

A CONTRIBUTION TO THE ANATOMY OF *TINOSPORA CORDIFOLIA* (WILLD) MIERS

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The macroscopic and microscopic characters of the stem and leaf of *Tinospora cordifolia* (Willd) Miers, are described.

The stem is characterised by the presence of a brownish, scaly periderms. There is also a complete ring of sclerenchymatous pericycle encircling the vascular region. Secretory sacs and idioblasts are scattered in the cortex and pith. The vascular bundles retain their separate entity even after secondary growth. The medullary rays are very broad. Vessels are small in length but large in diameter.

The petiole structure differs in different regions. In the basal part it resembles the young stem in having a ring of sclerenchymatous pericycle, while in the upper distal part the pericycle is altogether absent. Leaf shows a typical bifacial structure with a small amount of collenchyma in the midrib. The vascular bundle is enclosed in a bundle sheath. Idioblasts and secretory sacs like stem are also present in the spongy parenchyma.

Introduction

Tinospora cordifolia (Willd) Miers belongs to the family *Menispermaceae*. It is a climbing dioecious vine, distributed throughout the tropical parts of Indo-Pakistan subcontinent. It is often found cultivated.¹ Stem is bitter, stomachic, antiperiodic, antipyretic and when made into an infusion, used as alterative and aphrodisiac. Starch from stem and root is used as a nutrient, in chronic diarrhoea and chronic dysentery. The juice of fresh plant has diuretic properties and is useful in gonorrhoea. Berberine, crude gilonin and giloinine are the chemical substances reported from it.² In the Philippines and Malaya the vine is considered to be a universal medicine. It is commonly prescribed as an aqueous extract in the treatment of stomach trouble, indigestion, diarrhoea, as a tonic in the treatment of ulcer, and as a cure for rheumatism and flatulence in children. It is also used as a febrifuge, vulnerary for itches, internally as an antimalarial agent and externally as a parasiticide.³ The anatomy of this important medicinal plant has not been worked out previously.

Botanical Description

The plant is a dioecious vine reaching a height of 4-10 meters (Fig. 1). The bark is corky and the shoots are glabrous. The leaves are 5-10 cm. in diameter, alternate, acute or acuminate. The petiole is 4.5-7.5 cm. long. Racemes exceeding the leaves, axillary, terminal or on the old wood.¹

Material and Methods

The material used in the present study was collected from the cultivated plants growing in the experimental farm of North Regional Labora-

tories, P.C.S.I.R., Peshawar. The methods employed for the fixation, dehydration, embedding, microtome sectioning etc. were the same as described previously.⁴ For maceration of the material and also for the microchemical tests the previous procedure was employed.

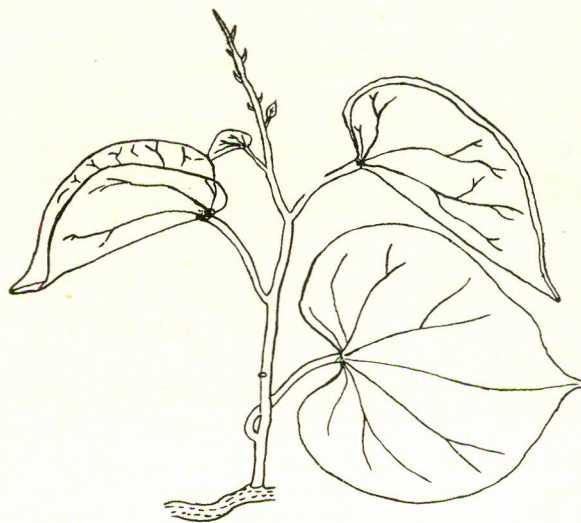


Fig. 1.—Shoot of *Tinospora cordifolia*.

Anatomy of the Stem

The young stem is green, while the older one is brownish green. In the older stem brownish scaly periderm is sloughed off. The stem is somewhat fleshy with scattered protuberances. Leaf scars occur on the stem. The arrangement of leaf is alternate. The stem is slightly odourous and bitter in taste.

