Pak. J. Weed Sci. Res., 19(4): 447-464, 2013

MORPHO-ANATOMICAL STUDY OF SELECTED PLANTS OF DISTRICT BANNU, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRICT

The present investigation was carried out during March 2012 to evaluate morphological and anatomical characteristics of selected plants. Investigations were made on Taxonomical classification of seven prevalent species found in different fields of District Bannu. These plants are Physalis angulata L., Polygonum barbatum L., Portulaca oleracea L., Rannunculus muricatus L., Solanum surattense (Burn.) F., Sonchus asper L. and Xanthium stramurium L. Proper identification and Taxonomy is made through their transactions of root and stem along with photomicrograph of the species.

Key Words: Morphology, anatomy, plants, Bannu.

Citation: Khan, S.U., R.U. Khan, I. Ullah, S. Mehmood, A. Muhammad and M. Ullah. 2013. Morpho-anatomical study of selected plants of district Bannu, Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res. 19(4): 447-464.

INTRODUCTION

Bannu district lies in the valley, which is a low structural basin. The valley is bounded in north by the hills of Kohat district and in the west by hills of Karaghora, which is expanded to north Waziristan hills.The highest place in northern hills is Baraganatu post with a height of 434 meter while in the Western hills, the height goes up to 708 meters. The river flowing through these hills have formed a number of passes. The important passes are Kurram and Tochi (Costea and De-Mason, 2001).

Rajput (2002) studied the anatomy of Secondary xylem of seventeen species from nine genera of Amaranthaceae and said that in

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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* and *Digera arvensis* the inter fascicular regions exclusively differentiated into thin walled axial parenchyma cells on both xylem and the phloem side. 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 ray-less nature of xylem. Morphological, anatomical characters are now applied in solving of controversial taxonomical and phylogenetical 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, their herbarium specimens were prepared. 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).

Morphological study:

The general morphological description of the characters like habit, root, stem, leaves and flowers from fresh material of the collected weeds were recorded along with their photographs.

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.

RESULT AND DISCUSSION

Investigations were made on Taxonomical classification of seven prevalent species found in different fields of District Bannu. These plants are *Physalis angulata* L., *Polygonum barbatum* L., *Portulaca oleracea* L., *Ranunculus muricatus* L., *Solanum surattense* (Burn.) F., *Sonchus aspe*r L. and *Xanthium stramurium* L.

Table-1. Systematic position of *Physalis angulata* L.

Systematic Position	
Botanical Name	*Physalis angulata* L.
Synonym	*Physalis lanceifolia* Nees *Physalis pendula* Rydb.
Family	Solanaceae
Local name	Hotelie
English Name	Cape gooseberry, wild tomato.
Propagation	By seeds and vegetative method.
Part used	Whole plant
Flowering period	January-Feb

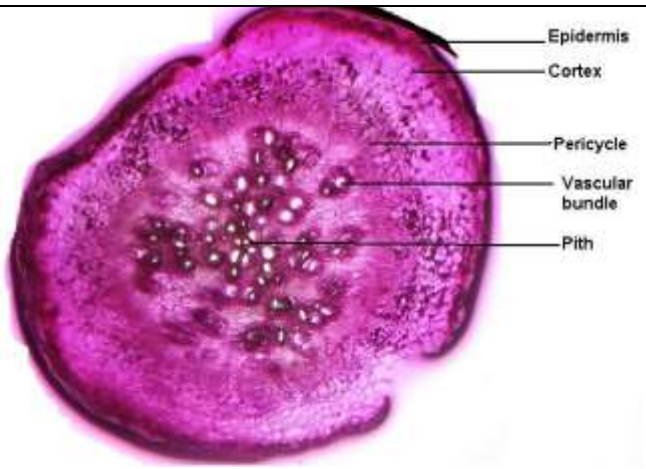
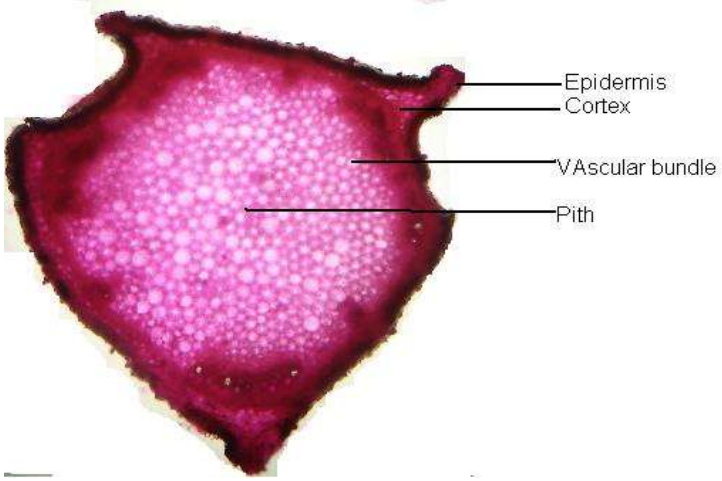
Fig. Transverse section of stem	 **Stem:** The outermost is compact cells of epidermis surrounds the Cortex that is composed of several layers of collenchymatous cells. Another layer the endodermis separates the cortex from vascular region. Disperse vascular bundles are present in the centre along with Pith.
Fig. Transverse section of Root	 **Root:** The transverse section shows a thick layer of epidermis which sourronding the cells of cortex. Cortex is large composed of paranchymatous cells. The endodermis and pericycle are absent. Pith is also present. Fig.11

