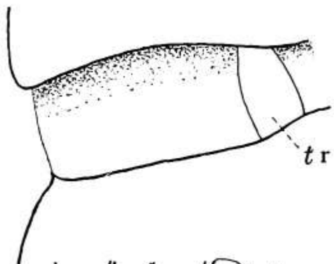
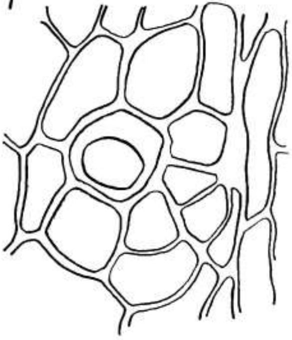
Further, the cylindrical primary pulvinus is covered with the epidermal cells arranged in circular and contain anthocyan in their upper half. The primary pulvinus transfers into the petiole gradually, but on careful examinations it can be seen that their transitional zone will be found inflated a little. The anthocyan is not formed in the epidermis of this zone[1] (Fig. 1 *tr*). On the upper half of the epidermis, many hydathodes are found evenly distributed.

1





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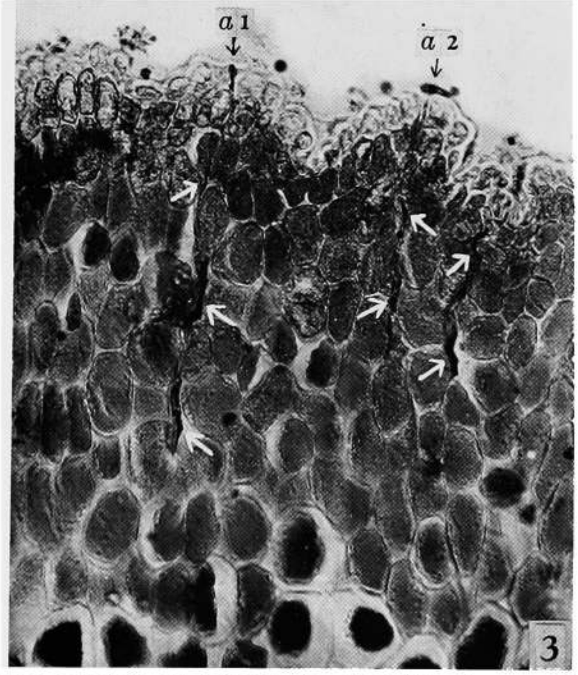

Figs. 1-3. 1. Side view of primary pulvinus of *Mimosa*. *tr*, transitional zone. 2. Surface view of hydathode on the upper half of the primary pulvinus. ×800. 3. Tannin issued into canaliculated intercellular spaces which are in the middle part of the upper side of the motor tissue, tannin being indicated by arrows. *a*1, *a*2, apertures of hydathodes. ×320.

The author has found every aperture of hydathode to be bounded by several guard cells. The vertical view of the structure of these hydathodes on the primary pulvinus is indicated in Figs. 4 to 6. In the fixed material, cells with a considerable amount of cytoplasm at their cell peripheries are seen underlining the epidermis (Fig. 4). In two or three cells especially which are situated just under the aperture of the hydathode, the cytoplasm seems to be dense in the appearance after fixation with Kaiser's solution. These cells may therefore be called 'internal guard cells' (Fig. 4 *ig*). It is noteworthly that the tannin substance from the parenchymatous motor cells is discharged into the canaliculated intercellular spaces (Fig. 3 arrows), which lead to the hydathodes as narrow canalicules (Fig. 3a_1, a_2). As shown in Fig. 3 the

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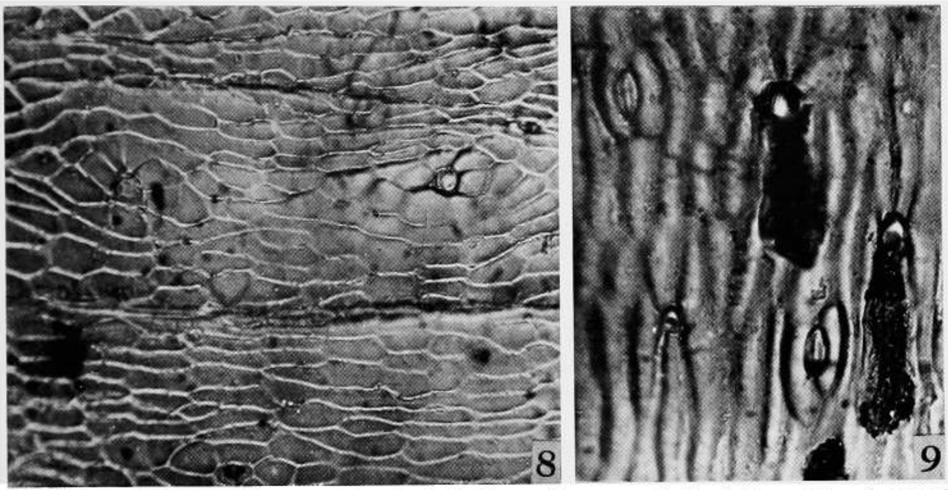
[1] This zone is called 'transitional zone' or '*tr*-zone' in this paper.

