International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

The Study of Phytochemical Constituents and Medicinal Applications of Argemone Mexicana L

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Abstract

Many plants are considered wild or weed with no economical value, *Argemone Mexicana L.* is one such widely growing neglected weed in almost all the regions of India. *Argemone Mexicana L.* belongs to the family *papaveraceae*, also known as the poppy family, including 44 genera and approximately 460 species of flowering plants. *Argemone Mexicana L.* (Mexican poppy), commonly known as "Satyanasi" in India, is a valuable medicinal plant and considered to have miraculous therapeutic potential. It is used to cure several diseases in the Indian traditional medicine system of Ayurveda for over 5000 years. The leaves, stem, latex, roots and seeds of *Argemone Mexicana L.* have several pharmacological activities. Many of the phytochemical compounds obtained from the *Argemone* seeds are especially effective in the treatment of chronic diarrhea, dysentery, peptic ulcers, as well as respiratory infections. . In this study, many medicinal applications, phytochemical constituents and some hazardous effects of this plant has been highlighted.

Keywords: Argemone Mexicana L., Papaveraceae, Phytochemical Constituents, Medicinal Applications Etc.

Introduction

Argemone Mexicana L. is an annual herb, growing up to 100-140 cm with a slightly branched tap root. The stem is branched and usually extremely prickly. Leaves are thistle-like and alternate, without leaf stalks (petioles), toothed (serrate) and the margins are spiny. The grey-white veins stand out against the bluish-green upper leaf surface. The stem is oblong in cross-section. Flowers are terminal and solitary, yellow and of 2.5-5 cm diameter. Fruit are capsules. Seeds are small about 1 mm in diameter, very numerous, nearly spherical, covered in a fine network of veins, brownish black. It occurs in almost every region of India (Dash & Murth,2011). The plant mostly grown in sandy, well drained, nutritionally poor and alkaline soil (Rastogi & Mehotra, 1979). Scientific studies have validated numerous medicinal applications of *Argemone Mexicana L.*, which include analgesic, antispasmodic, depurative, emetic, antipyretic, sedative, vulnerary, healing dermatological problems *etc*. However, its medicinal property is not much highlighted due to a popular misconception that this plant is poisonous and causes epidemic dropsy, with symptoms including extreme swelling, particularly of the legs, but this is what after the adulteration process of edible oils. The plant is used in different parts of the world for the treatment of several ailments including tumors, warts, skin diseases, inflammation, rheumatism, jaundice, leprosy, microbial infections and malaria. A fatty acids and phytochemical compounds were identified which are utilized in antibacterial, antifungal, anti-inflammatory and antimycotic activities.

Fig.1 *Argemone Mexicana L.*

1. Phytochemical Constituents

Argemone Mexicana L. has lots of Phytochemical which is used for managing of various health problems, and this plant can be also easily accessible and it is economically feasible also (Stary and Hans, 1998). Scientific studies have shown that *Argemone Mexicana L.* contains numerous phytochemical in high levels, such as carotenoids, phenolic, alkaloids, pectins, tannins, coumarins, flavonoids and terpenoids (Sing *et al.*,2012; Khan & Bhadauria,2019). Similarly, various bioactive compounds from those groups have been isolated and identified. The many substances are among the products isolated from the *Argemone Mexicana L.* namely α & β allocryptopines, codeine, paveramine, narcotine, papaverine etc. Important bitter principles derived are papaverosin, chelidoxanthin, glaucopicrin *etc.* (Brahmachari G. *et al.,* 2013; Bhattacharjee I. *et al.*,2010). The fresh flowers of *Argemone Mexicana L.* contain isorhamnetion etc. and seed contain essential oil which is known as Argemone oil while resin contains berberine and protopine (Brahmachari *et al*., 2010). The whole plant of *Argemone Mexicana L.* was reported to possess isoquinoline alkaloids such as berberine, cheilanthifoline, coptisine, muramine, scoulerine, stylopine, cryptopine, thalifone, sanguinarine, protopine, optisine, chelerytherine and benzylisoquinoline alkaloids (Israilov & Yunus, 1986; Santos & Adkilen,1932; Haisova & Savik, 1975; Chang *et al*., 2003; Kenneth & Bentley,2001). Various isoquinoline alkaloids viz. berberine, cryptopine, coptisine, muramine, scoulerine, stylopine, cheilkanthifoline, sanguinarine, sarguinarine, chelerytherine, sanguinarine, thalifoline and protopine have been reported from the plant (Gupta *et al*., 1990). Seed oil otherwise called as Argemone oil reported to contain sanguinarine and dihydrosanguinarine. It also contains palmitic, myristic, oleic and linoleic acids (Bhattacharjee *et al*., 2006). The seed oil also contains 40% free glycerides of fatty acids (Anonymous, 2004).

