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Research Article

Assyrian Plum (*Cordia myxa*): A Valuable Ethnomedicinal Plant

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Abstract

Introduction: *Cordia myxa L.* (CM) is a Boraginaceae family medicinal plant. CM is recognized from primitive times for its therapeutic uses. Each part is utilized for the treatment of various infections and diseases in particular fruits, and leaves are used in tuberculosis, fever, urinary tract infections, etc.

Objective: In the present research work, we have attempted the quantitative estimation of element contents and antimicrobial activity of Cordia myxa leaf, fruit and bark extracts against bacteria.

Results and discussion: Elemental examination shows that it as a respectable basis of minerals like phosphorous, nitrate, sulphate, potassium, magnesium, and nitrite. This study reveals that CM leaves, fruit and bark can be used as food supplement with valuable nutrition, disease restraint and health benefits. Antimicrobial activity was analyzed by Agar well diffusion method against bacterial strains viz. *Bacillus subtilis, E. coli, Salmonella enterica, Staphylococcus aureus, and Pseudomonas aeruginosa. S. aureus, Bacillus subtilis* produced highest zone of inhibition and then *E. coli*.

Conclusion: Efficient preclinical findings support the traditional asserts of CM. The analysis showed that CM could be used as medication. Furthermore, studies are required for strengthening the scientific value of this revered medicinal plant. A higher demand in the prospect could be predicted for various products from this tree for concern towards a possible integration into the food safety and healthcare approach.

Keywords: *Cordia myxa*; Nutritional value; Traditional usage; Phytochemistry

Introduction

From thousands of years plants have been used as medicines all over the world. Medicinal plants have unique properties that qualify them as articles of therapeutic agents and can be used for pharmaceutical purposes. Phytomedicines have been used for thousands of years by folks in India, China, and many other countries. Prehistoric records of plants as medicines are found in the Artharvaveda, in India [1]. Biological and chemical compositions of phytomedicine have received renewed scientific concentration in the past few years [2]. *Cordia myxa* is a class of flowering plant. *Cordia myxa*, deciduous tree grows in many parts of the world, including tropical Africa and Asia, the Americas, Eastern Mediterranean to Eastern India [3,4]. In the month of July-August, light pale fruit begins appearing and tends to grow dark as ripening proceeds. In conventional medicine, fruit was used especially in the Middle East, India, and China. Because of Emollient properties of the fruit, it has been used to treat many infections such as respiratory, sore throat, urinary. In other allied treatments pulp is used to mature pustules, rheumy pain, ringworm [5-7]. Scientific fiction postulates that *Cordia myxa* has certain anti-inflammatory, antimicrobial analgesic, gastrointestinal, cardiovascular, antiparasitic immunomodulatory, insecticidal [8-10]. Fruit of *Cordia myxa* fruit contains fibres, biological compound and proteins, and some investigates that fruit as a carbohydrate and protein supplement for cereal-based regimes in deficient countryside communities [11].

Botany

Cordia myxa, the Assyrian plum, belongs to deciduous tree in the borage family (Boraginaceae) indigenous to Asia. Fruits are small and edible and are found in hotter zones beyond Africa and Asia. Other popular names in diverse dialects are lasura, spistan, pidar laveda, panugeri, geduri, naruvilli. It is observed in Asia, tropical regions. It is innately growing in Myanmar, west Syria and east Lebanon. Its territory begins 660 ft above mean sea level in the plains and move upward to a height 4,900 ft in the mountains (Wikipedia) (Figure 1).

Due to urbanization and increase in population, insufficient nutrient supplies, very expensive animal protein is the principal reasons for malnutrition and undernourishment. Because of hasty alteration in socioeconomic conditions of the peoples, a very less community get advantage from the plant. Therefore, the herbal has been badly ignored for scientific researches [12]. No scientific data has been carried out on the phytomedicine and nutritional potential perspective. In our prior investigation we analysed

Figure 1: The *Cordia myxa* leaves, fruit and bark.

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the potency of cedar deodar for antibacterial and secondary metabolite potential [13], Antioxidant and antimicrobial properties of mangrove and Ghaf [14], nutraceutical properties of Ghaf [15-18]. Therefore, to maintain our additional research and to gather the mounting requirement of antimicrobial agent, we investigated natural resources and unconventional strategies to search of new antimicrobial agent. Despite tremendous significance of CM, there is fewer scientific investigations and minimal perception, in the established communities. Consequently, the objectives of the present investigation were to explore the antimicrobial properties and nutritional potential of leaves, bark, and fruit extract of CM. The research work is carried out as recognition of phytomedicinal value and to give value-added products.

Material and Methods

Collection of Sample

Cordia myxa, leaves, bark, and fruit (Three different trees and three samples of each) were collected from Dahan and Al Dhait area of Ras Al Khaimah, United Arab Emirates. Samples were retained in sterile bags till their use.

Chemicals

The chemicals used in the present research were of high purity and analytical grade from Merck, Honeywell and Himedia. Polysorbate 80, hydrogen peroxide from Merck; biochemical identification kits for Gram negative rods KB002 and gram-positive cocci, rabbit plasma, grams stains from Himedia; ethanol from Honeywell. Standard kits and reagents used for investigation were purchased from Germany and USA.

