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Antibacterial and antioxidant activity of plant latex

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ABSTRACT

Antioxidants are having the tremendous scope in food and drug industries. These have been used in treatment of many diseases. In this study the ethanol and acetone extracts of latexes of 16 different plants were screened for their in vitro antioxidant and antimicrobial activity. Both ethanol and acetone extracts of these latexes showed good scavenging activity. The antioxidant activity ranged between 27.69 ± 1.54 to 93.33 ± 1.66. Ethanol extract of the *Euphorbia geniculata* plant latex had shown almost 93.33 ± 1.66 percent inhibition. The antibacterial activity of 16 plant latexes was screened. The zone of inhibition was observed in the range of 8 ± 0.01 to 22 ± 0.47 mm. The methanolic extract of *Carica papaya* latex gave the widest zone of inhibition.

Key words: Plant latex; antibacterial activity; antioxidant activity

INTRODUCTION

Infectious diseases are a leading cause of death worldwide and antibiotic resistance has become a global concern (Westh et al. 2004). One way to prevent antibiotic resistance of pathogenic species is by using new compounds that are not based on existing synthetic antimicrobial agents (Shah 2005). Plants have been a major source of medicine and the presences of plant secondary metabolites have been implicated for most plants therapeutic activities (Ogunleye & Ibitoye 2003; Aibinu 2006). Phytomedicines derived from plants have shown great promise in the treatment of intractable infectious diseases (Idu et al. 2007). Reports on the antibiotic properties of various plants are clearly documented (Avato et al. 2006). In India, the secretions from the root bark are traditionally used for the treatment of skin diseases, enlargement of abdominal viscera and intestinal worms (Parrotta 2001). In Senegal, the milky latex is locally applied in the treatment of cutaneous diseases such as ringworm, syphilitic sores and leprosy. In addition preparations from latex with honey are used as anti-rabies and also in treatment of toothache and cough (Kew 1985).

Most of the diseases are linked to oxidative stress due to free radicals (Gutteridgde 1995). Free radicals are fundamental to any biochemical process and represent an essential part of aerobic life and metabolism (Tiwari 2001). Current research is now directed towards finding naturally occurring antioxidants of plant origin (Velavan et al. 2007). It is in this context, the latexes of 16 plants were screened for antibacterial and antioxidant activity.

MATERIALS AND METHODS

Sample Collection

The latex from various plants was collected from Ahmednagar district, Maharahtra, India. The plants used were *Calotropis procera, Alstonia digitata, Michelia champaca, Thevetia species, Pedilanthus tithymaloides, Euphorbia geniculata, Ficus glomulurata, Ficus carica, Carica Papaya, Ficus bengalensis, Ficus religiosa, Ficus elastic, Ipomia pistula, Ervatamia species, Cryptostegia grandiflora,* and *Synadenium grantii*.

Extraction of antimicrobial compounds. Five ml of Latex collected separately from different 16 plants were extracted with 5 ml petroleum ether and then same latex was subjected to 5 ml methanol extraction (Parekh & Chanda 2006; Sudharameswari & Radhika 2007).

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Test for antibacterial activity.

The extracts of plant latex were tested against *P. aeruginosa* (NCIM-5029), *E. coli* (NCIM-2065) and *S. aureus* (NCIM-2079). These bacteria were obtained from NCIM, Pune, India. Bacterial strains were maintained on nutrient agar slants at 4°C. The agar disc diffusion method was employed for the determination of antimicrobial activity of the latex. Briefly, a suspension of the microorganism was spread on the solid media plates. Whatman filter paper discs (6 mm in diameter) were soaked with 10 µL of the extract and placed on inoculated media (Singh et al. 2004; Vaghasiya & Chanda 2007). After being kept at 4°C for 2 h, plates were incubated at 37°C, for 24 h. The diameter of the inhibition zones were measured in mm.

Test for antioxidant activity.

The antioxidant activity of the latex extract was estimated using a slight modification of the DPPH radical scavenging protocol reported by Chen et al. (1999). For a typical reaction, 2 ml of 100 µM DPPH solution in ethanol/acetone was mixed with 2 ml of 100 µg/ml of plant extract. The effective test concentrations of DPPH and the extract were therefore 50 µM and 50 µg/ml, respectively. The reaction mixture was incubated in the dark for 15 min and thereafter the optical density was recorded at 517 nm against the blank. For the control, 2 ml of DPPH solution in ethanol/acetone was mixed with 2 ml of ethanol/acetone and the optical density of the solution was recorded after 15 min. The assay was carried out in triplicate. The decrease in optical density of DPPH on addition of test samples in relation to the control was used to calculate the antioxidant activity, as percentage inhibition (%IP) of DPPH radical.

