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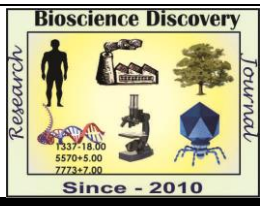

The Antibacterial and Antifungal Activity of Medicinal Plants from Kinwat Forest

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Abstract

The pathogens like *Alternaria brassicicola*, and *Xanthomonas campestris pv. citri*. were selected to test antimicrobial activity of plants. The three solvent extracts were used to screen against plant pathogens i.e. aqueous, alcoholic and ethyl acetate extracts of different parts of some plant species collected from Kinwat forest. The antibacterial and antifungal activities of all these extracts were determined by zone of Inhibition and paper disc method. Most of the extracts were found more effective against these pathogens. The positive results so obtained were compared with the reference standard fungicide (Carbendazim) and bactericide (Streptomycin). It was found that most of the extracts were more effective against pathogens than the fungicide and bactericide.

INTRODUCTION

Medicinal uses of plants range from the administration of the roots, barks, stems, leaves and seeds to the use of extracts from the plants. These plant extracts are a source of many potent and powerful drugs. Brazil, Cuba and India are examples of countries that have a diverse flora and rich tradition in the use of medicinal plants both as antibacterial and antifungal applications.

More than 30000 diseases of plants are known worldwide, of which over 5000 are present in India. Almost, all the cultivated crops are infected by one or more pathogens causing economic losses. The majority of the diseases are caused by fungi, bacteria and viruses. Apart from cultural methods of disease management, chemical control methods are widely used to control the diseases caused by these pathogens.

More use of bactericides and fungicides like organomercurical, carbamates etc. has posed serious problems to human and environmental health, so search for natural biodegradable source of bactericides and fungicides have always been quest for the researchers for control of bacterial and fungal diseases of plants. However, the need for repeated application of fungicides to manage disease discourages the extensive adoption of chemical control by most poor farmers. (Rajarajan S and Rao MS, 2004; Chaudhari, M and Mengi S, 2006; Baby *et al.*, 2006) Because of the present day public perception on pesticide contamination of foods especially the edible fruits, seeds, vegetables and oils, there is need for development of alternative economical and eco-friendly approaches for bacterial and fungal disease management. We tried to explore the potential of locally available plants against bacterial and fungal diseases of plants. Looking into the wealth of plants in Marathwada region especially in Nanded, it was thought proper to explore the available plant wealth for their efficacy of their antimicrobial potential. This could provide an alternative to the present day pollution problem of air, soil, water and residual effects of synthetic pesticides. (Saheb L Shinde *et al.*, 2010; Saheb L Shinde *et al.*, 2011 Saheb L

Shinde and Wadje, 2011) With this view, the present investigation was undertaken to select plant extracts that could be effective in the development of new tools for the control of diseases caused by bacteria and fungi to the plants of economic importance.

MATERIAL AND METHODS

Collection of plant materials:

The plants were collected from Kinwat forest. The leaves, stem, bark, fruits, roots and rhizomes were separated and dried at room temperature. The dried plants were milled to a fine powder and stored at room temperature in close containers in the dark until used.

Source of microorganisms:

The pathogens used were *Xanthomonas campestris* pv. *citri* and *Alternaria brassicicola*. These are the most common and important disease causing pant pathogens of plants. The pathogens were isolated from their respective hosts.

Extract preparation:

For testing efficacy of plant extracts aqueous, alcoholic and ethyl acetate extracts of these plant parts were prepared. 5 ml of the alcoholic and ethyl acetate extracts were evaporated on water bath under hood and slowly sterile distilled water was added to make up the volume of 5 ml.

Antifungal activity of plant extracts:

The paper disc method was used for testing antifungal activity. The media (25 ml) inoculated with suspension of experimental organisms was poured into sterilized Petri dishes and left to get at room temperature. Whatman's No. 1 filter paper discs (6 mm dia) were soaked in 0.5 ml aqueous, alcoholic and ethyl acetate extracts as well as a 10 ppm solution of carbendazim. The filter paper discs were placed equidistantly on inoculated media and diffusion of solution was allowed to occur for 30 minutes at room temperature. Plates were incubated at 37ºC for 72 hours. Three plates were employed per treatment and the average zone of inhibition was recorded.

