

Datura species (Dhatura Safed and Dhatura Seyah): A Review with special emphasis on single-use and compound formulations and pharmacological studies relevant to Unani System of Medicine

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ABSTRACT

Background: Datura is a genus belonging to family *Solanaceae*, consisting of 15 species that include annual and perennial herbs, shrubs, and trees. In the Unani System of Medicine, two varieties are commonly used for medicinal purposes. One is black called Dhatura Seyah which is obtained from *Datura stramonium* and *D. niger*, and second is Dhatura Safed (white) obtained mainly from two sources *D. metel* and *D. innoxia*. All the species are poisonous especially their seeds and flowers but used medicinally after detoxification by specific methods and along with their correctives mentioned in Unani Tibb. **Methods:** The literature search was performed using online databases including PubMed and Google Scholar and relevant information were extracted from articles. **Results:** Various scientific studies have been done and the drug is proved as an anti-catarhal, anti-cancerous, anthelmintic, anti-rheumatic, anesthetic, and anti-diarrheal. Different species of datura used in Unani Medicine for the management of various ailments have been justified through various pharmacological researches like analgesic, sedative, antidiabetic, and anti-ulcer properties. These plants are important for pharmacological research and drug development, not only when bioactive phytochemicals are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds. **Conclusions:** This review gives an account of the current knowledge on the morphology, phytochemistry, and pharmacological aspects of all the species of Datura along with its action and uses in the perspective of Unani Medicine.

Keywords: *Datura metel* L., *Datura stramonium* L., *Solanaceae*, asthma, anticonvulsive; alkaloids

Unani Medicine, as its name suggests, owes its origin to Greece. It was the Greek philosopher physician Hippocrates, who gave the concept of humors, the causes of disease, and their management through natural resources like plant and animal substances. Further, this knowledge was propagated by Aristotle (384 B.C.–322 B.C.), Theophrastus (371 B.C.–287 B.C.), Dioscorides (40–90 A.D), Galen (129 A.D–210 A.D). Unani System prefers treatment through single drugs and their combination in raw form, as well as in compound formulation. Dioscorides (40–90 A.D) is known in the field of Ilmul Advia (pharmacology) as its founder. He described 500 single drugs. Ibn Baitar (1176–1248 A.D), the great herbalist, compiled a book on pharmacology after

extensive field survey and research describing 1500 single drugs used in Unani medicine.

Despite great advances made in modern medicine during the last few decades, plants still have an important role in healthcare. It is estimated that about 25% of all the allopathic drugs are directly or indirectly derived from the plants. However, the Unani system of Medicine uses the natural product as a whole (roots, leaves, fruits, seeds) rather than their active ingredients. So, Unani treatment is safe, efficacious, and easily available, and hence, widely accepted [1]. Datura is obtained from plant sources, mainly *Datura stramonium* having black seeds and white seeds obtained from *Datura innoxia* and *D. metel* L. (Syn.

D. fastuosa L., *D. alba* Nees). The name of Genus owes its origin to Sanskrit and Persian words [2]. Jawz refers to walnut as it's walnut-shaped. Jimson weed probably refers to the settlement of Jamestown in Virginia USA.

Datura innoxia P. Mill. is herbaceous annual, bushy by nature, and attain a maximum height of 120 cm seeds are brown. *D. metel* L. is an erect annual herb or under shrub reaches a height of about 1.5 m whose alkaloid content varies with altitude and season of the year. It grows on a variety of soils but prefers loam soil and open areas with light sunshine. It can be propagated by seeds which are sown in rows 45 to 60 cm apart and covered with soil. The crop is ready for harvest 6 to 7 months after sowing. Leaves, flowering tops, and seeds are collected from June to August. While harvesting, the entire plant is cut when the fruits are mature but green and partially dried in the sun or the shade. The leaves are stripped and separately dried. The seeds are shaken off from the capsules when the fruit begins to burst [3]. Alkaloids of pharmaceutical importance extracted from these plants are hyoscyamine, hyoscyne, and neteloidin.

The whole plant of *Datura metel* L. is Dafi-i-Ta`affun (anti-septic), munashshi (narcotic), mukhaddir (sedative) properties. Its species is being used to treat various ailments, Diq al-Nafas (asthma), Suda (headache), Waja' al-mafasil (arthritis), Irq al-nasa (sciatica), insanity, and toothache [4-8]. Various compound formulations such as Habb-i-Shifa, Ma'jun Falaksair, Roghan Haftbarg, Roghan Chaharbarg [9] also are used successfully to treat various diseases (see Table 02). *Datura* is the chief commercial source of hyoscyne. Hyoscyne is used as pre-anesthetic in surgery, childbirth, ophthalmology, and prevention of motion sickness in the form of hyoscyne hydrobromide. It is also employed to relieve the withdrawal symptoms of Afiyun (opium) and alcoholic addiction, paralysis agitans, post-encephalitic Parkinsonism.

