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Anti-bacterial potency of weed plants

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Abstract
The present study was planned to evaluate the anti-bacterial potency of some common weeds such as *Quercus infectoria Olivier, Chromolaena odorata* (L.), *Ageratum conyzoides, Tridax procumbens, Mikania micrantha, Leucas cephalotes, Oxalis acetosella, Achyranthes aspera, Eupatorium odoratum, Oxalis corniculata* Linn. Aqueous extracts were prepared using leaves of selected weeds. All the weed plants leaf extracts were tested for the anti-bacterial potency against two bacteria strain i.e. Gram-positive (*Bacillus cereus)* and Gram-negative (*Pseudomonas aeruginosa)* using agar well diffusion method. All the extracts showed anti-bacterial potency against tested bacteria while *Quercus infectoria Olivier* inactive against *Pseudomonas aeruginosa*.

Keywords: Anti-bacterial potency, weed plants, *Bacillus cereus, Pseudomonas aeruginosa*

Introduction
Weeds are the most problematic organisms in agricultural areas (Oerke, 2005; Baucom, 2019) [5, 6]. The weeds are common, dominant and easily available in almost all the crop fields. These are produced in very huge quantity and competing to crops for water, nutrients and light. The total yield losses per year caused by weeds were more than 24% (Dhole *et al*., 2011) [7]. But weed plants are helpful in controlling erosion, serving as food for wild animals and birds. Weeds are also found to be resistant to most of the microbial disease when compared to the crops which shows disease symptoms (Udayaprakash, 2011) [8]. Weeds have been used in traditional medicine in different parts of the world for curative and health care purposes (Jakhar and Dahiya, 2017) [9]. The leaves and juices of roots are used to cure asthma, urinary disorders, leukorrhea, rheumatism, and encephalitis, in the traditional Ayurvedic system. Hence, the work has been planned to evaluate the anti-bacterial potency of some common weeds. The usage of the selected weed plants were described as below.

Quercus infectoria Olivier (Family: Fagaceae), a shrub that is one of the popular medicinal plants which has been traditionally used (Dar *et al*., 1976) [3]. Different parts of oak are known to have multiple therapeutic properties and are used widely in several folk medicine as an analgesic CNS depressant, anti-parkin-sonian, anti-diabetic, and anti-inflammatory drug (Iminjan *et al*., 2014) [2]. *Quercus infectoria* also have various anti-microbial properties including anti-bacterial, anti-viral, and anti-fungal (Kheirandish *et al*., 2016) [4].

Chromolaena odorata (L.) (Family: Asteraceae) weed plants are used by traditional medicine practitioners for treatment of burns, wound healing, skin infections, post-natal wounds, and anti-malarial. The leaf extract of *Chromolaena odorata* has anti-oxidant, anti-inflammatory, analgesic, anti-microbial, cytoprotective and many other medicinally significant properties (Pragadheeswari and Sangeetha, 2016) [10].

Ageratum conyzoides (Family: Asteraceae), is an annual herb has traditional medicinal properties. A wide range of chemical compounds including alkaloids, flavonoids, chromenes, benzofurans and terpenoids have been isolated from this species. Extracts and metabolites from this plant have been found to possess pharmacological and insecticidal activities (Okunade, 2002) [11].

Tridax procumbens (Family: Asteraceae), all plant parts of these weeds have noble pharmacological activities. It has been extensively used in Indian traditional medicine as anti-coagulant, anti-fungal and insect repellent; in bronchial catarrh, diarrhoea and dysentery. (Kale and Deshmukh, 2014; Krishnaswamy and Christina, 2015) [12, 13].

Mikania micrantha (Family: Asteraceae), is one of the worst invasive weeds in the world (Sapkota, 2007) [1]. The plant has been reported to possess anti-inflammatory, anti-bacterial, anti-stress, trypanocidal, anti-viral activity, inhibitory effect against plant pathogens and anti-spasmodic effect (Jyothilakshmi *et al*., 2015) [14].

Leucas cephalotes (Family: Lamiaceae), is useful in bronchitis, inflammation, asthma, dyspepsia, paralysis and leucoma. The leaves are useful in fever and urinary discharge. The plant contain triterpenes, oleanolic acid, sterols and flavones (Sailor *et al*., 2010) [15].

