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Research Article

PHYTOCHEMICAL AND PHARMACOLOGICAL EVALUATION OF *ARGEMONE MEXICANA*

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Abstract:

Introduction: *Argemone mexicana* is one of the most important plant belonging to papaveraceae family. It is native to India and grows in tropical and subtropical areas of the world. It used as anti-diabetic, anti inflammatory, anti fertility, anti bacterial, anti fungal. Therefore the present review is aimed to highlight the botanical characters, its Phytochemical and pharmacological activities in various diseases.

Aim & Objective: The present study aimed at the extensive scientific evaluation of extracts and fractions of the aerial parts of *Argemone mexicana* Linn. followed by chromatographic separation, isolation, characterization and study of phytoconstituents and pharmacological activity from potent fractions.

Results: The phytochemical screening indicated the presence of alkaloids, carbohydrates, triterpenoids, phytosterols, saponins, and tannins in extracts/fractions of *A. Mexicana*.

Key words: Traditional, phytochemical screening, medicinal, *Argemone Mexicana*, papaveraceae.

Introduction:

Argemone mexicana Linn is a road sided plant available abundantly in all parts of India. It is belonging to the family papaveraceae and extensively distributed throughout the subtropical and tropical regions of the world (1). Commonly it is known as 'Mexican prickly poppy' and 'Satyanashi'. *A. mexicana* is a weed generally available in the agricultural and waste lands. It is an erect, prickly annual herb, up to 1.2 meter in height, naturalized throughout India up an altitude of 1,500 meter (2). It is a prickly, glabrous, branching herb with yellow juice and showy yellow flowers. The Sanskrit name Svarnakshiri is given because of the yellow juice (Svarna – Gold; Kshiri - Juice). The height of the plant varies between 60-90 cm, Leaves are thistle like. Stem clasping; Oblong, sinuately spinous and veins are white. Flowers are terminal, yellow and 2.5 – 5.0cm in diameter. Fruits are capsule. Prickly and oblong ovoid. Seeds numerous, globose, netted and brownish black. Flowering time is all around the year in Indian conditions. The plant is toxic to the animals and cattle avoid grazing this plant.

Throughout the hotter parts of India, in areas up to 1500m elevation on road sides and waste places.

Figure 1:Plant of *Argemone mexicana* Linn.

Traditional Uses and ethnopharmacology of *A. mexicana* Linn

In ayurveda whole plant is used as Guinea worm infestations, Purgative, Diuretic, leprosy, skin – diseases, inflammation and bilious fevers, seeds are used as Antidote in Snake poisoning, Emetic, Expectorant, Demulcent, Laxative, Curing warts, Cold sores, cutaneous infections, itches, jaundice & Dropsy, Juice of plant used as Ophthalmic, Opacity of Cornea, dropsy, jaundice, skin diseases, leprosy, blisters, conjunctivitis, Roots are Used in Leprosy, Inflammations, pruritus, blennorrhagia. In Homeopathy whole plant used as Tapeworm infections, Whooping cough & Bronchitis. In siddha whole plant used in Venereal sores, photophobia, scorpion bite,

leucorrhoea, the latex of *A. mexicana* used to treat boils by topical application on the site of boils and treat Dental disorders, Leaf decoction is used in the treatment of malarial fever and ulcers, leaves along with black pepper are used to cure diabetes and seeds are used in Leprosy, Jaundice & Dropsy. In unani system whole plant Acts in enrichment of blood showing the activity as an Aphrodisiac and Expectorant and Skin diseases & Leucoderma(3-8)

Pharmacological activities of *A. mexicana*

Several pharmacological activities Antibacterial, antifungal, anticancer, Analgesic antipyretic & anti-inflammatory, Antimutagenic, wound healing, hepatoprotactive, antioxidant, Toxicity study, Acetylcholinesterase inhibitory potential, Anthelmintic, Central nervous system activities, Antitrichomonal, Aphrodisiac, vasoconstriction activity of different parts of the plants had been reported.(9-18)

Phytochemical constituents in *A. mexicana*

Presence of various phyto-constituents had been reported by several authors and the important phyto-constituents Berberine & Protopine from Apigeal parts (Seeds), Dehydrocorydalmine, Allocryptopine, (±)-6-acetonyl dihydrochelerythrine, Angoline, oxyberberine & Chelerythrine from Whole plants, (+)-reticuline from Apigeal parts & Aerial parts, (+)-argenaxine, (+)-higenamine, Pancorine, N-demethyloxysanguinarine, Protomexicine, mexitin, 8-methoxydihydrosanguinarine, 13-oxoprotopine, rutin and quercetrin, Triacontane-6,l I-diol from Aerial parts , β-amyrin, Cysteine, Phenylalanine, Isorhamnetin from leaves, Sanguinarine, dihydropalmatine hydroxide, N methyloxysanguinarine, 5, 7, 2', 6'-tetrahydroxyflavone and 5, 'I-dihydroxychromone 7-neohesperidoside, Luteolin and eriodictyol from seeds, Nor-sanguinarine from roots and Isorhamnetin-7-O-β-D-glucopyanoside, Isorhamnetin, Hentriacontane-3,20-diol from flowers reported to be present in different parts of the plant.(19-24)

MATERIAL AND METHODS

- **PlantSelection:** The selection of plant species for our study was based on their traditional use for diabetes treatment, the information being gathered from published sources and traditional healers. The plants aerial parts of *Argemone mexicana* Linn. was selected for the present studies.
- **Collection and identification:** Fresh and mature plant of *A. Mexican* L was, collected from the road side area from pali, Rajasthan, India, during summer and was authenticated. After due authentication, fresh matured leaf parts *A. Mexicana* L was collected in bulk, initially rinsed thoroughly with distilled water, shade dried for 15 days. The shade dried materials were coarsely powder by a mechanical grinder and preserved in a nylon bag in a deep freezer, till further use.
- **Preparation of plant material (leaf part):** The extraction yield of the extracts from plant species is vastly depends on the solvent polarity, which find out both qualitatively and quantitatively the extracted compounds. Ethanol and water are the commonly used solvent for the extraction because of their low toxicity and high extraction yield with the advantage of modulating the polarity of the solvent by using mixtures at different ratios (Jackson et al, 1996).The plant materials (1 kg) were initially defatted with petroleum ether and then extracted with alcohol and water using a Soxhlet apparatus. The yield of the plant extracts ethanol (95%) and aqueous measured about 20 g each after evaporating the solvent using water bath. The standard extracts obtained from *A. mexicana* were then stored in a refrigerator at 4°C for further use for phytochemical investigation and pharmacological screening.

