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## Review Paper

# Antifungal Properties of *Argemone Mexicana* Leaves; A Scientific Review

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### ABSTRACT

As a traditional medicine, *Argemone Mexicana* has been extensively used in Ayurveda, Siddha, Unani, and Homeopathic treatments for many diseases. It is also reported to have antimicrobial properties, wound healing property, larvicidal and chemo sterilant activity, nematocidal and allelopathic potential, antimalarial, antibacterial and antifungal, molluscicide, anticancer, hepatoprotective, anti-HIV and neuropharmacological activity. Poppy plants belong to the Papaveraceae family, which contains 42 genera and approximately 730 species of flowering plants, all of which have significant ethnopharmacological uses. The species is renowned for producing a wide range of chemical compounds, including long-chain aliphatic alcohols, terpenoids, steroids, polysaccharides, carboxylic acids, flavonoids, and other phenolic compounds.

### INTRODUCTION

Antifungal refers to any substance, drug, or compound that kills or inhibits the growth of fungi. These agents are used to treat fungal infections (mycoses) that affect humans, animals, or plants. Fungi are eukaryotic organisms found in nearly every environment, with only a limited subset contributing to human disease. These pathogenic fungi can cause infections ranging from mild cutaneous conditions to invasive, life-threatening diseases such as cryptococcal meningitis. Antifungal agents serve as a critical therapeutic class for managing these infections.

Understanding the pharmacologic characteristics of antifungal medications including spectrum of activity, mechanism of action, and pharmacokinetics is essential for effective treatment selection. By protecting the body from external agents, preventing sunburn, and controlling body temperature, skin serves as a barrier for internal organs. Nevertheless, microorganisms can occasionally infiltrate the body and disrupt the skin's protective qualities, resulting in skin infections or illnesses [1]. Skin disorders can be caused by bacteria, viruses, parasites, and fungi; fungal infections are more

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serious because they affect the skin's third layer [2], and fungi affect keratin tissue, which includes skin, nails, and hair [3]. Fungi cause subcutaneous infections in the skin, and in recent years, fungal skin infections have become more common, particularly in people with weakened immune systems [4]. A number of well-known serious skin illnesses (Table 1). Trichophyton species are the primary cause of tinea pedis, tinea facies, tinea magnum, tinea cruris (Jock-itch), and tinea barbae [5,6].

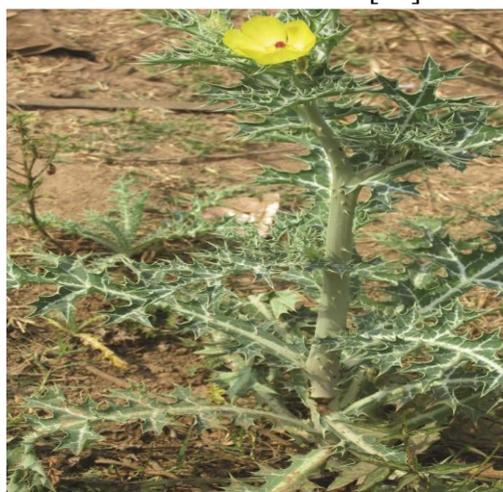
**Table 1: The occurrence of Tinea infection in various body parts [7-12].**

Tinea Infection	Affected Locations
Tinea pedis	Feet
Tinea facies	Face
Tinea magnum	Hands
Tinea corporis	Trunk
Tinea capitis	Scalp

### PLANT PROFILE: A. MEXICANA

There are countless plants on this verdant planet that are regarded as wild or undesirable because they have no economic worth. Even so, these plants have adapted effectively to hostile environments without any extra care. However, every living thing that nature made has value; nothing is worthless. Therefore, the *Argemone Mexicana* has something valuable in its genetic makeup as well. However, to continuously detect scientifically, we need to have keen eyes and a strong desire. Manifold of the plants that were once thought to be worthless or undesirable also contain a number of crucial components [13]. Medicinal herbs are commonly employed to treat several infectious diseases, metabolic problems, and cancer. *Mexicana Argemone L.* frequently found in Maharashtra, India, and many other nations and places. In India, it grows in the temperate region as a weed in waste lands, cultivating fields and road sides [14]. The Indian

