ROOT DISEASES OF SUGAR CANE IN PUERTO RICO

PART I.—NORMAL STRUCTURE OF ROOTS

By MELVILLE T. COOK, *Plant Pathologist*,
Agricultural Experiment Station, Río Piedras, Puerto Rico.

Before starting the studies on the diseases of roots of sugar cane, it appears to be desirable to give a brief review of our knowledge of normal healthy roots. This has been done in other publications and there is nothing new in this brief discussion but it appears desirable in order to make comparisons. When a cutting is planted, it produces two kinds o roots. Very small roots develop just above the node which are known by several names, such as primary, adventitious, etc. Much larger roots are formed at the bases of the buds soon after the shoots start to elongate. They are known as secondary or true roots, etc.

The primary or adventitious roots usually die early but under some conditions presist and form dense mossy like growths. A very large percentage of the large or true roots die early but many of them grow to twelve inchs or more in length. Some few of them attain a much greater length, sometimes as much as six feet. They branch to some extent by the formation of small lateral roots. The number of these small lateral roots is extremely variable. We do not know all the factors that may influence the number of small lateral roots but injuries by insect larvae, fungi and other agencies at or near the apex are important. The writer is inclined to believe that the environmental factors, such as character of the soil, water supply, etc., are extremely important. When a root attains a length of about six or eight inches the cortex usually dies except for three or four inches at the tip. Many people in digging the roots of sugar cane believe these roots are dead, but an examination of the axis cylinder will show that they are alive. The absorption is restricted entirely to the small amount of living cortex near the tip. The dead cortex usually contains many fungi and bacteria, usually saprophytic forms.

The structure of the large roots is practically the same as for the roots of most plants. An axis cylinder, a cortex, an epidermis and a root cap. All of which are shown in longitudinal section (figure 1). The tracheary tubes begin to form early and just back of the root tip (figure 1). They originate from several single rows of

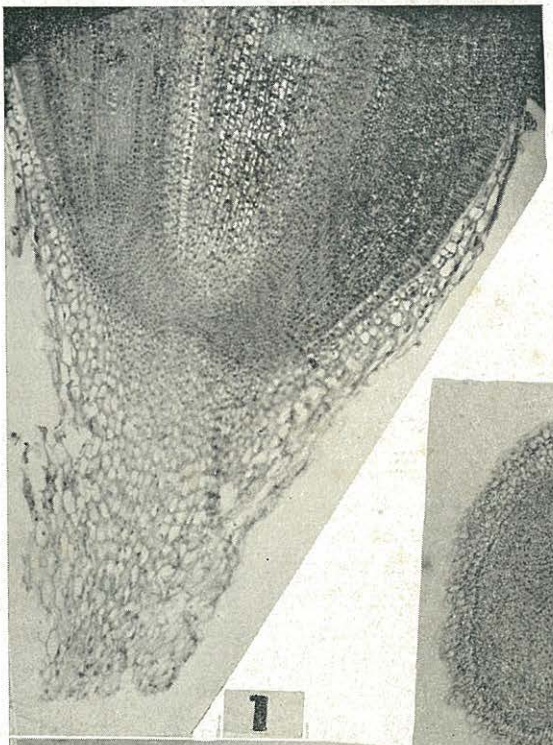
cells in the axis cylinder and are arranged so that they form a circle in cross section (figures 1, 2 and 12). They are small at first (figure 7) but increase in size (figures 8 and 9). This relationship to the surrounding cells is shown in figures 5 and 10. They are cells of the axis cylinder which differentiate, enlarge and exert a pressure on the surrounding cells (figures 5 and 10). The density of the protoplasm in these cells is variable (figures 5, 10 and 11). The general appearance of these cells is that of great activity until they have reached their full growth when the contents undergoes degeneration (figure 6). Eventually the cell walls between the cells of a row disappear and the tracheary tube is complete.

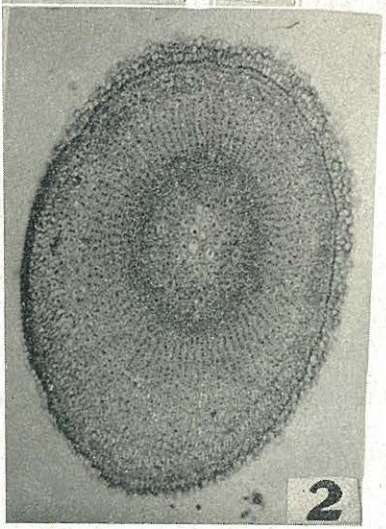
The demarkation between the axis cylinder and the cortex and between the cortex and epidermis appear early and are well defined (figures 12, 13 and 14). The axis cylinder may presist for a long period, as previously stated in this paper, but in other cases the entire root dies very early.

