

TRICHOMES IN RELATION TO TAXONOMY : 1. MIMOSOIDEAE

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ABSTRACT

The structure and organographic distribution of trichomes in 20 species of the Mimosoideae have been studied. In all, 32 trichome types are recognised of which 22 are new. They are distinguishable into five categories. The distribution of the trichomes has been found to be of taxonomic value. Six of the species can be identified on the basis of exclusive occurrence of specific trichome types in them. Based on the leaf trichome types and their distribution patterns, all the 20 species have been identified for which a key is presented.

INTRODUCTION

Though trichomes display greater diversity than other plant epidermal elements and hence offer taxonomically valuable evidence, information based on comparative studies on their structure and distribution in the angiosperms is negligible. Our knowledge of these structures in Mimosoideae is likewise scanty being only derived from general anatomical studies in the taxon (SOLEREDER, 1908 ; SABNIS, 1920 ; METCALFE & CHALK, 1950). The studies that have appeared earlier on the trichomes include those on *Acacia* (HARDY, 1912 ; VERDOORN, 1951), *Mimosa* (WEISS, 1867) and Mimosaceae (SHAH *et al.*, 1972). The present investigation was, therefore, taken up to make a detailed comparative study of the structure, classification, distribution and the taxonomic significance of the vegetative trichomes in Mimosoideae.

MATERIAL AND METHODS

Of the 20 species of Mimosoideae studied, 16 were collected from Hyderabad and its surroundings, whereas the remaining four were obtained from outside Hyderabad (India), as given in Table 1. Young and mature parts of the collected materials were fixed in Carnoy's fixative (JOHANSEN, 1940). To get an integrated picture of the trichome types and their organographic distribution, varied micropreparations, viz., epidermal peels, mounts of cleared whole organs or their portions, scrapings of trichomes and microtome sections were used. Epidermal peels were removed from all mature plant parts—leaflet, petiolule, stipel, petiole, stipule, stem, penduncle, pedicel, bract, bracteole, sepal, petal, androecium, and gynoecium, by scraping with a scalpel, wherever possible. In case of difficult materials, peels were separated by following the "Double-treatment method" (LEELAVATHI & RAMAYYA, 1975). Since floral parts are small and soft, entire organs were used for making the mounts. Mounts of isolated trichomes were essential to study morphology of the individual trichomes. Trichomes were separated by scraping the plant organs with a scalpel or blade, or by directly crushing shoot apices after treating them with dilute acids.

Permanent canada-balsam mounts of microtome sections of vegetative and floral buds were made for all the species by following the usual paraffin embedding method

(JOHANSEN, 1940). Stain combinations employed were Ehrlich's hematoxylin with basic fuchsin as counter stain. These preparations were particularly essential to make a thorough study of the organic distribution of the trichomes. Terms of description were used after RAMAYYA (1962a, 1975).

OBSERVATIONS

1. *Unicellular cylindrical hair*—Unicellular, cylindrical, slight to much longer than broad ; obtuse at apex ; contents scanty or dense, early evanescent ; wall thin or thick ; surface smooth ; in some basally expanded into a foot-like region (Figs. 1 F & G).
2. *Unicellular conical hair*—Similar as above but conical, tapering above, straight or curved ; surface smooth or verrucose ; in some basally expanded into a foot-like region or subtended by an emergence (Figs. 1 A—E).
3. *Unicellular flagellate hair*—As in the unicellular cylindrical hair but flagellate, pointed or obtuse at apex ; content scanty ; wall thin ; surface finely verrucose (Fig. 1H).
4. *Unicellular papillate hair*—Similar to the unicellular cylindrical hair but slightly broader than long ; wall thin ; surface smooth (Fig. 1 I).
5. *Filiform capitate hair*—Foot : 1-celled ; contents scanty ; wall thin. Stalk : unicellular to uniseriate, cylindrical, 1-18- celled. Cells of varied lengths, quite longer than broad or broader than long ; contents scanty ; walls thin ; surface smooth. Head : multiseriate, capitate, 2- 4- celled in length and width. Cells of varied lengths, longer than broad or broader than long ; contents dense ; walls thin, surface smooth (Figs. 1 K, M & O).
6. *Filiform hollow capitate hair*—Similar to the filiform capitate hair except—Stalk : 2- 8- celled. Head : centrally cavitated ; cavity empty (Fig. 2 F).
7. *Filiform clavate hair*—Similar to the filiform capitate hair, except—Stalk : 1-8- celled. Head : clavate, 2-4- celled in length and width (Figs. 1N & P).
8. *Filiform hollow clavate hair*—Similar to the filiform clavate hair except—Stalk : 3- 8- celled. Head : 3- 5- celled in length and width, centrally cavitated ; cavity empty (Fig. 2 E).
9. *Filiform cylindric-clavate hair*—Similar to the filiform clavate hair except—Stalk : 1-4-celled. Head : uniseriate to multiseriate, cylindric-clavate, 3-6-celled in length, 1-3-celled in width ; cells quite longer than broad (Figs. 1L ; 2 A—D).
10. *Filiform cylindrical hair*—Foot : 1-celled ; contents scanty ; wall thin. Body : unicellular to uniseriate, 1-9-celled in length, obtuse at apex. Cells of almost equal length, mostly longer than broad, few broader than long ; contents dense in terminal cell, rarely evanescent or persistent, walls thin ; surface smooth (Fig. 1 J).
11. *Macroform conical hair*—Foot : 1-celled ; contents scanty ; wall thin or thick. Body : unicellular to uniseriate, 1- 11- celled, straight to curved, tapering above, pointed at apex. Cells almost of equal length or of varied lengths, longer than broad ; contents translucent or scanty ; cross walls thin or thick ; lateral walls thin or thick ; surface smooth or verrucose (Figs. 2 G-I).
12. *Macroform septate conical hair*—Similar to the macroform conical hair except —Body : 1-6-celled, terminal cell longer than the others ; contents scanty ; lateral walls thick ; cross walls thin ; surface smooth (Fig. 2 J).
13. *Biseriate capitate hair*—Foot : 2-celled ; cells juxtaposed ; walls thin ; contents scanty. Stalk : biseriate or rarely 3-celled in width, cylindrical, 3- 7- celled in length ;