RESULTS AND DISCUSSION

In this studies, the extracts of twenty medicinal plants were tested for antimicrobial activity against a test bacterial plant pathogen i.e. *Xanthomonas campestris pv*. *citri* and a test fungal plant pathogen i.e. *Alternaria brassicicola*. (Elizabeth, 2005; Harish, 2004).

In this screening, the root, rhizome, stem, bark, leaves and fruits extracts of the commonly found medicinal plants were used. The dried powders of these plant parts were extracted in alcohol, ethyl alcohol and distilled cold water and were used in this screening. The effect of extracts of all plants for antibacterial and antifungal activities against selected plant pathogens *in vitro* was undertaken. It was clear that, most of the plants possessed antimicrobial activity with few exceptions. However, there was a slight variation in the activity of the plant extracts. It was clear from this screening that *Emblica officinalis*, *Curcuma longa*, *Cyperus rotundus* and *Melia azedirach* extracts exhibited maximum antimicrobial activity against selected test bacterium and fungus. (Gupta *et al.,* 2002; Fyhrquist *et al.,* Harish *et al.,* 2004.)

Alcoholic extracts of plant were found maximum inhibitory effect than fungicide and bactericide (control) used against the test pathogens. It is followed by ethyl acetate and water extracts. (Silva *et al.,* 2000; Srivastava *et al.,* 2000)

The experiments were conducted to assess efficacy of some medicinal plants as antibacterial and antifungal agents against plant pathogens. In the present study twenty plants belonging to different families were preliminary screened to test their antimicrobial efficacy.

The aim of study was to find out efficient bio-pesticides against plant pathogens. In agriculture use of synthetic bactericides and fungicides are creating numerous problems of pollution and upsetting the ecosystem. Thus efforts are made in the direction of evolving a cheap source of bactericides and fungicides for the use of farmers. But in most of the extracts of plants antimicrobial activity was absent.

Out of twenty plants tested for their antifungal and antibacterial activities most of them showed antimicrobial activity against plant pathogenic fungi i.e. *A. brassicicola* and bacteria i.e. *Xanthomonas campestris* pv. *citri.* There plant pathogens were inhibited by the extracts of bark, stem, root, rhizome, leaves and fruits extracts of most of all twenty plants. Antimicrobial activity of the extracts of *Emblica officinalis* was recorded higher and it is followed by *Curcuma longa*, *Cyperus rotundus* etc. (Iwalokun *et al.,* 2001; Kubmarawa *et al.,* 2007; Shinde *et al.,* 2009; Shinde *et al.,* 2010)

Table 1. List of plants screened for their antimicrobial activity

Sr. No.	Plants screened	Family
1.	*Combretum albidum* G. Don	Combretaceae R. Br.
2.	*Curcuma longa* L.	Zingiberaceae Lindl.
3.	*Curcuma pseudomontana* Grah.	Zingiberaceae Lindl.
4.	*Cyperus bulbosus* Vahl	Cyperaceae Juss.
5.	*Cyperus rotundus* L.	Cyperaceae Juss.
6.	*Dolichandrone falcata (Wall. Ex DC.) Seem.*	Bignoniaceae Juss.
7.	*Emblica officinalis* Gaertn.	Euphorbiaceae Juss.
8.	*Eucalyptus globulus* Labill.	Myrtaceae Juss.
9.	*Ficus benghalensis* L.	Moraceae Link.
10.	*Ficus carica* L.	Moraceae Link.
11.	*Ficus hispida* L.f.	Moraceae Link.
12.	*Ficus racemosa* L.	Moraceae Link.
13.	*Ficus religiosa* L.	Moraceae Link.
14.	*Ficus amplissima* J.E. Sm.	Moraceae Link.
15.	*Ipomoea fistulosa* Mart. Ex Choisy	Convolvulaceae Juss.
16.	*Lawsonia inermis* L.	Lythraceae J. St. Hil.
17.	*Limonia acidissma* L.	Rutaceae Juss.
18.	*Madhuca longifolia* (Koen.) Macbr.	Sapotaceae Juss.
19.	*Mangifera indica* L.	Anacardiaceae Lindl.
20.	*Melia azedirach* L.	Meliaceae Juss.

Table 2. Antimicrobial activity of alcoholic extracts of some plant species.

