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Some Special Plant Disease Surveys in New York State in 1929

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SOME SPECIAL PLANT DISEASE SURVEYS IN NEW YORK STATE IN 1929

Prepared by

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CONTENTS

INTRODUCTION

H. H. Whetzel

With the financial cooperation of the Plant Disease Survey of the Bureau of Plant Industry, United States Department of Agriculture, some special plant disease survey work in the State of New York was undertaken by the writer during June, July, and August, 1929. B. H. Davis, assistant in the Department of Plant Pathology at Cornell University, and J. H. Lee, assistant in the Department of Botany in Wabash College, Indiana, devoted much of their time to the work in the field and in the determination of the specimens collected in the course of the surveys. Dr. J. G. Horsfall, in charge of Investigations on the Diseases of Canners' Crops at the Geneva Experiment Station, assisted with the survey work on these crops; Dr. A. G. Newhall, in charge of Truck Crop Disease Investigations at Cornell University, gave considerable time to the surveys of diseases in crops grown on the muck lands of the State. Dr. D. S. Welch, Forest Pathologist in Cornell University, took notes on the diseases of trees and shrubs that came to our attantion during the summer.

The writer made a special study of the occurrence and distribution of willow blight and the bacterial blight of lilac in the State. He also made two trips through the ginseng-growing sections of the State during the summer to study the diseases of this crop. (Dr. Whetzel's observations on ginseng diseases were published in the Plant Disease Reporter 13:136-7.1929.) Special attention was given to the occurrence of leaf rust and loose smut in wheat by Messrs. Davis and Lee.

Specimens of the more interesting and uncommon fungous and bacterial diseases encountered were collected and preserved as herbarium specimens. Duplicates of these have been deposited in the Mycological Collections of the United States Department of Agriculture.

To all those who have assisted and cooperated in the work of the survey the writer is greatly indebted and records his appreciation.

A PLANT DISEASE SURVEY OF MUCK CROPS

A. G. Newhall

Approximately 20,000 acres of muck land in New York are utilized to grow onions, lettuce, celery, and carrots; perhaps 1,000 acres of this are devoted to potatoes, spinach, Chinese cabbage, and other miscellaneous vegetables, such as beets, turnips, and asparagus.

A number of serious diseases annually cause enormous losses to these crops, and the weather largely determines which of them will be the most destructive. Thus a wet spring favors onion smut and a wet summer onion mildew and celery blight. In a dry season onion pink root and lettuce yellows become very prevalent, and tipburn is most severe in a hot summer.

For the State as a whole the season of 1929 was characterized by a very wet spring followed by very dry, cool weather in July and August. Two or three hot periods of short duration occurred. As a result of these conditions onion smut was very severe wherever the formaldehyde treatment was not employed. In

many fields the treatment was rendered less efficient than usual due to heavy rain falling immediately after sowing. Onion mildew, though present, was held in check by the dry weather. Pink root was more common than usual. Lettuce yellows became very destructive by August 15. Tipburn was severe only in certain regions where heavy fertilization is practiced and hot weather occurred. Bottom rot was again the most destructive disease of lettuce, causing the loss of over one-third of the crop. Mildew of lettuce was prevalent on the early spring and late fall sowings. Celery blights, though present, were held in check by the dry weather, as was true also of spinach mildew. A direct loss to the growers from all causes is estimated at a million and a quarter dollars, of which about half was due to diseases.

Since conditions were not the same in all parts of the State, a more detailed account of the diseases found in the principal muck regions follows. This is based on the field counts made by the fellowship men in field laboratories in three of the principal muck regions of the State and upon special survey trips to all the important areas.

The Genesee-Orleans Region

In the Elba section, where close to 2,200 acres are nearly evenly divided between lettuce and onions and about 300 more are devoted to carrots, potatoes, spinach, and miscellaneous crops, the chief diseases were bottom rot (Rhizoctonia sp.) and yellows (virus) of lettuce. According to Mr. Cook, our field laboratory man stationed at Elba, over 50 per cent of the lettuce crop was destroyed during the season by bottom rot, the heaviest losses coinciding with rains and high temperatures occurring the last weeks of June and July.

Lettuce yellows (virus) appeared two or three weeks earlier than usual (June 23), and due to the dry season favorable for leaf-hopper development became very prevalent by the middle of August. A 5 per cent loss for the season has been estimated for the disease.

Warm weather the third week of June and last of July caused considerable loss from tipburn, although for the season the disease was less severe than usual, the estimated total loss for the Genesee-Orleans region being but 2 per cent.

Mosaic (virus) of lettuce was present in most fields in small quantities, one-half to 3 per cent, but toward the end of the summer it could be found three to four times as abundant.

Mildew (Bremia lactucae) was prevalent on practically all the early spring and late fall-sown lettuce. Its stunting and discoloring effects together with the fact that affected plants are more subject to transit rots make it of more importance than is usually realized.

A lettuce wilt (cause unknown) was more prevalent than in the past, being present in most fields and often affecting 3 or 4 per cent of the plants.

Gray mold (Botrytis) and a stem girdle of unknown cause together with cutworms further reduced the yield by approximately 16 per cent.

Thus it may be seen that over three-fourths of the lettuce that was sown was destroyed by various diseases and insect pests in the Elba section, which was not especially exceptional. Undoubtedly this amounted to more than $100,000 loss.

Onion mildew (Peronospora schleideni) appeared three weeks later than usual (August 13), but made little progress on account of dry weather, probably causing but 2 per cent loss.

Smut (Urocystis cepulae) has now been found in several places on the Elba muck and caused an appreciable loss on several farms so that control measures will

doubtless be introduced there another year. A 2 per cent loss is estimated for the entire Elba section. It is a remarkable fact that smut has been absent from that region for so many years (over 12).

High temperatures the last week in May caused many onion seedlings to burn off at the surface of the muck. In spite of these handicaps, together with maggots and thrips, a very good crop of onions was harvested, since a dry season is very favorable for this crop.

Pink root (Phoma sp.) was more abundant than usual on account of dry conditions but is estimated to have caused only 4 per cent loss.

A Botrytis neck-rot was found causing perhaps 1 per cent damage, mostly to set onions.

The greatest losses to onions were from maggots, cutworms, and thrips, all of which thrive in a dry summer and which are estimated by Mr. Cook to have cut the yield 20, 15, and 3 per cent, respectively.

Thus, in spite of the fact that 1929 was considered to have been a very favorable one for onions little better than half the possible yield was realized in the Genesee-Orleans region.

