STRUCTURE OF TRICHOMES IN SIX SPECIES OF *PREMNA* (VERBENACEAE) WITH A NOTE ON THEIR TAXONOMIC SIGNIFICANCE

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ABSTRACT

Trichomes are glandular and eglandular. Eglandular ones are uniseriate, with one- to two-celled foot and one- to seven-celled, warty body. The body is most commonly unbranched and conical, straight, hooked or whip-like; rarely it is branched in the petiole of *P. herbacea*. Glandular trichomes are sessile or stalked, with unicellular or many-celled head.

INTRODUCTION

During a survey of the literature on the structure of trichomes in Verbenaceae, it was found that there is practically no information about them in the genus *Premna* (METCALFE & CHALK, 1950 ; INAMDAR, 1969). Therefore, they are studied on the vegetative and floral organs of some species of *Premna*, available to us, with a view to supplement the information about trichomes in the family.

MATERIAL AND METHODS

Dried specimens of *Premna barbata* Wall., *P. herbacea* Roxb. and *P. tomentosa* Willd. are obtained from the Botanical Survey of India, Northern Circle, Dehradun, whereas *P. coriacea* Cl. and *P. resinosa* Schau. from the herbarium, Sardar Patel University, Vallabh Vidyanagar. The herbarium material is rehydrated by putting in boiling water before routine fixation in Formalin-Acetic acid-Ethanol. The F. A. A. fixed material of *P. latifolia* is collected from Kerala. The trichomes are studied from the peels and transections of different organs stained with safranin (1% aqueous) or Delafield's hematoxylin. They are studied on leaves, stem, petiole, inflorescence axis, calyx and corolla in *P. coriacea*, *P. herbacea* and *P. latifolia*, on the first four organs in *P. barbata*, *P. tomentosa* and on the leaf and petiole of *P. resinosa* because the material of the last species is scant.

OBSERVATIONS

Trichomes are present on all the investigated organs of the different species. They are glandular and eglandular, both the types often found side by side on the same surface, except on the leaf, stem and inflorescence axis in *P. coriacea*, stem and corolla in *P. herbacea* and corolla in *P. latifolia* where only the eglandular type is encountered. Further, the frequency of eglandular trichomes is more than that of the glanduldar ones in different organs (Table 1).

Eglandular trichomes are uniseriate consisting of a foot and cuticularized, warty body. The foot consists of 1-2 cells, cells thin-walled, rectangular, polygonal or trapezoidal and devoid of contents. The body is 1-7-celled. The terminal cell may be conical (Fig. 1 A, B, E, G—J, O, S, U ; Fig. 2 A—C, S), ovate to ovate-conical (Fig. 1 C, D, K, M), triangular (Fig. 8 F, L), plano-convex (Fig. 1 N, T, V) or cylindric (Fig. 2 Q). In 2-more-celled body it is longer or shorter than the basal cell. Very rarely

Table 1—Showing organographic distribution and frequency (%) of the eglandular and glandular trichomes.