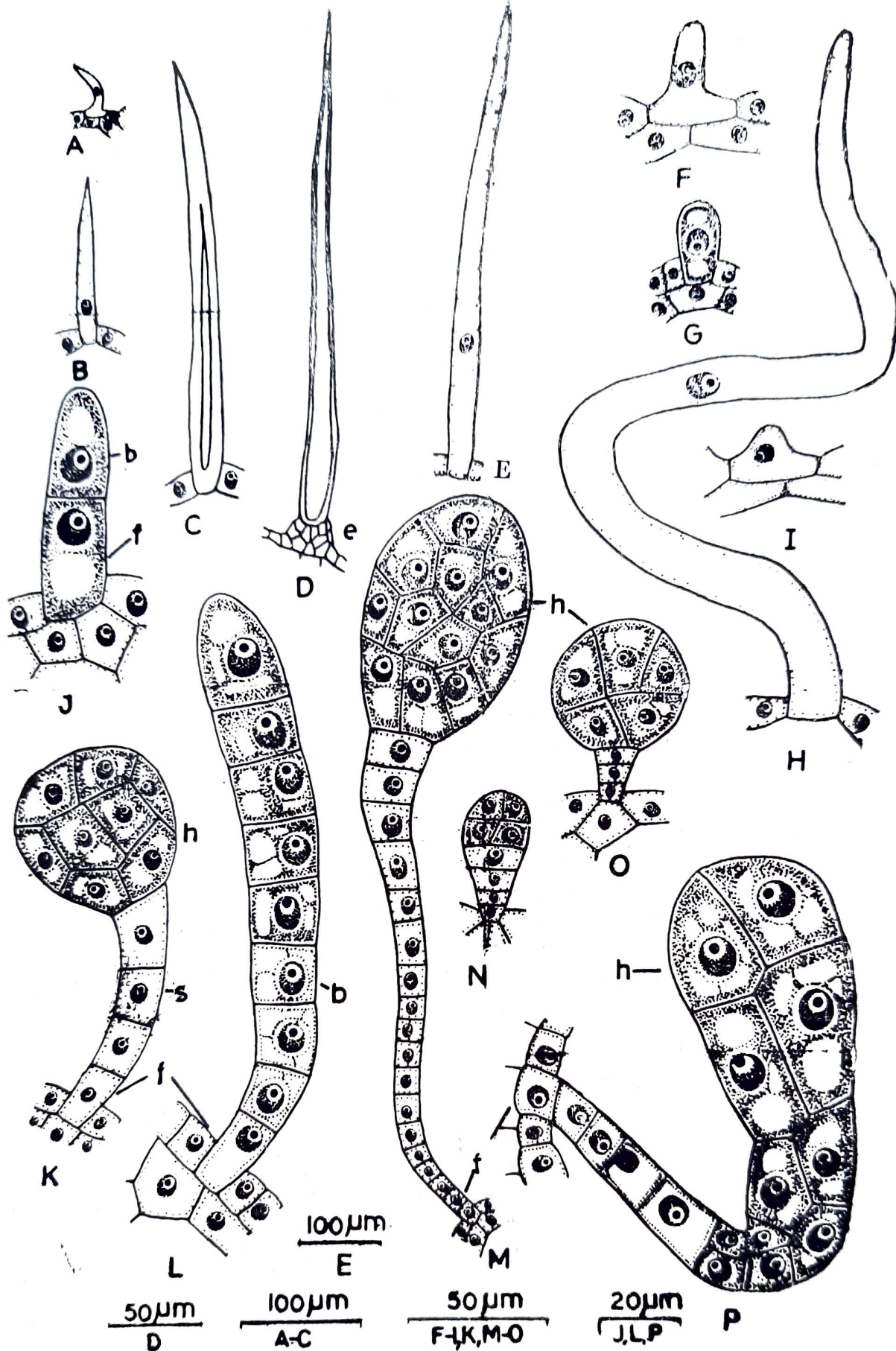


Figure 1. A, M, O, *Albizia amara* : A, unicellular conical hair from primary rachis, M, O, uniseriate filiform capitate hairs from stipule and sepal margins respectively ; B, C, P, *Pithecellobium dulce* : B, C, unicellular conical hairs from bracteole, P, uniseriate filiform clavate hair from l.s. primary rachis ; E, G, *Acacia arabica* : E, unicellular conical hair from stem, G, unicellular cylindrical hair from petal margins ; D, K, *Calliandra haematocephala* : D, unicellular conical hair from l.s. stem ; K, uniseriate filiform capitate hair from l.s. stem ; F, H, I, *Samanea saman* : F, unicellular cylindrical hair from leaflet, H, unicellular flagellate hair from bract margins ; I, unicellular papillate hair from leaflet ; J, L, *Acacia auriculiformis* ; J, uniseriate filiform cylindrical hair from sepal margins ; L, uniseriate filiform cylindrical-clavate hair from l.s. stem ; N, *Mimosa pudica* : uniseriate filiform clavate hair from leaflet margins. (b, Body ; e, Emergence ; f, Foot ; h, Head ; s, Stalk).

