

## PHARMACOGNOSTIC STUDY OF THE STEM AND LEAF OF PAEDERIA FOETIDA LINN.

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A taxonomic description, and the macroscopy and microscopy of the stem and leaf of *Paederia foetida* Linn. used in the indigenous systems of medicine are described. The diagnostic microscopic feature of the leaf are: presence of clustered acicular crystals in the long sausage shaped cells in the mesophyll, spirally thickened tracheids in the mesophyll and uniseriate hairs on the upper epidermis. Usually there are two to three layers of hypodermis in the petiole. The stomata which are mostly found in the lower side of the leaves are accompanied by two subsidiary cells which are placed parallel to the pore. The stem is characterised by the presence of uniseriate epidermal hairs. Two to three layers of stone cells or sclereids which constitute the pericyclic fibres are present below the endodermis. Xylem bundles are simply collateral type and the vessels usually consist of simple perforations. Pith cells contain acicular crystals. Fat bodies, mucilage and resin are present in the leaves and in stipular sheaths.<sup>1</sup>

### Introduction

*Paederia foetida* Linn: (Bengali: Gandhabhadulia; Hindi: Gandhali; Somraj; Urdu: Gandhana) belongs to the family *Rubiaceae*. The word "Paederia" has been derived from the Latin word "Pædor" meaning bad smell and the word "Foetida" also conveys the same meaning i.e. an offensive or stinking smell. According to Hooker,<sup>2</sup> the plant is distributed from the Central and Eastern Himalaya ascending to 5000 ft. southward to Malacca. This plant is also commonly available in West Bengal, East Pakistan and in Assam.

The plant *Paederia foetida* is a slender twining shrub, foetid when bruised, branches terete, flexuous, leaves 2-6" by  $\frac{3}{4}$ -2 $\frac{1}{2}$ ", opposite, ovate, acute, base cordate, nerves 4-5 pairs fine, petioles  $\frac{1}{2}$ -1" long. Stipules in trapetiolar with shaggy hairs, ovate-lanceolate, bifid deciduous. (Plate I, Fig. 1). Panicle 2-6" long, puberulous. Flowers violet, shortly pedicelled in slender trichotomous often scorpioid cymes, calyx small, tube campanulate. Corolla  $\frac{1}{2}$ - $\frac{2}{3}$ " tomentose. Fruits  $\frac{1}{4}$ - $\frac{2}{3}$ " polished, crowned by conical disk and minute calyx-teeth. The stem and the leaf of the plant are used medicinally in the indigenous systems of medicine both in Ayurvedic and Unani systems.<sup>3-4</sup> Soup prepared from the leaves is considered a good remedy for diarrhoea and dysentery and in fact, is given as a household remedy during convalescence from acute illness. The extract of the stem and leaf is bitter, indigestible, aphrodisiac, tonic; cures "Vata" and "Kapha" inflammations, piles, fever, and is good for diseases of the eye and night blindness, laxative. It is also used for rheumatic affections, in which it is administered both internally and externally. As no work has been carried out on the pharmacognosy of the drug, the present work was undertaken.

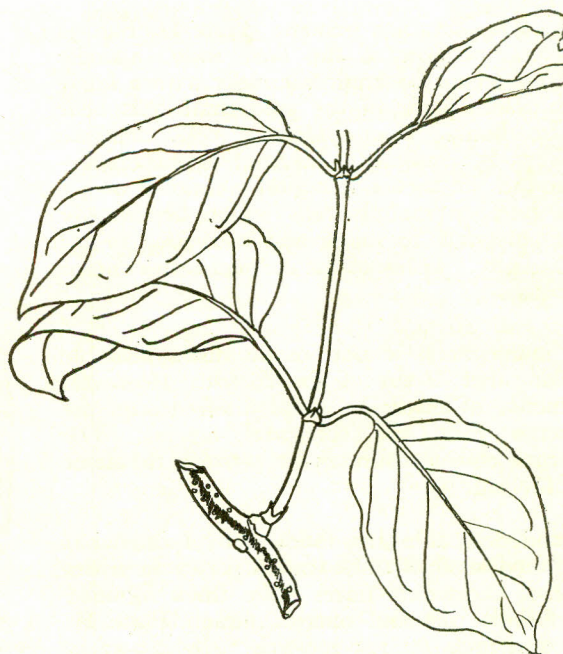


Fig. 1.—Macroscopic characters of stem and leaves.

