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APPLE TROUBLES IN 1902.

F. H. HALL, F. C. STEWART AND H. J. EUSTACE.

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POPULAR EDITION*
OF
BULLETINS NOS. 220 AND 227.
APPLE TROUBLES IN 1902.
F. H. HALL.

**Weather
responsible.**

During the past season, apple-growers in western New York suffered anxiety and loss through three unusual troubles affecting foliage or fruit. Two of these troubles were due directly to the peculiar weather which characterized the season; and similar injuries need not be feared unless similar climatic conditions again occur. The third and most serious trouble was due to the remarkable development and changed habit of a species of fungus, ordinarily harmless, which found conditions just right for rapid increase, spread from its usual places of growth, and caused a very destructive apple rot. For this disease, also, the weather was probably responsible, but whether a drier, warmer season will lead to the disappearance of the fungus as a destroyer or whether it has become so thoroughly established in our orchards that it will again be destructive, only time can tell.

FROST BLISTERS ON LEAVES.

**Deformed
foliage.**

First of these troubles to attract attention was a peculiar distortion of the apple leaves,—a wrinkling, curling or failure to unfold, very similar in appearance to that produced on peach foliage by leaf curl or on currant leaves by attacks of plant lice. Neither fungus nor insect was the cause in this case, however; the injury

This is a brief review of Bulletin No. 220 of this Station, on Two Unusual Troubles of Apple Foliage, by F. C. Stewart and H. J. Eustace, and of Bulletin No. 227 on A Destructive Apple Rot Following Scab, by H. J. Eustace. Anyone interested in the detailed account of the investigations will be furnished, on application, with the complete bulletins. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular edition or complete edition as desired. Bulletins are issued at irregular intervals as investigations are completed, not monthly.

was a direct result of the heavy frosts of May 10 and 11, 1902. The trouble became noticeable about June 1st; and prevailed to a greater or less extent in all sections of the State where these frosts were felt, but was not observed in the Hudson Valley or on Long Island where the temperature did not fall below the freezing point.

How caused.

The cold produced ice crystals between the tissues of the leaf and the lower epidermis so that the surface of the leaf was "split off" or a "blister" was produced. Upon thawing, the separated tissues failed to unite, and the lower "skin" of the leaf, cut off from the living tissues within, died and dried up, sometimes rupturing or tearing. The leaf itself, however, continued to grow, but the affected areas on the lower surface could not change in size, hence the growing parts above, being held by bonds of dead tissue, raised in blisters and arches, curled up, twisted and were otherwise distorted. Generally the dead areas on the under surface remained unbroken; in which case the parts above remained green and performed their functions as leaf tissue to the end of the season. This was true also in some instances where the "blisters" were broken; but in other cases the breaking of the lower surface was followed by death of tissues within and the formation of irregular, brown, dead spots.

Injury done.

The damage from this trouble was slight. Only the earliest leaves were affected and many of those injured served the purposes of foliage fairly well. Few of them were so badly injured as to drop off.

There was a noticeable difference in varieties as to susceptibility to injury of this character. One unknown variety was so seriously affected as to resemble a peach tree with leaf curl; Baldwin and Rhode Island Greening were badly affected, Red Canada, Paragon and Fall Pippin, considerably, Keswick and Northern Spy, somewhat, while some other varieties were almost free from the trouble.

Quince leaves showed the same injury, to a less extent than apple; but pear leaves showed none of the distortion.