Name of the plant	Eglandular Trichomes						Glandular Trichomes		
	Organ	Type I	Type II	Type III	Type IV	Type V	Type VIa	Type VIb	Type VII
Premna barbata Wall.	L	25.0	50.0	25.0	—	—	—	34.0	66.0
	St	—	84.0	16.0	—	—	16.0	52.0	32.0
	P	32.0	52.0	16.0	—	—	50.0	50.0	—
	Ia	—	50.0	50.0	—	—	—	100.0	—
P. coriacea Cl.	L	—	100.0	—	—	—	33.0	33.0	34.0
	St	—	—	—	100.00	—	—	100.0	—
	P	—	50.0	50.0	—	—	—	100.0	—
	Ia	100.0	—	—	—	—	25.0	75.0	—
	Ca	84.0	16.0	—	—	—	—	100.0	—
	Co	—	50.0	50.0	—	—	—	—	—
P. herbacea Roxb.	L	67.0	20.0	13.0	—	—	50.0	50.0	—
	St	100.0	—	—	—	—	50.0	—	50.0
	P	90.0	—	—	—	10.0	—	100.0	—
	Ia	87.0	13.0	—	—	—	—	16.0	84.0
	Ca	72.0	—	28.0	—	—	—	50.0	50.0
	Co	100.0	—	—	—	—	—	100.0	—
P. latifolia Roxb.	L	90.0	10.0	—	—	—	50.0	50.0	—
	St	58.0	42.0	—	—	—	—	100.0	—
	p	51.0	42.0	7.0	—	—	32.0	68.0	—
	Ia	86.0	14.0	—	—	—	25.0	75.0	—
	Ca	28.0	72.0	—	—	—	—	—	—
	Co	100.0	—	—	—	—	—	—	—
P. resinosa Schau.	L	50.0	25.0	25.0	—	—	—	100.0	—
	P	50.0	25.0	25.0	—	—	—	100.0	—
P. tomentosa Willd.	L	20.0	30.0	50.0	—	—	50.0	50.0	—
	St	30.0	30.0	40.0	—	—	33.0	67.0	—
	P	46.0	18.0	36.0	—	—	50.0	50.0	—
	Ia	13.0	37.0	50.0	—	—	33.0	67.0	—

L—Leaf, St—Stem, P—Petiole, Ia—Inflorescence axis, Ca—Calyx, Co—Corolla. Type I—straight, Type II—falcate, Type III—hooked, Type IV—whip-like, Type V—branched, Type VIa—sessile capitate with unicellular head, Type VIb—sessile capitate with 2-many celled head, Type VII—stalked capitate.

it is shortest of all the cells (Fig. 1 F, L). The basal cell is rectangular but in some cases it is trapezoidal (Fig. 1 A, G, H, N, O), rarely dumb-bell-shaped (Fig. 1 J) or cylindrical (Fig. 1 K). The body is sparingly branched in the petiole of *P. herbacea* (Type V ; Fig. 2 B, C).

On the basis of the shape of the body the following types are recognized : *Type I—straight* (Fig. 1 A—F, I—L, U) ; *Type II—falcate* (Fig. 1 G, M—O, R, T, V ; 2 A) ; *Type III—hooked* (Fig. 1 H, P); *Type IV—whip-like* (Fig. 1 Q) ; *Type V—branched* (Fig. 2 B, C).

