An Analytical Study based on a Virus Disease Infecting Datura stramonium L.

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ABSTRACT

India has a great wealth of various naturally occurring plant drugs which have great potential pharmacological activities. Datura stramonium (D. stramonium) is one of the widely well known folklore medicinal herbs. Datura (Familily-solanaceae), a genus of poisonous herbs, shrubs or small trees, is distributed throughout the tropical and warm temperate region of the world. The word ‘Datura’ is derived from the Arabic name ‘Tatorah’ or the Hindustani ‘Dhatura’. This genus is represented by about 11 species (Datura ceratocaula, D. innoxia, D. metel, D. quercifolia, D. stramonium, D. tatula, D. discolor, D. wrightii, D. alba, D. fastuosa, D. ferox) of which D. innoxia, D. metel and D. stramonium are important drug plant whereas some are ornamentals. (D. innoxia and D. metel). This paper is based on the analytical issues related with Datura.

Keywords: Datura, Scopolamine, herbs, virus etc.

INTRODUCTION:

Datura stramonium, known by the English names jimsonweed or Devil’s snare, is a plant in the nightshade family. It is believed to have originated in Mexico but has now become naturalized in many other regions. Other common names for D. stramonium include thornapple and moon flower, and it has the Spanish name toloache. Other names for the plant include hell’s bells, devil’s trumpet, devil’s weed, tolguacha, Jamestown weed, stinkweed, locoweed, pricklyburrr, devil’s cucumber[6] and Thornapple. All species of Datura contain powerful alkaloids which in sufficient quantities have the power to kill. The main alkaloids are Scopolamine, Hyoscyamín and Atropine.

Datura has always played a significant role as “Culture plant” and evidence regarding their uses both in Asia and in New World date back atleast 3000 years. In both hemispheres Daturas were regarded as sacred and especially valued for their power to induce visionary dreams to see the future and to reveal the causes of diseases and misfortune. In Eurosia references to the uses and sacred status of Datura (mainly D. metel) can be found from the Caspian Sea to China. Especially in India, it found highly revered place of honour as one of the Shiva’s sacred plants. According to the Yamana Purana it grew out of...
Shiva’s chest and the Garuda Purana gives instruction for ritual offerings to Datura flowers, which should be made to Yogashwara (Shiva) on the 13th day of waxing moon in January. Sadhus and yogis smoke the leaves and seeds mixed with Ganja, another plant sacred to Shiva. Besides, Kali worshippers also held Datura sacred. Nevertheless, despite its unpropitious reputation as a witch’s herb, it was valued and commonly employed for its medicinal properties throughout the world. Datura acts antispasmodically and has a particularly relaxant effect on the respiratory muscles. Furthermore, it suppresses glandular secretion, thus reducing the amount of mucous excreted through the lungs. The combination of these valuable properties makes it an ideal remedy for the treatment of Asthma. Throughout the middle ages Datura flowers were commonly sold for their aphrodisiac qualities all over central and southern Europe. They had the reputation of breaking down any resistance to sexual approaches.

**Datura Stramonium**

It is a very important ancient herb, having great religious importance. Its flower are believed to be associated with Lord Shiva. Ancient Hindu physicians regarded this herb as an intoxicant, with digestive, emetic and healing properties. Datura is infected by a number of pathogens such as Fungal (Roy et al., 1998), Bacterial (Kranz et al., 1977, Bashon and Okony 1986, Viczian et al., 1988, Stevenson et al., 2001, Gera et al., 2004) Nematode (Vau terin et al., 1995), Phytoplasma (Al Ani et al., 2001) and Viral (Biichen-Ormond., 2006, Steele & Thomas., 2009).

The present investigation was taken up to characterize the virus causing mosaic disease in *Datura stramonium*.

**2. Existing Studies:**

The review of literature infecting *Datura stramonium* has revealed the infection of about 60 viruses on this important weed and medicinal plant but only 22 viruses have been recorded to cause natural infection in Datura.

**2.1: Capoor and Verma**: A mosaic disease of Datura alba was first described by Capoor and Verma in 1948 and they suggested the name distortion mosaic of Datura alba. The virus caused light and dark green mosaic accompanied by blister like patches of dark green portion on leaf lamina, distortion and reduction in leaf size. The plants were seldom dwarfed. The causal virus withstood heating for 10 min. at 60°C, retained infectivity at a dilution of 1 in 10,000 and after storage for 13 days at room temperature (80°F). The virus also infected *Nicotiana tabacum*, *Petunia* sp. and *Solanum tuberosum* and produced local necrotic lesions on *Phaseolus vulgaris*, *Vigna sinensis* and *Solanum melongena*. The virus was also transmitted by *Myzus persicae*.

