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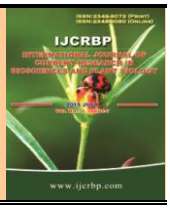

Original Research Article

Anatomical Studies of *Kedrostis foeditissima* (Jacq.) Cogn. (Cucurbitaceae)

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Abstract

The present investigation has been carried out to determine the anatomical features of whole plant of *Kedrostis foetidissima* belonging to the family Cucurbitaceae and occurring in particular geographical condition. *K. foetidissima* shows b collateral vascular bundles. The lamina possesses reticulate venations and many hairs. The epidermal cells possessed chemical substances. The internal structure of *K. foetidissima* has not been reported so far from any other part, hence the present research investigation is the first report.

Keywords

Anatomical features

Kedrostis foetidissima

Medicinal plant

Vascular bundle

Introduction

Kedrostis foetidissima (Jacq.) Cogn. is a traditional medicinal plant, belonging to the family Cucurbitaceae. This plant possesses various biological activities like antioxidant and antimicrobial in which the antimicrobial activities of various parts of this plant is well pronounced (Elavazhagan and Balakrishnan, 2013; Kavitha et al., 2014; Amutha and Lalitha, 2015) and all these studies form the evidenced utility of this medicinal plant. The detailed pharmacognostical evaluation gives valuable information regarding the morphology, microscopical and physical characteristics of crude drugs (Dave et al., 2006). Pharmacognostical study is the preliminary step in the standardization of anatomical and histochemical analysis. The medicinal plants gained momentum after revival of interest throughout the world in the field of medicine. Efforts are being made to prepare a database on medicinal plants in floristically rich countries. Thought the anatomical studies are important for pharmacognostical evaluation and identification of drugs, it is least studied with reference to *K. foetidissima*. In this study, detailed anatomical investigation on all parts of the plant, *K. foetidissima* has been made and reported with anatomical evidences.

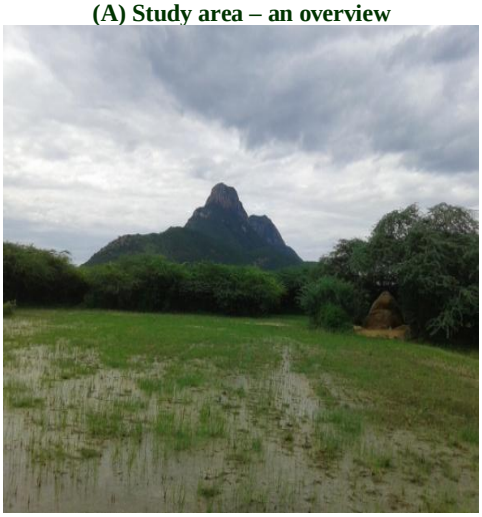
Materials and methods

Collection of specimens

The plant specimens for the study were collected from Chittoor District (Fig. 1), and the identification was confirmed with local floras. The samples of different organs were cut and removed from the plant and fixed in FAA (Farmalin-5ml+ Acetic acid-5ml + 70% Ethyl alcohol-90ml). After 24 h of fixing, the specimens were dehydrated with graded series of tertiary - butyl alcohol as per the schedule given by Sass (1940). Infiltration of the specimens was carried by gradual addition of paraffin wax (melting point 58-60°C) until TBA solution attained super saturation. The specimens were cast into paraffin blocks.

Fig. 1: The collection site and the natural habit of *K. foetidissima*; collection and processing of various parts of the plant.

(A) Study area – an overview

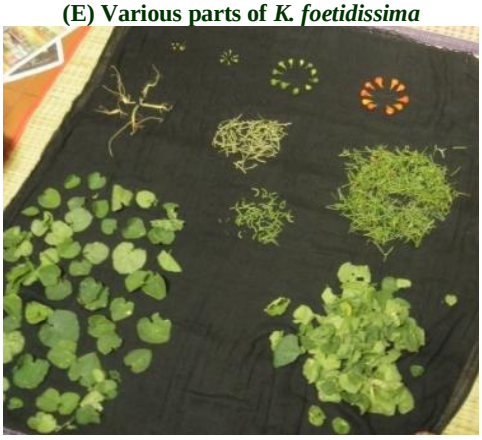


(B) Collection site

(C) Collection of plant parts

(D) Natural habit of *K. foetidissima*

(E) Various parts of *K. foetidissima*



(F) *K. foetidissima* growing without host.

