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Review Article

PHYTOCHEMICAL AND PHARMACOLOGICAL STUDY OF DHATURA: A REVIEW

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ABSTRACT

Dhatura is a well known medicinal plants belonging to solanaceae family and also known as devil's trumpet or thorn apple. According to *ayurvedic* text it's all part is used as medicinal drug and as a preparation with other drugs in various diseases. Preparation with other drugs is depends on *Rog* (disease), *Desh* (region), *Kaal* (time), *Ritu* (season) and *Ras panchak*. In modern era selection of drug and route of administration very much depends upon the chemical composition or alkaloids present in drug. *Dhatura* is a rich source of alkaloids such as Hyoscyamine, hyoscine, scopolamine, atropine, withanolides (lactones) and other tropanes. According to alkaloid present, the formulation containing *Dhatura* having antibacterial, antioxidant, herbicidal, antifungal, antiviral and antiulcer activity. Traditionally it is used in skin disorder, ear pain, cough, fever and asthma etc. The present review summarizes the phyto-chemistry, pharmacological and traditional uses of the *Dhatura.*

INTRODUCTION

Dhatura stromonium is commonly known as Jimson weed, devils trumpet, Jamestown weed, mad apple, thorn apple is a perennial herbaceous and extremely deadly plant and belongs to family Solanaceae. its name derived from *Sanskrit* word "*Dhutra*" (divine inebriation) is used for its healing properties. In India *Dhatura* plants are abundant and grow wild all over the country. It can reach a height of 1.5m. Its Leaves are simple, alternate, dark green, broadly ovate, shallowly lobed and glabrous. Their fragrance can be sweet or unpleasant depending on the season. There are many varities of *dhatura* like *D.fastuosa, D.stromonium, D.alba, D. niger* etc. Its all species are poisonous. Among them *Dhatura fastuosa* grows in plain and *Dhatura stromonium* grows in the range of Himalayan altitude. *Dhatura alba* is a white flowered plant known as *Safed dhatura* and *Dhatura niger*, a black or deep purple flowered plant known as *Kala dhatura*. Its flowers are bell shaped and fruits are spherical and have sharp spines, giving the name thorn apple. Fruits contain brown seeds resembling chilli seeds. An average sized fruit contains 450-500 seeds. *Dhatura stramonium* is a most important medicinal plant. Traditionally it has an important medicinal value throughout the world.[1-2] Its leaves and seeds are used in different treatment recipes including the treatment of epilepsy, hysteria, insanity, heart diseases, and for fever with catarrh, diarrhea and skin diseases etc.

MATERIAL & METHOD

Material is collected from the classical Ayurvedic literatures, modern medical books, magazines, research journals and internet.

Conceptual Study

Synonyms

Kanak, Doorta, Devta, Kitava, Shatha, Unmattaka, Madanaka, Kaali, Harivallabha, Kantaka phal, Dhatur, Shivshekhar, Maatal, Toori, Taral, Vyalahaa, Dhoostoor, Mahamohi, Matulputrak, Kanakahvaya[3-4]

Vernacular Name[5]

S.No.	Language name	Synonyms
1.	Hindi	*Dhatura*
2.	English	Thorn apple, Devil's trumpet

3.	*Bengali*	*Dhattura*
4.	*Telugu*	*Unmetta*
5.	*Tamil*	*Unmattangani, Ummathai*
6.	*Gujrati, Marathi*	*Dhattura*
7.	*Kannada & Malayalam*	*Unmatta, Dhattura*
8.	*Arabian*	*Datur*
9.	*Farsi*	*Tatur*

Classification

According to *Nighantu*

S. No.	*Nighantu name*	*Varga*
1.	*Dhanvantri nighantu*	*Karaveeradi*
2.	*Madanapaal nighantu*	*Abhayaadi*
4.	*Bhavprakash nighantu*	*Guduchyadi*
5.	*Priya nighantu*	*Shatpushpadi*

- Constituent-*Chetan dravya*
- Morphology : *Karya Dravya*
- Use : *Aaushadhi*
- As per modern

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

Types of *Dhatura*

According to *Raj nighantu* there are five types of varieties based on colours of its flowers[6]

1. *Shweta* (White)
2. *Neel* (blue)
3. *Krishan* (black)
4. *Lohitta* (red)
5. *Peeta* (yellow)

Distribution

Dhatura stramonium is native to deserts of the North American Southwest, Central and South America, Europe, Asia, and Africa. It is mainly distributed in the Himalaya region from Kashmir to Sikkim up to 2700 m, in the hilly district of central and south India.[7]

