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## A Review on Phytochemical and Pharmacological status of *Datura fastuosa* Linn

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### Abstract

*Datura* name derived from Sanskrit word "Dhutra" (divine inebriation) is used for its healing properties. Various species of *Datura* are known and widely employed for their medicinal and toxic properties that are based upon more than 30 alkaloids. Traditional system of medicine enlightened the importance of *Datura fastuosa* to have a great medicinal value. *Datura fastuosa* is a much branched shrub cultivated for its leaves although flowers, roots, fruits and seeds have also been used in traditional medicine. The plant has been reported to have anti-microbial activity, anti-spasmodic, antioxidant, febrifuge, anthelmintic, emetic, leucoderma, skin disease, ulcers, bronchitis, jaundice and piles. The plant is reported to contain Alkaloids (Scopolamine), triterpenoids, flavonoids, phenolic compounds and fatty acids. This review gives an idea mainly on the pharmacognostical characteristics, traditional uses, Phytochemical and Pharmacological activities of the plant.

**Keywords:** Alkaloids, *Datura fastuosa*, scopolamine, flavonoids, phenolic compounds

### 1. Introduction

The therapeutic efficacies of many indigenous plants for various diseases have been described by practitioners of traditional herbal medicines. Natural products are a significant source of synthetic and traditional herbal medicine and are still the primary health care system<sup>[1]</sup>. *Datura fastuosa* is also known as devil's trumpet, angel's trumpet, thorn apple, Indian apple, *Datura metel*, purple *Datura*, garden *Datura*. It is a shrub or woody herb up to 2m in height that is often grown as annual in temperate zones. The root, dried leaves and flowering tops have been used in India for their narcotic and antispasmodic properties in the treatment of numerous ailments and conditions. In ayurveda, the plant is considered bitter, acrid, astringent, germicide, anodyne, antiseptic, antiphlogistic, narcotic and sedative. The leaves and seeds are used in herbal medicine as antispasmodic, antitussive, bronchodilator and as hallucinogenic, anodyne, anti-asthmatic. The plant finds itself useful in the treatment of diarrhea, skin diseases, epilepsy, hysteria, rheumatic pains, hemorrhoids, painful menstruation, skin ulcers, wounds and burns<sup>[2,3]</sup>.

### Plant Profile

#### Taxonomy

Kingdom	:	Plantae
Division	:	Magnoliophyta
Subdivision	:	Angiospermae
Class	:	Magnoliopsida
Sub class	:	Asterids
Order	:	Solanales
Family	:	Solanaceae
Genus	:	<i>Datura</i>
Species	:	<i>Fastuosa</i>

### History

The plant has a rich history of medicinal use and has been valued for centuries in Ayurvedic and Unani systems of medicine. The plant is considered bitter, acrid, astringent, germicide, anodyne, antiseptic, antiphlogistic, narcotic and sedative. The leaves and seeds are used in herbal medicine as antispasmodic, anti-tussive, bronchodilator, anodyne, anti-asthmatic and hallucinogenic.

*Datura* is probably a native of America, but it has long been introduced and naturalized in Asia, it is found in tropical, warm temperature regions of the old world, throughout the hill of

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India, up to an altitude of 8000 ft, and it is common in the north-western Himalayas<sup>[4]</sup>. Navajos chewed dried roots to reduce fever. Zunis made poultice from it to treat inflammation and bruises<sup>[5]</sup>

1966. In China it is known as “yangjinhua” and used for the treatment of asthma, convulsions, pain and Rheumatism and psoriasis for clinical use<sup>[6]</sup>. In Italy it is used to remove lice from hen bundles. *D. stramonium* seeds are used for acne and bronchitis. In Sakarya province of North-West Turkey and locally called “Tatala”<sup>[7]</sup>.

### Plant Chemicals

The plant mainly contains alkaloids hyosyamine, hyoscyne and atropine. The total alkaloid content of the leaves is 0.426% mainly atropine. The seeds contain 0.426% hyoscyamine. The flower contains 0.43%. The whole plant of *D. fastuosa* contains scopolamine and atropine that increases gradually with the progress of developmental growth, and are most pronounced when the plant is at the end of its reproduction stage. The root contains the highest amount of atropine compared to the other parts. The aerial parts usually accumulate a relatively higher amount of scopolamine and relatively lower amounts of atropine as compared with the root of the plant<sup>[8]</sup>.

