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THE PLANT DISEASE BULLETIN

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THE PLANT DISEASE SURVEY

Supplement 28

Diseases of Fruit and Nut Crops

In the United States in 1922

July 15, 1923 .

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DISEASES OF FRUIT AND NUT CROPS IN THE UNITED STATES IN 1922

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INTRODUCTORY STATEMENT

The fruit disease situation in the United States in 1922 was in marked contrast to that in the preceding year. Notwithstanding the spring freezes, conditions were more generally favorable for a normal crop in 1922. It was commonly predicted that the general neglect of control practices in the sections affected by frosts in 1921 would result in an increase in the prevalence of orchard diseases in the following year, due to the more abundant supply of overwintering inoculum and the consequent increased possibility of infection and greater difficulty of control. This prediction of greater importance of diseases proved to be quite true in the eastern apple belt, but the favorable weather conditions in the spring of 1922 must be considered as an important contributing factor.

The economic loss due to unmarketable fruit resulting from disease was much greater than in 1921, due both to increased yield and increased amount of disease. The production of apples, pears, and peaches showed the following respective increases over 1921: 35.5%, 38%, and 30.9%. Nowadays a complete loss seldom results from unmarketable fruit, as was formerly the case. A larger number of "cull apples" are being utilized at present for by-products such as jelly, apple butter, cider, vinegar, etc., and even the pomace from the cider mills is being used in the production of pectin.

In summarizing the data submitted by collaborators in 1922, certain conditions have been stated and suggestions made which are pertinent to disease problems of general concern. Greater cooperation along certain lines indicated in the summary would assist materially in explaining and correlating disease conditions and contribute to the working-out of more effective control measures. The Plant Disease Survey affords a "clearing-house" for brief reports on the results of investigations that might be seriously delayed through other means of publication.

Information on the first seasonal appearance of a disease would be more valuable if definite data were included on the stage of growth of the host. Phenological data should prove of great assistance in correlating facts regarding disease prevalence. The association of a certain stage of development of the host, such as the pink or petal-fall stage of apples, for instance, with the dates of first appearance of a disease, would prove of great assistance in determining the reasons for regional occurrence and varietal susceptibility.

Greater cooperation is needed in the control of certain diseases in order to prevent their increased distribution through nursery stock. This situation is particularly true of crown gall and apple blotch. More intensive investigations as well as greater publicity through the extension specialist are timely necessities for the future economic control of these diseases.

A number of special reports on orchard disease surveys have been included in this summary. The detailed data given in these reports present most strikingly the situation with regard to diseases in large commercial orchard communities and indicate the importance of the control problems.

Several collaborators, also, have submitted extensive observations on relative varietal susceptibility to certain diseases. Where large varietal tests of fruits are being conducted it is possible to secure data on susceptibility or resistance which are of especial importance, and it is urged that collaborators send more reports of this nature where opportunity presents.

Considerable interest is manifested in the use of the home-made and commercial calcium caseinate spreader in connection with the orchard sprays. Reports of the results of experiments on the use of spreaders in increasing the distribution and fungicidal efficiency of sprays should prove of interest for next year's summary.

WEATHER OF 1922.Rainfall by Months

(Abstracted from Monthly Weather Review, Volume 50, 1922.)

January. The total precipitation for the month was generous over the Gulf and Atlantic Coast states and in the Ohio and lower Mississippi Valleys. The precipitation was usually light over the northern districts east of the Rocky Mountains and over the Pacific Coast and northern Plateau states there was a well marked deficiency.

February. The rainfall of the month was generous and usually above normal over the Gulf and South Atlantic states, the total amounts ranging from 4-8 inches over a wide area from eastern Texas to southern Virginia. Precipitation was generally above normal in California, the middle Plateau, northern Plains, and Great Lakes region.

March. In the Central Valleys and eastern districts, March was generally rainy, the total falls for the month being in excess of the normal over all states from the Great Plains eastward to the Atlantic Coast, save in Maine, Florida, and the Dakotas.

April. In general the month had decidedly more rainfall than is normally received in April over a large part of the Central Valleys and portions of the near Southwest. It was less than normal in most Atlantic Coast sections, along the east Gulf Coast, over the Florida peninsula, and generally over California, Oregon, and portions of adjoining states.

May. Rain was generally abundant, and in many sections far above normal, from Texas and Oklahoma eastward. In Ohio and middle Mississippi Valleys, Iowa, and Missouri, the monthly amounts were usually slightly less than normal.

June. Precipitation was frequent and usually heavy over most eastern districts. In fact portions of New York and New England had more rain than ever previously recorded in June. In portions of Illinois, Indiana, Iowa, and locally in adjoining states, the total fall for the month was less than one inch.

July. Rainfall was frequent, and in many instances heavy over most districts from the Rocky Mountains eastward during the first two decades of the month, and there were local heavy falls during the last decade in portions of the South Atlantic states and the lower Missouri Valley.

August. Precipitation was well distributed during the month, though the amounts were mainly less than normal, over the Atlantic Coast districts, particularly from North Carolina to Florida, and rain was frequent in Colorado and adjoining portions of the Mountain and Plateau regions.