Physiological parameters of Powder material

- **Determination of total ash value:**Accurately weighed about 3 gms of air dried powdered drug was taken in a tared silica crucible and incinerated by gradually increasing the temperature to make it dull red hot until free from carbon. Cooled and weighed, repeated for constant value. Then the percentage of total ash was calculated with reference to the air dried drug.
- **Determination of acid insoluble ash value:**The ash obtained as directed under total ash was boiled with 25 ml of 2N HCl for 5 minutes. The insoluble matter was collected on an ash less filter paper, washed with hot water, ignited and weighed, then calculated the percentage of acid insoluble ash with reference to the air dried drug.
- **Determination of Alcohol Soluble Extractive Value:**

10gms of the air-dried coarse powder of *Argemone mexicana Linn.* D.C.was macerated with 100 ml of 90% ethanol in a closed flask for 24 hours, shaking frequently during the first 6 hours and allowing standing for 18 hours. Thereafter, it was filtered rapidly taking precautions against loss of the solvent. Out of that filtrate, 25 ml of the filtrate was evaporated to dryness in a tared flat bottomed shallow dish, dried at 105°C and weighed. The percentage of ethanol soluble extractive value was calculated with reference to the air-dried drugs.

- **Determination of Water Soluble Extractive Value:**

Weigh accurately the 10 gm of coarsely powdered drug and macerate it with 100 ml of chloroform water in a closed flask for 24 hours, shaking frequently during the first 6 hours and allowing standing for 18 hours. Thereafter, it was filtered rapidly taking precautions against loss of the solvent. Then 25 ml of the filtrate was evaporated to dryness in a tared flat-bottomed shallow dish, dried at 105°C and weighed. The percentage of water soluble extractive was calculated with reference to the air dried drug. The percentage of water soluble extractive and alcohol soluble extractive was calculated with reference to the air dried drug.

- **Loss on Drying:**About 1.5 gm. of powdered drug was weighed accurately in a tared porcelein dish which was previously dried at 105°C in hot air oven to constant weight and then weighed. From the difference in weight, the percentage loss of drying with reference to the air dried substance was calculated and listed in result.

Phytochemical testing of powdered extract in different solvents

1 kilogram of powdered drug was packed in soxhlet apparatus and continuously extracted with petroleum ether (60-80^{o}C) to defat the drug. Petroleum ether was removed from the powdered defatted drug, which was then extracted with ethanol (95%). The alcoholic extract thus obtained was further fractioned with hexane and ethanol. The solvents were removed from each extract and fraction by distillation and the last traces of solvent being removed under reduced pressure. The extracts and fractions were weighed and their % value was recorded and also the physical appearance, color and odor was evaluated and recorded and thereafter, were stored in refrigerator for further experimental work.

