminalia arjuna*. (Roxb.ex DC.) Wt. & Arn, *Mimosops elengi L.*, *Morus alba* L., *Acacia leucophloea* (Roxb.) Willd., and *Terminalia chebula* Retz.. Antibacterial activity was tested against 5 bacterial strains *Escherichia coli, Bacillus subtilis, Pseudomonas florescence, Klebseilla pneumonia* and *Proteus vulgaris*. Two methods, Agar disc diffusion and Agar ditch diffusion method were used to study the antibacterial activity of all these plant barks. *P. vulgaris* and *K. pneumonia* were the most resistant bacterial strains. *B. subtilis* showed strong activity against the tested bacterial strains. Therefore, this can be selected for further investigation to determine its therapeutic potential.

Keywords: *Azardirchata indica, Terminalia arjuna, Mimusops elenga, Morus alba, Acacia leucophloea, Terminalia chebbula*, Antibacterial Activity.

Introduction

Nature has been a source of medicinal agents for thousands of years and a remarkable number of modern drugs have been isolated from natural sources, many based on their use in traditional medicine. Various medicinal plants have been used for existence in daily life to treat disease all over the world. They have been used as source of medicine. The pervasive use of herbal remedies and healthcare preparations, such as those described in ancient texts like the Vedas and the Bible, has been traced to the occurrence of natural products with medicinal properties. In effect, plants produce a diverse range of bioactive molecules, making them a rich source of different types of medicines. Higher plants, as sources of medicinal compounds, have continued to play a dominant role in maintenance of human health since ancient times[1]. Over 50% of all modern clinical drugs are of natural product origin[2] and natural products play an important role in drug development programs in the pharmaceutical industry[3]. The relatively lower incidence of unpleasant reactions to plant preparations compared to current conservative pharmaceuticals, coupled with their reduced cost, is heartening both the consuming public and national health care institutions to consider plant medicines as alternatives to synthetic drugs. Plants with possible antimicrobial activity should be tested against an appropriate microbial model to confirm the activity and to ascertain the parameters associated with it. The effects of plant extracts on bacterial have been studied by very large number of researchers in different parts of the world [4-6].

Much work has been done on ethno medicinal plants in India[7-9]. Interest in a large number of traditional natural products has increased[10]. It has been suggested that aqueous and ethanolic extracts from plants used in allopathic medicine are potential sources of antiviral, antitumoral and antimicrobial agents[11, 12]. The selection of crude plant extracts for screening programs has the potential of being more successful in initial steps than the screening of pure compounds isolated from natural products[13]. In the present work a few selected medicinal flora were selected for potential antibacterial activity.

Screening Of Medicinal Plants:

Terminalia chebula belongs to family Combretaceae. It is a deciduous tree growing to 30 m tall, with a trunk up to 1 m diameter. The leaves are alternate to sub opposite in arrangement, oval, 7-18 cm long and 4.5-10 cm broad with a 1-3 cm petiole. Bark Uses: It is astringent, purgative, stomachic and laxative.

Terminalia arjuna belongs to family Combretaceae. It is a medicinal plant of the genus Terminalia, widely used by Ayurvedic physicians for its curative properties in organic/functional heart problems including angina, hypertension and deposits in arteries. Arjuna bark (T arjuna) is thought to be beneficial for the heart.

Morus alba belongs to family Moraceae. It is a short-lived, fast-growing and small to medium sized

mulberry tree, which grows to 10-20m tall. The bark is used to treat cough, wheezing, edema, and to promote urination. It is also used to treat fever, headache, red dry and sore eyes, as well as cough. Roots and bark are purgative, anthelmintic, and astringent.

Azadirachta indica belongs to family Meliaceae. Neem is a fast-growing tree that can reach a height of 15-20 m (about 50-65 feet), rarely to 35-40 m (115-131 feet). It is evergreen but in severe drought it may shed most or nearly all of its leaves. The branches are wide spread. The fairly dense crown is roundish or oval and may reach the diameter of 15-20 m in old, free-standing specimens. All parts of the tree (seeds, leaves, flowers and bark) are used for preparing many different medical preparations.

Mimusops elengi belongs to family Sapotaceae. Its Leaves are glossy, dark green, oval shaped, 5-14 cm long and 2.5-6 cm wide. Flowers are cream, Hairy and scented. The edible fruit is softly hairy becoming smooth, ovoid, bright red-orange when ripe. The bark, flowers, fruits and seeds are astringent, cooling, anthelmintic, tonic, and febrifuge. It is mainly used in dental ailments like bleeding gums, pyorrhea, dental caries and loose teeth. Decoction of bark is used to wash the wounds.