In transverse sections (Fig. 2), the stem shows a single-layered epidermis of rectangular cells,

These cells measure $25\mu-45\mu-60\mu$ in length and $15\mu-25\mu-33\mu$ in breadth. Later the continuity of the epidermis is broken by the formation of phellogen. The phellogen gives rise to phellem on the outer side and phelloderm towards the inner

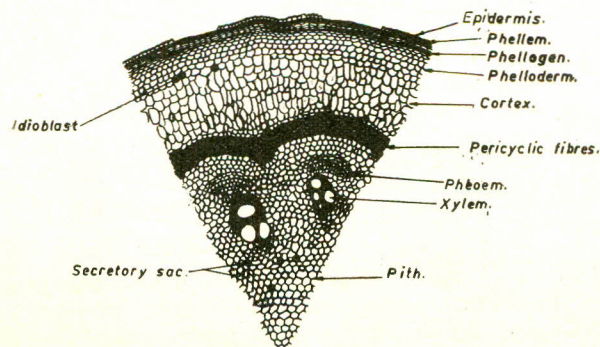


Fig. 2.—T. S. Stem of *Tinospora cordifolia*.

side. The cork cells measure $35\mu-50\mu-80\mu$ in diameter in surface view. (Fig. 3a). Below the periderm is the cortical region. The cortical cells are polygonal and parenchymatous (Fig. 3b). They are $35\mu-55\mu-85\mu$ in diameter. Within the cortex a large number of secretory sacs and idioblasts are scattered irregularly. The secretory sacs are elongated cells with yellowish or brown contents (Fig. 3j). The idioblasts occur in chains (Fig. 3c) and contain crystals.⁵ The cortical region is separated completely from the stellar region by a continuous ring of sclerenchymatous pericycle. The pericycle is multicellular in thickness and its sclerenchymatous fibres are thick-walled and pointed (Fig. 3f). These pericyclic fibres measure about $425\mu-1000\mu-1400\mu$ in length and $15\mu-20\mu-30\mu$ in width.

The vascular bundles are collateral and the phloem is only on the outer side (Fig. 2). The vascular bundles are embedded in the pith. The phloem tissues are only a few cells in thickness and consist of sieve tubes and phloem parenchyma. Only a very limited amount of secondary phloem is formed due to the activity of vascular cambium. The bundles retain their separate entity even after secondary growth. These bundles are separated by pith cells and very broad medullary rays.

The xylem consists of vessels, tracheids, fibres and xylem parenchyma (Fig. 3h). The vessels have annular, spiral, scalariform and pitted thickenings (Fig. 3e). The metaxylem vessels have large diameters. The vessel perforations are simple. These measure about $120\mu-205\mu-320\mu$ in length and $30\mu-90\mu-125\mu$ in diameter. The tra-

cheids have annular, spiral, scalariform or pitted thickenings (Fig. 3d). These measure about $245\mu-430\mu-900\mu$ in length and $20\mu-25\mu-35\mu$ in breadth. Xylem fibres are thick-walled with pointed ends (Fig. 3g). Some xylary fibres are also branched, and measure about $400\mu-900\mu-1200\mu$ in length and $15\mu-25\mu-35\mu$ in width.

The pith cells are polygonal and parenchymatous (Fig. 3i). Secretory sacs and idioblasts are also dispersed irregularly in the pith. These cells measure about $35-70-100\mu$ in diameter.