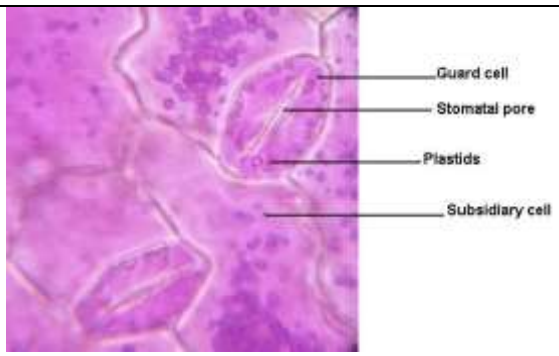
Fig. Anatomy of stomatal aperture:	 It has "Anomocytic" type of stomata.

Table-2. Systematic position of *Polygonum barbatum* L.

Systematic Position		
Botanical Name	*Polygonum barbatum* L.	
Synonym	*Persicaria barbata* (L) H.Hara *P. omerostroma* (Ohki) Sasaki *Polygonum kotoshoense* Ohki *P. omerostromum* Ohki.	
Family	Polygonaceae	
Local name	Khowar	
English Name	Small Knotweed	
Propagation	By seeds	
Part used	Root, stem and leaves	
Flowering period	June-December	

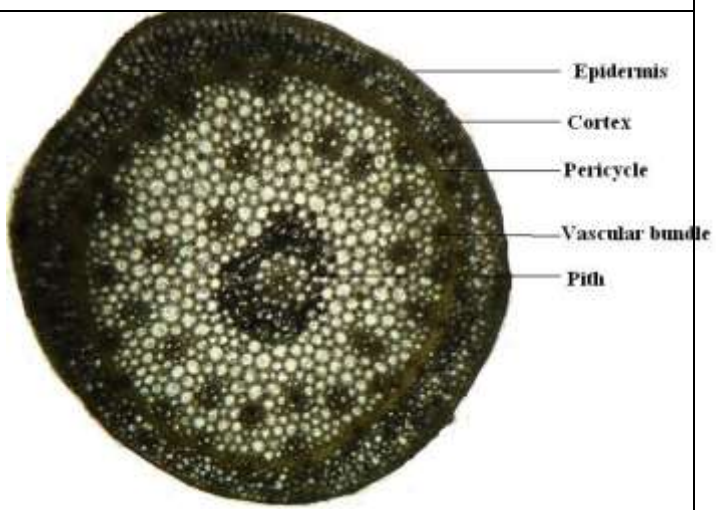
Fig. Transverse section of stem	 **Stem:** The epidermis is thick. Cortex is composed of few layers of cells. Vascular budles are arranged in scattered form inside the endodermis. The pith is composed of collenchymatous cells.
Fig. Transverse section of Root	 **Root:** The cortex is large and surrounded by epidermal layer. Cortex consists of both parenchyma and collenchymas cells . large endodermis is present beneath the cortex. The central region consist of large number of vascular bundles which are arranged in ring form. The figure shows presence of large center pith.

