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Research Article

EVALUATION OF ANTIBACTERIAL ACTIVITY OF DIFFERENT PLANT PARTS OF *RUMEX VESICARIUS L.* AT EARLY AND LATE VEGETATIVE STAGES OF GROWTH

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ABSTRACT

The present work has been carried out to investigate the antibacterial activity of all plant parts of *Rumex vesicarius* L. at vegetative stages of growth (early and late vegetative stages). Results of antibacterial activity studies of successive extractives solvents (petroleum ether, ether, chloroform, methanol and ethanol) of different plant parts, at vegetative stages of growth (early and late vegetative stages) revealed that, there were highly significant variations (at 5% and 1% levels) within antibacterial activities of different extracts of different plant parts (50 mg/disc), at these stages of growth. It was found that, methanol extract of leaves (at late vegetative stage) was found to be the most effective against *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus* (inhibition zones = 55.00, 55.00 and 55.00±0.00 mm, activity indexes = 1.76, 1.59 and 1.93, respectively), chloroform and ether extracts of whole plant parts (at early vegetative stage) were found to be the most effective extracts against *Pseudomonas aeruginosa* and *Streptococcus pneumonia,* respectively (inhibition zones = 28.75±4.73 and 20.00 ± 0.00 mm, activity indexes = 2.17 and 0.36, respectively). Ether extract of leaves (at early vegetative stage) was found to be the most effective one against *Streptococcus pyogenes* (inhibition zone = 33.00 ± 11.01 mm, activity index = 1.06).

Keywords: *Rumex vesicarius* L.

INTRODUCTION

The *Rumex* includes many edible plants attracted the attention of many investigators because of their medicinal importance for the treatment of the most dangerous diseases including viral infectious diseases (such as AIDS disease that caused by human immunodeficiency virus-1 reverse transcriptase (HIV), herpes and influenza) and sexually transmitted diseases, including genital herpes, genital warts and chlamydial genital infections (Vermani and Sanjay, 2002 and Orhanp *et al*., 2009).

In addition, plants belonging to genus *Rumex* are used as antitumor for different tumor cell lines including colon, ovary, melanoma, breast, central nervous system and gastric cancer, oophoroma and non-small cell lung (Lee *et al.,* 2005 and Zhang *et al.,* 2012).

Rumex spp. were also used for the treatment of tuberculosis and skin diseases (Gautam *et al*., 2007). These plants were also used for the treatment of bilharzia, diarrhea, malaria, cardiac diseases and are used as vomoting, aphrodisiac, safe contraceptive, antidiabetic, antioxidant and antimicrobial agents (Yildirim *et al*., 2001; Geberie *et al*., 2005; Maregesi *et al*., 2007 and Ssegawa and Kasenence, 2007). For these and other reasons these plants are economically important plants because synthetic drugs for these lethal diseases are too expensive and causes many side effects (Prasad and Ramakrishnan, 2012.a).

Rumex vesicarius L. is a wild edible plant used as a sorrel and collected in spring time and eaten fresh, or cooked. The species has many important medicinal uses such as treatment of tumors, hepatic diseases, bad digestion, constipation, calcules, heart troubles, pains, diseases of the spleen, hiccough, flatulence, asthma, bronchitis, dyspepsia, piles, scabies, leucoderma, toothache and nausea. The plant is also used as antioxidant, cooling, laxative, stomachic, tonic, analgesic, appetizer, diuretic, astringent, purgative, antispasmodic, aphrodisiac and antibacterial agents. The roasted seeds were eaten for the cure of dysentery. Finally, the plant can be used also to reduce biliary disorders and control cholesterol levels. The medicinal importance of this plant is a reflection to its chemical composition, since this plant contains many bioactive substances such as flavonoids (vitexin, isovitexin, orientin and isorientin), anthraquinones particularly in roots (emodin and chrysophanol), quinines, carotenoids, vitamins (especially vitamin C), proteins, lipids, carbohydrates, reducing sugars, phenols, tannins, saponins, triterepenoids and organic acids. This plant is also a good source of minerals, such as; K, Na, Ca, Mg, Fe, Mn, Cu (Mostafa *et al.,* 2011 and Prasad and Ramakrishnan, 2012. a,b,c).

The previously mentioned bioactive phytochemicals found in *Rumex vesicarius* L. (such as polyphenols, flavonoids, carotenoids, tocopherols and ascorbic acid) have a role as antioxidant and detoxifying agents. The intake of dietary antioxidant phytochemicals like carotenodis, phenolic compounds and flavonoids will lead to the protection against noncommunicable diseases in human beings; cancer, cardiovascular diseases and cataract (Rao, 2003 and Matkowski, 2008). Flavonoids and anthraquinones (such as quercetin and emodin) are good antibacterial agents against many human pathogenic bacteria such as; *Escherichia coli, Streptococcus sp, Staplylococcus aureus* and *Pseudomonas aeruginosa*. The previously mentioned bacterial strains are causative agents of many dangerous diseases such as vomiting, diarrhrea, urinary infections, gastroenteritis; *Escherichia coli*, ears and eye diseases may also be caused by bacteria; *Pseudomonas*, infections around nose and spreading over the face, piles, carbuncles may be also caused by bacteria; *Streptococci*, bacteria also considered to be the major cause of impetigo; *Staphylococcus*, urinary tract infections may be also caused by bacteria; *Klebsiella* (Gillespie, 1994; Meng *et al.,* 2005; Cushnie and Lamb, 2005; Park *et al.,* 2006; Yaecob and Tolba, 2006 and Stevic *et al.,* 2010). The main target of this study is the determination of antibacterial activity of all plant parts of *Rumex vesicarius* L. at vegetative stages of growth (early and late vegetative stages).

