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DIEFFENBACHIA: BENEFITS VS RISKS OF A HOUSEHOLD ORNAMENTAL PLANT-A REVIEW

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ABSTRACT

The main aspects of selected biological and toxicological profile of Dieffenbachia, as a poison effects to animal and human as well as remedial for various disease are reviewed. Plant profile, cause and symptoms of poisoning due to calcium and magnesium oxalate crystals induce ocular toxicity and biological action like defence mechanism, anti-bacterial actions and anticancer effects are analysed in order to assess a risk profile and better understanding of adverse and beneficial effects balance. The general conclusion is that the reviewed plant having various biological activities and recommended further studies to develop new formulation in order to utilization of such plants in effective manner.

KEYWORDS: Dieffenbachia, biological weapon, Calcium oxalate, Ocular, angiogenesis.

INTRODUCTION

Dieffenbachia is a perineal herbaceous plant with straight stem, simple and alternate leaves containing white spots and flecks, making it attractive as indoor foliage as because of their tolerance of shade. The common name, “Dumb Cane” refers to the poisoning effects of raphides, which can causes temporary inability to speak thus gained the nick name “mother in law plant.[1] Dieffenbachia was named by Heinrich Wilhelm Schott, Director of Botanical gardens Vienna to honour his head gardener Joseph. It is also known as Caladium(Germen), Canne d’ eu (West Indian), Canne Seguine (West Indian), Dieffenbachia Dieffenbachia

(Czech), Dieffenbachia Pestra (Slovak), Giftaron (Germen), poison arum, Schierlingscaladium (German), Schweigrohr (germen) and Spotted dumb cane.[2]

Biting or chewing the stem can cause burning sensations, oral irritation and pronounced swelling and the consumption of exudates are poison. When ingested it can cause swelling which restrict the normal speaking[3] by physical contact may cause dermatitis.[4] This plant was once used to torture slaves and was also said to have been used by Caribbean Indian tribes to poison their enemies and is also avoiding by live stock.

Ironically although known for its toxicity, therapeutic activity of Dieffenbachia is also reported (Bosch et al., 2002). The shoot and root extract have been described as a narcotic, a gastric and kidney irritant and historically used as arrow poisons by the west Indians in the new world (Cheney, 1931). It is reported to be highly poisons plant to human and when brought into the eye, the sap can cause injury of the cornea and all part of the plant are very poisonous (Ardittia and Rodrigueza, 1982; Fochtman *et al*., 1969; Cumpston *et al*., 2003). This plant can cause blistering and swelling in the mouth may be severe enough to prevent normal speaking and swallowing.

It is said that in Britain, dumb cane wad used years ago by journey man gardeners for playing cruel practical jokes upon their peers. Apparently, they would persuade the unwriting victim that the green and white stem was a variety of sugar cane (Saccharum officinarum), and when the gullible fellow bit into it he would immediately begin to suffer extremely painful and uncomfortable throat swelling that would prevent him front speaking for days.

Aim of the present work is to provide awareness and overview over therapeutic and toxicological aspects of dumbcane. In order to assess the beneficial effects and evaluate the level of poisonous effects connected with its use.

Plant description

Dieffenbachia is a long lived, evergreen plant growing to a height to 1.6 meters. The stem portion is branchless, having 2.5cm thickness, cylindrical erect with base. Leaves concentrated towards the apical part of the stem, the stalk elongated, broadly grooved, the lower part forming as a sheath around the stem. Leave are 15-35cm long, 15-25 cm width, oblong, lanced shape, dark to glossy green in colour with numerous yellowish white or off-

white sports or lines, the base rounded to acute, the tip narrow. The flower is stalk less. Fruits are berries and orange in colour.[5]

Pharmacogenetic Information[6]

