

Phytochemistry and Pharmacological Properties of *Datura stramonium*: An Analysis

Sukhpreet Kaur¹, Neeraj Pandey¹ and Shallu^{2*}

¹Department of Botany, ²Department of Zoology,
School of Agriculture and Natural Sciences, CT University, Ferozepur road, Ludhiana, Punjab

*Corresponding Author E-mail: kaur99845@gmail.com

Received: 5.04.2020 | Revised: 9.05.2020 | Accepted: 14.05.2020

ABSTRACT

Plants are used long before antiquity for medicinal functions. Herbal medicine is a major part of both the conventional and modern medicine systems. In 2002, the Organization for Food and Agriculture estimated that over 50,000 medicinal plants are used worldwide. In 2016, the Royal Botanic Gardens, Kew, reported more conservatively that 17,810 plant species have a medicinal use, out of some 30,000 plants for which some form of use is known. Medicinal plants are considered to be a rich source of ingredients that can be used in the development of either pharmacopoeial, non-pharmaceutical or synthetic drugs. *Datura stramonium* is a medicinal plant of the order of the Solanales family, the Solanaceae family. Plant due to its therapeutic and narcotic activity used as ancient traditional knowledge healthful herb, this plant includes many primary and secondary metabolites, primary metabolites directly accountable for the growth, regulation and development as carbohydrates, protein, fatty acids, mineral and secondary metabolites or Phytochemical like alkaloids, phenols, flavonoids, tannis, saponins etc. biological activities as cytotoxic. Anti-inflammatory drug, inhibitor, analgesic properties. These medical specialty activities created the plant potent to targeted organism and promote the healthful aspects of phytomedicines in medicine industries. This paper aims to offer an exclusive analysis research on this plant's ethno-medical, phytochemical, pharmacological activities.

Keywords: Medicinal Plants, *Datura stramonium*, Alkaloids, Ethanopharmacology, Pharmacological properties, Anti-inflammatory activity, Anti-oxidant.

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 (Bamola et al., 2018).

Cite this article: Kaur, S., Pandey, N., & Shallu (2020). Phytochemistry and Pharmacological Properties of *Datura stramonium*: An Analysis, *Ind. J. Pure App. Biosci.* 8(3), 92-105. doi: <http://dx.doi.org/10.18782/2582-2845.8097>

The genus name *Datura* is derived from dhatura, the Bengali name for the plant (Joy et al., 1998). *Datura* species, also called thornapple, devil's apple, angel's trumpet (in a broad sense) or devil's trumpet, have their main center of origin in Mexico and the southwest United States (US) (Symon & Haegi 1991, Luna-Cavazos et al., 2009). Today, representatives of the genus *Datura* are considered as cosmopolitan and naturalized in many regions with tropical and temperate climate conditions (Benítez et al., 2018). In most parts of India *Datura stramonium* grows as a wasteland weed (Oudhia et al., 1998, 1999) but is cultivated for its alkaloids in some parts of India and in Europe (Chandra & Pandey 1989). There is a group of nine incredible species (*Datura stramonium*, *Datura ferox*, *Datura quercifolia*, *Datura pruinosa*, *Datura leichahardtii*, *Datura inoxia*, *Datura discolor*, *Datura metel*, *Datura wrightii*) in the *Datura* genus, but the two famous species are *D. inoxia* and *D. stramonium* (Buchholz et al., 1935; Palazo'n et al., 2006). Other species of *Datura* reported in India include *Datura innoxia* Mill. (syn. *D. metel* Sims), common name sadahdhatura; and *Datura metel* L. (syn. *D. alba* Nees Syn. *D. fastuosa* L. common name kaladhatur. *Datura stramonium* is a medicinal plant with antinociceptive (Abdollahi et al., 2003) antioxidant (Couladis et al., 2003), hypolipidemic (Resekh et al., 2001), anti-inflammatory, anti-rheumatoid (Tariq et al., 1989), and hypoglycemic properties (Gharaibeh et al., 1988). The plant was used by Red Indians for many years as euphoric agent and since the 1800's, used as a therapeutic agent and in Great Britain (Dessanges, 2001). It is a hallucinogenic plant that causes serious poisoning. Cases of poisoning have been reported after eating the berries. Death may occur from heart failure after ingesting 125 seeds, because the seeds contain the highest concentration and has a rapid onset of action, thus may be potentially useful as an alternative to atropine for the treatment of the muscarinic symptoms of

organophosphate toxicity and some of central anticholinergic effects. The wide distribution, the strong toxicity and the potential for occurrence in foodstuffs are responsible for the numerous incidents in humans (Das et al., 2012). The deadly dose for adults is 15-100 g of leaf or 15-25 g of the seeds (Nayyar et al., 2020). The 2005–2017 annual reports of the HTIS were reviewed to identify plant-related poisoning cases (Kerchner & Farkas, 2020).

Morphology

Datura stramonium is a bushy, smooth, foetid annual. The branching stem is spreading and leafy. Leaves are generally light dull green, ovate to triangular ovate. Flowers are axillary, erect, white, and sweet scented (especially at night). The average length of flower is about 3 inches. Fruits are as large as walnuts and full of thorns (hence the English name "thorn apple"). Seeds are black (Lindley 1985). *D. Stramonium* bears funnel shaped, white or purple colored flowers, with 5 stamen and superior ovary. The ovary is bilocular at the upper part and quadrangular on lower portion. Leaves are very thin, brittle, shortly petiolate and unequal at the base. The apex is acuminate and margin is dentately lobed or irregularly serrate. Flowers are solitary, about 7.5cm in length. They arise in the axil, where from the stem forks, and are erect with a short pedicel. Calyx is about 3.5 cm and sharply folded. Corolla is funnel shaped. Five stamen and superior ovary, which is bilocular in the upper part and quadrangular in lower part, are present. Leaves have smooth cuticle followed by a layer of wavy epidermal cells. Palisade in single layer is present on upper surface only. At the base of the palisade tissue, crystal layer is present. The midrib shows a bicolateral structure. Upper and lower hypodermal collenchyma characteristics to midrib. Epidermis shows numerous multicellular conical trichomes. Short glandular occasionally present on both the surfaces (Soni et al., 2012).



Fig. 1: Showing Plant twig, leaves, flower and fruit.

