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A CRITICAL REVIEW DHATURA IN AYURVEDIC & MODERN CONTEXT

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ABSTRACT

Plants have prodigious potential for the treatment and managing of many diseases and have been used in many nations for the management of different diseased conditions. The medicinal value of plants lies in their bioactive phytochemical elements that yield definite physiological activities in living beings. Many medicinal plants comprehend some chemical elements that may cause injurious effects to humans if consumed in large quantities. Alkaloids occurring in large amounts could make plants poisonous despite its medicinal effects. Datura is a genus of nine species of poisonous vespertine flowering plants fitting to the family Solanaceae. They are known as angel's trumpets, occasionally sharing that name with the closely related genus Brugmansia, and ordinarily known as daturas. Datura metel is known as Jimson weed and in Arabic known as "Jaozmasel", is one of the well-known Ayurvedic medicinal herbs with wide application, Chemical investigation of which revealed its constituents as alkaloids, carbohydrates, and proteins among which alkaloids containing scopolamine, hyoscyamine and atropine are the main active ingredients that reveals various activities, such as anti-asthmatic, sedative, analgesic and anti-rheumatoidal effects.

KEYWORDS: Dhatura, Dhatura metal, Sthavar Visha.

1. INTRODUCTION

Plants have always played a major role in the treatment of human traumas and diseases worldwide. The demand for medicinal plant is growing in both developed and developing countries due to growing recognition of natural product. Herbal medicine is an important part of both traditional and modern system of medicines[1]. The universal role of plants in the treatment of disease is exemplified by their employment in all the major systems of medicine irrespective of the underlying philosophical premises. The use of single pure compounds, including synthetic drugs, is not without its limitations, and in recent years, there has been an immense revival in interest in the herbal and homeopathic systems of medicine, both of which rely heavily on plant sources. Datura, commonly known as thorn apple, jimson weed, locoweed, and devil's weed. Common species encountered are D. fastuosa, D. atroxa and D. metal. D. fastuosa is of twovarieties- niger and alba. Dhatura metal L., with local name "Dhatura". Is an erect shrub with spreading branches. Datura has a wide range of traditional applications, including the treatment of epilepsy, hysteria, insanity, heart diseases, and for fever with catarrh, diarrhea andskin diseases. Crushed leaves are used to relieve pain. During the Sanskritic period, Indian medicine valued the old world species of Datura metal for treating mental disorders, various fevers, tumors, breast inflammations, skin diseases, and diarrhea.

2. HISTORICAL ASPECT

2.1 Samhita Kala

Charak Samhita- Aacharya Charaka explained the use of Dhatura in Madhvasava and Manashiladilepa.
Sushrut Samhita: Dhatura root is the content of Mushikakalpa which is used for Alarkavisha (dog bite) Sangraha Kala Ashtang Hridayam:Use of Dhatura phala (fruit) in Kakkurdansha chikitsa.

Ashtang Sangraha: Signs and symptoms of Dhatura

poisoning are mentioned. Use of Dhatura phala (fruit) in Mushika, alarkavisha.

Laghutrayi Sharangdhar Samhita: Dhatura is one of the content in Dhatura tailam (Ref- 9/ 199) and Sannipatabhairava Rasa (Ref - 12/233-247)

Bhavprakash: Dhatura included under Guduchyadi Varga (1st part) Use of Dhatura in Samanyajwara (Ref -2nd part/177-179)

According to Yogratnakar (Uttarardha)

- Dhatura phala is used in Shwanchikitsa.
- Dhatura Swaras is used in Garudanjanam.
- Dhatura is used in Kameshwar Rasa.
- Dhatura is used in Kameshwar Modak.
- Dhatura Swaras Bhavna is used in Sannipatik jvar.
- Dhatura phala (fruit) Bhasma is used in Sannipatik jvar.
- Dhatura one of the content is used in Bhairava rasa.

Bhaishajyaratnawali There is reference of Dhatura as a Upavisha (ref. 2/165) Reference of Dhatura Shodhan (Ref. 2/166, 176)
Rastarangini: There is description of Dhatura as a content in Chaturvinshastarang, Bradhna shodhahar, Pralapantak rasa (Ref. Shlok No. 342, 360, 369). Description of Matra of Dhatura (Ref. 367-368)

3. REGIONAL AND OTHER NAMES

Sanskrit: Umatta-virkshaha
English: Thorn apple Hindi: Sadah-Datura, Safed Datura
Tamil: Umatai Arab: Jonz-masal
Gujrat: Dhatoria Bengali: Dhattura
Malayalam: Maraummam Marathi: Kanaka

4. SCIENTIFIC CLASSIFICATION OF DHATURA METAL

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Solanales
Family: Solanaceae
Genus: Datura
Species: Datura stromonium