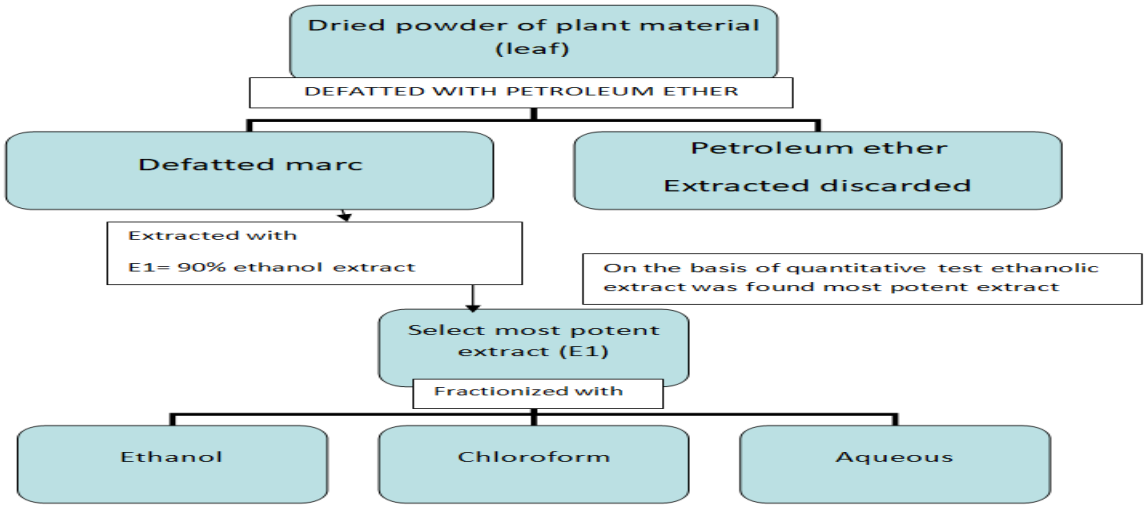

Figure 2: General scheme of extraction and fractionation

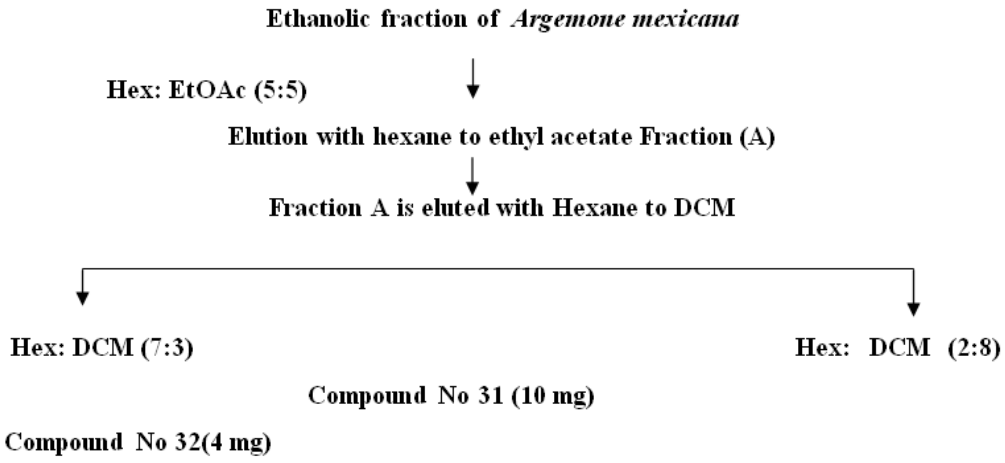

Figure 3:Scheme 1st for isolation of phytoconstituents from.*Argemone mexicana*

Result &Discussion

Table 1: physical properties of *saussurea obvallata:*

S.no.	Parameters	Observation %w/w
1	Loss on drying	8.56%
2	pH	6.3
3	Total ash value	9.5%
4	Acid insoluble ash value	0.29%
5	Water soluble ash value	3.44%
6	Alcohol extractive value	4.87%
7	Water extractive value	7.67%

Table 2: Qualitative examination of phytoconstituents

Chemical constituents	Chemical Test	Extracts/Fractions			
		Ethanol extract	Ethanol fraction	Chloroform fraction	Aqueous fraction
Alkaloids	Mayer's	+	+	+	+
	Dragendorff's	+	+	+	+
	Wagner's	-	-	-	-
	Hager's	+	+	+	+
Saponin	Foam	-	+	-	-
	Haemolytic	-	-	-	-
Phenolic compounds and Tannins	Ferric Chloride	+	+	+	+
	Gelatin	-	-	-	
	Lead acetate test	+	+	+	+
Proteins	Million's	+	-	+	-
	Biuret	+	+	+	-
	Xanthoprotein	-	-	-	-
Flavonoids	Ferric Chloride	+	+	-	+
	Shinoda	-	-	-	-
	Lead Acetate	+	+	+	+
Glycoside	Baljet's	-	-	-	-
	Legal's	-	-	-	-
	Borntrager's	-	-	-	-
	Killer killani	-	-	-	-
Fixed oil	Spot	-	-	-	-
Carbohydrate	Molisch's	-	-	-	-
	Fehling's	+	+	+	+
	Benedict's	-	-	-	-
	Barfoed's	+	+	+	+
	Cobalt-chloride	-	-	-	
Gums and mucilage	Swelling Index	-	-	-	-
Amino Acids	Ninhydrin	-	-	-	-
	Tyrosin	-	-	-	-
	Tryptophan	-	-	-	-
Sterols and triterpenes	Liebermann-Burchard's	+	+	+	-
	Salkowski's	+	-	+	-

Table 3: TLC Studies of Ethanolic extract and Ethanolic fraction of of *A. Mexicana*

Fraction/ Extract	Solvent system	No. of spots	TLC profile	
			R_f value	Color
Ethanolic extract	Toluene:Ethylacetate:Methanol: Water(7:6:5:2)	8	0.95;0.92;0.80; 0.71;0.68;0.59; 0.52;0.45	Dark green, green, green, faint green ,pale green, yellow , light yellow
Ethanolic Fraction	Ethylacetate:methanol:toluene:water (5:4:6:5)	5	0.86;0.82;0.75; 0.51;0.40	Dark green, green, light green, light yellow, brown
chloroform fraction	Hexane:DCM: Ethyl acetate: Methanol (10:5:2:3)	4	0.41;0.29;0.27;0.22	Dark yellow, Dark brown, Dark brown, Light yellow brown
Aqueous fraction	Ethyl acetate:methenol Toluene: water (5:4:6:0.5)	7	0.8,0.72,0.65,0.6,0.58,0.32,0.20	Light green, faint, brown, faint green, dark green, light brown, light brown, brown

5.5. CHARECTERIZATION AND IDENTIFICATION OF COMPOUNDS:

5.5.1. COMPOUND 31

IR (KBR, Vmax): 3432, 2945, 1642, 1444, 1247, 1068, 579

^{1}H NMR (400MHZ, $CDCL_3$; ppm): δ 0.79d (J=13.2 Hz), 0.81- 0.83mbr, 2.61s,3.17m,3.19m, 3.20m, 3.22m , 4.71s.

Compound 31 was isolated and characterized by Its IR peaks (cm^{-1}) at 3432 (free –OH of an aliphatic moiety), 2945 (aromatic C-H), 1642 (aromatic C-C), 1444 (ά- CH_2), 1247 and 1068 (aryl ether C-O-) and The 1 H NMR showed δ value of 1.7 to 3.58indicating the presence of Methylene carbons (-C=C-), 7.4 to 6.5 indicating the presence of Unsaturated carbons and Aromatics, δ value of 4.9 to 3.2 indicating the presence of Carbon with OH group.

