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Phytochemical screening, antioxidant and antibacterial activity of crude extracts from leaves of *Cordia myxa* tree grown in Iraq.

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Abstract:
Cordia myxa, Lasura tree, is a medium-sized deciduous tree from the borage family (Boraginaceae) .It is one of the traditional medicinal plants, that has been used for more than decades in Iraq to treat many diseases. Thus, the present study was conducted to analyze the phytochemical constituents and antioxidant/antibacterial properties of this plant's aqueous and ethanolic leaf extracts. Results show that aqueous and ethanolic leaf extracts of *Cordia myxa* were revealed to have substantial phenol content as 89.24 and 67.55 mg gallic acid/g of dried extracts respectively, while flavonoid contant is 3.12 and 1.42 mg quercetin/g of dried aqueous and ethanolic extract respectively. The highest percentage of DPPH radical inhibition (86.45%), was achieved by ethanol extract at the concentration of 1 mg/ml with good antibacterial activity against *Salmonella typhi, Pseudomonas aeruginosa*, *Shigella sonnei*, and *Klebsiella pneumonia* with mean diameter of inhibition zone (12, 13, 14, and 16 mm respectively). Therefore, it turns out that it could be a strong candidate for developing a natural medicine against microbial infections.

Keywords: *Cordia myxa*, Lasura tree leaves; Antimicrobial activity; Antioxidant activity; free radical scavenging.

1. Introduction

Traditional medicinal plants have played an important role in complementary healing practices in different parts of the world because of their natural remedies for a wide range of diseases and disorders. Some of them act as antibacterial (Raghad et al., 2022; Khadija and Sawsan, 2023; Ban et al, 2022) others act as anticancer (Khulood,2023 ; Hiba, 2024) or antioxidants M. Afzal (2016). However, in recent years, some plants may generate increased scientific interest in their potential for sources for new, effective treatments. Among such plants, *Cordia myxa* belongs to the Boraginaceae family, which constitutes one of the traditionally most important medicinal herbs in southern and central Iraq. This plant is also known as the Sebestan

plum. It is highly valued because of its medicinal uses, which are prominently centered upon its fruits and stems, along with its leaves as well Rat et al. (2021); Sahib & Al, (2019); Jasiem & Al, (2016). The therapeutic potential of the intensive research that has been carried out has directed it to *Cordia myxa* thus:. For instance, Singh et al. (2022) demonstrated that it exhibits high anti-inflammatory activities, largely owing to active biomolecules such as flavonoids and phenolics. In addition, this plant has antimicrobial activities against a wide array of pathogenic microorganisms due to the study conducted by Eloff (2019) and may hereby be situated as a potential agent for natural antimicrobial chemotherapy.

Despite the increasing literature reporting on the medicinal properties of *Cordia myxa*,, debates within the scientific community go on about the consistency and efficacy of such findings. Some researchers have pointed out that this plant may give inconsistent results concerning its pharmacological properties due to variation in its chemical composition according to geographic location, environmental conditions, and extraction methods. These studies were conducted by Meghwal et al. (2022), Keshani (2018), and Murthy et al. (2019). In this regard, for instance, Abbas et al. (2022), Cunliffe et al. (2021) raise a word of caution on the basis that while there have been some studies which post a significant antibacterial impact, on the other hand, others have identified this to be only moderate or negligible thus raising concerns over the findings of reliability and reproducibility.

Another brain-twisting issue touches the antioxidant potential of the plant. Although many studies, like that of Hojjati and Beirami (2020), were carried out to show that *Cordia myxa* enjoyed the free radical scavenging potential, some critiques have been made against the potency of its antioxidant capacity compared to other common medicinal plants used for the same purpose. This has resulted in the implication of various calls for more efficient and unified tests to rightly assess the plant's therapeutic efficiency. The arising continuous discourses, together with the identified shortcomings of the previous research works , have informed this study in the chemical constitution of *Cordia myxa* leaves and the assessment of the antioxidant and antibacterial activities of those leaves. The study involves the use of both aqueous and ethanolic extracts with a guarantee of the complete understanding of the plant's potential as a natural therapeutic agent. Moreover, comparison of the findings with past studies attempts to provide some insight into the issues of variability and reproducibility of the medicinal properties of *Cordia myxa*.

