CHAPTER II

STOMATA
TRIBE GENISTEAR

(TABLE V FIGS. PLATE A 1-179)

Number of species investigated is 31.

Aspects of mature epidermis

In surface aspect anticlinal walls of the epidermis may be straight or wavy on both surfaces. Cells are rectangular, polygonal or variously elongated. But for Cytisus (cf. Figs. 143-144), leaflets of the species investigated are amphistomatous. Stomata are more on the abaxial surface than on the adaxial one as can be judged from the stomatal index and frequency, with exception of C. *filipes*, C. *madurensis* and Lupinus where the converse applies. They are evenly distributed on each surface without any definite pattern of orientation, though at times they occur in close proximity (Figs. 1, 5-6, 9-10, 13, 23, 25, 30, 34-37, 45-47, 52, 58-59, 68, 71-72, 82, 89-90, 95-96, 100-102, 104-105, 108, 110, 117-118, 125, 134, 137-138, 142-143, 151-152, 156, 162, 164).

Nature stomata

Stomata may be paracytic, anisocytic, anomocytic, diacytic or haplocytic, different types often occurring side by side on each surface. There is considerable diversity in stomatal patterns on leaflets. The diversity is manifested both in the number of combinations of stomatal types and in the frequencies within the combinations. However Goniogyna (Fig. 151) is an exception in having only anisocytic stomata.
An inspection of the table shows that combinations of stomatal types are as follows:

(a) Paracytic, anisocytic, anomocytic, dicocytic and haploccytic

- on adaxial surface of *C. burhia* (Figs. 6, 7) and *Rothia* (Fig. 164), and on abaxial surface of *C. juncea* (Figs. 32-34).

(b) Paracytic, anisocytic, anomocytic and haploccytic

- on both surfaces of *C. albida* (Figs. 1-2), *C. evolvoloides* (Fig. 15), *C. filipes* (Figs. 23, 177, 178), *C. laburnifolia* (Fig. 45), *C. linifolia* (Fig. 52), *C. madurensis* (Figs. 68-70), *C. medicaginea* (Fig. 71), *C. myosorensis* (Fig. 82), *C. nana* (Fig. 89), *C. notonii* (Figs. 90, 91), *C. obtecta* (Figs. 92, 93, 95, 171-173), *C. orizensis* (Figs. 96, 99), *C. retusa* (Fig. 110), *C. spectabilis* (Fig. 117), *C. triquetra* (Figs. 134, 135) and *Lupinus* (Figs. 152-154, 156),

- on abaxial surface of *C. burhia* (Fig. 5), *C. calycina* (Fig. 10), *C. hirsuta* (Fig. 30), *C. leptostachya* (Figs. 46, 48), *C. lutescens* (Figs. 57, 58, 174, 175), *C. ovalifolia* (Figs. 98, 100), *C. quinquefolia* (Fig. 105), *C. vestita* (Figs. 138-139), *Rothia* (Fig. 162)

(c) Paracytic, anisocytic and anomocytic

- on adaxial surface of *C. juncea* (Fig. 35).
on both surfaces of C. striata (Figs. 118, 119) and C. verrucosa (Figs. 137, 179), and on adaxial surface of C. leptostachya (Figs. 47, 51), C. ovalifolia (Figs. 101, 176) and C. vestita (Figs. 141, 142).

(d) Anisocytic, anomocytic and haploecytic on abaxial surface of C. prostrata (Figs. 102-103).
(e) Paracytic, anomocytic and haploecytic on abaxial surface of Cytisus (Fig. 143).
(f) Paracytic, anisocytic and haploecytic on adaxial surface of C. hirsuta (Fig. 36).
(g) Paracytic and anisocytic on adaxial surface of C. calycina (Fig. 9), C. lutescens (Fig. 58) and C. prostrata (Fig. 104).
(h) Anisocytic and haploecytic on adaxial surface of C. quinquesfolia (Fig. 108).

In spite of the diversity in Crotalaria and Rothia, the highest frequency is anisocytic, though it is anomocytic in C. obtecta, C. ovalifolia (ab) and Lupinus. The next type with higher frequency is various in different species, paracytic on both surfaces of C. albida, C. calycina, C. laburnifolia, C. leptostachya, C. lutescens, C. madurensis, C. notonii, C. spectabilis, C. vestita and Rothia, on abaxial surface of C. hirsuta, C. nana, C. obtecta, C. quinquesfolia, and on adaxial surface of C. burhia, C. evolvuloides, C. juncea, C. linifolia, C. myserensis and C. prostrata.
anomocytic on both surfaces of *C. medicaginosa*, *C. orizensis*, *C. retusa* and *C. striata*, on abaxial surface of *C. evolvuloides*, *C. juncea*, *C. linifolia*, *C. mysorensis* and *C. prostrata* and on adaxial surface of *C. filipes* and haploecytic on both surfaces of *Lupinus* and on abaxial surface of *C. hirsuta* and *C. quinquefolia*.

Seldom two stomatal types have almost equal frequency (i) paracytic and anomocytic on both surfaces of *C. verrucosa* and on abaxial and adaxial surfaces of *C. filipes* and *C. nana* respectively, (ii) paracytic and anisocytic on adaxial surface of *C. obtecta* and (iii) paracytic and haploecytic on abaxial surfaces of *Cytisus* and *Lupinus*, (iv) anomocytic and haploecytic on abaxial surface of *C. burhia*.

Variations in the morphology of stomata are brought about in any one of the following ways, (a) By wall formation in the subsidiary cell of a paracytic stoma (Cf. Fig. 10); (b) the orientation of the subsidiary cells with reference to guard cells is such that a stoma is neither diacytic nor paracytic. Such stomata are transitional forms (Figs. 160, 166); (c) the arrangement of the perigones around guard cells is such that a stoma may look cycloecytic (Figs. 136, 141) or actinocytic (Fig. 155). (d) two adjacent anisocytic stomata are so arranged that they have two common subsidiary cells and each of such stomata simulates haploecytic (Figs. 18, 40, 49, 65, 140, 145, 163). A few stages in their organization are depicted in Figs. 8, 76, 78, 146).
Abnormalities:

At times adjacent stomata are connected by cytoplasmic strands (Figs. 24, 163). (b) Sometimes 2-3 stomata are continuously juxtaposed (Figs. 4, 11, 43, 75A, 80, 94, 117, 133, 168), superposed (Figs. 31, 97), nearly at right angles to each other (Figs. 3, 22, 55) or obliquely oriented (Figs. 42, 54); seldom a complete stoma is contiguous to a stoma with one guard cell (Fig. 112); (c) Because of the arrested development during ontogeny, rarely the guard cell mother cell and subsidiary cells are devoid of contents (Fig. 40); (d) At times stomata are with unequal guard cells (Fig. 160), with only one guard cell (Figs. 12, 20, 56, 67, 81, 111, 112, 120, 161, 170) or the stomatal pore is without guard cells (Figs. 170). (e) Degeneration of guard cells is also sparingly observed (Figs. 21, 113, 154, 170).

Stomatal ontogeny

It is traced on both surfaces in C. juncea (Figs. 25-29) C. laburnifolia (Figs. 37-39, 41, 45), C. medicaginea (Figs. 72-75), C. mysoresensis (Figs. 76-79, 83-87), C. retusa (Figs. 207, 111, 113-116), C. triquetra (Figs. 125-131) and on abaxial surface of C. evolvuloides (Figs. 13-14, 16-17, 19) C. lutescens (Figs. 60-64, 66, 175), C. striata (Figs. 118, 121-124, 132), Goniogyna (Figs. 146-150) and Lupinus (Figs. 157-159). It follows a mixed sequence in that ontogenetical stages are found along with the fully organised stomata (Figs. 8, 13-14, 16, 17, 19, 25, 26, 34, 37, 38, 45, 53, 60, 61, 64, 66, 72-73, 75, 76-78, 83, 90, 111, 118, 125-126,
A meristemoid (M) may be cut off from a perigene cell (P) by an asymmetrical wall formation (Figs. 25, 37, 41, 60, 72, 73, 76, 129, 134, 143, 146, 166); (b) a perigene cell itself may transform into a meristemoid (Figs. 25, 121, 137, 163); (c) it may be cut off from a subsidiary cell, (Figs. 8, 13, 14, 26, 64) or from a perigene by the side of a fully organized stoma (Figs. 14, 17, 53, 66, 77).

Meristemoids have denser cytoplasm and relatively large nuclei, variable in shape being triangular (Figs. 17, 26, 45, 53, 73, 75, 76, 77, 118, 121, 129, 163, 167), rectangular (Figs. 13, 14, 25, 34, 66, 79, 90, 107, 128, 147, 167, 179), lenticular (Figs. 8, 73, 83, 146), or trapezoidal (Figs. 25, 37, 41, 60), but rarely oblong (Fig. 157). They are scattered throughout the surface; at times they occur side by side (Figs. 41, 79, 107, 128, 167).

A meristemoid (M) divides by a curved wall to cut off a larger rectangular derivative (S1) and a smaller one (M) (Figs. 14, 19, 25, 34, 38, 61, 72-74, 78, 113, 116, 118, 122, 125, 128, 148, 158, 169). The smaller derivative may transform into a guard cell mother cell and the larger one (S1) into a subsidiary cell. The resultant stoma would be haploecytic.

Sometimes a meristemoid divides by two straight of intersecting walls to cut off two larger derivatives (S1 and S2) flanking the small central derivative (SC) (Figs. 16, 27, 37, 39, 43, 62, 72-73, 84-86, 114, 123, 126, 130, 137, 149, 159, 175). The smaller derivative transforms into a guard
cell mother cell and flanking derivatives into subsidiary cells. The resultant stoma would be paraectytic or diaectytic, depending upon the direction of the wall formation in guard cell mother cell. More commonly it takes place in the same direction as the long axes of the flanking subsidiary cells and the stoma is paraectytic; seldom the wall is nearly at right angle to the long axes of flanking subsidiary cells, resulting stoma being diaectytic.

The central small derivative undergoes one more division so that the central smallest cell (SC) is surrounded by three cells (S₁-S₃) of which the recently formed one (S₃) is smallest (Figs. 28, 37, 45, 63, 74, 87, 88, 115, 124, 127, 131, 150). The smallest derivative (SC) now transforms into a guard cell mother cell and the surrounding cells transform into subsidiary cells. This will be an anisocytic stoma.

When the meristemoid transforms into a guard cell mother cell without cutting of subsidiary cell/cells, the resultant stoma is anomocytic.

The guard cell mother cell divides by a straight wall (Figs. 25, 29, 115, 117, 125, 128, 129, 132) into two cells which gradually become bean-shape, developing a pore between them.

The ontogeny of stomata with subsidiary cell/cells is mesogenous since the guard cells and subsidiary cells are derivatives of the same meristemoid. Anomocytic stomata are ontogenetically perigenous (Fig. 132).
During the course of the present investigation, some anisocytic stomata are found to be mesoperigenous, in that one mesogene and guard cells are derived from one meristemoid but the other subsidiary cells are neighbouring perigenous (Cf. Figs. 29, 158, 169).

Similarly a haplocytic stoma rarely becomes perigenous in the following way: A meristemoid, which is contiguous to a mature stoma, may increase in size and become a subsidiary cell. Here the subsidiary cell and guard cells are not the products of the same meristemoid (Figs. 53, 57, 77).

The formation of two adjacent anisocytic stomata with two common subsidiary cells may have their origin as follows. A meristemoid (M) is cut off from a subsidiary cell of a mature stoma (Fig. 8). This meristemoid transforms into a guard cell mother cell, after cutting off one derivative (S₁). (Cf. Fig. 78). The derivative (S₁) transforms into a subsidiary cell (Fig. 76), and the smaller derivative (M) into guard cells. Ultimately, two anisocytic stomata become adjacent. Thus there are different modes of development, mesogenous, mesoperigenous and perigenous, with common subsidiary cells (Cf. Figs. 40, 65 etc.,)

Contiguous stomata may be formed by any one of the following methods: (i) They may be the products of adjacent meristemoids (Cf. Figs. 41, 79, 107, 128, 167), (ii) A meristemoid, cut off contiguous to a mature stoma, also develops into a stoma which is now, by position, contiguous to the earlier formed one. (Cf. Figs. 14, 17, 53, 66, 77).
Seldom the guard cell mother cell fails to produce guard cells. It becomes bean-shaped with its concave side becoming thick-walled, with an intervening pore (Cf. Figs. 12, 20, 67 etc.)
TRIBE TRIFOLIEAE

(TABLE VI FIGS. PLATE B 1-94)

Number of species investigated is 12.

Aspects of mature epidermis

In surface aspect, anticlinal walls of epidermis may be straight or wavy on both surfaces, but they are almost straight in developing leaflets of some species (Compare Figs. 2 and 3; 22, 29 and 34). Epidermal cells are rectangular, triangular or polygonal and variously elongated. Leaflets are amphistomatomic, usually with more stomata on abaxial surface than on adaxial one. *Med. lupulina*, *Med. sativa*, *Trif. repens*, *Trig. corniculata* and *Trig. pubescens* being exception in that stomata are more on adaxial surface than on abaxial one. Stomata are evenly distributed on both surfaces, without any definite pattern of orientation; at times they occur in close proximity (Figs. 1-3, 22, 29, 35-36, 40, 47, 52-53, 60-61, 64, 67-68, 75, 76, 78, 80-81, 86-87, 94).

Mature stomata

Stomata may be paracytic, anisocytic, anomocytic, haploocytic and transitional forms, different types often occurring side by side, even on the same surface. The diversity is manifested both in number of combinations of stomatal types and in the frequencies within the combinations. An inspection of table shows combination of stomatal types as follows:
(a) Paracytic, anisocytic, anomocytic, haploecytic and transitional forms

on both surfaces of *Medi. polymorpha* (Fig. 2),
on adaxial surface of *Trif. repens* (Figs. 61-63),
*Trig. foenum-graecum* (Figs. 73, 78), and
on abaxial surface of *Trif. occultae* (Figs. 81, 88, 91), and *Trig. pubescens* (Figs. 93, 94).

(b) Paracytic, anisocytic, anomocytic and haploecytic

on both surfaces of *Medi. lupulina* (Fig. 1), *Medi. sativa* (Figs. 22, 29, 34), *Medi. alba* (Figs. 35, 40, 41, 44) and *Trif. alexandrinum* (Fig. 53), *Trig. corniculata* (Figs. 67-69)
on adaxial surface of *Trig. occultae* (Fig. 86) and *Trig. pubescens* (Fig. 87) and
on abaxial surface of *Trig. foenum-graecum* (Figs. 74, 75).

(c) Paracytic, anisocytic and anomocytic

on abaxial surface of *Trif. repens* (Fig. 64).

