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A comparative evaluation of morpho-Anatomical features of the root of *Cynodon dactylon* (Durva) & *Desmostachya bipinnata* (Darbh)

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Abstract
Cynodon dactylon (Durva) and *Desmostachya bipinnata* (Darbh) are an important drug used in Ayurveda. Both plants are used as a medicinal herb as well as sacred plants also. Both plants are C_4 plants and belong to the family Poaceae or Gramineae. Before using any herb to make an Ayurvedic medication, it is very important to study in detail the morphological and anatomical features of that plant. Through which the quality of medication can be enhanced. In this study, root morphology and anatomy of two plants of the family Gramineae or Poaceae have been studied on Axio – Microscope for anatomy. Differences and similarities of these two species described in this study. This study helps to identify the correct plants and their structures for the preparation of Ayurvedic medication.

Keywords: *Cynodon dactylon, Desmostachya bipinnata*, durva, darbh, root morphological and anatomical features

Introduction

Cynodon dactylon and *Desmostachya bipinnata* are such types of species which can be used as medicinal plants, as weed plants and as sacred plants. They are C_4 plants and they belong to the family Gramineae or Poaceae. They are found all over the world in open areas with sandy or saline soil. *Cynodon dactylon* also called as Durva grass, Bermuda grass, Devil's grass (It become difficult to remove hence it is called Devil's grass), Dog's tooth grass (Dog's, tigers chew this grass and swallow the extract by splitting the pulp whenever they get stomach disturbances hence it is called Dog's tooth grass), Hariyali grass [5]. Other common name include Sanskrit: Durva, Niladurva; Hindi: Doob, Neelee Doob; Gujarati: Dhro, Lilidhro; English: Bermuda grass, Bahama grass [1]. Durva grass is known as the second most significant weed in the world after *Cyperus rotundus* [4]. In Ayurvedic medicine it is used to cure wounds and indigestion [8] and for burning sensation, piles, headache, dysentery, urinary tract infection, etc. [7]. Durva grass is used as a sacred grass because Hindu worship the God Ganesha with the leaves of Durva religiously [9].

Desmostachya bipinnata is commonly known as Darbh grass, Khusha grass, Halfa grass, Big cordgrass and Salt reed grass [3]. Other common names include Sanskrit: Darbha, Barhi; Hindi: Dabh, Dabhena; Gujarati: Kush; English: Sacrificial grass. Darbh grass occurs in desert or semi-desert conditions. This grass has salt and drought tolerant capacity [4]. Darbh grass is a very good sand binder because it has deep and strong rhizomes [6]. According to the AIP, Government of India Ministry of Health and Family Welfare Department of Ayush, the roots are used for skin disease, asthma and jaundice, bleeding piles, burning sensation, cystitis, dyspepsia and vaginal discharges [11]. Darbh grass is also called 'Kusha' and it is considered perhaps the second most sacred herb in the Vedas after Soma. It protects from all types of negative energy and toxic radiation [10].

Materials and Methods

Fresh roots of Durva and Darbh were collected from the local area of Valsad district in Gujarat, Bharat. The taxonomically, authenticated and identified plant material by Dr Farzin M. Parabia, Bioscience Department with reference number "VNSGU/BVBRC/2020/12/TC-04" for *Cynodon dactylon* and "VNSGU/BVBRC/2020/12/TC-05" for *Desmostachya bipinnata*. The herbarium specimens were preserved in the Herbarium of Veer Narmad South Gujarat University, Surat, Gujarat, bharat. For anatomy, required plants parts like roots were cut and removed from the plant. The roots were washed in pure water to remove all the impurities. For stem, root and stolon cylindrical portion of almost straight and sufficient length to hold the sample was selected. Enough number of free hand sections was taken. These sections were carefully transferred to a Petri-dish containing water using a fine painting brush for selection of good sections. Selected good sections were transferred to a Petri-dish containing safranin stain. Sections were stained by safranin to confirm its lignification. After 2-3 minutes of staining, sections were transferred onto a slide, mounted in glycerol and then examined under a microscope. Photomicrographs were taken with Axio-scope – A1, ZEISS company, (Ocular: P1 - 10X * 23; Objective: 10X, 20X, 40X, 100X). Photomicrographs were taken with the help of Axio Camera.

Table 1: Summary of studied plant

Sr. No.	Taxa	Source	Plant parts used for anatomy	Parts medicinally used
1	*Cynodon dactylon*	Valsad	Root	Whole plant
2	*Desmostachya bipinnata*	Valsad	Root	Whole plant

Result

Morphological characters

Cynodon dactylon

Durva plants have a deep root system. Roots are fibrous, cylindrical, very small hair like roots arise from the main roots, cream coloured.

