

TRICHOMES IN SOME SPECIES OF *CLERODENDRUM*

G. L. SHAH AND L. MATHEW

Dept. of Biosci., Sardar Patel Univ., Vallabh Vidyanagar-338 120, Gujarat, India

ABSTRACT

In this paper, organographic distribution, morphology and ontogeny of eglandular and glandular trichomes on the vegetative and floral organs in ten species of *Clerodendrum* are described. The eglandular trichomes are uniseriate, two- to many-celled, and warty. The glandular ones are sessile, short or long stalked, capitate, with unicellular or two- to many-celled head.

INTRODUCTION

Our knowledge about the structure of trichomes on leaves in Verbenaceae is through the works of METCALFE AND CHALK (1950) and INAMDAR (1969). Since there are no reports about them on the vegetative and floral organs in various taxa of Verbenaceae, except on *Verbena hybrida* (JAIN & POONIA, 1974), they are being reported here on ten species of *Clerodendrum* with a view to assess their taxonomic significance.

MATERIAL AND METHODS

FAA-fixed material of different organs of various species of *Clerodendrum* were obtained locally or from the forests of Kerala. The trichomes are studied from the permanent transections of various organs stained in Safranin-Fast-Green combinations.

OBSERVATIONS

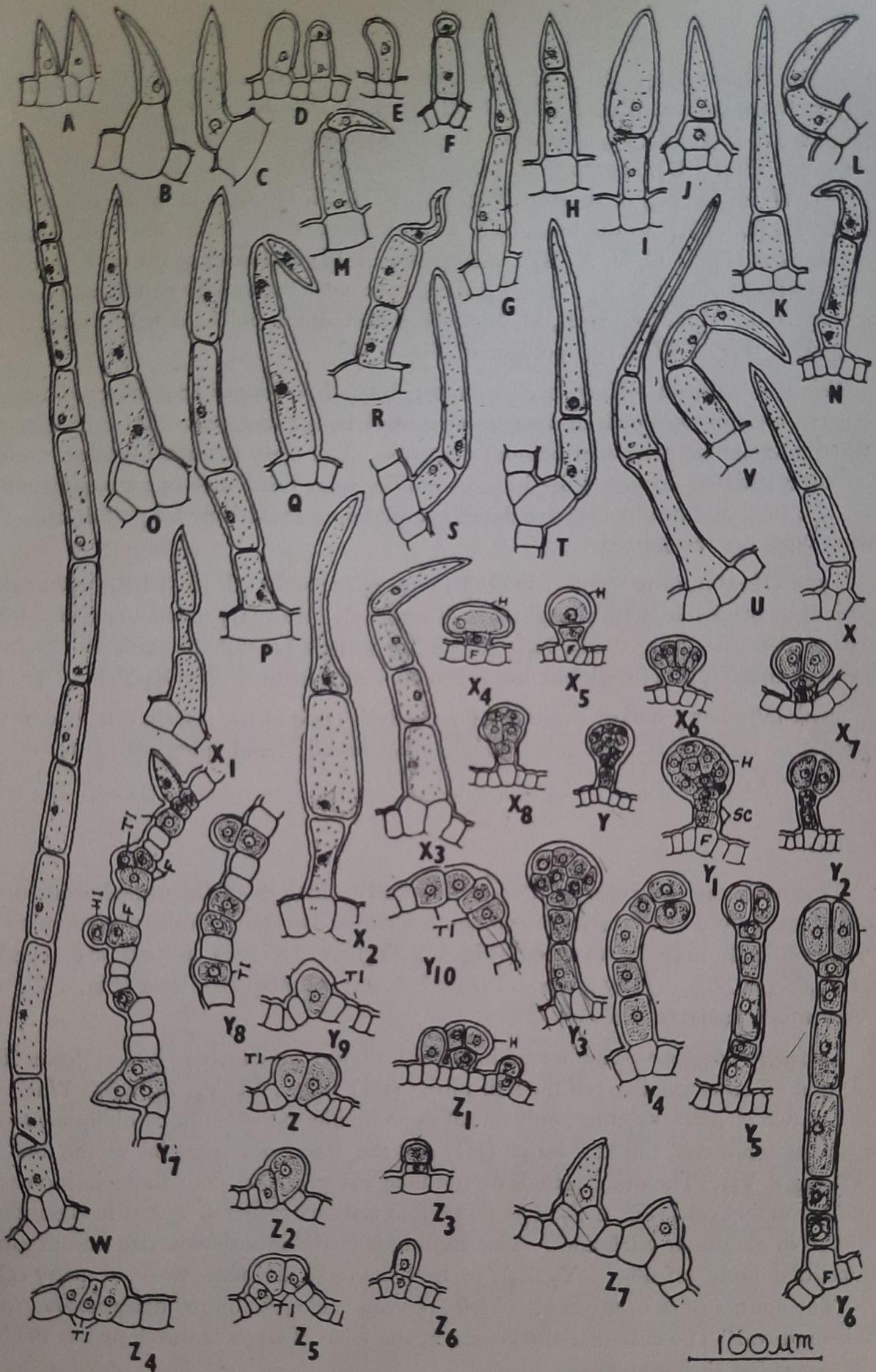
MATURE TRICHOMES

They are eglandular and glandular, both the types found together on the same surface except in *Clerodendrum indicum* where glandular trichomes are present on leaves. From the organographic distribution (Table 1), it is evident that Types I, II, IIIb are present on most of the organs of different species whereas Types IIIa, IIIc and IV have a restricted distribution.

Eglandular uniseriate trichome—It is differentiated into one- to two-celled foot and 1- 2- or many-celled body; foot cells squarish, rectangular, polygonal or trapezoidal at the level of other epidermal cells or slightly to much projecting beyond them, thin-walled, more commonly without contents or contents present only during ontogenetic stages (Fig. 1 Y₇). The body is variable in shape and size, thin-walled, with tubercled surface; contents evanescent.

Type I—Body unicellular : Foot cells 1-2, projecting or not; body conical and straight, at an angle to the foot-cell or bent (Fig. 1 A-C), cylindrical (Fig. 1 D), or narrowly or broadly obovate (Fig. 1 E) and straight.

