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MORPHOLOGICAL VARIATION OF TRICHOMES IN SOME COMMON SPECIES OF ASTERACEAE

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Abstract

The family Asteraceae (Compositae) is a very large cosmopolitan family. It is represented by about 24,000 species, which are distributed throughout the world except Antarctica. (Funk et.al. 2009). In West Bengal the family is represented by about 83 genera 205 species (Ghosh and Mitra, 1982). Trichomes or hairs furnish rich field for morphogenetic investigation and are among the most useful of all anatomical features for systematic comparison of angiosperms. The available information in regards to hairs of common plants of West Bengal in Asteraceae is very scanty. Present study deals with 10 common taxa of the family Asteraceae. The present study is therefore, aimed for identification of some plants along with other characters in the family Asteraceae in some parts of Bengal. Hairs of the studied taxa are basically non-glandular sometimes glandular type. Non-glandular hairs are variable from unicellular to multicellular, but glandular hairs are always multicellular. Some of the studied genera can be distinguish from the other genera by some species type of hairs. For example the *Vernonia cinerea* L. can be separated from other genera by the presence of T-shaped hairs. The basic structures of hairs are more or less constant in *Eclipta alba* (L.) Hassk, *Helianthus annuus* L. and *Synedrella nodiflora* (L.) Gaertn. In other taxa forms of hairs are greatly variable i.e. different parts of plant possess different morpho-types of hairs. The *Ageratum houstonianum* Mill. Have maximum types of hairs, i.e. ten types. The second highest number of hairs has been reported in *Parthenium hysterophorus* L. containing nine types of hairs. In *Blumea lacera* L., eight types of hairs have been reported. Glandular hairs of variable size and shaped have been noticed in *Blumea lacera* L., *Parthenium hysterophorus* L. and *Synedrella nodiflora* (L.). 5-celled, shriveled, swollen terminal celled hairs have been observed only in leaves of *Ageratum houstonianum* Mill. Similarly many celled triseriate, conical based with truncate apex hairs are found only in stems and petioles in *Parthenium hysterophorus* L. Petiolar part of *Synedrella nodiflora* (L.) Gaertn. has unique type of hairs, usually uncommon in other studied taxa. In *Tridax procumbens* L., peduncle has unique type of hairs. Flagellate type of hairs can be broadly divided into two categories on the basis of morphological character of apical cell. It may be

INTRODUCTION

The family Asteraceae (Compositae) is a very large cosmopolitan family. It is representated by about 24,000 species, which are distributed throughout the world except Antarctica. (Funk et.al. 2009).The family is highly advanced and is easily recognized by its capitulum inflorescence, pappus structure and cypselar type of fruit.

The members of the family are largely herbaceous, sometimes shrubs and a few are trees. (Bremer, 1994). In West Bengal the family is represented by about 83 genera 205 species (Ghosh and Mitra, 1982).

Many plants in the family Asteraceae are economically important as ornamentals, medicinal and green vegetables. A large number of species of this family are available in our locality as weeds and obnoxious weeds. Some of the plants of the family are also known to be ethnobotanical uses in West Bengal.

Trichomes or hairs furnish rich field for morphogenetic investigation and are among the most useful of all anatomical features for systematic comparison of angiosperms. This is because of their variety, wide occurrence, superficial position and sometimes their close correlation to variation partners among the taxa (Carlquist, 1961).

Solereder (1908) was, perhaps, the first person to reveal the systematic value of hairs, although attempts were made earlier by De Bary (1884) and Goebel (1900). After that many workers have been successfully used the hair characters for the classification and identification of plants belong to many angiospermic families (Metcalfe and Chalk, 1950, Ramayya, 1962a, 1972b, Aleykutty and Inamdar, 1980). Structures of hairs in the family Asteraceae have been studies by Carlquist (1958a, 1958b, 1961). Ramayya (1962, 1969), Sahu (1983, 1985), Tiwari (1996), Adedeji (2004), and Adedeji and Jewoola (2008). But the available information in regards to hairs of common plants of West Bengal in Asteraceae is very scanty. The present study is therefore, aimed for identification of some plants with the help of hairs along with other characters in the family Asteraceae in some parts of Bengal.

MATERIALS & METHODS

For this work ten plant species under nine genera (Table 1) belonging to Asteraceae were studied. Stem, leaves and floral parts of different species were collected from different parts of Kalyani Township from the month of December 2011 to May 2012. These were fixed in 70% FAA solution. The epidermal layers from leaves, stems, different floral parts were separated, stained in 0.5% aqueous safranin and mounted in phenol glycerine and sealed with Quickfix gum for semi permanent preservation. Trichomes were drawn using prism type of Camera Lucida. Table 1 shows the types of hairs in each individual in different parts of plants.

Terminology and nomenclature of trichomes was partly adopted after Ramayya (1962a). Metcalfe and Chalk (1979) and Inamdar et.al. (1990) and some terms are newly introduced by the authors.

NAME OF THE TAXA

Ageratum conyzoides L.

Ageratum houstonianum Mill.

Blumea lacera L.

Dahlia hybrida (Jersey Beauty Dahlia)

Eclipta alba (L.) Hassk.

Helianthus annuus L.

Parthenium hysterophorus L.

Synedrella nodiflora (L.) Gaertn.

Tridax procumbens L.

Vernonia cinerea L.

RESULTS AND DISCUSSION

Different types of hairs from different parts of plants such as leaves, stems, petioles, peduncles and involucral bracts and receptacle are shown in tabular form in Table 1.

The study of hairs in some species of Asteraceae reveals that hairs are useful in systematic consideration of different taxa. Hairs of the studied taxa are basically non-glandular, sometimes glandular type. Non-glandular hairs are variable from unicellular to multicellular, but glandular hairs are always multicellular.