DISTRIBUTION:

Datura is distributed throughout the world, particularly, the warm regions. *D. fastuosa* (syn. *D. metel* L. and *D. alba*) is native of Asia, Africa, and Mexico [10] and found all over the tropical parts of India in waste places [11]. They are found commonly in wastelands, gardens, and roadsides. *Datura innoxia* P. Mill is indigenous to Mexico and is distributed in Latin American countries. In the India it is grown in Bangalore, Ahmedabad, Pune, Lucknow, Pilani, and Jammu. *Datura stramonium* L. is native to the Caspian region of Europe, North America and Indian subcontinent. In the India it has been successfully grown in Kashmir valley, hills of Himachal Pradesh, U.P, and also grown

during the winter season in Northern plains. It occurs in nature in Temperate Himalayas up to 2500 m and in hilly regions of Central and Southern India [9, 12, 13].

BOTANICAL DESCRIPTION:

The leaves of *D. stramonium* L. and *D. metel* L. are very similar, they have long petioles, unequal at the base, ovate, acuminate, sinuate, dentate, with large irregular pointed lobes when fresh they are firm and juicy and have a disagreeable fetid odor, which they lose when dry. In *D. stramonium* L. and *D. metel* L. the young leaves are pubescent. In size, the leaves vary greatly, in vigorous plants the largest is 7 to 8 inches long and 4 to 5 inches breadth. All the species have large, trumpet-shaped, night-scented flowers, which in *D. metel* L. are whitish purple to yellow, in *D. stramonium* L. they are solitary, axillary, purplish outside and whitish within while in *D. innoxia* P. Mill they are white.

The fruit is an ovoid capsule about the size of a walnut, thickly studded with blunt spines, its bilocular, with each cell incompletely divided into two, and in *D. stramonium* L. opens at the summit, when ripe, in four regular valves, disclosing a large number of flattened, kidney-shaped black or dark brown seeds, about 2 lines long and ½ a line thick. The surface of the seeds is finely pitted and also marked with a much coarser series of shallow reticulations. The embryo follows the outline of the seed and has the tip of the radicle everted. The fruit of *D. metel* L. dehisces irregularly when ripe, and the seeds are ear-shaped and of a light yellowish-brown color. The testa is much thicker than in the seeds of *D. stramonium* L., but like them is reticulated and finely pitted. The seeds of both plants have a bitter taste and disagreeable odor when bruised. The outer envelope of the seed is formed of a layer of thick-walled, sinuous cells, which in *D. metel* L. are much more developed than in *D. stramonium* L. and contain secondary deposits; the inner is formed of tangentially extended cells. Albumen consists of polyhedral cells, containing granular matter and fatty oil [14].

SCIENTIFIC CLASSIFICATION:

Kingdom:	<i>Plantae</i>
Sub-kingdom:	<i>Tracheobionta</i>
Super-division:	<i>Spermatophyta</i>
Division:	<i>Magnoliophyta</i>
Class:	<i>Magnoliopsida</i>
Subclass:	<i>Asteridae</i>
Order:	<i>Solanales</i>
Family:	<i>Solanaceae</i>
Genus:	<i>Datura</i> [15]

DESCRIPTION IN UNANI LITERATURE:

The fruit is green in color, ovoid in shape nut like covered with numerous sharp spikes. Based on color, there 5 types are mentioned in classical literature but only two varieties; white and black seeds are used medicinally. According to Najmul Ghani, those five varieties are as follows: Type 1: One whose flowers are white; Type 2: One whose flowers are blue; Type 3: One whose flowers are red; Type 4: One which has yellow flowers; Type 5: One which has black flowers; It is mentioned in the book “Ganj badaward” that Jawz mathil is considered to be of better quality which resembles Guava, and has black triangular seeds [5].

