RESEARCH ARTICLE

Screening of Antibacterial Activity of Rose Varieties against Bacterial Pathogens

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ABSTRACT

Rose is an ornamental aromatic plant belong to the family Rosaceae. In all 22 varieties from 2 different rose species viz Hybrid Tea and Floribundas (F) were used in this study. Out of these 19 rose petals varieties were moderately to strongly antibacterial against all the screened bacteria and the remaining 3 varieties demonstrated weak antibacterial activity. Pseudomonas aeruginosa was found to be strongly sensitive to all the 22 rose varieties with maximum zone of inhibition (32mm). Bacillus coagulans, Escherichia coli, Staphylococcus epidermidis, Shigella flexeneri and Salmonella typhi were moderately sensitive while Enterobacter aerogenes, Enterococcus faecalis, Klebsiella pneumoniae, Proteus vulgaris, Staphylococcus aureus and Salmonella typhimurium were weakly sensitive. Pseudomonas aeruginosa was resistant to most of the standard antibiotics. Enterococcus faecalis was resistant to 2 varieties namely Koppies and Zorina. Staphylococcus aureus was resistant to 2 varieties namely Vimala and Zorina. Proteus vulgaris was resistant to 3 varieties namely Charleston, Viamala and Zorina where as Klebisella pneumoniae was resistant to 2 varieties namely Viamala and Zorina and Bacillus coagulans was resistant to 1 variety namely Zorina. These rose varieties may act as good alternatives to reduce the excess use of antibiotics to some extent, without side effect. Further studies are required for the screening of volatile and non-volatile active antimicrobial chemical constituents of rose petals to utilize them in pharmaceutical industries.

Key words: Rose petals, bacterial pathogens, antibacterial activities.

INTRODUCTION

In this long struggle to achieve mastery over powerful forces of nature, man has always turned to plants for help. This is especially so when he was struck with ailments both physically and mentally. “Arkprakash” one of the Vedas of Ayurveda gives the evidences of use of rose petals for medicine.

One of the major problems that concerns human health is bacterial resistant against antibiotics (Karlowsky *et al*., 2012; Gayatri *et al*., 2013). Therefore, researchers have been screening natural sources for an undiscovered antimicrobial agents (Mahesh *et al*., 2008).

The floral petals of higher plants are known to possess antibacterial activity (Darokar *et al*., 1998). The aroma in flower is due to essential oil secreted in the papillae from epidermal cells. The rose oil contains genaniol, citronellol, ethanol, rose oxide, linalool, nerol, eugenol, etc (Sharma, 2003).

The petals of rose species possess antibacterial activity against different pathogenic bacteria reveals presence of several different volatile and non-volatile chemical constituents in the petals of different varieties leading to bacterial inhibition (Mankar and Tambekar, 2006). Efforts are thus directed to identify plant product, which have broad spectrum antimicrobial property and no ill effect (Farnsworth, 1998). *Rosa damascena* was used in ancient medicine in the effective treatment of abdominal pain, digestive problems, skin problems and headaches (Foster and Duke, 1990).

R. damascena act as an anti – diabetic by reducing blood glucose level there by acting as potent of α – glucosidase enzyme inhibitor (Gholamhoseinian *et al*., 2008). *R. damascena* has potential to increase heart rate and contraction. The mechanisms of these effects are unknown (Boskabady *et al*., 2011). *R. damascena* has mild excitatory effect on ileum contraction and this aqueous fraction may be useful as a mild laxative agent (Dolati *et al*., 2013).

So the aim of present investigation was to evaluate the antimicrobial profile of rose petals varieties against bacterial pathogens.

MATERIALS AND METHODS

Plant Material

Rose Petals were collected from 22 rose varieties maintained in the Amravati Garden Club, (M.S.), India. The Hybrid Tea and Floribandas varieties were used. The rose varieties were collected in the morning between 7.30 am to 9.30 am and stored in refrigerator until further use. All the rose varieties were repeated for 3 times during rainy to winter season.

Using a metal borer, 10 mm diameter discs were cut from the rose petals and then sterilized by distilled water and then with 0.1% mercury chloride for 2 min. and again resterilized with distilled water for 5 to 6 times.

