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Original Article

Anatomic Standardisation of traditional drug Jimsonweed leaf

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ABSTRACT

India has a great wealth of various naturally occurring plant drugs which have potential pharmacological activities. The troublesome weed, *Datura stramonium* (Jimsonweed) is a plant with both poisonous and medicinal properties and has been proven to have great pharmacological potential with a great utility and usage in folklore medicine. The present investigation was therefore undertaken to determine the microscopic or anatomical studies analysis were reported and also encourages cultivation of the highly valuable plant in large scale to increase the economic status of the cultivators and provide a support to use of the plant in traditional medicine.

Keywords: *Datura stramonium*; Anatomical; Microscopical.

INTRODUCTION

Plants have always played a major role in the treatment of human traumas and diseases worldwide. The demand for medicinal plant is increasing in both developed and developing countries due to growing recognition of natural product. Herbal medicine is an important part of both traditional and modern system of medicines[1]. *Datura stramonium* (*D. stramonium*) is a widespread annual plant from the Solanaceae family. It is one of the widely well-known folklore medicinal herb. It is a wild growing flowering plant and was investigated as a local source for tropane alkaloids which contain a methylated nitrogen atom (N-CH3) and include the anti-cholinergic drugs atropine, and scopolamine. The god lord Shiva was known to smoke Cannabis and *Datura*. People still provide the small thorn apple during festivals and special days as offerings in Shiva icons at temples. An extract made from the leaves is taken orally for the treatment of asthma and sinus infections and stripped bark are applied externally to treat swellings, burns and ulcers.

The incidence of *D. stramonium* poisoning is sporadic with a cluster of poisoning cases in the 1990s and 2000s, the United States media reported some cases occurring mostly among adolescents and young adults dying or becoming seriously ill from ingesting. Some medicinal uses of the plant are its anti-inflammatory property of all parts of the plant, stimulation of the central nervous system, respiratory decongestion, and treatment of dental and skin infections, alopecia and in the treatment of toothache. It is a hallucinogenic plant that causes serious poisoning.

Consumption of any part of the plant may result in a severe anticholinergic reaction that may lead to toxicity and occasionally cause diagnostic difficulties[2]. *Datura* genus distributes over tropical and warm temperate regions of the world. About ten species of *Datura* are found, of which *Datura anoxia* and *D. stramonium* are most important drug plants. *Datura* has long been known as a medicinal plant and as a plant hallucinogen all over the world. Pre-historic use of *Datura* in medicinal and ceremonial rituals could be observed in aboriginal in Indian sub-continent[3].

The therapeutic activities of most plants are due to the presence of one or more of such components like alkaloids, tannins, saponins and cardiac glycosides[4]. Atropine and scopolamine are competitive antagonists of muscarinic cholinergic receptors and are central nervous system depressants. All parts of the plant are toxic, but the

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highest amount of alkaloids is contained in the ripe seeds[5].

Regional and other names

Sanskrit	: Umatta-virkshaha
English	: Thorn apple
Hindi	: Sadah-Datura, Safed Datura
Tamil	: Umatai
Arab	: Jonz-masal
Gujrat	: Dhatoria
Bengali	: Dhattura
Malayalam	: Maraummam
Marathi	: Kanaka

Scientific classification of *D. stramonium*

Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Order	: Solanales
Family	: Solanaceae
Genus	: Datura
Species	: stramonium

Botanical description

Plant appearance: *D. stramonium* is an annual plant. The stem is herbaceous, branched and glorious or only lightly hairy. By cultivation the plant reaches a height of about one meter[7]. The branching stems are spreading, leafy, stout, erect, and smooth and pale yellowish green in colour, branching repeatedly in a forked manner. Leaves are hairy, big, simple dentate, oval glorious, apposite veins of leaves are pale black, stalked, 4-6 inch long, ovate and pale green. The upper surface is dark and greyish-green, generally smooth, the under surface paler, and when dried, minutely wrinkled[8].

D.stramonium bears funnel shaped, white or purple coloured flowers, with 5 stamens and superior ovary. The average length of flower is about 3 inches. The calyx is long, tubular and somewhat a swollen below and very sharply five angled surmounted by five sharp teeth. Corolla is funnel shaped. Stem stalk is pale blue or greenish white. Seeds are black, kidney shape and flat[9]. Fruits are as large as walnuts and full of thorns (hence the English name "thorn apple").