2. Materials and Methods

2.1. Plant Material Collection

The fresh leaves of the *Cordia myxa* tree were collected from Baghdad Province, Iraq (33°15'51.3"N 44°28'50.3"E) ,in August 2023. Collection involved the selection of healthy leaves that had attained full maturity from the grown trees. Leaves taken from the tree were then taken to the laboratory in clean, dried plastic bags to avoid contamination. Upon arrival, the leaves were washed with sterile distilled water for cleaning purposes, removing dust and every foreign particulate matter. Leaves were washed and shade dried for seven days to conserve the property of phytochemicals. After complete drying, they are powdered on an electric grinder. The powder was stored in airtight containers kept at 2-8°C in order to keep it away from absorption of moisture to avoid microbial contamination until further use.

2.2. Extraction Procedure

In the present work, phytochemical extraction was done using aqueous and ethanolic extracts of the of *Cordia myxa* leaves.

a. **Defatting Process:** The process initiated with the defatting of 15 g of the air-dried and powdered leaves for the removal of the fatty elements of the leaves. For performing the said defatting, the powdered leaves were subjected to the Soxhlet extraction device steeped in 250 mL of diethyl ether. Extraction of ingredients therefore began for 12 hours continuously after putting them on Soxhlet extractor. Later on, the defatted powder was air-dried and then kept in an airtight container.

b. **Water Extract:** Water extract was prepared by put 15 g of the leaf powder into a 1 L conical flask already containing 400 mL of boiled distilled water; the mixture is allowed to incubate at 25^0C with shaking for 30 minutes then filtered on Whatman No. 1 filter paper. Then, this filtrate was centrifuged at 4000 rpm for 15 min to separate residual solid particles. The supernatant was evaporated using a rotary evaporator at 45°C. The dried aqueous extract was stored in the refrigerator at 2-8°C until further analysis, which was stored in the refrigerator until use Al-Janabi, (1996).

c. **Ethanolic Extract:** Ethanolic extract was prepared by keeping 15 g of defatted *Cordia myxa* leaves powder in soxhlet apparatus along with 250 mL of 96% ethanol. Extraction was carried out for 8 hrs. The extract obtained after extraction; the solvent was evaporated in a rotary evaporator at 45^0C to obtain the dried ethanolic extract. The extract was preserved at 2-8 0C in impermeable containers for further analysis Deshmukh and Brole (1975).

2.3. Phytochemical Screening

Screening of phytochemicals for aqueous and ethanolic extracts of *Cordia myxa* leaves was performed for different bioactive chemicals. Following tests were performed by using the methods described by Harborne (1984):

- Alkaloids: The test for alkaloids was performed by adding the extract with Mayer's reagent. A cream-colored precipitate indicates the existence of alkaloids.
- Tannins: To be determined by Gelatin test, the formation of white precipitate
- Flavonoids: This is because the detection of flavonoids is brought about by the use of the Lead acetate test. This involves the formation of yellow precipitates showing the presence of flavonoids.
- Phenols: Ferric chloride test shows deep blue or green coloration showing the presence of phenols.
- Saponins: Determined through the Foam test, the existence was indicated by taking time to break the persistent foam when extract and water are shaken.
- Glycosides by Fehling test: The principle of the test is that the color changes when the extract is heated with Fehling solution.
- Cardiac Glycosides: The drug subjected to Keller-Killani test. Absence of brown ring in the interface of the extract and the reagent indicates its negative existence of cardiac glycosides.

2.4. Quantitative Analysis of Phytochemicals

- TPC: the total phenolic content was determined in the aqueous and ethanolic extracts of *Cordia myxa* leaves by Folin-Ciocalteu method as standard by Kairupan et al, (2019). Stock solution was prepared with 1mg/mL of each extract in 95% ethanol. 0.2 mL of the extract was added to 1.0 mL Folin-Ciocalteu reagent, diluted in the ratio 1:10 and incubated for 4 minutes. Then, add 0.8 ml of 7.5 % $NaCO_3$ solution to the mixture . The reaction mixture was incubated in the dark at 25^0C for 2 hours. After that time, the absorbance of the mixture was measured in a UV-spectrophotometer at 765nm. Gallic acid was used as a standard, and results were expressed as milligrams of gallic acid equivalent per gram of dried extract weight (mg GAE/g dried extracts).
- TFC : Total flavonoid content was assayed using a method outlined by Jiao & Wang, (2000). In this test, 1 mL of the extract (1 mg/mL) was mixed with 3 mL of 95% ethyl alcohol , 0.2 mL of 10% $AlCl_3$ solution, and 0.2 mL of