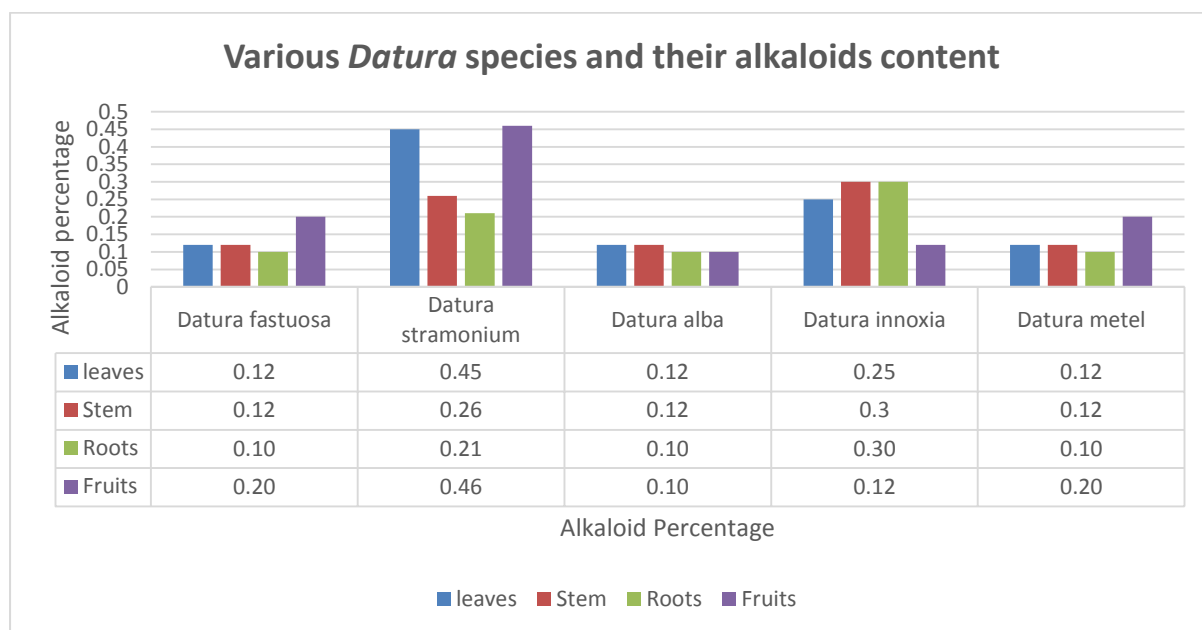


Fig. 2: showing seed capsule dehiscence by four valves to release seeds.

Chemical constituents of Datura stramonium

Extensive research has been carried out since 1925 for the isolation and characterization of the total alkaloid contents in *Datura* species (Berkov et al., 2006). Vitale et al. (1995) has

shown that the total alkaloid content in *Datura* varies from 0.02 to 0.52% and scopolamine from 0.0029 to 0.32% relative to the dried material, depending on the geographical area, the part of the plant studied and the stage of growth.



Graph 1: showing Various *Datura* species and their alkaloids content (Theodore CB et al., 2004)

The amount of total alkaloids found in drug is 0.2- 0.5 percent, in which hyoscyamine and hyoscyne is principle alkaloid along with small quantities of atropine (*dl*-hyoscyamine). Hyoscyne occurs in high quantity in young leaves. However +/- hyoscyamine content of fully grown plant is more i.e. up to 2/3rd of total alkaloids. The percentage of alkaloids is very less in stems and hence pharmacopoeia

limits its content to 3 percent. The atropine and scopolamine concentration of *D. stramonium* seeds was determined as 1283 and 678 µg/g, respectively (Caligiani et al., 2011). The seed contain 0.2 percent of alkaloids and about 25 percent of fixed oil. Atropine is found to have more exciting properties, while scopolamine has more relaxing and hallucinogenic properties (Weitz, 2003).

Isolectins have been isolated from *D. stramonium* seeds. Two of these lectins are homodimers made up of either A/B subunits while the third is a heterodimer composed of one A and B subunit with approximate molecular weights of 32,000 and 28,000 respectively (Broekart et al., 1998). *Datura* lectins show its greatest affinity for glycopeptides. The different domains contain many contiguous hydroxyproline residues which are glycosylated and other which lack

glycosylated residues, have higher proportions of cysteine residues containing the binding sites. The structure of the glycosylated region of these lectins is similar to that of hydroxyproline rich glycopeptides of plant cell wall and these lectins could be precursors for such material (Desai et al., 1981). Seeds yield diploid I and tetraploid II other than alkaloids (Monira & Munan, 2012; Bo et al., 2003; Bellila et al., 2011).

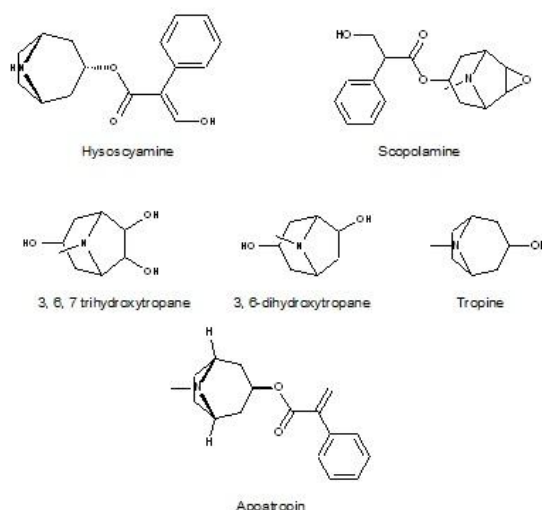


Fig. 2: Chemical constitutes of *Datura stramonium*
(retrieved from <http://folkmedsindh.com.pk/datura-stramonium/>)

The major tropane alkaloids hyoscyamine and scopolamine and several minor tropane alkaloids have been identified in *Datura* species. Typical examples of minor alkaloids in *D. stramonium* are tigloidin, aposcopolamine, apoatropin, hyoscyamine N-oxide and scopolamine N-oxide 17-20. 6- β -ditigloyloxytropine and 7-hydroxyhyoscyamine are reported for the first time in this species (Das S et al., 2012). During the past ten years, an extensive effort has been put forth for the isolation and determination of alkaloids in plant materials. Using high end techniques such as High Performance Liquid Chromatography (HPLC) and Gas Chromatography Mass

Spectroscopy (GC-MS) the alkaloids, tropanes and withanolides have been isolated and given in Table 2.

Alkaloids from roots and leaves of *Datura* spp. (Neeraj et al., 2013)

Miscellaneous alkaloids

Hygrine, Tropinone.