The Wayne County Muck

In Wayne County, where over 5,000 acres of muck are said to be in cultivation, celery is the leading crop. Ordinarily late blight (Septoria apii) and bacterial leaf spot (Pseudomonas apii) caused much loss, but on account of drought during the months when celery was growing there was but a trace of early, late, and bacterial blights. The crop was cut about 20 per cent by lack of moisture, and Mr. Gaines, the fellowship man at Williamson, estimated at least a 12 per cent loss from the tarnished plant bug, which was much worse than usual.

Carrots are the next crop of importance in this region, having taken the place of much of the lettuce that used to be grown. The principal reduction in yield was occasioned by the rust fly, which damaged about 10 per cent of the crop. Leaf spot, (Cercospora) soft rot (Sclerotinia and bacteria), a crown rot caused by Rhizoctonia, and yellows (virus) were noted in a few fields, but were not serious.

The onion crop was nearly 20 per cent above normal on account of the dry weather, although smut would have ruined it in this region if the formaldehyde treatment had not been very generally practiced. In one untreated field the stand was reduced about 80 per cent and the yield almost the same. The loss for the county is set at 10 per cent. The treatment doubtless saved the county $80,000 in 1929. Pink root was more abundant than usual, on account of dry soil conditions. Over 80 per cent of the onions were affected, but the loss is estimated at less than 5 per cent. Neck rot (Botrytis) and mildew (Peronospora) were found in a few fields, but caused appreciable loss in only one or two. Maggots and thrips are thought to have reduced the yields by about 15 per cent, the latter being fairly abundant.

There are still hundreds of acres of lettuce grown in the county, but 20 per cent of it was lost on account of tipburn and about 10 per cent from each of the other two major diseases, bottom rot and yellows, which would bring the total loss to the lettuce crop well above $45,000 for the county. Mosaic was present to the usual extent of about 3 per cent for the season, being much more than this on the later crops. A stem girdle of unknown cause and Botrytis gray mold were present in several fields.

The Oswego County Muck

At least four-fifths of the 3,000 acres of tilled muck in Oswego County are devoted to lettuce. The season of 1929 was cooler and drier than usual, although April and May were very wet. Again, nearly a third of the crop was unmarketable on account of bottom rot, according to Mr. Townsend, the fellowship man located at Oswego, who made counts in the field once a week throughout the harvest season. It is likely the county lost over $225,000 from bottom rot and about that sum in 1928. Leaf hoppers (Cicadula sexnotata) became exceedingly abundant, so that yellows (virus) ruined over 50 per cent of some fields by August 15, and the average loss for the season is placed at 10 per cent. Mosaic (virus) also affected as high as 23 per cent of some fields the latter part of the summer and is credited with an average reduction of about 5 per cent of the crop. Drop (Sclerotinia), mildew (Bremia), damping-off (Rhizoctonia), Botrytis rot, and stem girdle (cause unknown) were all found during the season and together are believed to have reduced the yield by 4 per cent, since nearly half of the crop was rendered unmarketable on account of one disease or another. It is evident, therefore, that by a conservative estimate the diseases of lettuce cost the county over $300,000.

Little reduction in yield is thought to have occurred to the 200 acres of carrots in the county, although a disease thought to be yellows was present in many fields to a small extent.

A seed-borne Fusarium caused considerable loss to spinach by damping-off the seedlings. It was controlled by soaking the seed one hour in bichloride at 1 to 1,000.

Approximately 100 acres of celery in the county were much damaged by drought. The tarnished plant bug caused heavy losses also by its injury known as black joint. Only a trace of early and late blight was found.

The Orange County Muck

Some 4,000 acres of muck in Orange County are devoted to vegetables, nearly three-fourths of which are onions. Onion smut probably took 10 per cent of the crop, some growers still refusing to use the formaldehyde treatment. Pink root was more prevalent than usual on account of the dry weather. But in spite of this and of thrips and maggots an exceptionally good crop was harvested. No mildew was seen.

Tipburn of lettuce ruined a number of spring sowings during a very hot period the last week in May and again in the latter part of June. Bottom rot likewise destroyed a high percentage of the heads at these times. The late sowings were badly affected with yellows and mosaic, some fields showing over 30 per cent.

Celery blights were almost unknown this season, but the dry weather reduced the yield approximately 25 per cent, and much loss was reported by growers in February from damping off in the greenhouse seedbeds.

After an absence of four years from the State the writer was impressed by the 1929 muck survey with two interesting things in regard to lettuce tipburn. In the first place, from the fellowship reports of the past two or three seasons it is evident there is much less tipburn than five years ago. In the second place a marked change in fertilizer practice has taken place in certain sections where tipburn formerly was very severe. The old formula of 2-8-10 has been replaced with one much lower in potash and higher in nitrogen, such as a 4-8-4 or 5-10-5. In view of the positive correlation between tipburn and fertilizers high in potash, which was pointed out in Wayne County by the author several years ago, and in view of the fact that tipburn is still more severe in those

sections of the State where the most potash is used, the improved condition can be attributed to the change in fertilizer practice; a change induced largely by the efforts of the vegetable gardening extension service.

In regard to bottom rot of lettuce, Mr. Townsend is getting considerable evidence of the positive value of cleaning off all refuse from the soil immediately after harvest, in order to remove the sclerotia of Rhizoctonia that formed in the unharvested heads and to avoid turning under any leaves on which the fungus can grow. Certain growers who have been practicing this "clean up" program for several years are notably freer from bottom rot than their neighbors who have been regularly plowing under their refuse.

Increasing evidence is being gathered by Mr. Cook indicating that onion mildew is commonly carried over as mycelium in the seed as well as in the bulbs of set onions.

DISEASES OF CANNING CROPS

J. G. Horsfall

Since the writer was employed early in 1929 to devote his time to studying the diseases of canning crops in New York State, it seemed desirable first of all to learn what diseases are affecting these crops in the State, how serious they are, and how widespread. The survey method was adopted as a means to this end.

Many of the observations, especially near Geneva, were made incidental to other work in the field, but several exploratory trips by automobile were made through the canning-crops area, the most important being a 500-mile trip in company with Prof. H. H. Whetzel and Messrs. B. H. Davis and H. J. Lee, of the Department of Plant Pathology, Cornell University. The major results of this trip have been reported briefly already (Plant Disease Reporter 13:93-95. 1929).