At the species level, studied of hairs have been documented as value by many workers (Faust and Jones, 1973; Adedeji et.al., 2007), According to Metcalfe and

Chalk (1979) the presence of particular type of hair can usually delimit the species, genera, and even entire family. The distribution of hairs is very complex in nature, because different parts of the same species have different types of hairs in the family Asteraceae. Some of the studied genera can be distinguished from the other genera by some specific type of hairs. For example, the *Vernonia cinerea* L. can be separated from other genera by the presence of T-shaped hairs or two armed flagellate hairs. This type of hair is again divided into two broad categories; one is unicellular, which is found in leaves, petioles and involucral bracts. Other type is 2-3 celled hairs, usually restricted in stem and peduncle. Therefore, the distribution of hairs in specific part of plant body is also a significant taxonomic parameter.

In some taxa general basic type of structure of hairs are important. Out of studied 10 taxa, the basic structure of hairs is more or less constant in *Eclipta alba* (L.) Hassk, *Helianthus annuus* L. and *Synedrella nodiflora* (L.) Gaertn. In other taxa forms of hairs are greatly variable i.e. different parts of plant possess different morphotypes of hairs.

Out of studied taxa, the *Ageratum houstonianum* Mill. has maximum types of hairs, i.e. ten types. The second highest number of hairs has been reported in *Parthenium hysterophorus* L. containing nine types of hairs. In *Blumea lacera* L., eight types of hairs have been reported.

Glandular hairs of variable size and shaped have been noticed in *Blumea lacera* L., *Parthenium hysterophorus* L. and *Synedrella nodiflora* (L.).

Some of the taxa possess unique type of hairs which are not found in other taxa or other parts of plants. 5-celled, shriveled, swollen terminal celled hairs have been observed only in leaves of *Ageratum houstonianum* Mill. Similarly many celled triseriate, conical based with truncate apex hairs are found only in stems and petioles in *Parthenium hysterophorus* L. Petiolar part of *Synedrella nodiflora* (L.) Gaertn. has unique type of hairs. (Fig VII: 1-9), usually uncommon in other studied taxa.

In *Tridax procumbens* L., peduncle has unique type of hairs (Fig-VI, 15-17) with the help of this category of hairs, the taxa can be separated from others.

Flagellate type of hairs are very common in many taxa of the family Asteraceae and this category of hairs again can be broadly divided into two categories on the basis of morphological character of apical cell. It may be septate and aseptate types. Many celled (15-20) conical hairs are restricted in petiolar parts of *Dahlia hybrida*. Therefore, not only the type of hairs but also specific part of plant body is also valuable for the study of hairs in different taxa.

CONCLUSION

According to present study, the hair characters from different floral and vegetative parts can be treated as diagonstic features of the family Asteraceae. However, their value as taxonomic criteria will be greatly increased if the information can be interpreted with other lines of evidence such as that obtained from gross morphology, biochemical evaluation, and molecular studies etc.

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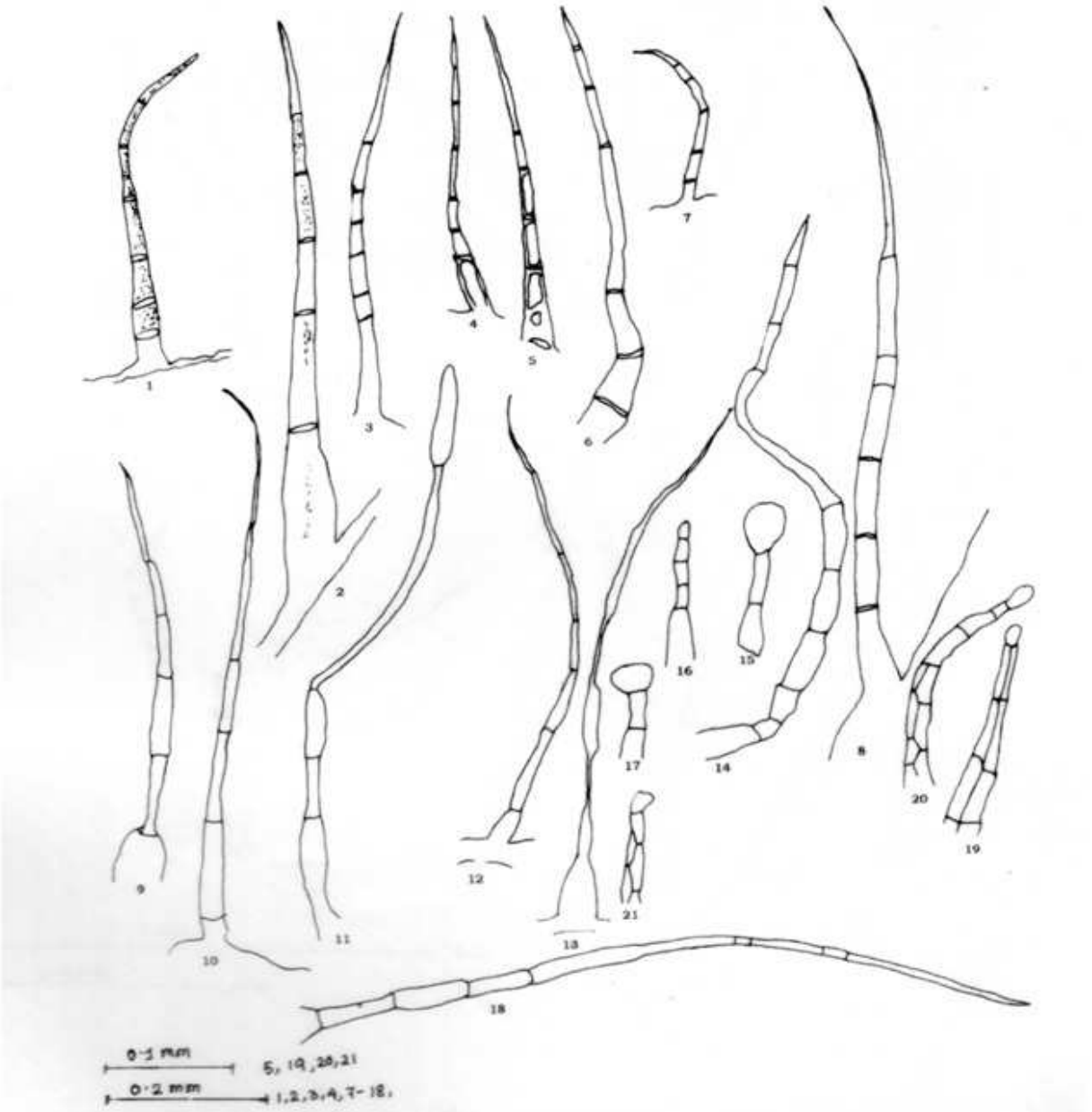