Anitimicrobial Susceptibility Testing

Standard antibiotic susceptibility and antibacterial activity of rose petals were screened for these bacteria by a standardized single disc method (Bauer *et al*., 1966). Broth cultures of both Gram - positive bacteria *Bacillus coagulans* (MTCC 2302), *Enterococcus faecalis* (MTCC 439), *Staphylococcus aureus* (MTCC 96), *Staphylococcus epidermidis* (MTCC 435) and Gram - negative bacteria *Enterobacter aerogenes* (MTCC 111), *Escherichia coli* (MTCC 390), *Klebsiella pneumoniae* (MTCC 109), *Pseudomonas aeruginosa* (MTCC 424), *Proteus vulgaris* (MTCC 426), *Shigella flexeneri* (MTCC 1457), *Salmonella typhimurium* (MTCC 98), *Salmonella typhi* (MTCC 733). The bacterial lawns were prepared by spreading of 0.1ml over night grown bacterial culture (approximately 10^8 CFU/ml) on nutrient agar plates. The petal discs were placed on seeded nutrient agar and incubated at 37^0C for 24 h. All the bacterial strains were obtained from Institute of Microbial Technology (IMTECH), Chandigarh, India. The results were recorded as zone of inhibition in mm.

RESULTS AND DISCUSSION

In the present study, *P. aeruginosa* was found to be highly sensitive against all 22 rose varieties with zone of inhibition in between 21 to 32mm. *B.coagulans, E. coli, S. epidermidis, S. flexeneri, S. aureus, E. aerogenes, S. typhi* and *S. typhimurium* were moderately sensitive while *E. faecalis, K. pneumoniae, P. vulgaris,* were weakly sensitive (Table 1). *P. aeruginosa*, which was resistant to most of the standard antibiotics, found sensitive to almost all varieties of rose petals while *K. pneumoniae*, was sensitive to all of the standard antibiotics, found weakly sensitive to almost all varieties of rose petals (Fig. 1). The pattern of antibacterial activity was measured in terms of zone of inhibition and compared with standard antibiotics such as, ampicillin, cephalothin, co-trimoxazole, gentamicin, nalidixic acid, nitrofurantioin, norfloxacin and tetracycline. It was observed that the antibacterial activity of rose varieties was similar to antibiotics in terms of zone of inhibition. (Fig. 2).

Table1: Antibacterial activity in the floral petals of different varieties of roses against bacterial pathogens.

Name of Rose Varieties	(zone of inhibition in mm)											
	B. coagulans MTCC2302	*E.aerogenes* MTCC 111	*E. coli* MTCC 390	*E. faecalis* MTCC 439	*K. Pneumoniae* MTCC 109	*P.aeraginosa* MTCC 424	*P. vulgaris* MTCC 426	*S. aureus* MTCC 96	*S.epidermidis* MTCC 435	*S. flexeneri* MTCC 1457	*S.typhimurim* MTCC 98	*S. typhi* MTCC 733
Azure Sea (HT)	16	15	16	14	15	30	13	14	20	16	16	16
Alabama (HT)	17	18	18	16	12	28	17	20	16	21	16	18
Ace of Heart (HT)	16	16	18	18	14	26	15	15	23	14	14	20
Barkarole (HT)	16	15	14	20	13	22	14	15	17	25	14	14
Century Two (HT)	15	13	21	12	14	21	12	13	20	22	18	16
Catalonia (HT)	21	12	14	17	16	30	14	16	14	21	15	13
Cabaret (HT)	20	21	20	18	17	32	25	21	26	18	15	23
Charlestron (F)	20	15	26	15	15	21	-	15	15	20	15	22
Deep purple (F)	20	15	14	16	14	25	16	20	20	20	13	18
Disco Dancer (F)	15	14	20	17	13	20	16	17	22	16	18	17
Garden Delight(HT)	18	15	17	13	16	23	17	14	16	17	12	18
Garden Medaillon (HT)	16	13	12	13	15	27	12	15	18	20	19	14
Koppies (HT)	21	14	18	-	12	26	16	12	16	21	13	13
Lustige (HT)	18	16	16	18	13	21	16	17	19	19	14	19
Madame violet (HT)	24	18	17	16	18	30	20	18	21	22	16	15
Perfume Delight (HT)	17	13	15	14	16	29	16	20	18	20	18	16
Summer Holiday (HT)	16	16	18	15	20	30	28	17	18	24	21	18
Summer snow (F)	20	14	20	14	15	24	16	17	17	22	16	21
Simplicity (F)	20	17	20	20	16	23	12	20	21	18	18	23
Valentine (F)	15	18	20	13	17	25	17	19	25	26	18	20
Viamala (HT)	-	12	17	13	-	20	-	-	16	13	15	14
Zorina (F)	15	14	19	-	-	22	-	-	12	20	-	-

Zone of inhibition : 12mm – 14mm (weakly sensitive), 15mm – 20m (moderately sensitive), 21mm – 32mm (highly sensitive), - = no zone of inhibition

