Proceedings of the Iowa Academy of Science

Volume 2 | Annual Issue Article 28

1894

Structure of the Seed Coats of Polygonaceae

Emma Sirrine

Copyright ©1894 Iowa Academy of Science, Inc.
Follow this and additional works at: https://scholarworks.uni.edu/pias

Recommended Citation
Sirrine, Emma (1894) "Structure of the Seed Coats of Polygonaceae," *Proceedings of the Iowa Academy of Science, 2(1),* 128-135.
Available at: https://scholarworks.uni.edu/pias/vol2/iss1/28

This Research is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

STRUCTURE OF THE SEED COATS OF POLYGONACEÆ.

BY EMMA SIRRINE.

Much work has been done on the structure of the seed coats of different orders of plants. The objects of studying the seed coats of plants microscopically are two-fold. First, to help detect adulterated foods, etc., and in this respect the study has been of very great value. Second, to aid in the distinction and separation of species.

From a systematic standpoint the characters afforded by the structure of the seed coats have been found wanting. In some instances in the order *Polygonaceæ* marked differences in structure are present in some species; in all, however, the same general structure occurs.

Among the European investigators who have studied seed coats in general may be mentioned *H. Godfrin, Harz, Lohde, Schleiden and Vogel, U. Dammer and Moeller. But few Americans have taken up this work. Of these, several papers by L. H. Pammel, and one by P. H. Rolfs, on the structure of seed coats of Malvaceæ, may be mentioned.

L. H. Pammel has shown that in the seed coats of the genus *Euphorbia* some marked differences occur. In *Euphorbia polygonifolia* gelatinous spiricles were found when moistened with water; this also occurs in *Euphorbia Geyeri*, but not in *E. Preslli* and *E. maculata*. In the seed coats of leguminous plants the

*H. Godfrin:—Etude histologique sur les teguments seminaux des angiospermes; Adv. Sc., Vol. 39, 1890, page 328. Harz: Landwirthschaftliche Samenkunde, Berlin, 1885. Lohde: Ueber die Entwickelunggeschichte und der bau einiger Samenchalen, Naumberg, 1874, page 34. Schleiden und Vogel; Ueber das Albumen insbesondere der Leguminoseen. U. Dammer in Engler and Prantl, Pflanzfamillen III Thiel, pages 6-7. Mœller: Mikroskopie der Nahrugs und Geunssmittel aus dem Pflanzenreiche, pages 119-124. Pammel: On the Structure of the Seed-coats of the genus Euphorbia. Transactions St. Louis Academy of Sciences, Vol. XIII, p. Rolfs: On the Structure of the Seed-coats of Malvaceæ, Botanical Gazette, Vol. XII, p. 33. On the Testa of some Leguminous Plants, Bull. Torrey Bot. Club, Vol. XIII, p. 17. Hanausek: Die Nahrungs und Guensmiotel aus dem Pflanzenreiche. Haberlandt: Sitzungsber. d. k. Akad. d W. zu. Wien. Vol. LXXV., 1877, p. 33 separate.

same general structure occurs throughout the order. The malpighian cells are very characteristic. Haberlandt, Hanausek, Pammel and others have shown that in *Phascolus vulgaris* twinned or simple crystals occur in the layer immediately following the malpighian cells. In related species and genera these are not found. Harz does not call attention to crystals in this layer in *Phaseolus multiflorus*; and L. H. Pammel, who has studied American species like *P. lunatus* and *Strophostyles pauciflorus* and *S. angulosa* has not found crystals in the second layer. We may reasonably conclude that for diagonostic purposes this is a valuable character.

Very little attention has been given to a study of the seed coats of the order *Polygonaceæ*. Buckwheat, *Fagopyrum esculentum* and *F. tartaricum*, have been studied for economic reasons by Harz, Weisner, Hanausek, Moeller, while Kraus has studied not only *Fagopyrum*, but *Polygonum* and *Rumex*.

In *Coccoloba*, according to Lindau and Dammer, the seed is provided with two integuments. In one the parenchymatous portion of the seeds becomes much expanded during growth, rifts are found, usually two at each corner; into these the outer integument grows; and the parenchyma rapidly develops.