September. There was a general lack of rainfall over all parts of the country. Of the 48 states only 4 had average precipitation equal to or above the normal; namely, Florida, Ohio, Michigan, and North Dakota.

October. Precipitation was deficient over the greater part of the country. Only a few of the states along the south Atlantic and east Gulf Coasts and those bordering the Pacific had state-wide averages appreciably above the normal.

November. While precipitation was markedly deficient over the more eastern sections, those immediately west of the Mississippi River and extending thence to the Rocky Mountains had, in the main, abundant moisture.

December. From the middle and lower Mississippi Valley eastward the month's precipitation was generally well above normal, but from Maryland north-eastward and in the Lake region the amounts were mainly less than normal, though

not seriously deficient save in a few areas. From the upper Mississippi Valley and South Dakota southwestward to the Rio Grande and the southern borders of Arizona and California there was a marked deficiency. Over most of California, Nevada, and Utah, and the states to northward, and usually in Montana and North Dakota the monthly totals were close to or above normal, and considerable excesses were the rule in the central and northern portions of Utah and Nevada, in western and north-central Oregon, and in central California, also near the south-central coast of that state.

Temperature by Months

(Abstracted from Monthly Weather Review, Volume 50, 1922.)

January. For the month as a whole, temperatures were below normal in all districts west of the Rocky Mountains. Monthly averages were also below normal by small amounts from Texas northeastward to the Ohio Valley and over much of the Atlantic Coast area.

February. The month as a whole was marked by continuous but not severe cold over the upper Missouri Valley, and it was colder than normal over all districts from the Rocky Mountains westward.

March. For the month as a whole, the temperature averaged below normal over all districts from the Rocky Mountains westward and in portions of the West Gulf states. Over the districts to the eastward, the temperature averages were mainly above normal.

April. As a whole, the month continued warmer than normal over most districts from the Great Plains eastward. It continued colder than normal over the more western districts. Cold periods occurred about the 22nd to 24th in portions of the Ohio Valley and Middle Atlantic states.

May. From the Rocky Mountains eastward the month, as a whole, was warmer than normal, and distinctly so over the central and northern districts. The month was among the warmest of record.

June. No unusual heat or cold occurred during the month over extensive areas or periods, and the ranges from day to day were usually small.

July. The average temperatures were below normal throughout the Great Central Valleys, most eastern districts, and over the middle Gulf states. They were well above normal over Texas and the far Southwest, the central valleys of California, and the central and eastern portions of Washington and Oregon.

August. The month as a whole, was distinctly warm over the Great Central Valleys, and mainly cool over eastern districts, but with marked variations from normal conditions save in a few instances at any period.

September. The mean temperature of the month, as a whole, was above normal in practically all parts of the United States. Throughout much of the country from the Rocky Mountains westward it was the warmest September in many years.

October. Average temperatures above normal over all portions of the country from the Erie region northeastward, along the immediate middle Gulf Coast, and in the Great Valley of California. Freezing weather occurred in all the states except Florida, the more northern portions of the Gulf states, and the elevated sections of the South Atlantic states.

November. The average temperature for the month, as a whole, was above normal in practically all portions of the United States and to the eastward of the Rocky Mountains, and decidedly so from Kansas and Missouri northward.

December. The month averaged colder than normal in all northern portions, the deficiency being greatest, 5° to 9° per day, from central Washington east-

WEATHER - Temperature and rainfall

Table 78. Departure from the normal temperature and rainfall by states - April to September, 1922. (Figures taken from United States Department of Agriculture Monthly Weather Review 50: 1922.)

