

EPIDERMAL STUDIES IN SOME FRUITS OF PAPILIONACEAE

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The epidermal structure, stomatal complexes and trichomal types are studied in *Sesbania grandiflora* Pers., *Crotalaria striata* D.C., *Crotalaria juncea* L., *Clitoria ternatea* L. and *Centrosema pubescens* Benth. All taxa have polygonal and straight-walled epidermal cells. Unicellular conical and filiform trichomes; multicellular filiform, clavate and hooked trichome types are observed in *Centrosema* and *Crotalaria juncea*. In *Sesbania* and *Crotalaria striata*, the trichome, are absent. Anomocytic, anisocytic and paracytic types of stomata are observed. Stomatal abnormalities like single guard cell with pore, paired stomata having common subsidiary cell, stomata with aborted guard cells and contiguous stomata are observed.

Key words : Fruit wall; Papilionaceae; Stomata; Trichome.

Introduction

The outer and inner epidermis in fruits of papilionaceae were not studied in detail. It is evident from the published works on fruits of Papilionaceae (Metcalf and Chalk, 1950; Fahn and Zohari, 1955; Heyn, 1968; Shah, 1968; Shah and Gopal, 1969; Deshpande and Untawale, 1971; Leela et al., 1974; Shah and Kothari, 1976).

The present investigation aims at a study of the epidermal cells, stomatal complexes and the morphological characters of trichomes on the epidermis of fruit walls of some Papilionaceae.

Materials and Methods

Mature fruits were collected and fixed in F.A.A. Epidermal peels were obtained by treating with 10% cupric sulphate and concentrated hydrochloric acid. Para oblique sections were also taken for epidermal studies of the basal, middle and terminal regions of the fresh and F.A.A. fixed mature fruits. Starch grains were localized with I_2KI (Johansen, 1940). The stomatal index has been calculated following Salisbury (1927); Metcalf and Chalk (1950) and Pant (1965) were followed for the terminology of stomata and trichome types.

Results and Discussion

Outer epidermis—In all the taxa investigated the epidermal cells of various size are polygonal, straight walled and simple pitted (Table 1). The outer epidermis is covered with a smooth and thin cuticle. Trichome scars are noticed in *Crotalaria juncea* and *Centrosema*. Abnormal cell wall thickenings are noticed in *Sesbania grandiflora*. In all the taxa the epidermal cells have dense cytoplasm and spherical nuclei in the centre (Figs. 1-5). Starch grains are present in the epidermal cells. The crystals are observed only in *Clitoria* and *Crotalaria striata*.

Cell frequency and cell area—The outer epidermal cell frequency in *Crotalaria juncea*, *Crotalaria striata*, *Centrosema pubescens*, *Clitoria ternatea* and *Sesbania grandiflora* is highest in basal parts of their fruits (Table 1). Except in *Sesbania grandiflora*, the cell area is found to be the highest in the middle of their fruits. In *Sesbania grandiflora* the epidermis of the terminal part of the fruit has the highest cell area (Table 1).

Trichomes—Frequency and size of the trichomes are recorded in table 1. Five types of trichomes could be observed on the fruit walls of *Clitoria*, *Crotalaria juncea* and *Centrosema* whereas *Crotalaria striata* and *Sesbania grandiflora* have no trichomes.

(a) **Unicellular conical trichomes**—Foot single celled which is embedded in the epidermis; body conical in shape with pointed end; contents present, wall smooth and thin e.g. *Crotalaria juncea* (Fig. 6).

(b) **Unicellular filiform trichomes**—Unicellular long celled; apically pointed; thick walled; contents present; smooth surface eg. *Crotalaria juncea* (Fig. 7) and *Centrosema pubescens* (Fig. 8).

(c) **Multicellular clavate trichomes**—Foot one celled; embedded in the epidermis, head clavate; multi-seriate 4 to 8 celled; surface smooth; wall thin; contents present eg. *Clitoria* (Fig. 9) and *Centrosema* (Fig. 10).

(d) **Multicellular hooked trichomes**—Basal cell and long hooked terminal cell; contents present; thick and smooth walled eg. *Clitoria* (Fig. 11) and *Centrosema* (Fig. 12).

(e) **Multicellular hooked trichomes**—Apically pointed; uniseriate 3 to 4 tabular cells at the basal; wall of the trichome is thick and with ornamentations eg. *Clitoria* (Fig. 13).

Stomata—In all the taxa investigated the stomata are distributed irregularly throughout the outer epidermis of the fruit walls. Stomatal frequencies vary in the taxa and in different parts of their mature fruits investigated (Table 1).

Table-1 Epidermal cell frequency and area, stomata frequency, area, stomatal index and trichomes frequency of various plants.

