# TRICHOMES OF GENUS *ABUTILON* MILL. (MALVACEAE)

Muhammad Tahir M. Rajput, Ashraf Bano, Shamsa Yasmeen & Basir Ahmed
*Department of Botany, University of Sindh, Sindh, Pakistan*

**Abstract**

The trichomes of 18 specific and intraspecific taxa of genus *Abutilon* Mill. found in Pakistan were examined with light and stereozoom microscope. Unicellular uniseriate and multiarmed type of trichomes are recognisable within the species of genus *Abutilon* Mill. and can be used for species identification.

## Introduction

The genus *Abutilon* Mill. belongs to the family Malvaceae. It consists of about 100 species distributed in the tropical and subtropical regions (Willis, 1988). In Pakistan it is represented by 15 species and 3 intraspecific taxa (Abedin, 1979). Metcalf & Chalk, (1957) studied the trichomes of family Malvaceae and generally applied the term stellate to the trichomes in the members of the family.

Trichome or plant hairs, now a days are of great interest to systematic botanists, as the use of trichomes is well established in comparative systematic studies of angiospermic plant groups. As a simple tool of morphology, trichomes are useful because of the ease with which they can be examined and also of their variety, wide occurrence and close relation of their structural patterns to the taxonomic position (Carlquist 1961), Payne, (1978) and Rajput *et al.*, (1985).

Perhaps Solereder (1908) was the first person to reveal the systematic value of the trichome although attempts were made earlier by De Bary (1884) and Goebel (1900). Later on many botanist, e.g., Carolin (1970), Roe (1971), Payne (1974), Narayana (1979) and Inamdar (1968) examined the hairs of different taxa of angiospermic plants. Rajput *et al.* (1985) used the characteristic forms of trichomes as a criteria for distinguishing the species of genus *Dampiera*.

Plant scientists often have difficulty in understanding the trichomes terminology, as trichomes are often compound structures; thus a single term cannot describe their details. Therefore, a descriptive terminology is necessary to denote the trichomes parts, ray, orientation, colour, size, texture and density etc. Metcalf & Chalk (1957) used the term "stellate" for the hairs of family Malvaceae, but "stellate" is a descriptive term which conveys no concrete information about the structure of the trichomes. The so called stellate trichomes may consist of a cluster of unicellular or multicellular trichomes; moreover, the component cells may be smooth or papillose, thin or thick walled, short or long etc.

Another term, densely or sparsely tomentose, which is used in the literature for the distribution of trichomes is also not appropriate and clear; Whether densely means a relatively great number of hairs on a particular surface or a great number of rays per hair, is not clear from the term. To avoid confusion regarding the sense of terms in which they are used, most of the terms are defined here. This contribution is an attempt to illustrate the types of trichomes found in the genus *Abutilon* of the family Malvaceae, and to ascertain their taxonomic significance.

## Material and Methods

For the study of trichomes morphology, the material was taken directly from the herbarium specimens from the surface of leaves, sepals and fruit. For temporary mounts commercial Glycerine was used. Four to five samples of trichomes from different surfaces for each species, were examined with compound light microscope. Distribution pattern of trichomes on different organs of the plant body was studied with the help of stereozoom microscope.

The permanent slides were prepared with liquid Canada balsam by carefully scraping the trichomes material from the epidermal surfaces with a single edge razor blade. The diagrame of trichomes structure were drawn using the camera lucida. The specimen of the *Abutilon* species used in this study were obtained from the Herbarium (KUH) collection of the Karachi University.

Terminology of trichomes is particularly adopted after Payne (1978), Roe (1971) and Theobald *et al.*, (1979). The voucher specimens are held at Karachi University Herbarium (KUH) and are listed in appendix–1.

## Results and Discussion

All the species of genus *Abutilon* occuring in Pakistan are tomentose; the trichomes are non-glandular and have completely smooth surface. In the species of this genus the trichomes are formed solely from epidermal cells.

The trichomes of 18 specific and intraspecific taxa of the genus *Abutilon* investigated from the leaves, sepals and fruits showed both single celled and complex type of trichomes; although they are mostly similar in basic structure yet or still varaiation is noticed in colour, thickness and density of hairs on the surface.

In the species of genus *Abutilon* following two main types of trichomes are recognized.