Oxalis acetosella (Family: Oxalidaceae), is a popular wild food plant. The leaves are an excellent source of important bioactive phytochemicals. *Oxalis acetosella* is very rich in b-carotene, ascorbic acid, tocopherols and xanthophylls, and that it is one of the best sources of flavonoids (Šircelj *et al*., 2010) [16].

Achyranthes aspera (Family: Amaranthaceae), is popularly used in Ayurveda, Unani, Sidha and Homoeopathy for treating various ailments. It has many medicinal properties, anti-microbial, anti-inflammatory, foeticide and anti-oxidant activity (Pandey *et al*., 2014; Mishra, 2018) [17, 18].

Eupatorium odoratum (Family: Asteraceae), is used in folk medicine as a cure for various ailments including malaria, cuts and bruises, infantile impetigo contagiosa, internal haemorrhage and influenza. It also has anti-microbial properties (Inya-Agha *et al*., 1987) [19].

Oxalis corniculata Linn. (Family: Oxalidaceae), is traditionally used in anaemia, dysentery, diarrhoea, skin diseases. The plant contains alkaloid, tannin, phenol, flavonoid, glycoside, cardiac glycoside. The plant also has anti-oxidant ant anti-microbial activity (Chetia *et al*. 2014) [20].

Methodology

Weed plant collection

The leaves of ten common weed plants i.e. *Quercus infectoria* Olivier, *Chromolaena odorata* (L.), *Ageratum conyzoides*, *Tridax procumbens*, *Mikania micrantha*, *Leucas cephalotes*, *Oxalis acetosella*, *Achyranthes aspera*, *Eupatorium odoratum*, *Oxalis corniculata* Linn. were collected. The leaves of all the ten weed plants were carefully washed with distilled water and then shade dried. The dried leaves were grinded in a laboratory grinder mixer to form a fine powder and stored in a air tight container.

Extraction process

Aqueous extracts of all ten weed plants were prepared using maceration and soxhlet extraction method. Dry powder of leaves, 10 gm each, separately dissolved in conical flask containing 160 ml of distilled water. The solutions were then kept in a shaking incubator at 370 °C overnight and were further filtered using Whatman No.1 filter paper and evaporated to dryness using soxhlet method. The extracts obtained were transferred to petri dishes and kept at a temperature of 40 °C.

Selecton of bacteria

Pure cultures of two common human pathogenic bacteria namely Gram-positive (*Bacillus cereus*) and Gram-negative (*Pseudomonas aeruginosa*) were selected. These bacteria procured from the Department of Microbiology, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Anti-bacterial assay

There are various methods involved in testing the anti-microbial activity of test extracts, from which the agar well diffusion method (Dey *et al*. 2010) [21] with slight modification was employed to test the anti-bacterial activity of aqueous extracts of weed plants leaf. To test the anti-bacterial potency of the prepared extracts, 0.1ml of bacterial inoculum was taken from cultures and poured on the test petri plate of Nutrient agar and evenly spread with the help of L spreader. The cultured petri plates were then set aside in an incubator at 30±20 °C for 24-48 hours and the bacterial cultures were allowed to grow.

After a uniform and required growth of the bacteria on petri plates, a uniform well was created in the centre of the plates with the help of a sterilized cork borer of 5 mm diameter and the aqueous extracts were poured into the well using a pipette. The plates were then rested for about 24 hours in incubator at 370 °C in inverted position to analyse the bacterial growth. After 24 hours, the zone of clearance was observed around the well and was considered for the anti-bacterial activity of the extracts. The amount of resistance shown by the extracts toward the bacterial growth was determined by measuring the diameter of the zone of inhibition formed around the wells.

Results and Discussion

Anti-bacterial activity of weed plants extracts: The ten weed plants were assessed for their anti-bacterial activity. Aqueous extracts of the leaves of all the ten weed plants were prepared by maceration process and assessed for anti-bacterial efficacy against *Bacillus cereus* (Gram positive) and *Pseudomonas aeruginosa* (Gram negative) using Well Diffusion Method.