5. BOTANICAL DESCRIPTION

5.1. Plant appearance

Dhatura is an annual plant The stem is herbaceous, branched and glabrous or only lightly hairy. By cultivation the plant reaches a height of about one meter.[2,3] The branching stems are spreading, leafy, stout, erect, smooth and pale yellowish green in color, branching repeatedly in a forked manner. Leaves are hairy, big, simple dentate, oval glabrous, apposite veins of leaves are pale black, stalked, 4-6 inch long, ovate and pale green. The upper surface is dark and grayish-green, generally smooth, the under surface paler, and when dried, minutely wrinkled. D. stramonium bears funnel shaped, white or purple coloured flowers, with 5 stamens and superior ovary. The average length of flower is about 3 inches. The calyx is long, tubular and somewhat a swollen below and very sharply five angled surmounted by five sharp teeth. Corolla is funnel shaped. Stem stalk is pale blue or greenish white. Seeds are black, kidney shape and flat.[4,5] Fruits are as large as walnuts and full of thorns (hence the English name “thorn apple”). The plant is strong narcotic, but has a peculiar action on the human which renders it very valuable as medicines. The whole plant is poisonous and the seeds are the most active; neither dying nor boiling destroys the poisonous properties. The symptoms of acute Jimsonweed poisoning included dryness of the mouth and extreme thirst, dryness of the skin, pupil dilate ion, impaired vision, urinary retention, rapid heartbeat, confusion, restlessness, hallucinations, and loss of consciousness.[6]

Figure 1: Dhatura Plant.

Figure 2: Flower of Dhatura.

5.2. Distributions: D. stromonium is probably originated in Caspian Sea territories and speeded to Europe in the first century. At present it cultivates in waste places in Europe, Asia, America and South Africa. D. Stromonium is cultivated in Germany, France, Hungary, South America and throughout the world.[7]

5.3. Cultivation and collection: Thorn apple is easily cultivated, growing well in open, sunny situation. It flourishes in most moderately good soil but cultivates best in calcareous rich soil, or in a good sandy loam, with leaf mould added. Seeds are spread in open in May, in drill 3 feet apart, barely covered. Sown thinly, as the plants attain a good size and cultivate freely from seed. Thin out the young plants to a distance of 12 to 15 inches between each plant in the drill. The soil should be kept free from weeds in the early stages. If the summer is hot and dry, give a mulching of rotted cow-manure. If grown for leaf crop, the capsule should be picked off as soon as formed, as in a wind the spines tear the leaves. In August the plant spreads to a hight of 1 meter and bears flowers and fruits. In the end of August stems with leaves and flowering tops are collected and dried as soon as possible at 45 °C to 50 °C. The leaves should be gathered when the plant is in full bloom and carefully dried. They are generally garnered in late summer. In August, the crop is cut by the sickle on a fine day in the morning, after the sun has dried off the dew, and the leaves are unprotected from the stem, dried carefully as quickly as possible.[8,9,10]

6. CLASSIFICATION

According to Ayurveda
Kula: kantakari kula
Varga-According to Nighantus

Nighantu Varga

1) Priyanighantu Shatpushapadi
2) Bhavprakash Guduchyadi
3) Aadarsh Kantakaryadi
Constituent : Chetan Dravya
Morphology : Karya Dravya
Use : Aaushadhi

Types of Dhatura

They are 5 types according to colour of flower (Raj nighantu in karaveeradi varg)

• White • Blue, • Black, • Red • Yellow

Now a days white, black colour plants are seen and Black colour Dhatura having High percentage of active principles and they are used in medicines also. There are 3 types - Raja, Krishna and Shveta dhattura. D. Stramonium is Krishna Dhatura. It is herb is bluish

black, seeds are black, thorns on the fruit are pointed and the latter decimate in 4-5 parts.

Species

1. Datura wrightii also called Southwestern Thorn Apple
2. Datura stramonium also called Jimson weed
3. Datura metaloides also called sacred datura
4. Datura inoxia named as Toloache
5. Datura discolor is also known as Moon Flower.
6. Datura ceratocaula
7. Datura ferox : long spined thorn –apple
8. Datura leichhardti : Leichhardt´s datura
9. Datura quercifolia : Oak-leaf thorn-apple

7. ETHANOPHARMACOTHERAPEUTIC

Plant derived drugs come into use in the modern medicine through the uses of plant material as ethnic cure in traditional systems of medicine. The leaves of D. stromonium L. are used for the release of headache and vapours of leaf infusion are used to relief the pain of rheumatism and gout. The smoke from the burning leaf is inhaled for the relief of asthma and bronchitis. European remedy of D. stromonium for haemorrhoid is to steam the part over boiling water containing leaf. The fruit juice is applied to the scalp for the treatment of falling hair and dandruff. It is also applied to smooth painful wounds and sores. Seeds and leaves of D. stromonium were used to sedate hysterical and psychotic patients, also to treat insomnia[11]. D. stromonium was used as hallucinogenic drug. It is also used to relax the smooth muscles of the bronchial tube and asthmatic bronchial spasm. It was stated that D. stromonium was used inside to treat madness, epilepsy and depression. Externally it forms the basis of ointment for burns and rheumatism[12]. It is also used in the treatment of parkinsonism and hemorrhoids. Its leaves, applied after roasting, are useful in relieving pain. The bitter narcotic plant releases pain and boosts the healing process. The seeds of the plant are medicinally the most active. Externally, the plant is used as a poultice in considering fistulas, abscesses wounds and severe neuralgia. Scopolamine is also found in the plant, which makes it a potent cholinergic-blocki hallucinogen that has been used to calm schizoid patients. Its leaves, containing hyoscyamine and atropine, can be used as an immensely powerful mind-altering drug. The seeds of Datura are analgesic, anthelmintic and anti-inflammatory and as such, they are used in the treatment of stomach and intestinal pain that results from worm infestation, toothache, and fever from inflammation. The juice of its fruit is applied to the scalp, to treat dandruff and falling hair. The growing plant works as an insect repellant, which protects neighboring plants from insects.[13] D. stromonium is mostly used as anthelmintics and antiparasitic in Marche, Abruzzo and Latium. Records of continued use of the plant in these sectors was collected from farmers and shepherds (mostly old people).[14,15]

