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Development of pharmacognostic standards of plants from Borginaceae family

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ABSTRACT

Objective: To study the morpho-anatomy of the leaf, stem and root of these plants to increase the knowledge and standardization parameters of *Trichodesma sedgwickianum* (TRS) and *Trichodesma indicum* (TRI) of Borginaceae family. **Methods:** Transverse section of different organs of plants carried out by free hand and various types of histochemical tests were performed for the identification of microchemical by using different reagents. **Results:** Transverse section of TRS leaf shows presense of phloem tissue and anomocytic stomata with both glandular and covering trichomes. Stem contain epidermal brown tissue and collenchyma. Root shows presence of xylem and starch grains. TRI leaf contains radiating arc of xylem, phloem and pericyclic fiber. Stem shows presence of cortex with chlorenchymatous cells. Anatomically roots revealed the presense of xylem, phloem and oil globules. Uicerate covering trichomes and anisocytic stomata are present. **Conclusions:** The pharmacognostic constants and diagnostic microscopic features reported in this work could be useful for the compilation of a suitable monograph and its proper identification and standardisation of these two species.

1. Introduction

TRS annually erect herb growing up to 12–30 cm height, usually hispid, obovate leaves with opposite or alternate arrangement. Flowers in terminal are racemose or unilateral. Cymes flowers are simple or bifid and calyx is deep and contains five lobed. Corolla tube is broadly cylindrical. Stamens with five filaments contain short and broad connectives. TRI morphologically annually erect, much branched, and are 15–45 cm in height. Leaves are linear or lanceolate-oblong, obtuse or sub acute, clotted above with stiff hair. Flowers are bluish white or nearly white when fully ripe, leaving five deep ovate pits on the membranous axis when falling. Traditionally it is used as an emollient and poultice. Paste of roots are used to reduce the swelling of joints and leaves are used as a depurative^[1]. Phytochemically TRS contains monocrotolin, suspininine as pyrrazolidine alkaloids and triterpemoid, hexcosane, amylin and lupeol. Traditionally it is used as an emollient and poultice. The roots with water administered as a drink to the children suffering from dysentery. While TRI,

chemically it also contains triterpenoids and pyrazolidine alkaloids^[2]. Due to its ethnopharmacological importance and in literature survey, no evidence was reported for Pharmacognostic investigation of TRS & TRI. In the present study an attempt has been made for morpho-anatomical as well as physicochemical evaluation of these plants for contribution in the pharmacognostic quality control and knowledge of Borginaceae family.

2. Material and methods

2.1. Collection and authentication of plants

Crude material of TRS and TRI collected in the month of August to September from Amravati District, Maharashtra, and it is authenticated by Prof. Dr. Bhowagaokar, VIHS, Amravati, Maharashtra. A voucher specimen (VMT-37) has been preserved for future reference.

2.2. Pharmacognostic investigation

2.2.1. Organoleptic evaluation

Organoleptic evaluation is evaluated by means of organs of sense or appearance of the drug. External morphological characters of freshly collected leaves, young stem and roots

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were study [3].

2.2.2. Microscopical evaluation

For anatomical description material was sectioned free-hand, in transverse direction [4–5]. Various types of histochemical tests were performed for the identification of starch grain, globules and xylem with the following solutions: hydrochloric and phloroglucin, for the detection of lignin; Sudan III for oil globules, lugol for starch, and sulphuric acid to confirm the chemical nature of the crystals of calcium [5].

2.2.3. Leaf constant & physicochemical investigation

For establishing standardization parameter various leaf constants, palisade ratio, vein islet number, vein termination number and stomatal index evaluated as per Khandelwal [6] and physicochemical parameters such as ash value, extractive values and moisture content [7].

3. Results

3.1. Morphological study

It is a technique of qualitative evaluation based on the study of morphological and sensory profile of drugs. In the

case of whole drugs, macroscopical and sensory characters are usually sufficient to enable the drug to be identified. Morphological characteristics are presented in Table 1.

3.2. Microscopical study

3.2.1. Study of TRS

Leaf (Midrib): Transverse section of dorsiventral leaf passing through midrib is curved shape. Meristele centrally located with many lactiferous cells in phloem tissue lying on either side of xylem. Five to six rows of collenchyma tissue lie under beneath of both the epidermis of midrib (Figure 1A). The remaining tissue is large, spherical parenchyma. Epidermis with cutinise cork with number of glandular and covering trichomes (Figure 1B).

Lamina: Epidermal cells of lamina are composed of tangentially elongated tubular cells with anomocytic stomata and well developed cuticle. A row of palisade cell almost occupied one-third area (Figure 1C, 1D).

