REVIEW ARTICLE

Medicinal values of *Datura*: A synoptic review

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Abstract

Datura, a wildly growing plant from Solanaceae family, commonly known as Jimson weed or Devil's snare is attributed with both poisonous and medicinal values. It contains varieties of toxic alkaloids such as atropine, hyoscamine, and scopolamine. In Ayurveda, it has been used for curing various ailments including wounds, inflammation, rheumatism, sciatica, swellings, fever, and asthma. A wide range of medicinal values has been attributed to this plant. Different studies reported safety and toxicity aspects while other studies reported analgesic, anti-inflammatory, anti-viral, anti-diarrheal, etc. activities of different extracts of the plant. This study is a review on this plant.

Key words: Analgesia, *Datura*, phytotherapy, safety, toxicity, traditional medicine

INTRODUCTION

Plants have been used for health and medical purposes for several thousands of years. The use of herbal medicinal products and supplements has increased tremendously over the decades with not <80% of people worldwide relying on them for some part of primary health care. A majority of the world's population in developing countries still relies on herbal medicines to meet its health needs. Herbal medicines are often used to provide first-line and basic health service, both to people living in remote areas where it is the only available health service and to people living in poor areas where it offers the only affordable remedy. Even in areas where modern medicine is available, the interest on herbal medicines and their utilization have been increasing rapidly in recent years.[1]

Datura is a herbaceous perennial plant from Solanaceae family is grown in temperate and tropical region of the globe. It has been used in traditional medicine to relieve pain, breathlessness, fevers, etc. It is a powerful deliriant and hallucinogen. However, as the alkaloids are responsible for both the medicinal and hallucinogenic properties, are toxic in higher amounts, and careless use often results in hospitalization and deaths. Considering this, the plant has been grouped under Schedule E-1 of Drugs and Cosmetics Act-1940.[2] Even being a poisonous plant, it is being used since the ancient times by Ayurveda physicians for various purposes.

The therapeutic activities are due to the presence different active components and researches revealed the presence of saponins, tannins, steroids, alkaloids, flavonoids, phenols, and glycosides in this plant.[3]

Vernacular Names

Few vernacular names of the plant are shown at Table 1.

Classical Names Mentioned in Ayurveda Texts

This plant is known with different names in Sanskrit. A few are *Dhattura*, *Dhuttura*, *Dhustura, Kanaka, Unmatta, Matula, Shivapriya, Dhurta, Devata, Kitava, Toori, Mahamohi, Kanakahvaya,* etc. Possible derivation for few such terms is provided in Table 2.

BOTANICAL DESCRIPTION

Datura metal is an erect, succulent, spreading annual herb, a meter or more in height with divaricate often purplish branches, leaves triangular ovate in outline, unequal at base, flowers large solitary, short-pedicelled, purplish outside, and white

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inside [Figure 1a-d]. Fruits subglobose, capsules covered all over with numerous fleshy prickles, irregularly breaking when mature, seeds numerous, smooth yellowish brown.[4]

Distribution

Common as a weed growing in waste places and roadside throughout India, Sub-Himalayan tracts including North West Himalaya, Kashmir, Bihar, Orissa, West Bengal, Madhya Pradesh, open forests of Rajasthan, mountains of Deccan, Karnataka and Tamil Nadu.[4]

Ayurvedic Properties

Rasa, *guna*, *virya*, *vipaka*, *prabhava*, etc., of the plant are shown in Table 3.

Parts Used

This plant is used as a whole in therapeutics. Its leaf, flower, and seed are also used individually for different purposes.