Harz, in his paper, describes the anatomy of several species of the order *Polygonaceæ*, especially the economic species *Fagopyrum esculentum*, *F. tartaricum* and *F. rotundatum*, giving several excellent figures. Harz also speaks of *Rheum* which has been described by Kraus, but I have not seen this paper. Kraus has also studied a specie of *Rumex* and several species of *Polygonum*. According to this author the outer epidermis of the achenium of *P. Persicaria* consists of long star-shaped, thickened cells. The middle portion agrees with *Rumex crispus*. He states that the glistening appearance of these seeds is due to the thickened cuticle. Tannin is very abundant in the undeveloped fruit; a little is found in the outer epidermis, but it is largely developed immediately underneath; farther in this material diminishes. The fruit of *P. Hydropiper*, *P. aviculare*, *P. dumetorum*, and *P. convolvulus* are structurally alike. The fruit of *P. convolvulus* is not shining and is covered with strong, irregular one and two-rowed cuticular projections. Harz describes seeds of *P. tinctorum*, but he does not figure the species. He states that it resembles *Fagopyrum esculentum*.

In the arrangement of the genera and species Gray's Manual has been followed. The different North American genera of

this family have been studied, but in some cases not all the species. The representatives of the different sub-genera have been studied except in Bistorta which was omitted for want of good material. The palisade portion constitutes the outer part of the achenium; this is followed, in most cases, by the testa, consisting of several layers of cells, varying in some cases however; they are quite regular in form and in some cases are dark in color. In a mature palisade cell the cell-cavity is present. This varies greatly in the different genera, in some cases occupying nearly the entire cell; in others it is small and irregular. The light line does not occur and hence they differ materially from the malpighian cells found in *Malvaceæ*, *Leguminosæ*, etc. Elongated cells of this character, without the light line have been called palisade, but this term is preoccupied by one used for the elongated cells found in the leaf, *i. e.* the so-called palisade parenchyma. I shall therefore use the term "palisade" in quotation marks. For brevity I shall refer to section of fruit and seed coat as achenmium.

Polygonum virginianum, L.

Figure 1, plate vii.

In the specimens of this species the "palisade" cells are long and narrow, with a cell cavity extending the whole length of the cell. The cell is nearly truncate at the ends, but sends out from its sides minute canals. The whole cell is colored light brown, while the cavities are of a deeper color. The "sub-palisade" portion consists of four layers of nearly square cells arranged systematically. The endosperm is composed of large, irregular cells, containing both simple and compound starch grains. Measurements—achenium 165u, "sub-palisade" cells, 132u, "sub-palisade" 33u.

P. convolvulus, L.

Figure 2, plate viii.

In this species the "palisade" cells are long but not as narrow as in *P. Virginianum*, while the cell cavity is also broader, the cavity has some canals as in that species, but in addition to this occur papillate projections. The whole cell is clear and light, while the cell-cavity is light brown. The "sub-palisade" portion consists of four layers of isodiametric cells. The endosperm is made up of long, regular cells of about the same size as *P. Virginianum*. Measurements—achenium, 132u, "palisade" cells, 99u, "sub-palisade," 33u.

P. dumetorum var. *scandens*, Gray.

Figure 3, plate vii.

In this species the "palisade" cells are long with papillate projections, giving the cells an irregular outline. The cell avity is long and narrow, with quite long, slender canals, extending from sides; at the upper end of the cell the cavity divides into two branches which terminate in the end of the cell; the cell and the cell-cavity is light brown in color, the cavity being somewhat darker than the rest of the cell. In the "sub-palisade" portion but two layers of cells occur. The endosperm is composed of cells much broader than those of *P. Virginianum* and are quite irregular in form. Measurements—achenium 142u; "palisade" cells, 122.1u; "sub-palisade," 13.2u; papillate projection, 9.9u.

P. Hydropiper, L.

Figure 1, plate ix.

In specimens of *P. Hydropiper* the "palisade" cells are long and narrow, very irregular and truncate at ends. The cell-cavity is very narrow and extends the whole length of the cell. The cavity has minute canals which extend out from sides: the cavity also truncate at ends. The cell is colored light brown while the cavity is deeper in color. The "palisade" cells resemble very much those of *P. Virginianum*. The "sub-palisade," however, are much smaller with more numerous indistinct layers, there being at least six layers well defined. The endosperm cells also are small and quite irregular. Measurements—achenium, 132u; "palisade" cells, 92.4u; "sub-palisade," 39.6u.

P. erectum, L.

Figure 5, plate vii.