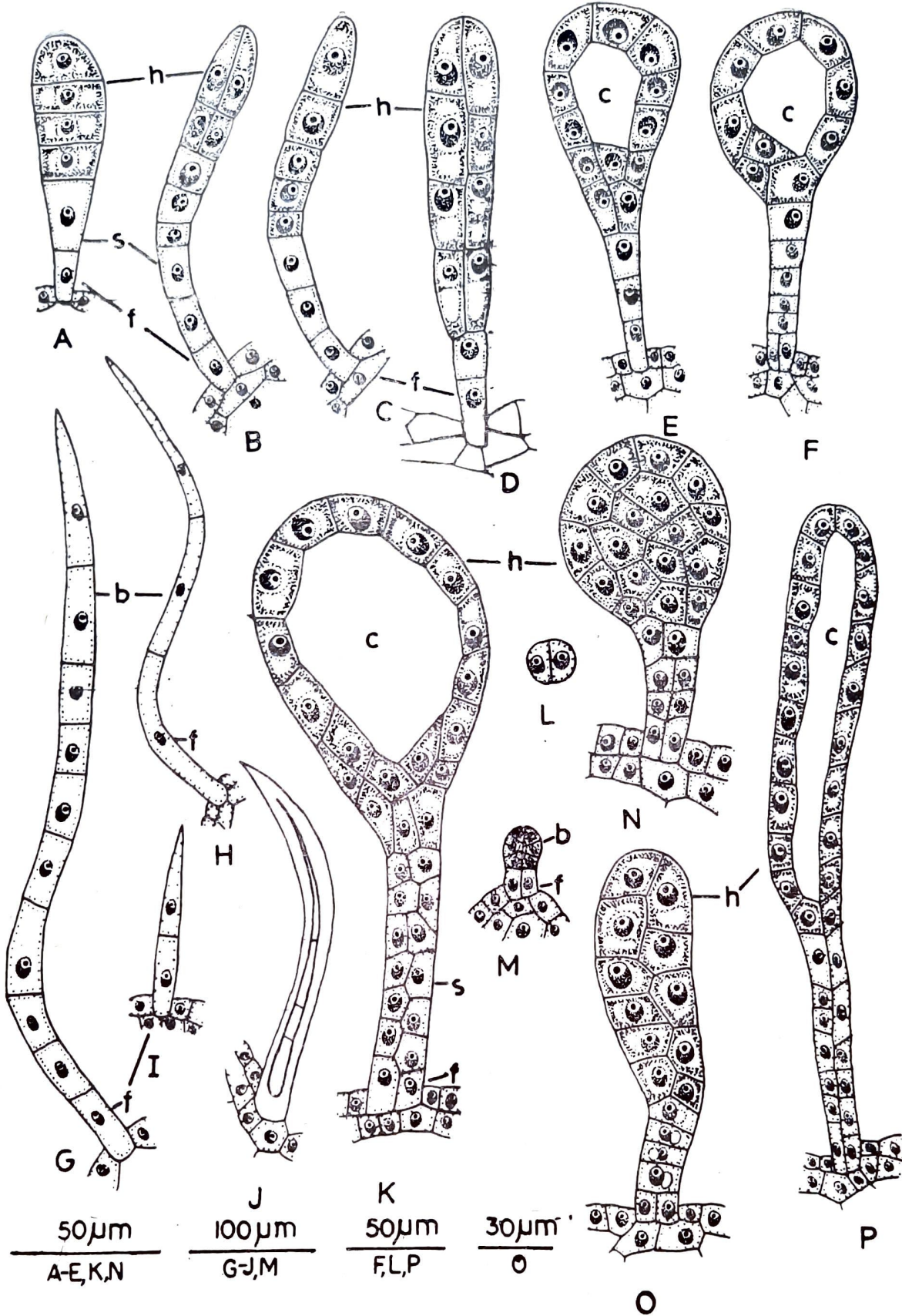


Figure 2. A, *Albizia amara* : uniseriate filiform cylindrical-clavate hair from sepal margins ; B, C, J, *Calliandra haematocephala* : B, C, uniseriate filiform cylindrical-clavate hairs from sepal margins, J, uniseriate macroform septate conical hairs from stipule margins ; D, H, *Mimosa pudica* : D, uniseriate filiform cylindrical-clavate hair from ovary, H, uniseriate macroform conical hair from pedicel, E, F, K, P, *Acacia arabica* : E, uniseriate filiform hollow clavate hair from l.s. primary rachis, F, uniseriate filiform hollow capitate hair from l.s. primary rachis, K, biseriate hollow capitate hair from l.s. primary rachis, P, Biseriate hollow cylindrical-clavate hair from l.s. primary rachis, G, *Samanea saman* : uniseriate macroform conical hair from primary rachis ; I, *Adenanthera pavonina* : uniseriate macroform conical hair from leaflet ; L, M, O, *Dichrostachys cinerea* : L, t.s. stalk of biseriate clavate hair from t. s. primray rachis, M, O, biseriate clavate hairs from sepal margin and l.s. primary rachis respectively ; N, *Mimosa hamata* : biseriate capitate hair from bracteole margin, (b, Body ; f, Foot ; h, Head ; c, Cavity ; s, Stalk).