1. *Unicellular-uniseriate trichomes:-* A sessile trichome consists of an elongated single cell which is broad at the base, and becoming narrow and curved toward the apex (Fig. A.). This type of trichomes are found independently on bracts in some species, e.g., *A.muticum,* or they are also found in association with the multi-armed trichomes (Fig.C.). Such trichomes are often thicker than multi-armed trichomes. Moreover, in this type of trichome the basal or foot cell is not separately distinguishable.

2. *Multi-armed trichomes:-* A compound trichome consisting of a few to many rays which are sparsely or fasciculately arranged. The arm cells or rays are straight. The ray cells may be equal or unequal (Fig.B). The basal cell, a compound structure, is mostly separate and clearly distinguishable, and usually consists of small angular cells. The number of small cells in the basal cell usually corresponding to the number of rays in the trichomes.

On the basis of number of rays and their arrangement, the multi-armed trichomes found in the species of *Abutilon* are classified into two types.

*Multi-armed fasciculate:-* In this type the rays are mostly of equal size and are fasciculately arranged, resembling the spines of *Cactus* species. The number of rays ranges from 10-12, e.g., in *A.fagarianum* (Fig. D&E). When this type of trichomes is viewed from top it looks like a star as described by Metcalf & Chalk (1950).

*Multi-armed non fasciculate:-* In this type the rays of the trichomes are mostly of unequal size, and are sparsely arranged, resembling more or less a

dendritic type of trichomes. The number of rays usually varies from 4 to 8, e.g., in *A.ghafoorianum and In A.pannosum* (Fig. B & J); rarely upto 10 rays are also found, e.g., in *A.ramosum* (Fig.1). In this type of trichomes the rays are mostly longer than fasciculate type of trichome.

In the multiarmed trichomes, the number of rays varies from 3–21 on leaves and sepals and 4–15 on fruit. The minimum number of rays 3–4 are found in sepals of *A.theophrasti* Medic, and maximum number of rays (20 to 21) are found on the leaves and sepals of *A.fruiticosum* var.*microphyll.*

Length and thickness of the rays also varies on leaves, sepals and fruits. The minimum average length (0.11 mm.) is found in leaves trichomes of *A.ghafoorianum* S. Abedin and maximum average length (1.10mm.) is found in *A.theophrasti* Medic. The minimum thickness is reported in the leaf trichomes of five species of *Abutilon* and maximum thickness is reported in the fruit of *A.karachianum.* For further details of size of trichomes on leave, sepals and fruits see Table 1.

