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MEDICINAL AND TOXICOLOGICAL ASPECTS OF *DHATURA*: A REVIEW

Anita Sahu[1], S.R. Inchulkar[2], Yuvraj Kaushik[3]

[1]Post Graduate Scholar, Department of Agad Tantra Evum Vidhi Vaidyak, Govt. Ayurved College, Raipur, Chhattisgarh, India
[2]Professor, Department of Agad Tantra Evum Vidhi Vaidyak, Govt. Ayurved College, Raipur, Chhattisgarh, India
[3]Lecturer, Department of Agad Tantra Evum Vidhi Vaidyak, Govt. Ayurved College, Raipur, Chhattisgarh, India

Corresponding Author: aniwhat@gmail.com

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ABSTRACT

Dhatura is a toxic shrub and also a medicinal plant. *Ayurvedic* literature mentions the use of poisonous plants in the treatment of various human ailments. *Dhatura* is one of the *Upvisha*. It is a wildly growing plant from the Solanaceae family, used in many *Ayurvedic* formulations. This plant has contributed various pharmacological actions in the scientific field of Indian systems of medicine like analgesic, anti-inflammatory, anti-asthmatic, hypoglycemic, anti-rheumatoid, and wound healing activities. It contains a variety of toxic tropane alkaloids such as atropine, hyoscyamine, scopolamine, etc. every part of the plant is toxic, but the highest number of alkaloids is contained in the seed. *Dhatura* poisoning is common in India. The administration of improper amounts of *Dhatura* affects the central nervous system with symptoms such as dysphagia, dementia, confusion, convulsions, delirium, and hallucination. However, death by *Dhatura* poisoning is rare, recovery may take several days. Therefore, understanding the possible medicinal and toxicological effects of *Dhatura* is needed.

Keywords: *Dhatura*, *Ayurvedic*, medicinal plant, toxic effect, pharmacological action

INTRODUCTION

Dhatura is a perennial wild plant grown all over the country especially in wasteland. It is a small coarse shrub with an unpleasant smell, belongs to the Solanaceae family. Etymologically the word *Dhatura* is derived from a Sanskrit word "*Dhatur*". Other common name for *Dhatura* is thorn apple, jimson weed, hell's bell, and devil's trumpet. It comes under the *UpvishaVarga* in *Ayurveda.* In modern medicine, it is classified under deliriant type of cerebral poison. The plant contains a variety of toxic tropane alkaloids such as atropine, hyoscyamine, scopolamine, etc. which are responsible for both the medicinal and hallucinogenic properties, as well as toxic in a higher dose. Considering this, the plant has been grouped under schedule E-1of Drug and Cosmetics Act – 1940[1]. In *Ayurveda, Dhatura* is described as a useful remedy for various human ailments including asthma, cough, fever, inflammations, wound, edema, neuralgia, insanity, myalgia, hyperacidity, and dysmenorrhoea. *Dhatura* poisoning is common in India, the seeds being usually employed mainly as a stupefying poison prior to robbery, kidnapping and rape. It is sometimes known as roadside poison. Accidental poisoning is commonly occurring when children and adults eat the raw fruit or seeds mistaking them for edible fruits or capsicum seeds. The administration of improper amounts of *Dhatura* affects the central nervous system with symptoms such as dysphagia, dementia, confusion, convulsions, delirium, and hallucination. However, death by *Dhatura* poisoning is rare, recovery may take several days. As this plant is responsible for both medicinal and toxic effects on human beings, so it is necessary to use it after appropriate knowledge.

Objective: The present review article summarizes the medicinal importance, toxic effects, therapeutic doses, antidotes and medico-legal aspects of *Dhatura.*

Methodology: Material is collected from the classical *Ayurvedic* literatures, modern medical books and research journals.

Taxonomic Classification

Kingdom: Planate**; Division:** Mangoliophyta**; Subdivision:** Angiospermae**; Class:** Mangoliospida**; Subclass:** Asterids**; Order:** Solanales**; Family:** Solanaceae**; Genus:** Datura

***Ayurvedic* Classification**[2, 3, 4, 5, 6, 7]

Table 1: *Ayurvedic* classification of *Dhatura* according to different *Nighantu*

S. No.	*Nighantu* Name	*Varga*
1	*Raj Nighantu*	*Karviradi*
2	*Madanpal Nighantu*	*Abhayadi*
3	*Kaiyadev Nighantu*	*Aoushadhi*
4	*Bhavprakash Nighantu*	*Guduchyadi*
5	*Dhanvantari Nighantu*	*Karviradi*
6	*Shaligram Nighantu*	*Guduchyadi*

Table 2: Vernacular Name[8]

Language Name	Synonyms
Hindi	*Sada Dhatura*
English	*Thorn-Apple*
Telugu	*Ummetta*
Tamil	*Ummattai, Umate*
Bengali	*Dhatura, Dhotra*
Kannada	*Unmatta*
Gujrati	*Dhatura, Dhaturo*
Marathi	*Dhotra, Dhatura*
Bihar	*Khunuk*
Kashmir	*Dather*

Classical Name: *Dhattura, Dhuttura, Dhustura, Dhurta, kitava, kanaka, unmatta, matula, shivpriya, Dhurta, Devata, Kitava, Toori, Mahamohi, Kanakahvaya* etc.

