

STRUCTURE OF LEAF AND STEM OF LOPHANTHUS ANISATUS

by

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## INTRODUCTION.

*Lophanthus Anisatus* is included among the many American plants of the structure of which we know very little or nothing. While many plants belonging to the family of which this is a member have been studied in detail and extensively used as medicines, this one does not rank as a medicinal plant. It is known to contain anisol, which fact alone is sufficient to make it of interest to the pharmacist and chemist. Although it has never been used as a source of anisol, it may be possible that by further study and cultivation it may be useful as a source of this compound. Further, the plant possesses an interest of a purely scientific nature, since from a careful examination of the available literature it appears that nothing is known of its structure. The material used for study was obtained from Douglas County, Wisconsin, and was preserved in alcohol.

## GENERAL DESCRIPTION.

*Lophanthus Anisatus* is a member of the natural order Labiatae and grows on the prairies and plains of Minnesota and Northwest Territory, south to Illinois and Nebraska, and blossoms in the months of July, August, and September.

It has a tall, slender, leafy stem with very few branches, and frequently attains a height of six feet. The leaves (Fig.I.) which are 2-1/2 inches long, are ovate, firm and short-petioled, having an acuminate apex, and a subcordate base, with a sharply serrate margin. The upper surface of the leaf is dark green while the lower one is glaucous white. The flowers grow in dense terminal and axillary spikes. The bracts are broadly ovate with an abrupt acuminate apex and have the same color as the leaf. The flowers are blue and have a bilabiate corolla and four stamens. The calyx is tubular-bell-shaped and five toothed, the upper teeth longer than the others.

## ANATOMY.

The Leaf. The mid-rib and its branches are very prominent on the lower side of the leaf. They contain complex fibro-vascular bundles, which have no cambium, and are like the bundles of the petiole, which will be described later. The epidermis of the leaf (Fig.II.) is composed of one layer of cells ranging from 20 to 60  $\mu$  in diameter. The cells of the upper epidermis (Fig.II.) are from 30 to 60  $\mu$  in diameter and have straight cell-walls of 2.5  $\mu$  thickness. The cuticle of the epidermis is about 15  $\mu$  in thickness. The walls of the lower epidermis (Fig.III.) are only three fourths as thick as those of the upper, and they are wavy, thus forming cells of various shapes and sizes, from 15 to 40  $\mu$ , which have many trichomes and stomata. The trichomes of the lower epidermis are of different kinds, each cell having one conical two-celled branchless trichome, from 75 to 90  $\mu$  long, (Fig. V.,a), and 6 to 12  $\mu$  in diameter at the base. The others are of the glandular type and are not as numerous as the conical ones. They are either sunken below the surface of the epidermis, and having their cells covered by a secretory bladder, (Fig.V.,b), or they are above the epidermis,

composed of a 1-celled head, about 25  $\mu$  in diameter and a 1-celled neck 15  $\mu$  in diameter and length, (Fig.V., c). The trichomes of the upper epidermis are conical and not as long as those of the lower. The stomata are raised above the epidermis and are from 12 to 15  $\mu$  long and 10 to 12  $\mu$  wide. The guard cells are very regular in shape and size and contain starch. The subsidiary cells are not of any regular form or size.

The mesophyll (Fig.IV.) is composed of one row of palisade cells, all having a length of about 90  $\mu$  and a width from 25 to 35  $\mu$ , and the spongy tissue, whose cells have a roundish form, from 40 to 60  $\mu$  in diameter. These cells have large, intercellular cavities and, like the palisade tissue, have very thin cell-walls, of only 1  $\mu$  thickness. Chlorophyll almost completely fills the cells of the mesophyll, and is of a regular, egg-shaped granules, about 2  $\mu$  wide and 3  $\mu$  long.

Petiole. The epidermis of the petiole consists of a single layer of more or less regular cells lying parallel and having a width of from 12 to 17  $\mu$  (Fig.VIII.). The length of these cells varies from 35 to 90  $\mu$ . The cuticle is very much shriveled, thereby giving the petiole

a rough appearance. The cell walls of the epidermis, (Fig.VIII.,b), are only 2 to 3  $\mu$  thick between the cells, while the outer wall is as thick as 6  $\mu$ . The nuclei are very plainly visible and are about 8  $\mu$  in diameter. Some of the cells contain a few granules of chlorophyll.

The sclerenchyma tissue (Fig.VIII.,a) has cell walls from 3 to 14  $\mu$  thick, with cells from 10 to 25  $\mu$  in diameter. The corners of the petiole (Fig.VII.) are completely made up of this tissue, while at the dorsal and ventral sides it is only about three rows wide (Fig.VIII.,a). The cells of the parenchyma tissue (Fig.IX.) vary greatly, the smallest having a diameter of 15  $\mu$ , while the largest are as wide as 50  $\mu$ , with cell walls of 3.5  $\mu$  in thickness. In a cross-section of the lower half of the petiole we find four bundles, (Fig.VII.), one at each corner, and two crescent-shaped ones in the center. The vessels (Figs.XII. and XIII.) of these bundles are very numerous, lying so close as to form almost a compact mass of this tissue. They have a diameter from 6 to 20  $\mu$ , with cell walls 3  $\mu$  thick. The xylem parenchyma, lying between and around the vessels, is not lignified. The phloem region encloses the vessel and the xylem, (Fig.

XIII.). The cells of the xylem and phloem are from 3 to 8  $\mu$  in diameter. The secondary thickening of the petiole is spiral and annular, (Fig.XI.).

The Stem. The stem of this plant exhibits the general characteristics of the Labiatae. The epidermis (Figs.XVI. and XIX.) is very similar to that found on the petiole, the cells having the same width and about the same length. Stomata were found in the epidermis which, unlike those of the leaf, were not raised, but on the same level with the surrounding cells. The shape of these varied. Some were almost circular, while others were oval. The cells around the stomata were not all of the same shape nor were all the stomata lying in the same direction. The trichomes of the stem are like those of the leaf, but only a few were found. The cytoplasm with the nucleus and a few chlorophyll bodies were readily seen. The bundles of the stem are at the corners and also between them, connected by the cambium running around the stem, (Fig. XIV.). The cambium connects all the bundles of the stem and its cell walls are lignified and about 3  $\mu$  thick. The cells are from 4 to 7  $\mu$  wide, and from 10 to 15  $\mu$  long. This cambium has a width of 5 to 8 rows of cells, inside

of which the pith is found. The cells of the pith are all large, ranging from 15 to 75  $\mu$  in diameter, with cell walls 2.5  $\mu$  thick. The vessels of the bundles are not as numerous as they were in the petiole, but they are of the same size, (Fig.XV.). The xylem is composed of cells from 3 to 6  $\mu$  in diameter, with cell walls which are lignified and are 4  $\mu$  thick. The phloem is surrounded on the outer side by 2 to 4 rows of strongly lignified fibres the walls of which are about 5 to 6  $\mu$  thick, (Fig.XV.). Between this tissue and the sclerenchyma tissue there are 3 to 4 layers of parenchyma cells. The walls of the sclerenchyma tissue are greatly thickened, some being as thick as 15  $\mu$ , having a cavity of 10  $\mu$ , (Fig.XVIII.). This tissue occupies all the space between the parenchyma tissue and the epidermis, and is from 3 to 12 cells wide.

