

INVESTIGATIONS OF ANTIBACTERIAL ACTIVITY OF SOME ETHNOMEDICINAL PLANTS AGAINST CERTAIN PATHOGENIC BACTERIAL STRAINS

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ABSTRACT

50% (v/v) ethanolic and aqueous extracts of 20 plants were assayed for their antimicrobial activity against seven gram negative strains, *Pseudomonas aeruginosa*, *Pseudomonas testosteroni*, *Proteus mirabilis*, *Proteus vulgaris*, *Enterobacter aerogenes*, *Escherichia coli* and *Citrobacter freundii* and five gram positive strains, *Staphylococcus epidermidis*, *Bacillus cereus*, *Streptococcus fecalis*, *Streptococcus cremoris* and *Streptococcus agalactiae*. Maximum antibacterial activity was shown by the aqueous extracts of *Parthenium hysterophorus*. The aqueous extract of *Parthenium hysterophorus* inhibited the growth of seven strains among the 12 bacterial strains studied. It showed maximum activity against *Pseudomonas aeruginosa*. The aqueous extracts showed less activity than ethanol extracts. The antibacterial action of the extracts is more pronounced on gram positive than on gram negative bacteria. *Boerhavia diffusa* did not exhibit any antibacterial property and *Proteus vulgaris*, *Enterobacter aerogenes* and *Escherichia coli* were the most resistant bacterial strains investigated.

KEYWORDS: Antimicrobial, antibacterial, plant extracts, zone of inhibition

Infectious diseases are the world's leading cause of premature deaths, killing almost 50,000 people every day. In recent years, drug resistance to human pathogenic bacteria has been commonly reported from all over the world (Davis, 1994 and Robin et al., 1998). The drug-resistant bacteria and fungal pathogens have further complicated the treatment of infectious diseases. In the present scenario of emergence of multiple drug resistance to human pathogenic organisms, this has necessitated a search for new antimicrobial substances from other sources including plants.

Traditionally used medicinal plants produce a variety of compounds of known therapeutic properties (Chopra et al., 1992). The substances that can either inhibit the growth of pathogens or kill them and have no or least toxicity to host cells are considered candidates for developing new antimicrobial drugs. In recent years an antimicrobial properties of medicinal plants are being increasingly reported from different parts of world (Saxena, 1997). In India, from ancient times different parts of medicinal plants have been used to cure specific ailments. Today there is widespread interest in drugs derived from plants. To determine the potential and promote the use of herbal medicine, it is essential to intensify the study of medicinal plants that find place in folklore. (Awadh et al., 2001 Nair and Chanda et al., 2005).

MATERIALS AND METHODS

Plants were collected for this study based on their medicinal uses. A total of 20 plants were screened. Different parts of the plants were collected, air dried and powdered in a homogenizer and 10g. of each plant parts was used for aqueous and ethanol extraction. The aqueous extraction was done in distilled water for 6 hours at slow heat. The extract was concentrated to 1/5th of the original volume for antimicrobial assay. For ethanol extraction, the sample was extracted in ethanol kept on a rotary shaker overnight. The filtrate was collected and centrifuged at 5000 rpm. The extract was concentrated to 1/5th of the original volume and used for antimicrobial assay.

Seven gram negative strains, *Pseudomonas aeruginosa*, *Pseudomonas testosteroni*, *Proteus mirabilis*, *Proteus vulgaris*, *Enterobacter aerogenes*, *Escherichia coli* and *Citrobacter freundii* and five gram positive strains, *Staphylococcus epidermidis*, *Bacillus cereus*, *Streptococcus fecalis*, *Streptococcus cremoris* and *Streptococcus agalactiae* were used in the investigation of antibacterial activity. The media employed were Mueller Hinton agar No.2, Nutrient broth, MRS media, and MRS broth. Agar disc diffusion method (Bauer et al., 1966) were used for the antibacterial assay. The rest bacterial strains were maintained on agar slants at 40°C. The bacterial strains were recovered for testing by inoculating nutrient broth as well as MRS broth on rotary shaker for antibacterial evaluation, 100 µl of the inoculum size (1x10⁸ cells/ml) was

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taken. The plates were incubated at 37°C for 24h. The result were obtained by measuring the zone of inhibition (mm).

