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Morphological and Anatomical Studies on Selected Dicot Xerophytes of District Karak, Pakistan

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Abstract: The present study was conducted during 2011, nine (dicots plant species belonging to eight families were collected from Karak district. The plants were studied morphologically, as well as anatomically. The family Asteraceae was dominant followed by the Mimosaceae and Sapindaceae. Similarly, the plant *Acacia nilotica* (Mimosaceae) was dominant followed by *Dodonaea viscose* (Sapindaceae).The plants were found to be well adapted to the environment of district Karak. The morphological adaptations were observed by dense hair, powder and cuticle layers on leaves and stem. The leaves were found to be leathery, needle like and elongated shapes. Sometimes, the leaves were found to be modified into thorns and spines. Similarly, thick and short rhizome, compact epidermis, wide cortex and many water storing tissues were observed during the study. The xerophytes of district Karak were found to be well adapted in the extreme environmental factors of temperature, humidity, rainfall ratio, soil and wind velocity etc.

Key words: Xerophytes · Morphology · Anatomy · Nine dicot species · Karak · Pakistan

INTRODUCTION

Morphology of plant species is extremely essential field for all types of research because without it no one can understand about the plant and its characters. Similarly anatomy is also very needed as in the old days scientists were used this tool for the identification of the plants. Xerophytes are the plants which are able to survive in an environment with a limited supply of water as compared to the hydrophytes and mesophytes. [1] stated that xerophytes may have adapted in shapes and forms (morphology) or internal structure anatomy that reduce their water loss or store water during long periods of dryness. Plants with such adaptations are called xeropyhtes [2]. Xerophytes are naturally grow in dry regions [3]. The *Alhaji maurorum* has sharp thorns to compensate the harsh environment [4]. Hadidi *etal*., [5] reported that morphological and genetically variations among four desert *Sphaeralcea* species. Islam *et al*., [6] reported anther types of Dicots within Flora of Karachi. Phillips and Comus [1] discussed that xerophytes have many lateral roots accompanied by very long tape roots which can develop tens of meters. Such tape roots reach the deep layers of soil where water is permanently present. The drought stems are often the primary photosynthetic organs in desert species. Stem of some xerophytes is modified to leaf like, flattened and fleshy structures, which are called phylloclades [7]. In some xerophytes, a number of axillary branches become modified into small needle like green structures which look like leaves and are called cladodes. This study might be helpful for the future research [1]. Effect of different stresses should be studied upon the internal structure of these plants as Hameed *et al*., [8] discussed five sedge species (*Bulboschoenus affinis, Cyperus alternifolia*, *C. conglumeratus*, *Fimbristylis dichotoma* and *Schoenoplectus litoralis*), to investigate the leaf anatomical modifications to withstand environmental stresses. Similarly phytochemical analysis should be linked with the changes in the internal structure of the plants. As mentioned above, many workers have documented the ethnobotanical uses of medicinal plants

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from district Karak but the morphological and anatomical study was still unexplored. Therefore, a need was felt to document such adaptation and internal characters of the xerophytes. The aim of the present study was to investigate the morphological and anatomical characters of xerophytes of the district Karak, Khyber Pakhtunkhwa.

MATERIALS AND METHODS

District Karak Khyber Pakhtunkhwa, Pakistan, is situated at an altitude of 70.40°-70.30°N and the longitude of 32.48°-33.23°E. It is situated at 340m above the sea level.

The xerophytes(dicot)of the Karak were studied adopting following strategies.

Survey and Collection of Plants: The surveys of the study area were conducted during the May-June 2011. Two samples of each plant species were collected and packed properly.

Drying and Preservation of Plant Specimens: The xerophytic plants were properly sprayed with mercuric chloride, $CuSo_4$ and spirit to protect them from the decomposition. After poisoning, they were mounted on standard herbarium sheets with proper taxonomical identification as Gostin [9] anatomical and micromophological peculiarities of Ranunculaceae.

Taxonomical Studies: The proper identification and taxonomy of each and every xerophyte was carried out with the help of available literature.The identification was confirmed and authenticated by Mr. Abd- ur-Rehman, Professor of Botany, Govt Post Graduate College Bannu and Dr. Jan Alam, Assistant Professor, Department of Botany, Hazara University, Mansehra.

Morphological Studies: The general morphological descriptions of the characters like habit, root, stem, leaves and flowers were done according to method of Gostin [9].

Anatomical Studies: Study of the anatomy and histology of the collected species through preparing the safranine double stained slides of transverse sections of leaves, stem and roots of the collected plants were managed. T.S of leaves, stem and roots were examined under power microscope. Microphotographs of the prepared sections were made by using digital camera.

RESULTS

The plants of district Karak were collected, identified and studied for their morphological and anatomical features. The details of description is given below:

Botanical Name: *Acacia nilotica*
Voucher Number: 3612
Local Name: Kikar
Distribution: Common throughout the area.