Type II—Body 2 to many-celled : Foot cells 1-2, projecting or not. Body conical and straight (Fig. 1 G-K, O-P, W, X-X₂), bent (Fig. 1 T), falcate (Fig. 1 L, U, V), flagellate (Fig. 1 R) or hooked (Fig. 1 M, N, Q, X₃) or cylindrical and straight (Fig. 1 D,



Figs. A ; B and T ; Y₇ ; Y₈ *C. inerme* (ST, L, IA, PE). C and P ; I ; X₂ *C. serratum* (S, ST, IA), D ; V, Z₁ and Z₆ *C. splendens* (L, ST). E and S *C. aculeatum* (ST). F and M ; H ; X₆ *C. thomsonae* (PE, ST, L). G, Y₄, N, W, X₇, Y₁, Y₅, R ; X₅, X₈, Y, Y₂ and Y₃ ; Y₆ *C. viscosum* (IA, PE, S, L, ST). J, X₃, Z and Z₅ ; O, Y₁₀ and Z₄ ; Y₉ and Z₂ ; Z₇ *C. macrosiphon* (ST, IA, L, PE). K, U and X₄ ; X₁ ; X and Z₃ *C. multiflorum* (PE, L, ST). L ; Q *Clerodendrum* sp. (L, ST).

Eglandular and glandular trichomes as seen in transsections. Figs. A—X₃ different types of eglandular trichomes ; X₄—Y₆ various types of glandular trichomes ; Y₁—Z₇ stages in the development of trichomes.

F) or slightly falcate (Fig. 1 S). The terminal cells is ovate-triangular (Fig. 1 H, I, P, X₁, X₃) or ovate-conical (Fig. 1 J-M, O, W, R, T, V, W, X), rarely hemispherical or nearly spherical (Fig. 1 D, F), ellipsoidal (Fig. 1 Q), ovate-cylindric (Fig. 1 S), narrowly linear-conical (Fig. 1 U), falcate (Fig. 1 X₂) or beaked (Fig. 1 N), longer (Fig. 1 I-L, N, P, S-U, W, X, X₂, X₃) or shorter (Fig. 1 D, F, H, M, Q) than or equal or nearly so (Fig. 1 G, O, R, V, X₁) to the basal cell. In 3 or more-celled forms the middle cell(s) may be shortest (Fig. 1 O, V, X₁ X₃), longest (Fig. 1 W) or shorter or longer than terminal and basal cells (Fig. 1 N, P). The basal cells are more commonly rectangular, sometimes trapezoidal (Fig. 1 G, H, L, M, X₃), somewhat dumb-bell-shaped (Fig. 1 I, U, X₂), squarish (Fig. 1 W, X) or polygonal (Fig. 1 J).

Glandular trichomes—They are capitate; body is distinguished more commonly into one, rarely two foot cells and sessile or stalked body; foot cells thin-walled, trapezoidal, rectangular or polygonal without contents. The body is smooth-walled, cuticularized, differentiated into an unicellular or multicellular head with one to many-celled stalk. The stalk and head cells have dense cytoplasm and relatively larger nuclei. The following types are recognized.