The writer traveled more than 1,500 miles during the summer in making the survey through the canning-crops area in central and western New York, and inspected 143 fields of these crops as well as 25 fields of dry beans and 6 fields of market garden tomatoes for comparison. This mileage was consumed in surveying 32 fields in all parts of Ontario County, 29 fields in Wayne, 7 in Yates, 9 in Steuben, 9 in Livingston, 2 in Wyoming, 12 in Genesee, 18 in Niagara, 19 in Orleans, 10 in Monroe, 6 in Oswego, 2 in Madison, 1 in Onondaga, and 6 in Dutchess.

P E A S

Canners everywhere in the State were bemoaning the poor pea pack of 1929. Almost without exception the men were in agreement that the crop was the poorest that they had had in many years. One individual said that he had been canning peas for 30 years, but he had never had such a poor pack. It seems that two major factors operated in producing this condition--drought as such and disease as aggravated by the drought. A prolonged wet spring retarded planting operations over the entire pea area, and the peas which did go into the ground formed roots only in the upper layers of soil. Then the season turned dry, catching the shallow-rooted peas unprepared. In some cases peas were planted in wet soil and never received enough rain to wet the soil again before they were harvested. Certainly such conditions are not conducive to a bumper crop. The lack of moistur

does not tell the whole story. The wet weather in the spring was highly stimulating to the diseases, especially the root rots, to which the pea plant is subject. When dry weather hit the infected peas, their yield was curtailed tremendously.

Altogether 69 pea fields were seen, totaling about 188 acres. Peas as a rule are planted in small patches by the farmer. Usually he grows two varieties, an early and a late, in order to prolong the harvest season and reduce the peak load in the canning factory.

ROOT ROT caused by Aphanomyces euteiches was the most powerful factor among the diseases in curtailing yields, especially of the earlier varieties. It was found in 27 per cent of the 56 pea fields examined, ranging from a trace to 100 per cent of infected plants. Frequently this disease occurs in a field in patches which may be seen from the road as yellowed areas in the peas. These patches cause trouble in determining the percentage of diseased plants in a field. Only one field was seen where the disease was recorded as a trace. On the other hand it was estimated to affect 10 per cent of the plants in one field, 25 per cent in another, 50 per cent in two more, and from 75 to 100 per cent in six fields. In six other fields it was adjudged serious or very serious. Several fields scattered over the State were hardly worth harvesting because of this disease; one was not harvested; and one was plowed up in the spring.

Loss in any field is difficult to estimate. Haenseler (New Jersey Rep. 1928: 275. 1929) states that infected plants produce less seed by 20 per cent than healthy plants, but this seems too conservative, especially where the soil is thoroughly contaminated with the organism. He obtained his figures by mixing naturally contaminated soil with the soil in certain rows of peas as contrasted with adjacent check rows. His reductions in yield probably would have been greater if he could have mixed the inoculum more intimately with the soil. Aphanomyces euteiches causes increased loss from year to year if peas are planted in the same soil. This probably is due to a progressively more thorough contamination of the soil. The yield was reduced almost to the vanishing point, and the quality was very poor in several fields where the plants were affected severely. The writer refrains from offering estimates of actual loss in the State. Suffice it to say that Aphanomyces root rot was the most important malady affecting early peas in the State. It should be said, however, that plants which were infected suffered greatly when the drought struck them.

The disastrous cases of Aphanomyces root rot, in which the pertinent facts concerning the rotation were available, always occurred in fields which had been in peas from once to several times before, usually within two to four years. Several interesting fields came to light in this connection. Near Lyons, in Wayne County, two neighbors agreed to plant their peas cooperatively. Accordingly they fitted their two adjoining fields as one piece the same day with the same machinery. They planted it as one piece the same day with the same drill with the same seed, and yet even a casual observer could detect the difference in the growth of the peas a few weeks after they had been planted. The crop in one field had a dark-green color, with large sturdy stalks on white unblemished roots. The crop in the other field had a sickly yellow-green color, with scrawny stems on dark shrunken epicotyls and roots, which contained Aphanomyces oospores in abundance. The first field was growing its first crop of peas; the second had produced several before. On the canning-crops farm of the experiment station peas on soil which had not had the crop before were free of Aphanomyces root rot; peas on soil which had grown peas two years or one year before had from 25 to 50 per cent of the plants affected; and peas on soil which had been planted to the crop for four years consecutively were too poor to be harvested. On the other hand, a field

of peas near the experiment station grounds was so severely infected with Aphanomyces euteiches that it had to be plowed up, and yet it had not had peas for 15 years, according to the local informants.

RHIZOCTONIA ROOT ROT caused by Rhizoctonia solani injured many peas in New York during 1929, but was decidedly of less importance than Aphanomyces root rot. The fungus frequently attacked a few scattered plants in the field without affecting the stand or the yield appreciably. It was found in seven fields where it could be rated as a trace. It affected also 100 per cent of the plants along one side of a field in Ontario County, near Rushville. The plants were simply drying up like newly-cured hay, beginning at the bottom. The cortex of the roots and epicotyl of such plants was full of Rhizoctonia hyphae.

MISCELLANEOUS ROOT ROTS. Peas are almost universally infected in the State with a browning which starts at the decayed seed and spreads both ways in the taproot. No fungus has been found constantly associated with this condition, and the extent of the damage resulting is uncertain. Rhizoctonia and Fusarium have been found, but probably these symptoms result from penetration by various soil organisms through the rotted seed which serves as an excellent infection court.

This year the seed-corn maggot (Phorbia fusciceps) has exceedingly complicated the pea root-rot problem. According to Dr. Hugh Glasgow, the station entomologist dealing especially with canning crops, the seed-corn maggot usually does not attack peas, because the crop is in the ground before the brood of maggots appears. The wet weather this spring delayed planting so long, however, that many of the peas were in the right stage to be attacked. Not infrequently the pea roots were browned and rotted adjacent to the maggot injury much as they were adjacent to the decomposed seed, as described in the last paragraph. This trouble also seems to be caused by various soil organisms which are able to enter the pea root through injuries.

Alaska peas in the vicinity of Geneva occasionally were affected with a disease which caused the roots to shrivel excessively without becoming discolored. This was not attributable apparently to drought, but frequent and careful microscopical examination failed to reveal any causal organism.

MYCOSPHAERELLA BLIGHT caused by Mycosphaerella pinodes was the most serious malady on the late varieties of peas. In the absence of reliable data on losses, it is difficult to decide upon the relative importance of this disease and Aphanomyces root-rot. Certainly both of them together destroyed a large part of the pea crop in 1929. The disease was found in 10 of the 56 pea fields examined. It was rated as unimportant in two fields, 25 per cent infection in one field, 50 per cent in one, 75 to 100 per cent in three others, and serious or very serious in three fields.