(d) Paracytic, anomocytic and haploecytic

on both surfaces of *Trig. hamosa* ssp. *uncata* (Fig. 80)

In spite of the diversity, the highest percentage is anomocytic in all species studied, though *Medi. lupulina* (ad) and *Medi. sativa* (ab) form exceptions in having paracytic type with highest frequency. Exceptions are also found in
Trif. repens (ad) and Trig. foenum-graecum (ad) where no one type is with highest percentage, but two types with higher percentage have almost an equal frequency, anisocytic and anomocytic in the former species and paracytic and anomocytic in the latter.

The second abundant type is different in various species. It may be (a) paracytic on both surfaces of Trig. hamosa, on abaxial surface of Meli. alba, Trif. repens and Trig. pubescens; (b) anisocytic on adaxial surface of Meli. alba, Trig. occulta, and Trig. pubescens, on abaxial surface of Trif. alexandrinum; (c) anomocytic on adaxial surface of Medi. lupulina and on abaxial surface of Medi. sativa; (d) haploecytic on both surfaces of Medi. polymorpha, Meli. indica, Trig. corniculata and Trig. foenum-graecum, on abaxial surface of Trig. occulta and on adaxial surface of Trif. repens. But in Medi. lupulina (ab) the next types with higher but equal frequency are paracytic and haploecytic. The remaining types may be rare or form relatively sizable proportion.

Variations in the morphology of normal structure of stoma are but sparingly met with. (a) Some anomocytic stomata may look cyclocytic (Fig. 21) or actinocytic (Fig. 62). (b) Seldom two morphologically anisocytic stomata are so arranged that they look haploecytic (Figs. 17, 44, 49).

Abnormalities

(a) Two stomata may be contiguously juxtaposed (Figs. 47, 65, 70, 72, 84), superposed (Fig. 38), at right angles to
each other (Figs. 50, 79; Plate K 36) or obliquely oriented (Figs. 15, 43, 90); contiguous stomata are rarely three in number (Fig. 39); (b) some stomata are with one guard cell (Figs. 18, 34, 42, 51, 66; Plate K 8).

**Stomatal ontogeny**

Stomatal ontogeny is traced on both surfaces in *Medi. polymorpha* (Figs. 4-14, 16), *Medi. sativa* (Figs. 19-20, 23-25, 27, 28, 30-31, 33), *Medi. alba* (Figs. 36, 37), *Medi. indica* (Figs. 45-46, 48-50), *Trig. foenum-graecum* (Figs. 71, 76, 77) on abaxial surface of *Trif. alexandrinum* (Figs. 54-59). It follows a mixed sequence (Figs. 1, 10, 11, 13, 14, 16, 22, 29, 33, 35-37, 45, 56, 59, 76, 82-83, 85, 89; Plate K 24, 35).

A meristemoid (M) may be a derivative of perigene cell due to an asymmetric division (Figs. 29, 35, 36), the perigene cell itself may become a meristemoid (Figs. 4, 19, 22, 27, 45, 48, 54, 76) or it may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 13, 14, 33, 48, 58, 59, 82, 89; Plate K 35); very rarely it may be cut off from a subsidiary cell of a mature stoma (Fig. 16).

Shape of meristemoid may be triangular (Figs. 4, 14, 16, 22, 27, 29, 33, 36, 45, 48, 71, 76), rectangular (Figs. 5, 33, 36, 85) trapezoidal (Figs. 19, 54, 89), somewhat semilunar (Figs. 13, 59, 82) or polygonal (Figs. 10, 58).

Meristemoids have denser cytoplasm and relatively large nuclei. They are scattered throughout the surface; at
times they occur in groups of 2-3 (Cf. Figs. 5, 36, 71).

Meristemoids (M) may undergo division by one (Figs. 6, 11, 12, 20, 24, 25, 28, 31, 37, 46, 55, 56, 76), two (Figs. 1, 8-9, 23, 30, 46, 57, 77; Plate K 24) or rarely three (Fig. 1) walls intersecting one another to cut off derivatives S₁-S₃. These stages of ontogeny may lead to mesogenous haplocytic, paraecytic or anisocytic stomata; but anomocytic stomata are perigenous (Figs. 46, 76); haploecytic stomata may be also perigenous (Cf. Fig. 48). The guard cell mother cell (SC) divides by a straight wall into two guard cells (Figs. 46, 48-50, 58, 76) which gradually become bean-shaped, developing a pore between them.

Some paraecytic and anisocytic stomata are ontogenetically mesoperigenous. After the meristemoid (M) has cut off S₁, it transforms into a guard cell mother cell and S₁ into subsidiary cells; at the same time the perigene (P) from which meristemoid is cut off becomes subsidiary cell-like (Figs. 28, 76) and the stoma is paraecytic. At times two perigenes (P) flanking M are so arranged that the stoma looks anisocytic (Figs. 7, 31, 37, 76; Cf. also Figs. 25-26). Seldom an anisocytic stoma has two mesogene subsidiary cell and one perigene (P) (Figs. 9, 23; also Cf. Fig. 32).

Contiguous stomata may be derived from two adjacent meristemoids (Cf. Figs. 5, 36, 71) or they may be formed by a meristemoid cut off contiguous to a mature stoma (Cf. Figs. 82, 83).
TRIBE GALEGNAE

(TABLE VII FIGS. PLATE C 1-20; K 1-7)

Number of species investigated is 51

Aspects of mature epidermis

In surface aspect, anticlinal walls of epidermis may be straight or wavy on both surfaces. Epidermal cells are rectangular, squarish, trapezoidal or polygonal and variously elongated. The species investigated are amphistomatic exceptions being Caragana (Fig. 11), Gliricidia (Fig. 21), Indigofera suffruticosa (Fig. 75) Millettia extensa, M. ovalifolia and M. racemosa (Fig. 100) where leaflets are hypostomatic. In most of the species stomata are more on the abaxial surface than on the adaxial one but in some species e.g. Astragalus caschmiensis, I. astragalina, I. caerulea var. monosperma, I. caerulea var. caerulea, I. cordifolia, I. glandulosa, I. limifolia var. limifolia, I. limifolia var. campbelli, I. linnaei, I. oblongifolia, I. parviflora, I. tinctoria, Psoralea plicata, Sesbania bispinosa, S. candelina, S. javanica, T. purpurea, T. senticosa and T. villosa where they are more on the adaxial surface than on the abaxial one. Stomata are evenly distributed on both surfaces without any definite pattern of orientation, sometimes they occur in close proximity (Figs. 1, 7-8, 12-13, 20, 22, 23-27, 32-33, 36-38, 41-43, 46-48, 51-53, 62-64, 68-69, 72-74, 79-80, 87-88, 93-94, 101-102, 109, 114, 126-127, 129-130, 142, 147-148, 159, 162-164, 172, 179-180, 190-191, 197, 209).
Mature stomata

Stomata may be paracytic, anisocytic, anomocytic or haploocytic, different types often occurring side by side even on the same surface. The stomatal combinations are as follows:

(a) Paracytic, anisocytic, anomocytic and haploocytic

on both surfaces of *A. caschmiensis* (Figs. 1, 2), *A. obrostachys* (Figs. 5-7), *A. prolixus* (Figs. 8, 12), *Camptosia* (Figs. 18-20), *I. angulus* (Figs. 24-25), *I. astragalina* (Fig. 26), *I. caerulea* var. monosperma (Figs. 27-28), *I. solutae* (Fig. 37), *I. cordifolia* (Figs. 38-39), *I. heteranthae* (Figs. 43-46), *I. hochstetteri* (Fig. 47), *I. linifolia* var. campbellii (Figs. 50, 51), *I. linnaei* (Figs. 53-54), *I. oblongifolia* (Fig. 63), *I. parviflora* (Figs. 64-65), *I. prostrata* (Figs. 66-68), *I. spicata* (Fig. 73), *I. tinctoria* (Figs. 76, 79), *I. trita* ssp. trita var. waaffei (Figs. 86-87), *S. bispinosa* (Fig. 129), *S. camabina* Fig. 142), *S. grandiflora* (Fig. 147), *S. javanica* (Fig. 130), *S. sesban* var. sesban (Fig. 148), *T. collina* (Figs. 159, 161), *T. jannagerensis* (Fig. 164), *T. paciflora* (Fig. 172), *T. pumila* (Figs. 178-179), *T. purpurea* (Figs. 180-181), *T. senticos* (Figs. 184, 189-190), *T. strigosa* (Figs. 191-192), and *T. villosa* (Figs. 197-198).
on abaxial surface of *Gliricidia* (Figs. 22, 23),
*I. mysorensis* (Figs. 60-62), *I. suffruticosa* (Fig. 74) and *M. tetrapetala* (Fig. 102).

on adaxial surface of *I. glandulosa* (Figs. 40-41) and *T. hamiltonii* (Fig. 163).

(b) Paraerptic, anomoerptic and haploerptic

on both surfaces of *I. caerulea var. caerulea* (Figs. 30, 32), *I. cassioides* (Figs. 33-34, 36),
*I. trita ssp. trita var. trita* (Figs. 88-89),
*Mundulea* (Fig. 114) and *P. plicata* (Fig. 126).

on abaxial surface of *Caragena* (Fig. 13), *I. glandulosa* (Fig. 42), *M. extensa* (Fig. 93), *M. ovatifolia* (Fig. 94), *T. hamiltonii* (Fig. 162), and

(c) Paraerptic, anisocytic and anomocytic

on both surfaces of *I. linifolia var. linifolia* (Figs. 41-42).

and

on abaxial surface of *I. sessiliflora* (Figs. 63, 70).

(d) Paraerptic and anomocytic

on both surfaces of *I. trifoliata* (Fig. 80), *P. acrylifolius* (Fig. 127),
on adaxial surface of *I. mysorensis* (Fig. 52), *I. sessiliflora* (Fig. 72) and *M. tetrapetala* (Fig. 109).

Diversity is seen in all species investigated; however the highest percentage is anomocytic on both surfaces in various species of *Astragalus* (except *A. chlorostachys* (ad))
Cyanopsis, Indigofera (except I. angulosa (ad)), Mundulea, and Sesbania, and on abaxial surface of Caragana. It is paracytic on both surfaces in Millettia tetraptera, Psoralea, Tephrosia, on abaxial surface of Gliricidia, M. extensa, M. racemosa, and on adaxial surface of I. angulosa. In A Chlorostachys the difference between two abundant types on adaxial surface is very slight and anomocytic type is more by 0.2% than the paracytic one.

The second abundant type varies in different species, It is (a) paracytic on both surface of I. astragalina, I. caerulea var. monosperma, I. caerulea var. caerulea, I. cassioides, I. cordifolia, I. heterantha, I. hochstetteri, I. linifolia var. linifolia, I. linifolia var. campbellii, I. linnæi, I. mysoresia, I. oblongifolia, I. parviflora, I. prostrata, I. sessiliflora, I. spicata, I. tinctoria, I. trifoliata, I. trita ssp. trita, var. trita, Mundulea, S. haptinosa, S. canadina, S. sesban var. sesban, on abaxial surface of I. angulosa, I. glandulosa, I. suffruticosa, S. grandiflora and S. javanica, and on adaxial surface of A. caschmirensis, Cyanopsis and I. trita ssp. trita var. maffei. (b) anisocytic on abaxial surface of A. chlorostachys and adaxial one of S. grandiflora; (c) anomocytic on both surfaces of M. tetraptera, P. corylifolia, P. plicata and Tephrosia species, on abaxial surface of Gliricidia, M. extensa, M. ovalifolia, M. racemosa and on adaxial surface of I. angulosa; and (d) haploctytic on both surfaces of A. prolixus, on adaxial surface of I. glandulosa, and S. javanica.
Variations in stomatal morphology are very few but they are brought about in the following way: (a) An increase in the number of subsidiary cells by wall formation in the subsidiary cell/cells of a paracytic or an anisocytic stoma (Figs. 126, 208, 209). (b) The neighbouring perigene/perigenes also assume the form of subsidiary cells so that a stoma is flanked on one side by a pair of subsidiary cells and by one subsidiary cell on the other (Cf. Figs. 106, 182), or by a pair of subsidiary cells on either side (Cf. Figs. 105, 119). The former type of paracytic stomata are incompletely amphicytic whereas the latter type is completely amphicytic. (c) Very rarely a transitional form is also observed (Fig. 160). (d) Sometimes an anomocytic stoma looks cyclocytic (Figs. 31, 171, 176, 204); (e) Seldom a pair of anisocytic stomata are with common subsidiary cells (Figs. 77, 203).

Abnormalities

(a) Contiguous stomata may be juxtaposed (Figs. 10, 29, 108, 125, 137, 142, 158, 169, 207), superposed (Figs. 9, 71, 170, 183), at right angles (Figs. 17, 85) or obliquely oriented (Figs. 10, 35, 102, 154). (b) Arrested development of stomata is met with only in M. tetraperta (Figs. 111, 112). (c) Rarely stomata are with one guard cell (Figs. 42, 59, 78, 94, 110, 113, 128, 177).
Stomatal ontogeny

It is traced on both surfaces in *Cyamopsis* (Figs. 14-17; Plate K 1-6), *S. javanica* (Figs. 131-136, 138-141), *S. grandiflora* (Figs. 143-146, 149, 153, 157), *S. sesban* (Figs. 150-152, 155, 158). On abaxial surface of *I. linnæi* (Figs. 55-58), *I. tinctoria* (Figs. 81-84), *I. trite* ssp. *trite var. maffei* (Figs. 90-92), *N. ovalifolia* (Figs. 95-99), *N. tetraperta* (Figs. 103-107), *Mundulea* (Figs. 115-118), *P. plicata* (Figs. 120-124), *T. jammagerensis* (Figs. 165-168), *T. pauciflora* (Figs. 173-175), *T. purpurea* (Figs. 185-188), *T. strigosa* (Figs. 193-196) and *T. villosa* (Figs. 199-202, 205-206) and on adaxial surface of *A. caschmirensis* (Figs. 3-4).

It follows a mixed sequence (Figs. 3, 22, 55, 64, 81-82, 94-95, 103, 106, 117, 120-121, 142-144, 146, 148, 153, 155, 157-158, 167, 174, 180, 182, 185, 187, 196, 200, 205; Plate K 1-3, 5-6).

