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ANATOMICAL STUDY OF SELECTED WEEDS IN HIGH STRESS AREA OF BANNU, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT

The present study was carried out during March 2012 to evaluate morphological and anatomical characteristics of some selected plants. Investigations were made on Taxonomical classification of eight prevalent species found in the fields of District Bannu. These plants were Abutilon indicum (L.) Sweet., Chenopodium polyspermum L., Citrullus colocynthesis L., Dichanthium annulatum Stapf., Eclipta alba (L.) Hassk. Euphorbia oblongata L., Heliotropium europium L., Oxalis corniculata L., and Parthenium hysterophorus L. Proper identification and taxonomic classification was made through the transactions of the roots and stems along with photomicrograph of the species.

Key words: Anatomy, Bannu, stress, weeds, Pakistan.

INTRODUCTION

Bannu is a district of Khyber Pakhtunkhwa province of Pakistan. It is situated at a distance of 200 km, in the south of Peshawar. It lies between 32.44 to 33.06 North latitude and from 70.22 to 70.57 East longitudes. It is bounded in the North by the Tribal Area and in the East by Karak district, while in the South by Lakki Marwat. The total area of the district is 1227 sq. kilometers. Its population is increasing day by day and it is now more than half a million. Majority of the people live in villages. Costea and De-Mason (2001) and Rajput (2002) studied the anatomy of secondary xylem of 17 species from nine genera of Amaranthaceae and said that in all these species' radial growth in the main stem was achieved by the formation of cambial variants. Among all these species the segment of cambium producing conducting elements of xylem and phloem (i.e. fascicular segment) and another segment of cambium exclusively producing axial parenchyma cells/conjunctive tissues (inter fascicular segment), staggered according to the different cambium rings.

In *Amaranthus* sp. and *Digera arvensis*, the inter fascicular

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regions are exclusively differentiated into thin walled axial parenchyma cells on both xylem and the phloem sides. This variation in the formation of xylem derivatives gives an impression that vascular bundles were embedded in parenchymatous groundmass. All these species accumulated scanty secondary xylem, which was composed of vessel elements, tracheids, fibres and axial parenchyma while xylem rays were absent in the early stages of secondary growth. In the later part of secondary growth, species of *Amaranthus* and *Digera arvensis* produced axially elongated upright ray cells in the region of cambium that differentiates only into thin walled parenchyma. Occurrence of nucleated xylem fibres is an interesting feature of all the species and is correlated with the rayless nature of xylem.S. Morphological, anatomical characters are now applied in solving of controversial taxonomical andphylogenetical problems (Balasbramania *et al.*, 1993). Theanatomicalstudy was done by simple transverse section of root stems and leaves (Johanson, 1940). To study the stomatal complexes, theparadermal cross sections were taken (Algan, 1981).

MATERIALS AND METHODS

The plant species were collected from the fields of District Bannu during March 2012.After the collection the species then prepared herbarium specimens. For the classification and identification of the collected species important instruments were utilized. These requirements were Microscope, Slide, and Blades, Beaker, Polythene bags, distal water and chemical like safranin and digital camera with computer.

Collection of plants species

Plants were collected from Bannu. The fresh parts of plants ware used for the identification and classification of various parts of the plants like epidermis, cortex, endodermis, Pericycle, Medullary rays, vascular bundles and Pith. The botanical name and concerned family were properly identified. The plants, collected from different fields were dried, preserved and identified with the help of Flora of Pakistan (Nasir and Ali, 1971-95; Ali and Qaisar, 1995-2005).

Anatomical study

The anatomical study of the collected species is carried out through preparing the stained slides of the root and stem of the collected species which are examined under high power microscope to identify the epidermis, cortex, vascular bundles and pith.

RESULTS AND DISCUSSION

The present study was carried out during 2012 to evaluate characteristics, proper identification, Investigations on Anatomical,

Morphological, Taxonomical classification of 08 selected plant species found in District Bannu. Proper identification and Taxonomy is made through their transactions of root and stem along with photomicrograph of these species as follows;

Systematic position of *Abutilon indicum* (L.) Sweet.