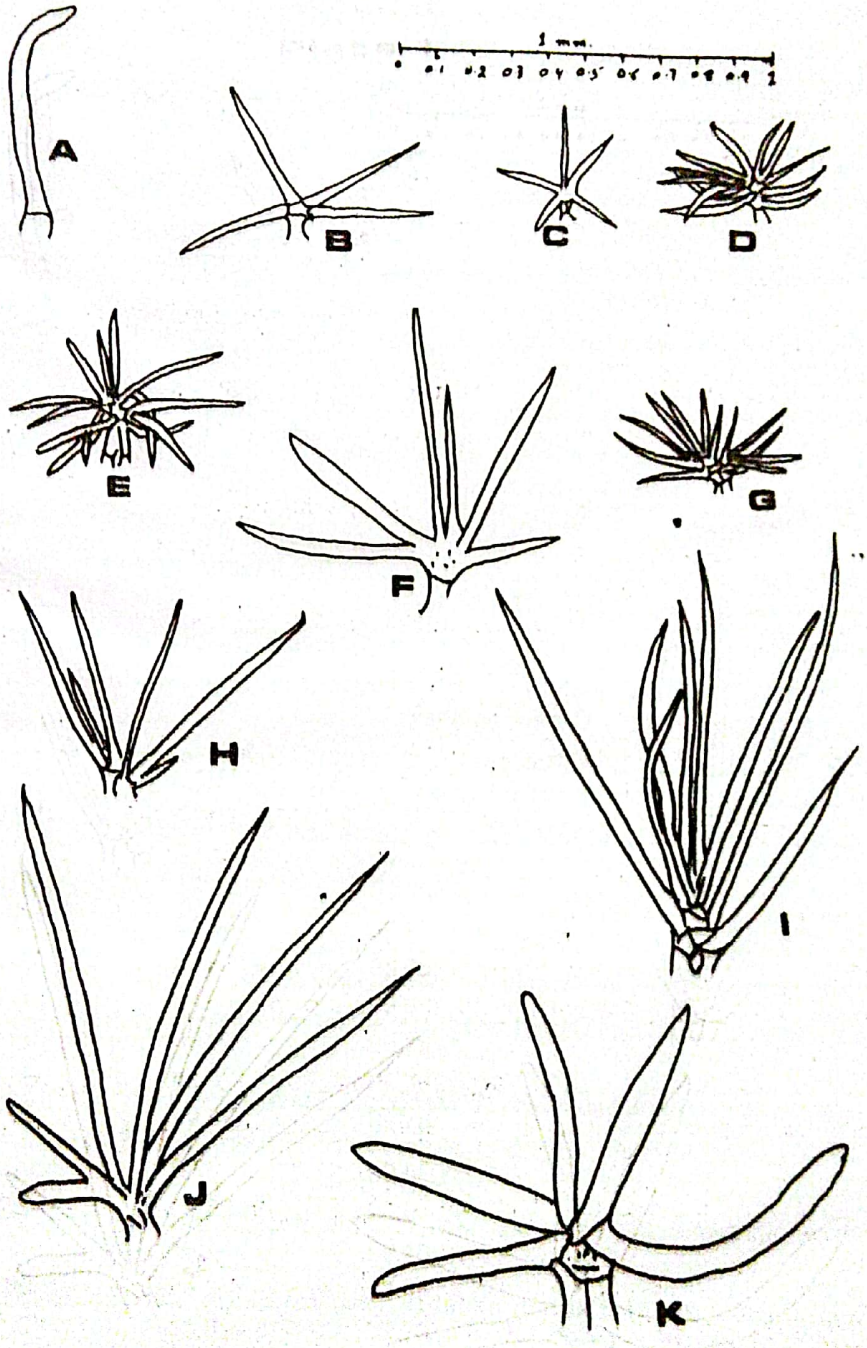
Generally the leaf trichomes are smaller than the trichomes of sepals and fruits. In species where the hairs are densely arranged the density of hairs is both due to the greater number of trichomes on a surface and a greater number of rays per trichome. In the multi-armed non-fasciculate type of trichomes the stalk or basal cell is more broad and elongated and consists of less number of cells as compared with basal or stalk cell of multi-armed fasciculate type of trichomes.

In all the species of *Abutilon* the hairs are brown or gray, mostly spreading. In a few species, e.g., *A.theophrasti* and *A.pannosum*, the trichomes are velvetimous, i.e., soft and silky in nature. In most of the *Abutilon* species, multi-armed trichomes are intermingled with simple spreading hairs, e.g., in *A.indicum*.

**Acknowledgements**

We are grateful to Professor Dr. S. I. Ali and Dr. Muhammad Qaisar, Professor Systematic Botany University of Karachi, for providing us material for this study from Karachi University Herbarium. We are also grateful to Dr. M. Qaisar for his encouragement during the course of this study.

Plate. I




## Explanation of Plates

Figures showing different type of trichomes found in different species of genus *Abutilon*.

A: *A.muticum* (Sepal)
B: *A.pannosum* (Leaf)
C: *A.pakistanicum* (Leaf)
D: *A.fagarianum* (Leaf)
E: *A.karachianum* (Fruit)
F: *A.grandifolium* (Fruit)
G: *A fruticosum* Var. *microphyllum* (Leaf)
H: *A.hirtum* (Leaf)
I: *A.sepalum* (Leaf)
J: *A.theophrasti* (Leaf)
K: *A.karachianum* (Leaf)

## Reference


Abedin, S. U. (1979) Malvaceae IN Flora of West Pakistan **130:** 1–107.

Carlquist, S. (1961) Comparative plant anatomy. Holt, Rinehart and Winston, New York.

Carolin, R. C. (1971) The trichomes of the Goodeniaceae, Prof. Linn. Soc. of N.S.W. Australia, **96:** 8–22.

De Barry, A. (1884) Comparative anatomy of the vegetative organs of the Phanerogams and Ferns. Oxford Press London.

Goebel, H. (1900) Organography of plants especially of the Archegoniatae and spermatophyta, Part 1., Clarendon press, Oxford.

Inamdar, J. A. (1968) Studies of trichomes of some Oleaceae, Structure and Ontogeny. Proc. Indian, Acad. Sc1., **66:** 164–177.

Metcalf, C. R. & Chalk, L. (1950) Anatomy of Dicotyledons Vol. I & II, Clarendon Press, Oxford.