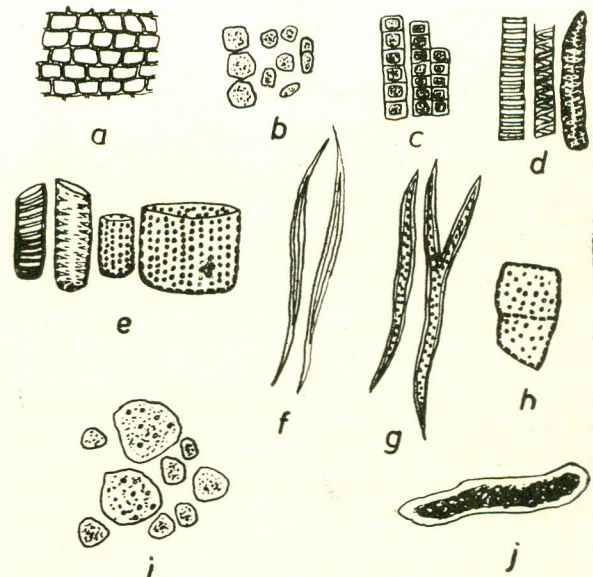


Fig. 3.—Macerate stem of *Tinospora cordifolia*, (a, cork cells; b, cortical cells; c, Idioblast; d, Tracheids; e, Vessels; f, Pericyclic fibres; g, Fibre; h, Xylemparenchyma; i, Ground tissue; j, Secretory sac.

Anatomy of the Leaf

The leaves are alternate, ovate, thin, 6-12 cm. in length and 7-12 cm. in width, with pointed end and truncate or somewhat cordate base, smooth and shining. The petiole is long, slender and green. The lower basal and distal part of the petiole is swollen.

Petiole.—A transverse section cut from the different portions of the petiole shows different structures (Fig. 4). A section cut from the lower swollen portion resembles that of the young stem in having a complete ring of sclerenchymatous pericycle, while in the middle portion the pericycle is not well differentiated. Sclerenchymatous pericyclic ring does not occur in the upper portion.

A transverse section of the distal part of petiole shows a single-layered epidermis (Fig. 5a). The epidermal cells measure 25-40-60 μ in diameter.

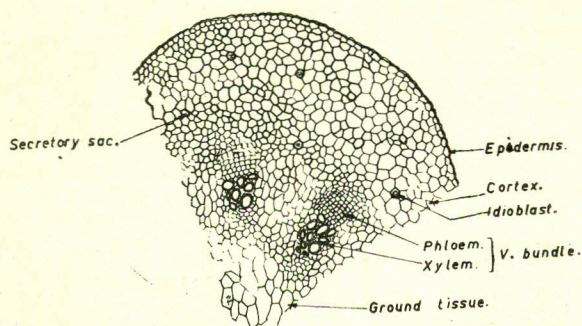


Fig. 4.—T. S. petiole of *Tinospora cordifolia*.

Below the epidermis is the cortical region composed of polygonal and parenchymatous cells, measuring 30 μ -60 μ -95 μ in transverse section. (Fig. 5b). In between the cortical cells are secretory sacs and idioblasts which resemble scattered those of the stem. (Fig. 5e and h).

The vascular region is not delimited from the cortex by the endodermis or pericycle. The vascular bundles are collateral and arranged in a ring (Fig. 4). The phloem consists of sieve tubes and phloem parenchyma. The xylem consists of vessels, tracheids, fibres and xylem parenchyma. Vessels are mostly with annular or spiral thickenings, while some are pitted (Fig. 5d). The vessel perforations are simple, and measure about 125 μ -170 μ -300 μ in length and 25 μ -45 μ -70 μ in width. Tracheids have annular or spiral thickenings and measure 260-600-800 μ in length and 15-20-30 μ in width (Fig. 5g). Fibres are thick-walled and elongated with pointed ends (Fig. 5c). Xylem parenchyma cells are thick-walled and pitted. Pith is composed of parenchymatous cells measuring 40-70-130 μ in diameter (Fig. 5f).