The plant is strong narcotic, but has a peculiar action on the human which renders it very valuable as medicines. The whole plant is poisonous and the seeds are the most active; neither dying nor boiling destroys the poisonous properties[6]. The symptoms of acute Jimsonweed poisoning included dryness of the mouth and extreme thirst, dryness of the skin, pupil dilate ion, impaired vision, urinary retention, rapid heartbeat, confusion, restlessness, hallucinations, and loss of consciousness[2]. This plant has contributed various pharmacological actions in the scientific field of Indian systems of medicines like analgesic and antiasthmatic activities[10]. The present paper presents an exclusive research work on the anatomical studies of this plant.

MATERIALS AND METHODS

Collection and Drying of plant leaf: Mature leaves of *Datura stramonium* were collected from the near ponds, River Bridge, Ladapuram village, Perambalur district, Tamil Nadu, India. The leaves of *D. stramonium* were washed thoroughly three times with water and once with distilled water. Sample was shade dried and then grinded into powder form.

Pharmacognostic evaluation:

Anatomical studies:

Microscopy: Free hand section of the materials were taken using a sharp blade, suitably stained and subjected to microscopic observations. Photomicrographs were taken using compound Microscope (NikonYS2-H) attached with digital camera. Photomicrographs were taken at different magnifications depending upon the anatomical details[10, 11, 12, 13 & 14].

RESULTS AND DISCUSSION

The beneficial medicinal effects of plant materials typically result from the secondary products present in the plant although, it is usually not attributed to a single compound but a combination of the metabolites. The medicinal actions of plants are unique to a particular plant species or group, consistent with the concept that the combination of secondary products in a particular plant is taxonomically distinct. The screening of plants usually involves several approach; ethno botanical approach is one of the common methods that are employed in choosing the plant for anatomical study[15].

The lamina portion of the T.S of *Datura stramonium* is dorvsiventral with smooth adaxial and abaxial sides (P.fig 1). It is 350µm thick. The adaxial epidermis consists of slightly thicker elliptical thick walled cells. The abaxial epidermis is thin with narrow cylindrical cells. The mesophyll tissue includes a single horizontal band of wide cylindrical compact mesophyll cells and 4 or 5 layers of spherical or lobed loosely arranged spongy mesophyll tissue (P.fig 2). The sand crystals are abundant in the median row of cells of the spongy mesophyll. The lamina is amphistamatic and stomata occur both on the adaxial and abaxial sides of the lamina (P.Fig 3).

The adaxial epidermal cells are angular and their anticlerical walls are thick and straight. The stomata are predominantly anisocytic type. Each stoma has three unequal subsidiary cells one of them being smallest other two are larger. The guard cells are elliptical measuring 25×20µm in size. The abaxial epidermis consists of fairly larger cells with thin wavy anticlerical walls. The epidermal cells appear amoeboid in outline. The cells have prominent nuclei. The stomata are anamocytic type. No district subsidiary cells are evident. The guard cells are broadly elliptical measuring 25×20µm in size. Druses type of calcium oxalate crystals is abundant in the mesophyll tissue (P.Fig 4). The druses are closely aggregated and diffuse in distribution. Apart from the druses there are also sand crystals in the ground parenchyma cells of midrib. The crystal particles are densely accumulated inside the cell. The crystal bearing cells are also random in distribution.

The venation is reticulate and the veins are thick and prominent. The vein islets are aquarist, triangular, rectangular or polygonal in outline (P.Fig 5). The vein boundaries of the islets are thick and prominent. Vein terminations are mostly short and unbranched. Some of the terminations are fairly long and may be branched ones. The vein islets are occupied by large number of calcium oxalate crystals of druses. The druses are diffuse in distribution and are 20µm in diameter.