medical system known as Ayurveda has been in use for over 2000 years. Certain drugs have a relatively poor response to certain illnesses, such as HIV and tuberculosis. Therefore, Ayurvedic formulations are typically prepared to alleviate these conditions. Roots, stems, leaves, blossoms, and fruits are used to prepare the formulation. We can treat a variety of infections brought on by bacteria, fungi, viruses, parasites, etc. by employing these Ayurvedic formulations [15]. *Argemone Mexicana* is an annual herb, growing up to 120 to 150cm with a slightly branched and extremely spiny. It releases a yellow juice when cut. It has yellow flowers, fruit is numerous, nearly spherical about 1mm in diameter [16].



**(Fig. no.1: A. Mexicana)**

*Argemone Mexicana* is considered an important medicinal plant in India. Different part of this plant is use in chronic skin disease and also use as expectorant, demulcent and diuretic, the seeds and Asthma, ulcers, diarrhoea, and other intestinal disorders are treated with seed oil. Additionally, the human body uses leaves and seeds to maintain appropriate blood circulation and cholesterol levels. These plant parts have antivenom properties. These plants' flowers have expectorant properties and are used to treat coughs; their seeds are used as laxatives and purgatives; and their latex has antibacterial properties and is used to treat conjunctivitis [17].

## 1. Scientific Classification

Rank	Description
Kingdom	Plantae
Division	Magnoliophyte
Class	Magnoliopsida
Order	Papaverales
Family	Papaveraceae
Genus	<i>Argemone</i>
Species	<i>A. mexicana</i> Linn

## 2. Common Names

Language/Region	Name
English	Mexican poppy, Prickly poppy
Hindi	सत्यानाशी, कटाई या भड़भंडा (Satya nashi, Katai, Bhadbhanda)
Sanskrit	Svarnalata
Tamil	Kodiyattu
Bengali	Shivakanta
Marathi	Pival Dhatri

## 3. Botanical Description:

- **Type:** Annual herb
- **Height:** Up to 1.5 meters
- **Stem:** Erect, branched, and covered with sharp prickles
- **Leaves:** Sessile, lobed, bluish-green with white veins and prickly margins
- **Flowers:** Bright yellow, solitary, and large (3–5 cm in diameter)
- **Fruits:** Capsule, oblong, prickly, containing numerous small black seeds
- **Seeds:** Resemble mustard seeds but are *toxic*

## 4. Habitat and Distribution:

- **Native:** Mexico and West Indies
- **Naturalized in:** India, Africa, and tropical America

- **Habitat:** Grows wild on wastelands, roadsides, and dry regions
- **Climate:** Thrives in warm and arid climates [18].

## 5. Biological source:

It consists of dried whole plant of *Argemone Mexicana*.

**Uses:** *Argemone Mexicana* has Antimicrobial, Antifungal action against the bacterial and fungi strain i.e. *Staphylococcus aureus* and *Candida albicans*.

## HISTORICAL BACKGROUND:

Inadvertently, *Argemone Mexicana* has being marketed as a spectacular plant through seeds. Aside from this, a portion of gens or tribes used to cultivate this plant which is essentially for cultural purpose. The plant is still very uncommon, and it is anticipated that it will eventually pose a significant threat to arable or cultivable land. The occurrence of special is extremely successive at the locales of development and it is also favoured for any new landscape's landscaping. The plant's seeds are dispersed efficiently through specific soil, yield, and product pace [19].

## MORPHOLOGY: A. MEXICANA

**Stem:** *Argemone Mexican* stems are cylindrical, straight, herbaceous (not woody), and branching.[20] There are a few long yellowish spines and very short hairs all around the pale greenish stem [21].



(Fig. no.2: *A. Mexicana*'s stem)26

**Leaves:** The leaves are thick, tough, blue-green, alternating, and stocklist, leaf base measures 3 to 8 cm in width and 6 to 20 cm in length [22]. It has also been stated that leaves and seeds can help the human body maintain regular blood circulation and cholesterol levels [23]. Cough, wounds, ulcers, warts, cold sores, cutaneous disorders, skin

conditions, itches, etc. can all benefit from the leaves [24]. The leaf has a smooth upper surface with a midrib and a few spines on the underside. Many spines are present on the leaf's margins [25]. Terpenoids and Flavonoids chemical constituent are present in leaves.