1M potassium acetate. The mixture was dilated with 5.6 mL of deionized distilled water and incubated at 25°C for 30 minutes. Then, absorbance was measured by using a spectrophotometer at 415 nm by taking quercetin as the standard. TFC was expressed in micrograms of quercetin equivalent per milligram of dried extract weight (µg QE/mg dried extracts).

2.5. Antioxidant Activity (DPPH Radical Scavenging)

Antioxidant potential of aqueous and ethanolic extracts of *Cordia myxa* leaves was performed by a 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method according to Narzary et al. (2016). A 0.1 mM DPPH solution was equipped by dissolving 4 mg of DPPH in 100 mL of methanol. The different concentrations of extracts (31.25–1000 µg/mL) were prepared and mixed with 3 mL of DPPH solution. Then, the mixture was incubated at room temperature in the dark for 30 min. The absorbance was read at 517 nm by a spectrophotometer. Ascorbic acid was used as reference compound. The percentage of DPPH radical scavenging was estimated by:

$$\text{DPPH radical scavenging (\%)} = \left(\frac{\text{Abs.of control} - \text{Abs. of test sample}}{\text{Abs. of control}}\right) \times 100 \quad (1)$$

The IC50 value, indicating the concentration needed to inhibit 50% of the DPPH radicals, was calculated for both extracts.

2-6 Bacterial isolates

Bacteria used in this project (Table 1) were isolated from various samples, collected from patients who suffering from many clinical signs and symptom, admitted to Al-Kindi General Hospital in Baghdad and then plated on agar media at 37°C for 18 hours. These pathogenic bacteria was diagnosed by A vitek II device.

Table1: types and sources of isolates

Types of isolates	Source of isolation
Salmonella typhi	Blood
Shigella Sonnei	Stool
Pseudomonas aeruginosa	Burns
Staphylococcus aureus	Urine (UTI)
klebsiella pneumoniae	Wounds
Escherichia coli	Urine (UTI)

2.7. Antibacterial Activity Assay

The aqueous and ethanolic extracts of *Cordia myxa* leaves were evaluated for their antibacterial activity by the agar well diffusion method. A homogenous suspension of each bacteria strain was prepared at the McFarland standard

concentration (0.5N), which corresponds to a cell count of 10^8 CFU/mL. Then, the bacterial suspension was evenly rubbed on sterile Muller-Hinton Agar plates using a sterile L-shaped glass spreader. About five wells per agar plate of diameter 6 mm were punched with the aid of a sterile cork borer. The remaining four wells were each filled with 100 µL of various concentrations of the extracts: 12.5, 25, 50 and 100 mg/mL, respectively, while the fifth well contained 100 µL of distilled water serving as a control. Plates were incubated at 37°C for 24 hours. Then, the diameter of inhibition zones in millimeters around each well was measured. Results were considered positive if the value of the inhibition zone was higher than 6 mm Baydaa et al., (2015).

2.8. Antibiotic Susceptibility Testing

Antibiotic susceptibility testing of bacterial isolates was performed through Kirby-Bauer Disk Diffusion Susceptibility Test as declared in CLSI, (2023) as cited by Mahon and Lehman, (2019). The following: Isolates were blot tested against panels of antibiotics such as: Amikacin AK, Aztreonam ATM, Amoxicillin AX, Ceftazi-dime CAZ, Ciprofloxacin CIP, Ceftriaxone CRO, Imipenem IMP, Levofloxacin. The results obtained shall be interpreted in comparison to the zone of inhibition to guidelines provided by CLSI break-point for F-AST 2023, whereby the categorization of the isolates fell into S-susceptible and R-resistant against each antibiotic.