Acacia leucophloea belongs to family Fabaceae It is a moderate sized tree sometimes mistaken for prosopis cineraria with spreading crown and somewhat malformed and crooked trunk. It attains a height of about 20 to 30 ft and a girth of 2 to 3 ft. New leaves appear in April, and yellowish white flowers appear from August to October. The pods ripe by April and the seeds germinate readily if moisture is available. The tree is very hardy and stands drought well. It is frost hardy except in young age. It coppices well and produces good root suckers. It suffers from goat browsing particularly in early stage. Fruits are thin, flat, curved tomentose pods (difference from Prosopis Cineraria).

Materials and Methods

Barks of the plant parts were collected randomly from different places of Acharya Nagarjuna University, Guntur, India, in August, 2008. Plant materials were washed under running tap water, air dried and then homogenized to fine powder and stored in airtight bottles.

Test microorganisms:

The microbial strains are identified strains and were obtained from the IMTECH, India. The bacterial strains studied are *Pseudomonas florescence* MTCC 1748, *Proteus vulgaris* MTCC *1771, *Klebsella pneumonia* MTCC 3384, *Escherichia coli* MTCC 2124, and *Bacillus subtilis* MTCC 1790.

Aqueous extraction:

For aqueous extraction, 10g of air-dried powder was placed in distilled water and boiled for 6 h. At intervals of 2 h it was filtered through 8 layers of muslin cloth and centrifuged at 5000 x g for 15 min. The supernatant was collected. After 6 h, the supernatant was concentrated to make the final volume one-fourth of the original volume. Finally 10g of material was extracted in 25ml of distilled water giving a concentration of 40 mg/0.1 ml. It was then autoclaved at 121º C and 15 lbs pressure and stored at 4º C.

Solvent extraction:

Ten grams of air dried powder was placed in 100 ml of organic solvent (methanol) in a conical flask, plugged with cotton and then kept on a rotary shaker at 190-220 rpm for 24 h. After 24h, it was filtered through 8 layers of muslin cloth and centrifuged at 5000 x g for 15 min. The supernatant was collected and the solvent was evaporated to make the final volume one-fourth of the original volume, giving a concentration of 40 mg/0.1 ml. It was stored at 4º C in airtight bottles for further studies.

Antibacterial assay:

A loop full of the strain was inoculated in 30 ml of nutrient broth in a conical flask and incubated on a rotary shaker for 24 h to activate the strain. The assay was performed using 2 methods. Agar disk diffusion (15) for aqueous extract and Agar ditch diffusion (16) for solvent extract. The media and the test bacterial cultures were poured in to Petri dishes (Hi-Media). The test strain (0.2 ml) was inoculated into the media (inoculum size 10^3 cells/ml) when the temperature reached 40-42º C. Care was taken to ensure proper homogenization. The experiment was performed under strict aseptic conditions. For the Agar disk diffusion method, the test compound (0.1 ml) was introduced onto the disk (0.7 cm) (Hi-Media) and then allowed to dry. Thus the disk was completely saturated with the test compound. Then the disk was introduced onto the upper layer of the medium with the bacteria. The plates were incubated overnight at 37º C. For the Agar ditch diffusion method, after the medium was solidified, a ditch was made in the plates with the help of cup-borer (0.85 cm). The test compound was introduced into the well and the plates were incubated overnight at 37ºC. Microbial growth was determined by measuring the diameter of the zone of inhibition. Methanol and distilled water were used as the control. The control activity was deducted from the test and the result obtained was plotted.

Results and Discussion

The antibacterial activity of *T. chebula* bark extract of both solvents (aqueous and metanolic) against all bacterial species is shown in fig 1a. It inhibited all the bacterial species. The methanolic extract showed considerably more activity than the aqueous extract. Neither of the extracts was able to inhibit the *K. pneumoniae* and *P. vulgaris* except *T. chebula*. The antibacterial activity of *A. leucophloea* and *A. indica* had comparitively less activity than *T. chebula* shown in figure 1b and 1c respectively. The antibacterial activity of *T. arjuna* and *M. alba* are shown in fig 1d and 1e respectively. The aqueous or methanolic extracts were showed very low activity against tested bacterial strains. In figure 1f the antibacterial activity of *M. alba* against the tested bacterial strains is shown. Neither of the extracts (aqueous or methanolic) was able to inhibit any of the tested bacterial strains. The methanol extract inhibited all the bacterial strains compared to aqueous. Similar type of results reported by Nair R *et al* (2004), the methanol extract was more active than aqueous against tested microorganisms. The maximum and minimum antibacterial activity was recorded for methanol extract against *B. subtilis* (20mm) and *E. coli* (16mm) respectively. Aqueous extract inhibited *E. coli* (14mm) and *P. florescence* (16mm) to lower extent when compared to methanol extract. The antibacterial activity in methanolic extract indicates most of the active components are extracted with methanol. The overall results indicate promising baseline information for the potential uses of the methanol and aqueous extracts of plant barks in the treatment of infectious diseases. The *T. chebula* showed maximum antibacterial activity and so this plant can be used to discover bioactive natural products that may serve as leads for the development of new pharmaceuticals that address hitter to unmet therapeutic needs.