The microscopic examination of leaf material was on dried powder. Calcium oxalate crystals of druses and sand crystals are seen abundant in the leaf tissue. The sand crystals are densely aggregated inside the mesophyll cells of the leaf. The sand crystals appear in densely aggregated masses (P.Fig 6). Druses are also prominently seen in leaf tissues. The druses are seen in close lines. They are spherical and 60µm in diameter. Epidermal trachoma is fairly common in the powder. The trichomes are multicellular, uniseriate and unbranched. They are broad at the base and gradually become tapering into pointed ends (P.Fig 7). The cells walls of the trachoma have prominent circular pits. The trichomes are 200-250µm long and 20µm thick at the base. The surfaces of the trachoma appear warty due to dense pits on the walls.

The epidermal peelings are frequently seen in the powder. When these peeling appear in surfaces view the stomata and epidermal cells are seen from above. The abaxial epidermal cells are very lobed with wavy thin anticlinal walls. The stomata are distributed diffusely among the epidermal cells. The stomata appear to be anamocytic due to absence of well defined subsidiary cells (P. Fig 8). The species of the genus *Datura* are characterized by anisocytic stomata, glandular trichomes, non-glandular and drusa, differentiating *D. inoxia* from *D. stramonium* by the arrangement of drusa types in the form of "U" in *D. inoxia*, while in *D. stramonium* were distributed in dispersed form. Besides, the glandular trichomes in *D. inoxia* possess stalk and unicellular head; in *D.stramonium* the stalk is bicellular and the head is multicelular[16], coinciding with the observation by they describe *D. Stramonium* var. tatula, possess glandular trichomes of 1 or 2 cells; others with pedicels of 2 cells and with oval head of 2 - 7 cells[17].

CONCLUSION

The findings of the present investigation suggests that the organic solvent extraction was suitable to identify the various compounds of medicinal plants and they supported by many investigation. The present study justifies the claimed uses of leaves in the traditional system of medicine to treat various infectious diseases caused by the microbes. Utilizing the techniques of pharmacognosy of the species it is observed that the most important anatomical characters are types of stomata, non-glandular, and glandular trichomes and crystal types. This study also encourages cultivation of the highly valuable plant in large scale to increase the economic status of the cultivators in the country. The obtained results may provide a support to use of the plant in traditional medicine. These results may serve to relate with their medicinal values. Based on this further antibacterial and antioxidant investigations can be done and to screen other potential bioactivities may be recommended.

ACKNOWLEDGEMENTS

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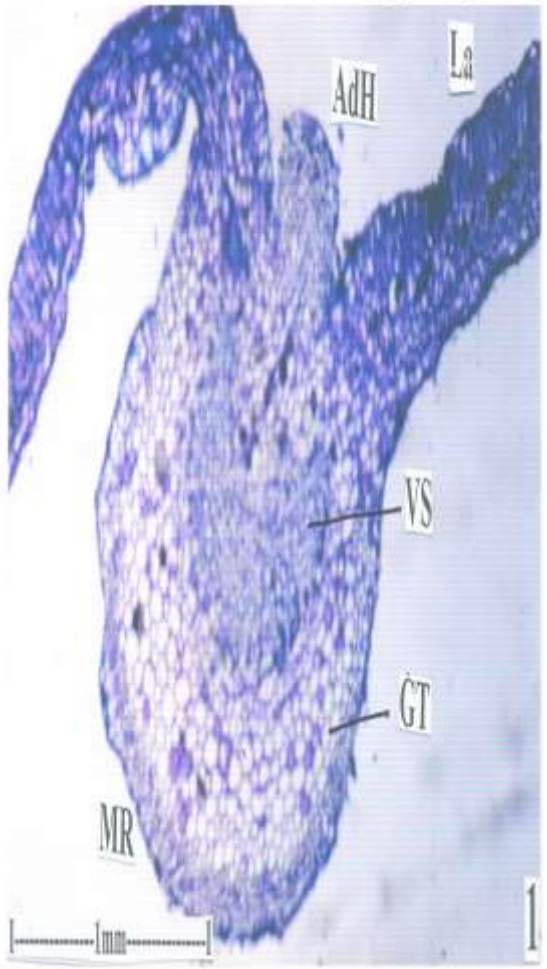
Plate Figure 1– T.S of leaf through midrip