Botanical Name *Abutilon indicum* (L.) Sweet. (Fig. 1)
Synonym *Abutilon asiaticum* (L.) Sweet
Family Malvaceae
Local name Koso beta
English Name Country mallow
Propagation By seeds
Part used Leaves, bark, seeds and roots
Flowering period Throughout the year.
Transverse section of stem
Stem: Trichomes are absent on epidermis. A thick layer of epidermis is present. The cortex is parenchymatous. Endodermis is present between the cortex and vascular bundles. The vascular bundles are in rays form. The central region consists of pith (Fig. 2).
Transverse section of Root
Root: The outermost layer is epidermis. The cortex is composed of colenchyma cells. The endodermis is well-developed. The vascular bundle covers the central region in scattered form (Fig. 3).
Anatomy of stomatal aperture:
As revealed by microscopic observation that the Stomata type of *Abutilon indicum* (L.) Sweet. is "Anisocytic" in which the guard cells are surrounded by three unequally sized subsidiary cells (Fig. 4).

Systematic position of *Chenopodium album* L.

Botanical Name *Chenopodium album* L. (Fig. 5)
Synonym *C. reticulatum* L.
Family Chenopodiaceae
Local name Surma, Bathu (Punjabi)
English Name Wild spinach
Propagation By seeds
Part used Whole plant.
Flowering period February-march.
Transverse section of stem
Stem: A thick layered epidermis is present around the cortex. Cortex is single layered. Well-developed endodermis is present. Separate groups of vascular bundles are arranged in a circle. Each bundle is comprised of central xylem covered by phloem. The centre is covered by large pith composed of collenchymatous pentagonal cells (Fig. 6).
Transverse section of Root

Root: The outermost layer is epidermis which is present around the cortex. The cortex is composed of parenchyma and is laying below the epidermis. Endodermis is also present in the root. Vascular bundles are less in number and arranged in cycle. Fig.7

Anatomy of stomatal aperture:

Chenopodium album L. has Staurocytic type of stomata (Fig. 8).

Systematic Position of *Citrullus colocynthis* L.

Botanical Name *Citrullus colocynthis* L. (Fig. 9)

Synonym Nil

Family Cucurbitaceae

Local name Maragheniey, Tuma (Urdu)

English Name Colocynth, Bitter apple

Propagation By seed and vegetative methods

Part used Roots and fruits

Flowering period Jan-Jun

Transverse section of stem

Stem: The epidermis consists of compact cells. Cortex is composed of several layers of collenchymatous cells. The endodermis separates the cortex from vascular region. Separate vascular bundles are present in the centre. Immature and matured vascular bundles are apparent in the vascular region. Big vessels indicate that the plant is capable to absorb water from the surrounding speedily. The stem is pentangular (Fig. 10).

Transverse section of Root

Root: The transverse section shows thick layer of epidermis. The cells of cortex are paranchymatous and regularly arranged in circle . The endodermis comprises of single layer of cells. Next to the endodermis a thin layer of pericycle is also present. The vascular bundles are arranged radially. The protoxylem are lying in the centre while metaxylem are lying at the periphery. The phloem are arranged in an alternate way along with the xylem. Pith is not present (Fig. 11).

Anatomy of stomatal aperture:

As observed by microscope, the Anatomy of stomatal aperture: of Citrullus colocynthisis "Anomocytic" type and The guard cells are surrounded by a certain number of cells that do not differ in size and shape from other Epidermal cells. Fig.12

Systematic position of *Dichanthium annulatum* Stapf.

Botanical Name *Dichanthium annulatum* Stapf. (Fig. 13).