A meristemoid (M) may be a derivative of perigene cell due to an asymmetrical division (Figs. 79, 82, 96, 97, 126, 142, 153, 157, 167), perigene cell itself may become a meristemoid (Figs. 14, 55, 64, 96, 115, 120, 131, 138, 142, 143, 157, 163, 165, 173, 180, 193, 199) or a meristemoid may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 103, 158, 196, 205); rarely it may be cut off from a subsidiary cell of a mature stoma (Figs. 22, 81, 185).
Shape of the meristemoid may be triangular (Figs. 14, 22, 64, 81, 96, 97, 103, 115, 120, 131, 142, 143, 153, 157, 180, 182; Plate K 1), rectangular (Figs. 55, 103, 107, 124, 136, 138, 167, 173, 199; Plate K 1, 6) lenticular (Figs. 82, 167), semilunar (Figs. 95, 141, 155, 158, 196), trapezoidal (Figs. 90, 94, 116, 193), rhomboidal (Fig. 167) polygonal (Figs. 120, 157, 167), or oblong (Figs. 95, 180). Meristemoids have denser cytoplasm and prominent nuclei. They are scattered throughout the surface, at times two meristemoids occur juxtaposed (Figs. 107, 124, 136, 167; Plate K 6) or rarely superposed (Fig. 157).

Meristemoids (M) may undergo division by one (Figs. 3, 14, 56, 82, 91, 98, 104, 117, 121, 132, 139, 144, 148, 151, 166, 174, 187, 194, 200, 206), two (Figs. 4, 15, 57, 83, 92, 99, 105-106, 118, 122, 133, 140, 145, 148, 149, 150, 168, 173, 186, 193, 201; Plate K-2, 3), three (Figs. 16, 58, 84, 134, 135, 146, 152, 188, 202; Plate K 4, 5) walls intersecting one another to cut off derivatives $S_1$-$S_2$. These stages of ontogeny may lead to mesogenous haploooytic, paraooytic or anisoooytic stomata; but in anomoooytic stomata the ontogeny is perigenous (Figs. 17, 97, 134, 141). The guard cell mother cell (SC) divides by a straight wall into two guard cells (Figs. 17, 97, 123, 134-135, 141, 152) which gradually becomes bean-shaped, developing a pore between them.

Contiguous stomata may be derived from two adjacent meristemoids (Cf. Figs. 107, 124, 136, 157, 167) or they may be formed due to a meristemoid cut off contiguous to a mature stoma.
TRIBE HEDYSAREE

(TABLE VIII Figs. PLATE D 1-222; K 9-16)

Number of species investigated is 45.

Aspects of mature epidermis

In surface aspect, anticlinal walls of the epidermis may be straight or wavy on both surfaces. (Compare Figs. 112 with 118 and 125 with 126), but in some species they may be straight on adaxial surface and slightly or distinctly wavy on the abaxial one (compare Figs. 136 with 137, 150 with 151, 160 with 161, 167 with 168 and 172 with 173). Epidermal cells are rectangular, polygonal or variously elongated. Leaflets are amphistomatic except those of Brya which are hypostomatic (see Figs. 125 and 126). Stomata are mostly found near veins on adaxial surface of D. concinnum (Fig. 136), D. dichotomum (Fig. 139), D. Anneticum (Fig. 141), D. heterocarpon (Fig. 150), D. laxiflorum (Figs. 142), D. neomexicanum (Fig. 144), D. repandum (Fig. 159) D. tiligefolium (Fig. 161), D. triangulare (Fig. 167) and Ourgania (Fig. 185) and they may be rare to very rare. But for the above cited species, stomata are more on abaxial surface than on the adaxial one but a converse applies in Arachis and Tavelniera. Stomata are evenly distributed throughout the surface without any definite pattern of orientation, though at times they occur in close proximity (Figs. 1, 7-8, 16, 32, 42-49, 61, 68-69, 73, 75-80, 94, 99-100, 107-108, 112, 118, 122, 124-125, 136-140, 143, 145, 151-153, 158-160, 168-169, 171-174, 176-178, 180, 186-188, 190-193, 196-197, 212-213, 221-222).
Crystals are observed in the epidermal cells of *Alybalgaumensia* (Fig. 7b), *Arachis* (Fig. 8; Plate K 12), *D. gangeticum*, *D. laxiflorum*, *D. neomexicanum*, *D. rotundifolium*, *D. triangulare* var. *congestum*, *D. velutinum*, *Eliotis*, *Lespedeza* (Fig. 215), *Ougemia*, *Pseudarthria* and *Uraaria*. They may be squarish, rectangular, rhomboidal or polygonal and occur mostly near vein region.

**Mature stomata**

Stomata may be paracytic, anisocytic, anomocytic or haploctytic; only paracytic stomata are found on both surfaces of *Geissaspsis* (Fig. 16; Plate K 16), *S. blanda* (Fig. 188), *S. conferta* (Fig. 190), *S. sensitive* (Fig. 191), *S. setulosa* (Fig. 192); on adaxial surface of *Aly. vaginalis* var. *stocksi* (Fig. 122), *D. triangulare* (Fig. 167), *D. triflorum* (Fig. 169), *S. bigemina* (Fig. 187) and *U. rufescens* (Fig. 196). In the remaining species and surfaces as the case may be, different types often occur side by side even on the same surface. The stomatal combinations are as follows:

(a) Paracytic, anisocytic, anomocytic and haploctytic on both surfaces of *Asschynomene* (Fig. 1), *Alhagi* (Fig. 7), *Aly. montifer* (Figs. 32, 36), *Aly. rugosus* (Fig. 99), *D. rotundifolium* (Fig. 42), *Eliotis* (Figs. 47, 50, 51, 177), *L. sericea* (Fig. 43), *Ormocarpum* (Figs. 49, 52), *Taverniera* (Figs. 63, 68) and *Zornia* (Fig. 48).
on abaxial surface of Aly. bupleurifolius (Fig. 75), Aly. heyneanus (Fig. 77), Aly. longifolius (Fig. 79), Aly. vaginalis var. vaginalis (Figs. 112, also Cf. Fig. 117), D. pulchellum (Figs. 152, 154), D. triflorum (Fig. 171), D. velutinum (Figs. 174, 175), Ougania (Figs. 61-62, 64), U. picta (Figs. 44, 67) and U. rufescens (Fig. 197).

on adaxial surface of Aly. scariosus (Fig. 100) and L. gerardiana (Figs. 179, 180, 213).

(b) Paracytic, anisocytic and anomoecytic

on both surfaces of Aly. tetragonolebus (Figs. 108, 111), Arachis (Figs. 8, 12, 13),

on adaxial surface of D. pulchellum (Fig. 153),
on abaxial surface of D. concinnum (Fig. 137), D. dichotomum (Fig. 138), D. triangularare (Fig. 168) and Pseudarthria (Figs. 45, 57).

(c) Paracytic, anomoecytic and haploecytic

on both surfaces of Aly. proocumbens (Figs. 94, 98),
on abaxial surface of Aly. belgaumensis (Fig. 69), Aly. scariosus (Figs. 105, 107), Aly. vaginalis var. stocksii (Figs. 123, 124), Brya (Fig. 125), D. heterocarpum (Figs. 149, 151), D. laxiflorum (Fig. 143) and D. tiliaefolium (Fig. 160),
on adaxial surface of Aly. belgaumensis (Figs. 71-73), Aly. bupleurifolius (Fig. 76).
(d) Para cyt ic, anisocytic and haplo cyt ic
on abaxial surface of *L. gerardiana* (Fig. 178),
and
on adaxial surface of *Pseudarthria* (Figs. 186, 221, 222).

(e) Para cyt ic and anomocytic
on abaxial surface of *D. neomexicanum* (Fig. 145,
and
on adaxial surface of *D. velutinum* (Fig. 176).

(f) Para cyt ic and anisocytic
on adaxial surface of *Aly. heynesianus* (Fig. 78),
*Aly. vaginalis* var. *vaginalis* (Figs. 118, 119) and
*D. triquetrum* (Figs. 172, 212);
on abaxial of *D. repandum* (Fig. 158) and *S. bigemina* (Fig. 46).

(g) Para cyt ic and haplo cyt ic
on adaxial surface of *U. picta* (Figs. 193, 194) and
on abaxial surface of *D. triquetrum* (Figs. 173, 214).

In some species it is mentioned earlier and in the table
that stomata on adaxial surface are rare or very rare and
they are mostly found near vein region. Such stomata may be
only para cyt ic (Figs. 136, 139, 141, 142, 144, 150, 185) or
anomocytic (Figs. 159, 161).

In spite of the diversity the highest percentage is a
anomocytic in *Aeschynomena, Alhagi* and *Taverniera* and
anisocytic in Zornia, but it is paracytic in the rest of the genera. The next type with higher frequency may be (a) paracytic on both surfaces of Aeschynomene, Alhagi and Zornia; (b) anisocytic on both surfaces of Aly. rugosus and L. sericea, on adaxial surface of Aly. scaricosus, Aly. tetragonolobus, Aly. vaginalis var. vaginalis, D. rotundifolium, on abaxial surface of Arachis, D. dichotomum, D. gangeticum, Ougainia and U. rufescens; (c) anomocytic on both surfaces of Aly. bupleurifolius, D. velutinum and Bleiotis, on adaxial surface of Arachis and on abaxial surface of Aly. belgaumensis, Aly. heyneanus, Aly. monilifer, Aly. procumbens, Brya, D. heterocarpon, D. laxiflorum, D. pulchellum, D. tiliacefolium, Ormocarpum, Pseudarthria, and U. picta; (d) haploecytic on both surface of Taverniera, on adaxial surface of Ormocarpum, U. picta, and on abaxial surface of Aly. longifolius, Aly. scaricosus and L. gerardiana.

Seldom two to three stomatal types have higher but equal frequency as follows: (i) anisocytic and anomocytic on abaxial surface of Aly. tetragonolobus, D. concinnum, D. triangulare and on adaxial surface of D. pulchellum; (ii) anomocytic and haploecytic on abaxial surface of Aly. vaginalis var. stocksii and on adaxial surface of Aly. procumbens; (iii) anisocytic and haploecytic on abaxial surface of D. rotundifolium and on adaxial surface of Pseudarthria; (iv) anisocytic, anomocytic and haploecytic on abaxial surface of D. triflorum and on adaxial surface of L. gerardiana.

Variations in the morphology of stomata are brought about as follows: (a) Increase in the number of subsidiary
cells is brought by any of the following methods: (a) by wall formation in a paracytic stoma (Figs. 13, 51, 92, 153, 216); as a result some of such stomata may simulate anisocytic (Cf. Figs. 92, 216), anomocytic (Cf. Fig. 153), tetraoletic (Cf. Fig. 66) or haplooletic (Cf. Fig. 51); (b) by neighbouring perigenes assuming the form of subsidiary cells (Figs. 33, 91, 106, 221); (c) at times the number is increased by wall formation in the perigene simulating a subsidiary cell (Cf. Figs. 212, 217, 219). (d) Seldom, an increase in the number of subsidiary cells takes by both the processes operating simultaneously in the same stoma (Fig. 220). (e) Sparingly both, a mesogene subsidiary cell and a perigene subsidiary cell-like cell increase in number by wall formation (Fig. 218). (f) Rarely one of the subsidiary cells of a paracytic stoma assumes the form of an epidermal cell so that the stoma simulates a haplooletic one (Cf. Fig. 222). (g) Sometimes two paracytic stomata have a common subsidiary cell (Figs. 23, 93, 189). (h) Sparingly a paracytic and anisocytic stoma have a common subsidiary cell (Fig. 86). (i) Rarely two paracytic stomata have a common subsidiary cell, and each stoma is unilaterally flanked by a pair of subsidiary cells (Fig. 58). This is due to perigenes assuming the form of a subsidiary cell flanking the mesogene subsidiary cell. (j) Rarely transitional forms between paracytic and diacytic stomata are met with in Asschynomene (Fig. 6) and Taverniera (Fig. 63)) right hand stoma.
Abnormalities

(a) Contiguous stomata may be juxtaposed (Figs. 11, 65, 84, 195, 207), superposed (Figs. 10, 28, 206), at right angles (Figs. 34, 85, 205) or obliquely oriented (Fig. 53).

(b) Rarely an arrested development in an anisocytic stomata is observed (Fig. 121); (c) Stomata with one guard cell are met with (Figs. 19, 56, 82-83, 109, 120, 170, 187, 204; Plate K 22). (d) Very rarely both the guard cells degenerate and the pore remains (Fig. 177). (e) Seldom cytoplasmic strands between guard cells of two adjacent stomata are seen (Plate K 21).

Stomatal ontogeny

Ontogeny of a stoma is studied on both surfaces in Alhagi (Figs. 127-135), Aly. procumbens (Figs. 95-98), Aly. scariousus (Figs. 100-104), Aly. tetragonolobus (Figs. 110-111), Aly. vaginalis var. vaginalis (Figs. 24-28, 33), Afachia (Figs. 14-15, 17-22; Plate K 9, 11-13) and Taverniera (Figs. 29-31; Plate K 17-20) and on abaxial surface in Aeschynomene (Figs. 25), Aly. balgaumensis (Fig. 70), Aly. monilfer (Figs. 37, 87-90), D. neomexicanum (Figs. 146-148), D. rotundifolium (Figs. 155-157), D. triflorum (Figs. 162-166), B. leiotia (Figs. 38-41; Plate K 14, 15), L. sericea (Figs. 181-182, 184), Ormocarpum (Figs. 201-203), Ougelina (Figs. 53-55, 59-60), S. sensitiva (Figs. 198-200) and Zornia (Figs. 208-211).

It follows a mixed sequence (Figs. 9, 19, 21, 24, 28, 37, 40, 43, 53-55, 68, 70, 79, 88-89, 98, 111-112, 118,
A meristemoid (M) may be a derivative perigene cell due to an asymmetrical division (Figs. 29, 55, 101, 110, 113, 118, 132, 156, 163, 181, 201; Plate K 17) or the perigene cell itself may become a meristemoid (Figs. 2, 7, 15, 24, 87, 95, 114, 146, 162, 198) or a meristemoid may be cut off from a mature perigene by the side of a fully organised stoma (Figs. 9, 14, 28, 54, 79, 128); rarely it may be cut off from a subsidiary cell of a mature stoma (Figs. 21, 88).

Shape of meristemoid may be triangular (Figs. 2, 9, 14, 24, 29, 54, 68, 88, 95, 110, 113, 118, 156, 163, 181, 198, 208; Plate K 17), rectangular (Figs. 7, 28, 55, 79, 128, 201), oblong (Figs. 15, 21, 101), trapezoidal (Figs. 87, 114, 127, 135, 162), polygonal (Figs. 38, 132 somewhat) or rarely irregular (Fig. 146).

Meristemoids have denser cytoplasm and relatively large nuclei. They are scattered throughout the surface, rarely two meristemoids occur juxtaposed (Fig. 68) or superposed (Fig. 28).