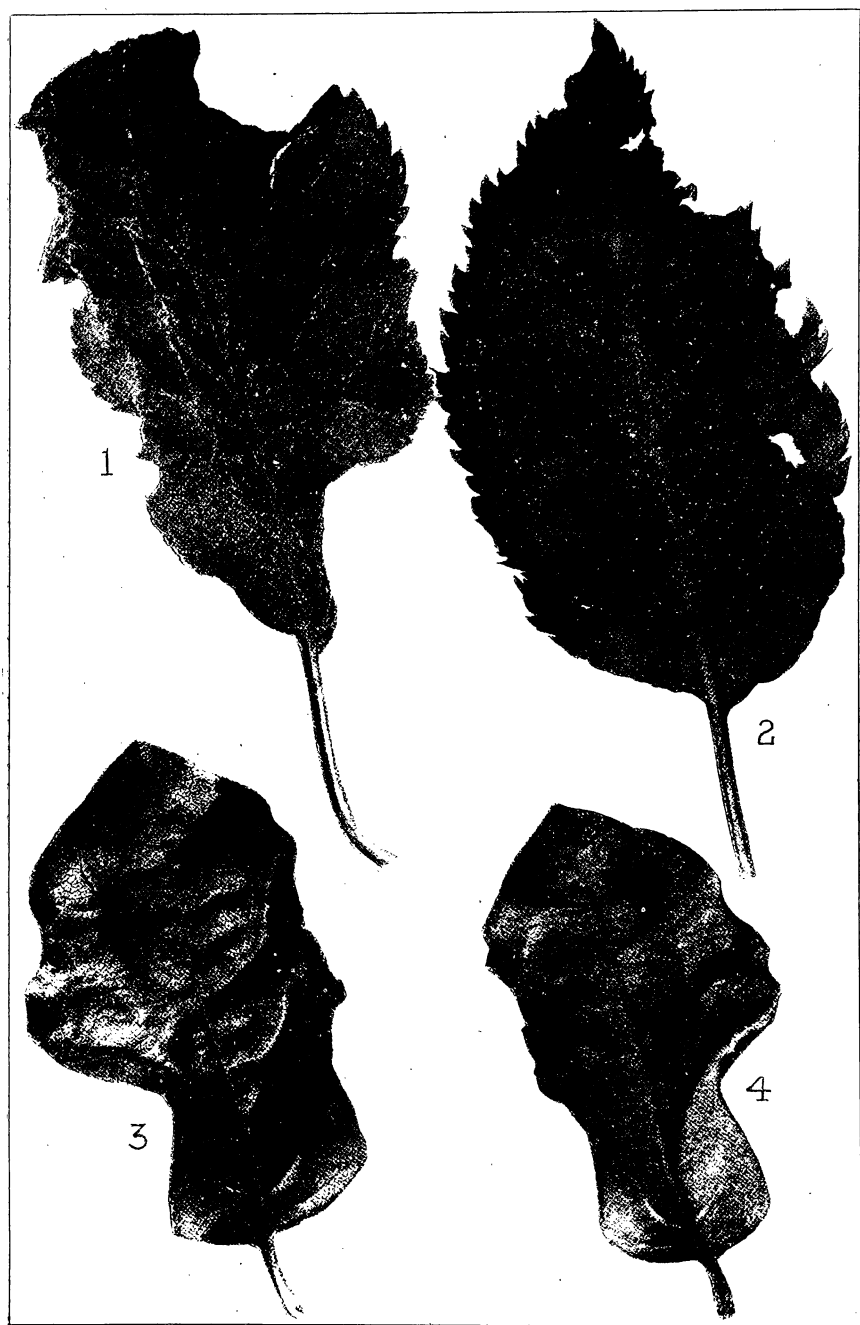


PLATE I.—APPLE AND QUINCE LEAVES AFFECTED WITH FROST BLISTER.

