



Screening of Antimicrobial Activity of The Stems, Leaves and Flower Extracts of *Argemone mexicana* Against Selected Pathogenic Microorganisms

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Abstract

Madhya Pradesh is rich in forests and resources. Madhya Pradesh's tribes are extremely knowledgeable about the medicinal applications of numerous plants and their extracts. *Argemone mexicana* extracts were used for medicinal purposes by the tribes of Madhya Pradesh, Uttar Pradesh, and Rajasthan. In the present study, *Argemone mexicana* was selected to test its antibacterial activities as it is abundantly available in Madhya Pradesh and is used by the tribes as folk medicine. During the present study, several extracts (aqueous extract, ethanol extract, acetone extract, and methanol extract) of *A. mexicana* leaves, stems, and flowers showed significant antibacterial activity against the clinical and environmental isolates of *E. coli*, *P. aeruginosa*, *S. typhi*, and *S. aureus*. The present investigation shows that the knowledge of tribes for tribal medicine is tremendous. The need is to use their knowledge after proper experimental proof.

Key words: *Argemone mexicana*, antibacterial activity, *E. coli*, *P. aeruginosa*, *S. typhi*, and *S. aureus*.

Introduction

Argemone mexicana is a folk medicine used by different tribes for centuries. It a native of Mexico that is now a common annual weed in the Papaveraceae family, is frequently related to agricultural and severe conditions. In tropical, sub-tropical, and humid areas around the world, it is a major weed for a number of cash crops. This plant is also known as Mexican prickly poppy, flowered thistly, cardo/cardosantro, and other names. In India, this plant is known as agara, bharband, bharbhar, and brahamandandi. This hardy plant is regarded as harmful to human health. When eaten with unclean food, it produces excessive scratching, which is troublesome for farmers (1).

Roadsides, unfarmed land, cultivated lands, riverbanks, disturbed regions, and floodplains are all places where *Argemone mexicana* can be found very easily. In some areas, it competes with and replaces native plants, and it is also a serious crop weed (2; 3).

The plant is diuretic, purgative, and eliminates worms, according to Ayurveda. Leprosy, skin disorders, inflammations, and bilious fevers are all treated with it. The roots include antihelmintic properties. Juice is used to cure ophthalmia and corneal opacity. Seeds include sedative and purgative effects. Seeds that look like mustard seeds are used to adulterate mustard seeds in India. The seed produces toxic, non-edible oil that causes deadly dropsy when fried in mustard oil. This herb is used in the homoeopathic system of medicine to treat tapeworm problems. *A. mexicana* is utilised in Unani medicine to help with blood enrichment, as well as an expectorant and aphrodisiac. It is also used to treat skin conditions like lecoderma (4).

From ages, *A. mexicana* has been used in India as a diuretic. Since the Aztecs, it has been utilised in traditional medicine as a pan - tropical species. Traditional medicine uses the entire plant of *A. mexicana* to cure tumours, warts, skin disorders, inflammations, rheumatism, jaundice, leprosy, piles, warm infestations, and dysentery. *A. mexicana* is used to cure a variety of diseases in traditional Mexican medicine. Different parts of the plant are used in Ayurveda, Siddha, Unani, and homoeopathic medicines. *Argemone mexicana* is a popular folk remedy for a variety of diseases, it has analgesic, antibacterial, antimalarial, antispasmodic, sedative, and narcotic properties. Skin problems are commonly treated using *A. mexicana* and its ingredients in traditional and folk medicine. To demonstrate the plant's ethnobotanical diversity and ubiquity, the entries on the multiple uses of *A. mexicana* in traditional medicine have been grouped into areas.

Its leaf extract is used to cure spleen and liver problems, as well as jaundice and whooping cough. Fever, cough, and asthma are treated with an infusion of the young leaves or blossoms. Diabetes is treated with its leaves and black pepper. The decoction of the leaves is used to cure malaria and ulcers. The leaves and seeds of this plant are said to help maintain normal blood circulation and cholesterol levels in humans (5). These plant parts also have anti-venom properties (6).