Mono substituted tropanes

Tropine
Pseudotropine
3-Acetoxytropine
3-(Hydroxyacetoxy)-tropine
3-(2-Methylbutyryloxy)-tropine
3-Tigloyloxytropine
3 α Tigloyloxytropine
3 β Tigloyloxytropine

- 3 α Phenylacetoxytropane
- 3 β Phenylacetoxytropane
- Apoatro pine
- Norapoatro pine
- Litorine
- Hyoscyamine
- 3-(30-Acetoxytropoyloxy)-tropane
- 3-(20-Hydroxytropoyloxy)-tropane

- 3-substituted-6,7- epoxytropanes**
- Scopoline
- Scopine
- Methylscopolamine
- 3-Phenylacetoxy-6, 7-epoxynortropane
- Aponorscopolamine
- Aposcopolamine
- Norscopolamine
- Scopolamine
- 3-(20-Hydroxytropoyloxy)-

- 3,6- Disubstituted tropanes**
- 3,6-Dihydroxytropane
- 6-Hydroxyacetoxytropane
- 3 α -Hydroxy-6 β acetoxytropane
- 3 β -Hydroxy-6 β acetoxytropane
- 3,6-Diacetoxytropane
- 3-Hydroxy-6-propionyloxytropane
- 3-Propionyloxy-6-hydroxytropane
- 3-Hydroxy-6-isobutyryloxytropane
- 3-Isobutyryloxy-6-hydroxytropane
- 3-Hydroxy-6-(2-methylbutyryloxy)-tropane
- 3-Hydroxy-6-methylbutyryloxytropane
- 3-Isovaleryloxy-6-hydroxytropane or
- 3-(2-methylbutyryloxy)-6-hydroxytropane
- 3 α -Tigloyloxy-6 β hydroxytropane
- 3 β -Tigloyloxy-6 β hydroxytropane
- 3 β -Hydroxy-6 β tigloyloxytropane
- 3 α -Tigloyloxy-6 β acetoxytropane
- 3 β -Tigloyloxy-6 β acetoxytropane
- 3-Tigloyloxy-6-propionyloxytropane
- 3 α -Tigloyloxy-6 β isobutyryloxytropane
- 3 α -Tigloyloxy-7 β isobutyryloxytropane
- 3-Tigloyloxy-6-(20-methylbutyryloxy)-tropane
- 3-Tigloyloxy-6-methylbutyryloxytropane
- 3-Phenylacetoxy-6-hydroxytropane
- 3 α , 6 β -Ditigloyloxytropane
- 3 β , 6 β -Ditigloyloxytropane
- 3 α -Apotropoyloxy-6 β -hydroxytropane
- 6-Hydroxyhyoscyamine
- 7-Hydroxyhyoscyamine
- 3-Tropoyloxy-6-acetoxytropane
- 6-Tigloyloxyhyoscyamine
- 6-(2-Methylbutyryloxy)-hyoscyamine

- 3,6,7- Trisubstituted tropanes**
- 3-Tigloyloxy-6-propionyloxy-7-hydroxytropane
- Meteloidine
- 3,6-Dihydroxy-7-tigloyloxytropane
- 3 α -Tigloyloxy-6 β -isovaleryloxy-7 β -hydroxytropane
- 3 β -Tigloyloxy-6 β -isovaleryloxy-7 β -hydroxytropane
- 3 α , 6 β -Ditigloyloxy-7 β -hydroxytropane
- 3 β , 6 β -Ditigloyloxy-7 β -hydroxytropane

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 (Cornelius et al., 2019).

Table 1: showing extraction of phytochemicals from various plant parts (Cornelius et al., 2019)

Phytochemical	Plant parts
Carbohydrates, fat, protein, ash, fiber	Seed coat
Phytate, tannin, oxalate	Seed
Calcium, tannin and oxalate iron, potassium, phosphorous	Seed coat
Glycosides, saponins, flavonoids, alkaloids, phenol, phlobatanins	leaves
Scopolamine, atropine, fastunine, daturaolone	Seed
Hyoscine, norhyoscine, hyoscimine, tropine	Root
Daturanolone and daturadiol	Fruits
Hyoscine and hyoscyamine	Whole plant
Scopolamine and fastusine	Pericarp

Total alkaloids content in leaves are 0.25–0.45%, and in seeds 0.47–0.65%. Hyoscine content in leaves are 0.1%, in stems 0.05% and in roots 0.1%; and hyoscyamine content are

0.4% in leaves, 0.2% in stems and 0.1% in roots (Boumba et al., 2004). Dry seeds contain 14%–19.4% protein, 18.4–28.5% fat and 2.7% ash. Seed fatty oil contains 87.7% fatty acids

and 2.6% unsaponifiable matter containing sitosterol (Montcriol et al., 2007).

ETHANOPHARMACOLOGY (Das et al., 2012)

- *Datura* is internally used in relieving the spasm of bronchitis in asthma. It is also used in the treatment of Parkinsonism and Hemorrhoids. Its leaves, applied after roasting are useful in relieving pain.
- *Datura* is internally used for treating giddiness, dry mouth, hallucinations and coma.
- Externally, the plant is used as a poultice in treating fistulas, abscesses wounds and severe neuralgia.
- The bitter narcotic plant relieves pain and encourages the healing process. The plant has a very long history of being used as herbal medicine.
- The growing plant works as an insect repellent, which protects neighboring plants from insects.

- The seeds of *Datura* are analgesic, anthelmintic and anti-inflammatory and as such, they are used in the treatment of stomach and intestinal pain that results from worm infestation, toothache, and fever from inflammations.
- Its leaves, containing hyoscyamine and atropine, can be used as an immensely powerful mind-altering drug.
- Its leaves, flowering tops and seeds have anodyne, antiasthmatic, antispasmodic, hallucinogenic, hypnotic, mydriatic and narcotic properties. The seeds of the plant are the most active medicinally.
- Trace of scopolamine is also found in the plant, which is a potent cholinergic-blocking hallucinogen that has been used to calm schizoid patients.
- The juice of its fruit is applied to the scalp, to treat dandruff and falling hair.

Table 2: showing the traditional uses of *Datura stramonium* in different parts of the world (Singh et al., 2013)

Entry	Countries	Traditional uses
1	India	Fruit is burnt and ash is given orally with honey in bronchitis and asthma.
2	Pakistan	Green leaves are used for softening the boils. The juice of flower is useful for earache.
3	Bulgaria	It is used as antiasthmatic, spasmolytic, and antiviral remedy.
4	Rwanda	It is used for acaricidal activity.
5	Ethiopia	It is used for wound treatment against wound causing bacteria.