**2.2: Salamon (1989)**: It recorded the natural occurrence of a new potyvirus (a strain of henbane mosaic virus) spontaneously infecting the thornapple (*D. stramonium L*)., in Hungary. Hiskias et al. (2001), studied biological characteristics of tomato mild virus a potyvirus isolated from tomato thorn apple in Ethiopia. The two isolates (246/94 and 277/94) from thornapple (*Datura stramonium*) and tomato to (*L. (Figure 1. *D. stramonium*)
lycopersicon) respectively, were characterized biologically and serologically and compared with local isolates of potato virus isolated from tomato and other viruses and isolates infecting vegetables. Both isolates of TMMV infected only 16 of 28 plants species inoculated by sap and induced indistinguishable symptoms. The most susceptible host were Datura metel, Datura stramonium and Nicotiana glutinosa L. However, these isolates differed from the PVY isolate infecting Datura spp. and Solanum demissum L., while Potato Virus Y isolate infected Chenopodium quinoa wild and Capsicum annuum L., isolate 277/94 was transmitted non persistently by Myzus persicae Sulz. from diseased tomato to virus free Datura stramonium, Datura metel L., Nicotiana glutinosa L. and tomato plants and from this back to virus-free test plants of each species purified particles isolate 277/94 contained a single protein species with a molecular weight of 39 KDa in double antibody sandwich enzyme linked immunosorbent assay (DAS-ELISA) antiserum to isolate 277/94 reacted strongly with a Yemeni isolate of TMMV, (Y 90/7), but did not react with any other potyvirus. This clearly shows that the Yemeni and Ethiopian isolates of TMMV are similar serologically.

3. Structure of Datura stramonium:
* Datura stramonium is a foul-smelling, erect, annual, freely branching herb that forms a bush up to 60 to 150 cm (2 to 5 ft) tall. The root is long, thick, fibrous, and white. The stem is stout, erect, leafy, smooth, and pale yellow-green. The stem forks off repeatedly into branches, and each fork forms a leaf and a single, erect flower. The leaves are about 8 to 20 cm (3–8 in) long, smooth, toothed, soft, and irregularly undulated. The upper surface of the leaves is a darker green, and the bottom is a light green. The leaves have a bitter and nauseating taste, which is imparted to extracts of the herb, and remains even after the leaves have been dried. Datura stramonium generally flowers throughout the summer. The fragrant flowers are trumpet-shaped, white to creamy or violet, and 6 to 9 cm (2½–3½ in) long, and grow on short stems from either the axils of the leaves or the places where the branches fork. The calyx is long and tubular, swollen at the bottom, and sharply angled, surmounted by five sharp teeth. The corolla, which is folded and only partially open, is white, funnel-shaped, and has prominent ribs. The flowers open at night, emitting a pleasant fragrance, and are fed upon by nocturnal moths. The egg-shaped seed capsule is 3 to 8 cm (1–3 in) in diameter and either covered with spines or bald. At maturity, it splits into four chambers, each with dozens of small, black seeds.
4. Pharmacological Properties:

4.1: Antiasthmatic activity

D. stramonium in asthma treatment and possible effects on prenatal development was studied. Exposure of the foetus to D. stramonium when a mother use it for asthma, will cause a continuous release of acetylcholine, resulting in the desensitization of nicotinic receptors, this could ultimately result in permanent damage to the foetus. Therefore we conclude that this African herbal remedy should be used with caution during pregnancy.

4.2 Anticholinergic activity

The alkaloids found in D. stramonium, are organic esters used clinically as anticholinergic agents. Jimson weed has been reported as a drug of abuse and has been involved in the accidental poisoning of humans and animals. Symptoms of acute jimson weed poisoning included dryness of the mouth and extreme thirst, dryness of the skin, pupil dilation and impaired vision, urinary retention, rapid heartbeat, confusion, restlessness, hallucinations, and loss of consciousness. The anticholinergic syndrome results from the inhibition of central and peripheral muscarinic neurotransmission.

4.3 Acaricidal, repellent and oviposition deterrent properties

The ethanol extracts obtained from both leaf and seed in D. stramonium (Solanaceae) were investigated for acaricidal, repellent and oviposition deterrent properties against adult two-spotted spider mites (T. urticaeKoch) (Acari: Tetranychidae) under laboratory conditions. Leaf and seed extracts, which were applied in 167.25 and 145.75 g/L concentrations, respectively (using a Petri leaf disc-spray tower method), caused 98% and 25% mortality among spider mite adults after 48 h. These results suggest that D. stramonium extracts could be used to manage the two-spotted spider mite[21].

4.4 Antimicrobial Activity

The methanol extracts of D. stramonium and Datura inoxia showed activity against Gram positive bacteria in a dose dependent manner. Little or no antimicrobial activity was found against Escherichia coli and Psuedomonas aeruginosa[22]. 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 subtilis, Escherichia coli, Klebsiella pneumoniae, Micrococcus luteus and Candida albicans with compare Ciprofloxacin standard drug[23].

4.5 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. stromonium 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[24].

4.6 Antiinflammatory activity

Coriandrum sativum (C. sativum), D. stromonium and Azadirachta indica (A. indica) are traditionally used in treatment of inflammation. Ethanolic extracts of fruits of C. sativum, leaves of D. stromonium. Ethanolic extracts of fruits of C. sativum, leaves of D. stromonium and A. indica were subjected to preliminary screening for anti-inflammatory activity in albino rats. All ethanolic extracts exhibited significant anti-inflammatory activity comparable to the standard drug diclofenac sodium against carrageenan induced rat paw edema method. Among these plant A. indica showed maximum anti-inflammatory activity per hour.

5. Virus culture specifications:

Single lesion culture form Chenopodium amaranticolor was used and the virus isolate was maintained on Datura stramonium by mechanical sap inoculation. Periodic check to ensure identity of the isolate was made on Datura stramonium, Chenopodium amaranticolor and other appropriate hosts. Chenopodium amaranticolor plants were used in all cases. Standard extract was used as inoculum for maintaining the culture.

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