Synonym *Andropogon annulatus* Forsk., *Dichanthium nodosum* Willemet

Family Poaceae

Local name Shpozhoka barrowa

English Name sheda grass, ringed dichanthium

Propagation Seed
Part used Whole plant
Flowering period March-November
Transverse section of stem
Stem: A thick layer of epidermis is present. Next to epidermis is cortex. Below the cortex is pericycle. Xylum phloem are present in the form of bundles. Pith is situated in the center (Fig. 14).
Transverse section of Root
Root: outer surface comprises of root hair. A thin layer of epidermis along with the endodermis is present. Small portion of cortex, pith, pericycle and vascular bundles are present (Fig. 15).
Anatomy of stomatal aperture:
In the microscopic study it was observed that the *Amaranthus viridis* L.has "Anomocytic" type of stomata, in which the guard cells are surrounded by certain number of cells i.e., four number of subsidiary cells (Fig. 16).

Systematic position of *Eclipta alba* (L.) Hassk.

Botanical Name *Eclipta alba* (L.) Hassk. (Fig. 17).
Synonym *Eclipta prostrata* L
Family Asteraceae
Local name Theriza
English Name False Daisy
Propagation Seeds and Vegetative method
Part used Root, stem and leaves
Flowering period July - October.
Transverse section of stem
Stem: The outermost layer is epidermis. The second layer is cortex which contains large air spaces. Inside the cortex thin endodermis layer is present. Scattered vascular bundle is present. Pith is also present in the center (Fig. 18).
Transverse section of Root
Root: The root has trichome on epidermis which is the outer most layer. It has thin layer cortex and endodermis. Xylum phloem is in the form of bundles. Pericycle and pith are also found (Fig. 19).
Anatomy of stomatal aperture:
Eclipta alba (L.) Hassk. Has anisocytic type of stomata (Fig. 20).

Systematic position of *Euphorbia helioscopia* L.

Botanical Name *Euphorbia helioscopia* L. (Fig. 21)
Synonym *Euphorbia dominii* Rohlena, *Tithymalus obovata* Raf.
Family Euphorbiaceae
Local name Purporai
English Name Spurge
Propagation Seed
Part used Whole plant

Flowering period June-July
Transverse section of stem
Stem: A thin layered epidermis is present around the cortex. Cortex is composed of many layers. Well-developed pericycle is also present. Separate groups of vascular bundles are arranged in a circle. Vascular bundles are of amphicribal type. The center is covered by pith composed of collenchymatous rounded cells (Fig. 22).
Transverse section of Root
Root: The thin layer of epidermis surrounds cortex. A well-developed endodermis is present which makes partition between cortex and vascular bundles. The vascular bundles are distributed near the periphery of vascular cylinder. Pith is also present in the center which is surrounded by the pericycle (Fig. 23).
Anatomy of stomatal aperture:
It has anomocytic type of stomata (Fig. 24).

Systematic Position of *Oxalis corniculata* L.

Botanical Name *Oxalis corniculata* L. (Fig. 25)
Synonym Nil
Family Oxalidaceae
Local name Tarveka, Khatti-boti (Urdu)
English Name Yellow sorrel
Propagation By seeds
Part used Whole Plant.
Flowering period Through out the year
Transverse section of Stem
Stem: The epidermis is surrounded by trichomes. Cortex is surrounded by thick layer of epidermis. Next to the epidermis collenchymatous cortex is present. Endodermis is also found. Vascular bundles are arranged as separate bundles along the pericycle in the form of a ring. Parenchymatous pith is present in the centre (Fig. 26).
Transverse section of Root
Root: Epidermis encloses the cortex. Vascular bundles are radially arranged from centre towards the cortex. Metaxylems are present in the centre while Protoxylems are arranged towards the periphery (Fig. 27).
Anatomy of stomatal aperture:
Oxalis corniculata L has Paracytic type of stomata: In the paracytic type guard cells are accompanied by two subsidiary cells (Fig. 28).

Systematic position of *Parthenium hysterophorous* L.