# EXPLANATION OF PLATES.

## Leaf.

- |      |  |                |
|------|--|----------------|
| I.   | Leaf of <i>Lophanthus Anisatus</i> ,   | (2 diameters). |
| II.  | Face view of upper epidermis,  | (450 " ).      |
| III. | Face view of lower epidermis, showing<br>trichomes and stomata,                            | ( " " ).       |
| IV.  | Cross section of leaf, showing epider-<br>mal cells and mesophyll,                         | ( " " ).       |
| V.   | Trichomes of lower epidermis,<br>(a) Conical trichome.<br>(b) and (c) Glandular trichomes. | ( " " ).       |
| VI.  | Stomata,<br>(a) Cross section.<br>(b) Longitudinal section.<br>(c) Face view.              | ( " " ).       |

## Petiole.

- |       |  |           |
|-------|--|-----------|
| VII.  | Cross section of petiole,  | ( 55 " ). |
| VIII. | Cross section of epidermal cells from<br>the inside,             | (265 " ). |
| IX.   | Parenchyma tissue,   | (450 " ). |
| X.    | Longitudinal section of petiole,                                 | ( 96 " ). |
| XI.   | Longitudinal section of bundle, showing<br>secondary thickening, | (450 " ). |
| XII.  | Cross section of bundle from center,                             | (265 " ). |
| XIII. | Cross section of bundle from ends,                               | ( " " ).  |

Stem.

- XIV. Cross section of young stem, ( 55 diameters).  
XV. Cross section from corner of stem ( 96 " ).  
XVI. Cross section of epidermal scler-  
enchyma cells, (450 " ).  
XVII. Sclerenchyma tissue from corner, ( " " ).  
XVIII. Section through lignified scler-  
enchyma tissue outside of phloem, ( " " ).  
XIX. Longitudinal view of stem, showing  
stomata, ( " " ).

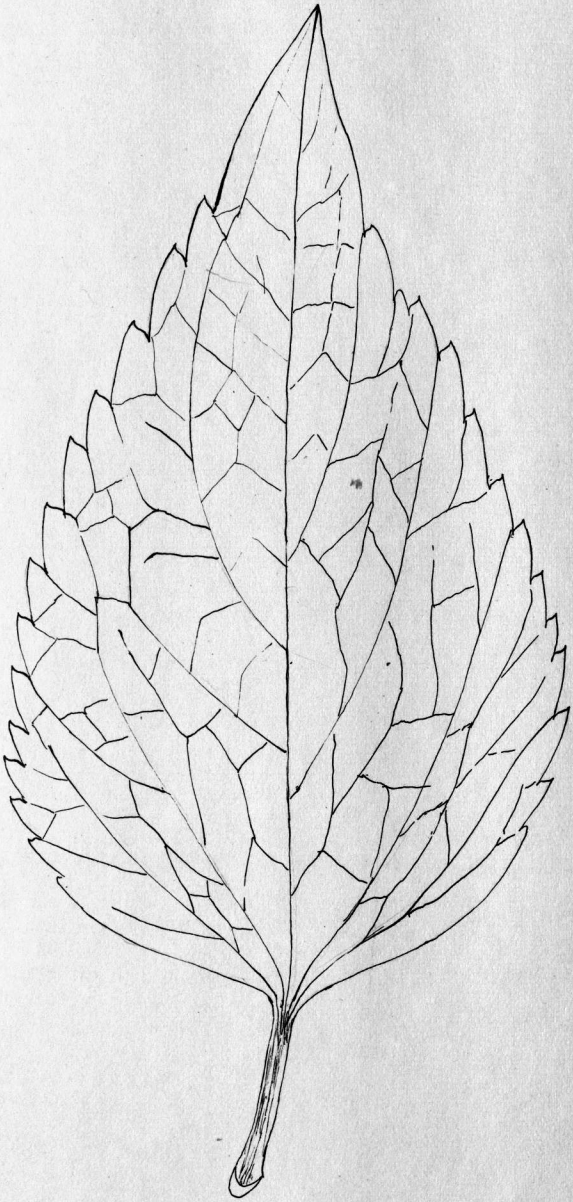


Plate I.

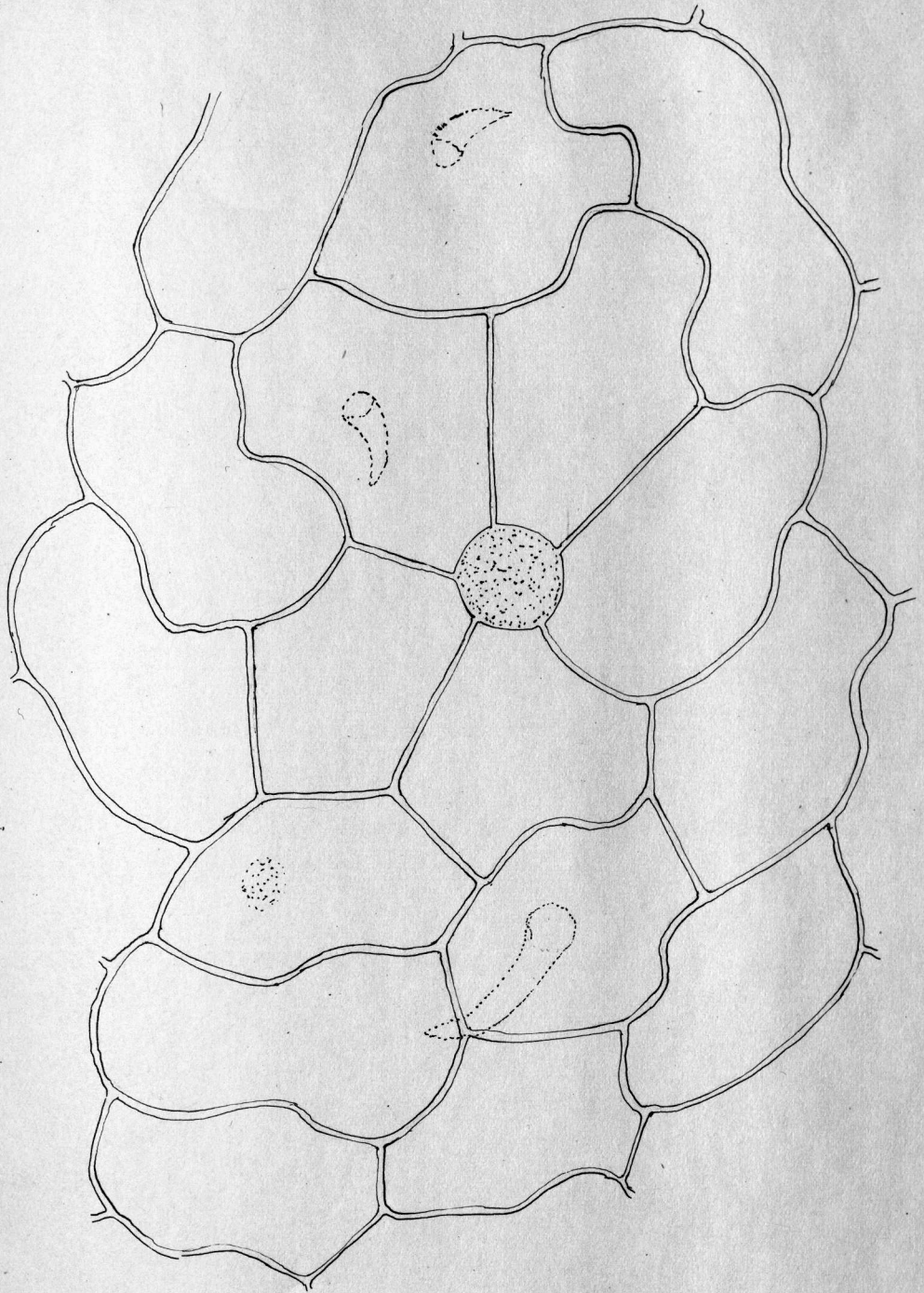


Plate II.

