In Vitro Screening of Antibacterial Properties of *Rhus coriaria* and *Origanum vulgare* Against Some Pathogenic Bacteria

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***Abstract*—This study investigates the antibacterial property of *Rhus coriaria* (Sumac) and *Origanum vulgare* (Jatra) aqueous extracts against *Escherichia coli* ATCC 25922, *Klebsiella pneumoniae*, *Proteus mirabilis* and *Pseudomonas aeruginosa* ATCC 27835. Results confirm the resistance of the bacterial isolates against more than three antibiotics. The aqueous extract of *R. coriaria* showed the highest activity as an inhibitor against tested bacteria, while the aqueous extract of *O. vulgare* shows low effect against the above mentioned bacteria. MIC for *R. coriaria* and *O. vulgare* aqueous extracts were determined for four bacterial isolates. The MIC of *O. vulgare* against tested bacteria was >12%, while the MIC of *R. coriaria* was 4% for *E. coli*, <0.025% for both *K. pneumoniae* and *P. mirabilis* and 2% for *P. aeruginosa*. The phytochemical groups of both plants extract were analyzed; the results indicated both plants contain tannins, phenols and saponins, flavonoid, alkaloid, and phlobatanin. The antimitotic effect of both plants extracts were investigated on *Allium cepa*, and the extracts showed inhibitory role in the root growth in contrast to the control when grown in the tap water for 5 days. In addition, the 24 hours treatment of grown roots in tap water with both extracts resulted in significant decrease in mitotic index.**

***Index Terms*—Antibacterial agents, antimitotic index, *E. coli*, *K. pneumoniae*, plant extracts, *P. aeruginosa*, *P. mirabilis*.**

I. Introduction

Due to the rapid increase in the rate of infections, antibiotic resistance in microorganism increase, in addition to the side effects that are caused by synthetic antibiotics (Levy and Marshall, 2004), medicinal plants are gaining popularity over these drugs. The use of plants in medicine goes far back as thousands of years and continues today. Plants integrate incorporate substances that have potential therapeutic values for the cure of disease. These natural products from plants including saponin, alkaloids, tannins, cardiac glycosides and anthraquinones, are synthesized for defense purposes (Adebisi and Ojokoh, 2011). Medicinal plants have been found useful in the cure of a number of diseases including bacterial diseases, because they are a rich source of antimicrobial agents. Although medicinal plants lead to slow recovery, the therapeutic use of medicinal plant is becoming popular because of their lesser side effects and low resistance in microorganisms (Solanki, 2010). Antibiotic resistant bacteria may keep people sick longer, and sometimes people are unable to recover at all. Because of the concerns about the side effects of conventional medicine, the use of natural products as an alternate to conventional treatment in healing and treatment of various diseases has been on the rise in the last few decades (Frieden, 2013). The exchanging of genetic material between microorganisms through transformation, conjugation or transduction processes or may by mobile genes (transposons) have been proposed as a major contribution in the rapid evolution of microorganisms resistance to antibiotics. On the other hand using inaccurate concentrations of antibiotics or drugs or unnecessary of medicine appointment (medical checkups) lead to the resistance to multiresistance, in addition to weakening the immune system in some human due to poor nutrition or hereditary factors make bacteria to be more resistant (Salah, 2007; Levy and Marshall, 2004). Increasing of infections based on antibiotic resistant microorganisms call for new strategies and use of natural antimicrobials (Keskin and Toroglu, 2011).

People need to be documented and investigated for modern therapeutics. Due to lack of modern medical facilities, expensive drugs and poor transportation, patients of these localities normally suffer for a long. In these unfavorable situations, traditional herbal therapeutics of these remote locations plays a vital role to provide them with alternative sources of therapeutic facilities for their primary healthcare. Subsequently, with the advanced in the techniques of phytochemistry and pharmacology, a number of active ingredients of medicinal plants were isolated and introduce as valuable drugs in medicine (Kumari, *et al.*, 2011).