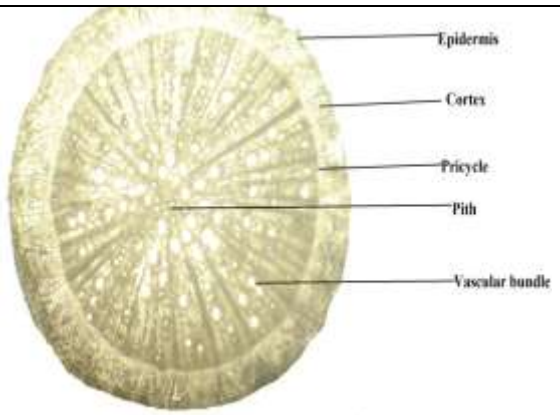
Botanical Name *Parthenium hysterophorous* L. (Fig. 29)
Synonym *Parthenium lobatum* Buckl.
Family Asteraceae

Local name Kerbotta
English Name white top weed, congress grass
Propagation By seeds
Part used Whole Plant.
Flowering period March to November
Transverse section of Stem
Stem: The epidermis is thick. The cortex is not much large. Vascular budles are arranged along the endodermis. The pith is composed of collenchymatous polygonal cells and is very large (Fig. 30).
Transverse section of Root
Root: The cortex is large and surrounded by epidermal layer. Cortex consists of both parenchyma and collenchyma. Endodermis is present beneath the cortex. The central region consist of thick vascular bundles. The figure shows presence of pith (Fig. 31).
Anatomy of stomatal aperture:
Parthenium has Anomocytic (irregular celled) type of stomata. In this type, the stomata are surrounded by a limited number of epidermal cells which are indistinguishable from other (Fig. 32).

The present study proved very helpful and resulted in exploration of valuable variations in the configuration of foliar epidermal, root and stem anatomy that can be used as an important taxonomic tool for the identification and differentiation of different species of wild plants. Anatomical studies revealed clear cut differences in size, shapes of epidermal cells, vascular bundles, stomata and trichomes etc. anatomical characteristics have an important role in taxonomy and determining the number of plant genera and species (Rajput, 2002). The epidermis possesses a number of important diagnostic characters that offer valuable clues for identification, like size, shape and orientation of stomata, guard cells and subsidiary cells, structural peculiarities of epidermal cell walls, distinctive or specialized form of trichomes (Nadkarni and Chopra, 2002). Leaf epidermal features like shape of epidermal cells, stomata and trichomes are useful anatomical tools. Vascular bundles, cortex, pericycle, pith, Length and width of epidermal cells is a useful aid in distinguishing verities. The plant epidermis consists of three main cell types: epidermal cells, guard cells and their subsidiary cells that surround the stomata and trichomes, otherwise known as leaf hairs. The present study confined to leaf epidermal, stem and root anatomical features of same important species of wild plants. Some species have been investigated first time for anatomical characters that might be useful for plant biologist for the identification of important wild plants at global level. Stomatal guard cells are essential to keep one particular component inside the plant that is, water. However, they must also allow the gaseous exchange

essential for photosynthetic activity. Stomata and associated epidermal cells are an important source of taxonomic characters. The pattern and frequency of stomata on any leaf surface are under conservative genetic control, but may be modified by environmental parameters such as the availability of CO_2 (Ali and Qaisar, 1995-2005). Different types of stomata were observed in all the examined species of wild plants. These types comprises of Anomocytic, Paracytic and Anisocytic. In all these species stomata are present mostly on abaxial surface and a very few species possess stomata on both surfaces.

Figure 1.