MATERIALS AND METHODS

Plant materials

Rumex vesicarius L. samples were collected at early vegetative stage of growth (February), late vegetative stage (March) from 60 km away from Ain Sokhna, Quatamia- Ain Sokhna desert road, Egypt. Plant specimens were botanically identified and authenticated by comparing with herbarium specimens (Boulos, 1999). Sample was deposited in the Herbarium of the Botany and Microbiology Department, Faculty of Science, Helwan University, Helwan, Egypt (Number : 1057). All experimental studies on the plant were carried out in Botany Department and Central Services Labs., National Research Centre, Dokki, Giza, Egypt.

Tested microorganisms

Antibacterial activity of different extracts of different plant parts of *Rumex vesicarius* L. was investigated against six human pathogenic bacterial isolates, obtained from Clinical Pathology Department, Faculty of Medicine (Kasr El- Eini), Cairo University, Egypt. These included three gram-negative bacteria including *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and

Klebsiella pneumoniae (ATCC 700603), three gram-positive bacteria including *Streptococcus pneumoniae* (ATCC 49619), *Staphylococcus aureus* (ATCC 25923) and *Streptococcus pyogenes* (ATCC 19615). The purity and viability of these cultures were checked by culturing on nutrient agar slants, incubated at 37ºC for 24 hours. Cultures were subcultured regularly (every week) and stored at 4ºC (Yaecob and Tolba, 2006 and Arya *et al.,* 2010).

Inoculums preparation

Inoculums preparation was carried out according to Arya *et al*., 2010.

Antibacterial bioassay

The antibacterial bioassay was carried out following Disc Diffusion Method according to Arya *et al.,* (2010). The concentration of each extract per disc equals 50 mg/disc in case of different plant parts and positive controls (synthetic drugs; Cefotaxime, Cephradine and "Amoxycilin, Flucloxacilin"). In case of Quercetin and Emodin (natural compounds used as positive controls) different lesser concentrations were used (12.5, 50, 100 µg/disc). Negative controls were petroleum ether, ether, chloroform, methanol, ethanol, water and empty discs. The diameter of inhibition zone (mm) is indicated by clear area in the Petri dish which was devoid of bacterial cells growth was measured. Each Petri dish contains four centered disks, r value of each disk = 5 mm, one layer, Whattman number 1 filter paper.

Determination of activity and proportion indexes

Calculations were carried out following the methods of Singh *et al.,* 2002 and Borgio *et al.,* 2008.

Statistical analysis

Statistical analysis was done using Fisher analysis of variance methodology. A least significant difference test was applied at 5 and 1% probability level to determine differences among treatment means (Steel and Torrie, 1984). The CO-STAT computerized package program was subjected to the regular statistical analysis of variance (Nissen *et al.,* 1985), using two designs -1- Anova-1 completely randomized design (CRD) -2- Factorial implemented in completely randomized design. Each reading = mean of three replicates + SE for all experiments.

RESULTS

Antibacterial activity studies of successive extractives solvents of different plant parts at vegetative stages (early and late vegetative stages of growth)

Results of antibacterial activity studies (Tables. 1-3 and Figures. 1-3) of successive extractives solvents (petroleum ether, ether, chloroform, methanol and ethanol) of different plant parts at vegetative stages (early and late vegetative stages of growth) revealed that, there were highly significant variations (at 5 and 1% levels) within antibacterial activities of different extracts of different plant parts at both early and late vegetative stages of growth.

It was found that (Table. 1 (a, b, c, d) and Figures. 1 and 3 (a, b, c, d, e, f), methanol extract of leaves (at late vegetative stage of growth) was found to be the most effective one against Escherichia coli, Klebsiella pneumoniae and Staphylococcus aureus (inhibition zones = 55.000, 55.000 and 55.000 ± 0.000 mm, activity indexes = 1.760, 1.588 and 1.930, respectively) and chloroform and ether extracts of whole plant parts (at early vegetative stage of growth) were found to be the most effective extracts against Pseudomonas aeruginosa and Streptococcus pneumoniae respectively (inhibition zones = 28.750±4.732 and 20.000 ± 0.000 mm, activity indexes = 2.170 and 0.364 respectively); While ether extract of leaves (at early vegetative stage of growth) was found to be the most effective one against Streptococcus pyogenes (inhibition zone= 33.000 ± 11.008 mm, activity index = 1.056). It was found also that, petroleum ether extracts of all plant parts (at both early and late vegetative stages of growth) were not effective against all pathogenic bacterial isolates under investigation.

The proportion index of antibacterial activity (Table. 2) of successive extractives solvents of different plant parts of *Rumex vesicarius* L. on pathogenic bacterial isolates under investigation reached its highest value (1), using - a– Methanol extracts of whole plant parts (at early vegetative stage of growth) and b- Methanol extracts of leaves (at late vegetative stage of growth).

Positive controls in these experiments (Table. 3 and Figure. 2) were Quercetin and Emodin (natural products) and it was found that, Quercetin is a potent antibacterial agent, while Emodin has lesser effect at the used concentrations. In addition to, three synthetic drugs, Cefotaxime was the most effective one, followed by Amoxycilin, Flucloxacilin, while Cephradine was the least effective one.

Table 1: Antibacterial activity of different extracts of different plant parts, at vegetative stages of growth (early and late vegetative stages of growth) on pathogenic bacterial isolates under investigation.

