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A CRITICAL REVIEW ON PHARMACOLOGICAL AND TOXICOLOGICAL PROPERTIES OF DHATURA

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Abstract: *Ayurveda is called as "Science of life". It is the oldest medical system of the world. It is based on balancing of doshas namely vata, pitta and kafa in a natural way. According to ayurveda if any poison is used after purification and used in a proper way it act like a medicine but if a medicine is used in a improper way it might acts like a poison. Dhatura is an important plant which had been described in ayurveda. This article deals with Dhatura's characteristics and toxicological properties according to ayurveda and modern toxicology. Dhatura is also called as thorn apple, unmatta, matul etc. It is classified as a systemic poison under the group cerebrals and subgroup deliriants. It is used as a stupefying poison prior to robbery, kidnapping and rape. Dhatura is also known as a famous "rail road poison" as it is commonly encountered during a journey. It is purified with cow milk in dolayantra before consumption as a medicine. The active principle contains the alkaloids levohyoscyamine, hyoscyamine, scopolamine and traces of atropine.*

Keywords: *Ayurveda,Dhatura, Deliriants, Rail road poison, Dolayantra, Hyoscyamine, Scopolamine, Atropine.*

Introduction: *Dhatura* is an important plant known from the earliest time. It is a plant having both medicinal and toxicological effects on human body. *Dhatura* plant grows all over India and is considered to be blessed by Lord Shiva [1]. *Dhatura* is a member of family solanaceae and belongs to the genus *Dhatura* which consist of 14 species such as D. *metel*, D. *stramonium*, D. *ferox* and D. *alba*. *Rajanighantu* explained five varieties of *Dhatura* viz. *shweta, nila, Krishna, rakta and pita*. D.*stramonium* is the *Krishna Dhatura* owing to its seed colour [2]. The Indian species include D.*fastuosa* , D.*atrax*, D.*metel*, there are two varieties of D.*fastuosa*,- *niger* (with purple flowers) and *alba* (with white flowers) [3].

Sanskrit Synonyms: *Unmatta, kanak, matul, shivapriya, Devata, Dhurta, Kitava, Madana, kanakahaya*, Mahamohi [4]

Common Name: Thorn apple, Jimson seed, stink weed, devil's weed, Angel's trumpet, Jamestown weed [5]

General Description

1. D. *metel Linn*.: An annual branched herb, upto 1 meter tall, stem with purple spots and prominent scars of fallen leaves. Leaves broadly ovate, slightly oblique at the base. Flowers funnel shaped, white or light yellow or purplish outside. Fruits greenish, triangular and have 3-4 mm long spines. Seeds ear shaped and light brown in colour [6].

2. D. *stramonium Linn*.: It's common name is thorn apple. Strong smelling leafy annual, upto 120 cm. Leaves ovate, coarsely lobed or toothed, upto 18 cm. Flowers white, rarely violet, narrow funnel shaped upto 12 cm long. This species is native to tropical America [7].

3. D. *fastuosa Linn*.: An erect perennial, 2-4 feet high, Stem woody below, purplish towards the tips. Leaves upto 3-8 inches long and 2-4 inches broad, ovate or ovate lanceolate. Flowers solitary, erect, pedicelled, corolla funnel shaped, 5-7 inches long, at the mouth violet or purplish outside, white within, fairly common in

Dehradun and Saharanpur districts, mostly found on waste ground [8].

4. D. *innoxia Mill*.: An annual bushy herb upto 1.2 meter tall. Corolla of its flowers is 10 degree angled broad. Fruits have very slender prickled. Seeds are brown. It is found in Bangalore, Ahmadabad, Pune, Lucknow and Jammu [9].