The canners' field men, who determine when the peas are just at the right stage for canning, experienced great difficulty as a result of this disease. A field man said that he might see a certain field, say on Monday, and decide that he would order it cut for the viner on Thursday. Then he would go back on Wednesday afternoon to check his judgment only to find that the peas had "gone by." They had become too hard for the best quality pack. Furthermore, they would be undersized, which reduced the yield to the farmer, causing him to say unkind things. Apparently the malady retards the movement of the large quantity of water to the seeds which is necessary for their final enlargement just before reaching the stage for canning. Hence they dry and harden more quickly than normally.

It appears that the whole story of the origin of an infection in a field has not been written. For example, the Geneva Preserving Co. in 1929 used only seed from the dryland Western States, supposedly relatively free of the blight pathogene. Seed from the same lot planted in different places produced plants with different quantities of infection. No peas had been on any of the fields in question for several years, according to the field man. This indicates a local origin of inoculum.

ASCOCHYTA LEAF AND POD SPOT caused by Ascochyta pisi was found occasionally, but never in a severe amount.

ASCOCHYTA FOOT ROT caused by Ascochyta pinodella also occurred sporadically in pea fields without doing much apparent damage.

B E A N S

In general, beans were comparatively free of the troubles like anthracnose and blight, which canners usually recognize as serious. The exceedingly dry season during the germination and growth of the beans held the spread of these two diseases to a minimum, so that canners over the State were fairly well pleased with the bean pack. The dry weather reduced the yields some, but the pods were unusually free of spots. Forty-two fields containing 313 acres of canners' beans were examined, as well as 21 fields of field beans for comparison.

MOSAIC, a disease not usually recognized by canners or field men, was the most destructive trouble of string beans in the State in 1929. Several canners, when questioned, averred that their bean crop was singularly free of disease, but in all cases a short field trip was sufficient to demonstrate that the individual was laboring under a delusion, because mosaic was present in severe form in the neighborhood of all canneries from Mount Morris, in the western part of the State to Canastota, in the central. Out of the 42 fields of string beans examined late in July, 32, or 76 per cent, showed mosaic ranging from a trace to 100 per cent of the plants affected. The Idaho-grown seed almost invariably showed large percentages of mosaic. It is of interest that only 2 out of 21 areas of field beans showed mosaic. One field had only a trace of the trouble, and one field of Genevas had 20 per cent of the plants affected, as shown from an average of three counts.

Seven fields of string beans showed only a trace of mosaic; three showed 1 per cent of the plants diseased; three showed 5 per cent; five showed 10 per cent; five showed from 20 to 25 per cent; and nine showed practically all the plants affected. By weighing the percentage of diseased plants in the fields of various sizes it was found that an average of 16 per cent of the string beans in the State were affected with mosaic. In the absence of definite information regarding the reduction which mosaic causes in individual plants, it is difficult to say what loss was sustained, but 10 per cent probably is not too high.

BACTERIAL BLIGHTS caused by various bacterial pathogenes were not causing any serious trouble in late July when the majority of the bean fields were surveyed. The blight caused by Bacterium phaseoli was rated as a trace to 1 per cent in nine fields totaling 53 acres. Burkholder's bacterial disease, halo blight caused by Bacterium medicaginis var. phaseolicola, occurred in five fields totaling 115 acres where it was causing some loss, which, however, was not serious. These two bacterial diseases seemed to be somewhat more prevalent in the dry beans.

ANTHRACNOSE caused by Colletotrichum lindemuthianum was not observed in any of the 63 fields of beans examined. It doubtless occurred in very small quantities, but the dry weather reduced its ravages almost to the vanishing point. No anthracnose appeared in one field planted with seed showing 8 per cent infection on the germinator.

DRY ROOT ROT caused by Fusarium martii var. phaseoli occurred in 14 fields containing 167 acres, sometimes only as a trace, sometimes very severe. In some cases the plants had put out adventitious roots above the injury which were allowing them to combat it. Although fields containing 100 per cent infection were not uncommon in the canners' bean area, they were less frequent than they were in the dry bean section in Livingston and Wyoming Counties. Root rot caused by Rhizoctonia solani was found occasionally.

T O M A T O E S

Tomatoes are grown for canning in western New York near Lake Ontario and Lake Erie from Rochester to Buffalo and southwest of the latter city in Erie County. All of this area except Erie County was surveyed, as well as a small section of market-garden tomatoes near Poughkeepsie, in the Hudson Valley. Altogether 44 fields, including about 270 acres, were inspected. In general, tomatoes were decidedly free of diseases. In western New York this condition of affairs seems directly attributable to the meticulous care used by the large plant growers there. The premises are kept scrupulously clean, and all growers use soil which has not had tomatoes on it, certainly not for many years. One man, at least, steams his soil and flats for one hour before using. Several treat their seed with copper sulphate at the rate of 4 pounds in 50 gallons of water, which aids in controlling damping-off when the conditions are unfavorable. Several in Chautauqua County also add charcoal to the soil, thinking that it helps them to control damping-off (according to Chupp, Plant Disease Reporter 13:88. 1929). The source of the seed is not controlled, however.

MOSAIC. Contrary to expectations mosaic was not a serious factor in the tomato industry. Ten fields of 52 acres scattered throughout the tomato area showed a trace of the disease. Counts in several fields planted from seedlings originating in the same greenhouse near Geneva revealed 0.7 per cent in one field, 2.4 per cent in another, and 8.5 per cent in a third. These plants were affected with the fernleaf type of the disease. One field near Ontario Center had 1 per cent of the plants affected with mottled mosaic, and a field near Poughkeepsie had a 30 per cent infection.

SEPTORIA LEAF SPOT (Septoria lycopersici) sometimes called blight, was unimportant in the State as a result of the dry weather which obtained throughout the season. In fact, the writer had difficulty in inducing the disease to spread in some artifically inoculated plots on the station farm. When the majority of the tomato fields were inspected late in July, only traces of the disease were observed in three fields. Near Lockport the only two fields examined had a small amount of infection on the lower leaves. The local county agent thought that Lockport had had more rain than some of the neighboring sections. The farmers owning these two fields probably stood an appreciable loss in yield from the disease. Early in September two small contiguous fields of Landreth and Marglobe were seen near Wilson, in Niagara County. Leaves on Landreth plants were much more severely spotted than those on the Marglobe. In fact, the Landreth plants

were almost defoliated, but only a few leaves were gone from the Marglobe plants. Also, near Poughkeepsie one field contained plants which were more than half defoliated by Septoria by September 6.