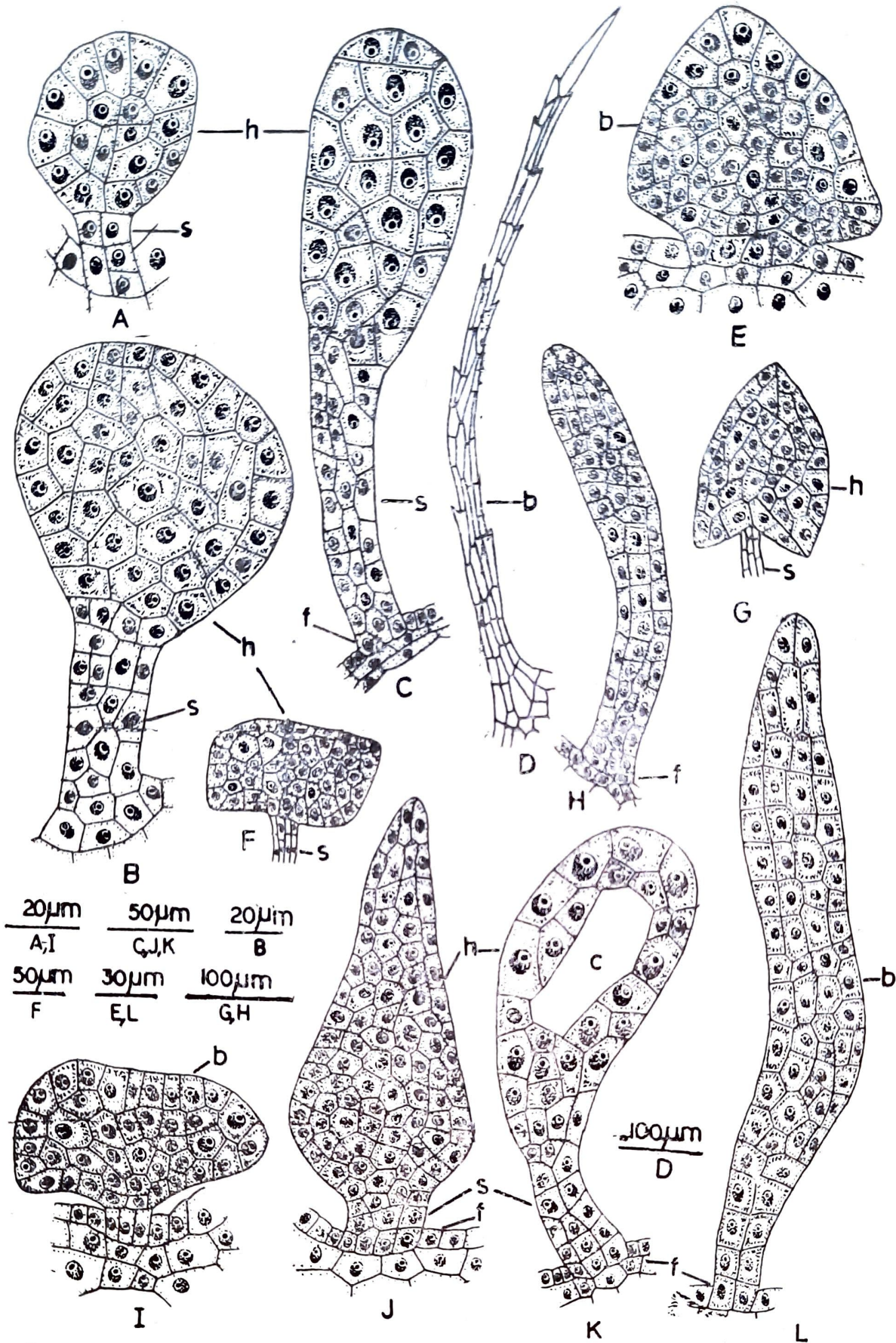


Figure 3. A, E, I, J, L, *Neptunia oleracea* : A, multiseriate capitate hair from l.s. primary rachis, E, multiseriate cordate hair from l.s. stipule, I, multiseriate peltate hair from l.s. stem, J, multiseriate obclavate hair from l.s. primary rachis ; B, *Mimosa praniana* : multiseriate capitate hair from l.s. stem ; C, *Parkia biglandulosa* : multiseriate clavate hair from l.s. primary rachis ; D, *Mimosa pudica* : multiseriate spinulose conical hair from l.s. stem ; H, *Leucaena leucocephala* : multiseriate cylindrical hair from l.s. primary rachis ; F, G, *Desmanthus virgatus* : F, multiseriate quadrangular hair from primary rachis ; G, multiseriate sagittate hair from primary rachis ; K, *Acacia arabica* : multiseriate hollow clavate hair from l.s. primary rachis. (b, Body ; f, Foot ; h, Head ; c, Cavity ; s, Stalk).

cells of varied lengths, slightly longer than broad or broader than long; contents scanty; walls thin; surface smooth. Head: multiseriate, capitate, 3-5-celled in length and width; cells slightly longer than broad or broader than long, contents dense; walls thin; surface smooth (Fig. 2 N).

14. *Biseriate clavate hair*—Similar to the biseriate capitate hair except—Stalk: 2-10-celled in length or absent. Head/Body: Clavate, 2-6-celled in length and width (Figs. 2 L, M, & O).

15. *Biseriate hollow capitate hair*—Similar to the biseriate capitate hair except—Stalk: 5-9-celled in length. Head: 4-6-celled in length, 3-5-celled in width, centrally cavitated; cavity empty (Fig. 2 K).

16. *Biseriate hollow cylindric-clavate hair*—As in the biseriate hollow capitate hair except—Head: cylindric-clavate, 6-10-celled in length, 3- or 4-celled in width; cells mostly longer than broad (Fig. 2 P).

17. *Multiseriate capitate hair*—Foot: multicellular; cells juxtaposed; contents scanty; walls thin. Stalk: multiseriate, cylindrical, 1-20-celled in length, 2-8-celled in width. Cells of varied lengths, longer than broad or broader than long; contents scanty; walls thin; surface smooth. Head: multiseriate, capitate to truncate, 3-9-celled in length, 3-8-celled in width. Cells of varied lengths, longer than broad or broader than long; contents dense; walls thin; surface smooth (Figs. 3 A & B).

18. *Multiseriate cordate hair*—Similar to the multiseriate capitate hair except—Stalk: 1-3-celled in length, 3- or 4-celled in width or absent. Head/Body: cordate, 5-11-celled in length, 3-10-celled in width (Fig. 3 E).

19. *Multiseriate obclavate hair*—Similar to the multiseriate capitate hair except—Stalk: 2- or 3-celled in length, 3 or 4-celled in width; cells mostly broader than long, Head: obclavate, 14-45-celled in length, 2-12-celled in width; contents scanty (Fig. 3 J).

20. *Multiseriate quadrangular hair*—As in multiseriate capitate hair except—Stalk: 4- or 5-celled in length, 3- or 4-celled in width. Head: quadrangular, 4-7-celled in length, 8-12-celled in width (Fig. 3 F).

21. *Multiseriate sagittate hair*—Similar to the multiseriate capitate hair except—Stalk: 4- or 5-celled in length, 3- or 4-celled in width. Head: Sagittate, 5-9-celled in length, 2-8-celled in width (Fig. 3 G).

22. *Multiseriate clavate hair*—Similar to the multiseriate capitate hair except—Stalk: 1-12-celled in length, 2-4-celled in width; contents scanty. Head: Clavate, 4-8-celled in length, 3-5-celled in width (Fig. 3 C).

23. *Multiseriate hollow clavate hair*—Similar to the multiseriate clavate hair except—Head: 5-7-celled in length, 3- or 4-celled in width, centrally cavitated; cavity empty (Fig. 3 K).

24. *Multiseriate cylindrical hair*—Foot: multicellular; cells juxtaposed; contents scanty; walls thin. Body: multiseriate, cylindrical, 11-20-celled in length, 3- or 4-celled in width. Cells longer than broad or broader than long; contents dense or scanty; walls thin; surface smooth (Fig. 3 H).

25. *Multiseriate peltate hair*—Similar to the multiseriate cylindrical hair, except—Body: shield-like, circular in shape, 4- or 5-celled in thickness, 7- or 8-celled in diameter (Fig. 3 I).

26. *Multiseriate fusiform hair*—Similar to the multiseriate cylindrical hair except—

Body : Fusiform, 14- 24-celled in length, 2-4-celled in width (Fig. 3 L).

27. *Multiseriate spinulose conical hair*—Similar to the multiseriate cylindrical hair except—Body : conical, 10- 14-celled in length, 1- 5-celled in width, gradually tapering above into a long terminal cell, pointed at apex. Cells several times longer than broad; contents scanty; walls thick; distal end of the outer cells spinulose (Fig. 3 D).

DISCUSSION

A. STRUCTURE

The trichome types recorded are either unicellular or multicellular which confirm the earlier observations in the family (SOLERDEDER, 1908; METCALFE & CHALK, 1950; SHAH *et al.*, 1972).