Figure 1: Morphological characters of *Cynodon dactylon*

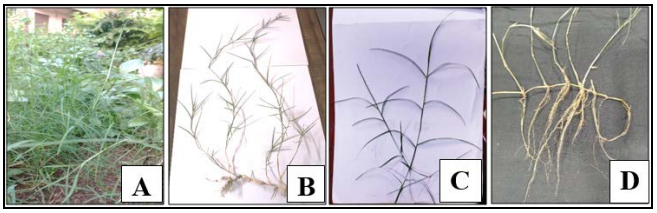

Fig 1: *Cynodon dactylon* A. Whole plant B. Plant with leaf, stem, and root C. Plant with leaf and stem D. Fibrous root

Figure 2: Morphological characters of *Desmostachya bipinnata*

Fig 2: *Desmostachya bipinnata* A. Whole plant with Inflorescence B. Plant with leaf, stem and root C. Inflorescence D. Plant root

Desmostachya bipinnata

Darbh plants also have a deep root system. Their roots are formed from the stem nodes and they are fibrous, cylindrical and brown to cream in colour, small hairy like roots were formed from the main roots.

Table 2: Summary of Morphological characters of *Cynodon dactylon* and *Desmostachya bipinnata*

Sr. No.	Plant parts	*Cynodon dactylon*	*Desmostachya bipinnata*
1	Root	Fibrous, cylindrical, small hair like and cream in colour	Fibrous, cylindrical, brown to cream in colour and small hair like roots

Anatomical characters

Cynodon dactylon

Transverse section of roots of Durva revealed the presence of epidermis. Epidermal cells are small and occur and in one to three layered. Cortex region differentiated into two regions: outer cortex and inner cortex. Outer cortex is two to three layered and made up of sclerenchymatous cells. Inner cortex contains aerenchymatous cells with large air cavities. Endodermis is a single layered and innermost layer of cortex. Pericycle is one to two layered and made up of sclerenchymatous cells.

Figure 3: Anatomical characters of *Cynodon dactylon*

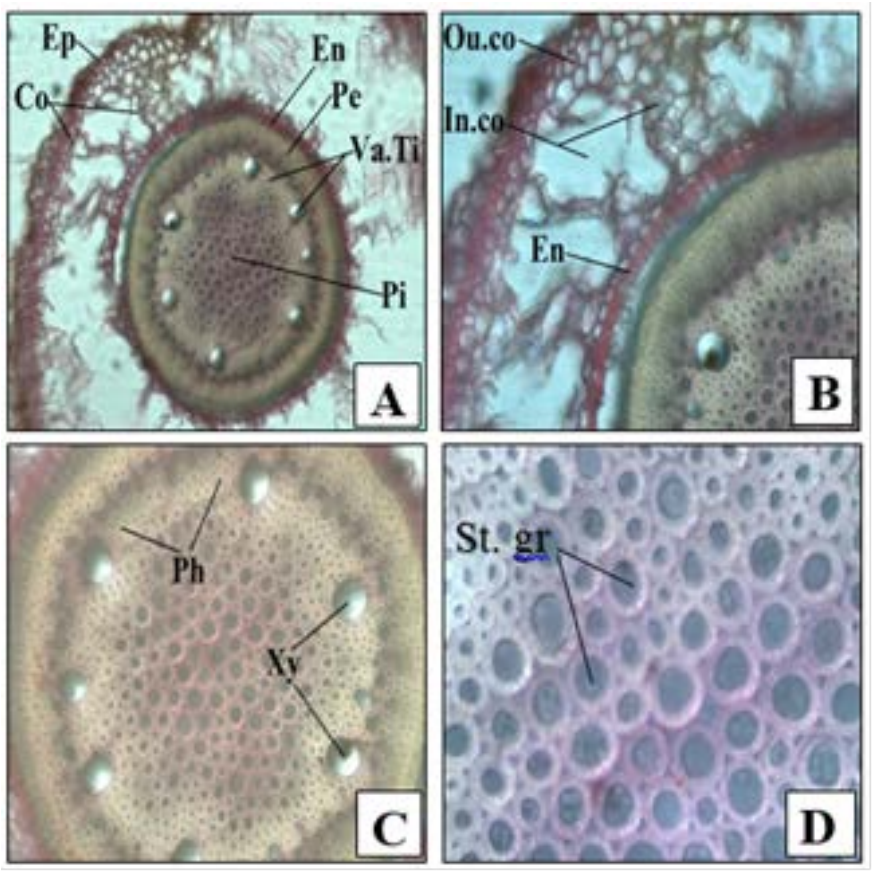

Fig 3: *Cynodon dactylon* A. T.S. of root (Ep – Epidermis, Co - Cortex, En – Endodermis, Pe – Pericycle, Va.ti – Vascular tissue, Pi – Pith) B. T. S. of root showing Ou. Co – Outer cortex, In. co – Inner cortex, En – Endodermis C. Arrangements of Xy – Xylem and Ph – Phloem D. Section showing St.gr – Starch grain in Pith cells.

Vascular area occurs between the pericycle and pith region. Vascular areas have two types of vascular tissue that is xylem and phloem, they are arranged in a ring. Pith is the centre region of the root and made up of oval to round shaped parenchymatous cells. Pith cells contain starch grain.