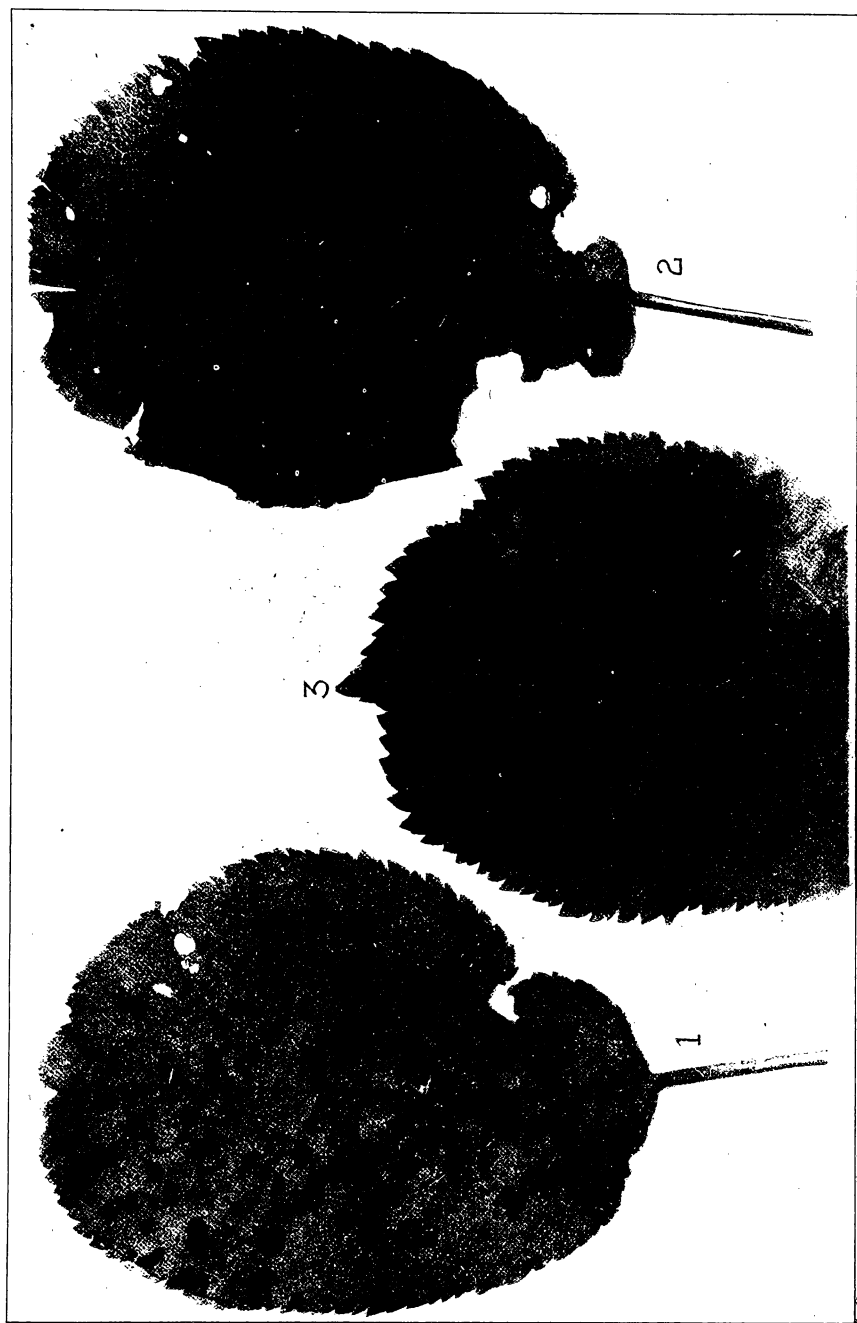


PLATE II.—DEAD, BROWN SPOTS ON APPLE LEAVES, CAUSED BY SPRAYING.

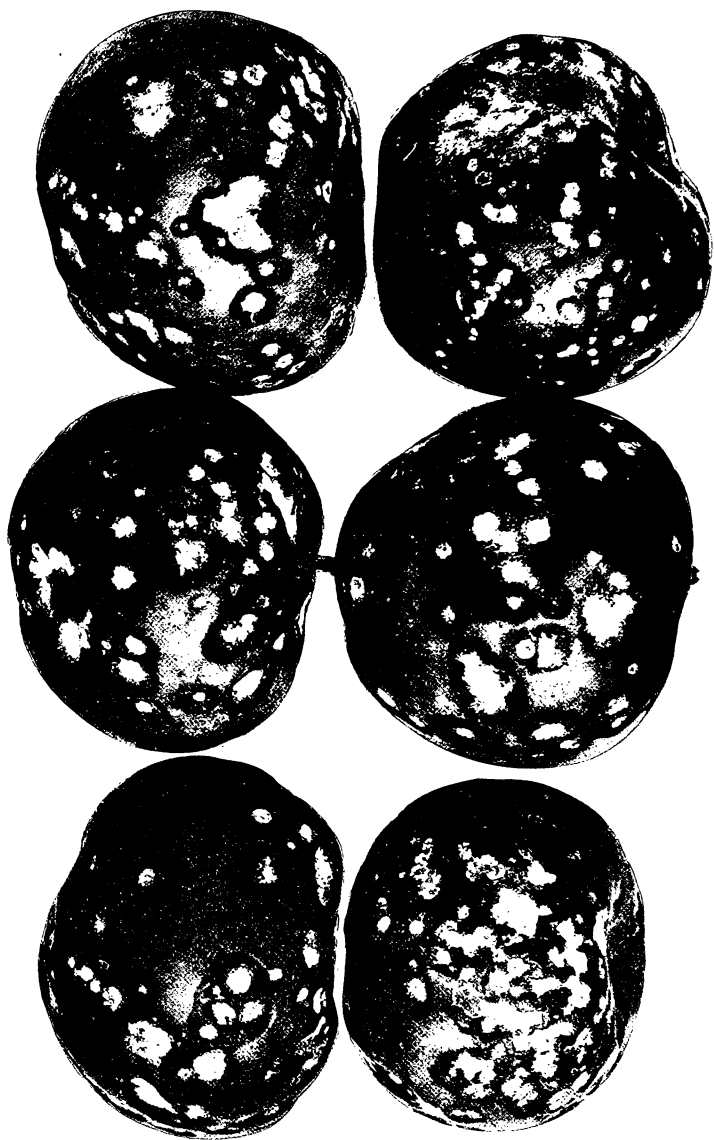


PLATE III.—GREENING APPLES AFFECTED WITH THE ROT.