RESULTS AND DISCUSSION

Searching of compounds with antimicrobial properties has generally targeted to the plants with a history of ethno botanical uses (Sindambiwe et al. 1999; Sokmen et al. 1999; Shrinivasan et al. 2001), while a few studies have targeted randomly collected plants (Khafagi & Dewedar 2000). The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for their potential antimicrobial activity (Colombo & Bosisio 1996; Iwu et al. 1999). Present study targeted to search the antibacterial activity of randomly selected 16 plant latexes. As latexes are known to have a defensive purpose in plant, they may contain strong antimicrobial activity and plants may provide the good source of antimicrobial compounds.

The antibacterial activity of both Petroleum ether and Methanol extracts of different plant latexes namely *Calotropis procera, Alstonia digitata, Michelia champaca, Thevetia species, Pedilanthus tithymaloides, Euphorbia geniculata, Ficus glomulurata, Ficus carica, Carica Papaya, Ficus bengalensis, Ficus religiosa, Ficus elastica, Ipomia pistula, Ervatamia species, Cryptostegia grandiflora,* and *Synadenium grantii* against three different strains namely *P. aeruginosa, E. coli*

Table 1. Antibacterial activity of latexes against three bacteria *P. aeruginosa, E. coli* and *S.aureus*.

Sr.No. Plant	Zone of inhibition in mm					
	E. coli		*P. aeruginosa*		*S. aureus*	
	Pet ether	Methanol	Pet ether	Methanol	Pet ether	Methanol
1.*Calotropis procera*	12.33± 00.57	-	11.66 ± 01.52	12.66 ± 00.15	-	09± 01.00
2. *Alstonia digitata*	12.00 ± 01.00	-	-	10.83 ± 01.04	-	09.33 ± 01.52
3.*Michelia champaca*	-	-	-	09.00± 01.00	-	12.66 ± 01.15
4.*Thevetia species*	-	9.33± 01.52	-	-	-	-
5.*Pedilanthus tithymaloides*	09.33 ± 01.52	-	-	08.83 ± 00.76	12.00 ± 01.00	12.33 ± 00.57
6.*Euphorbia geniculata*	09± 00.57	10.50 ± 00.50	14.00 ± 01.00	-	-	-
7. *Ficus glomulurata*	10.66 ± 01.52	09.00± 00.00	-	-	08.66 ± 00.57	-
8. *Ficus carica*	10.00 ± 01.00	-	-	-	-	-
9. *Carica Papaya*	13.00 ±01.00	-	20.66± 1.52	11.00 ±01.00	10.83 ± 01.75	22.33± 02.08
10.*Ficus bengalensis*	11.00 ± 01.00	-	-	-	-	10.33± 00.57
11. *Ficus religiosa*	12.00 ± 01.00	08.33± 00.05	-	11.33± 01.52	08.50 ± 00.50	12.33 ± 01.15
12. *Ficus elastica*	09.33± 01.52	09.00 ± 01.00	-	11.66± 02.08	-	08.33 ± 00.57
13. *Ipomia pistula*	-	09.33± 01.52	08.33± 00.57	09.33 ± 01.15	16.00 ± 01.00	09.66± 00.57
14. *Ervatamia species*	-	-	-	09 ± 01.00	10.66± 01.52	13.83 ± 01.04
15. *Cryptostegia grandiflora*	-	-	-	13.33± 01.00	10.66 ± 01.52	12.18± 01.27
16. *Synadenium grantii*	08.33± 00.57	09.66 ± 01.52	-	13.00± 01.00	13.16 ± 01.25	13.50± 00.05

Table 2. Antioxidant activity of plant latexes

Sr. No.	Plant Name	DPPH radical Scavenging activity(% inhibition)	
		Ethanol	Acetone
1	*Euphorbia geniculata*	93.74 ± 01.10	75.45 ± 00.71
2	*Ficus religiosa*	88.23 ± 01.55	72.24 ± 01.71
3	*Ficus elastica*	58.52 ± 01.45	52.85 ± 02.47
4	*Ficus bengalensis*	70.39 ±00.76	58.89 ± 01.15
5	*Ervatamia species*	82.21 ± 02.23	52.81 ± 02.39
6	*Ficus glomulurata*	54.56 ± 01.35	NIL
7	*Thevetia specios*	72.88 ± 00.97	53.02 ± 01.65
8	*Michelia champaca*	72.23 ± 01.00	71.35 ± 01.30
9	*Ipomia pistula*	56.94 ± 03.22	NIL
10	*Pedilanthus tithymaloides*	27.20 ± 01.78	54.06 ± 01.69
11	*Ficus carica*	53.79 ± 02.81	50.58 ± 01.60

