

ORIGINAL ARTICLE

Morpho-Anatomical Study and Classification of Trichomes in Prominent Selected Plants of University of Science and Technology, Bannu

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ABSTRACT

To investigate the structure and distribution of trichomes along with taxonomical exposure of ten prevalent species of weeds belonging to nine different families growing in the premises of new campus of university of Science & technology Bannu was initiated in April-June 2013. They were properly collected and identified and studied their taxonomical and morphological features along with the structure of trichomes within the laboratory of Department of Botany under the supervision of supervisor and co supervisor. So far as the investigation about the structure of trichomes is concerned in *Aerva javnica* L. (Amaranthaceae), *Heliotropium europaium* L., (Boragoniceae), L., *Citrollus colocynthis* L., (Cucrbiteaceae), *Xanthium strumarium* L., and *Helianthus annuus* L. (Asteraceae) they are simple unicellular and hook like, whilst in *Tribulus terresteris* L., (Zygophylaceae), *Cyperous rotandous* L., (Cyperaceae), and *Conyza bonariensis* L., (Asteraceae) *Ficus carica* (Moracea) are simple, unbranched, multicellular and hair like. The presence of trichomes reflect the capabilities of adaptation in the severe climate of this rain fed area by preventing the excessive transpiration in acute intensity of sunlight and as well as in scarcity of sunlight trichomes in the majority of species highlighted have a very crucial role in helping taxonomical status of each specie along with the phylogenetic relationship with other flora irrespective of distribution in xerophytes, mesophytes and halophytes. *Citrullus collosynthis* L., one of the species like wise observed with trichomes having stinging nature and they cause serious irritation when they are touched. Nevertheless some of the trichomes were also noted as having similarity in morphology to spines for example in case of *Xanthium strumarium* L., and *Conyza bonariensis* L.

Keywords: Trichomes, weeds, Taxonomy

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INTRODUCTION

Bannu District is one of the twenty four districts of the Khyber Pakhtunkwa of Pakistan. The chief city of the district is Bannu. Of the rivers the larger is the Kurram, which, entering the District at its north-western corner close to Bannu town runs first south-east, then south into Lakki Marwat. The Tochi River enters the District about 6 miles (9.7 km) south of the Kurram and flows in the same direction, into Lakki Marwat where the streams eventually unite. Between these rivers, and on the left bank of the Kurram in the upper portion of its course, lie the only tracts which are perennially irrigated. For the first 10 miles (16 km) of its passage through the District the Kurram runs between banks of stiff clay which rise abruptly to a height of 10 to 30 feet (9.1 m), and its bed is full of stones and boulders; but lower down it spreads over long stretches of marsh land. Its flow is rapid, but it is highly charged with rich silt which renders it most valuable for irrigation.

Location

Bannu district is approximately 192 kilometers to the south of Peshawar and lies in a sedimentary basin. It is flanked and guarded on all sides by the hard and dried mountain ranges of Koh-e-Safed and Koh-e-

Suleiman. It is a scenic part of the southern region, due to the "Kurrum" river and its tributaries. They have made it a land of meadows, crops and orchards. Every kind of crop and fruit can be grown in it, but the banana, dates, figs and rice are unique in their taste, smell and shape. Geographically, the modern Bannu is located in the heart of the southern region with its boundaries touching the districts of Karak, Lakki Marwat and the North, South Waziristan Agencies.

Most plants have hairs, called trichomes, on their surface that serve a number of functions ranging from protection against insect pests to heat and moisture conservation. Most plants have hairs on their aerial surfaces, superficially similar to the hairs on the human body. Oda *et al.* [1] investigated the vegetative morphology and epidermal features of three species of the genus *Paspalum* L. (*P. conjugatum* Berg, *P. scrobiculatum* L. and *P. vaginatum* Sw.). Buyisile *et al.*, 2008 stated that these plants hairs or trichomes affect the plant in a number of ways. It has been suggested that plant hairs can change the optical properties of the leaf surface and could help to conserve heat and moisture. There are two main types of trichomes: glandular and non glandular. Glandular trichomes contain or secrete a mixture of chemicals that have been found to have an enormous array of uses in the pesticide, pharmaceutical, and flavor/fragrance industries Ghazala *et al.*, [2]. Besides these industrial uses, glandular trichomes on some crop species confer resistance against insect pests. Thus, there is today an increasing interest in understanding the chemistry of glandular trichome exudates and taking advantage of their potential uses.

