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A PANORAMIC VIEW ON *ARGEMONE MEXICANA*: ITS MEDICINAL IMPORTANCE AND PHYTOCHEMICAL POTENTIALS.

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ABSTRACT

Argemone mexicana, a prickly plant commonly called as prickly poppy is found in sub tropical regions and is well known for its medicinal properties. Its potential as a medicinal plant has been practiced traditionally and been prescribed as medicines by Ayurvedic, Unani, Siddha and Homeopathic practices since several years. Each part of plant posses bio active compounds that help in curing ailments like HIV, malaria, ring worm infections, fungal infections, cancer etc. These activities have been studied in vivo and in vitro set up and results have been obtained in favor. Further, phytochemical evaluation has unveiled the presence of compounds like berberine, *argemonine*, protopine etc, which show curative actions and could be used for treatment of diseases with future preception. This review is a sum up of all literature available through the internet and was searched using keywords '*Argemone mexicana*', 'phytochemical importance of *Argemone*' and many other exclusive words with respect to different activities scanned for reviewing. The references provided in the papers were also given a thorough look and retrieved the respected data from them too. 'Scopus', 'Pubmed', 'Google Scholar', 'Research Gate' were used to search for the relevant papers through different journals available. The literature has then been framed in a way with up gradation about *Argemone mexicana* and its promising affects seen with the potential of the plant which is still undiscovered but could be utilized as curative methods.

Keywords: Curative, Diseases, Medicinal Plant, Phytochemicals, Prickly Poppy

INTRODUCTION

Use of medicinal plants can be dated back to ancient times when these were the only reliable source of treatment of any disease. Use of plants as medicine has been taken into practice since ages in literatures like Ayurveda, Siddha and Unani. Each and every part of a plant has some curative property for any particular disease that could be thought of. According to WHO more than 60% of population still depends on plants as their primary source of treatment specially the tribal population, people living in villages or rural areas or other enthusiasts who found this dependence on natural sources much beneficial in terms of side-effects (Khan and Bhadauria, 2017).

In this context, India, a biodiversity hotspot, a country rich in plant resources traditional knowledge of their usage could exploit the healing properties of plants for their benefit in health. In this row, *Argemone mexicana* could be thought of one such plant with multi-dimensional uses. It is a prickly plant commonly called 'Mexican poppy' and 'satynashi' in hindi is found in US, India, Ethopia, etc (Das and Misra, 1987). This is mainly found in abundant places, near wells and road side. It is a wild type on plant and prefers somewhat alkaline soil for its growth. Although it is poisonous in nature and seeds were been used with mustard seeds as an adulterant as observed cases of food adulteration. Traditionally the plant has been taken in use to cure fungal infections, skin disease, ringworm, jaundice, etc by the folks. The oil from seeds has been used to cure ulcers and intestinal infections, relieving of tooth ache, treating scorpion sting etc (Shaukat *et al.,* 2002; Kala, 2005). Further with improvement in technology and introduction of *in vitro* and *in vivo* experimentations certain activities have also been studied exhibited by the plant parts like anti-HIV, anti-malarial, anti-cancerous, cytotoxicity etc. Active phytochemicals have been reported from different parts of plants that are responsible for the curative responses. They include alkaloids like berberine, chleritherine, sargurinanrine, fatty acids like palmitic acid, oleic acid, etc (Merlin *et al.,* 2007; Ji *et al.,* 2011).

Morphological Description: *Argemone mexicana* belonging to family Papavercaea is commonly called as Mexican poppy; it is prickly, dicot plant. Its height vary from 0.3 m to 1.2 m. Stem is green in color and oblong. Leaves are green with white veins and yellow flower which is terminal. A fruit is in oval capsule covered with prickles all over. Whole plant is covered in prickles and hence it got it name 'prickly poppy'. This is a wild plant that grow as a weed near road side, wells, abandoned lands, near fields, agricultural waste lands etc. It prefers little alkaline medium for growth and light sandy soil.

It is widely distributed in tropical and sub-tropical countries like United States, Ethopia, Africa, Mexico and Bangladesh and could be found widely in every part of India (Zafar *et al.,* 2010).

