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An assessment of the pharmacognostic properties of *Prosopis juliflora*

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Abstract
Prosopis juliflora (P. jiliflora), often known as mesquite or Velayati babul, is a species of plant that is available in desert and desert like environments worldwide. It is a species that competes and has been designated as poisonous in numerous countries. WHO found that herbal medicines are used traditionally for the treatment of diseases, nearly 80% of the population utilize plants due to their less side effects and easy availability as compared to allopathic systems of medicine. *P. juliflora* is a species of the Leguminosae family and is used successfully in conventional healthcare. This plant includes many plant-based compounds, primarily flavonoids, alkaloids, tannins, phenolics, terpenes, and saponins, in its all parts.

Keywords: *Prosopis juliflora*, mesquite, arid area, semiarid area, weed, alkaloids, tannins

1. Introduction
Among the fastest-growing plants in both India and also in the rest of the world, *P. juliflora* is a plant, having 44 species worldwide and is a member of the Leguminosae family and Mimosoideae subfamily [1-2].Traditionally, *P. juliflora* is used for the relief of inflammatory conditions, hoarseness, measles, colds, diarrhoea, dysentery, and sore throatand for the curing and healing of wounds [3]. *P. juliflora* species' woods can be utilised to produce charcoal, paperboard, fibre, and carbon in active form for the hardboard & paper industries. Additionally, *P. juliflora* blossoms are utilised by bees to produce honey, and the pods are fed to animals as food [4-6]. The tree, which dries up the soil and clashes with all plants, especially grasses in arid places, is a competitive weed that is also considered as a noxious weed in several nations [7]. Employing published sequence tags, drought-resistant genes of *P. juliflora* have been found, and these genes are employed in a variety of genetically modified plants or crops. Alkaloids, saponins, and flavonoids are some of the phytoconstituents that are readily available in the plant. Because of its biological and pharmacological properties, this plant is significant as a potential provider of phytomedicines [8].

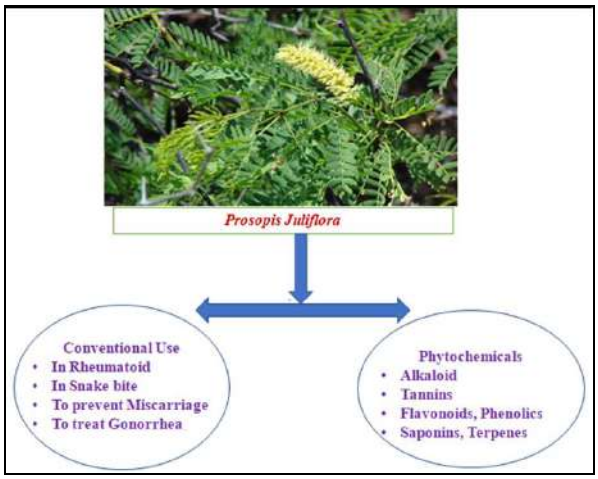


Fig 1: Interpretation of Pharmacognostical Aspect of *P. juliflora*

2. Basic Information

2.1 Botanical information

Table 1: Taxonomical classification.

Kingdom	Plantae
Phylum	Angiosperms
Order	Fabales
Class	Dicot
Family	Leguminosae
Subfamily	Mimosoideae
Genus	*Prosopis*
Species	*Juliflora*

2.2 Synonym

Mimosa juliflora, Mimosa piliflora, Prosopis domingensis, Prosopis dulcis, Prosopis vidaliana.

2.3 Common Name

Mesquite, Honey Mesquite, Velvet Mesquite [9].

2.4 Geographical source

In semi-arid and dry regions of the world, *P. juliflora* is a species of tree that is biologically and ecologically significant. It may be noticed across India, from Punjab to Tamil Nadu and from Gujrat to the dry region of Orissa. On Earth, various *Prosopis* species can be identified, each with unique chemical, physical, and physiological characteristics. These are the states in India where this species is primarily found: Haryana, Uttar Pradesh, Orissa, Tamil Nadu, Rajasthan, Karnatak, Andhra Pradesh, Madhya Pradesh, Maharashtra,

Table 2: Vernacular Names

Language	Name
Hindi	Velayati babul, Velayati Babool, Velayati khejra
Gujrati	Gando baval
Marathi	Velayati kikar
Marwari	Angrezibavaliya
Kannada	Bellari jali
Tamil	Velikaruvel, Velimullu

3. Morphology

P. juliflora can be found as a tree or a shrub with a range of sizes. Most of it is aculeate, xerophilous, spiky, and armed. The glands can be found near the pinne and leaflet junction. Upon being dried, the legume is straw-yellow or brown in colour, up straight with an apex that is bent inwardly, and is 8 to 29 cm long, 9 to 17 mm wide, and 4 to 8 mm thickness. It may also be falcate, linear, compressed, stipulate, rectangular, or subquadrate at times. Spines on the plant range in length from 0.5 to 5 cm, and they can be unilateral or bilateral [10–11].