(a) Ether extract:

Pathogenic bacterial isolates	Early vegetative stage				Late vegetative stage			
	Whole plant parts	Leaves	Stems	Roots	Whole plant parts	Leaves	Stems	Roots
1	0.00	0.00	0.00	0.00	21.50±1.44	0.00	0.00	0.00
2	17.50±4.33	0.00	0.00	0.00	17.00±0.71	0.00	0.00	0.00
3	28.50±1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	20.00±0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	11.00±5.08	0.00	0.00	0.00
6	23.75±1.32	33.00±11.01	0.00	0.00	24.00±1.16	0.00	0.00	0.00
L.S.D. (0.05)	4.80	4.60	-	-	3.91	-	-	-
L.S.D. (0.01)	6.61	6.27	-	-	5.46	-	-	-

1- Escherichia coli (ATCC 25922)*, 2- Pseudomonas aeruginosa* (ATCC 27853), *3- Klebsiella pneumoniae* (ATCC 700603), *4- Streptococcus pneumoniae* (ATCC 49619), *5- Staphylococcus aureus* (ATCC 25923) and *6-- Streptococcus pyogenes (ATCC 49623).*

(b) Chloroform extract:

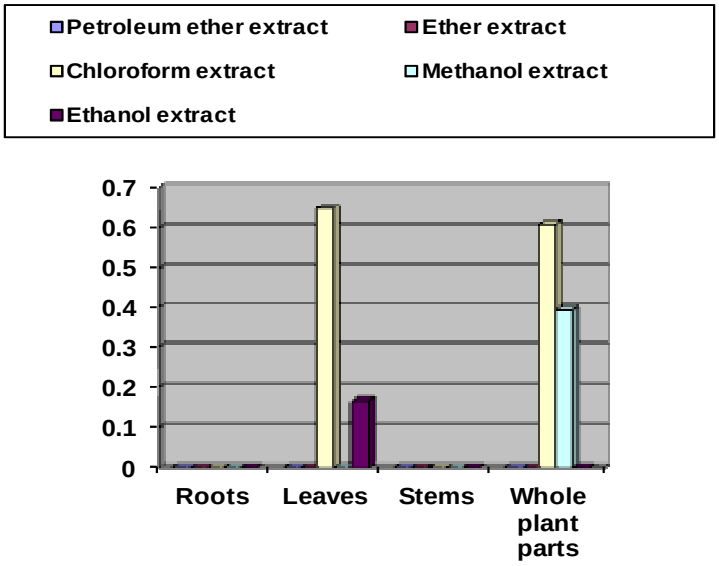
Pathogenic Bacterial isolates	Early vegetative stage				Late vegetative stage			
	Whole plant parts	Leaves	Stems	Roots	Whole plant parts	Leaves	Stems	Roots
1	19.00±0.58	20.25±1.03	0.00	0.00	0.00	0.00	0.00	0.00
2	28.75±4.73	27.00±0.58	11.00±0.41	0.00	0.00	0.00	0.00	0.00
3	35.25±0.48	25.75±0.48	13.50±1.32	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	28.00±6.98	0.00	14.25±0.48	0.00	0.00	0.00	9.75±0.25	0.00
L.S.D. (0.05)	3.56	2.21	5.07	-	-	-	4.06	-
L.S.D. (0.01)	4.95	3.04	6.98	-	-	-	5.53	-

(c) Methanol extract:

Pathogenic bacterial isolates	Early vegetative stage				Late vegetative stage			
	Whole plant parts	Leaves	Stems	Roots	Whole plant parts	Leaves	Stems	Roots
1	12.25±0.25	0.00	0.000	0.00	0.00	55.00±0.00	0.00	0.00
2	16.50±0.65	21.50±1.32	8.00±0.00	0.00	0.00	7.25±0.25	0.00	0.00
3	7.00±0.00	20.00±0.00	12.00±9.52	0.00	0.00	55.00±0.00	0.00	0.00
4	17.50±0.29	17.00±1.00	0.00	0.00	0.00	7.25±0.25	0.00	0.00
5	14.75±1.44	16.70±0.63	0.00	0.00	3.50±2.02	55.00±0.00	0.00	0.00
6	12.25±1.03	0.00	13.50±5.50	0.00	0.00	7.00±0.00	0.00	0.00
L.S.D. (0.05)	2.54	5.72	5.23	-	3.57	3.56	-	-
L.S.D. (0.01)	3.53	7.91	7.13	-	4.85	4.85	-	-

(d) Ethanol extract:

Pathogenic bacterial isolates	Early vegetative stage				Late vegetative stage			
	Whole plant parts	Leaves	Stems	Roots	Whole plant parts	Leaves	Stems	Roots
1	0.00	5.25±1.75	0.00	0.00	0.00	0.00	29.00±1.73	0.00
2	0.00	8.00±0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	7.75±0.75	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	8.50±0.50	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	7.75±0.75	7.00±0.00	7.00±0.00	0.00	0.00	7.00±0.00	0.00
L.S.D. (0.05)	-	2.92	1.98	1.98	-	-	2.09	-
L.S.D. (0.01)	-	3.98	2.69	2.69	-	-	2.85	-