Fig. I : Hairs in *Ageratum conyzoidos* L. and *Ageratun houstonianum* Mill

Fig. I : 1 - 7, *A. congzoidos* ; Fig. I : 8 - 21 *A. houstonianum*

Stem hairs :- 1, 2, 3 ; 8 , Leaf hair 4, 5 ; 9, 10, 12, Petiole hairs : 6; 12, 13,
Peduncle hairs : 14, 15, 16, 17, Involucral bract hairs : 7; 18, 19, 20, 21

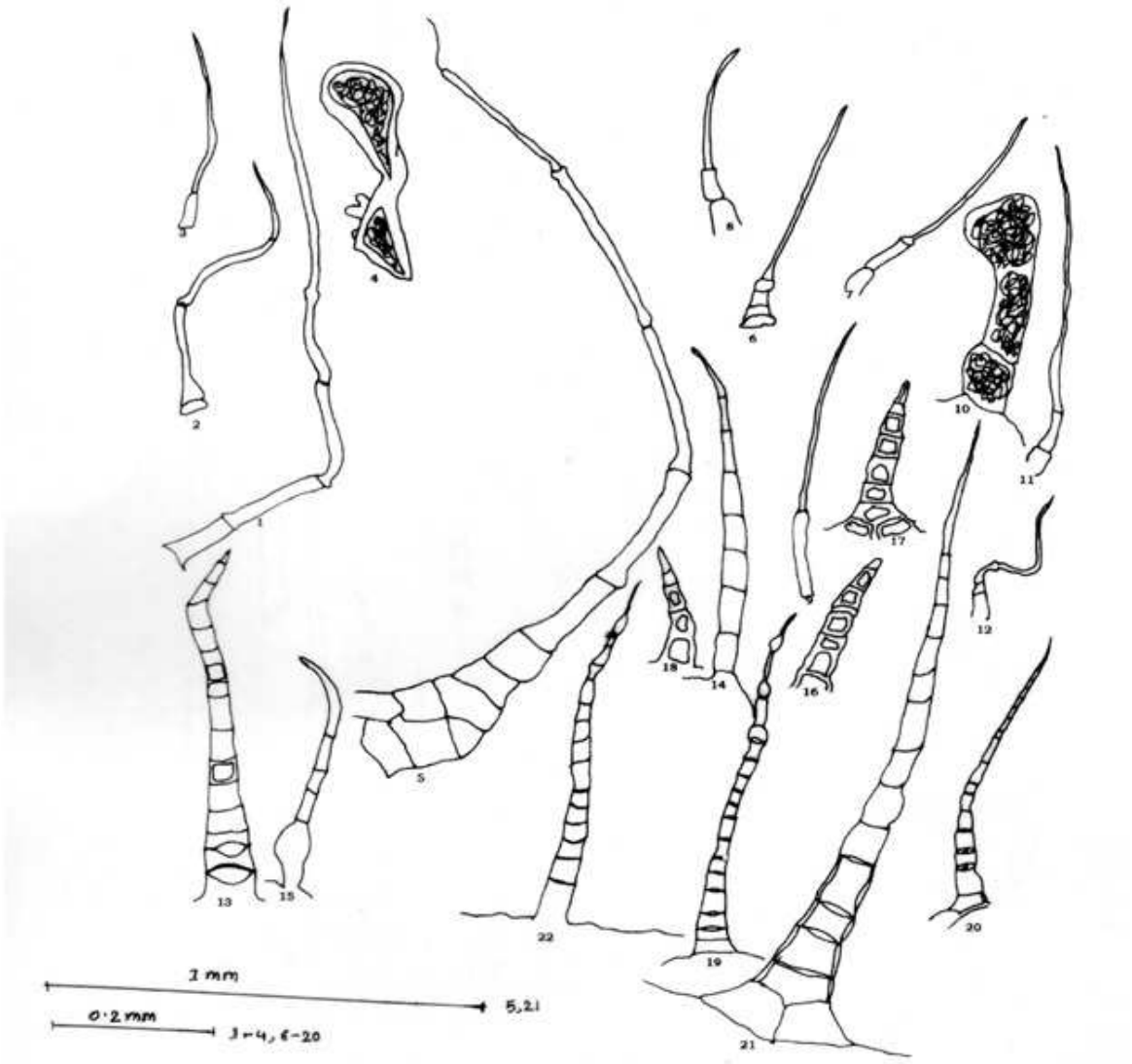

Fig. II : Hairs in ***Blumea lacera*** L. and ***Dahlia hybrida***

Fig. II : 1 - 12 *B. lacera;* Fig. II : 13-22 *D. hybrida*

Stem hairs : 1 - 5 ; 13, Leaf hairs : 6 - 8, 14 - 18,
Petiole hairs : 19, 20, 21, 22, Peduncle hairs : 9 - 10,
Involucral bract hairs: 11 - 12