Morphology
Habit:*A. nilotica*is a spiny tree (Fig.1).
Leaf: Leaves compound, peteolate and small.
Stem: Stem rough, black to blackish grey with sharp spines.
Root: Tape roots long and branched.
Flower: Flowers yellow with pleasant smell. Fruit pod. Seeds flat, lying transversely in the pods.

Anatomical Description: The transverse sections of leaf, stem and root showed the following anatomical features.

Leaf: Epidermis present above paranchymatous mesophyll tissues found. Vascular bundles clear in the rings form. Around the vascular tissues, bundle sheath cells like (Xhylem and Plhoem) were present, the characteristic property of xerophytes (Fig.1).

Stem: Epidermis enclosed the cortex. Cortex composed of collenchymatous cells. Beneath the cortex, endodermis found. Next to the pericycle, radially arranged parenchymatous tissues present with the capacity to retain large quantity of moisture. Numerous vascular bundles in the centre and some of them was in scattered form (Fig.2).

Roots: Epidermis surrounding the cortex. Scattered vascular bundles. The protoxylems in the centre while metaxylems towards the cortex. Xylem vessels, many in numbers, the xerophytic character of the plant (Figure.3).

Scientific Name: *Calotropis procera*
Voucher Number: 3633
Local Name: Spalmaka.
Distribution: Common throughout the area.

Morphology
Habit: A shrub (Fig. 2).
Leaves: Simple, opposite, extipulate, sessile and ovate.

Stem: Woody below and herbaceous above.
Roots: Deep tape root.
Inflorescence: Umbellate with lateral cymes.
Flower: Regular, whitish purple color and bisexual. Fruit pod. Seeds oval or rounded.

Anatomical Description: Transverse section of leaf, stem and roots of *Calotropisprocera* showed the following features.

Leaf: Outermost layer epidermis, beneth a cortical region. In leaf anotomy, mesophyll tissues are found. The section clearly showing endodermis.Vascular bundles in the the form of rings.The white colour tissues to store water, lying at the centre (Fig. 4).

Stem: The epidermis consisting of single layer of compact cells without intercellular spaces. The cortex consists of collenchymatous cells. Endodermis separating the vascular region from the cortex. The vascular bundles arranged radially. Pith, tvast and parenchymatous (Fig. 5).

Roots: The epidermis consists of elongated cells. The massive parenchymatous cortex. Endodermis beneath the cortex. Heavy development of xylem vessels. Protoxylem vessels arranged towards the peripherl layer, while the metaxylem was in the centre (Fig. 6).

Botanical Name: *Carthamus oxycantha*
Vaucher Number: 3615
Local Names: Azghai
Distribution: Found in the hilly region of the area.

Morphology
Habit: Annual herb, small, bushy, erect and spiny weed (Fig. 3).
Leaves: The leaves are alternate, opposite or whorled in some cases and often deeply lobed. The margins were dentate
Stem: Non-woody.
Roots: Deep tape roots.
Inflorescence: Capitulum.
Flower: Flowers yellow. Fruit is achene. Seeds flat and elongated.
Anatomical Description: Transverse sections of leaf stem and roots showed the following features.

Leaf: The epidermis surrounding the thick cortex. Vascular bundles in rings shape. Water retention and conservation tissues in the center. Bundle sheath cells surrounding the vascular bundles (Fig. 7).

Stem: A cuticle layer around the epidermis. Beneath the epidermis, parenchymatous cortex.Endodermis, the inner layer. Vascular bundles numerous (Fig. 8).

Roots: Epidermis around the cortex. Parenchymatus cortical zone. Vascular tissues in a circle around the pith, showing high capacity of water conduction. Pith composed of ground tissue (Fig. 9).

Botanical Name: *Cicer arietinum*
Vaucher Number: 3616
Local Name: Channa
Distribution: Ahmad Abad, Chukara, AmberiKela, Hamidan Banda BahadurKhel., Banda Daud Shah, Soor Dag and Latamber.

Morphology
Habit: Small herb (Fig. 4).
Leaves: Leaves compound, small with hair on its both surfaces.
Stem: Stem herbaceous and slightly tough due to dry condition of the area.
Roots: Tape roots, branched and deep.
Flower: Flowers complete, regular and pink. Fruit, caryopsis. Seeds, rounded.

Anatomical Description: Transverse sections of leaf stem and root showed the following anatomical features.

Leaf: A thick epidermis which prevents water loss. Beneath the epidermis, photosynthetic mesophyll tissues are found. Palisade mesophylls elongated, just below the epidermis, while spongy mesophylls, irregular in shape. Vascular bundles in rings (Fig. 10).

Stem: A cuticle layer around the epidermis. Beneath the epidermis, parenchymatous cortex.Pericycle separating the cortex from the vascular region. Vascular tissues numerous and in rings from (Fig. 11).

Roots: Thick epidermal layer. Vascular bundles radially arranged. Large parenchymatous cortex which retains moisture and faces the xeric environment (Fig. 12).

Botanical Name: *Datura alba*
Vaucher Number: 3617
Local Name: Barbaka
Distribution: Ahmad Abad, AmberiKela, Gardi Banda, Chukara, Musakan,BandaDaud Shah, BahadurKhel.

