

# Chemical Constituents and Pharmacological Properties of *Datura Stramonium* (Thorn Apple) - A Review

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**Abstract** - *Datura stramonium* is a plant of medicinal plant family Solanaceae. Plant because of its therapeutic and narcotic activity used as traditional folklore medicinal herb, this plant comprises of many primary and secondary metabolites; primary metabolites directly responsible for the growth, regulation and development as carbohydrates, proteins, fatty acids, minerals and secondary metabolites or phytochemicals like alkaloids, phenols, flavonoids, tannis, saponins etc. possesses many biological activities as cytotoxic, anti-inflammatory, anti-viral, antibacterial, antioxidant, analgesic, antiulcer, insecticidal properties. These pharmacological activities made the plant potent to targeted organism and promote the medicinal aspects of phytomedicines in pharmaceuticals industries.

**Key words:** Antioxidant, insecticidal, therapeutic, phytochemicals, medicines.

## INTRODUCTION

Medicinal plants from the ancient time have been used to prevent living organism from ailment. From the Vedic era Ayurvedic, Siddha, Unani techniques has been practised for therapeutic potential. In India around 4.5 million plant species are present in which 250,000-500,000 possesses medicinal properties [1]. These plants with their bioactive compounds (Phytoconstituents) used in pharmacological and remedial perspective. Nowadays with negligible harmful effect, plants made drugs or phytomedicines has highly in practice by the pharmaceutical companies to inhibit negative outcome from the diseases. Many medicinal plants like *Datura stramonium*, *Eucalyptus spp*, *Aloe barbadensis*, *Butea monosperma*, *Calotropis procera*, *Allium sativum*, *Syzygium cumini*, *Mentha spicata* etc. contains alkaloids, flavonoids, phenolic groups, saponins, tannins, tropine, glycosides, carbohydrates, fats, proteins etc. and through these components they contributed anti-inflammatory, antioxidant, antibacterial, antifungal, analgesic, anticancer, nematicidal, antiperspirant, cercaricidal actions.

**MORPHOLOGY OF PLANT**- DS or (jimsonweed) is a member of Solanaceae. It is generally known by mahamohi, ghantapushpa, ghantika, devil's snare. This plant distributed all over the world. Plant with 90-125 cm height or greater than that, with smooth, light weight, thin, stem. Ovate, furcated, spiny leaves 6-18 cm with light green in color has dark veins, leaves has repulsive and

pungent taste and egg shaped capsular immature (Green) fruit contains spines and after maturation fruit splits into four chamber and every chamber obtain numerous black seeds. *Datura stramonium* because of its secondary metabolite uttered curative potential. *Datura* with its bioactive compounds major and minor alkaloids enhances the immunity, through inhibits the repulsive activities.

## VERNACULAR NAME OF *Datura stramonium*

Sanskrit	Devika, Shivapriya, Kharjhugna
Hindi	Dhattura, Kaladhatura
English	Apple of Peru, Devil's Trumpet, Jamestown Weed
Kerela	Rotecubung
Tamil	Simaiyumattai, Turutturam
Telgu	Ummetha
Punjab	Tattur
Urdu	Tukhm
Bihar	Khunuk
Bangal	Sadadhutura

## Classification of *Datura stramonium*

Kingdom	- Plantae
Subkingdom	- Tracheobionta
Superdivison	- Spermatophyta
Division	- Magnoliophyta
Class	- Magnoliopsida
Subclass	- Asteridae
Order	- Solanales
Family	- Solanaceae
Genus	- <i>Datura</i> L.
Species	- <i>stramonium</i>

### CHEMICAL CONSTITUENTS

Thorn apple contains higher amount of chief alkaloids as hyoscyamine and scopolamine and also minor alkaloid. Every part of the plant contains poisonous as well as

restorative potential; leaves, seed, fruit, bark, stem, root, seed coat with the bioactive compound exhibited pharmacological effect. Plant expressed strong nauseating and therapeutic efficacy because of its phytoconstituents.

Table - 1

Phytochemical	Plant part(s)	References
Carbohydrates, fat, protein, ash, fiber	Seed coat	[2]
Phytate, tannin, oxalate	Seed	[2]
Calcium, tannin, and oxalate, iron, potassium, phosphorous	Seed coat	[3]
Glycosides, saponins, flavonoids, alkaloids, phenol, phlobatanins	Leaves	[4]
Scopolamine, atropine, fastunine, daturaolone	Seed	[5]
Hyoscine, norhyoscine, hyoscyamine, tropine	Root	[5]
Daturanolone and daturadiol	Fruits	[5]
Hyoscine and hyoscyamine	Whole plant	[5]
Scopolamine and fastusine	Pericarp	[5]

### PHARMACOLOGICAL PROPERTIES

#### Anticancer Effect

Worked against cancer cell of breast (specially MCF-7 cell line) through MTT assay with methanolic extract of leaves and stem of *Datura spp.* and compared it with vero line, resulted that leaf extract expressed higher anticancer property against MCF-7 cell and vero cell line as compared to stem extract [6]. Cancer inhibiting effect on head, neck (FaDu), Breast (MDA-MB231), lung (A549) cancer cell line in in vitro condition by *Datura stramonium* leaf-aqueous extract (1mg/mL) for 24 & 48 hrs. respectively anticipated that plant parts possesses toxicity against living cells with increasing GSSG and agitating oxidative stress as well as considered changed quantity of enzyme which expresses redox sensitivity [7].