A novel withanolide, daturilin, has been isolated from the alcohol soluble extract of the fresh leaves of *Datura metel* and its structure established as 1-oxo-21, 24 s-epoxy-(205,225) - with 2, 5, 25-trienoside through spectral studies including 2D NMR<sup>[9]</sup>. A new pentahydroxywithanolide called fastuosin F and several other known withanolides have been isolated from the flowers of *Datura fastuosa*<sup>[10]</sup>. The structure of the new compound has been elucidated as 5 $\alpha$ , 6 $\beta$ , 12 $\delta$ , 21,27-pentahydroxy-1-oxo-21,22-dienol from comprehensive spectral analysis. The structure of two new C-21 oxygenated withanolides, withafastuosin D (1a) and (2a), isolated from the leaves of *Datura fastuosa*, has been fully classified from chemical and detailed spectral analysis. The isolation of fastusine, scopolamine and betasitosterol has been isolated from fruits of *D. fastuosa*<sup>[11]</sup>.

### Pharmacological potential

#### Anti microbial test

The antimicrobial test of hydro-alcoholic and methanolic seed extracts of *Datura fastuosa* L. was evaluated against three clinical bacterial strains (*Escherichia coli*, *Staphylococcus aureus* and *Bacillus subtilis*) and two clinical fungal strains (*Candida albicans* and *Aspergillus niger*) by tube dilution method. Both the plant extracts were found to be active against the tested micro-organisms. The methanolic extract of *D. fastuosa* was found to inhibit bacterial strain, *E. coli* effectively with minimum bactericidal concentration (MBC) of 25 g/ml. The hydroalcoholic extract of *D. fastuosa* seeds was found to be more potent in terms of its bactericidal concentration for *B. subtilis* with both minimum inhibitory concentration (MIC) and MBC values as 25 g/ml. Also, methanolic extract was found to be more efficient in inhibiting *S. aureus* having MIC 12.5 g/ml<sup>[12]</sup>.

#### Anti-inflammatory activity

The anti-inflammatory activity was evaluated with the use of carrageenan induced rat paw edema method by using Digital Plethysmometer. The study was carried out by using administered dose of 50, 100, 150, 200 mg/kg of ethanolic and ethyl acetate extracts by orally. Indomethacin was used

as a standard drug for measurement of anti-inflammatory activity. All extracts showed significant activity at 200 mg/kg dose as compared to Indomethacin (10 mg/kg) against carrageenan induced rat paw edema. The percentage inhibition was calculated and compared with all doses of different extracts, so it was concluded that ethanolic extract having the higher significant anti-inflammatory activity<sup>[13]</sup>.

### Wound healing activity

The ethanolic extract of *Daturafastuosa* Linn was evaluated for the wound healing activity using Wistar Albino rats. *Daturafastuosa* Linn commonly known as Karu-ummattai (Tamil) is distributed throughout India especially in wild places. It is official *Datura* herb in Indian pharmacopoeia. The medico-ethno botanical review of the plant *Datura fastuosa* Linn reveals that in Siddha system, leaf extract was used in skin disorder. As there is no systematic record on its wound-healing efficacy, the present work was taken up, to justify the folklore claim in the treatment of wounds. The wound healing study was carried out by Excision wound model. The extract is formulated as simple ointment at two concentrations (5% w/w, 10% w/w). Nitofurazone ointment (0.2% w/w) is used as standard. The parameters analyzed are percentage wound closure, mean epithelization time, hydroxyproline, DNA and protein level. The histopathological studies were also carried out on wound tissue. The result suggests that 10% w/w *Daturafastuosa* ointment exhibit significant wound healing activity as that of the standard<sup>[14]</sup>.

### Neuropsychopharmacological effect

The neuropsychopharmacological effects of aqueous extracts of leaves and seeds of *D. fastuosa*, a Solanaceae recently introduced in Congo as ornamental plant, were studied in rat and mice by oral administration using classical methods. The extracts of *D. fastuosa* were well tolerated by rats. No mortality was observed up to 3200 mg kg<sup>-1</sup>. The leaf and seed extracts at doses of 400 and 800 mg kg<sup>-1</sup> increased motor activity, reduced slightly the duration of barbituric sleeping, antagonized catalepsy and ptosis induced by haloperidol and the immobility induced by forced swimming. *D. fastuosa* exhibited analgesic effect in acetic acid test with tolerance phenomenon in the leaf but not in the seed extracts. Only the leaf extract reduced rectal temperature, apomorphine hypothermia and increased water intake. These results showed that, at low doses, *D. fastuosa* has some antidepressant profile<sup>[15]</sup>.

### Analgesic activity

The aqueous extracts of *Datura fastuosa* leaves and seeds were evaluated for the analgesic effect on acetic acid-induced writhing and hot plate reaction in mice. According to the results, *D. fastuosa* leaves and seeds extracts at oral doses of 400 and 800 mg/kg are effective as analgesic. The analgesic activity of leaf extract is reduced by naloxone but not that of seed extract<sup>[16]</sup>.