Classification:

Kingdom- Plantae

Subkingdom - Tracheobionta

Superdivision - Spermatophyta

Division- Magnoliophyta

Class- Magnoliopsida

Subclass- Magnoliidae

Order- Papaverales

Family- Papaveraceae

Genus- *Argemone*

Species- *Argemone mexicana* L

Vernacular names:

Its vernacular names are as follows:

Hindi- Satyanashi

Sanskrit- Kankkshiri

Bengali-Barashit-kantal

Kannada- Datturigidda

Konkani - Phirangi-dhutro

Malayalam- Ponnummattu

Marathi -Phirangi-dhotra

Tamil - Kudiyotti

Telugu-Brahmadandi

Medicinal importance and uses: Further going into chemical profiling of the plant, several useful bioactive compounds have been discovered till date. A large group of phytochemicals belonging to the alkaloid group have been screened including isoquinoline, berebrine, protopine, chelerythrine and many more (Nakkady and Shamma, 1998). Other groups found include phenolics (tannic acid), amino acids (cysteine, phenylalanine), fatty acid, flavanoids etc (Sukumar *et al.,* 1984; Dinda and Bandyopadhyay, 1986). These bioactive compounds hold medicinal importance and act accordingly on different kinds of diseases is given in details below. The plant have been used since ancient times to cure many disease like tooth ache, scabies, malaria, snake bites, jaundice, opthalmia, dropsy etc (Sharma *et al.,* 2012). That was the time when even the present studied and propagated science and technology didn't exist and medicinal treatment was based only on practices and observation. Use of *Argemone mexicana* has been reported in many diseases as shown in table no 1.

In vitro* evaluation of activities of different parts of *Argemone mexicana: The past experimentations and researches that have supported the use of *A. mexicana* in various kinds of ailments and conditions have been described categorically below and represented in tabular form in table no 2.

Anti-microbial activity: *A.mexicana* has been a plant that has been in used since years even by the tribal for its established use as an anti-microbial agent. The crude extracts of plant consist of chemicals that are likely to induce toxic activities against microbes. Rahman *et al.,* 2009 studied crude stem hexane, chloroform, ethyl acetate and alcohol extracts against food borne gram negative and positive bacteria like *Bacillus subtilis, Staphylococcus aureus, Listeria monocytogenes, Clostridium botulinum, Clostridium perfringens, Escherichia coli, Pseudomonas aeruginosa* and *Salmonella typhimurium.* On the other hand in the same year Singh *et al,.* 2009 used extact from the seeds to study activity against *E. coli, P. aeroginosa, Enterococcus* sp. *Salmonella typhi, and S. aureus.* Chloroform extract was used and results were foun to be positive.

Fruit of *A.mexicana* waa also used wirh 50% aqueous methanolic extract which showed positive result in inhibition of *Klebsiella oxytoca, Vibrio damsella, Enterobactor aerogens* and *E. coli* (Jain *et al.,* 2012). Similar findings were reported by Pandey and Karanwal, 2011 and Bhardwaj *et al.,* 2012 that advocated use of ethanolic exctracts of seeds showing significant anti-bacterial activities against *P. aeruginosa, E. coli* and *S. aureus*.

Ethanolic extracts of *A.mexicana* were found to have anti- bacterial potential against *Streptococcus mutans* and *Porphyromonas gingivalis* that cause oral cavity infection (Rosas-Pinon *et al.,* 2012). Leaf extracts (acetone, methanol, ethanol, aqueous) were found to work on drug resistant strain of *P. aeruginosa* (Sahu *et al.,* 2012) chloroform extract of leaves, stem and roots were also found to show activity against *E. coli, Klebsiella pneumoniae, Bacillus cereus* and *S. aureus* that too were drug resistant (Alagesaboopathi and Kalaiselvi, 2012).

Alkaloid *N*-demethyloxysanguinarine was found to be the main responsible phytochemical responsible for such activity. Other studies included *Streptococcus agalactiae, Escherichia coli, Staphylococcus aureus* and *Klebsiella pneumonia* getting resisted by aqueous and alcoholic extract of leaves (Doss *et al.,* 2012). Whereas, water borne pathogens like *E. coli, Shigella* sp., *Staphylococcus* sp. and *Salmonella* sp were found to get resisted by petroleum ether, acetone, ethyl acetate extracts of leaves and stem (Rahman *et al.,*2009).