No. Name of the taxa	Outer epidermal cells		Inner epidermal cells		Stomata			Trichomes frequency				
	Fre- quency	Cell area μm	Fre- quency	Cell area μm	Fre- quency	Sto- matal area	Sto- matal index	Coni- cal	Fili- form	Clavate	Hooked	Filiform
1. <i>Crotalaria juncea</i>	B	187.9	920.86	—	—	8.60	576.78	4.37	25.30	4.6	—	—
	M	176.00	1006.74	23.00	11379.25	7.60	474.92	4.12	22.40	4.0	—	—
	T	174.80	921.06	—	—	10.00	548.37	5.41	20.60	3.6	—	—
2. <i>Crotalaria striata</i>	B	91.4	2219.44	—	—	4.40	365.31	4.59	—	—	—	—
	M	69.0	2509.31	42.00	6022.84	9.20	636.54	11.76	Trichomes absent	—	—	—
	T	84.30	2007.44	—	—	7.0	355.64	7.69	—	—	—	—
3. <i>Centrosema pubescens</i>	B	465.8	315.02	—	—	7.60	803.77	1.60	—	2.0	2.6	3.0
	M	385.2	778.75	168.0	1493.56	8.00	735.34	2.03	—	3.0	6.0	4.0
	T	414.2	560.26	—	—	4.00	784.64	0.84	—	1.0	2.0	3.5
4. <i>Clitoria ternatea</i>	B	475.4	530.85	—	—	4.8	380.72	0.99	—	—	2.4	11.2
	M	394.0	813.96	64.00	3945.67	7.4	696.55	1.84	—	—	1.8	10.0
	T	423.8	308.33	—	—	5.0	525.65	1.16	—	—	1.8	9.2
5. <i>Sesbania grandiflora</i>	B	461.0	840.90	—	—	4.0	1492.60	0.86	Trichomes absent	—	—	—
	M	405.0	1005.53	192.0	1320.30	4.2	1577.97	1.02	—	—	—	—
	T	421.0	1068.02	—	—	2.8	1459.43	0.66	—	—	—	—

— Not observed; T — terminal; M — Middle, B — base.

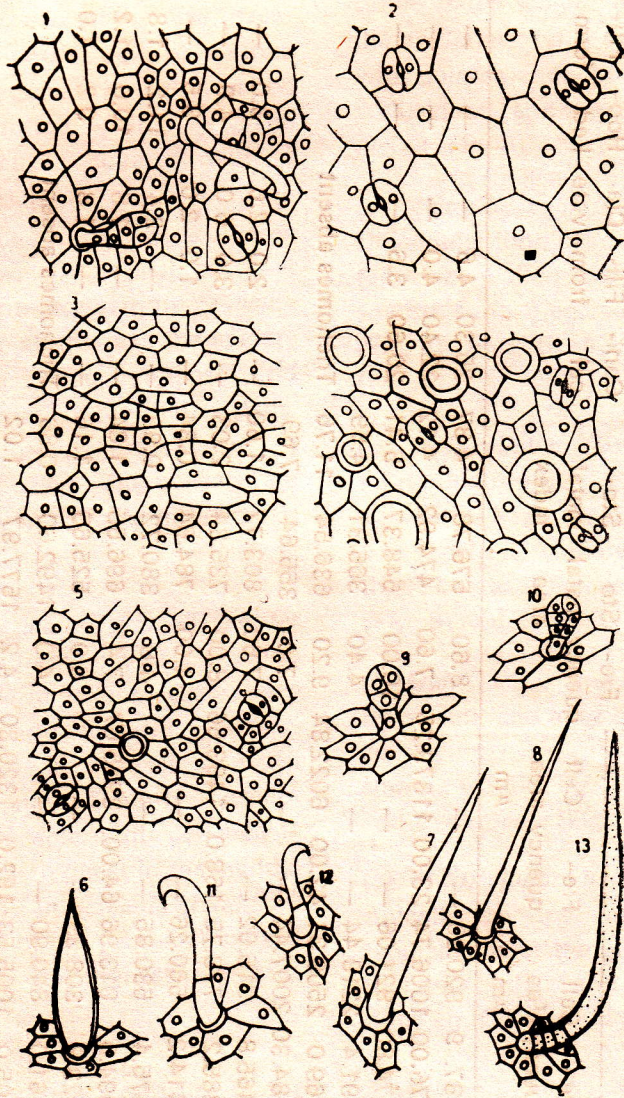
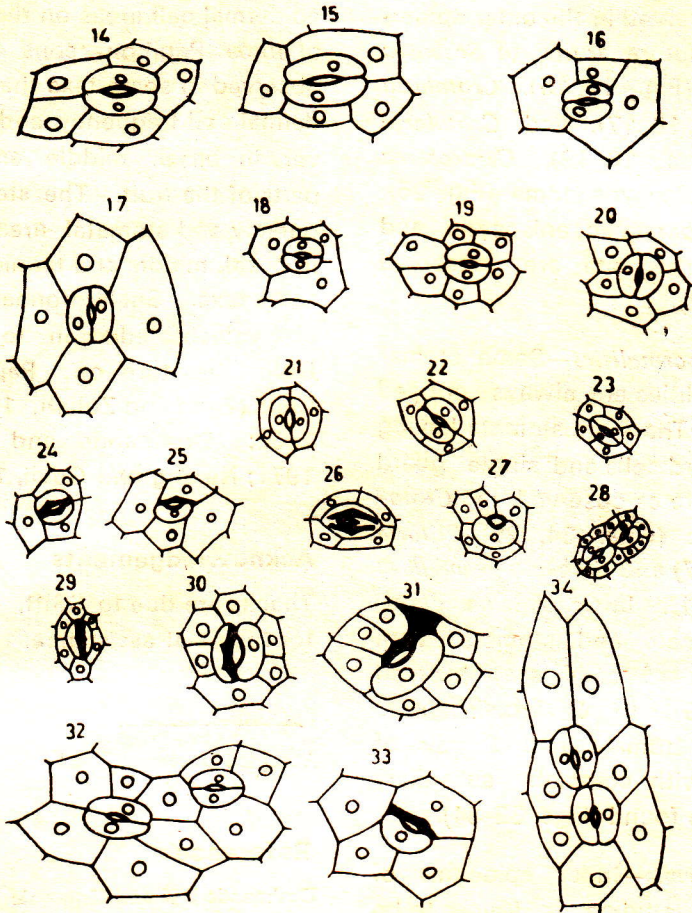