Morphology
Habit: It is poisonous annual herb with strong smelling (Fig. 5).
Leaves: Simple, extipulate, alternate, while, opposite in floral region.
Stem: Herbaceous, erect and branched.
Roots: Tape roots, branched and deep.
Inflorescence: Auxiliary cyme.
Flower: Flowers regular and bisexual. Colour ranges from white to cream. Fruit, capsule.Seeds, ovate.

Anatomical Description
Transverse sections of leaf, stem and roots showed the following features.

Leaf: The transvers section showing the outer layer of cells of epidermis. The epidermis, stores large quantity of water. Vascular bundles, like xhylem and phloem. (Fig. 13).

Stem: A cuticle layer around the epidermis. Beneath the epidermis, parenchymatous cortex. Endodermis, the inner layer.Numerous vascular bundles were found in rings shape (Fig. 14).

Roots: Epidermis around the cortex. Wide cortex. Star shaped vascular tissues. Large number of ground tissues showing high capacity of water storage (Fig. 15)

Botanical Name: *Dodonaea viscose*
Vaucher Number: 3618
Local Name: Sanatha.
Distribution: Ahmad Abad, Chukara, Soor Dag. Latamber, MitaKhel, Bogara, Musakan and Sabir Abad.

Morphology
Habit: Itis an evergreen shrub (Fig. 6).
Leaves: Leavessimple, alternate and secrete a resinous substance. Pinnate and stipulate.
Stem: Erect and forked at apex.
Roots: Deep tape roots.
Inflorescence: Panicle.
Flower: Flowers yellow to orange-red, small, unisexual and actinomorphic. Fruit winged capsule. Seeds rounded and small.

Anatomical Description: Transverse sections of leaf, stem and roots showed the following features.

Leaf: The transevers section of leaf showed the various internal tissues. The first row of cells, epidermis, below which mesophyll tissues are found. Endodermis is below the mesophyll. Star shaped vascular bundles. Many tissues for retention and conservation of water were observed (Fig. 16).

Stem: The epidermal layer covering the cortex. The paranchymatuos cortex which stores large amount of water that helps the plant to survive in severe climate. Vascular bundles polyarch.. Pith large, parenchymatous and can retain maximum water to sustain its life in critical period (Fig. 17).

Roots: Epidermis enclosed the cortex. The thick parenchymatous cortex retains large amount of water. Radial vascular bundles, large pith. Much of the root section is covered by vascular bundles (Fig. 15).

Botanical Name: *Echinopsechinatus*
Vaucher Number: 3619
Local Name: Kata sora.
Distribution: Ahmad Abad, Hujaki, Musakan Banda, AmberiKela, TakhteNusrati, Bogara, Hamidan Banda, Sabir Abad, MitaKhel, Latamber.

Morphology
Habit: It is an erect, spiny and branched herb (Fig. 7).
Leaves: The leaves simple, alternate and rough.
Stem: Short, stout, branching from the base, covered with white cottony hairs, erect and spiny.
Roots: Branched tape root.
Inflorescence and Flower: Corymb, flower white, hermaphrodite. Fruit, achene.

Anatomical Description: Transverse sections of leaf, stem and roots showed the following features.

Leaf: The epidermis surrounding the thick cortex. Vascular bundles numerous and in rings. Water storing tissues in the center.Bundle sheath cells surrounding the vascular bundles (Fig. 19).

Stem: A cuticle layer around the epidermis. Beneath the epidermis, parenchymatous cortex. Vascular bundles numerous and in rings (Fig.20).

Roots: Epidermis around the cortex. Large cortical zone Widecortex. Radial vascular bundles. Clear endodermis (Fig. 21).

Botanical Name: *Eucalyptus lanceolatus*
Vaucher Number: 3621
Local Name: Lochaie.
Distribution: Ahmad Abad, Chukara, AmberiKela, Musakan Banda, Hamidan Banda, MitaKhel and Gardi Banda.

Morphology
Habit: Tree (Fig. 8).

Leaves: The leaves lanceolate, petiolate, alternate and waxy green. While the leaves of seedlings often opposite and sessile.

Stem: Erect woody and branched.
Roots: Branched tape roots.
Flower and Inflorescence: Flowers with numerous white, creamy or yellow stamens. Petals absent.Fruit capsule.Seeds small and rounded.

Anatomical Description: Transverse sections of leaf, stem and roots showed the following features.

Leaf: The epidermis is thick. Below the epidermis Mesophyll tissues are found..Vascular bundles was in rings form. (Fig. 22).

Stem: A cuticle layer around the epidermis. Beneath the epidermis, parenchymatous cortex.Vascular tissues, numerous (Fig. 23).

Roots: Thick epidermis, enclosing the cortex. Cortex comprised of dense parenchymatous cells. Vascular bundles, arranged radially in the center. Protoxylems and metaxylems clear (Fig. 24).