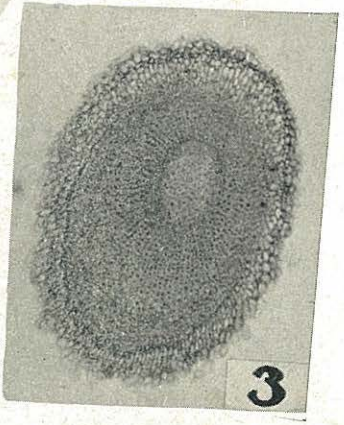
The root cap is the same as in the roots of most plants. It projects beyond the apex of the root. The cells at point of origin are well supplied with protoplasm (figure 4) while those most remote contain little or no protoplasm (figure 1). The root cap extends up the sides of the root tip for a short distance and the demarkation between epidermis and cap is very distinct (figures 1, 2, 3 and 14).

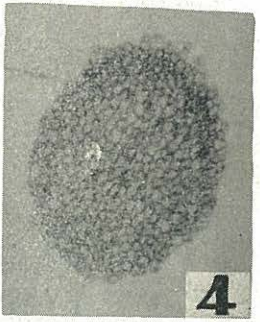
The injuries to the root originate in the active, healthy cortex. Fungi and bacteria may be found in the dead cortex of the old roots but their presence does not indicate that they are injurious. Most of them appear to be saprophytic. Of course some of the organisms found in the dead cortex may cause some injury. The healthy cortex is attacked by fungi, bacteria, nematodes, the larva of insects and possibly other forms of life. The results of the writers studies on these forms of life will be published from time to time.

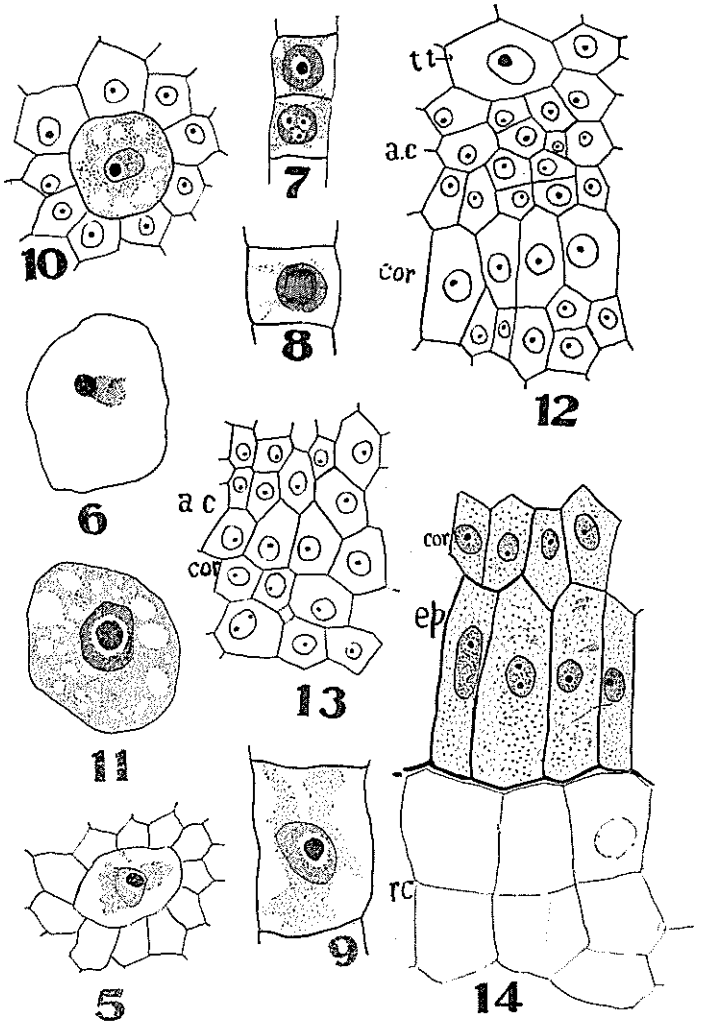
Studies on *Marasmius sacchari,* which has been referred to so often and from so many different countries as a cause of root diseases, have been made by the writer and the results published in the proceedings of the Fourth Congress of the International Society of Sugar-Cane Technologists held in San Juan, Puerto Rico, March 1932, under the title of "The Parasitism of Marasmius sacchari Wakker" and in The Journal of the Departament of Agriculture of Puerto Rico, Volume XVI, No. 2, pages 213–226, 1932, under the title of "*Marasmius sacchari;* a Parasite of Sugar Cane". The latter is the more complete. It should have been included in this series on Diseases of Roots of Sugar Cane.


1


2


3


4


10
7
8
tt
a.c
cor
12
6
a c
cor
13
11
cor
ep
5
9
rc
14