Sectioning

The paraffin embedded specimens were sectioned with the help of Rotary Microtome. The thickness of the sections was 10-12 µm. Dewaxing of the sections was by customary procedure (Johansen, 1940). The sections were stained with Toluidine blue as per the method published by O'Brien et al. (1964). Since Toluidine blue is a polychromatic stain. The staining results were remarkably good; and some cytochemical reactions were also obtained. The dye rendered pink colour to the cellulose walls, blue to the lignified cells, dark green to suberin, violet to the mucilage, blue to the protein bodies etc. wherever necessary sections were also stained with saffranin and Fast-green and IKI (for starch)

For studying the stomatal morphology, venation pattern and trichome distribution, paradermal sections (sections taken parallel to the surface of leaf) as well as clearing of leaf with 5% sodium hydroxide or epidermal peeling by partial maceration employing Jeffrey's maceration fluid (Sass, 1940) were prepared. Glycerin mounted temporary preparations were made for macerated / cleared materials. Powdered materials of different parts were cleared with Noah and mounted in glycerin medium after staining. Different cell component were studied and measured.

Photomicrographs

Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Nikon Labphoto 2 Microscopic Unit. For normal observations bright field was used. For the study of crystals, starch grains and linified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background. Magnifications of the figures are indicated by the scale-bars. Descriptive terms of the anatomical features are as given in the standard Anatomy books (Esau, 1964).

Results and discussion

Leaf

The leaf consists of fairly thick less prominent midrib and thin lamina. The midrib is slightly spindle shaped. It is 350 µm in thickness. It consists of 2 or 3 short vertical rows of xylem elements and two strands of phloem, located on the upper and lower ends of the xylem strand. So the bundle is called bicollateral vascular bundle (Fig. 2 A, B). The upper bundle (adaxial bundle) is also bicollateral and it is slightly smaller than the lower bundle.

Lamina

The lamina is bilateral and measures 150 µm in thickness. The adaxial epidermis consists of thick, squatish, thick walled cells. The abaxial epidermis is comparatively thinner and the cells are small and thick walled. Some of the epidermal cells are dilated into cylindrical, elongated cells (Fig. 2 A, B).

Epidermal cells and stomatal type

The epidermal cells are fairly thick walled and their anticlinal walls are highly varied. The epidermal cells appear amoeboid in outline. They have wide, elongated stomatal aperture. The stomata are actinocytic type. Each stoma is surrounded by about five large radiating subsidiary cells. The guard cells are 15 × 20 µm in size.

Venation pattern

The vein islets are wide and are not well defined. The vein terminations are simple or branched once or twice. The terminations are thin, long and vary. Epidermal trichomes are abundant on the lamina. The trichomes are non-glandular type. They are multicellular, unbranched and uniseriate.

Petiole

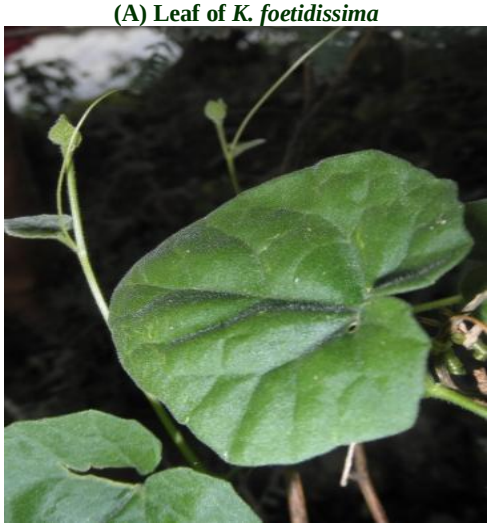
The petiole consists of small, spherical or spindle shaped thick walled cells (Fig. 2 C). The ground tissue includes 2 or 3 layers of sub epidermal thick walled cells and the remaining ground tissue is parenchymatous wide thin walled cells they are located in the wings of the petiole (Fig. 2 D). The vascular bundles are bicollateral, vertically elongate and posses a single row of xylem elements and phloem strands are located both on the outer and inner regions (Fig. 2 D).