Botanical Name: *Melia azadarch*
Vaucher Number: 3624
Local Name: Bakana
Distribution: Common throughout the area.
Morphology
Habit: *M. azadarch*is a tree (Fig. 9).
Roots: Branched and deep Tape roots.
Stem: Erect and woody with numerous branches. Grey in colour or sometimes light black, straight and smooth.
Leaves: Leaves opposite, pinnate. Medium to dark green leaflets, Petioles short.
Inflorescence: Inflorescence branched spike with many flowers.
Flower: Flower bisexual. Male and female flowers on the same individual. Fruit berry. Seeds, rounded and rough.

Anatomical Description: Transverse sections of leaf, stem and root showed the following features.

Leaf: Epidermis, the outer covering, below, cholenchymatus cortex tissues is found to supporting midrib zone. Vascular bundles clear. Arround the vascular tissues, water storing cells was observed (Fig. 25).

Stem: The epidermal layer covering the cortex. Vascular bundles, polyarch and radially arranged. It retains maximum water to sustain its life in critical period (Fig. 26).

Roots: Epidermis around the cortex.Cortex, wide.Radial vascular bundles.Pith large and composed of ground tissues (Fig. 27).

DISCUSSION

During the survey total 9 important dicot xerophytes were collected which are important in various ways to the local community of district Karak. *Acacia nilotica* is a branched tree of 2–15m height. Bark rough, black, with deep tape roots. Leaf compound, leaflets 12–27 pairs per pinnate. Stem hard and woody with spines. Inflorescence a head. Flowers golden yellow, sweetly scented. Seeds, rounded. Epidermis with cuticle, cholenchymatus cortex, vascular bundles in rows, scattered. Protoxylems in the centre while metaxylems towards the cortex. Xylem vessels many in number, pericycle in ring. The results of present studies are agreement with Elbasheer *et al*., [10] who reported that *A.nilotica* has compound leaves, woody and hard stem, branched and deep tape roots system. They stated that the vascular tissues are arranged radially, sheathing with parenchymatous tissues. However, results of the present studies are different from the work of Iqbal *et al*., [11] who stated that the parenchyma is present in banded form in *A.nilotca*. *Calotropisprocera* is a branched shrub. Diarch and deep tape roots. Body covered with white powder. Leaves simple and peteolate. Plant has viscous latex. Flowers whitish purple in colour. Seeds are rounded or oval. Outer most layer epidermis, wide parechymatous cortex, radialy arranged numerous vascular bundles which are diarch. Pericycle in ring form.The present results is agreement with the work of Satija *et al*., [12]. He stated that the primary root is diarch in *C.procera.* The roots have vascular tissues in two strands each are called diarch. With growth and maturity, the roots become polyarch. The cortex, massive and composed of parenchymatous cells. The stem had numerous vascular bundles to conduct large amount of water. The results of the present

studies are agreement with the work of other workers Subhan *et al*., [13] discussed that the stem of *C.procera* can store and conduct large amount of water due to more vascular bundles. The results of present studies are not supported by previous worker Kumar *et al*., [14] reported that the pericycle is in the form of patches. The patched pericycle might be adaptation due to very intense climatic condition i.e. scarcity of water, less rainfall and high temperature. Pericycle in the present studies, was in the form of a ring. The vascular bundles were arranged radially in the pattern that the protoxylems were laying towards outer periphery while the metaxylems were lying towards the pith.