Actions and Uses

The plant is acrid, narcotic, anodyne, antispasmodic, intoxicant, and emetic. It is useful in asthma, cough, fever, inflammations, edema, neuralgia, insanity, myalgia, hyperacidity, duodenal ulcer, renal colic, calculi, and dysmenorrhea. Roots are used for bites of rabid dogs. Leaf is useful in inflammations and piles. Leaf juice is applied externally for lice and in skin diseases. Leaves in the 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.[4]

Chemical Constituents

The plant contains different functional groups such as saponins, tannins, steroids, alkaloids, flavonoids, phenols and glycosides. Atropine and scopolamine are competitive antagonists of muscarinic cholinergic receptors and are central nervous system depressants. All parts of the plant are toxic but the highest amount of alkaloids is contained in the ripe seeds.[5] A brief is presented in Table 4.

Few Formulations

A huge number of formulations with *Datura* as an ingredient have been mentioned in Ayurveda classics. It is not possible to enlist them in this attempt, but a few are enlisted in Table 5.

Toxicity

Administration of scopolamine in drinking water to pregnant rabbits on days 10-14 of gestation led to fetal deformities

Table 1: Vernacular names of *Datura*

English	Thorn apple
Hindi	Dhattura, Kaladhattura
Bengali	*Dhotra, Dhatura, Dhutura*
Gujarati	*Dhatura, Dhaturo, Dhanturo*
Kannada	*Unmatta, Unmatte-gida*
Malayalam	*Ummattu, Unmatta, Rotecubung, Ummam*
Marathi	*Dhotra, Dhatura*
Punjabi	*Dhattur, Dhattura*
Tamil	*Ummattai, Umate*
Telugu	*Ummetta, Ummatta*
Bihari	*Khunuk*
Kashmiri	*Dather*

Table 2: Possible meaning of synonyms of *Datura*

Unmatta	The drug that produces delirium
Kanaka/ Kanakahva	The drug with synonyms of gold
Kitava	People who consume will behave idiotic
Madana	That paralises the function of the body parts
Shivapriya	Favourite of Lord Shiva
Dhustura	Drug causing giddiness and palpitation (with its delerient effect)
Dhurta	Drug that kills headlies (*yuka*), body-lies (*liksha*), etc.
Dhattura	It destroy vitiated *doshas* and *dhatus* by its *ushna guna*. Hence it cures diseases like *vrana*, *sleshma vikaras*, etc.
Matula	No other drug is equal to its therapeutic effects or in other words there is no comparision of its efficay with other drugs

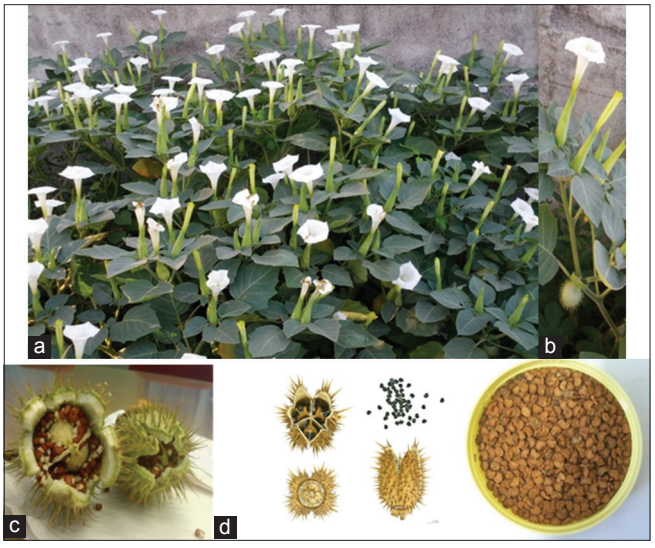

Figure 1: (a) Natural habitat, (b) flowers and fruits, (c) fruits – fresh and dried, (d) dried seeds

Table 3: Pharmacodynamics of *Datura* according to Ayurveda

Rasa	*Tikta, Katu*
Guna	*Laghu, Ruksha, Vyavayi, Vikasi*
Virya	*Ushna*
Vipaka	*Katu*
Prabhava	*Madaka*
Doshaghnata	*Kaphavatashamaka*
Rogaghnata	*Shotha, Vedana, Arsha, Vatavikara, Hridmandata, Nadimandata, Amlapitta, Parinamashoola, Pittashmari, Shwasa, Vrikkashoola, Ashmari, Shaiyyamootra, Rajahkrichchhra, Yuka, Liksha*
Karma	*Jantughna, Vedanasthapana, Twagdoshahara, Madaka, Antrashamaka, Shoolaprashamana, Hridayottejaka, Basti avum Gavini sankochaka, Garbhashaya prasaraka, Shukrastambhana, Swedavarodhaka*