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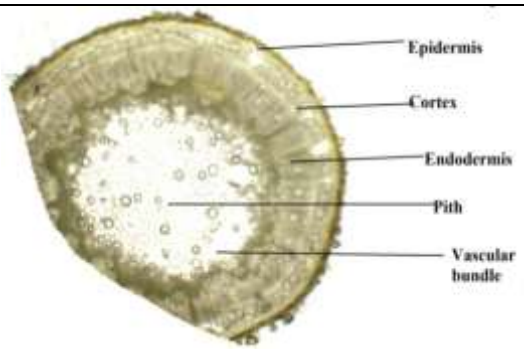

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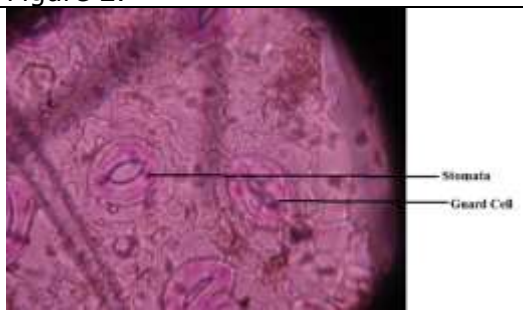
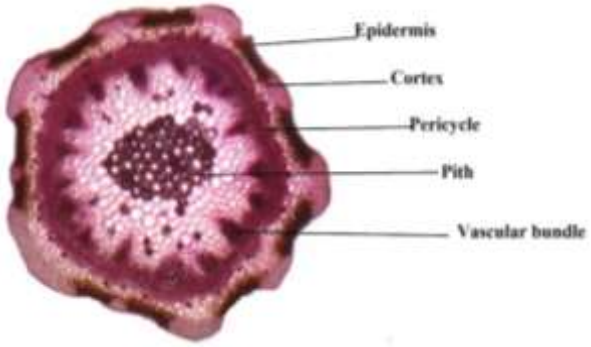


Figure 4.

Figure 5.



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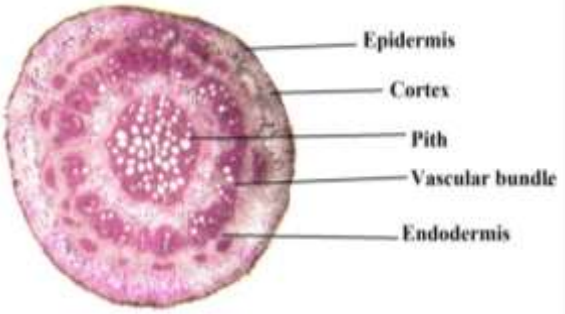

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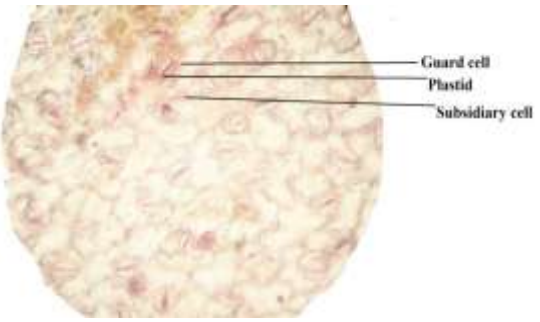

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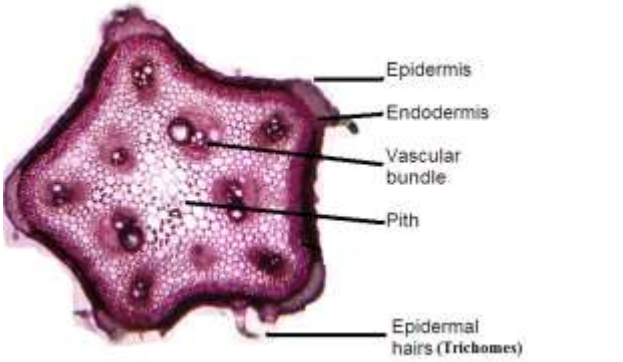