EARLY BLIGHT caused by Alternaria solani was not seen except as mere traces in western New York, but it caused a peculiar condition in the Hudson Valley near Poughkeepsie where it was called to the writer's attention by E. V. Shear, pathologist in the branch laboratory of the New York State Agricultural Experiment Station dealing with fruit investigations. It appeared shortly after the Georgia-grown plants were set into the field. Different diagnosticians pronounced the disease of different origins. One said it was due to Bacterium vesicatorium or Aplanobacter michiganense. Another said it was due to Phoma destructiva, and still another thought it was caused by Alternaria solani. Ascochyta lycopersici also was suggested as a possible causal agent. A conference between Miss Mary K. Bryan, of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C., Mr. Shear, and the writer at Poughkeepsie early in September resulted in diagnosing the disease as early blight. It had none of the symptoms of the bacterial diseases, and pycnidia were too scarce to admit of a causal relationship with the Phoma or the Ascochyta. Briefly, the symptoms early in the season were sharply delimited spots on stems, usually superficial, but occasionally deep seated, sometimes girdling the stem, causing it to swell above the lesion or to break over and then grow upright again at the end. The lesions were dark brown and frequently zonate. When the writer saw the disease in the field in September, the stems and petioles as well as the leaves were peppered with typical zonate Alternaria lesions. The inclement weather kept many tomato plants in the greenhouse until they were quite large. The result in several cases was a severe attack of Alternaria, which caused the loss of several hundred plots in Chautauqua County.

FUSARIUM WILT caused by Fusarium lycopersici does not occur as a rule in northern and western New York, but one field observed in the Hudson Valley had more than 5 per cent of the plants killed by this vascular parasite. This is the only record which the writer has of this disease in the State in 1929.

BACTERIAL CANKER caused by Aplanobacter michiganense was observed in only one field of the 44 examined in the State. A few plants from Utah seed were affected in an experimental field on the station farm. A survey especially for this disease through the tomato area in company with Miss Mary K. Bryan failed to discover a single trace of the malady.

SUNSCALD was so severe in a field near Egypt, Montoe County, that the local canner sent in specimens for identification. This seemed to be due to a lack of shade for the fruit as a result of early defoliation by Septoria.

LEAF ROLL, which is alleged to be caused by disturbed water relations, occurred occasionally. Two fields in Orleans County and two fields on the station farm showed large percentages of the malady.

S W E E T C O R N

RUST caused by Puccinia sorghi occurred in a small quantity here and there.

SMUT caused by Ustilago zeae is an almost ubiquitous parasite of sweet corn in the State without resulting in much damage as a rule.

ROOT ROT caused by various pathogenes occurred in a small amount in an experimental field on the station farm. It was rated as a trace in one field near Mount Morris.

C A B B A G E

WIRE STEM caused by Rhizoctonia solani injured about 75 per cent of the seedlings in a plant bed near North Rose, in Wayne County.

BLACK-LEG caused by Phoma lingam was brought in once from Hall near Geneva, and was present in a number of other fields in Ontario County. The source very evidently was the seed bed.

CLUBROOT caused by Plasmodiophora brassicae occurs very commonly in the State on the more acid soils. Growers, however, are coming more and more to realize that lime is a good preventive.

TIPBURN, which is a physiological trouble appearing as dead leaf terminals, was seen in a small area in a field of cabbage on the station farm. It was much less common throughout the State than usual.

BLACK-ROT (Bacterium campestre) was rare in the State. In the Schenectady-Albany district some affected fields were observed. The growers named it yellows, and many had bought yellows-resistant seed to combat it. Apparently the yellows-resistant seed also was free from black rot.

B E E T S

CERCOSPORA LEAF SPOT caused by Cercospora beticola was negligible near Geneva, probably because of the dry weather.

DAMPING-OFF caused by various pathogenes occurred in a small field of market garden beets with an overhead irrigation system. It ruined the stand completely. In a field of about 160 acres of beets near Mount Morris, in Livingston County, the stand was exceedingly poor a few weeks after planting. The local canner ascribed this condition to the extreme drought which prevailed after planting.

C U C U M B E R S

WILT caused by Bacillus tracheiphilus was destroying 5 per cent of the crop in one 5-acre field examined near Holley, Orleans County.

MOSAIC was a serious factor in several plots of market garden cucumbers near Rochester. This disease was very severe also in certain squash and melon plantings near Geneva. It was more common generally upstate than in 1928.

The cucumber crop was very poor, not due so much to disease as to very strong, dry winds that seemed to scorch the leaves and vines. The plants that grew behind windbreaks looked much better.

The general practice of treating the seed, together with the dry weather, suppressed almost entirely the angular leaf spot.

DISEASES OF WINTER WHEAT

H. H. Whetzel

The leaf rust of wheat, caused by Puccinia triticina, was very general and severe throughout the wheat-growing sections of western New York. Several long trips were made through the wheat sections and many fields examined. In most of the fields the leaves were all more or less rusted and yellowing at blossoming time, the latter part of June. The rust appeared early and developed rapidly.

On the basis of studies made by Mains in Indiana (communicated to the writer by letter) on losses in winter wheat due to leaf rust in 1927 in that State, the writer is of the opinion that the injury to the wheat crop of western New York in 1929 was not less than 15 to 20 per cent. By dusting 5 times with sulphur Mains obtained an increased yield of approximately 11 per cent on plots which at heading time showed from a trace to 10 per cent rusted leaves. At this stage of development of the wheat in New York in 1929 the rust was general and severe in most fields. In fact, in many fields all the foliage was dead or dying by the time blossoming was over. It seems safe to say, therefore, that a loss at least twice as heavy as that recorded by Mains for his plots in 1927 is well within reason for the wheat crop of New York in 1929.

Little or no stem rust was observed in any of the fields examined.

Records taken of counts of smutted heads in 31 wheat fields showed but little loss from loose smut in western New York in 1929. As high as 5 per cent was counted in but 3 or 4 fields. In 11 fields no smut was to be found. The remaining fields showed from a trace to 2 per cent. The average was below one-half of 1 per cent.

IMPORTANT DISEASES OF TREES AND SHRUBS

D. S. Welch

The following is a brief summary of some observations on important diseases of woody plants made during the season of 1929. No attempt has been made to include the score or more of wood-rotting diseases which are constantly present and destructive.

Foliage diseases of the anthracnose group attracted considerable attention during the year. The following cases were observed in the field or were received from correspondents:

Anthracnose of oaks caused by Gnomonia veneta (Sacc and Speg.) Kleb. appeared to be more serious on members of the white-oak group.