Stem: Stems are roughly trigonal in transverse section. Epidermis was single layer followed by narrow zone of collenchymatus hypodermis with thick cuticle. Brown color tissue, collenchyma is present, vasculature in form of roughly trigonus ring. Secondary growth takes place to some extent producing a continuous cylinder of xylem and phloem outside vascular cylinder. Several patches of fibers

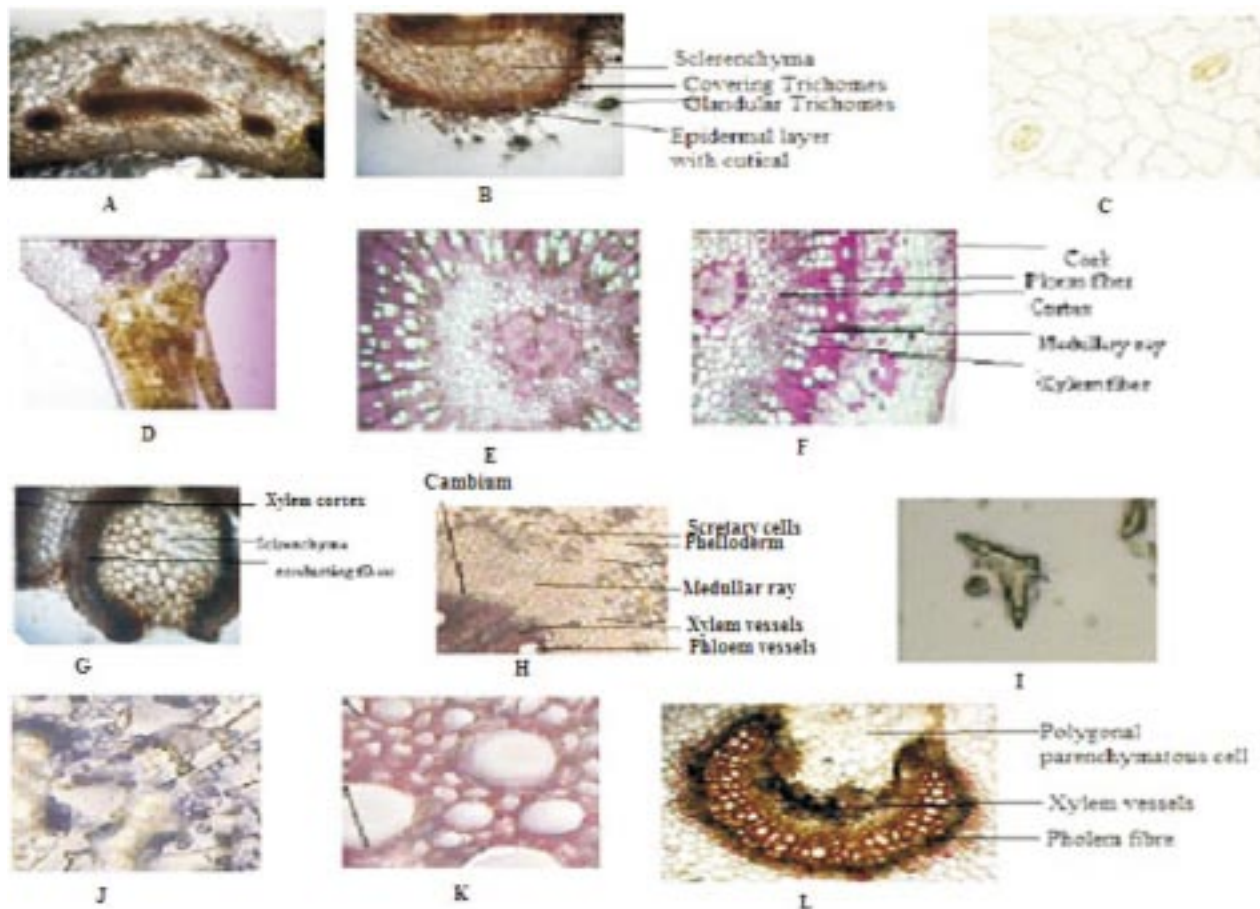


Figure 1. Microscopy of TRS

- | | |
|---------------------------------|---|
| A. TS of midrib | B. Sclerenchyma with glandular & covering trichomes |
| C. Anomocytic stomata | D. lamina with palisade cells |
| F. TS of stem (Outer portion) | E. TS of stem (Inner portion) |
| J. Starch grains after staining | G. TS of Petiole |
| K. Lignified trichomes | H. TS of root |
| | I. Starch grains |
| | L. Vascular Bundle |

simulating the pericyclic zone are present (Figure 1E, 1F).

Petiole: In the petiole two to three layer of thick walled collenchymas followed by five to six layer of cortical parenchyma are observed. Endodermis & pericycle are not distinct but concentric in nature. Inner cortex is regular & isodimetric in nature having three to four layered cell. Vascular bundle is circular in shape, openings are conjoint and arrange in ring. Each bundle capped by sclerenchyma on outer side. Vascular bundle showed secondary growth to some extent, but this growth restricted to vascular bundle (Figure 1G). Secondary conjunctive tissue is lignified.

