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Pharmacognostical Standardization and Phytochemical Studies on the leaves of *Solanum torvum* Sw

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ABSTRACT

A genus of plant belongs to the family ***Solanaceae*** well distributed in India more than 26 species which are found naturalised in India**.** ***Solanum torvum* Sw.** is a medium sized flowering plant in the *Solanaceae* family that is found in India, Malaysia. Transverse section of lamina showed the adaxial part has thick, short hump; the midrib and the adaxial hump have thin, angular epidermal cells. The upper part of adaxial hump has a few layers sclerenchyma cells. The inner layer of the adaxial midrib also has few layers of thick walled cells. The ground tissue consists of wide circular thin walled parenchyma cells with narrow inter cellular spaces. The vascular system of the midrib showed bi-collateral structure. Non glandular, profusely branched, thick walled, lignified epidermal trichome occurs as both on the veins and lamina. Physico-chemical standards such as Foreign Matter, Total Ash, Water Soluble Ash, Sulphated Ash, Loss on Drying, Water Soluble Extractive, Alcohol Soluble Extractive and Crude Fiber Content in percentage were estimated**.** Preliminary phytochemical screening of appropriate solvent extracts showed the presence of Alkaloids, Amino Acids, Carbohydrates, Cellulose, Lignin, Fats & Fixed Oils, Flavonoids, Glycosides, Tannins, Proteins, Starch, Steroids and Triterpenoids and absence of Volatile Oil, Mucilage and Pectin. Microscopic analysis and other parameters were informative and provide valuable information in the identification, standardization of *Solanum torvum* leaves.

Keywords: *Solanum torvum,* Solanaceae, leaf, Microscopical evaluation.

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INTRODUCTION

A genus of plant belongs to the **family *Solanaceae*** well distributed in India more than 26 species which are found naturalised in India. *Solanum torvum* Sw. is a medium sized flowering plant in the *Solanaceae* family that is found in India, Malaysia. *Solanum torvum* Sw. is an extremely widely distributed species with weedy characteristics and thus not threatened by genetic erosion [1]. *Solanum torvum* Sw originates from Central and South America, where it is found from Mexico to Brazil and Peru, and is widespread in the Caribbean. It is now a pan tropical weed. In West and Central Africa it is locally a kitchen garden crop, and it probably occurs in other regions of Africa as well. It is cultivated as a small-scale vegetable in southern and eastern Asia and is especially popular in Thailand [2-4].

Leaves of this plant have been reported as the Treatment of Epilepsy [5], Haematopoietic, anti-microbial [6], Inflammation [7], Anti-tumour, anti-bacterial, anti-viral, anti-inflammatory [8], Anthelmintic [9], Sedative, diuretic and digestive [10], Treatment of fever, wounds, tooth decay, reproductive problems and arterial hypertension [11].

SCIENTIFIC CLASSIFICATION:

- Kingdom - Plantae
- *Clade* (Unranked) - Angiosperms
- *Clade* (Unranked) - Eudicots
- *Clade* (Unranked) - Asterids
- Order - *Solanales*
- Genus - *Solanum*
- Species - ***torvum***

VERNACULAR NAMES [2]:

It is also known as **turkey berry**, **prickly nightshade**, **shoo-shoo bush**, **wild eggplant**, **pea eggplant**, **pea aubergine**,

- Common Name- Pea Eggplant, Turkey berry, Devil's Fig, Prickly Nightshade, Wild Eggplant, Turkey Berry
- Botanical Name - ***Solanum torvum* Sw.**
- Tamil Name - *Sundaikkai, Sundai, Soondai* (சுண்டைக்காய்)
- Kannada -*Balengène*, *Zamorette*, *Friega-Platos*, *Kudanekayi*
- Malayalam - Gujarati
- Telugu - Kottuvastu
- Sanskrit - Brihati
- Marathi - Marang
- Hindi - Bhankatiy, Bhurat
- Sinhala - *Thibbatu*
- Japan - *Suzume nasu*
- Thai - *Makhuea phuang*
- Others -Shoo-shoo Bush, Wild Egg Plant, Bed Sundai, Susumber, Devil's Fig, Kothu Kathiri, Turkey Berry, Prickley Solanum, Chunda.

