



Research Journal of Pharmaceutical, Biological and Chemical Sciences

Macroscopical and microscopical study of *Tecoma stans* Linn. Leaf

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ABSTRACT

Tecoma stans Linn. (Leguminosae) is an useful traditional plant used in the treatment of diabetes, yeast infection, syphilis. Leaves and flower have medicinal value for the treatment of various cancer. The plant is considered as an effective remedy for snake and rats bites and for scorpion sting, diuretic, vermifuge and tonic. Only a very limited research has been carried out on the plant, under the present study assumes singular significance and it is supposed to contribute a great deal to the existing literature. The present paper highlights the macroscopic and microscopic characters of leaf and petiole studies of the plant (leaves). These observations would be of immense value in the botanical identification and standardization of the drug in crude form. This study would help distinguish the drug from its other species.

Keywords: *Tecoma stans* Linn. Macroscopy, Microscopy, Leaf, Petiolule.

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INTRODUCTION

Tecoma stans Linn. is a shrub or small tree. It is a Central and South American tree that grows to 25 ft. Leaves opposite, odd-pinnate, up to 20 cm in length; leaflets 5 or 7 in number, lanceolate to oblong-lanceolate, 6-13 cm long, long and slenderly acuminate, base acute or acuminate, margins sharply serrate. Its primary applications have been in treating diabetes and digestive problem [1]. The present investigation has been undertaken with an objective to establish pharmacognostical standards for *Tecoma stans* Linn. leaf so that authentic plant material could be explored properly for its traditional claims.

MATERIALS AND METHODS

The fresh leaves of *Tecoma stans* Linn. were collected in the month of September from Tambaram, Chennai, India. These were identified, confirmed and authenticated by Prof.P.Jayaraman, PARC, Chennai. The voucher specimen was given the No.PARC/2007/83. Collected fresh leaves were washed and used for study of organoleptic and microscopic characteristics.

Macroscopy:

The plant is a shrub growing up to 6 m in height. It is usually grown in gardens and temples. The leaves are green in colour, slight bitter in taste and have no specific odour. The leaf is trifoliate; the leaflets are oblanceolate with serrate margins. The leaf on both adaxial and abaxial side is soft, lamina thin and membranous. The size of leaf is about 6.5-12 cm in length, 5-2.5 cm in wide [2].

Microscopy:

Fresh leaves of *Tecoma stans* Linn. were selected for the microscopical studies. Microscopic sections were cut on a microtome and by free hand sectioning. Numerous temporary and permanent mounts of the microscopical sections of the leaf specimen were made and examined microscopically. Histochemical reactions were applied with hydrochloric acid-phloroglucinol to reveal lignified elements, iodine-iodide for starch, Sudan IV for lipophilic substances, Dragendorff reagent for alkaloidal substances, ruthenium red for mucilage and ferric chloride for phenolic compounds [3].

Photomicrographs:

Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Nikon Labphot 2 Microscopic Unit. For normal observation bright field was used. For the study of crystal, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background. Magnification of

the figures is indicated by the scale-bars. Descriptive terms of the anatomical features are as given in the standard Anatomy books [4, 5].

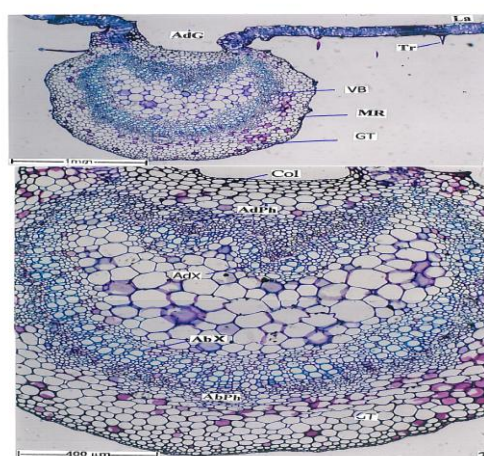
RESULTS AND DISCUSSION

Morphological characteristics

The leaves are green in colour, slight bitter in taste and have no specific odour. The leaf is trifoliate; the leaflets are oblanceolate with serrate margins. The leaf on both adaxial and abaxial side is soft, lamina thin and membranous. The size of leaf is about 6.5-12 cm in length, 5-2.5 cm in wide. **(Fig. a)**



(Fig. a)Entire leaf



(Fig. b-1, 2) Transverse section of leaf

(Fig. b-1, 2)Transverse section of leaf: **1)** T.S of leaf through midrib with lamina; **2)** T.S of midrib enlarged: Abph= Abaxial phloem, Abx= Abaxial xylem, Adg= Adaxial groove, Adph= Adaxial phloem, Adx= Adaxial xylem, Col= Collenchyma, GT= Ground tissue, La= Lamina, MR= Midrib, Tr= Trichome, VB= Vascular bundle