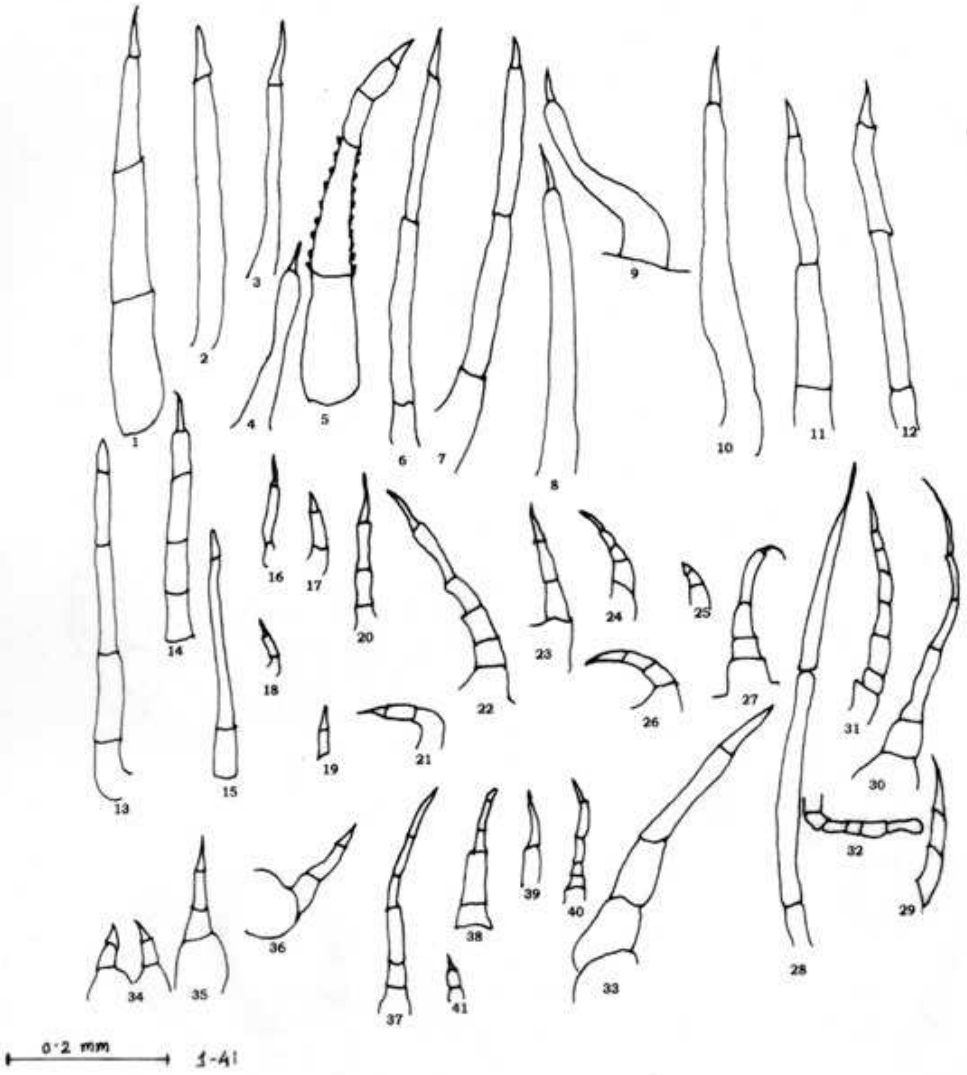

Fig. III : Hairs in ***Eclipta alba*** (L.) Hassk. and ***Helianthus annuus*** L.

Fig. III : 1 - 19 : *E. alba* ; Fig. III : 20 - 41 : *H. annuus*

Stem hairs : 1 - 4; 20 - 23 , Leaf hairs: 5 - 6; 24 - 26,
Petiole hairs: 7 - 10; 27 - 33, Peduncle hairs: 11, 12; 34 - 36,
Involucral Bract hairs: 13 - 15; 37 - 41, Disc hairs: 16 - 19