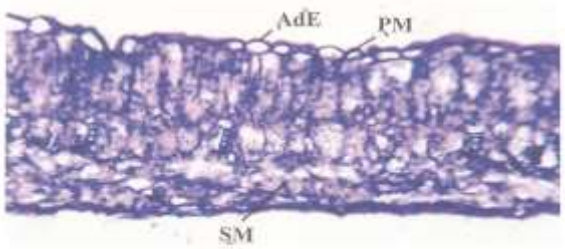
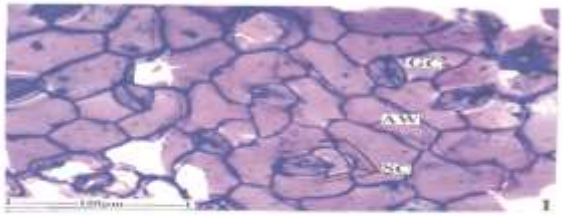
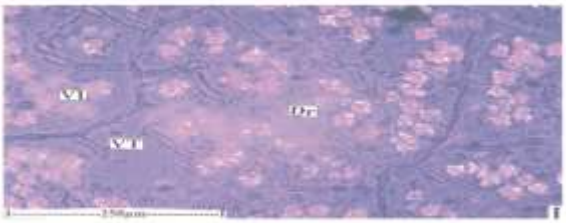


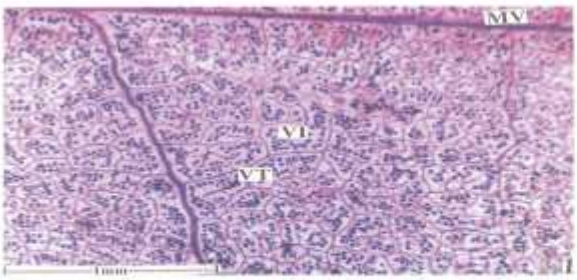
Plate Figure 2- T.S of lamina



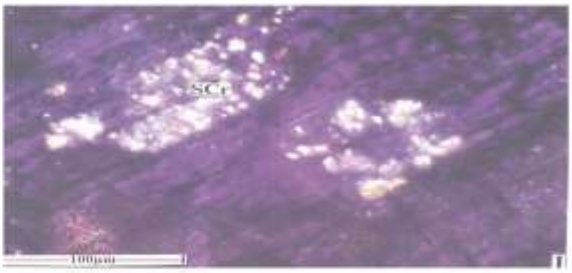
P.Fig 3 – Paradermal section of the adaxial epidermis showing stomatal type



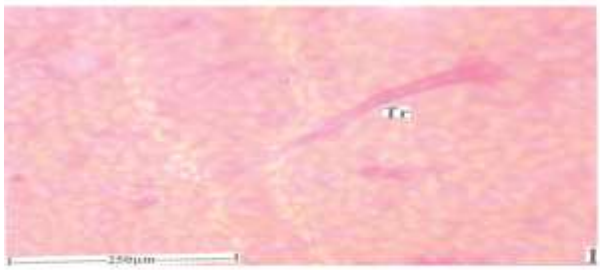
P.Fig 4 – Surface view of the lamina showing distribution of druses



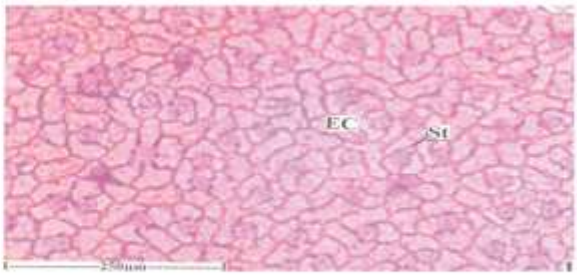
P.Fig 5 – Venation pattern of lamina



P.Fig 6 – Sand crystals in the leaf mesophyll



P.Fig 7 – Epidermal trichome on the lamina



P.Fig 8 – Abaxial epidermal peeling of the lamina showing wavy epidermal cells, stomata and trichomes

Adh-Adaxial hump; La-Lamina; VS-Vascular strand; GT-Ground tissue; MR-Midrip; Ade-Adaxial epidermis; PM-Palisade Mesophyll; SM-Spongy Mesophyll; GC-Guard Cells; AW-Antidrial Wall; SC-Subsiduary Cell; Dr-Druses; VI-Vein Islet; VT-Vein Termination; MV-Midrib Vein; SCr-Sand Crystals; Tr-Trichome; EC-Epidermal Cell; St-Stanata

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