3.1 Tree form and size

The dimensions as well as the form of trees vary between species and are impacted by both genetic and environmental factors. *P. juliflora* normally grows to a height of 12 m, but in the right circumstances, it may even reach 20 m.

3.2 Seeds

They are epigeous in germination. The cotyledons are fleshy and are first seed leaves that also exist after the first true leaves have formed, they are green or pale green in colour.

3.3 Wood

P. juliflora's woods have a widely porosity coarse texture and a pale brown tint (bark) when they are present in their dried state. *P. juliflora* has fibres (48%), vessels (18%), rays (18%), and axial parenchyma (16%) at the level of the microscope [12].

3.4 Leaves

They're bipinnate in shape with nodes, petioles, and rachis that are all between 5 and 20 cm long. The medium to large leaves measure 10 to 20 cm in length. The elliptic-oblong, linear-oblong, or ovate-shaped leaflets range in length from 8 to 18 mm and have a pointed apex. At the intersection of pinnae or leaflets are glands that are sessile, cuculiform, and have an apical hole.

3.5 Flowers

Racemes, or long spike-like inflorescences of flowers, are cylinder-like in form. Their coloration ranges from yellow - yellowish white. Inflorescences (9.5-16.5 cm) with 237–344 blooms might be slightly longer or slightly shorter than the leaves. Flowers are naturally hermaphrodite, actinomorphic, sterile, and pentamerous. There are numerous components in an inflorescence, including a corolla, petals, pedicel, calyx, pistils, and stamen.

3.6 Fruit

Based on manner the various fruit components are organised, this species also belongs to the Leguminosae family. The fruit is an undifferentiated legume with an incurved apex that may or may not have parallel margins. The fruit's borders measure 16-28 cm in length, 14-18 mm in breadth, and 6-10 mm in depth without having parallel margins. Once young and fully developed, the pods that we once referred to as fruit are green in appearance. They undergo compression to sub-compression and sub-moniliform, squashed in part of subquadrate, acuminate, and stipitate.

3.7 Thorns

There are presence of diverging and geminating axillary spines. Straight, mono or multimodal form, single and coupled on one branch or single and paired on another. The size and number of thorns, which are either absent, present, or not on all branches, differ amongst trees [13].

4. Physiochemical properties

Ash value and moisture content of *P. juliflora* are 6.1-1.36 percent in green pods, 7.3-1.88 percent in dry pods, 4.8-1.02 percent in leaves, and 8.9-1.19 percent in bark, respectively, and 61.3-5.4 percent in green pods, 26.3-4.09 percent in dry pods, 56.0-6.38 percent in leaves, and 35.0-4.99 percent in bark respectively [14].