Echinopes echinatus an erect branched herb. Short, stout stems, covered with spines and white cottony hair. Branched tape roots. Leaves, simple, horny, rough, alternate and deeply pinnatifid. Flowers, outside bluish green and white inside, hermaphrodite. Seeds, rounded. Outer layer, epidermis, wide cortex. Numerous vascular bundles. Ring edpericycle. Zafar and Rafiq [15] reported that *E.echinatus* has spines on leaves and stem, white flowers and bracts. Cortex is wide and vascular bundles are numerous. Spines are special appendages which minimize the loss of water and protect the plant from drying. *Cicer arietinum* a small branched herb. Tape roots, branched and long. Stem herbaceous and slightly hard. Leaves, compound, Flowers, pink and complete. Seeds, rounded. In dry condition, the branched stem is a certain type of adaptation to prevent the plant parts from drying. A cuticle layer above epidermis, parenchymatous wide cortex. Endodermis found. Pericycle in ring form. *Datura alba* an annual, poisonous herb with branched and long roots.Leaves, simple, extipulate and alternate. Flowers regular and bisexual. Color of the flower from white to creamy. Seeds rounded. Anatomically, epidermis, the first layer, stomata anomocytic. parenchymatous cortex, pericycle in ring. Dawar *et al*., [16] reported that *D.alba* is an annual and bushy herb having the height of three feet and white flowers. Perveen *et al*., [17] discussed the anatomical features of *D.albaand* concluded that *D.alba* has anomocytic stomata. Anomocytic stomata are also called irregular shaped stomata, because the cells around it can't be differentiated from other epidermal cells. They remain closed at night to conserve more water.*Tribulus terrestris* a perennial prostrate herb, roots fibrous and adventitious. Leaves, pinnately compound. Flowers, yellow coloured, seeds rounded.Cuticle, above epidermis. Stomata, anomocytic.Wide parenchymates cortex.Pericycle, found. The results of present studies have similarity with the results of Arshad *et al*., [18] who studied the morphology of *T.terrestri* and stated that it has compound leaves, prostrate branches and yellow flowers. Prostrate branches creep at the surface of the ground to prevent the lower parts of the plant from direct intense sun light. Similarly, compound leaves reduce the leaf surface area to decrease the more loss of water. These are the adaptations to dry environment. The present studies have similarties with the results of Perveen *et al*., [17] who reported that the stomata of *T. terrestris* is anomocytic. *Eucalyptus lenseoleta* a tree, with deep and branched tape roots system, stem erect and woody. Leaves alternate, waxy and green. Flowers, cream coloured with numerous stamens and no petals. Seeds, small and in large number. Thick epidermis, wide parenchymatous cortex.Radial vascular bundles with protoxylems and metaxylems. Baloch *et al.,* [19] worked on *E.lenseoleta*a tree. Stem hard and woody while flowers are numerous. The present studies are agreement with previous work of Zwieniecki& Newton [20] and Baloch *et al.,* [19] who discussed that larger cortical area is related to better storage of moisture content that is essential for survival under harsh climates. Rashid *et al*., [21] and Bahaji *et al.,* [22] reported that thick epidermis is useful in minimizing water loss under limited moisture conditions. *Carthamus oxycantha* an annual, bushy, erect, spiny herb. Long tape roots system, with non woody stem. Leaves have secretary canals with resin or latex. Morphology of leaves is simple, deeply lobed and alternate. Flower yellow coloured. Seeds elongated and flat. Cuticle is found, thick epidermis, wide cortex and metaxylems around the pith. Pith composed of ground tissues. The results of present studies are agreement with previous findings of [23-25]. They reported the morphology and anatomy of *C.oxycantha.* Inboth the studies, plants have spines and lobed leaves. Spines are a type of adaptation in xerophytes. They reduce the water loss and prevent the plant from desiccation. *Meliaazadarch* is an erect tree. Plant has 4-6 feet girth and 40-50 feet height branched and deep roots system. Stem erect and woody. Leaves compound, opposite and pinnate. Inflorescence, branched panicle. Flowers, whitish purple, bisexual and complete. Seeds, rounded and rough.The epidermal layer paranchymatous and cortex wide. Vascular bundles, radially arranged. Pith large of parenchymatous cells. The results of the present studies are agreement with Kumar *et al.,* [14] who reported that *M.azadarch* is a tree of 5 feet girth and 45 feet height having branched roots system. Vascular bundles, radially arranged. Sieve tubes,separated and cortex, wide. *Dodonaea viscosa* is a branched shrub of 1–3m height.

Tape roots system. Stem erect and forked at the apex. Leaves simple, pinnate, alternate and stipulate. Inflorescenc, panicle. Flowers yellow, unisexual and actinomorphic. Seeds, rounded. Epidermis single layered, paranchymatuos cortex. Anomocytic stomata. Vascular bundles, polyarch and radially arranged. Pith large and composed of parenchymatous tissues. Present study show that the plant of *D.viscosa* grew upto 3m height. The plant is an evergreen shrub with thick cuticle and leathery leaves.The vascular bundles were in ring.

The findings of present study are agreement with the previous reports. However, some differences in adaptations and modifications were also observed in few cases. Overall the plants were found well adapted to harsh climatic condition of the study area.

Systematic Classification of the plants.

Kingdom	Division	Class	Order	Family	Genus	Species	Botanical name
Plantae	Angiospermae	Dicotyledoneae	Fabales	Mimosaceae	*Acacia*	*Nilotica*	*A.nilotica*
Plantae	Angiospermae	Dicotyledoneae	Gentianales	Apocynaceae	*Calotropis*	*Calotropis*	*C. procera*
Plantae	Angiospermae	Dicotyledoneae	Asterales	Asteraceae	*Carthamus*	*Oxycantha*	*C. oxycantha*
Plantae	Angiospermae	Dicotyledoneae	Papilionales	Papilionaceae	*Cicer*	*Arietinum*	*C.arietinum*
Plantae	Angiospermae	Dicotyledoneae	Solanales	Solanaceae	*Datura*	*Alba*	*D. alba*
Plantae	Angiospermae	Dicotyledoneae	Apindales	Sapindaceae	*Dodonaea*	*Viscose*	*D.viscosa*
Plantae	Angiospermae	Dicotyledoneae	Asterales	Asteraceae	*Echinops*	*Echinatus*	*E. echinatus*
Plantae	Angiospermae	Dicotyledoneae	Myrtales	Myrtaceae	*Eucalyptus*	*Lanceolatus*	*E. lanceolatus*
Plantae	Angiospermae	Dicotyledoneae	Sapindales	Meliaceae	*Melia*	*Azadarch*	*M. azadarch*