#### Anti-Insect Effect

*Datura stramonium* seed extract among ethanol, chloroform, and acetone has strong insecticidal efficacy than methanol and n-hexane [8]. The insecticidal repellency properties of *Chromolaena odorata*, *Senna siamea*, *Andrographis paniculata*, *Vernonia amygdalina*, *Datura stramonium* against *Callosobruchus maculatus* indicated *C. maculatus* egg laying capacity effectively reduced by *Senna siamea* as compared to other plants [9].

#### Antimicrobial Effect

Worked on review of many medicinal plants of Bulgaria including *Datura stramonium* explained their antimicrobial, antioxidant, anti-inflammatory activity [10]. Aerial part (mainly stem and bark) of *Datura stramonium*'s aqueous and ethanolic extract opposite to *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Klebsiella pneumonia*, *Shigella* and *Neisseria gonorrhoea* revealed that ethanol extract of the plant contains higher antimicrobial potential than aqueous extract but not in *Neisseria* and only *Staphylococcus aureus* displayed action to aqueous extract [11]. Methanolic extract of different parts of *Datura* leaves shows higher antimicrobial efficacy on *Staphylococcus aureus* ATCC25923 and *Escherichia coli* ATCC25922 by even small amount [12].

#### Antioxidant Effect

Investigation of anticancer activity by methanolic seed extract of *Datura stramonium* through DPPH radical scavenging, ABTS<sup>+</sup> radical cation, Nitric oxide radical, Ferric reducing power assay and gained values as 35.26, 10.50, and 49.36 [13]. On behalf of in vitro study of highest free radical scavenging effect DS showed the 6.7±0.1 µg/ml inhibitory concentration value [12].

#### Nematicidal Effect

Whole plant of *Datura stramonium* has noxious property and because of that aqueous leaf extract of plant stated strong nematicidal activities [14].

#### Antifungal Effect

Many medicinal plant together with *Datura stramonium* acquired antifungal effect [14]. Fermented or boiled mixture of *Azadirachta indica* (Neem), *Calotropis gigantean*, *Datura stramonium*, and cow fertilizer with methanol & water decoction (70/30 vv) of *Azadirachta indica* (Neem), *Calotropis gigantean* and *Datura stramonium* beside fungi *Fusarium mangiferae* contains efficient antifungal effect [15].

#### Larvicidal and repellent Effect

*Datura stramonium* leaves extract with ethanol for controlling the larva of *Culex quinquefasciatus*, *Anopheles stephensi*, *Aedes aegypti*, exhibited the Lethal dose values as 86.25, 16.07, 6.25 ppm and they also possesses the repellency effect of above three insects and provided the values 2.73, 71.66, 117.7 in min. at 1% concentration [16].

#### Analgesic Effect

The analgesic property by intraperitoneally administration of alcoholic seed extract of *Datura stramonium* in severe but short and continual pain, through the hot plate test and formalin test, point out that pain was condensed dose dependently with Ed values = 25 and 50 mg/kg [17].

#### Antifeedant Effect

Leaves and seed extract of *Datura stramonium* L. (Solanaceae) respond against *Triboleum castenum* for the

reason that, insect depicted different mortality rate at different time exposure [18].

#### Antiasthmatic Effect

With mild airway obstruction, *Datura stramonium* cigarette worked as good bronchodilator for asthmatic patients [19]. *Datura stramonium* plant has various phytochemical including atropine, scopolamine and hyoscyamine. Scopolamine & atropine manifested anticholinergic properties and responsible for the blocking of M2 receptor of submucosal gland cell and smooth muscles of air pathway, In an observation when pregnant women's took *Datura stramonium* for asthma treatment, with the constant releasing of acetylcholine, nicotinic receptor could desensitize finally result displayed in as damage fetus [20].

#### Antiperspirant Effect

Cholinergic compound esters exhibited effectual antiperspirant activity and Scopolamine; hydrobromide also rendered this potential with the higher skin incisive property [21].

#### Toxicological Evaluation of *Datura Stramonium* in Rats

In 3 months or 90 days subchronic study of different percentage of *Datura* seed (0.5, 1.58 and 5.0) containing diet were given to male and female rats with the 2.71 and 0.66 mg alkaloids and atropine respectively. Many observation including body weight, water intakes, gross clinical observation and feed were observed and recorded (weekly) with the pupil dilation and tears production (in whole study). The plant seed exhibited many effect on rats as decreased serum calcium, body-weight gain and serum albumin; increased serum alkaline phosphatase, testes weights, blood urea nitrogen and liver. Female rats displayed reactions more efficiently than male by decreasing cholesterol, serum total protein and increased Red Blood Cell Count, transaminase, Chloride and serum glutamicpyruvic transaminase [22].

#### CONCLUSION

Since ancient time plants used as for food, shelter, fiber, tan, gum, oil, latex etc. Plants are rich source of nutrients, antioxidants, vitamins, carbohydrates, proteins, because of that they also contributed immuno-modulatory effect. From the above information we concluded that *Datura stramonium* with its medicinal properties exploited for cancer, rheumatism, ear pain, head ache, wound, burn, stress, depression, insomnia, asthma, boils, and inflammation. Whole plant with secondary metabolites (Phytochemicals) such as alkaloids, flavonoids, tannins, saponins manifested anticancer, antioxidant, antifungal, antibacterial, anti-inflammatory, larvicidal, repellent, analgesic, nematocidal properties [23], the alleopathic property of essential oil of *Datura stramonium* against five crops also reported [2]. This Plant with the adequate quantity exhibits pharmacological effect and prepared as herbal or botanical drugs by pharmaceutical industries for many diseases, but not used in native form because of its lethal effect, furthermore from this plant, plant based

biopesticides also have been made to control the harmful effect from the conventional pesticides.

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