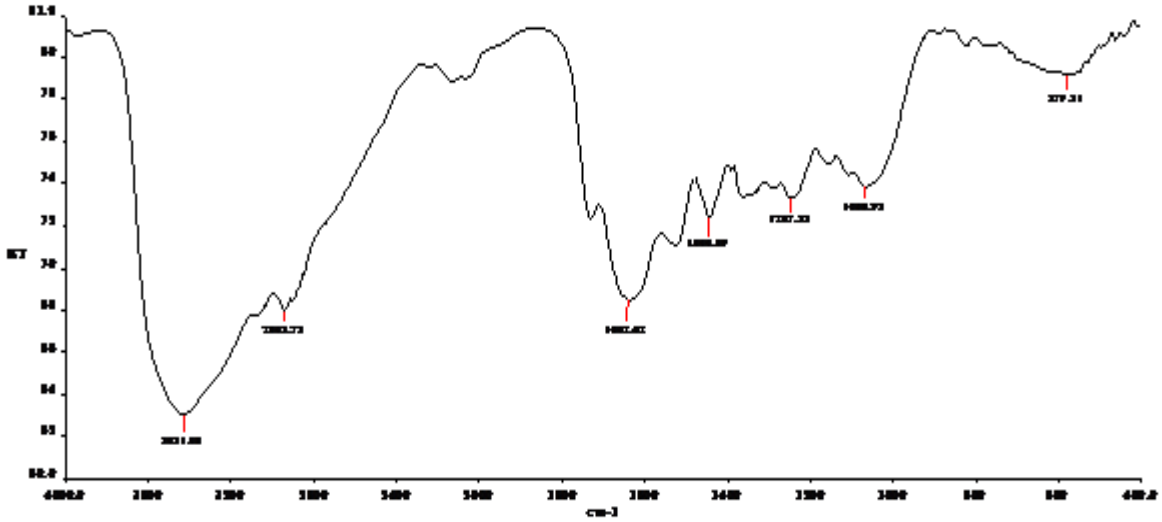

Figure 4: IR Spectra of compound 31

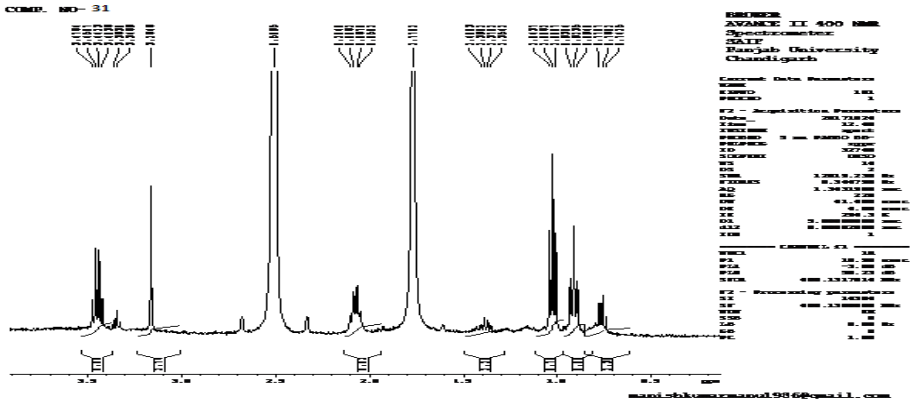

Figure 5:[1] H- NMR Spectra of compound 31

5.5.2. COMPOUND 32

IR (KBR, Vmax): 3390, 2938, 1732, 1611, 1522, 1443, 1368, 1249, 1064, 766, 615.

^{1}H NMR: (400MHZ, $CDCL_{3;}$ ppm): δ 1.02d (J=13.2 Hz), 1.04- 1.06m, 2.5s, 3.41m, 3.43m, 3.44m, 3.46m , 3.76s, 4.60s

Compound 32 was isolated and characterized by Its IR peaks (cm^{-1}) at 3390 (free –OH of an aliphatic moiety), 2938 (aromatic C-H), 1611, 1368 (aromatic C-C), 1443 (ά- $CH_{2)}$, 1249 and 1064 (aryl ether C-O-) and The 1 H NMR showed δ value of 1.49 to 2.083 indicating the presence of Methylene carbons (-C=C-) with the singlet peak , δ value of 2.5029 to 2.5111 indicating the presence of Methylene carbons (-C=C-) with the multiplate peak , δ value of 2.8364 to 2.9440 indicating the presence of Methylene carbons (-C=C-) with the multiplate peak, 4.5230 to 4.67 indicating the presence of Unsaturated carbons and Aromatics, δ value of 3.1654 to 3.4851 indicating the presence of Carbon with OH group.