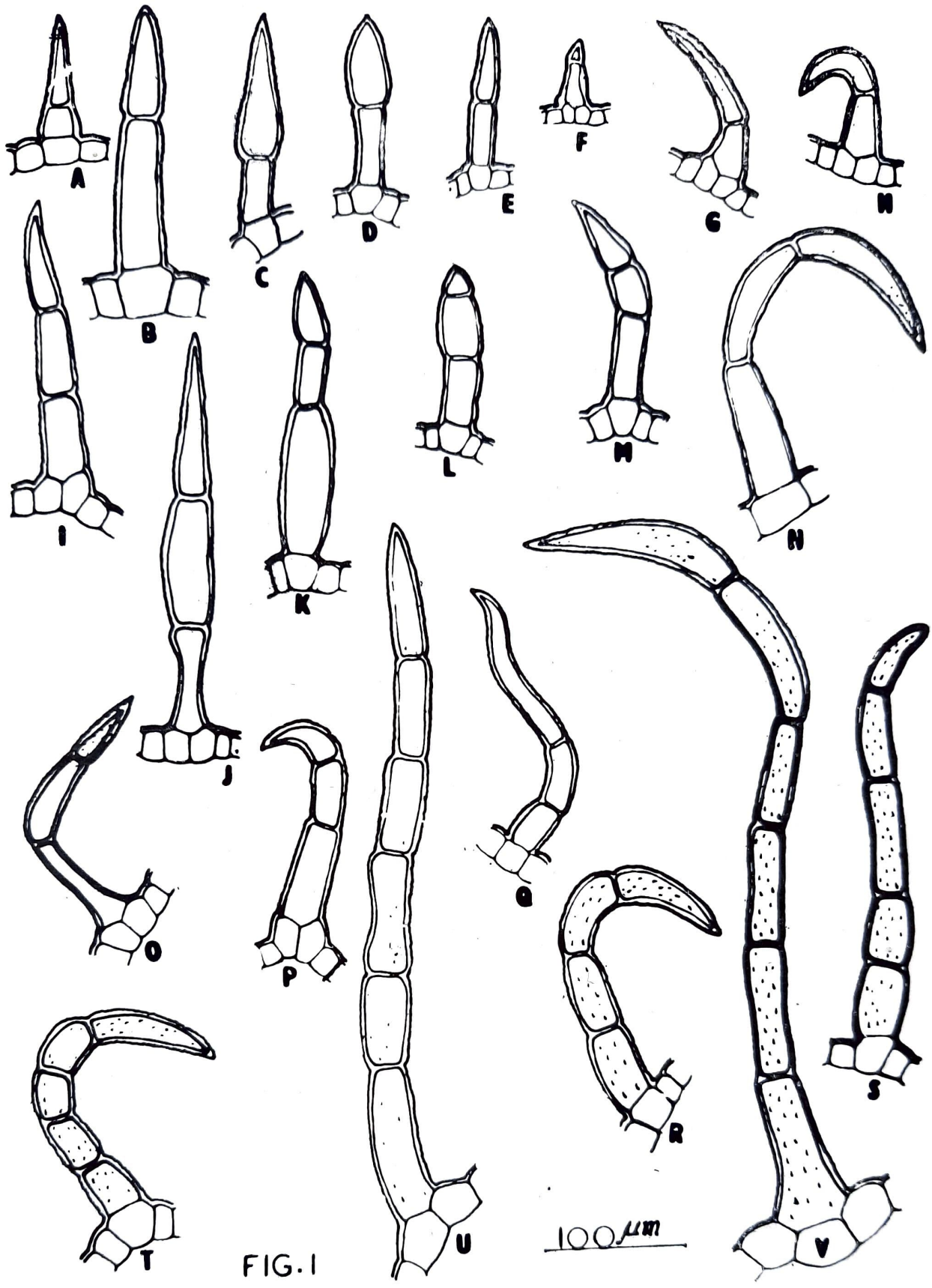

Fig. 1 A-V. Eglandular trichomes as seen in T. S.—*P. latifolia*—Leaf (A), petiole (F, H), stem (G); *P. tomentosa*—leaf (B, T), petiole (D, K, M, P), inflorescence axis (L); *P. herbacea*—petiole (C, U), leaf (J), inflorescence axis (I); *P. coriacea*—leaf (V), stem (Q), inflorescence axis (E); *P. resinosa*—leaf (N), petiole (O); *P. barbata*—inflorescence axis (R, S).