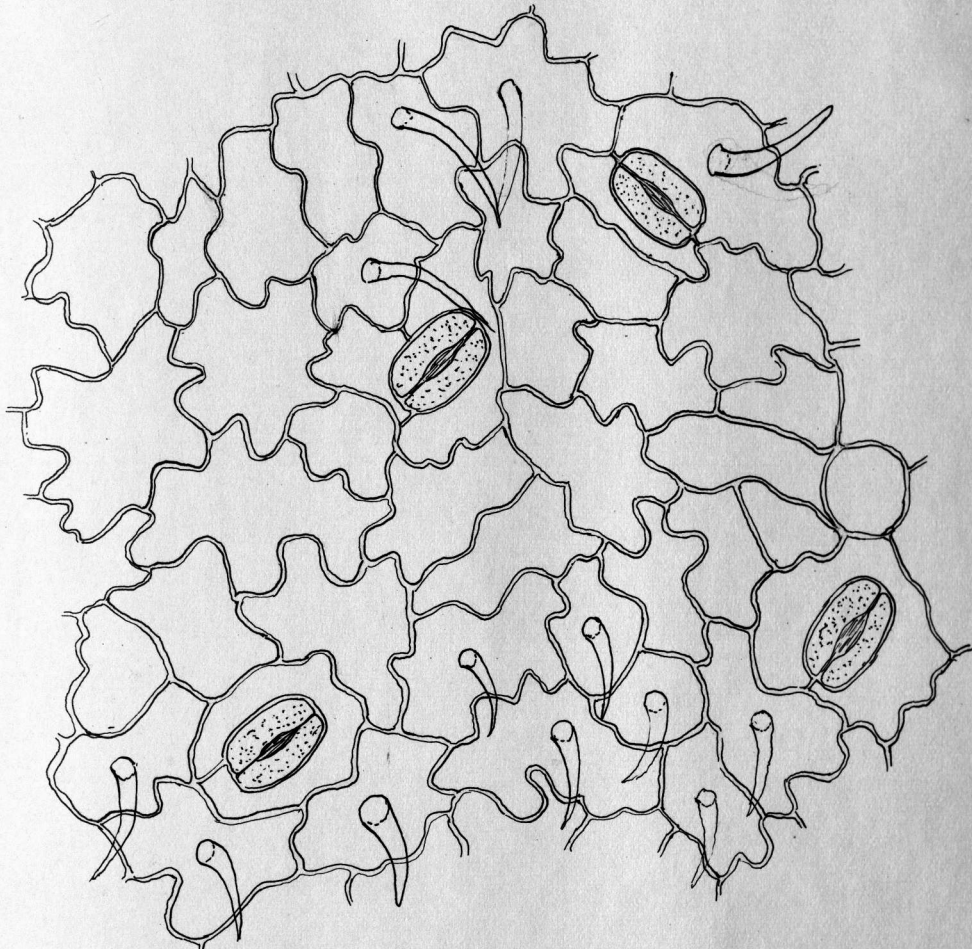


Plate III.

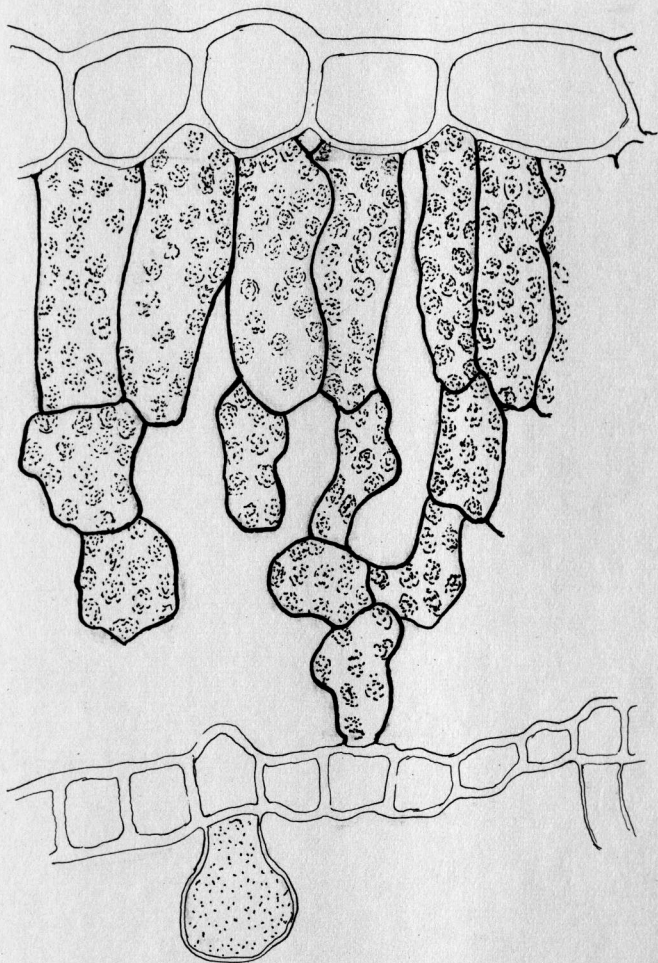


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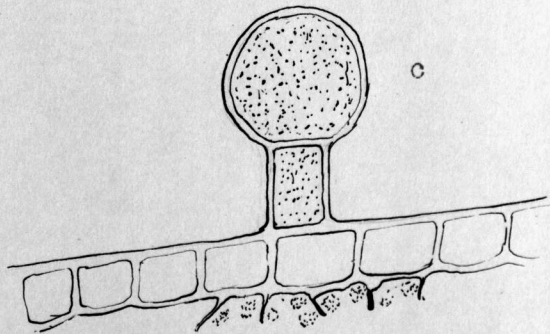
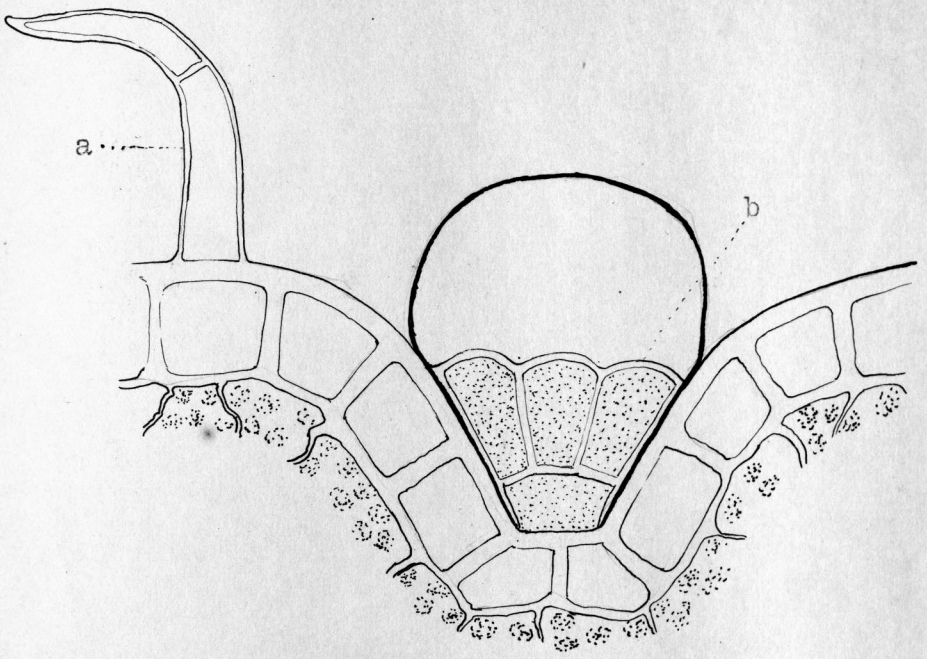