Mutaradifat (vernacular names): Arabic: Jawz-i-mathil (*D. metel L.*), Jawz-i-afat, Jawz al-dab, Jawz-i-muhlik, Jawz-i-matil, Jawz-i-marad (*D. stramonium L.*); [4, 7, 16] Jowz-i-mathil Aswad (*D. innoxia P. Mill*); [16] Bengali: Sada Dhatura (*D. stramonium Linn*); [7] Dhatura (*D. innoxia P. Mill*); [3, 15] Kala Dhatura (*D. fastuosa Linn*); [16] English: Thorn apple, Jimson weed; [15] Devil’s trumpets, Moon flowers, Hell’s bells; Apple of Peru, Mad apple, Stink weed (*D. stramonium L.*); [16] Prickly burr, Black Datura, Purple Datura (*D. innoxia P. Mill*); [15, 16] Downy Datura (*D. metel L.*); [15] German: Asthmakraut, dornaphal (*Datura stramonium L.*); [16] Greek: Strychnosmanikos (*Datura stramonium L.*); [16] Gujrati: Kaladhatura, Kalodhatura (*D. innoxia P. Mill*); [16] Hindi: Sada dhatura (*D. innoxia*); [15] Kashmiri: Datir, datur; [4] Kannad: Ummati (*D. metel L.*); [3] Dattura (*D. stramonium L.*); [3] Malayalam: Umattu (*D. stramonium L.*); [3,15] Ummatta (*D. innoxia P. Mill*); [15] Ummathai (*D. metel L.*); [3] Persian: Tatura, tatula, gawzmathil (*D. stramonium L.*); [16] Guzgiah, Kaizmasalesiyah (*D. innoxia P. Mill*); [16] Punjabi: Dattura, Tattur (*D. stramonium L.*); [16] Sanskrit: Dhustura (*D. innoxia P. Mill*); [15] Dhatura, Devika, Madakara (*D. stramonium L.*); [3, 16] Dhatura (*D. metel L.*); [3] Tamil: Vellummattai (*D. innoxia P. Mill*); [15] Karuumattai (*D. metel L.*), Umatai (*D. stramonium Linn.*); [3, 15].

Mizaj (temperament): Cold and dry in 4th degree [5, 17].

Ajza-i-musta’amala (parts used): The whole plant (*D. stramonium L.*); seeds in (*D. innoxia P. Mill*); leaves, fruit, roots and seeds (*Datura metel L.*) [18].

A’al wa Mahl-i-Iste’mal (action and therapeutic uses): Leaves are Dafi’-i-Tashannuj (spasmolytic), Mujaffif Rutubat (siccative), Muhallil (anti-inflammatory), Dafi’-i-Ta’affun (anti-septic), Musakkin-i-Alam (sedative) [5,17]. Seeds are externally used as, mukhaddir (anesthetic), musakkin (sedative), and internally as, muharrrik-i-

Dimagh, Mawjib-i-Sukr (narcotic), Mawjib-i-Hadhayan (dilerient), Dafi’ Humma Balghami (antipyretic), Qatil-i-kirm Shikam (antihelminthic), etc [5, 17, 18]. It is useful in Suda’(headache) which occurs especially due to Safra (yellow bile) and in Humma (fevers) caused by Balgam (phlegm). Due to its dafi’ tashannuj (anti spasmotic) property, it is given in hepatic colic, laryngeal cough, chorea, and stammering. It is very useful in Ushr-i-tamth (dysmenorrhoeal), Waja’al-a’sab (neuralgia), Irq al-Nasa (sciatica), Ashob-i-Chashm (conjunctivitis), Warm-i-pistan (mastitis) in females especially due to accumulation of Safra (bile) [5, 17]. Other indications are Diq al-Nafas (asthma), Warm-i-Sho’b al-Riya (bronchitis), Bawasir (haemorrhoids), Shiqaq al-maq’ad (anal fissure), etc. It is also applied in Amrad Jild (skin diseases) like Da al-sadaf (psoriasis), Qamal (lice), (pediculi), and shara (urticarial) [5, 17]. The mode of administration of the drug for the treatment of various diseases are as follows:

Intishar-i-Sha’r (hair fall): Fruit juice is applied to the scalp for intishar-i-sha’r (hair fall) and bafa (dandruff) [5].

Junun (insanity): A drink is prepared by boiling the leaves of datura with honey and ghee and the patient of Junun is made to drink [5].

Waja’ al-Asnan (toothache): The root is powdered and applied to the gums to relieve pain [5].

Diq al-Nafas (asthma): Inhalation of smoke from the burning leaves is recommended to relieve the attack of asthma [5].

‘Irq al-Nasa (sciatica): Warm leaves are applied topically over the areas where the pain is felt [5].

Bawasir (hemorrhoids): The remedy is to steam the part over boiling water containing the leaf [5].

Amraz-i-jild (skin disease): Externally a paste of seeds is used to treat Shara (urticarial) and other skin diseases, such as presence of lice, or other parasites. Local application of datura oil also eradicates itching of skin [5].

Ziabetes (diabetes): Equal quantities of datura seeds and Filfil Seyah (pounded) and tablet is formed and taken daily with Arq-i-Saunfis beneficial in diabetes [5].