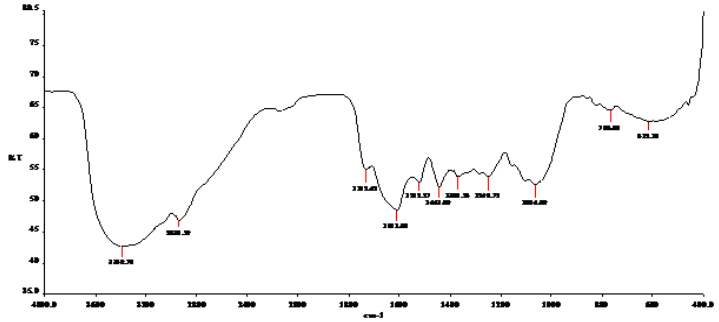

Figure 6: IR Spectra of compound 32

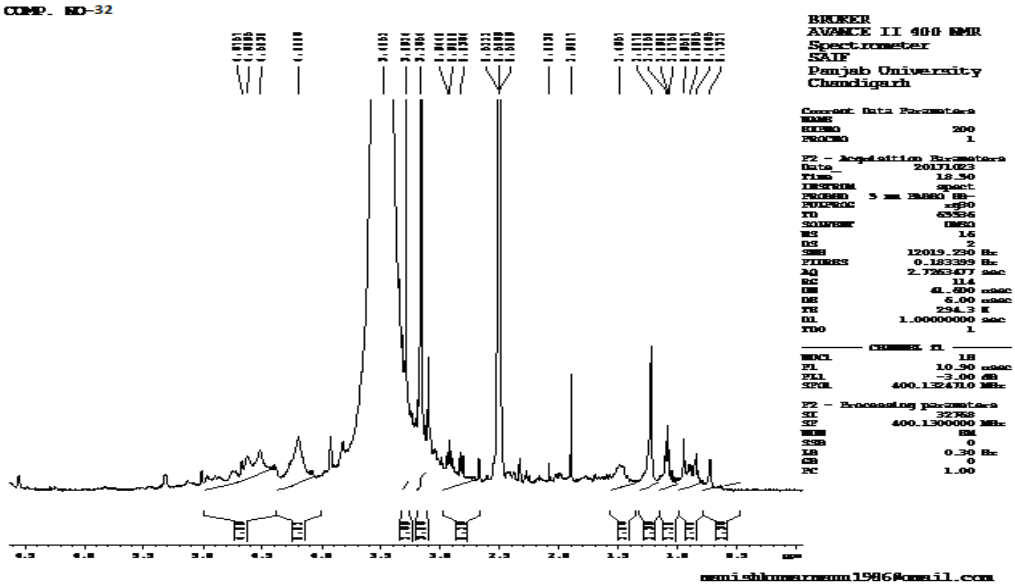

Figure 7:[1]H NMR Spectra of compound 32

5.6. Results of acute oral toxicity study of different extracts of *A. mexicana*

A preliminary toxicity study was designed to demonstrate the appropriate safe dose range that could be used for subsequent experiments rather than to provide complete toxicity data on the extract.Acute toxicity studies conducted revealed that the administration of graded doses of both the crude aqueous and ethanol extracts (up to a dose of 4000 mg/kg) of *A. mexicana* did not produce significant changes in behaviors such as alertness, motor activity, breathing, restlessness, diarrhea, convulsions, coma and appearance of the animals. No death was observed up to the dose of 4 g/kg body weight. The mice were physically active. These effects were observed during the experimental period (72 hrs). The result showed that in single dose; the plant extracts had no adverse effect, indicating that the medium average lethal dose (LD_{50}) could be greater than 4 g/kg body weight in mice. Based on these results 1/10th of the maximum safe dose was taken for further pharmacological screening. So the doses selected for further study were 200 mg/kg b.w. and 400 mg/kg b.w. for *A. mexicana*. Hydro-alcoholic extract also did not show any toxic effect up to 4 g/kg, so average lethal dose (LD_{50}) for hydro-alcoholic extract was 200 mg/kg b.w. and 400 mg/kgb.w.

Table 4: Acute oral toxicity study of different extracts of *A. mexicana*

Group	Dose (mg/kg)	Route	Death/Total in Ethanolic extract	Death %	Death/Total in Aqueous extract	Death %
I	500	Oral	00/10	0	00/10	0
II	1000	Oral	00/10	0	00/10	0
III	1500	Oral	00/10	0	00/10	0
IV	2000	Oral	00/10	0	00/10	0
V	3000	Oral	00/10	0	00/10	0
VI	4000	Oral	00/10	0	00/10	0

Result: Mortalities after 72hrs were recorded as shown in the Table.

Effect of various extracts of *A. mexicana* on Blood Glucose Level of normoglycaemic rats (hypoglycemic activity)

The effects of ethanol and aqueous extracts of aerial parts of *A. mexicana* on fasting blood glucose levels of normal rats are presented in table5.6.The plant extracts at both the dose level of 200 and 400 mg/kg registered 79.87 to 85.83 mg/dl of fasting blood glucose level at the end of 10h of the study, while the standard drug, glibenclamide showed 71.63 mg/dl at the same time, with a low degree of significance while compared with the solvent treated group. The percentage change of blood sugar of test extracts treated groups at the end of 10 h showed 3 to 12% fall when compared with initial BGL in a dose dependent manner. The potency order of the test extracts towards the falling of BGL is an ethanolic extract followed by aqueous extract.

Effect of various extracts of *A. mexicana* on BGL of glucose loaded hyperglycemic rats (oral glucose tolerance test, OGTT)

The effect of the test extracts on blood glucose level (BGL) in OGTT is depicted in Table. The aqueous and ethanol extracts at 200 mg/kg dose level registered 92.13, 95.50 mg/dl at the end of 3 h of the study, while it was 91.50, 96.53 mg/dl with dose level of 400 mg/kg. However, at the same time the standard drug glibenclamide at 5mg/kg showed 62.51 mg/dl of BGL. However the calculated percentage fall of BGL demonstrated 6.22, 18.26 and 14.73, 24.79% with respect to 200 and 400 mg/kg dose levels when measured at the end of the 3 h of the study, while at the same time glibenclamide showed a 30.10% fall of BGL. The progressive fall of BGL of the test extracts, in the different test hour showed a statistical significant of $p<0.05$ to $p<0.01$, while analyzed by using ANOVA followed by Dunnett's t-test. The ethanol extract possesses more BG lowering potency than that of the aqueous extract in a dose dependent manner. The test extracts at tested dose levels also showed a significant fall of BGL while compared with solvent control group during the study period of 30, 60 and 120 min.

Table 5: Effect of ethanolic and aqueous extracts of *A. mexicana* on blood glucose level in normoglycemic rats.