Foot of the trichomes may be simple or compound, as defined by RAMAYYA (1962a, 1962b). In Mimosoideae, however, the foot in all the uniseriate filiform and uniseriate macroform and biseriate trichome types is of simple type. In the multiseriate trichome types (Figs. 3 A-L), it was practically difficult to classify the foot into simple or compound type because of its large number of cells as also reported in Compositae (RAMAYYA, 1962a, 1962b).

Structurally, the foot shows variations depending on the type of the trichome and the species in the Mimosoideae. Generally the foot cells in the uniseriate filiform, uniseriate macroform and biseriate trichome types are slightly projected above the epidermis (Figs. 1 J-P, 2 A-G, J-K, M-P) as in other families (DE BARY, 1884; RAMAYYA, 1962a, 1962b). In the macroform conical hair, however, the foot cell sometimes appears projected above the epidermis (Figs. 2 H, I). In some trichome types the foot shows unique modifications (i.e., tangentially elongate or bulbous) so that the trichomes are distinctive and, hence, are of taxonomic value, e.g., the unicellular papillate and cylindrical hairs in *Samanea saman* (Figs. 1 F-I) and the unicellular conical hair in *Albizia amara* (Fig. 1A). Trichome types seem much variable in their length in a given taxon and also from taxon to taxon in the Mimosoideae. But the variation in any type of trichome occurs within certain limits in a given species, and, hence, is taxonomically useful (refer key). In the Mimosoideae the longest type is the multiseriate spinulose conical hair in *Mimosa pudica* (1420 μm), while the shortest (3 μm) is the unicellular papillate hair in *Samanea saman*. The broadest trichome has been found to be the multiseriate cordate hair (132 μm) in *Neptunia oleracea* as measured in the sectional view and the thinnest is the unicellular papillate and cylindrical hairs (6 μm) in *Samanea saman*.

Cells of the trichomes studied are either broader than long or *vice versa*, or isodiametrical (RAMAYYA, 1962a). The longest observed is the terminal cell of macroform conical hair in *Mimosa pudica* (450 μm ; Fig. 2 H), while the shortest is the basal cell of the filiform capitate hair (6 μm) in *Albizia amara* (Fig. 1 M). Similarly the broadest cell observed is the uniseriate macroform septate conical hair (33 μm) in *Galliardra haematocephala* (Fig. 2 J) and the thinnest is represented by the unicellular papillate hair (3 μm) in *Samanea saman* (Fig. 1 I).

Trichomes are one cell in height as all those classified under the category of unicellular trichomes (Figs. 1 A-I), or many cells in length as represented by the multicellular trichomes (Figs. 1 J-P, 2 A-P & 3 A-L). But in the latter the cell number shows a limit in height and width, the maximum being about 45-celled long in multiseriate obclavate hair of *Neptunia oleracea* (Fig. 3 J), or it may be only two cells, often noted in the macroform conical hair and filiform cylindrical hair (Figs. 1 J & 2 I). In width, the

trichomes may be 1-celled as in the unicellular, macroform and some filiform trichomes, while up to 10-celled in the multiseriate cordate hair in *Neptunia oleracea* (Fig. 3 E).

The cytoplasmic contents are scanty or absent mostly in the unicellular trichomes macroform trichomes and multiseriate spinulose conical hairs (Figs. 1A-F, 2 G-J & 3D) or mostly dense in the filiform trichomes, biseriata and multiseriate trichomes (Figs. 1 J-P; 2A-F, K, M-P; 3A-C & E-L).

Cavity occurs in the head region of the filiform hollow capitate, filiform hollow clavate, biseriata hollow capitate, biseriata hollow cylindrical-clavate, and multiseriate hollow clavate hairs in *Acacia arabica* and *A. leucophloea* (Table 1; Figs. 2E, F, K, P & 3K). Occurrence of such trichomes, though in few taxa, has been recorded in the past. CARLQUIST (1959) described it in 'hollow-stalked gland' of *Holocarpha* (Compositae), while PRABHAKAR AND RAMAYYA (1975) in the multiseriate hollow cylindrical hairs in *Portulaca oleracea*, *P. suffruticosa* and *P. quadrifida*. The location of the cavity seems to show wide variation uncorrelated with exomorphological differentiation in the trichome. In *Portulaca* species, though the cavity is located in the terminal region of the trichome, the latter is not differentiated into stalk and head (PRABHAKAR & RAMAYYA, 1975), while in *Holocarpha*, the body of the trichome is distinguishable into stalk and head but it is the stalk which is cavitated (CARLQUIST, 1959). In the present study though the trichome body is externally distinguished into stalk and head the cavity occurs in the head region, unlike in *Holocarpha* (Figs. 2E, F, K, P & 3K). Further, no correlation can be made with the plant habit or habitat.

Lateral walls of the trichomes are either thin or thick. The thickest walls occur in the macroform septate conical hair (Fig. 2J) in *Galliardra haematocephala*, whereas the thinnest in the unicellular papillate hair in *Samanea saman* (Fig. 1 I). The cross walls are usually thin but they are quite thick in the multiseriate spinulose conical hair in *Mimosa pudica* (Fig. 3 D).

RAMAYYA (1962a) distinguished five types of wall surfaces in the trichomes of Compositae, viz., smooth, ridged, echinulate, verrucose and granulate, of which in Mimosoideae only the smooth and verrucose patterns occur.

B. CLASSIFICATION

In Mimosoideae altogether 32 trichome types are so far recognisable, including those described by earlier workers. From the literature (SOLEREDER 1908; METCALFE & CHALK, 1950; SHAH *et al.*, 1972) ten types could be identified after leaving out those which could not be made out clearly on the basis of their description and illustrations. From amongst the previous ten records, only five types are presently confirmed. Thus, out of 32 trichome types occurring in Mimosoideae, 27 are presently recorded, of which 22 are new.

In Angiosperms the trichomes have been categorised into three groups by WEISS (1867), and into five categories by HUMMEL AND STAESCHE (1962). DE BARY (1884) grouped them into five based mainly on both their form and function. SOLEREDER (1908) and METCALFE AND CHALK (1950) divided them into two major groups and several subtypes based on their structure and function. However, RAMAYYA (1975) has shown that the categories recognised in these various classifications reveal discrepancies and, hence, do not serve the desired purpose.

In his studies in Compositae and other angiosperms, RAMAYYA (1962a, 1975) stressed the value of mature structure of trichomes to be more significant in their primary

classification rather than either structure cum function or merely form or function, or a combination of all the three characters—form, function and structure. Accordingly, he classified the vegetative as well as floral trichomes of angiosperms on the basis of their structure into five major categories, which are as follows :

I. Unicellular trichomes, II. Uniseriate filiform trichomes, III. Uniseriate macroform trichomes, IV. Biseriate trichomes, V. Multiseriate trichomes.