Stem

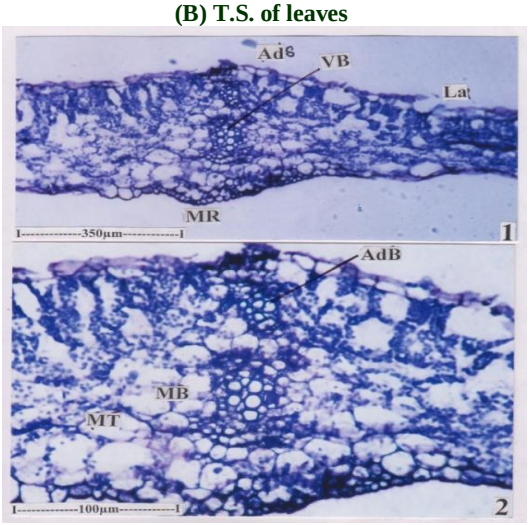
Inner to the epidermis there is a narrow zone of 6 or 7 layered sclerechyma cells, the remaining ground cells are parenchymatous, large, compact, angular and thin walled. There are about 8 independent vascular bundles located along the peripheral zone of the stem (Fig. 2 E, F) the metaxylem element is 20 µm in diameter.

Fig. 2: Morphological and anatomical features of various parts of *K. foetidissima.*

