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Variations in Epidermal Trichomes of Some Members of the Family Asteraceae

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Abstract: ***The Asteraceae family, one of the largest and most diverse families of flowering plants, exhibits a wide range of trichome morphologies that are vital for both taxonomic identification and ecological adaptation. This study focuses on the detailed examination of trichome types in 16 species of Asteraceae collected from various locations in Amravati. Using methods such as microscopy and staining, we identified six distinct trichome types, each with unique structural features and ecological functions. The findings underscore the taxonomic significance of trichomes, highlighting their role in species differentiation and plant defense mechanisms. This research contributes to the broader understanding of trichome diversity and its application in plant taxonomy.***

Keywords: Asteraceae, trichome diversity, plant taxonomy, species identification, plant defense

1. Introduction

Asteraceae or Compositae is an exceedingly large and widespread family of flowering plants. The family is peculiar in being herbs, shrubs, vines, or trees. (Bayer *et al*., 2009). The Asteraceae family comprises a vivid range of species of plants, predominantly found in tropical and subtropical regions. The family is comprised of more than 32, 000 recognized species of flowering plants in more than 1, 900 genera within the order Asterales (Werker, 2005, Adedji *et al.*, 2007).

The most unique morphological characters exhibited by all members of the family Asteraceae is that small floral blooms are arranged into compact inflorescences or heads, which have the appearance of individual flowers and are called capitulum. An involucre of tiny modified leaves called bracts; typically subtends each such head provide protection. The two types of florets that are found are disc and ray florets. Presence of pappus is a significant feature considered as modification of calyx, a characteristic of family Asteraceae. It is a structure composed of bristles, awns, scales, etc. The pappus work as a parachute for wind dispersal of fruits. In addition, all members of the Asteraceae family have Hair - like projections that extended from the epidermis are called trichomes (Syah *et al.*, 2014).

Trichomes are found in many different plant groups, including the Asteraceae, and they show a great deal of morphological variation and functional adaptability. The Asteraceae family, also referred to as the sunflower or daisy family, is well - known for its variety of trichome types, which helps the family adapt well to various environmental conditions.

The extensive distribution, variety, ease of preparation for study, and strong relationship between their variation patterns and the taxonomic system, trichomes are often used in comparative systematic studies of several groups of angiosperms (Carlquist, 1961). These are abundantly dispersed throughout the aerial reproductive and vegetative sections of plants.

In resolving taxonomic conflicts, the foliar trichomes have been found to play a significant role in plant taxonomy (Hardin, 1979; Fang and Fan, 1993). The trichome are not only useful in the identification of the two species, but also their corresponding parts, thus being important in pharmacognosy, archaeobotany, paleobotany and agronomy (Rao and Ramayya, 1977).

Trichomes and their characteristics can provide valuable information for plant identification; they frequently have a taxonomic significance (Suntar, 2014). This study aims to identify the micro - morphological makeup of the vesture of trichomes type, variation and diagnostic traits of trichome diversity of selected Asteraceae members as important markers for defining various species.

2. Materials and Method

The study is based on observations of fresh specimens and materials collected from natural populations. The structures appear late or early in the development of the plants, so care was taken to ensure that only every part were screened. All 16 members of the family Asteraceae were screened and collected from the different locations of Amravati. Trichome structures were studied on vegetative as well as reproductive parts of the species. Samples were prepared from hand cut or peeled epidermis.

The trichomes from the leaf surface were removed with the help of cello tape. Another method used to remove trichomes from the surface with the help of transparent nail paint. The nailpaint was applied on the leaf surface and peeled off slowly after drying. The scratch method is used to remove the trichomes; the stem of the plant was scratched with the help of a needle and the trichomes were taken on the slide.

Characterize the morphology of trichomes found in Asteraceae species, including variations in size, shape, density, and glandular structures, using the Cainda F210 USB Digital Microscope.

All the trichomes were stained with the help of safranin. Stained peel or trichomes were mounted in glycerin and then observed under a microscope. The qualitative macromorphological characteristics of trichomes were

observed, microphotographs were taken. Basic terminology used for trichome classification and different types of trichomes were recorded.

3. Results and Discussion

Trichomes are epidermal outgrowth, which exhibit great variation in structure and function and are thus of much taxonomic value. They may be glandular or non - glandular, simple or branched, with the branches dendritic (arising like those of a tree) or star - like, terete, flattened, basally swollen, whip - like, capitate or of various other forms in different species. There is also a large variation seen in the types of vesture, gland and trichome base in the present work.
A comprehensive investigation of the trichome form and distribution in several Asteraceae family members demonstrates a striking diversity. Trichomes are present on the surface of plants and have astonishing range in terms of size, shape, and structure. The most crucial factor in the separation and differentiation of specific species is the richness and distribution of trichomes. The diversity of trichomes in some species of the family Asteraceae is examined thoroughly.