A number of metabolites are in good yield and some have been shown to possess useful biological activities belonging mainly to steroid glycosides and saponins, flavonoid, vitamin B group, vitamin C, iron salts and steroidal alkaloids [12].

As mentioned earlier several reports have been published regarding chemical constituents and different biological activities *in-vitro* and *in-vivo*. An investigation to explore its pharmacognostic examination is inevitable. The present work was undertaken with a view to lay down standards which could be useful to detect the authenticity of this medicinally useful plant *Solanum torvum* leaves to treat various diseases and disorders.

2. MATERIALS AND METHODS

2.1: Chemicals: Formalin, acetic acid, ethyl alcohol, chloral hydrate, toludine blue, phloroglucinol, glycerin, hydrochloric acid and all other chemicals used in this study were of analytical grade.

2.2: Collection and authentication of Plant

The leaves of the selected plant were collected from in and around Salem, Tamilnadu with the help of field botanist. Care was taken to selected healthy plant and for normal leaves. It was authenticated by Dr. P.Jeyaraman Ph.D, Director of Plant Anatomy Research centre, Tamilnadu, India.

2.3: **Macroscopic analysis**: Macroscopic observation of the plant was done. The shape, size, surface characters, texture, colour, odour, taste etc were noted [13].

2.4: **Microscopic analysis:** The leaves were fixed in FAA (Formalin - 5 ml + acetic acid - 5 ml + 70% ethyl alcohol - 90 ml). After 24 hrs of fixing, the specimens were dehydrated with graded series of tertiary-butyl alcohol (TBA). Infiltration of the specimens was carried by gradual addition of paraffin wax (melting point 58-60°C), until TBA solution attained super saturation. The specimens were cast into paraffin blocks [14].

Sectioning: The paraffin embedded specimens were sectioned with the help of rotary microtome. The thickness of the sections were about 10-12 µm. After de-waxing the sections were stained with toludine blue. Since toludine blue is a polychromatic stain, the staining results were remarkably good and some cytochemical reactions were also obtained. The dye rendered pink color to the cellulose walls, blue to the lignified cells, dark green to suberin, violet to the mucilage, blue to the protein bodies etc [15].

Photomicrographs: Photographs of different magnifications were taken with Nikon lab-photo 2 microscopic Unit. For normal observations bright field was used. For the study of crystals, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background.

2.5: Powder microscopy: Coarse powder of the leaf was used to study the microscopical characters of the leaf powder [16].

2.6: **Physicochemical analysis**: Total ash, acid insoluble ash, water soluble ash, loss on drying and extractive values was determined [17].

2.7: **Preliminary phytochemical screening:** Preliminary phytochemical screening of ethanolic and aqueous extract carried out to find out the presence of various phytoconstituents using standard procedure [18, 19].

3. RESULTS

3.1: Macroscopy:

Growth Form: A spreading or sprawling shrub that can grow up to 2 to 3m in height.

Foliage: The leaves are simple and ovate to elliptical in shape and are lobed.

Leaf surface is pubescent.

Stems: The stems have slightly hooked thorns growing along its length and have a layer of hairs growing on it. The thorns are sparser on growth.

Flowers: Flowers are white and are borne on a dense, branched corymb. The flowers are bisexual. The plant flowers throughout the year.

Fruits: The fruit is a globular, glabrous berry and measures about 1.0 to 1.15cm in diameter. Each fruit has about 300 to 400 flat, brownish seeds.

Habitat : It is common on roadsides and in disturbed soils, usually as individual plants.