Wound healing activity: Use of *Argemone mexicana* has been taken into use since ages for curing of external wounds. This was experimented by Ghosh and group in 2005 that evaluated the wound healing activity of leaf extract and latex on incision and excision type of wounds (Ghosh *et al.,*2005). As per the investigations carried out, it was seen that after 12 days of post wounding

period, significant wound healing activity was observed which was although not as effective as the standard nitrofurazone but still has shown visible affects. Wound healing and antimicrobial activity *Argemone mexicana* in experimental rats were reported (Dash and Murthy, 2011) .

Impotency/anti-fertility activity: The seeds of *Argemone mexicana* could be utilized to create impotency or can act as natural anti-fertility with the administered doses. It was studied in spermatogenesis in dogs. With the administration of seed extract, inhibitory activity of late spermatids at stage 3 was observed in dogs. A decrease of 95-97% in spermatid count was also observed in experiments carried by Gupta *et al.,* 1990 (Gupta *et al.,* 1990).

Larvicidal and Chemostiraant activity: Larvicidal activity of any compounds is a thing that could be exploited espically in the season that favours mosquito breeding leading to fever transmitted by them. Larvicdal property has been studied in *A. aegypti* and *culex.* A siginificant LC50 activity has been noted for 2nd-3rd 4th instar larvae of these mosquiots using acetone fraction of petroleum ether extract at both natural and laboratory conditions (Sakthivadivel and Thilagavathy, 2003; Sakthivadivel *et al.,* 2012).

Mollusicidal activity: Fatal activity on snail has been observed by Singh and Singh, 1999 from the seed extract of *A.mexicana.* protopine and sanguinarine from the seeds were identified to act deadly on snails by decresing the level of proteins, DNA, RNA in nervous tissue of *Lymnaea acuminate.* Seed powder could be used to contol snail population and cause death (Singh and Singh, 1999).

Anti- – oxidant activity: Different extracts from leaves and roots have been reported to exhibit scavenging activities. Roots were been tested against DPPH (85.17%), ABTS (75.27%) and H2O2 (84.25%) radicals and activity was seen on other hand leaves were reported to exhibit superoxide anion scavenging activity by Nitro blue tetrazolium assay (Bhardwaj *et al.*, 2011).

Cytotoxic activity: Uddin and group in 2011 tested extract from leaves to exhibit cytotoxic activites against human cancer cell lines (AGS, HT-29, MDA-MB-435S) with the help of MTT assay. Methaolic extracts was found to be most efficient in comparison to others and showed feasible amount of acitivty against MDA-MB-435S cell lines. Other lines tested by Chang *et al.,* 2003 included HONE-1 and NUGC cancer cell lines and alkaloids like angoline, chelerythrine, *N*-demethyloxysanguinarine etc were the most active types causing the cytotoxic effect.

Anti-diabetic activity: Rout *et al.,* 2011 experimented extract from aerial parts of *A. mexicana* on diabetic rats. It showed hypoglycemic efficacy in the rats that were administered with the aqueous extract of aerial part of plant. Reduction in glucose level, creatinine, urea, cholesterol and triglyceride values were observed as results with the gaining of lost body weight. A doses of 400 mg/kg was found to be effective and comparable to the standard drug for diabetes that is metformin which shows efficacy with the dose of 300mg/kg body weight and hence the result seem to be satisfactory.

Hepato-protective activity: Das *et al.,* 2009 examined the anti- hepatoprotective activity of aqueous extract of stem of *A.mexicana* in male albino wistar rats induced with carbon tetrachloride. The extract was found to be useful to decrese serum asparate transaminase, alanine aminotransferase and alkaline phosphatase levels in the rats. Another group of researchers used crude leaf powder to demonstrate activity against CCl4-induced hepatotoxicity and found significant increase in ASAT/ GOT (aspartate aminotransferase), ALAT/GPT (alanine aminotransferase) and ALP (alkaline phosphate) while decrease in total bilirubin (TBIL) and direct bilirubin (Sourabie *et al.,* 2019).

Anti-HIV: Methanolic extract isolated from air dried plant of *A mexicana* was found to show anti- HIV activity against H9 lymphocytes (Leyva-Peralta *et al.,* 2015).

Anti-fungal activity: Seed extracts from *A.mexicana* was found to be fungitoxic against fungal strains like *Trichophytan mentagrophytes,* leaf extract exhibit activity against fruit pathogens like *Alternaria alternata, Dreschlera halodes*, and *Helminthosporium speciferum* (Srivastava and Srivastava, 1998).