HT = Hybrid Tea, F = Floribanda

Table 2 : Antibacterial activity of Standard antibiotic against bacterial pathogens

Antibiotics	(Zone of inhibition in mm)											
	B. coagulans MTCC2302	*E.aerogenes* MTCC 111	*E. coli* MTCC 390	*E. faecalis* MTCC 439	*K. Pneumoniae* MTCC 109	*P.aeraginosa* MTCC 424	*P. vulgaris* MTCC 426	*S. aureus* MTCC 96	*S.epidermidis* MTCC 435	*S. flexeneri* MTCC 1457	*S.typhimurim* MTCC 98	*S. typhi* MTCC 733
Ampicillin	14	15	17	16	13	-	14	26	29	13	15	13
Cephalothin	17	16	16	14	16	-	12	26	29	15	14	16
Co-trimoxazole	14	14	23	15	15	-	14	23	23	15	14	15
Gentamicin	15	12	19	17	14	16	12	18	19	12	12	12
Nalidixic acid	15	16	22	14	17	-	12	-	-	16	18	17
Nitrofurantioin	16	15	20	15	16	-	13	20	20	15	12	15
Norfloxacin	13	14	24	14	16	21	16	21	19	16	15	14
Tetracycline	18	13	20	15	12	-	15	24	25	16	13	12

– = no zone of inhibition

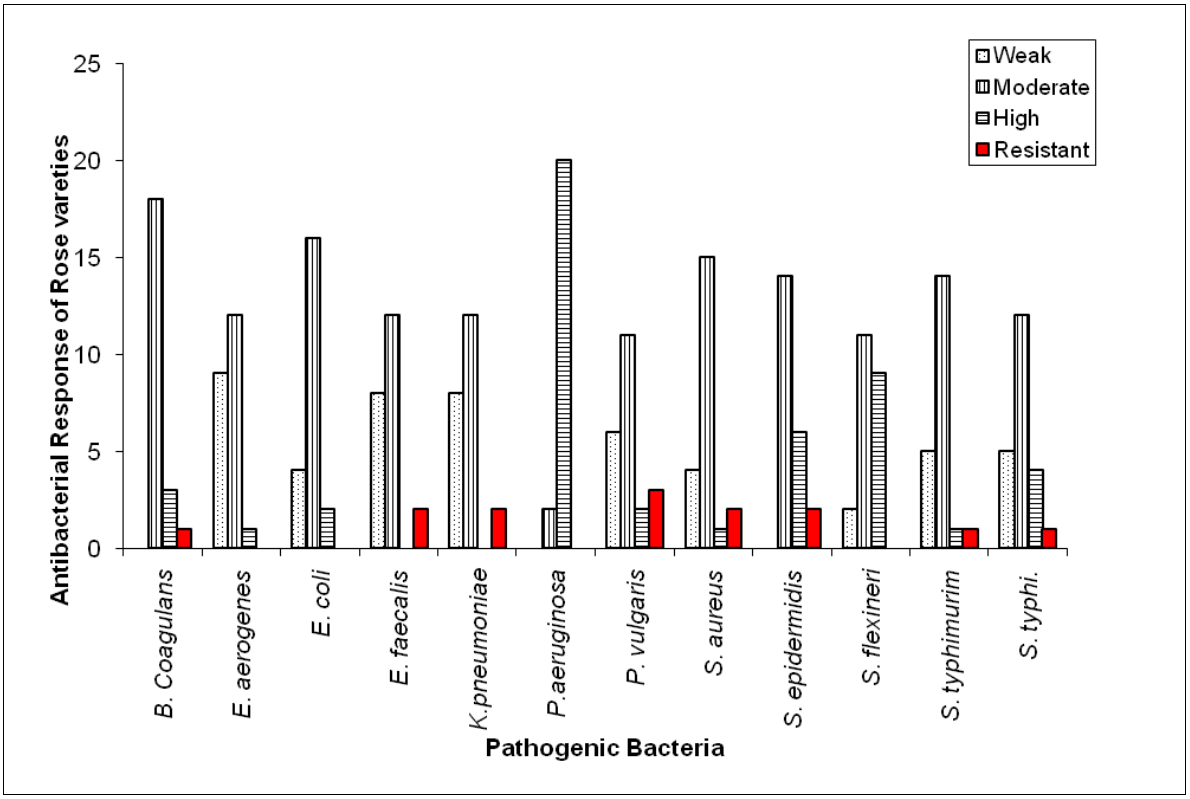

Fig. 1 : Antibacterial response of rose petals to pathogenic bacteria.