Fig.No:1. THE WHOLE PLANT of ***Solanum torvum* Sw.**

Fig.No:2. The Flowers of ***Solanum torvum* Sw.**

3.2: Microscopy:

Anatomy of the leaf:

In transverse section of the leaf, the midrib appears wide, thick and fan shaped and thin lamina **(Fig.No:3).**

The midrib is 1.65mm in horizontal plane and 1.45mm in vertical plane. The adaxial part has thick, short hump; the midrib and the adaxial hump have thin, angular epidermal cells. The upper part of adaxial hump has a few layers scleranchyma cells. The inner layer of the adaxial midrib also has few layers of thick walled cells **(Fig.No:4).** The ground tissue consists of wide circular thin walled parenchyma cells with narrow inter cellular spaces.

The vascular system of the midrib has wide deep are shaped bi collateral structure. There are several vertically arranged parallel lines of xylem elements and small units of adaxial as well as adaxial phloem element **(Fig.No:5).** Thus the entire system is bi collateral with phloem inner and outer regions of the xylem.

Lateral Vein

The lateral vein is also thick with adaxial hump and adaxial wide hemi spherical adaxial part. The lateral vein is 7.1mm thick and 7.05mm to vertical phloem. The lateral vein has thick epidermal layer, paranchymatous ground tissues and a flat planoconvex prominat vascular strained. It consists of a horizontal band of short vertical fiber of xylem elements and thin layer of phloem elements on both upper and lower sides of the xylem segment **(Fig.No:6).**

Epidermal Trichomes:

Non glandular, profusely branched, thick walled, lignified epidermal trichomes are a abundant both on the veins and lamina. These trichomes have pointed sharp tip and the trichomes have narrow cell lumus **(Fig.No:7 & 8)**

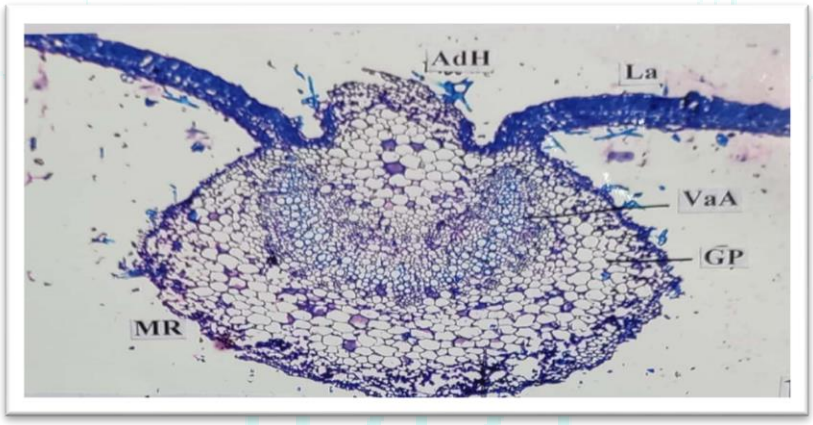

Fig.No:3. T.S of leaf through midrib.

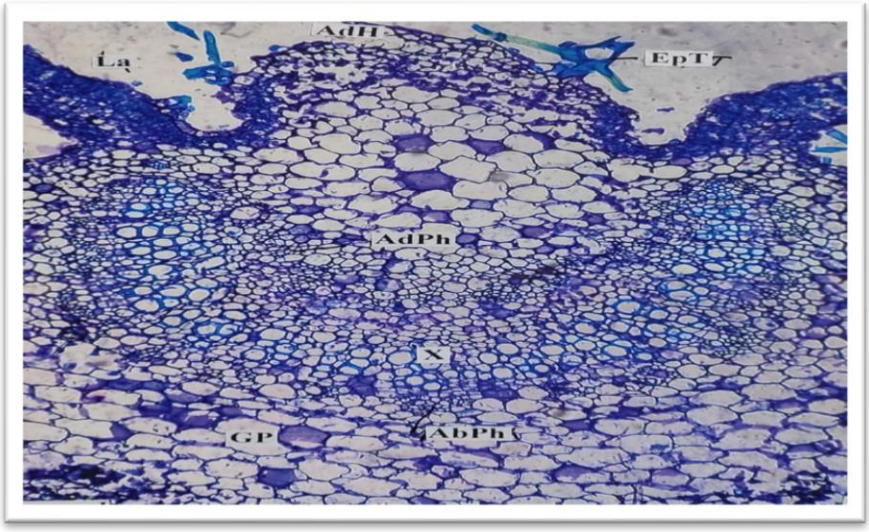

Fig.No:4. T.S of midrib-enlarged.