In this species the "palisade" cells are much broader than in any other Polygonum studied. The cells have irregular papillate projections as in *P. dumetorum* var. *scandens*. The cell-cavity is narrow with long canals extending from it; the cavity branches are forked. In *P. erectum* the whole cell is of a light brown color, while the cavity is colorless. The "sub-palisade" portion consists of two layers of isodiametric cells. The endosperm has long, narrow, regular cells. Measurements—achenium, 82.5u, "palisade," cells, 60u; "sub-palisade," 22.5u; papillate projection, 3.3u.

P. Persicaria, L.

Figure 6, plate viii.

In this species the "palisade" cells are long, narrow and truncate. The cell cavity extends the whole length of the cell; at the

upper end, branched. All along sides of the canal are minute projections which sub-divide, forming three or more branching canals. The "sub-palisade" portion consists of four layers of small, round cells, with a small chain-like layer also between "sub-palisade" and endosperm. Endosperm consists of large, irregular cells. Measurements—achenium, 128.6u; "palisade" cells, 108.9u; "sub-palisade," 29.7u.

Eriogonum sp?

Figure 7, plate ix.

In *Eriogonum* the "palisade" cells are narrow and not very long; rectangular in shape, and regularly arranged; the cell-cavity is situated at the lower end of the "palisade" cells, and extends only half its length; the cavity is broad at the base, filling the whole width of the cell, but tapers to a point at the upper end. The cell is light colored, while the cell-cavity is of a deep brown color. The "sub-palisade" consists of two layers of cells, slightly oval in shape, and regularly arranged. The endosperm consists of large cells, nearly as broad as long.

Polygonella gracilis, Meisner.

Figure 8, plate ix.

In this species the "palisade" cells are nearly square, being only a trifle longer than broad. The cell-cavity runs nearly the whole length of "palisade cell", is quite broad and ends in forked canals, which run nearly to the end of cell. The cell walls are light in color, while cavity is somewhat darker. The "sub-palisade" portion consists of round, slightly elongated cells, which are quite small. The endosperm consists of cells a trifle larger than broad and arranged somewhat irregularly. Measurements—achenium, 59.4u; "palisade," 33u; "sub-palisade," 26.4u.

Brunnichia cirrhosa, Banks.

Figure 9, plate viii.

In the specimens of *Brunnichia cirrhosa* very long, broad "palisade" cells occur. The cell-cavity is large and nearly square. A delicate layer of cells occurs between "palisade" and "sub-palisade" layers, beaded in appearance. The "sub-palisade" cells are nearly square and are regularly arranged. The endosperm cells are large rectangular, irregularly placed. Measurements—achenium, 141.9u; "palisade" cells, 99.u; "sub-palisade," 42.9u.

Rumex crispus, L.

Figure 10, plate vii.

In this species the "palisade" cells are broader than in the *Polygonum* but not so long. The cell-cavity is short, only extending a short distance into cell. It is quite regular in form with no branching canals. The cell is light, while the cavity is slightly brownish. The "sub-palisade" cells are irregular in shape, being slightly oval and consisting of three layers. The endosperm is made up of large irregular cells about as broad as long. Measurements—achenium 92.4u, "palisade" cells 36.3u, "sub-palisade" portion 23.1u.

Rumex verticillatus, L.

Figure 11, plate viii.

In this species the "palisade cells" are narrower and longer than in *R. crispus*. The cell-cavity extends the whole length of the cell, differing in this from *R. crispus*, but has no projecting canals. The cell is light colored while the cavity is brown. The "sub-palisade" cells are regular in form and position. The endosperm is made up of irregular cells. Measurements—achenium 92.4u, "palisade" cells 59.4u, "sub-palisade" portion 33u.

Rumex acetosa, L.

Figure 12, plate viii.

This species has very small "palisade cells," rectangular in shape and with a small cell-cavity which occupies only a small portion of the lower end of the "palisade" cell. There are no canals or irregularities of the cell cavity. The cell is light in color while the canal is darker. The "sub-palisade" portion is composed of small round cells variable in number. The endosperm is composed of cells irregularly arranged. Measurements—whole achenium 36.3u, "palisade cells" 23u, "sub-palisade" cells 13.2u.

Oxyria digyna, Hill.

Figure 13, plate ix.

