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Antibacterial Activity Of Dianthus Caryophyllus L. Against Antibiotic Resistant Pathogenic Bacteria

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ABSTRACT

The existing study was conducted to research the effect of plant extract from flower buds of Dianthus caryophyllus L.by using two different solvents such as Methanol and Ethanol against UTIs hospitals pathogenic bacteria in Iraq, such as Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa and klebsiella pneumoniae. The antibacterial activity was tested against certain hospital harmful bacteria using the agar well diffusion method, with three concentrations (50, 100, 200, and 400 mg/ml) for each extract. Plant extract in ethanol solvent (400 mg/ml) outperformed the antibiotic by a wide margin ($P \leq 0.05$) when applied to P. aeruginosa and E. coli pathogenic bacteria, and no effect on S. aureus and K. pneumonia . Finally plant extract in flower buds of Dianthus caryophyllus L. regard a good exporter for controlling hospital pathogenic bacteria.

Keywords: Dianthus caryophyllus L, Antibacterial activity, UTIs infections, GC-MS.

INTRODUCTION

The most prevalent bacterial contagion in the human people is urinary tract infection (UTI), which is eles one of the most common originating in a hospital diseases [1]. Urine is the most common specimen received in routine microbiology laboratories, with hundreds of urine antimicrobial sensitivity reports produced every day [2]. With an estimated yearly global incidence of at least 250 million, UTI is one of the generality frequent infectious disorders detected in outpatients. [3]. Antimicrobial resistance patterns of major uropathogens, as determined by local epidemiology, are critical for delivering clinically appropriate and cost-effective treatment for urinary tract infection [3,4].

The bacterium pathogens (Staphylococcus aureus, Klebsiella pneumonia, Pseudomonas aeruginosa, and Enterobacter species) are the most common cause of hospital diseases worldwide. Most of them are multidrug-resistant (MDR) isolates, which is one of the generality complex problems to deal with in clinical practice. MDR is one of the upper three dangers to international public health, and it is typically caused by overuse of the prescription drug, wrong antimicrobial use, and poor

pharmaceuticals. Understanding the resistance mechanisms in these bacteria is critical for developing innovative antimicrobial drugs or other alternate instruments to address these general health issues [5].

Antimicrobial-resistant bacteria are increasingly connected with nosocomial infection, posing a severe concern for healthcare systems and resulting in considerable global economic expenditures. The implications include high mortality and morbidity rates, rising treatment costs, diagnostic ambiguity, and a lack of faith in traditional medicine. Recent reports have begun to indicate a set of nosocomial pathogens as "Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumonia, Acinetobacter baumanni, Pseudomonas aeruginosa and Enterobacter species " based on data from hospital-based surveillance studies and the American Society for Infectious Diseases [6,7].

Carnation (Dianthus caryophyllus L.) belongs to the Caryophyllaceceae family and is thought to have originated in the Mediterranean region [8].

Carnations are a cultivated flower. It is cultivated all over the world. Italy, Spain, and the Netherlands are the leading producers in Europe. Flowers from Africa, South America, and the Middle East are imported into Europe as carnations. D. caryophyllus is a rare wild species found predominantly in France and Italy[9,10].

The plant is an annual or perennial herb that grows 15-60 cm long and is branching and glabrous. Leaves are linear-lanceolate with a sharp apex and a smooth or ciliate border at the base. Flowers bloom singly or in groups at branch tops. Epicalyx scales are 4- 6, abruptly mucronate at apex, broad-ovate, appressed to calyx tube, herbaceous, and cover one-fifth to one-fourth of its length. The calyx tube is cylindrical and 20-30 mm long. Petals are five, limb-exercised, toothed at apex, triangular obovate, auricle missing, pink-red or white, occasionally speckled with darker centers, glabrous, claw cuneate [11].

The aim of this work, is to investigate the biological activity of plant extract of Cloves against pathogenic some bacteria isolated from several Iraqi hospitals.

MATERIALS AND METHODS

Plant material:

Flower buds of the carnation (Dianthus caryophyllus L.) were acquired from local markets and identified by a botanist based on taxonomic traits. This plant's flower buds were washed, dried, and stored under the manufacturer's instructions [12].

