A Bacterial Disease of Tomatoes.*

[Abstract.]

By William Stuart.

During the winter of 1898-99, while engaged in an experimental study in the growing of tomatoes by the aid of chemical fertilizers, considerable annoyance was occasioned by the appearance of a disease which attacked the fruit and rendered it unmarketable.[1] Usually the fruit showed no sign

Fig. 1. Tomatoes affected with bacterial disease.

of injury until two-thirds grown, and sometimes not until fully developed. The first visible appearance of the disease in infected fruits was in a slight watery discoloration of the tissue beneath the epidermis. As the disease

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[1]A disease similar in its character was reported by Beach, in Bulletin 125 of the New York State Agr. Exp. Sta., Geneva, pp. 305-306, July, 1897.

progressed, the affected portion assumed a darker color, followed by a gradual depression of the infected tissue, resembling in many cases that caused by the black rot Macrosporium solani (see Fig. I), but without any fruiting hyphae growing on the surface of the epidermis. It rarely wholly destroyed the fruit, but as a rule seemed to hasten its maturity. Generally the disease attacked the apical portion of the fruit; in a few instances, however, the central or basal portions would show the characteristic watery discoloration.

a b

Fig. 2. Original condition of the fruit prior to infection.

a b

Fig. 3. Changed condition of fruit "b" due to infection.

A microscopical examination of diseased portions of the fruit gave no evidence of the presence of any parasitic fungus. The presence of a motile bacillus seemed, however, to be fairly constant in all tissue examined.

Isolation of the germ.—In the isolation of the germ two different methods were employed. In one sections of the diseased tissue were removed from the fruit with a flamed knife and transferred to bouillon tubes, from which loop plate cultures were made in agar. In the other method direct

inoculation of the tubes were made from the inner portions of diseased tissue by means of a sterilized platinum wire.

The cultures obtained from both of these methods were apparently similar, both contained a minute motile bacillus, having the same appearance as that noted in the microscopical examination. The germ thus obtained was assumed at the time to be the same as that seen in the diseased fruit, but its after behavior did not in all respects bear this out.

Growth of the germ upon agar.—The growth of the germ upon slightly acid slant agar was quite characteristic; it produced a vigorous growth, with irregular outline all along the track of the needle. The color of the colonies upon agar was creamy white on the margins, becoming yellowish towards the center, and having a marked viscid surface.

Inoculation experiments.—On February 15 two tomatoes which had every appearance of being perfectly healthy were removed from plants in an adjoining room. One of these was inoculated with a pure culture of the germ, by puncturing the epidermis with a sterilized needle, and with a sterilized platinum wire transferring the germs from the tube to the interior of the fruit. The other fruit was infected by merely smearing the germs over the surface of the pistillate portion of the fruit. After inoculation both fruits were placed under a bell jar. At the end of the second day the first fruit showed signs of infection; a portion of the cells adjacent to the opening made for the introduction of the germ were fast turning a dark color. In a week the greater portion of the tomato was diseased and was giving off an offensive odor. By March 1, or fourteen days after the time of infection, it was completely decomposed, while the one on which infection material had been smeared showed no signs of disease.

On March 2 two more healthy tomatoes were removed from the vines, and after photographing them they were inoculated in the same way as those in the previous experiment. The progress of the disease in this experiment was not quite so rapid as in that of the first, some twenty days elapsing before the whole fruit was affected. Like the first the fruit into which the germs were introduced was totally destroyed, while the other remained perfectly sound. The fruits were again photographed on March 22. Fig. II represents them previous to inoculation, while in Fig. III the changed condition of the diseased fruit is shown.

In order to determine whether the same effects would be obtained by inoculating the fruit on the vine, a cluster of fruit containing four half

to two-thirds grown tomatoes was selected for experimentation. Two of the tomatoes were inoculated by introducing the germs into the tissues of the fruit with a sterilized needle. In order to note the effect of the injury from needle puncture the third fruit in the cluster was punctured with a sterilized needle, while the fourth was reserved for control. All inoculations were made on the north side of the fruit in order to avoid any action of the sun upon the wounds. Three days later the tissues surrounding the infected portions of the first two fruits had begun to grow darker. From this time on the progress of the disease was quite rapid No ill effects could be noted on the fruit punctured with the sterilized needle, both of the latter fruits remaining perfectly healthy.

In comparing the action of the disease produced in the artificially inoculated fruit with that of one naturally infected, it will be noted that with the exception of the first appearance of the disease their action was entirely different. In the natural infected fruit there was no offensive odor, the disease rarely affected the whole fruit, and never caused a sloughing of the cell tissues, as did the artificial infections. The wide difference in the action of the germ in the natural and artificially infected fruits may indicate that they were not the same, although looking so much alike, or it may be explained by supposing that in the naturally infected fruits the epidermis, not being broken, excludes all putrefactive bacteria. The putrefactive bacteria having access through the wound caused by artificial inoculation, feed upon the tissues destroyed by the inoculated germ, and thus the two acting in conjunction make the destruction of the fruit much more rapid and complete. The uniformity of the results obtained seems to favor the latter assumption.

SUMMARY.

A decay of green fruits on tomato plants grown in the greenhouse seemed from microscopical examination to be of bacterial origin.

The fruit showed patches that looked watery, became depressed, and after a time turned blackish. Usually the disease started at the apical portion of the fruit. No evidences of a fungus were present. Attempts to separate a specific germ were apparently successful.

Introducing the supposed germ into the fruit by puncturing the epidermis in every instance produced a disease.

The disease caused by the germ from the cultures did not coincide very closely with that from natural infection, and there is still doubt if the two be the same.

No preventive measures can be suggested with the limited knowledge of the disease yet available.

Device for Supporting a Pasteur Flask.

By Katherine E. Golden.

Notes on the Microscopic Structure of Woods.

By Katherine E. Golden.

Movement of Protoplasm in the Hyphæ of a Mould.

By Katherine E. Golden.

Description of Certain Bacteria Obtained from Nodules of Various Leguminous Plants.

By Severance Burrage.

(A preliminary study on the constancy of the distribution of bacterial species in definite species of leguminous plants.)

It has been quite thoroughly proven that several different species of bacteria may be found in the nodules of various leguminous plants. The following questions, however, have not, it seems to me, been definitely settled with regard to them:

Does the same species of bacteria always occur in the same species of legume?

Does the same species of bacteria always occur throughout all the nodules on the same plant of any species of legume?

Does the same species of bacteria always occur in the nodules of all the plants in a field planted with one species of legume?