In this species the "palisade" cells are much reduced, consisting of medium sized rectangular cells, with the cavity situated in center of cell and occupying the same for two-thirds of the distance. The cell-cavity is darker than the rest of the cell. The "sub-palisade" portion consists of two layers of rectangular cells, while the endosperm consists of long, regularly arranged cells. Measurements—whole achenium 66u, "palsade" cells 39.6u, "sub-palisade" 26.4u.

Fagopyrum esculentum, Moench.

Figure 14, plate. ix

In this species "palisade" cells appear different in the angles of the seeds than on sides. In the angles the "palisade" cells are much reduced, being nearly round, with a small, round cell-cavity. but in the angles of achenium, the "palisade" cells become longer and the cell-cavity also elongates. The cell is light colored and cavity brown. In the "sub-palisade" portion five layers of cells are present. First—a large square layer occurs; immediately beneath this is a small chain-like layer of cells, and lastly occurs a layer resembling very much the first. The endosperm consists of long regular cells. Measurements—whole achenium 1.65u, "palisade" cells 99u, "sub-palisade" cells 66u.

CONCLUSIONS.

In general the structure of the testa offer few characters that are of sufficient importance to distinguish species, as the related species have similar structures. The genus *Polygonum* is easily distinguished from *Rumex*, by its papillate projections which occur on the surface of the achenium. In *Polygonella gracilis* these papillate projections likewise occur. The small canals radiating from cell-cavity in palisade like cells of the genus *Polygonum* are too variable and not constant enough to be of service in the separation of species. However, studies of this kind are of service and value in botanical work simply as a knowledge of plants as a whole.

DESCRIPTION OF PLATES.

Figure 1.—*Polygonum virginianum; a*, palisade cells; *b*, sub-palisade cells; *c*, endosperm; *b*, embryo. (Plate vii.)

Figure 2.—*P. convolvulus; a*, palisade cells; *b*, sub-palisade; *c*, endosperm. (Plate viii.)

Figure 3.—*Polygonum dumentorum*; *a*, palisade cells; *b*, sub-palisade; *c*, endosperm; *b*, embryo. (Plate vii.)

Figure 4.—*Polygonum Hydropiper; a*, palisade cells; *b*, *c*, sub-palisade layers; *d*, endosperm; *b*, embryo. (Plate ix.)

Figure 5.—*P. erectum; a*, palisade cells; *b*, sub-palisade: *c*, endosperm; *b*, embryo. (Plate vii.)

Figure 6.—*P. Persicana; a*, palisade cells: *b*, sub-palisade layer; *c*, endosperm; *b*, embryo. (Plate viii.)

Figure 7.—*Erigonum; a*, palisade cells; *b*, sub-palisade; *c*, endosperm.

Figure 8.—*Polygonella gracilis; a*, palisade cells; *b*, sub-palisade: *c*, enodsperm; *b*, embryo. (Plate ix.)

Figure 9.—*Brunnichia cirrhosa; a*, palisade cells; *b*, sub-palisade; *c*, endosperm; *b*, embryo. (Plate viii.)

Figure 10.—*Rumex Crispus; a*, palisade cells; *b*, sub-palisade; *c*, endosperm; *b*, embryo. (Plate vii.)

Figure 11.—*Rumex virticillatus; a*, palisade cells; *b*, sub-palisade; *c*, endosperm; *b*, embryo. (Plate viii.)

Figure 12.—*Rumex acetosa; a*, palisade cells; *b*, sub-palisade; *c*, endosperm; *b*, embryo. (Plate viii.)

Figure 13.—*Oxyria digyna; a*, palisade cells; *b*, below this the sub-palisade; *c*, endosperm; *b*, embryo. (Plate ix.)

Figure 14.—*Fogopyrum esculentum; a*, cross section of *b*, palisade portion; *c*, sub-palisade above and endosperm below. (Plate ix.)