Media used for study

Nutrient agar, Muller Hinton agar and nutrient broth were used for the analysis. Preparation of media and broth was done according to the manufacturer's instructions available in manual and experiments were performed in the microbiology division of Environment laboratory of Ras Al Khaimah Municipality, United Arab Emirates.

Sample Preparation for nutrient analysis

Sterile water was used to wash the samples (leaves, bark and fruit). 10g of sample (each) weighed by analytical balance (RADWAG-PS 2100.R2, Poland). Sample preparation procedure according to Bhardwaj [19] (Figure 2).

Pure bacterial culture

In the present examination, the bacterial strains used were *Bacillus subtilis* (ATCC 6633), *E. coli* (ATCC 8739), *Pseudomonas aeruginosa* (ATCC 27853) obtained from the American Type Culture Collection (ATCC) to determine the antibacterial activity. The bacterial strains were provided by LTA srl Italia. Pure strains of bacteria were preserved at 4°C on nutrient agar slants. Triplicate of each strain were used with each sample.

Figure 2: Sample preparation for Nutrient Analysis.

Inoculums preparation for pure bacterial isolates

Suspension of each of the bacterial pure culture isolates was made by collecting a loopful of colony from each slant and was incubated overnight at 37°C in Nutrient broth. Preparation of inoculum according to Bhardwaj [20].

Agar well diffusion assay

The antibacterial activity of C. myxa leaves, bark and fruit extract was examined against pure isolates strains by agar-well diffusion method [21].

Statistical analysis

Experiments performed in triplicate. Data are expressed as mean. Experimental error was determined for triplicate and expressed as Standard Deviation (SD).

Results and Discussion

According to the research results, this is possibly the first report of comparison of *C. myxa* nutrient content in leaves, bark and fruit; to recognise its health advantages and nutritional properties. In the present research work, HACH spectrophotometer DR3900 and Spectroquant prove100, Merck, Germany was used for nutrient analysis.

Different sorts of nutrient like phosphorous, nitrate, sulphate, nitrite, magnesium, copper, ammonium, nickel, iron, lead was examined (Table 1). According to the present research findings, CM leaves have maximum amount of sulphate (10890 mg/kg), magnesium (2620 mg/kg), potassium (4960 mg/kg), iron (23 mg/kg) as compared with CM fruit, which have sulphate (4900 mg/kg), magnesium (1110 mg/kg), potassium (3180 mg/kg), Iron (12 mg/kg), phosphate (1424 mg/kg). CM bark showed sulphate (8500 mg/kg), phosphate (500 mg/kg), nitrate (18880 mg/kg) and nitrite (2550 mg/kg) (Table 1).

Similar work was reported [21], stated that CM leaf extracts showed antimicrobial activity against pathogenic microorganisms as well as showed positive tests for phytochemicals. According to Aberoumand [22,23], some mineral analytic research results, the amounts of potassium (29 ppm), and sodium (13 ppm) represent the greatest proportion in the fruits of CM. The fruits have no lead, cadmium, chromium, and copper thereof, this plant has a very low toxic proportion with heavy metals [24].

Antibacterial activity of *Cordia myxa* extract against Human pathogenic bacteria

The research results of antibacterial activities by agar well diffusion method is summarized in Table 2, which was evaluated on *Bacillus subtilis* (ATCC 6633), *E. coli* (ATCC 8739), *Salmonella enterica* (ATCC 14028), *Staphylococcus aureus* (ATCC 6538), *Pseudomonas aeruginosa* (ATCC 27853). *C. myxa* Leaves (Figure 3) produced zone of inhibition with all the five strains of microorganisms. Fruit of *C. myxa* (Figure 4) methanolic extract produced maximum zone of inhibition with *Staphylococcus aureus* which are 42 ± 0.6 mm and bark (Figure 5) showed maximum zone of inhibition with *Staphylococcus aureus* 26 ± 0.5 mm (Figure 3) (Table 2). Similar

Table 1: Elements analysis of *Cordia myxa* bark, fruit, and leaves.

Parameter	*Cordia Myxa* Bark (mg/kg)	*Cordia Myxa* Fruit (mg/kg)	*Cordia Myxa* Leaves (mg/kg)
Nitrate-Nitrogen	18880	4210	460.35
Nitrite-Nitrogen	2550	1100	940.5
Sulphate	8500	4900	10890
Phosphate	500	1424	31.68
Copper	0	15	217
Magnesium	0	1110	2620
Nickel	0	82	613
Iron	0	12	23
Potassium	0	3180	4960

Table 2: Antibacterial Activity of methanolic extracts of *Cordia myxa* Leaves, fruit and bark.