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R. coriaria (Anacardiaceae) is a notoriously used in the Mediterranean region and Middle East as a spice, sauce and drink. The fruits have been reported to possess antimicrobial and antioxidant properties (Kossah, *et al.,* 2009). *O. vulgare* L. is a perennial, aromatic, hairy herb; belonging to Lamiaceae family. It is one of the most popular herbs that have widely been used in Mediterranean cooking. It is traded both as 'whole' dried leaves and in ground form. The leaves and dried herb of Oregano as well as its essential oil are used medicinally. The volatile oil of Oregano has been used traditionally for respiratory disorders, indigestion, dental caries, rheumatoid arthritis and urinary tract illnesses (Shivali and Kamboj, 2009; AL–Neemy and AL–Jebury, 2006). Mitosis is a process of cell division, it occurs in the somatic cells, and it is meant for the multiplication of cell number during embryogenesis and blastogenesis of plant and animals. An agent that prevents or disrupts mitosis is called as antimitotic agent, so that beneficial in life threatening diseases like cancer. Anti-mitotic constituents can stop the mitosis anywhere in the cell cycle (Gaikwad, *et al.,* 2011).

This study was conducted to investigate the possible antibacterial at different concentrations and antimitotic activity of the Sumac and Oregano extracts against four isolates of pathogenic bacteria.

II. Materials and Methods

A. Bacterial Strains

The bacterial strains used in this study were *E. coli* ATCC 25922, *P. aeruginosa* ATCC 27835, *K. pneumoniae* (was obtained from Lab of Bacteriology, Erbil Teaching Hospital) and *P. mirabilis* was obtained from Microbiology Lab, Department of Biology, College of Education.

B. Phytochemical Screening of Extract

The methods described by (Odebiyi and Sofowora, 1978; Salna, *et al.,* 2011) are used to test for the presence of saponins, tannins, alkaloids, flavonoids and in the test samples.

Saponins

Each of the plant extracts (0.5 g) was separately stirred in a test tube, foaming which persisted on warming was taken as an evidence for the presence of saponins (Odebiyi and Sofowora, 1978).

Tannins

Extract of each sample (0.5 g) was separately stirred with 10ml of distilled water and then filtered. To the filtrate two drops of 5% Iron (III) Chloride ($FeCl_3$) reagent was added. Blue–black or blue–green coloration or precipitate was taken as an indication of the presence of tannins (Odebiyi and Sofowora, 1978).

Alkaloids

Extract of each plant sample (0.5 g) was separately stirred with 1% hydrochloric acid (HCl) on a steam bath. The solution obtained was filtered and 1ml of the filtrate was treated with two drops of Mayer's reagent. The two solutions were mixed and made up to 100 ml with distilled water. Turbidity of the extract filtrate on addition of Mayer's reagent was regarded as evidence for the presence of alkaloids in the extracts (Odebiyi and Sofowora, 1978).

Phenols

Two ml of test solution, added alcohol and then few drops of neutral ferric chloride solution were added. The test result was observed (Odebiyi and Sofowora, 1978).

Quinones

To the test substance, sodium hydroxide was added. Blue green or red color indicates the presence of Quinone (Odebiyi and Sofowora, 1978).

Flavonoids

Four ml of extract solution was treated with 1.5 ml of 50% methanol solution. The solution was warmed and metal magnesium was added. To this solution, 5–6 drops of concentrated hydrochloric acid was added and red color was observed for flavonoids and orange color for flavones (Salna, *et al.,* 2011).

Anthroquinone

About 0.5 g of the extracts was boiled with 10% HCl for few minutes in a water bath. It was filtered and allowed to cool. Equal volume of $CHCl_3$ was added to the filtrate. Few drops of 10% NH_3 were added to the mixture and heated. Formation of rose–pink color indicates the presence of anthraquinones (Salna, *et al.,* 2011).

C. Plant Extraction for Antibacterial and Antimitotic Experiments

Collection and Preparation of Plant Sample

The plants Sumac and dry Oregano were purchased from market in Erbil city, Iraq. Sumac was converted into powder by using mortar (household flourmill), then the ground (extract powder) plant was separated from its stone form (dry powder), while dry Oregano was ground and both were stored in polyethylene bags in the refrigerator at 4˚C for further processing.