Historical Aspect as Per[8]

S.No.	*Ayurveidc books*	Description
1.	***Charak samhita***	In *Madhvasava* and *Manashiladi lepa*.
2.	***Sushrut samhita***	Content of *Mushika kalpa* which is used for *Alarka visha*
3.	***Ashtang hridyam***	In *Kakkurdansha chikitsa.*
4.	***Ashtang samgrah***	Signs and symptoms of *Dhatura* poisoning are mentioned Use of *Dhatura phala* in *Mushika, Alarka visha*
5.	***Sharangdhar samhita***	In *Dhatura tailam (Ref- 9/ 199)* and *Sannipatabhairava Rasa (Ref - 12/233-247)*
6.	***Bhav-prakash***	under *Guduchyadi Varga* (1st part) and Use of *Dhatura* in *Samanya jwara (Ref -2nd part/177-179)*
7.	***Bhaishajya ratnawali***	*Dhatura* as a *Upavisha* (ref. 2/165) and its *Shodhan* (Ref. 2/166, 176)
8.	***Rasa tarangini***	In 24th chapter(Chaturvinshti adhyaya)
9.	***Yogratnakar***	In *Shwanchikitsa, Garudanjanam, Kameshwar Rasa, Sannipatik jvar, Bhairava rasa.*

Ayurvedic Pharmacological Property[5]

Rasa (Taste)	*Tikta* (Bitter), *Katu* (Pungent)
Guna (Physical properties)	*Laghu* (Light), *Ruksha* (Rough), *Vyavayi* (Piercing), *Vikasi*
Veerya (potency)	*Ushan* (Hot)
Vipaak (Metabolic properties)	*Katu* (Pungent)
Prabhav	*Madak* (Intoxicating)

Active Principal

Hyoscyamine, Hyoscine, Scopolamine and trace of Atropine[2]

Phytochemistry (Alkaloidal Constitution)

Its contains[9]

Sr.no.	Plants part	Main constituents
1.	Leaves	Atropine, hyoscyamine and scopolamine l-oxo21,24S-epoxy-(20S,22S-witha-2,5,25-trienolide, pyrrole derivative (2'-(3,4-dimethyl-2,5-dihydro1Hpyrrol-2-yl)-1'-methylethyl pentanoate)
2.	Seeds	Hyoscyamine, daturanolone and fastusic acid and many other tropane alkaloids
3.	Roots	Hyoscyamine, 3α, 6β-Ditigloyloxytropane, 3α, 6β-ditigloyloxytropan-7β-ol, tigloidine, apohyoscine, hyoscine, 3α-tigloyloxytropane, norhyoscine, meteloidine, hyoscyamine, cuscohygrine and tropine
4.	Flowers	Withanolide (baimantuoluoline A, B, and C and withafastuosin E and withametelin C), withametelins I, J, K, L, M, N, O, P, 12βhydroxy-1,10-seco-withametelin B and 1,10seco-withametelin B
5.	Fruits	β-sitosterol, triterpene, daturanolone and daturadiol

Bioactive compound and its activity[9]

Sr.no.	Name of compound	Plant part	Activity
1.	Baimantuoluoline A	Flowers	Exhibiting activity for psoriasis
2.	Withanolides	Flowers	Exhibiting activity for psoriasis
3.	Withafastuosin	Flowers	Exhibiting activity for psoriasis
4.	(E)-methyl 4-(3-(4 hydroxyphenyl)-Nmethylacrylamido) butanoate	Flowers	Treatment of psoriasis
5.	6,7-dimethyl-1-D-ribitylquinoxaline-2,3(1H,4H)dione-5′-O-βDglucopyranoside	Flowers	Treatment of psoriasis
6.	(5α,6α,7β,22R)-5,6,7,27tetrahydroxy-1-oxowitha2,24-dien-27-O-β- D-glucopyranoside	Flowers	Treatment of psoriasis
7.	(5α,6β,7α,12β,22R)5,6,7,12,27-pentahydroxy-1oxowitha-2,24-dien-27-O-β- D-glucopyranoside	Flowers	Treatment of psoriasis
8.	(5α,6β,22R)-5,6,27trihydroxy-1-oxowitha-2,24dien-27-O-β-Dglucopyranoside	Flowers	Treatment of psoriasis
9.	Withametelins	Flowers	Cytotoxic
10.	1, 10-seco-withametelin B	Flowers	Cytotoxic
11.	12 β -hydroxy-1,10-secowithametelin B	Flowers	Cytotoxic
12.	alkaloid datumetine	Leaves	Antispasmodic drug
13.	2-(3,4-dimethyl-2,5dihydro-1H-pyrrol-2-yl)-1methylethyl pentanoate	Leaves	Antifungal activity
14.	Serotonin	Flower	Induced during stress
15.	Melatonin	Flower	Cold stress

