

Between love, medicine and poison: A review of *Datura stramonium* (Toloache) in Mexican Ethnobotany

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Abstract

This review compiles and synthesizes ethnobotanical, pharmacological, and toxicological information on *Datura stramonium* L. (Solanaceae), commonly known in Mexico as "Toloache." Based on an extensive bibliographic survey, a total of 43 distinct medicinal and ritual uses were recorded, with leaves being the most frequently employed plant part (25 uses), followed by seeds, roots, and flowers. The highest number of uses correspond to the respiratory system (10 records), including treatments for asthma, cough, whooping cough, and influenza. The musculoskeletal system ranks second (eight uses), with applications for rheumatism, joint pain, neuralgia, and neuritis, while the integumentary system occupies third place (seven uses), addressing burns, ulcers, acne, erysipelas, superficial tumors, and wounds. Beyond these biomedical categories, *D. stramonium* holds important cultural value in Mexico, particularly in traditional medicine and rituals for culturally defined illnesses such as love-sickness and fright, as well as other ailments. The plant's pharmacological properties are largely attributed to its potent tropane alkaloids, especially hyoscyamine and scopolamine, which confer bronchodilator, antispasmodic, analgesic, and anti-inflammatory activities. However, these compounds also make the species highly toxic, with a very narrow therapeutic window, requiring caution in its use and emphasizing the need for controlled pharmacological research to validate traditional practices.

Keywords: Toloache; Ethnobotany; Tropane alkaloids; Traditional medicine

1. Introduction

The Solanaceae is a diverse group comprising more than 2,700 species in approximately 98 genera, distributed worldwide but especially abundant in tropical and subtropical regions [1]. This family is notable for its economic and medicinal importance, encompassing food crops such as tomatoes (*Solanum lycopersicum* L.), potatoes (*Solanum tuberosum* L.), and peppers (*Capsicum* spp.), as well as several species rich in bioactive compounds [2]. Within this family, the genus *Datura* L. holds ethnobotanical and pharmacological relevance. Native primarily to the Americas, especially Mexico, *Datura* species are recognized for their potent tropane alkaloids and their long-standing role in traditional medicine, ritual use, and as ornamental plants [3].

The genus *Datura* comprises of herbaceous plants and shrubs widely recognized for their large, showy, trumpet-shaped flowers. Species of the genus are generally characterized by simple, alternate leaves, often with an undulating or lobed margin, and erect or nodding flowers that are actinomorphic, typically with a tubular corolla that flares into five lobes. The fruit is a spiny capsule that is dehiscence irregularly to release numerous seeds. The species *Datura stramonium* L., commonly known as Toloache, is one of the most widespread species of the genus. It is an annual herb reaching up to

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1.5 m in height, with coarsely toothed leaves that emit a strong odour when crushed. The flowers are large, white to violet, funnel-shaped, and can reach up to 10 cm in length, opening mostly in the evening or early morning. Its fruit is a globose, spiny capsule that splits into four valves at maturity, containing numerous kidney-shaped seeds (Figure 1) [4, 5].

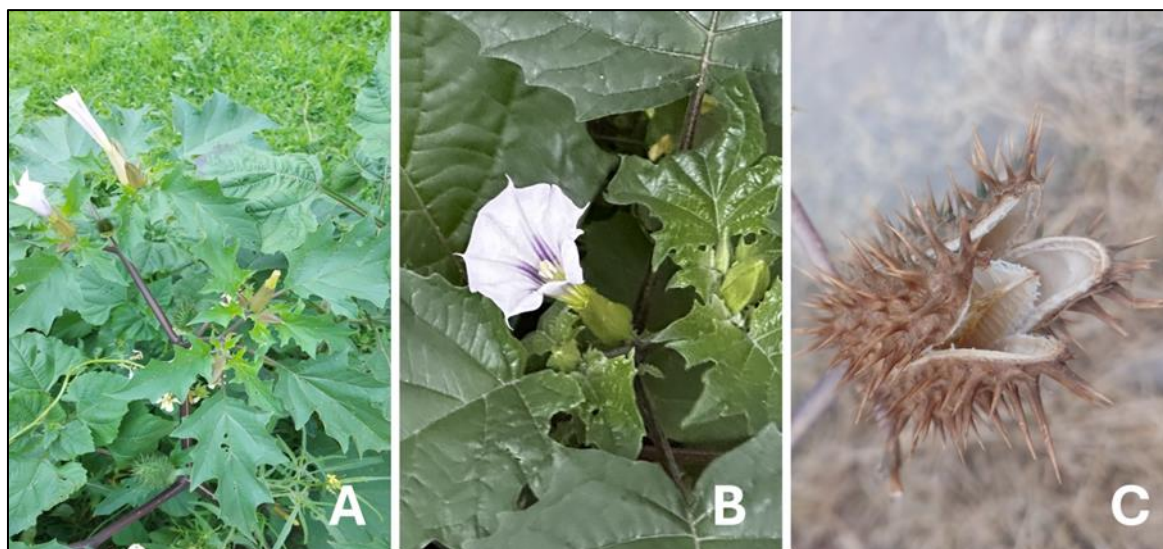


Figure 1 Toloache (*Datura stramonium*). A. Plant. B. Flower. C. Mature fruit

These plants commonly colonize open and unstable habitats, often in areas disturbed by human activity, such as roadsides, construction zones, and livestock enclosures [4]. While the distribution of Central and South American species is well documented [5, 6], the genus reaches its greatest diversity in Mexico, particularly in the Balsas River Basin, which is considered its center of diversity, and most species are adapted to arid or semi-arid conditions [5].