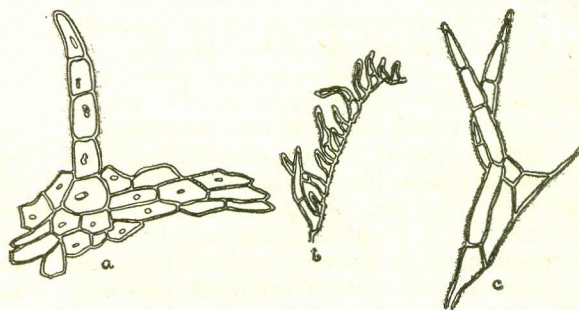


Fig. 2.—Epidermal hairs a, b, and c.  
(PLATE 1.—PAEDERIA FOETIDA LINN.)

### Material and Methods

The plant material used for pharmacognostic investigations was obtained from plants growing in the garden of the first author and also collected from the P.C.S.I.R. Campus. Samples of the drug sold under the name of "Gandhabadhalia" were also obtained from the local drug markets. The identity of the material was in each case checked by reference to the description available in the literature and was rechecked and compared with authentic herbarium specimens available in these Laboratories. For microscopical studies both free hand sections and paraffin embedded sections of stem, leaf and petiole were cut. Hand sections of the fresh material were cut for the various microchemical tests as given by Johansen.<sup>5</sup>

**Microscopic Characters.**—Stem: (Plate II, Fig. 3) A transverse section of the stem shows a single layered epidermis covered externally with a fairly thick cuticle. Some of the epidermal cells bear uniseriate hairs. The epidermal cells measure  $12.5-18.75-25\mu$  radially. Internal to the epidermis is found the cortex, a region composed of 3-4 layered parenchymatous cells which are mostly oval to polygonal in shape and measure  $12-25-62.5\mu$  radially. Some of the cortical cells contain chloroplasts.

The endodermis is not easily distinguishable from the other layers of the cortex. However, the presence of casparian strips differentiates the endodermis from the corticatal layers. The endodermal cells measure  $25-37.5-50\mu$  in diameter (Plate II, Fig. 3).

The endodermal layer is followed by a somewhat discontinued layer of thick walled pericyclic fibres (sclereids); individual fibres have thick lignified walls, oblique pits and narrow lumen (Plate II, Fig. 3) and measure  $125-200-312.5\mu \times 25-37.5-62.5\mu$ . The vascular bundle of the stem is of the simple collateral type. A thin strip of cambium is present between the external phloem and the xylem. The xylem consists of vessels tracheids, fibres, xylem parenchyma (Plate II, Fig. 4). Majority of the xylem elements show pitted type of thickening. The vessels are broad, flat, usually shorter in length and larger in breadth (Plate II, Fig. 4 q,r,s.). Some of the vessels have end walls that have tails like tips and measure  $150-225-287.5\mu \times 337.5-362.5-400\mu$  (those vessels which are shorter in length and greater in breadth). Some vessels measure  $250-287.5-750\mu \times 25-31.25-37.5\mu$ . There are two types of tracheids: One is the ordinary type of tracheid and the other is the ray-tracheid (Plate II, Fig. 4, p). In both the cases the

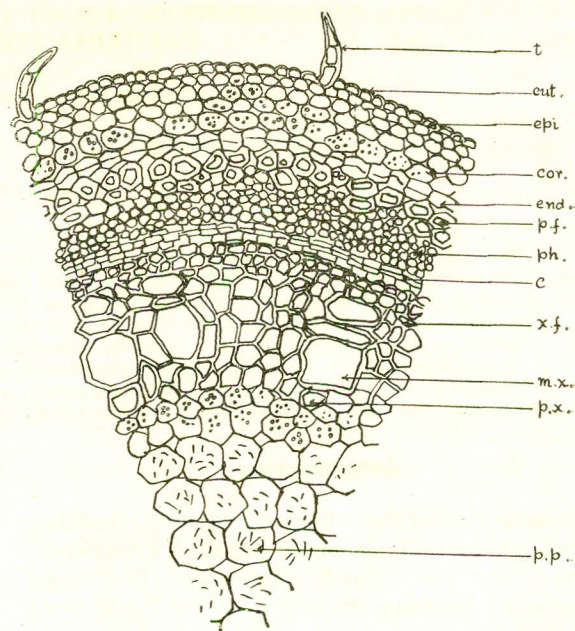


Fig.3.—T.S. of the stem.