Pharmacological properties of *Datura stramonium*

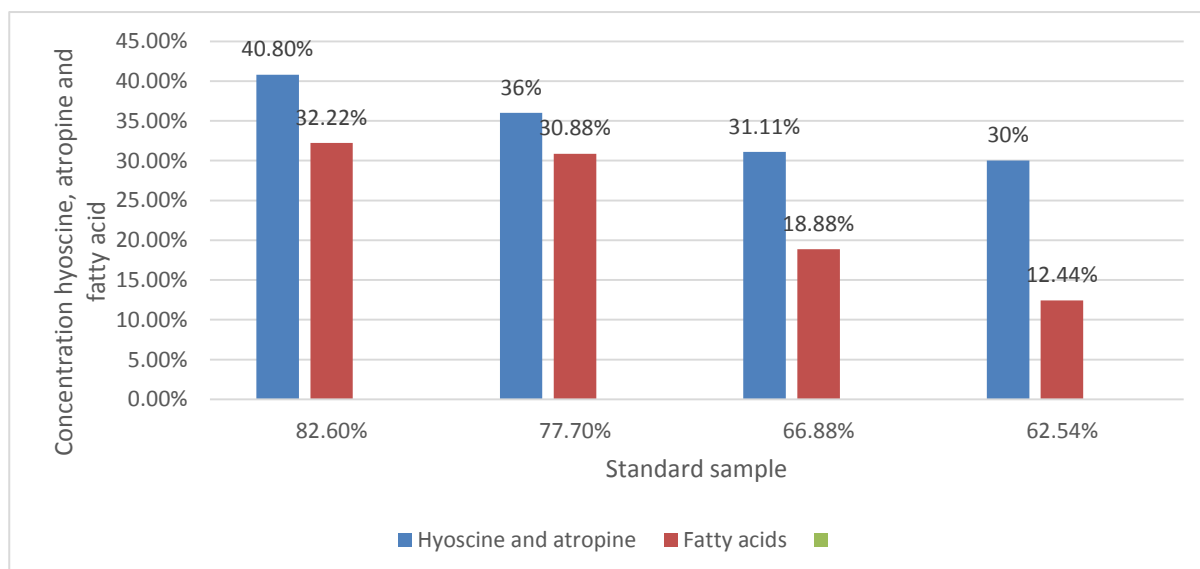
Antiasthmatic: With mild airway obstruction, *Datura stramonium* cigarette worked as good bronchodilator for asthmatic patients. Inhaling the smoke of one *Datura* cigarette by 12 asthmatic patients with mild airway obstruction substantially decreased specific airway resistance in 11 patients, the mean maximal decrease being 40% at 30th minute. In seven patients, subsequent inhalation of 200 micrograms salbutamol caused no further decrease in airway obstruction (Charpin et al., 1979). *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 took *Datura stramonium* for asthma treatment, with the constant releasing of acetylcholine, nicotinic receptor could desensitize finally result displayed in as damage fetus (Pretorius & Marx, 2006). Significantly higher serum levels of pancreatic polypeptide in patients with bronchial asthma and chronic bronchitis during attacks are decreased after the use of *D. stramonium* (Zhang, 1989). Exposure of the foetus to this plant when a mother uses it for asthma, will cause a continuous release of

Ach, resulting in the desensitizing of nicotinic receptors, this could ultimately result in permanent damage to the foetus (Pretorius & Marx, 2006).

Analgesic: *D. stramonium* seed extract has an analgesic effect on both acute & chronic pain which were produced by hot plate and formalin tests, point out that pain was condensed dose dependently with Ed values = 25 and 50 mg/kg. The whole plant is toxic, particularly the foliage and seeds (Khalili et al., 2004). Aqueous extract of *D. fastuosa* leaves and seeds (10% w/v) were taken to evaluate the analgesic effect on acetic acid induced writhing pain and hot plate reaction in mice. Oral treatment of 400 and 800 mg/kg proved effective and showed significant analgesic effect. Upon naloxone administration, analgesic effect was reduced in leaf extract while the seed extract remained unaffected. Swiss mice under standard environment conditions were subjected to i.p. acetic acid injection (0.6%, 10 ml/kg) and hot plate to check the analgesic effect (Abena et al., 2003). Aqueous seed extract of *D. metel* L. was found not to possess analgesic activity on acetic acid induced model as well as the radiant heat tail-flick model (Wannang et al., 2009).

Antioxidant. Investigation of anticancer activity by methanolic seed extract of *Datura stramonium* through DPPH radical scavenging, ABTS+ radical cation, Nitric oxide radical, Ferric reducing power assay and gained values as 35.26, 10.50, and 49.36 (Iqbal et al., 2017). On behalf of in vitro study of highest free radical scavenging effect DS showed the $6.7 \pm 0.1 \mu\text{g/ml}$ inhibitory concentration value (Sreenivasa et al., 2012). The antioxidant activity of the plant extract was assessed on the basis of the free radical scavenging effect, using modified DPPH method. *Datura stramonium* leaf extracts exhibit potent antioxidant property. Graph 2 shows that the fatty acids of the *Datura* plant recorded the highest free-radical inhibitory (DPPH) for concentration (500 $\mu\text{g/ml}$) and Ration (32.22%), and The lowest inhibition ratio was (12.44%) for concentration (200 $\mu\text{g/ml}$), as compared with the standard sample (L-Ascorbic acid) which was much better than fatty acids at the same concentration. The results show that alkaloids compounds of *Datura* plant are better than fatty acids in inhibiting free radicals, possibly because alkaloids compounds have more hydroxyl groups. (Hasan et al., 2019).



Graph 2: Concentration ($\mu\text{g/ml}$) and % of the standard sample and quaternary compounds hyoscyne, atropine and fatty acid separated from the datura as antioxidants

Larvicidal and repellent activities: The ethanolic extracts of leaves of *Datura stramonium* were evaluated for larvicidal and mosquito repellent activities against *Aedes aegypti stephensi* and *Culex quinquefasciantus*. The LD₅₀ values for larvicidal activity were found to be 86.25, 16.07 and 6.25 ppm against *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciantus*. The ethanolic leaves extract of *Datura stramonium* provided complete protection time (mosquito repellency) of 2.73, 71.66, 117.7 mins against these insects at 1% concentration (Swathi et al., 2012).