Type III—Capitate sessile : Foot (F) one-celled; stalk cell (SC) 1-2, rectangular, trapezoidal or brick-like, with straight lateral walls; (a) head (H) unicellular (Fig. 1 X₄ X₅), (b) or 2-4-celled (Fig. 1 X₆, X₇); (c) similar to type (a) but the stalk cell (s) (SC) form a very distinct, short stalk bearing 2-4-many-celled head (Fig. 1 X₈-Y₂).

Type IV—Long stalked capitate : Foot cells (F) one to two; stalk cells two to six, trapezoidal or rectangular and much longer than broad; head spherical 2 to many-celled (Fig. 1 Y₃-Y₆).

ONTOGENY

The trichome develops from an initial (TI) which is distinguished from other epidermal cells by denser contents and the nucleus. The outer walls are rounded or flat. The initials may be scattered (Fig. 1 Y₇-Y₉) or 2-4 such initials are together (Fig. 1 Y₈, Y₁₀, Z, Z₄). They are equal (Fig. 1 Z, Z₄) or unequal in size (Fig. 1 Z₂, Z₅) and very much variable in shape.

Eglandular trichome—The trichome initial divides periclinally into a lower foot cell (F) and an outer smaller cell the hair initial (HI) (Fig. 1 Y₇, Y₈, Z₁, Z₆). When the initials are two or more together, only one of them divides periclinally or obliquely to cut off an upper small cell, the hair initial (HI) and the lower one remains as the foot cell (F ; cf. Fig. 1 Y₇). The other initials do not take any part but contribute in increasing the number of foot cells (Fig. 1 Y₇, Z₇). Two foot cells are rather frequent in eglandular but seldom in glandular trichomes. The small hair initial increases in size and produces an unicellular body (cf. Fig. 1 Y₇, Z₇), or by transverse divisions two- to many-celled body. The contents are evanescent, which are very thin and almost disappearing when the hair matures. The cuticular thickening in the form of warts is developed as the hair begins to assume the final form.

Glandular trichome—The hair initial divides periclinally into an upper head-cell initial and lower stalk-cell initial (Fig. 1 Z₃). The head-cell initial increases in size and may remain unicellular or divide variously to produce a multicellular head (Fig. 1 X₄-X₆, Y, etc.). This is a *capitate sessile gland*. In other cases the stalk-cell initial divides

periclinally into two or more cells which subsequently may increase in length to form a distinct short or long stalk. In the meanwhile the head becomes 2-celled or multicellular by division in the head-cell initial (cf. Fig. 1 X₇, Y₁, Y₃-Y₆). These are *short or long stalked capitate glands*. During maturation the head and stalk cells retain the dense but faintly vacuolated cytoplasm and the nuclei.

DISCUSSION

According to METCALFE AND CHALK (1950) the trichomes are uniseriate simple type in *Clerodendrum*. But INAMDAR (1969) reported uniseriate multicellular eglandular trichome with two-celled foot in this genus, and peltate glandular trichome seated on a simple foot, particularly in *Clerodendrum inerme*. We have described uniseriate eglandular trichomes with 1-2-3-many-celled body which may be conical, cylindrical, straight, bent, falcate, flagellate and hooked. The glandular sessile, short stalked and long stalked capitate ones are reported for the genus by METCALFE AND CHALK (1950) but not by INAMDAR (1969). The trichome ontogeny is described for the first time in *Clerodendrum*. Further, the formation of the compound foot is not described in Verbenaceae by any earlier author. The tubercled surface of the trichome is also not reported in earlier works.

An organographic distribution of different types of trichomes shows that some forms are widely spread in different organs but a few forms have a restricted distribution (see Table 1).

The taxonomic significance of trichomes has also been emphasized by a number of workers (RAMAYYA, 1962; SINGH *et al.*, 1975; GUPTA & BHAMBIE, 1978, etc.).

The present work also suggests that taxonomically trichomes can be used to delineate the investigated species.

- (1) Trichomes glandular, on leaf only.C. INDICUM
- (1) Trichomes both eglandular and glandular in all or most organs :
 - (2) Long- stalked capitate glands absent on all organs :
 - (3) Short- stalked capitate glands present on all organs (except on leaf in C. MULTIFLORUM) :
 - (4) Short- stalked capitate glands absent on leaf.....C. MULTIFLORUM.
 - (4) Short- stalked capitate glands present on leaf.....C. THOMSONAE.
 - (3) Short- stalked capitate glands absent on all organs.....C. INERME, C. SPLENDENS, CLERODENDRUM sp.
 - (2) Long- stalked capitate glands present on one or more organs :
 - (5) Long- stalked capitate glands present on leaves only..... C. ACULEATUM.
 - (5) Long- stalked capitate glands present on sepals only C. SERRATUM.
 - (5) Long- stalked capitate glands on most of the organs :
 - (6) Short- stalked capitate glands absent on all organs C. MACROSIPHON.
 - (6) Short- stalked capitate glands present on all organs except stem C. VISCOSUM.