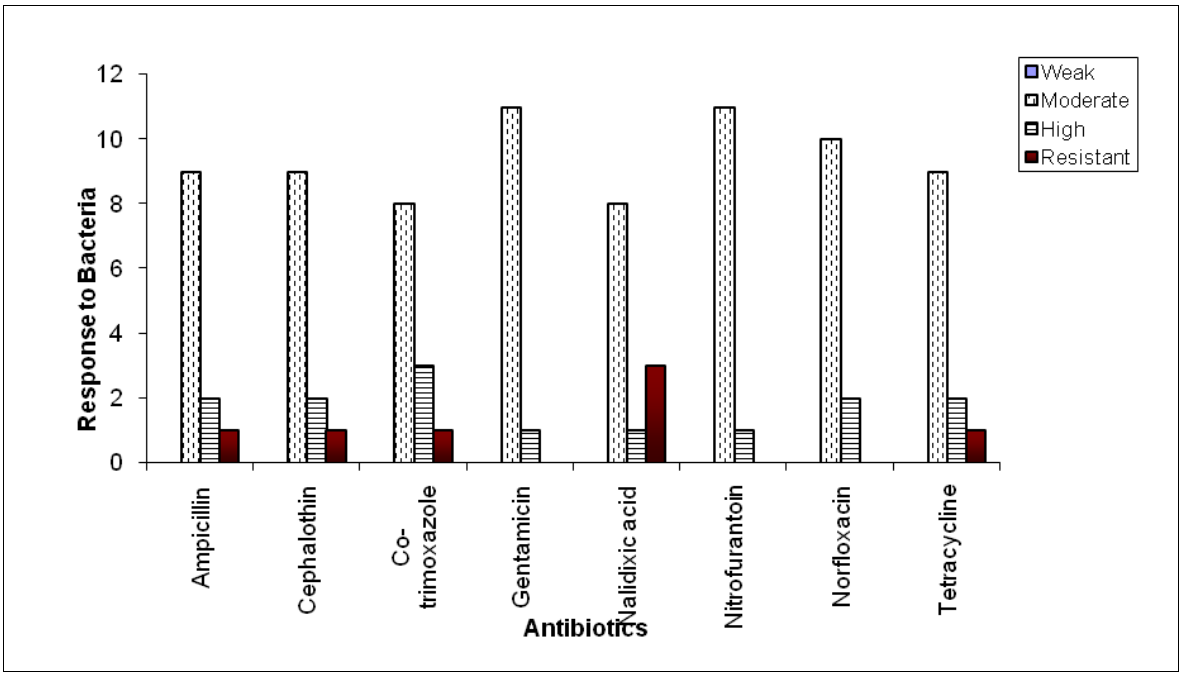

Fig. 2 : Antibacterial response of antibiotics to pathogenic bacteria.

The rose varieties Cabaret, Summer holiday, Valentine, Simplicity, Madame violet and Lustige were highly antimicrobial against Garm positive bacteria such as *B. coagulans, E. faecalis, S. aureus, S. epidermidis* and Gram negative bacteria such as *K. pneumoniae, P. aeruginosa, P. vulgaris, E. coli, E. aerogenes, S. flexeneri, S. typhi* and *S. typhimurium* (Fig. 3).