The *A. mexicana's* root is used to treat chronic skin disorders and as a diuretic. Roots are antihelmintic, and they're also used to treat skin conditions, leprosy, and inflammations (7). Antibacterial, cytotoxic, wound-healing, antioxidant, and antifungal activities are all present in it (8; 9; 10; 11).

Flowers have traditionally been used to cure coughs because they are expectorant (12). The antioxidant capacity of *A. mexicana* was evaluated using the 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH) free radical scavenging assay, which demonstrated a substantial relationship between total phenolic (23.5mg

GAE/gdw) and flavonoidal content (34.5mg QE/gdw). With an IC50 of 23.75g/ml, the flowers of *A. mexicana* had the strongest radical scavenging action. The antioxidant activity of *A. mexicana* is strong. As a result of these findings, the plant could be used to treat diseases caused by free radicals as a medicine (13). Flowers have traditionally been used to heal coughs and other chest ailments, as well as to feed teething children and as a sleep aid.

The whole plant has analgesic, antispasmodic, depurative, emetic, emmenagogue, perhaps psychedelic, sedative, and vulnerary qualities. IT contains alkaloids similar to those found in the opium poppy (*Poppy Somniferum*), making it a mild pain reliever. It has been used to treat cancer and epilepsy. The entire *A. mexicana* plant is a purgative and diuretic that can help with guinea worm infestations. This herb is used to cure venereal sores, photophobia, scorpion bites, and leucorrhoea. The entire plant is used to cure dental issues (14). Traditional medicine treats leprosy, malaria, jaundice, rheumatism, pain, inflammation, skin disorders, fever, piles, warts, diarrhoea, tumours, and worm infestations with the entire plant, roots, leaves, stem, and flowers.

Increased microorganism resistance may be linked to the unrestricted use of antibacterial agents or antibiotics. Due to a growth in microorganism resistance to a number of medications, antibiotic treatment of a variety of diseases is becoming increasingly difficult. As a result, novel drugs to treat a wide range of microbial infections and diseases are urgently needed. It prompted scientists to investigate innovative plant-based chemicals as modern antibacterial agents, which could be a safe, cost-effective, and successful treatment option. The goal of this study is to determine the phytochemicals and antibacterial properties of *A. mexicana*, a medicinal plant utilised by tribals in Madhya Pradesh.

Materials and methods

Plant Materials

The sampling of *Argemone mexicana* plants were done in the month of March 2022 from Sanjivani Nagar, Garha Jabalpur, India.

Cleaning and separation of plant materials

To eliminate soil and dust, the plants were rinsed many times with tap water. The leaves, stems, and flowers of the plants were then removed and dried in the shade for 10 days. The dried plant pieces were then powdered and stored separately in airtight containers.

Sample preparation

Powdered samples of *Argemone mexicana* leaf, stem, and flowers were extracted using the Soxhlet extraction equipment according to the method of Subramanian and Nagarajan, 1969. On a heating pad, extraction was carried out in a mixture of water and 80% methanol for 24 hours. The plant extracts were filtered separately using Whatman filter paper No. 1. Using a separating funnel, the filtrate was divided into an ether layer and a below-side water layer by adding 7% H₂SO₄ and ether.

Antibacterial Properties of extracts of *A. mexicana* :

The study's bacterial strains were obtained from the M.T.C.C. in Chandigarh, India. The organisms chosen for the investigation were *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Staphylococcus aureus*, all of which were found to be resistant to board range antibiotics.

Qualitative assay :

The modified Kirby Bauer Disk Diffusion susceptibility method was used to test bacterial strains' sensitivity to commonly used antibiotics as well as aqueous and organic extracts of *A. mexicana* stem leaves and flower (15). The bacterial strains were suspended in 4 ml of normal saline (0.85 percent) and the density of the suspension was adjusted to approximately 10⁸ CFU ml⁻¹ using a 0.5 M barium sulphate suspension as the turbidity standard. To obtain a bacterial lawn, the surface of the sterile 3.8 percent MH (Mueller Hinton) agar in the petri dishes was dried, and the test bacteria were inoculated separately with a sterile swab.