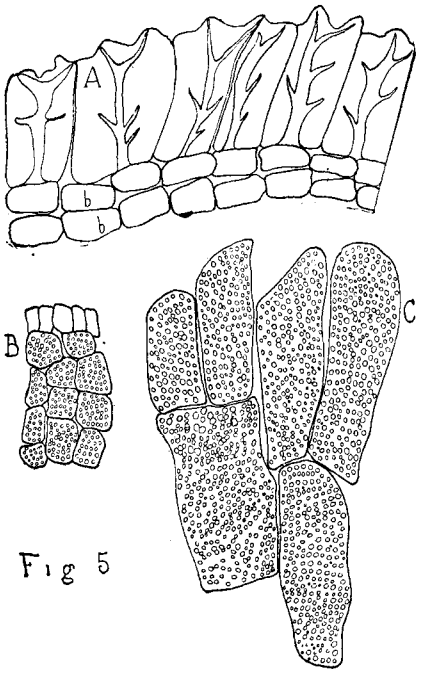


Fig 5

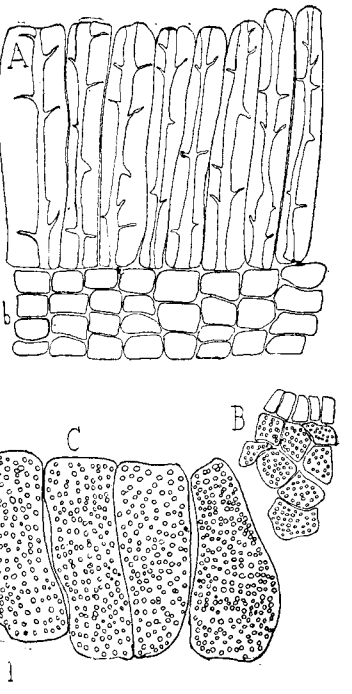


Fig 1

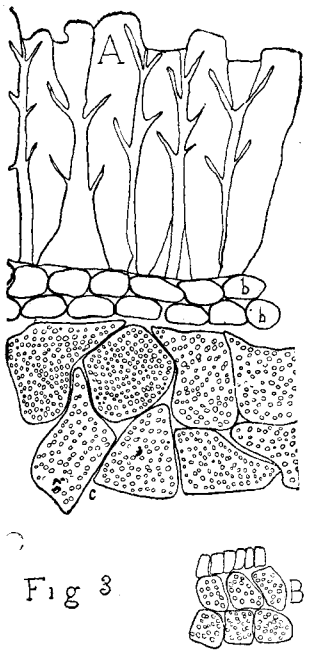


Fig 3

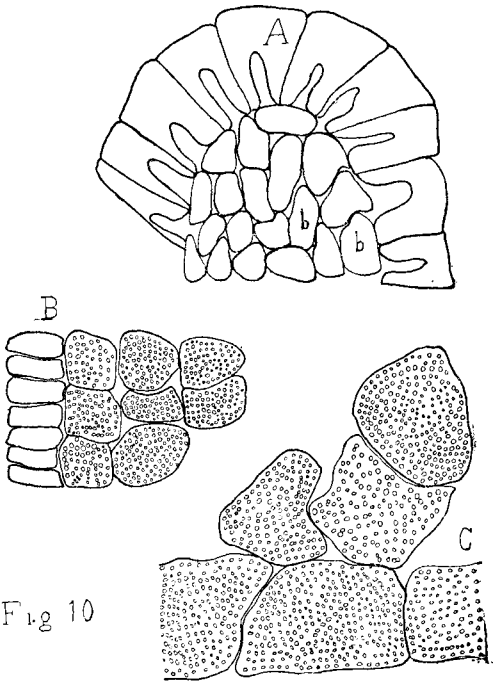


Fig 10

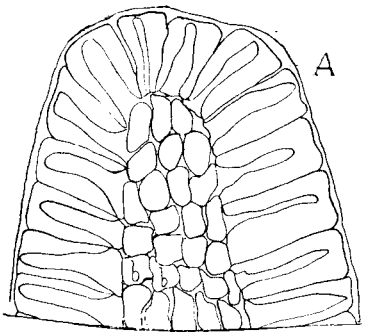


Fig. 11

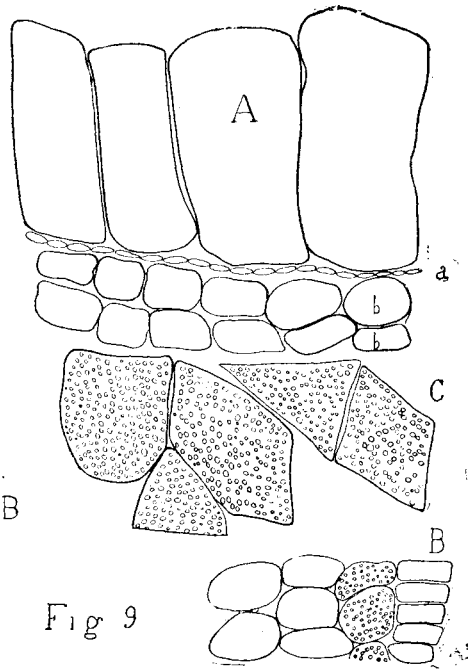
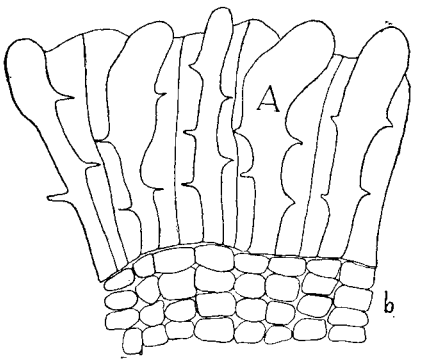
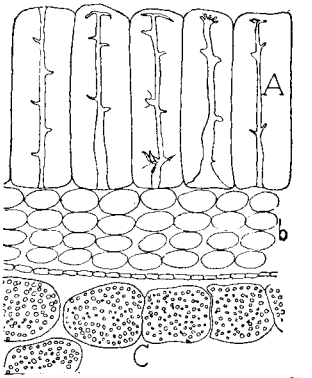


Fig 9





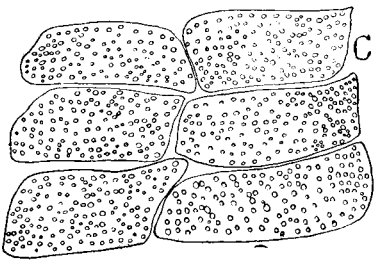


Fig. 2

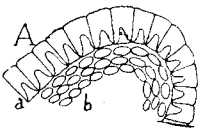


Fig 6