8. FOLKLORIC USES[16,17,18]

- Leaves: Used a lot in resolute and mitigate poultices. Smoked like stramonium in cases of dyspnea produced by asthma. Seeds and roots have the same uses; some considered the seeds to be more potent.
- Asthma: cut the dried leaves and stems into small slices and mix with an equal quantity of tobacco and roll into a cigarette and smoke 2 to 3 times a day.
- Muscle Pains and Cramps Due To Rheumatism: Boil the drug and obtain a concentrated decoction. Wash the painful parts with the warm decoction.
- Gastric Pain: 0.3 gm of dried material in decoction form uses.
- Sprains, Contusions, Snakebites, Piles: pounded fresh leaves and applied over afflicted areas.
- Severe Cold Accompanied by Excessive Sneezing Similar to Hay Fever Symptoms: powdered seeds (0.1 gm) in pills or loose form.
- Psoriasis: the oil prepared by boiling Datura seeds with sesame (linga) oil in alkaline water made from ashes of gabi. For the preparation of the alkaline water, simply dissolve the white ashes of gabi in water.
- For rheumatic swelling of the joints, lumbago, painful tumors, nodes, etc. the plant is applied locally as a poultice of leaves, epithem, fomentation or liniment.
- Leaves applied as an anodyne poultice: to inflamed breasts, or to check the excessive secretion of milk. A paste made from turmeric and datura fruit is also useful for the same.
- Leaves boiled in oil: or the oil itself is a useful application for hemorrhoids, anal fissures, and other rectal diseases associated with tenesmus.
- Juice of leaves Administered internally for the prevention of gonorrhea.
- Leaves steeped in spirits used to stimulate hair growth.
- Heated leaves applied to the spleen for intermittent fever.
- Malays used the leaves for boils, leg sores, hemorrhoids, rheumatism, swollen joints, and fish bites. Heated leaves also used enlarged spleen and swollen testicles.
- Juice of leaves dropped inside the ear for earaches.
- Salt and some amount of oil mix in a decoction of seeds induce severe vomiting and could be caused delirium.
- Oil of datura uses in apoplexy.
- Application of Paste of root with vinegar beneficial to Ascitis and inflammation.
- Due to the antispasmodic of bronchioles, fumigation of leaves prevents the Asthmatic episodes or used in chilam in place of tobacco and internally used with appropriate drugs.
- In Purulia (West Bengal) and Rajasthan, seeds use for the treatment of leprosy, leaf in guinea– worms.
- Ointment of seeds used for smallpox.

- Flowers digested in wine used as an anesthetic tincture.
- Lotion made from the flowers used for facial eruptions and feet swellings.
- In Cambodia, coconut oil is heated inside the fruit capsule, and the juice, with the oil, is squeezed into the ear.
- Plant used as an indigenous substitute for belladonna in the treatment of cataract and other eye diseases. Mydriatic potency has been reported - the watery extract of leaves is applied around the eyes, causing dilatation for two days. Also, dilatation may be achieved through an alcoholic extract of the seeds in four ounces of spirits, the tincture evaporated to dryness in a water bath, and the residue dissolved in an ounce of water.
- Roasted leaves applied to the eyes for ophthalmia.
- Powdered roots are rubbed on the gums for toothache.
- Roots used for the bites of wild dogs.
- Pill made from pounded seeds placed on decayed teeth to relieve toothaches.
- Roots boiled in milk and administered with clarified butter and treacle for insanity.
- Seeds pounded in oil used as an embrocation in rheumatism also applied to syphilitic swellings and boils.
- In Konkan, plant juice is given with fresh curds for intermittent fevers.
- In India, used for hysteria, insanity, diarrhoea, asthma, skin diseases. For epilepsy, seeds of ripe fruit are burned and the smoke inhaled. Seeds used in small doses as an analgesic.
- In China, used for asthma, the dried leaves are rolled and smoked like a cigar. Dried flowers used for as anesthetic and prescribed for the treatment of asthma, cough, and convulsions.
- In Ayurvedic medicine, seeds used to treat skin rashes, ulcers, bronchitis, jaundice and diabetes
- In Brazil, used for making tea for its sedative effect. Flowers are dried and smoked as cigarettes.
- In Vietnam, dried flowers and leaves cut into small chips and smoked as cigarettes for asthma.
- In Bangladesh, leaves of D. metel, Zizyphus mauritiana, Calotropis gigantea, and bark of Terminalia arjuna are cut in pieces, boiled in water, then applied to paralyzed portions of the body 3-4 times a day and daily till cure.