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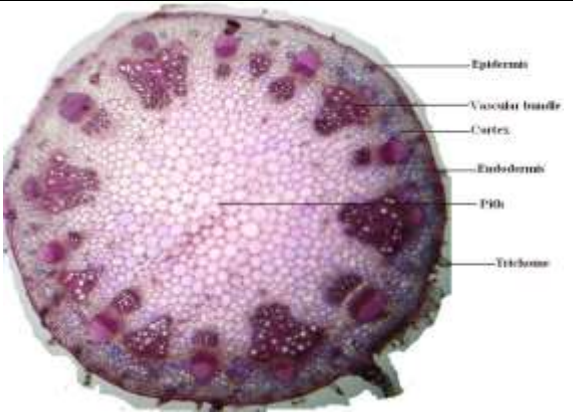

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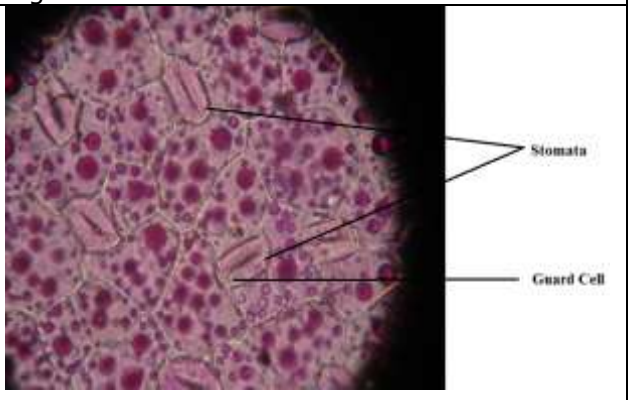

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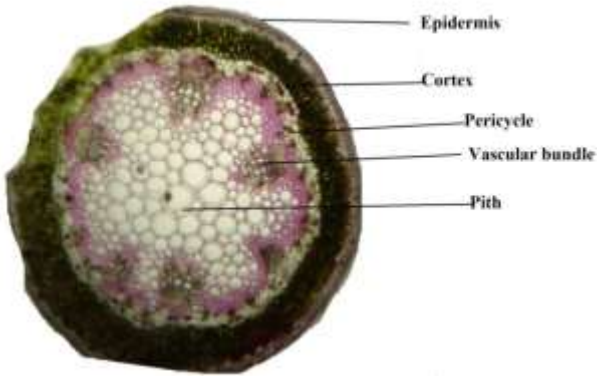
Figure 13.



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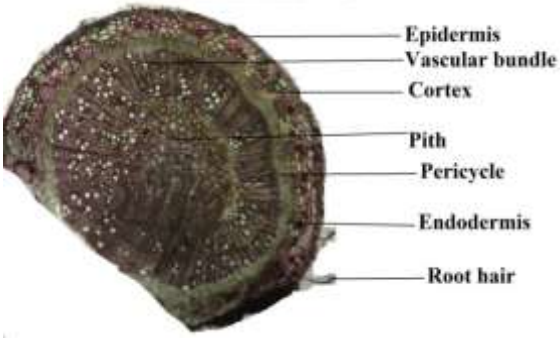

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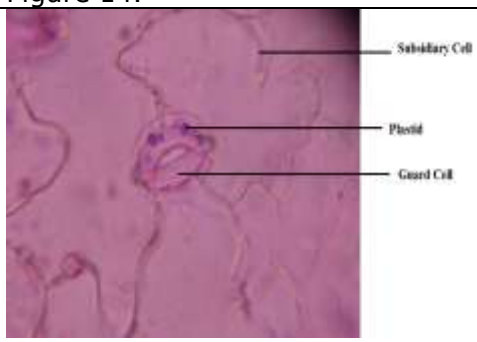

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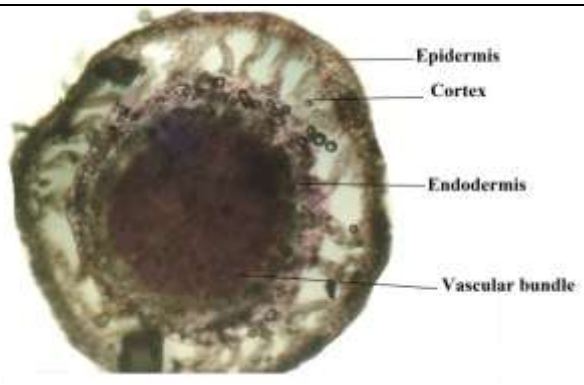