Groups	Treatment and dose	Blood Glucose Levels(mg/dl)							% decrease at 10 hrs
		0 hr	1 hr	2 hr	4 hr	6 hr	8 hr	10 hr	
I.	Solvent Control (Tween + Water)	94.6 ± 1.1	87.2 ± 4.62	91.43 ± 1.86	89.56 ± 0.81	91.58 ± 2.23	89.66 ± 0.46	92.67 ± 3.22	--
II.	Glibenclamide (5mg/kg)	91.43 ± 1.31	81.22 ± 2.63	67.53 ± 2.34*	58.12 ± 2.61**	54.72 ± 2.44**	73.83 ± 1.42**	71.63 ± 2.81**	21.65
III	Aq. Ext. (200mg/kg)	89.13 ± 1.2	87.8 ± 1.1	86.93 ± 2.65	86.73 ± 1.46	86.57 ± 1.43	86.29 ± 0.89*	85.83 ± 1.51	3.70
IV	Aq. Ext. (400mg/kg)	88.4 ± 2.43	87.31 ± 2.16	86.13 ± 1.87	85.78 ± 1.67	84.97 ± 2.69	84.11 ± 1.43*	82.21 ± 2.49*	7.0
V	Eth. Ext. (200mg/kg)	92.53 ± 1.27	91.46 ± 1.68	89.88 ± 1.09	87.19 ± 0.91	86.07 ± 2.13	85.78 ± 1.18*	83.66 ± 1.89*	9.58
VI.	Eth. Ext. (400mg/kg)	91.18 ± 0.93	87.19 ± 0.78	85.71 ± 2.61	85.23 ± 1.37	84.83 ± 2.38*	83.11 ± 1.21**	79.87 ± 2.73**	12.40

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test (t-value denotes statistical significance at * $p<0.05$, and ** $p<0.01$ respectively, in comparison to group-I).

Table 6: Effect of ethanolic and aqueous extracts of *A. mexicana*on oral glucose tolerance in normal rats

Gr.	Treatment and dose	Blood glucose concentration (mg/dl)					% decrease at end of 3hr
		0 min	30 min	60 min	120 min	180 min	
I	Normal Control	83.75 ± 0.47	86.50 ± 0.84	88.50 ± 1.56	83.50 ± 0.98	86.50 ± 1.47	--
II	Solvent control	90.50 ± 0.64	135.52 ± 0.64**	118.83 ± 0.85**	98.50 ± 0.61**	91.50 ± 0.24**	--
III	Glibenclamide (5mg/kg)	89.43 ± 0.40	95.50 ± 1.04**	81.53 ± 0.91**	72.50 ± 0.64**	62.51 ± 0.66**	30.10
IV	Aq. Ext. (200mg/kg)	83.62 ± 1.78	98.25 ± 0.85**	97.61 ± 1.91**	93.50 ± 1.63**	92.13 ± 0.95	6.22
V	Aq. Ext. (400mg/kg)	87.50 ± 0.89	107.31 ± 1.37**	102.32 ± 1.10**	94.50 ± 0.54*	91.50 ± 0.54	14.73
VI	Eth. Ext.. (200mg/kg)	91.50 ± 0.64	116.84 ± 1.10**	109.83 ± 0.85**	102.65 ± 1.91*	95.50 ± 0.64*	18.26
VII	Eth. Ext. (400mg/kg)	84.87 ± 0.91	128.36 ± 0.85**	117.36 ± 1.70	103.51 ± 0.77**	96.53 ± 1.27**	24.79

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test (t-value denotes statistical significance at * $p<0.05$, ** $p<0.01$ respectively, in comparison to group-II)

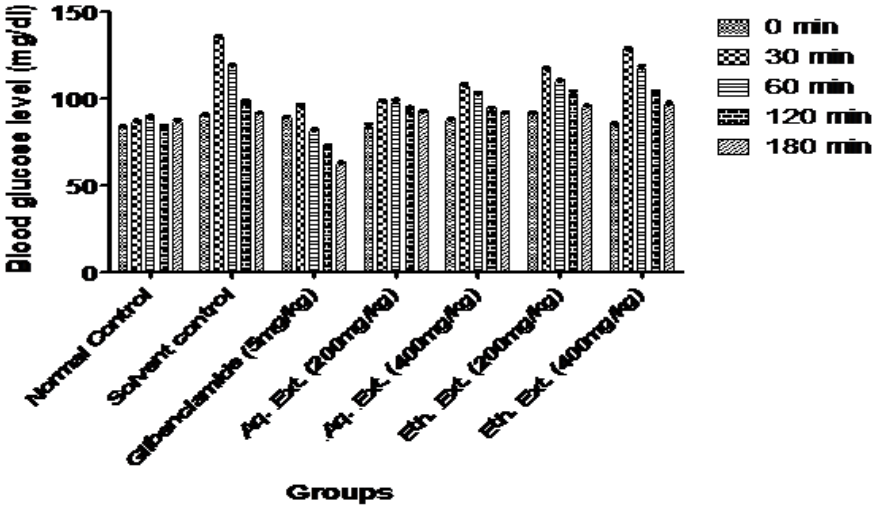

Figure 8: Effect of ethanolic and aqueous extracts of *A. mexicana*on oral glucose tolerance in normal rats

Effect of the extracts on blood glucose level in alloxan induce hyper glycemic rats
(Acute and sub-acute models)

a. Acute model (In single dose treated alloxan induced hyperglycemic rats)

The effects of ethanol and aqueous extracts on fasting blood glucose levels on single dose treated alloxan induced diabetic rats are presented in table. The aqueous and ethanol extracts at 200 mg/kg dose level registered 149.36, 141.32 mg/dl at

the end of 10 h of the study, while it was 132.59, 112.64 mg/dl with dose level of 400 mg/kg. However, at the same time the standard drug glibenclamide at 5mg/kg showed 98.59 mg/dl of BGL. A dose dependent effect of the test extracts was observed. The aqueous and ethanol extracts of *A. mexicana*in both dose levels (200 and 400 mg/kg) showed a persistent decrease in blood glucose level till the end of 10 hr., with maximal decrease noted in aqueous extract at 400 mg/kg dose, reaching 70.25% (p<0.01), while the standard drug glibenclamide showed a 66.65% decrease. The statistical significance of one way ANOVA showed significant reduction of BGL @ p<0.05 to 0.01 starting from 1 hr up to the end of 10 hr within the groups. The potency order of the test extracts towards the falling of BGL is an ethanolic extract followed by aqueous extract.