Extracts Preparation

Three hundred ml of sterilized distilled water was added to 30 g of ground dried plant, heated below the boiling point and stirred for 2 ½–3 hrs. The extract was filtered by muslin cloth, then by filter paper (Whatman No. 1) and then stored in the refrigerator at 5 ˚C for using (modified method of Babpour, *et al.,* 2009).

D. Sensitivity to Antimicrobial Agents

Antimicrobial susceptibility testing for isolates was done following Kirby–Bauer disk diffusion method by using fifteen different antimicrobial agents as mentioned in Table I.

E. Screening of Antibacterial Activity

The antimicrobial assay was performed using the standard procedure as described (Bauer and Kirby, 1966) with some modifications. The previously prepared inoculums were adjusted to 0.5 McFarland standards, which are equal to 1×10^8 CFU/ml and then 0.1 ml was transferred to Mueller Hinton agar (MHA) plates and spread with cotton swabs. One hundred microliters of extract were poured on wells with 8 mm diameter made by cork borer in MHA. Inoculated plates were incubated at 37 ˚C overnight. After incubation period for 24 hours, the inhibition zone diameters (mm) were measured.

F. Measurement of minimal inhibition concentration (MIC) using agar well diffusion technique

According to NCCLS agar dilution method (Alderman and Smith, 2001), the MIC of plant extracts was tested with some modifications. Briefly, a series dilution of each extract ranging from (0.025%, 0.05%, 1% (v: v) to 10% (v: v)) was prepared with Mueller Hinton agar media. Bacterial strains grown on nutrient agar at 37°C for 18 hours were suspended in a saline solution (0.85% NaCl) and adjusted to a turbidity of 0.5 McFarland standards. Briefly, 50 µl inoculum was used to inoculate 90 mm diameter petri plates containing 25 ml Mueller Hinton Agar, with a sterile nontoxic cotton swab on a wooden applicator. Wells with 6 mm diameter were punched in the agar and filled with 100 µl extract solution. Inoculated plates were incubated at 37 ˚C for 24 hrs. Minimum inhibitory concentrations (MICs) were determined as lowest concentration of extracts by measuring the inhibition zones which are produced by inoculated bacteria (Oskay *et al.*, 2009).

G. Antimitotic Activity

Local *A. cepa* test has been used for evaluating cytotoxicity of substances, small onion bulbs were cultivated on top of test tubes filled with the aqueous extracts. Tap water was used as a control. The test tubes were kept in an incubator at 24±2 ˚C and the test samples were changed daily. After 5 days the roots were counted and their lengths were measured for each onion. The above step was repeated by cultivating the onion bulbs on top of test tubes filled with tap water, when the roots were about 5 mm long the bulbs were placed on test tubes containing the extracts such that the roots were immersed in the extracts. The duration of extract treatments for each bulb was 24 hrs. Three bulbs were used for each extract at the whole duration of the treatment. The sprouted roots were also treated with distilled water (Control group). The root tips were cut and transferred for fixation. The fixative was glacial acetic acid/absolute alcohol (1/3 v/v). The root tips were kept in the aceto–alcohol solution for 24 hrs. For mitotic effect examination, slides were prepared by putting the plant root tips into a watch glass to which 9 drops of Giemsa and 1 drop of 1 M HCl were added and warmed over a flame of spirit lamp for 2–3 min. These were kept at room temperature for 15–30 min. After removing the root caps from well stained root tips, 1 mm of the mitotic zones were immersed in a drop of %45 acetic-acid on a clean slide and squashed under a cover glass. In order to spread the cells evenly on the surface of the slide, squashing was accomplished with a bouncing action by striking the cover glass with a matchstick (Ozzmen, *et al.*, 2007).

H. Statistical analysis

The data obtained from antimitotic activity of mentioned plant extracts were analyzed using one–way analysis of variance (ANOVA). The level of significance was determined in comparison with the control group. Statistical significance was accepted for $p<0.01$.

