of spirally marked cells of the outer cortex.' The patches were apparently of some breadth, but only a tangential section near the surface of the rootlet could show clearly the extent and arrangement of these cells. Such a section I have found on a slide (prepared by the late Mr. J. Spencer) kindly lent me by Dr. Scott from his collection. Its cabinet number is 1527. This slide has two rootlets cut tangentially through the outer cortex, and from the better one of the two the accompanying drawing has been made with the camera lucida. The rootlet could hardly have been cut in a better direction or at a better depth for revealing the details of the vascular

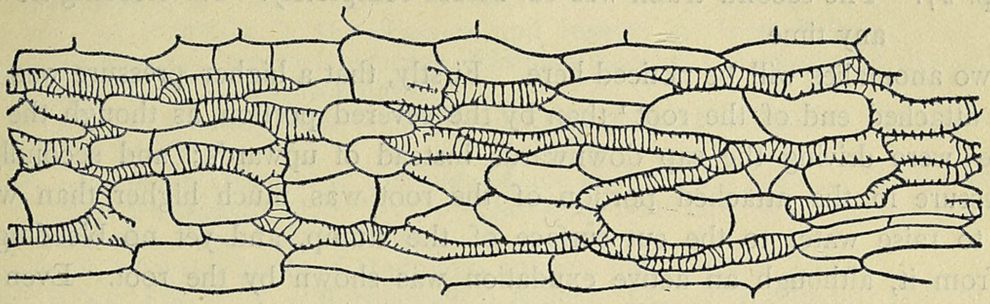

FIG. 34.

elements of the cortex. As will be seen from the Fig. 34, they form a complete network, over a width of six or seven cells, and greatly resemble the termination of the vascular bundles in the leaf. Between the spirally thickened cells are found wide thin-walled elements from which water could readily pass into the spiral elements and thence through the vascular branch into the stele of the rootlet.

At one or two points where the spiral elements are shown in the drawing in an incomplete condition, it is obvious from the difference in focussing that the spiral cells were there connected with a vascular branch lying at a different level and not in the plane of the section. In the other rootlet seen on the slide there seemed to be a slight difference between the cells at the ends of the ramifications and the connecting tracheids. The latter were slightly narrower and had a closer spiral marking than the former which were of greater width.

I must express my indebtedness to Dr. Scott, who has placed at my disposal this excellent preparation which throws further light on the curious vascular supply of the Stigmarian rootlets.

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ROOT-PRESSURE IN TREES.—The following observations made upon the Wych Elm (*Ulmus montana*) appear to be of some interest. The tree used was over thirty feet high, and branched at the base into two main trunks.

Feb. 20. The larger trunk was sawn across. No bleeding now or subsequently.

Mar. 15. The second trunk was ringed, from eight to ten annual rings of wood being removed, which formed one half of the alburnum. Flowering and foliation in April were hardly at all delayed.

Ap. 19. A root 2·5 cm. diameter was cut through and mercury manometers attached to both ends. A rapid escape of sap took place from the end attached to the stem, the pressure varying from ten to fifteen feet of water until the fourth day when it began to fall. Practically no escape of sap took place from the end of the severed portion on the first day, but on the second, pressures equivalent to between two and three feet of water were shown, rising on the fourth day to nearly six feet, but distinctly falling on the sixth and seventh days.

Ap. 27. The second trunk was cut across completely. No bleeding now or at any time.

Two anomalies will be noticed here. Firstly, that a higher pressure was shown by the attached end of the root[1] than by the severed portion, as though the 'root-pressure' were driving the sap downwards instead of upwards; and secondly, that the pressure in the attached portion of the root was much higher than was required to raise water to the cut surface of the stump, and yet no bleeding took place from it, although an active exudation was shown by the root. Even when the second trunk was cut and covered with indiarubber no actual drops of water exuded, although both the duramen and the remaining alburnum were quite moist.

The explanation appears to be that, early in the year, the wood of the intact trunk offers a higher resistance to the passage of water than it does later on, although to obtain direct evidence of this is by no means easy. Furthermore, different portions of the root-system appear to awaken to active absorption at dissimilar times. Even although the pressure in the intact root-system was nearly uniform throughout, the maximal pressures shown by manometers attached to severed portions of it might vary considerably, according to the amount of absorbing surface and the relative activity of absorption. This is because the maximal pressure in a severed root always decreases sooner or later, so that the height of the pressure shown by an attached manometer will depend upon the rapidity with which the maximal pressure is attained, which again depends upon the rapidity of escape of sap, and this upon the activity of absorption. It would, in fact, be more accurate to test the pressure of absorption in a severed root by applying increasing pressures of Mercury until sap neither escapes nor is driven backwards.

To perform an extended series of observations of this kind, each of which demands the sacrifice of a large tree, is however possible only to a privileged few. The above observations are therefore merely put forward as suggesting the need of solving the following questions:—(1) Does the total resistance to the flow of water in the trunk of a deciduous tree vary and show an annual rhythm or periodicity? (2) Is the root-pressure comparatively constant throughout large root-systems, and do all regions of such systems awaken to active absorption at the same period of time?

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[1] The root was subsequently traced to its junction with the parent-tree.