+



(Fig. no. 3: *A. Mexicana*'s Leaves)27

**Flowers:** The flowers are enormous, measuring 4–7 cm in diameter. Five to six spherical, bright yellow petals are present [28]. Chemical Constituents are present in *A. Mexicana*'s Flower (Terpenoids, Amino acid, Flavonoids present in Flowers).



(Fig. no. 4: *A. Mexicana*'s Flower)

**Fruits:** Fruits are oval-shaped capsules that measure 5 centimetres in length and 2 cm in diameter. Rough, golden spines cover it. These fruits open from their apex when they are mature.

It has several seeds and is divided into five compartments [29]. Alkaloids are present in *A. Mexicana's* Fruits



(Fig.no. 5: *A. Mexicana's* Fruits)

**Seeds:** Spinney shells that are about 1.5 inches long are where the seeds are grown. The capsule have about three to five holes that let the seeds spread but a lot of seeds can stay inside the capsule

for weeks until the plant is disturbed by wind or an animal [30]. Alkaloids, Long chain Alcohols, Flavonoids, Phenolic and Aromatic acid, Miscellaneous C. constituent present in seeds.



(Fig. no. 6: *A. Mexicana's* Seeds)31

**Whole plant contain:**

Berberine, Protopine, Pancorin, Argentine, Allocryptopine, Coptisine, Oxyberberin,

Protionamide [32]. Alkaloids and flavonoids also present in whole plant.

**Phytochemical Constituents:**

Phytoconstituent	Phytochemical
Alkaloids	Sanguinarine Berberine Protopine Dihydrosanguinarine Allocryptopine

<b>Flavonoids</b>	Quercetin Kaempferol
<b>Sterols</b>	$\beta$ -Sitosterol
<b>Fatty acids</b>	Palmitic, Oleic, Linoleic acids (in seed oil)
<b>Others</b>	Tannins, Phenols, Glycosides

## PHARMACOLOGICAL ACTIVITIES:

### Antibacterial activity:

Researchers have discovered that plants possess antimicrobial properties. In the study of pharmacology, research on plants as sources of antibiotics has opened a new era [33]. An evaluation of the antibiotic properties of *Argemone Mexicana L.* and its effectiveness against pathogenic bacteria (*e. coli*) and fungi (*C. albicans*) was conducted in this study. Flowers, berries, and leaves were extracted using three solvents: methanol, ethanol, and chloroform. Antibacterial and antifungal experiments were then performed using agar disc diffusion and tube dilution [34].

### Antifungal activity:

A fungal infection (mycosis) is a disease caused by a pathogenic organism called fungi. Fungi are eukaryotic organisms that live in nearly every environment. The skin's protective qualities can sometimes be compromised by microorganisms, resulting in skin infections and illnesses.[35] Bacteria, viruses, parasites, and fungi can cause skin disorders; fungal infections are more serious since they affect the third layer of the skin.[36] In *A. Mexicana's* leaves present Antifungal activity and fungi affect keratin tissue, which includes skin, nails, and hair.[37] Trichophyton species are the primary cause of tinea pedis, tinea facies, tinea

magnum, tinea cruris (Jock-itch), and tinea barbae [38- 39].

### Anticancer activity:

This plants and their separated components have been found to possess significant anticancer properties. Alkaloids are the most common chemical constituents in plants. Alkaloids from *Argemone Mexicana* have been widely researched for their cytotoxic activities in HONE-1, NUGC, A-549, HT-29, and HL-60 cancer cell lines. The six alkaloids found in *A. mexicana* inhibit the proliferation of tumour cells, including 13-oxoprotopin, 8-ethyl dihydro sanguinarine, dehydrocorybulbine, jatrorrhizine, and 8-berberine, were obtained from the aerial part of *A. mexicana* in one study, and their cytotoxicity was tested on a cell line that is derived from a human colon cancer patient. The stem and leaves of *Argemone Mexicana* (*Satya nashi*) can be used to treat cancer, as they have anticancer properties [40-41].