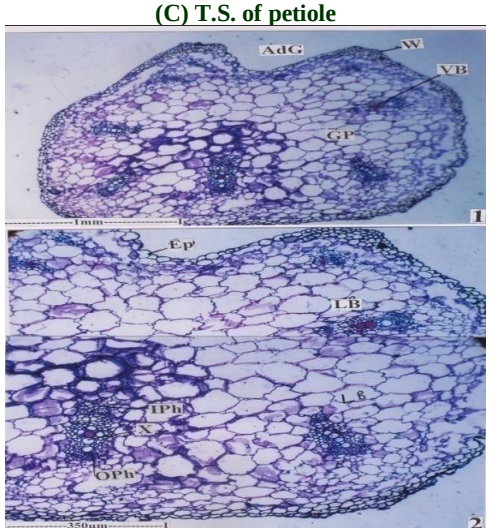
(A) Leaf of *K. foetidissima*



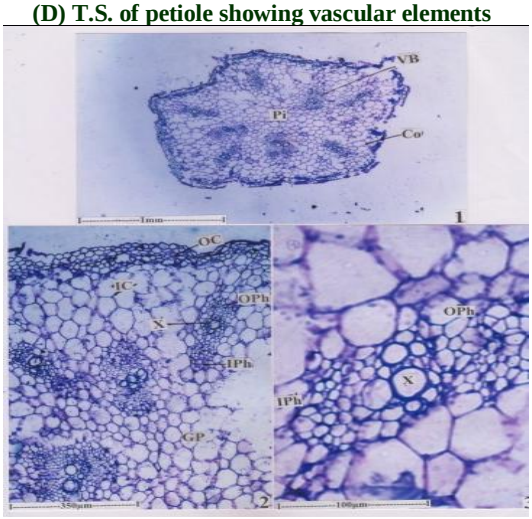
(B) T.S. of leaves



(C) T.S. of petiole



(D) T.S. of petiole showing vascular elements



(E) Stem of *K. foetidissima* with leaves

(F) T.S. of stem

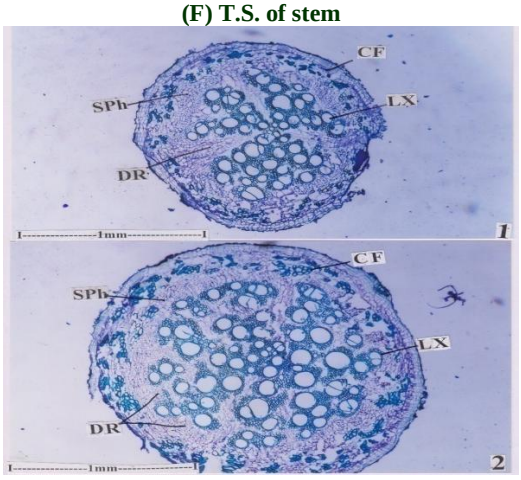
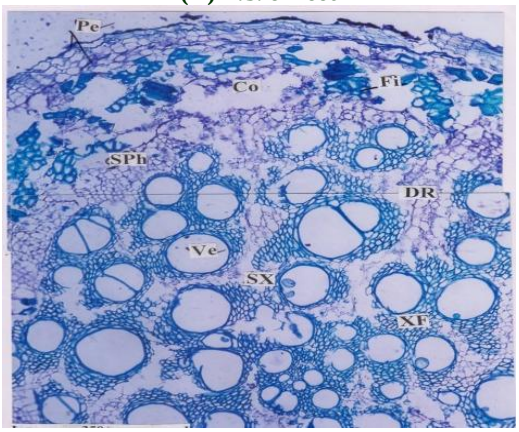