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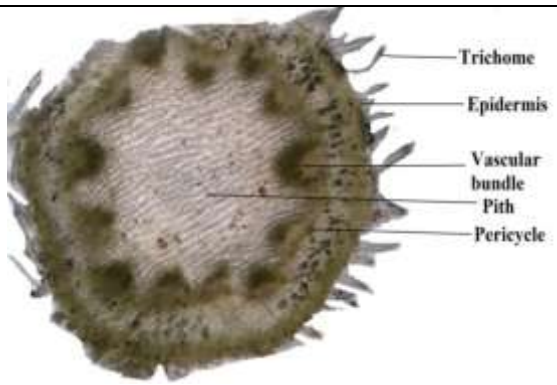

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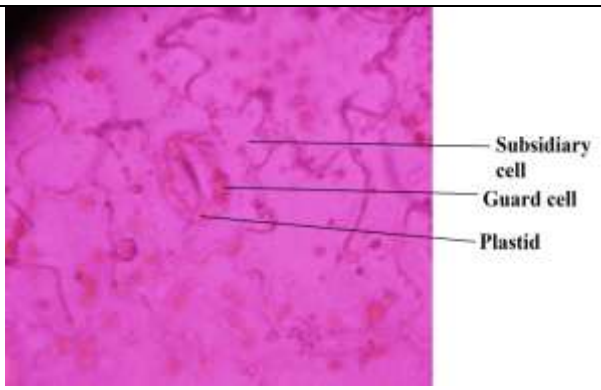

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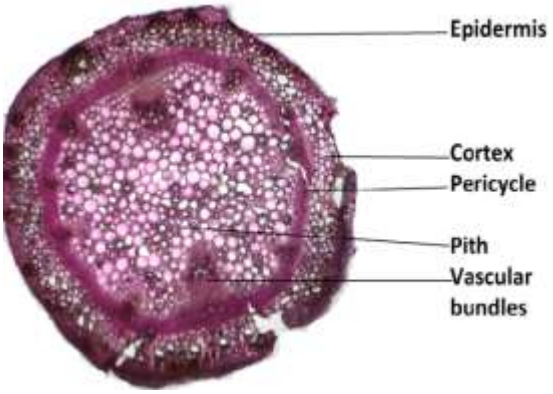

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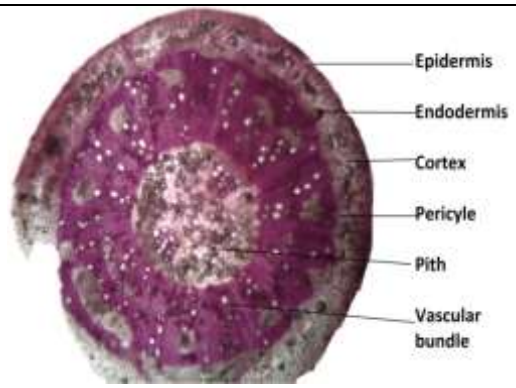

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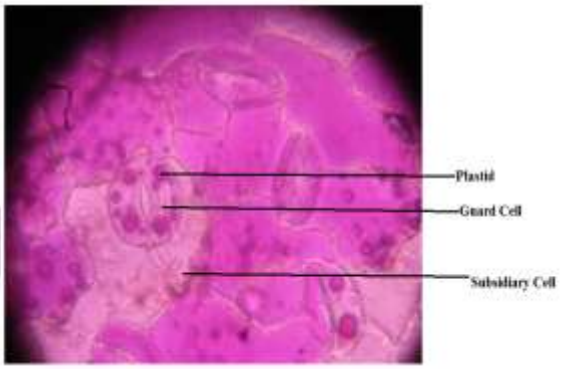