3. Results and discussion

3.1. Phytochemical Analysis

Some major bioactive compounds were determined in the aqueous and ethanolic extracts as part of the phytochemical analysis undertaken for *Cordia myxa* L. leaves. Most of the major phytochemicals tested, including alkaloids, tannins, flavonoids, phenols, saponins, and glycosides, were present in the alcoholic extract, hence justifying the fact that ethanol, being a moderately polar solvent, is capable of extracting various types of compounds. Contrarily, the aqueous extract was positive, showing tannins, flavonoids, phenols, saponins, and glycosides, while being negative for alkaloids-probably because the alkaloids have a very poor solubility in water or their concentration is very small in the extract (Table 2) .

Indeed, the more intense coloration represented in the ethanolic extract for flavonoids and phenols shows higher concentrations of those compounds and further justifies ethanol as superior in extracting the referred phytochemicals. These results would suggest that though both extracts contain useful

bioactive compounds, the ethanolic extract offers a more comprehensive phytochemical profile that might translate into high therapeutic efficacy.

These results further indicate that the choice of solvent to be used is one of the most critical factors in phytochemical extraction; ethanol is able to acquire higher levels of bioactive compounds across a wider spectrum from *Cordia myxa* leaves. This result also agrees with Singh and Sharma (2015), hence serving as a good basis for further research into the pharmacological uses of these extracts.

Table 2: Phytochemical Screening of *Cordia myxa* Extracts.

Phytochemical constituents	Methods used for screening	Result	
		Aqueous extract	Ethanolic extract
Alkaloids	Mayer's test	-	+
Tannins	Gelatin test	+	+
Flavonoids	Lead acetate test	+	++
Phenols	Ferric chloride	++	++
Saponins	Foam test	+	++
Glycosides	Fehling's test	+	+
Cardiac Glycosides	keller killani	-	-

(++) Deep coloration (+)Slight coloration (-)Not detected

Total Phenol Content (TPC)

The TPC of *Cordia myxa* leaves for the aqueous and ethanolic extracts was determined using the standard gallic acid curve represented in (Figure 1) below. TPC was expressed as gallic acid equivalent (mg GAE/g of extract) using the equation y=0.0052 X + 0.817, manifested by a very high value of the linear relationship (R2=0.9989) between the absorbance at 765 nm and the concentration of gallic acid.

Remarkably, the respective ethanolic extract showed a highly superior value of total phenol content of 89.24 mg GAE/g of the extract, whereas the aqueous extract gave a rather low value of 67.55 mg GAE/g of the extract. In this way, these results can be interpreted to show the efficiency of ethanol as an extracting solvent in the effective extraction of phenolic compounds from *Cordia myxa* leaves.

These results clearly indicate that the type of solvent used is critical for the extraction of phenolic compounds, highly appreciated for their strong antioxidant activity. The higher content of phenolics in the ethanolic extract

provides further evidence of its therapeutic value and points out the importance of selection of the right solvent during extraction.

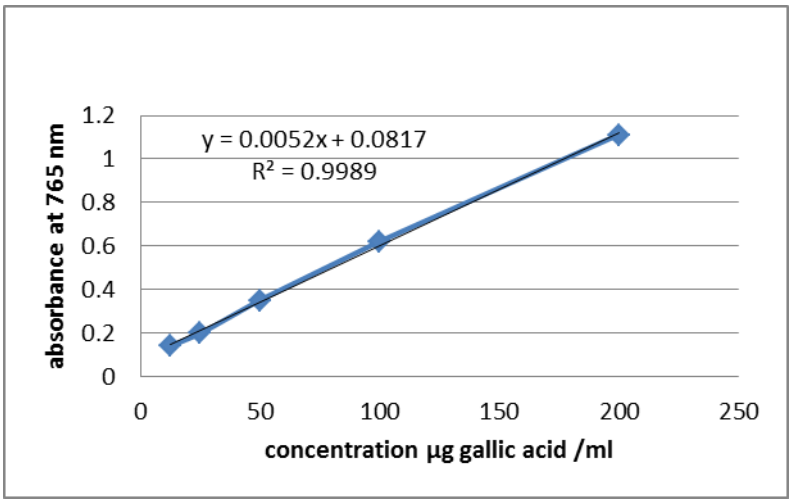

Figure 1. Gallic acid standard curve

Total flavonoid Content (TFC)