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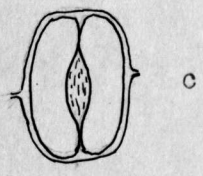
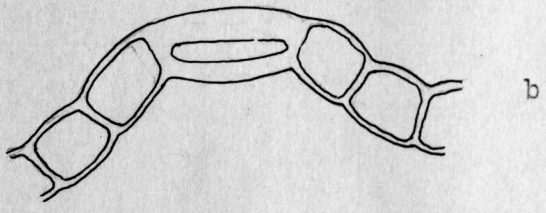
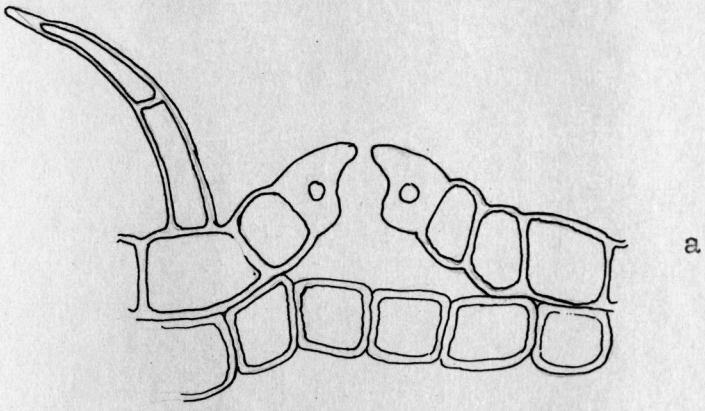


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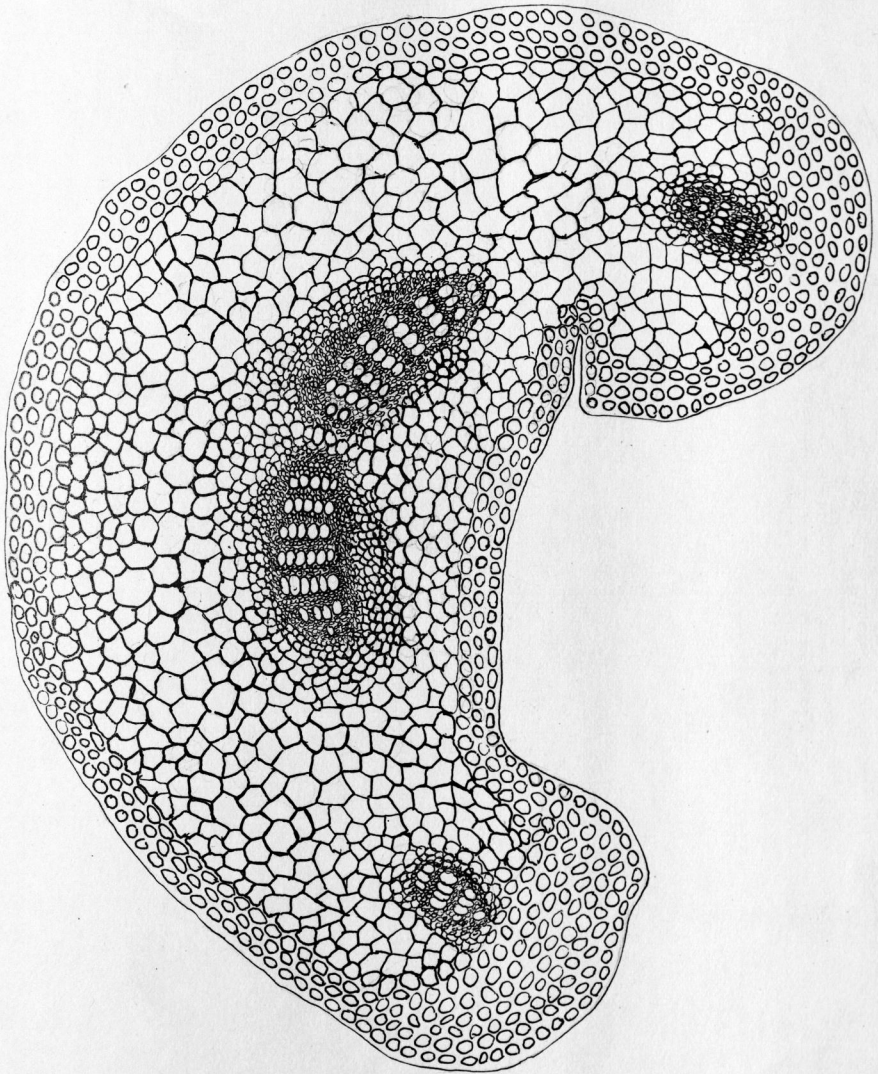
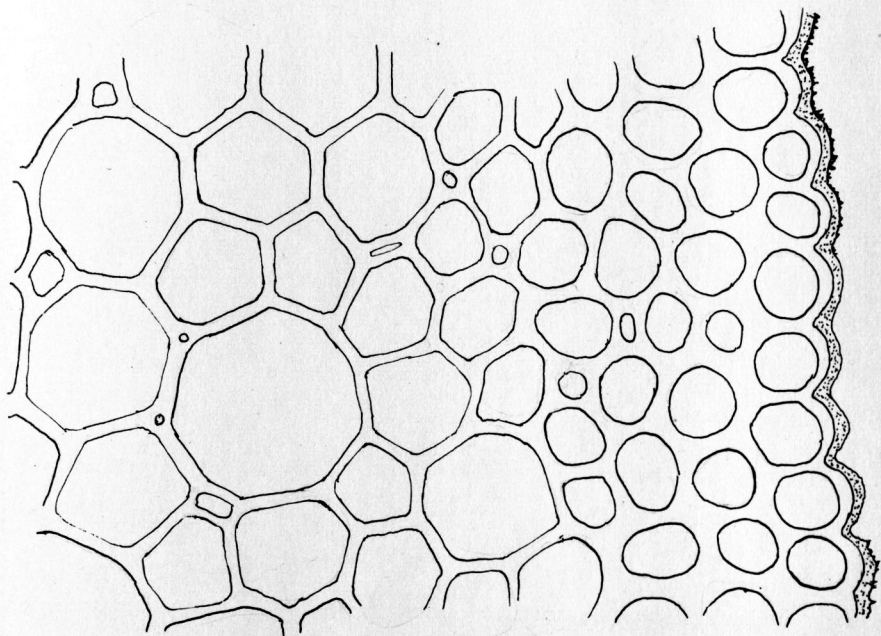


Plate VII.



a



b

Plate VIII.