Table 3: Possible meaning of synonyms of *Dhatura*

Dhattura	It destroys vitiated *Doshas* and *Dhatus* by its *Ushna Guna*
Unmatta	The drug that produces delirium
Kanaka/Kanakahva	The drug with synonyms of gold
Kitava	People who consume will behave idiotic
Madana	That paralysis the function of the body parts
Shivapriya	Favorite of lord *Shiva*
Dhustura	Drug causing giddiness and palpitation (with its delirient effect)
Dhurta	Drug that kills head lies (*Yuka*), body lies (*Leeksha*) etc.
Matula	No other drug is equal to its therapeutic effects or in other words there is no comparison of its efficacy with other drugs

Types[9]There are 5 types based on color of flowers.

1. White; 2. Blue, 3. Black, 4. Deep red, 5. Yellow

Botanical Description[10]

Dhatura is a messy smelling, erect, annual, freely branching herb that forms a shrub up to 60 to 150 cm (3 to 5 ft) tall.

Root: cylindrical with lateral branches, brown coloured, roughsplintry.

Stem: Dichotomously branched, cylindrical, blackish-dark to purple colour, internode very short.

Leaf:6 to 11 cm long, 2 to 8 cm broad, alternately arranged with pointed margin, dark green colour.

Flower: The flowers are trumpet or bell shaped.

Fruit: Capsule, Spherical with soft spines and contains 50 to 100light brown reniform seed.

Seed: Light brown, reniform, compressed, flattened, 0.4 to 0.5 cm long, and 0.4 cm wide, foveate, surface finely pitted, yellowish brown colour and resembling chilly seeds.

Distribution: In India, *Dhatura* plants are abundant and grow wild throughout the country.

Ayurvedic Properties[11]

Table 4: Showing *Ayurvedic* properties of *Dhatura*

Rasa	*Tikta, Katu*
Guna	*Laghu, Ruksha, Vyavayi, Vikasi*
Veerya	*Ushna*
Vipaka	*Katu*
Prabhava	*Madaka*
Doshaghnata	*Kaphavatashamaka*
Rogaghanta	*Shotha, Vedna, Arsha, Vatavikara, Amlapitta, Shwasa, Shaiyyamootra, Yuka, Liksha*
Karma	*Jantughana, Vedanasthapana, Shukrastambhan, Twagdoshahara, Swedavarodhak, Shoolaprashmana, Hridayottejaka, Garbhashayaprasaraka*

Table 5: Chemical Constituents of *Dhatura*[12]

Root	3α, 6β-Ditigloyloxytrone, 3α, 6β-Ditigloyloxytropan-7β-ol, tigloidine, apohyoscine, hyosine, 3α-tigloyloxytropane, norhyoscine, meteloidine, hyoscyamine, cuscohygrine and tropine.
Pericarp	β - sitosterol, scopolamine and fastusine.
Leaves	Scopolamine and mixture of two unidentified alkaloids.
Flower, leaves, aerial parts and roots	Hyoscine and hyoscyamine.
Fresh aerial parts	21, 24R-epoxy-27- methoxy-1-oxowitha- 2, 5-dienolide and hyoscyamine.
Fruit	Daturanolone and daturadiol.
Seed	Scopolamine, atropine, fastuine, fastusidine, daturanolone and fastusic acid.
Seed oil	4α-methylsterols- 31-norlanost-9(11) enol, 31-norcycloartenol, cycloeucalenol, 31-norlanost-8-enol, 31 nolanosterol; obtusifoliol, 4α-methyl cholesta-8-enol, lophenol and citrostadienol.

Therapeutic Parts[13]Root, fruit, seed, flower, leaves

Traditional Uses[14]

Dhatura is useful in asthma, cough, fever, inflammations, oedema, neuralgia, insanity, myalgia, hyperacidity, duodenal ulcer, renal colic, calculi, and dysmenorrhoea. The whole plant is of medicinal importance, but especially roots are used for bites of rabid dogs. Leaf is useful in inflammations and piles. Leaf juice is applied externally for lice and skin disease. Leaves in form of poultice are used in lumbago, sciatica, neuralgia, mumps, and painful swellings. Seeds are aphrodisiac and used in toothache, earache, gastric disorders, and are good to treat dandruff and lice.