Roots: TRS root circular in outline and encircled by obligatory cork cells. Phelloderms are six to eight layered, outermost being thickly submerized. Cortex is paranchymatous and some cortical cells filled with simple oval to circular starch grains. Endodermis of root is well developed, phloem narrow and paranchymatous, encircling the central wide xylem consisting of solitary or groups of two to three radially arranged vessels and tracheids (Figure 1H, 1K).

Pith: In the pith parenchymatus and medullary vascular

bundles are present. Orientation of medullary vasculature was somewhat irregular. Vascular bundles are concentric, emphphollic or irregular orientation (Figure 1I).

3.2.2. Study of TRI

Leaf: Transverse section of leaf shows pot shaped midrib and thin lamina with uneven lower epidermis attached at the lateral sides, its upper side leaving a concave central dorsal depression. Midrib meristele consists of a radiating arc of xylem, phloem and discontinuous rows of pericyclic fibers. The upper and lower epidermis of midrib contains collenchymatous cell along with anisocytic stomata and simple, unicerate covering trichomes (Figure 2A, 2E).

Lamina: Mesophyll in lamina region divided into a single layer of dorsal palisade parenchyma with columner cells and few layer of spongy parenchyma having rounded cells with chloroplast (Figure 2F).

Stem: TRI stem circular in outline and epidermis covered with thick cuticle. Cortex consists of four to five layers of chlorenchymatous cells. Medullary rays are present with xylem and large size phloem vessels (Figure 2G, 2I).