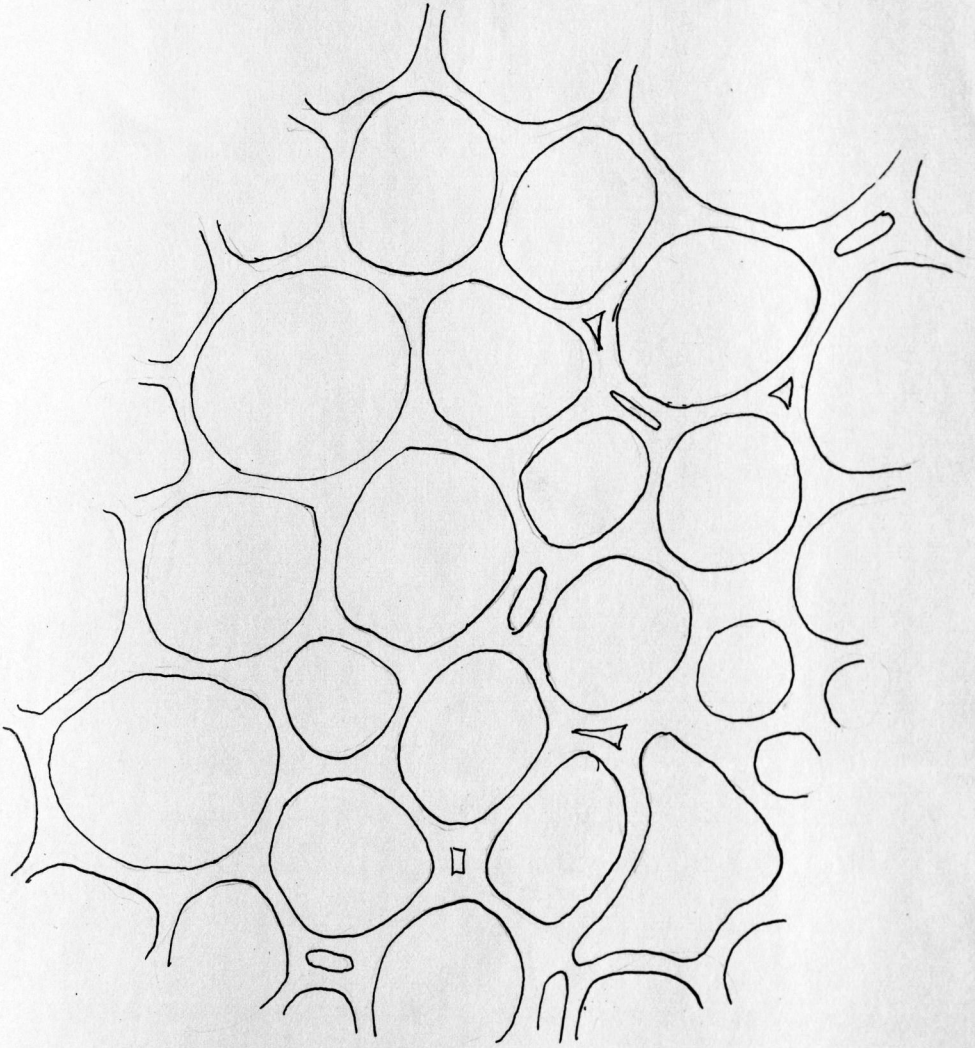


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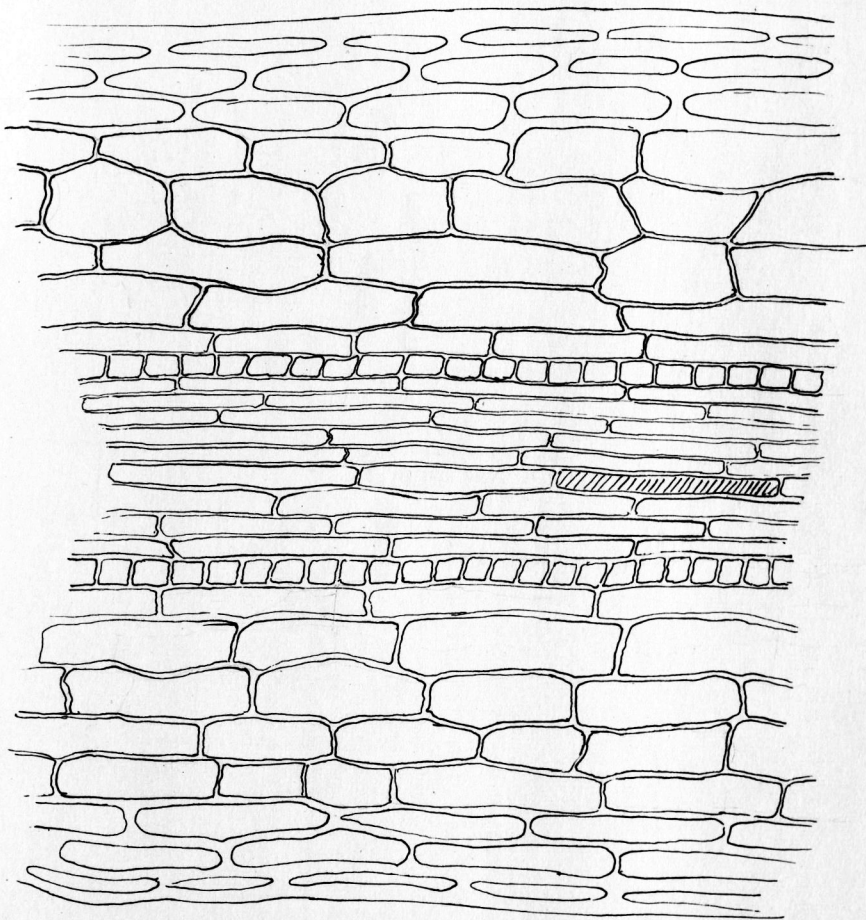


Plate X.