ETHNOMEDICINAL USES:

***Datura fastuosa L.*:** The leaves possess antispasmodic, sedative, and anodyne properties. They are used for treating cough, asthma, rheumatism, gastric, ulcers,

hemorrhoids, seasickness, and air sickness. The dried leaves and flowers are cut into small chips and used in anti-asthmatic cigarettes. A poultice of the pounded fresh leaves has an anodyne effect [19]. Its seeds, leaves, and roots are used in insanity; fever with catarrh, diarrhea, cerebral complication, and skin diseases and as antiseptic. An extract of its bruised leaves or seeds in oil is found often very effective in allaying the pain in rheumatic swellings, boils, and tumors. Besides, its roots are known as an anti-diarrheal, antipyretic, and antiseptic and are used in toothache and for brushing the teeth. After boiling in milk, these are administered with clarified butter to treat the insanity [20].

Seeds are burnt to make ash with clove and taken with honey to treat malarial fever. In case of bronchial asthma after removing the seeds, half part of one mature fruit is filled with cloves, then roasted, ground and made into pills of 5gm each with honey, one pill is given with water twice a day for 7 days and also at the time of the asthmatic attack. The treatment is repeated every alternate month, till the cure is obtained. Seed paste is applied externally for 4 to 5 days, to treat boils. Leaf juice is applied externally on the affected parts to treat the fistula of the spinal cord. The fruit is wrapped in a wet cloth which is then burnt along with cow dung cakes and given with flour of bakery to the cattle for diarrhea. A Poultice of unripe fruit is applied externally on the affected parts of cattle, to cure swelling, and eruption of the skin [18].

Dried leaves are rolled and smoked when required in case of cough. Dried leaves are rolled as bidi and burnt. The smoke is inhaled for curing wheezing. A few leaves of the plant are boiled in 50 ml of sesame oil and are used as poultice supposed to remove whole poison without any side effect. To terminate the pregnancy, the root stick (5 cm) is placed in the vagina for ½ hour. It causes uterine contraction and terminates a 3 to 4 months old pregnancy. Swollen finger and thumb are covered with capsules and tied in case of the Whitlow. Thumb finger covered with an empty capsule (fruits) is tied to treat nail infection.

Fruit paste is applied to the belly of infants in a disease locally known as “Kodabat”. Datura along with “Zeera”, “elaichi”, “laung” and “sonthi” in equal quantity are made into powder and given orally twice a day to treat joint pain. In another recipe, leaf with “begonia” root in equal quantity crushed and prepared in oil. The oil is applied to joints affected with pain [21]. In Mysore, the juice of the leaves is given once daily with curdled milk for Gonorrhoea [16].

Datura stramonium L.: The chief use of the drug is in

asthma; used internally in place of belladonna [22]. Leaves are used in cigarettes for asthma. Seeds are quite often employed for homicidal purposes [23]. Leaves are used in the treatment of Parkinsonism; Stramonium ointment is employed in the treatment of hemorrhoids. Leaves are also applied to boils, sores, and fish-bites and flower juice used for earache [24]. It is applied externally as a poultice to reduce local pain. It also controls muscular spasms and salivation in post-encephalitic Parkinsonism [25]. It is a good anodyne when prepared in the form of a warm infusion of leaves. It is effective in inflammatory pains [11]. Thorn apple relaxes the muscles of the gastrointestinal, urinary, and bronchial tracts and also reduces digestive and mucous secretions [19].

A decoction of flowers and roots is used as a sedative to calm patients during the setting of fractures [26]. The leaves are crushed, mixed with oil, and used as an antidote for poisonous insect bites, such as those of Tarantula species. Europeans apply a warm pad of the leaf to a painful and swollen part and a similar poultice to ingrowing toenails and burns. In the former times, the fresh warmed leaf or the vapor of an infusion of a leaf was applied particularly to relieve the pain of rheumatism and gout. Europeans also make an ointment containing the juice of leaf and young shoot for application to running sores. A poultice of the leaf was formerly applied to carcinomatous ulcers. In Ceylon, roots are used in bites from the mad dogs; they are supposed to cure insanity [16]. The Leaf is taken in the morning with some sweets or uncooked grains of rice, on three days in a week to treat malarial fever [18].

Datura innoxia L.: Half kg of the plant is boiled in 1 liter of water and made into the decoction. The decoction is used to cook rice in it. The rice is advised to be eaten by the patient to treat rabies. Half kg of seeds is mixed with one kg of Khashkhash (seeds) and boiled in 5 liters of water until the oily layer appears. The oily layer is extracted and is used for massage to treat falij (paralysis) [27].