Purification of *Dhatura* Seeds

- *Dhatura* seeds are tied into the piece of cloth and dipped into the cow's milk and boiled for three hours in *Dola yantra* and then washed with hot water.[10]
- New seeds of *Dhatura's* are boiled into the cow's urine by *Dola yantra* method and then dried in sun light.[10]
- According to *Rasajalanidhi* Seeds of *Dhatura* are purified, if they are kept immersed, for 12 hours, in cow's urine, and then deprived of their husks,

by being thrashed with an iron rod in an iron morter.

Mechanism of Action

Its alkaloids exert both central and peripheral actions. Its small doses stimulate the central nervous system causing excitement and restlessness while large doses produce depression, delirium and later coma. Its peripheral effects are due to blockage of cholinergic fibers with resultant parasympathetic paralysis. Therefore they inhibit secretion of sweat and saliva, dilate the cutaneous blood vessels, dilate the pupils and stimulate the heat regulating centre.[1]

Absorption and Excretion

The alkaloids are absorbed through the mucous membrane of GIT and respiratory tract and through the skin and conjunctiva. It destroyed in the liver by enzyme atropinase and part of it is excreted through the urine.[11]

Medicinal Uses of Dhatura[12]

- *Dhatura's* leaves juice along with *Arka* (calotropis) milk and *Gud* destroy the effect of *Alarka visha* (dog poison).
- Paste of *Dhatura* leaves and *Ahiphen* subside the inflammatory pain by applying it on effected area.
- Its application on hairs destroy the lices
- Application of Its paste along with *Haridra* (turmeric) and *Ahiphen* gives relief in pain occur due to breast inflammation.
- It destroy the conjunctivitis by pouring its leaves juice along with *Rasaanjana* and *Ahiphen*
- Lukewarm *Dhatura* juice by pouring in ear subside the earache.
- For destroying dog poison, the mixture of *Dhatura* leaves powder and *Kaakodumbara* should be given along with *Tandulodaka*.
- It's seeds paste by applying on effected teeth subside the toothache in *Krimidanta*
- It destroy the *Bardhnashoth* by applying its root or leaves paste on affected area.
- It is best drug for subside the *Shvaasa roga* and *Kapha*.
- It is useful for destroying the *Unmaada, Krimidanta, Karnashoola, Arbuda* and *Lasika Granthi shoth.*
- It subside the *Stanashoth, Pralaapa* and *Sannipata roga.*
- It subside the *Stri kamonmaada* and pain occur due to *Shotha.*
- It is beneficial in *Visarpa, Jvara, Kanthashundi roga.*
- It is also helpful in *Atisaar, Kapha* or *Kapha-pitta* or *Vaata-kaphajanay udhrvajatrugata rogas*

Pharmacological Uses

Antibacterial Activity

Crude aqueous and ethanol extracts of leaf, stem bark and roots of *D. metel* were investigated against eight clinical bacterial isolates The leaf and stem bark extracts was antagonistic against the test bacteria species with inhibitory zones and Staph. Aureus was the most inhibited majorly with the ethanol extract.[13]

Antioxidant Activity

The aqueous extracts of leaf, stem bark and roots of *D. metel* showed phytochemical and antioxidant activities. The aqueous extract of the plant displayed antioxidant activity of between 49.30-23.82% and can consider the plant as a natural source of antioxidants.[14]

Herbicidal Activity

Aqueous and organic solvent (methanol and nhexane) 0, 5, 10 and 15% (w/v) extracts of shoot and root of *Datura metel* L. (Syn, *Datura alba* Nees.) were studied against Phalaris minor Retz., one of the most problematic weeds of wheat. 5-15% of methanol and 15% nhexane root extract significantly reduced the germination, shoot and root length was significantly suppressed by all the employed concentrations of aqueous as well as organic solvent extracts in fact reduce the biomass a lot.[15]