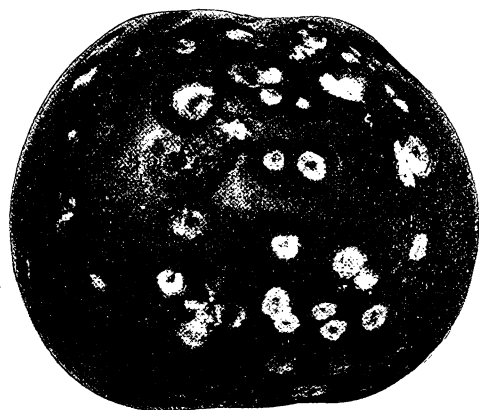
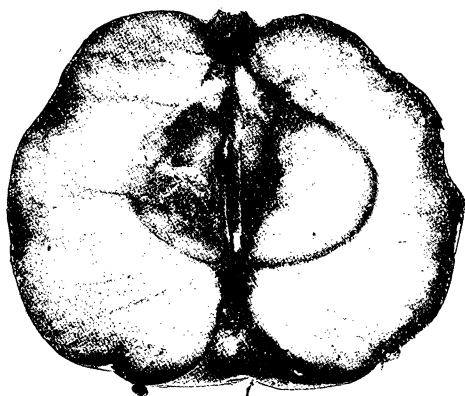


PLATE IV.—AN AFFECTED GREENING APPLE AND CROSS-SECTION
OF THE SAME.

SPRAY INJURY.

Unusual effect.

The cold, wet weather of spring and early summer made foliage of all kinds very tender; and spraying with bordeaux mixture and insecticides caused much spotting and yellowing of leaves. Under ordinary conditions, properly made bordeaux mixture, well neutralized with lime, may be used with perfect safety on apple foliage, even if arsenical poisons be combined with it; but during the past season the leaves in many sprayed orchards began to turn yellow and fall off early in July.

Spraying should not be abandoned.

Considerable damage was caused by the loss of foliage, for which careful investigation proved the spraying responsible; but later developments showed that most sprayed orchards had great advantage over unsprayed ones, notwithstanding this loss. In only a few cases was the injury from spraying sufficient to prevent a fair crop; while in the unsprayed orchards codlin moth and scab did great harm and the new follower of scab, "pink rot," made much fruit unsalable. Injury from spraying is most liable to occur in years which favor disease, so the certain gain is more than likely to offset any small loss. Whether an additional amount of lime in the spray mixtures would tend to prevent damage in wet, cold seasons is not definitely known. Some reports indicate that it may do so.

ROT FOLLOWING SCAB.

"Pink rot." By far the most serious pest of the orchardist the past season was a new or very rare disease to which the fitting name "pink rot" has been given. This is new only as a disease; for the fungus producing the trouble is a well-known one, but one which has hitherto been almost harmless, living on dead wood and other places where it has been of no economic importance.

Outbreak.

As a disease it was first brought to the attention of the Station in August when growers noticed upon scabbed spots on early fall apples, still on the trees, a white or pinkish mildew-like growth which later produced a brown, sunken, rotten spot with a bitter taste. Where apples were badly

scabbed the rotten spots united, so that large areas of surface were affected and the apples ruined.

The spread of the trouble was rapid and its distribution wide; so that before harvesting the fall apples had proceeded far, the disease was recognized as one of the most destructive which had ever attacked New York orchards. It did not cease its work when the apples were picked, but seemed to develop with great rapidity where apples were stored in heaps to "sweat," and especially where they had been put into barrels which were left in the orchard or stored under ordinary conditions. In such cases the moisture and warmth in the air, due to the sweating process, were especially favorable to rapid growth of the fungus and the stored fruit became a mass of decay.