Sr. No.	Name of the plants	Inhibition zone diameter (mm) of *Xanthomonas campestris* pv. *citri*						Per cent inhibition of spore germination of *Alternaria brassicicola*					
		Plant parts used						Plant parts used					
		R	Ri	S	B	L	F	R	Ri	S	B	L	F
1.	*Combretum albidum*	-	-	-	08	00	00	-	-	-	05	00	00
2.	*Curcuma longa*	**-**	**12**	**-**	**-**	**-**	**-**	**-**	**11**	**-**	**-**	**-**	**-**
3.	*Curcuma pseudomontana*	-	09	-	-	-	-	-	09	-	-	-	-
4.	*Cyperus bulbosus*	-	08	-	-	-	-	-	08	-	-	-	-
5.	*Cyperus rotundus*	**-**	**10**	**-**	**-**	**-**	**-**	**-**	**09**	**-**	**-**	**-**	**-**
6.	*Dolichandrone falcata*	-	-	00	-	00	-	-	-	00	-	00	-
7.	*Emblica officinalis*	**10**	**-**	**-**	**13**	**13**	**11**	**-**	**09**	**-**	**10**	**11**	**10**
8.	*Eucalyptus globulus*	-	-	-	07	09	-	-	-	-	07	09	-
9.	*Ficus benghalensis*	07	-	-	09	07	-	04	-	-	09	07	-
10.	*Ficus carica*	-	-	-	07	00	-	-	-	-	07	00	-
11.	*Ficus hispida*	-	-	-	00	00	-	-	-	-	00	00	-
12.	*Ficus racemosa*	-	-	-	08	07	-	-	-	-	08	07	-
13.	*Ficus religiosa*	-	-	-	09	10	10	-	-	-	09	10	10
14.	*Ficus amplissima*	-	-	-	08	09	10	-	-	-	08	09	10
15.	*Ipomoea fistulosa*	-	-	-	00	00	-	-	-	-	00	00	-
16.	*Lawsonia inermis*	03	-	-	08	09	-	02	-	-	08	09	-
17.	*Limonia acidissma*	-	-	-	00	00	-	-	-	-	00	00	-
18.	*Madhuca longifolia*	-	-	-	00	00	-	-	-	-	00	00	-
19.	*Mangifera indica*.	-	-	-	07	00	-	-	-	-	07	00	-
20.	*Melia azedirach*	-	-	-	10	12	12	-	-	-	10	12	12
21	Control Carbendazim and Streptomycin	03						04					

Used extracts were extracted in cold water. R = Root, Ri = Rhizome, S = Stem, B = Bark, L = Leaf, F = Fruit, - = Not attempted, 00=Activity absent.

Table 3. Antimicrobial activity of ethyl acetate extracts of some plant species.

Sr. No.	Name of the plants	Inhibition zone diameter (mm) of *Xanthomonas campestris* pv. *citri*						Per cent inhibition of spore germination of *Alternaria brassicicola*					
		Plant parts used						Plant parts used					
		R	Ri	S	B	L	F	R	Ri	S	B	L	F
1.	*Combretum albidum*	-	-	-	05	00	00	-	-	-	04	00	00
2.	*Curcuma longa*	**-**	**09**	**-**	**-**	**-**	**-**	**-**	**08**	**-**	**-**	**-**	**-**
3.	*Curcuma pseudomontana*	-	05	-	-	-	-	-	04	-	-	-	-
4.	*Cyperus bulbosus*	-	03	-	-	-	-	-	03	-	-	-	-
5.	*Cyperus rotundus*	**-**	**10**	**-**	**-**	**-**	**-**	**-**	**04**	**-**	**-**	**-**	**-**
6.	*Dolichandrone falcata*	-	-	00	-	00	-	-	-	00	-	00	-
7.	*Emblica officinalis*	**04**	**-**	**-**	**11**	**11**	**10**	**02**	**-**	**-**	**08**	**09**	**09**
8.	*Eucalyptus globulus*	-	-	-	04	03	-	-	-	-	03	04	-
9.	*Ficus benghalensis*	04	-	-	03	03	-	03	-	-	04	02	-
10.	*Ficus carica*	-	-	-	04	00	-	-	-	-	02	00	-
11.	*Ficus hispida*	-	-	-	00	00	-	-	-	-	00	02	-
12.	*Ficus racemosa*	-	-	-	05	05	-	-	-	-	04	05	-
13.	*Ficus religiosa*	-	-	-	04	05	03	-	-	-	03	03	03
14.	*Ficus amplissima*	-	-	-	05	03	04	-	-	-	02	04	04
15.	*Ipomoea fistulosa*	-	-	-	03	00	-	-	-	-	00	00	-
16.	*Lawsonia inermis*	02	-	-	02	02	-	00	-	-	04	04	-
17.	*Limonia acidissma*	-	-	-	00	01	-	-	-	-	00	00	-
18.	*Madhuca longifolia*	-	-	-	01	00	-	-	-	-	00	00	-
19.	*Mangifera indica*.	-	-	-	02	00	-	-	-	-	02	02	-
20.	*Melia azedirach*	-	-	-	05	04	03	-	-	-	04	04	02
21.	Control Carbendazim and Streptomycin	03						04					