b. 'Transitional zone' of the primary pulvinus and the petiole

As mentioned above, the anthocyan is not formed in the epidermis of this 'transitional zone'[1] The hydathodes described in the primary pulvinus are seem also in this zone, their surface view being shown in Fig. 8. Under the epidermis, and just under the hydathodes or adjacent to them, several cells are observed which have a thick cytoplasmic layer at the periphery of the cell. In the fixed material, the cytoplasm of these cells are markedly stained by the toluidin blue. It must be remarked here that the internal guard cells are also found, and that they surround a small cavity as



Figs. 8–9. 8. Surface view of the hydathode on the upper half of 'transitional zone.' ×320. 9. The lower surface of the petiole adjacent to '*tr*-zone.' Tannin substance issuing from the apertures of hydathodes. Two stomatal apparatus are shown. ×320.

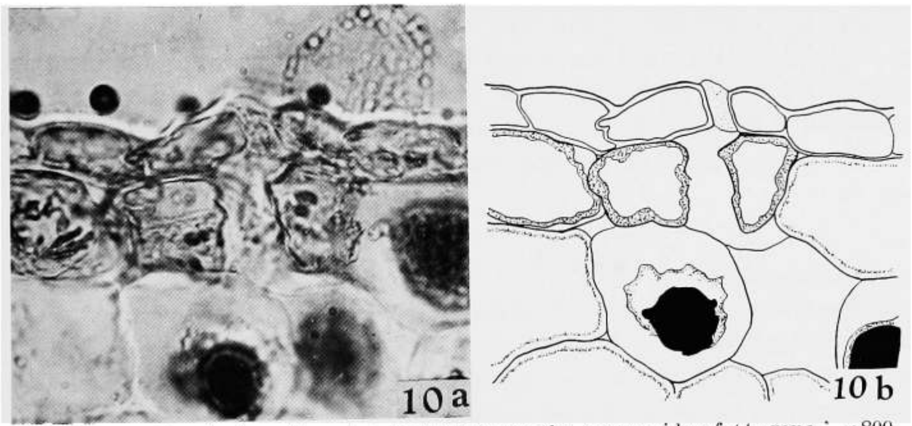


Fig. 10. a. Vertical section of a hydathode on the upper side of '*tr*-zone.' ×800. b. Schematic figure of a.

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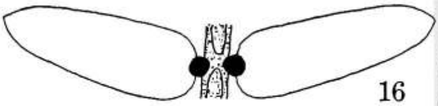
[1] The histological and physiological investigation on this zone shall be reported in another paper in near future.

vinule are shown in Figs. 19 and 20. Directly under these attached cells lack the intercellular air-chamber which is generally present without an exception as the respiratory cavity of the ordinary stomata. These stomata are underlined with cells which have thin cytoplasm at their periphery. By use of the "Sump method" and the ultropaque microscope, these stomata are observed to be in the closed condition irrespective of the closing and the opening of the tertiary pulvinules. It is difficult to tear off the epidermis from the mesophyll, therefore, it is difficult to observe the epidermal system cytophysiologically.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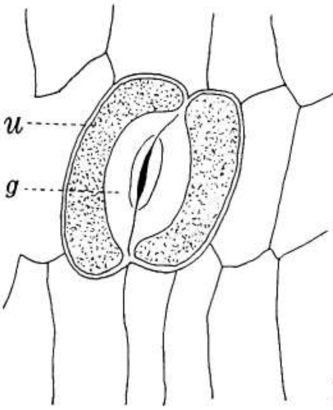

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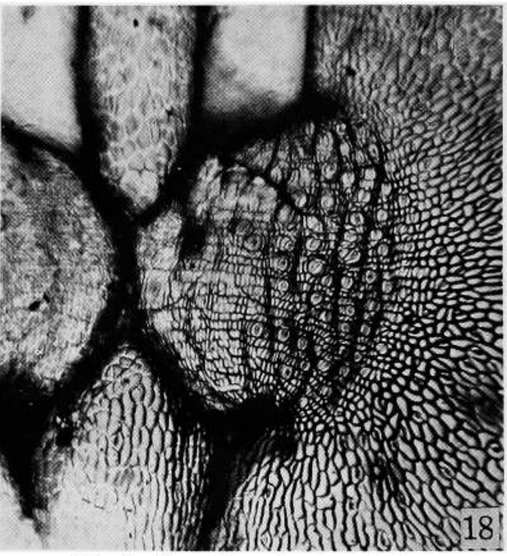
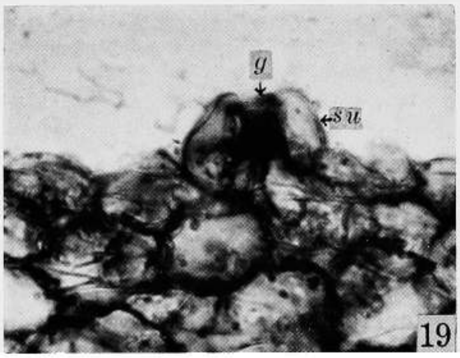
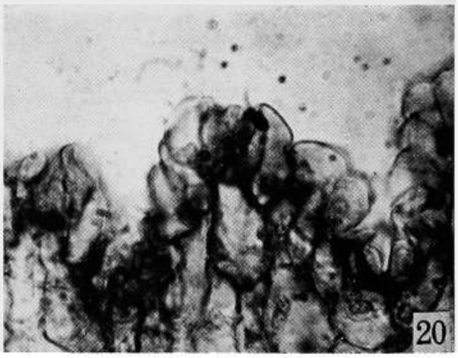