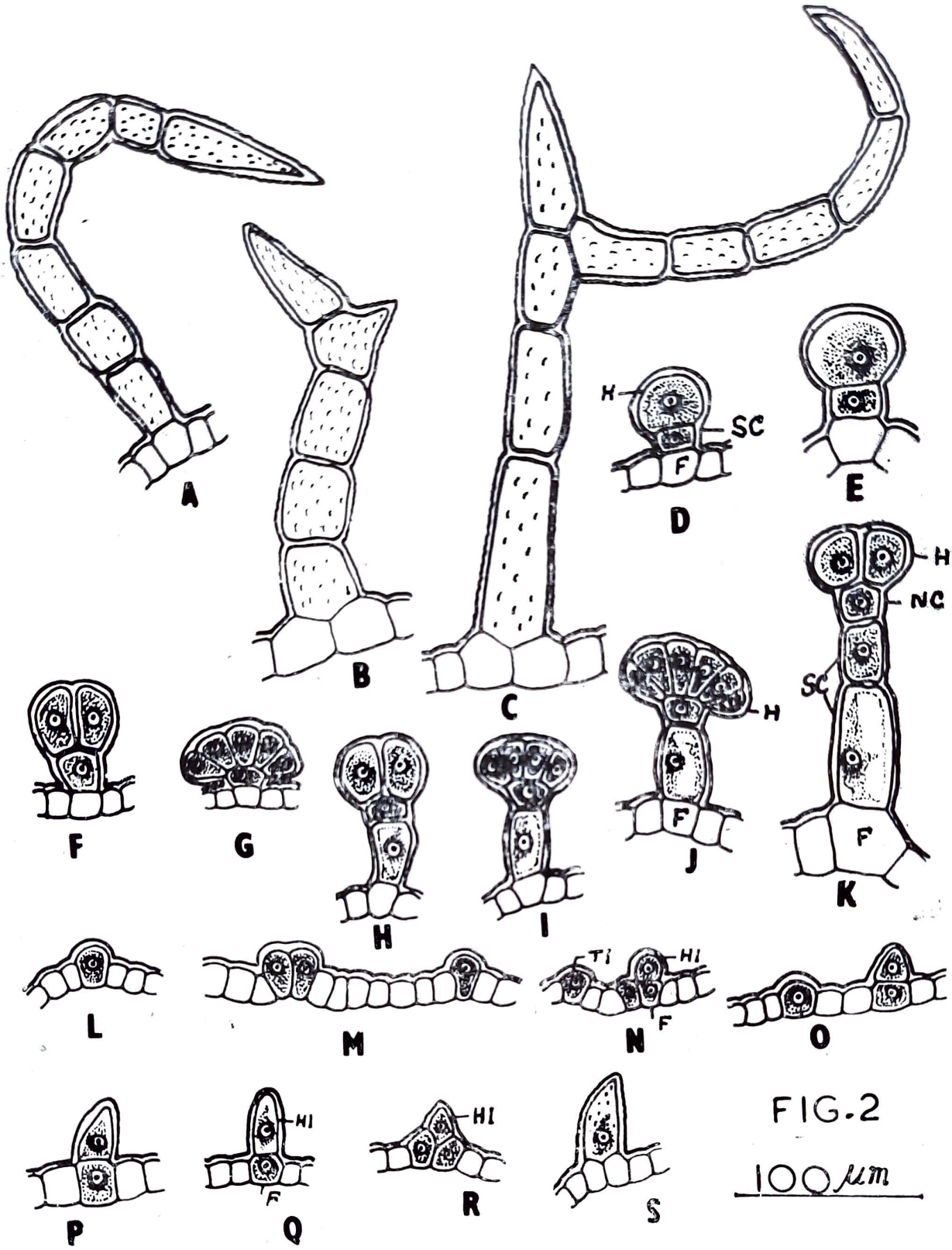

Fig. 2 A-C. Eglandular trichomes; D-K. Glandular trichomes; L-S. Stages in trichome ontogeny. *P. tomentosa*—stem (A), petiole (D, E), inflorescence axis (R, S); *P. herbacea*—petiole (B, C), inflorescence axis (J, K); *P. barbata*—leaf (I), stem (F, H), inflorescence axis (G); *P. latifolia*—leaf (M, N, P), petiole (O, Q), inflorescence axis (L).

Glandular trichomes, like eglandular ones, consist of foot and body. The foot (F) is most commonly 1-celled, rarely 2-celled in *P. barbata* (L, St) and *P. herbacea* (Ca), cells being thin-walled, trapezoidal, polygonal, rectangular or squarish, devoid of contents. The body is thin-walled, cuticularized, differentiated into stalk cell(s) and head. The head cells and stalk cells have relatively denser cytoplasm and larger nuclei. The two types are :

Type VI : Sessile capitate—The stalk cell (SC) is one, rectangular, trapezoidal or discoid, with straight or bulging lateral walls. The head is (*a*) spherical and unicellular (Fig. 2 D, E) or (*b*) peltately 2 or more-celled (Fig. 2 F, G).