Used extracts were extracted in cold water. R = Root, Ri = Rhizome, S = Stem, B = Bark, L = Leaf, F = Fruit, - = Not attempted, 00=Activity absent.

Table 4. Antimicrobial activity of aqueous extracts of some plant species.

Sr. No.	Name of the plants	Inhibition zone diameter (mm) of *Xanthomonas campestris* pv. *citri*						Per cent inhibition of spore germination of *Alternaria brassicicola*					
		Plant parts used						Plant parts used					
		R	Ri	S	B	L	F	R	Ri	S	B	L	F
1.	*Combretum albidum*	-	-	-	07	00	00	-	-	-	06	00	00
2.	*Curcuma longa*	**-**	**12**	**-**	**-**	**-**	**-**	**-**	**11**	**-**	**-**	**-**	**-**
3.	*Curcuma pseudomontana*	-	07	-	-	-	-	-	05	-	-	-	-
4.	*Cyperus bulbosus*	-	07	-	-	-	-	-	03	-	-	-	-
5.	*Cyperus rotundus*	**-**	**11**	**-**	**-**	**-**	**-**	**-**	**11**	**-**	**-**	**-**	**-**
6.	*Dolichandrone falcata*	-	-	00	-	00	-	-	-	00	-	00	-
7.	*Emblica officinalis*	**07**	**-**	**-**	**13**	**12**	**13**	**08**	**-**	**-**	**11**	**10**	**09**
8.	*Eucalyptus globulus*	-	-	-	04	06	-	-	-	-	04	07	-
9.	*Ficus benghalensis*	03	-	-	03	04	-	03	-	-	05	06	-
10.	*Ficus carica*	-	-	-	05	00	-	-	-	-	04	02	-
11.	*Ficus hispida*	-	-	-	00	00	-	-	-	-	00	00	-
12.	*Ficus racemosa*	-	-	-	04	04	-	-	-	-	03	02	-
13.	*Ficus religiosa*	-	-	-	03	06	03	-	-	-	05	03	03
14.	*Ficus amplissima*	-	-	-	04	05	06	-	-	-	04	06	04
15.	*Ipomoea fistulosa*	-	-	-	00	00	-	-	-	-	00	00	-
16.	*Lawsonia inermis*	02	-	-	05	05	-	03	-	-	06	04	-
17.	*Limonia acidissma*	-	-	-	00	02	-	-	-	-	00	00	-
18.	*Madhuca longifolia*	-	-	-	00	00	-	-	-	-	00	00	-
19.	*Mangifera indica.*	-	-	-	03	00	-	-	-	-	05	03	-
20.	*Melia azedirach*	-	-	-	05	05	07	-	-	-	09	06	03
21.	Control Carbendazim and Streptomycin	03						04					

Used extracts were extracted in cold water. R = Root, Ri = Rhizome, S = Stem, B = Bark, L = Leaf, F = Fruit, - = Not attempted, 00=Activity absent.

CONCLUSION

It is concluded that antibacterial and antifungal activity of leaves extracts of *Emblica officinalis, Curcuma longa, Cyperus rotundus* and *Melia azedirach* and its active constituents would be helpful in treating various kinds of plant diseases and seed borne diseases. Very few numbers of papers has been appeared to work on screening of antimicrobial activity. These results may contribute to a resolution of these difficulties.

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