9. RASA PANCHAKA IN VARIOUS NIGHANTU AND CLASSICAL TEXT

Table Nu- 1: Rasa Panchaka in different Classic.[19.20.21.22,23]

Text	Rasa	Guna	Virya	Vipak	Prabhav	Doshkarma
P.V.Sharma Dravyaguna	Tikta, katu	Laghu, Ruksha, Vayavyi, Vikashi	Ushna	Katu	Madak	Kapha-Vata Shamak
Raj Nighantu	Katu	-	Ushna	-	-	-
Bhavaprakash Nighantu	Madhur, Tikta, Kashya	Guru	Ushna	-	-	Vatakarak
Madanpala Nighantu	Guru	-	Ushna	-	-	-

10. AYURVEDICA PROPERTIES IN NIGHANTU[24,25,26,27,28,29,30]

Karma	Raj Nighantu	Bhavprakash Nighantu	Madanpal Nighantu	Kaidev Nighantu	Chakradatta	Vangsen
Tamakshvashahara	-	+	-	-	-	-
Vishghna	-	+	+	+	-	-
Kandughna	+	+	-	+	-	-
Kraminashaka		+	+	+	-	-
Jwaranashak	+	+	-	+	-	-
Vrannashak	+	+	+	-	-	-
Kusthaghna	+	+	+	-	-	-

11. PHYTOCHEMICAL CONSTITUENTS

- Phytochemical screening of seeds yielded alkaloids, tannins, phlorotannins, cardiac glycosides, carbohydrates, flavonoids, amino acids, and phenolic compounds.[31]
- A 50% ethanol eluate fraction of a macroporous resin of the flower isolated a new compound, yangjinhualin A, and five known megastigmane sesquiterpenes.[32]
- Yields tropane alkaloids such as hyoscyamine, scopolamine, anisodamine and anisodine.
- Flowers: Scopolamine, 0.5%; hyoscyamine, 0.04%; atropine, 0.01%.
- Leaves: Total alkaloid content is 0.426%, mainly as atropine and a small amount of hyoscyamine.
- Seeds contain 0.426% alkaloid, mainly hyoscyamine.
- Roots contain 0.35% hyoscyamine.
- The highest percentage of scopolamine accumulation in the root was after 16 weeks.
- The aerial parts, if compared with the root of the plant, usually accumulated relatively higher amounts

of scopolamine and relatively lower amounts of atropine.

- Screening of leaves yielded alkaloids and steroids, with an absence of saponins and flavonoids. The concentration of Ca2+, Mg2+, Fe3+ and PO3- were found to be (4.28 ± 0.05) × 104, 4 (3.86 ± 0.009) ×104, (2.33 ± 0.007) × 104 and (4.65 ± 0.06)×104 ppm respectively.[33]
- Methanol extract of whole plant isolated seven compounds viz.1. pterodontriol B 2. disciferitriol 3. Scopolamine 4. Adenosine 5. Thymidine 6. 7. Ilekudinoside C 8. Dioscoroside D.[34]
- Study of methanol extract of flowers isolated 10 new with anolides, with ametelins I-P 9. 10-seco-withametelin B 12ß- hydroxy-1 10. 10-seco-withametelin B together with seven known withanolides.[35]
- **Mechanism of Action:** Atropine has a stimulating action on the central nervous system and dampens the nerve endings to the secretory glands and plain muscle. Hyoscine lacks the central stimulant action of atropine; its sedative properties enable it to be used in the control of motion sickness. Hyoscine hydrobromide is active in preoperative medication, usually with papaveretum, some 30–60 min before the induction of anesthesia. Atropine and hyoscine are used to a large magnitude in ophthalmic practice to dilate the pupil of the eye.

12. ACTION OF CHEMICAL CONSTITUENTS OF DHATURA SCOPOLAMINE: It is used as in asthma & anti depressant and anti nausea drug. It is anticholinergic and antimuscarinic. Paradoxically, overdoses can produce depression. Atropine: It is also an anticholinergic, antimuscarinic drug that causes dilate pupil and surges secretion of saliva. A fatal dose of atropine is greater than 10 mg, whereas scopolamine is toxic at 2–4 mg. The name "belladonna" comes from Italy where it was once used to dilate the eyes of women to make them more attractive ("bella") to men. Hyoscyamine : It is the levorotatory isomer of atropine and is also the precursor for the synthesis of scopolamine. Its actions are similar to scopolamine and atropine. Hyoscyamine is named for the genus of henbane that concentrates tropane alkaloids in the leaves and seeds.

13. SCIENTIFIC RUMOURS ON ACTIONS OF DATURA

- **Anti-asthmatic:** Quisumbing's compilation defines a mechanism for the plant's anti asthmatic effect. Asthma relief is ascribed to depression or paralysis of the receptive mechanism of the parasympathetic nerves in the bronchi (a known action of solanaceous alkaloids), an effect established by the relaxation created by the alkaloid extract from the smoke, on an isolated inter cartilaginous portion of a bronchial ring earlier contracted by pilocarpine. When smoke is inhaled, it is possible the sticky, resinous substance may help by coating the mucosa and thus declining the bronchial irritation. The study assessed the potential of Datura metel in controlling resistant response and bettering asthma in a mice model. Results showed potential of D. metel in bettering asthma symptoms by promoting naive T cell development and reducing activated T. cells.[36]

- **Hypoglycemic / Anti-hyperglycemic:** seed powder of DM suggestively produced a dose reliant reduction of blood glucose at graded doses (25, 50, and 75 mg/kg, p.o.) when given to both normal and alloxan induced diabetic rats.[37]