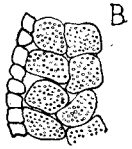


Fig 12

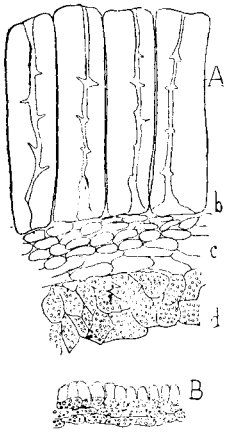


Fig 4

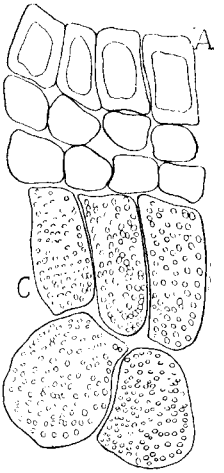
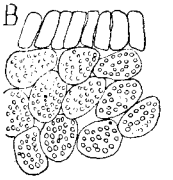


Fig 13



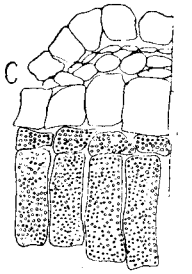
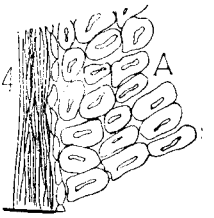
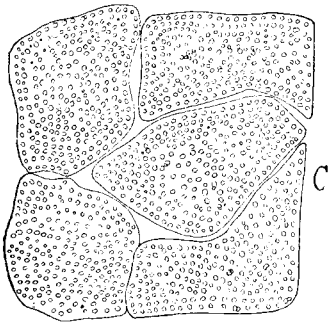
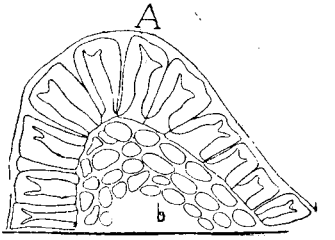
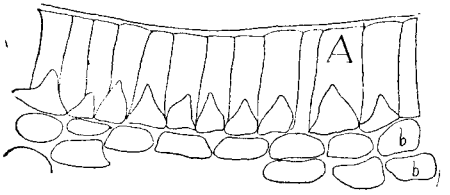


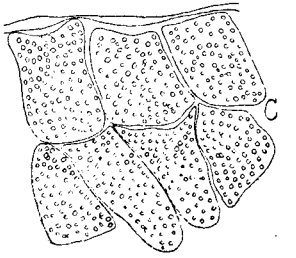
Fig 14











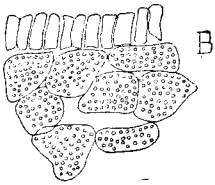


Fig 7

Fig 8