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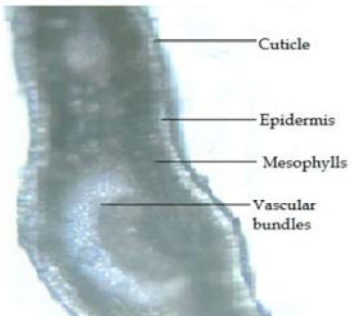

Fig. 1: Transverse section of leaf of *Acacia nilotica*

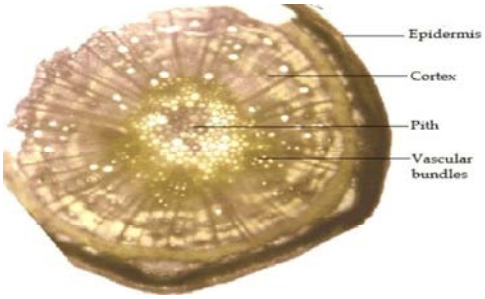

Fig. 2: Transverse section of stem of *Acacia nilotica*

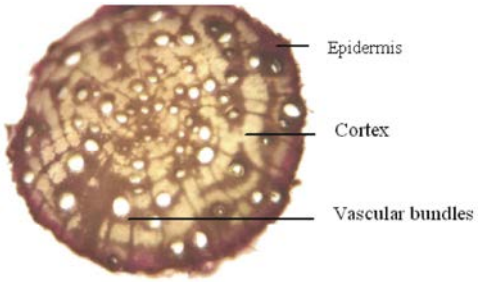

Fig. 3: Transverse section of root of *Acacia nilotica*

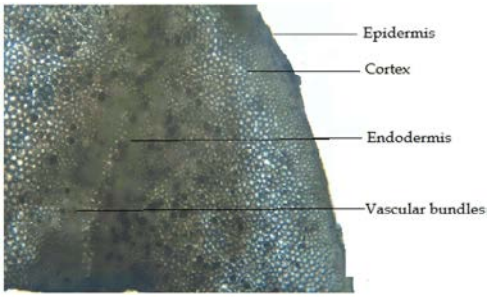

Fig. 4: Transverse section of leaf of *Calotropisprocera*

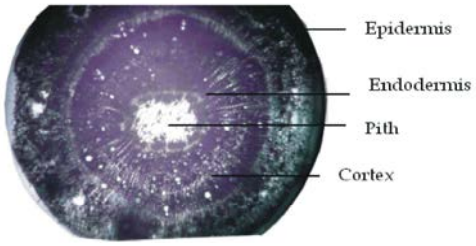

Fig. 5: Transverse section of stem of *Calotropisprocera*

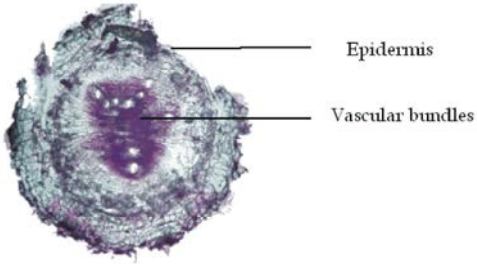

Fig. 6: Transverse section of root of *Calotropisprocera*

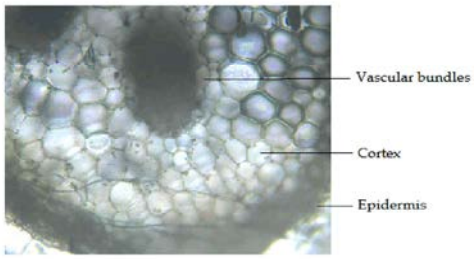

Fig. 7: Transverse section of stem of *Carthamus oxycantha*

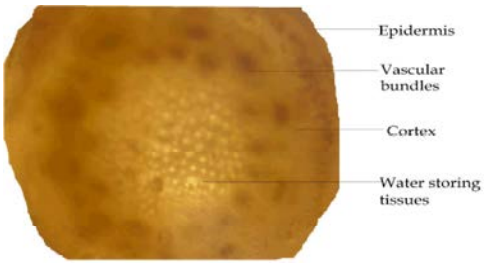

Fig. 8: Transverse section of leaf of *Carthamus oxycantha*

Fig. 9: Transverse section of root of *Carthamus oxycantha*

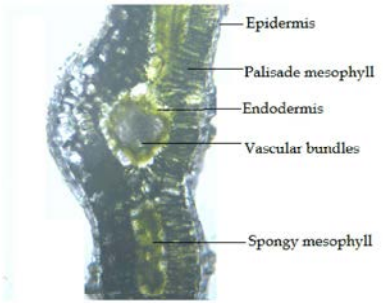

Fig. 10: Transverse section of leaf of *Cicer arietinum*

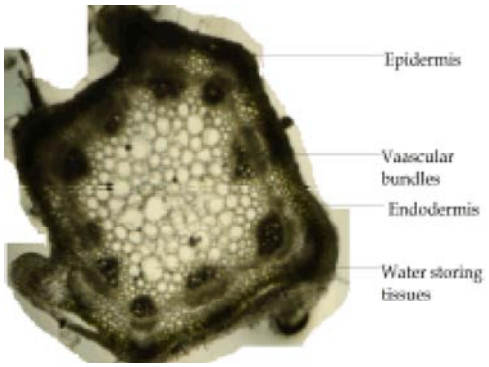

Fig. 11: Transverse section of stem of *Cicer arietinum*

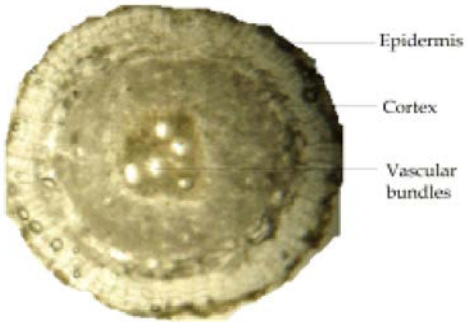