Uses in Folklore of Kashmir: Leaves of *D. stramonium* are useful in bronchitis and asthma [28]. They also control salivation in the mouth; they are antispasmodic and narcotic [29]. Seeds are crushed with mustard oil are applied for rheumatism, decaying teeth, piles, tumors, and parasitic skin diseases [30]. The leaf and seed poultice is used externally on boils [31]. A spoonful of dry powdered seeds is orally given to cattle for the treatment of pneumonia for purulent discharges from ailments [32].

Mazarrat (toxicity): According to Ibn Sina it is harmful

to the heart and brain [33]. All parts of the plants including nectar (honey) are poisonous, especially the seeds and the fruits. It induces symptoms of poisoning similar to those caused by deadly nightshade causing delirium and maniac activity. It affects the sympathetic nervous system but not sensory or motor nerves. Flowers, fruits, leaves, root, and branches all are stimulant, especially leaves and seeds have a lethal effect.

In full dose actions of the heart becomes irregular, and there is furious delirium [7]. It causes mydriasis due to the presence of atropine. Muscle stiffness, urinary retention, temporary paralysis, and confusion is often reported and pronounced amnesia is another commonly reported effect [34]. Muhlik Miqdar Khurak (lethal dose) is 1gm (100-125 seeds); and 4mg-6mg alkaloid (in children). It causes death within 24 hrs [35].

Musleh (corrective): Before medicinal use, it is purified by the specific method as described in Unani literature. The method is, "Datura seeds are taken in a clean cloth, tied in the form of suspending pack, and kept dipped in a vessel containing cow's milk and boiled in cow's milk for 3 hours. After 3 hours, the seeds are washed in hot water, dried and preserved". Further, it is used along with some drugs viz; Filfil Seyah (*Piper nigrum L.*), Badyan (*Foeniculum vulgare Mill.*), Honey, Roghan Zard (cow ghee) and Milk to avoid its toxicity and adverse effects [5, 17].

Badal (substitute): Opium (*Papaver somniferum L.*), Ajwain Khurasani (*Hyoscyamus niger*) [4], Beekh Luffah (*Atropa belladonna*) are used as a substitute [4, 17].

Miqdar Khurak (dosage): 250 mg [36]; 250-750mg [17].

D. metel L.: Seeds: 30-60 mg [12].

D. stramonium L., leaf: 60-185 mg powder, Seeds: 60- 120 mg powder [12].

FAMOUS COMPOUNDS:

Habb-i-Shifa, Roghan Chahar Barg, Roghan Haft Barg, Ma'jun Falaksair, Ma'jun Lana, Dawa-i-tatura, Roghan Dhatura, Bukhur-i-Dama, etc. (table 01) [9, 37].

SCIENTIFIC STUDIES:

Phytochemistry: The plant is reported to contain alkaloids (scopolamine), flavonoids, triterpenoids, phenolic compounds, and fatty acids. The whole plant contains 0.26% alkaloids (seeds 0.98% and stem 0.08%); also

flavonoids, with astramonolide, with anolides, coumarins, and tannins; the major alkaloid is hyoscyamine (44-67%), hyoscyne (13.2-25.3%) and atropine (0.01-0.1%). Seeds contain daturine, resin, mucilage, proteids, malic acid, scopolamine, and ash 3 cents.

Daturina is an alkaloid identical with atropine, combined with malic or daturic acid and consisting of hyoscyamine and atropine. Fruit contains daturalone and daturadiol while roots contain additionally ditigloylloxy tropane derivatives, tiglodine, apohyoscyne, nor hyoscyne, cusiohygrine, and tropine.

Other alkaloids isolated from the plant are apohyoscyamine, DL-scopolamine, Normeteloidine, tigloylputrescine, scopine, nortigloidine, tropine, pseudovaleroidine, fastudine, fastunine, fastusinine, 7-hydroxyl -3, 6-ditigloyloxytropane daturanolone, and fastusic acid. The tropane alkaloids are similar to those found in *Atropa belladonna* [7, 12].

Datura innoxia P. Mill., contains hyoscyamine, hyoscyne, meteloidine; flower & seeds: hyoscyamine, hyoscyne [29].

Datura stramonium L., is a rich source of alkaloid-hyoscyne, hyoscyamine, skimmianine, apohyoscyne, apoatropine, apoatrophine, alpha and beta belladonine, tropine, alpha, and beta elladonine. Root: alkaloid, stem, and leaf: alkaloid-nicotianamine, scopolamine, hyoscyamine; fruit: alkaloids, beta sitosterol, triterpene, seed: alkaloids-hyoscyne, hyoscyamine, daturone [38].

Datura fastuosa (D. metel. L.) contains an alkaloid, hyoscyne, hyoscyamine; root, alkaloid; stem and leaf, alkaloid- nicotianamine, scopolamine, hyoscyamine; fruit, alkaloids, beta sitosterol, triterpene; seeds: alkaloids-hyoscyne, hyoscyamine, daturaolone [18, 27, 29]. The plant contains alkaloids: Scopolamine, hyocyanine, atropine, and norhyoscyamine, as well as vitamin C [20].