MI was expressed in terms of divided cells/ total cells. A statistical analysis was performed on the collected data. The means of the control and extracts were obtained from descriptive. Mitotic index was calculated using the following formula and all experiments were applied in triplicates:

$$Mitotic\ Index = \frac{Number\ of\ Dividing\ Cell}{Total\ Number\ of\ Cells} \times 100 \qquad (1)$$

III. Results

The results of antibiotic susceptibility in the present study, as elucidated in Table I, showed that tested bacterial isolates were resisting to most antibiotics. *E. coli* ATCC 25922 was resistant to each of AK, AMC, CTR, CE, DO, G, NIT, NV and TE, intermediate to MY and TIC and susceptible to CFM, OB, ME, and PRL. *K. pneumoniae* was resistant to AMC, DO, G, NIT, NV and TE, intermediate to CTR, MY and TIC and susceptible to AMC, CFM, CE, OB, ME, and PRL antibiotics.

TABLE I
RESISTANCE OF BACTERIA UNDER STUDY TO ANTIBIOTICS

Antibiotics µg/disc	Zone of inhibition (mm)			
	E. coli ATCC 25922	*K. pneumonia*	*P. aeruginosa* ATCC 27835	*P. mirabilis*
Amikacin (A)30	R	R	R	R
Amoxicillin- acid 30 (AMC)	R	S	R	S
Cefixime (CFM)5	S	S	S	S
Ceftriaxone (CTR)30	R	M	R	S
Cephradine (CE)30	R	S	S	S
Cloxacillin (OB)5	S	S	S	S
Doxycycline (DO)30	R	R	R	R
Gentamycin (G)10	R	R	R	R
Lincomycin (MY) 15	M	M	S	R
Methicillin (ME)10	S	S	S	S
Nitrofurantoin (NIT) 300	R	R	R	R
Novobiocin (NV)30	R	R	S	R
Pipercillin (PRL)100	S	S	S	S
Tetracycline (TE)30	R	R	R	R
Ticarcillin (TIC)75	M	M	R	S

R: Resistant, M: Intermediate or Moderate of Resistant, S: Sensitive.

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P. aeruginosa ATCC 27835 was resistant to AK, AMC, CTR, DO, G, NIT, TE and TIC, and was susceptible to CFM, CE, OB, MY, ME, NV and PRL antibiotics. While *P. mirabilis* was resistant to AK, DO, G, MY, NIT, NV and TE and was susceptible to AMC, CFM, CTR, CE, OB, ME, PRL and TIC antibiotics.

A. Antibacterial activity of R. coriaria and O. vulgare

The antibacterial activity of aqueous extracts of *R. coriaria* and O. vulgare plants against each isolates of *E. coli* ATCC 25922, *P. aeruginosa* ATCC 27835, *K. pneumoniae* and *P. mirabilis* as clarified in Table II; the aqueous extract of *R. coriaria* demonstrates the high activity playing the role of inhibitory agent against tested bacteria, while the aqueous extract of O. vulgare show less effects against bacterial isolates, on the other hand the tested bacteria showed a variation in their susceptibility for these extracts. MIC of aqueous extract of both plants was determined for all bacteria, where the MIC of O. vulgare against all bacteria was 12%, while the MIC of *R. coriaria* was 4% for *E. coli* ATCC 25922, 2% for *P. aeruginosa* ATCC 27835 and 0.025% for both *K. pneumoniae* and *P. mirabilis*.

TABLE II
ANTIBACTERIAL ACTIVITY OF *R. CORIARIA* AND *O. VULGARE* AQUEOUS EXTRACT AGAINST TESTED BACTERIA

Scientific Name	Concentration					MIC (V:V) %
	Zone of inhibition/mm *R. coriaria*					
	100 %	75 %	50 %	25 %	12.5 %	
E. coli ATCC 25922	30	29	28	24	20	4
K. pneumoniae	30	26	20	19	17	<0.025
P. aeruginosa ATCC 27835	30	26	24	22	22	2
P. mirabilis	28	25	25	23	20	<0.025
	Zone of inhibition/mm *O. vulgare*					
E. coli ATCC 25922	18	17	15	-	-	12
K. pneumoniae	13	-	-	-	-	12
P. aeruginosa ATCC 27835	18	18	15	13	-	12
P. mirabilis	-	-	-	-	-	12

(-) : Inhibition zone not appeared.

