

Pharmacogenostical studies on Aerial Parts of *Toddalia Asiatica* Var. *gracilis* (L.) Lam.

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ABSTRACT: *Toddalia asiatica* var. *gracilis* (L) Lam is a commonly used medicinal plant in Indian system of Medicine. A detailed pharmacognostic study on the aerial parts of the medicinal plant is presented. Physico-chemical microscopical and fluorescent characteristics have been described. Qualitative phytochemical tests have also been carried out and the results presented.

INTRODUCTION

Toddalia asiatica var. *gracilis* (L) Lam., (Family –Rutaceae) known as “Milakarani” in Tamil, ‘Kanchana’ in Sanskrit, ‘Kanj’ in Hindi, is commonly used in Indian systems of medicine like Ayurveda and siddha for malaria, rheumatism and fever (Kirtikar and Basu, 1933; Chopra et al., 1956). Fruits are eaten for relief from burning sensation in stomach. (Ramachandran and Nair, 1981). Leaf and root is used to cure rheumatic swellings, fever pain in the bowels. This therapeutic value is due to the presence of coumarins (Bandara et al., 1990).

Two varieties of *toddalia asiatica*, viz var. *gracilis* and var. *floribunda* are found in the west and southern parts of India. Plants of var. *gracilis* are generally found in denuded slopes. Waste lands and lower hill whereas that of var. *floribunda* found grown only on high altitudes.

Several compounds were isolated from *T. asiatica* Alkaloids like Dihydrochelerythrine and berberin obtained from *T. asiatica* (Syn.t.aculeata pers). (Pakrashi and Bhattacharyya, 1965). Stem yield compounds like toddalinine, robustine,

skimmianine, dictamnine, bergapten, luvangetin and isopimpinelline. (deshmukh et al., 1976); Coumarins, fatty acid esters, β -sitosterol, alkaloids and some other compounds (Reis and Strobel, 1982). Steam distillates from the leaves of *T. asiatica* shows high antifungal activity against *Cladosporium cladosporioides* and cause mortality of the aphid (Bandra et al., 1990). Though many phytochemical and pharmacological works were carried out on *T. asiatica* no pharmacognostical work is recorded yet and there was no mention in the previous works about the variety on which the works were based. Hence the present investigation is undertaken with a view to bring out all the diagnostic pharmacognostic characteristics of both varieties of *T. asiatica* and this being the first phase of work on aerial parts of *T. asiatica* var. *gracilis*.

MATERIALS AND METHODS

Aerial parts like stem, petiole and leaf of *T. asiatica* var. *gracilis* were collected from plants grown in Herbal garden. Tamil university, Thanjavur. Stem, petiole and leaves were fixed in FAA. Customer

microtoming were done and sections were stained in safranin-fast green (Johanson, 1940) Physico chemical test of the samples were carried out according to Ka (1938), and fluorescent characters of the powdered drugs were analysed by the method of Kokoski et al., (1958). Qualitative phytochemical tests of the samples were also carried out following the method of Peach and Tracy (1955).

MACROSCOPICAL CHARACTERS

T. asiatica var. *gracilis* is a profusely armed, branched straggler, 4 to 6 M in height, prickles recurved. Leaves trifoliate, leaflets sessile, lanceolate – elliptic (3-6 x 1-1.5cm), thin coriaceous, base narrow, cuneate, margin entire, apex obtuse or acute, nerves obscure, >15 pairs, mid vein spin below petiole to 2.5cm prickled. Male inflorescence in axillary racemes or panicles to 6cm peduncle 2.5-5cm armed solitary or paired. Flowers 4mm across. Sepals small, petals cream 3x1.5mm, glandular, Stamen 3mm. Female inflorescence in racemes or panicles to 5cm. peduncle 1-2cm, unarmed. (Plate I).

MICROSCOPICAL CHARACTERS:

Stem:

T.S of stem (Plate II Fig 1&2) reveals the following ones: epidermis, hypodermis, cortex, pericycle, vascular cylinder and pith. Epidermis is made up of single layered oval shaped parenchyma cells. Epidermal cells have resinous contents. Epidermis is covered by thick cuticle. Few unicellular trichomes and stomata are present in the epidermis. Hypodermis is present which is single layered and consists of large sized parenchyma cells devoid of cell contents. Spine is the extension of cortex and is made up of 5 layers of sclerenchyma and 8 layers

of parenchyma cells (Plate II, Fig 3). Hypodermis and chlorenchyma cells are absent in this region. Endodermis is not distinct. Pericycle consists of one or two layers of sclerenchyma cells and arranged in a discontinuous ring. Endarch xylem is present. Vessels are arranged in radial rows. Phloem consists of phloem parenchyma, fibres, sieve-tube and companion cells. Uni or biseriate rays are present.