Table 4: Different active components of *Datura*

Root	3α, 6β-ditigloyloxytropane, 3α, 6β-ditigloyloxytropan-7β-ol, tigloidine, apohyoscine, hyoscine, 3α- tigloyloxytropan, norhyoscine, meteloidine, hyoscimine, cuscohygrine and tropine
Pericarp	β-sitosterol, scopolamine and fastusine
Leaves	Scopolamine and a mixture of two unidentified alkaloids
Flower, leaves, aerial parts and roots	Hyoscine and hyoscyamine
Fresh aerial parts	Withanolide, (17R, 20R 22R, 25R)-21, 25R-epoxy–2-methoxy-1-oxowitha-2, 5-di enolide and hyoscine and hyoscyamine
Fruits	Daturanolone and daturadiol
Seeds	Scopolamine, atropine, fastunine, fastudine, fastusidine, daturanolone and fastusic acid
Seed oil	4α-methylsterols-31-nprlanost-9(11) enol. 31-norcrcloartenol. Cycloeucalenol, 31-norlanost-8-enol. 31 norlanosterol; obtusifoliol, 4α-methyl cholesta-8-enol, lophenol and citrostadienol

of eye. These malformations were observed in all living fetuses present in six different animals.[4] Lethal dose 50% (LD_{50}) of petroleum ether extract was reported to be 5 times more potent than the aqueous extract. This difference in LD_{50} may be due to the presence of functional groups such as flavonoids, glycosides, and essential oil that are soluble in petroleum ether but insoluble in water.[6] The effects of acute, subacute and chronic administration of atropine and scopolamine were studied in male Albino-Wistar rats. After acute intraperitoneal (i.p.) administration of dose 100 mg/kg (1/4 DL50) of total alkaloids to the seeds of *Datura*, there were no remarkable changes in general appearance and no deaths occurred in any experimental groups. 24 h after total alkaloids of seeds, a significant reduction in liver, spleen and brain was observed. Red blood cells, hematocrit, hemoglobin, and white blood cells were significantly higher in the treated groups than the control group. There were no statistical differences in glutamic-oxaloacetic transaminase, glutamic-pyruvic transaminase and alkaline phosphatase observed between the groups. Histological examination of liver showed no histopathological changes. Subacute study for 4 weeks showed no resulting mortality or signs of toxicity.[7] Synthetic alkaloids in higher doses for prolonged periods are reported to be toxic.[8]

Careful consideration of the toxicity of the plant is required before its use. Its ingestion induces characteristic symptoms such as dry mouth, intense thirst, blurred vision, mydriasis, and increased heart rate followed by hallucinations, delirium, and loss of motor coordination leading to comma and ultimately to death by respiratory failure.[9]

Classics also considered this spp. under the category of *Upavisha* (semi-poisonous drugs)[10] and emphasized on different processing techniques (*Shodhana*) before their application in therapeutics to avoid possibilities of toxicity. Bypassing such classical guidelines will affect adversely and may even lead to death.