	Departure from normal											
	Temperature (°F)						Precipitation (inches)					
	April	May	June	July	August	Sept- ember	April	May	June	July	August	Sept- ember
Ala.	+3.7	+0.5	+0.6	0.0	-0.7	+2.5	-0.24	+2.63	-0.54	-1.06	-1.54	-2.04
Ariz.	-4.0	+1.8	+2.4	+1.6	+1.4	+2.4	+0.02	+0.05	+0.22	-0.69	+0.04	-0.76
Ark.	+2.2	+1.6	+1.8	+0.3	+1.0	+2.3	+0.72	-0.12	-1.44	+0.20	-1.93	-2.08
Calif.	-4.1	+0.7	+0.6	+0.2	-1.2	+4.5	-0.97	+0.04	-0.10	+0.07	-0.02	-0.50
Colo.	-2.2	+0.3	+2.7	+3.5	+2.8	+2.5	+0.30	-0.41	-0.57	-0.33	+0.11	-1.05
Fla.	+3.4	+0.9	+0.4	-0.4	-1.3	-0.8	-1.71	+3.16	-0.37	-0.89	+1.44	+0.73
Ga.	+3.4	0.0	+0.5	+0.2	-1.6	+1.3	0.00	+3.79	+0.45	-0.81	-2.05	-2.10
Ida.	-4.2	-0.5	+4.0	+1.1	+2.3	+3.4	+0.28	-0.49	-0.34	-0.26	+0.88	-0.71
Ill.	+2.1	+3.8	+2.4	-0.9	+1.0	+3.3	+1.64	-0.64	-2.36	+0.25	-1.62	-1.57
Ind.	+2.6	+4.3	+1.4	-1.1	+0.3	+3.9	+2.61	-0.50	-1.91	+0.04	-1.15	-1.15
Iowa	+1.2	+2.9	+3.1	-2.6	+2.0	+3.7	+0.20	-1.04	-2.56	+2.35	-0.62	-1.33
Kansas	+0.8	+1.2	+2.3	-1.1	+2.9	+3.8	+2.62	+0.04	-1.87	+1.49	-1.70	-0.78
Ky.	+3.6	+2.3	+1.7	-0.3	-0.5	+2.7	+0.30	-0.08	-1.08	+0.47	-1.13	-0.54
La.	+3.5	+1.2	+0.3	-0.4	-0.2	+0.9	-0.49	+2.45	+0.87	-0.46	+0.09	-0.76
Md.-Del.	+1.4	+1.8	+2.7	-0.4	-1.7	+1.3	-1.44	-0.48	+1.10	+1.37	-1.06	-0.53
Mich.	+0.6	+5.9	-	-1.4	+1.0	+2.7	+1.07	-0.38	-	+0.71	-0.74	+0.76
Minn.	+0.1	+5.9	+2.6	-1.7	+3.9	+4.3	-0.16	-0.35	-1.00	-1.40	-1.59	-0.96
Miss.	+3.7	+1.1	+0.9	-0.2	-0.3	+1.5	-0.23	+1.34	-0.59	-0.42	-1.17	-1.95
Mo.	+1.9	+2.3	+3.1	-0.7	+1.2	+2.6	+2.42	-1.77	-2.89	+1.82	-1.60	-0.57
Mont.	-3.9	-0.3	+3.6	-0.4	+3.4	+4.2	+0.78	+0.03	-0.37	+0.48	+0.24	-0.73
Nebr.	+0.2	+1.2	+2.9	-2.0	+3.7	+4.7	+0.22	-0.82	-1.35	+1.10	-1.00	-1.25
Nev.	-5.5	+0.3	+3.6	+1.1	-0.5	+3.9	-0.01	-0.29	+0.01	+0.19	+0.72	-0.44
New Eng.	+1.0	+2.3	+1.3	-0.5	+0.1	+1.4	-0.33	+0.82	+4.95	-0.29	+1.49	-1.06
N.J.	+1.5	+2.6	+2.5	-0.7	-0.9	+1.1	-1.08	+0.04	+2.52	+1.00	-0.65	-1.45

WEATHER - Temperature and rainfall

State	Departure from normal											
	Temperature (°F)						Precipitation (inches)					
	April	May	June	July	August	Sept- ember	April	May	June	July	August	Sept- ember
N. M.	-0.8	+0.6	+1.2	+1.3	+2.5	+2.3	+0.05	-0.19	-0.18	-1.25	-0.88	-0.53
N. Y.	+1.0	+3.1	+1.5	-0.5	-0.4	+1.9	+0.32	-0.36	+4.26	-0.63	+0.91	-1.33
N. C.	+2.9	+0.4	+1.5	+0.5	-2.2	+1.5	+0.13	+1.04	+1.40	+1.05	-0.32	-2.23
N. D.	+0.6	+3.7	+0.7	-1.9	+4.4	+3.4	-0.45	+0.56	+0.26	-0.21	-0.32	+0.52
Ohio	+2.6	+3.3	+1.5	-0.9	-1.3	+2.7	+1.32	+1.11	-0.76	-0.15	-0.33	+0.14
Okla.	+0.8	+1.4	+1.3	+0.7	+3.0	+2.6	+3.52	+0.56	-2.29	+0.97	-1.79	-1.57
Ore.	-3.2	+0.7	+4.1	+2.3	0.0	+2.9	-0.11	-0.75	-0.65	-0.52	+0.51	-0.48
Pa.	+1.4	+2.7	+1.9	-0.2	-1.2	+3.0	-0.50	-0.54	+0.91	-0.53	-1.03	-1.79
S. C.	+2.1	-0.2	+0.6	+0.1	-2.4	+1.0	+2.14	+2.31	+0.58	+1.22	-0.98	-2.70
S. D.	+0.8	+2.7	+3.0	-1.7	+4.0	+4.4	-0.69	-0.05	-0.33	+0.55	-1.14	-1.47
Tenn.	+3.6	+1.5	+1.4	-0.1	-0.9	+2.6	+0.84	+0.57	-0.29	+0.86	-1.08	-1.32
Texas	+1.5	+2.0	-0.7	+0.5	+1.8	+1.3	+3.04	+1.14	+0.36	-0.99	-1.43	-0.34
Utah	-5.8	+0.2	+4.0	+0.9	+1.8	+3.6	+0.53	+0.02	-0.25	-0.17	+1.04	-0.87
Va.	+2.5	+1.0	+1.9	-0.2	-1.6	+1.2	-1.19	+0.38	+0.73	+2.22	-0.01	-2.11
Wash.	-2.9	-0.7	+4.6	+1.7	+1.0	+2.7	+0.09	-0.74	-1.38	-0.72	+0.72	-0.05
W. Va.	+2.9	+1.8	+1.8	-0.1	-2.8	+1.6	-0.37	-0.22	+0.45	-0.19	-0.07	-0.60
Wis.	+0.1	+6.1	+1.7	-2.1	+1.9	+2.8	+1.05	-0.40	+0.18	+0.22	-1.38	-0.03
Wyo.	-3.6	+0.3	+3.2	-0.9	+4.1	+4.0	+0.51	-0.04	-0.31	+0.24	+0.55	-1.01