The classification based on the mature structure of trichomes is of particular significance because of ease in the determination of the concerned trichome types and its taxonomic value. On a comparison of the trichome types recorded in Mimosoideae with those described by RAMAYYA (1975), it is found that they could be classified on the same basis. Accordingly, the trichome categories, their general features and their constituent types in Mimosoideae are as follows:

Category I—Unicellular trichomes—Foot : Distinct or indistinct. Body entire. Four trichome types belong to this category, viz., 1. Unicellular conical hair, 2. Unicellular cylindrical hair, 3. Unicellular flagellate hair, and 4. Unicellular papillate hair.

Category II—Uniseriate filiform trichomes—Foot : Unicellular. Body : Unicellular or multicellular, entire or differentiated into stalk and head. Stalk : Unicellular or uniseriate. Head : Uniseriate to multiseriate. This category is represented by six trichome types. 1. Filiform capitate hair, 2. Filiform clavate hair, 3. Filiform cylindrical hair, 4. Filiform cylindrical-clavate hair, 5. Filiform hollow capitate hair, 6. Filiform hollow clavate hair.

Category III—Uniseriate macroform trichomes—These are generally larger than the uniseriate filiform trichomes. Foot : Unicellular, distinct or indistinct. Body : Unicellular or uniseriate. In this, only two trichome types have been observed. 1. Macroform conical hair, 2. Macroform septate conical hair.

Category IV—Biseriate trichomes—Foot : 2-celled; cells juxtaposed. Body : 2-celled to multicellular, entire or differentiated into stalk and head. Stalk : Biseriate; but some times may be multiseriate. Head : Biseriate to multiseriate. Four trichome types are represented by this category. 1. Biseriate capitate hair, 2. Biseriate clavate hair, 3. Biseriate hollow capitate hair, and 4. Biseriate hollow cylindrical-clavate hair.

Category V—Multiseriate trichomes—Foot: 3 or more-celled; cells juxtaposed. Body: Multiseriate, entire or differentiated into stalk and head. Stalk : Multiseriate. Head : Multiseriate. Eleven trichome types represent this category. 1. Multiseriate capitate hair, 2. Multiseriate clavate hair, 3. Multiseriate cordate hair, 4. Multiseriate cylindrical hair, 5. Multiseriate fusiform hair, 6. Multiseriate hollow clavate hair, 7. Multiseriate obclavate hair, 8. Multiseriate peltate hair, 9. Multiseriate quadrangular hair, 10. Multiseriate sagittate hair, 11. Multiseriate spinulose conical hair.

C. DISTRIBUTION

According to COETER (C. F. SOLEREDER, 1908) occurrence of glandular trichomes is a consistent feature in the family, which is presently confirmed (Table 1). He found the glandular trichomes to consist of a uniseriate stalk of variable length and a multiseriate ellipsoid head of variable size in the genera *Acacia*, *Adenantha*, *Albizia*, *Calliandra*, *Desmanthus*, *Leucaena*, *Mimosa*, *Neptunia*, *Parkia*, *Pithecellobium*, *Prosopis*, and *Samanea*. Though this situation is presently confirmed in *Albizia*, *Calliandra*, *Pithecellobium*, and *Samanea*, the trichome types are uniseriate to multiseriate in *Acacia* and *Mimosa* and only multiseriate in *Desmanthus*, *Leucaena*, *Neptunia*, *Parkia* and *Prosopis* (Table 1).

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Category IV—Biseriate trichomes—Foot : 2-celled; cells juxtaposed. Body : 2-celled to multicellular, entire or differentiated into stalk and head. Stalk : Biseriate; but some times may be multiseriate. Head : Biseriate to multiseriate. Four trichome types are represented by this category. 1. Biseriate capitate hair, 2. Biseriate clavate hair, 3. Biseriate hollow capitate hair, and 4. Biseriate hollow cylindrical-clavate hair.

Category V—Multiseriate trichomes—Foot: 3 or more-celled; cells juxtaposed. Body: Multiseriate, entire or differentiated into stalk and head. Stalk : Multiseriate. Head : Multiseriate. Eleven trichome types represent this category. 1. Multiseriate capitate hair, 2. Multiseriate clavate hair, 3. Multiseriate cordate hair, 4. Multiseriate cylindrical hair, 5. Multiseriate fusiform hair, 6. Multiseriate hollow clavate hair, 7. Multiseriate obclavate hair, 8. Multiseriate peltate hair, 9. Multiseriate quadrangular hair, 10. Multiseriate sagittate hair, 11. Multiseriate spinulose conical hair.

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Table 1—List of species investigated along with organographic distribution of vegetative trichomes