RESULTS AND DISCUSSION

Maximum antibacterial activity was shown by the

aqueous extracts of *Parthenium hysterophorus*. None of the plant extracts could inhibit *Streptococcus agalactiae*, *Escherichia coli*, *Citrobacter freundii* and *Proteus vulgaris*.

The aqueous extract of *Parthenium hysterophorus* inhibited the growth of seven strains among the 12 bacterial strains. It

Table 1 : Antibacterial zone produced by aqueous and ethanol extracts of plants screened against few medically important bacteria

S.N.	Botanical Name	Family	Parts Used	Extract	Zone of inhibition (mm)												
					Pa	Pt	Pm	Pv	Ea	Ec	Cf	Sc	Bc	Stf	Stc	Sta	
1	<i>Anethum graveolens</i>	Apiaceae	Leaf	Aq	-	-	-	-	-	-	-	-	-	-	-	-	-
				Et	-	1.5	1	-	-	-	-	7	-	-	-	-	
2	<i>Annona squamosa</i>	Annonaceae	Seeds	Aq	-	-	-	-	-	-	2	-	1.5	-	-	-	
				Et	-	-	-	-	-	-	-	-	-	-	-		
3	<i>Asparagus racemosus</i>	Liliaceae	Leaf	Aq	-	-	-	-	-	-	-	-	2.7	-	-	-	
				Et	-	-	-	-	-	-	-	-	-	-	-		
4	<i>Boerhavia diffusa</i>	Nyctaginaceae	Leaf	Aq	-	-	-	-	-	-	-	-	-	-	-	-	
				Et	-	-	-	-	-	-	-	-	-	-	-		
5	<i>Boerhavia chinensis</i>	Nyctaginaceae	Leaf	Aq	-	-	-	-	-	-	-	-	2	3.5	9.2	-	
				Et	-	-	-	-	-	-	-	-	-	-	-		
6	<i>Carica papaya</i>	Caricaceae	Leaf	Aq	15.7	-	-	-	-	-	-	-	-	8	-	-	
				Et	-	-	2	-	-	-	-	-	4.2	-	-		
7	<i>Commelina benghalensis</i>	Commelinaceae	Leaf	Aq	-	5.5	-	-	-	-	-	-	-	-	-	-	
				Et	-	-	1.5	-	-	-	-	-	2	-	-		
8	<i>Commiphora wightii</i>	Burseraceae	Stem	Aq	-	-	1	-	-	-	-	11	1	2	7.2	-	
				Et	1	-	2	-	-	-	-	1	-	-	-		
9	<i>Derris indica</i>	Fabaceae	Leaf	Aq	10	-	2.2	-	-	-	-	-	8	-	-	-	
				Et	-	-	2.5	-	-	-	-	1	1.5	2.5	-		
10	<i>Emblica officinalis</i>	Euphorbiaceae	Leaf	Aq	3	-	2	-	-	-	-	10	7.5	-	-	-	
				Et	7	21	7	3.5	3.5	-	-	7.5	8.5	-	-		
11	<i>Ficus benghalensis</i>	Moraceae	Bark	Aq	-	-	-	-	-	-	-	-	-	-	-	-	
				Et	2	-	1	-	2	-	-	-	6.5	-	-		
12	<i>Ficus racemosa</i>	Moraceae	Bark	Aq	-	-	-	-	-	-	-	-	-	3	-	-	
				Et	2.5	-	1	-	-	-	-	-	8.5	-	-		
13	<i>Ficus religiosa</i>	Moraceae	Bark	Aq	-	-	-	-	-	-	-	-	-	-	-	-	
				Et	-	-	-	-	-	-	-	-	12	-	3.5		
14	<i>Ficus lesila</i>	Moraceae	Bark	Aq	-	-	-	-	-	-	-	-	2.5	-	-	-	
				Et	3	-	1	-	2	-	-	1	6.5	-	9.5		
15	<i>Hibiscus sabdariffa</i>	Malvaceae	Stem	Aq	-	-	-	-	-	-	-	-	-	24.5	-	9	
				Et	-	1	-	-	-	-	-	-	7	-	-		
16	<i>Parthenium hysterophorus</i>	Compositae	Leaf	Aq	16	3.5	10.2	-	-	-	-	13	13	4	6	-	
				Et	-	-	3.5	-	-	-	1	5	7	-	-		
17	<i>Polyalthia longifolia</i>	Annonaceae	Leaf	Aq	-	-	1.2	-	12	-	10	7.2	-	-	-	-	
				Et	-	-	11	-	17.5	-	17	32	-	-	-		
18	<i>Punica granatum</i>	Punicaceae	Leaf	Aq	-	-	3	-	-	-	-	3	6	-	-	-	
				Et	6	2.5	9.5	2	-	-	-	12.5	-	-	-		
19	<i>Ocimum sanctum</i>	Labiataeae	Leaf	Aq	-	-	-	-	-	-	-	-	2	-	-	-	
				Et	-	-	2	-	-	1.5	2.5	1.5	3.5	-	-		
20	<i>Zizyphes hummularia</i>	Rhamnaceae	Leaf	Aq	-	-	-	-	-	-	-	-	2.5	-	-	-	
				Et	-	2	1	-	-	-	2.5	4	3.5	-	-		

