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# A Review: Datura Metel

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## Abstract
There are many plants which are known to be not safe but still have been proven to possess the therapeutic properties on of such a plant is datura. In the present paper phytochemical and pharmacological profile is provided for the information to the reader.

**Keywords**
Datura, Datura metal.

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**INTRODUCTION:**
Plants have always been a great source of medicine. Ayurveda, unani, siddha, traditional medicine, tribal medicine and other literatures mention the use of plants in the treatment of various human ailments. A large portion of the world population, especially in developing countries depends on the traditional system of medicine for a variety of disease. Datura metel is a perennial herb belonging to family solanaceae, commonly known as angel's trumpet, devil's trumpet, and metel[2]. The name Datura comes from the early Sanskrit Dustura[3] or dahatura. Datura metel L. Datura metel is well known for its Insecticidal, Herbicidal, Anti-fungal, Anti-bacterial, Anti-cancer, Anaesthetic, Anti-asthmatic, Anti-spasmodic, Anti-tussive, Hallucinogenic, Hypnotic, Mydriatic, Anti-inflammatory and Anti-rheumatoid activity. It was first described by Linnaeus in 1753.[4]

**CLASSIFICATION:**
**Kingdom:** Plantae
**Subkingdom:** Viridaeplantae
**Infrakingdom:** Streptophyta
**Division:** Tracheophyta
**Subdivision:** Spermatophytina
**Infradivision:** Angiospermae
**Class:** Magnoliopsida
**Superorder:** Asteranae
**Order:** Solanales
**Family:** Solanaceae
**Genus:** Datura L.
**Species:** Datura metel L.

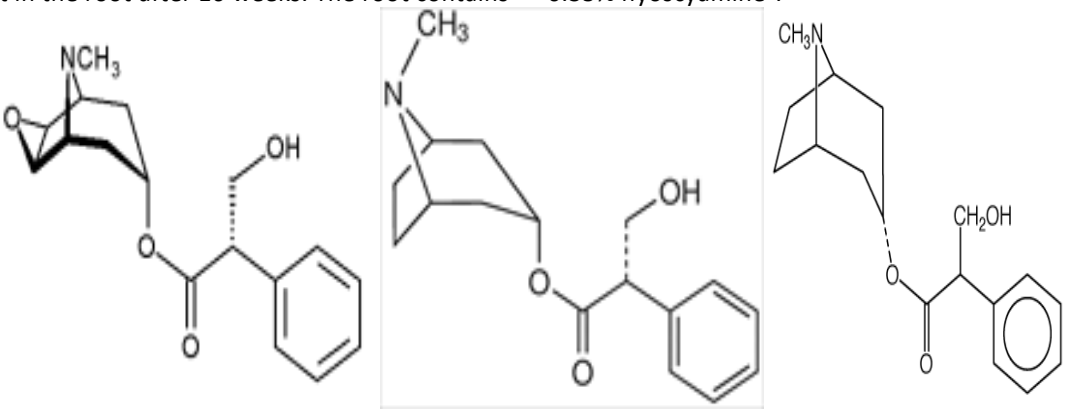
**Common Names:**
**English:** Devil's trumpet, metel, downy thorn apple
**Sanskrit**: Dhattura, Dusthara, Unmatta, Durdhura
**Tamil:** Oomathai
**Chinese:** Yangjinhua
**Hindi:** Dattura
**Malayalam:** Ummam, Ummat

**HABIT&HABITAT**
Datura metel is a shrub like perennial herb, found in India, England and other tropical and subtropical regions[10]. Datura is a mesophyte, grows in tropical and subtropical regions. It is cultivated all around the world for its chemical and ornamental properties. It is also grown for its spiritual values.

**STANDARDS**
Total ash: 14 %
Acid insoluble ash: 3%
Foreign organic matter: not more than 3%
Vitali-morin reaction: positive[10]

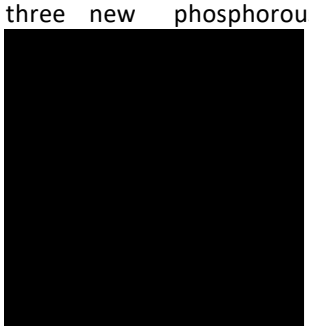
**PHYTOCHEMICAL DETAILS**

Datura contains tropain alkaloids, among which hyoscine is the main alkaloid, while l-hyocyamine and atropine are present in less quantities[10]. The whole plant of D. metel contains scopolamine (hyoscine) and atropine which increased gradually with the progress of developmental growth and are most pronounced when the plant is at the end of its reproductive stage. The scopolamine accumulation is highest in the root after 16 weeks. The root contains higher amount of atropine compared to the other parts. The aerial parts usually accumulated relatively higher amounts of scopolamine and relatively lower amounts of atropine as compared with the root of the plant[11]. The plant contains the alkaloids hyoscyamine, hyoscine and atropine. The total alkaloid content of the leaves is 0.426%, which is mainly atropine. The seeds contain 0.426% alkaloids, which is mainly hyoscyamine. The roots contain 0.35% hyoscyamine[1].