PHARMACOLOGICAL STUDIES

Analgesic effect: Aqueous extract of *D. fastuosa M.* leaves and seed (10% w/v) were evaluated for analgesic effect on hot plate reaction and acetic acid (0.6%, 10 ml/kg/l.p) induced writhing in mice. Oral treatment of 400 and 800 mg/kg proved effective and showed the significant the analgesic effect. Upon naloxone administration, the analgesic effect was reduced in leaf extract while the seed extract remained unaffected[31].The Aqueous seed extract of *D. metel L.* was found not to possess analgesic activity on an acetic-acid induced model as well as the radiant heat tail-flick model [39].

Table 1: Compound formulations having Dhatura as an important ingredient, with their dosage, mode of administration, and indication [9, 37]

Name of compound drugs (forms)	Dose and mode of administration	Indications
<i>Bukhur Dama</i> (fumigation)	Sprinkle the pinch of powder on burning coal and to inhale it	Asthma [attack]
<i>Habb-i-Shifa</i> (pills)	250–500 mg, orally	Fevers, Lung collapse, Bronchial asthma, Gout
<i>Habb-i-Ambar Momya'i</i> (pills)	250–500 mg, orally	Sexual weakness, Cardiac, Nerve, & Cerebral weakness
<i>Habb-i-Hamal</i> (pills)	250–500 mg, orally	Uterine weakness, Sterility
<i>Habb-i-Jadwar</i> (pills)	250–500 mg, orally	Nerve weakness, Chronic catarrh, Lethargic
<i>Anushdaru</i> (semisolid)	5–10 gm, orally	Palpitation, Cardiac weakness, General weakness, Obstructive jaundice, Diarrhoea, Dysentery
<i>Itrifal Ghudadi</i> (semisolid)	10-20 gm, orally	Scrofula, Glandular inflammation
<i>Jawarish Kundur</i> (semisolid)	5–10 gm, orally	Excessive diuresis
<i>Jawarish Ood Shirin</i> (semisolid)	5–10 gm, orally	Diarrhea, Indigestion, Anorexia
<i>Jawarish Utraj</i> (semisolid)	5-10 gm, orally	The weakness of stomach, Hepatic Insufficiency.
<i>Luboob Kabir</i> (semisolid)	5-10 gm, orally	Sexual & Nerve weakness, Oligospermia, Cardiac weakness, Renal insufficiency, Dystonia of bladder, Riqqat-i-Mani
<i>Ma'jun Aarad Khurma</i> (semisolid)	10-15gm, orally	Spermatorrhea, Riqqat-i-Mani, Oligospermia, Sexual weakness.
<i>Ma'jun Baladur</i> (semisolid)	5-10gm, orally	Nerve weakness, Amnesia
<i>Ma'jun Bandkushad</i> (semisolid)	5-10gm, orally	Sexual weakness
<i>Ma'jun Falaksair</i> (semisolid)	250-500gm, orally	Acute pain, Spermatorrhea, Premature ejaculation
<i>Ma'jun Fanjnosh</i> (semisolid)	4-10 gm, orally	Weakness of stomach, Indigestion
<i>Ma'jun-i-Ispan Sokhtani</i> (semisolid)	5-10gm, orally	Premature ejaculation, Excessive nocturnal emissions, Spermatorrhea, Neuralgia
<i>Ma'jun-i-Muluki</i> (semisolid)	5-10 gm, orally	Nerve weakness, Stomach weakness
<i>Roghan Haft Barg</i> (semisolid)	Q.S / for external use	Arthralgia, paralysis, facial paralysis
<i>Ma'jun Lana</i> (semisolid)	3–5 mg, orally	Paralysis, Facial Paralysis, Tremors, Epilepsy
<i>Ma'jun-i-Nankhwah</i> (semisolid)	5–10 gm, orally	Flatulence, Anorexia.
<i>Ma'jun-i-Rahul Mominin</i> (semisolid)	5-10 gm, orally	Bronchial Asthma, Cardiac and Sexual weakness, Palpitation
<i>Ma'jun-i-Salab</i> (semisolid)	5-10 gm, orally	Sexual weakness, Riqqat-i-Mani.
<i>Ma'jun-i-Suparipak</i> (semisolid)	10-15 gm, orally	Leucorrhoea, Sterility, Premature ejaculation.
<i>Mufarrih Sosambari</i> (semisolid)	5-10 gm, orally	Cardiac and Intestinal weakness, Ascites, Gout, Jaundice, Indigestion, Arthralgia
<i>Roghan-i-Baladur</i> (semisolid)	Q.S/ for external use	Paralysis, Facial paralysis, Flaccidity
<i>Roghan-i-Chahar Barg</i> (semisolid)	Q.S/ for external use	Arthralgia, Arthritis
<i>Roghan-i-Haft Barg</i> (semisolid)	Q.S/ for external use	Paralysis, Facial Paralysis, Arthralgia
<i>Roghan-i-Ispand</i> (semisolid)	Q.S/ for external use	Tremors, Spasm
<i>Roghan-i-Jawzbuwa</i> (oil)	Q.S/ for external use	Arthralgia, Hemiplegia, Facial Paralysis
<i>Arq-i-Chobchini</i> (liquid)	50-100 ml, orally	General weakness, Miraq, Melancholia
<i>Safoof-i-Qaranfal</i> (liquid)	5-10 gm, orally	Colitis, Carminative, Antiseptic