Table III shows the phytochemical groups of both plant extracts, in which the tested plants contain tannins, phenols, saponins, flavonoid, alkaloid, while both plants do not contain anthraquinone and quinone.

TABLE III
PHYTOCHEMICAL SCREENING OF BOTH PLANT AQUEOUS EXTRACTS

Plant Extract	Tanin	Phenol	Quinone	Anthraquinone	Alkaloid	Flavonoid	Saponin
R. coriaria	+	+	-	-	+	+	+
O. vulgare	+	+	-	-	+	+	+

+: Positive (present), -: Negative (absent)

B. Antimitotic Effect of Aqueous extract of both R. coriaria and O. vulgare

Table IV illustrates the antimitotic effect of aqueous extract of both *R. coriaria* and O. vulgare on *A. cepa*, in comparison with control; the onions that treated with the extracts for 5 days did not show any growth in roots, in addition to those that treated with the mentioned extracts for 24 hours showed a significant decreasing in mitotic index.

TABLE IV
THE AVERAGE OF ROOT LENGTHS AND NUMBERS IN CONTROL AND IN EXTRACTS AFTER 5 DAYS AND MITOTIC INDEX AFTER 1 DAY

Extract	Average of Roots Number (±SD)	Average of Roots Length/ cm (±SD)	MI% (±SD)
Control	16±1	7± 2.64	70 ± 6.55
R. coriaria	-	-	29.19 ±1.84
O. vulgare	-	-	15 ± 2.63

IV. DISCUSSION

To help characterizing the evolution of drug resistance in tested bacteria since antimicrobial drugs were first widely used, we tested existing strain collections of *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *P. mirabilis* for their susceptibility to a common panel of 15 antibiotic agents, and for treatment of bacterial infections, antibiotics are widely used and this has led to the emergence and spread of resistant bacterial strains. The appearance of multiple drug resistant bacteria has become a major cause of failure of the treatment of infectious disease (Ibrahim, *et al.*, 2011). The resistance of bacteria may return to overuse, abuse, and misuse of antibiotics and also bacteria different mechanisms as efflux pump to protect it selves (Coyle, 2005; Lewis *et al.*, 2002). Resistant bacteria might have antibiotic resistance genes carried on either their DNA chromosome or on plasmids. It is well known that plasmids are major vectors for the dissemination of both antibiotic resistance and virulence determinants among bacterial populations (Hamada, *et al.*, 2008). The other major factor in the growth of antibiotic resistance is spread of the resistant strains of bacteria from person to person, or from the non-human sources in the environment, including food (Frieden, 2013).

The rapid spread of bacteria expressing multidrug resistance (MDR) has necessitated the discovery of new antibacterial and resistance modifying agents (Tariro and Stanley, 2011). Since the initial discovery of bacterial efflux pumps in the 1980s, many have been characterized in community and hospital acquired pathogens, (Stavri, *et al.*, 2007). Efflux pumps are able to extrude structurally diverse compounds, including antibiotics used in a clinical setting, rendering the drugs therapeutically ineffective (Amusan, *et al.*, 2007). Antibiotic resistance can develop rapidly through changes in the expression of efflux pumps. It is, therefore, imperative that new antibiotics, resistance-modifying agents and, more specifically, efflux pump inhibitors (EPIs) are characterized (Stermitz, *et al.*, 2000). The use of bacterial resistance modifiers such as EPIs could facilitate the re-introduction of

therapeutically ineffective antibiotics back into clinical use and might even suppress the emergence of MDR strains (Stavri, *et al*., 2007).