SNo.	Microorganisms	*Cordia myxa* Leaves (mm)	*Cordia myxa* fruit (mm)	*Cordia myxa* bark (mm)
1	*Bacillus subtilis* (ATCC 6633)	22 ± 0.0	24 ± 0.5	26 ± 0.1
2	*E.coli* (ATCC 8739)	11 ± 0.5	10± 0.2	12 ± 0.5
3	*Salmonella enterica* (ATCC 14028)	12 ± 0.2	12 ± 0.3	12± 0.1
4	*Staphylococcus aureus* (ATCC 6538)	35 ± 0.2	42 ± 0.6	26 ± 0.5
5	*Pseudomonas aeruginosa* (ATCC 27853)	13 ± 0.1	9 ± 0.2	13 ± 0.5

results are reported [25] explained that the alcoholic extracts of *C. myxa* leaves (Figure 3) can be inactivate against all bacterial isolates. However, observed that *C. myxa* gave a good inhibition zone against gram-negative bacteria (*E. coli*) and gram-positive bacteria (*S. aureus*). While Ali did not agree with Jasiem [26] as he explained that the extracts of *C. myxa* leaf can show antimicrobial activity against three kinds of bacterial isolates (*Escherichia coli, P. aeruginosa and S. aureus*). Like our research results Pandey, reported that the *Cordia myxa* extracts of leaf showed antimicrobial activity against three fungal strains (*Aspergillus niger, Penicillium spp* and *Scytalidium spp*) and three bacterial strains (*E. coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*). Highest inhibition was showed by *Staphylococcus aureus* and then *E. coli*. However, it showed no antifungal activity. Kaushik reported similar research results of our findings.

Conclusion

This investigation was carried out as an awareness of nutritive and medicinal value of *C. myxa*, for their activity against selected bacterial isolates. Mineral analysis shows that it as a good source of sulphate, nitrite, magnesium, phosphorous, nitrate, magnesium, and potassium. The assay of antibacterial activity of fruit extract of CM against *Staphylococcus aureus* showed the highest susceptibility while *Pseudomonas aeruginosa* had the least. According to the research findings of CM fruit extract, it was identified and concluded from their average zones of inhibition 42 mm for *Staphylococcus aureus*, 12 mm for *Salmonella enterica*, 10 mm for *Escherichia coli*, 9 mm for *Pseudomonas aeruginosa* and 24 mm for *Bacillus subtilis*. In case of CM bark 26 mm for *Staphylococcus aureus* and *Bacillus subtilis*. CM leaves showed 35 mm for *Staphylococcus aureus* and 22 mm for *Bacillus subtilis*. This study endorses the use of *Cordia myxa* as therapeutic agent as well as in combating antibiotic resistant. This study however recommends use of CM leaves, bark and fruit in treating some of the emerging and re-emerging diseases as well as improving health status. Further studies should be done to

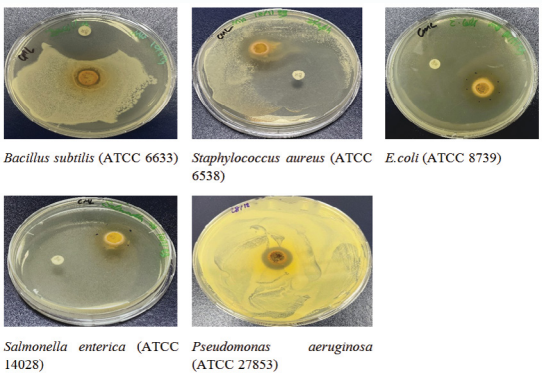

Figure 3: Extracts of *Cordia myxa* Leaves showed antibacterial activity as indicated by the zone of inhibition against different microorganism's strain.

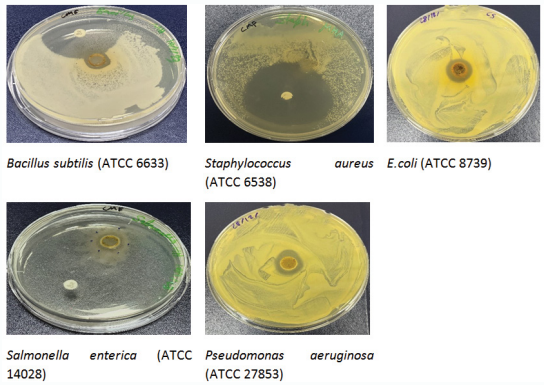

Figure 4: Extracts of *Cordia myxa* fruits showed antibacterial activity as indicated by the zone of inhibition against different microorganism's strain.

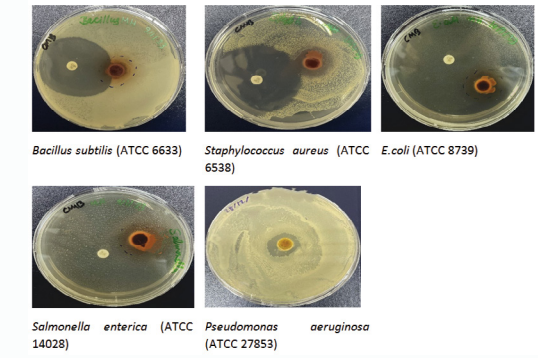

Figure 5: Extracts of *Cordia myxa* Bark showed antibacterial activity as indicated by the zone of inhibition against different microorganism's strain.

ascertain the mechanisms of actions of CM leaves, bark and fruit on microorganism generally and their susceptibility pattern and mechanism of action.

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