

Antimicrobial Potential of Root, Stalk and Leaves Extracts of *Rheum Ribes*

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ABSTRACT

Plants, as sources of medicinal compounds have continued to play a dominant role in the maintenance of human health since ancient times. *Rheum ribes* from *Polygonaceae* family which is endemic to Iran and a few neighboring countries. In this investigation, antimicrobial effects of root, stalk and leaves methanol extracts of *R. ribes* against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Shigella flexneri* were studied, using well diffusion method. Methanol extracts obtained from root, stalk and leaves of *R. ribes* exhibited antimicrobial activity against test micro-organisms. *R. ribes* extracts were found to be more active against *S. flexneri* and *K. pneumoniae* with inhibitory, 13.75 and 13.5 mm. The results suggested that extracts of *R. ribes* could be effectively used against diseases caused by selected human pathogens.

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Introduction

In the last three decades, although pharmacological industries have produced number of new-antibiotics, but microbial resistance to these antibiotics has increased because of genetic ability of the bacteria to acquire and transmit the resistance against therapeutic agents. Herbal drugs have been used since ancient times as remedies for various diseases across the world. Medicinal plants are rich sources of potent antimicrobial agents. Traditional medicinal plants always play a positive role in the prevention or control of diabetes, heart disease and various types of cancers. Various drugs are prepared singly or in combination of medicinal plants and they are even used as principal raw material for the other medicines [1,2,3]. *Rheum ribes* which is the perennial plant from *Polygonaceae* family is an element of Iran-Turan phyto- geographic region. It is reported that this plant grows in Iran and other countries such as Palestine, Lebanon, Iraq (Northern Iraq) and East Anatolian of Turkey [4]. Its Persian name is, Rivas and roots are used as oriental laxative medicine and an anti-psoriatic drug in Iran [5,6]. This plant grows especially at rocky and gravelly areas. *R. ribes* is the source of one of the most important crude drugs in the Middle East [7]. The roots, stalk and leaves of extracts of *R. ribes*, grown in Iran, were investigated for their antimicrobial activity using the cup plate and paper disc methods against gram negative pathogens such as *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus spp.*, and *Pseudomonas aeruginosa*. The roots and leaves extracts have demonstrated significant antimicrobial activities [5]. In another antimicrobial activity study against *Bordetella bronchiseptica*, *Micrococcus luteus*, *K. pneumoniae*, *Serratia marcescens*, the root extract of *R. ribes* exhibited an effective antibacterial activity on *M. luteus* and *K. pneumoniae* [8]. In the present work, the antimicrobial activities of the root, stalk and leaves of *R. ribes* against some gram positive and negative bacterial strains were investigated.

Materials and methods

Plant material and preparation of extracts

Leaves, roots and stalks of the plant were collected from Guilan Province, North of Iran. Different parts of

plant were cleaned from debris, air-dried and finally ground to a coarse powder. Powdered plant materials (50 g) were extracted with methanol (300 ml) by the aid of a Soxhlet apparatus. Finally, the obtained solution was passed through Whatman No.1 filter paper.

Bacterial strain

The hospital strains were from different specimens of patients referring to Razi Hospital, Rasht, Iran. These micro-organisms were *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Shigella flexneri*. Ciprofloxacin (0.3% w/v) was used as a standard antibiotic for in vitro antimicrobial activity.

Antimicrobial Activity Assay

Agar well diffusion method used to detect antimicrobial activities of root, stalk and leaf extracts. Muller Hinton agar media (Merck, Germany) was used for conducting antimicrobial tests. The pathogenic strains (*S. aureus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *S. flexneri*) were adjusted to a density of 10^9 CFU/ml by adding sterile water and spread on the surface of MHA. 100 μ l of each root, stalk and leaf extract, placed into each well. The culture plates were incubated at 37°C for 24 h and antimicrobial activity was evaluated by measuring the diameter of the inhibition zone and presented in millimeter [1,5]. The experiments were performed in duplicate and the mean values were observed. Statistical analyses were performed using SPSS software.

Results and discussion

In this study antimicrobial activity of root, stalk and leaf extracts of *R. ribes* was evaluated against selected human pathogens. Table 1 represents the antibacterial activity of these extracts on pathogens. Results indicate that the extracts were active against pathogenic bacteria. Of the three extracts used all showed good activity against *S. aureus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *S. flexneri*. The highest zone was observed against *S. flexneri* and *K. pneumoniae* with inhibitory, 13.75 and 13.5 mm of root extract. Leaf extract showed minimum activity

(7.75 mm) against *P. aeruginosa*. The root extract showed maximum activity of 13.75 mm against *S. flexneri* and maximum activity shown by stalk extract of 12.75 mm was observed against *S. flexneri*. Many studies confirm positive role of *R.ribes* extract obtained from various plant parts in inhibitory pathogenic bacteria. In a study by Fazly-bazzaz et al, the *R. ribes* extracts of the root and leaf have demonstrated significant antimicrobial activities. Generally, the extracts showed a broad spectrum of activity, although they were more effective against *P. aeruginosa* and *Proteus* spp. in comparison with the positive control [5]. In another study, antimicrobial activity was evaluated against *Bordetella bronchiseptica*, *Micrococcus luteus*, *Klebsiella pneumoniae*, *Serratia marcescens* and three isolates of *Staphylococcus aureus*, the extract of roots of *R. ribes* exhibited an effective antibacterial activity on *M. luteus*, *K.*

pneumoniae and *S. aureus* [8,9]. Antiviral activities of *R. ribes* were also evaluated against *Herpes simplex* virus and its extracts showed high anti-herpetic activity [10]. Najafpour et al, showed that 0.5%-2% extract from *R. ribes* that added to the basal diet of *Rutilus frisii kutum* can have significant effect on the blood parameters and improve responses of *Rutilus frisii kutum* to heat stress [6]. In chemical studies on *R. ribes*, in a study by Tosun and Akyuz the aerial parts of *R. ribes*, collected from Hakkari province (Turkey), chrysophanol, physcion, emodin, quercetin, 5-desoxyquercetin, quercetin 3-O-rhamnoside, quercetin 3-O-galactoside and quercetin 3-O-rutinoside have been found. In another study, the roots of the plant collected from Erzincan province (Turkey), chrysophanol, physcion, rhein, aloemodin, physcion-8-O-glucoside, aloemodin-8-O-glucoside, sennoside A and rhaponticin have been isolated [7, 11].

Table 1. Antimicrobial activity of *R. ribes* stalk, leaf and stem root by agar well diffusion method

Pathogens	Leaf Extract	Stalk Extract	Root Extract	Ciprofloxacin
<i>S. aureus</i>	8.25±0.35	9.75±0.35	11.15±0.21	25
<i>E. coli</i>	9.5±0.70	12.25±0.35	12.5±0.70	24
<i>K. pneumoniae</i>	10.5±0.70	12.5±0.70	13.5±0.35	26
<i>P. aeruginosa</i>	7.75±0.35	8.25±0.35	10.5±0.70	18
<i>S. flexneri</i>	11±0.76	12.75±0.35	13.75±0.35	25

Values, including the diameter of the well (6 mm), are means of duplicates ± standard deviation. Ciprofloxacin (positive control), DMSO (negative control)

Conclusion

In conclusion, the results clearly indicated that using *R. ribes* extract had the beneficial effect on controlling the microbial infections of *S. aureus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *S. flexneri*.

Conflict of interests

Authors certify that no actual or potential conflict of interest in relation to this article exists.

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