Anthracnose of maple, caused by various species of Gloeosporium, was most commonly found on Acer platanoides var. schwedleri and A. palmatum var rubrum.

Serious cases of anthracnose were observed on Fagus grandifolia and Betula lutea, associated in both cases with species of Gloeosporium.

Leaf blotch of horse-chestnut caused by Guignardia aesculi (Pk.). Stewart continues to be epiphytotic and was unusually destructive this year.

The anthracnose of catalpa caused by Gloeosporium catalpae was received from Long Island.

A Gloeosporium has been observed for several years associated with a leaf and twig blight of Salix alba var. vitellina (?). Severe damage to the new growth occurs every year.

A serious anthracnose of European linden, caused by Gloeosporium tiliae was discovered on Long Island. This appears to be the first report of this disease in America.

Other tree diseases of importance are indicated in the following list:

Leaf blister of oak, caused by Taphrina coerulescens (Mont. and Desm.) Tul., was found in abundance on several trees. The actual damage appeared to be slight.

Bacteriosis of walnut (Juglans regia) caused by Bacterium juglandis (Pierce) EFS., was received from several correspondents. This disease of the cultivated walnut appears to be well established in the State.

Leaf scorch of Acer saccharum, cause physiological, was quite prevalent during the year.

Twig blight and die-back of Acer saccharum were found in numerous cases associated with Coryneum negundinis B. and C.

Leaf blister rust of Pinus resinosa caused by Coleosporium solidaginis (Schw.) Thuem. was received from two correspondents in the Hudson Valley. This disease does not appear to be causing much damage.

Dothichiza populea Sacc. and Briard, on Populus nigra var. italica, twig blight.

Guignardia vaccinii Shear on Kalmia latifolia, leaf spot.

Cytospora chrysosperma (Pers.) Fr., on Salix caprea, twig blight and canker.

Dothidea tetraspora B. and Br. on Osage-orange (Maclura aurantiaca).

Cytospora syringae Sacc. on Syringa vulgaris, die-back of twigs.

THE WILLOW BLIGHT

H. H. Whetzel

The pioneer work of Clinton and McCormick, as set forth in Connecticut Bulletin 302, 1929, on the willow "scab" [Venturia chlorospora (Ces.) Karst. (Fusicladium saliciperdum (All. and Tub.) Tub.)] in North America, first stimulated the author to search for the disease in the State of New York. This brief article sets forth the results of a rather limited survey for this disease in the State during the summer of 1929.

As suggested by Haskell (special memo: Willow Scab, June 10, 1929) the disease is a "blight" rather than a "scab" disease. The writer, therefore, proposes the name "willow blight" to designate this disease.

According to Clinton and McCormick (1929:445) the willow blight was reported from "restricted localities" in New York as early as 1927, and was again collected by Miss McCormick along the Hudson-Hillsdale highway and on the road from Pittsfield to Albany in the Hudson Valley region in 1928. Thus, so far as published records go, the disease was unrecorded west of the Hudson River Valley in this State at the beginning of 1929. Our efforts, therefore, were primarily directed to determining if it had spread to the western sections of the State. The shaded portion of the accompanying map will show roughly the area included in our survey. The eastern extension of the survey comprises a narrow strip along the Cherry Valley highway covered by D. S. Welch and the writer returning from the summer meeting of the American Botanical Society held at Hanover, N. H., the latter part of June. Although we were on the sharp lookout for the blight all along the way, it was not picked up until we reached the little village of West Winfield, in the very southwest corner of Herkimer County.

The northwestern part of the State, from Niagara County east to Oswego, was covered by three rather extensive survey trips during the season, the first of which was made July 22 to 28, in connection with the canning-crop survey trip reported on elsewhere in this supplement by J. G. Horsfall. Several survey trips

through central New York, the first of which was made early in June, yielded the only records of the disease which we obtained. Only seven stations for the disease were discovered. With one exception all the collections were made during June and early July. The surveys of western New York and the two trips north of Oswego into Jefferson and St. Lawrence Counties were all made after July 15. A newspaper article on the willow blight published the latter part of July brought a considerable number of specimens from different parts of the State, but only one, that from Slaterville Springs, a few miles from Ithaca, proved to be this disease.

It seems improbable that the willow blight in the western half of the State is confined to the south-central area represented by the seven stations where it was taken. Frequent trips were made either by the writer or by Messrs. Lee and Davis during June north and west of Ithaca as far as Batavia in Genesee County, yet the blight was never discovered in that section of the State. There are, however, good grounds for believing that surveys for this disease are likely to prove most fruitful early in the season, in most seasons probably from the middle of May to the first of July. This is illustrated by observations made at South Bay, the locality where the disease was first taken by us. When we first saw this willow swamp at the east end of Oneida Lake on June 13, the bushes appeared as if swept by fire, and the destruction was visible for a long distance. This station was visited again in July and August. The shrubs had put forth new leafy shoots, and the old blighted leaves had largely dried and fallen, so that the bare dead twig tips were almost completely hidden by the new leafage. From a short distance the bushes appeared normal and healthy. One had to go into the swamp to discover the blighted, more or less bare twigs which had stood forth so prominently early in the season. To what extent this "recovery" of blighted willows may have hidden other stations from us during the July and August trips, I can not be sure. It seems highly probable, however, that it did.

It is interesting that in only one case was the disease taken on a tree willow (Salix fragilis). That was on two young trees planted in the Catholic churchyard at West Winfield. In all the other cases it occurred only on shrub willows; five cases on S. cordata and one case on S. sericea. The most general and severe outbreak seen was that at South Bay where the species involved was S. cordata. Here several acres of swamp were covered with this species and practically all the early twig growth on all the plants was killed back more or less completely. It is remarkable that the new twig growth put out during late June and July was practically free from infection. Our collections confirm the observations of Clinton and McCormick (1929:448) that S. cordata is the most susceptible of our willows. S. discolor growing intermixed with badly diseased bushes of S. cordata at Erieville were entirely free of infection.

The accompanying map shows the stations where diseased specimens were collected, and the species of willows affected.

Duplicates of most of the specimens were sent to Dr. Clinton for confirmation, and duplicates of all of them have been deposited in the Mycological Collections of the Bureau of Plant Industry. The host species were in every case determined by Dr. K. M. Wiegand, of the Department of Botany at Cornell University.