In the present work plants were screened for vesture, gland type, base of trichomes and its types (Table no. - 1). Different species showed various kinds of trichomes (Table no - 2). Six types of trichomes are reported, from all sixteen species. Simple Uniseriate Trichomes were quite representative occurring 100 percent in all studied species. Peltate Glandular trichomes observed in *Cosmos caudatus* Kunth. And *Chromolaena odorata* L. Moreover Coiled/ Hook shaped Trichomes found in *Amberbua recemosa (*Roxb.) Jafri. *Blenvillia acmella [*L] Philipson, *Blumea lacera* DC., *Cosmos caudatus* Kunth., *Parthenium hysterophorus* L. Multi - Seriate Glandular trichomes is only found in *Blumea jacquemontii* Dc. [Prodr.]. While, *Parthenium hysterophorus* L., *Blumea lacera* DC., *Amberbua Recemosa (*Roxb.) Jafri also shows Capitate Glandular - Multicellular trichomes with short stalk, unicellular head. Multi - Seriate Trichomes found commonly in *Sonchus oleraceus* L., *Blumea jacquemontii* Dc. [Prodr.] , *Lagasca mollis Cav.*, and *Erigeron bonariensis* L.

A compilation of the family's morphological traits, with particular attention to the trichome variety of some species mentioned. (Table no.3)

The resolution of taxonomic problems and the support for the taxonomy of many plants are aided by the discovery of distinct trichome types in various taxa explained by Carlquist (1961) and Hardin (1979). Certain trichome types can be used in taxonomic analysis to designate species, genera, and families (Metcalf and Chalk, 1950).

Bendre & Kumar (1997) and Cooper (1931) also reported the diversity in trichome structure and function within the family is highlighted by the existence of several trichome types, including coiled/hook - shaped, simple uniseriate, multi - seriate, peltate glandular, and capitate glandular also supports the findings of earlier research that highlight the taxonomic significance of trichome features. Wagner *et al*., 2004 also divided trichomes based on their form and function into different categories**.**

Trichomes help plants survive and adapt to a variety of situations by serving important ecological and functional purposes. In the present work Asteraceae members exhibit a variety of trichome morphologies that are both functionally and taxonomically significant.

Trichomes can help spread seeds and pollen, prevent water loss, and offer defense against herbivores (Wagner *et al*., 2004; Werker, 2005). Given that glandular trichomes, like those on *Parthenium hysterophorus* and *Cosmos caudatus*, can release secondary compounds that repel pathogens and herbivores, their existence supports a function in chemical defense (Suntar, 2014).

Trichomes have a crucial function in safeguarding plants from biotic and abiotic stresses, highlighting their ecological value. In species such as *Blumea lacera* and *Chromolaena odorata*, glandular trichomes are probably involved in producing substances that offer chemical protection and enhance the plant's hardiness in natural environments (Schilmiller *et al*., 2012). Similar to glandular trichomes, non - glandular trichomes on *Ageratum conyzoides* and *Vernonia cinerea* may assist in preventing water loss by reflecting sunlight and lowering leaf temperature—two essential nutrients for plants in semi - arid and arid environments (Tissier, 2012).

In the present study, *Vernonia cinerea* showed T - shaped trichomes; Adedeji and Jewoola (2008) reported glandular and non - glandular trichomes in *Vernonia cinerea*. As in comparison to present work, the trichomes of *Vernonia cinerea* were also eglandular and multicellular. They also reported glandular and non - glandular trichomes in *Tridax procumbens* having capitate often with bicellular stalk and unicellular head. From our data, *Tridax procumbens* showed Less strigoes, eglandular, uniseriate with swollen base.

In the presented observations, different kinds of trichomes have been reported. The remarkable morphological differences were found in structures. The study of trichome morphology would also assist in the identification of various taxa belonging to the same family.

4. Conclusion

This study highlights importance of trichomes in taxonomy and usefulness for identifying the Asteraceae species. Their significance as taxonomic markers and their functional roles in plant defense and adaptation are underscored by the diversity of trichome morphologies seen in the studied species. The ecological functions and useful uses of trichomes should be further investigated in future studies to improve panoramic view of these crucial plant characters.