Fig. 2: Cntd…

Fig. 2: Continuing…

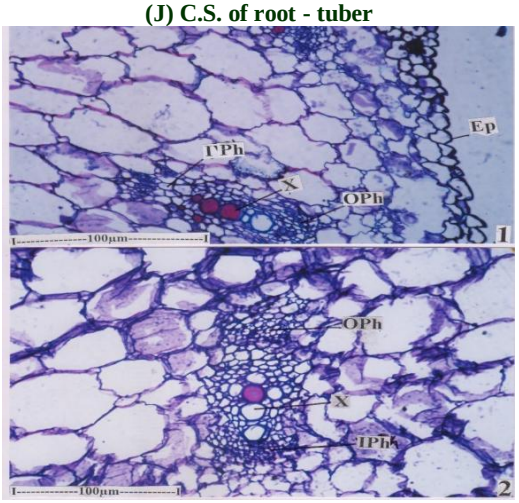
(G) The roots of *K. foetidissima*

(H) T.S. of root

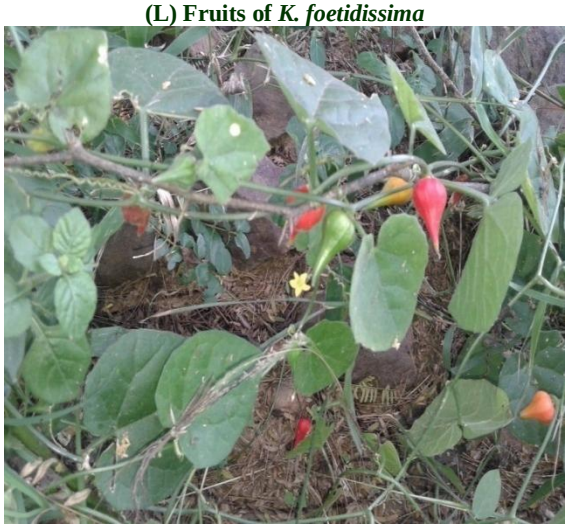


(I) Root – tuber of *K. foetidissima*

(J) C.S. of root - tuber



(L) Fruits of *K. foetidissima*



(M) C.S. of fruits

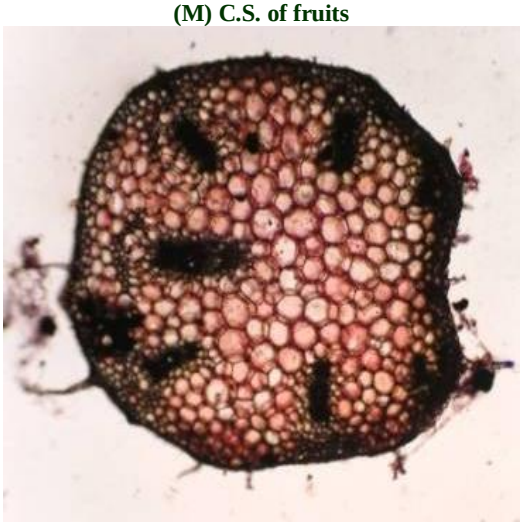
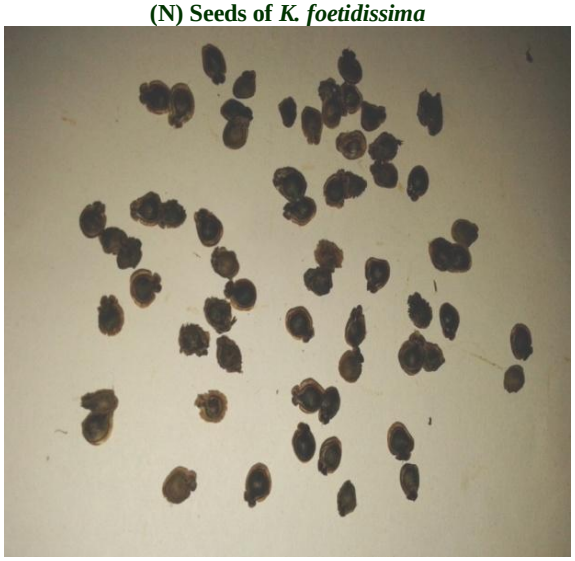