FRUIT DISEASES

ward to western North Dakota. From a line through northern Pennsylvania, southern Iowa, and the northern borders of Utah and Nevada southward, the month averaged milder than normal, and in the Gulf and southern Appalachian regions usually as much as 6° warmer than normal.

FRUIT DISEASES OF 1922DISEASES OF POME FRUITSAPPLE

The spring freezes this year were not as destructive throughout the commercial apple region east of the Mississippi as last year. Conditions were more favorable generally for the possible maturity of a normal crop. The larger yield in apples this year is indicated by the comparative estimate of production of apples in the United States for 1922 and 1921 as shown in Table 79. The average for all the states was 68.5 in 1922 compared with 33.0 in 1921. There were ten states showing less than 50% of a possible full crop. Five of these ten states, Rhode Island, Virginia, West Virginia, Ohio, and Arizona, experienced severe frost injury according to the weather data and reports by collaborators. In Table 79 is further indicated the region of lowest production because of frost injury in 1921 and 1922 in apples as well as pears and peaches.

Scab caused by Venturia inaequalis (Cke.) Wint.

While there was less scab than usual in the Northwest, because of unfavorable weather; increased prevalence and loss characterized the disease as epiphytotic in the commercial apple growing sections of the East. (See figs. 38 and 39.) This condition would naturally be expected because of the general neglect of spraying in 1921, which allowed the overwintering of an unusual amount of infective material. Moreover, analysis of the reports of collaborators indicates that weather conditions in this region this spring favored infection in two ways: first, by inducing in many sections the earlier beginning and longer continuance of the period of ascospore discharge; and second, by preventing the timely application of spray materials so as to obtain their maximum efficiency.

Importance of apple scab in 1922

Scab was probably the cause of sending more apples to the "cull pile" in 1922 than any other factor.

It will be seen from figure 38 that almost every state east of the Mississippi, and Missouri and Kansas, reported apple scab as more prevalent than usual. Several states reported it as the worst disease of the year on apple. In Virginia Fromme says that for apple scab 1922 was the "worst year in history," and Butler states that it was "the worst year I have seen since I have been in New Hampshire." Anderson said that in Illinois it was worse than he had ever seen it before. In Michigan the disease was said to be more severe than in any

Table 79. Comparative estimates of percentages of a full crop of apples, pears, and peaches, in 1921 and 1922. (U. S. Dept. Agr. Mo. Crop Reporter 7: 110, 137, Sept. and Nov., 1921, Weather, Crops, and Markets 2: 248, 448, Sept. 16 and Nov. 18, 1922.)

State	Per cent of a full crop							
	Apples		Pears		Peaches			
	1921	1922	1921	1922	1921	1922		
Maine	85	33	80	70	--	--		
New Hampshire	42	45	64	97	61	65		
Vermont	40	60	60	85	--	--		
Massachusetts	25	70	46	84	60	80		
Rhode Island	15	40	40	68	30	70		
Connecticut	31	52	60	85	75	75		
New York	28	78	50	93	60	95		
New Jersey	24	87	23	63	13	80		
Pennsylvania	12	60	25	72	14	65		
Delaware	7	98	6	45	2	92		
Maryland	8	60	3	57	7	55		
Virginia	4	44	6	54	4	56		
West Virginia	4	45	2	35	3	55		
Kentucky	9	78	3	75	7	87		
Tennessee	12	80	21	60	16	91		
North Carolina	13	78	38	65	40	86		
South Carolina	50	66	72	65	58	65		
Georgia	40	76	61	74	100	59		
Florida	--	--	40	60	72	60		
Alabama	45	61	63	65	68	45		
Mississippi	41	66	59	76	50	69		
Louisiana	46	37	55	69	54	45		
Texas	45	44	60	65	44	40		
Oklahoma	24	57	14	73	10	69		
Arkansas	2	40	30	67	20	68		
Ohio	19	41	18	75	8	66		
Indiana	15	64	19	88	5	93		
Illinois	15	81	16	85	7	110		
Michigan	40	75	51	96	24	90		
Wisconsin	40	88	65	94	--	--		
Minnesota	47	68	--	--	--	--		
Iowa	16	98	10	95	15	100		
Missouri	4	85	1	75	0	99		
North Dakota	--	--	--	--	--	--		
South Dakota	30	94	--	--	--	--		
Nebraska	7	90	5	90	0	90		
Kansas	4	80	2	90	1	90		
Montana	81	60	81	90	--	--		
Wyoming	--	90	--	--	--	--		
Colorado	65	85	120	90	70	90		
New Mexico	30	50	25	20	4	40		
Arizona	30	45	60	70	31	85		
Utah	83	90	76	88	57	85		
Nevada	50	75	55	90	25	55		
Idaho	91	78	81	90	60	74		
Washington	103	77	80	30	59	75		
Oregon	90	80	80	85	38	85		
California	75	88	63	118	72	98		
United States	33.0	68.5	48.2	86.3	46.5	77.4		

APPLE - Scab

Fig. 38. Prevalence of apple scab in 1922 as compared with the average year.