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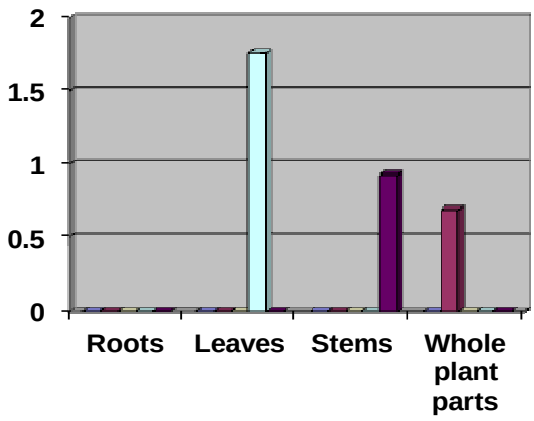

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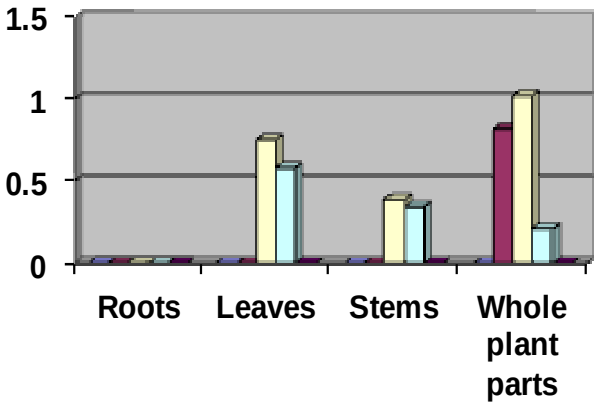
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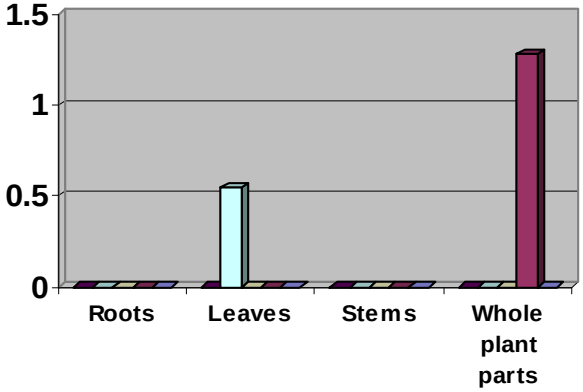
0
Roots
Leaves
Stems
Whole plant parts

2- (a)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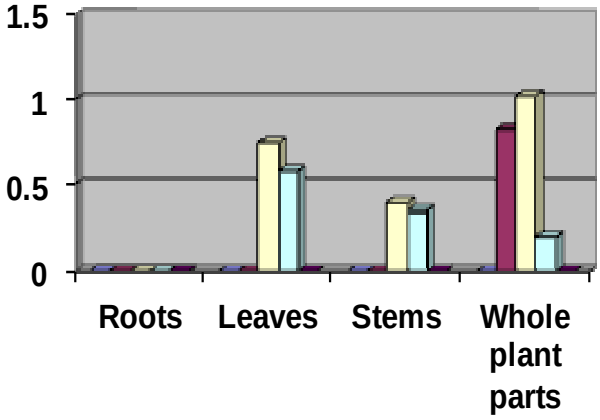
0.5
0
Roots
Leaves
Stems
Whole plant parts

2- (b)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0
Roots
Leaves
Stems
Whole plant parts

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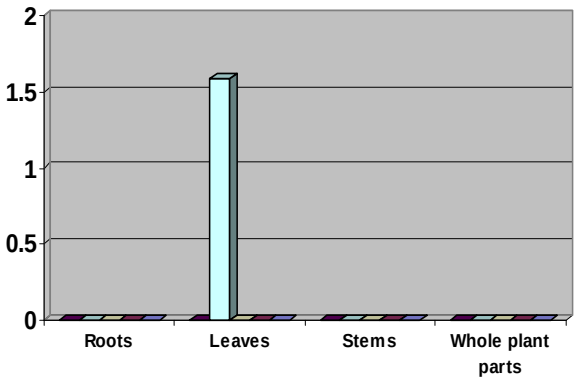
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1
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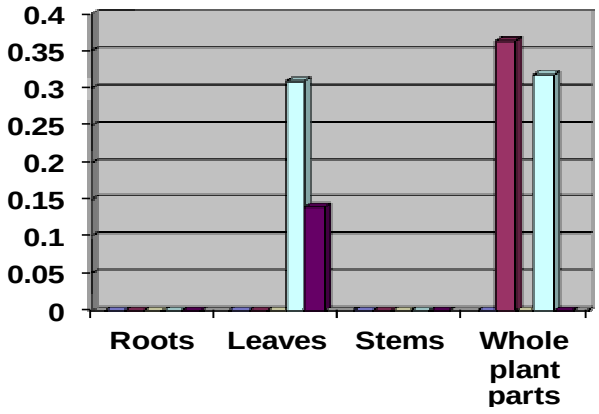
0
Roots
Leaves
Stems
Whole plant parts

3- (b)


0.4
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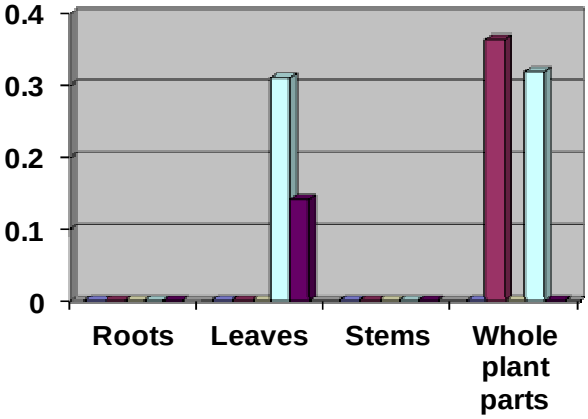
0.15
0.1
0.05
0
Roots
Leaves
Stems
Whole plant parts