Lamina.—A transverse section of the leaf lamina shows a typical bifacial structure (Fig. 6). The epidermis is one-layered with rectangular cells and covered by a cuticle (Fig. 6). Stomata are seen only in the lower epidermis (Fig. 7a), while absent in the upper (Fig. 7b). It has also no characteristic structure.⁵ The epidermal cells are covered with two types of trichomes: small unicellular and uniseriate multicellular hairs. The cells of the upper epidermis measure 30-55-70 μ while those of the lower epidermis measure 20-50-60 μ in diameter.

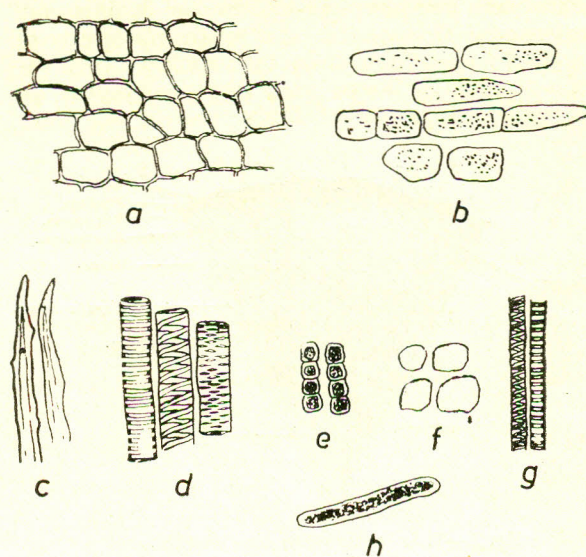


Fig. 5.—Macerate of Petiole of *Tinospora cordifolia* a, Epidermis; b, Cortical parenchyma; c, Fibres; d, Xylem vessels; e, Idioblast; f, Ground tissue cells; g, Tracheids; h, Secretory sac.

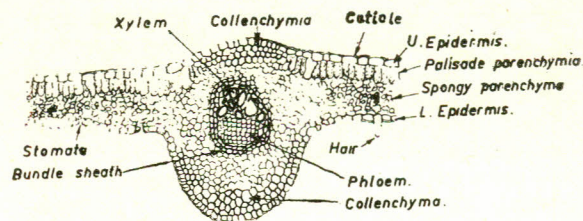


Fig. 6.—Leaf of *Tinospora cordifolia*,

Beneath the epidermis, a band of collenchyma occurs in the region of midrib, while in the other parts, occurs a single-layered palisade parenchyma. The palisade cells contain chloroplast (Fig. 7c) and the cells measure 30-40-50 μ in length. Below the palisade parenchyma many-layered spongy parenchyma of rounded or polygonal cells occur. Calcium oxalate crystals are also present in the mesophyll tissues. Intermingled in between the spongy cells are the secretory sacs and idioblasts (Fig. 7g), which resemble those of the stem and petiole.

There is only single vascular bundle in the midrib region. Small bundles also occur in the veins. The large bundle of the midrib is collateral, and is surrounded by a sheath. The bundle sheath is two-to three-layered in thickness, and its cells are thin-walled and parenchymatous. The phloem occurs towards the lower side and is com-

posed of sieve tubes and phloem parenchyma cells. The xylem consists of vessels, tracheids, fibres and xylem parenchyma cells. Tracheids are with annular, spiral or pitted thickenings (Fig. 7f) and measure 200-300-445 μ in length and 15-20-35 μ in breadth.

The vessels are with simple perforations and measure 115-140-300 μ in length and 35-50-60 μ in breadth (Fig. 7d). Fibres are elongated, thickwalled and pointed (Fig. 7e). Some branched fibres are also seen, and measure approximately 300-700-1100 μ in length and 15-20-35 μ in diameter. Xylem parenchyma is thick-walled and pitted.