b. Sub-acute model (In multi dose treated alloxan induced hyperglycemic rats)

The alloxan-induced hyperglycaemia was significantly (p<0.05 to 0.01) corrected by the ethanol and aqueous extracts of aerial parts of *A. mexicana* at the end of the treatment (11 days). The effects of aqeous and ethanolic extracts on fasting BGL on multi dose treated alloxan induced diabetic rats are depicted in table5.9.The aqeous and ethanolic extracts at 200 mg/kg dose level registered 174.5, 136.3 mg/dl at the end of 11 days of the study, while it was 146.3, 120.7 mg/dl with dose level of 400 mg/kg. However, at the same day the standard drug glibenclamide at 5mg/kg showed 101.8 mg/dl of BGL. Study results reveals that on treatment with crude aqueous extract at dose level 200 and 400 mg/kg reduce the BGL to an extent of 57.76% and 65.38% respectively. While in the case of crude ethanolic extract treatment at dose level 200 and 400 mg/kg the fasting mean BGL was reduced by extent of 68.37% and 73.10% respectively at the end of 11 days study. However, at the same day the fasting mean BGL of diabetic rats treated with standard drug glibenclamide showed a reduction of 74.27% as compared with diabetic control (positive control) rats. However the individual data for test planttreated groups showed a statistical significance p<0.05 to 0.01 throughout the experimental result when compared with solvent control. In general, the aqueous extract showed a better reduction towards blood glucose level as compared with the ethanol extract. This study indicated that the reduction of blood glucose level in aqueous and ethanol extracts of both *A. mexicana* in alloxan-induced diabetic rats were a dose dependent.

Table 7: Effect of ethanolic and aqueous extracts of *A. mexicana* on blood glucose level in single dose treated alloxan induced hyperglycemic rats.

Groups	Treatment and dose	Blood Glucose Levels (mg/dl)							%age decrease at 10hrs
		0 hr	1 hr	2 hr	4 hr	6 hr	8 hr	10 hr	
I	Normal Control	93.09 ± 1.38	89.50 ± 0.64	88.50 ± 1.67	90.50 ± 1.78	87.59 ± 0.98	88.67 ± 2.14	89.76 ± 2.33	--
II	Diabetic Control (Tween + Water)	307.5 ± 4.34	297.63 ± 4.93**	301.81 ± 2.89**	291.88 ± 3.51**	287.89 ± 3.67**	303.77 ± 4.29**	279.61 ± 2.71**	--
III	Glibencamide (5mg/kg)	295.7 ± 2.17	258.62 ± 3.21**	198.31 ± 2.49**	139.21 ± 2.63**	126.31 ± 3.28**	118.91 ± 2.96**	98.59 ± 2.87**	66.65
IV	Aq. Ext. (200mg/kg)	363.2 ± 3.98	348.38 ± 3.26	307.53 ± 3.24	240.79 ± 3.81**	211.44 ± 2.59**	163.53 ± 4.28**	149.36 ± 3.71**	58.87
V	Aq. Ext. (400mg/kg)	382.7 ± 4.15	369.68 ± 2.88	309.81 ± 2.36*	222.37 ± 3.77**	153.69 ± 3.91**	141.84 ± 3.28**	132.59 ± 2.93**	65.35
VI	Eth. Ext. (200 mg/kg)	371.09 ± 5.22	352.23 ± 3.91	292.62 ± 3.11*	246.59 ± 4.12**	167.84 ± 3.86**	158.63 ± 3.57**	141.32 ± 2.98**	61.91
VII	Eth. Ext. (400 mg/kg)	378.7 ± 7.25	312.33 ± 2.34	259.36 ± 2.47	176.34 ± 4.26**	143.76 ± 3.51**	127.34 ± 2.15**	112.64 ± 2.38**	70.25

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test (t-value denotes statistical significance at * p<0.05, ** p<0.01 respectively, in comparison diabetic control group).

Table 8: Effect of ethanolic and aqueous extract of *A. mexicana* on blood glucose level in Multi- dose treated alloxan induced diabetic rats.

Groups	Treatment and dose	Blood glucose concentration (mg/dl)				%decrease at 11 day
		0^{th} day	3^{rd} day	7^{th} day	11^{th} day	
I	Normal Control	88.33 ± 2.155	89.33 ± 1.745	89.33 ± 1.820	90.33 ± 1.687	--
II	Diabetic control	407.5 ± 4.341	407.7 ± 6.458**	419.5 ± 5.708**	452.7 ± 10.53**	--
III	Glibenclamide (5mg/kg)	395.7 ± 27.17	212.3 ± 3.603**	173.5 ± 3 .63**	101.8 ± 4.90**	74.27
IV	Aq. Ext. (200mg/kg)	413.2 ± 7.998	327.8 ± 8.080**	143.2 ± 11.57**	174.5 ± 5.97**	57.76
V	Aq. Ext. (400mg/kg)	422.7 ± 15.15	346.7 ± 7.360**	214.8 ± 5.081**	146.3 ± 4.787**	65.38
VI	Eth. Ext. (200mg/kg)	431.0 ± 21.22	323.8 ± 12.16**	241.3 ± 12.44**	136.3 ± 3.921**	68.37
VII	Eth. Ext. (400mg/kg)	448.7 ± 18.25	324.3 ± 9.330**	216.2 ± 2.770**	120.7 ± 5 .207**	73.10

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test (t-value denotes statistical significance at * p<0.05, ** p<0.01 respectively, in comparison diabetic control group).