Species & trichome types	Source	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29											
1. <i>Acacia arabica</i> (Lamk.) Willd.																																									
Unicellular conical ..	H	—	—	—	+	*	*	*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—								
Unicellular cylindrical	..	—	—	—	—	*	*	*	—	—	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
Uniseriate filiform cylind.	..	—	—	—	—	*	*	*	—	—	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—						
Uniser. filif. hollow capitate	..	—	—	+	+	*	*	*	+	—	—	+	+	+	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Uniser. filif. hollow clavate	..	—	—	+	+	*	*	*	+	—	—	+	+	+	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Biser. hollow capitate	..	—	—	+	+	*	*	*	+	—	—	+	+	+	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Biser. hollow cylind. clavate	..	—	—	—	—	*	*	*	+	—	—	+	+	+	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Multiseriate hollow clavate	..	—	—	—	+	*	*	*	+	—	—	+	+	+	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
2. <i>Acacia auriculiformis</i> A. Cunn. Ex. Benth.																																									
Uniser. filif. cylind.	..	—	—	—	—	—	—	—	+	—	—	+	+	+	+	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Uniser. filif. cylind. clavate	..	—	—	—	—	—	—	—	+	—	—	+	+	+	+	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
3. <i>Acacia leucophloea</i> (Roxb.) Willd.																																									
Unicellular conical	..	—	—	+	+	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Uniser. filif. hollow capitate	..	—	—	—	+	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Uniser. filif. hollow clavate	..	—	—	—	+	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Biser. hollow capitate	..	—	—	—	—	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Biser. hollow cylind. clavate	..	—	—	—	+	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Multiseriate hollow clavate	..	—	—	—	+	*	*	*	+	—	—	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4. <i>Adenanthera pavonina</i> L.																																									
Unicellular conical hair	H	+	+	+	+	*	*	*	+	—	—	+	+	+	*	*	*	+	+	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Uniseriate macroform conical hair	..	+	+	+	+	*	*	*	+	—	—	+	+	+	*	*	*	+	+	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Biseriate clavate hair	..	—	—	—	+	*	*	*	+	—	—	—	—	—	*	*	*	—	—	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate clavate hair	..	—	—	—	+	*	*	*	+	—	—	—	—	—	*	*	*	—	—	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Table 1—(Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
5. <i>Albizia amara</i> Boivin .. H	—	—	+	+	*	*	*	+	+	+	+	+	+	+	—	+	+	—	+	+	—	+	—	—	+	—	—	—	
Unicell. conical ..	—	—	+	+	*	*	*	+	+	+	+	+	+	+	—	+	+	—	+	+	—	+	—	—	+	—	—	+	
Uniser. filif. capitate ..	—	—	+	+	*	*	*	+	+	+	+	+	+	+	—	+	+	—	+	+	—	+	—	—	+	—	—	—	
Uniser. filif. cylind. ..	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	—	—	—	—	—	—	
Uniseriate macroform conical ..	—	—	+	+	*	*	*	+	+	+	+	+	+	+	—	+	+	—	—	+	—	+	—	—	—	—	—	—	
6. <i>Albizia lebeck</i> (L.) Willd. H	+	+	+	+	*	*	*	+	+	+	+	+	+	—	+	+	+	+	+	+	+	+	—	—	—	—	—	—	
Unicellular conical ..	+	+	+	+	*	*	*	+	+	+	+	+	+	—	+	+	+	+	+	+	+	+	—	—	—	—	—	—	
Uniser. filif. clavate ..	—	—	—	+	*	*	*	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Uniser. macroform conical ..	—	—	—	+	*	*	*	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
7. <i>Calliandra haematocephala</i> Hassk. .. H	—	+	+	+	*	*	*	+	—	+	+	+	+	—	+	+	+	—	+	+	—	—	—	—	—	—	—	—	
Unicellular conical ..	—	+	+	+	*	*	*	+	—	+	+	+	+	—	+	+	+	—	+	+	—	—	—	—	—	—	—	—	
Uniser. filiform capitate ..	—	—	—	+	*	*	*	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Uniser. filiform clavate ..	—	—	—	+	*	*	*	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Uniser. filiform cylind. ..	—	—	—	—	*	*	*	—	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Uniser. filif. cylind. clavate ..	—	+	—	+	*	*	*	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Uniser. macrof. sep. conical ..	—	—	—	—	*	*	*	—	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
8. <i>Desmanthus virgatus</i> Willd. .. C	—	+	+	+	*	*	*	+	+	+	+	+	+	*	—	+	+	*	*	*	*	*	*	*	*	*	*	*	
Unicellular conical ..	—	+	+	+	*	*	*	+	+	+	+	+	+	*	—	+	+	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate capitate ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate clavate ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate cordate ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate cylindrical ..	—	—	—	+	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate obclavate ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate quadrangular ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate sagittate ..	—	—	—	—	*	*	*	+	+	—	—	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
9. <i>Dichrostachys cinerea</i> L. .. H	—	—	+	+	*	*	*	+	—	—	+	+	+	*	—	+	+	*	*	*	*	*	*	*	*	*	*	*	
Unicellular conical ..	—	—	+	+	*	*	*	+	—	—	+	+	+	*	—	+	+	*	*	*	*	*	*	*	*	*	*	*	
Uniser. macroform conical ..	—	—	—	—	*	*	*	—	—	—	+	—	—	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Biseriate clavate ..	—	—	—	+	*	*	*	+	—	—	—	+	+	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	
Multiseriate clavate ..	—	—	—	+	*	*	*	+	—	—	—	+	+	*	—	—	—	*	*	*	*	*	*	*	*	*	*	*	

Table 1—(Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
16. <i>Neptunia triquetra</i> Benth. W																													
Unicellular conical ..	—	—	+	+	*	*	*	—	—	—	+	—	*	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
Multiseriate clavate ..	—	—	—	—	*	*	*	—	+	—	—	+	*	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
Multiseriate cordate ..	—	—	—	—	*	*	*	—	—	—	—	—	+	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
Multiseriate fusiform ..	—	—	—	—	*	*	*	—	+	—	—	—	+	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
Multiseriate obclavate ..	—	—	—	—	*	*	*	—	+	—	—	—	+	—	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
17. <i>Parkia biglandulosa</i> W. & A.																													
Unicellular conical ..	+	+	+	+	*	*	*	+	—	+	+	+	+	*	—	+	+	*	*	*	+	+	+	—	—	—	—	—	—
Multiseriate clavate ..	—	—	—	+	*	*	*	—	—	—	—	—	—	*	—	—	—	*	*	*	—	—	—	—	—	—	—	—	—
18. <i>Pithecellobium dulce</i> (Roxb.) Benth. H																													
Unicellular conical ..	+	+	+	*	*	*	*	+	+	+	+	+	+	+	—	—	+	+	—	+	+	+	+	—	—	—	—	—	—
Uniser. filif. capitate ..	—	—	—	*	*	*	*	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uniser. filif. clavate ..	—	—	—	*	*	*	*	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uniser. macroform conical ..	—	—	—	*	*	*	*	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19. <i>Prosopis juliflora</i> (Swartz.) DC. H																													
Unicellular conical ..	—	—	+	+	*	*	*	+	—	+	+	—	+	*	—	+	+	—	+	+	—	+	+	—	—	—	—	—	—
Multiseriate clavate ..	—	—	—	+	*	*	*	+	—	+	—	—	+	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Multiseriate fusiform ..	—	—	—	—	*	*	*	+	—	—	—	—	—	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20. <i>Samanea saman</i> (Jacq.) Merr. H																													
Unicellular conical ..	+	+	+	+	*	*	*	+	—	—	—	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unicellular cylindrical	—	+	—	—	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unicellular flagellate	—	—	—	—	*	*	*	—	+	—	—	—	—	—	—	+	+	+	—	—	—	—	—	—	—	—	—	—	—
Unicellular papillate ..	—	+	—	—	*	*	*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uniser. filiform capitate	—	—	+	+	*	*	*	+	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uniser. macroform conical ..	+	+	+	+	*	*	*	+	+	+	+	+	+	+	+	+	+	+	+	+	—	+	+	—	—	—	—	—	—

A—Aurangabad ; C—Coimbatore ; D—Delhi ; H—Hyderabad ; W—Warangal ; +, trichomes present ; —, trichomes absent ; *, organ of the plant absent ; .., not studied.