The result presented in Table 1 and Figure 1 highlighted that the aqueous extracts of different weed plants showed varied anti-microbial activity. The anti-bacterial efficacy of Ghamra and Apamarga showed strong activity i.e. 25 mm and 14 mm zone of inhibition against *Bacillus cereus* and 22 mm and 11 mm zone of inhibition against *Pseudomonas aeruginosa* respectively. Siam weed (08 mm and 06 mm), goat-weed (7.3 mm and 7.1 mm), bitter vine (7.9 mm and 7.7 mm), wood sorrel (08 mm and 07 mm) and creeping wood sorrel (9.1 mm and 08 mm) weed plants showed moderate anti-bacterial activity against both *Bacillus cereus* and *Pseudomonas aeruginosa*, respectively. Devil weed with 07 mm zone of inhibition showed moderate anti-bacterial activity against *Bacillus cereus* and weak anti-bacterial activity against *Pseudomonas aeruginosa* with 05 mm zone of inhibition. Drona puspi exhibited weak anti-bacterial activity i.e. 05 mm and 02 mm zone of inhibition against both *Bacillus cereus* and *Pseudomonas aeruginosa*. The aqueous extract of Aleppo oak also indicated weak anti-bacterial activity i.e. 02 mm against *Bacillus cereus* whereas no anti-bacterial activity was found against *Pseudomonas aeruginosa*. Amongst all the weed plants, extracts of Ghamra and Apamarga indicated maximum zone of inhibition against both the tested bacteria.

Table 1: Anti-bacterial efficacy of extracts of weed plants

Sr. No.	Local name of the weed plant	Scientific name of the plant	Zone of inhibition (mm)	
			Bacillus cereus	***Pseudomonas aeruginosa***
1.	Aleppo oak	*Quercus infectoria* Olivier	02	-
2.	Siam weed	*Chromolaena odorata* (L.)	08	06
3.	Goat-weed	*Ageratum conyzoides*	7.3	7.1

4.	Ghamra	*Tridax procumbens*	25	22
5.	Bitter vine	*Mikania micrantha*	7.9	7.7
6.	Drona puspi	*Leucas cephalotes*	05	02
7.	Wood sorrel	*Oxalis acetosella*	08	07
8.	Apamarga	*Achyranthes aspera*	14	11
9.	Devil weed	*Eupatorium odoratum*	07	05
10.	Creeping wood sorrel	*Oxalis corniculata* Linn.	9.1	08

Anti-bacterial activity: No activity; < 5 mm: Weak; 5 - 10 mm: Moderate; >10 mm: Strong

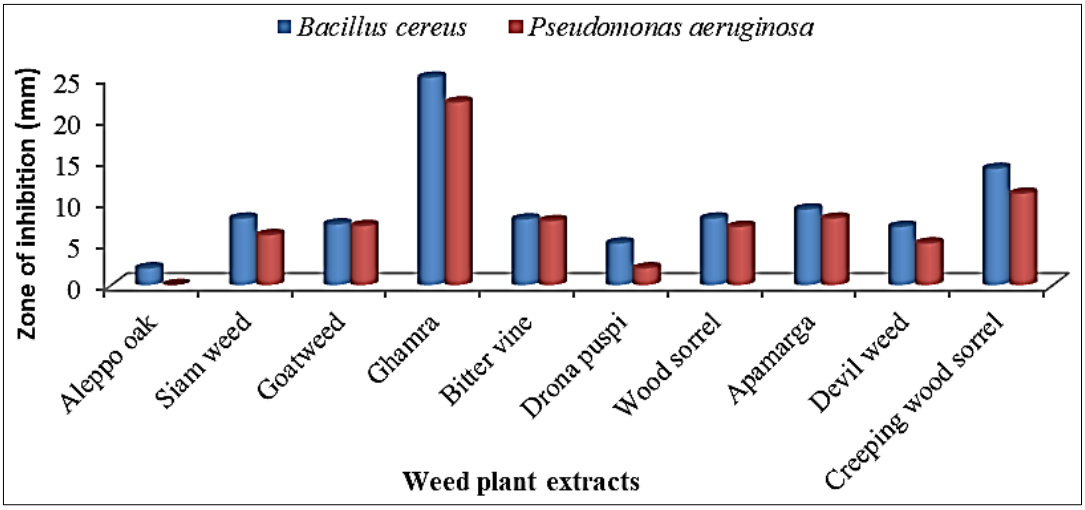

Fig 1: Anti-bacterial efficacy of extracts of screened weed plants

Conclusion

The results revealed that all weed plants showed anti-bacterial activity. Among ten weed plants, the maximum zone of inhibition was indicated by extracts of Ghamra and Apamarga leaf against *Bacillus cereus* (25 mm and 14 mm) and *Pseudomonas aeruginosa* (22 mm and 11 mm), respectively.

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