2. Medicinal and Pharmacological applications

Argemone Mexicana L. shows positive response against the analgesic, narcotic, antispasmodic and sedative properties (Chopra *et al*., 1986). *Argemone Mexicana L.* is used in India as traditional medicine in Ayurveda for jaundice, scabies, cutaneous affections and dropsy (Chopra *et al*., 1956; Ambasta SP,

1986, Sharma *et al*., 2012). Leaves and seeds extract are helps to maintain normal blood circulation and cholesterol level in human (Albuquerque *et al*., 2007). These plant parts possess anti-venom property as well (Makhja & Khamar, 2010; Minu *et al*., 2012). Flowers are found to be expectorant and have been used in the treatment of cough. In Brazil, the plant is commonly known as 'cardo-santo' and used traditionally in the treatment of a number of diseases. Seeds of the plant used as purgative, laxative and digestive while its latex is used against conjunctivitis. *Argemone Mexicana L.* shows great pharmacological activity and it is being used from ancient time. Traditionally the extract from whole plant is beneficial for different types of pharmacological activities like anti-fertility activity, effect on ileum contraction in guinea pig, antimalarial activity, antifungal activity, cytotoxic activity, mollucicidal activity, anti HIV Activity, anti-inflammatory and analgesic activity used in chronic disease and leprosy inflammation anti oxidant. The aerial parts extract of the plant exhibit anti- parasite activity. Every part of *Argemone Mexicana L.* possesses so many medicinal properties, either in small or large proportion. However, different parts of the plant contain same or different active ingredients (Chopra *et al*., 1956, Jaiswal & Sharma, 2020; Alagesaboopathy & Kalaiselvi, 2012). Most of the bioactive compounds are quite harmless whereas toxicity has been evaluated in Argemone oil (Upreti *et al*., 1989). All the parts of the plants are highly useful. They are stem, leaves, flowers, fruits and seeds. It is clearly evident that all parts of *Argemone Mexicana L.* plant having target specific medicinal value.

Wound healing activity

Wound healing activity using excision, incision and dead space wound models in wistar albino rats with different extracts of *Argemone Mexicana L.* leaves. The results revealed that the treatment with methanol extract of leaves of *Argemone Mexicana L.* accelerated wound healing agent in rats (Patil *et al*., 2001).

Antipyretic activity

The antipyretic potential showed by the two doses of drug extract might be attributed to the phytochemical constituents such as alkaloids, glycosides, flavonoids, phenolic compounds as tannins, saponins found in the water aqueous extract of *Argemone Mexicana L.* leaves (Sourabie *et al*, 2012; Owele *et al*,2005).

Anti-diabetic activity

Diabetes mellitus is a chronic metabolic disorder which is characterized by the symptoms of hyperglycemia. The plant of *Argemone Mexicana L.* is known to have anti-diabetic effects in traditional medicine system. Several *in vitro* and *in vivo* studies have been carried out to determine the role of various extracts of different parts of *Argemone Mexicana L.* for potential anti-diabetic activity. The anti-diabetic effect of *Argemone Mexicana L.* aqueous extract was evaluated in a study involving alloxan induced diabetic rats (Nayak *et al*., 2011).