The TFC of the leaves extracts of *Cordia myxa* were quantified against the quercetin standard curve presented in (Figure 2) . Hence, the TFC values were expressed in quercetin equivalents as mg QE/g of the dried extract, based on the highly correlated regression equation ($y = 0.0075\,X + 0.0023$) with R^2 (0.999). This ensued in a very strong linear relationship between quercetin concentration and absorbance at 415 nm, indicating the reliability of the method adopted. Significantly higher flavonoid content was extracted with an ethanolic extract 3.12 mg QE/g of Cordia myxa leaves against the aqueous extract 1.42 mg QE/g. The above results truly indicated that ethanol is a better extraction solvent than water for flavonoids from the leaves of *Cordia myxa*.

Besides that, flavonoids are also well documented as antioxidants, and this would mean that an increase in their percentage content through alcoholic extraction may translate into very good therapeutic potential, especially under natural medicine. This underlines the importance of choosing the appropriate solvent when attempting to optimize the extraction of these important bioactive compounds for the medicinal value they have in the plant. This difference in observed flavonoid content underlines the variabilities that exist in the extraction of desired phytochemicals extractions by employing different solvents. Hence, the optimized processes for their extraction can be developed to maximize the yield. This paper serves as an overview of the

phytochemical composition of and provides the backbone necessary toward further exploration of its therapeutic potential in natural medicine. These findings support the study conducted by Azwanida (2015).

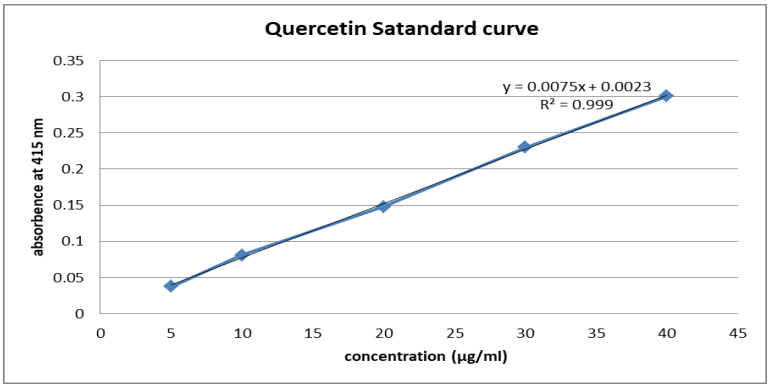

Figure 2. Quercetin standard curve

3.2 .Antioxidant Activity of *Cordia myxa* leaves Extracts via DPPH Assay

An assay of the scavenging property of the DPPH radical by aqueous and ethanolic extracts of Cordia myxa leaves was done with a comparison to a standard antioxidant ascorbic acid. The inhibition of the DPPH radical in both extracts exhibited a dose-dependent increase. Ascorbic acid at 50 µg/ml resulted in an extremely high rate of inhibition-95.54%, showing its high potential for radical scavenging. The resultant IC50 value, which is the concentration required to inhibit 50% of DPPH radicals, was 220 µg/ml and 450 µg/ml for ethanolic and aqueous extracts, respectively (figure 3) .

Thus, this could be due to the higher phenolic and flavonoid contents of this ethanolic extract in comparison to the aqueous one, and might be why the ethanolic extract expressed by far a stronger DPPH radical-scavenging activity. Apparently, the type of solvent used in extraction is thus primordial in yield and effectiveness during tests for bioactive compounds. These findings emphasize that Cordia myxa leaves extracts, especially ethanolic extract, hold immense potential as a natural antioxidant and can be utilized instead of synthetic antioxidants in a variety of ways. These results are in agreement with Shahidi and Ambigaipalan (2015).