Conclusion

The present study provides enough data to show the potential of bark extracts for the development of antibacterial agents against pathogens. This study reaffirms the medicinal property of medicinal plant barks.

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Fig 1a:

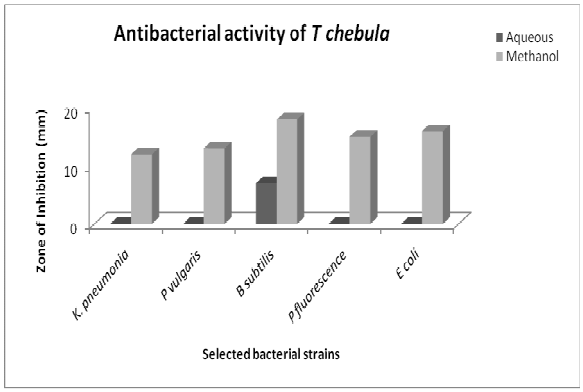


Fig 1b:

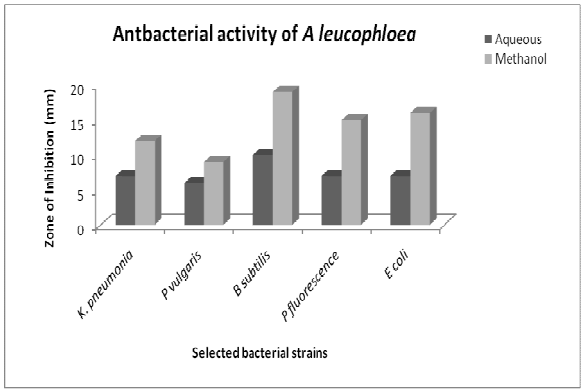


Fig 1c:

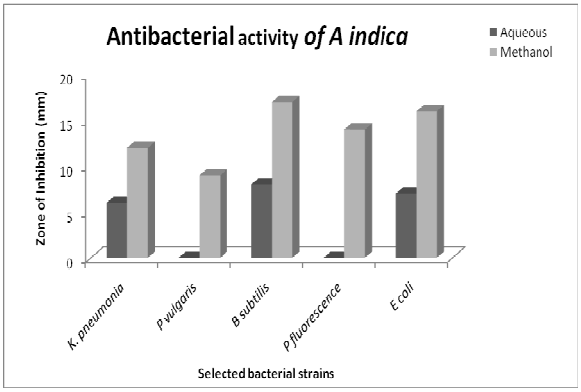


Fig 1d:

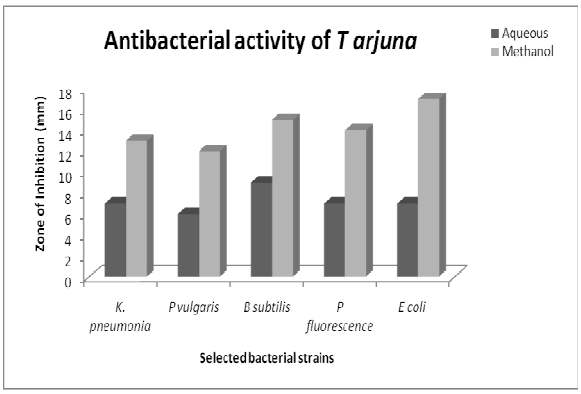


Fig 1e:

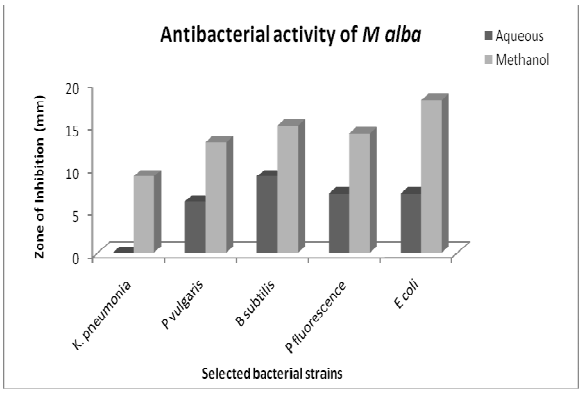
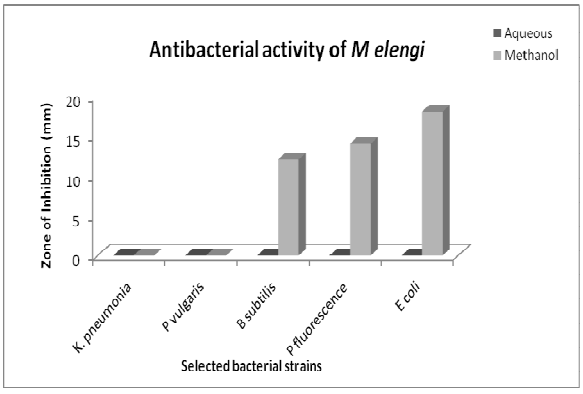


Fig 1f:



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