5. Traditional use

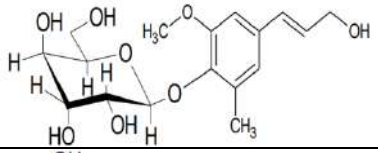
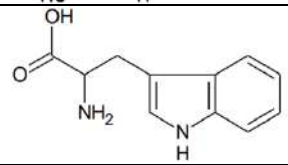
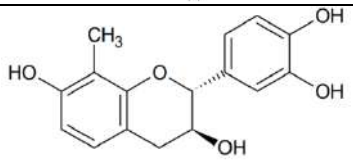
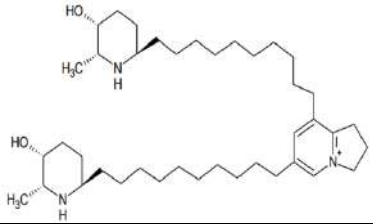
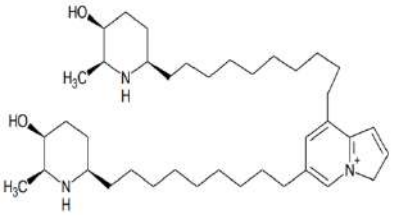
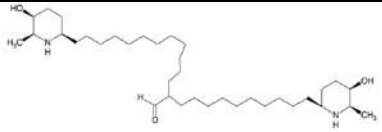
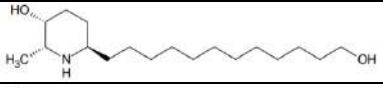
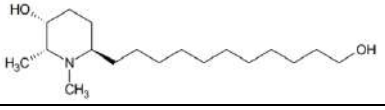
The *Prosopis* genus has a wide range of chemical, agricultural, biological, and therapeutic uses that can be traced back to ancient times. Individuals utilise it as a medication for rheumatism and as an antidote for scorpion stings and snake bite. Additionally, in some countries pregnant women take sugar and flower powder for safety. Neisseria gonorrhoeae, which has been taken from patients with symptoms and used for the management of gonorrhoea, is also susceptible to *P. juliflora*'s antimicrobial properties.

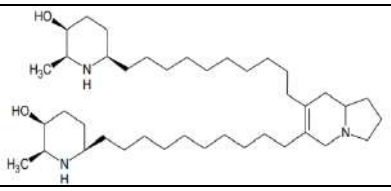
Additionally, other *Prosopis* species are utilised to treat liver and eye issues in addition to diuretics [15]. Tooth decay, malaria, dermatitis, bronchitis, stomach cramps, and dysentery are all conditions that can be treated using *Prosopis Africana* (Roots, leaves, bark twigs). It is also employed in some regions to cure dental decay, sore throats, and wounds and cuts [16]. Traditional Iranian medicine uses *Prosopis farcta* as a remedy for angina pectoris and heart discomfort [17]. Earaches, leprosy, leukoderma, dyspepsia, dysentery, asthma, and other conditions can all be treated using *Prosopis cineraria* [18].

6. Phytochemistry

Alkaloids, saponins, phenols, flavonoids, and tannins were examined in the dried with air leaves of *P. juliflora*, commonly referred to as Velayati Kikar [19]. Saponin and alkaloid are the only compounds that is having anti-bacterial, anticancer, anti-inflammatory, and antiviral pharmacological effects. *P. juliflora*, also known as mesquite, contains a broad range of phytochemicals in its many parts, including the leaves, stem, pods, flowers, and seeds. In comparison to other aspects of *P. juliflora*, leaves and pods contain a lot of phytoconstituents. The pods and leaves contain steroids, alkaloids, terpenoids, flavonoids, phenolics, and tannins, according to phytochemical study. The floral extract contains terpenoids, flavonoids, phenolics, alkaloids, and steroids. Additionally, the stem has the fewest phenolics, terpenes, flavonoids, and steroids, whereas roots extracts contain phenolics, tannins, flavonoids, steroids, alkaloids, flavonoids, flavonoids, and saponin. All plant sections are devoid of phlobatannin and cardiac glycoside, but only the roots contain saponins [20]. Extraction is the initial step of various phytochemical screening or for the isolation of phytoconstituents. Different solvents are used in increasing order of polarity for better extraction of all secondary metabolites i.e. petroleum ether, benzene, chloroform, ethyl-acetate, ethanol and water. Here, petroleum ether is least polar and water is most polar solvent [21].

Table 2: Chemical structure of various constituents in *P. juliflora* with Medicinal activity

Sl. No.	Constituents	Chemical Structure	Activity	Reference
1	Glycoside (Syringin)		Plant Growth Inhibitor	22
2	Amino acid (L-Tryptophan)		Plant Growth Inhibitor	23
3	Flavonoid ((-)-Mesquitol)		Antioxidant	24
4	Isojuliprosine		Antifungal	25
5	Juliprosinene		Antibacterial	26
6	Secojuliprosopin al		Plant Growth Inhibitor	27
7	Alkaloid (Julifloridine)		Not Specified	28
8	N-Methyl Julifloridine		Not Specified	29