Pharmacological Activities

Ethanolic extracts of *Datura* leaves exhibited significant anti-inflammatory activity comparable to the diclofenac sodium against carrageenan-induced rat paw edema.[11] Methanol extracts of *Datura* showed activity against Gram-positive bacteria in a dose-dependent manner. Little or no antimicrobial activity was found against *Escherichia coli* and *Pseudomonas aeruginosa*.[12] Its extracts found to serve as broad-spectrum vibriocidal agents.[13] Leaf and seed extracts, respectively, at 167.25 and 145.75 g/L concentrations, caused 98% and 25% mortality among spider mite adults after 48 h suggesting their germicidal activity specifically against spider.[14] Hydroalcoholic extracts at a dose of 50 and 100 mg/kg body weight (BW) caused a dose-dependent anti-diarrheal effect similar to atropine sulfate (0.1 mg/kg BW i.p.).[15] The analgesic effect was compared with diclofenac (0.75 mg/kg BW i.p.) indicate a dose-dependent effect possibly by narcotic and non-narcotic mechanism.[15] A solution prepared out of *Datura* seeds by heating in water to make 2 mg/mL atropine solution, when administered to male rats as a single i.p. injection 5 min before the subcutaneous injection of 25 mg/kg of dichlorvos. Pretreatment with this extract significantly increased survival in a rat model of

Table 5: Few formulations of *Datura*

Kanakasava	Bhaishajya Ratnavali Hikkaswaschikitsa 16/115-119
Pralapantaka rasa	Bhaishajya Ratnavali 24/379-382
Unmadaganjakusha rasa	Bhaishajya Ratnavali 24/383-385
Kanakasundara rasa	Rasendra Sara Sangraha Jwaratisara Chikitsa 26-27
Lakshmivilasa rasa	Rasendra Sara Sangraha Vatavyadhi Chikitsa 45-48
Unmatta rasa	Sharangadhara Madhyama 12/135
Mahajwarankusha rasa	Sharangadhara Madhyama 118/119
Bruhatkanakasundara rasa	Rasendra Sara Sangraha Jwaratisara Chikitsa 34-35
Tribhuvanakirti rasa	Yoga Ratnakara Jwara chikitsa
Kanakaprabha vati	Rasendra Sara Sangraha Jwaratisara Chikitsa 28-29
Grantishothanivarika varti	Rasa Tarangini 24/386-388
Datura taila	Bhaishajya Ratnavali Shirorogdhikara/93

severe organ phosphorous poisoning.[16] Atropine present in the plant inhibited the growth of enveloped viruses independent of the nucleic acid content of the virus. The test viruses included Herpes simplex virus, influenza virus, newcastle disease virus, *Sindbis, Vaccinia,* adenovirus, Japanese encephalitis virus.[17] Virions formed in the presence of atropine are non-infectious.[18] Seed powder showed rapid normalization of blood glucose level in alloxan induced hyperglycemic rats. A possible mechanism could be that some of the beta-cells might have survived the damage and secreted insulin when treated with seed extract.[19] *In vivo* healing potential of *Datura alba* alcoholic extract on burn rat wounds was studied. A 10% w/w ointment was prepared and applied topically on thermal wounds. Complete wound healing was observed within 12 days in treated rats against control rats which required about 30 days for healing.[20]

CONCLUSION

Medicinal plants becoming the most important aspect of global health care and formed the basis of health care throughout the world since the earliest days of humanity. They are still widely used and have considerable importance in international trade. Plants are important for pharmacological research and drug development, not only when bioactive phytocompounds are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds.

Present review gives brief information about the active constituents along with scientifically claimed medicinal uses of *Datura* spp. in Ayurveda, different parts of *Datura* are used for various human ailments when applied both locally and through oral administration. Several functional groups have been reported to be present in different parts of the plant. The plant shows various types of activities such as analgesic, anti-inflammatory, anti-viral, and anti-diarrheal that may be due to the presence of the active chemical constituents. There is a need of investigation and quantification of phytoconstituents responsible for the specified pharmacological profiles. On the other hand, the plant should only be used therapeutically under the care of knowledgeable health care professionals. The adverse effects can be extremely severe and detrimental. Therefore, even in light of its many beneficial effects, the risk-benefit ratio should be always taken into consideration before using it.