(Ab Ph: Abaxial Phloem; AdH:Adaxial Hump; Ad Ph: Adaxial Phloem; EpT:Epidermal Trichome; GP:Ground parenchyma; La:Lamina; MR:Midrib; VaA:Vascular Arch.)

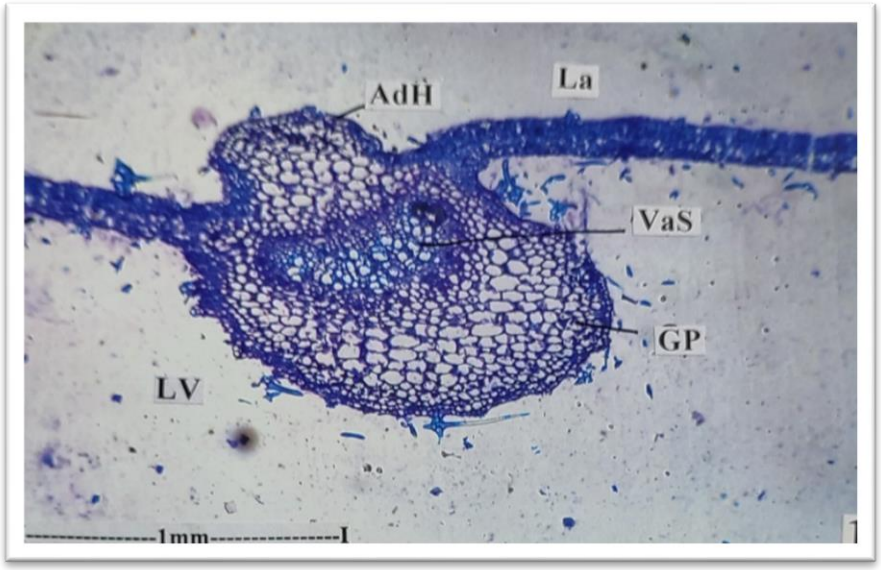

Fig.No:5. T.S of lateral vein of the leaf

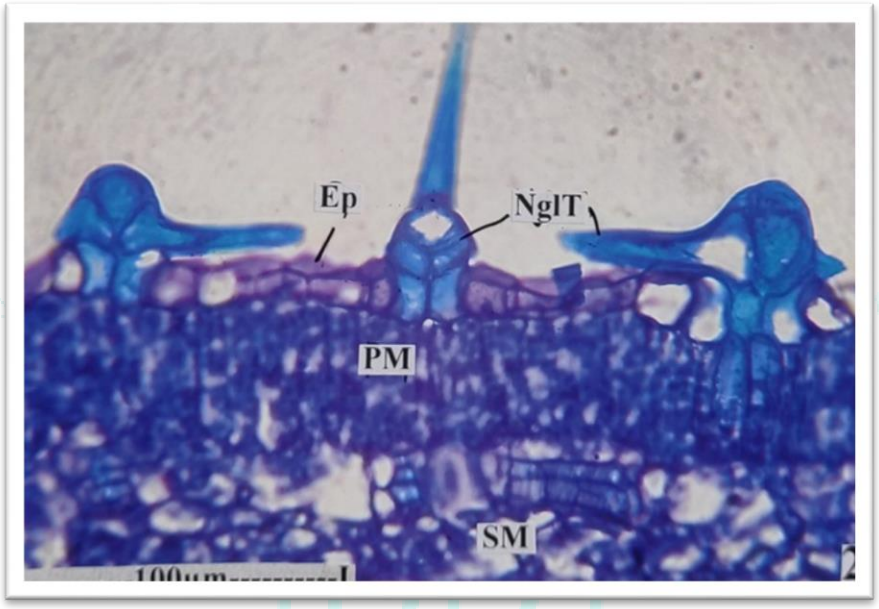

Fig.No:6. T.S of lamina leaving non glandular epidermal trichomes.
(AdH:Adaxial Hump; Ep:Epidermis; GP:Ground parenchyma; La:Lamina; Lv:Lateral vein; NglT:Nonglandular Trichomes on the epidermis; PM:Palisade Mesophyll; SM:Spongy mesophyll; VaS:Vascular strands.)