SCOPOLAMINE 1-HYOCYAMINE ATROPINE

A colourless crystalline constituent, daturilin has been obtained from the acid-insoluble fraction of the alcoholic extract of D. metel leaves. This compound has been identified as l-oxo-21,24S-epoxy-(20S,22S-witha-2,5,25-trienolide[12]. Three withanolide compounds were discovered from the leaves of D. metel. These compounds were recognized as withametelin C, D, and E[13]. The three new withanolide (22-hydroxyergostan-26-oic acid-lactone) compounds named baimantuoluoline A, B, and C and the two known withanolides withafastuosin E and withametelin C were isolated from the fraction exhibiting activity for psoriasis from the flower of D. metel[7]. The inorganic content of the leaf of Datura metel were calcium, magnesium and phosphorous present in the ionic state[16].



DATURILLIN

A new antibacterial agent 51, 71 dimethyl 61–hydroxy 31, phenyl 3 α- amine β- yne sitosterol 1 has been isolated from Datura metel leaves. The structure was established using 13C, 1H NMR, IR and MS spectroscopic data. It displayed antibacterial activity against Staphylococcus aureus, Pseudomonas aeruginosa, Proteus mirabis, Solmonella typhi, Bacillus subtilis and Klebsiella pneumonia but could not inhibit Escherichia coli. This result supported the use of Datura metel in phytomedicine for the treatment of asthma, cough, burns and healing of wounds in Nigeria[17].

**PHARMACOLOGICAL PROPERTIES**

The whole plant, but especially the leaves and seed, is Analgesic, Antimicrobial, Antifungal, Antiasthma tic, Antispasmodic, Antitussive and Bronchodilator, Hallucinogenic, Hypnotic, Hypoglycemic, Mydriatic and Cytotoxic activity

**Analgesic activity:**

The analgesic activity of datura metel was investigated using dried seeds. A concentrated aqueous extract was obtained, mimicking conditions used in traditional treatment setting, which includes dissolving the extract in water. The experiments

were carried out with the aqueous extract for its peripheral and central antinociceptive potentials on acetic acid-induced writhing and radiant heat tail-flick models in rats, respectively. There was sensation of pain by the rats administered with the extract in the two test models used, after 60 min and above of pretreatment with the seed extract of D. metel. Hence, the analgesic activity of D. metel seed extract was found to be significant ($P<0.05$) on acetic acid induced model, as well as the radiant heat tail-flick model. The behavioral pattern of sedation and decreased appetite on administration of seed extract could be explained on the basis of the action of some receptors like μ-receptors in the CNS, which when stimulated have the intrinsic potential to reduce the distress or the affective component of pain without having any significant change in the intensity of the actual sensation[18].

**Antimicrobial study:**

The aerial parts of Datura metel L were evaluated against the resistant pathogens belong to aquatic, human and plant origin. Soxhlet extraction method was used to get the corresponding extracts of hexane, chloroform and methanol. The antimicrobial activities of the organic solvent extracts on the various test microorganisms, including bacteria and fungi investigated using agar well diffusion technique.The length of inhibition zone was measured in millimeters from the edge of the well to the edge of the inhibition zone. Methanol and chloroform extracts exhibited promising antimicrobial activity than hexane extracts. The zone of inhibition of chloroform varies from (9 to 18 mm) whereas with methanol (11 to 30 mm) at 100 mg/ml and chloroform (11 to 19 mm) and methanol (12 to 35 mm) with 250 mg/ml DMSO concentrations consequently. Among all microorganisms studied Erwinia caratovara and Pseudomonas syringae showed the considerable growth inhibition with chloroform and methanolic extracts. D. metel can be used in the treatment of infectious diseases caused by resistant pathogenic microorganisms[3].

**Antifungal activity:**

The antifungal activity using pathogenic species of Aspergillus were investigated in the hexane, chloroform, acetone and methanolic fractions of D. metel. In this study, 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. metel L. was 625.0 mg/mL against all the three species of Aspergillus, i.e. A. fumigatus, A. flavus and A. Niger, using the micro broth dilution and percent spore germination inhibition assays. The MIC by disc diffusion assay was found to be 12.5 mg/disc. These results showed that the chloroform fraction of D. metel, was 9.2 times less active than amphotericin B (a standard drug for aspergillosis treatment). Although the chloroform fraction of D. metel extract was less potent against aspergillosis compared to amphotericin B, it's in vitro toxicity as studied by MTT assay using monocyte-macrophage mouse RAW cells was 117.8 times less toxic compared to the toxicity of amphotericin B. Based on these results, constituents in the chloroform extracts of D. metel showed potential for development into better drugs against pathogenic fungi[20].