- **Cytotoxic:** Withanolides: Research on methanol extract of flowers of DM isolated 10 new withanolides with seven known withanolides. Compounds 1, 3, 4, and 6 exhibited cytotoxic actions beside lung, gastric, and leukemia cancer cell lines.[38]

- **Antimycotic:** The Research, has been stated the chloroform section of Datura metel to be capable with antifungal action beside all three species of Aspergillus, i.e., A. fumigatus, A. flavus and A. niger. However, the cytotoxicity of the chloroform fraction was less than amphotericin B.[39]

- **Anti-fungal:** Research of root and shoot extracts revealed significantly suppression of growing of the target fungal pathogen, Ascochyta rabiei, the cause of chickpea blight diseases.[40]

- **Herbicidal / Roots and Shoots:** Research for the root and shoot extracts of Datura metel stated towards encompassing herbicidal constituents in this herb that exhibited activity against Phalaris minor Retz., one of the most problematic weeds of wheat in Pakistan.[41]

- **Toxicity Studies:** Suspensions of powdered leaf of Datura metel and D. stramonium on virgin female albino mice revealed dose dependent reversible and irreversible changes. Generally, D. metel-treated mice showed less anatomical abnormalities than D. stramoniumtreated mice and suggests D. metel could serve as a substitute for D. stramonium in drug development.[42]

- **Antibacterial / Alkaloid**: A new antibacterial agent was sequestered from Datura metel leaves with exploit beside S. aureus, P. aeruginosa, P. mirabilis, S. typhi, B. subtilis and K. pneumonia. Effects support its use in phytomedicine for the treatment of asthma, cough, burns and wound healing in Nigeria.[43] Other studies have explored the antibacterial activity of methanol, n-hexane, ethyl acetate and chloroform extracts of plant species Datura alba. The extract from leaves, stem, roots and seeds were tested in-vitro against four bacterial strains by agar diffusion methods. The outcomes

suggested that leaf extracts have the highest inhibitory potential against K. pneumoniae and E. coli. The extracts from other parts showed moderate to low activities against the tested bacterial strains that reveal that the leaves of D. alba has the highest concentration of secondary metabolites and may ascertain to be an important candidate in pharmaceutical formulations beside these two pathogens.[44]

- **Deleterious Frontal Cortex Effect:** A Research of aqueous leaf extract in adult Wistar rats caused deleterious belongings on the frontal cortex of adult albino Wistar rats, with dose-depended vacuolations in the stroma of the brains of treatment group.[45]

- **Sedation / Decreased Appetite**: A study of seed extract for analgesic action presented unimportant results. The study presented a behavioral pattern of sedation and reduced appetite on the administration of the seed extract, accredited to action on u-type receptors in the CNS, which on stimulus have and intrinsic potential to diminish the distress or the effective component of pains without any significant change in the intensity of the actual sensation. Another study discovered that 25 g/kg of methanolic crude extract induced behavioral sleep patterns (EEG) similar to that of thiopental in rats.[46,47]

- **Antimicrobial/Alkaloid:** In a Research showing 17 different coastal medicinal plants for antibacterial and antifungal action, Datura metel presented a wide range of antimicrobial action beside many fish pathogens. Outcomes advocated DM can be used as a putative antimicrobial drug in the aquaculture keep. The antimicrobial activity of leaf, stem bark and root extracts of D. metel was assessed by agar well diffusion method, against β hemolytic Streptococcus, E. coli, P. aeruginosa, and S. aureus. They were sensitive to the ethanol and aqueous leaf and stem bark extracts of D. metel. The root extracts of the plants had no antibacterial activity. The leaf extracts applied potential properties on above isolates. The crude ethanol extract exhibited an inhibitory zone of more than 30 mm against P. aeruginosa. It was create that the inhibitory zones were more than 20 mm for E. coli, S. aureus, and β haemolytic Streptococcus according to previous reports. The MIC assessed using the broth macro dilution method for these organisms was 20 mg/mL, which indirect that the antimicrobial activity of the plant extracts depends on the solvent used for the extraction process.[48,49]

- **Spasmogenic:** Research of D. metel leaf and root extracts, scopolamine, and acetylcholine on insulated smooth muscle preparations. Leaf extract and scopolamine presented antispasmodic effects while the root extract and acetylcholine cause contracture in isolated rat uterus and whole rectum muscle. Results suggest a spasmogenic factor in the DM root extract.[50]

- **Antioxidant:** Results the aqueous extract contained more phytochemical compounds than ethanol extracts. Antioxidant actions were higher in the plant leaf than the bark. Results suggest the plant as a natural source of antioxidants and phytochemical quality for antibacterial effectiveness.[51] Another study exposed that the extracts of the methanolic seeds showed the highest total phenolic content. At 1 mg/ml concentration, the DPPH radical scavenging actions of leaves and seeds were 66.4% and 63.3%, correspondingly and the reticence percentages of ABTS radical were between 96.54% and 97.01%. Outcomes propose that D. metel extracts from both leaves and seeds could be used as potential bases of new antioxidant agents, useful in pharmacological and food industries.[52]

- **Anti-microbial:** Research assessed aerial parts of Datura metel for antimicrobial activity against resistant pathogens of aquatic, human, and plant origin. Results showed antimicrobial property and potential for use in the treatment of infectious diseases caused by resistant pathogenic organisms.[53]

