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A Study on Antibacterial Activity of Common Weeds in Northern Districts of Tamil Nadu, India

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ABSTRACT

The present study reports the antibacterial potency of the methanolic extract of 25 common weeds, *Abutilon indicum*, *Acalypha indica*, *Ageratum conyzoides*, *Alangium platanifolium*, *Anisomeles* sp., *Boerhavia diffusa*, *Cardiospermum helicacabum Cassia alata*, *Centella asiatica*, *Coccinia grandis*, *Commelina benghalensis*, *Corchorus* sp., *Croton sparsiflorus*, *Dodonea viscosa*, *Hyptis sauveolens*, *Lantana camara*, *Leonotis nepetifolia*, *Mimosa pudica*, *Martinea annua*, *Occimum americanum*, *Oldenlandia umbellata*, *Parthenium hysterophorus*, *Solanum nigrum*, *Tinospora cordifolia* and *Xanthium stromarium* belonging to 15 different families. The plants were collected from the districts of Chengalpet, Chennai, Kancheepuram, Vellore and Tiruvellore belonging to the Northern part of the State of Tamil Nadu. The antibacterial property were determined using disc diffusion method on the following species of bacteria, i.e., *Bacillus subtilis* (MTCC121), *Escherichia coli* (MTCC443), *Staphylococcus aureus* (MTCC96), *Streptococcus mutans* (MTCC890) and *Klebsiella pneumoniae* (MTCC1320). The following weeds, *Parthenium hysterophorus, Leonotis nepetifolia, Martinea annua* and *Xanthium stromarium* have showed positive zone of inhibition to all the bacteria studied.

Key words: Common weeds, pathogenic bacteria, *Croton sparsiflorus*, *Lantana camara*, *Martinea annua*, *Xanthium stromarium*

INTRODUCTION

Bacterial resistance to currently used antibiotics is becoming a concern to public health (Monroe and Polk, 2000). The development of bacterial super resistant strains is resulting in currently used antibiotic agents failing to end many bacterial infections. For this reason the search is ongoing for new antimicrobial agents, either by the design and synthesis of new agents, or through the search of natural sources for as yet undiscovered antimicrobial agents (Bhavnani and Ballow, 2000). The antiseptic qualities of medicinal plants have been long recognised. A major part of total population in developing countries till uses folklore medicine obtained from plant resources (Fabricant and Farnsworth, 2001). Biologically active compounds present in plants have always been of great interest. Recently there has been a revival of interest

in herbal medications (Chariandy *et al*., 1999) due to a perception that there is a lower incidence of adverse reactions to plant preparations compared to synthetic pharmaceuticals. Literature reports and ethnobotanical records suggest that plants are the sleeping giants of pharmaceutical industry (Hamburger and Hostettmann, 1991). They may provide natural source of antimicrobial drugs that will/or provide novel or lead compounds that may be employed in controlling some infections globally.

A weed is commonly defined as a plant that grow out of place and is competitive, persistent and pernicious (James and Evans, 1991). Weeds have been a part of civilization and many ancient documents speak of humans battling weeds in the crops they grow. Weeds are also found to be resistant to most of the microbial disease when compared to the crops which shows disease symptoms. The resistance nature and their sustenance towards the microbial disease weeds made the authors to have an interest to know the potency behind. And hence, this study is conducted to know the antibacterial potency of common weeds present in the Northern Districts of Tamil Nadu state, India.

MATERIALS AND METHODS

Source of plant materials: The leaves of *Abutilon indicum, Acalypha indica, Ageratum conyzoides, Alangium platanifolium, Anisomeles* sp., *Boerhavia diffusa, Cardiospermum helicacabum Cassia alata, Centella asiatica, Coccinia grandis, Commelina benghalensis, Corchorus* sp., *Croton sparsiflorus, Dodonea viscosa, Hyptis sauveolens, Lantana camara, Leonotis nepetifolia, Mimosa pudica, Martinea annua, Occimum americanum, Oldenlandia umbellata, Parthenium hysterophorus, Solanum nigrum, Tinospora cordifolia* and *Xanthium stromarium* were collected from the districts of Chengalpet, Chennai, Kancheepuram, Vellore and Tiruvellore belonging to the Northern part of the State of Tamil Nadu. The leaves collected were inspected for their pathogenic infections. Healthy materials were selected after examining the leaves carefully. The leaves were washed in running tap water for removing the surface contaminants. The washed materials were dried at room temperature for two to three days under shade. After drying the materials were powdered using electric blender.