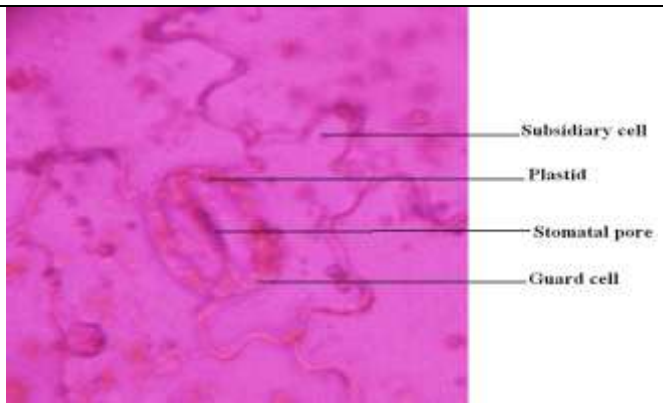
Fig. Anatomy of stomatal aperture:	 This plant has Anomocytic (irregular celled) *type of stomata.* In this *type*, the *stomata* are surrounded by a limited number of epidermal cells which are indistinguishable from other.

Table-3. Systematic position of *Portulaca oleracea* L.

Systematic Position		
Botanical Name	*Portulaca oleracea* L.	
Synonym	Nil	
Family	Portulacaceae (Aizaoaceae)	
Local name	Woorkhora.	
English Name	Garden purslane.	
Propagation	By seeds and vegetative method.	
Part used	Whole plant	
Flowering period	May-June.	
Fig. Transverse section of stem	**Stem:** The cortex is surrounded by thick epidermal layer. The well-developed cortical cells are parenchymatous which are tightly arranged. Vascular bundles are lying along the endodermis forming a ring like structure. The center consists of parenchymatous pith.	

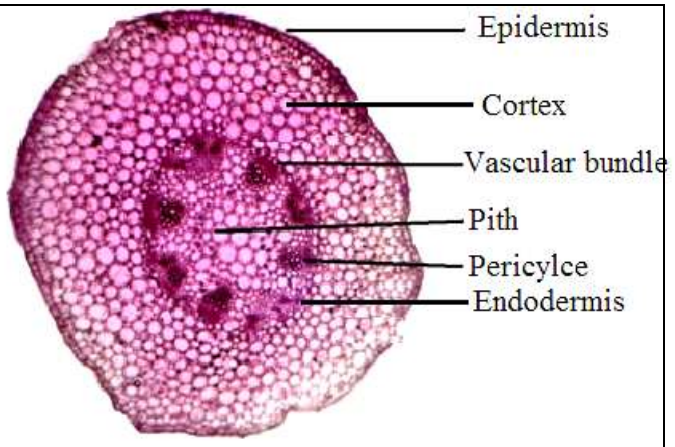
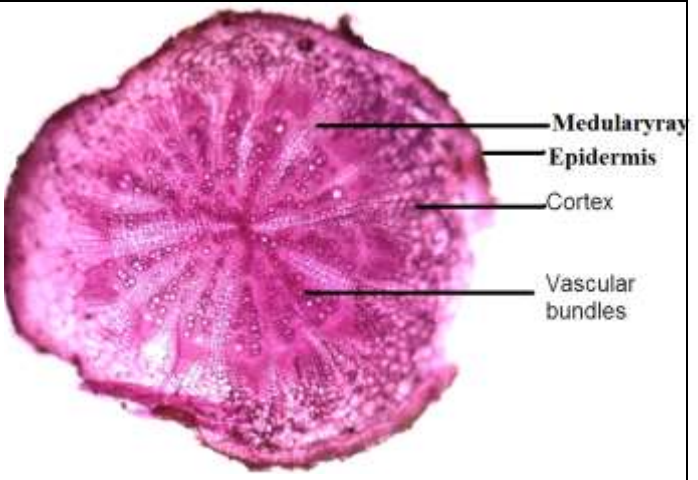


Fig. Transverse section of Root



Root:

Epidermis is composed of several layers. Large cortex is present composed of thick parenchymatous cells. The central zone of root is covered by radially arranged vascular bundles. Medulary rays alternate with vascular bundles.