Type VII : Stalked capitate—The stalk is differentiated into a rectangular, polygonal, trapezoidal or squarish neck cell (NC) below the head and an elongated stalk cell (Fig. 2 H—J). Seldom stalk cells are two (Fig. 2 K). The head is peltately 2-or-more-celled (Fig. 2 H—K).

From Table I, it will be seen that, of the eglandular trichomes, only Type I is found in *P. coriacea* (Ia), *P. herbacea* (St, Co) and *P. latifolia* (Co), Type II in *P. coriacea* (L), and Type IV in *P. coriacea* (St.) On other organs in different species more than one type of eglandular trichomes are met with. In such cases, the most frequent types are Type I in *P. coriacea* (Ca), *P. herbacea*, *P. latifolia* (all organs except Ca in *P. latifolia*) and *P. resinosa* (L, P), Type II in *P. barbata* (all organs except Ia) and Type III in *P. tomentosa* (all organs except P). Where no one type is dominant, two of the Types I—III are equally proportionate viz., *P. barbata* (IA), *P. coriacea* (P, Co).

Similarly, among glandular types, Type VIb is found in all the organs of the species investigated and it constitutes the only type or dominant type in most of the organs. In *P. barbata* (P), *P. herbacea*, *P. latifolia* and *P. tomentosa* (L), Types VIa and VIb are equally proportionate. Type VII is much restricted in its occurrence, being dominant in *P. barbata* (L) and *P. herbacea* (Ia). Rarely Types VIa and VII and Types VIb an VII have equal frequency (%) in *P. herbacea* (P and Ca respectively) but in *P. coriacea* (L), all the three types are in almost equal proportions.

Trichome initials (TI) are scattered in the epidermis, though at times two are juxtaposedly arranged. They are distinguished from other epidermal cells by their larger size, denser cytoplasm and relatively larger nuclei. They may be squarish, rectangular, trapezoidal, obovate or obtusely wedge shaped with rounded outer walls (Fig. 2 L—O). The initial divides by a periclinal wall to cut off a hair initial (HI) and a foot cell (F) (Fig. 2 N, O). The hair initial increases in size and develops into an unicellular body (Fig. 2 P, Q), or by subsequent divisions form a multicellular body attaining different shapes (Type I—IV) at maturity. Seldom, one of the two meristemoids divides by a periclinal wall into an upper hair initial (HI) and lower foot (F) but the other meristemoid contributes another cell to the foot. Thus the foot is 2-celled (Fig. 2 N, R). The ontogeny of other types of trichomes is not traced.

SUMMARY AND DISCUSSION

This is the first record on the structure of trichomes in *Premna*. The body of the eglandular trichomes is uniseriately 1-7-celled, warty, the only forms or most frequent forms being straight, falcate or hooked, very rarely whip-like. Branched type is extremely rare, observed in *P. herbacea* (P) only. The glandular capitate trichomes are sessile or stalked. The warts on eglandular trichomes are not reported by any of the earlier workers (METCALFE & CHALK, 1950 ; INAMDAR, 1969 ; JAIN & POONIA, 1974).

It seems that the trichomes are useful to delineate the investigated species on the basis of most frequent type of eglandular trichomes or restricted distribution of some types of glandular ones.

Among eglandular trichomes, the dominant types are Type I in *P. herbacea*, *P. latifolia* (except Ca in the latter species) and *P. resinosa*; Type II in *P. barbata*; Type III in *P. tomentosa* (except P) and Type IV in *P. coriacea* (only St). Of the glandular trichomes

Type VII occurs only in *P. barbata* (L, St), *P. coriacea* (L) and *P. herbacea* (St, Ia, Ca). It is absent in other species. The restricted occurrence of Type VII, as indicated, can help further delineation of the species in which it occurs.

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REFERENCES

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*, **1** : 134-136.

METCALFE, C. R. & CHALK, L. (1950). *Anatomy of the Dicotyledons*. 2. Oxford.