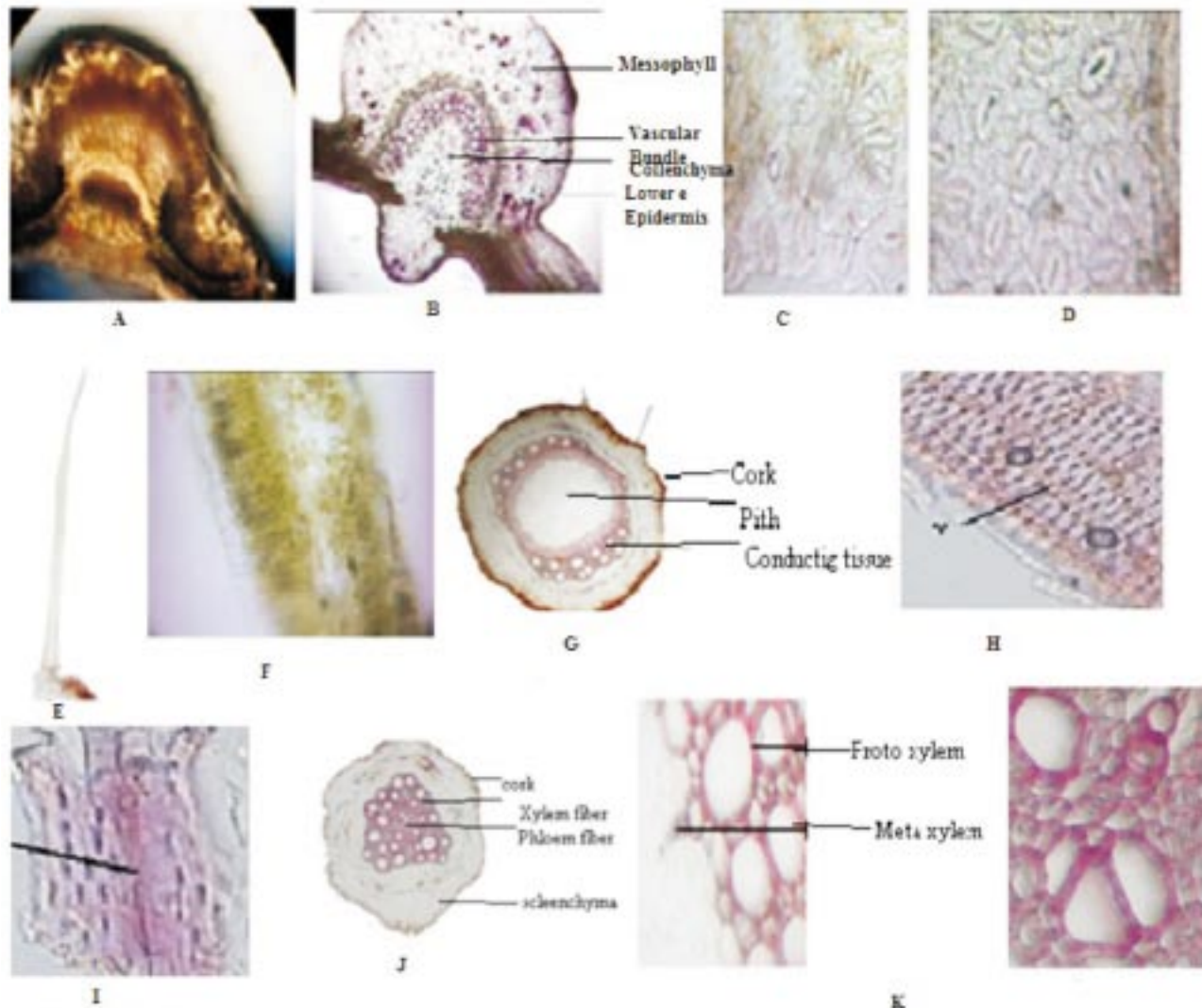


Figure 2 Microscopy of TRI

- A. TS of midrib (younger leaf)
- B. TS of midrib (mature leaf)
- C. Lower epidermis
- D. Anisocytic stomata
- E. Covering trichomes
- F. TS of Lamina
- G. TS of stem
- H. Phloem vessels
- I. Xylem fibres
- J. TS of root
- K. TS of root showing vessels

Roots: TRI root is circular in outline like stem. Cork and cortex narrow in centre, bulk of meta and proto xylem and phloem fibres are present along with starch grains (Figure 2J, 2K).

Table 1
Morphological characteristics.

| Plant Organ | TRS | TRI |
|---------------|-------------|----------------------|
| Leaf Colour | Light green | Dark green |
| Flower colour | Purple | White |
| Odour | Odourless | Odourless |
| Test | Astringent | Astringent |
| Shape of leaf | Obovate | Linear or lanceolate |
| Root | Advantious | Advantious |

Table 2
Histochemical color reactions.

| Reagents | Species | Constituent | Color | Histological zone |
|--------------------------------------|------------|--------------|--------------|---------------------|
| Phloroglucinol + HCl | TRS TRI | Lignin | Pink | Xylem, Sclerenchyma |
| Conc. H ₂ SO ₄ | TRS TRI | Cellulose | Green | Mesophyll |
| Lugol solution | TRS TRI | Starch | Blue/ Violet | Cork |
| Sudan Red | TRS TRI | Oil globules | Red | – Cork |

Table 3
Leaf constants.

| Leaf constants | TRS | TRI |
|-------------------------|-------|-------|
| Stomatal Index | 17–22 | 15–19 |
| Vein islet number | 19–23 | 18–23 |
| Vein termination number | 27–32 | 29–39 |
| Palisade ratio | 4–7 | 3–7 |

Table 4
Physicochemical study.

| Parameters | | TRI % (w/w) | TRS % (w/w) |
|-------------------|--------------------|-------------|-------------|
| Ash Values | Total ash | 10.54 | 8.26 |
| | Acid insoluble ash | 8.82 | 7.90 |
| | Water soluble ash | 3.96 | 0.2 |
| | Sulphated ash | 0.23 | 0.31 |
| Extractive values | Alcohol | 2.19 | 4.91 |
| | Water | 3.2 | 4.21 |
| Moisture content | | 9.7 | 12.23 |

The common features in both species are arrangement of medullary rays, xylem and phloem nature, morphology of roots (Table 2). The important distinguishing characters in between the species are arrangement of vascular bundle in leaf, types of stomata, trichomes, oil globules, nature of cork in stem and leaf constants (Table 3).

3.3. Qualitative microscopy and Physicochemical study

The qualitative determinations of some Pharmacognostic

parameters are useful for setting standards for crude drugs and in detecting adulteration or improper handling of the drug. Various types of ash values, extractive values and moisture content are important to determine purity of the drug (Table 4).

4. Discussion

The present study was undertaken with aim to develop the stringent pharmacognostic and physicochemical standards of TRI and TRS. These two species of *Trichodesma* were widely used in traditional system of medicine. Anatomical characteristics are relevant in Pharmacognosy. TRS leaves, externally entire, lanceolate with opposite arrangement. It shows presence of anomocytic stomata on the abaxial side, dorsiventral mesophyll and collateral vascular bundles encircled by asclerenchymatic sheath with glandular and hairy trichomes. While TRI possessing leaflets with unicellular non-glandular trichomes covered with a papillose cuticle, isobilateral mesophyll and anisocytic stomata on epidermal surfaces.

The numerical Pharmacognostic standards and diagnostic microscopic features reported in this work could be useful for the compilation of a suitable monograph for their proper identification and standardisation of these two species. To the best of our knowledge we are the first to report the distinguishing Pharmacognostical characteristics of these medicinally important plants. It will also help in future research and revalidation of its use in Ayurveda.

Conflict of interest statement

We declare that we have no conflict of interest.

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