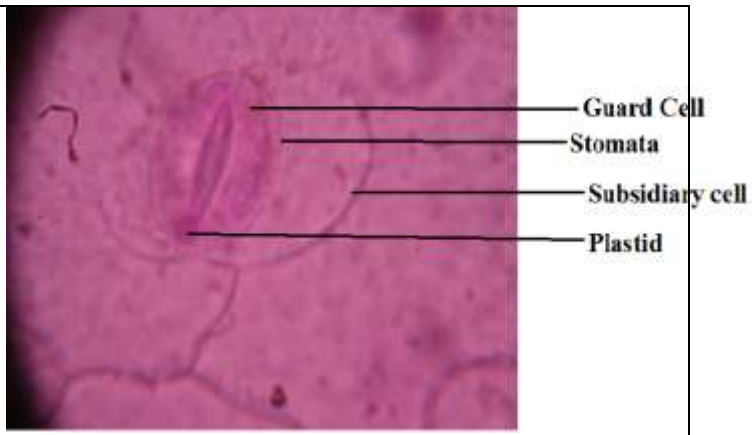
Fig. Anatomy of stomatal aperture:	 *Portulaca oleracea. Has* Parallelocytic type of stomata**:** In parallelocytic stomata, an alternating complex of three or more cshaped subsidiary cells is present.

Table-4. Systematic position of *Ranunculus muricatus* L.

Systematic Position	
Botanical Name	*Ranunculus muricatus* L.
Synonym	Nil
Family	Ranunculaceae
Local name	Zeiarhgulai
English Name	Spiny fruit buttercup
Propagation	By seeds**.**
Part used	Whole plant
Flowering period	March- April

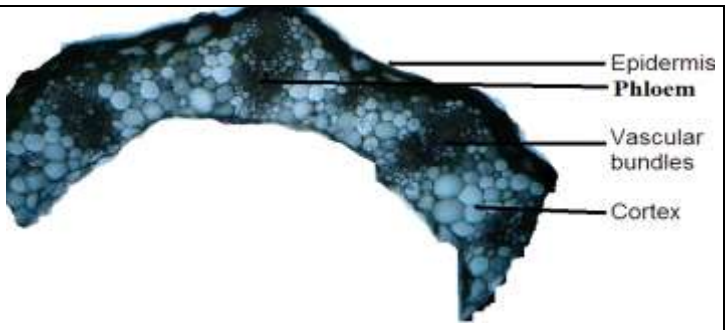
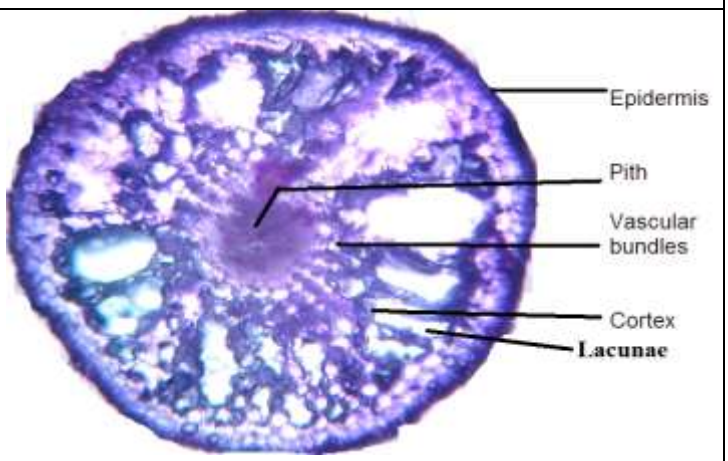
Fig. Transverse section of stem	 **Stem:** It has hallow stem. The epidermis is composed of compact cells, The cells of cortex are parenchymatous. The vascular bundles are embedded in the parenchymatous region of ground tissues.
Fig. Transverse section of Root	 **Root:** Epidermis is composed of single layer. Large cortex is present composed of thick parenchymatous cells and having large spaces. The central zone of root is covered by vascular bundles. Pith is also present in the center of root.