Narayana, B. M. (1979) Taxonomic value of trichomes in *Verninia* Schrels (Asteraceae) Proc. Indian Acad Sci., **183:** 11: 5: 347–357.

Payne, W. W. (1978) A glossary of plant hairs terminology, Brittonia, **30** (2): 239–255.

Rajput, M. T. M., Carolin, R. C. & Tahir, S. S. (1985), The indumentum of the genus *Dampiera* R. Br. (Goodeniaceae). Pak. J. Bot., **17** (2): 184–194.

Roe, K. E. (1971) Terminology of hairs in the genus *Solanum*. Taxon, **20:** 501–508.

Solereder, H. (1908) Systematic anatomy of the dicotyledons (English edn. Translated by L. A. Boodle and F. E. Fritsch) Vol: 2. Clarendon Press, Oxford.

Theobald, W. L., Krahulik, J. L. & Rollins, R. C. (1979) Trichome description and classification, IN Metcalf and Chalk, Anatomy of dicotyledons. 2nd. edn., 41–53.

Willis, J. C., (1988) A dictionary of the flowering plants and ferns. Cambridge University Press.


## APPENDIX – 1

List of voucher specimens, held at Karachi University Herbarium. (KUH)

*A.ali* S. Abedin; Karachi, Zoology Department, University of Karachi, Sultan–ul–Abedin 5396, 12 Oct. 1970.

*Abidentatum* A. Rich. var. *bidentatum*; Karachi Mangopir, Sultan–ul–Abedin 5717, 24 Dec. 1970.

*A.bidentatum* A. Rich. var. *forrestii*; (Hu) S. Abedin; Saidpur Islamabad, Sultan–ul–Abedin 8572, 6 Aug. 1971.

*A.figarianum* Webb. Dathana, 3 miles from Malir on the way to the Darsano Chano, S. Abedin 5415 (KUH).

*A.fruticosum* Guill. & Pers. var. *fruiticosum*; Kohat to Thal, ca–30 Km. from kohat roadside slope, Jennifer Lamond 1561, 26 May 1965.

*A.fruticosum* Guill. & Pers. var. *microphyllum* (A. Rich) S. Abedin; 4 miles from Thal, on the way to Peshawar Dist. Kohat, M. Qaisar & Sultan–ul–Abedin 5832, 11 May 1974.

*A.ghafoorianum* S. Abedin; 1 miles from Chichawatni, on the way to Sahiwal along roadside, Sultan–ul–Abedin; 7508, 8 July 1971.

*A.grandifolium* Sweet; P. C. S. I. R. Karachi, Sultan–ul–Abedin 9361 6 Jan. 1972.

*A.hirtum* (Lamk) Sweet var. *hirtum*; Near pond 3 miles fro rest house, Gwadar, Sultan–ul–Abedin & Abrar Hussain 6398, 30 March, 1971.

*A.hirtum* (Lamk) Sweet var. *heterotrichum* Hochst. ex. Mattei; Sonmiani beach, S. A. Farooqi & Sultan-ul-Abedin 1198, 24 Feb. 1970.

*A.indicum* (L) Sweet; Thana Malir 3 miles from Malir on he way to Darsano chano, Sultan-ul-Abedin 5413, 14 Oct. 1970.

*A.karachianum* Hus. & Baq; Karachi, Zoology Department, University of Karachi, Sultan-ul-Abedin 5393 12 Oct. 1970.

*A.muticum* (Del. ex. DC) Sweet; Karachi, near Botany Department, University of Karachi, M. Sadiq Sn., 24 Nov. 1971.

*A.pakistanicum* Jafri & Ali; Mangopir, Sultan-ul-Abedin 5700 24 Dec. 1970.

*A.pannosum* (Forest) Schlecht; Near Hub Chowki police station, ca., 15 miles from Karachi on the way of Bella, Sultan-ul-Abedin 5562, 17 Dec. 1970.

*A.ramosum* (Cav.) Guill. & Perr.; Jhinghari Jungle, India Punjab, J. R. Drumnond, 22052, 1st Nov. 1887.

*A.sepalum* Hus. & Baq; Near Cereal research Distt. Station, University Campus, Karachi, Sultan-ul-Abedin 5371, 10 Oct. 1971.

*A.theophrasti* Medic.; Rest house, Booni, Chitral, Sultan-ul-Abedin 8040, 31 July 1971.