Antiarthritic effect: A clinical trial on waja' al-mafasil (rheumatoid arthritis) was done, for which 40 patients were taken and divided into 2 groups (test and control) having 20 in each. Triherbal capsule (test drug) comprises of *Withania somnifera*, *Piper nigrum*, and *Datura fastuosa* was given in one group, and Aspirin was introduced in the

second group. After 21 days of treatment, significant improvement with no adverse effects of test drug was observed in comparison to the control drug [40].

Wound healing activity: Wound healing activity of ethanolic extract of *Datura fastuosa* L. was done on Wistar

Albino rats. The study was carried out by the excision wound model. The extract is formulated as simple ointment at two concentrations (5%w/w, 10%w/w). Nitrofurazone ointment (0.2%w/w) was used as standard. The parameters analyzed were percentage wound closure, mean epithelization time, hydroxyproline, DNA, and protein level. The histopathological studies were also carried out on wound tissue. The result showed that 10%w/w *Datura fastuosa L.* ointment has significant wound healing activity as that of the standard [41].

Antifungal activity: The hexane, chloroform, acetone, and methanolic fractions of *D. metel L.* were investigated for antifungal properties against three species of *Aspergillus*, those are, *A. fumigates*, *A. flavus*, and *A. niger* [42]. The MIC of the chloroform extract was found to be 625.0 µg/ml by micro broth dilution method and 12.5 µg/disc by the disc diffusion assay although the chloroform extract of *D. metel L.* was 9.2 times less active than amphotericin B, it was 117.8 times less cytotoxic than the standard drug. A concoction brewed from *D. stramonium*, *Calotropis gigantea*, *Azadirachta indica*, and cow manure was used against floral malformations caused by *Fusarium mangiferae* [43].

Antimicrobial Activity: The methanol extracts of *D. stramonium L.* and *Datura innoxia P. Mill.* showed activity against Gram-positive bacteria in a dose-dependent manner. Little or no antimicrobial activity was

found against *Escherichia coli* and *P. aeruginosa* [44]. The anti-microbial activity of combined crude ethanolic extract of *D. stramonium L.*, *Terminalia arjuna*, and *Withania somnifera L.* in cup plate diffusion method for antibacterial and antifungal activity. The extracts were subjected to screening to detect potential antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Micrococcus luteus*, and *Candida albicans* in comparison to standard drug ciprofloxacin [45].

Anti-stress activity: With anolides from *D. fastuosa L.* possess anti-stress activity. When administered with diazepam, it exhibited an anxiolytic effect and inhibited the immobilization stress-induced depletion of adrenal cortisone. Adrenal cortisone helps an organism to overcome annoying stimuli, but such responses can cause stress-induced disorders [46].

Antiulcer activity: An investigation was done to evaluate the antiulcer activity and its mechanism on various models on experimentally induced ulcers in rats. In the study, it was found that with anoloids extract (20 mg/kg) reduced the ulcer and ulcer index significantly in rats. 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 [47].