**Hypoglycemic activity:**

The seed powder of Datura metel was tested for its hypoglycemic activity in normal and alloxan-induced diabetic rats. Graded doses (25, 50 and 75 mg/kg, p.o.) of the seed powder when given to both normal and diabetic rats produced significant reduction in blood glucose at the 8 h. The effect was found to be dose dependent with all treatments at the doses administered. The statistical significance was found to be $<0.01$[25].

**Hallucinogenic property:**

Datura has been documented as a plant with hallucinogenic properties. The aim of study is to highlight some of the effects of aqueous leaf extracts of Datura metel on the frontal cortex of adult Wistar rats. Twenty wistar rats were used for this study. The treatment groups consisted of 3 subgroups designated A, B, and C and these were given 200 mg/kg, 150 mg/kg and 100 mg/kg bwt of the extract respectively, while the control group, designated D, received equal volumes of phosphate buffered saline (PBS). Administration was performed once daily over seven days using an orogastric tube. Twenty-four hours after the last administration, all the animals were sacrificed by cervical dislocation. The brains were carefully extracted from the skulls of the animals and fixed in 10% formol calcium for histological examination. Special staining techniques such as Cresyl fast violet (CFV) and Feulgen DNA were employed followed by routine hematoxylin and eosin (H&E) stain. It was observed from this study that the administration of aqueous extracts of Datura metel (at the doses administered) had deleterious effects on the frontal cortex of adult albino Wistar rats. There were vacuolations in the stroma of the brains of the rats in the extract treatment group and the degree of vacuolation was dose-dependent[22].

The hallucinogenic effect of aqueous seed extract of D. metel was evaluated. The Male wistar rats were divided into four groups and were orally administered with aqueous seed extract of 0.0, 0.4, 0.6 and 0.8mg/kg body weight respectively. The treated groups exhibited some behavioral changes

such as restlessness, aggressiveness, agitation and disorientation. The effect of the extract on the food and water intake shows a significant decrease ($p<.05$) in the 0.6 and 0.8mg/kg extract treated groups as compared with control. The heart rate increased significantly ($p<.05$) in 0.6 and 0.8mg/kg treated groups while the respiratory rate increased in the 0.8mg/kg treated group as compared with control respectively. The hallucinogenic effect observed may be due to the presence of the alkaloid scopolamine[28].

**Anti-asthmatic activity:**

Asthma relief is attributed to depression or paralysis of the receptive mechanism of the parasympathetic nerves in the bronchi (a known action of solanaceous alkaloids), an effect confirmed by the relaxation produced by the alkaloidal extract from the smoke, on an isolated intercartilaginous portion of a bronchial ring previously contracted by pilocarpine. When smoke is inhaled, it is possible the sticky, resinous substance may help by coating the mucosa and thus lessening the bronchial irritation.[27]

**Antioxidant:**

Study the aqueous extract contained more phytochemical compounds than ethanol extracts. Antioxidant activities were higher in the plant leaf than the bark. Results suggest the plant as a natural source of antioxidants and phytochemical quality for antibacterial effectiveness[24].

**Cytotoxic activity:**

Withanolide-type steroids, withametelin Q (1) and 12α-hydroxydaturametelin B (2) along with three known withanolides, were isolated from leaves of Datura metel L. (Solanaceae). The respective structures, characterized mainly by NMR spectroscopy, were identified as (20R,22R,24R)-21,24-epoxy-1α,3β-dihydroxywitha-5,25(27)-dienolide-3-O-β-D-glucopyranoside (1) and (20R,22R,24R)-12α,21,27-trihydroxy-1-oxowitha-2,5,24-trienolide-27-O-β-D-glucopyranoside (2). The cytotoxicity of isolated compounds was evaluated against human lung carcinoma cells (A549) and human colorectal adenocarcinoma cells (DLD-1), respectively. Compound 2 exhibited cytotoxicity against A549 and DLD-1 cell lines, with IC50 values of 7 and 2.0 µM, respectively. However, for compounds 6 and 7, cytotoxicities were higher against DLD-1 cells with IC(50) values of 0.6 and 0.7 µM. Both compounds blocked the cell cycle in the S-phase and induced apoptosis[19].