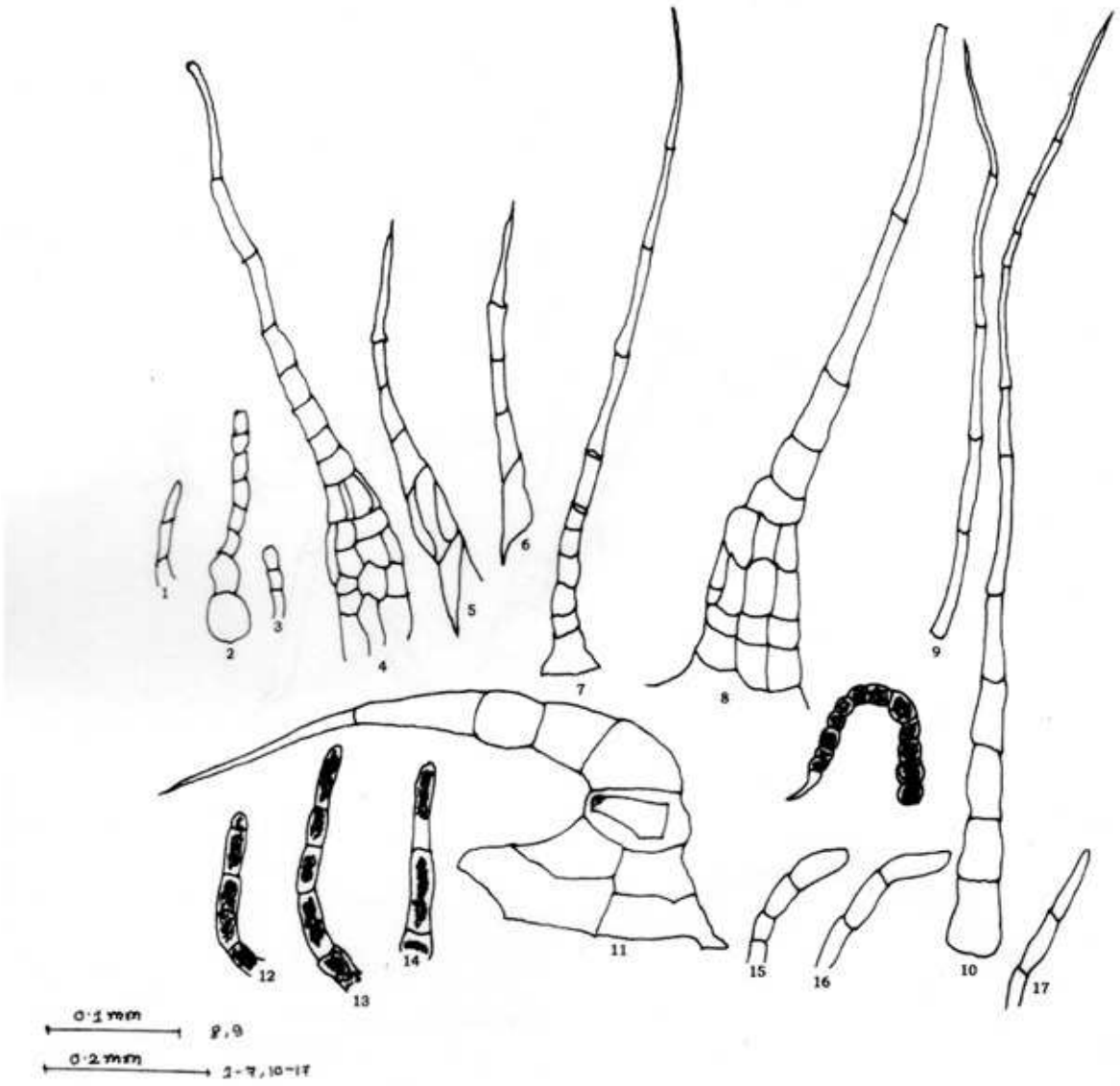

Fig. IV : Hairs in ***Parthenium hysterophorus*** L.

Fig. IV: 1 - 17 *P.* ***hysterophorus***

Stem hairs: 1 - 4, Leaf hairs: 5, 6,
Petiole hairs: 7, 8, 9, 10, 11, Pedurcle hairs: 12 - 14,
Involucral Bract hairs: 15 - 17

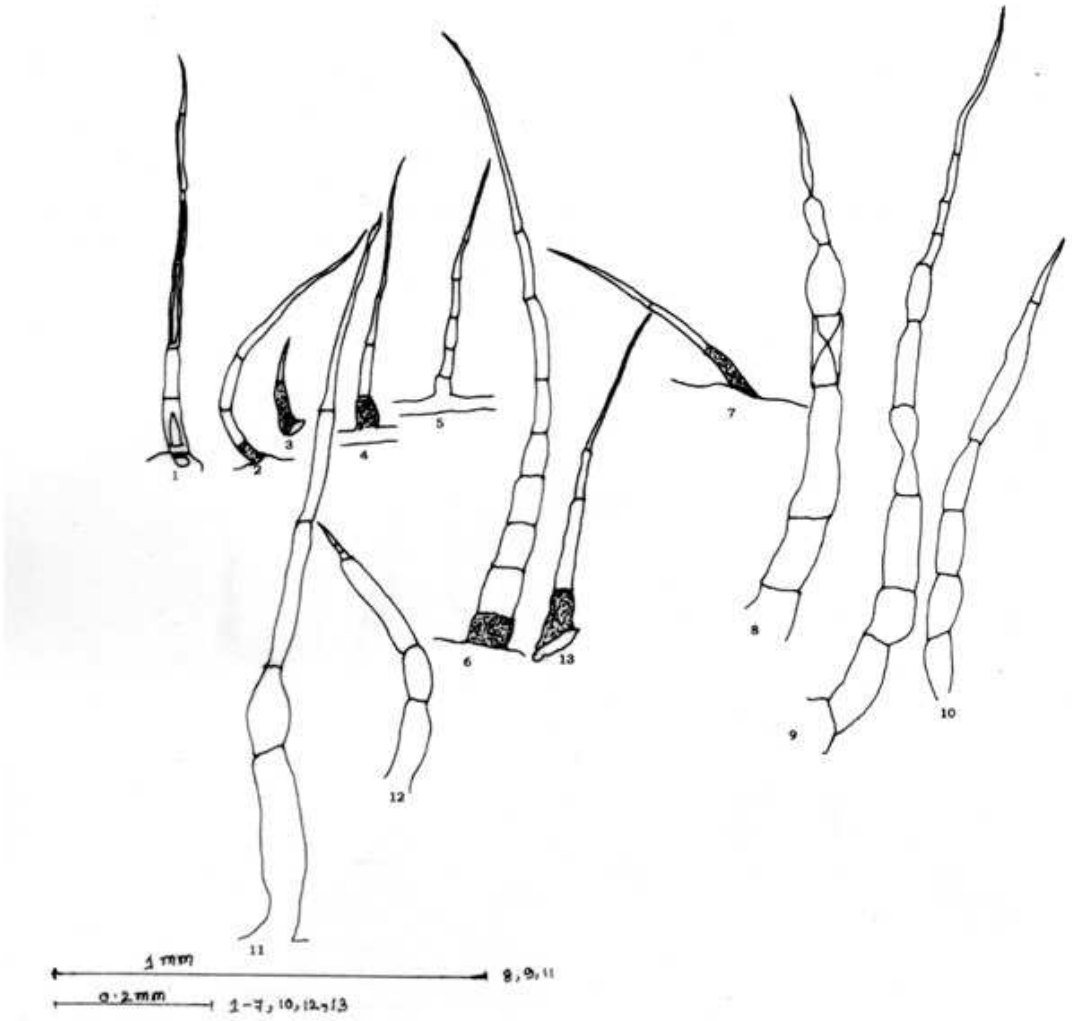

Fig. V : Hairs in ***Synedrella nodiflora*** (L.) Gaertn.