4- (a)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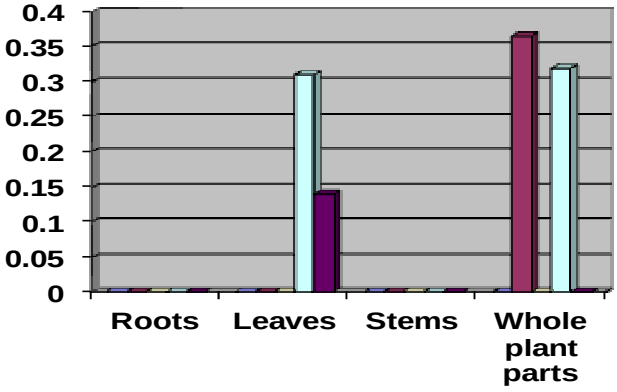
Roots
Leaves
Stems
Whole plant parts

4-(b)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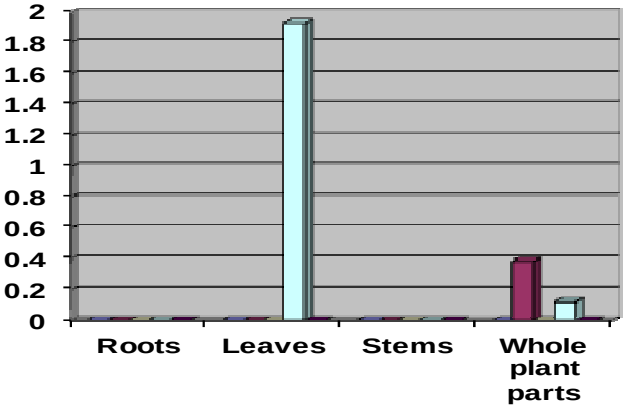
0.05
0
Roots
Leaves
Stems
Whole plant parts

5- (a)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1.6
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1
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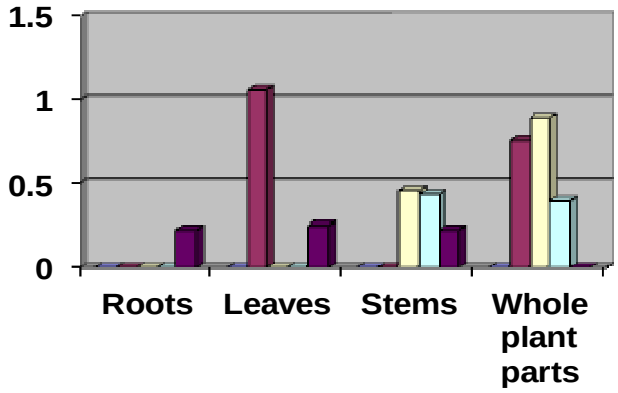
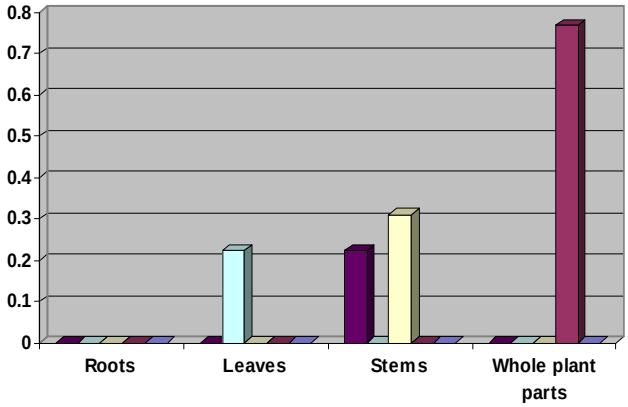
0.4
0.2
0
Roots
Leaves
Stems
Whole plant parts

5-(b)



6- (a)



6- (b)

(1) Escherichia coli (ATCC 25922). *(2) Pseudomonas aeruginosa* (ATCC 27853). *(3) Klebsiella pneumoniae* (ATCC 700603). *(4) Streptococcus pneumoniae* (ATCC 49619). (5) *Staphylococcus aureus* (ATCC 25923). *(6) Streptococcus pyogenes* (ATCC 19615). (X axis = Different plant parts, Y axis = Inhibition zones in mm). (a) Early vegetative stage (b) Late vegetative stage.