Antifungal activities: Many medicinal plant together with *Datura stramonium* acquired antifungal effect (Sharma et al., 2002). The hexane, chloroform, acetone and methanolic fractions of *D. metel* L. were investigated for antifungal properties against three species of *Aspergillus*, that is, *A. fumigates*, *A. flavus*, and *A. niger* (Rajesh & Sharma, 2002). Antifungal activity of a concoction brewed from *D. stramonium*, *Calotropis gigantea*, *A. indica* (neem) and cow manure (T1) followed by methanol-water (70/30 v/v) extracts of *D. stramonium*, *Calotropis gigantea* and *A. indica* T2 against *Fusarium mangiferae*. The study proved that the concoction-brewed compost T1 is effective, inexpensive, easy to prepare and constitutes a sustainable and eco-friendly approach to control floral malformation in mango when it is sprayed at bud break stage and again at fruit set stage (Usha et al., 2009).

Organophosphate poisoning: Since *D. stramonium* contains atropine and other anticholinergic compounds, it is a useful remedy for the central cholinergic symptoms of organophosphate (OP) poisoning. Bania et al., determined the beneficial effect of *Datura* seed extracts following a severe OP poisoning. According to their experiment, *D. stramonium* seeds were heated in water to make 2 mg/mL atropine solution and administered to male rats as a single intraperitoneal injection 5 min before the subcutaneous injection of 25 mg/kg of dichlorvos. Pretreatment with *Datura* seed

extracts significantly increased survival in a rat model of severe OP poisoning (Bania et al., 2004). Treatment of patients following an organophosphate (OP) exposure can deplete a hospital's entire supply of atropine. Given the possibility of multiple severe exposures after a terrorist attack using OP nerve agents, there exists a need for either greater atropine stores or the development of alternative antidotes. Jimsonweed (*D. stramonium*) contains atropine and other anticholinergic compounds and is common and readily available. It is used recreationally for its central anticholinergic effects and is easy to be made into an extract by boiling the crushed seeds. The extract has rapid onset of effects and may be useful for treatment of OP poisoning. (Theodore et al., 2004).

Acaricidal, repellent and oviposition deterrent properties: The ethanolic extracts obtained from both leaf and seed in the thorn apple were investigated for acaricidal, repellent and oviposition deterrent properties against adult two-spotted spider mites (*Tetranychus urticae* Koch) under laboratory conditions. Leaf & seed extracts, which were applied in 167,250 and 145,750 mg/l concentrations, respectively caused 98% and 25 % mortality among spider mite adults after 48 h (Nabi et al., 2009).

Antimicrobial activity: Worked on review of many medicinal plants of Bulgaria including *Datura stramonium* explained their antimicrobial, antioxidant, anti-inflammatory activity (Ivancheva et al., 2006). The antimicrobial activity of combined crude ethanolic extract of *D. stramonium*, *Terminalia arjuna* and *Withania somnifera* 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* with compare Ciprofloxacin standard drug (Sharma, Sharma, 2010). The methanol extracts of *D. stramonium* and *Datura innoxia* showed activity against Gram positive bacteria in a

dose dependent manner. Little or no antimicrobial activity was found against *Escherichia coli* and *Pseudomonas aeruginosa* (Takhi, Ouinten, 2011). Aerial part (mainly stem and bark) of *Datura stramonium* 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 (Shagal et al., 2012). Methanolic extract of different parts of *Datura* leaves shows higher antimicrobial efficacy on *Staphylococcus aureus* ATCC25923 and *Escherichia coli* ATCC25922 by even small amount (Sreenivasa et al., 2012). *D. stramonium* was very effective as vibriocidal against various strains of *Vibrio cholera* and *Vibrio parahaemolyticus*. The minimum inhibitory concentration (MIC) value of acetone extracts of *D. stramonium* was in the range of 2.5 to 15 mg/mL serving as broad-spectrum vibriocidal agents (Sharma et al., 2009). After extraction of *Datura stramonium* extract in Soxhlet using methanol as a solvent, extract was subjected to various quantitative phytochemical analysis result of phytochemical analysis. The zone of inhibition produced by *Datura stramonium* leaf extract against microorganisms is observed and noted antimicrobial activity of methanol extract of *Datura stramonium* 16mm, 19 mm, 18mm, 19mm against different bacterial species *Bacillus thuringiensis*, *seudomonas aeruginosa*, *Agrobacterium tumefaciens* and *Klebsiella pneumonia* respectively. Standard antibiotic (Azithromycin) was used as a positive control and Methanol was used as a negative control (Deshmukh et al., 2015).

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 (Dugan et al., 1989).

Anticancer activity: An integrated approach is needed to manage cancer using the growing body of knowledge gained through scientific developments. Thousands of herbal and traditional compounds are being screened worldwide to validate their use as anti-cancerous drugs. *D. stramonium* in therapeutic dose of 0.05-0.10 g was used to cure cancer. Likely unsafe produce vomiting, hypertension, loss of consciousness may lead to coma but may interact with anti-cholinergic drugs (Balachandran & Rajgopal, 2005). 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 (Ahmad et al., 2009). 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 (Kumaresan et al., 2014).

Other activities: *Datura stramonium* seed extract among ethanol, chloroform, and acetone has strong insecticidal efficacy than methanol and n-hexane (Jawalkar et al., 2016). Whole plant of *Datura stramonium* has

noxious property and because of that aqueous leaf extract of plant stated strong nematicidal activities (Sharma et al., 2002). Cholinergic compound esters exhibited effectual antiperspirant activity and Scopolamine; hydrobromide also rendered this potential with the higher skin incisive property (Millan et al., 1964). An extract prepared from the seeds of the DS possess activity typical of a protien haemagglutinin or lectin. The extract is capable of agglutinating erythrocytes from several species, and is non-specific with regard to human ABO blood groups (Kalpatrick et al., 1978). Though the antiepileptic activity of *D. stramonium* has not been reported yet, combination therapy with other herbs has the protective effect on status epilepticus. An experimental model of status epilepticus was induced in male rats and the results of this experiment strongly suggest that the appropriate combination of herbs with *D. stramonium* may be helpful as adjunctive interventions to treat epilepsy (Peredery & Persinger, 2004).

CONCLUSION

Medicinal plants becoming the foremost important aspects of worldwide health care and formed the idea of health care throughout the planet since the earliest day of humanity. *D. stramonium* is one in all the widely well-known folklore medicinal herb. *Datura stramonium* to be utilize for several therapeutic purposes as a results of wide pharmacological activities performed in vitro and in vivo both. This paper provides a comprehensive overview of the phytochemistry and ethno pharmaceuticals of *D. stramonium*. Several alkaloids, carbohydrates, fat, proteins and tannins have been reported to be present in several parts of *D. stramonium*. The plant show various sorts of activities like analgesic and Antiasthmatic activity which can flow from to the presence of investigated active chemical constituents.