Damage. Thousands upon thousands of barrels thus put up had to be thrown away or rushed to evaporators and sold for a song. Much of the fruit could be used for drying, as the rot is not a deep-seated one but extends only one-eighth of an inch or so below the surface. Rhode Island Greening, Fall Pippin and Fameuse were probably most affected, but Tompkins King, Maiden Blush and Twenty Ounce suffered severely, while more or less damage was done on Gano, Mammoth Black, McIntosh, Rambo, Quebec Winter Sweet and Wine-sap. It was thought at harvesting time and for some weeks later that Baldwin and Northern Spy had escaped the trouble, as it did not show on them, even though badly scabbed, when it did on Greenings and Pippins; but in December, when these winter apples had reached a corresponding stage of ripeness, the disease appeared on them also. It did not do so much damage, however, as the temperature was lower and less favorable to fungus growth. It is probable that no variety not immune to scab is immune to the pink rot; but where the apple is not scabbed the rot is harmless; for unless the skin of the apple is broken by the growth of the scab fungus, the spores of the rot fungus do not find suitable germinating ground, or if they do germinate are unable to send their little tubes into the tissues of the apple. They, of themselves, are powerless to break the skin of the fruit.

Cause of disease.

Recognizing the importance of this outbreak, the Station made careful studies of the fungus and conducted several series of experiments to determine its parasitism and to test suggested methods of control or repression.

Microscopic examination speedily showed the cause of the disease to be *Cephalothecium roseum*, a fungus which has been known for sixty years. Ordinarily, as previously stated, it lives on decaying wood or rotting leaves and fruit and does no harm. Very few instances, indeed, are recorded where it has attracted attention by doing any damage; but some orchardists recall a similar but milder outbreak in New York some fifteen or twenty years ago.

Parasitism.

To ascertain whether it would rot other fruits as well as apples, inoculations were made upon sound apples, pears, quinces and grapes. The fruits were first washed with a sterilizing solution to destroy all germs that might be present on the skin and were then punctured in pairs. A sterilized needle was thrust through the skin of one fruit of each pair, while its companion was punctured and inoculated with a particle of the fungus. The fruits were then placed under similar conditions in a warm, moist atmosphere and watched for several days. In every case the fruits punctured with the sterilized needle, only, remained sound; but every one inoculated with the fungus showed signs of the white growth and rot.

No damage unaided.

Similarly, to test the power of the fungus to break the skin of fruit, pairs of apples of several different varieties were compared. One of each pair was punctured and inoculated, while portions of the fungus were placed upon the unbroken skin of the other apple. In only one case—a very thin-skinned variety—did rot develop on the apples not punctured; while the others rotted readily.

Treatments tested.

Several lines of preventive treatment were tested. When apples were placed in cold storage the progress of the disease was checked, but as soon as this fruit was again exposed to ordinary conditions, the spores germinated and the disease progressed with great

rapidity. It was necessary to market or use fruit very soon after removal from cold storage if good results were secured.

However, the growth of the fungus will be retarded and the fruit saved from rot if the apples are kept in ordinary storage houses if these are thoroughly dry, well ventilated and maintained at a temperature below 45°.

Dipping the apples in some solution which is known to kill the spores should, theoretically, protect them from the disease; but very thorough and extensive experiments along this line gave disappointing results. Badly scabbed Greening apples were used in these tests, barrels of apples being soaked in solutions of copper sulphate and of formalin of different strengths. The apples were then stored under fair average conditions for about six weeks. Upon examination the treatments were found to have prevented the spread of the "pink rot" to some extent; but the dipped apples were in very bad condition from blue mold and other soft rots. The wetting of the apples, even with a fungicide, seemed to exert a very unfavorable influence upon rots of this character.

Recommendations.

Since the "pink rot" affects only scabbed apples, that which prevents scab is the most efficient preventive; and the most perfect remedy for scab is regular, thorough and repeated spraying with bordeaux mixture.

In picking, sorting and packing, discard all fruits that show any of the white or pinkish growth.

The development of the rot is greatly favored if scabby apples are left in piles on the ground, or barreled and allowed to stand where it is only moderately warm.

Get the fruit into storage as soon after picking as possible.

Store the fruit in a dry place and keep the temperature below 45° F. if possible.

Cold storage simply retards the growth of fungi that cause the various decays of fruits. As soon as the fruit is taken into a warm place the spores of the fungi at once begin to grow, and decay results. Therefore it is advisable to leave the fruit in storage as long as possible before it is wanted for use.