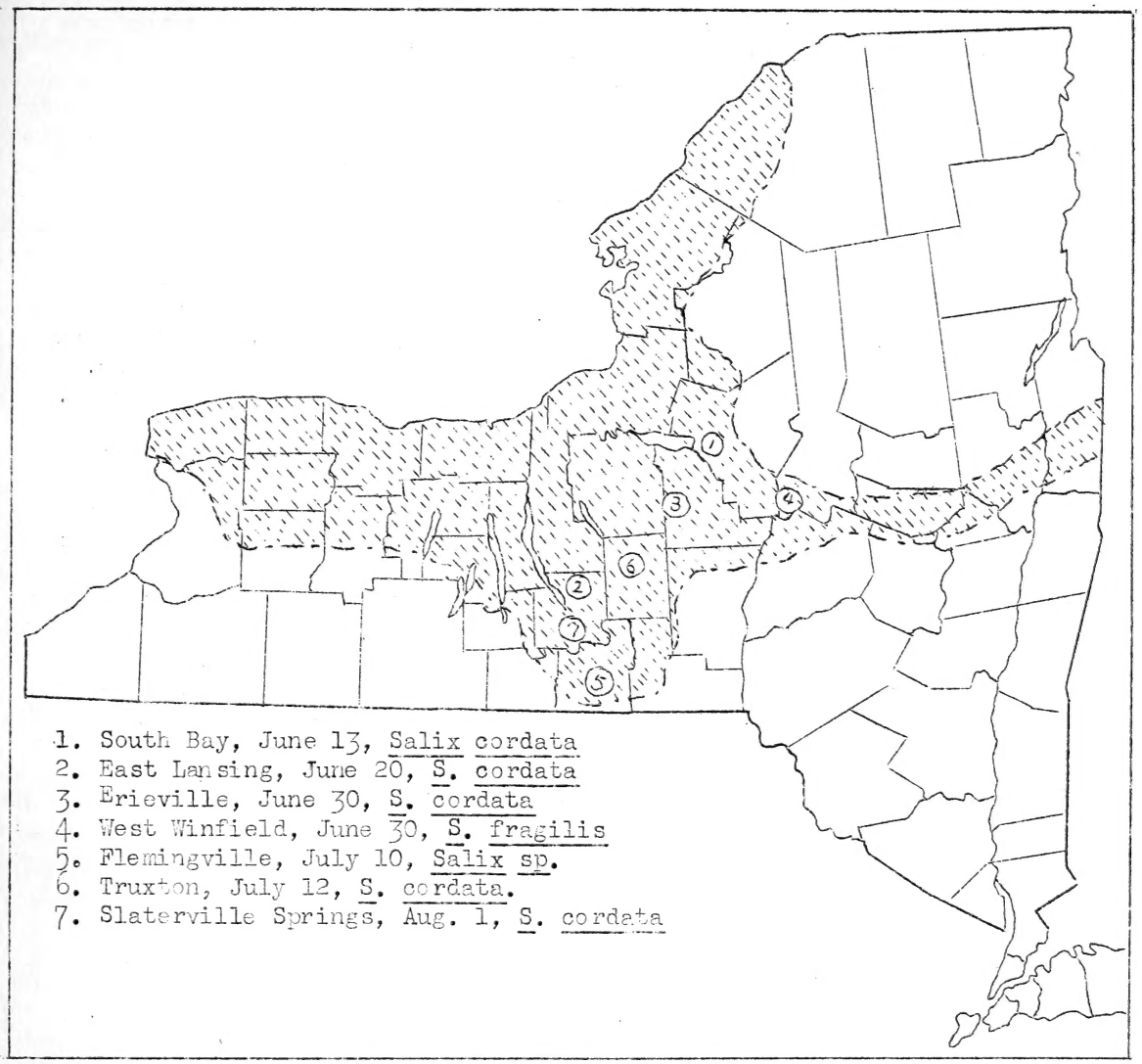

Figure 7. Showing surveyed area and stations for willow blight in State of New York for 1929. By H. H. Whetzel

LILAC BLIGHTS

H. H. Whetzel

The bacterial blight of lilac, caused by Bacterium syringae, was widely prevalent in the State during the spring of 1929. In some sections, especially in the northwestern part of the State, it appears to have been very severe. Assistant County Agent E. J. Hamilton, who sent specimens from this section on June 6, wrote: "Practically all the way from Lancaster in Erie County through East Aurora, Colden, Glenwood, and Springville into Cattaraugus County the lilacs appear as if swept by fire. They vary of course in the degree of infestation,

some showing only traces of symptoms while others show few green leaves." He found the disease prevalent as far south as Salamanca, beyond which he did not go.

The writer collected or received specimens of this disease from many widely separated sections of the State: Olean, Schenectady, Oswego, Morrisville, Colden, Webster, Camden, West Amboy, and Ithaca.

There seems to be marked variation in the susceptibility of species and varieties of Syringa. There is also a most puzzling variation in the incidence of the disease on individuals of the same variety in any given locality. The common (lilac) variety of Syringa vulgaris appears to be most frequent and severely affected. The white-flowered form is less severely attacked. S. Persica was also found to be affected in one garden, though not nearly so severely as a bush of S. vulgaris standing beside it.

The season, especially during May, was generally wet, which appears to have favored the dissemination of the bacteria. Invasion seems to take place commonly through the stomata into the leaves which are rapidly blighted, the infection proceeding down the petiole into the young rapidly growing shoots. These quickly die back to last season's wood. Infection takes place only when the leaves are quite young. The young shoots or suckers arising from the trunks and main branches are most severely blighted. No case, however, was observed where the infection extended from the blighted sucker into the bark of the limb or trunk. The disease does not appear to cause cankers as does the fire blight of pomaceous trees, with which in other respects the lilac blight is strikingly similar. Blossom infection was very common, the blossom clusters often being killed when half grown and before the flowers opened. Infection of open blossoms was also common, causing premature browning and fall of flowers.

A severe outbreak of this disease in the writer's own garden afforded excellent opportunities for study and observation on the symptomatology of the bacterial blight.

The Phytophthora blight, caused by Phytophthora syringae, was received from two localities not far from Ithaca. This disease, while somewhat like the bacterial disease in its general aspect, is distinguished by the light brown color of the leaf and stem lesions. The mycelium and conidia of the fungus can readily be detected in the lesions.

THE LEAF SPOT OF THE IRIS

H. H. Whetzel

The leaf spot of the cultivated iris, caused by Heterosporium gracile, the conidial stage of Didymellina macrospora Kleb., was to be observed in every iris plantation in the State.

The disease appeared early in the summer of 1929, and by the middle of June was already very severe on susceptible varieties. The leaves were not only spotted but were already dying back severely from the tips. This disease is clearly more harmful to the iris than is commonly realized by iris growers. While some varieties are almost or quite immune, many of our choice forms are almost always severely affected.