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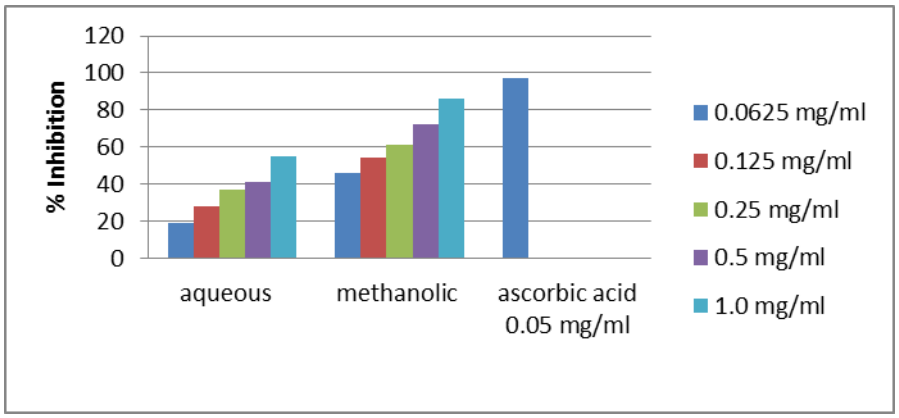

Figure 3. DPPH Radical Scavenging Activity of *Cordia myxa* leaves extracts

3.3.Susceptibility of bacterial isolates to antibiotics

This experiment was done to understand the susceptibility of six bacterial isolates to a variety of antibiotics. Table 3 clarifies pattern of resistance and sensitivity to various antibiotics. It was learned from this table that a high rate of resistance to Nafcillin AK and Azithromycin ATM. That means these two were of lesser effectiveness in treatment of pathogens tested in this experiment. On the contrary, most of the isolates were found sensitive to Imipenem IMP and Meropenem MEM makes the drugs effective for the treatment of bacterial infection.

- High resistance to Nafcillin and Azithromycin is presumably due to their poor and over-usage, respectively. It enumerates the cautious use of the said antibiotics in clinical practice in order not to create further resistance.
- Of importance is the remarkable sensitivity to Carbapenems, showing their role as antibiotics of last resort in the treatment of infections caused by these bacteria. This has specific significance in view of the growing concern regarding antibiotic resistance.

Table 3: Resistance and sensitivity of bacterial isolates to antibiotics

	Types of bacterial isolates					
Antibiotics	***S.Typhi***	***S.sonnei***	***P.aeruginosa***	***S.aureus***	***K.pneumoniae***	***E. coli***
AK	**R**	**R**	**R**	**S**	**R**	**R**
ATM	**R**	**R**	**R**	**R**	**R**	**S**
AX	**S**	**R**	**R**	**S**	**R**	**R**
CAZ	**R**	**R**	**R**	**R**	**R**	**R**
CIP	**S**	**S**	**R**	**S**	**R**	**S**
CRO	**R**	**R**	**R**	**R**	**R**	**R**
IMP	**S**	**S**	**R**	**S**	**S**	**S**
LEV	**S**	**S**	**R**	**S**	**R**	**S**
MEM	**S**	**S**	**S**	**S**	**S**	**S**
TE	**S**	**S**	**R**	**S**	**S**	**S**

S= Sensitive – R= Resistance
AK= Amikacin, ATM= Aztreonam, AX= Amoxicillin, CAZ= Ceftazidime, CIP= Ciprofloxacin, CRO= Ceftriaxone, IMP= Imipenem, LEV= Levofloxacin, MEM= Meropenem, TE= Tetracycline.

Accordingly, the crude leaves extracts of *Cordia myxa*. were screened for their antibacterial activities, and the respective results were tabulated in Table 3 below. Higher concentrations of 100% and 200% w/v crude ethanolic extract was able to elicit a larger zone of inhibition measured at 16mm against *Klebsiella pneumoniae* and *Shigella sonnei* at 14mm, while it proved less effective against *Pseudomonas aeruginosa* at 13mm. The aqueous extract does not show any inhibitive effect or very little effect on such concentration against all these bacteria (Table 4)

Table 4. Antibacterial Activity of *Cordia myxa* Leaves Extracts

Con.% w/v	Mean diameter of zone of inhibition (mm) ±SD											
	Ethanolic extract of						Aqueous extract					
	St	Ss	Pa	Sa	Kp	Ec	St	Ss	Pa	Sa	Kp	Ec
25	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
100	0	11	10	0	14	0	0	0	0	0	0	0
200	12	14	13	0	16	0	12	0	0	0	0	0

Pa= *Pa=seudomonas aeruginosa* , Ss= *Shigella Sonnei* , St= *Salmonella typhi*,
Ec= *Escherichia coli*, Kp= *klebsiella pneumonia*, Sa= *Staphylococcus aureus*