The isolated xylem elements (Plate II Fig 4), reveals vessels, tracheids and fibres. Vessels are cylindrical to barrel shaped with tapered ends, some have blunt tips. Vessels in the young stem have simple pits and that in mature stem have bordered pits. The pits are arranged in scalariform manner. Perforation plate is simple. Minimum, mean and maximum dimensions of vessels are 210x40 μ - 408x53 μ -460x75 μ . Tracheids are short with blunt as well as tapering ends and the pits are bordered. Average size of the tracheid is 341x28 μ . (Range: 250x20v-341x28 μ - 470x40 μ) Fibres are long with narrow lumens. Minimum, mean and maximum size of the fiber is 410x10 μ - 610x14 μ -970x25 μ (Table I).

Petiole:

Petiole in TS is spherical in shape with two wings and a central ridge on the adaxial side (Plate II, Fig 5). The following zones are visible in the petiole: epidermis, hypodermis, cortex, central vascular cylinder and pith. The epidermis is single layered covered by a thin layer of cuticle. The epidermal cells are small and oval shaped and contains resinous contents. Multicellular uniseriate (Plate II, Fig 6) and glandular trichomes are present in the epidermis. The stalk of the glandular trichomes are uniseriate. Single layered hypodermis is present and consists of barrel shaped large parenchyma cells.

The cortex consists of 2-3 layers of chlorenchyma cells followed by 5 to 6 layers of polygonal parenchyma cells. Tannin and sand crystals are present in the parenchyma region. Secretary cavity is observed in the peripheral region of the cortex. Few tanniferous cells are present in the inner region of the cortex. Endodermis and pericycle are not distinct. Vascular tissues are arranged in closed cylinder, collateral and is hemispherical in shape. Xylem is endarch (Plate II, fig &). Pith consists of large thin walled parenchyma cells. Some of the cells have tanniferous contents.

Leaf:

TS of leaf reveals (Plate II, Fig 8) epidermis, hypodermis, cortex and centrally located vascular cylinder, in the mid-rib region and epidermis, palisade layer and spongy layer in the laminal region. The leaf is covered on both surfaces by a single layered epidermis consisting of oval shaped parenchyma cells, Epidermal cells have resinous content. In the adaxial side the epidermal cells are larger than that of abaxial side. Cuticle is present. Anamocytic stomata is present in the lower epidermis only. Multi-cellular glandular trichomes (Plate II, fig 9) are present on both surfaces. The stalk of the glandular hair is uniseriate. A single layer of hypodermis is present in the mid-rib region and the cells are oval shaped and larger in size. Two layers of chlorenchyma cells are present in the outer most region of the mid-rib. In the mid rib, cortex consists of 6-9 layers of parenchyma cells which are polygonal in shape. Endodermis and pericycle are not distinct. Centrally located vascular cylinder consists of endarch xylem consists of radial arranged vessels and tracheids and the phloem consists of sieve

tube and companion cells. Pith is very narrow and parenchymatous.

The mesophyll tissue is differentiated into palisade and spongy parenchyma. The palisade cells are single layered and compactly arranged (Plate II, Fig 9). The spongy cells are located on the abaxial side. They are elongated and polygonal in shape and arranged loosely with large intercellular spaces. Rosette crystals of calcium oxalate are found in the spongy cells. Both palisade and spongy parenchyma cells have enormous amount of chlorophyll. Secretary cavities are present on the adaxial side and on flanks of the lamina.

Leaf epidermal peelings shows presence of anamocytic stomata on the lower epidermis (Plate II, Fig 11&12). Average stomatal number is 14 and stomatal index is 9.4. Vein islet and veinlet termination number is 4 and 3 respectively. Minimum, mean and maximum values of palisade ratio is 4-6-9. (Table II).

Physico-Chemical characters:

The physico-chemical characters of air-dried powders of stem and leaves are given in Table III. Total ash value is higher in the stem and acid insoluble value is higher in leaves. The percentage of extractive values in different solvent except chloroform is greater for stem than that for leaves. Extractive value in chloroform is more or less equal for both stem and leaf. Colour characteristic of crude powders of the stem and leaf in different solvents in visible and fluorescent light are given in table IV.