In the present study, *E. coli* was resist to Amikacin, Amoxiclave, Ceftriaxone, Cephradine, Doxycycline, Gentamycin, Nitrofurantoin, Novobiocin and Tetracycline. Daniel *et al.* (2012) demonstrated that the isolates of *E. coli* show the different percentage of resistance against Sulfonamide, Tetracycline, Chloramphenicol, Gentamycin, extended spectrum cephalosporins (Ceftiofur and Ceftriaxone) and they clarified the resistant genes are commonly associated with mobile genetic elements, and these elements play a major role in dissemination of multiple antimicrobial drug resistance genes in *E. coli* isolates. Schito, *et al*, (2009) testified in their research that among 2315 isolates of *E. coli*, 48.3% show resistance to Amoxiclave, 3.8% to Ampicillin, 2.4% to Cefotaxime, 8.6% to Nalidixic acid, 8.1% to Ciprofloxacin, 29.4% to Sulphamethaxazole–Trimethoprim and 1.6% to Nitrofurantoin. *In vitro* data showed a wide range of resistant of *K. pneumoniae* toward beta lactams, aminoglycosides, quinolones and other antibiotics, which we found that *K. pneumoniae* resist to Amoxiclave, Doxycycline, Gentamycin, Nitrofurantoin, Novobiocin and Tetracycline antibiotics. Toroglu and Keskin (2011) demonstrate that resistance rate of twenty two isolates of *K. pneumoniae* which collected from urine, vaginal fluid, wound, cerebrospinal fluid and blood against eleven antibiotics were 95% to Penicillin G, 82% to Amoxiclave, 77% to Ceftazidime, 59% to Ceftriaxone and Tetracycline, 46% to Gentamycin, 332% to Nitrofurantoin, 27% to Cefoxitin and Ofloxacin, 23% to Sulphamethaxazole–Trimethoprim and 19% to Chloramphenicol. Plasmid encoded resistance to broad spectrum cephalosporins is becoming a widespread phenomenon in clinical medicine. These antibiotics are inactivated by an array of different extended spectrum beta lactamases (ESBLs) which have evolved by stepwise mutation of TEM/SHV type beta lactamases. Plasmid encoding these enzymes has been encountered in several members of the family Enterobacteriaceae, but are, for unknown reasons, most often harbored by *K. pneumoniae* (Sikarwar and Batra, 2011). In concordance to these results, Egbebia and Famurewa (2011) study on 970 samples which collected from urine, high vaginal swab, blood, ear, sputum, pus, cerebrospinal fluid, semen, stool and nasal fluids. Among of all samples they detected 544 isolates of *K. pneumoniae* (56.1%), when 120 isolates (96%) resist to Cefixime, 117 (93.6%) to Amoxiclave, 109 (87.2%) to Cefotaxime, and 106 (84.4%) to Cefadroxil. In the other hand, Ghafourian *et al.*, (2011) isolated and identified 113 isolates of *K. pneumoniae* which taken from respiratory tract infections (RTIs). They found that 19 isolates (28.3%) resist to Amikacin, 67 (100%) to Amoxiclave, 62 (92.5%) to Cefixime, 46 (68.6%) to Cefotaxime, 11 (16.4%) to Ciprofloxacin, 62 (92.5%) to Cefoperazone and 0.00% to Imipenem.

Increasing resistance to different anti–pseudomonal drugs particularly among hospital strains has been reported world–wide and this is a serious therapeutic problem in the management of diseases due to these organisms. The resistance profiles of *P. aeruginosa* to the fifteen antimicrobial agents tested varied among the isolates investigated. One striking feature in this study was that all the *P. aeruginosa* isolates were found to resist Amikacin, Amoxiclave, Ceftriaxone, Doxycycline, Gentamycin, Nitrofurantoin, Tetracycline and Ticarcillin antibiotics. Younis (2011) reported that 397 samples (13.8%) are positive growths of bacterial genera among 2872 patients were admitted with clinical diagnosis of neonatal sepsis. *P. aeruginosa* comprise with 14 (3.5%). He reported that the resistance percent to Amoxiclave was 86%, Gentamycin 71%, Amikacin 29%, Cefoperazone 43%, Cefixime 86%, Cefotaxime 43%, Imipenem 28.5% and the rates of resistances of Ciprofloxacin was 36%. The cause of the multi–drug resistant among *P. aeruginosa* strains due to: First, including the community acquired isolates of *P. aeruginosa* along with hospital isolates would have provided a much better picture of resistance patterns of strains in this geographical area. Second, molecular typing and plasmid profile of the *P. aeruginosa* isolates would provide the much needed details about the strains and lastly extended spectrum beta lactam (ESBL) producing *P. aeruginosa* which have become a major cause of nosocomial infections with MDR strains should be analyze (Anil and Shahid, 2013). While *P. mirabilis* was resistant to Amikacin, Doxycycline, Gentamycin, Lincomycin, Nitrofurantoin, Novobiocin and Tetracycline antibiotics. The main problem associated with infections caused by biofilm forming bacteria is the low sensitivity of the *P. mirabilis* to the antimicrobials used and there exists a possible level of correlation between the ability of the *P. mirabilis* to form biofilm and the isolation site of the strain (Wasfi, *et al.*, 2012).