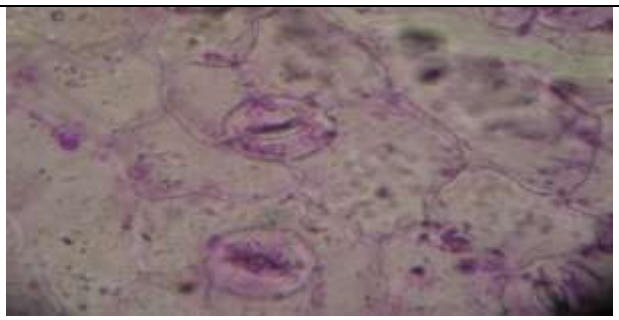
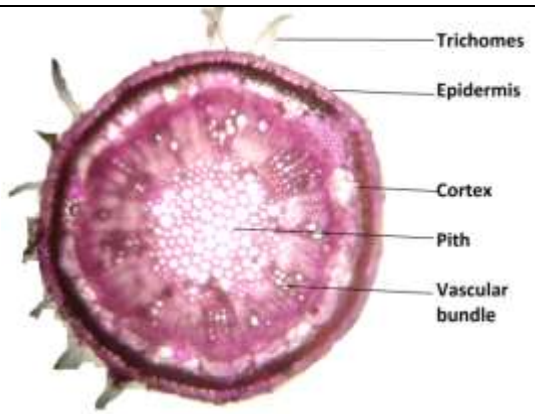
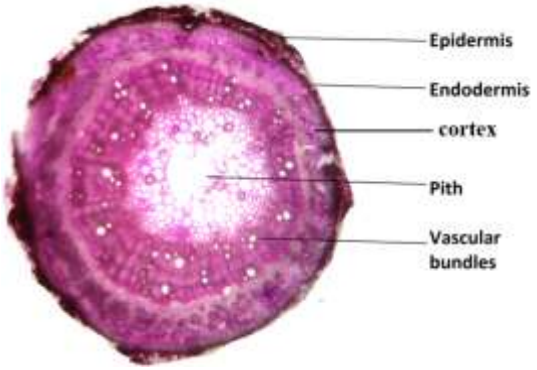
Fig. Anatomy of stomatal aperture:	 The Anatomy of stomatal aperture of this plant is of "Anomocytic" type, in which the guard cells are surrounded by a certain number of cells. ***stomatal aperture L.*** That don't differ in size and shape from the other epidermal cells.

Table-5. Systematic position of *Solanum surattense* (Burn.) F

Systematic Position		
Botanical Name	*Solanum surattense* (Burn.) F	
Synonym	*S. xanthocarpum* schrad & wendl	
Family	Solanaceae	
Local name	Wara-mara-ghinrhye.	
English Name	Yellow-berried nightshade	
Propagation	By seeds	
Part used	whole plant	
Flowering period	Through out the year.	
Fig. Transverse section of stem	**Stem;** Few layered epidermis is surrounded by Trichomes. The cortex lies beneath the epidermis. Vascular bundles are found in scattered form. . The center consists of large parenchymatpus pith.	

	
Fig. Transverse section of Root	**Root:** Epidermis is thick layered. Thin layered cortex is present which is composed of parenchymatous cells. Endodermis is found in the root. The central zone of root consists of hollow pith. Scattered vascular bundles are there in the root of *Aerva lanata* L. 
Fig. Anatomy of stomatal aperture:	It was observed during microscopic study that the stomata type of *Solanum surattense*. "Anisocytic" in which the guard cells are surrounded by three unequally sized subsidiary cells