REFERENCES

1. Available from: http://www.apps.who.int/medicinedocs/en/d/Jh2945e/2.html. [Last accessed on 2016 Feb 23].
2. Anonymous. Schedule E-1 of Drugs and Cosmetics Act-1940 and Rules-1945, List of Poisonous Substances under Ayurveda System of Medicine, Government of India, New Delhi.
3. Shagal MH, Modibbo UU, Liman AB. Pharmacological justification for the ethnomedical use of *Datura stramonium* stem-bark extract in treatment of diseases caused by some pathogenic bacteria. Int Res Pharm Pharm 2012;2:16-9.
4. Sharma PC, Yelne MB, Dennis TJ. Database on Medicinal Plants used in Ayurveda. Vol. 2. New Delhi: CCRAS, Ministry of AYUSH; 2001. p. 200.
5. Oseni OA, Olarinoye CO, Amoo IA. Studies on chemical compositions and functional properties of thorn apple (*Datura stramonium* L) Solanaceae. Afr J Food Sci 2011;5:40-4.
6. Abo Kutaifa MA, Abbas DA, Kadhim FM. Acute toxicity of aqueous and petroleum ether extracts of *Datura innoxia* leaves in mice, Al-Anbar J Vet Sci 2012;5:68-74.
7. Abdelouahab B, Nadia M, Nabila K. Toxicity studies of alkaloids of seeds of *Datura stramonium* and synthesis alkaloids in male rats. J Med Plant Res 2011;5:3421-31.
8. Mahdeb N, Bouzidi A, Kara N, Benouadah Z, Soufane S. Acute and subacute toxicity studies of alkaloids of seeds and synthetic alkaloids of *Datura stramonium* in female rats. Pharmacology 2012;3:598-604.
9. Chang SS, Wu ML, Deng JF. Poisoning by *Datura* leaves used as edible wild vegetables. Vet Hum Toxicol 1999;41:242-5.
10. Sharma S. Rasa Tarangini. 11th ed. Ch. 24/163. Varanasi: Motilal Banarasidass; 1979.
11. Gupta S, Raghuvanshi M, Jain D. Comparative studies on anti-inflammatory activity of *Coriandrum sativum*,

Datura stramonium and *Azadirachta indica*. Asian J Exp Biol Sci 2010;1:151-4.
12. Takhi D, Ouinten M. Study of antimicrobial activity of secondary metabolites extracted from spontaneous plants from the area of Laghouat, Algeria. Adv Environ Biol 2011;5:469-76.
13. Sharma A, Patel VK, Chaturvedi AN. Vibriocidal activity of certain medicinal plants used in Indian folklore medicine by tribals of Mahakoshal region of central India. Indian J Pharmacol 2009;41:129-33.
14. Kurnal NA, Yalcin SC. Acaricidal, repellent and oviposition deterrent activities of *Datura stramonium* L. against adult *Tetranychus urticae* (Koch). J Pest Sci 2009;14:54-7.
15. Duraid AA. Analgesiac, anti-Inflammatory and antidiarrhoeal effects of *Datura stramonium* hydroalcoholic leaves extract in mice. IJRRAS 2013;14:193-9.
16. Bhakta PG, Lalita S. A review on the pharmacological and toxicological aspects of *Datura stramonium* L. J Integr Med 2013;11:73-9.
17. Yamazaki Z, Tagaya I. Antiviral effects of atropine and caffeine. J Gen Virol 1980;50:429-31.
18. Alarcon B, Gonzalez ME, Carrasco L. Antiherpesvirus action of atropine. Antimicrob Agents Chemother 1984;26:702-6.
19. Krishnamurthy B, Nauri S, Kota MK, Krishna Rao RV, Koteswara Rao N, Annapurna A. Evaluation of hypoglycemic and antihyperglycemic effects of *Datura metel* (Linn) seeds in normal and alloxan-induced diabetic rats. J Ethnopharmacol 2004;91:95-8.
20. Shanmuga PK, Gnanmani A, Radhakrishnan N, Mary B. Healing potential of *Datura alba* on burn wounds in albino rats. J Ethnopharmacol 2002;83:193-9.

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