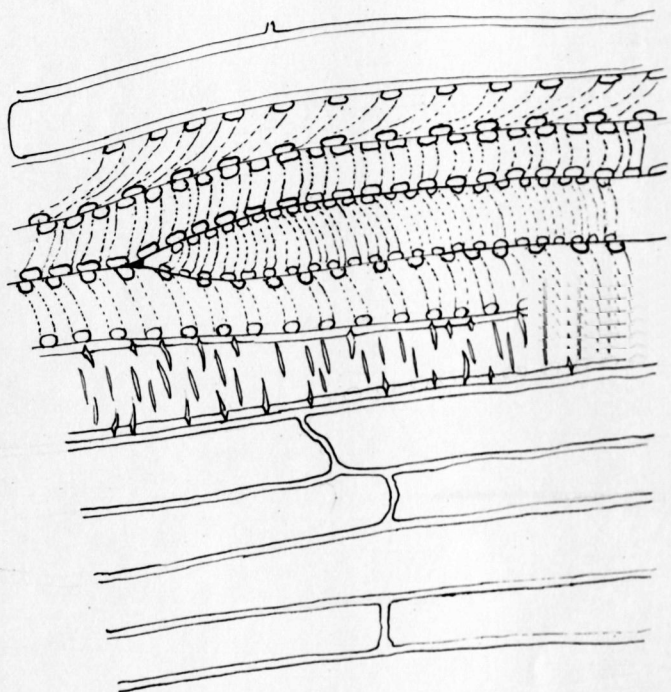


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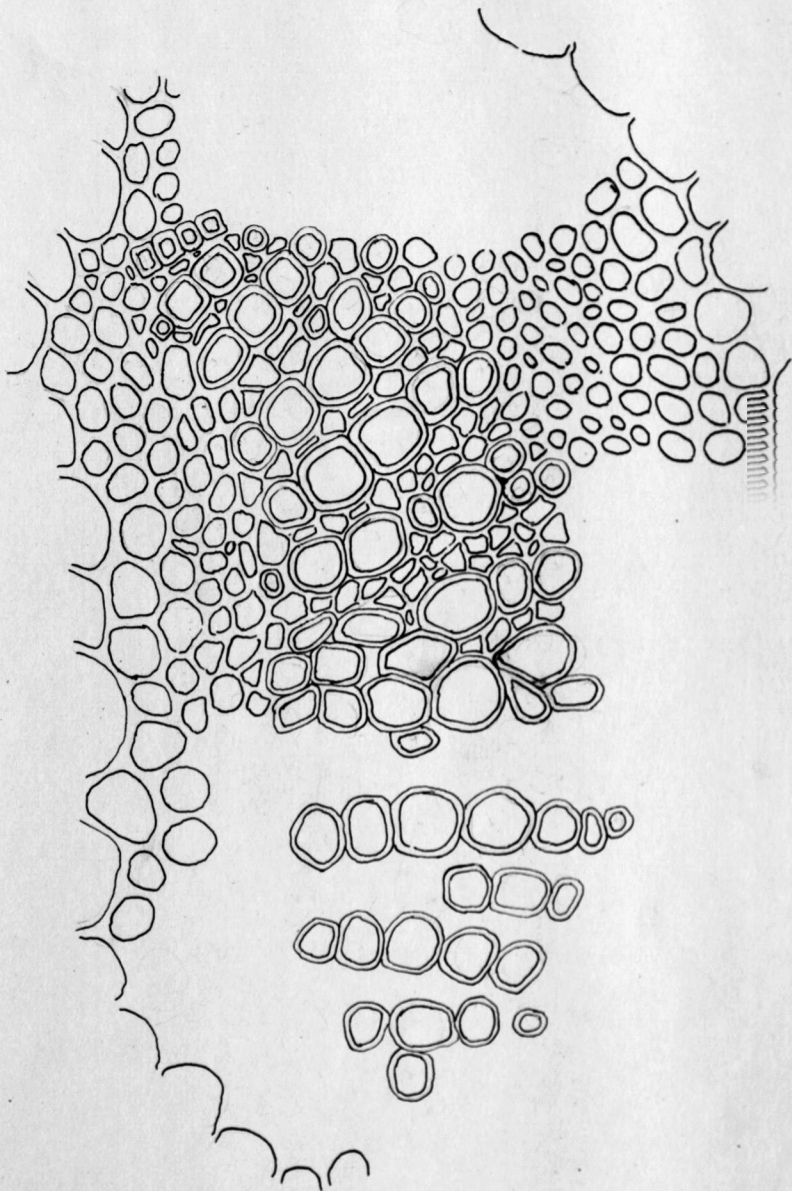


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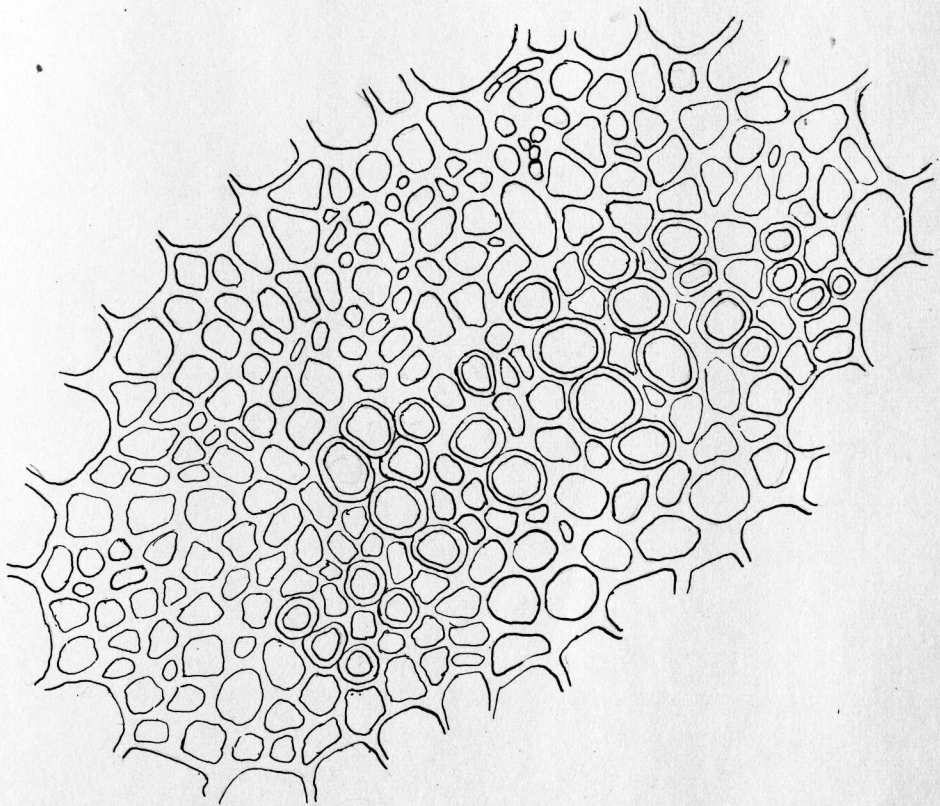