**Potentiating action**

Datura metel Linn. leaf extract, which is known to contain scopolamine, a tropane alkaloid, was found to inhibit rat intestinal cholinesterase in vitro. The inhibition could not be reversed with higher concentrations of cholinesterase substrate. Whereas Dutura metel root extract was found to activate cholinesterase enzyme activity at optimal or higher substrate concentrations. With root and leaf extract together, the cholinesterase activity level at higher concentrations of substrate, was elevated compared with the inhibitory effect of Datura leaf extract alone, suggesting a potentiating action of Datura root extract on cholinesterase[23].

**Antifertility Activity:**

The crude extract of Datura metel seeds were administered orally to the female mouse in the concentration of 0.5%, 1% and 2% respectively. Control was maintained using NaCl solution. After 15th day of treatment, the female mouse was mated with the normal male mouse in the ratio of 1:3. After 10 days of mating they were dissected and observed the number of implantation sites in the uterine horns. The results stated that the females treated with 2% seed extracts caused cent percent anti-implantation activity followed by 1% and 0.5% seed extracts caused 40% and 80% anti implantation activity respectively. The result of the present study concludes that the seed extracts of Datura metel L may be a good source of antifertility compounds with minimal side effects[29].

## TOXICOLOGICAL DETAILS

All parts of the plant contain tropanic alkaloids in varying concentrations; mostly parasympatholytic. Common side effects: tachycardia (fast heartbeat), slight increase in blood pressure, dryness of the mouth and eyes, sedation. Early symptoms of poisoning are dilatation of the pupil, drowsiness, general weakness, with varying degrees of hallucinations. At toxic levels, tropanic alkaloids can cause hallucinations, delirium, mental confusion, coma and death. Excessive doses can cause hallucinations, severe intoxication and death. The window of toxic and medicinal dose is quite small. With medium doses, recovery can occur in 12 to 24 hours, however, with loss of memory and confusion that may last for days.

Suspensions of the powdered leaf of Datura metel L. and Datura stramonium L. (Solanaceae) were administered by intubation at different doses: 0.125 mg/kg, 0.250 mg/kg, 0.500 mg/kg, 1.000 mg/kg, 1.224 mg/kg and 1.400 mg/kg to virgin female albino mice and were observed daily. After two weeks, the mice were sacrificed and the liver, kidney and intestine were removed, preserved in 10% formalin solution and embedded in paraffin wax. Tissues from these organs were stained for assessment of tissue morphology. Pathological changes observed at 1.224 mg/kg and 1.400 mg/kg (LD100) were irreversible. At all other dose levels, there were reversible changes

in the liver, kidney and intestine. Generally, D. metel-treated mice showed less anatomical abnormalities than D. stramonium-treated mice. Hence, D. metel could serve as a substitute for D. stramonium in drug development.

**CLINICAL UTILITY**

Datura has a wide range of traditional applications, including the treatment of epilepsy, hysteria, insanity, heart diseases, and for fever with catarrh, diarrhea and skin diseases. Crushed leaves are used to relieve pain. In China, the plant is used in the treatment of asthma. About 3 to 5g of the flower extract can be used as an anesthetic through oral consumption that produces general anesthesia within 5 minutes, which lasted for about 5 to 6 h. The flower of the D. metel is used in the treatment of pain, chronic bronchitis and asthma[27]. Its medical usage has been reported in Indian & British Pharmacopeias and in traditional system of medicine such as Ayurveda, Unani & Siddha.[30]

**TABLE I: ACTIVITY OF DATURA MATEL**

| S. No | Part | Activity | Model | Extract | Animal species | Dose | 'p' value | Reference & year |
|---|---|---|---|---|---|---|---|---|
| 1 | Leaf and root | Antispasmodic activity | Isolated rat uterus and rectum whole muscle | Aqueous extract | Albino rats | - | - | N. V. Nanda Kumar et al. (1994)[21] |
| 2 | Whole plant | Anti-asthmatic activity | Intercartilaginous portion of a bronchial ring | - | Albino rats | - | - | Liew S et al. (2002)[27] |
| 3 | Seeds | Hypoglycemic activity | Alloxan induced | Crude powder | Wistar rats | 20, 50, 75mg/kg | <0.01 | B Krishna Murthy et al. (2004)[25] |
| 4 | Seeds | Analgesic activity | Tail flick method & writhing method | Aqueous extract | Albino rats | - | <0.05 | N. N. Wannang et al. (2009)[18] |
| 5 | Leaves | Hallucinogenic properties | - | Aqueous extract | Wistar rats | 200, 150, 100 mg/kg | - | A.A. Tijani et al. (2010)[22] |
| 6 | Seeds | Hallucinogenic properties | - | Aqueous extract | Wistar rats | 0.4, 0.6 and 0.8mg/kg | <0.05 | M.G. Abubakar et al (2012)[28] |
| 7 | Seeds | Antifertility activity | - | Crude extract | Albino mouse | 0.5%, 1% and 2% | - | Sankarasivaraman K et al (2012)[29] |

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