REFERENCES

Abdollahi, M., Karimpour, H., & Monsef-Esfehani, H.R. (2003). Antinociceptive

effects of *Teucrium polium* L. total extract and essential oil in mouse writhing test. *Pharmacological Resources* 48(1), 31– 35. PMID: 12770512.

Abena, A.A., Miguel, L.M., Mouanga, A., Assah, H.T.H., & Diatewa, M. (2003). Evaluation of analgesic effect of *Datura fastuosa* leaves and seed extracts. *Fitoterapia* 74(5), 486-488. [https://doi.org/10.1016/S0367-326X\(03\)00124-2](https://doi.org/10.1016/S0367-326X(03)00124-2)

Ahmad, I.M., Abdalla, M.Y., Mustafa., N.H., Qnais, E. Y., & Abdulla, F.A. (2009). *Datura* Aqueous Leaf Extract Enhances Cytotoxicity via Metabolic Oxidative Stress on Different Human Cancer Cells. *Jordan Journal of Biological Sciences*, 2(1), 9-14.

Bania, T.C., Chu, J., Bailes, D., & O'Neill, M. (2004). Jimson weed extract as a protective agent in severe organophosphate toxicity. *Academic Emergency Medicine: 11*(4), 335-338. DOI: [10.1197/j.aem.2003.12.002](https://doi.org/10.1197/j.aem.2003.12.002)

Bamola, N., Verma, P., & Negi, C. (2018). A Review on Some Traditional Medicinal Plants. *International Journal of Life Sciences Scientific Research*, 4(1), 1550-1556. DOI: [10.21276/ijlssr.2018.4.1.7](https://doi.org/10.21276/ijlssr.2018.4.1.7)

Balachandran, P., & Rajgopal, G. (2005). Cancer—an ayurvedic perspective. *Pharmacological Resources* 51(1), 19–30. DOI: [10.1016/j.phrs.2004.04.010](https://doi.org/10.1016/j.phrs.2004.04.010)

Benítez, G., March-Salas, M., Villa-Kamel, A., Cháves-Jiménez, U., Hernández, J., Montes-Osuna, N., Moreno-Chocano, J., & Cariñanos, P. (2018). The genus *Datura* L. (Solanaceae) in Mexico and Spain—ethnobotanical perspective at the interface of medical and illicit uses. *Journal of Ethnopharmacological* 219, 133–151. <https://doi.org/10.1016/j.jep.2018.03.007>

Berkov, S., Zayed, R., & Doncheva, T. (2006). Alkaloid pattern in some

- varieties of *Datura stramonium*. *Fitoterapia* 77(3), 179-182. DOI: [10.1016/j.fitote.2006.01.002](https://doi.org/10.1016/j.fitote.2006.01.002)
- Broekaert, W.F., Allen, A.K., Peunes, W.J. (1987). Separation and characterization of isolectin with different subunits components from *Datura stramonium* seeds. *FEBS Letters* 220(1), 116-120. [https://doi.org/10.1016/0014-5793\(87\)80887-6](https://doi.org/10.1016/0014-5793(87)80887-6)
- Bellila, A., Tremblay, C., Pichette, A., Marzouk, B., Mshvildadze, V., Lavoie, S., & Legault, J., (2011). Cytotoxic activity of withanolides isolated from Tunisian *Datura metel* L. *Phytochemistry* 72(16), 2031-2036. doi: 10.1016/j.phytochem.2011.07.009.
- Bo, T., Li, K.A., & Liu, H., (2003). Investigation of the effect of space environment on the contents of atropine and scopolamine in *Datura metel* by capillary zone electrophoresis. *Journal of Pharmaceutical and Biomedical Analysis* 31(5), 885-891. DOI: [10.1016/s0731-7085\(02\)00670-2](https://doi.org/10.1016/s0731-7085(02)00670-2)
- Boumba, V.A., Mitselou, A., & Vougiouklakis, T. (2004). Fatal poisoning from ingestion of *Datura stramonium* seeds. *Veterinary and Human Toxicology* 46(2), 81–82. PMID:15080209
- Buchholz, J., Williams, L., & Blakeslee, A., (1935). Pollen-tube growth of ten species of *Datura* in interspecific pollinations. *Proceedings of the National Academy of Sciences* 21, 651-656. doi: [10.1073/pnas.21.12.651](https://doi.org/10.1073/pnas.21.12.651)
- Caligiani, A., Palla, G., Bonzanini, F., Bianchi, A., & Bruni, R. (2011). A validated GC–MS method for the detection of tropane alkaloids in buckwheat (*Fagopyron esculentum* L.) fruits, flours and commercial foods. *Food Chemistry*, 127(1), 204–209. <https://doi.org/10.1016/j.foodchem.2010.11.141>
- Chandra, V., & Pandey. M. (1989). Jadbhotion Ki Kheti. Indian Council of Agricultural Research, New Delhi, 61-62.
- Charpin, D., Orehek, J., & Velardocchio, J.M. (1979). Bronchodilator effects of antiasthmatic cigarette smoke (*Datura stramonium*). *Thorax*, 34(2), 259-261. doi: [10.1136/thx.34.2.259](https://doi.org/10.1136/thx.34.2.259)
- Cornelius, G., Lohiya, G., & Sharma, R., (2019). Chemical Constituents and Pharmacological Properties of *Datura Stramonium* (Thorn Apple) – A Review, *International journal of Engineering Research and Technology*, 8(11), 512-515.
- Couladis, M., Tzakou, O., Verykokidou, E., & Harvala, C. (2003). Screening of some Greek aromatic plants for antioxidant activity. *Phytotherapy Research* 17(2), 194–195. DOI: [10.1002/ptr.1261](https://doi.org/10.1002/ptr.1261)
- Das, S., Kumar, P., & Basu, S.P. (2012). Review article on phytoconstituents and therapeutic potentials of *Datura stramonium* linn. *Journal of Drug Delivery and Therapeutic* 2(3), 4–7. <http://jddtonline.info>
- Dessanges, J.F. (2001). A history of nebulization. *Journal of Aerosol Medicine and Pulmonary Drug delivery* 14(1), 65–71. DOI: [10.1089/08942680152007918](https://doi.org/10.1089/08942680152007918)
- Desai, N.N., Allen, A.K., & Neuberger, A. (1981). Some properties of lectins from *Datura stramonium* (thorn apple) and nature of its glycoprotein linkages. *Biochemical Journal* 197(2), 345-353. doi: [10.1042/bj1970345](https://doi.org/10.1042/bj1970345)
- Deshmukh, A. S., Shelke, P. D., Palekar, K. S., Pawar, S. D., & Shinde, H. S. (2015). Antimicrobial Investigation of *Datura stramonium* Leaf Extract against different Microorganisms. *Journal of Environmental Science, Toxicology and Food Technology*: 9(9), 17-19. DOI: 10.9790/2402-09911719.
- Dugan, G.M., Gumbmann, M.R., & Friedman, M. (1989). Toxicological evaluation of jimson weed (*Datura stramonium*) seed. *Food and Chemical Toxicology*,