### Hypoglycemic activity

The seeds of *D. fastuosa* were evaluated for hypoglycemic and antihyperglycemic activities in normal Wistar strain albino rats against diabetic rats and results were compared with gliclazide (0.56 mg/kg). A dose dependent hypoglycemia was observed in animals treated with *D. fastuosa* seed powder. A significant reduction in blood glucose of 22, 35, 31.89 and 34.26% was observed with

doses of 25, 50 and 5mg/kg body weight, respectively. The dose dependent antihyperglycemic activity was also observed with *D. fastuosa* in alloxan- induced diabetic rats. The finding results showed that *D. fastuosa* seed powder possessed blood glucose lowering effect in normal glycemic and in alloxan-induced hyperglycemic rats. Thus the folk usage of the seeds of *D. fastuosa* for controlling diabetes may be validated by this study and the seeds offer promise for the development of potent phytomedicine for diabetes [17].

#### Xanthine oxidase inhibitory activity

*D. fastuosa* is being traditionally used for the treatment of gout and related symptoms by the indigenous people of India. The xanthine oxidase inhibitory activity was evaluated for *D. fastuosa*. More than 50% xanthine oxidase inhibitory activity (in vitro) was seen in the methanolic extracts of *D. fastuosa* when compared with the standard antigout drug, allopurinol, and showed 93.21% inhibition at 100 µg/ml concentrations. In general, the methanolic extract was found to be more active compared to the aqueous and hydro alcoholic extracts. *D. fastuosa* was found to be safe up to dosage of 2000 mg/kg body weight with no symptoms of toxicity or mortality. The methanolic extract was also screened for *in vivo* hypouricaemic activity against potassium oxonate-induced hyperuricaemia in mice, but not showed significant activity compared to the methanolic extract of *Coccinia grandis* and *Vitex negundo* [18].

#### Antifungal activity

The antifungal activity of *D. fastuosa* using pathogenic species of *Aspergillus* was investigated in the hexane, chloroform, acetone and methanolic fractions of *D. fastuosa*. The chloroform fraction was found to have antifungal activity compared to the other fractions. The minimum inhibitory concentration (MIC) of the chloroform fraction of *D. fastuosa* was 625.0 mg/mL against all the three species of *Aspergillus*, i.e. *A. fumigatus*, *A. flavus* and *A. niger*, using the microbroth dilution and percent spore germination inhibition assays. The MIC by disc diffusion assay was found to be 12.5 mg/disc. Results showed that the chloroform fraction of *D. fastuosa* was 9.2 times less active than amphotericin B. In brief, constituents in the chloroform extracts of *D. fastuosa* showed potential for development into better drugs against pathogenic fungi [19].

#### Antiproliferative activity

The five compounds isolated from the methanolic extract of the aerial parts of *D. fastuosa* were tested for their antiproliferative activity towards the human colorectal carcinoma (HCT-116) cell line. The compounds were withanolide glycosides named daturametelins H, I, J, daturaturin A and 7,27-dihydroxy-1-oxowitha-2,5,24-trienolide. Only the nonglycosidic compound (7,27-dihydroxy-1-oxowitha-2,5,24-trienolide) exhibited the highest antiproliferative activity in HCT-116 cells, with an IC<sub>50</sub> value of 3.2±0.2 µM [20].

#### Antispasmodic effects

Antimicrobial activity of ethyl acetate and methanol extracts of *D. fastuosa* was investigated by agar disc and well-diffusion method against HIV associated opportunistic infections causing bacterial pathogens. The plant extracts showed better inhibitory activity against the *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*,

*Staphylococcus aureus* and *Salmonella typhi*. The compound isolated from *D. fastuosa* leaves showed antibacterial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*, *Bacillus subtilis* and *Klebsiella pneumoniae* but could not inhibit *Escherichia coli* [21].

#### Herbicidal activity

*D. fastuosa* has been evaluated for herbicidal activity against the noxious weed *Parthenium* (*Parthenium hysterophorus* L.). The effect of aqueous, methanol and n-hexane shoot and root extracts of 5, 120, 15 and 20% w/v (on a fresh weight basis) concentration of *D. fastuosa* were tested against the germination and seedling growth of *P. hysterophorus*. Both aqueous and methanol extracts markedly suppressed the germination and seedling growth of *P. hysterophorus* [22].

#### Conclusion

The present study shows the Phytochemical, pharmacological status of *D. fastuosa*. This extensive survey of literature revealed that *D. fastuosa* is highly regarded as a remedy for most diseases in the herbal medicine with great pharmacological activity spectrum. This versatile medicinal plant is the unique source of various types of chemical compounds, which are responsible for the various activities of the plant. Hence extensive investigation is needed to exploit their therapeutic utility to combat diseases.

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