Fig. 39. Estimated percentage, loss of apples due to scab, 1922.

APPLE - Scab (weather relations.)

year since 1915. Osmun reports the outbreak in Massachusetts also as the most severe in many years. While there was not more than the usual amount in West Virginia, Arkansas, Wisconsin, and Iowa, and less than normal in Minnesota, the disease was reported as of very considerable importance in these states.

On the other hand scab was unimportant in the Northwest in 1922. In Montana it was said to be "of no account except where spray schedules have been neglected." In Idaho, according to Hungerford, scab was found only in a few instances in the northern part of the state. In Washington the disease was said to be "less prevalent and less severe than usual," and in Oregon, while it was general in the Coast section, infection was apparently very light in other apple growing regions.

South Carolina, Mississippi, and North Dakota also report the disease as unimportant. (See also Pl. Dis. Bul. 6. 1922)

Losses from apple scab are indicated in figure 39.

Weather relations

As has been said before (p.273), collaborator's reports indicate that the spring weather conditions were exceptionally favorable for the scab fungus in the regions where the disease was so prevalent. The early maturity of the ascospores and their early discharge induced by early spring rains, lengthened the period when primary infections were possible, and greatly increased the difficulty of control. In addition, unfavorable weather often prevented proper timing of sprays, thus aiding further the spread of the disease. Moreover, in many cases weather conditions favoring the fungus extended late into the season. Tennessee, Ohio, and Illinois, however, report that while the disease was favored by the spring weather, its spread was somewhat checked later by unfavorable conditions.

In the Northwest, where scab was unimportant, Idaho and Oregon both report a dry spring; while in Montana, according to Jennison, spring weather conditions were favorable to the disease.

Following are some typical or especially interesting reports made by collaborators. (See also Pl. Dis. Bul. 6: 14, 31, 73, 102, 156. 1922.)

Vermont: Weather conditions very favorable to its start in May and its spread in June.(Lutman.)

Massachusetts: Moisture conditions ideal for infection and development of scab.(Osmun.)

Delaware: Weather conditions in July were favorable for secondary infection.(Adams.)

West Virginia: Lack of prolonged rainy periods resulted in no one heavy infection, but several waves occurred. (Giddings.)

Indiana: Very heavy rains in March and April favored scab. High temperatures in March and cool rains in April and May favored infection. Early spring rains prevented proper timing of sprays and protracted cool weather at blossoming time caused this period to extend over several weeks so that proper timing of sprays was still further complicated. (Gardner.)

Ascospore discharge

March 28	- - - - -	Seaford, Del.
April 5	- - - - -	Urbana, Ill.
April 18	- - - - -	Woodside, Del., Winchester, Va.
April 20	- - - - -	Orleans Co., N.Y. (ascospores mature)
May 2	- - - - -	Massachusetts
May 8	- - - - -	Minnesota (mature perithecia)

Event	Date		
	Seaford	Woodside	Winchester
Bud opening	Mar. 27	Apr. 1	---
First ascospore discharge	Mar. 28-Apr. 1	Apr. 18-21	Apr. 18-21
Second ascospore discharge	Apr. 5-9	May 4-15 (max.)	May 3-5
Third ascospore discharge	Apr. 12-17(max.)	May 16-20	May 10-18
Subsequent ascospore discharges	Apr. 19-27	** ---	May 26
	May 3-11	---	June 3, 4
	May 13-20	---	June 11
	May 29-June 1	---	---
Last date on which ascospore discharge was observed	June 1	** May 26	---
First scab infection	May 10(fruit & leaves)	# May 16(leaves)	About middle of May (fruit)
Spray			
Delayed dormant	Mar. 22	Apr. 3	
Pink	Apr. 10	Apr. 11	
Calyx	Apr. 20	Apr. 29	
Seven day	Apr. 27	---	

*In Delaware data obtained from a series of five slides exposed in each section, in Virginia 10 slides were used. Reporters: Delaware, Adams; Virginia, Schneiderhan.

**No data taken after May 27

#On leaves; had been established for some days

Krout makes the following comparison between 1921 and 1922 of the dates of significant events in connection with apple scab in Massachusetts.