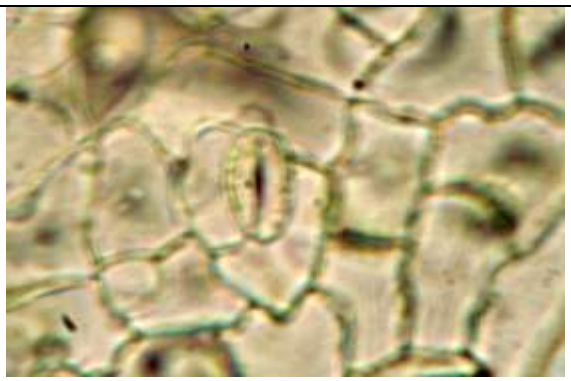
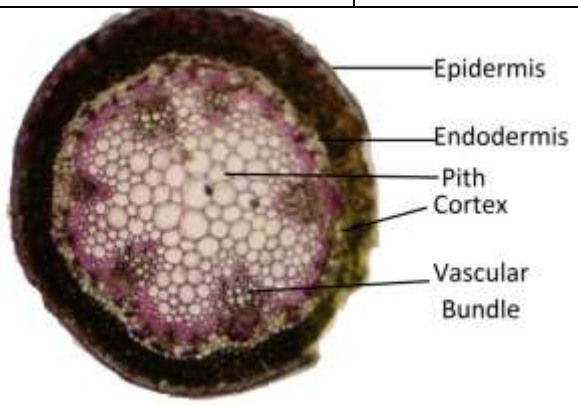
	. 

Table-6. Systematic position of *Sonchus asper* (L.) Hill

Systematic Position		
Botanical Name	*Sonchus asper* (L.) Hill	
Synonym	Sonchus nymanii Tineo & Guss.	
Family	Asteraceae	
Local name	Tharezha	
English Name	Spiny Sow Thistle	
Propagation	By seeds	
Part used	Whole plant	
Flowering period	Mostly at bloosoms seasons	
Fig. Transverse section of stem	 **Stem:** Athick epidermal layersurrounds the cortex. Endodermis is well developed. Vascular bundles are	

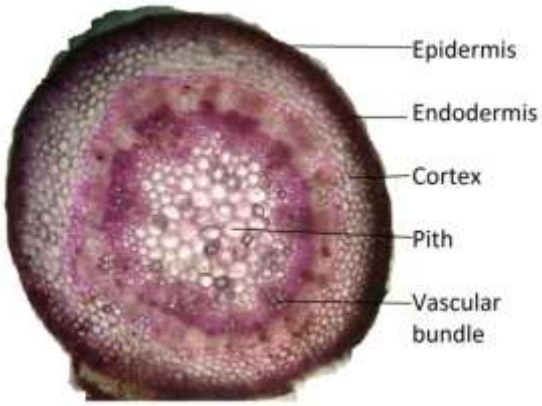
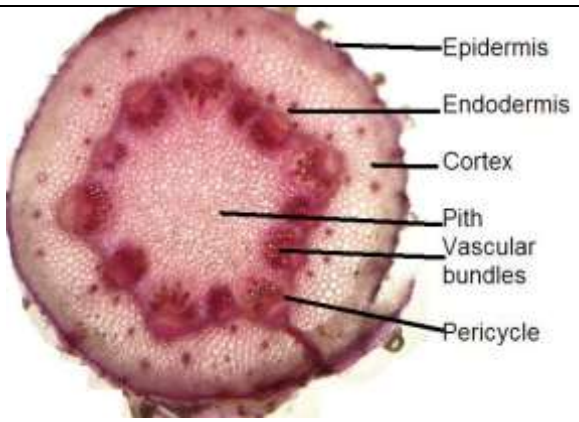
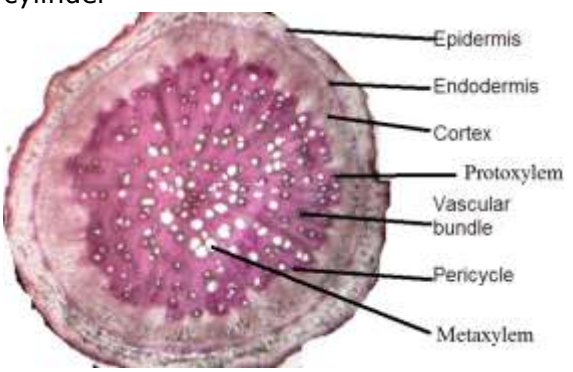
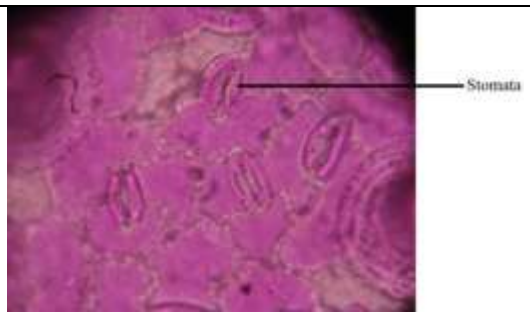
	lying along the endodermis. The centre consists of large parenchymatpus pith.
Fig. Transverse section of Root	 **Root:** The transverse section shows thick layer of epidermis with few layered cortex. The endodermis is also found. The vascular bundles are arranged in bundles. Pith is also present.
Fig. Anatomy of stomatal aperture:	 *Sonchus asper* L. has anomocytic*type of stomata*