Meristemoids (M) may undergo division by one (Figs. 3, 17, 25, 29, 39, 60, 68, 89, 98, 102, 110, 115, 129, 133, 147, 155, 164, 182, 199, 202, 209; Plate K 18-20), or two (Figs. 4, 18, 26, 30, 37, 41, 43, 53, 59, 70, 90, 96, 103, 110A, 116, 130, 134, 148, 157, 165, 184, 200, 203, 210) or three (Figs. 5, 20, 27, 31, 40, 97, 111, 117, 131, 135, 166, 211) walls
intersecting one another, to cut off derivatives $S_1-S_2$. These stages of ontogeny may lead to mesogenous haplocytic, paracytic or anisocytic stomata; but anomocytic stomata are perigenous. Rarely guard cells of a paracytic stoma are flanked on one side by a mesogene and on the other by a subsidiary cell-like perigene. The stoma is mesoperigenous (Cf. Fig. 19).

Seldom in a mesogenous paracytic stoma, one of the subsidiary cells cuts off a meristemoid (Fig. 21). Such a stage is also observed during ontogenetical stages (Cf. Fig. 22). We have not been able to trace the future of this meristemoid in this tribe but the occurrence of two paracytic stomata with a common subsidiary cell, may suggest that the meristemoid may produce one subsidiary cell before transforming into a guard cell mother cell. In such a group of paracytic stomata one of them is mesoperigenous, other is mesogenous, but the mature group simulates haplocytic stomata.

Contiguous stomata may be the product of two adjacent meristemoids (Cf. Fig. 68) or they may be formed due to a meristemoid cut off contiguous to a mature stoma (Cf. Figs. 9, 14, 28, 54, 79, 128).
TRIBE VICIBAE

(TABLE IX FIGS.; PLATE 1-94; K 25-33,37-38)

Number of species investigated - 11

Aspects of mature epidermis

In surface aspect, anticlinal walls of the epidermis may be straight or wavy on both surfaces but they are mostly straight in young leaflets (Cf. Figs. 7, 8, 11-13, 50). Epidermal cells are rectangular, polygonal or variously elongated. Leaflets are amphistomatic. Stomata are more on abaxial surface than on adaxial one in Abrus, Cicer, L. aphaca, V. faba and V. sativa. In the remaining species they are more on the adaxial surface than on the abaxial one. Stomata are evenly distributed on both surfaces, without any definite pattern of orientation. Sometimes they occur in close proximity (Figs. 1, 2, 6, 15-16, 31-34, 37, 46-49, 53, 65, 70, 71, 84-85, 94).

Mature stomata

Stomata may be paracytic, anisocytic, anomocytic, diacytic, haploecytic and transitional forms, different types often occurring side by side even on the same surface. Different types of stomatal combinations are as follows:

(a) Paracytic, anisocytic, anomocytic, diacytic, haploecytic and transitional forms

on both surfaces of V. sativa (Figs. 85-87, 89, 91-92),
on abaxial surface of L. niger (Figs. 26, 33, 35-36), L. odoratus (Figs. 37, 40, 44; Plate K 30, 31).
L. sativus (Figs. 45, 46) and Lens (Figs. 48, 53) and on adaxial surface of Pisum (Figs. 54-55, 69-70).

(b) Paracytic, anisocytic, anomocytic, diacytic and haploocytic
on abaxial surface of V. faba (Fig. 71).

(c) Paracytic, anisocytic, anomocytic, haploocytic and transitional forms
on adaxial surface of Abrus (Figs. 4-6, L. niger (Figs. 25, 32), L. odoratus (Figs. 34, 40), L. sativus (Fig. 47) and
on abaxial surface of Cicer (Figs. 14-15, 17) and Pisum (Figs. 57, 65).

(d) Paracytic, anisocytic, anomocytic and haploocytic
on both surfaces of V. pallida (Figs. 93, 94) on adaxial surface of Cicer (Figs. 16, 18), V. faba (Figs. 79, 83, 84) and on abaxial surface of Abrus (Figs. 1, 2).

(e) Paracytic, anomocytic and haploocytic
on both surfaces of L. aphaca (Fig. 31).

(f) Anomocytic and haploocytic
on adaxial surface of Lens (Fig. 49).

In spite of the diversity, the highest percentage is anomocytic on both surfaces of Abrus, Cicer, L. sativus, Lens.
Pi**sum**, **V. faya** and **V. pallida** are haploectic on both surfaces of **L. aphaca** and paracytic on both surfaces of **L. odoratus** and **V. sativa**. However, in **L. niger** the highest percentage is anomocytic and haploectic on adaxial and abaxial surfaces respectively.

Stomatal types with higher percentage becoming second abundant type are (a) haploecytic on both surfaces of **Abrus**, **L. odoratus**, **L. sativus** and **V. faya**, on adaxial surface of **L. niger**, **Lens** and **V. sativa**; (b) anomocytic on both surfaces of **L. aphaca**, on abaxial surface of **L. niger** and **V. sativa**; (c) anisocytic on both surfaces of **Pi**sum.

From the table it will be seen that diaectic and transitional forms are rare in the species investigated. In some species, stomatal types other than the most abundant or second abundant types are also rare as can be judged from their frequency percentage.

Variations in the morphology of normal types of stomata are but rarely met with. (a) Increase in number of subsidiary cells by transverse wall formation in one of the subsidiary cell of a paracytic stoma (Cf. Fig. 32) by a neighbouring perigene assuming the form of a subsidiary cell (Fig. 64); (c) Rarely two anisocytic stomata are with a common subsidiary cell (Plate K 27).

Abnormalities

Two or three stomata are contiguously juxtaposed (Figs. 6, 28, 30, 71, 80, 82; Plate K 38), superposed (Figs. 53, 65).
at right angles to each other (Fig. 81) or obliquely oriented (Figs. 56, 67, 88; Plate K 38); (b) some stomata are with one guard cell (Figs. 3, 68, 90).

**Stomatal ontogeny**

Ontogeny of a stoma is studied on both surfaces of *Abrus* (Figs. 7-13; Plate K 37), *L. niger*, *L. odoratus* (Figs. 38-39, 41-43; Plate K 25-29), *Lens* (Figs. 50-52), *Pisum* (Figs. 57-61, 63, 66; Plate K 33) and *V. faba* (Figs. 72-78; Plate K 32) and on abaxial surface of *Cicer* (Figs. 19-24) and *L. sativus*. It is not traced in *L. aphaca*, *V. sativa* and *V. pallida*. Stomata follow a mixed sequence of development (Figs. 6, 10, 20, 23, 24, 28, 38, 43, 46-47, 49, 57, 63, 70, 84; Plate K 25, 27-29, 32, 33).

A meristemoid (M) may be derived from a perigene cell due to an assymetrical division (Figs. 7, 20, 27, 38, 46, 47, 49, 50, 58, 70, 72, 84; Plate K 28, 32, 34) or the itself may become a meristemoid (Figs. 7, 19), sometimes a meristemoid may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 9, 10, 23, 24) or it may be cut off from one of the subsidiary cell of a parasite stoma (Plate K 25).

Shape of meristemoid may be triangular (Figs. 7, 9, 10, 19, 24, 27, 34, 38, 49, 66, 72, 77, 84; Plate K 25, 28), rectangular (Figs. 13, 23, 77), lenticular (Figs. 20, 47; Plate K 33) trapezoidal (Fig. 7, 27, 46, 47, 50, 58), oblong (Figs. 29, 57, 70).

* Figures not shown.
Meristemoids have denser cytoplasm and relatively large nuclei, they are scattered throughout the surface; at times they occur in pairs (Figs. 13, 27, 66, 76, 77; Plate K 26, 33).

Meristemoids (M) may undergo division by one (Figs. 8, 11, 12, 21, 39, 41, 46-47, 50, 57, 72, 73, 76, 77; Plate K 27, 28, 32, 33), or two (Figs. 8, 22, 42, 43, 51, 60, 75; Plate K 33), rarely by three (Figs. 32, 61; Plate K 29) walls intersecting one another, to cut off derivatives $S_1$-$S_3$ either flanking or surrounding the central cell SC. These stages of ontogeny may lead to mesogeneous haplocytic, para cytotic, diacytic or anisocyrtic stomata; the ontogeny of anomocyrtic stomata is perigenous (Fig. 8); the central small cell (SC) transforms into guard cell mother cell. The guard mother cell divides by a straight wall into two guard cells (Figs. 8, 9, 21, 28, 29, 50, 63, 78; Plate K 33) which gradually become bean-shaped, developing a pore between them.

Some para cytotic, diacytic and anisocyrtic stomata are ontogenetically mesoperigenous (Cf. Figs. 11, 12, 57, 59, 72, 77, 78 also Cf. Figs. 62, 87; Plate K 33).

Contiguous stomata may be derived from two adjacent meristemoids (Cf. Figs. 13, 27-29, 66, 76, 77 also Cf. Figs. 9, 29, 50; Plate K 33) or they may be formed due to a meristemoid cut off contiguous to a mature stoma (Cf. Figs. 9, 10, 23, 24, 28).
Aspects of mature epidermis

In surface aspect, anticlinal walls of epidermis may be straight or wavy on both surfaces but in some species they may be straight on adaxial surface and slightly or distinctly wavy on the abaxial one (Compare Figs. 49 and 50, 54 and 56, 131 and 132, 244 and 245). Epidermal cells are triangular, rectangular, trapezoidal or polygonal and variously elongated. In many species the epidermal walls are straight in developing leaflets but in mature ones they are wavy (Cf. Figs. 37 and 46). At times they are semilunar (Cf. Figs. 12, 23, 46, 59, 81, etc.) or quite irregular in shape (Cf. Figs. 110, 113, etc.) Leaflets of most of the species are amphistomatic, but those of A. lineata (Fig. 2), A. sericea, B. monosperma, B. parviflora (Fig. 13), B. superba, Cylista (Fig. 50), Dumasia (Fig. 56), Dunbaria (Fig. 57), Galactia (Fig. 82), N. strobilifera (Fig. 108), M. monosperma (Fig. 113), Pueraria (Fig. 141), R. bracteata (Fig. 145), V. unguiculata ssp. unguiculata (Fig. 245) and V. vexillata (Fig. 247) which are hypostomatic. Stomata are extremely rare on adaxial surface of A. scorhabdoides (Fig. 7), M. prurite (Fig. 110), R. rothii (Fig. 160) and Teramnus (Fig. 177). Stomatal indices and frequency per mm² show that stomata are more on abaxial surface than on the adaxial one, exception being Cajanus and Canavalia where the converse applies.
Stomata are evenly distributed on both surfaces without any definite pattern of orientation, at times they occur in close proximity (Figs. 1, 3-5, 11-12, 16-17, 23-24, 33, 37, 44, 46-49, 54-55, 58-59, 63-64, 74, 80-81, 87-89, 101-102, 107, 109-112, 122-123, 130-132, 139-140, 142, 146-147, 158-159, 169-171, 184, 190, 199-202, 212-215, 220-222, 224-230, 237, 244, 246).

Crystals may be squarish, rectangular or polygonal and occur mostly near veins regions in A. lineata (Fig. 1), A. platycarpa (Figs. 6, 9), Canavalia (Fig. 24), Mo. strobilifera (Fig. 104) and R. minima (Fig. 157).

Mature stomata

Stomata may be paracytic, anisocytic, anomocytic, diacytic and haploacytic. They are only paracytic on both surfaces of Mo. tuberosa (Fig. 109), Psophocarpus (Fig. 139), R. aurea (Fig. 142), V. umbellata (Fig. 227) and V. unguiculata asp. sesquisipalpis (Fig. 237);

on adaxial surface of A. platycarpa (Fig. 8), V. grandis (Fig. 214), V. radiata var. radiata (Fig. 215), V. radiata var. sublobata (Fig. 222) and V. trilobata (Fig. 226) and

on abaxial surface of A. lineata (Fig. 1), A. sericea (Fig. 4), B. parviflora (Fig. 12), B. superba (Fig. 16) and V. vexillata (Fig. 246). Where more than one type of stoma are found, different types often occur side by side, even on the same surface. Different stomatal combinations are as follows:
(a) Paraepytic, anisocytic, anomocytic and haploepytic

on abaxial surface of CaJanus (Figs. 17, 18), Canavalia (Figs. 24-26), Dumasia (Figs. 53-54), Ph. eocinseus (Figs. 123-125), E. variegata (Figs. 74-76), Pueraria (Figs. 140, 144) and Stizolobium (Figs. 155, 169)

(b) Paraepytic, anisocytic and anomocytic

on both surfaces of No. lineata (Figs. 101-103), on adaxial surface of CaJanus (Fig. 23), C. ternatea (Fig. 48), Ph. lunatus (Figs. 190, 198) and Stizolobium (Figs. 170, 178),

on abaxial surface of A. platycarpa (Figs. 3, 9), A. scarabaeoides (Fig. 5), B. monosperma (Figs. 10, 11), C. biflora (Figs. 37, 46), Dunbaria (Figs. 58, 67), E. cristagalli (Fig. 63), E. suberosa (Figs. 79-80), Glycine (Fig. 88), R. minima (Figs. 147-148, 153), Teramnus (Fig. 171).

(c) Paraepytic, anomocytic and haploepytic

on both surfaces of Lablab (Figs. 89, 93), on adaxial surface of C. biflora (Figs. 43, 44) and on abaxial surface of V. aconitifolia (Figs. 197, 200).

(d) Paraepytic, anomocytic and diacycic

on abaxial surface of C. ternatea (Fig. 47)
(e) Paracytic, anisocytic and haplocytic

on abaxial surface of *Mu. prurita* (Figs. 105, 111)
*Ph. vulgaris* (Figs. 132-133), *R. rothii* (Fig. 159)
and *V. unguiculata* var. *unguiculata* (Figs. 241-244).

(f) Paracytic and anomocytic

on both surfaces of *D. trilobus* (Fig. 59), *V. angularis* (Fig. 201).

on adaxial surface of *B. suberosa* (Fig. 81), *Ph. coocineus* (Fig. 130) and *R. minima* (Fig. 158),
on abaxial surface of *Cylista* (Fig. 49), *Galactia* (Figs. 86, 87), *M. strobilifera* (Fig. 107), *M. monosperma* (Fig. 112), *Ph. lunatus* (Fig. 184),
*R. bracteata* (Fig. 146), *V. grandis* (Fig. 213), *V. radiata* var. *radiata* (Fig. 220), *V. radiata* var. *sublobata* (Fig. 221) and *V. triacobata* (Fig. 225).

(g) Paracytic and anisocytic

on both surfaces of *V. unguiculata* ssp. *cylindrica* (Figs. 228-229),
on adaxial surface of *Canavalia* (Figs. 33, 34) and *Ph. vulgaris* (Figs. 121, 131).

(h) Paracytic and haplocytic

on both surfaces of *V. dalzelliana* (Fig. 212), and
on adaxial surface of *V. aconitifolia* (Fig. 199).