All *Datura* species contain tropane alkaloids nitrogen containing bicyclic compounds derived from secondary metabolism. These alkaloids, including hyoscyamine and scopolamine (hyoscine), are also found in other Solanaceae genera such as *Brugmansia* Pers., *Atropa* L., *Mandragora* L., and *Physalis* L. [7]. Despite its cultural and pharmacological significance, in Mexico there is currently no comprehensive study compiling the traditional uses of *Datura stramonium*. Therefore, the objective of this work is to provide a bibliographic review to address this gap and serve as a reference for future ethnobotanical and pharmacological research.

2. Material and methods

The review was conducted through a comprehensive search of major scientific databases, including Google Scholar, Scopus, PubMed, Medline, and ScienceDirect. Additional sources consulted comprised English and non-English reference books, theses, and peer-reviewed research articles addressing the useful properties of *Datura stramonium*. In total, over 50 publications related to Mexican ethnobotany were examined to gather accurate and relevant information on the various aspects of this species.

3. Results and Discussion

A total of 43 uses were registered for Toloache in Mexico (Table 1). The leaves are the most frequently used plant part, in 25 of the 43 recorded uses. Other plant parts are used less often, with seeds appearing in nine uses, roots in three uses, flowers in two uses (Table 1).

Three ailments stand out for having the highest number of uses: rheumatism, asthma, and headache. Each of these ailments is associated with three distinct uses involving different plant parts or preparation methods.

The respiratory system has the highest number of uses, with a total of ten records. This category includes ailments such as asthma, cough, whooping cough, and flu, each with different preparation methods and plant parts used. It is followed by the musculoskeletal system, with eight uses, covering rheumatism, joint pain, neuralgia, neuritis, and uric acid. The

integumentary system (skin) ranks third, with seven uses related to burns, ulcers, acne, erysipelas, superficial tumors, and wounds.

Table 1 Traditional medicinal uses of Toloache (*Datura stramonium*) in Mexico

Ailment	Plant part	Use	Citation	Physiological system
Acne	Leaves	Decoction and topical application	[8]	Integumentary system
Divination	Leaves	ND	[8]	Nervous system
Analgesic	ND	ND	[9]	Nervous system
Asthma	Leaves	Cigarette	[10]	Respiratory system
Asthma	Leaves, Roots	Cigarettes, Decoction	[11]	Respiratory system
Asthma	Roots	Decoction	[10]	Respiratory system
Burns	Leaves	Topical application	[12]	Integumentary system
Conjure removal	Leaves	ND	[13]	Nervous system
Cough	ND	ND	[11]	Respiratory system
Cough	Leaves	Infusion	[8]	Respiratory system
Depression/ Love-sickness	Flowers	Decoction	[8]	Nervous system
Dental pain	Leaves	Poultice	[11]	Immune/infectious diseases
Dental pain	Seeds	Poultice	[11]	Immune/infectious diseases
Erysipelas	Leaves	Topical application	[11]	Integumentary system
Fever (flu)	ND	ND	[11]	Respiratory system
Headache	Flowers	Decoction	[11]	Nervous system
Headache	Leaves	Topical application	[11]	Nervous system
Headache	Seeds	Tincture	[10]	Nervous system
Haemorrhoids	ND	ND	[11]	Digestive/parasitic system
Haemorrhoids	Leaves	Decoction	[8]	Digestive/parasitic system
Helminthiasis	ND	ND	[11]	Digestive/parasitic system
Helminthiasis	Leaves	Decoction	[8]	Digestive/parasitic system
Inflammation	Leaves	Topical application	[8]	Integumentary system
Inflammation of uterus	Leaves	Topical application	[11]	Reproductive system
Wounds	Leaves	Decoction, bath	[8, 12]	Integumentary system
Joint pain	Leaves, Seeds	Decoction and bathing with that water or direct application	[11]	Musculoskeletal system
Labour pain	Seeds	Poultice	[10, 11]	Reproductive system