Mode of Action[15]

- ✓ Atropine and hyoscine block the acetylcholine receptor and produces sympathomimetic or parasympatholytic action.
- ✓ It stimulates the central nervous system in early phase, but later CNS depression occurs, especially of the respiratory center.
- ✓ Vagolytic action resulting in stimulation of the heart.

Pharmacological Effects[16]

Researches revealed that *Dhatura* shows various types of activities such as Analgesic, anti-pyretic, anti-inflammatory, anti-viral, anti-cancer, and anti-ulcer, anti- stress, immunomodulatory activity, anti-microbial, anti-fungal activity, hypoglycemic effect, and wound healing effect.

Common Formulations

Kankasawa, Ekangvira Rasa, Puspadhanwa Rasa, Tribhuvana Kirti Rasa, Laghu Vishgarbha Taila, Visatinduka Taila, Dhattura Tail.

Toxicological Profile

Type of Poison:

- *Ayurveda*: *Sthavara Vanaspatik Visha, Upavisha*
- Modern: Cerebral Deliriant Poison

Fatal Dose[17]

- ✓ About 60 to 100 *Datura* seeds.
- ✓ Usally60 to 75 mg of atropine.

Fatal Period 24 hours

Clinical (Toxic) Features[19]

- Summarized in the classic phrase: *blind as a bat, hot as a hen, dry as a bone, red as a beet and mad as a wet hen.*
- The important manifestation of *Dhatura* poisoning can be summarized as 9Ds:

1. Dryness of mouth, thirst, slurred speech.
2. Dysphagia.
3. Dilated pupils.
4. Diplopia.
5. Dry hot skin with flushing, hyperpyrexia.
6. Drunken gait (ataxia), hyperpyrexia, convulsions.
7. Delirium with hallucinations, agitation, amnesia, incoherence.
8. Dysuria, Urinary retention, bladder distension.
9. Death preceded by tachycardia, arrhythmias, coma and respiratory depression.

Treatment Principle[20]: Monitoring of pulse, respiration and body temperature, Stomach washes by

KMnO4 or 4 - 5% tannic acid., hysostigmine1-4 mg i.v./i.m. (repeated, if necessary at intervals of 1-2 hrs.) 0r Neostigmine (2.5 mg i.v. every 3 hrs.), Pilocarpine 5mg s.c**.**

Ayurvedic Antidote[21] Cow milk with sugar, juice of *Vrintaka* fruit in a dose of one *pal, Karpasasthi Pushpa Kwath, Nimbu Swarasa, Jiraka*.

Post- Mortem Appearance[22]**:** Not characteristic, Dilated pupil, Sign of asphyxia, General signs of poisoning, Seeds or their fragments may be detected in the stomach and small intestines. It resists putrefaction and may be found even in a decomposed body.

Medico-Legal Aspects[23]

1. Accidental: a) Therapeutic misadventure due to quackery.

b) Ingestion of seed by children.

c) Over enthusiastic use of atropine as an antidote for organophosphate or carbamate poisoning.

2. Suicide: Mostly reported from rural areas.

3. Homicide: Extremely rare.

4. Stupefaction: Used as stupefying agent for theft, robbery, rape or kidnapping. The powdered seeds are mixed with food, tea, drink.

DISCUSSION

The plant of *Dhatura* grows abundantly throughout India and easily accessible. Traditionally *Dhatura* has been used for mystic, religious purposes and as herbal medicine. In *Ayurvedic* literature*, Dhatura* is described as a useful remedy for various ailments like *Asthma, Jwara, Kustha, Alarka-visha, Amlapitta, and Krimi*. It can be used both locally and through oral administration. For the preparation of many *Ayurvedic* formulations like *Tribhuvana Kirti Rasa, Sootshekhara Rasa, Kanakasava, Mahavishagarbha Taila Dhatura* is used as one of the ingredients. In modern, many previous reviews revealed that the plant shows various type of activities such as analgesic, anti-inflammatory, anti-cancer, anti-viral, anti-bacterial, antipyretic, anti-spasmodic, neurologic and wound healing that may be due to the presence of the different active components like alkaloids, tannins, saponins, steroids, flavonoids, and glycosides. It is a powerful deliriant and hallucinogen. The main toxic alkaloids are atropine, hyoscyamine, and scopolamine. The administration of improper or higher amounts of *Dhatura* produces toxic effects such as dryness of mouth, thirst, nausea, vomiting, dysphagia, dementia, confusion, hallucination, and convulsion; often resulting in hospitalization and death. Although *Dhatura* is toxic in nature but after purification and when used in therapeutic doses, it has been potential to treat many diseases.

CONCLUSION

There are plenty of descriptions available in *Ayurvedic* literatures about *Dhatura.* It has many therapeutic and a few toxic effects. Despite being toxic, it can be converted into a powerful medicine to treat many diseases by proper use. Hence in the present review indicated of multiple uses of *Dhatura* in clinical condition as well as its toxicity.

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