Very few stomata are observed on adaxial surface in some species and they may be paracytic in *A. scarabaeoides* (Figs. 7),
*Mu. prurita* (Fig. 110), *R. rothii* (Fig. 160) and *Teramnus* (Fig. 177) or paracytic and anisocytic in *E. cristagalli* (Fig. 64),
*R. variegata* (Figs. 77, 79) and *Glycine* (Figs. 95, 96).
In spite of the diversity the highest percentage is paracytic in all the species investigated.

The second abundant type is anomocytic, anisocytic or haploecytic; (a) anomocytic on both surfaces of *Cajanus*, *C. biflora*, *C. ternatea*, *Lablab*, on adaxial surface of *Stizolobium* and on abaxial surface of *B. monosperma*, *Dumasia*, *B. cristagalli*, *Ph. coccineus*, *Ph. lunatus* and *V. radiata* var. *sublobata*; (b) anisocytic on abaxial surface of *Canavalia* and *Teramnus*; (c) haploecytic on adaxial surface of *Ph. coccineus*.

Variations observed in the morphology of stomata are as follows: (a) An increase in the number of subsidiary cells in a paracytic stoma (Figs. 9, 23, 55, 60, 63-65, 74, 131, 170, 242) and rarely in an anisocytic one (Fig. 126) is brought about by transverse wall formation in one or both subsidiaries. Some of such stomata may simulate anomocytic (Cf. Figs. 25, 60) or anisocytic (Cf. Figs. 64, 242). It may also take place by neighbouring perigenes around paracytic stomata assuming the form of subsidiary cells (Figs. 8, 12, 15-17, 21-23, 42, 47, 54, 62, 80, 139, 199-201, 203, 208, 215-216, 222, 225-228, 237; Plate K 47). As a result such stomata become completely (Cf. Figs. 15, 22) or incompletely amphicytic (Cf. Figs. 15, 21, 42, 139, 201 etc.) Rarely subsidiary cell-like perigenes also increase in number by wall formation (Figs. 208, 210; Plate K 34, 44). (b) Some anomocytic stomata morphologically simulate actinocytic (Fig. 6) or cycloecytic (Cf. Fig. 63). (c) Rarely transitional form...
is met with in Pueraria (ab) (Fig. 138). (d) Sometimes two paracytic stomata have a common subsidiary cell (Figs. 38, 52, 99, 118, 137, 175).

Abnormalities

(a) Cytoplasmic connections between guard cells of two adjacent stomata are sparsely met with in Lablab (Plate K 41). (b) Rarely wall formation in one or both the guard cells of a paracytic stoma is observed (Figs. 182-183, 203). (c) Two or three stomata are contiguously juxtaposed (Figs. 14, 35, 49, 61, 97, 106, 176, 206), superposed (Figs. 41, 106, 207), or rarely obliquely oriented (Figs. 143, 150, 181). (d) An arrested development of a paracytic stoma is observed as a rare phenomenon (Figs. 40, 91, 109, 117, 168). (e) Stomata with one guard cell are but rarely met with (Figs. 36, 39, 54, 66, 78, 94, 100, 109, 120, 130, 154, 156, 179, 204, 205, 212, 220, 221; Plate K 39, 40). (f) Rarely guard cells of a paracytic stoma are unequal (Figs. 239, 240).

Stomatal ontogeny

Ontogeny of a stoma is traced on both the surfaces in Cajanus (Figs. 19-20, 22), C. ternatea, Lablab (Figs. 98-99), Ph. cocineus (Fig. 122; Plate K 43), Ph. lunatus (Figs. 180, 185-189, 191), Ph. vulgaris (Figs. 127-129, 131-132, Plate K 34, 44), V. aconitifolia (Figs. 192-196), V. angularis (Figs. 202, 209-211), V. trilobata (Figs. 223-224), V. unguiculata var. cylindrica (Figs. 230-234; Plate K 45-46).
V. unguiculata var. sesquipedalis (Figs. 235-236, 238); on abaxial surface of C. biflora (Figs. 44, 46), R. cristagalli (Figs. 68-70), R. variegata (Figs. 71-73), Glycine (Figs. 83-85), Mu. prurita (Figs. 114-116), Psophocarpus (Figs. 134-136, 139), R. minima (Figs. 149-152), Stizolobium (Figs. 161-167), Teramnus (Figs. 172-174), V. grandis (Fig. 213), V. radiata var. radiata (Figs. 217-219).

It follows a mixed sequence (Figs. 19, 29, 44, 46, 51, 71, 83-84, 90, 92, 99, 119, 122, 131-132, 139, 147, 149-150, 161, 164, 166-167, 170, 174, 180, 184, 191, 202, 211, 213, 224, 230, 235, 237, 238; Plate K 34, 42, 44-46).

A meristemoid (M) may be a derivative of perigene cell due to an asymmetrical division (Figs. 19, 46, 80, 83, 99, 129, 132, 134, 139, 149, 162, 213, 217, 224, 233; Plate K 45), or the perigene cell itself may become a meristemoid (Figs. 28, 30, 68, 80, 186, 230) or a meristemoid may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 90, 119, 149, 150, 166, 223); sometimes it may be cut off from a subsidiary cell of a mature paraotic stoma (Figs. 29, 51, 92, 161, 191).

The shape of the meristemoid may be triangular (Figs. 27, 45, 80, 98, 114, 119, 132, 134, 149, 170, 172, 186, 202, 224, 230, 232), rectangular (Figs. 27, 28, 68, 166), lenticular (Figs. 29, 46, 80, 92, 99, 122, 129, 149, 161, 235; Plate K 45), oblong (Figs. 19, 90, 162, 230), trapezoidal (Figs. 71, 213, 217), polygonal (Fig. 30) or semilunar (Figs. 150, 223).
Meristemoids have denser cytoplasm and relatively large nuclei. They are scattered throughout the surface; rarely they occur groups of two (Fig. 27).

Meristemoids (M) may undergo division by one (Figs. 20, 30, 46, 69, 72, 84, 99, 115, 122, 129, 132, 135, 151, 163, 167, 173, 189, 193-194, 202, 213, 187-218, 224, 230, 233, 236, 237, Plate K 45, 46), two (Figs. 22, 31, 44, 46, 70, 73, 85, 99, 116, 122, 127, 131, 132, 136, 139, 147, 152, 164, 174, 184, 189, 195, 196, 210, 211, 213, 219, 224, 230, 231, 234, 238, Plate K 34, 43-46) or three (Figs. 32, 46, 128, 165, 188) walls intersecting one another to cut off derivatives $S_1$-$S_3$. These stages of ontogeny may lead to mesogenous haploecytic, paracytic or anisocytic stomata but anomoecytic stomata are perigenous. The guard cell mother cell (SC) divides by a straight wall into two guard cells (Figs. 131-132, 185, 187, 189, 196, 209, 213, 224, 231) which gradually become bean-shaped, developing a pore between them. Some paracytic stomata are ontogenetically mesoperigenous (Cf. Figs. 163, 209, 224; Plate K 43). The mature paracytic stomata with very unequal subsidiary cells at times also hint at the mesoperigenous development (Cf. Fig. 123). Seldom in a mesogenous paracytic stigma, one of the subsidiary cell cuts off a meristemoid (Figs. 29, 51, 161). Sometimes it is cut off even during the early stages of ontogeny (Figs. 231). This meristemoid further divides by a straight wall to produce $M$ and $S_1$ (Cf. Fig. 167). This may lead to develop two paracytic stomata with a common subsidiary cell (Cf. Figs. 52, 231). Here one stigma is mesogenous, other is mesoperigenous.
Contiguous stomata may be derived from (i) two adjacent meristemoids (Cf. Fig. 27), or (ii) they may be formed due to a meristemoid cut off adjacent to a mature stoma (Cf. Figs. 90, 119, 149-150, 166, 223, see also Fig. 180 and Plate K 42.)
TRIBE DALBERGIEAE

(TABLE XI  FIGS. PLATE G 1-95; K 48-50)

Number of species investigated is 16.

Aspects of mature epidermis

In surface aspect, anticlinal walls of the epidermis may be straight or wavy on both surfaces but in some species they are straight on adaxial surface and slightly or distinctly wavy on the abaxial one (Compare figs. 12 and 17, 44 and 46). Epidermal cells are rectangular, polygonal or variously elongated. Leaflets of Andira (Fig. 7), D. lanceolata (Fig. 10), D. latifolia (Fig. 17), D. melanoxylon (Fig. 18), D. paniculata (Fig. 25), D. sympathetica (Fig. 44), D. volubilis (Fig. 51), D. indica (Fig. 60), D. uliginosa (Fig. 79), Fuscidia (Fig. 87), Pt. indicus (Fig. 88) and Pt. marsupium (Fig. 90) are hypostomatic whereas those of D. sissoo, D. spinosa, D. elliptica and D. scandens are amphistomatic but stomata mostly found near the vein region on the adaxial surface. Stomata are evenly distributed without any definite pattern, though at times they occur in close proximity (Figs. 1, 9, 12, 19, 27, 28, 38, 40, 46, 47, 55, 62, 77-78, 83, 89, 91).

Mature stomata

Stomata may be paracytic, anisocytic, anomocytic and haploocytic, but only paracytic stomata are found on abaxial surface of Pt. indicus (Fig. 89). In other species, more than one type are found, different types often occurring side by side even on the same surface.
Stomatal combinations are as follows:

(a) Paracytic, anisocytic, anomocytic and haploocytic
  on both surfaces of *D. spinosa* (Figs. 35-38, 40),
  on abaxial surface of *D. lanceolaria* (Figs. 8-9),
  *D. sissoo* (Figs. 28, 29), *D. volubilis* (Fig. 47)
  and *Pt. marsupium* (Fig. 91).

(b) Paracytic, anisocytic and anomocytic
  on abaxial surface of *D. indica* (Figs. 62, 71).

(c) Paracytic, anomocytic and haploocytic
  on abaxial surface of *Andira* (Fig. 1), *D. latifolia*
  (Figs. 11, 12), *D. melanoxylon* (Fig. 19), *D.
  paniculata* (Figs. 23, 27) and *D. sympathectica*
  (Figs. 45-46);
  on adaxial surface of *D. sissoo* (Figs. 32-34) and
  *D. scandens* (Figs. 76, 78).

(d) Paracytic and anomocytic
  on both surfaces of *D. elliptica* (Fig. 55),
  on abaxial surface of *D. scandens* (Figs. 54, 77),
  *D. uliginosa* (Fig. 83) and *Piscidia* (Fig. 86).

The diversity is accompanied by predominance of para-
acytic stomata in all the species studied.

The second abundant type is (a) anomocytic on abaxial
surface of *D. lanceolaria*, *D. paniculata*, *D. sympathectica*,
*D. volubilis* and on adaxial surface of *D. elliptica* and
De. scandens and (b) haplocytic on adaxial surface of D. spinosa. Other types are relatively less frequent.

Variations in the morphology of normal types of stomata are as follows: (a) Increase in number of subsidiary cells is brought about by (i) transverse wall formation in one or both subsidiary cells of a paracytic stoma (Figs. 8, 16, 20 31, 75, 81, 83, 91; Plate K 48) as a result some of such stomata simulate anisocytic (Cf. Figs. 8, 16, 20, 75, 81, 91) or anomocytic (Cf. Figs. 31, 83) ones, and (ii) by neighbouring perigenes assuming the form of subsidiary cells; e.g. in a paracytic stoma guard cells are flanked on one side by one subsidiary cell and on the other by two to three subsidiaries (Figs. 30, 33, 52, 73-74, 78, 80, 89; Plate K 49, seldom the guard cells are flanked on either side by a pair of subsidiaries (Figs. 6, 81). Such stomata are respectively termed incompletely or completely amphicyclic by Pant (1965). (b) Rarely the two subsidiaries of a paracytic stoma are so unequal that a paracytic stoma simulates haplocytic (Figs. 77, 91), (c) Seldom the subsidiary cells of a paracytic stoma are much broader than long so that a stoma looks anomocytic (Fig. 27). (d) In some anomocytic stomata, neighbouring perigenes cut off cells which are arranged in one or two rings, and the stomata are cyclocytic (Figs. 53, 54). Figs. 61, 76 are stages in the cyclocytic organization.

Abnormalities

(a) Contiguous stomata are very rare. They may be juxtaposed (Figs. 1, 5, 41; Plate K 50), or obliquely oriented
(Fig. 43). (b) Stoma with one guard cell (Figs. 42, 74) or only with a pore are but sparingly encountered (Fig. 81). (c) In a paraotic stoma some stages of arrested development are also observed (Figs. 82, 95).

**Stomatal ontogeny**

It has been studied on abaxial surface of *Andira* (Figs. 1-4), *D. latifolia* (Figs. 13-15), *D. melanoxylon* (Figs. 21-22), *D. sissoo* (Figs. 30, 31), *D. volubilis* (Figs. 48-50), *D. elliptica* (Figs. 55-59) *D. indica* (Figs. 62-69, 72-73; Plate K 48-49), *D. scandens* (Figs. 84-85) and *P. marsupium* (Figs. 92-94). Stomatal ontogeny follows mixed sequence (Figs. 1-2, 13-14, 22, 27, 30-31, 39, 48, 55-59, 62-63, 65-69, 72-73, 92).

A meristemoid (M) may be a derivative of perigene cell due to an asymmetrical division (Figs. 13, 30, 48, 62-63; Plate K 48); or the perigene cell itself may become a meristemoid (Figs. 2, 21, 56, 73, 84), or a meristemoid may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 57, 67); rarely it may be cut off from a subsidiary cell of a mature stoma (Figs. 27, 30, 39, 92). The shape of the meristemoid may be triangular (Figs. 1, 2, 4, 21, 30, 39, 48, 56, 57, 62, 63, 84), rectangular (Figs. 62, 92), lenticular (Figs. 27-28), polygonal (Figs. 4, 67), irregular (Fig. 13), or trapezoidal (Figs. 30, 73).

Meristemoids have denser cytoplasm and relatively large nuclei. They are scattered throughout the surface; rarely they occur in pairs (Fig. 4).
Meristemoids (M) may undergo division by one (Figs. 1, 3, 14, 22, 49, 55, 58, 62, 64, 68-69, 85, 93), or two (Figs. 1, 3, 15, 22, 31, 50, 59, 62, 65, 72, 85, 94), rarely three (Fig. 66) walls that may (Cf. Figs. 59, 66, etc.) or may not (Cf. Figs. 62, 72) intersect one another, cutting off derivatives $S_1-S_3$. These stages of ontogeny may lead to mesogenous haplocytic, paracytic or anisocytic stomata; but anomocytic stomata are perigenous (Fig. 66). The guard cell mother cell (SC) divides by a straight wall into two guard cells (Figs. 26, 66; Plate K 49), which gradually become bean-shaped, developing a pore between them.

Rarely a meristemoid (M) is cut off from a subsidiary cell of a paracytic stoma (Cf. Fig. 39). This meristemoid cuts off $S_1$ and M (Fig. 69). When the stoma is fully organized, two paracytic stomata with a common subsidiary cell are formed (Figs. 24, 70, 92).