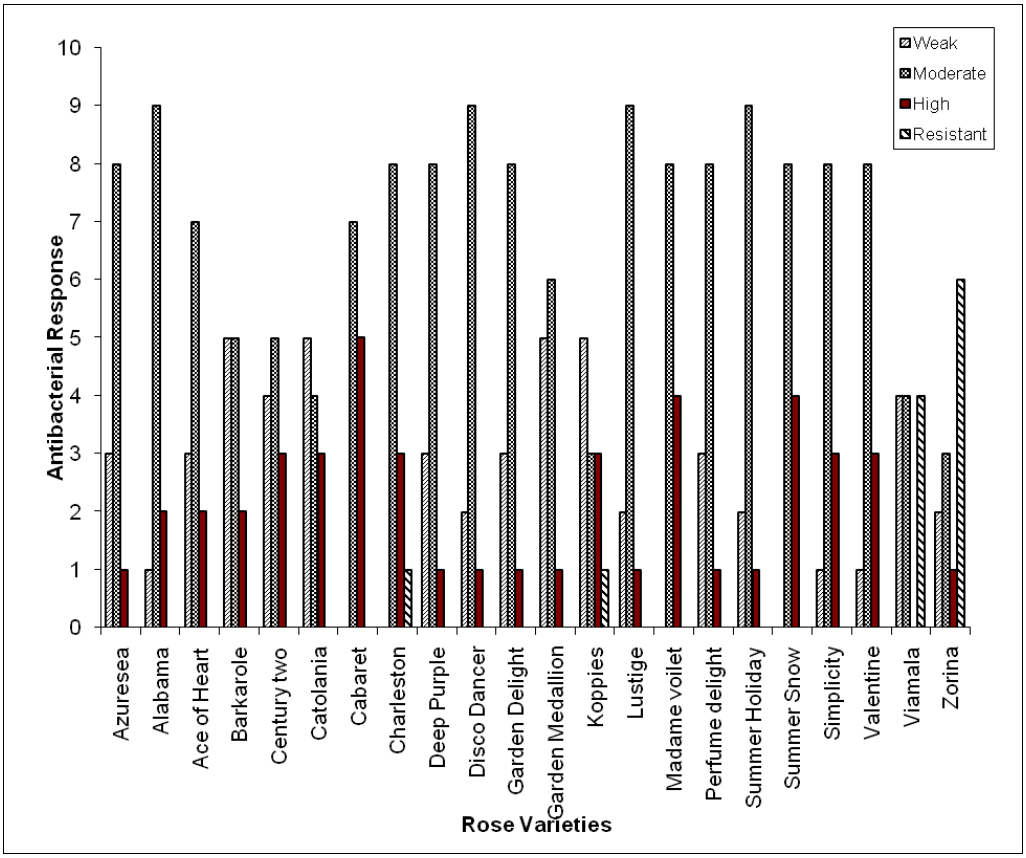

Fig. 3: Antibacterial activities of rose petals against pathogenic bacteria.

E. faecalis was found resistant against two rose varieties namely, Koppies and Zorina. *S. aureus* was found resistant to two rose varieties namely, Viamala and Zorina. *B.coagulans* was found resistant to Viamala only. *P. vulgaris* was found resistant to three rose varieties namely, Charleston, Viamala and Zorina. *K. pneumoniae* was found resistant to Viamala and Zorina where as *S. typhimurium* and *S. typhi* were resistant to Zorina only.

In the study of antibacterial activity petals of rose varieties the results showed that *P. aeruginosa* was proved to be the most sensitive to rose petals where as in case of Gram positive bacteria *S. epidermidis, S. aureus, E. faecalis* were moderately sensitive to rose varieties. The Gram negative bacteria *E. coli, E. aerogenes* were more resistant to rose petals as compared to *K. pneumoniae, S. typhimurium* and *P. aeruginosa* (Darokar *et al*., 1999). However, in present study we get similar result in case of *P. aeruginosa* which was highly sensitive to rose petals and Gram positive bacteria *S. epidermidis, S. aureus, E. faecalis* were moderately sensitive to rose varieties, but in case of Gram negative bacteria we found contrast result base on our study it showed that *K. pneumoniae* was weakly sensitive to rose varieties as compared to *E. coli, E. aerogenes, S. typhimurium* and *P. aeruginosa.*

Today, the realization that many pathogenic microorganisms are becoming resistant to antibiotics, that increases the need for the screening of new sources of antibacterial agents.

The use of our traditional medicinal aromatic plants thus may become a good alternative to synthetic drugs in future, The rose, which is known as queen of Flowers is one of them. Roses are ornamental aromatic flowers and differ in their fragrance with volatile constituents. The rose petals tissues, may possess antibacterial activity as a natural protection system for reproduction and further perpetuation through seed formation (Fabry *et al*., 1998).

The plants are expected to synthesize a variety of secondary metabolites capable of providing them protection against the infectious agents such as viruses, bacteria, fungi and other parasites that are specific to them (Williams *et al*., 1989). The presence of antibacterial compounds of wide specificity in the

petals of rose plants appears to vary in the different varieties. It was found that petals of poorly fragrant varieties were possess stronger antibacterial activity than highly fragrant varieties like *R. damascena.* The antibacterial profile of rose petals against the various bacteria indicated the presence of such antibacterial compounds of wide specificity and antibacterial activities which was found equivalent to streptomycin (Darokar *et al*., 1999).

The broad spectrum antimicrobial activity of the petals of *R. damascena* extracts use in folklore medicine. The petal extract of *R. damascena* may be used for the treatment of skin infections and for the throat infections (Shohayeb *et al*., 2014). The petals of rose varieties may be used against infection caused by pathogenic bacteria that may decrease the use of antibiotics and its ill effects (Mankar and Tambekar, 2006).

This study shows that rose petals may possess some chemical constituents which are responsible for antimicrobial activity that can partially minimize the use of antibiotics to some extent. However, further studies are required for screening of the volatile and non-volatile active antimicrobial constituents of rose petals to utilize them in pharmaceutical industries.

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