- 27(8), 501-510. DOI: [10.1016/0278-6915\(89\)90045-8](https://doi.org/10.1016/0278-6915(89)90045-8)
- Gharaibeh, M.N., Elayan, H.H., & Salhab, A.S. (1988). Hypoglycemic effects of *Teucrium polium*. *Journal of Ethnopharmacology* 24(1), 93– 99. DOI: [10.1016/0378-8741\(88\)90139-0](https://doi.org/10.1016/0378-8741(88)90139-0)
- Hasan, H. M., Khorsheed, A. C., & Sale S M, (2019). Chromatographic investigation of alkaloids (atropine and hyoscyne) and fatty acid compounds of datura stramonium and study of its antioxidant effect, *Plant archives*, 19(2), 4115-4120.
- Iqbal, S., Sivaraj, C., & Gunasekaran, K. (2017). Antioxidant and Anticancer Activities of Methanol Extract Seeds of *Datura stramonium* L. *Free Radicals and Antioxidants*, 7(2), 184-189. DOI: [10.5530/fra.2017.2.28](https://doi.org/10.5530/fra.2017.2.28)
- Ivancheva, S., Nikolova, M., & Tsvetkova. (2006). Pharmacological activities and biologically active compounds of Bulgarian medicinal plants. *Phytochemistry Advances in Research*, 87-103.
- Jawalkar, N., Zambare, S., & Zanke, S. (2016). Insecticidal property of *Datura stramonium* L. seed extracts against *Sitophilus oryzae* L. (Coleoptera: Curculionidae) in stored wheat grains. *Journal of Entomology and Zoology Studies*, 4(6), 92-96
- Joy, P., Thomas, J., Mathew, S., & Skaria, B.P., (1998). Medicinal plants. Tropical horticulture 2, (eds. Bose, T.K., Kabir, J., Das, P. and Joy, P.P.). Naya Prokash, Calcutta) 449-632.
- Kilpatrick, D.C., YeOman, MM., & Kipatrick, S.P. (1978). A lectin from seed extracts of *Datura stramonium*. *Plant Science Letters*. 13(1), 35-40. [https://doi.org/10.1016/0304-4211\(78\)90062-7](https://doi.org/10.1016/0304-4211(78)90062-7)
- Kerchner, A., & Farkas, A. (2020). Worldwide poisoning potential of *Brugmansia* and *Datura*. *Forensic Toxicol* 38, 30–41. <https://doi.org/10.1007/s11419-019-00500-2>
- Khalili, N.M., & Atyabi, S.M. (2004). Evaluation of analgesic of *Datura stramonium* seed extract in hot plate and formalin tested on male rats. *Iranian journal of medicinal and aromatic plants*, 20(3), 309-322. <https://www.sid.ir/en/journal/ViewPaper.aspx?id=100590>
- Kumaresan, R., Shanmugam, K., & Rajasree, S. (2014). Anti- Cancer Activity of *Datura metel* on MCF-7 Cell Line. *Asian Journal of Pharmaceutical and Clinical Research*, 7(1), 181-183.
- Lindley, J. (1985). Flora medica. Ajay Book Service, New Delhi.
- Luna-Cavazos M, Bye R, & Jiao M (2009). The origin of *Datura metel* (Solanaceae): genetic and phylogenetic evidence. *Genetic Resources and Crop Evolution* 56, 263-275. <https://doi.org/10.1007/s10722-008-9363-5>
- Mac Millan, F.S., Reller, H.H., & Sunder, F.H. (1964). The antiperspirant action of topically applied anticholinergics. *Journal of Investigative Dermatology*, 43, 363-377. DOI: [10.1038/jid.1964.167](https://doi.org/10.1038/jid.1964.167)
- Monira, K.M., & Munan, S.M., (2012). Review on *Datura metel*: a potential medicinal plant. *Global Journal of Research on Medicinal Plants & Indigenous Medicine: 1*(4), 123-132.
- Monteriol, A., Kenane, N., & Delort, G. (2007). Intentional *Datura stramonium* intoxication: an unknown etiology of mydriasis. *Annales Francaises d'Anesthesie et de Reanimation*, 26(9), 810–813. DOI: [10.1016/j.annfar.2007.04.006](https://doi.org/10.1016/j.annfar.2007.04.006)
- Nabi A.K., & Sultan C.C.Y. (2009). Acaricidal, repellent and oviposition deterrent activities of *Datura stramonium* L. against adult *Tetranychus urticae* (Koch). *Journal of Pest Science* 83(2), 173-180. DOI: [10.1007/s10340-009-0284-7](https://doi.org/10.1007/s10340-009-0284-7)
- Nayyar, M. S., Hanif, M. A., Mjaeed, M. I., Ayub, M. A., & Rehman, R.