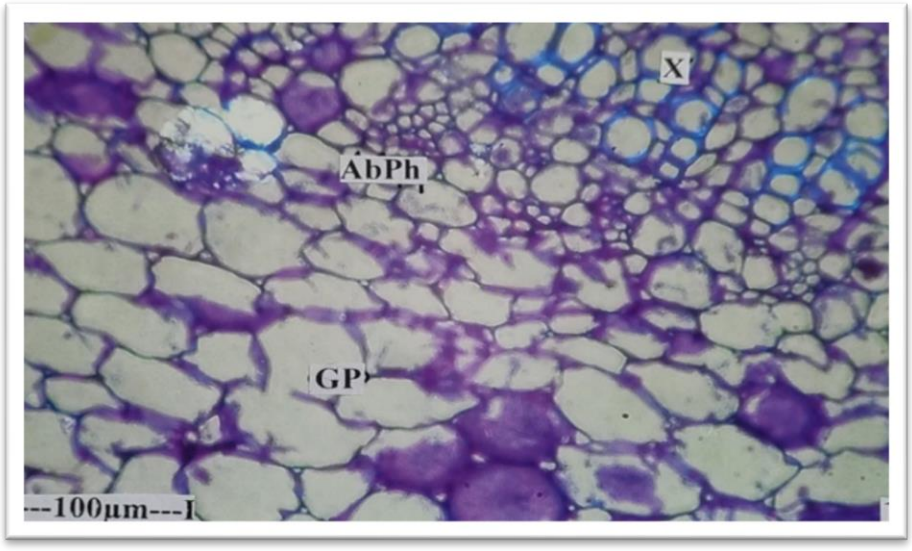

Fig.No:7. TS of midrib showing phloem tissue of the abaxial part

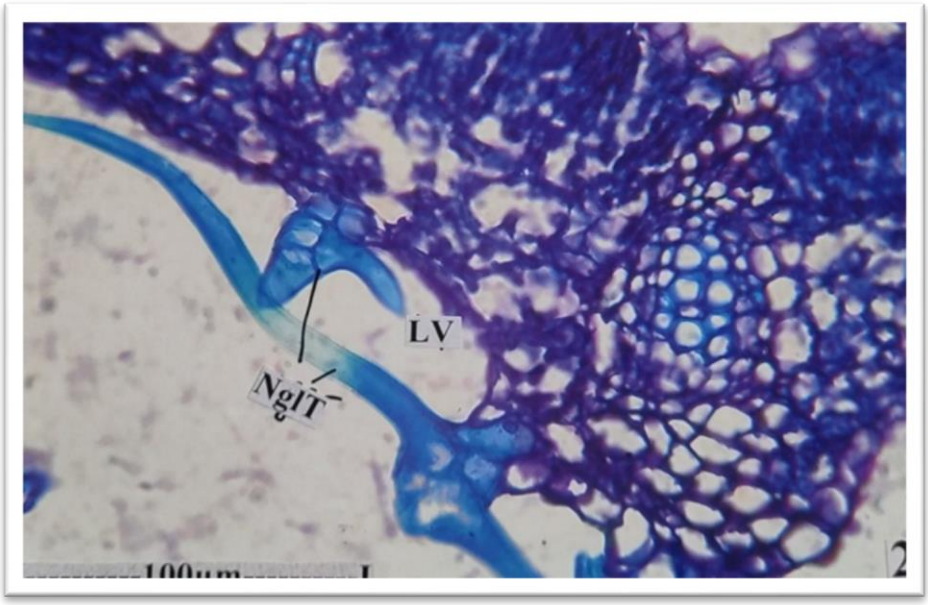

Fig.No:8. Non glandular lobed epidermal trichomes

(AbPh:Abaxial phloem; GP:Grond Parenchyma; LV:Lateral vein; NglT:Non glandular Trichomes)

3.4: Physio-chemical parameter

3.4.1: Ash Value of leaves of *Solanum torvum* Sw.