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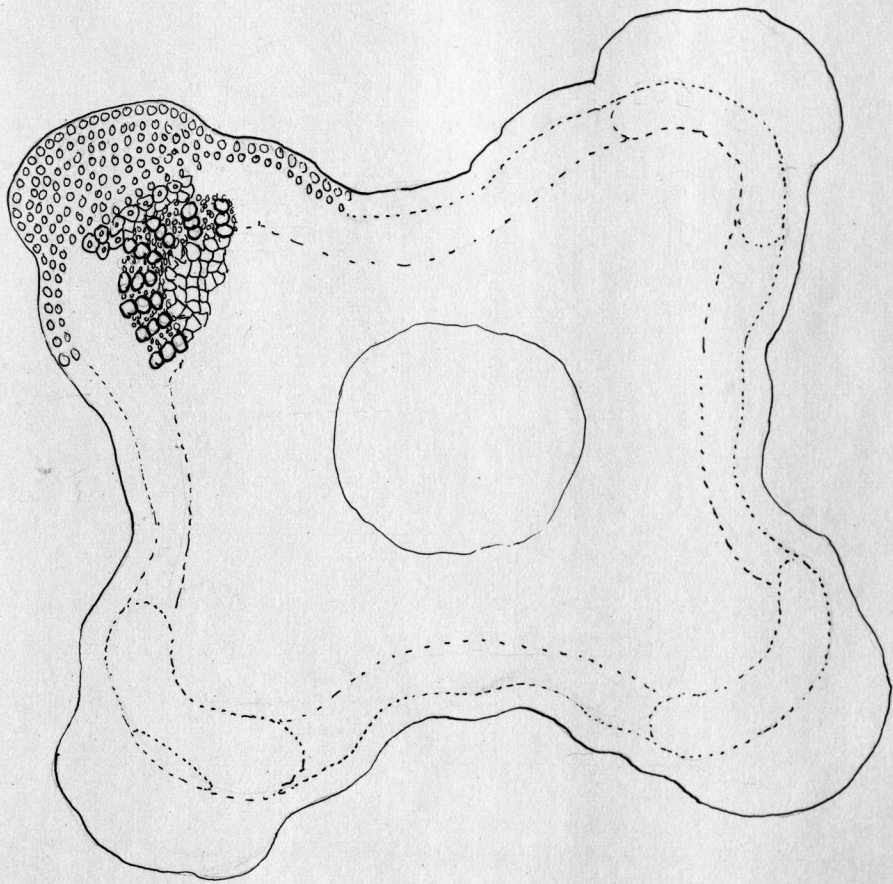


Plate XIV.

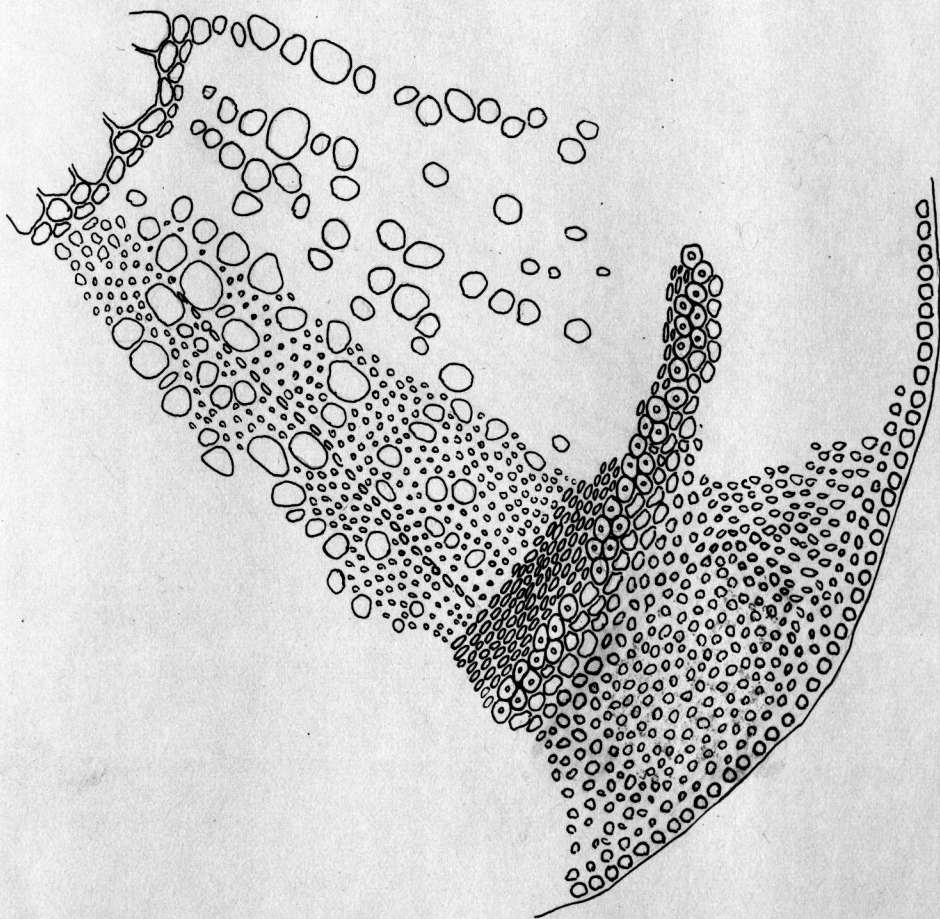


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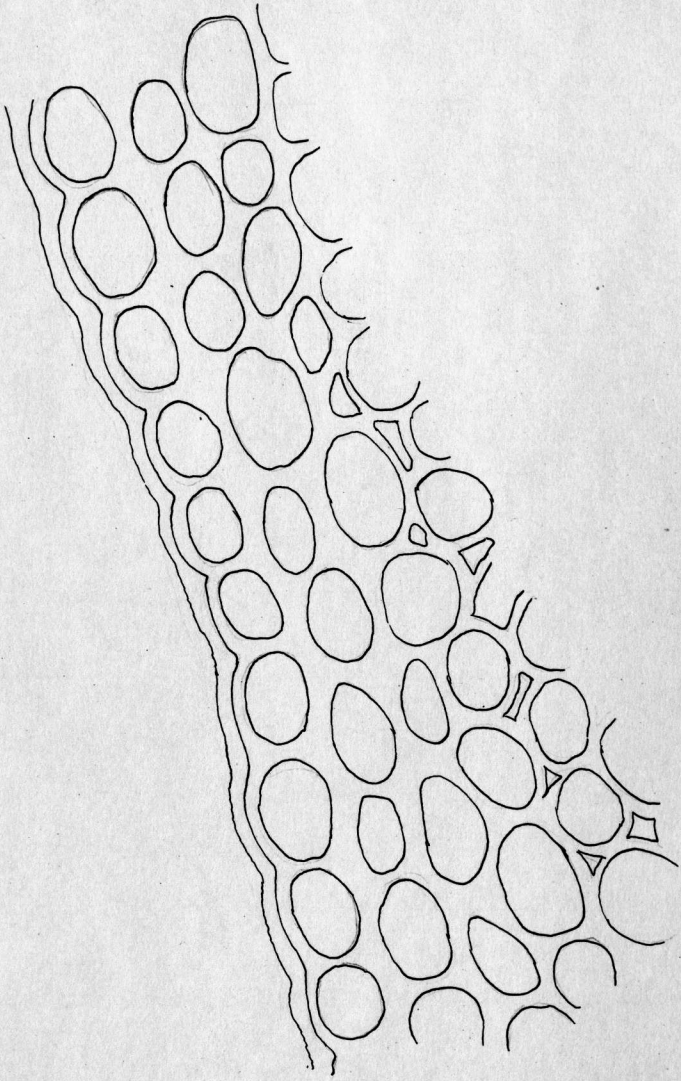