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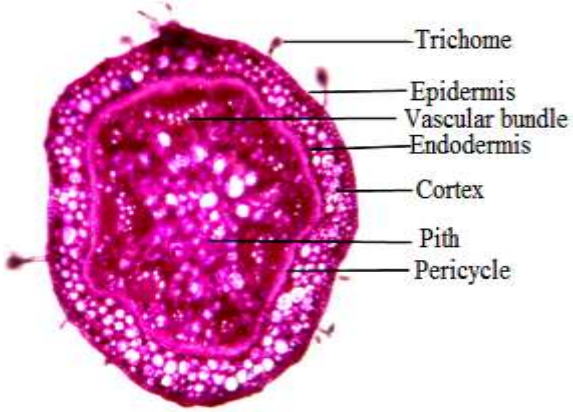

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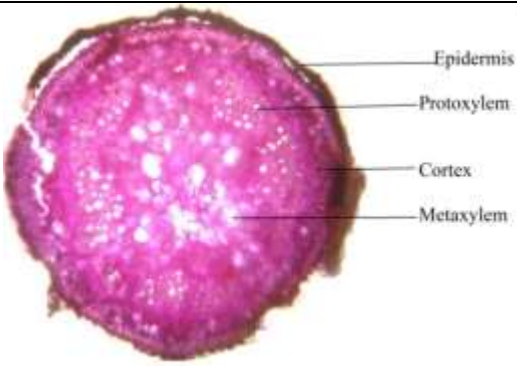

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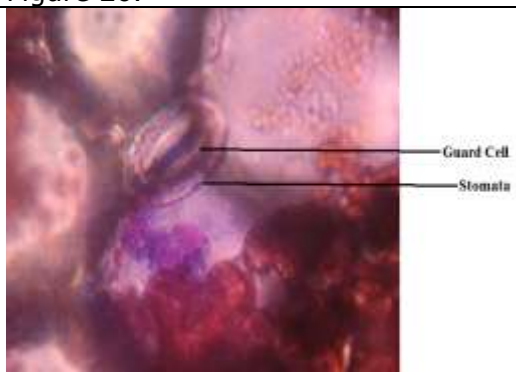

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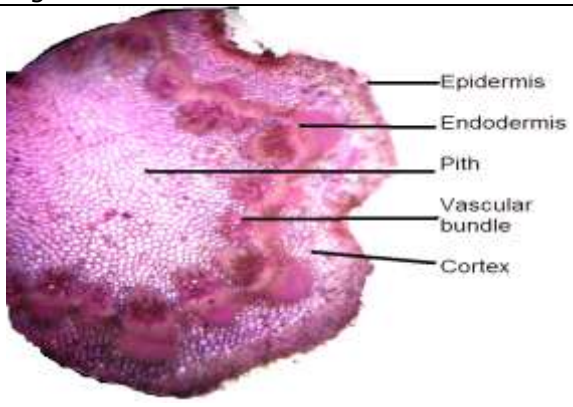

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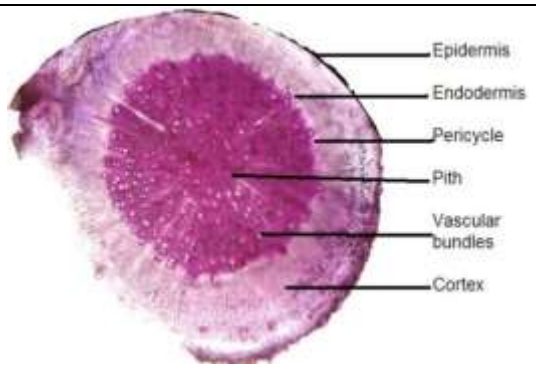

Figure 31.

Figure 32.

Figures of the weeds along with the transverse section of their stems and roots

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