- **Anesthetic / Seeds:** Study assessed a methanolic extract of D. metel seeds as a potential oral anesthetic in dogs. The extract persuaded surgical anesthesia in dogs with recovery without obstacles. Outcomes presented the seed extract to be relatively safe, inducing sleep similar to thiopentone sodium.[54]

- **Anti-stress:** Withanolides from D. fastuosa possess anti-stress action. When administered with diazepam, it showed an anxiolytic effect and reticent the immobilization stressinduced depletion of adrenal cortisone. Adrenal cortisone helps the organism to overcome annoying stimuli, but such reactions can cause stress prompted disorders. Exhaustive study of varying doses, duration, and mode of administration is essential to know the effectiveness as an anti-stress agent.[55]

- **Anti-depressant Effects**: The neuropsycho pharmacological effects of aqueous extracts of leaves and seeds of Datura fastuosa, were studied in rats and mice. The leaf and seed extracts at doses of 400 and 800 mg/kg improved motor activity, abridged the duration of barbituric sleeping slightly, antagonized catalepsy and ptosis persuaded by haloperidol and the immobility persuaded by forced swimming. The results also presented that Datura fastuosa has some antidepressant profile at small doses.[56]

- **Flower Components / Antimicrobial**: Research of methanol extracts of D. metel flowers produced four compounds. Constituents identified as acetic acid, trifluoro-, 2, 2- dimethylpropyl ester, 4-Trifluoroacetoxyoctane, and 1, 4-Cyclohexadiene, 1 - methylhave antimicrobial property.[57]

- **Corrosion Inhibition of Mild Steel**: Research evaluated the corrosion reserve potential of D. metel in acid average on mild steel. Outcomes presented significant corrosion inhibitive effect, probably through adsorption of phytoconstituents.[58]

- **Anti-Inflammatory / Antioxidant / Leaves:** Research assessed the in-vitro anti-inflammatory and antioxidant potential of leaves of D. metel. Outcomes advocate considerable activity and suggest in-vivo studies.[59]

- **Anti-Gout / Antiarthritis / Antioxidant / Leaves:** Research of a methanolic extract of D. metel presented more than 50% xanthine oxidase inhibitory activity in-vitro, equivalent to standard anti-gout medicine, allopurinol. It also presented in-vivo hypouricemic activity beside potassium oxonate-induced hyperuricemia in mice.[60]

- **Dry and Fresh Leaves Antimicrobial and Antioxidant Activity:** In a relative Research of phytochemical screening, antioxidant and antimicrobial capabilities of dissimilar crude extracts from dry and fresh leaves shown that both have a positive outcome for alkaloid, flavonoid, saponin and tannin compounds and all organic crude extracts from both fresh and dry leaves could be used as potential bases of new antioxidant and antimicrobial agents. Different organic solvents, including methanol, chloroform, hexane, ethyl acetate, and butanol were used to prepare the crude extracts from the fresh and dry leaves. The antioxidant activity of dry crude extracts as equivalent to DPPH (2, 2-diphenyl-1 - picrylhydrazyl) was in the order of butanol > chloroform > ethyl acetate extract > methanol > hexane extract. However, the order of antioxidant action for fresh organic crude extracts to DPPH was in the order of methanol > hexane > chloroform > ethyl acetate extract > butanol 9.

- **Anti-cancer / MCF-7 Cell Line:** Research evaluated a methanolic extract of Datura metel for anticancer activity against MCF-7 cell line. Outcomes presented a leaf extract to have remarkable anticancer activity. Sequestration of the compound contributing to the action has a potential for a novel and natural phytomedicine for the disease[61]. On assessing the cytotoxic property of the methanolic extract of D. metel leaves beside two isogenic human tumour cell lines, namely, HCT116 derived from human colorectal cancer and MCF 7 resulting from estrogen-dependent human breast cancer cells. The cell proliferation assay was achieved using tetrazolium (MTT) method. The methanolic extract showed noteworthy cytotoxicity against HCT 116 cells with an IC50 28.4 µg/mL. It applied potent cytotoxicity towards MCF7 cells (IC50 28.77µg/mL). That highlights the potential of D. metel in the treatment of breast and colorectal cancer.[62]

- **Withametellins / Alkaloids / Cytotoxicity Against Cancer Cell Lines / Flowers:** MTT investigation of methanol extract of flowers yielded withametelins I-P, 12-ß-hydroxy-1, 10-secowithametelin B and 1, 10-seco-withmetelin B. Withametelins I, K, L, and N exhibited cytotoxic activities against A549 (lung), BGC- 823 (gastric) and K562 (leukemia) cancer cell lines, with IC50 ranging from 0.05 to 3.5 µM. Withamilin J exhibited moderate cytotoxicity against BGC-823.

- **Bio-pesticidal:** The research assessed solvent extracts of Datura metel beside larvae of gram pod-borer Heicoverpa armigera. The most active was the ethyl acetate fraction of the leaf extract, with a significant potential for usage as a bio-pesticide for the control of destructive polyphagous agricultural pest-H. Armigera.[63]

- **Insecticide/Leaves/Red Ants and Grasshoppers:** The Research assessed the leaf of Datura metel for acute toxicity at variable deliberations on grasshoppers and red ants. The study showed a statistically important dose-dependent decrease in the survival rate and an increase in the percentage mortality of red ants and grasshoppers in the occurrence of Datura metel.