Plant materials extraction:

The leaves were hand-crushed after being cleaned and dried in the shade. To obtain the methanol or ethanol extract, the powder was extracted using a cold maceration procedure at room temperature using methanol or ethanol for 48 hours. To eliminate particulate debris from the solvent extract, a millipore filter was used. At 37 °C, the filtrate was concentrated in a rotary evaporator. The anti-

inflammatory and phytochemical experiments were conducted using the obtained product. The extract was stored in the dark at 4°C [13]. (EI Azhary et al.,2017).

Antibacterial Efficacy:

Using the agar-well diffusion method, the antibacterial activity flower buds of D. caryophyllus L. extract was evaluated against isolated bacteria [14]. (Perez,1990). Wells (6mm) in diameter were made by using a cork porer. Distilled water (D.W.) was used as a negative control.

Statistical analysis:

Three replicates were used to determine all treatment data. An analysis of variance was done on the data using the SPSS 16.0 program, with a completely randomized project and the least significant difference (L.S.D) set at $P \leq 0.05$.

RESULTS

The antibacterial activity of phytochemical components isolated from (D. caryophyllus L.) flower buds against hospital pathogenic microorganisms using various solvents such as ethanol and methanol Table 3 and 4. The plant's activity was assessed using agar well diffusion methods (Figure 1 and 2). The results showed that the extracts of ethanolic and methanol of (D. caryophyllus L.) flower buds showed a significant reduction in the growth of hospital pathogenic bacteria.

Antibacterial activity was applied at (50, 100, 200, and 400 µg/ml) and then compared with Distilled water (D.W.) as a negative control. Inhibitory zone diameter increases significantly by increasing concentration from 50 to 400 µg/ ml.

The results also revealed that plant extract by ethanol solvent at (400 µg/ml) showed significant superiority over the (Azteronam, Cefeime, Ceftazidime, and Piperacillin) resistant rate 100%, (Tobramycin) 80%, (Trimethorim) 95% and (Rifampicin) 80% in the plant extract compared with (22±1) in the antibiotic when applied to E. coli pathogenic bacteria.

On the other hand, plant extract by ethanol solvent at (400 µg/ml) showed a different effect between medicinal plant and the antibiotic as the inhibition(Azteronam, Cefeime, Ceftazidime, and Piperacillin) resistant rate 100%, (Tobramycin) 80%, (Trimethorim) 100% and (Rifampicin) 80%, in the plant extract compared with (26±1) in the antibiotic when used to p. aeruginosa pathogenic bacteria (Table: 3).

Table (3): Antibacterial activity of the ethanolic extract of Dianthus caryophyllus L. against some UTI pathogenic bacteria..

concentration	Pathogenic bacteria			
	E. coli	P. aeruginosa	S. aureus	K. pneumonia
	Inhibition zone/mm			
Control negative	0±0	0±0	0±0	0±0

(D.W)				
50 mg/ml	16±1	18±0.5	0	0
100 mg/ml	18±1	20±0.5	0	0
200 mg/ml	20±1	23±0.5	0	0
400 mg/ml	22±1	26±1	0	0

Compared to the negative control D.W., the present study found that increasing the concentration of phytochemical substances extracted by methanol solvent resulted in a considerable reduction in pathogenic bacteria growth (Table: 4).

In the same state, The results also revealed that plant extract by methanol solvent at (400 µg/ml) showed clear superiority over the antibiotic as the inhibition in the plant extract compared with (26±0.55) in the antibiotic when applied to E. coli pathogenic bacteria.

The plant extract by methanol solvent at (400 µg/ml) showed clear superiority over the antibiotic as the inhibition in the plant extract compared with (28±1) in the antibiotic when applied to P.aeruginosa pathogenic bacteria.

In contrast, there is no significant difference between phytochemical compounds extracted by methanol solvent at (400 µg/ml) and the antibiotics used when applied to S. aureus and K. pneumonia pathogenic bacteria.

Table (4) Antibacterial activity of the crude methanol extract of Dianthus caryophyllus L. againast some UTI pathogenic bacteria.

concentration	Pathogenic bacteria			
	E. coli	p. aeruginosa	S. aureus	K. pneumonia
	Inhibition zone/mm			
Control negative (D.W.)	0 ± 0	0 ± 0	0 ± 0	0 ± 0
50 mg/ml	16±1	17±1	0	0
100 mg/ml	19±1	20±1	0	0
200 mg/ml	22±0.55	25±1	0	0
400 mg/ml	26±0.55	28±1	0	0