MATERIALS AND METHODS

The targeted weeds were collected from the premises of University of Science And Technology Bannu in order to study the taxonomical, morphological and structure of their trichomes. There were picked 10 species from 9 families during April-June 2013.

Weeds which were collected can be quoted as under:

Plants Name	Family	Local Name
<i>Aerva javnica</i> L.,	Amaranthaceae	Kharvorrah
<i>Conyza bonariensis</i> L.,	Asteraceae	Shpalyea
<i>Cyperous rotandous</i> L.,	Cyperaceae	Deli
<i>Heliotropium europaium</i> L.,	Boragoniceae	Tapwar
<i>Tribulus terresteris</i> L.,	Zygophylacea	Aghzai
<i>Citrollus colocynthis</i> L.,	Cucrbiteaceae	Tarkha Manrha
<i>Ficus carica</i> L.,	Moracea	Injeer
<i>Xanthium strumariu</i> L.,	Asteracea	Kishay
<i>Halinthous annuus</i> L.,	Asteracea	Nwarparast

Detail of Materials

For the classification and identification of the collected species of different Weeds, some important instruments were utilized. These requirements were Microscope, Slide, and Blades, Beaker, Polythene bags, Distill water and chemical like safranin and digital camera with computer.

Collection of plants species:

Different weeds species were collected from UST Bannu. The fresh parts of plants were used for the identification and classification of trichomes types. The botanical name and concerned family were properly identified. During plant identification help was taken from available literature, and supervisor.

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 through preparing the stained slides of the upper and lower epidermis of their leaves of the collected species which were examined under high power microscope to identify the structure and classification of trichomes.

RESULTS AND DISCUSSION

Investigation of Taxonomical, Morphological Anatomical, and classification of trichomes of 10 prevalent weed species is carried out to evaluate their characteristics. Proper taxonomical identification was completed prior to explore the actual anatomy of trichomes and finally their photomicrograph were preserved of the species as follows; *Citrollus colocynthis* L., *Cyperus rotundus* L., *Xanthium strumarium* L.,

Withania somniferous L., *Xanthium strumarium* L., *Coniza Bonariensis* L., *Aerva javanica* L., *Ficus caraca* L., *Tribulus terresteris* L., *Helianthus annuus* L., *Heliotrophium europium* L.

Table. 01, Systematic Position of *Citrullus colocynthis* L

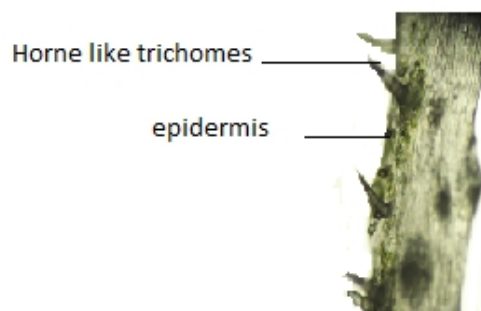
BOTANICAL NAME:	CITRULLUS COLOCYNTHIS L.	
FAMILY:	CUCURBITACEAE	
LOCAL NAME:	TARKHA MANRHA	

Morphological Description:

An extensively trailing annual herb of xerophytic situation with bifid tendrils, angular branching stems and woolly tender shoots. Leaves deeply divided, lobes narrow, thick, somewhat hairy. Flowers are monoecious, yellow, both male and female solitary, corolla pale-yellow. Fruit a globose, fleshy indehiscent berry, 5-7.5 cm in diameter and variegated with green and white. Seeds mostly pale brown.


Propagation : By seeds and vegetative method.

Anatomy of Trichomes. As observed under microscope the trichome of *Citrullus collusynthes* L., are multicellular. The walls of trichomes of *Citrullus collusynthes* is some time impregnated with silica or calcium. The composition of silica may differ specie to specie. Their content each is varied in relation to function. The trichomes of *citrullus* are stinging trichomes because of causing irritation when touched. Scattered on lower epidermis of the leaf and this type of trichomes are already worked out and reported by Quesada et al., [3] and Han-Yi Fu et al., [4].



Photograph of *Citrullus colocynthis* L.

Table.02, systematic position of *Cyperus rotundus* L.