- **Antifertility / Seeds:** Research evaluated crude acetone extracts of seeds of Datura metel in female albino mouse for anti-fertility activity. A 2% seeds extract caused anti-implantation activity, and suggests a potential good source of anti-fertility compounds with minimal side effects after testing in human models.[64]

- **Mineral Composition / PhytomonitorPotential:** The Research assessed the mineral compositions of leaf, seed, and flower of D. metal. Results yielded 12 elements, containing Cu, Co, Ni, Mn, Zn, Fe, Na, K, Ca, Mg, P, and Al. Leaves were minerals richer than seed and flower counterparts. Datura metel was found tolerant for Co and Ni and may be used as phytomonitor for these elements in the soil.[65]

- **Acetylcholinesterase Inhibitory Property / Withanolides:** The s Research showed the acetylcholnesterase inhibitory properties of Datura metel is due to the occurrence of withanolides. The

methanolic extracts showed extra significant dose-dependent inhibition of acetylcholinesterase.[66]

- **Anti-termite / Datura:** The Research assessed the efficacy of extracts from Datura metel, local soap, and garlic in the management of Macrotermes belicosus. The synthetic insecticide, chlorpyrifos 0.1%, was used as control. In the laboratory, all the treatments had 75% - 100% repellence value with 100% mean insect mortality. On the field, only D. metel and chlorpyrifos were effective in preventing upsurge and innovation of termitaria. Outcomes advise an eco-friendly botanical potential for the managing of termites in the field. (See leaf extract preparation above).[67]

- **Hallucinogenic / Seeds:** Research assessed the hallucinogenic outcome of aqueous seed extract of D. metel in male Wistar rats. Treated groups showed some behavioral changes: restlessness, aggressiveness, agitation, and disorientation, with a significant decrease in food and water intake. Results validate the action of D. metel on the central and peripheral nervous systems. The hallucinogenic effect may be due to the presence of the alkaloid scopolamine.[68]

- **Neuro-Toxicological Effects / Leaves:** Use of leaves has been stated to cause adverse alteration in behavior. The Reserch assessed the acute neuro-toxicological effects of aqueousmethanol extracts of D. metel on total locomotive activity, motor coordination, and spatial memory in Y-maze in mice. The leaves extract caused neuro-toxicological effects in mice categorized by sedation and hypokinesia motor coordination impairment and disruption of short-term memory. The oral LD50 was greater than 2000 mg/kbw.[69]

- **Effects on Visual System:** By oral administration of Datura metel on the visual system, as marker of toxicity using neuro histochemical it has been shown that on the visual system of male Wistar rats caused neurodegeneration of the occipital cortex, right lateral geniculate nucleus and right superior colliculus that are all indicative of necrotic process in the tissues with the involvement of lysosomal destruction. Datura metel is seen from the research work to be neurotoxic to the visual system in male Wistar rats.[70]

- **Effects on Medial Prefrontal Cortex Histology:** The action of ethanolic seed extract of Datura metel on Nissl substances, astrocytes, axonal and neuronal integrity of the medial prefrontal cortex was studied in rats. Extract was given 100 and 200 mg/kg b.w. for 14 days. The outcomes exposed that Datura metel was harmful to the health of Wistar rats at a dose-dependent rate as perceived in its actions on the medial prefrontal cortex at 100 mg/kg b.w. and 200 mg/kg b.w. The histological study of the preserved Wistar rats exhibited features of unsettled neuronal integrity such as, chromatolysis, reduced protein synthesis due to loss of Nissl substances and nuclei, neuronal loss as well as axonal injuries.[71]

- **Nephrotoxic Effect:** Phytochemical screening and effect of Datura metel aqueous seed extract was assessed in albino rats revealed the occurrence of phytochemicals which recognised the plant to its possessions on the functional ability of the kidney as revealed by alterations in the kidney function parameters analyzed. Aqueous seed extract of Datura metel may suggest that there may be possible kidney damage that has occurred. Kidney function parameters are valued tools for assessing the integrity of various parts of the kidney. The level of creatinine, electrolytes, urea and serum total protein could also deliver significant information regarding the influence of a drug/compound/extract on the glomerular and tubular region of the kidney. The study therefore, exposed likely compromised in tubular and glomerular function leading to renal dysfunction following administration of Datura metel aqueous seed extract in rats and may have some nephrotoxic effect on the basic purposes of the kidney investigated.[72]

- **Effects on Kidney**: Possessions of ethanolic extracts of leaf, seed and fruit of Datura metel on kidney purpose of male albino rats was investigated which designate that the extracts mildly altered most of the biochemical parameters used in evaluating kidney function as assessed and presented its interference in kidney function. the histo architecture of the kidney of the animals show glomerular extrusion and collapse with subsequent augmented urinary space, widened tubules, vacuolations in the epithelial lining of some of the tubules in the medulla and inflammatory cellular infiltration at some peritubular regions which spectacles that some parts of Datura metel retain mild negative effects, while some parts (in specific concentrations) could regulate the kidney function of male albino rats. This calls for caution in the use of this plant parts and therefore suggests that the use of this plant parts should be based strictly on pharmacological need.[73]