Source of microorganisms: Microbial cultures of *Bacillus subtilis* (MTCC121), *Escherichia coli* (MTCC443), *Salmonella typhi* (MTCC531), *Proteus mirabilis* (MTCC425) and *Klebsiella pneumoniae* (MTCC1320) were obtained from Microbial Type Culture Collection and Gene Bank, Chandigarh, India.

Preparation of plant extract: The extracts were prepared using Soxhlet apparatus with methanol as a solvent. The plant materials were dried under shade and grind into fine powder using electric blender. Around 15 g of each powder made into three bags containing 5 g each were used in Soxhlet for extract. Around 150 mL of methanol was used. The plant extracts were filtered and concentrated using rotary evaporator. The concentrated extracts were stored in refrigerator for further use. The stored product was reconstituted again using a same solvent for required concentration. The pooled extracts were re-constituted and were loaded into sterile readymade discs (Himedia, Bombay) in different volumes of 15, 20 and 25 μL $disc^{-1}$, respectively and allowed to dry for 24 h at room temperature.

Disc diffusion method: Mueller Hinton agar plates were spread with 100 μL of actively growing broth cultures of the respective bacteria and are allowed to dry for 10 min. The sterile readymade

discs loaded with each extract individually (15, 20 and 25 μL disc^{-1}) were imposed on the inoculated plates. The plates were then incubated at 37°C for 36 h. The development of the inhibition of zone around the extract loaded disc was recorded.

RESULTS

The growth of the bacterium, *Escherichia coli* is controlled by the plant, *Croton sparsiflorus*. The activity of the plant is maximum against the bacteria when it is compared with other weeds studied. The other plants like, *Xanthium stromarium* and *Commelina benghalensis* have showed significant level of resistance against the bacteria. Only 13 weeds have shown resistance to the growth of the bacteria all other weeds have not shown any antibacterial activity against the bacteria, *Escherichia coli*.

Among the 25 weeds studied for its biopotency against the bacteria, *Bacillus subtilis*, only 10 of the weeds showed positive activity. *Lantana camara, Ageratum conyzoides* and *Xanthium stromarium* have showed maximum resistance among the weeds studied for their antibacterial potency against *Bacillus subtilis*.

Similarly, weeds studied for its biopotency against the bacteria, *Salmonella typhi*, only 12 of them showed activity against the bacteria. The maximum resistance for the bacteria was recorded from the methanolic extract of the plant, *Croton sparsiflorus* which recorded maximum zone of inhibition followed by *Martinea annua, Parthenium hysterophorus* and *Boerhavia diffusa*.

Among the 25 weeds studied for its biopotency against the bacteria, *Proteus mirabilis*, only 9 of them showed activity against the bacteria and the remaining 14 weeds have not shown any antibacterial potency against the bacteria, *Proteus mirabilis*. The maximum resistance for the bacteria was recorded from the methanolic extract of the plant, *Croton sparsiflorus* followed by *Martinea annua, Leonotis nepetifolia* and *Alangium platanifolium*.

Against the bacteria, *Klebsiella pneumoniae* only 8 of the weeds showed positive zone of inhibition against the growth. Remaining 17 species of weeds showed no reaction against the bacteria. Among the weeds showed positivity against the growth of bacteria, the weed, *Martinea annua* showed maximum zone of inhibition followed by *Xanthium stromarium* and *Leonotis nepetifolia*.