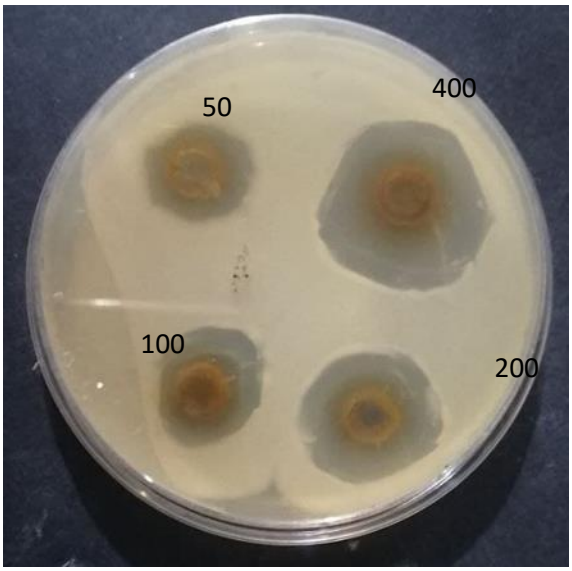

Fig.1: Antibacterial activity of methanol extract of extract of (D. caryophyllus L) at (50, 100, 200, and 400 µg/ml) 200, and 400 µg/ml) against E. coli.

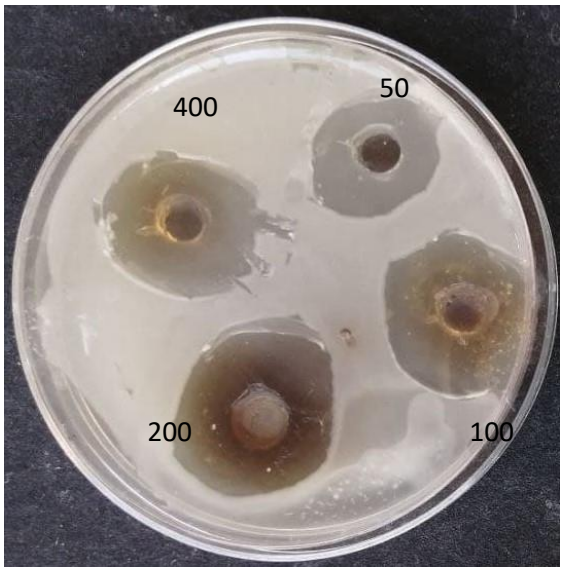

Fig.2: Antibacterial activity of methanol (D. caryophyllus L) at (50, 100, Against p. aeruginosa.

The eugenol it has an anti-microbial effect on bacteria, as it has an effect on bacteria, **Gas chromatography–mass spectrometry** (GC-MS) for, Cloves flower buds.

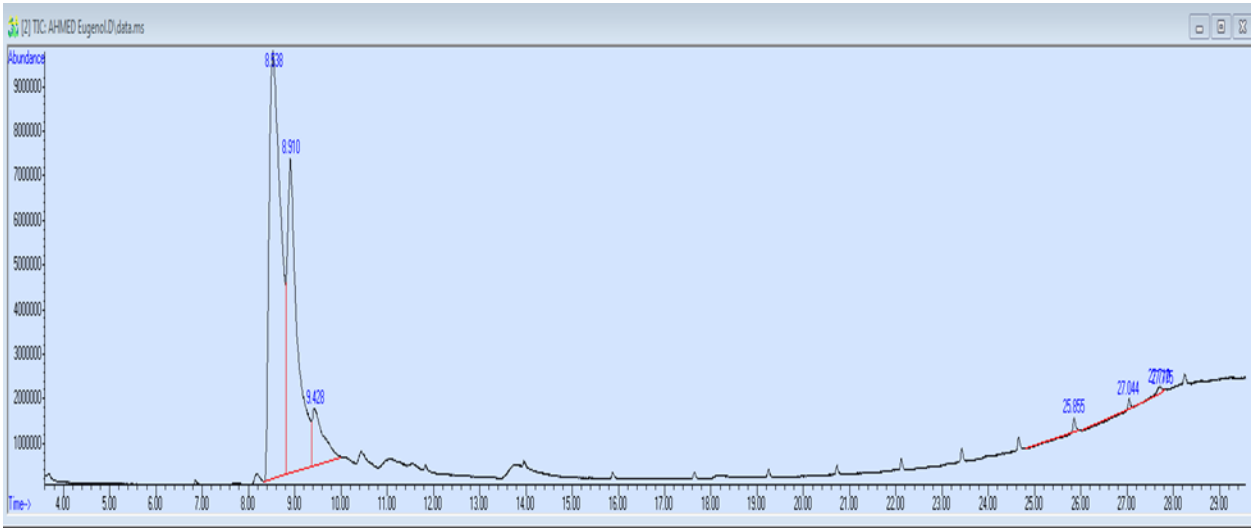

Table (12-4). The active substances in the Cloves plant by GC-MS.