Fig. 12: Transverse section of root of *Cicer arietinum*

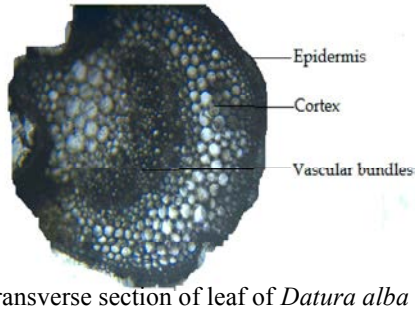

Fig. 13: Transverse section of leaf of *Datura alba*

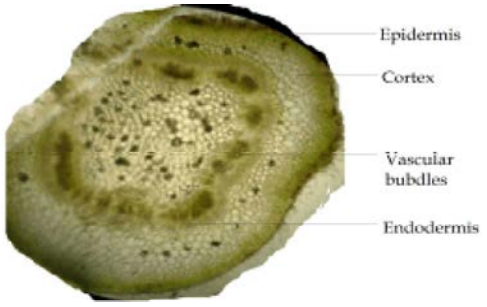

Fig. 14: Transverse section of stem of *Datura alba*

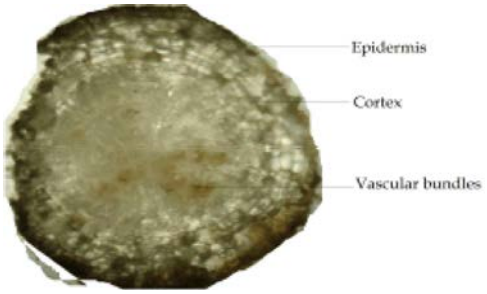

Fig. 15: Transverse section of root of *Dodonaea viscosa*

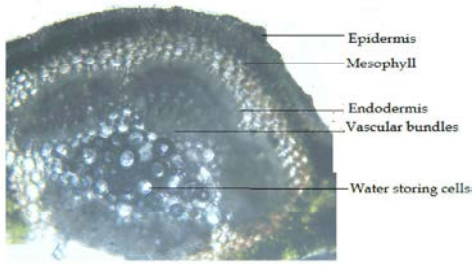

Fig. 16: Transverse section of leaf of *Dodonaea viscosa*

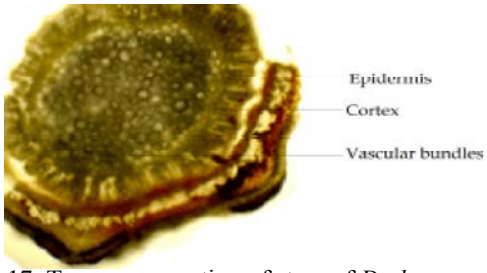

Fig. 17: Transverse section of stem of *Dodonaea viscosa*

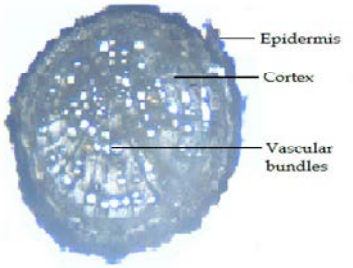

Fig. 18: Transverse section of root of *Dodonaea viscosa*

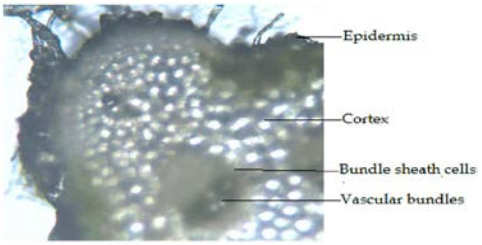

Fig. 19: Transverse section of leaf of *Echinopsechinatus*

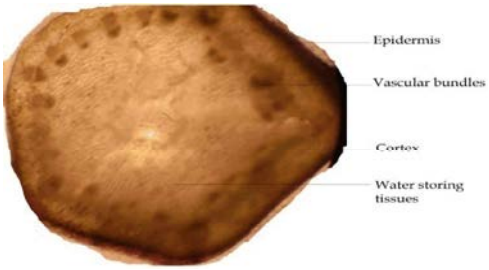

Fig. 20: Transverse section of stem of *Echinopsechinatus*

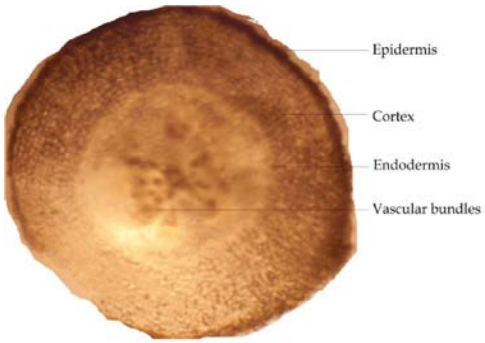

Fig. 21: Transverse section of root of *Eucalyptus lanceolatus*

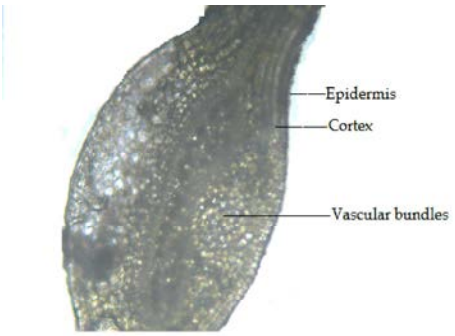

Fig. 22: Transverse section of leaf of *Eucalyptus lanceolatus*

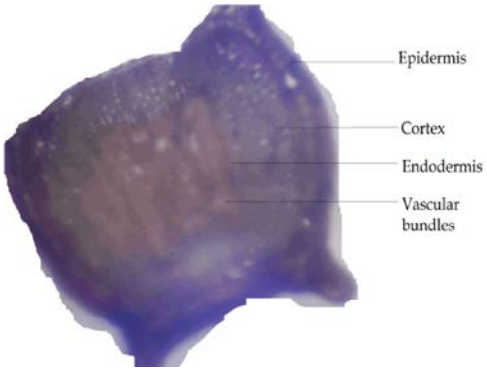

Fig. 23: Transverse section of stem of *Eucalyptus lanceolatus*