Analytical parameter	(%)w/w
Total Ash	3.5
Acid Insoluble ash	1.5
Water soluble Ash	1

3.4.1: Extractive Values and LOD of leaves *Solanum torvum* Sw.

Solvent	Method of Extraction	Extractive value (% w/w)
Alcohol soluble extractive	Continues hot percolations (**Soxhlet** apparatus)	20.80
Water soluble extractive		15.26
LOD	105^0 C	20

3.5: Preliminary Phytochemical Screening of leaves of *Solanum torvum* Sw.

Preliminary Phytochemical Screening of Different Solvent Extracts

Tests	Ethanolic extract	Aqueous extract
Alkaloids		
Mayers Reagent	+	-
Dragendorffs reagent	+	-
Hagers reagent	+	-
Wagners reagent	+	-
Carbohydrates		
Molishch's Test	+	+
Fehlings Test	+	+
Benedicts Test	+	+
Glycosides		
General Test	-	-
Anthraquinone	-	-
Cardiac	-	-
Cyanogenetic	-	-
Coumarin	-	-
Phytosterols		-
Salkowski Test	+	-
Libermann Burchard Test	+	-
Saponins	+	+
Tannins	+	+
Proteins & Free Amino Acid		
Millons test	+	+
Biuret test	+	+
Flavonoids		
Shinoda test	+	+
Alkaline Reagent test	+	+
Terpenoids	+	-
Fixed Oil	-	-

4. DISCUSSION

Organoleptic evaluation of a crude drug is mainly for qualitative evaluation based on the observation of morphological and sensory profile [20]. Hence we have undertaken this study to serve as a tool for developing standards for identification, quality and purity of leaves of *Solanum torvum*.

Adulteration and misidentification of crude drugs can cause serious health problems to consumers and legal problems for the pharmaceutical industries. The observation of cellular level morphology or anatomy is a major aid for the authentication of drugs [21]. Microscopic evaluation is one of the simplest and cheapest methods for the correct identification of the source of the materials [22].

Transverse section of lamina showed the adaxial part has thick, short hump; the midrib and the adaxial hump have thin, angular epidermal cells. The upper part of adaxial hump has a few layers sclerenchyma cells. The inner layer of the adaxial midrib also has few layers of thick walled cells. The ground tissue consists of wide circular thin walled parenchyma cells with narrow inter cellular spaces. The vascular system of the midrib showed bi-collateral structure. Non glandular, profusely branched, thick walled, lignified epidermal trichome occurs as both on the veins and lamina.

The ash values are particularly important to find out the presence or absence of foreign inorganic matter such as metallic salts and or silica (earthy matter) [23]. Acid insoluble ash provides information about non-physiological ash produced due do adherence of inorganic dirt, dust to the crude drug [24]. Phytochemical evaluation and molecular characterization of plants is an important task in medicinal botany and drug discovery [25]. Preliminary phytochemical screening of appropriate solvent extracts showed the presence of alkaloids, sterols, tannins, proteins and amino acids, flavonoids, terpenoids, saponin, carbohydrates and absence of glycosides and volatile and fixed oil.

5. CONCLUSION

Solanum torvum has a wide range of therapeutically active phytochemicals which could be useful for treatment of various ailments. Many reports were done on screening of leaves of *Solanum torvum* both *in-vivo* and *in-vitro* exhibited its potency to cure diseases. No report available on quality assessment of leaves of *Solanum torvum*. Keeping in this view an attempt was made for standardization of purity and quality of therapeutically valuable leafy portion of *Solanum torvum* Sw.

Conflict of interest statement: We declare that we have no conflict of interest.

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