- **Prenatal Exposure Effects:** Throughout the prenatal stages the ethanolic extract of D. metel leaves can be used as a contraceptive because there is no signs of pregnancy in rats that were given 500 mg/kg body weight from the day of fertilization to parturition. It can also be used as an abortive drug when used in early period of gestation as it produced abortion in rats that were given 500 mg/kg body weight for the last 2 weeks of gestation period (821 st day of gestation). It should be evaded in the late period of gestation, as seen in the histological remark of tissues of litters in Group C, there was

retarded hippocampal development, neuronal damage and neural cell death that will mark the normal functioning of the hippocampus.[74]

- **Bioefficacy against Colletotrichum Gloeosporioides / Leaves:** Research Anthracnose disease instigated by Colletotrichum gloeos-porioides is the most damaging disease causing reduction of flower set and yield losses in mango. Study assessed the antifungal activity of various extracts Datura metel leaves against C. gloeosporioides. The chloroform fraction presented the best inhibition of the fungus. GCMS analysis identified bioactive constituents i.e., n-hexadecanoic acid, phytol, octadecanoic acid, oleic acid, o-xylene and cyclohexanol.[75]

- **Anti-rabies / Seed:** The Research assessed Soxhlet and cold extracts of Datura metel fruit and seed extract for anti-viral action beside the rabies virus. In-vitro cytotoxicity assess was done using 3-(4, 5-dimethyl- thiazolyl-2)-2, 5- diphenyltetrazolium bromide assay. The Datura seed extract presented potential in-vitro antirabies activity. The Research advocates further screening for in-vivo activity against rabies virus in a murine model[76].

- **Toxicity / Poisoning**: Wholly plant parts are poisonous. It encompasses tropanic alkaloids in variable attentions, mostly parasym-patholytic.

- Even a small dose is very poisonous because of the toxic tropane alkaloid or the attendance of anticholinergic substances (scopolamine, hyoscyamine, and atropine), which can cause neural toxicity.
- In the Bicol area, reports of abuse by smoking an herbal cigarette of dried leaves and lightly fried seeds resulted in permanent mental and behavioral problems.

14. DOSE[77]

DOSE – Seed Powder – 50-100 mg.
Lethal Dose – 100-125 seed

15. PURIFICATION OF DATURA[78,79,80]

In the purification process ofDhattūra, seeds are sodden in freshly serene Gomūtra and kept aside for 12 h. After washing, the seeds are reassigned to the dolā yantra for svedana method for 3 h. The seeds are again washed with lukewarm water, permissible to dry and the seeds testa are removed. Decrease in total alkaloid content and rise in total protein content of seed were observed after Śodhana. Complete removal of scopolamine and partial removal of hyosciamine reflects the importance of Śodhana of Dhattūra by means of which the toxic effects are disinterested.

16. DHATURA POISIONING SIGNS AND SYMPTOMS[81]

It creates characteristic manifestations of anticholinergic poisoning. 1. Dryness of mouth, nausea, vomiting 2. Dysphagia 3. Dysarthria (1–3 are due to inhibition of salivation) 4. Diplopia (due to dilated pupil) 5. Dry, hot (due to inhibition of sweat secretion), and red (due to the dilation of cutaneous blood vessels) skin, especially in the face/chest 6. Drowsiness leading to coma.

17. TREATMENT DHATURA POISONING[82]

According to rasa jala nidhi –1) Poison of Dhatura is nullified by drinking four tolas of the juice of seeds of egg fruits (brinjals). Poison of Dhatura is destroyed by drinking the decoction of flowers of cotton combined with their stones. Drinking of saline water also serves the same purpose. One prastha (64 tolas) of cow's milk and eight tolas of sugar, drunk together, counter-act the poison of Dhatura. According Basavarajeeyam text "visha prativishani kanake nimbu rasa jeerakam" this shloka is denoted for -nimburasa mixed with Jeeraka churna which counter-act the poison of Dhatura. Accroding to Rasadhatuprakash for the treatment of Dhatura poisoning.

- Kalka of samudra phala mixed with cow urine.
- Acorus clamus (Vacha) powder along with curd.
- The Kalka of erandmoola (ricinus communis) + kashaya (decoction) of karpasa beeja kashaya + cow milk and sugar for the treatment of Dhatura poisoning.

18. IMPORTANT FORMULATIONS:

KANAKASAVA, Ekangavira Rasa, Puspadhanva Rasa, Tribhuvana Kerti Rasa, Sri Jayamangala Rasa, Laghu Vishagarbha Taila, Vishatinduka Taila, Dhattura Taila.

19. CONCLUSION

Current appraisal gives a broad information about the bioactive constituents, ethnopharmacology along with the scientifically claimed medicinal uses of D. stramonium. Several alkaloids, carbohydrates, fat, proteins and tannins have been reported to be present in different parts of Dhatura. Morphological, cultivation, Purification, Dose, Pharmacological action, Uses and Poisoning of the Dhatura explained in a very good manner. The plant indications various types of activities such as analgesic and antiasthamatic action which may be due to the occurrence of the examined lively chemical constituents. The pharmacological researches so far have been performed in vitro and in vivo. Consequently, there is a essential of investigation and quantification of phytoconstituents and pharmacological profile.

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