9	Juliprosopine		Antibacterial	30

The piperidine alkaloids (secojuliprosopinal) and shikimic acid metabolites ((-)-lariciresinol, phenylpropanoids), both of which have allelopathic properties, are produced by *P. juliflora* through two major biosynthetic pathways: the shikimic acid pathway and the acetic acid or polyketide metabolic pathway through the lysine amino acid pathway [31]. *P. juliflora* leaves include a significant amount of phenolic substances and alkaloids, including mesquitol 24, juliprosine, juliprosopine. Syringin, (-)-lariciresinol, juliprosinene, L-tryptophan, juliprosopine, juliprosine, juliprosopine and juliprosopinal are a few of the compounds that are readily soluble in water and get released into the environment via the leaves with rainfall [32]. Throughout the process of development cycle, differences across parts or organs are observed despite the fact that the chemical makeup of all botanical compounds and the amount they contain are not the same in all parts. The antifungal actions of the bark of *P. juliflora* include quercetin, 4,7-dimethylether, kaempferol 4-O-methylether, retusin, and L-mannopyranoside. Additionally, it has 3-oxo-juliprosopine, a secojuliprosopinal with anti-inflammatory properties. Besides leaves and bark, several elements such as pods, heartwood, flowers, and roots also contain some components that have some biological activity.

7. Parts of Plant

Table 3: Plant metabolites (in gram) extracted by using various solvents from dry plant material.

Solvents / Plant Parts	Water	Ethanol	Hexane	Chloroform	Acetone	Total
Root	3.35	4.04	0.74	1.79	0.56	10.48
Pod	5.84	5.55	1.05	2.23	0.72	15.30
Stem	2.48	3.08	0.82	1.51	0.68	7.92
Leaf	4.97	5.63	1.31	2.85	0.96	15.72
Flower	4.30	5.04	0.95	2.62	0.77	13.68

7.1 Wood
The woody biomass contains several constituents and can be divided into cellulose, hemicellulose, hemicellulose, lignin and extractives with levels 40-45%, 25-30%, 11-28% and 3-15% respectively [33].

7.2 Fruit
56% of the fruit's whole weight is in the pulp. 90% of the sugar that dissolves in pulp is represented by sucrose (45%), a very hydrophilic component. Few other reducing sugars such glucose, fructose, xylose, raffinose, inositol also present [34-35].

7.3 Leaves
The quantity of essential amino acids (AA) is at its highest in leaves, while S-containing AA are limited. Chemical components such as polyphenol, alkaloids, flavonoids, tannins, and others are also present. The components of the leaves can be divided into mineral elements, basic extractives, and extracts devoid of nitrogen. Protein (26.3%), fibre (24.8%), extract (8.5%), ash (1.4%), and mineral components such as macronutrients and micronutrients are the main mineral extraction found in the leaves.

Table 4: Phytochemicals present in the extracts obtained from various parts of P. *juliflora.*

Plant Parts / Phytochemicals	Root	Flower	Pod	Leaf	Stem
Steroids	*	*	**	***	*
Terpenes	**	*	**	**	*
Tannin	**	-	*	*	-
Saponin	*	-	-	-	-
Alkaloids	*	**	***	**	-
Cardiac Glycosides	-	-	-	-	-
Flavonoids	**	***	**	***	*
Phenolics	**	***	***	***	*

"*" Low concentration, "**" Moderate Concentration, "***" High Concentration, "-" Absent

Table 5: Patents Regarding *P. juliflora*

Sl. No.	Patent No.	Title	Date	Reference
1	BR102017006458-1 A2	Cosmetic compositions containing *Prosopis juliflora* extracts	30/10/2018	36
2	WO2011009184A1	Use of *Prosopis juliflora* for producing a water- based, xanthan gum-like polysaccharide polymer	27/01/2011	37
3	BR 102016020554A2	Froze milk derivative using vegetable hemicellulose	02/05/2018	38
4	US2898260A	Fiber board and process of making same from desert shrubs	04/08/1959	39
5	BRPI1106864A2	Topical and oral photo-protective formulations containing Brazilian vegetable extracts and/or oils	19/07/2016	40

8. Conclusion
It might be inferred from the above review, *P. juliflora* has a broad range of therapeutic effects. As stated in numerous literary works, humans have been using it to fulfil their requirements. It is versatile and widely useful in the agricultural, food, renewable energy, cosmetic, and pharmaceutical industries. Because this plant contains bioactive metabolites, it might be exploited to create novel medications that cater to the vast majority of unmet therapeutic requirements in our culture.

9. Acknowledgement
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Jharkhand, for its continued support with the study.

10. Conflict of Interest

The writers declare that they have no incentives in dispute.

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