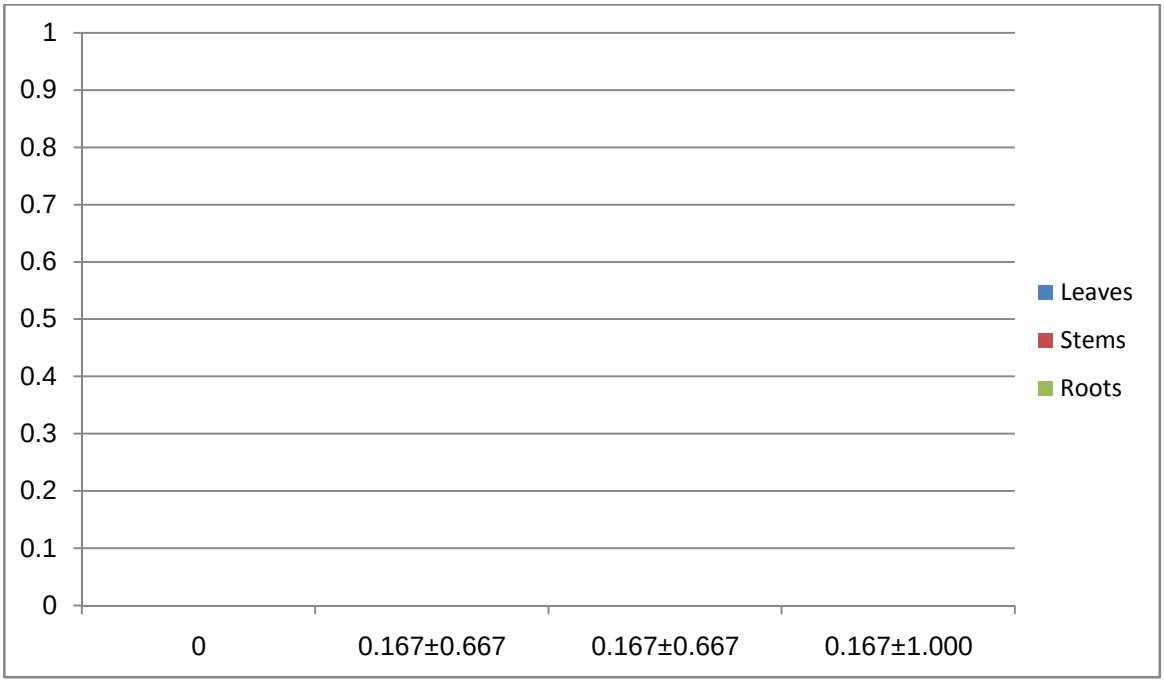
Fig. 1: Antibacterial activity index of successive extractives solvents of different plant parts, at vegetative stages (early and late vegetative stages of growth) on pathogenic bacterial isolates under investigation.

Table 2: Proportion index of antibacterial activity of successive extractives solvents of different plant parts, at vegetative stages of growth (early and late vegetative stages of growth) on pathogenic bacterial isolates under investigation.

Extracts	Early vegetative stage				Late vegetative stage			
	Whole plant parts	Leaves	Stems	Roots	Whole plant parts	Leaves	Stems	Roots
Petroleum ether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ether	0.67	0.17	0.00	0.00	0.67	0.00	0.00	0.00
Chloroform	0.67	0.50	0.50	0.00	0.00	0.00	0.17	0.00
Methanol	1.00	0.67	0.50	0.00	0.17	1.00	0.00	0.00
Ethanol	0.00	0.83	0.17	0.17	0.00	0.00	0.17	0.00

Table 3: Antibacterial activity of different antibacterial agents (Positive controls) on pathogenic bacterial isolates under investigation.

Bacteria	Cephradine (50mg/disc)	Amoxycillin, Flucloxacillin (50 mg/disc)	Cephotaxime (50 mg/disc)	Quercetin (µg/disc)			Emodin (µg/disc)		
				25	50	100	25	50	100
1	0.00	0.00	31.25±0.00	6.38±0.07	8.25±0.14	11.50±0.14	0.00	0.00	0.00
2	0.00	0.00	13.25±7.65	0.00	0.00	0.00	0.00	13.38±6.28	0.00
3	0.00	11.38±3.54	34.63±0.22	0.00	5.25±0.43	1.13±0.65	0.00	0.00	0.00
4	8.25±0.00	54.88±2.09	28.25±5.92	0.00	5.75±1.00	8.88±0.36	0.00	0.00	0.00
5	11.25±0.00	11.13±1.08	28.50±2.74	14.00±2.60	21.00±5.73	8.50±0.00	2.25±0.00	0.00	0.00
6	0.00	31.25±7.94	6.00±0.00	14.63±5.56	25.63±3.54	0.00	0.00	0.00	0.00
L.S.D. (0.05)	-	11.33	12.65	7.72	8.63	0.95	7.90	7.89	-
L.S.D. (0.01)	-	15.88	17.73	10.82	12.10	1.34	11.07	11.0	-



1- Escherichia coli* (ATCC 25922). *2- Pseudomonas aeruginosa* (ATCC 27853). *3- Klebsiella pneumoniae* (ATCC 700603). *4- Streptococcus pneumoniae* (ATCC 49619). *5- Staphylococcus aureus (ATCC 25923). 6- Streptococcus pyogenes (ATCC 49623).