The antibacterial activity of aqueous extract of *R. coriaria* was the most effective against bacteria and this could be linked to the chemical constitutes of the plant including the phytochemical groups and the rate of these substances in screened extracts, where most of these groups have the antibacterial properties (Cowan, 1999). Plants have formed the basis of classy traditional medicine system and natural products make excellent lead for new drug development. The World Health Organization (WHO) is encouraging, promoting and facilitating the effective use of herbal medicine in developing countries for health programs (Ibrahim, *et al.*, 2011). *R. coriaria* contains phenols, tannins, and as in many research explained the action of hydrophobic property of phenolic compounds in impairing the cellular function and membrane integrity as mentioned in (Seyyednejad, *et al.*, 2008) and also interpreted that the aqueous extracts of *R. coriaria* and *O. vulgare* have contain phenols, tannins and others integrates and these may have influence on enzymatic system of bacteria especially those that prevent the plasmid replication or may affected on cell membrane specially on mesosome which is considered as the attachment point for plasmids. The effect of tannins may be related to their ability to inactivate microbial adhesions, enzymes, and cell envelope transport proteins, etc. they also complex with polysaccharide (Ya *et al.*, 1989). Sumac is rich in water soluble tannins, and the antimicrobial activity of tannins is well documented

(Salna, *et al.*, 2011). Roopashree *et al.*, (2008) have demonstrated that not only the organic acids but also the other substances in water extracted sumac were found to be effective antimicrobial agents. It is generally believed that the fully protonated species of organic acids can diffuse into the bacterial cells, and cause cell death, and also the activity of phenols and glycosides of *R. coriaria* belonging to rich in anthocyanin and hydrolysable tannins, gallic acid (the main phenolic acid in *R. coriaria*), anthocyanin fraction contained cyanidin, peonidin, pelargonidin, petunidin, and dolphinidin glucosides and coumarates (AL–Jubory, *et al.*, 2010; Chaudhry, *et al.*, 2007). The most important components of Oregano are the limonene, gamma cariofilene, rho-cymenene, canfor, linalol. Alpha pinene, carvacol and thymol. Among them thymol and carvacrol are the main components of the essential oil of Oregano, which are responsible for its antioxidative, antimicrobial and antifungal effects (Kırmusaoğlu, *et al.*, 2007).

In the present study, both aqueous extracts show significant effect as antimitotic in comparison with the control (Distilled water). The mechanism of inhibiting mitosis growth that the extract may bind with the cell proteins responsible for cell division (Vidyalakshmi, *et al.*, 2007); and this action may be return to the presence of glycoside especially anthraquinone glycosides, and phenolic compounds responsible for antimitotic activity (Gaikwad, *et al.*, 2011). They exhibit cytotoxic effect by interfering with cell cycle kinetics. However most of the cytotoxic drugs exhibit side effects, and hence, there is a need for drugs that are efficient and have less side effects as plant extracts (Bhujbal, *et al.*, 2011).

V. Conclusion

It is concluded that aqueous extract of *R. coriaria* and *O. vulgare* have the antibacterial potency, and they were vary in their effect against four isolates of bacteria. The aqueous extract of *R. coriaria* was the strongest extract as bacterial inhibitory agent when compared to *O.* vulgare. On the other side, the aqueous extract of each plant showed antimitotic activity. We recommend using both plants as antitumor agents after separate all components and performance each of them separately.

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