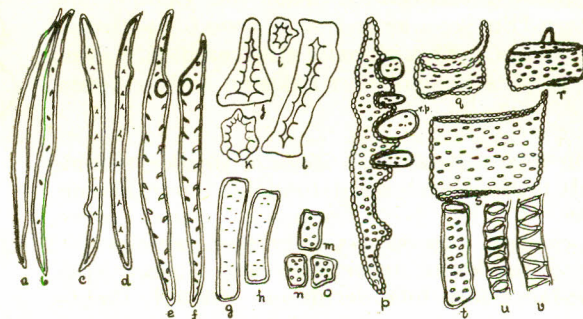


Fig. 4.—Macerated cells of the stem. a and b, fibres; c and d, tracheids; e and f, xylem tracheids; g and h, parenchyma; i, j, k and l, stone cells; m, n and o, xylem parenchyma, p, ray tracheids; q, r, s, t, u and v, xylem vessels; t, trichome; cut, cuticle; epi, epidermis; cor, cortex; end, endodermis; p, f, phloem fibre; c, cambium; x, f, xylem fibre; m.x., meta xylem; p.x., proto xylem; p.p. pith parenchyma.

(PLATE 2.—MICROSCOPIC CHARACTERS OF THE STEM.)

tracheids are longer than the vessels and have tapering ends. The tracheids measure  $500-725-1000\mu \times 18.75-25-31.25\mu$ . The ray-tracheids possess furrows and ridges on one side. The measurement of the ridges varies from  $37.5-43.75-62.5\mu$  and the furrows  $18.75-25-31.25\mu$ . The tracheids are provided with simple pits on their walls. The ray parenchyma (Plate II, Fig. 4, p) consists of thin semioval cells and are closely fitted in bet-

ween the two ridges of the ray-tracheids. The ray-parenchyma measure  $50-62.5-75\mu$  (radially).

The large central pith (Plate II, Fig. 3) constitute nearly half of the thickness of the stem and is composed of thin walled parenchymatous cells which are comparatively bigger than the parenchymatous cells of the cortex and measure  $25-75-112.5\mu$  (radially). The pith shows very small intercellular spaces. The pith contains acicular crystals of various lengths.

*Leaf.*—A transverse section of the leaf (Plate III, Fig. 5) reveals the presence of a thin cuticle on both the surfaces. The cells of the upper epidermis are longer than those of lower epidermis. The upper epidermal cell measure  $25-31.25-37.5\mu$  radially. The cells of the lower epidermis measure  $12.5-18-75-25\mu$  radially.

The stomata (Plate IV, Fig. 7) are mostly present on the lower epidermis. The stomata are accompanied by two subsidiary cells which are placed parallel to the pore. The stomata measure  $25-37.5-43.75\mu \times 18.75-25-31.25\mu$ . The acicular crystals of calcium oxalate are distributed in the mesophyll between the two epidermises (Plate III, Fig. 5). The cells containing the crystal are sausage shaped. Uniseriate hairs are present on the upper epidermal cells. Spirally thickened tracheids (Plate III, Fig. 5) are present in the mesophyll. Each small vascular bundle in the lamina is surrounded by a layer of parenchyma cells which constitute the bundle sheath. The palisade cells constitute a single layer and measure  $12.5-15-18.8\mu \times 6.25-7.5-12.5\mu$  (Plate III, Fig. 5) and the spongy parenchyma measure  $5-6-8.75\mu$  radially. The spongy parenchymatous cells are loosely arranged and air spaces are present in it.

A transverse section of the leaf through the midrib region (Plate III, Fig. 5) shows that it is convex on the abaxial side. Next to the upper and lower epidermis there are several layers of thin walled parenchymatous cells which measure  $12-25-37.5\mu$  radially. Large and small crystals of calcium oxalate occur at places in these cells. The vascular arc is crescent shaped. The phloem is present on both sides of the xylem. (Plate III, Fig. 5).

*Petiole.*—A transverse section through the petiole (Plate III, Fig. 6) shows a structure essentially similar to that of the midrib region with some differences, e.g., (1) presence of a small circular vascular bundle in each of the two grooves on the upper side, (2) presence of hypodermis (3-4 layered) which measure  $18-75-25-43.75\mu$  radially, and

(3) the parenchymatous cells of the cortex are also larger than those in the midrib region and measure  $37.5-62.5-75\mu$  in diameter.

*Powder of the Stem and Leaf.*—(Plate IV, Fig. 8). The powder of the stem and leaf is dark grey in colour with an offensive odour and has a bitter taste. The microscopic investigation of the powder shows the presence of the following structures: (i) fragments of the petiole showing hypodermis vascular bundles (Fig. 8 g.); (ii) fragments

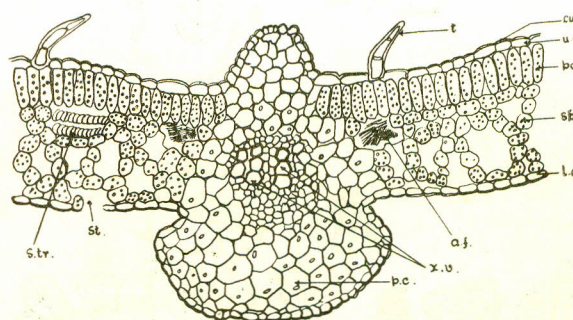


Fig. 5.—T.S. through the leaf.