Table 1—Organographic distribution of various types of eglandular and glandular trichomes. Type I eglandular trichome with unicellular body; Type II eglandular trichome with 2- many- celled body; Type III glandular capitate (a) sessile with unicellular head (b) sessile with 2- many- celled head and (c) short- stalked, 2- many- celled head; Type IV glandular long- stalked capitate.

Abbreviations : L—Leaf ; ST—stem ; PE—petiole ; IA—inflorescence axis ; S—sepals ; P—petals.

Name	Organ	Eglandular trichomes			Glandular trichomes			
		Type I	Type II	Type IIIa	Type IIIb	Type IIIc	Type IV	
1	2	3	4	5	6	7	8	
<i>C. aculeatum</i> Griseb.	.. L	.. +	+ +	+ +	—	—	+	
<i>C. indicum</i> O. Ktze.	.. L	.. —	—	+	+	—	—	
	.. ST	.. —	—	—	—	—	—	
	.. PE	.. —	—	—	—	—	—	
	.. IA	.. —	—	—	—	—	—	
	.. S	.. —	—	—	—	—	—	
<i>C. inerme</i> Gaertn.	.. L	.. +	+ +	+ +	+	—	—	
	.. ST	.. +	+ +	—	+	—	—	
	.. PE	.. +	+ +	—	+	—	—	
	.. IA	.. +	+ +	—	+	—	—	
	.. S	.. +	+ +	—	+	—	—	
<i>C. macrosiphon</i> Hook.	.. P	.. +	+ +	—	—	—	—	
	.. L	.. +	+ +	—	+	—	+	
	.. ST	.. +	+ +	—	+	—	—	
	.. PE	.. +	+ +	—	+	—	+	
	.. IA	.. +	+ +	—	+	—	—	
<i>C. multiflorum</i> O. Ktze.	.. S	.. —	+ +	—	+	—	+	
	.. P	.. —	+ +	—	+	—	+	
	.. L	.. +	+ +	+	+	—	—	
	.. ST	.. +	+ +	+	+	+	—	
	.. PE	.. +	+ +	+	+	+	—	
<i>C. serratum</i> Moon.	.. IA	.. +	+ +	—	+	—	—	
	.. S	.. +	+ +	—	+	—	—	
	.. P	.. +	+ +	—	+	—	—	
	.. L	.. +	+ +	+	+	—	—	
	.. ST	.. +	+ +	—	+	—	—	
<i>C. splendens</i> G. Don	.. PE	.. +	+ +	—	+	—	—	
	.. IA	.. +	+ +	—	+	—	—	
	.. S	.. +	+ +	—	+	—	—	
	.. P	.. +	+ +	—	+	—	—	
	.. L	.. +	+ +	+	+	—	—	
<i>C. thomsonae</i> Balf.	.. ST	.. +	+ +	+	+	—	—	
	.. PE	.. +	+ +	—	+	—	—	
	.. IA	.. —	+ +	+	+	—	—	
	.. S	.. +	+ +	—	+	—	—	
	.. P	.. +	+ +	—	+	—	—	
<i>C. viscosum</i> Vent	.. L	.. +	+ +	+	+	+	+	
	.. ST	.. +	+ +	—	+	—	—	
	.. PE	.. +	+ +	—	+	+	+	
	.. IA	.. +	+ +	—	+	+	+	
	.. S	.. +	+ +	+	+	+	—	
<i>Clerodendrum</i> sp.	.. P	.. +	+ +	—	+	+	—	
	.. L	.. +	+ +	+	+	—	—	
	.. ST	.. +	+ +	+	+	—	—	
	.. PE	.. +	+ +	+	+	—	—	

REFERENCES

- GUPTA, M. L. & BHAMBIE, S. (1978). Studies in Lamiaceae-IV. Foliar appendages in *Ocimum* L. and their taxonomic significance. *Proc. Indian nat. Sci. Acad.*, **44** : 154-160.
- INAMDAR, J. A. (1969). Epidermal structures and ontogeny of stomata in some Verbenaceae. *Ann. Bot.*, **33** : 55-66.
- JAIN, D. K. & POONIA, O. P. (1974). Structure and development of trichomes in *Verbena hybrida* Voss. *Geobios.*, **7** : 134-136.
- METCALFE, C. R. & CHALK, L. (1950). *Anatomy of Dicotyledons*. Vol. II. Oxford.
- RAMAYYA, N. (1962). Studies on the trichomes of some Compositae-I. General structure. *Bull. bot. Surv. India*, **4** (1-4) : 177-188.
- SINGH, V., SHARMA, M. & JAIN, D. K. (1975). Trichomes in *Salvia* (Labiatae) and their taxonomic significance. *Bull. bot. Surv. India*, **16** : 27-34.