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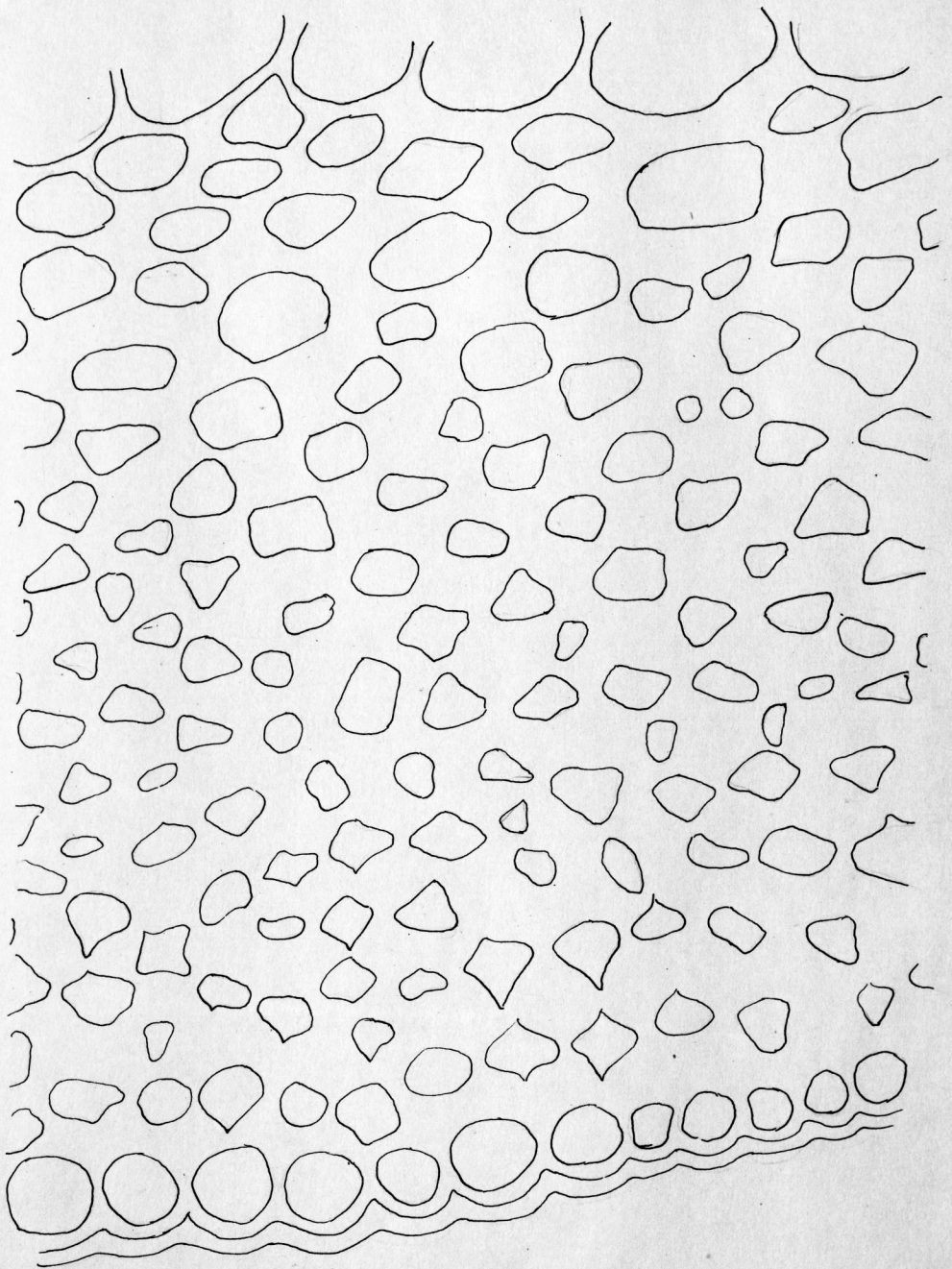


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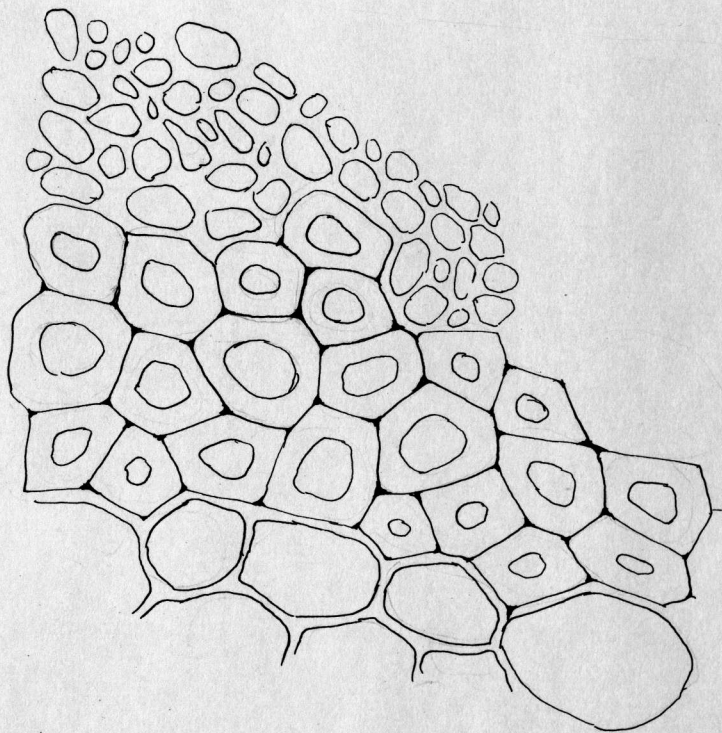


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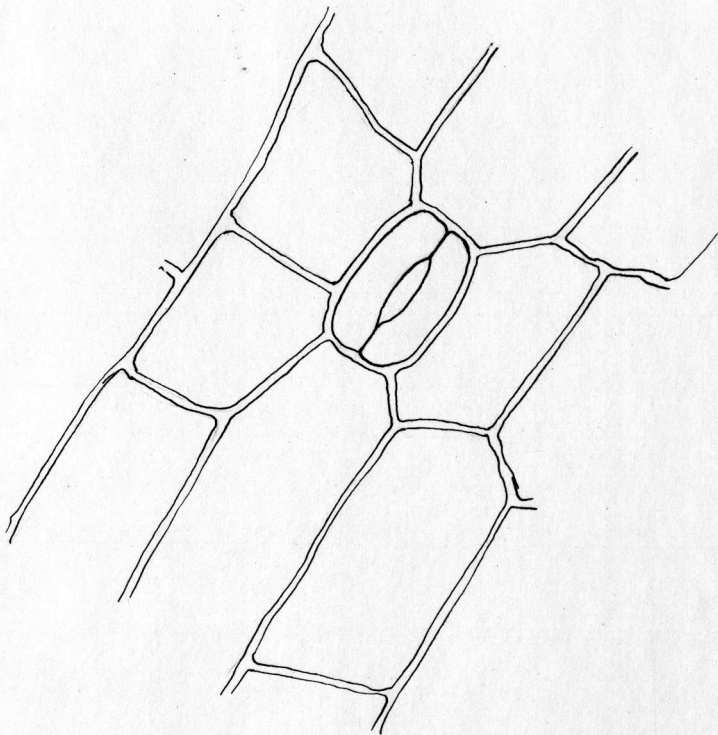


Plate XIX.

APPROVED,

June 15 1899 L. S. Cheney

Asst. Professor of Pharmaceutical Botany.