### Anti-inflammatory activity:

These days, it is known that a lot of long-term illnesses are caused by inflammation that doesn't go away. The anti-inflammatory properties of many medicinal plants make them a good alternative for fighting pain and inflammation [42]. It has also been said that *A. mexicana* leaf powder can significantly reduce inflammation in



rats. This effect may be caused by chemical components of the leaf extract, including isorhamnetin-3-O-glucopyranoside, -amyrin, cysteine, and phenylalanine [43].

#### **Anti-ulcer activity:**

The plant *A. mexicana* has been employed in traditional medicine to treat ulcers and related conditions. In everyday life, millions of people suffer from peptic ulcer disease due to its widespread prevalence. Gastric ulcers are those that develop in the stomach, whereas duodenal ulcers are those that develop in the duodenum. The methanolic and aqueous extracts of *A. mexicana* were administered orally to rats for the prevention of duodenal ulcers caused by cysteamine hydrochloride. There is evidence that ethanol leaf extracts of *A. Mexicana* can reduce the gastric pH, volume, and acidity of the stomach. Helicobacter pylori infection, excessive use of nonsteroidal anti-inflammatory medications, smoking, dietary habits, alcohol consumption, and both mental and physical stress play a role [44-45-46].

#### **Antiasthma activity:**

The word "asthma" comes from a Greek word that means "breathless." Asthma is a chronic inflammatory condition of the respiratory system caused by excessive airway narrowing in response to viruses, allergens, and physical activity. A common symptom is chest tightness, wheezing, coughing, and/or dyspnoea, which can last for a short period of time or persist for years at a time. The presence of inflammatory cells in the airway, including eosinophils, macrophages, mast cells, epithelial cells, and activated lymphocytes, is a characteristic of asthma. Numerous cytokines, adhesion molecules, and other mediators are produced by these cells. It has been generally observed that the ethanol extract from the stem

of *Argemone Mexicana* is effective against asthma [47-48].

#### **Antimicrobial activity:**

The aerial and root components of *Argemone mexicana* were collected, cleaned with clean water, and dried in the air. *Argemone Mexicana*'s antibacterial activity was examined at different doses using agar well diffusion. The study involved seven microorganisms, including four bacteria and three fungi. Ampicillin and ketoconazole, two common antibiotics, served as positive controls, while 75% methanol served as a negative control [49].

#### **Medicinal uses/important of A. Mexicana:**

##### **Leaves:**

Black pepper and leaves are combined to treat diabetes. A leaf decoction is used to treat fungal infections, ulcers, and malarial fever.[50] It has also been suggested that leaves and seeds may help maintain normal blood circulation and cholesterol levels in humans, these plant components have anti-venom characteristics as well. The leaves' aqueous extract has been noted for its anti-inflammatory effects. Itching, warts, cold sores, warty skin, coughs, wounds, and other skin conditions can be treated with the leaves. [51-52-53-54]

##### **Roots:**

This root is used to treat skin diseases, leprosy, inflammations, and chronic skin conditions. It is also used as an anthelmintic.[55] It is used as antibacterial, cytotoxicity; wound healing, inflammation, leprosy, antioxidant and antifungal agent. It can be used to treat vesicular calculus, purities and menorrhagia, all forms of poisoning, constipation, flatulence, and colic. A maceration of the roots can also be used to treat hepatobiliary



problems and vaginal discharge. [56-57-58-59-60-61-62]