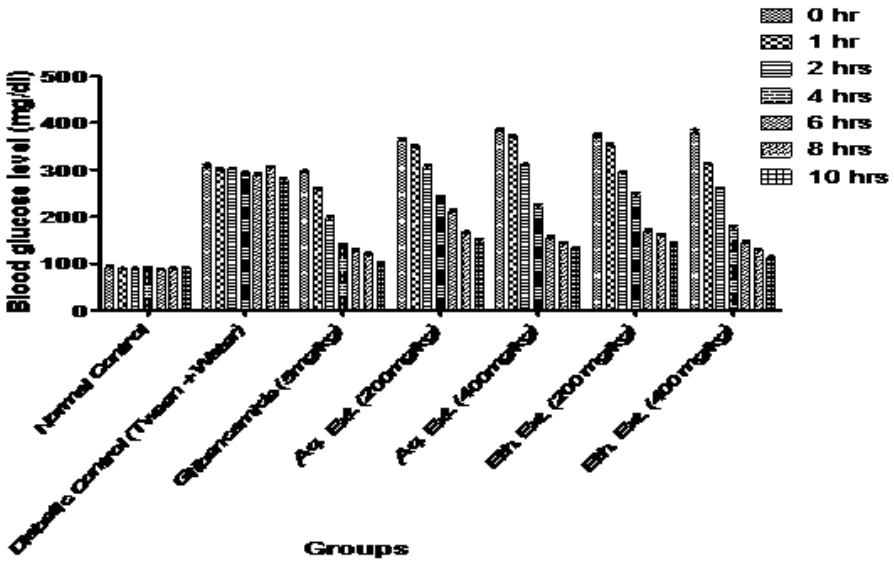

Figure 9:Effect of ethanolic and aqueous extracts of *A. mexicana* on blood glucose level in single dose treated alloxan induced hyperglycemic rats

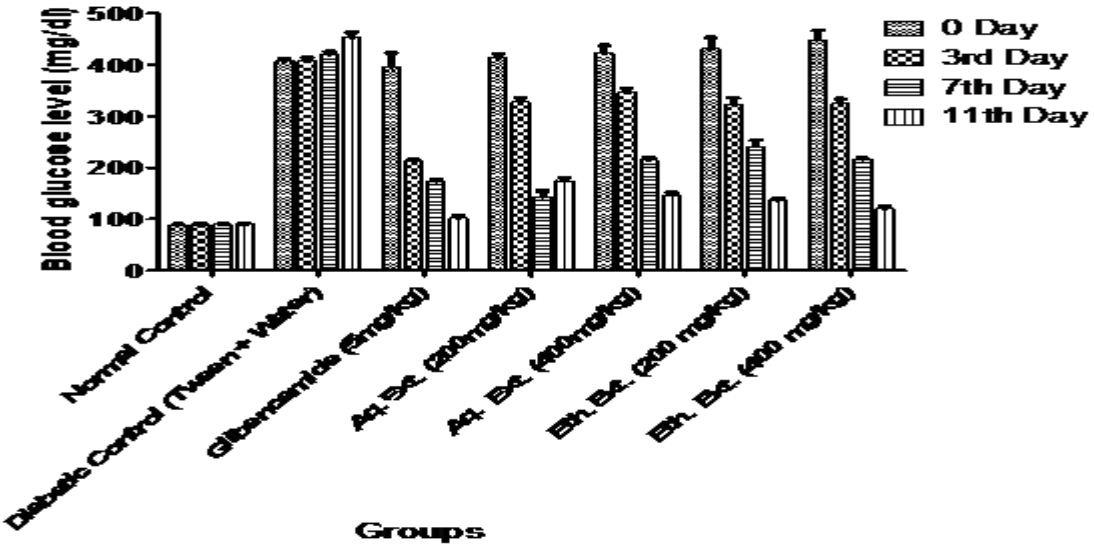

Figure 10:Effect of ethanolic and aqueous extract of *A. mexicana* on blood glucose level in Multi- dose treated alloxan induced diabetic rats.

Conclusion

- The plant *Argemone mexicana Linn.* have been found to be source of medicinal agents based on their use in traditional medicines In present work the taxonomic identification of collected plant by Dr. S. R. Kshirsagar. In brief preparation of plant material by different techniques such as drying, grinding, sieving.
- Extraction of plant material by using different solvents ethanol and water and phytochemical screening has been done. This chapter deals with description, review of literature and finding of phytochemicals and pharmacological studies of *Argemone mexicana Linn.*.
- Physical parameters were- Loss on drying 8.53%(w/w), Total ash value 9.5%(w/w), acid in soluble ash value 0.29%(w/w), alcoholic extractive value 4.87%(w/w) and water extractive value 7.67 %(w/w).
- The TLC study of extract and fractions represents that ethanolic extract in the solvent system Toluene:Ethylacetate:Methanol:Water(7:6:5:2)gave 8 spot (the rf values were 0.95;0.92;0.80;0.71;0.68;0.59;0.52;0.45) and Ethenolic fraction in the solvent system Ethylacetate:methanol:toluene:water(5:4:6:5) gave 5 spot (rf values were 0.86;0.82;0.75;0.51;0.40), Chloroform fraction in the solvent system Hexane:DCM:Ethylacetate:Methanol(10:5:2:3) gave Sunlight 4 spots (rf values were 0.41;0.29;0.27;0.22) and aqueous fraction in the solvent system Ethyl acetate:methenolToluene:water(5:4:6:0.5) gave Sunlight 7 spots (rf values were 0.8,0.72,0.65,0.6,0.58,0.32,0.20) .
- Ethanolic extract of *Argemone Mexicana* show antidiabetic activity.
- Two compounds (31 and 32) were isolated by silica gel column chromatography from ethenolic soluble fraction of ethenolic extract of *Argemone mexicana.*

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