Microscopy

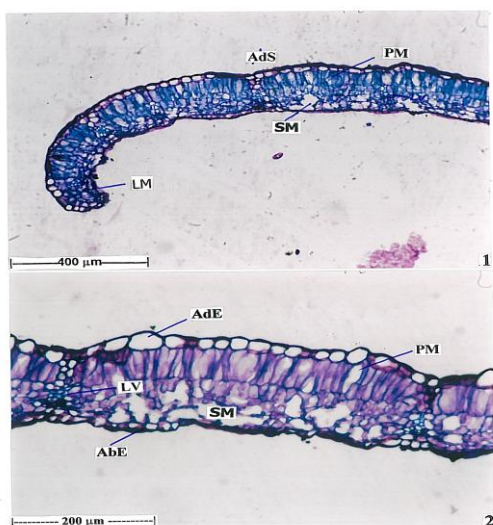
Transverse section of leaf: **(Fig. b-1, 2)**

The vascular system is quite prominent and occupies entire midrib. It consist of a wide deep bowl shaped main strand and a flat thick adaxial plate of strand .The adaxial plate and the abaxial bowl are more or less continues forming a cylinder **(Fig.b-1)**.

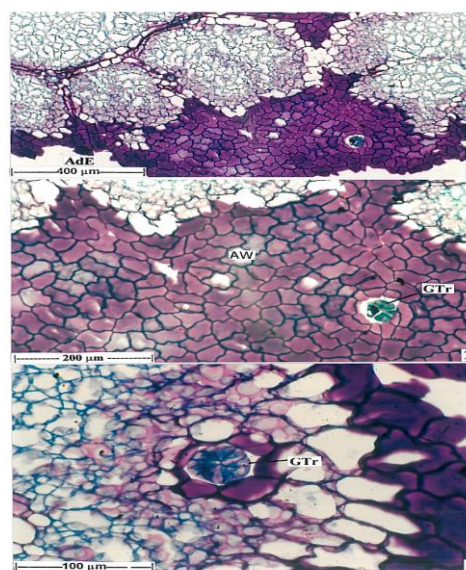
The xylem elements are in several parallel close rows. Phloem elements are small numerous groups, situated along the outer part of the xylem cylinder **(Fig.b-2)**.The xylem elements are angular, thin walled and there are three to five xylem elements in each row. The meta xylem elements are 40 µm wide. The abaxial zone of ground tissue is 250 µm in wide. Adaxial ground tissue is 150 µm in wide. The vascular cylinder is 150-250 µm thick.

Lamina (Leaf blade): (Fig. c-1, 2)

The lamina is smooth on both surfaces; it is slightly depressed at the region of the lateral veins. The margins are curved abaxially (**Fig. c-1**). The lamina is 130-150 μm thick. The adaxial epidermis is thick and prominent comprising of squarish or barrel shaped cells with prominent circle. The adaxial epidermis is 20-30 μm thick and the cells are squarish. The palisade tissue consists of an upper layer and lower layer of shorter cells. The palisade zone is 80 μm in height. The spongy parenchyma has 3 or 4 layer of lobed loosely arranged cells enclosing wide air chamber. The vascular bundles the lateral veins are situated in the lower part of the lamina. They surrounded by a thin layer of parenchyma cells which extend into adaxial vertical pillar of cells.



(Fig. c-1, 2) Lamina (Leaf blade)



(Fig .d-1, 2, 3) Epidermal tissue

(Fig. c-1, 2) Lamina (Leaf blade):1) T.S of leaf margin; 2) T.S of lamina through lateral vein: AbE= Abaxial epidermis, AdE= Adaxial epidermis, AdS= Adaxial side, LM= Leaf margin, LV= Lateral vein, PM= Palisade mesophyll, SM= Spongy mesophyll

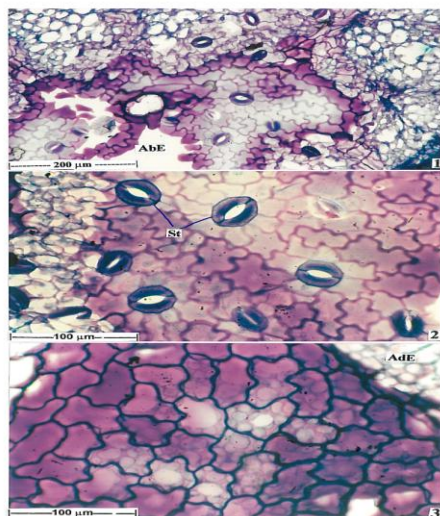
(Fig .d-1, 2, 3) Epidermal tissue: 1) Adaxial epidermis under low magnification; 2) Adaxial epidermis with glandular trichome; 3) Glandular trichome and palisade cells enlarged: AdE= Adaxial epidermis, AW= Anticlinal wall, GTr= Glandular trichome.