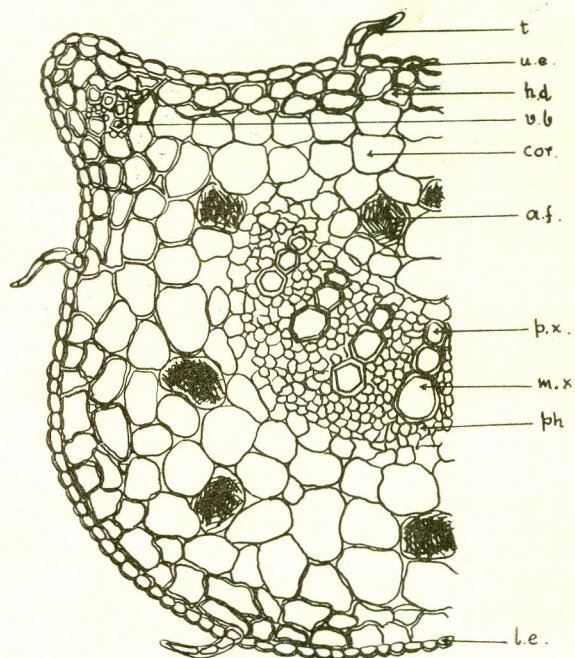


Fig. 6.—T.S. through the petiole; t, trichome; cut, cuticle; u.e., upper epidermis; pal, palisade cells; sp, spongy parenchyma; a.f. acicular fibres; x.v. xylem vessels; p.c. parenchyma cells; st, stomata; s. tr. spiral tracheids; h.d. hypodermis; v.b. vascular bundle; cor, cortex; p.x., proto xylem; m.x., meta xylem; ph, phloem; l.e., lower epidermis.

(PLATE 3.—MICROSCOPIC CHARACTERS OF LEAF AND PETIOLE.)

of epidermal cell of the leaf showing stomata. (Fig. 8 k); (iii) fragments of uniseriate hairs (Fig. 8, h, i, j.); (iv) fragments of xylem vessels, ray-

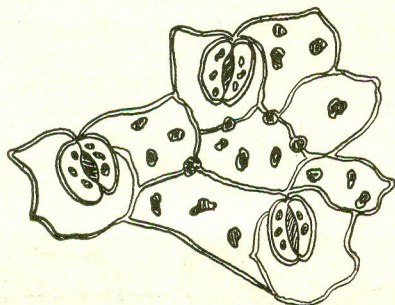


Fig. 7.—Stomata on the leaf.

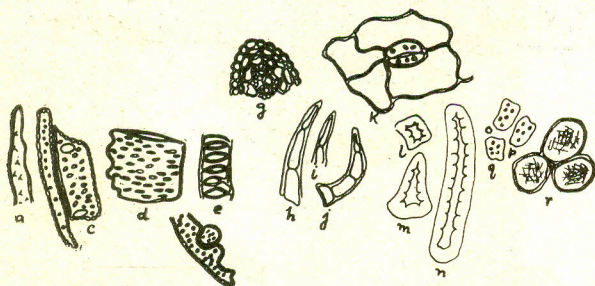


Fig. 8.—Powdered stem and leaf: a and b, tracheids; c, d and e; xylem vessels; f, ray tracheids (a portion); g, a corner (ridge) of the petiole showing vascular bundles and hypodermis; h, i and j, trichomes; k, stomata; l, m and n, stone cells; o, p and q, xylem parenchyma; r, pith parenchyma containing acicular fibres.

PLATE 4.)

tracheid; (Fig. 8, c,d,e,f.); (v) ray-parenchymatous cells, pith parenchymatous cells, xylem parenchymatous cells and stone cells (Fig. 8, o,p,q,r,s,i,m and n) and (vi) bundles of acicular crystals in the pith cells (Fig. 8, r).

### Microchemical Test

Microchemical tests have shown the presence of the following in the stem and the leaf: (1) mucilage is present mostly in the leaves; (2) fat is present in the assimilatory tissues; (3) acicular crystals of calcium oxalate are present in the mesophyll, cortex and in the pith of the stem.

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