Nematicidal: Seed oil from *A.mexicana* was reported to kill *Meloidogyne incognita* larvae in only 17 mins. Reduction in nematode infections in roots and soil was observed after application of aqueous mixture (0.2%) with leaves of *Hibiscus esculentus* inoculated with *M. incognita* which supported as an evident in the nematicidal property of *A.mexicana* (Nath *et al.,* 1982). The plant extract was tested and reported to kill the nematode population in field where larvae was found to bloom.

Vasoconstrictor and vasorelaxant: The vascular effect of methanolic extracts from aerial parts of *A. mexicana* was observed by Paez-Sanchez and coworkers in 2006 in aortic lines of rats. It was found that relaxation from contraction was induced in a contraction dependent way. It could be concluded with the experiment that a direct effect is laid upon smooth muscle by the adrenergic receptors.

Anti-feedant: Petroleum ether and aqueous leaf extracts of *A. mexicana* was found to exhibit significant anti- feedant activity against second stage larvae of *Henosephilachna vigintiocto puncata* (Gacche *et al.,*2011).

Anti-cancerous: Extracts from leaves specially have been reported to possess anti-cancerous activity against human cell lines of HeLa-B75, HL-60 and PN-15. Methanolic extract of leaves has shown considerable amount of activity against HeLa and MCF-7 cancer cell

evaluated using the MTT assay. The nature of activity was also found to be apoptotic not necrosis which could be predicted under the influence of flavanoid and alkaloids present (Gacche *et al.,* 2011; Gali *et al.,* 2011).

Anti-inflammatory activity: Notable and significant anti-inflammatory activity has been observed with addition to analgesic activity on rats by the ethnolic extracts of leaves. Cysteine, phenylalanine could be held responsible for the activity (Sukumar *et al.,* 1984).

Anti-helminthic activity: The aqueous plant extract showed significant action against Indian earthworm or *Pheritima posthuman* (Jaliwala *et al.,* 2011). This experiment was carried on at a dose dependent manner and anti-helminthic activity was observed at a concentration of 100mg/ml. Another helminthes that was used as the experimental model was *Ascardia galli* and significant activities were seen against this too.

Immunomodulatory activity: *Argemone mexicana* was reported to decrease the cell mediated immune response in albino rats (Goel *et al.,* 2008). But increased humoral response against Salmonella antigen was found in chicken model (Varshney *et al.,* 2013).

Miscellaneous activities reported: Other miscellaneous activities have also been reported by some reporters including anti-asthmatic, anti-stress, anti-malarial etc. A dose-escalating clinical trial was performed by using decoction of *A.mexicana* and was given 3 times a day. All patients had symptom and infection of *Plasmodium falciparum* and at 14th day, the results could be seen in all patients including children to meet out the infection in body. Other activities reported includes applications in neuropharamacology, the plant was found to relaxant activity on mouse and extracts showed potency for central nervous system showing analgesic, anxiolytic and sedative effects (Amartha and Chaudhari, 2011). Similarily aqueous extracts showed decrease in leucocytes and eosinophils responsible fpr anti-stress and anti-allergic activity in a work done by Piacente in 1997 (Piacente *et al.,* 1998).

Toxicity: As mentioned, *Argemone mexicana* is a wild and toxic plant and its safety and toxicity evaluation are a necessary point to deal with. Works showed plant extracts inhibit acute toxicity when administered IP. Seeds oil of plant has an alkaloid sanguinarine that induce the toxic effect (Ibrahim and Ibrahim, 2009). The compound is inconvertible by redox process and can cause glaucoma and epidemic dropsy (Verma *et al.,* 2001). The process of toxicity is still not understood but it is believed that the sanguinarine present interferes with the oxidation of pyruvic acid and accumulate causing dilation in capillaries and arterioles (Husain *et al.,* 1999). It is also reported to be hepatotoxic in rats and increase the activity of SGPT and SGOT (Dalvi, 1985).

In a case highlighted, people used to mix mustard oil (*Brassica nigra*) with *argemone* oil but this could lead to epidemic dropsy even if consumed for short time period. This could cause serious threat to human health (Challagundla *et al.,* 2007).