Observations made in a large iris plantation at Ithaca during the summer of 1929 prove beyond question that the disease is really very injurious and incidentally indicate that it may be quite readily controlled. The grower had two plantations of many varieties separated only by a grassy swale. His "show" plot, situated on one slope, faced his stock plantings of the same varieties opposite.

Soil conditions, etc., were essentially the same. The show plot had been thoroughly cleaned the previous autumn by the removal and destruction of all diseased leaves. The stock plot had been allowed to go into winter with the blighted and spotted foliage untouched. This was not removed in the spring before culture began. By the middle of June when the iris were in full bloom, the stock plot was brown and ragged, due to the severe spotting and dying back of the foliage. The show plot showed only traces of the leaf spot on the foliage of the more susceptible varieties. The show plot had, it is true, received one good application of copper-lime dust early in May, but this can hardly account for the extraordinary contrast between the two plots. The plants in the show plot were larger and more vigorous, the flowers on the average larger and more numerous for the same variety, foliage more abundant, and the aspect of the two plots a striking and instructive contrast.

The Heterosporium leaf spot appeared in very severe form on the blackberry-lily, (Belamcanda chinensis)in the writer's garden in a planting quite isolated from iris plants. These plants were grown from seed collected from escaped plants in a meadow at Crawfordsville, Ind., some years before. It is interesting that this plant should also be a host for the pathogene. The native wild iris, Iris versicolor, seems to be completely immune to the disease.

TWO WHITE SMUTS OF THE GARDEN

H. H. Whetzel

For a number of years the writer has observed two Entyloma diseases which appear regularly each season in his garden at Ithaca, N. Y.

About 10 years ago he introduced into his garden Physalis pruinosa, the fruits of which make a most tasty jam. Since that time plants of this ground-cherry come up regularly each spring as volunteers all over the garden. For the first year or two the plants were large, spreading, and healthy, producing an abundance of fruit. In 1921 the white smut was observed on several plants. The leaves were covered with rather small white erumpent areas covered with a powdery white coating of the oblong conidia of Entyloma australe Speg. These spots soon turn to a rusty brown. Cross sections of the leaf through these lesions exhibit the brownish globose thick-walled chlamydospores in great abundance in the tissues.

The disease has appeared regularly every summer since, becoming very severe and destructive by August. The affected plants are dwarfed, due to severe leaf injury and defoliation. The fungus apparently winters as chlamydospores in the rotted leaves in the soil. Although no attempt at control has been made it is quite probable that dusting with sulphur or copper-lime dust would largely prevent secondary infections by the conidia.

Entyloma australe Speg. also occurs on another species of Physalis in New York. It has been twice collected on P. subglabràta, in 1922 at Taughannock, N. Y. (C. U. Plant Pathology Herb. 11889) and once 1923 at Auburn, N. Y. (C. U. Plant Pathology Herb. 12538). It has been reported on P. pruinosa in this State only from the writer's garden at Ithaca (C. U. Plant Pathology Herb. 11750, 12439, 12441, 17743). Clinton (N. A. Fl.) reports this fungus on several other species of Physalis, as well as on Solanum nigrum, S. triflorum, and Solanum sp. (From Florida). He does not list it on either P. pruinosa nor on P. subgladràta. It appears to be world-wide in its distribution.

Another white smut also occurs regularly in the writer's garden on a weed, Lobelia inflata. This is caused by Entyloma lobeliae Farl. It has also been take

several times on the same host in the fields and forests about Ithaca. It causes circular white patches on the leaves. The lesions are larger than those of E. australe on Physalis. They are fewer in number per leaf and do not appear to seriously injure the plant.

LIST OF SPECIMENS DEPOSITED IN THE MYCOLOGICAL COLLECTIONS OF THE BUREAU OF PLANT INDUSTRY

No. 17531 * Venturia chlorospora (Ces.) Karst on Salix cordata
17539 Venturia chlorospora (Ces.) Karst on Salix cordata
17540 Bacterium syringae (Van Hall) EFS. on Syringa vulgaris
17541 Scolecotrichum graminis Fckl. on Alopecurus geniculatus
17542 Phytophthora syringae Klebh. on Syringa vulgaris
17543 Gloeosporium tiliae Oud. on Tilia cordata
17573 Puccinia cyani (Schleich) Pass. on Centaurea cyanus
17676 Venturia chlorospora (Ces.) Karst. on Salix fragilis
17577 Venturia chlorospora (Ces.) Karst. on Salix cordata
17601 Cintractia caricis (Pers.) Magn. on Carex muricata
17602 Corynoum negundinis B and C. on Acer saccharum
17603 Nectria cinnabarina (Tode) Fr. on Malus malus.
17609 Phacidium tini Duby on Viburnum cassinoides
17611 Fusicladium radiosum (Lib.) Lendr. on Populus grandidentata
17618 Peronospora polygoni Thümen on Polygonum scandens
17620 ? Sphaerotheca humuli (DC) Burr. on Filipendula rubra
17621 Puccinia thalictri Chev. on Thalictrum polygonum
17622 Cercospora zebrina Pass. on Melilotus alba
17623 Phyllosticta lantanoides Pk. on Viburnum dentatum
17625 Ramularia aromatica (Sacc.) V. Höhnel on Acorus calamus
17626 Pseudopeziza trifolii (Fr.) Fckl. on Trifolium pratense
17630 Venturia chlorospora (Ces.) Karst. on Salix sericea
17644 Aphelenchus olesistus Ritz. Bos. on Begonia melior
17743 Entyloma australe Speg. on Physalis pruinosa
17787 Venturia pyrina Aderh., on Pyrus communis
17788 Gloeosporium catalpae E.and E. on Catalpa speciosa
17796 Entyloma alismacearum (Cr.) Sacc. on Alisma phantago-aquatica
17803 Septoria lycopersici Speg. on Lycopersicum esculentum
17804 Bacterium medicaginis Sackett, var. phaseolicola Burk on Phaseolus vulgaris
17805 Bacterium medicaginis Sackett var. phaseolicola Burk. on Phaseolus vulgaris
17806 Fusarium martii var. phaseoli (Burk.) on Phaseolus vulgaris
17807 Aphanomyces euteiches Drechsler on Pisum sativum
17808 Microsphaera alni (Wallr.) Salmon on Lathyrus palustris
17834 Venturia chlorospora (Ces.) Karst. on Salix cordata

* Plant Pathology Herb. Cornell Univ. numbers.