SHAH *et al.* (1972), while dealing with leaflet trichomes in the Mimosoideae, have recorded glandular hairs of 3-6-celled height only in *Mimosa pudica*, but presently they have also been observed in *Acacia arabica*, *Dichrostachys cinerea*, *Mimosa hamata*, and *Samanea saman* (Table 1). Further, the trichomes in *M. pudica* consist of 1- to 4-celled stalk and 3- to 6-celled head (Fig. 2 D).

SHAH *et al.*, (1972) have recorded mere unicellular hairs in the leaflets of *Acacia arabica*, *Adenanthera pavonina*, *Albizia lebbek*, *Dichrostachys cinerea*, *Leucaena leucocephala*, *Mimosa hamata*, *Neptunia triquetra*, *Prosopis juliflora* and *Parkia biglandulosa*, whereas multicellular eglandular and glandular types in *Mimosa pudica*. Though this is presently confirmed, the trichomes are, however, unicellular or uniseriate in *Acacia arabica*, *Adenanthera pavoniana*, *Leucaena leucocephala* and *Mimosa pudica* (Table 1).

According to SHAH *et al.* (1972) the leaflets in *Acacia arabica* and *Neptunia oleracea* are glabrous, while trichomes occur on both surfaces in *Adenanthera pavonina*, *Albizia lebbek*, *Dichrostachys cinerea*, *Leucaena leucocephala*, *Mimosa hamata*, *M. pudica*, *Parkia biglandulosa*, *Pithecellobium dulce*, *Prosopis juliflora* and *Samanea saman*. But present study reveals that leaflets of *Acacia arabica* and *Neptunia oleracea* are not glabrous as the trichomes are present in young stage. Further, in *Dichrostachys cinerea*, *Prosopis juliflora* the trichomes are confined to their margins, while in *Leucaena leucocephala* and *Mimosa hamata* they occur only on the abaxial surface and margins (Table 1).

D. TAXONOMIC VALUE

From the table 1 it is evident that some of the trichome types are restricted to particular taxa, e.g., *Calliandra haematocephala* (macroform septate conical hair), *Desmanthus virgatus* (multiseriate quadrangular and multiseriate sagittate hairs), *Mimosa pudica* (multiseriate cordate and multiseriate peltate hairs), *Samanea saman* (unicellular flagellate hair) and, hence, these can be identified on the mere possession of the concerned trichome types.

Beside the above, the trichomes studied are of general identification value when their distribution patterns are considered. For example, though unicellular conical hair is present on one or the other organ of the 20 species presently investigated, their foliar trichome distribution varies from species to species, being totally absent (in four species) or confined to margins (in six species) or only to the abaxial surface (in five species) or distributed on both adaxial and abaxial surfaces (in five species, cf. Table 1). Thus, based on differences in the trichome morphology, their distribution on the leaf alone, a key for the identification of the species studied is given below:

I A. Unicellular hairs present

II A. Only unicellular conical hairs present

III A. Unicellular conical hairs subtended by an emergence .. *Neptunia triquetra*

III B. Unicellular conical hairs without an emergence

IV A. Hairs confined to margins

V A. Surface of the trichomes faintly verrucose

VI A. Hairs up to 145 μm in length and persistent .. *Prosopis juliflora*

VI B. Hairs up to 178 μm in length and caducous .. *Neptunia oleracea*

Explanation for Table 1.—Numbers on horizontal caption column indicate cite of occurrence, as—
 1. Leaflet adaxial, 2. Leaflet abaxial, 3. Leaflet margin, 4. Secondary rachis, 5. Stipel adaxial, 6. Stipel abaxial, 7. Stipel margin, 8. Primary rachis, 9. Stipule adaxial, 10. Stipule abaxial, 11. Stipule margin, 12. Stem, 13. Peduncle, 14. Pedicel, 15. Bract adaxial, 16. Bract abaxial, 17. Bract margin, 18. Bracteole adaxial, 19. Bracteole abaxial, 20. Bracteole margin, 21. Sepal, adaxial, 22. Sepal abaxial, 23. Sepal margin, 24. Petal adaxial, 25. Petal abaxial, 26. Petal margin, 27. Androecium, 28. Ovary, 29. Style and Stigma.

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V A. Surface of the trichomes faintly verrucose

VI A. Hairs up to 145 μm in length and persistent .. *Prosopis juliflora*

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- V B. Surface of the trichomes smooth *Acacia leucophloea*
- IV B. Hairs distributed on abaxial surface and margins
- VII A. Hairs up to 190 μm in length *Desmanthus virgatus*
- VII B. Hairs up to 387 μm in length *Mimosa rubicaulis*
- IV C. Hairs distributed on adaxial, abaxial and margins.
- VIII A. Hairs up to 180 μm in length *Pithecellobium dulce*
- VIII B. Hairs up to 320 μm in length.
- IX A. Hairs caducous on abaxial midvein *Parkia biglandulosa*
- IX B. Hairs persistent and dense on abaxial midvein *Albizia lebbek*
- II B. Unicellular conical hairs along with macroform conical hairs.
- X A. Hairs confined to abaxial surface and margins *Leucaena leucocephala*
- X B. Hairs distributed on adaxial, abaxial surface and margins *Adenantha pavonina*
- II C. Unicellular conical hairs along with filiform cylindric-clavate hairs present *Calliandra haematocephala*
- II. D. Unicellular conical along with macroform conical and filiform capitate hairs present *Albizia amara*
- II. E. As in II C but unicellular papillate and cylindrical hairs also present *Samanea saman*
- II F. Unicellular conical hairs along with multiseriate clavate hairs present *Dichrostachys cinerea*
- II G. Unicellular conical along with macroform conical and multiseriate capitate hairs present *Mimosa hamata*
- I B. Unicellular hairs absent
- XI A. Only filiform cylindric-clavate hairs present *Acacia auriculiformis*
- XI B. Only filiform hollow capitate hairs present *Acacia arabica*
- XI C. Macroform conical hairs along with filiform cylindric-clavate and multiseriate spinulose conical hairs present *Mimosa pudica*
- XI D. Macroform conical and multiseriate capitate hairs present *Mimosa praniana*.

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