DISCUSSION

Argemone mexicana, a wild plant with prickly spines all over the surface is found to be growing at abundant and moist place, near wells, road, etc. It has been found to hold a treasure of phytochemicals that have medicinal potentials and could be used to deal with ailments. Most important factors behind using of phytochemicals for treatment are the approach by every kind to economical section of the society and null- side effects that could be seen in contrast to the allopathic medicines administered. Experimental studies have supported the use of *A. mexicana* effective in many diseases as mentioned in the review but also at the same time, the point of safety evaluation could also be taken into consideration as it being a toxic plant. The seeds were used as adulterants with the mustard seeds after the incident was highlighted few years back. This gathered information about the plant could help future researchers for the work related to use and development of pharmacological drugs that could be pocket friendly and easily available with good amount of efficiency, this could be anticipated in future. Systematic researches in all relevant aspects could help to achieve the goal.

CONCLUSION

Argemone mexicana has been identified as a plant with wide spectrum use and most important use as an indigenous medicine. Several applications have been discussed in the review that favors the medical application of the plant. Being a wild plant it is easily procurable and available in abundance in the season. Belonging to the Papavercaea family or the poppy family, it is commonly known as Mexican poppy and has been taken into use as a traditional medicine to cure skin infections, tumors, malaria, warts. Rheumatoid pain and the list continues, the plant is found to be effiecient in pharmaceutical aspects tooand hence several more researches were and are been carried out to unveil many more uses of the plant which was supported by experimentation including activities like Anti- HIV, Anti-fertility, Anti-cancerous, etc and the concluding results were found to be positive. The plant is rich in alkaloids and also contains many kinds of phenols, flavanoids, carboxylic acid, amino acids etc. All are distributed over the, plant parts but some have exclusive existence amongst the parts of the plant. Apart from the uses A. mexicana has also been identified as a toxic plant, its safety evaluation is also a point to be considered. Hence, up-to date information about the plant has been tried to assemble in the review.

CONFLICT OF INTEREST

The authors declare no conflict of interest

Table no 1: Traditional uses of *Argemone mexicana*

Name of plant part	Traditional use	Reference
Whole plant	Used to cure malaria, leprosy, leucoderma, leucorrheoa, skin disease, bronchitis, whopping cough, itches, mild pain killer, guinea-worm infestation, purgative, dental disorder, cold sores, dysentery, rheumatism pain, inflammation, fever, piles, tumor, worm infection, snake venom, scorpion bite, photophobia, warts	Minu *et al.*, 2012
Leaves	Used to cure Malaria, ulcer, blood circulation, cholesterol level maintenance, stomach ache, warts, cold sore, used in baths to help in muscle pain, skin infection	More and Kharat, 2016
Roots	Use to treat leprosy, skin disease, wounds, fungal infections, cough, chest pain, to stimulate uterine stimulation, used as anti-dote for all types of poisoning, malarial fever, vaginal discharge, liver problems	Brahmachari *et al.*, 2010
Seeds	Used as anti-dote for all kinds of poisoning specially snake poisoning, used to relive toothache, help in inflammation, warts, cold sores, wound healing, , ulcers, itches, intestinal infection, conjunctivitis, asthma	Kala, 2005
Flowers	Used to treat boils, dermatitis, scorpion sting, wound dressing, as disinfectant for open wounds, for blisters, eye infection, skin disease, ulcer, conjunctivitis, is massaged on body for rheumatic pain	Agra, 2007

Table no 2: Phytochemicals reported in *Argemone mexicana* with reported biological activities