Figs. 16–18. 16. A pair of leaflets of *Mimosa*. 17. Surface view of a stomatal apparatus on the tertiary pulvinule. *su*, subsidiary cell which contains anthocyan; *g*, guard cell. ×800. 18. Surface view of a tertiary pulvinule by the "Sump method." ×80.





Figs. 19–20. 19. Vertical section of a stomatal apparatus on the pulvinule in opened condition. *su*, subsidiary cell; *g*, guard cell. ×800. 20. The same apparatus on the pulvinule in closed condition. ×800.

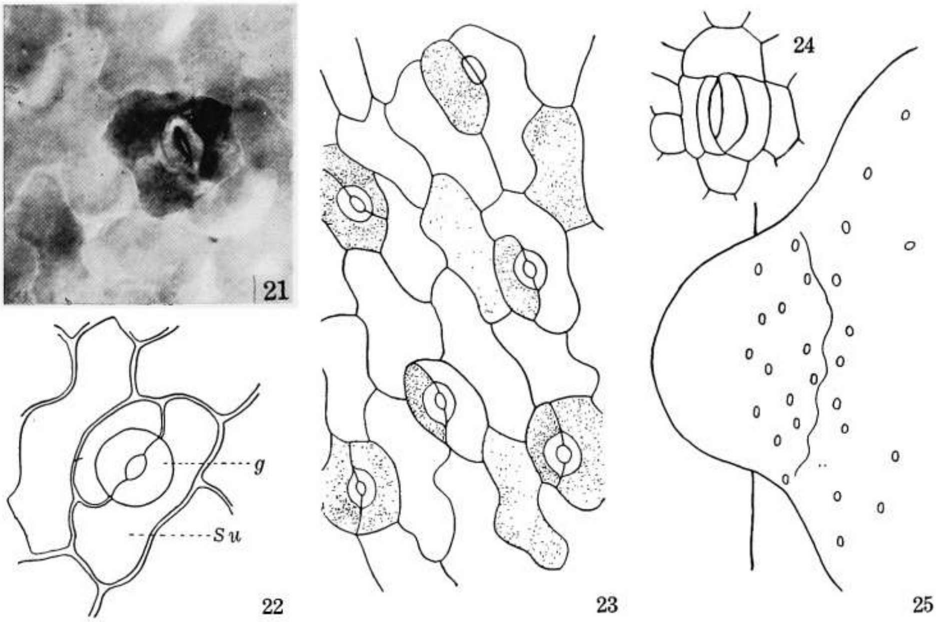
e. The leaflet of *Mimosa*

It is a well-known fact that the leaflets close by seismonastic stimulation

results of the above experiment, it may be said that the osmotic concentration of the contents of the subsidiary cell is equivalent to that of 1 mol KCl solution.

f. The epidermis of the pulvinus of some nyctinastic Leguminous plants

The pinnate leaf of *Cassia mimosoides* and *Albizzia Julibrissin* corresponds to the leaflet of *Mimosa pudica*. These plants do not display the seismonastic movement, but their leaflets close in the nocturnal period.



Figs. 21–25. 21. Surface view of a stomatal apparatus treated with chromic acid. The tannin reaction does not appear in the guard cells. ×480. 22. The opening of a stoma on the leaflet. *g*, guard cell; *su*, subsidiary cell. ×600. 23. The subsidiary cells and some epidermal cells which contain tannin on the leaflet of *Mimosa*. Tannin substance is shown by dots. ×500. 24. Stomatal apparatus of *Cassia Mimosoides*. ×480. 25. Surface view of the pulvinule of *Cassia Mimosoides*. ×100.

In the nocturnal period the leaflets close at the hinge-joints which are called pulvinule. A brief report of the observation on the surface of these pulvinules is indicated below. On the upper surface of the pulvinules of *Cassia mimosoides*, the stomatal apparatus (Fig. 24) are many in number and distributed evenly as shown in Fig. 25. The distribution is dense towards the upper surface of the leaflets. On the lower surface, however, they are not found at all. As for *Albizzia Julibrissin* the distribution and the features of the stomatal apparatus follow almost the same pattern of *Mimosa* and *Cassia mimosoides*. This coincidence engenders some interest from the view-point of comparative morphology.