3. Anti inflammatory/Analgesic Activity

Inflammation is a biological process that occurs at the beginning of many pathological situations which releases some anti-inflammatory agents like histamine, kinins, serotonins, and prostaglandin. Inflammation is considered as a primary physiologic defense mechanism that helps the body to protect itself against infection, burn, toxic chemicals, allergens or other noxious stimuli. The term analgesic refers to “relief from pain” and some of the phyto compounds obtained from *Argemone Mexicana L.* have been proved to be very effective analgesic.

Anti-cancer activity

Large numbers of plants and their isolated constituents have been found to possess potential anticancer

activity. Among the ethno-medicinal plants *Argemone Mexicana L.* has been extensively studied to inhibit proliferation of tumor cells since it contains a diverse kind of chemical constituents, alkaloids being most abundant. In one of the study, six alkaloids, 13-oxoprotopine, protomexicine, 8-ethoxydihydrosanguinarine, dehydrocorydalmine, jatrorrhizine, and 8-xyberberine were isolated from aerial part of *Argemone Mexicana L.* and their cytotoxicity were evaluated on SW480 human colon cancer cell line. The cytotoxic activities of isolated alkaloids were evaluated at different concentrations in terms of cell viability. At 200 mg/mL, protomexicine and 13-oxoprotopine showed mild cytotoxicity (~24–28%) where as dehydrocorydalmine exhibited moderate cytotoxicity (~48%) (Singh *et al*., 2015).

Antiulcer/anti-urolithiatic activity

The plant *Argemone Mexicana L.* is traditionally used to treat ulcers and associated diseases. Das *et al* investigated the effect of oral administration of methanolic and aqueous extract of *Argemone Mexicana L.* against cysteamine hydrochloride-induced duodenal ulcerationin rats. The study revealed that both the extracts of the plant produced a significant activity to prevent the development of experimentally induced duodenal ulceration in rats. The aqueous extract at the dose-dependent manner showed the potent activity than methanolic extract. *Argemone Mexicana L.* is also reported to possess diuretic and anti-urolithiasis activity. Urolithiasis is the calcifications that form in the urinary system, initially in the ureter (ureterolithiasis) or kidney (nephrolithiasis) and may also form in or migrate into the lower urinary system like bladder or urethra. Common signs of urolithiasis include reduced urinary volume caused by obstruction of the bladder or urethra by a stone and often described as one of the strongest pain sensations (Das *et al*., 2011).

Larvicidal / anti-parasitic / antimalarial activity

The plant extracts or phytochemical are popularly gaining interest as eco-friendly, environmentally safe, biodegradable, and low-cost natural sources of pest management, to prevent the inevitable toxicity and resistance issues caused by synthetic chemical insecticides. *Argemone Mexicana L.* plant parts have been reported to show mortal effect on various parasitic organisms such as mosquitoes, pests, worms and insects. Several studies have confirmed that

Argemone Mexicana L. contains alkaloids such as berberine, palmatine, sanguinarine, protoberberine, benzophenanthridine, benzylisoquinoline, and protopine that show target specificity to certain vectors causing infectious diseases. Sakthivadivel *et al* evaluated the larvicidal activity of plants leaf extracts against *Culex quinquefasciatus* larvae, the vector of

lymphatic filariasis (Sakthivadivel *et al*., 2012).

4. Antimicrobial (Antifungal/ Antibacterial/ Antiviral) activity

Argemone Mexicana L. plant inhibits the growth of numerous microbes such as viruses, bacteria and pathogenic fungi. Bacteria are the most versatile unicellular pathogens, normally transmitted through soil, water, air and food causes many infectious diseases in humans as well as in animals. Such types of diseases can be treated by many natural products obtained from medicinal plants. Turmeric plant also shown to inhibit the growth of a variety of bacteria, pathogenic fungi and parasites (Pardhe D.D.,2021). The role of *Argemone Mexicana L.* in the prevention of microbial growth is described in a number of research papers. Rahman *et al* studied various extracts (hexane, chloroform, ethyl acetate and ethanol) of *Argemone Mexicana L.* stems *in vitro* and determined the antibacterial activity, using agar diffusion and minimum inhibitory concentration (MIC) determination method against ten (five Gram positive and five Gram negative) food-borne pathogenic bacteria (Rahman *et al*., 2009). Many reports have been carried