To assess the inhibitory zones formed by different antibiotics, high potency antibiotic discs (Hi-media) were deposited on MH agar. 10 l aliquots of each seed extract were transferred aseptically to sterile paper discs (6 mm diameter) made from Whatman No.1 filter paper. The discs with the extract were placed directly on the bacterial lawn. The diameter of the inhibitory zones was determined after 18 hours of incubation at 37°C.

For aqueous and organic extracts, sterile distilled water and DMSO were used as controls. Organic extracts were aided by 1% (v/v) DMSO, while aqueous extracts were aided by water, both of which had no effect on the growth of test bacteria (9).

Antibacterial activity of *A. mexicana*:

In the present study antibacterial activities of *A. mexicana* stems, leaves and flower extracts were determined. Microorganism used in the present investigations was *E.coli*, *P.aeruginosa*, *S.aureus* and *S.typhi*. All the isolated were subcultured on Nutrient agar media at $37\pm 2^{\circ}$ C. Their growth pattern, cultural characteristics and staining behavior were observed in order to validate the cultures.

The usage of *A. mexicana* in traditional Indian treatments makes it intriguing to research its antibacterial capabilities. Several extraction techniques were used to create and test crud extract for antibacterial activity in this investigation. The antibacterial activity of different extracts from *A. mexicana* leaves, stems, and flowers against *E. coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Staphylococcus aureus* was first tested in this study. The phytochemical components of each extract were identified and linked to antibacterial action. It was also discovered that the plant extract utilised in the experiment is antimicrobial.

This was confirmed in the current investigation, which measured the extract's antibacterial activity in terms of zone of inhibition. The microorganisms *Staphylococcus aureus* and *E. coli*.

The antibacterial activity of different stem extracts of *A. mexicana* L. against the investigated microorganisms in vitro was assessed using the presence or absence of inhibitory zones. As shown in Table 1, four pathogenic bacteria were used to test the antibacterial activity of various stem extracts. As shown in Table 1, the aqueous, acetone, methanol, and ethanol extracts substantially inhibited most of the microorganisms tested, although the hexane extract had very minimal antibacterial activity in most cases. The antibacterial activities of methanol and ethanol extracts were found to be effective against all four microorganisms tested (*Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Staphylococcus aureus*).

Table 1: Organic extracts of *A. mexicana* stem, leaves, and flowers showed antibacterial activity

Bacteria	Zone of Inhibition											
	Stem				leaves				flowers			
	1	2	3	4	1	2	3	4	1	2	3	4
<i>E.coli</i>	2.8	3.5	1.5	2.0	2.5	2.3	1.8	2.6	1.9	1.4	2.2	1.5
<i>P. aeruginosa</i>	2.4	2.6	2.4	2.2	1.5	2.5	2.3	2.4	2.4	1.6	1.3	1.4
<i>S. Typhi</i>	1.3	2.2	2.6	18	1.2	2.2	2.0	1.7	1.6	1.5	1.4	2.6
<i>S. aureus</i>	2.8	4.5	1.5	2.4	1.4	2.4	1.8	1.0	2.5	1.3	1.3	2.0

1. Aqueous Extract, 2. Acetone Extract, 3. Ethanol Extract, 4. Methanol Extract

Conclusion

In the present investigation we screened the antibacterial activities of leaf, stems and flowers of *A. mexicana*. All the parts of *A. mexicana* are showing remarkable activity against selected pathogenic bacteria. Although more systematic research into this medicinal plant and its active ingredients is required, as well as more in-depth and comprehensive examinations into all essential elements. Pharmacological and clinical studies of several chemical constituents of *A. mexicana* have yielded encouraging results, highlighting the necessity for further comprehensive research into this medicinal plant and its active principles. The new probe is expected to help accelerate the present upward trend.

Acknowledgments

Authors are thankful to V.C (RGTU) and Head (Department of Botany, RDTU) for providing such a nice opportunity.

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