Table No. 1

Specification	Description
Common name (s)	Spotted dumbcane
Scientific name	Dieffenbachia *maculate*
Synonyms	Dieffenbachia bowmannii, D seguinum Raf, maguria A.D Hawkes
Pronunciation	Deef-en-back-ee-uh-mack-yoo-lay-tuh
Kingdom	Plantae
Family	Araceae
Subfamily	Aroideae
Genus	Dieffenbachia Schott
Order	Alismatale
Plant type	Perennial, herbaceous
Plant month for zone 10 and 11	Year round
Chemical Constituents[7]	Leaf oil yielded major constituents of pyrimidine5carboxylic acid, 4(1,3 dimethyl 1 Hypyrazol 4yls) 6 methylthioxol 12 thioxol1,2,3,4 tetrahydromethylester (5.81%) 5methyl12phynylindolizine (2.957%) 1(3Methylbutyl)4(4,4,5,5tetramethyl1,3,2diboxaborolan2yl) 1HPyrazole (2.674%) Dichotine 19hydroxyl1-methoxytriacetate.
Uses	Mass ornamental planting, suitable for growing indoors and traditionally used as biological weapon. Defence mechanism, ocular toxicity, antibacterial activity and anti-cancer therapy.

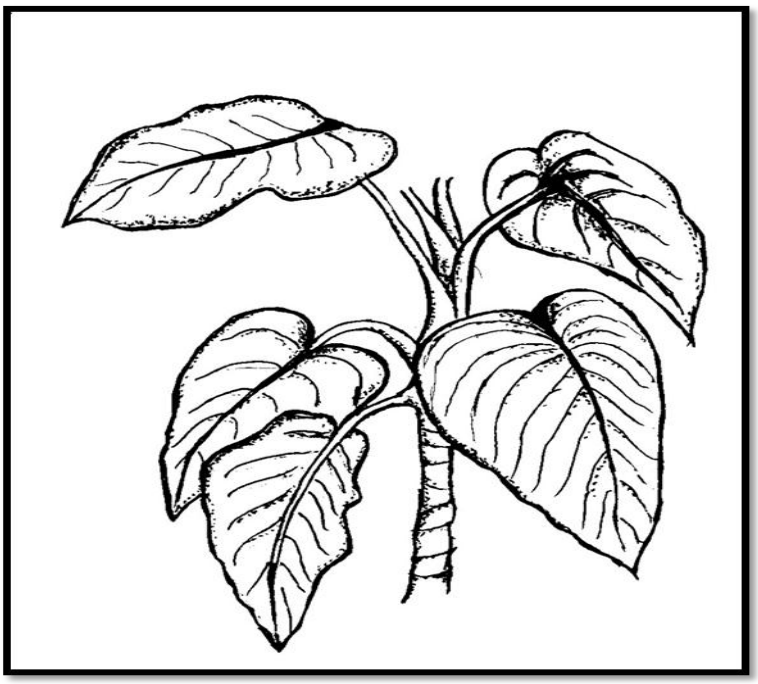

Fig. 1: Morphology of Dieffenbachia Plant.

Dieffenbachia poisoning

Accidental ingestion of plant and seed by children are not uncommon and can result in significant symptoms necessitating hospital admission and emergency treatment. Dieffenbachia is a type of house plant with large, colourful leaves. Poisoning can occur if you eat the leaf, stalk, or root of this plant.

Poisonous Ingredient[8]

The active principle is calcium oxalate and L-Asparginase, a protein found in this plant. The calcium and magnesium oxalate crystals are the main two components which producing toxicity or irritant effects along with a proteolytic enzyme like L-asp arginase, which enhance the production of histamine. The oxalate crystals which promote the irritation, inflammatory properties and vomiting. And presence of calcium crystals is the one of the main reasons of formation of kidney stones.so that the ingestion of these plants produce irritation, inflammation on skin and mucus membrane, gastric mucosa. Eye and it can damage the kidney and arteries.

Symptoms of Dieffenbachia toxicity

By accidental consumption of these the any part of the plant which producing, burning in the skin, mouth or throat[9], damage to cornea of the eye, diarrhoea, eye pain[10], horse voice, nausea or vomiting, swelling and blistering and swelling in the mouth may be serve enough to prevent normal speaking and swallowing.