***Ayurvedic* classification:** *Dhatura* is described in *Acharya Panini's* works. *Acharya Sushruta* indicated it specially for *alarka visha* (rabies). *Acharya Sushruta* described it by the name of '*Unmatta*' twice and Dhatura [10] thrice . *Acharya Vagbhatta* quoted it twice each as *Dhatturaka* [11] and *Kanaka*. *Harita samhita* indicated it for the treatment of *arsas (Arshhara varti*). Different *Nighantus* have highlighted it's therapeutic usage in respiratory disorders and other conditions.

Parts Used: Root, leaf, flower, seeds [12].

Therapeutic Dose: Powder 50-100 mg., liquid extract – 1-3 drops [13]

Chemistry: Upto 0.5% of total alkaloids, scopolamine (hyoscine) is the main alkaloid. Hyoscyamine and atropine are present in minor quantities [14]. The whole plant, especially the leaves and flowers contain alkaloids scopolamine, hyoscyamine, atropine and norhyoscyamine as well as Vit.C. The total alkaloid content of the roots is 0.10 %- 0.20 %, leaves 0.1-0.5 %, flowers 0.25 – 0.60 % and fruits 0.12% [15[.

Characteristics According to *Ayurveda*: According to *ayurveda Dhatura* have following properties- *Rasa – katu* and *tikta*, *Guna – laghu* and *snigdha*, *Virya – ushana*, *Vipaka – katu*, Effect on *tridosha* – pacifies *vata* and *kapha* [16].

Formulation of *Dhatura* and their Uses: Main formulationsof *Dhatura* are *Suttshekhar* rasa, *Unmadagjankush* rasa, *Kankasava* etc. *Suttshekhar* rasa is mainly indicated for *Amlapitta*, *Unmadagjankush* rasa is mainly indicated for *Unmada* and *Kankasava* is mainly indicated for *Hikka*, cough and asthma etc. *Dhatura* is also used for pain, Inflammation, muscle spasm and gastric ulcers etc. Alkaloids present in *Dhatura* causes relaxation of smooth muscles, Decreases secretion of acid and pepsin in stomach and Suppresses tremors due to blockage of Acetylcholine.

Pharmacology: Different researches on *Dhatura* has shown following activity -

1. Thealcoholic extract of D. *metel* showed anthelmintic and anticancer activity [17].
2. Atropine, hyoscine and total alkaloids obtained from D. *metel* (100 µg/ ml, each) caused 9, 14.7 & 15.2% inhibition of MAO and 8, 9.3 & 8.9 % inhibition of 5- HTP decarboxylase respectively [18].
3. Extract obtained from leaves of D.*metel* shows antioxidant, antimicrobial and antifungal activity [19].
4. The extract of D. *stramonium* seeds shows cytotoxic and genotoxic effect on Human lymphocytes [20].
5. The aqueous leaf extract of D. metal shows deleterious effects on the visual cortex of albino Wister rats [21].
6. **6)**Scopolamine disrupted regulation of local blood flow in brain and altered blood tone of cerebral pial artery system in rats [22].
7. Scopolamine was effective against experimental cardiac arrhythmias induced in mice, rats, rabbits and guinea pigs [23].

Uses in *Ayurveda*

1. Extract of *Dhatura* leaves with turmeric and mustard oil cures karnnadi [24].
2. The external application of *Dhatura* with *aranda* and *nirgundi* removes severe filarial [25].
3. The fruit juice of *Dhatura* is applied to the scalp for falling hair [26].
4. Juice of *Dhatura* leaves with honey is an excellent remedy for external parasites [27].
5. Application of mercury with the juice of *Dhatura* leaves kills lice [28].
6. Fruit of *Dhatura* act as an excellent digestive agent after eating food [29].
7. Eczema and ringworm are destroyed by local application of the juice of the leaves of *Dhatura*, *nimba* and *betel* separately [30].
8. External application of *Dhatura* leaves and turmeric is used for swelling and pain in breast [31].
9. Steaming of Black *Dhatura*removes Earcache induced by *kafa* and *vata* [32].
10. Mustard oil cooked with *Dhatura* seeds and alkaline water of *mankand* removes cracks of feets [33].
11. *Dhatura* and *shweta punarnava* combination is a very effective remedy for *alarka visha* [34].
12. Root of *Dhaura* with jaggery and ghee is useful in all types of insanity [35].