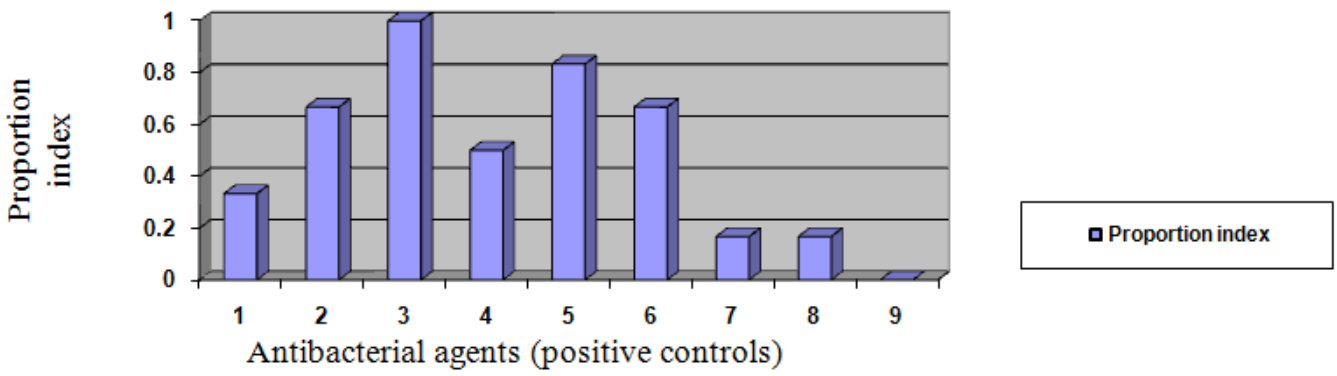
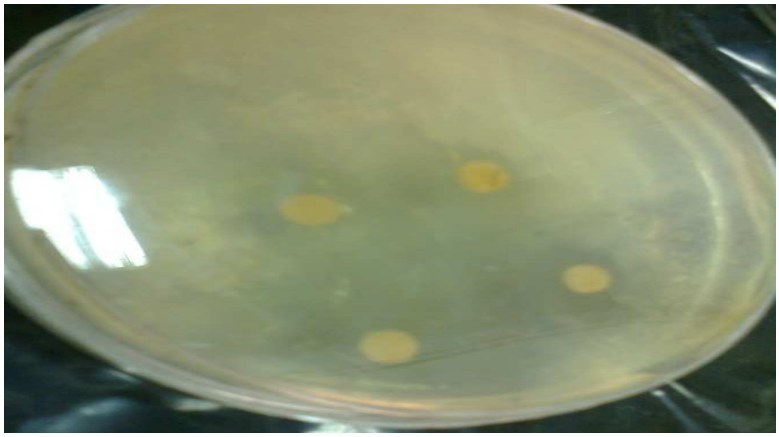
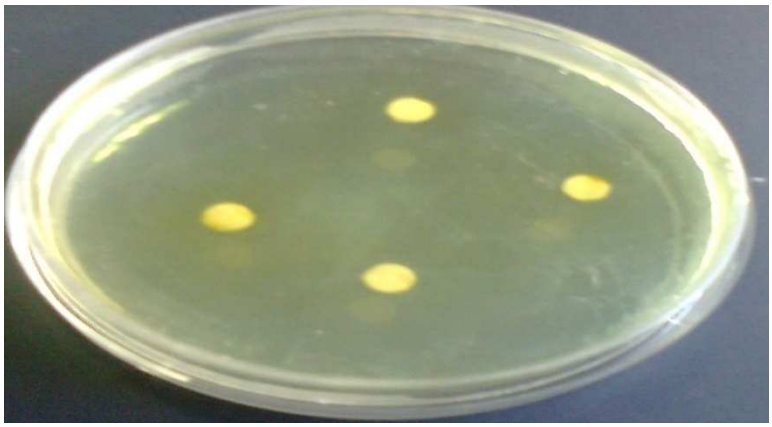


Fig. (2): Proportion index of antibacterial activity of different antibacterial agents "Positive controls" 1, 2, 3 = Cephradine, Amoxycillin, Flucloxacillin and Cephotaxime, respectively (50 mg/disc), 4-6 = Quercetin and 7-9 Emodin (25, 50, 100 µg/disc), respectively.

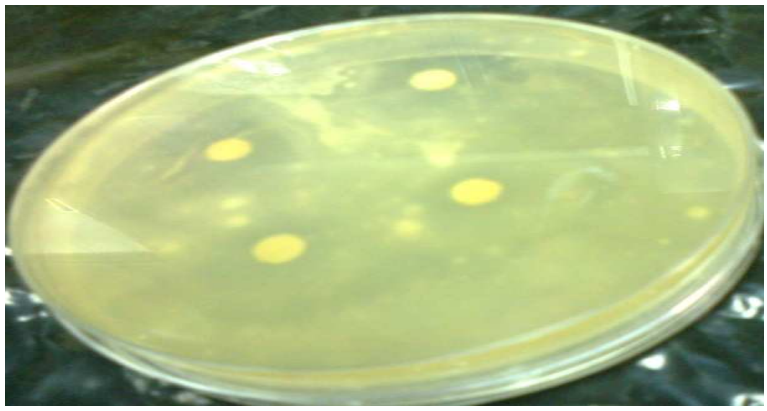
(a)



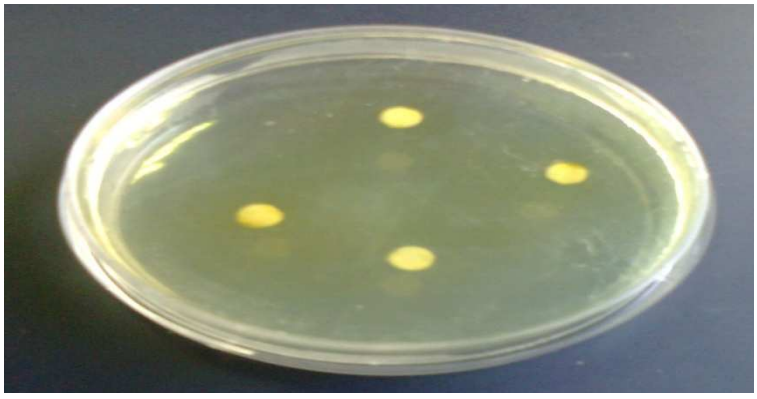
(b)



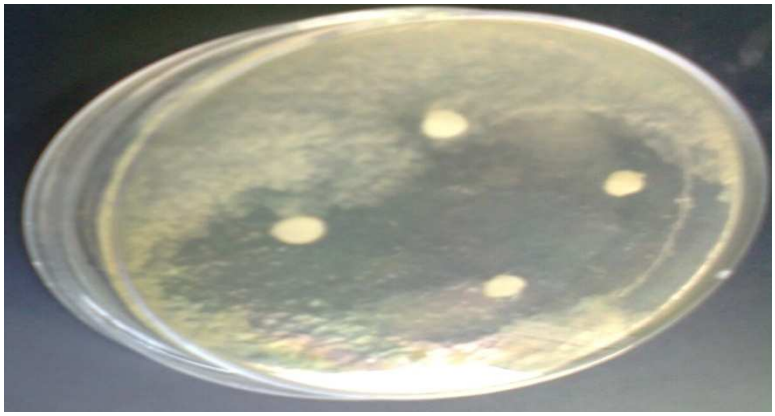
(c)