Botanical Name:	<i>Cyperus rotundus</i> L.	
Family name:	Cyperaceae	
Local name:	Dilgay	

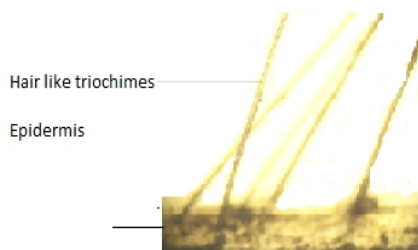
Description

Rhizomatus perennial plant, having underground shoot carry numerous tuberous thickening helping plants to breed. Stems 7-35 (50) cm high, usually single. Leaves are long bearing apical riabile bunches of spikes; the spikes oblong-linear, 10-20 mm in length and 1-2 mm in width; 2-3 basal leaves considerable exceed inflorescence in length. Style with stigmas 6-7 mm in length. Nutlet triquetrous, grayish-brown, about 1.5 mm in length. The species are widely distributed all over the world from eractic temperate or tropical zones, chiefly inhabiting swamps and wet pastures.

Propagation: Propagation is through underground rhizomes.


Anatomy of Trichomes

Microscopic observation shows that the trichomes of *Cyperus rotundus* are long up to 1.5cm. These trichomes are present in angles forming between leaf and stem. These are multicellular and unbranched as reported by Quesada *et al.*, [3].



Photograph of *Cyperus rotundus* L.

Table.03, systematic position of *Withania somnifera* L

Botanical name:	<i>Withania somnifera</i> L.	
Family name:	<i>Solanaceae.</i>	
Local Name:	<i>Khamazorai.</i>	

Description:

An erect branching shrub reaching about 150 cm in height. Flowers greenish or lurid yellow in auxiliary fascicles. The fleshy roots when dry are cylindrical tapering down. It is found throughout drier parts of India and Pakistan.

Propagation by seeds.

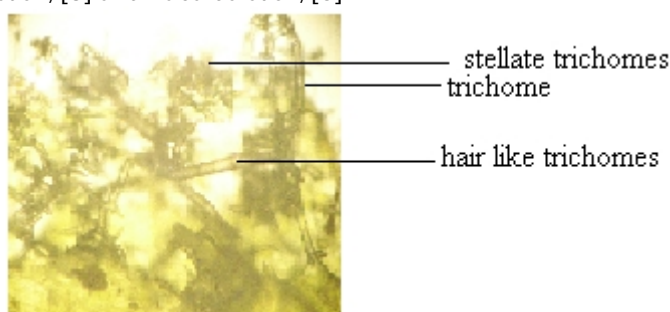
Anatomy of Trichomes

When the transverse section of *Withiana saminifera* shows the following observation. *Withiana saminifera* have two types of trichomes

1. Stellate trichomes
2. Multicellular branched trichomes


All of trichomes are small in size and give powdery and hairy appearance to the plant.

Trichomes are only distributed around the stem and there are no trichomes on the leaves of plant body as reported by Quesada *et al.*, [3] and Zubaida *et al.*, [5].



Photograph of *Withania somnifera* L.

Table.04.systematic position of *Xanthium strumarium* L.

BOTANICAL NAME:	<i>XANTHIUM STRUMARIUM</i> L.	
Family name	<i>Asteraceae.</i>	
Local name:	<i>Cheeshay</i>	

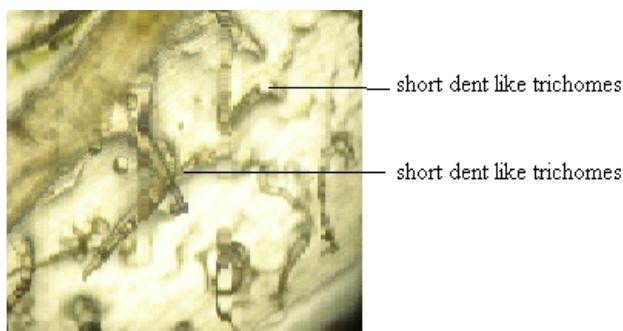
Description:

An erect, tall, weed with triangular, cordate or sub-orbicular, often with three lobed leaves. Flowers numerous, white or green in terminal position.