<u>Year</u>	<u>First ascospore discharge</u>	<u>Last discharge</u>	<u>First symptoms on foliage</u>
1921	April 28	June 10	May 12
1922	May 2	June 15	May 18

Detailed data on ascospore discharge which were collected in Delaware and Virginia are summarized in table 80, and table 81 gives the departures from the normal precipitation and temperature during the months of March, April, May, and June, at the stations where the observations were made. The ascospore discharge indicated in the first table is closely associated with rainy periods. It will be observed that the precipitations for April and May (which were the maximum primary infection periods) were below normal. However, the rain occurred, for the most part, during periods of from two to six days, and at a time when the trees were growing rapidly. It is obvious that a rainfall which is, as a whole, below normal, may be as favorable for a scab epiphytotic as one above normal, if it is properly distributed, that is, in periods of a few successive days during the time of progressive leaf development.

Table 81. Summary of monthly departures from the normal in precipitation and temperature at Seaford and Woodside, Delaware, and Winchester, Virginia.

<u>Place</u>		<u>Month</u>			
		<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>
Seaford	<u>Rainfall (in.)</u>	<u>+0.54</u>	<u>-1.27</u>	<u>-1.83</u>	<u>+0.5</u>
	<u>Temperature °F</u>	<u>+0.26</u>	<u>+1.9</u>	<u>+1.5</u>	<u>+2.1</u>
Woodside	<u>Rainfall (in.)</u>	<u>+0.19</u>	<u>-1.48</u>	<u>-1.85</u>	<u>-3.6</u>
	<u>Temperature °F</u>	<u>+2.7</u>	<u>+0.8</u>	<u>+0.8</u>	<u>+1.0</u>
Winchester	<u>Rainfall (in.)</u>	<u>-0.83</u>	<u>-2.54</u>	<u>-0.5</u>	<u>-0.9</u>
	<u>Temperature °F</u>	<u>+2.6</u>	<u>+1.5</u>	<u>+0.6</u>	<u>+1.8</u>

APPLE - Scab (growth relations)

Infection and control in relation to growth

The initial ascospore discharge producing infection can be found indirectly by numbering and dating the leaves unfolding from the leaf or flower buds according to the time of their emergence, and watching them for scab infection. Allowing the necessary length of time for the incubation period, the approximate date of infection can be determined. If this date is compared with those of spray applications, it may indicate the reason for a failure in control.

As observed in Delaware, primary infection upon leaves of new shoot growth occurred in definite zones, indicating the coincidence of ascospore discharge and growth development. Primary infection apparently occurred only on the young growing leaves. The first leaf showing such infection was always from the leaf bud, usually the fifth or sixth in origin, and was unfolding about the time of the calyx (petal-fall) spray, completing its growth before the next application in two weeks. The increase in size of this leaf, from the time it unfolded to completion of growth, averaged 11.6 to 12.88 square millimeters.

Measurements were also made of the fruit growth of Stayman and Jonathan apples between the two weeks spray after petal-fall (April 20) and the second codling moth application (July 7), with the following results:

	April 20		July 7	
	Minimum	Maximum	Minimum	Maximum
Jonathan - <u>length (mm.)</u>	<u>9.5</u>	<u>14</u>	<u>40</u>	<u>45</u>
<u>breadth (mm.)</u>	<u>7.0</u>	<u>12</u>	<u>50</u>	<u>50</u>
Stayman - <u>length (mm.)</u>	<u>8</u>	<u>13</u>	<u>33</u>	<u>47</u>
<u>breadth (mm.)</u>	<u>6</u>	<u>9</u>	<u>33</u>	<u>63</u>

These measurements show the extent of uncovered fruit surface which may develop between two spray applications, and emphasize the necessity of thorough protection during this growth period. In many instances a spray is put on between these two dates. There is evidence, further, that climatic conditions may so influence the periods of ascospore discharge and tree growth that the important spray application this year may be either earlier or later next year. Information of this nature is important in explaining the inconsistent results of scab control operations even within a single state.

Dates of first appearance, as reported by collaborators, 1922

Observations on the first appearance of scab are of little value unless accompanied by the dates of some definite stage of growth, such as the pink or petal-fall, of a specified variety. If such data were available, interesting correlations could be made for the commercial apple producing regions.

April - - - Arkansas	May 10 - - - Bridgeville, Del.
April 24 - - Urbana, Ill.	May 11 - - - Lovington, Va.
April 27 - - Columbia, Tenn.	May 12 - - - Middlesex Co., Mass.
April 29 - - Ottawa, Kans.	May 12 - - - Genesee Co., N.Y.
May - - - Delaware Co., O.	May 13 - - - Walhalla, S.C.
May 4 - - - West Virginia	May 19 - - - Franklin Co., Ind.

APPLE - Scab (susceptibility)

May 5 - - - Adams Co., Pa.	May 24 - - - New Boston, N.H.
May 5 - - - Ramsey Co., Minn.	June 8 - - - Jackson, Mo.
May 8 - - - Madison, Wis.	June 15- - - Vermont

Varietal susceptibility

There are many factors entering into the problem of susceptibility and in many instances observations in one place are not in agreement with those in another section. The question of ascospore discharge, period of initial tree growth, and climatic conditions are, no doubt, the primary factors. The correlation of phenological data in relation to ascospore discharge with the susceptibility of apple varieties should prove interesting.