Organophosphate Poisoning

Since *D. stramonium* contains atropine and other anticholinergic compounds, it is a useful remedy for the central cholinergic symptoms of organo-phosphate (OP) poisoning.[16]

Acaricidal, Repellent and Oviposition Deterrent Properties

Datura plant generates a characteristic odor that acts as repellent for various insects and pests. Kurnal et al have reported that the ethanol extracts of *D. stramonium* leaf and seed showed potent acaricidal, repellent, and oviposition deterrent activity against adult two-spotted spider mites (Tetranychus urticae) under laboratory conditions.[17]

ANTI-INFLAMMATORY ACTIVITY

The ethanolic extract of *D. stramonium* leaf showed significant anti-inflammatory activity against carrageenan induced paw edema in rats. In one experiment 39.43% inhibition of the edema was observed after 3 h of oral administration of 200 mg/kg extracts. Maximum activity was observed

when the extract was administered in doses of 3-hour intervals. Since the extract of *D. stramonium* inhibited the carrageenan-induced edema that involves the acute toxicity of 100 mg/kg *D. stramonium* includes decreases in the weight of the liver, spleen and brain, and significant increases in the levels of red blood cells (RBC), hematocrit (HCT), hemoglobin (HGB), and white blood cells (WBC).[18]

Antifungal Activity

Acetone extracts of *D. stramonium* have been reported to have antifungal activity against several fungi including *Penicillium expansum, Aspergillus niger, Aspergillus parasiticus, Colletotrichum gloeosporioides,Fusarium oxysporum, Trichoderma harzianum, Phytophthora nicotiana, Pythium ultimum* and *Rhizoctonia solani*.[19]

Anti-asthmatic Activity

D. stramonium contains a variety of alkaloids, including atropine and scopolamine, having anticholinergic and bronchodilating activity. Atropine and scopolamine act on the muscarinic receptors by blocking them (particularly the M2 receptors) on airway smooth muscle and submucosal gland cells, which dilate bronchial smooth muscle and ease asthmatic attacks.[20-21]

Insecticidal Activity

Different percentage (at 2.5, 5.0, 7.5 and 10.0%) of methanolic extract of *Datura metel* seeds, were tested against Helicoverpa armigera (Hubner), the cotton bollworm, is a moth, the larvae of which fed on a wide range of plants, including many important cultivated crops. The 1.5 and 2.0% fractions of methanolic extract showed significant adverse effects on various biological parameters viz. larval survival, weight and duration, pupal period, % of pupation and adult emergence.[22]

Anti-Viral Activity

Atropine inhibited only the growth of enveloped viruses independent of the nucleic acid content of the virus[23]. Atropine also blocks the glycosylaton of viral proteins of Herpes virus and hence the production of new infectious virus particles (virions). Virions formed in the presence of atropine are non infectious.[24]

Anti Ulcer Activity

It decreased the volume of gastric secretion, acid and peptic output significantly; it did not affect the mucin secretion and total mucosal glycoprotein content in terms of total carbohydrate, protein gastric cell shedding or cell replication. It also augments prostaglandins.[25]

Antimicrobial Activity

The methanol extracts of aerial parts of *D. stramonium* showed the bactericidal activity against Gram-positive bacteria in a dose-dependent manner. However, little or no antibacterial activity was found against Escherichia coli and Pseudomonas aeruginosa.[26-28]

Useful Part

Patra (Leaves), *Pushpa* (Flowers), *Beeja* (Seeds), *Moola* (Root)

Poisonous Part

All parts of plant are poisonous but seeds and fruits are more poisonous.[2]

Dose (*Matra*)[29,2]

1.	Therapeutic	Seeds-¼ to ½ *ratti* Leafs-½ to 1½ *ratti*
2.	Fatal	Seeds-100 to125 Alkaloids-60mg for adults, -04mg for children
3.	Stupefying	40 to 50 seeds

Important Formulations

Pralapantak rasa, Unmaadagajankush rasa, Granthishothnivarika vartika, Kanakasava, Ekangavira Rasa, Puspadhanva Rasa, Tribhuvana Kirti Rasa, Sri Jayamangala Rasa, Laghu Vishagarbha Taila, Vishatinduka Taila, Dhattura Taila.[30]

CONCLUSION

The present review is indicative that there are a lot of description available in different Ayurvedic books. It is a wild plant having various medicinal and pharmacological properties. Despite of a poisonous plant it have been used in many different diseases like asthma, epilepsy, hysteria, pain, inflammation, earache, dog bite, insanity etc.

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