Epidermal tissue: (Fig.d-1, 2, 3)

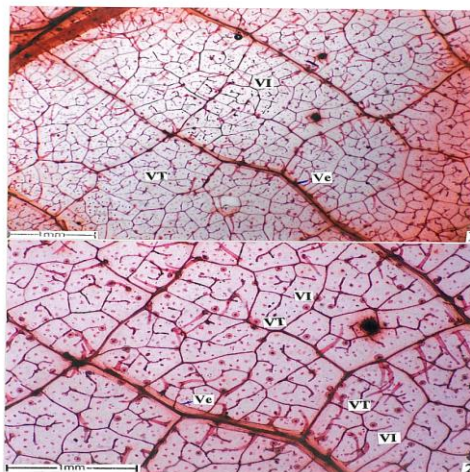
Adaxial epidermis is apostomatic (without stomata).The epidermal cells are polyhedral and randomly oriented. Their walls are slightly wavy and thick (**Fig. d-1, 2**).Some of them are amoeboid in shape. In the surface view of the epidermis are seen shallow circular cavities in which occur the glandular trichome. The gland are seen in their aerial view, they are circular. Dark stained and multicellular with triangular radiating cells (**Fig.d-3**).

Abaxial epidermis: (Fig .e-1, 2, 3)

The abaxial epidermis is stomati ferous the stomata are actinocytic. Each stoma has 5-10µm, wedge shaped radiating subsidiary cells all around the guard cells (**Fig, e-1, 2**).The guard cells are elliptic with wide opening. The stomata are 30-35 µm in long and 30 µm wide.



(Fig .e-1, 2, 3) Epidermal tissue with stomata



(Fig-f-1, 2) Venation pattern

(Fig .e-1, 2,3) Epidermal tissue with stomata: 1) Abaxial epidermis with stomata; 2) Same as above enlarged; 3) Adaxial epidermis: AbE= Abaxial epidermis, AdE= Adaxial epidermis, St=Stomata.

(Fig-f-1, 2)Venation pattern: Vein-islet and vein-termination under low magnification, Ve= Vein, VI= Vein-islets, VT= Vein-termination, CTr= Covering trichome, GTr= Glandular trichome.

Venation pattern: (Fig-f-1, 2)

The major lateral veins are thick, whereas the veinlets are uniformly thin and distinct. (**Fig. f-1, 2**). Scattered on the abaxial epidermal layer as seen numerous circular, peltate glandular trichomes. The trichome has a short central stalk, and a thin plate of glandular cells. The trichomes are random in distribution.

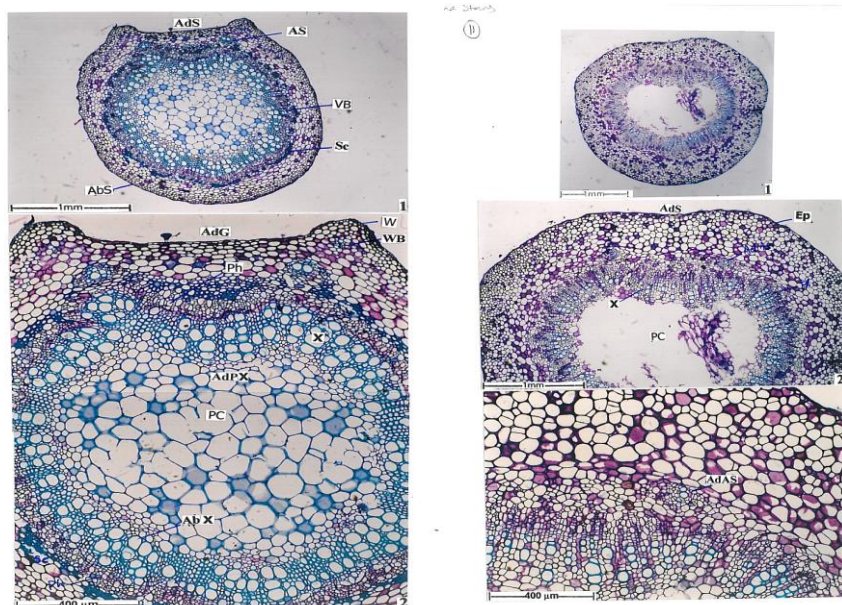
The vein lets are large and distinct. They are polygonal input line. The islet has one or occasionally two vein termination. Most of the vein terminals long, slender and branched into dendroid termination. Some of the termination are short and poorly branched (**Fig.f₂-1, 2**).