Menstrual problems	Leaves	ND	[12]	Reproductive system
Mumps	Leaves	Decoction and poultice	[11]	Immune/infectious diseases
Neuralgia	Seeds	Tincture	[10]	Musculoskeletal system
Neuritis	ND	ND	[11]	Musculoskeletal system
Parasites	Leaves	ND	[8]	Digestive/parasitic system
Psychotropic	Seeds	Direct ingestion	[8]	Nervous system
Rheumatism	Leaves	Poultice	[8]	Musculoskeletal system
Rheumatism	Roots	Poultice	[8]	Musculoskeletal system
Rheumatism	Seeds	Tincture	[10]	Musculoskeletal system
Scare (fright)	Leaves	ND	[11]	Nervous system
Superficial tumours	Leaves	ND	[12]	Integumentary system
Tranquiliser	ND	ND	[11]	Nervous system
Ulcers	ND	ND	[11]	Integumentary system
Uric acid	ND	ND	[11]	Musculoskeletal system
Whooping cough	Leaves	Decoction and bath	[11]	Respiratory system

The *Datura stramonium*, commonly known in Mexico as “Toloache,” is deeply embedded in both traditional medicine and cultural ritual practice. In Mexico, the *Toloache* holds a dual identity: it is a medicinal and ritual plant central to community practices, and simultaneously a dangerous weed from an agronomic and toxicological standpoint.

Ethnobotanical surveys reveal its use for a broad spectrum of ailments, ranging from respiratory disorders such as asthma, cough, whooping cough, and influenza to musculoskeletal conditions like rheumatism, neuralgia, neuritis, joint pain, and uric acid accumulation [3]. These uses are consistent with descriptions found in post-Conquest ethnomedical codices and have persisted despite formal warnings regarding toxicity [14].

Datura stramonium is classified as a highly toxic plant due to the unpredictable concentration and ratio of tropane alkaloids in its tissues [14]. Symptoms of poisoning include dry mouth, blurred vision from mydriasis, tachycardia, hyperthermia, urinary retention, confusion, hallucinations, and seizures, with severe cases progressing to coma or death (Soni et al., 2012). Toxicity is compounded by environmental factors such as soil composition, water availability, and phenological stage, which affect alkaloid biosynthesis [15].

3.1. Therapeutic uses

The therapeutic and psychoactive effects of *D. stramonium* are largely attributed to tropane alkaloids, especially hyoscyamine and scopolamine (hyoscine), both of which act as potent antagonists of muscarinic acetylcholine receptors [9]. This anticholinergic action accounts for the bronchodilatory, antispasmodic, and sedative effects sought in respiratory and pain treatments.

Phytochemical profiling demonstrates that alkaloid content varies markedly among plant organs and developmental stages. Miraldi et al. [15] reported leaf concentrations of 0.2–0.45% total alkaloids and seed concentrations around 0.2%, with hyoscyamine predominating and partially racemizing to atropine during extraction or metabolism. Such variability explains why leaves are preferred for inhalation-based remedies and why seeds are regarded as more potent for psychoactive or analgesic purposes.

Recent research has expanded the pharmacological scope beyond tropanes. Damergi et al. [16] identified withanolide steroidal lactones in flower extracts, including daturametelin B and 12 α -hydroxydaturametelin B, which demonstrated significant anti-inflammatory activity (IC₅₀ 6.8–14.5 μ g/mL in nitric oxide inhibition assays with RAW 264.7

macrophages), alongside antibacterial and antioxidant potential. These compounds may provide additional biochemical support for the topical treatment of inflammatory and infectious skin conditions recorded in ethnobotanical data.

3.2. Cultural Syndromes: Love poisons and Scare/Fright

Beyond biomedical categories, *D. stramonium* plays a role in addressing culturally specific syndromes in Mexico. Mal de amores (“love-sickness”) refers to an emotional and somatic state associated with unrequited love or romantic loss, while “susto” (fright) is interpreted as soul loss following a traumatic event. In traditional healing systems, both conditions are treated through rituals in which *Datura* may be ingested, smoked, or used in baths to induce altered states of consciousness, facilitating what healers describe as spiritual rebalancing (Figure 2) [3, 13].



Figure 2 A-B. Places selling medicinal plants at the Sonora Market, Mexico City. C-D. Toloache products available in the market: candle, extracts, and soap, for esoteric uses

From a pharmacological perspective, the central nervous system effects of tropane alkaloids, sedation, delirium, hallucinations, and amnesia, could create subjective experiences interpreted as cathartic or transformative within the cultural framework. These experiences, while meaningful in ritual contexts, arise from neurotoxic effects that can rapidly escalate to life-threatening intoxication if dosage is uncontrolled [9].

The narrow therapeutic window of *Datura* means that the margin between a psychoactive or medicinal dose and a lethal dose can be minimal. This pharmacological reality calls for caution, particularly given that most traditional preparations are unstandardized.

4. Conclusion

The ethnomedicinal versatility of *Datura stramonium* in Mexico reflects both its rich pharmacological profile and its deep cultural embedding. Alkaloid-based actions explain many of the reported therapeutic effects, while non-alkaloid metabolites expand the potential pharmacological relevance of this species. However, the plant's severe toxicity necessitates a critical, evidence-based approach to its use, balancing respect for traditional knowledge with rigorous pharmacological validation and public health safeguards.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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