Vermont: Observations in a 750 acre orchard at Castleton, July 7.

McIntosh had been practically defoliated in some cases. The severe infection was due apparently to sappy, tender growth produced by 3 pounds of ammonium sulphate to each tree, and a very wet June. As this orchard was a mixed one, the following list of varieties with disease resistance is of interest: McIntosh, foliage with scab and about two-thirds dead or dropped, no fruit; Northwestern Greening, leaves and fruit affected badly; Delicious, fruit badly scabbed, a little on foliage; Northern Spy, Wolf River, and Alexander Red, fruit affected only; Duchess of Oldenburg, free from scab of fruit and leaves. (Lutman.)

Connecticut: Bad on McIntosh, Fall Pippin, and Crab apple. Medium on Gravenstein and Smokehouse. Little on Red Astrachan, Delicious, Greening, and Baldwin. (Clinton.)

New York: Susceptibility in order (Ulster County), McIntosh, Banana, Northern Spy, Gano (Black Ben Davis), Winesap, Stayman, and Greening. (Chupp.)

Delaware: Delicious, Nero, Williams, Jonathan, Yellow Transparent, Strawberry, Stark, Stayman Sweet, Early Ripe, Red June, and Ben Davis. (Adams.)

Virginia: See orchard disease survey reports, page ____.

Kentucky: Yellow Transparent, Wealthy, Benoni, Maiden Blush, Grimes, Northern Spy, comparatively free. Winesap, Stayman, York Imperial, Delicious, commonly severe. (Valleau and Magill.)

Tennessee: Yates and Stayman very resistant. Mammoth Black Twig and Winesap, heavy scab infection. (Hesler.)

Indiana: Bad on fruit of Grimes, a variety usually immune to this disease from commercial standpoint. (Cullinan.)

Scab caused an early defoliation of a young Grimes orchard in Marion County, and killed many of the trees outright (some of the weaker trees.) The yield was reduced from 20 bushels per tree to one peck. (Burkholder.)

Observations on varietal susceptibility, orchard in Morgan County. Northwestern Greening, foliage fairly resistant but fruit badly scabbed; Stark, Wealthy, Benoni, Chenango, Ben Davis, and Jonathan, severe on leaves and fruit; Winter Maiden Blush, scab especially severe on petioles; Grimes, small amount of scab on leaves; Yellow Transparent, no scab on leaves; Maiden Blush, some scab on leaves; Indiana Favorite, scab on leaves; York Imperial, mild on leaves and fruit. (Gardner.)

Control of apple scabSpraying for scab, 1922

Because of the serious outbreak of apple scab, considerable data has been submitted by the collaborators, on control. In most instances results indicate that the pink spray is all-important in the initial control. Of additional interest is the increasing importance of a pre-pink spray in some states.

Maine: Have seen one orchard where excellent control, even on McIntosh was obtained. This orchard was sprayed last fall with copper sulphate solution after the fruit was harvested and then sprayed with lime-sulphur in the usual way this season. Unsprayed Ben Davis apples gave over 75% scabby fruit, while thorough spraying reduced the amount to less than 20%. (Morse.)

Massachusetts: The pink bud and calyx sprays seem to be most important. Liquid lime-sulphur, dry lime-sulphur, and lime sulphur and Bordeaux, using the latter for the pink bud application, appear to have given equally good results. (Osmun.)

New York: Nearly all commercial orchards were well sprayed, but where the spray applications were delayed or not well applied, the scab did serious injury. (Chupp.)

Virginia: Some of the spraying has been poorly done and frequently important applications have been omitted. In the best sprayed orchards, scab has been held satisfactorily and in our experimental work it has been reduced to a negligible amount in the plots receiving the field schedule of applications. (Fromme.)

West Virginia: Have observed some striking examples of heavy infection where pink spray was omitted, especially in central and western sections of state. (Sherwood.)

Ohio: Effect of reduced spraying during season of 1921 is very manifest by increased scab infection in nearly every orchard. (Thomas.)

Indiana: The pink spray and petal fall spray will not control scab in Indiana. The pink is too late and it is necessary to apply an additional "pre-pink" spray to obtain satisfactory control. (Gardner.)

Michigan: Pre-pink or delayed dormant demonstrated this year as very essential for control. (Coons.)

Studies made in 1920 and 1921 are said to have indicated that scab infection occurs previous to the time the pink cluster application of fungicides is usually made. As spore discharge studies indicated that an earlier spraying should be adopted, applications of lime-sulphur solution (one and one-fourth parts to 50 of water) were used according to the regular schedule with additional application before the buds had separated in the clusters. The pre-pink application was made about two weeks before the buds were in the condition generally called the pink state, and the results obtained showed that the earlier application is very desirable for the best control of apple scab, particularly in case of susceptible varieties. (Dutton and Johnston.)

The efficiency of the early spray in scab control was determined under Virginia conditions this year by Schneiderhan who reports as follows:

APPLE - Scab (control)

Table 82. Showing the efficiency of scab spraying and the relative values of the different scab sprays on old time Winesaps. Experimental plots, Winchester, Virginia, 1922.