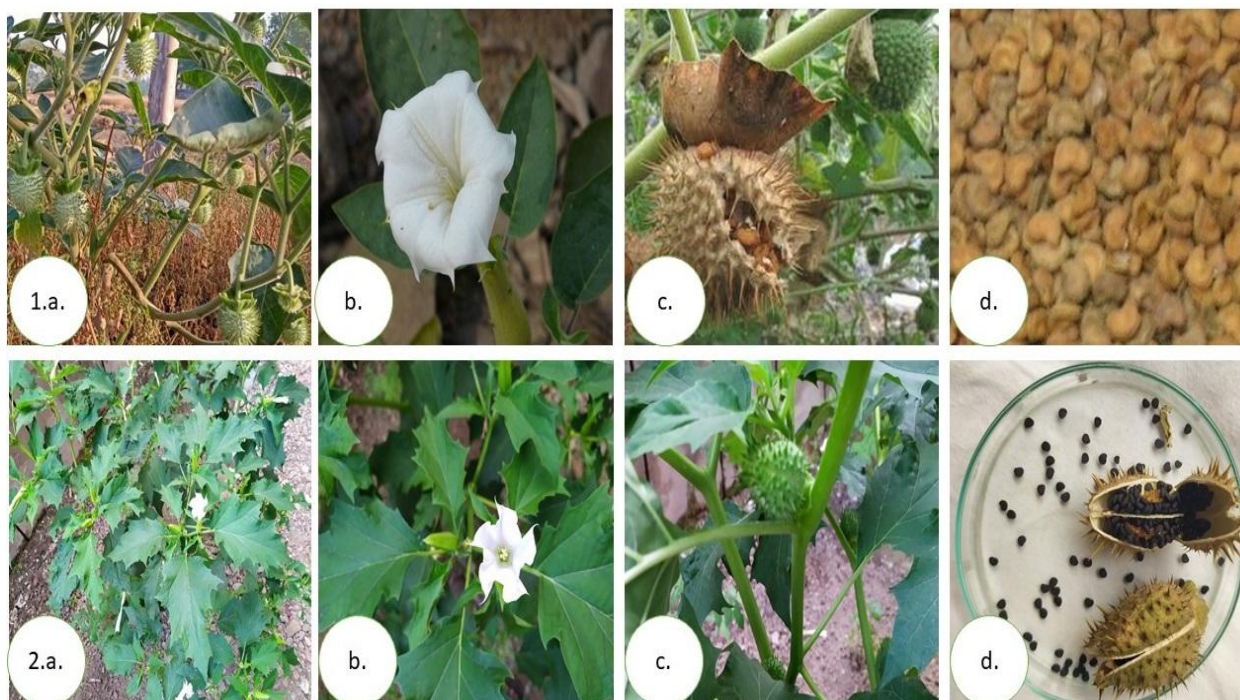


Figure 1: Showing 1.a. Datura Safed plant, b. Flower, c. fruit, d. seeds and 2.a.b Datura Seyah plant with flower, c. unripe fruit, d. ripe fruit with seeds

Hypoglycemic effect: The anti-hyperglycemic effect of *D. metel* seeds was carried out on normal and alloxan-induced diabetic rats. Gliclazide was used as standard control to reduce blood glucose levels. In the study, histopathological studies were not performed and hence the detailed mechanism of action could not be established. The effect of seed powder showed rapid normalization of blood glucose levels. The possible mechanism could be that some of the β -cells might have survived the damage and secreted insulin when treated with seed extract [48].

Toxicity studies: Toxicity studies of ethanol extract of the leaves of *D. stramonium* in rats were done by Giadado et al. (2007). Two doses of 50 and 200 mg/kg of the extract were administered to the rats for five weeks. Parameters studied were the indices of liver and kidney function and some biochemical and hematological parameters. Feed intake, final body weight, serum AST, ALT, bilirubin, total protein, urea, and the electrolyte studied were not affected by the extract administration. Serum creatinine levels were however significantly raised in the rats administered with ethanol extract at the dose of 200 mg/kg body weight. The biochemical and hematological parameters were also affected [49].

The effects of acute, subacute, and chronic administration of alkaloids atropine and scopolamine, the main constituents of the active principle of *D. stramonium L.*, with toxic properties, were studied in male Albino Wistar rats. After acute i.p. administration of dose 100 mg/kg of total alkaloids to the seeds of *D. stramonium L.*, there were no remarkable changes in general appearance and no deaths occurred in any experimental group. Twenty four hours after total alkaloids of seeds, a significant reduction in indices of the liver, spleen brain, and kidney function, and some biochemical and hematological parameters were observed. The red blood cells, hematocrit, hemoglobin, and white blood cells were significantly higher in the treated groups than the control group.

Subacute study for four weeks showed no resulting mortality or signs of toxicity. In a chronic study, the synthetic alkaloids administered i.p. at daily doses of 4.2 mg/kg of atropine and 1.6 mg/kg of scopolamine did not produce death. However, diarrhea and hypo-activity were observed. The relative weight of the liver was significantly less than that of the control group [50].

CONCLUSION:

Different species of datura used in Unani Medicine for the management of various ailments have been justified through various pharmacological researches like analgesic,

sedative, antidiabetic, and anti-ulcer properties. These plants are important for pharmacological research and drug development, not only when bioactive phytochemicals are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds. This review has been directed towards various interesting findings of the medicinal value of datura and their compound formulations apart from toxicity.

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