Petiolule (stock of the leaflet): (Fig.g-1, 2).

In cross sectional out line, the petiolule is circular with shallow adaxial concavity and two lateral short wings (**Fig.g-1**).The epidermis is thin and less conspicuous comprising of narrowly tabular cells. The outer zone of ground tissue is collenchymatous and four or five layered. The remaining part is parenchymatous, the cell elliptical, compact and thick walled.

The vascular system consist of a deep pot-shaped out line of xylem and phloem with an adaxial curved plate of numerous radical row of xylem tissue in which wide, thin walled vessel occur in radial multiples. The xylem consists of thick walled lignified fibers. Phloem occurs in wide continuous zone along this outer boundary of the xylem. It consists of fairly distinct phloem rays and narrow rows of sieve elements (**Fig.g-2**).

Within the adaxial wings, small circular vascular strands are seen. These wings bundles are not prominent; they have a few clusters of xylem elements and a small group of phloem (**Fig.g-1**).In central part of the petiolule has wide, thin walled compact parenchyma cells.



Petiolule (stock of the leaflet) (Fig-g.1, 2).

Rachis (Petiole) (Fig-h.1, 2, 3)

Petiolule (stock of the leaflet) (Fig-g.1, 2): 1) T.S of petiolule ground plan; 2) T.S of petiolule enlarged: AbS= Abaxial side, AbX= Abaxial xylem, AdG= Adaxial groove, AdS= Adaxial side, AS= Accessory strand, AdX= Adaxial xylem, PC= Parenchyma cells, Ph= Phloem, Sc= Sclerenchyma, VB= Vascular bundle, W= Wings, WB= Wing bundle, X= Xylem

Rachis (Petiole) (Fig-h.1, 2, 3): 1) T.S of rachis ground-plan,2) T.S of rachis half-portion enlarged; 3) Vascular system and parenchymatous tissue enlarge: AdAS= Adaxial Accessory strand, AdS= Adaxial side, Ep= Epidermis, Pc= Pith cavity, X=Xylem.

Rachis (Petiole) (Fig.h-1, 2, 3)

It consist of a thin inconspicuous epidermal layer followed by outer zone of small compact collenchyma cells and inner zone of layer, circular parenchyma cells (**Fig.h-2**). Central part of the rachis is hollow due to disintegration of cells. The vascular cylinder is hollow and thin. It consist of radial rows of vessels with inter veining rays of parenchyma, (**Fig.h-3**). The vessels are thick walled, wide, angular and are arranged in radial multiples. Phloem occurs in

small clusters distributed all around the xylem cylinder. The vessels are 10-50 μ m in diameter the vascular cylinder including phloem phloem is 35-40 μ m.

Apart from main vascular cylinder there are two small circular accessory strands, one on either side of adaxial part (**Fig.h-3**). These adaxial accessory strands have two or three xylem elements surrounded by phloem.

Powder microscopy

The powder microscopy character shows the venation pattern. The fragments have fairly large vein-islets of varying shape. Trichomes are fairly abundant in the powder. There are two types of trichomes; (a) nonglandular (covering) trichomes are abundant along the veins and the lamina surface. They are multicellular, uniseriate and unbranched; (b) glandular trichomes are seen in the powder. Stomata are seen in the epidermal fragments.

CONCLUSION

In the last two decades of the century the scientists are sincerely trying to evaluate many plant drugs used in traditional system of medicine. The pharmacognostical study is one of the major criteria for identification of plant drugs. The present study on pharmacognostical characteristics of *Tecoma stans* Linn. leaf will provide useful information for its correct identity. The leaves are greenish with a smooth texture and possess no odour. The leaflets are oblanceolate with serrate margin. The vascular system is quite prominent and occupies entire midrib. It consists of a wide deep bowl shaped main strand and a flat thick adaxial plate of strand. The xylem elements are in several parallel close rows. Phloem elements are small numerous groups, situated along the outer part of the xylem cylinder. The xylem elements are angular, thin walled and there are three to five xylem elements in each row. The lamina is smooth on both surfaces; it is slightly depressed at the region of the lateral veins. Adaxial epidermis is apostomatic (without stomata). The abaxial epidermis is stomatiferous the stomata are actinocytic. The trichome has a short central stalk, and a thin plate of glandular cells. These observations would be of immense value in the botanical identification and standardization of the drug in crude form.

ACKNOWLEDGEMENT

The authors are thankful to Prof.P.Jayaraman, Director, Plant Anatomy Research Centre, Tambaram, Chennai, India for authenticating the plant material and for his critical suggestions and helps in understanding the anatomical features.

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