Name Of Phytochemical	Part of Plant	Biological activities	References
11-Oxo Octacosanoic Acid	Seeds	Not reported	Gunstone *et al.*, 1977
11-Oxo Triacontanoic Acid	Seeds	Not reported	Fletcher *et al.*, 1993
13-Oxoprotopine	Aerial Parts	Colon cancer	Singh *et al.*, 2012
5,7-Dihydroxy Chromone-7-Neohesperidoside	Seeds	Not reported	Bhardwaj *et al.*, 1982
6-Acetonyl Dihydrochelerythrine	Whole plant	Anti- HIV	Chang *et al.*, 2003
8-Methoxy Dihydrosanguinarine	Seeds	Colon cancer	Chang *et al.*, 2003
9-Oxo Octacosanoic Acid	Seeds	Anti-microbial	Gunstone *et al.*, 1977
Adenine	Aerial Parts	Not reported	Chang *et al.*, 2003
Adenosine	Aerial Parts	Not reported	Chang *et al.*, 2003
Allocryptopine	Whole Plant	Anti-malarial	Avello Simoes Pires, 2009
Angoline	Whole Plant	Cytotoxic, Anti- canerous (nasopharyngeal, breast, cervical)	Brahamchari *et al.*, 2013
Arachidic Acid	Whole plant	Not reported	Badami & Gunstone, 1962
Argemexicaine	Whole Plant	Anti-microbial	Chang *et al.*, 2003
Argemexirine	Whole Plant, Aerial Parts	Anti-microbial	Singh *et al.*, 2010
Argemonic Acid	Whole Plant	Anti-microbial	Rukmini, 1975
Argemonine	Plant Resin	Leukemia, B-cell lymphoma, cervical cancer,	Leyva-Peralta *et al.*, 2015
Argenaxine		Cytotoxic	Chang *et al.*, 2003
Argenaxine	Aerial Part	Cytotoxic, anti- cancerous (Gall bladder, Breast cancer)	Chang *et al.*, 2003
Arnottianamide	Whole Plant	Not reported	Chang *et al.*, 2003
Benzoic Acid	Seeds	Anti-microbial	Dwivedi *et al.*, 2008
Benzphetamine N-Demethylase	Seeds	Anti-microbial	Chang *et al.*, 2003
Berberine	Apigeal Parts And Seeds	Anti-fertility, Anti-malarial, Anti-cancerous (for ovarian, lung, breast, cervical and Leukemia)	Avello Simoes Pires, 2009; Tan *et al.*, 2011
Caffeic Acid	Seeds	Anti-oxidant	Singh *et al.*, 2010
Cheilanthifoline	Apigeal Parts	Anti-inflammatory	Israilov *et al.*, 1986; Haisova & Slavik, 1975; Shamma, 1972
Chelerythrine	Whole Plant	Cytotoxic, Anti-canerous (Gastric, nasopharyngeal and breast)	Almeida *et al.*,2017