The higher antibacterial activity of the ethanolic extract than the aqueous extract is because the ethanolic one has a greater capacity for extracting the bioactive compounds contained in *Cordia myxa* leaves, which are responsible for the antibacterial properties of the said extract. Recorded inhibition zones for *Klebsiella pneumoniae, Shigella sonnei,* and *Pseudomonas aeruginosa* inhibition reveal that they are susceptible to compounds present in the ethanolic extract and, hence, the potential of this plant extract to become a candidate in developing natural antimicrobial agents. In fact, poor solubility of some active compounds in water, a factor that often arises in phytochemical and pharmacological studies, may be the reason for the marked activity in the aqueous extract.

Such antibiotic efficacy studies in various species of bacteria testify to the fact that potentially different types of bioactive compounds present in the leaves of *Cordia myxa* show activities differently for multiple target pathogens. This fact was also supportive of our observation about the completion of ethanolic extracts of *Cordia myxa*, which acted as a combination of alternative treatments against infections induced by antibiotic-resistant bacteria. It is the observed trends in antibiotic resistance that dictate the need for prudent use in the clinical applications and research studies with antibiotics and also for their more surveillance.

Isolation and identification of the bioactive principle, responsible for its antibacterial property in *Cordia myxa* leaves, call for detailed study. Investigation of their mode of action and possible Therapeutic applications, therefore, opens new approaches toward the challenge of antibiotic resistance. This is in agreement with the work of Seymour and Brennan, (2016).

Finally, we can conclude that the ethanolic extract of *Cordia myxa* leaves possessed a high total phenolic and flavonoid content, which is what would be expected to correspond with strong antioxidant activity, a feature validated in this work by a low IC50 value in the DPPH assay. This extract also has strong antibacterial activity against *Salmonella typhi, Pseudomonas aeruginosa, Shigella sonnei,* and *Klebsiella pneumonia,* which may have an indicative potentiality as a natural antimicrobial agent. These bacterial isolates further developed resistance against some common antibiotics, such as Nafcillin and Azithromycin; therefore, *Cordia myxa* leaves ethanolic extract may be an alternative. Further investigations are recommended for isolation and purification of particular bioactive compounds, understanding their mechanism of action, and clinical evaluations to produce natural therapeutic agents.

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الفحص الكيميائي النباتي والنشاط المضاد للأكسدة والمضاد للبكتيريا للمستخلصات الخام من أوراق شجرة Cordia myxa المزروعة في العراق

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مستخلص البحث:

شجرة الدبق اسمها العلمي *Cordia myxa* ,هي شجرة نفضية متوسطة الحجم من عائلة لسان الثور وهو أحد النباتات الطبية التقليدية، التي استخدمت منذ عقود في العراق لعلاج العديد من الأمراض. أجريت هذه الدراسة لتحليل المكونات الكيميائية النباتية والخصائص المضادة للأكسدة والمضادة للبكتيريا للمستخلصات المائية والإيثانولية لأوراقها . أظهرت النتائج أن المستخلصات المائية والإيثانولية لأوراق الكورديا مايكسا تحتوي على نسبة كبيرة من الفينول حيث بلغت 89.24 و 67.55 ملغ من حمض الغاليك / غرام من المستخلصات الجافة على التوالي وبلغت كمية والفلافونويدات 3.12 و 1.42 ملغ من الكيرسيتين / غرام من المستخلصات المائية والإيثانولية الجافة على التوالي. تم تحقيق أعلى نسبة تثبيط (86.45٪) لجذر DPPH بواسطة المستخلص الإيثانولي بتركيز 1 ملغ / مل مع نشاط مضاد للبكتيريا جيد ضد السالمونيلا التيفية، الزائفة الزنجارية، شيغيلا سوني، وكلبسيلا الرئوية مع متوسط قطر منطقة تثبيط (12، 13، 14، و 16 ملم) على التوالي . وبالتالي، يمكن ان يعتبر مرشح قوي لتطوير الأدوية الطبيعية ضد الالتهابات الميكروبية.

الكلمات المفتاحية: أوراق شجرة الدبق ; Cordia myxa ؛ ؛النشاط المضاد للميكروبات؛ النشاط المضاد للأكسدة؛ إزالة الجذور الحرة .

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