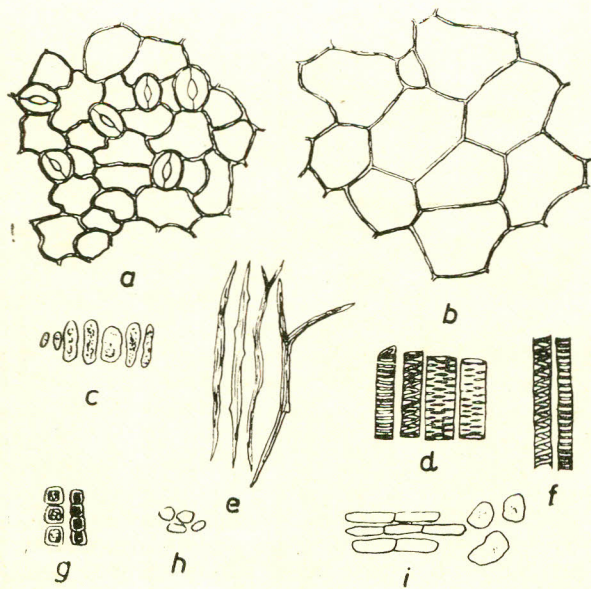


Fig. 7.—Macerate leaf of *Tinospora cordifolia* a, Lower epidermis; b, Upper epidermis; c, Palisade cells; d, Xylem vessels; e, Fibres; f, Tracheids; g, Idioblast; h, Spongy parenchyma; i, Cortical cells.

Microchemical Tests.—Microchemical tests have shown the presence of alkaloids in both the stem and leaf and that of proteins in the stem and veins of the leaf. Mesophyll cells of the leaf contain calcium oxalate crystals. Starch is present in all the regions of the stem.

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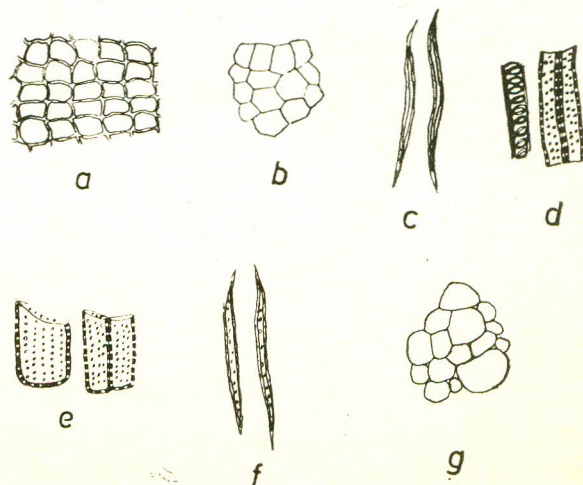


Fig. 8.—Powder stem:—*Tinospora cordifolia* a, Cork cells; b, Cortical cells; c, Pericyclic fibres; d, Tracheids; e, Vessels; f, Fibres; g, Ground tissues.

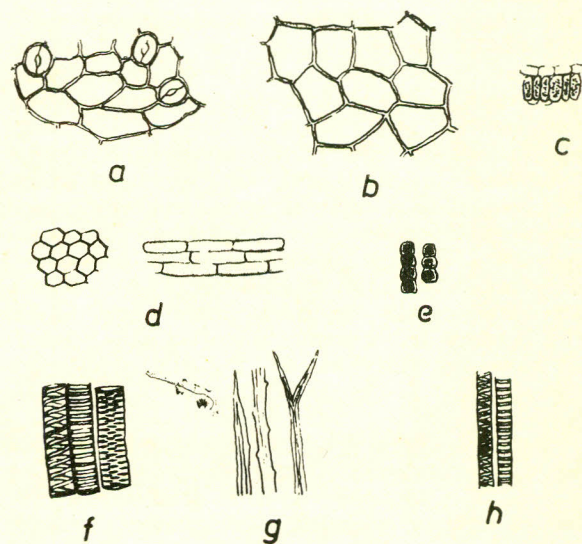


Fig. 9.—Powder leaf of *Tinospora cordifolia* a, Lower epidermis; c, Palisade cells; d, Cortical parenchyma; e, Idioblast; f, Broken Xylem vessels; g, Fibres; h, Tracheids.

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