Table-7. Systematic position of *Xanthium strumarium* L

Systematic Position		
Botanical Name	*Xanthium strumarium* L	
Synonym	*Xanthium arenarium* Lasch *Xanthium americanum* Walter *Xanthium abyssinicum* Wallr.	
Family	Asteraceae	
Local name	Shapazaoka	
English Name	Common Cocklebur	
Propagation	By seeds	
Part used	Leaves, roots and seeds.	
Flowering period	May to September.	
Fig. Transverse section of stem	**Stem:** The epidermis is composed of compact cells, having multicellular epidermal hairs. The cells of cortex are parenchymatous as well as collenchymatous. The endodermis is the inner most layer of cortex which is wavy and contains many starch grains. The schlerenchymatouspericycle is also present. The vascular bundles are imbedded in the parenchymatous region of ground tissues. The pith of stem has covered large area and consists of parenchyma cells.	

	
Fig. Transverse section of Root	**Root:** The thick layer of epidermis surrounds cortex. The cortex is large and collenchymatous and their cells are compactly arranged. 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 
Fig. Anatomy of stomatal aperture:	The Anatomy of stomatal aperture of *Xanthium strumarium*is "Anomocytic" type. The guard cells are surrounded by a certain number of cells that do not differ in size and shape from other Epidermal cells.



The present study proved very helpful and resulted in exploration of valuable variations in the configuration of foliar epidermal, stomatal aperture, 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 (Scatena et al., 2005; Uphof, 1962).

The epidermis possesses a number of important diagnostic character 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 (Dickison,2000). 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 platns 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 CO2 (Croxdale, 2000; Glover, 2000). 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.

REFERENCES CITED

Ali, S.I. and M. Qaisar.1995-2005.Flora of Pakistan. Botany Department, University of Karachi.

Algan, G. 1981. Microtechniques for plant tissues. University of Firrat publications, Istanbul, 1: 1-94.

Andreson, C., H. Stryhn and J.C. Streibig. 1996. Decline of the flora in Danish arable field. J. Appl. Ecol. 33 (3):619-626.

Balasbramanian A., A.J. Thresiammar and S. Saravanan. 1993. Petiolar anatomy as an aid for the identification of *Cinnmomum* species(Lauraceae). Indian Forester, 119: 583-586.

Costea, M. and D.A. DeMason.2001. Stem morphology and anatomy in *Amaranthus* L. described (Amaranthaceae)-Taxonomic significance. J. Torrey Bot. Soc. 128: 254-281.

Holm, L., J. V. Pancho, J. P. Herberger and D.L. Pluckenett. 1979. A geographical atlas of world weed. John Wiley, 391p.

Johanson, D.A. 1940. Plant microtechniques, Mc.Graw Hill, New York,pp. 105-116.

Rajput, K.S. 2002. Flora - Morphology, Distribution, Functional Ecology of Plants 197 (3): 224-232.

Nasir, E. and S.I. Ali.1970-1995.*Flora of West Pakistan and Kashmir*. Pakistan Agriculture Research Council, Islamabad.

Nadkarni, K.M. and R.N.Chopra. 2002.Indian Material Medica, 1**:** 21-22

Ravendra, K. and Martin, P., 2006. Ethnomedicinal plants, pp. 211. Agro.Bios.Publishers, India.