and *S. aureus* is shown in table no.1. Petroleum ether extract of *Carica papaya* showed highest activity (13.00mm ± 01.00 zone of inhibition) and *S. granti* showed lowest activity (08.33 mm ± 00.57 zone of inhibition) against *E. coli* while *Michelia champaca, Thevetia* species, *Ipomia pistula, Ervatamia species, and Cryptostegia grandiflora* not showed any activity in the same extract against same bacterial strain. Methanol extract of 7 of the 16 plant latexes showed antibacterial activity in the range of 08.33 mm ± 00.05 to 10.50 mm ± 00.50 against *E. coli.* But methanol extract of rest of the 9 plant latexes did not show activity against *E. coli.* Latexes of *Thevetia species*, *Ficus glomulurata*, *Ficus carica* and *Ficus bengalensis* did not show antibacterial activity in both the petroleum ether and methanol extracts tested against *P. aeruginosa.* The highest antibacterial activity of methanol extract was shown by *Cryptostegia grandiflora* (13.33mm±01.00) while *Pedilanthus tithymaloides* showed lowest antibacterial activity (08.83± 00.76) against *pseudomonas.*

The antibacterial activity of both extracts of the 16 plant latexes against *S. aureus* is shown in table no.1. Eight plant latexes of petroleum ether extract showed antibacterial activity against this bacterial strain. Maximum activity of petroleum ether extract showed by *Ipomia pistula* (16mm±01.00) followed by *Synadenium grantii* (13.16 mm±01.25). Methanol extract of the 12 of 16 plant latexes showed antibacterial activity against *S. aureus.* Highest activity was shown by methanol extract of *Carica papaya* (22.33mm±02.08) *followed by Ervatamia* species (13.83mm±01.04) and *Synadenium grantii* (13.50mm±00.05) against *S. aureus*. Lowest activity was shown by methanol extract of *Ficus elastica* (8.33mm±00.57) against *S. aureus*. Methanol extract of *Michelia champaca* (12.66mm±01.15), *Pedilanthus tithymaloides* (12.33mm±00.57), *Ficus bengalensis* (10.33mm±00.57), *Ficus religiosa* (12.33mm ±01.15), *Ipomia pistula* (9.66mm ±00.57) and *Cryptostegia grandiflora* (12.18mm ±01.27) showed mod -erate activity. Methanol extract of *Thevetia species*, *Euphorbia geniculata*, *Ficus glomulurata*, *Ficus carica*, demonstrated no activity against *S. aureus.*

Plants and plant products are being used as a source of medicine since long. The medicinal properties of plants have been investigated in the recent scientific developments throughout the world, due to their potent antioxidant activities, no side effects and economic viability (Auudy et al. 2003). The use of plants or herbs as antioxidants in processed foods is becoming of increasing importance in the food industry as an alternative to synthetic antioxidants (Madsen & Bertelsen 1995). Traditional Chinese drugs (Kampo drugs) are used for treatment and prevention of many diseases in China and Japan and are formulated from several crude drugs composed of dried plants or insects. These drugs have antioxidant activity (Ogataa et al. 1997).

The antioxidant activity (expressed as % inhibition) of plant latexes is shown in table 2. The antioxidant activity varied in the plant latexes and ranged from 27.20 ±01.78 to 93.74 ±01.10. The highest activity was found in ethanol extract of *Euphorbia genicalata* latex (93.74 ±01.10) followed by ethanol extract of *Ficus religiosaI* latex (88.23 ±01.55) and lowest in ethanol extract of *Pedilanthus tithymaloides* latex (27.20 ±01.78). All the ethanolic extracts of all plant latexes showed antioxidant activity but two acetone extracts did not show any activity. In general ethanol extracts of all tested plant latexes showed more activity as compare to acetone extracts except latex of *Pedilanthus tithymaloides* which showed more antioxidant activity (54.06 ±01.69) in acetone extract and less activity in ethanol extract (27.20 ±01.78). Overall studies indicating that the plant latexes can be considered for the medicinal purposes which is less studied so far. *Euphorbia geniculata* latex having the strong antioxidant as well as antimicrobial activity against the pathogenic bacteria itself suggesting it has to consider for the further study.

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