Toxicological Action: All parts of these plants are poisonous. (highest concentration of alkaloids are found in roots and seeds) [36]. The seeds resemble Chili seeds but Chili seeds are small, yellow, rounded, smooth and pungent in odor and taste and *Dhatura* seeds are large, brown, reniform, pitted, odorless and bitter in taste. Poisoning occurs only if seeds are

masticated and swallowed [37]. It is bitter in taste and can initially lead to, stimulation of higher centers of brain. Later the vital centers are depressed, resulting in death mainly due to respiratory paralysis [38].

Absorption and Excretion: The alkaloids are absorbed through the mucous membrane of the GIT and respiratory tract, and through the skin and conjunctiva. It is destroyed in the liver by enzyme atropinase. It is excreted through the urine.

Signs and Symptoms: symptoms are seen 30-60 minutes after ingestion. The mnemonic "red as a beet, dry as a bone, blind as a bat, mad as a hen and hot as a hare" is useful to remember the anticholinergic toxidrome. Signs and symptoms can be summarized under 9 Ds as- Dryness of the mouth, Dysphasia, Dysarthria, Dilatation of cutaneous blood vessels, Diplopia, Dry hot skin, Drunken gait, Delirium and Drowsiness [39].

Differential Diagnosis: The symptoms of *Dhatura* poisoning mimics with alcohol poisoning, sun stroke and intracranial hemorrhage. Dry, hot, red skin present in *Dhatura* poisoning and sun stroke but in intracranial hemorrhage there is no effect on skin and in alcoholism the skin is pale, bluish, cold and clammy. In *Dhatura*poisoning and alcoholism Dilated pupil presentbut in intracranial hemorrhage and sun stroke small pupil present.

Fatal Dose and Fatal Period: 75-125 seeds (stupefying dose – 40-50 seeds), hyoscine-15-30 mg, 24 hrs [40]

Treatment: GI decontamination by gastric levage with potassium permanganate 1: 5000 solution. Activated charcoal in multiple doses is useful in reducing the absorption of toxins from the gut. Physostigmine 0.5-1 mg slow IV over 5 minute under ECG monitoring (0.02 mg/kg/dose) is a best pharmacological antidote [41]. Injectable pilocarpine nitrate 5 mg subcutaneously, repeated every two hours as required to counteract the action of *Dhatura* on the brain. Also use oxygen inhalation and artificial respiration if needed.

Postmortem Finding : In external finding signs of asphyxia is present and in internal findings seeds may be detected in the stomach and small intestines, stomach mucosa may show inflammation and lungs showsedematous and congested features.*Dhatura* seeds resist putrefaction and hence can be detected after a long time in a dead body [42].

Conclusion: As described in this article*Dhatura* is widely and abundantly available herb. It is found mainly on wasteland all over India. *Dhatura* consists 14 species, in which Indian species include D.*fastuosa*, D.*atrox*, D.*metel*. All species of *Dhatura* have narcotic and poisonous effect because tropane alkaloids present in all parts of *Dhatura* is toxic. *Dhatura* is used as a medicine after purification since ancient time because if it is used without proper purification, even in small quantities, it may cause Diplopia, Deliriumand Drowsiness etc. It is not advised in pregnant, lactating mothers and children. *Dhatura* have plenty of therapeutic uses. It is specially indicated for Cough, Asthma, pain, inflammation, skin disease, Rabies and baldness etc. In ancient time *Acharyas* used formulations of *Dhatura* in many diseases like- *Kankasava* for *Hikka*, *Suttshekharrasa* for *Amlapiitta* and *Unmadagjankush rasa* for *Unmada*. They didn't know about alkaloids which presents in *Dhatura* but *Acharyas* observed*Dhatura's* effect on body according to *doshas*.

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