Distributed throughout the world in tropical and temperate region *Propagation* is by seed


Anatomy of Trichomes

The microscopic observation shows the trichomes of *Xanthium strumarium* L. are very short and dentate in structure. They appear as short spines they are distributed on the areas of where ever vascular bundles are present. They are similar to spines as they are very minute extensions of vascular bundles as reported by Quesada *et al.*, (1997) & C. S. Awmack [6].



Photograph of *Xanthium strumarium* L

Table.05, Systematic position of *Conyza bonariensis*.L

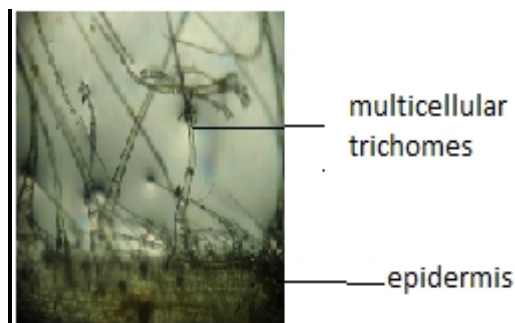
BOTANICAL NAME:	<i>Conyza bonariensis</i> . L	
Family nam	Asteraceae.	
Local name:	Shpalyea	

Description

The plant is annual herb, erect without branches leaves and stem are covered with hairs. Roots are adventitious and branched. Inflorescence is small and half white in colour. Wild all over subcontinent. Propagation is through seeds


Anatomy of Trichomes

Microscopic observations show that the trichomes of *Conyza* are multicellular long hair like and unbranched. These hair like projections are present on the lower epidermis of the leaf. It has minute amount of calcium and silica. These trichomes are much long which gives hairy appearance to plant. The result is same as reported by Perveen [7].



Photograph of *Conyza bonariensis*.L

Table.06, Systematic position *Aerva javanica* L.

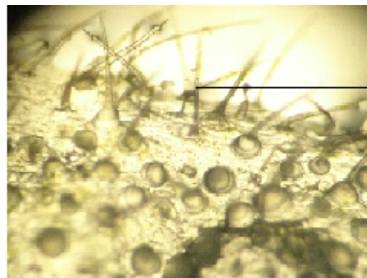
Botanical Name:	<i>Aerva javanica</i> L.	
Family Name:	<i>Amaranthaceae</i>	
Local name:	Harhsasai.	

Description

The Specie of family Amaranthaceae is herbs or shrubs with alternate or opposite simpler exstipulate leaves. Flower is bisexual or unisexual with the plant monocious or dioicious. Stem are erect, stoloniferous. Leaves are alternate, opposite, margin entire. Flowers are perfect, unisexual, small inflorescences which are spikes, terminal, simple bracts and bracteoles membranous, persistent. The species of amaranthaceae family are allergic distributed all over the America, Africa, India and Pakistan.

Anatomy of Trichomes


Under microscopic observations it was observed that the trichomes of *Arva javanica* are uniseriate, tapered at the end multiarticulate with stellate base cells as reported by Jaideep *et al.*, [8].



trichomes
multicellular at the
end

Photograph of *Aerva javanica* L.

Table.07, Systematic position of *Ficus carica*. L

BOTANICAL NAME:	FICUS CARICA L.	
FAMILY:	MORACEA	
LOCAL NAME:	INZAR	

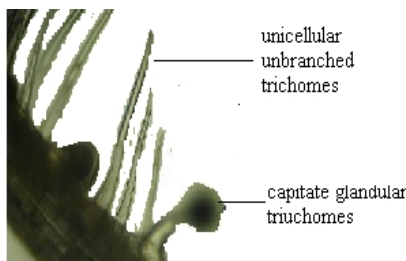
Description

It is a tree of medium height that grows up to 15 to 30 feet in height. Leaves are similar to that of ficus tree i.e. broad at the anterior part and have 3 to 5 partition on it. It is rough on the upper surface and dark at the lower surface. The flower is present in the racemes presentation and male and females flowers are small and big respectively

It is a native of Carica which present in Asia Minor. It is also found in turkey, Portuguese, Iran, Iraq, China, and Japan and in southern parts of India. It is also seen in Punjab, Uttar Pradesh and Mysore region of India.

Anatomy of Trichomes

The microscopic observations shows that the trichome present in ficus is single cell, unbranched, these are equally present on both surfaces of leaf. There is always present capitates glandular trichomes. Badmus and Afolayan [9] have already disclosed such type of findings which are clearly matching.




unicellular
unbranched
trichomes

capitate glandular
trichomes

Photograph of *Ficus carica* L.