Fig V: 1 - 13 *S.* ***nodiflora***

Stem hairs: 1 - 3, Leaf hairs: 4 - 7,
Petiole hairs: 8 - 9 Peduncle hairs: 10 - 12,
Involucral Bract hairs: 13

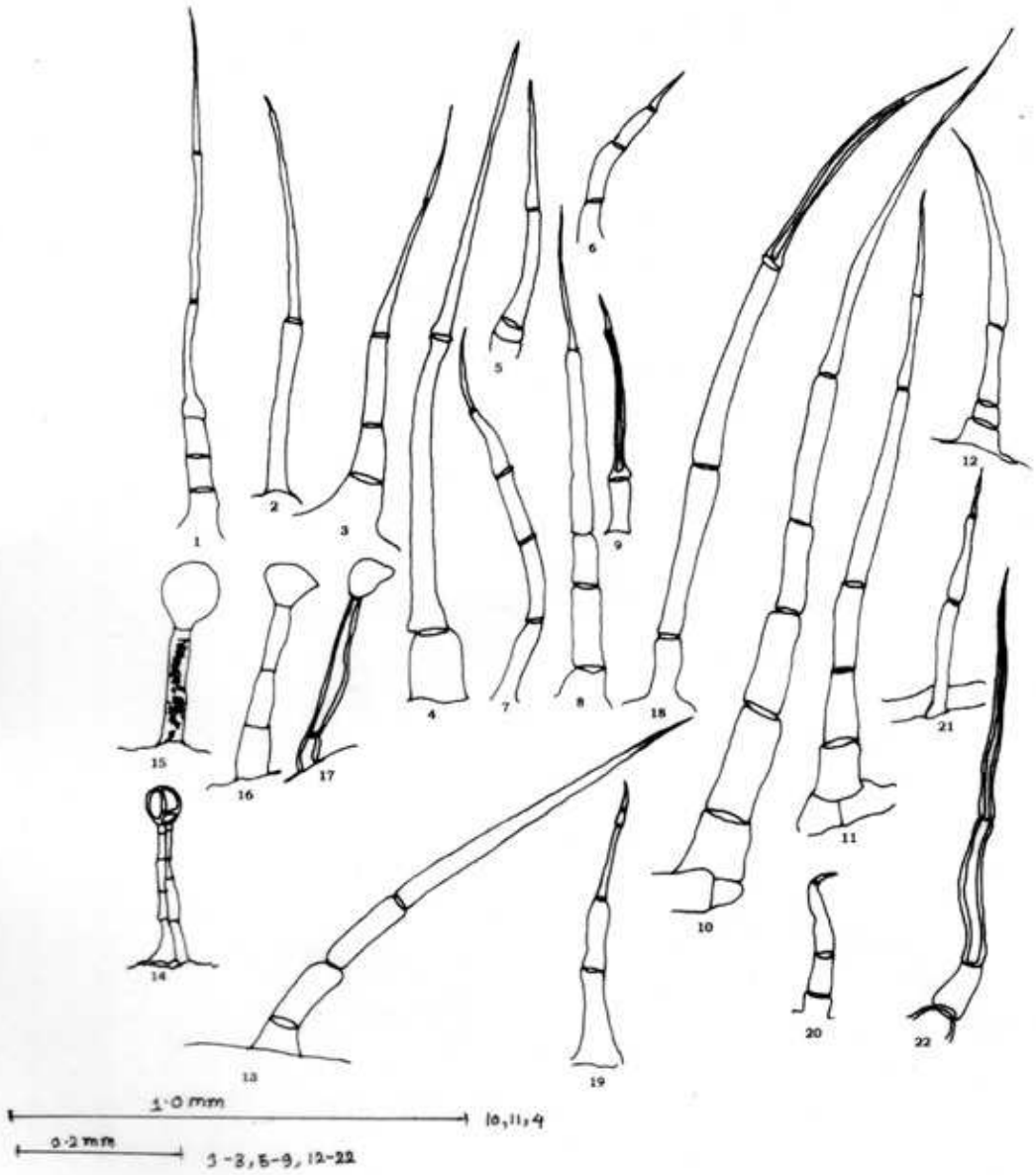

Fig. VI : Hairs in ***Tridax procumbens*** L.

Fig. VI : 1 - 22 *T. procumbens*

Stem hairs: 1 - 3 , Leaf hairs: 4 - 5,
Petiole hairs: 6 - 9, Peduncle hairs : 10 - 18,
Involucral Bract hairs: 19 - 22

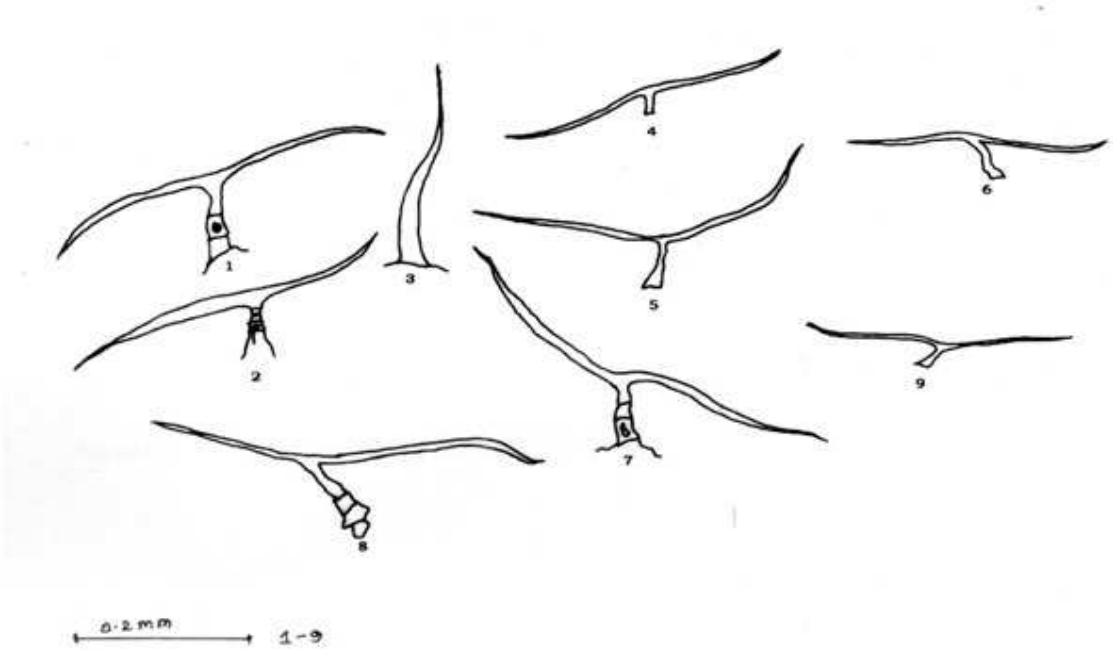

Fig. VII : Hairs in ***Vernonia cinerea*** L.