- Kaur et al.** *Ind. J. Pure App. Biosci.* (2020) 8(3), 92-105 ISSN: 2582 – 2845
- (2020). *Datura*. Medicinal Plants of South Asia, 207–216. doi:10.1016/b978-0-08-102659-5.00016-1
- Neeraj, O. Maheshwari, Khan, A., & Balu, A. Chopade, (2013). Rediscovering the medicinal properties of *Datura* sp.: A review, *Journal of Medicinal Plants Research*, 7(39), 2885-2897. DOI: 10.5897/JMPR11.1657
- Oudhia, P., Kolhe, S.S. & Tripathi, R.S. (1998). Germination and seedling vigor of chickpea as affected by allelopathy of *Datura stramonium* L. *International Chickpea Pigeonpea Newsletter*, 5, 22-24.
- Oudhia, P., Kolhe, S.S. & Tripathi, R.S. (1999). Germination and seedling vigour of rice var. Mahamaya as affected by allelopathy of *Datura stramonium* L. *Crop Research*, 18, 46-49.
- Palazon, J., Moyano, E., Bonfill, M., Cusido, R.M., Pinol, M.T., & Teixeira da Silva, J., (2006). Tropane alkaloids in plants and genetic engineering of their biosynthesis. *Floriculture, Ornamental and Plant Biotechnology*, Publisher: Global Science Books, 209-221.
- Peredery, O., Persinger, M.A. (2004). Herbal treatment following postseizure induction in rat by *lithium pilocarpine*: *Scutellaria lateriflora* (Skullcap), *Gelsemium sempervirens* (Gelsemium) and *Datura stramonium* (Jimson weed) may prevent development of spontaneous seizures. *Phytotherapy Research*, 18(9), 700-705. DOI:10.1002/ptr.1511
- Pretorius, E., Marx, J. (2006). *Datura stramonium* in asthma treatment and possible effects on prenatal development. *Environmental Toxicology and Pharmacology*, 21(3), 331-337. DOI: 10.1016/j.etap.2005.10.006.
- Rajesh, C., Sharma, G.L. (2002). Studies on antimycotic properties of *Datura metel*. *Journal of Ethnopharmacology* 80(2-3), 193-197. DOI: 10.1016/s0378-8741(02)00036-3
- Rasekh, H.R., Khoshnood-Mansourkhani, M.J., Kamalinejad, M. (2001). Hypolipidemic effects of *Teucrium polium* in rats. *Fitoterapia*. 72(8), 937–939. DOI: 10.1016/s0367-326x(01)00348-3
- Sharma, N., & Trivedi, P.C. (2002). Screening of Leaf Extracts of Some Plants for Their Nematicidal and Fungicidal Properties Against *Meloidogyne incognita* and *Fusarium oxysporum*. *Asian Journal of Experimental Science*. 16, 21-28.
- Sharma, M.C., & Sharma, S. (2010). Phytochemical, preliminary pharmacognostical and antimicrobial evaluation of combined crude aqueous extract. *International Journal of Microbiology Research*. 1(3), 166–170. Corpus ID: 56076366
- Singh, L. R., & Singh, O. M., (2013). *Datura stramonium*: An overview of its phytochemistry and pharmacognosy, Langonjam, *Research journal of Pharmacognosy and phytochemistry*, 5(3), 143-148.
- Soni, P., Siddiqui, A.A., Dwivedi, J., Soni, V. (2012). Pharmacological properties of *Datura stramonium* L. as a potential medicinal tree: an overview. *Asian Pacific Journal of Tropical Biomedicines*. 2(12), 1002-1008. doi:10.1016/S2221-1691(13)60014-3
- Sreenivasa, S., Vinay, K., & Mohan, N.R. (2012). Phytochemical Analysis, Antibacterial and Antioxidant Activity of Leaf Extract of *Datura Stramonium*. *International Journal of Science Research*. 1(2), 83-86.
- Shagal, M.H., Modibbo, U.U., & Liman, A.B. (2012). Pharmacological justification for the ethnomedical use of *Datura stramonium* stem-bark extract in treatment of diseases caused by some pathogenic bacteria. *International Journal of Pharmacy and*

- Pharmacological Reserach*, 2(1), 16-19. Corpus ID: 212503586
- Sharma, A., Patel, V.K., & Chaturvedi, A.N. (2009). Vibriocidal activity of certain medicinal plants used in Indian folklore medicine by tribals of Mahakoshal region of central India. *Indian Journal of Pharmacology*. 41(3), 129-133. doi: 10.4103/0253-7613.55212.
- Swathi, S., Muruganathan, G., Ghosh, S.K., Pradeep, A.S. (2012). Larvicidal and repellent activities of ethanolic extract of *Datura stramonium* leaves against mosquitoes. *International Journal of Pharmcognosy and Phytochemical Research*, 4(1), 25–27.
- Symon, D.E., & Haegi, L. (1991). *Datura* (Solanaceae) is a new world genus. In: Hawkes JG, Lester RN, Nee M, Estrada N (eds) Solanaceae III: taxonomy, chemistry, evolution. Royal Botanic Gardens Kew, London, 197–210.
- Takhi, D., & Ouinten, M. (2011). Study of antimicrobial activity of secondary metabolites extracted from spontaneous plants from the area of Laghouat, Algeria. *Advances in Environmental Biology*, 5(2), 469–476.
- Theodore, C.B., Jasan, C., Dallas, B., & Melanie, O. (2004). Jimson weed extract as a protective agent in severe organophosphate toxicity. *Academic Emergency Medicine*, 11(4), 335–338. <https://doi.org/10.1197/j.aem.2003.12.002>
- Tariq, M., Ageel, A.M., al-Yahya, M.A., Mossa, J.S., Al-Said, M.S. (1989). Anti-inflammatory activity of *Teucrium polium*. *International Journal of Tissue Reaction*, 11(4), 185–188. PMID: 2634627
- Usha, K., Singh, B., Praseetha, P., Deepa, N., Agarwal, D.K., & Agarwal, R., (2009). Antifungal activity of *Datura stramonium*, *Calotropis gigantea* and *Azadirachta indica* against *Fusarium mangiferae* and floral malformation in mango. *European Journal of Plant Pathology*, 124(4), 637–657. DOI: 10.1007/s10658-009-9450-2
- Vitale, A.A., Acher, A., Pomilio, A.B. (1995). Alkaloids of *Datura ferox* from Argentina. *Journal of Ethanopharmacology*. 49(2), 81-89. DOI: [10.1016/0378-8741\(95\)90035-7](https://doi.org/10.1016/0378-8741(95)90035-7)
- Wannang, N.N., Ndukwe, H.C., & Nnabuike, C. (2009). Evaluation of the analgesic properties of the *Datura metel* seeds aqueous extract. *Journal of Medicinal Plant Research*, 3(4), 192-195.
- Weitz, G. (2003). Love and death in Wagner's Tristan und Isolde. An epic anticholinergic crisis, British. *Internal Medicine Journal* 327(7429), 1469–1471. DOI: [10.1136/bmj.327.7429.1469](https://doi.org/10.1136/bmj.327.7429.1469)
- Zhang, J.C. (1989). Preliminary report on the serum level of pancreatic polypeptide in patients with chronic bronchitis and bronchial asthma during attacks. Chung-Hua Chieh Ho Ho Hu Hsi Tsa Chih, 12, 141–2, 190 (Chinese).