No.	Compound name	Retention Time min	corr. Max%	of total%
1	Eugenol	8.538	100.0	55.868
2	Eugenol	8.910	65.26	36.462

	Phenol, 2-methoxy-3-(2-propenyl)			
3	Eugenol	9.428	12.60	7.038
4	1,1,1,5,7,7,7-Heptamethyl-3,3-bis(trimethylsiloxy)tetrasiloxane Cyclononasiloxane, octadecamethyl- Hexasiloxane, tetradecamethyl-	25.855	0.46	0.258
5	Cyclopentane, 1,1'-[3-(2-cyclopentylethyl)-1,5-pentanediyl]bis- Oleic Acid , 9-Octadecenoic acid, (E)	27.710	0.62	0.348
6	cis-13-Octadecenoic acid	27.775	0.07	0.041

DISCUSSION

The emergence of multidrug resistance in animal and human pathogenic bacteria, as well as the adverse side effects of many antibiotics, has sparked a huge interest in the quest for new plant-based antimicrobial medications. Many scientists have recently focused on extracts of biologically active chemicals derived from plant species used in herbal treatments because of the adverse effects and antibiotic resistance that pathogenic germs develop [15]. As a result, the antibacterial properties of medicinal plants may have significant clinical relevance in the treatment of resistant microbial strains [16].

The primary components of carnation flower oil were detected using gas chromatography-mass spectrometry (GC-MS); the key components were eugenol, phenyl ethyl alcohol, hexyl benzoate, benzoin, hexenyl benzoate, benzyl benzoate, benzyl salicylate, nootkatone, m-cresyl phenyl acetate [17].

Coumarins, alkaloids, triterpenes, cyanogenic glycoside, pelargonidin, cyanidin, the yellow isosalipurposide, volatile oil, essential oil, and many other chemical components were discovered during a phytochemical examination of Dianthus caryophyllus. Antiviral, anticancer, antibacterial, insecticidal, antifungal, repellant, antioxidant, anesthetic, renoprotective, and analgesic properties were discovered in pharmacological research [18,19].

Eugenol extracted from D. caryophyllus flower buds demonstrated antibacterial action against Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa, according to the study [20]. Staphylococcus epidermidis, Klebsiella pneumonia, and Bordetella bronchiseptica were all treated with whole D. caryophyllus [21].

Methanolic and aqueous extracts of D. caryophyllus aerial parts were employed as antibacterials against Helicobacter pylori. Bioactive chemicals such as phenolics, terpenoids, and alkaloids were isolated from a variety of medicinal plants, including (Lepidium sativum L., Lactuca serriola L., Myrtus Communis L., Cassia senna L., Ricinus communis L., Cassia didymobotrya L., Cassia didymobotrya L., Cassia

didymobotrya L. (Fresenius) Irwin & Barneby and Melia azedarach L.) antimicrobial activity against a variety of harmful microorganisms [22,23].

Chlorella Vulgaris, a primitive plant, was employed as an antibiotic against harmful microbes [24]. Enterobacteriaceae germs were treated using Hibiscus sabdarifa extracts. Natural bioactive substances isolated from medicinal plants, on the other hand, exert their effects through a variety of methods, such as polyphenols attaching to polysaccharides and proteins (Macromolecules) and therefore blocking their involvement in metabolic processes. Terpenoids and flavonoids damage microbial membranes, whereas polypeptides upset bacterial proteins' attachment to host polysaccharide receptors, and alkaloids complexes hinder efflux pumps [25].

Finally, the antibacterial activity of (D. caryophyllus L.) could be attributed to phytochemical substances such as eugenol and their effects on proteins and polysaccharides, as well as membrane permeability disruption or efflux pump inhibition.

CONCLUSION Phytochemical substances isolated from D. caryophyllus L. utilizing various types of organic solvents such as (Ethanol and Methanol) is thought to be a good source for suppressing harmful germs in hospitals.

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