out to investigate the antibacterial determines of *Argemone Mexicana L.* extracts (Osho & Adentunji, 2010). *Argemone Mexicana L.* leaves and seeds extracts showed considerable antibacterial activity (Santosh K. Singh *et al*., 2009; Shyam & Dhanpal, 2010). Stem and essential oil of *Argemone Mexicana L.* was found to be good antimicrobial activity (Mashiar *et al*., 2009). The inhibition activity of plants extracts against the growth of microorganisms was attributed to the presence of antioxidants (Perumal *et al*., 2010).

Anti-HIV action

In the methanolic extract of *Argemone Mexicana L.* few alkaloids have been isolated and were evaluated for their anti-HIV action, viz., benzo[c]phenanthridine (+/-)-6-acetonyldihydro chelerythrine showed noteworthy anti-HIV action in H9 lymphocytes cells with EC50 and TI values of 1.77 μ ml-1 and 14.6, respectively (Chang *et al*., 2003).

Anti-asthmatic action

Argemone Mexicana L. seed powder (100–200 mg) taken twice daily for 2 weeks showed noteworthy outcome on the incidence of asthama as antiasthamatic activity (Bhalke and Gosavi, 2009).

Antistress and antiallergic action

Stem of *Argemone Mexicana L.* in asthma induced by leucocytosis and milkinduced eosinophilia showed antiallergic and anti-stress impending. This showed that polar constituents of plant stem are conscientious for anti stress and anti allergic activity (Piacente *et al*., 1997).

***Argemone Mexicana L.* seed oil** has been explored for low cost production of methyl ester. Many researchers examined the *Argemone Mexicana L.* crop pattern and potential of seed production in field conditions, oil extraction process from the seeds and the trans esterification process for ester production. They have also determined economic feasibility in terms of oil production and its methyl ester yield and compared to that of commercial diesel fuel (Singh D & Singh S.P., 2010).

5. Economic impact of *Argemone Mexicana L.* as a weed

Argemone Mexicana L. is a weed for the majority of cropping systems, including millets, cereals, vegetables, legumes, fibre yielding crops (sisal, cotton) and perpetual crops like coffee and sugar cane. It appears that any crop has the impending to be contaminated with *Argemone Mexicana L.* if grown within the habitat array of this plant. Apart from a principal weed of millets, cereals, cotton, vegetables, coffee, timber and fibre yielding plants, this plant is also considered as a potent contaminant in poultry and for grazing animals. The species produces aflatoxins of poisonous nature that are lethal to herbivorous animals, which even found in affected cattle's milk, eggs and their mutton based products (Alemayehu and Desalegn, 2016). *Argemone Mexicana L.* weed reduces biodiversity (Kumar and Rohatgi 1999). The plant is known to produce certain allelochemicals that can affect the seed germination, subsequent growth and content of photosynthetic pigments in nearby plants in native ecosystems (Namkeleja *et al.* (2014).

Conclusion

A weed can also be a good medicine if one is aware of its action. Also it is very essential to know its qualities and actions through unremitting research and development studies. On the basis of a number of studies, regarding this weed it is apparent that this habitually ignored, but remarkably shown plant of the arid regions remarkably has a range of benefits related to health issues. *Argemone Mexicana L* is an important source of various types of compounds with diverse chemical structures as well as many

pharmacological activities. The present study deals with an up to date review on the phyto-chemistey, pharmacology, medicinal uses of *Argemone Mexicana L.* Till date no more pharmacological work is done on this plant. The plant is in need to a greater research emphasis for better utilization of this plant for humankind. This review will be helpful in serve the purpose of aiding in future Research work on this plant.

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