Table 1: Morphology of Trichomes in various species of Asteraceae

S. No.	Plant Name	Vesture type	Gland type	Type of Trichomes	Trichome Base
1	***Ageratum conyzoides* L.**	Simple	Eglandular	Uniseriate	Bulbous
2	***Amberbou racemose* (Roxb.) Jafri.**	Simple	Glandular	Uniseriate	Bulbous
3	***Blainvillea acmella* [L] Philipson.**	Hirsute	Eglandular	Uniseriate	Flat
4	***Blumea jacquemonti* Dc. [Prodr.]**	Simple	Glandular	Multiseriate	Rounded
5	***Blumea lacera* DC.**	Simple	Glandular	Uniseriate	Bulbous
6	***Chromolaena odorata* L.**	Less Hirsute	Glandular	Uniseriate	Bulbous
7	***Cosmos caudatus* Kunth.**	Simple	Eglandular	Uniseriate	Flat
8	***Eclipta alba* [l.]Hssk.**	Strigoes	Eglandular	Uniseriate	Flat
9	***Erigeron bonariensis* L.**	Hirsute	Eglandular	Multiseriate	Flat
10	***Lagasca mollis* Cav.**	Simple	Eglandular	Uniseriate	Bulbous
11	***Parthenium hysterophorus* L.**	Strigoes	Glandular	Multiseriate	Bulbous
12	***Sonchus oleraceus* L.**	Strigoes	Eglandular	Multiseriate	Bulbous
13	***Synedrella nodifera* (L.) Gaertn.**	Strigoes	Eglandular	Uniseriate	Flat
14	***Tridax procumbens* L.**	Less Strigoes	Eglandular	Uniseriate	Bulbous
15	***Vernonia cinerea* [L.]Less**	Simple	Eglandular	Uniseriate	Bulbous
16	***Vicoa indica* [L.]DC**	Simple	Eglandular	Uniseriate	Bulbous

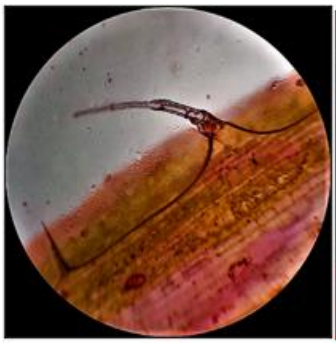
Table 2: Types of Trichomes

Sr no.	Plant Name	Pelate Glandular trichomes	Capitate Glandular trichomes	Multi - Seriate Glandular trichomes	Simple Uniseriate Trichomes	Multi - Seriate Trichomes	Coiled/ Hook Shaped Trichomes
1	*Ageratum conyzoides* L.	-	-	-	+	-	-
2	*Amberbou racemose* (Roxb.) Jafri.	-	+	-	+	-	+
3	*Blainvillea acmella* [L] Philipson.	-	-	-	+	-	+
4	*Blumea jacquemonti* Dc. [Prodr.]	-	-	+	-	+	-
5	*Blumea lacera* DC.	-	+	-	+	-	+
6	*Chromolaena odorata* L.	+	-	-	+	-	-
7	*Cosmos caudatus* Kunth.	+	-	-	+	-	+
8	*Eclipta alba* [l.]Hssk.	-	-	-	+	-	-
9	*Erigeron bonariensis* L.	-	-	-	-	+	-
10	*Lagasca mollis* Cav.	-	-	-	+	+	-
11	*Parthenium hysterophorus* L.	-	+	-	-	-	+
12	*Sonchus oleraceus* L.	-	-	-	-	+	-
13	*Synedrella nodifera* (L.) Gaertn.	-	-	-	+	-	-
14	*Tridax procumbens* L.	-	-	-	+	-	-
15	*Vernonia cinerea* [L.]Less	+	-	-	+	-	-
16	*Vicoa indica* [L.]DC	-	-	-	+	-	-

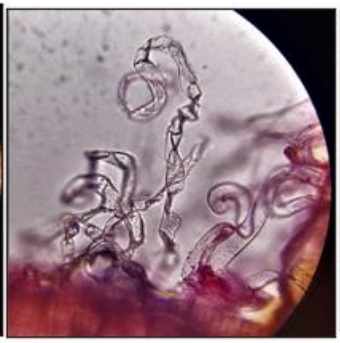
Table 3: Types of trichomes found in the plant species