The methanolic extracts of the following weeds, *Coccinia grandis, Oldenlandia umbellata, Abutilon indicum, Acalypha indica, Mimosa pudica, Tinospora cardifolia, Cardiospermum helicacabum, Dodonea viscosa* and *Solanum nigrum* have not showed any activity against the bacteria studied. A few weeds, i.e., *Centella asiatica, Hyptis sauveolens, Commelina benghalensis* and *Corchorus* sp., showed activity to any one of the bacteria studied. The following weeds, *Parthenium hysterophorus, Leonotis nepetifolia, Martinea annua* and *Xanthium stromarium* have showed positive zone of inhibition to all the bacteria studied (Table 1).

DISCUSSION

The term weed in broader sense is any plant growing where it is not wanted. A weed in a general sense is a plant that is considered to be waste and normally applied to unwanted plants in human-controlled settings, especially in farm fields and gardens, but also lawns, parks, woods and other areas. Their competive nature along with cultivable plants are due to their resistance and non susceptible nature to general microbial attack, pest etc (Bhuvaneswari *et al*., 2011). This specific attitude of weed made us to conduct this study to know about their antibacterial potency against few bacteria.

Table 1: Zone of inhibition (mm) recorded against bacteria for methanolic extract of common weeds of Tamil Nadu, India

	Escherichia coli			*Bacillus subtilis*			*Salmonella typhi*			*Proteus mirabilis*			*Klebsiellapnuemoniae*		
	15	20	25	15	20	25	15	20	25	15	20	25	15	20	25
Name	(µL)														
Centella asiatica	5	5	7	-	-	-	-	-	-	-	-	-	-	-	-
Occimum americanum	7	7	10	-	-	-	8	9	10	-	-	-	-	-	-
Cassia alata	5	6	8	7	8	11	9	10	11	-	-	-	-	-	-
Coccinia grandis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anisomeles sp.	13	14	16	15	18	19	-	-	-	6	9	12	12	13	16
Oldenlandia umbellata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lantana camara	6	8	9	20	21	23	7	7	7	-	-	-	5	7	9
Boerhavia diffusa	-	-	-	-	-	-	18	19	19	7	8	9	8	9	10
Ageratum conyzoides	-	-	-	18	21	22	6	7	8	-	11	12	8	9	10
Abutilon indicum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parthenium hysterophorus	10	15	17	11	14	16	18	19	20	14	15	16	9	10	12
Acalypha indica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leonotis nepetifolia	15	15	18	17	17	18	15	16	17	14	16	19	14	15	17
Mimosa pudica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alangium platanifolium	16	17	18	17	18	19	16	17	18	15	17	18	-	-	-
Hyptis sauveolens	-	-	-	-	-	-	5	7	9	-	-	-	-	-	-
Martinea annua	16	17	18	14	16	17	19	19	20	19	19	20	15	20	27
Commelina benghalensis	15	20	27	-	-	-	-	-	-	-	-	-	-	-	-
Tinospora cordifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Croton sparsiflorus	23	26	28	16	18	19	23	24	26	17	18	23	-	-	-
Corchorus sp.	7	8	10	-	-	-	-	-	-	-	-	-	-	-	-
Xanthium stromarium	19	20	22	18	20	20	13	15	19	9	11	12	16	17	20
Dodonea viscosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cardiospermum helicacabum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Usage of methanol as a solvent in conducting this present study is justified by the report of previous authors. Their study confirms that Methanolic extracts of the plant showed more antibacterial activity among the other solvents when compared. The potential antibacterial effects of the methanolic extracts of Myrtaceae was reported by Abdelrahim *et al.* (2002) and Bhuvaneswari *et al.* (2010).

The present study reveals that although many weeds have been studied for their antibacterial potency only few weeds possess the biopotency in controlling the growth of bacteria studied. It is further confirmed that the usage of the following weeds, *Parthenium hysterophorus, Leonotis nepetifolia, Martinea annua* and *Xanthium stromarium* towards their antibacterial efficacy has to be studied more as they have recorded positive zone of inhibition in a significant amount. It is also noticed that they have recorded zone of inhibition for all the bacteria studied. Hence, the study on the direction of multispecific antibacterial property on the above said weed is required.

It is concluded that the antibacterial efficacy of the weeds depend upon their phytoconstituents and the study on phytoconstituents of the above weeds were presented elsewhere (Udayaprakash *et al.*, 2011).

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