Fig. 1-5 Epicarpic surface view of *Clitoria*, *Crotalaria striata*, *Sesbania*, *C. juncea*, *Centresema*, respectively. Figs. 6-8. Unicellular trichomes. 6. Conical trichome in *C. juncea*. Figs. 7, 8 Uniseriate filiform trichome in *C. juncea* and *Centresema*, respectively. Figs. 9-13 multicellular trichomes. Figs. 9, 10 hooked trichome in *Clitoria* and *Centresema*. Figs. 11, 12 multicellular filiform trichome in *Clitoria*.



Figs. 14-23 Stomatal types. Figs. 14, 15 *Sesbania* Figs. 16, 17 *C. striata* Figs. 18, 19, *C. juncea* Figs. 20-22 *Clitoria*, Fig. 23 *Centrosema* Figs. 23-34 Stomatal abnormalities, Figs. 24, 26, 29, 30 aborted guard cells in *C. juncea*, *Centrosema*, *Sesbania*, respectively Figs. 25, 27, 31 single guard cell with pore in *C. juncea*, *Clitoria ternata*, *Sesbania* Fig. 31 single guard cell with pore in *C. juncea*, *Clitoria ternata*, *Sesbania*, respectively. Figs. 28 and 34 Contiguous stomata in *Centrosema* and *C. striata*, respectively. Fig. 32 Common subsidiary cell for two stomata in *C. striata*.

Anomocytic and anisocytic stomata are observed in the outer epidermis of the mature fruits of *Sesbania grandiflora* (Fig. 14, 15), *Crotalaria siriata* (Figs. 16, 17), and *Crotalaria juncea* (Figs. 18, 19). *Centrosema* has only anomocytic stoma (Fig. 25). In *Clitoria*, paracytic, anisocytic and anomocytic stomata are observed (Figs. 20–22).

Stomatal abnormalities—Some stomatal abnormalities are always noticed in all taxa. There are stomata having aborted guard cells and single guard cell with pore as observed in *Crotalaria juncea* (Figs. 24, 25), *Clitoria* (Figs. 26, 27) and *Sesbania grandiflora* (Figs. 30, 31). In *Centrosema* contiguous stomata and stomata with aborting guard cells are observed (Figs. 28, 29). In *Crotalaria siriata* contiguous stomata and a pair of stomata with common subsidiary cell are also found (Figs. 32–34).

Inner epidermis—Inner epidermis of all the taxa studied is found to be single layered with polygonal and straight walled cells. A thin and smooth cuticle is present over their inner epidermis. *Crotalaria juncea* and *Crotalaria striata* have columnar inner epidermal cells. Stomata and trichomes are found to be absent in the inner epidermis of all the taxa studied.

The present investigation gives information on the diversity in sto-

mal types, trichome types and outer epidermal cell areas on the fruit wall of some Papilionaceous taxa. It is observed in some taxa that the epidermal cell frequency and cell area vary in basal, middle and terminal parts of the fruit. The stomatal frequency and stomatal area also vary in basal, middle and terminal parts of same taxa. Such information is new and valuable addition to the available literature on Papilionaceous fruits (Fahn and Zohari, 1955; Heyn, 1968; Deshpande and Untawale, 1971; Narang and Govil, 1978).

Acknowledgements

Thanks are due to CSIR, New Delhi for financial assistance.

Accepted December, 1989

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