Fig VII: 1-9 , ***V. cinerea***

Stem hairs: 1 - 3, Leaf hairs: 4 - 5,
Petiole hairs: 6, Peduncle hairs: 4 - 5,
Involucral Bract hairs: 9

Table 1

Types of hairs in different parts of Plants

Name of plants	Stem hairs	Leaf hairs	Petiole hairs	Peduncle hairs	Involucral bract hairs	Disc hairs
1. *Ageratum conyzoides* L. Fig. I: 1-7.	6-8 celled, simple, filiform hair with pointed head. Fig. I: 1-3.	6-7 celled, simple, filiform, Juvenile hair. Fig. I: 4, 5.	5-6 celled, simple, filiform Juvenile hair. Fig. I : 6.	–	5-celled, simple, filiform, recurved hair with sharply pointed head. Fig. I : 7.	–
2. *Ageratum houstonianum* Mill. Fig. I: 8-21.	6-7 celled, simple, filiform, flagellate or whip-shaped aseptate hair. Fig. I : 8.	1. 4-5 celled, filiform whip-shaped, aseptate hairs. 2. 5-celled, shriveled swollen terminal cell hair. Fig. I: 9-11.	1. 4-5 celled, filiform whip-shaped septate hair. Fig. I: 12. 2. 4-5 celled shriveled whip-shaped, aseptate hair. Fig. I: 13.	1. 9-10 celled, simple, filiform hair. Fig. I: 14. 2. 3-celled, uniseriate, simple, swollen terminal celled hair Fig. I: 15, 17. 3. 5- celled, uniseriate, conical hair with obtuse end. Fig. I: 16.	1. 5-7 celled, simple, filiform whip-shaped, septate hair Fig. I: 18. 2. Simple, biseriate, unbranched hair with swollen terminal celled head. Fig. I: 19-21.	–
3. *Blumea lacera* L. Fig. II: 1-12.	1. 2-celled, simple filiform, whipshaped septate hair. Fig. II: 2, 3. 2. 3-4 celled, simple, filiform, whip-shaped aseptate hair. Fig. II : 1. 3. Multicellular, glandular capitate hair. Fig. II : 4. 4. 12-13 celled, biseriate base with uniseriate whip like hair. Fig. II : 5.	3-4 celled, simple filiform, whip-shaped aseptate hairs. Fig. II: 6-8.	–	1. 2 celled, simple, filiform whipshaped, aseptate hair. Fig. II : 9. 2. 5-6 celled simple unbranched glandular hair with truncate apex. Fig. II: 10.	3-4 celled simple, filiform, whipshaped, aseptate hairs. Fig II: 11-12.	–

Name of plants	Stem hairs	Leaf hairs	Petiole hairs	Peduncle hairs	Involucral bract hairs	Disc hairs
4. *Dahlia hybrida*. Fig. II: 13-22.	15-celled, simple, conical hair with short dentate apex. Fig. II: 13.	1. 7-8 celled, simple, conical hair with acuminate apex. Fig. II: 14. 2. 5-celled, simple, filiform bulbous base hair. Fig. II: 15. 3. 5-6 celled, simple, conical, thick-walled hair with obtuse apex. Fig. II: 16-18.	15-20-celled, simple, bulbo-shinkled, whip-shaped, aseptate conical hair. Fig. II: 19-22.	–	–	–
5. *Eclipta alba* (L.) Hassk. Fig. III: 1-19.	2-3 celled, simple, short, uniseriate, cylindrical hair with conical tuberculate cell. Fig. III: 1-4.	1. Same as before. Fig. III : 6. 2. Same as before, but finely denticulate at margin in a middle cell. Fig. III: 5.	Same as stem hairs. Fig. III: 7-10.	Same as stem hairs. Fig. III: 11, 12.	More or less same as stem hairs. Fig. III: 13-15.	Appearance as stem hairs but size is drastically smaller. Fig. III: 16-19.
6. *Helianthus annuus* L. Fig. III: 20-41.	2-5 celled, simple, short, straight or bent, uniseriate cylindrical hairs with sharply pointed apex cell. Fig. III: 20-23.	Same as before, but conspicuously bent always. Fig. III: 24-26.	1. Same as before, but whip-shaped, aseptate hair. Fig. III: 27-31, 33. 2. 5-6 celled, simple, short, cylindrical hair with obtuse apex. Fig. III: 32.	Same as leaf hairs, but always upright. Fig. III: 34-36.	Same as petiole and peduncle like hair. Fig. III: 37-41.	–

Name of plants	Stem hairs	Leaf hairs	Petiole hairs	Peduncle hairs	Involucral bract hairs	Disc hairs
7. *Parthenium hysterophorus* L. Fig. IV: 1-17.	1. 3-celled, short, simple, cylindrical hair with obtuse apex. Fig. IV: 1, 3. 2. 7-8 celled, filiform, simple, uniseriate, cylindrical hair with obtuse apex. Fig. IV: 2. 3. Many celled, filiform triseriate, conical based hair with truncate apex. Fig. IV: 4.	5-6 celled, simple, short conical hair with sharply pointed apex. Fig. IV: 5-6.	1. 7-9 celled, filiform, simple, Juvenile hair with aseptate whip-shaped apex. Fig. IV: 7,9,10. 2. Same as stem hair type. Fig. IV: 8. 3. 9-10 celled, filiform, simple, recurved, juvenile hair with biseriate base and aseptate whip like apical cell. Fig. IV: 11.	3-5 celled, simple short, glandular, cylindrical hair with obtuse apex. Fig. IV: 12-14.	3-4 celled, simpleshort, non-glandular cylindrical hair with obtuse apex. Fig. IV: 15-17.	–
8. *Synedrella nodiflora* (L.) Gaertn. Fig. V: 1-12.	2-6 celled, simple, filiform , uniseriate, whip shaped aseptate hair. Fig. V: 1-3.	1. Same as stem hair. Fig. V: 4, 5, 7. 2. Same as before, but longer, than previous one. Fig. V: 6.	7-10 celled, simple, filiform, shriveled and bulbiferous hair with whip-shaped, aseptate hairs. Fig. V: 8-9.	Same as petiole hairs. Fig. V: 10-12.	Same as stem hairs. Fig. V: 13.	–

