Some Effects of 2,4-Dichlorophenoxyacetic Acid, its Salts, and Esters on Several Physiologic Strains of the Potato Scab Organism Actinomyces scabies (Thaxt.) Guss.¹

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SYNTHETIC plant hormones have been used extensively since 1941 in the control and elimination of weeds. Since much of these chemicals used as herbicides probably reaches the ground, it is desirable to know the effect of these synthetic plant hormones on the soil flora. According to Stevenson and Mitchell (8) 0.02% 2,4-D, either as acid or as sodium salt, in potato dextrose agar had an inhibitory effect on three different species of bacteria, but 0.08% 2,4-D had no apparent effect on three fungi—Fusarium sp., Penicillium sp., and Penicillium notatum. Lewis and Hamner (4) found that Rhizobium leguminosarum Frank was not affected by any of the 2,4-D samples used even at concentrations as high as 1,000 ppm at pH 6.8. Worth and McCabe (9) demonstrated that several species of Rhizobium are inhibited by 2,4-D at concentrations as low as 20 ppm at pH 7.4. Carlyle and Thorpe (2) found that different species of Rhizobium differed in their sensitivity, but none was seriously inhibited in sand cultures by concentrations equivalent to less than 200 pounds of the sodium salt per acre. These reports suggest that 2,4-dichlorophenoxyacetic acid and similar chemicals may have effects on Actinomyces scabies, an organism closely related to the bacteria.

In our efforts to improve crop plants we are constantly on the lookout for new practices and new chemicals. Probably the best protection we have at present for the control of the common scab of potato is the use of resistant varieties adapted to local areas. That there are numerous physiologic races of the potato scab organism, Actinomyces scabies (Thaxt.) Guss., is well known and also that these races differ in their ability to scab different potato varieties (7). New races are apparently being formed due to changes in environment and variations in heredity. Some of these new races are nonpathogenic and others are virulent toward certain varieties of potato. Therefore cheap chemical control of potato scab applicable to all or at least to extensive and diverse potato-growing areas is highly desirable.

Many attempts have been made to control common scab with chemicals. Seed and soil treatment have not been entirely satisfactory. Cairns, et al. (1) obtained satisfactory control by disinfection of the affected seed tubers before planting if a sufficient interval between the growing of successive potato crops on the same land. Mercury salts are effective in killing the organism on the seed piece but not in killing the organism in the soil. Under Long Island conditions Cunningham and Wessels (3) found that 4 parts of yellow oxide of mercury or of calomel added to a ton of 5-8-5 fertilizer mixture on soils having a pH of 5.5 or lower reduced scab. Schaal (6) reported scab was not controlled on sandy alkaline soils in eastern Colorado with mercuric chloride, yellow oxide of mercury, sulfamic acid, aluminum sulfate, iodide, or sulphur.

OBJECTIVES

These studies were undertaken to determine if the sodium salt of 2,4-D has an inhibitory effect on the growth of Actinomyces scabies separate from the inhibitory effect of an acid medium and (b) the concentration of the acid, the sodium and ammonium salts, and the methyl, ethyl, and n-propyl esters necessary to inhibit the growth of four races of Actinomyces scabies at a pH of 6.5 to 7.0.

EXPERIMENTAL PROCEDURE

The first experiment was to study the effect of Actinomyces scabies with and without the sodium (J. T. Baker's sodium 2,4-dichlorophenoxyacetate, 84.7% acid content) in the medium. The scab was grown in Petri dishes on modified potato containing 5 grams of dextrose instead of the recommended 20 grams in standard potato dextrose agar. The pH was 5.0, 6.0, 7.0, and 8.0. The 2,4-D in an amount to make a final concentration of 500 ppm was added to the medium before the pH was adjusted and before it was autoclaved. This was done because it was shown that autoclaving medium containing 500 ppm sodium salt of 2,4-D did not alter the pH. Four scabies cultures (nonpathogenic as determined by the test) were plated in the same manner as in the following experiment.

In the second experiment the same four races of scab were plated in the same manner as in the first of

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² Numbers in parenthesis refer to "Literature Cited", p. 270.