Seldom a meristemoid contiguous to a mature stoma may develop into a stoma which is now contiguous with the fully organized stoma (Cf. Figs. 57, 67), or seldom a stoma is unilaterally flanked by two meristemoids (Fig. 68) which may transform into subsidiary cells. (Fig. 74).

Very rarely a meristemoid cuts off two subsidiary cells ($S_1, S_2'$ on one side and one subsidiary cell ($S_2$) on the other (Fig. 72). This may lead to the development of incomplete paracytic amphiocytic stoma (Cf. Fig. 78).

Contiguous stomata may be derived from two adjacent meristemoids (Cf. Fig. 4) or they may be formed due to a meristemoid cut off contiguous to a mature stoma (Cf. Figs. 57, 67).
In all 6 species are investigated, 5 of Sophoreae and
1 of Podalyrieae.

Aspects of mature epidermis

In surface aspect, anticlinal walls of epidermis may be
straight or wavy on both surfaces but they are straight in
developing leaflets (compare Figs. 108 and 112). Epidermal
cells are rectangular, polygonal, trapezoidal and variously
elongated. Leaflets are hypostomatoic in *Nyroxylon* (Fig. 99),
S. japonica (Fig. 101) and S. tomentosa (Fig. 120) but in
*Baphia* (Fig. 96) and *Thermopsis* (Fig. 131) a few stomata are
also found on adaxial surface. In *S. secundiflora* they are
present on both surfaces. The number of stomata on both
surfaces is highest in *S. secundiflora* and lowest on abaxial
surface of *S. tomentosa* respectively. Stomata are evenly
distributed throughout the surface without any definite
pattern of orientation; at times they occur in close proximity
(Figs. 100, 102, 108, 115, 124).

Mature stomata

Stomata may be paracytic, anisocytic, anomocytic and
haploocytic. On abaxial surface, stomata may be only paracytic
in *Baphia* (Fig. 97) or anomocytic in *S. tomentosa* (Fig. 115).
Stomata are sparingly met with on adaxial surfaces of *Baphia*
(Fig. 96) and *Thermopsis* (Fig. 131) and they are paracytic and
anomocytic respectively. In other species more than one type of stoma are present on one or both surfaces, different types often occurring side by side. Stomatal combinations are as follows:

(a) Paracytic, anisocytic, anomocytic and haplocytic on the abaxial surface of *Myroxylen* (Fig. 100), *S. japonica* (Figs. 102, 103) and *Thermopsis* (Figs. 118, 119, 124).

(b) Paracytic, anomocytic and haplocytic on both surfaces of *S. secundiflora* (Figs. 108, 112). Where there is diversity in the stomatal types, the highest percentage is anomocytic.

The second abundant type is paracytic on abaxial surface of *Myroxylen* and *S. japonica* and on adaxial one of *S. secundiflora*.

Variations in the morphology of normal types of stoma are but sparingly met with. (a) Increase in number of subsidiary cell is brought about by (i) wall formation in one or both subsidiaries of a paracytic stoma (Fig. 107), and (ii) by neighbouring perigenous assuming the form of subsidiary cells (Figs. 98, 104). (b) In at least some species, anomocytic stomata look cycloecytic (Figs. 115, 117).

**Abnormalities**

(a) 2-3 contiguous stomata may be juxtaposed (Figs. 102, 108, 124), superposed (Fig. 123), at right angles to each other (Figs. 115, 121, 124) or obliquely oriented (Figs. 105,
Stomata with one guard cell are sparingly observed (Figs. 100, 106).

Stomatal ontogeny

It is traced on both surfaces of *S. secundiflora* (Figs. 107, 109-111, 113-114) and on abaxial surface of *S. tomentosa* (Fig. 116) and *Thermopsis* (Figs. 125-130). It takes place in a mixed sequence (Cf. Figs. 100, 107-111, 113-114, 125, 128, 130).

A meristemoid (M) may be a derivative of perigene cell due to an asymmetrical division (Fig. 100) or the perigene cell itself may become a meristemoid (Figs. 108, 109, 113, 116, 125), or a meristemoid may be cut off from a mature perigene by the side of a fully organized stoma (Figs. 114, 128, 130); rarely it may be cut off from a subsidiary cell of a mature stoma (Fig. 107).

The shape of the meristemoid may be triangular (Figs. 100, 107, 125, 130), rectangular (Figs. 108, 113) lenticular (Fig. 100), polygonal (Figs. 116, 128, 129) or oblong (Figs. 109, 114).

Meristemoids have denser cytoplasm and relatively large nuclei. They are scattered throughout the surface; at times they occur in groups of two (Figs. 108, 129).

Meristemoids (M) may undergo division by one (Figs. 110, 126), or two (Figs. 111, 127) walls intersecting one another, to cut off derivatives $S_1$ and $S_2$. These stages of ontogeny
may lead to mesogenous haplocytic or paracytic stomata. The anomocytic stomata are perigenous (Fig. 116). The guard cell mother cell (SC) divides by a straight wall into two guard cells which gradually become bean shaped developing a pore between them.

Contiguous stomata may be derived from two adjacent meristemoids (Cf. Figs. 108, 129), or they may be formed due to a meristemoid cut off contiguous to a mature stoma, (Cf. Figs. 114, 130).
PLATE A

Figs. 1-22


- Figs. 1, 5-6, 9-10, 15. Epidermal peels
- Fig. 2 A haplocytic stoma.
- Figs. 3, 4, 11, 22 Contiguous stomata
- Fig. 7 A diacytic stoma.
- Figs. 8, 13-14, 16-17, 19 Stages in stomatal ontogeny.
- Figs. 12, 20 Stomata with one guard cell.
- Fig. 18 Two anisocytic stomata with common subsidiary cells.
- Fig. 21 A stoma with completely degenerated guard cells.

(Figs. 13-19, X440; rest X760. Figs. 6, 7 and 9 from adaxial surface; rest from abaxial one).
PLATE A
Figs. 23-44

*C. filipes* - Figs. 23, 24. *C. juncea* - Figs. 25-29, 31-35.
*C. hirsuta* - Figs. 30, 36. *C. laburnifolia* - Figs. 37-44.

Figs. 23, 25, 30, 34-37 Epidermal peels.

Fig. 24 Cytoplasmic strands between guard cells of two adjacent stomata.

Figs. 25-29, 37-39, 41 Stages in stomatal ontogeny; note arrested development in Fig. 40.

Figs. 31, 42, 43 Contiguous stomata.

Figs. 32 and 33 A haploecytic and dicytic stoma respectively.

Fig. 44 A group of anisocytic and haploecytic stomata.

(Figs. 30, 36 X440; rest X760. Figs. 23, 35, 36 from adaxial surface; rest from abaxial one).
PLATE A

Figs. 45-67

*C. laburnifolia* - Fig. 45. *C. leptostachya* - Figs. 46-51. *C. linifolia* - Figs. 52-56. *C. luteaens* - Figs. 57-67.

Figs. 45-47, 52, 58, 59 Epidermal peels.

Figs. 48, 57 Haplocytic stomata.

Figs. 49, 65 A group of anisocytic stomata with common subsidiary cells, simulating haplocytic ones.

Fig. 50 A group of anisocytic and anomocytic stomata with one common cell between them.

Fig. 51 An anomocytic stoma.

Figs. 53, 66 A meristemoid adjacent to a mature stoma.

Figs. 54, 55 Contiguous stomata.

Figs. 56, 67 Stomata with one guard cell.

Figs. 60-64 Stages in stomatal ontogeny.

(Figs. 45-51, 66 X440; rest X760. Figs. 47, 51, 58 from adaxial surface; rest from abaxial one).
PLATE A

Figs. 68-89

*C. madurensis* - Figs. 68-70. *C. medicaeina* - Figs. 71-75. *C. myserensis* - Figs. 76-88. *C. nana* - Fig. 89.

Figs. 68, 71, 82, 89 Epidermal peels.

Figs. 69, 70 An anemocytic and a haplocytic stomata respectively.

Figs. 72-75, 76-79, 83-88 Stages in stomatal ontogeny.

Figs. 75 A, 80 Contiguous stomata.

Fig. 81 A stoma with one guard cell.

(Figs. 68-70, 89 x440; rest x760. Figs. 76-81 from adaxial surface; rest from abaxial one).
PLATE A

Figs. 90-104

*C. notonii* - Figs. 90-91. *C. obtecta* - Figs. 92-95.

*C. orizensis* - Figs. 96-97, 99. *C. ovalifolia* - Figs. 98, 100-101. *C. prostrata* - Figs. 102-104.

Figs. 90, 95, 96, 100-102 Epidermal peels.

Figs. 91, 93 Haplocytic stomata.

Fig. 92 An anisocytic stoma.

Figs. 94, 97 Contiguous stomata.

Figs. 98 and 99 A paracytic and an anisocytic stoma respectively.

Fig. 103 A mesoperigenous anisocytic stoma.

Fig. 104 A group of paracytic and anomocytic stomata.

(Figs. 90-91 X440; rest X760. Figs. 92-94, 101, 104 from adaxial surface; rest from abaxial one).
PLATE A
Figs. 105-193

C. quinquefolia - Figs. 105-106, 108. C. retusa - Figs. 107, 109-116. C. spectabilis - Fig. 117. C. striata - Figs. 118-124, 132. C. triquetra - Figs. 125-131, 133.

Figs. 106, 109, 112, 117, 133 Contiguous stomata.
Figs. 107, 111, 113-116, 118, 121-122. Stages in stomatal ontogeny.
Figs. 111-112 Stomata with one guard cell. Fig. 120 also shows a stoma with a single subsidiary cell.
Fig. 119 A group of two paracytic and an anamorphic stoma; note a common cell between a paracytic and anamorphic stoma.

(Figs. 105-110, 117, 125-131 X440; rest X760. Figs. 108-109, 128, 130-131 from adaxial surface; rest from abaxial one).
PLATE A

Figs. 134-151
PLATE A

Figs. 134-151


Figs. 134, 137, 138, 142-144, 151 Epidermal peels.

Figs. 135, 139 Haploecytic stomata.

Figs. 136, 141 Cycloecytic stomata.

Figs. 140, 145 A group of two anisocytic stomata with common subsidiary cells.

Figs. 146-150 Stages in stomatal ontogeny.

(Figs. 143-146 x440; rest x760. Figs. 142, 144-146 from adaxial surface; rest from abaxial one).
Lupinus - Figs. 152-161. Rothia - Figs. 162-170.

**Figs. 152, 156, 162, 164** Epidermal peels.

**Fig. 153** A paracytic stoma.

**Fig. 154** A haploecytic stoma.

**Figs. 154, 161, 170** Degeneration of guard cells; note (i) stoma with one guard cell in Figs. 161 and 170 (ii) stoma only with pore only in Fig. 170.

**Fig. 155** An actinocytyic stoma.

**Figs. 157-159, 165-167, 169** Stages in stomatal ontogeny.

**Figs. 160, 166** Transitional forms; note unequal guard cells in Fig. 160.

**Fig. 163** Cytoplasmic strands between guard cells of two adjacent stomata.

**Fig. 168** Contiguous stomata.

*(Figs. 152-162, 164 X440; rest X760. Figs. 152-153, 164 from adaxial surface; rest from abaxial one).*
PLATE A

Figs. 171-179

C. objects - Figs. 171-173. C. lutescens - Figs. 174-175. C. ovallfolia - Fig. 176. C. filipes - Figs. 177-178. C. verrucosa - Fig. 179.

Figs. 171, 174, 179 Epidermal peels.

Fig. 172 An anisocytic stoma.

Figs. 173, 178 Haplocytic stomata.

Figs. 175-177 Paracytic stomata; note paracytic developmental stage in Fig. 175.

(All Figs. X760; Figs. 171 and 178 from adaxial surface; rest from abaxial one).
PLATE B
Figs. 1-34

Medi. lupulina — Figs. 1, 21. Medi. polymorpha —
Figs. 2-18. Medi. sativa — Figs. 19-20, 22-34.

Figs. 1-3, 22, 29 Epidermal peels.
Figs. 4-14, 16, 19-20, 23-25, 27-28, 30-31, 33
Stages in stomatal ontogeny.
Fig. 15 Contiguous stomata.
Fig. 17 A pair of anisocytic stomata with two
common subsidiary cells.
Figs. 18, 34 Stomata with one guard cell.
Fig. 21. A cycloctic stoma.
Figs. 26, 32 Anisocytic stomata.

(All figures x760. Figs. 10-12, 27-32, 34 from
adaxial surface; rest from abaxial one).
PLATE B
Figs. 35-52

**Heli. alba** - Figs. 35-44. **Heli. indica** - Figs. 45-52.

Figs. 35-36, 40, 47, 52 Epidermal peels.

Figs. 37, 45-46, 48, 49 Stages in stomatal ontogeny.

Figs. 38, 39, 43, 50 Contiguous stomata.

Fig. 41 A haplocytic stoma.

Figs. 42, 51 Stomata with one guard cell.

Figs. 44, 49 A pair of anisocytic stomata with common subsidiary cells.

(Figs. 47, 51 X440; rest X760. Figs. 40-41, 44, 52 from adaxial surface; rest from abaxial one).
PLATE B

Figs. 53-75


Figs. 53, 60-62, 64, 67-68, 73 Epidermal peels.

Figs. 54-59, 71 Stages in stomatal ontogeny.

Figs. 63, 69. Haploecytic stomata.

Figs. 65, 70, 72 Contiguous stomata.

Fig. 66 A stoma with one guard cell.

Fig. 73 An anisocytic stoma.

Fig. 74 A paraecytic stoma.

(Figs. 65-67 X760; rest X440; Figs. 60-63, 68-69 from adaxial surface; rest from abaxial one).
PLATE B
Figs. 75-94
PLATE B

Figs. 76-94

Trig. feanum-gracsum - Figs. 76-78. Trig. hamosa - Figs. 79-80. Trig. occulta - Figs. 81-86, 88-92. Trig. pubescens - Figs. 87, 93-94.

Figs. 76, 78, 80-81, 86-87, 94 Epidermal peels.
Figs. 77, 82-83, 85 Stages in ontogeny of a stoma.
Figs. 79, 90 Contiguous stomata.
Fig. 84 A group of anomocytic stomata and contiguous stomata.
Figs. 88, 91 A haploecytic stoma and transitional form respectively.
Fig. 89. A group of anomalocytic stomata.
Fig. 92 A group of paracytic, anisocytic and anomocytic stomata; note one stoma with single guard cell.
Fig. 93 A haploecytic stoma.

(Figs. 76-77 X760; rest X440. Figs. 78, 81, 86, 87 from adaxial surface; rest from abaxial one).
PLATE C

Figs. 1-25


*I. angulosa* Figs. 24-25.