Name of plants	Stem hairs	Leaf hairs	Petiole hairs	Peduncle hairs	Involucral bract hairs	Disc hairs
9. *Tridax procumbens* L. Fig. : VI: 1-22.	2-5 celled, simple, short, uniseriate, whip-shaped, aseptate hairs. Fig. VI: 1-3.	Same as stem hairs. Fig. VI: 4-5.	Same as stem hair. Fig. VI: 6-9.	1. Same as stem hair Fig. VI: 10-13, 18. 2. Multicellular, Simple, Short, glandular hair with biseriate stalk and 2 celled apical gland. Fig. VI: 14. 3. 3-4 celled, simple short, uniseriate hair with swollen terminal cell. Fig. VI: 15-17.	Same as stem hair. Fig. VI: 19-22.	–
10. *Vernonia cinerea* L. Fig. VII: 1-9.	1. 3-4 celled, T-shaped hair or two armed flagellate hair. Fig.VII:1, 2. It is 2 types a) Regular hair two armed equal in length Fig.VII: 1. b) Irregular hair two armed unequal in length Fig.VII: 2. 2) Unicellular, flagellate, aseptate hair. Fig.VII: 3.	1-celled, regular, two armed flagellate hairs. Fig. VII: 4-5.	Same as leaf hairs. Fig. VII: 6.	3-4 celled, two armed, flagellate hair with unequal in length. Fig. VII: 7, 8.	Same as leaf hair. Fig. VII : 9.	–

REFERENCES

1. Adedeji O: Leaf epidermal studies of the species of *Emilia* Cass. (Senecioneae, Asteraceae) in Nigeria. *Botanica Lithuanica.* 2004: 10 (2): 121-133.

2. Adedeji O, Ajuwon OY and Babawale OO: Foliar epidermial studies, organographic distribution and taxonomic importance of trichomes in the family Solanaceae. International Journal of Botany. 2007; 3 (3): 276-282.

3. Adedeji O. and Jewoola OA: Importance of leaf epidermal characters in the Asteraceae family. Not. Bot. Hort. Agrobot. Cluj 36 (2): 7-16

4. Aleykutty KM and Inamdar JA: Structure, ontogeny and classification of trichomes in Ranales. Feddes Repertorium 1980; 19 (1-2): 95-108.

5. Bremer K: *Asteraceae. Cladistics & Classification.* Timber Press, Port- land. 1994.

6. Carlquis S: Structure and ontogeny of glandular trichomes of Madinae (Compositae). Brittonia 1958; 10: 78 - 93.

7. Carlquist S: Anatomy of Guayana Mutisieae, Part II. Mem. N. Y. Bot. Gard. 1958; 10: 157-183.

8. Carlquist S: Comparative Anatomy. Holt Rienehart & Winston, New York. 1961.

9. De Bery A: A Comparative Anatomy of the Vegetative Organs of the Phanerogams and Ferns. Clerendon Press, Oxford. 1984.

10. Faust WZ and Jones SB: The systematic value of trichome complements in a North American group of *Vernonia* (Compositae). Rhodora 75: 517-528.

11. Funk VA, Susanna A, Stuessy TF and Bayer RJ: *Systematic Evolution and* Biogeography of Compositae. IAPT, Vienna. 2009.

12. Ghosh RB and Mitra Bimal: Contribution to the study of Asteraceae in West Bengal. Bull. Bot. Soc. Bengal 1982; 36 (1 & 2) : 61 - 66

13. Goebel H: *Organography of Plants Especially of the Archegoniatae and Spermatophyta*, Part 1, Clerendon Press, Oxford. 1900.

14. Inamdar JA, Gangadhara M and Shenoy KN: Structure, ontogeny, organographis distribution and taxonomic significance of trichomes and stomata in the Cucurbitaceae. In : Bates, D.M, Robinson, R.W. and Jeffrey, C (eds.) Biology and Utilization of the Cucurbitaceae. Cornell University Press. London. 1990.

15. Metcalfe CR and Chalk L: *Anatomy of the* Dicotyledons. Vol. 1. Oxford, U.K. 1950.

16. Metcalfe CR and Chalk L: Anatomy of the Dicotyledons. Vol. 2. Oxford, U.K. 1979.

17. Ramayya N: Studies on the trichomes of some Compositae I. General structure. Bull. Bot. Surv. India 1962: 4: 189-192.

18. Ramayya, N: The development of trichomes in the Compositae. In: Choudhury, K. A. (ed.) Recent Advances in the Anatomy of Tropical Seed Plants. Hindustan Publishers. 1969; 85 - 11

19. Ramayya, N: Classification and Phylogeny of the trichomes of Angiosperms. In : Ghouse, A.K.M. and Yunus, Mohd. (eds.) Recent Trends in Plant Anatomy, K.A. Choudhury Commemoration Volume. Tata McGraw Hill Pub. Ltd. New Delhi. 1972.

20. Sahu TR: Trichome studies in Senecio Linn., structure, distribution and taxonomic significance. J. Indian bot. Soc. 1983: 62.

21. Sahu TR: Taxonomic implication of trichome, complements in Vermonia (Compositae) in India. *Feddes Repertorium* 1984; 4 (4): 237-249.

22. Solerader H: Systematic Anatomy of the Dicotyledons. Vols. I & II. Clerendon Press, Oxford. 1908.

23. Tiwari Ela: Structure, classification and organographic distribution of trichomes in some Mutisieae. Pl. Syst. Evol. 1996; 30: 253-258.