Desmostachya bipinnate

Transverse section of roots of Darbh revealed the presence of epidermis. Epidermal cells are semi-circular shapes with thin walls. Cortex made up of several layers and divided into three layers-

Figure 4: Anatomical characters of *Desmostachya bipinnata*

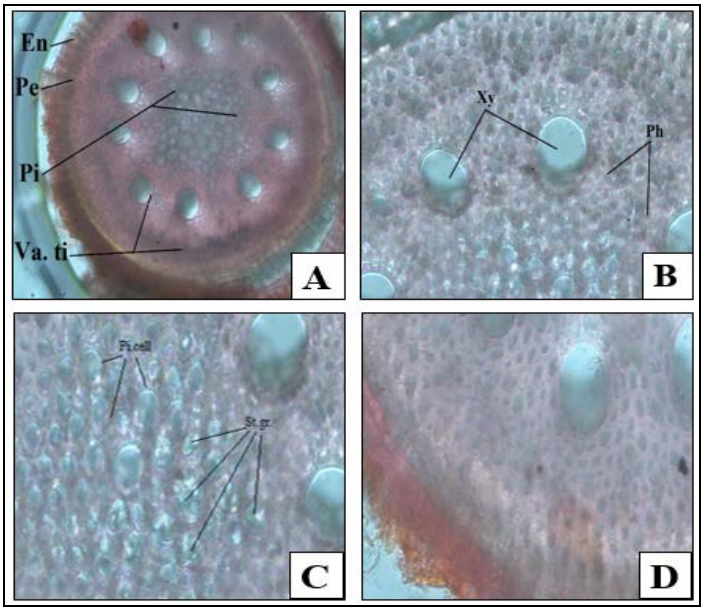

Fig 4: *Desmostachya bipinnata* A. T. S. of root (En – Endodermis, Pe – Pericycle, Va.Ti – Vascular tissue, Pi - Pith) B. Section showing arrangements of Xy – Xylem and Ph – Phloem C. Section showing arrangements of St.gr – Starch grain in Pith cells D. Section showing Endodermis, Pericycle and Vascular tissue.

Outer cortex: It is single layered and their cells are circular or pentagonal or hexagonal with thin wall; Central cortex: It has aerenchymatous cells with with large air cavities, at places group of parenchymatous cell is occur between the regions; Inner cortex: It is two to three layered, oval to rectangular in shape with thin wall, parenchymatous cells. Endodermis is a single, innermost layer of cortex and has an oval to rectangular shape cells. Pericycles are three to five layered and have pentagonal to hexagonal cells. Vascular bundle area is the innermost region of the pericycle. In vascular tissue nine to ten, thin walled Meta xylem occur. In between two Meta xylem, two to three phloem occur. Pith is the central most region of the root and made up of sclerenchymatous cells [2].

Table 3: Summary of Anatomical characters of *Cynodon dactylon* and *Desmostachya bipinnata*

Part	Component	*Cynodon dactylon*	*Desmostachya bipinnata*
Root	Epidermis	1 to 3 layered small cells	semi-circular shapes with thin walls
	Cortex	Outer cortex – 2 to 3 layered, contains sclerenchymatous cells Inner cortex – contains aerenchymatous cells with large air cavities	Outer cortex - single layered, cells are circular or pentagonal or hexagonal with thin wall Central cortex - aerenchymatous cells with with large air cavities Inner cortex - two to three layered, oval to rectangular in shape with thin wall, parenchymatous cells
	Endodermis	Single layered	Single layered
	Pericycle	1 to 2 layered, made up of sclerenchymatous cells	three to five layered with pentagonal to hexagonal cells
	Vascular tissue	Xylem and phloem arranged in a ring	Nine to ten, thin walled meta xylem occur, In between two meta xylem, two to three phloem occur
	Pith	Central region of the root, oval to round shape parenchymatous cells with starch grain	Sclerenchymatous cells with starch grain

Discussion

The fibrous root system is characteristic of the plants of the family Poaceae/ Gramineae and they arise from the nodes of rhizomes or stolon. Roots are one of the significant parts of the medicinal plant which is used in many Ayurvedic medicines in Ayurveda. Microscopic method is one of the simplest and cheapest methods to start with for establishing the correct identity of the source material. In the present study morphological characters and internal structure of the root was performed. In morphological features, roots are fibrous and cylindrical. Roots of Durva are brown to cream in colour while roots of Darbh are cream in colour. The morphological study of the plants would help for visual botanical identification of the plant. While evaluating anatomical features, the root anatomy of Durva has sclerenchymatous outer cortex and aerenchymatous inner cortex. Pericycle was 1 to 2 layered and sclerenchymatous. Vascular bundles were arranged in a ring with five to six

xylem tissues. These anatomical features are recommended to identify the root of Durva (*Cynodon dactylon*). Root anatomy of Darbh has a single layered outer cortex and aerenchymatous inner cortex. Pericycle was three to five layered and eight to ten xylems occurred in the vascular region and a small pith region with starch grain occurred. These anatomical features are recommended to identify the root of Darbh (*Desmostachya bipinnata*). The anatomical study of the plants would help in proper identification of plant and for taxonomic significance.

Conclusion

This comparative evaluation of morpho - anatomical features of the roots of Durva and Darbh would help for the correct identification and classification of the plant parts.

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