Figs. 1, 7-8, 11-13, 20-22, 25 Epidermal peels.

Figs. 2, 18, 23 Anisocytic stomata.

Figs. 3-4, 14-17 Stages in ontogeny of a stoma.

Figs. 5, 19 Paraocytic stomata.

Figs. 6, 24 Haploocytic stomata.

Figs. 9, 10, 17 Contiguous stomata.

(All Figs. X440. Figs. 1-2, 8, 11, 21 from adaxial surface; rest from abaxial one).
**PLATE C**

Figs. 26-47

*Indigofera astragalinga* - Fig. 26. *I. caerulea* var. *monosperma* - Figs. 27-29. *I. caerulea* var. *caerulea* - Figs. 30-32. *I. cassioides* - Figs. 33-34, 36. *I. glandulosa* - Figs. 35, 40-42. *I. oolutea* - Fig. 37. *I. cordifolia* - Figs. 38-39. *I. heterantha* - Figs. 43-46. *I. hochstetteri* - Fig. 47.


Figs. 28, 40, 44. Anisocytic stomata.

Figs. 29, 35 Contiguous stomata.

Figs. 30, 34, 39, 45. Haploecytic stomata.

Fig. 31 A cycloecytic stoma.

(All Figs. X440. Figs. 36, 40, 41, 46 from adaxial surface; rest from abaxial one).
PLATE C

Figs. 48-73

I. linifolia var. linifolia - Figs. 48-49. I. linifolia var. campbellii - Figs. 50-51. I. mysorensis - Figs. 52, 60-62. I. linnaei - Figs. 53-59. I. oblongifolia - Fig. 63. I. parviflora - Figs. 64-65. I. prostrata - Figs. 66-68. I. sessiliflora - Figs. 69-72. I. spicata - Fig. 73.

Figs. 48, 51-53, 62-64, 68-69, 72-73 Epidermal pools.

Figs. 50, 54, 61, 65 Haplocytic stomata.

Figs. 55-58. Stages in stomatal ontogeny.

Fig. 59 A stoma with one guard cell.

Figs. 49, 60, 67, 70 Anisocytic stomata.

Fig. 66 A pair of anomocytic and haplocytic stomata with common cells.

Fig. 71 Contiguous stomata.

(All figures X440. Figs. 52, 63, 72 from adaxial surface; rest from abaxial one).
PLATE C

Figs. 74-101

I. suffruticosa - Figs. 74-75. I. binatoria - Figs. 76-79, 81-84. I. trifoliata - Fig. 80. I. trita ssp. trita var. maffei - Figs. 85-87. I. trita ssp. trita var. trita - Figs. 88-92. M. extensa - Fig. 93. M. ovalifolia - Figs. 94-99. M. racemosa - Figs. 100-101.

Figs. 74, 75, 79-80, 87-88, 93-94, 100-101 Epidermal peels.

Figs. 76, 86, 89 Haplocytic stomata.

Figs. 77 A pair of anisocyctic stomata with common subsidiary cells.

Fig. 78 A stoma with one guard cell.

Figs. 81-84, 90-92, 93-99 Stages in stomatal ontogeny.

Fig. 85 Contiguous stomata.

(All Figs. X440. Figs. 75, 100 from adaxial surface; rest from abaxial one).
PLATE C
Figs. 102-141

M. tetraptera - Figs. 102-111. M. mundula - Figs. 112-119. P. pilosa - Figs. 120-126. P. corylifolia - Figs. 127-128. S. bispinosa - Fig. 129. S. javanica - Figs. 130-141.

Figs. 102, 107, 114, 126-127, 129-130 Epidermal peels.

Figs. 103-107, 115-118, 120-124, 131-136, 138-141 Stages in stomatal ontogeny

Figs. 108, 125, 137 Contiguous stomata.

Figs. 110, 113, 128 Stomata with one guard cell.

Figs. 111-112 Arrested development of anisocytic and paracytic stoma respectively.

Fig. 119 An amphicyclic stoma.

(Figs. 109-108, 110-113, 115-119, 123 X980; rest X440. Figs. 109, 128, 138-141 from adaxial surface; rest from abaxial one).
PLATE C

Figs. 142-171

*S. cannabina* - Fig. 142. *S. grandiflora* - Figs. 143-147, 149, 153, 156-157. *S. sesban* var. *sesban* - Figs. 148, 150-152, 155, 158, 160. *T. collina* var. *lanuginocarpa* - Figs. 159, 161. *T. hamiltonii* - Figs. 162-163. *T. jannagerensis* - Figs. 164-170. *S. javanica* - Fig. 171.

Figs. 142, 147-148, 159, 162-164 Epidermal peels.

Figs. 143-146, 149-153, 155, 157-158, 163-168 Stages in stomatal ontogeny.

Figs. 154, 158, 169-170 Contiguous stomata.

Figs. 156 A pair of anisocytic stomata with common subsidiary cells.

Fig. 160 A transitional form.

Fig. 171 A cyclocytic stoma.

Fig. 161 An anisocytic stoma.

(Figs. 143-146, 149-152, 155, 157-158, 165-171 X980; rest X440. Figs. 163 from adaxial surface; rest from abaxial one).
PLATE C

Figs. 172-209


Figs. 172, 179-180, 190-191, 197, 209 Epidermal peels.

Figs. 173-175, 182, 185-188, 193-196, 199-202, 205-206 Stages in ontogeny of a stoma.

Figs. 176, 204 Cycloxytic stomata.

Fig. 177 A stoma with one guard cell.

Figs. 178, 189, 198 Haploxytic stomata.

Figs. 181, 184, 192 Anisocytic stomata.

Figs. 183, 207 Contiguous stomata.

Fig. 203 A pair of anisocytic stomata with common subsidiary cells.

Fig. 208 Paracytic stomata showing wall formation in one or both subsidiary cells.

(Figs. 199-209, X980; rest X440; All figures from abaxial surface).
PLATE D
Figs. 1-42

Assohynomena - Figs. 1-6, 9-11. Alhagi - Fig. 7 Arachis
- Figs. 8, 12-15, 17-23, 35. Geissaspta - Fig. 16. Aly.
vaginalis var. vaginalis - Figs. 24-28, 33-34. Taverniera
polycumbens - Fig. 39. Aleiota - Figs. 38-41. D.
rotundifolium - Fig. 42.

Figs. 1,7,8,16,32 and 42 Epidermal peels.
Figs. 2-5, 9, 14-15, 17-20, 24-27, 29-31, 33, 37-41
Stages in stomatal ontogeny; note stoma with
one guard cell in Fig. 19.

Fig. 6 A transitional form.
Figs. 10-11, 28, 34 Contiguous stomata.

Fig. 12 An anomocytic stoma.
Figs. 13, 35 An incomplete amphicyclic paraocylic
stoma; note wall formations in one of the
subsidiary cell in Fig. 13.
Figs. 21-23 Ontogeny of two paraocylic stoma with
a common subsidiary cell.

Fig. 36 An anisocytic stoma.

(Figs. 8, 12-13 X44C; rest X760. Figs. 24-27, 33-
34 from adaxial surface; rest from abaxial one).
PLATE D

Figs. 43-68

*L. sericea* - Figs. 43, 58. *U. pista* - Figs. 44, 67.

*Pseudarthria* - Figs. 45, 57. *S. bigeminata* - Figs. 46, 56.

*Eleotheia* - Figs. 47, 50-51. *Zornia* - Fig. 48. *Ormocarpum*

- Figs. 49, 52. *Ougolinia* - Figs. 53-55, 59-62, 64.

*Taverniera* - Figs. 63, 65-66, 68.

Figs. 43-49, 61, 68 Epidermal peels.

Fig. 50 An *anomocytic stoma*.

Fig. 51 Paracytic stoma with very unequal subsidiary cells; note wall formation in larger subsidiary cell.

Figs. 52, 57, 62 Anisocytic stomata.

Figs. 53-55, 59-60 Stages in stomatal ontogeny.

Fig. 56 A stoma with one guard cell.

Fig. 58 Two paracytic stomata with a common subsidiary cells; note each stoma flanked on one side by two subsidiary cells.

Fig. 63 A group of anomocytic and transitional form.

Figs. 64, 67 Haploocytic stomata.

Figs. 65, 65 Contiguous stomata.

Fig. 66 An apparent tetracytic stoma, derived from an anisocytic one by wall formation in the largest subsidiary cell.

(Figs. 46, 48, 52 X440; rest X760. Fig. 56 from adaxial surface; rest from abaxial one).
PLATE D

Figs. 69-93

*Aly. belgaumensis* - Figs. 69-74. *Aly. bupleurifolius* - Figs. 75-76. *Aly. beyansenus* - Figs. 77-78. *Aly. longifolius* - Figs. 79-81. *Aly. procumbens* - Figs. 82-84, 86. *Aly. monilifer* - Figs. 85, 87-93.

Figs. 69, 73, 75-80  Epidermal peels.
Figs. 70, 87-90  Stages in ontogeny of a stoma.
Figs. 71, 72, 81  A paraotic, haplootic and anomocytic stoma respectively.
Fig. 74  Crystals in epidermal cells.
Figs. 82, 83  Stomata with one guard cell.
Figs. 84, 85  Contiguous stomata.
Figs. 86, 91  A group of two paraotic, paraotic and anisocytic stomata respectively with a common subsidiary cell.
Fig. 91  Increase in number of subsidiary cells by neighbouring perigenes.
Fig. 91  Same, by wall formation in one of the subsidiary cell of a paraotic stoma.

(Figs. 77-78 X440; rest X760. Figs. 71-73, 76, 78, 80 from adaxial surface; rest from abaxial one).
PLATE D
Figs. 94-111

_Aly. procumbens_ - Figs. 94-98. _Aly. rugosus_ - Fig. 99.

_Aly. sericosus_ - Figs. 100-107. _Aly. tetragonolobus_ - 108-111.

Figs. 94, 99-100, 107-108 Epidermal peels.

Figs. 95-98, 101-104, 110-111 Stages in ontogeny of a stoma.

Fig. 105 A haplocytic stoma.

Fig. 106. An incomplete amphicyclic paracytic stoma.

Fig. 109 A stoma with one guard cell.

(Fig. 99 X440; rest X760. Figs. 109-110 from adaxial surface; rest from abaxial one).
PLATE D
Figs. 112-137

_Aly. vaginalis var. vaginalis_ - Figs. 112-120. _Arachis_
- Fig. 121. _Aly. vaginalis var. stocksii_ - Figs. 122-124. _Brya_ - Figs. 125-126. _Alhagi_ - Figs. 127-135. _D. concinnum_ - Figs. 136-137.

Figs. 112, 118, 122, 124-126, 136-137 Epidermal peels.

Figs. 113-117, 127-135 Stages in ontogeny of a stoma.

Fig. 119 An anisocytic stoma.

Fig. 120 A stoma with one guard cell.

Fig. 121 Arrested development in an anisocytic stoma.

Fig. 123 A haploocytic stoma.

(Figs. 122-126 X440; rest X760. Figs. 118, 119, 122, 126, 136 from adaxial surface; rest from abaxial one).
PLATE D

Figs. 152-170
138-151
PLATE D

Figs. 138-151


Figs. 138-145, 150-151. Epidermal peels.

Figs. 146-148 Stages in ontogeny of a stoma.

Fig. 149 A haplocytic stoma.

(All Figs. X760. Figs. 139, 141-142, 144, 150 from adaxial surface; rest from abaxial one).
PLATE D
Figs. 152-170

_D. pulchellum_ - Figs. 152-154. _D. rotundifolium_ -
Figs. 155-157. _D. repandum_ - Figs. 158-159. _D. tiliifolium_ -
Figs. 160-161. _D. triflorum_ - Figs. 162-166, 169. _D. triangulare_ var. _congestum_ Figs. 167-168. _D. triquetrum_ - Fig. 170.

Figs. 152-153, 158-161, 167-169 Epidermal
peels.

Fig. 154 An anisocytic stoma.

Figs. 155-157, 162-166 Stages in ontogeny of a
stoma.

Fig. 170 A stoma with one guard cell.

(Fig. 160 X440; rest X760. Figs. 153, 159, 161,
167, 169 from adaxial surface; rest from
abaxial one).
PLATE D

Figs. 171-185

D. triflorum - Fig. 171. D. triquetrum - Figs. 172-173. D. velutinum - Figs. 174-176. Bleiotis - Fig. 177. L. gerardiana - Figs. 178-180. L. sericea - Figs. 181-184. Ougeina - Fig. 185.

Figs. 171-174, 176-178, 180, 185 Epidermal peels.

Fig. 175 A haplocytic stoma.

Figs. 179, 183 Anisocytic stomata.

Figs. 181-182 Ontogeny of a stoma.

(All Figs. X760, Figs. 172, 176, 177, 179-180, 185 from adaxial surface; rest from abaxial one).
PLATE D

Figs. 186-211

Psoudarthira - Fig. 186. S. bigemina
S. bigemina - Fig. 187.
S. bigemina - Fig. 188. S. setulosa
S. setulosa - Figs. 189, 192.
S. setulosa - Fig. 190.
S. setulosa - Fig. 191, 198-200.
U. picta - Figs. 193-195.
U. rufescens - Figs. 196-197.
Ornecarpum - Figs. 201-203.
Taverniera -
Figs. 204-207.
Zernia - Figs. 208-211.

Figs. 186-188, 190-193, 196-197 Epidermal peals.

Fig. 189 A pair of paracytic stomata with a
common subsidiary cell.

Fig. 194 A haploeytic stoma.

Figs. 195, 205-207 Contiguous stomata.

Figs. 198-203, 208-211 Stages in ontogeny of a
stoma.

Fig. 204 A stoma with one guard cell, along with a fully
developed stoma.

(Figs. 188-192 X440; rest X760. Figs. 186-187,
193, 194, 196 from adaxial surface; rest from
abaxial one).
PLATE D

Figs. 212-222


Figs. 222-213, 221 Epidermal peels.

Fig. 214 A haplocytic stoma.

Fig. 215 Crystals in epidermal cells.

Fig. 216 Anisocytic stoma.

Figs. 217-220 Increase in number of subsidiary cells.

Fig. 222 A paracytic stoma, with very unequal subsidiary cells simulating haplocytic one.

(All Figs. X760. Figs. 212, 213, 215, 221-222 from adaxial surface; rest from abaxial one).
PLATE II

Figs. 1-31

Abrus - Figs. 1-13. Cicer - Figs. 14-24. L. niger -
Fig. 29-30. L. aphaca - Fig. 31.

