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THE EPIDERMAL PORE OF OXYMITRA PALEACEA BISCHOFF

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Epidermal pore development in Oxymitra paleacea is similar to pore development of species of liverworts in other families of the Hepaticae, with the exception of the Riociaceae. Pore development is morphologically inseparable from air chamber development.

In taxonomic works, reference is made to the "border" cells as to their number surrounding the pore, and their general character. It has been noted in Hirsh's 1910 study of air chamber formation in various Riccias, that there are two ways in which this comes about: one method is by actual filamentous growth of air chamber walls from a basement of colorless parenchymatous tissue, and the other is by a succession of internal cleavage divisions with separation of these cells schizogenously. The latter method was very apparent in Oxymitra.

Mature Oxymitra plants were selected from material in which the maturation of spores took place in the spring and the fall of the year. The usual histological procedures were followed in the preparation of permanent slides for study. Whole mounts were made of epidermal strippings for study of the mature pore.

Oxymitra paleacea has a pyramidal apical cell that cuts off segments laterally, the derivatives of which give rise to most of the tissues of the thallus. The beginning of air chamber development can be detected by the schizogenous separation of number four and number five epidermal derivatives lining the median groove, which in turn is parallel to the median longitudinal axis of the thallus. The apical cell lies at the bottom of this groove and derivatives contributing to air chamber formation differentiate in a vertical arc from it. The apical cell is usually very dense and evacuolate.

The schizogenous separation of derivatives proceeds toward the interior of the thallus and away from the median groove for a distance of two or three cells before the number four or five epider-

mal derivatives divide unequally. The small cell of this division is the initial cell contributing to the formation of the roof of the air chamber. The number of these initials is determined by the number of derivatives surrounding an intercellular space which widens and becomes the actual stoma of the pore.

Actual air chamber development begins then, by a splitting apart of the cells lining the median groove, and this schizogenous process proceeds with enlargement of surrounding cells, until the air chamber is from 5 to 16 cells in depth.

Air chamber development precedes pore development in Oxymitra. One might consider the development of the roof of the air chamber as a second phase, preceding the third phase of development resulting in the mature pore of the thallus. On the other hand, roof development is incidental to actual pore development, since from the standpoint of developmental morphology, there is actually an opening which is just as functional as the mature pore with its greatly thickened or modified cell walls. All cells of the roof of the air chamber actually contribute to the formation of the mature pore, either directly or indirectly. Another point substantiating this view is the position of the roof cells, consisting of radiating rows arranged in three very definite concentric rings or series of cells surrounding the mature pore.

If none of the initials of this unequal division of the fourth or fifth derivative have a subsequent oblique division, then the mature pore of the thallus will possess only 3 or 4 border cells, but this rarely happens. More often one of the original initials divides into two secondary initials. If all these cells divide obliquely, the mature pore will possess 6 - 8 border cells.

If they differentiate in a direction parallel to the median groove and close to the rim of this groove, enlargement is very slow and there is a very regular division of initials with fewer oblique divisions evident. Hence, pores in this area have fewer cells surrounding the mature pore. Pores found differentiating at a high rate in a wide lateral arc away from the apical cell, were found to have a larger number of border cells surrounding the pore. Therefore, some correlation exists be-

tween the rate of enlargement of the original derivatives from the apical cell and the occurrence of the number of oblique divisions that take place in the subsequent initials contributing to the formation of the air chamber roof. In other words, this process determines the number of radiating rows of cells in the roof of the air chamber and around the mature pore.

The first division of the primary apical cell is an unequal division, which results in the cutting off of the first intercallary cell, a much larger one than its companion cell. The initial functions as an apical cell in the same way that apical cells behave in cellular division of many filamentous algae; that is, once it divides, it is the inner daughter cell, toward the pore opening, that remains capable of further divisions. The second division of this initial gives rise to the second intercallary cell, the outermost one of which never divides again. Between each division an enlargement of the intercallary cells takes place, the rate depending on what direction from the apical cell of the thallus that they are differentiating.

The apical cell of a given row then divides again into daughter cells known as the third intercallary cell and a border cell. The pore now is bound by rows of cells, radiating out in all directions. The first intercallary cell becomes the mature epidermal cell of the mature wall of the air chamber. The second and third intercallary cells and the border cell form the actual roof of the mature air chamber. Very soon after the border cell is cut off, its radial walls become secondarily thickened as well as the portion of the wall next to the stoma.

In the early stages of secondary wall formation in the border cell, seen in cross section, the rim or lip develops at the apical angle of the cell.

Aside from pore development, ventral scale development did not proceed by the splitting of the middle lamella of the marginal cells in the colorless, parenchymatous tissue of the thallus, but they develop from an initial papilla which again behaves much like that of the apical cell of an algal filament.

CONCLUSIONS

1. Air chamber development is closely allied to pore development in Oxymitra paleacea: consideration of one cannot be separated from the other.

2. Air chamber development in O. paleacea is, by internal cleavage and a schizogenous process, similar to the second type, cited by Sealey 1930 in referring to Hirsh's work, 1910.

3. There is some correlation of the number of ultimate border cells around the opening of the mature pore, depending upon the direction of differentiation from the apical cell with the rate of differentiation.

4. Pore development in O. paleacea is not of the simple type found in some species of Riccia, but definitely of a type more similar to pore development in other genera in the Marchantiales.

5. The number of border cells surrounding the mature pore opening falls within the range of 4 to 8, the most constant number being 5 or 6.

6. The beginning of air chamber development, which likewise marks the beginning of pore development, starts at a point removed from the apical cell by 13 to 15 cells. In microna, the actual vertical distance from the apical cell varied from 180 to 220 microns.

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