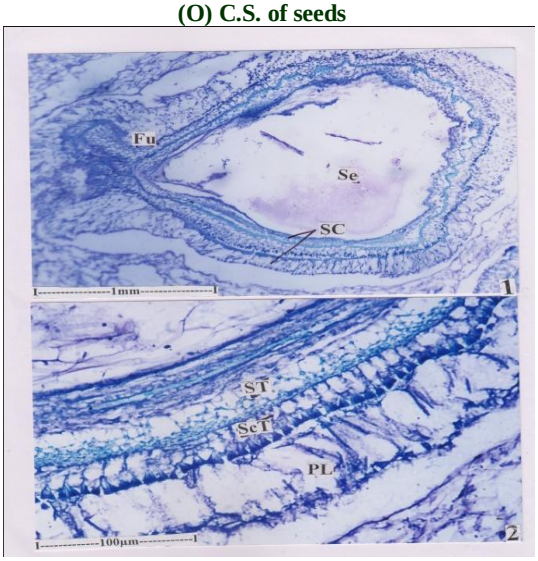
Fig. 2: Cntd…

Fig. 2: Continuing…

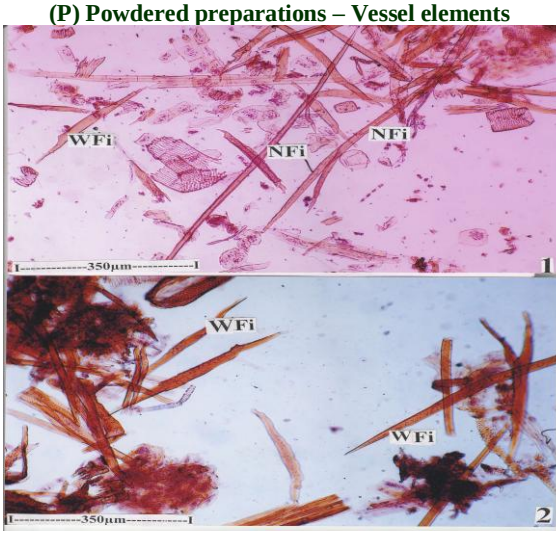
(N) Seeds of *K. foetidissima*



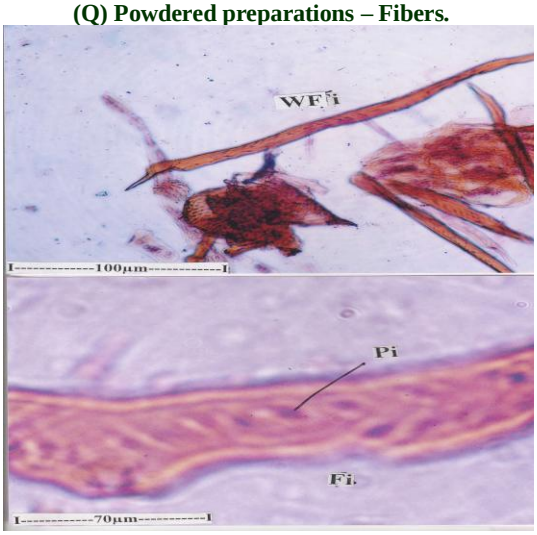
(O) C.S. of seeds



(P) Powdered preparations – Vessel elements



(Q) Powdered preparations – Fibers.



Root

Matured root with well developed secondary root was well studied. Both thin root and thick roots were investigated. The thin root is 1.3 µm is diameter. The thick root is 1.75 mm is diameter. Both thin and tick roots possessed uniformly a thin and continuous periderm layer, cortical sclerenchyma, secondary phloem zone are variously cleave vascular cylinder (Fig. 2 G, H)

Root-tuber

The root tuber is circular with even outline. The tuber is about 3 µm thick. It is soft and parenchymatous. Vascular strands are scattered in the parenchymatous ground tissues. The ground parenchyma possesses dense accumulation of starch grains (Fig. 2 I, J).

Fruit

The fruit is developed from tricarpellary syncarpous ovary with two or more seeds in each carpel. The pericarp of the fruit has smooth surface and it includes a thin layer of epidermis and a thick parenchymatous cylinder of mesocarp (Fig. 2 K). The cells of the mesocarp are small, fairly thick walled and compact, small vascular strands are found in the medium part of the mesocarp of the fruit. (Fig. 2 L).

Seed

The seed is thick and wide obovate in shape. It consists of a thick funical and highly complex and thick seed coat. The seed coat is more than 280 µm in thickness (Fig. 2 N, O). The seed is non-endospermous. The embryo is found within the seed surrounded by remnants.

Powdered microscopic observation

The powder preparation of the plant exhibits the following inclusions.

1. Vessel elements (Fig. 2 P)

Vessel elements are: abundant is the powder the elements are mostly wide, short, barrel shaped or drum shaped. They have wide, harizontal endwall preparations and multiseriate lateral wall pits. The pits are bordered. The vessel elements are 150 µm long and 150-250 µm wide.

2. Fibres (Fig. 2 Q)

a) Xylem fibres are very frequent in the powder. The fibres are of two types. Some of the fibres are very thin, long, thick walled and have tapering ends. The cell lumen is very narrow. The narrow fibres are 850 µm long 10 µm thick.

b) The second type of fibre is wide fibre, the wide fibres are short, thick and have wide lumen. The lumen of the wide fibre and seen prominent slit-like uni or bi seriate simple pits (Fig. 2 Q). The wide fibres are 430 µm and 20 µm thick.

Conclusion

Establishing standard is an integral part of establishing the correct identify and quality of a crude drug. Before any drug can be included in the pharmacopoeia, these standards must be established. The majority of the information on the identity, purity, and quality of the plant material can be obtained from its macroscopic, microscopic and physio–chemical parameters. As there is no record on detailed anatomical features of leaves and seeds of *K. foetidissima*, the present work has been under taken to produce some pharmacognostical standards. The above studies provide information with respect of their identification, chemical constituents and physicochemical characteristic which may be useful for pharmocognostical study under standardization of herbal drugs of folk medicinal practice of present era and enrichment of medicinal field. It will also determine therapeutic diagnostic tools for the scientists who are keen and sincere to evaluate the herbal medicine of indigenous resources.

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