Figs. 1, 6, 15, 16, 31 Epidermal peels.
Fig. 2 A group of paracytic and haplocytic stomata.
Fig. 3 An anisocytic stoma with one guard cell.
Figs. 4, 14, 17, 25, 26 Transitional forms.
Fig. 5 A paracytic stoma.
Figs. 7-13, 19-24, 27 Stages in ontogeny of a stoma.
Fig. 18 A haplocytic stoma.
Figs. 28, 30 Contiguous stomata.
Fig. 29 A mature stoma with a contiguous meristemoid.

(Figs. 3, 25-30 X760; rest X440. Figs. 4-6, 16, 18, 25 from adaxial and rest from abaxial surface).
PLATE E

Figs. 32-46

L. niger - Figs. 32-33, 35-36. L. odoratus - Figs. 34, 37-44. L. sativus - Figs. 45-46.

Figs. 32-34, 37, 40, 46 Epidermal peels.

Fig. 35 An anisocytic stoma.

Fig. 36 A group of dia cyt ic and anomocytic stomata.

Figs. 38-39, 41-43 Stages in ontogeny of a stoma.

Figs. 44-45. Transitional forms.

(Figs. 34, 37, 40, 44-46 X440; rest X760. Figs. 32, 34 from adaxial surface; rest from abaxial one).
Figs. 47-70

**L. sativus** - Fig. 47. **Lena** - Figs. 48-53. **Pisum** - Figs. 54-70.

Figs. 47-49, 53, 65, 70 Epidermal peels.

Figs. 50-52, 57-61, 63, 66 Stages in ontogeny of a stoma.

Fig. 54 A group of diacytic and haplocytic stomata.

Fig. 55 A transitional form.

Fig. 56 Contiguous stomata.

Figs. 62, 69 Paracytic stomata.

Fig. 64 An anisocytic stoma with an additional subsidiary cell.

Fig. 67 A group of anomocytic and contiguous haplocytic stomata.

Fig. 68 A group of paracytic stomata; note one stoma with one guard cell.

(Figs. 50-52 X760; rest X440. Figs. 47, 49, 54, 55, 70 from adaxial surface; rest from abaxial one).
PLATE B
Figs. 71-94

V. faba - Figs. 71-84, 89-90. V. sativa - Figs. 85-88, 91-92. V. pallida - Figs. 93-94.

Figs. 71, 84, 85, 94 Epidermal peels.
Figs. 72-78 Stages in the ontogeny of a stoma.
Figs. 79, 93 Paracytic stomata.
Figs. 80-82, 88 Contiguous stomata.
Fig. 83 An anisocytic stoma.
Figs. 86-87, 89, 92 Transitional forms.
Fig. 90 A stoma with one guard cell.
Fig. 91 A haploacytic stoma.

(Figs. 93-94, X440; rest X760. Figs. 79, 83, 84 from adaxial surface; rest from abaxial one).
PLATE F

Figs. 1-23

*Atylosia lineata* - Figs. 1-2. *A. platycarpa* - Figs. 3, 8-9. *A. seriene* Fig. 4. *A. scarabaeoides* - Figs. 5-7. *B. monosperma* - Figs. 10-11, 14-15. *B. parviflora* - Figs. 12-13. *B. superba* - Fig. 16. *Cajanus* - Fig. 17-23.

Figs. 1-5, 11-13, 16-17, 23 Epidermal peels.

Fig. 6 An actinocytic stoma.

Fig. 7 A paracytic stoma.

Figs. 8, 15, 21 Incomplete and complete amphicytic paracytic stomata; note crystal in an epidermal cell in Fig. 8.

Figs. 9, 18 Anisocytic stomata.

Fig. 10 An anomocytic stoma.

Fig. 14 Contiguous stomata.

Figs. 19-20, 22 stages in stomatal ontogeny.

(Figs. 7, 14-15, 17-23 X760; rest X440. Figs. 2, 7, 13, 23 from adaxial surface; rest from abaxial one).
PLATE F

Figs. 24-57

Cyclista - Figs. 49-50. Dumasia - Figs. 51-56.
Dunbaria - Fig. 57.

Figs. 24, 33, 37, 44, 46-50, 54-57 Epidermal peels.
Fig. 25 An anomocytic stoma.
Figs. 26, 43, 53 haploocytic stomata.
Figs. 27-32, 45-46 Stages in stomatal ontogeny.
Fig. 34 An anisocytic stoma.
Figs. 35, 41 Contiguous stomata.
Figs. 36, 39 A stoma with one guard cell.
Fig. 40 Arrested development in a paracytic stoma.
Fig. 42 An incomplete paracytic stoma.
Figs. 38, 51-52 A group of paracytic stomata with a common subsidiary cell.

(Figs. 27-34, 36, 39-40, 45-46 X760; rest X440.
Figs. 33, 43, 44, 48, 50, 57 from adaxial surface; rest from abaxial one).
PLATE F
Figs. 58-100

Dunbaria - Figs. 58, 66-67. Dolichos - Fig. 59. E. cristagalli - Figs. 60-64, 68-70. E. variagata - Figs. 71-78. E. suberosa - Figs. 79-81. Galetia - Figs. 82, 86-87. Glycine - Figs. 83-85, 88, 94-96. Lablab - Figs. 89-93, 97-100.

Figs. 58-59, 63-64, 74, 80-82, 87-89 Epidermal peels.

Fig. 60 A group of anomocytic stomata.

Figs. 61, 97 Contiguous stomata.

Fig. 62 A complete amphicyclic stoma.

Fig. 63 Wall formations in one of the subsidiary cell of a paracytic stoma.

Figs. 66, 78, 94, 100 Stoma with one guard cell; also note a stoma with pore only in Fig. 100.

Figs. 68-73, 83-85, 90, 92, 98-99 Stages in stomatal ontogeny.

Fig. 75 A haplocytic stoma.

Figs. 67, 76, 79, 96 Anisocytic stomata.

Figs. 77, 95 Paracytic stoma.

Figs. 86, 93 Anomocytic stomata.

Fig. 91 A group of two paracytic stomata; note arrested development in one of them.

(Figs. 90-92, 98-100 X760; rest X440. Figs. 64, 77, 79, 82, 95-96, 98-99 from adaxial surface; rest from abaxial one).
PLATE F
Figs. 101-131


Figs. 101-102, 107-113, 122-123, 130-131 Epidermal peels.

Figs. 103, 121, 124 Anisocytic stomata.

Fig. 104 Crystals in epidermal cells.

Figs. 105, 125 Haplocytic stomata.

Fig. 106 Contiguous stomata.


Fig. 117 A group of paracytic stomata with arrested development.

Fig. 118 A group of paracytic stomata with a common subsidiary cell.

Figs. 120, 130 A stoma with one guard cell.

Fig. 126 An anomocytic stoma.

(Figs. 114-116, 122-123, 127-131 X760; rest X440.

Figs. 102, 108, 110, 113, 121, 130-131 from adaxial surface; rest from abaxial one).
PLATE F

Figs. 132-169


Figs. 132, 139-147, 158-160, 169 Epidermal peels.

Figs. 133, 153, 155 Anisocytic stomata.

Figs. 134-136, 149-152, 161-167 Stages in stomatal ontogeny.

Fig. 137 A pair of paracytic stomata with a common subsidiary cell.

Fig. 138 A transitional form between paracytic and diacytic stoma.

Figs. 143, 150 Contiguous stomata.

Fig. 144 A haplocytic stoma.

Fig. 148 An anomocytic stoma.

Figs. 154, 156 A stoma with one guard cell.

Fig. 157 Crystals in epidermal cells.

Fig. 168 A group of paracytic stomata with a common subsidiary cell; note one stoma without contents.

(Figs. 134-136, 149-152, 161-169 x760; rest x440.

Figs. 141, 145, 158, 160 from adaxial surface; rest from abaxial one).
PLATE F

Figs. 170-211

Stixolobium - Figs. 170, 178. Tetramus - Figs. 171-177.
Ph. lunatus - Figs. 180-191, 198. V. aconitifolia - Figs. 192-197, 199-200, 204. V. angularis - Figs. 203, 205-211.

Figs. 170-171, 177, 184, 190, 196-201 Epidermal peels.
Fig. 175 A group of two paracytic stoma with a common subsidiary cell.
Figs. 176, 181, 206, 207 Contiguous stomata.
Fig. 178 An anisocytic stoma.
Figs. 179, 204, 205 Stomata with one guard cell.
Fig. 180 A stage in an organization of a contiguous stoma.
Figs. 182-183, 203 Wall formation in one or both the guard cells of a stoma.
Figs. 197, 198 A haplocytic and an anomocytic stoma respectively.
Fig. 208 A paracytic stoma with arrested development; note additional subsidiary cells on both the side of a stoma.

(Figs. 170, 172-174, 178, 180-196, 202-211 X760; rest X440. Figs. 170, 177, 190, 197, 199, 201, from adaxial surface; rest from abaxial).
PLATE F
Figs. 212-227

V. dalselliana - Fig. 212. V. grandis - Figs. 213-214. V. radiata var. radiata - Figs. 215-220. V. radiata var. sublobata - Figs. 221-222. V. trilobata - Figs. 223-226. V. umbellata - Fig. 227.

Figs. 212-215, 220-222, 224-227 Epidermal peels.

Fig. 216 A group of paraoytic stomata; each with an additional subsidiary cell on one side.

Figs. 217-219, 223-224 States in ontogeny of a stoma.

(Figs. 223-224 X760; rest X440. Figs. 214-215, 222, 226 from adaxial surface; rest from abaxial one).
PLATE F

Figs. 228-247

*V. unguiculata var. cylindrica* - Figs. 228-234, 239-240. *V. unguiculata var. sesquipedalis* - Figs. 235-238. *V. unguiculata var. unguiculata* Figs. 241-245. *V. vexillata* Figs. 246-247.

Figs. 228-230, 237, 244-247 Epidermal peels.
Figs. 230-236, 238 Stages in stomatal ontogeny.
Figs. 239-240 Paracytic stomata with unequal guard cells.
Fig. 241 A group of paracytic stomata.
Fig. 242 A paracytic stoma; note wall formation in a subsidiary cell.
Fig. 243 A haploecytic stoma.

(Figs. 230-236, 238 X760; rest X440. Figs. 229, 245, 247 from adaxial surface rest from abaxial one).
PLATE F

Figures 228-247
PLATE G
Figs. 1-27


Figs. 1, 7, 9-10, 12, 17-19, 25, 27 Epidermal peels.
Figs. 2-4, 13-15, 21-22, 26 Stages in stomatal ontogeny.

Fig. 5 Contiguous stomata.

Fig. 6 A complete amphicyclic paracytic stoma.

Fig. 8 A group of anisocytic stomata.

Figs. 11, 23 An anomocytic and haploecytic stomata respectively.

Figs. 16, 20 Paracytic stomata; note wall formation in one subsidiary cell.

Fig. 24 Two paracytic stomata with a common subsidiary cell.

(Figs. 1, 7 X440; rest X760. Figs. 7, 10, 17-18, 25 from adaxial surface; rest from abaxial one).
PLATE G
PLATE G
Figs. 28-54

*P. sissoo* - Figs. 28-34, 41, 52-53. *D. spinosa* - Figs. 35-40. *P. indicus* - Fig. 42. *D. melanoxylon* - Fig. 43. *D. sympathetica* - Figs. 44-46. *D. volubilis* - Figs. 47-51. *D. scandens* - Fig. 54.

Figs. 28, 38, 40, 44, 46-47, 51 Epidermal peels.

Fig. 29 A group of paracytic and haploecytic stomata.

Figs. 30-31, 39, 48-50 Stages in stomatal ontogeny.

Figs. 32, 34, 35 Haploecytic stomata.

Fig. 33 A complete amphicyclic paracytic stoma.

Figs. 35, 36 An anisocytic and anomocytic stomata respectively.

Fig. 37 Paracytic and haploecytic stomata.

Figs. 41, 43 Contiguous stomata.

Fig. 42 A stoma with one guard cell.

Fig. 52 A paracytic stoma with three subsidiary cells on one side.

Figs. 53, 54 Cyclocytic stomata.

(Figs. 42, 44-46 X440; rest X760. Figs. 32-36, 38, 44, 51 from adaxial surface; rest from abaxial one).
PLATE G

Figs. 55-82

De. elliptica - Figs. 55-59. De. indica - Figs. 60-75. De. scandens - Figs. 76-78. De. uliginosa - Figs. 79-82.

Figs. 55, 60, 62, 77-79 Epidermal peels.
Figs. 56-59, 63-69, 72, 73 Stages in stomatal ontogeny.
Figs. 61, 76 Incompletely organized cyclocytic stomata.
Fig. 70 Two paracytic stomata with a common subsidiary cell.
Fig. 71 Paracytic and anisocytic stomata.
Figs. 73, 80. A paracytic stoma with 2-3 subsidiary cells on one side.
Fig. 74 A stoma with one guard cell with two subsidiaries unilaterally flanking the guard cell.
Figs. 75, 81 A group of paracytic stomata note transverse wall formation in one of the subsidiary cell in Fig. 75.
Fig. 81 A group of completely amphicyclic paracytic stoma and a stoma with only pore.
Fig. 82 Same as 75; note arrested development.

(All Figs. X760. Figs. 60, 76, 78, 79 from adaxial surface; rest from abaxial one).
PLATE G

Figs. 83-101

De. uliginosa - Figs. 83-85. Fiscidia - Figs. 86-87.
Pt. indicus - Figs. 88-89. Pt. marsupium - Figs. 90-95.
Saphia - Figs. 96-98. Myroxylen - Figs. 99-100.
S. japonica - Fig. 101.

Figs. 84-85, 92-94 Stages in ontogeny of a stoma;
note two paracytic stoma with a common subsidiary cell in Fig. 92.
Fig. 95 A paracytic stoma showing arrested development.
Fig. 98 A completely amphicyclic paracytic stoma.

(Figs. 86-88, 96-100 X440; rest X760. Figs. 87-88, 90, 96, 99, 101 from adaxial surface; rest from abaxial one).
PLATE G

Figs. 102-131

*S. japonica* - Figs. 102-103. *S. secundiflora* - Figs. 104-114. *S. tomentosa* - Figs. 115-117, 120. *Thermopsis*

Figs. 118-119, 121-131.

Figs. 102, 108, 112, 115, 120, 124, 131 Epidermal peels.

Figs. 103, 118 Anisocytic stomata.

Fig. 104 A completely amphicyclic paracytic stoma.

Figs. 105, 121-123 Contiguous stomata.

Fig. 106 A stoma with one guard cell.

Figs. 107, 109-111, 113-114, 116, 125-130 Stages in stomatal ontogeny.

Fig. 117 A cyclocytic stoma.

Figs. 119, 131 A paracytic and anomocytic stomata respectively.

(Figs. 104-107, 109-114, 116-117, 125=130 X980; rest X440. Figs. 112, 120, 131 from adaxial surface; rest from abaxial surface).