### Seeds:

Seed oil is purgative and used to treat skin problems. In Mexico, the seeds have been used to treat snake poisoning.[63] Dysentery, ulcers, asthma, and other intestinal afflictions are treated with the seeds and seed oil. In India, the smoke of the seeds is used to relieve toothache. The fresh yellow, milky seed extract includes protein-dissolving chemicals beneficial in the treatment of diuretics, anti-inflammatory, malarial fever, leprosy, scorpion bite, warts, cold sores, wound healing, skin illnesses, itching, jaundice, and an antidote to many poisons. [64-65-66] There are three main properties of the seeds: demulcent, emetic expectorant, and laxative. While its latex is used to treat conjunctivitis. These seeds contain the alkaloids Berberine, Protopine, Protopine hydrochloride, Sanguinarine, and Dihydrosanguinarine, which are capable of improving circulation while simultaneously having psychedelic effects. Its infusion can be used as a sedative for children, but it should be taken with caution as its oil is strong purgative. Snake poison can also be treated with the seed in small amounts. Seeds and seed oil are used to treat dysentery, ulcers, asthma, and other intestinal affections. Latex is used to treat conjunctivitis, and seeds are purgatives and laxatives. [67-68-69-70] The pharmacological effects of Berberine on circulation can be improved in small doses, and it is also hallucinogenic. Other properties of Berberine include spasmolytic, antibacterial, and to some extent antifungal and antiprotozoal effects.[71]

### Juice/Latex:

The latex of *A. mexicana* is applied topically to the area of the boil to treat it. Plant juice is applied to

a scorpion sting. The plant's juice is used as a treatment for scorpion bite.[72] Dropsy, jaundice, skin conditions, leprosy, blisters, indolent ulcers, conjunctivitis, inflammations, burning sensations, and malarial fever can all benefit from the latex.[73] Rheumatic pain is relieved by massaging latex over the body, while eye infections are treated with a thin liquid.[74]

### Flowers:

Flowers are found to be expectorant and used to treatment in a cough. [75] *A. mexicana* was tested for antioxidant potential using 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH) free radical scavenging assay and showed good correlation with the total phenolic (23.5mg GAE/gdw) and the number of flavonoids (34.5 mg QE/gdw). *A. mexicana* flowers showed the most radical scavenging effect (IC<sub>50</sub>=23.75µg/ml). As a result of these results, *A. Mexicana* has the potential to be used as a medicine to treat free radical-induced diseases.[76]

### Whole plant:

*A. Mexicana's* whole plant is effective against guinea-worm infestations, a purgative, and a diuretic. It is widely used to treat venereal sores, photophobia, scorpion bites, and leucorrhoea. The whole plant is also used to treat dental problems.[77] Leprosy, malaria, jaundice, rheumatism, pain, inflammation, skin diseases, fever, piles, warts, dysentery, tumours, and worm infestations can all be treated with the whole plant, roots, leaves, stem, and flowers and also useful for wound healing. It is also used in treating skin diseases and leukoderma.[78] The plant showed significant effects on the healing of duodenal ulcers caused by cysteamine hydrochloride.[79]

### Plant's oil:

The oil is useful in indolent ulcers, wounds, leprosy, skin diseases, constipation, flatulence, colic and rheumatology.[80] The economic usefulness of *A. Mexicana* acc. To the medical system (Unani, Ayurveda, Ethnobotany (Folk and Traditional), Western, Homeopathy, and Chinese).

### Toxicity and safety evaluation:

In recent years, clinical pharmacologists have become increasingly concerned about the safety and efficacy of herbal therapies used for self-medication. Healthcare professionals, including physicians, nurses, chemists, and social workers frequently have a poor awareness of the toxicology and pharmacology related with the most widely prescribed herbal remedies for their patients. Different portions of plants are preferred for treating specific ailments, and traditional Mexican medicine recognises a wide range of healing procedures.[81] Toxicity, the alkaloid Sanguinarine isolated from seeds of *A. mexicana* was examined for its hepatotoxic potential in rats. Argemone Mexicana can target the liver, lungs, kidney and heart. Safety, A phytotherapy derived from *Argemone Mexicana* has been determined to be safe and well-tolerated in humans. The leaves of Argemone Mexicana were shown to be non-toxic in rat studies. Argemone Mexicana is importance of various traditional medicinal system, including Ayurveda, Siddha, Unani, and Homeopathy.

### CONCLUSION

The therapeutic properties of Argemone Mexicana are widely recognized in traditional medicine, making it an important medicinal herb. Furthermore, scientific research has demonstrated its pharmacological efficacy. This plant holds potential for the creation of new medications that do not produce adverse effects. Argemone Mexicana plants must also be conserved and used

appropriately. Numerous studies have been conducted on different parts of *A. mexicana* and proved that the plant can be exploited for the development of new drugs.

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