Preliminary phytochemical test of the stem and leaf (Table V) reveals the presence of alkaloids, reducing sugar, glycoside, phytosterol, phenol, saponin and fixed oil.

Plate:I

A flowering twig of *Toddalia asiatica* var. *gracilis*.

Plate:II

- Fig1 : TS of stem.
- Fig2 : TS of stem – A portion enlarged
- Fig3 : TS of Spine.
- Fig4 : Isolated elements from stem (Diagrammatic)
- Fig5 : TS of Petiole.
- Fig6 : TS of Petiole – A portion showing trichome
- Fig7 : TS of petiole – A portion enlarged
- Fig8 : TS of leaf.
- Fig9 : TS of leaf – Enlarged laminal region
- Fig10 : TS of leaf – enlarged mid-rib region
- Fig11 : Leaf epidermal peeling –Upper surface (Diagrammatic)
- Fig12 : Leaf epidermal peeling –Lower surface (Diagrammatic)

Abbreviations used:

- SC - Secretary cavity
- Tr - Trichome
- GTr - Glandular trichome.

Table -1
Dimensions of Different types of cells in the aerial parts of Toddalia Asiatica Var. Gracilis.

Types of cell	Dimension (Minimum, Average & maximum values in microns)		
	Stem	Petiole	Leaf
Epidermis	10x10-15x10-20x10	10x10-15x15-20x15	10x10-20x10-35x25
Hypodermis	10x10-12x10-20x15	10x10-15x10-25x10	15x10-20x15-25x20
Chlorenchyma	10x10-17x10-25x10	20x10-25x20-30x30	10x15-20x15-25x15
Parenchyma	15x10-22x20-30x20	20x15-35x25-50x40	20x20-30x20-40x25
Secretary cavity	60x60-70x70-90x80	60x60-70x70-100x90	50x60-70x60-90x80
Palisade	-	-	30x10-40x15-50x20
Spongy	-	-	10x10-25x10-35x20
Vessel	210x40-408x53-460x75	-	-
Tracheid	250x20-341x28-470x40	-	-
Fibre	10x10-610x14-970x25	-	-

Table II
Stomatal number, stomatal index, vein islet number, veinlet termination number and palisade ratio of leaf of toddlia asiatica var gracilis.

Leaf	Lower surface	Upper surface
Stomatal number	11-14-17	Nil
Stomatal index	7.3-9.4-12.5	Nil
Vein islet number	4-4.7-7	
Veinlet termination number	1-3.8-6	
Palisade ratio	4-6-9	

Table : III
Physical constants of stem and leaf of Toddalia Asiatica var. Gracilis.

Values	Percentage	
	Stem	Leaf
ASH Values		
Total ash	1.64	1.60
Acid insoluble ash	024	3.07
<u>Extractives</u>		
Petroleum ether	8.86	3.76
Benzene	14.86	578
Chloroform	4.82	4.00
Ethanol	34.58	12.94
Water	46.00	12.96

Table: IV Fluorescent analysis of stem and leaf of Toddalia Asiatica var Gracilis.

Treatment	Colour characteristics			
	Visible light		UV light	
	Stem	Leaf	Stem	Leaf
Powder as such	Yellow	Green	Yellowish Green	Yellowish Green
Powder + Water	Grey	Green	Yellowish Green	Dark Green
Powder + 1 N NaoH Yellow in water	Yellow	Green	Greenish Yellow	Green
Powder + 1N NaoH in ethanol	Green	Green	Green	Greenish Yellow
Powder + 1NHcl	Brown	Yellowish Green	Yellowish Green	Fluorescent green
Powder + 50% Hcl	Brown	Yellowish Green	Yellowish Green	Green
Powder + 50% H2So4	Dark green	Green	Dark green	Yellowish Green

**Table : V
Qualitative Phytochemical tests on stem and leaf of Toddalia Asiatica var. Gracilis**

Tests for	Petroleum ether		Benzene		Chloroform		Ethanol		Water	
	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf
Alkaloid	-	-	-	-	+	-	++	++	++	-
Reducing sugar	-	-	-	-	-	-	++	++	++	++
Glycoside	-	-	-	-	-	-	++	++	++	-
Phyto sterol	-	-	-	-	++	++	-	-	++	-
Phenol	-	-	-	-	-	-	++	-	++	-
Saponis	-	-	-	-	-	-	++	+	-	+
Fixed oil	++	++	+	++	-	-	-	-	-	-

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