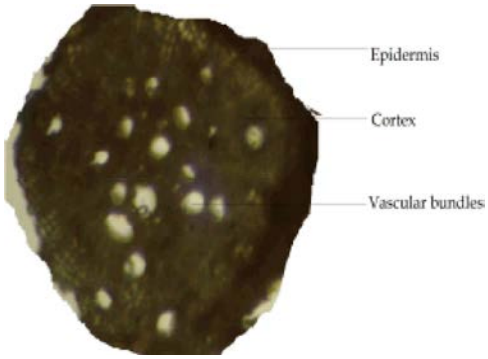

Fig. 24: Transverse section of root of *Eucalyptus lanceolatus*

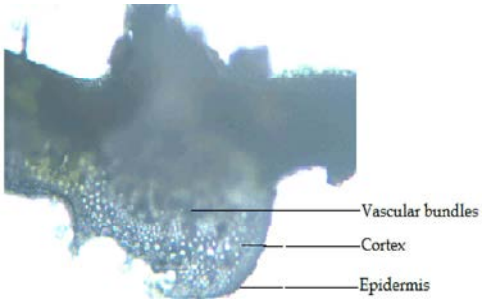

Fig 25: Transverse section of leaf of *Meliaazadarch*

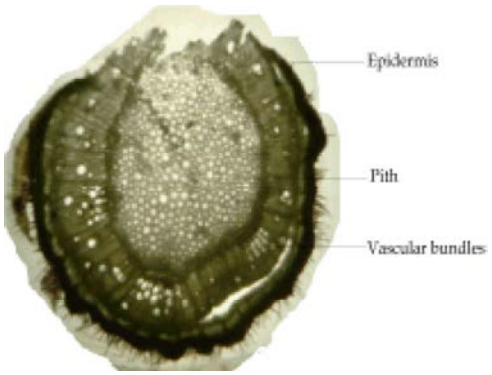

Fig. 26: Transverse section of stem of *Meliaazadarch*

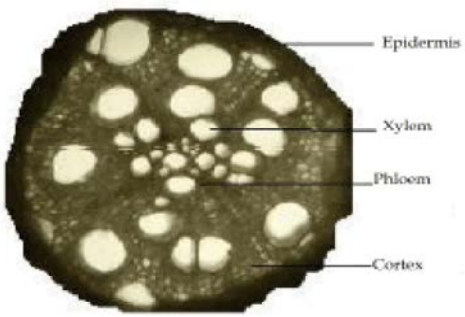

Fig. 27: Transverse section of root of*Meliaazadarch*

CONCLUSION

Karak is a dry area with a special xerophytic flora. It was found that the plants species are adopted to the harsh enveronment of the karak district. They have much developed cortical regions and well developed vascular bundles along with the water storage tissues. But due to the overexploitation and deforestation the natural flora is degrading with an alarming rate. Governments departments with the help of local community should provide a special check to protect the natural valueable flora. The people of the area should give education and awareness about the conservation of natural habitates and how to utilize plants for their better livelihood on sustainable basis.

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