Ocular injury[11]: -Dieffenbachia also produce eye irritation due to presence of sap, which induced conjunctival chemosis and formation fine blue crystals in the stroma due to the effects of calcium oxalate crystals. Ocular symptoms[12] developed in 5 to 18 hours. Close observation is required to prevent progressive swelling of tongue and adjacent tissues interfering with the airway. Educating the people about the toxicity of Dieffenbachia is crucial in view of the wide spread indoor use of this ornamental plant.

Defence mechanism[13]

Calcium Oxalate crystals was described as a defence mechanism against herbivores (Ward et al., 1997; Molano-Flores, 2001). In the study by Ward et al. on desert lily, 3 species of herbivores ate only those plants of leaves where Calcium oxalate raphides were absent. In Molano-Flores's study, Sida leaves from seedling not subjected to herbivory.

Anti-inflammatory action

Preparations containing Dieffenbachia were once used to treat gout, dropsy, sexual impotence, and frigidity (Fochtman et al., 1969). Sloane reported that Dieffenbachia stalk can effectively cure hydropic legs, according to Arditti and Rodriguez (1982). In addition, D. segunine was used to open obstruction and against inflammations. Sliced root was employed against gout (Arditti and Rodriguez 1982).

Ocular actions

Toxic constituents in A.Curassavica latex include calotropin, uscharin and calactin, which can penetrate the cornea without injury to the epithelium and act clinically by inhibiting the endothelial Na+K+ ATPase, thus causing decrease in intraocular pressure and corneal oedema for 24 to 48 hours.[14]

Anti-bacterial activity

Studies on Dieffenbachia demonstrated that a proteolytic enzyme and other compounds are responsible for the severe irritation caused by plant and raphides of calcium oxalate do not play major role.[15] Literature survey reveals that many plants of the family Araceae possess significant antibacterial activities.[16]

Temporary male sterility action

The report that Dieffenbachia seguine produce sterility is one of the most interesting and unusual aspects of its actions. Madaus (1938) stated that this plant has been used by the Brazilian Indians as a means of sterilizing their enemies, the juice being administered either in the food or as an arrow poison (Barnes and Fox, 1955). In 1950's, it was still a common belief among the inhabitants of many island of the Caribbean that a temporary male sterility of some 24 to 28 hours' duration is affected by chewing Dieffenbachia sanguine, and it was thus employed by them as a contraceptive.

Angiogenesis action

Researches have found that dumb cane plant contains active ingredients that cause angiogenic effect potential for the treatment of cancer. Anti-angiogenesis is a process that inhibit the growth and development of new blood vessels in the body. Anti-angiogenesis controls the spread of tumour cell in the body by disabling the transport of nutrients towards the cancerous cells. Normally tumour starts from a single cell and divides to make more cancer

cells. The growth of malignant cells will depend on the availability of specific nutrients being transported by blood vessels.

Finding of the study claimed that dumb cane's ability to prevent blood vessels growth and development can be possibly used in the formation of anticancer drugs to help prevent the spread of cancer cells in the human body.[16]

Consolidated Comparison of toxic and therapeutic effect

Table No. 2

Toxic Effect	Therapeutic Effect
Skin and mucus membrane.	Defence mechanism
Swelling and blistering of mouth and tongue.	Anti-Inflammatory action
Nausea, Vomiting, Diarrhoea.	Reduce intra ocular tension
Difficulty to speak.	Anti-Bacterial activity
	Anticancer activity

CONCLUSION

Dieffenbachia is a worldwide familiar ornamental plant. This review discusses the advantages and disadvantages of Dieffenbachia. It is clear that Dieffenbachia having various biological activities apart of some toxic effects. The researches recommended further studies to isolate the specific therapeutically active components of dumbcane there for necessary to bring a responsibilization to develop various beneficial formulation of this plant by masking the harmful effects.

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