(d)



(e)



(f)

Fig. 3: Antibacterial activity of different extracts of different plant parts, at late vegetative stage of growth on different pathogenic bacteria, a . Methanol extract of leaves, at late vegetative stage of growth on *Escherichia coli* (ATCC 25922), b. Chloroform extract of whole plant parts, at early vegetative stage of growth on *Pseudomonas aeruginosa* (ATCC 27853), c. Methanol extract of leaves, at late vegetative stage of growth on *Klebsiella pneumoniae* (ATCC 700603), d. Ether extract of whole plant parts, at early vegetative stage of growth on *Streptococcus pneumoniae* (ATCC 49619), e. Methanol extract of leaves, at late vegetative stage of growth on *Staphylococcus aureus* (ATCC 25923), f. Ether extract of leaves, at early vegetative stage of growth on *Streptococcus pyogenes* (ATCC 49623).

DISCUSSION

Results of antibacterial activity studies of successive extractives solvents (petroleum ether, ether, chloroform, methanol and ethanol) of different plant parts of *Rumex vesicarius* L., at vegetative stages of growth (early and late vegetative stages) revealed that, there were highly significant variations (at 5 and 1% levels) within antibacterial activities of different extracts of different plant parts, at both early and late vegetative stages of growth.

Methanol extract of leaves (at late vegetative stage of growth) was found to be the most effective one against *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus* (inhibition zones = 55.000, 55.000 and 55.000 ± 0.000 mm, activity indexes = 1.760, 1.588 and 1.930, respectively) and chloroform and ether extracts of whole plant parts (at early vegetative stage of growth) were found to be the most effective extracts against *Pseudomonas aeruginosa* and *Streptococcus pneumonia,* respectively (inhibition zones = 28.750±4.732 and 20.000 ± 0.000 mm, activity indexes = 2.170 and 0.364, respectively); While ether extract of leaves (at early vegetative stage of growth) was found to be the most effective one against *Streptococcus pyogenes* (inhibition zone=33.000±11.008 mm, activity index = 1.056). These results confirm that, methanol extract of leaves (at late vegetative stage of growth) was an bactericidal agent against *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*

The proportion index of antibacterial activity of successive extractives solvents of different plant parts (at vegetative stages of growth) on human pathogenic bacterial isolates under investigation reached its highest value (1), using a- Methanol extracts of whole plant parts (at early vegetative stage of growth) and b- Methanol extracts of leaves (at late vegetative stage of growth).

From the above mentioned results it can be confirmed that, methanol extract of leaves (at late vegetative stage of growth) not only bactericidal agent against *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*, but also it is one of extracts that have the highest value (1) of proportion index. Positive controls in these experiments were Quercetin and Emodin (natural products) where Quercetin is a potent antibacterial agent, while Emodin has lesser effect, at the used concentrations. In addition to three synthetic drugs, Cefotaxime was the most effective one, followed by Amoxycilin/Flucloxacilin, while Cephradine was the least effective one. Proportion index reached its highest value (1) in case of Cefotaxime only. All the above mentioned extracts of different plant parts {methanol extract of leaves (at late vegetative stage of growth), chloroform and ether extracts of whole plant parts (at early vegetative stage of growth) and ether extract of leaves (at early vegetative stage of growth)} were more potent antibacterial agents against all investigated bacterial isolates than all the studied positive controls, except in case of *Streptococcus pneumonia*, since Amoxycilin/Flucloxacilin was the most effective antibacterial agent in this regard (inhibition zone = 54.875±2.093).

Results of antibacterial activity of different extracts of different plant parts of *R. vesicarius* agreed with the findings of Panduraju *et al.,* (2009), who found that, aqueous, methanol and petroleum ether extracts of leaves have variable effects against both gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*) and gram-negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*). Elegami *et al.,* (2001) found that, chloroform extract of *R. vesicarius* L. (whole plant parts) had positive effect against *Bacillus subtilis,* but has no effect against *Escherichia coli* and *Staphylococcus aureus*. In our results, chloroform extract of whole plant parts had affected both organisms, this may be related to different concentrations used (10 mg/cup, 50 mg/disc in the present study, respectively). Other factors such as, locality of the plant collection (Sudan in Elegami *et al.,* (2001) and Egypt in this study), which may affect the phytochemical composition of the plant and hence may affect its antibacterial properties. Several previous investigators (Nishina *et al.,* 1993; Yildirim *et al.,* 2001; Al-zoreky and Nakahara, 2002 and Harshaw *et al.,* 2010) investigated different plant parts of different species of *Rumex* (*R. japonicas, R. crispus, R. nervosus* and *R. obtusifolius*, respectively) their results reaveled that, they were potent antibacterial agents against both gram-positive and gram-negative bacteria. Comparing the antibacterial activity of *R. vesicarius* and these species against *E. coli* and *Staphylococcus aureus*, it can be confirmed that *R. vesicarius* is a potent antibacterial agent against them, particularly methanol extract of leaves (at late vegetative stage of growth) which showed bactericidal effects against these organisms.

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