Table.08, Systematic position of *Tribulus Terristeris*

BOTANICAL NAME:	<i>TRIBULUS TERRISTERIS.L</i>	
Family nam	<i>Zygophyllacea</i>	
Local name:	<i>Puncture vine</i>	

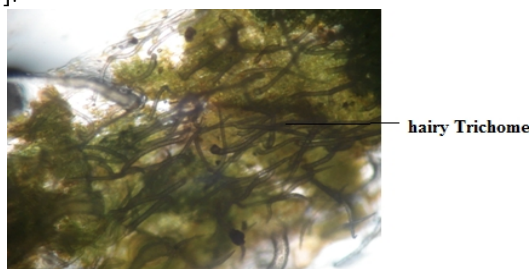
Description


Tribulus terrestris L. is a tropical vine common in sandy soil throughout India, Pakistan and Srilanka. *Tribulus terrestris* L. is a flowering plant in the family Zygophyllaceae, native to warm temperate and tropical regions of the Old World in southern Europe, southern Asia, throughout Africa, and Australia. It can thrive even in desert climates and poor soil. It is also called puncture vine.

Anatomy of Trichomes

Large number of trichomes are present on the stem of the plant of that give *Tribulus terrestris* hairy appearance to the plant.

The trichomes of *Tribulus terrestris* are short narrow and hair like and present abundantly. Quesada *et al.*[3] and Shui Wang, *et al.*[10].

**Photograph of *Tribulus Terristeris* L.****Table.09, Systematic Position of *Helianthus annuus* L.**

Botanical name	<i>Helianthus annuus</i> L.	
Family	<i>Asteracea</i>	
Local name	<i>Nwarparast</i>	

Description


Sunflower (*Helianthus annuus* L.) is an annual plant native to the Americas. It possesses a large inflorescence (flowering head). The sunflower got its name from its huge, fiery blooms, whose shape and image is often used to depict the sun. The sunflower has a rough, hairy stem, broad, coarsely toothed, rough leaves and circular heads of flowers. The heads consist of 1,000-2,000 individual flowers joined together by a receptacle base. They propagate through seeds

Trichome Anatomy

Under microscope it was observed the trichomes (*Helianthus annuus* L.) of are small hairy appendages giving hairy appearance to the stem and leaf. They are present on leaves abundantly. They are stiff in nature. Due to presence of these stiff hairs the surface appears rough. Quesada *et al.*[3].

**Photograph of *Helianthus annuus* L.**

Table.10, Systematic position of *Heliotropium europium* L.

Botanical name:	<i>Heliotropium europium</i> L.	
Family:	Boraginaceae	
Local name:	Tapwar	

Description

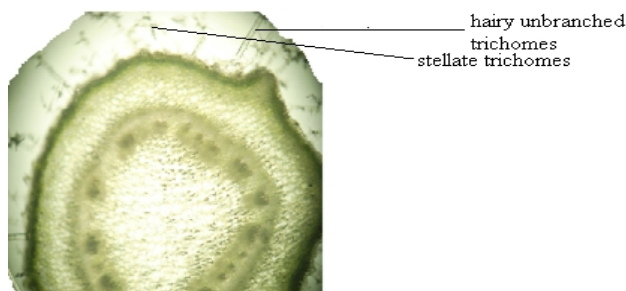
Heliotropium europaeum L., is a species of heliotrope known by the common names European Heliotrope and European Turnsole. It is native to Europe, Asia, and North Africa, but it is widely naturalized elsewhere, such as in Australia and North America. It grows as a roadside weed in some places. This is an annual herb growing from a taproot and reaching maximum heights near 40 centimeters. The stem and oval-shaped leaves are covered in soft hairs. The inflorescences are coiled spikes of white flowers with fuzzy or bristly sepals. Each flower is just a few millimeters wide. The fruit is a bumpy nutlet

Anatomy of Trichomes

As observed by high magnifying microscope the trichomes of *Heliotropium europaeum* are of two types

1. Stellate branched just like dendrite form
2. Simple unbranched hair like trichomes

They are not present in abundant but are present rarely Zubaida et al., [5] and Essiett et al., [11].

Photograph of *Heliotropium europium* L.**REFERENCES**

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