Aq- Aqueous, Et- Ethanol, Pa- *P. aeruginosa*, Pt- *P. testosteroni*, Se- *S. epidermidis*, Pm- *P. mirabilis*, Pv- *P. vulgaris*
 Bc- *B. cereus*, Cf- *C. freundii*, Ea- *E. aerogenes*, Ec- *E. coli*, Stf- *S. fecalis*, Stc- *S. cremoris*, Sta- *S. agalactiae*

showed maximum activity against *Pseudomonas aeruginosa*. The aqueous extracts of *Ficus benghalensis* and *Anethum graveolens* could not inhibit any of the bacterial strains, while the aqueous extracts *Boerhavia diffusa*, *Asparagus racemosus*, *Ficus religiosa*, *Commelina benghalensis*, *Ocimum sanctum* and *Zizyphus nummularia* showed minimum antibacterial activity. *Hibiscus sabdariffa* showed maximum activity against *Streptococcus fecalis*.

The antibacterial activity of ethanol extract of various plants screened are shown in table-1. The ethanol extracts of *Boerhavia diffusa*, *Annona squamosa*, *Hibiscus sabdariffa* and *Asparagus racemosus* showed the least antibacterial activity, while *Emblica officinalis*, *Commiphora wightii*, *Ficus religiosa*, *Parthenium hysterophorus*, *Ficus benghalensis*, *Ficus tesila*, *Ficus racemosa*, *Derris indica*, *Carica papaya*, *Ocimum sanctum*, *Anethum graveolens*, *Punica granatum* and *Zizyphus nummularia*, showed maximum antibacterial activity. The ethanol extracts of *Parthenium hysterophorus*, *Ficus tesila*, *Derris indica* and *Zizyphus nummularia* inhibited the growth of 9 strains. *Parthenium hysterophorus* showed maximum activity against *Bacillus cereus*. *Ficus tesila* was highly active against *Streptococcus agalactiae*, while *Derris indica* and *Zizyphus nummularia* were highly active against *Streptococcus agalactiae* and *Enterobacter aerogenes*, respectively. Aqueous extract showed less activity than ethanol extracts. The antibacterial action of the extracts is more pronounced on gram positive than on gram negative bacteria.

From the results, it can be concluded that the plant *Boerhavia diffusa* did not exhibit any antibacterial property and *Proteus vulgaris*, *Enterobacter aerogenes* and *Escherichia coli* were the most resistant bacterial strains investigated.

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