Sr no.	Type of Trichomes	Plant species names
1	Peltate Glandular Trichomes	*Cosmos caudatus* Kunth. and *Chromolaena odorata* L.
2	Capitate Glandular Trichomes	*Amberbou racemose* (Roxb.) Jafri., *Blumea lacera* DC., *Parthenium hysterophorus* L.
3	Multi - Seriate Glandular trichomes	*Blumea jacquemonti* Dc. [Prodr.]
4	Simple Uniseriate Trichomes	*Ageratum conyzoides* L. *Amberbou racemose* (Roxb.) Jafri *Blainvillea acmella* [L] Philipson. *Blumea lacera* DC. *Chromolaena odorata* L. *Eclipta alba* [l.]Hssk. *Cosmos caudatus* Kunth *Lagasca mollis* Cav. *Synedrella nodifera* (L.) Gaertn. *Tridax procumbens* L. *Vernonia cinerea* [L.]Less *Vicoa indica* [L.]DC
5	Multi - Seriate Trichomes	*Sonchus oleraceus* L. *Blumea jacquemonti* Dc. [Prodr.] *Lagasca mollis* Cav. *Erigeron bonariensis* L.
6	Coiled/ Hook Shaped Trichomes	*Amberbou racemose* (Roxb.) Jafri. *Blainvillea acmella* [L] Philipson. *Blumea Lacera* DC. *Cosmos caudatus* Kunth *Parthenium hysterophorus* L.

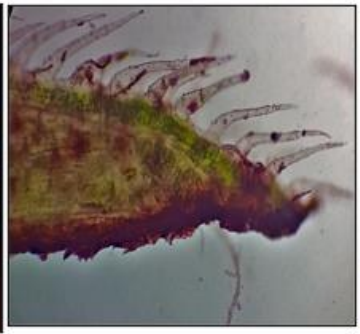
Photo Plate



Ageratum conyzoides L.



Amberbou racemose (Roxb.) Jafri.



Blainvillea acmella [L] Philipson.

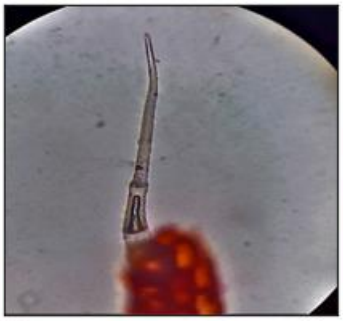
Blumea jacquemonti Dc.[Prodr.]

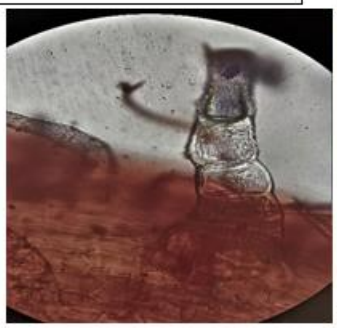
Blumea lacera DC.

Chromolaena odorata L.

Cosmos caudatus Kunth.

Eclipta alba [l.]Hssk.

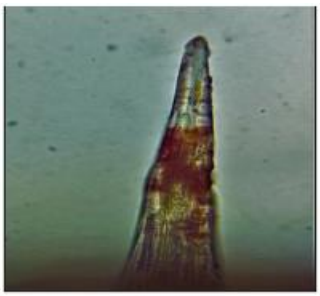




Erigeron bonariensis L.

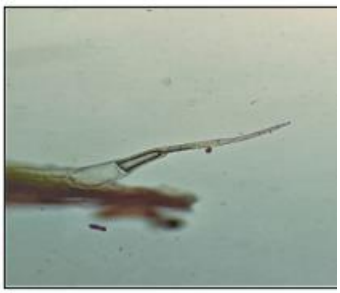
Lagasca mollis Cav.

Parthenium hysterophorus L.

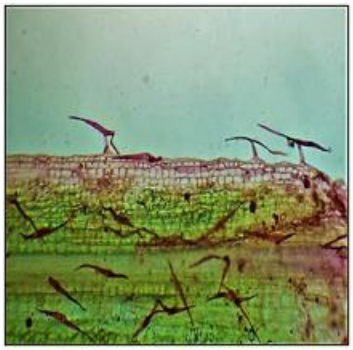


Sonchus oleraceus L

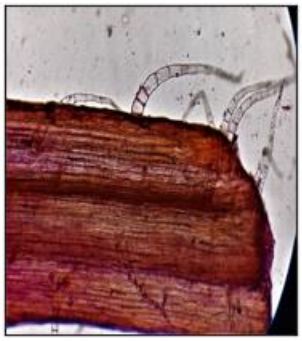
Synedrella nodifera (L.) Gaertn



Tridax procumbens L.



Vernonia cinerea [L.]Less



Vicoa indica [L.]DC

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