Name Of Phytochemical	Part of Plant	Biological activities	References
Cinnamic Acid	Seeds	Anti-oxidant, Anti-inflammatory, Anti-microbial	Dwivedi *et al.*, 2008
Columbamine	Whole Plant	Anti-inflammatory	Singh *et al.*, 2010
Coptisine	Whole Plant	Anti-inflammatory	Singh *et al.*, 2010
Cryptopine	Whole Plant	Anti- fertility, Anti-oxidant	Haisova & Slavik, 1975
Cysteine	Leaves	Anti-inflammatory, analgesic	Sukumar *et al.*, 1984
Dehydrocheilanthifoline	Whole Plant	Not reported	Chang *et al.*, 2003
Dehydrocorydalmine	Whole Plant	Anti- cancerous (colon), Anti-fungal	Singh *et al.*, 2010
Dihydrocoptisine	Whole Plant	Anti-inflammatory, Vasoconstrictor and vasorelaxant	Singh *et al.*, 2010
Dihydropalmatine Hydroxide	Seeds	Anti- fertility	Gupta *et al.*, 1990
Dihydrosanguiranine	Whole Plant	Anti-microbial	Chang *et al.*, 2003
Eriodictyol	Seeds	Anti-inflammatory, Anti-oxidant	Harborne & Williams, 1983
Ferulic Acid	Seeds	Anti-oxidant, Anti-inflammatory, Anti-microbial, Anti-allergic, Hepatoprotective, Anti- cancerous	Singh *et al.*, 2012
Hentriacontane-3,20-Diol	Flowers	Anti-microbial	Brahmachari *et al.*, 2010
Higenamine	Aerial Part	Cytotoxic , Anti- Cancerous (Gall bladder, Breast cancer)	Iqbal *et al.*, 2017
Isocorydine	Apigeal Parts	Anti- cancerous (Hepatic), Anti-oxidant	Israilov *et al.*, 1986
Isorhamnetin	Flowers	Anti-oxidant, Anti- cancerous, Anti-microbial, Anti-inflammatory	Rahman & Ilyas, 1962
Isorhamnetin-3-O-B-Dglucopyanoside	Leaves, Flowers	Anti-oxidant	Chang *et al.*, 2003
Isorhamnetin-7-O-B-Ddigluco-pyanoside	Flowers	Anti-oxidant, Anti- cancerous	Rahman & Ilyas, 1962
Jatrorrhizine	Whole Plant	Colon cancer	Singh *et al.*, 2010
Linoleic Acid		Not reported	Badami & Gunstone, 1962
Luteolin	Seeds	Anti-oxidant, Anti- cancerous	Harborne and Williams, 1983
Mexicanic Acid	Aerial Parts	Anti-oxidant, Anti- cancerous, Anti-microbial	Dinda & Banerjee, 1987
Mexitin	Aerial Parts	Not reported	Singh *et al.*, 2012
Muramine	Whole Plant	Not reported	Nakkady *et al.*, 1988
Myristic Acid	Seeds	Anti-oxidant	Rukmini, 1975
N-Demethyloxysanguinarine	Seeds	Cytotoxic	Chang *et al.*, 2003
Nor-Chelerythrine	Whole Plant	Anti- cancerous	Haisova & Slavik, 1975
Nor-Sanguinarine	Whole Plant	Cytotoxic	Tripathi *et al.*, 1999
Oleic Acid	Seeds	Not reported	Badami & Gunstone, 1962
O-Methylzanthoxyline	Whole Plant	Anti-oxidant, Anti- cancerous, Anti-microbial, Anti-inflammatory	Chang *et al.*, 2003
Oxyberberine	Whole Plant	Anti- cancerous (Colon), Anti-fungal	More and Kharat, 2016
Oxyhydrastinine	Whole Plant	Anti-oxidant	Nakkady *et al.*, 1988
Palmitic Acid	Seeds	Not reported	Badami & Gunstone, 1962
Pancorine	Aerial Part	Cytotoxic, Anti- cancerous (Gall bladder, breast)	Chang *et al.*, 2003
Phenylalanine	Leaves	Anti-inflammatory, analgesic	Sukumar *et al.*, 1984
Protoberberine	Apigeal Parts And Seeds	Anti-cancerous (Ovarian cancer, breast cancer, lung cancer, gastric cancer,cervical cancer)	Jing and Zhengwei, 2008
Protomexicine	Aerial Parts	Colon cancer	Singh *et al.*, 2012
Protopine		Anti- fertility, effect on guinea pig ileum, , Mollucicidal	Singh & Singh, 1999; Avello Simoes Pires, 2009

Name Of Phytochemical	Part of Plant	Biological activities	References
Quercetin	Whole Plant	Anti-oxidant	Singh *et al.*, 2011
Reticuline	Aerial And Apigeal Parts	Cytotoxic, Anti- cancerous (naso-pharyngeal, Gastric)	Chang *et al.*, 2003
Rutin	Whole Plant, Aerial Parts	Anti-fungal	Singh *et al.*, 2011
Sanguinarine	Seeds	Mollucicidal, Cytotoxic, Anti- cancerous (Cervical, Colorectal)	Haisova & Slavik, 1975; Xu *et al.*, 2012
Scoulerine	Apigeal Parts	Cytotoxic	Shamma,1972
Sn-Glycerol-1-Eicosa-9,12-Die-noate-2-Palmitoleate-3-Linoleate	Seeds	Not reported	Saleh *et al.*, 1987
Stearic Acid	Seeds	Anti-oxidant	Badami & Gunstone, 1962
Stylopine	Whole Plant	Mollucicidal, Cytotoxic, Anti- cancerous	Haisova & Slavik, 1975
Tannic Acid	Whole Plant	Not reported	Singh *et al.*, 2010
Tetradecanoic Acid	Whole Plant	Anti-oxidant, Anti- cancerous, Anti-inflammatory	Badami & Gunstone, 1962
Tetrahydrocoptisine	Whole Plant	Anti-inflammatory	Singh *et al.*, 2010
Thalifoline	Whole Plant	Anti- cancerous	Nakkady *et al.*, 1988
Triacotan-6, 11-Diol	Aerial Parts	Anti-inflammatory	Sangwan & Malik, 1998
Vanillic Acid	Flowers	Anti-microbial	Pathak *et al.*, 1985
A-Tocopherol	Aerial Parts	Anti-oxidant	Chang *et al.*, 2003
β-Amyrin	Leaves	Anti-inflammatory, analgesic	Sukumar *et al.*, 1984

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