: Percentage		: Percentage	
Spray omitted	: of scab	Spray omitted	: of scab
Green tip	: 10.6	:: All omitted (check)	: 99.0
Pink	: 54.6	:: None omitted	: 7.5
Two weeks	: 23.9	::	:

The relative value of these scab sprays on the basis of 100% is as follows: Green tip 3%, pink 41%, calyx 33%, and two weeks 12%.

Last year in Orleans County, New York, a demonstration was established to prove the value of the pre-blossom spray for scab control as follows: (News Letter, April 17, 1922.)

Trees receiving:	<u>No spray</u>	<u>All sprays</u>	<u>All except pre-blossom</u>
Percent scab	19.3	1.4	5.6

Dusting for scab, 1922

Massachusetts: In 1922 dusts were positively as effective as the spray materials. Sulphur dusts and copper lime dusts were tested. The former was more satisfactory than the latter as it did not russet the fruit or burn the foliage. (Krout.)

Connecticut: Spraying more effective this year, as before, than dusting. (Clinton.)

Indiana: In Miami County, Professor Cullinan found sulphur dust ineffective as a scab control in comparison with lime sulphur spray. (Gardner.)

Michigan: Dusting not successful generally. (Coons.)

British Columbia: We have... found under West Kootenay conditions that finely divided sulphur dust, used alone, was of little value in the control of apple scab during three seasons' tests. This may be due to the fact that under the conditions of the test the addition of lead arsenate was not called for to combat insect pests and there may consequently have been a loss of adhesiveness. Much more promising results have been obtained with the dry Bordeaux mixture made with de-hydrated copper sulphate and commonly known as Sanders' Copper Dust. While it has not given as good control of apple scab under Kootenay lake conditions as with liquid Bordeaux or liquid lime sulphur, still the resulting crop was fairly clean, the cost much the same and the rapidity of application much greater. So far as fungous diseases are concerned, it is quite likely that dusting could replace spraying with advantage and convenience to the grower. So far as I can see, the limiting factor to its general application at present is the control of certain sucking insects. So long as a liquid spray is necessary for this purpose, so long will dusting remain of secondary importance since it is only the large grower that can afford to invest in two sets of machinery for the control of pests and diseases. (J. W. Eastham²)

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Blotch caused by Phyllosticta solitaria E. & E.

During 1922 the reports upon blotch do not indicate any great progress northward although it was reported from Wisconsin for the first time. The general increased prevalence over previous years should be of immediate concern to the pathologist, particularly the extension pathologist, in extending greater efforts on publicity of the disease and control measures. In Mississippi blotch was reported as very prevalent and severe, especially in the northern counties and also in certain southern counties, being probably the most serious apple disease encountered in the state. It was found frequently on nursery stock, both in and out state nurseries (Neal). Illinois reports it especially severe in the central part of the state where a few years ago it was unknown (Anderson.) The disease is distinctly worse in southern and southwestern Ohio (Thomas). Delaware reports that blotch appeared in epidemic form throughout the state. Leaf infection in one orchard of the Yellow Transparent variety caused early

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defoliation. Orchardists experienced greatest loss with the early varieties. (Adams.) Indiana reports blotch as the worst disease on susceptible varieties of apples (Gardner).

The generally increased prevalence of apple blotch is indicated in Table 83. Climatic conditions were generally reported favorable to the disease and appeared to be more conducive to the development and dissemination of the fungus. The neglect of spraying in 1921 must also be considered as a factor in this increased prevalence.

Table 83. Prevalence of blotch in 1922 as compared with 1921.

Amount of blotch in 1922	:	States reporting
More than 1921	:	Pennsylvania, Delaware, Maryland, Virginia, Kentucky, Tennessee, Mississippi, Ohio, Wisconsin, Iowa, Nebraska, Kansas, Texas
Same as in 1921	:	New Jersey, Louisiana, Arkansas, Indiana
Less than in 1921	:	West Virginia, South Carolina, Illinois, Missouri

Table 84. Showing estimated percentage loss from blotch for 1921 and 1922.

State	: Estimated per- centage loss	:	State	: Estimated per- centage loss	:	State	: Estimated per- centage loss
:	: 1921 : 1922	:	:	: 1921 : 1922	:	:	: 1921 : 1922
N. J.	: Same : Same	::	Tenn.	: 5. : 8.	::	Ind.	: 2. : 2.
Pa.	: : More	::	S. C.	: : Less	::	Ill.	: 7. : 6.
Del.	: 0.5 : 3.0	::	Miss.	: 4. : 6.	::	Wis.	: : More
Md.	: 1.0 : 1.5	::	La.	: Same : Same	::	Iowa	: t : 3.
Va.	: t : 2.0	::	Tex.	: - : 2.	::	Mo.	: 3. : t
W. Va.	: 1. : t	::	Ark.	: 3. : 3.	::	Nebr.	: : More
Ky.	: 5. : 35.	::	Ohio	: 2. : 5.	::	Kans.	: 5. : 10.
:	: : :	::	:	: : :	::	:	: : :

Losses from apple blotch infection

The direct loss from this disease is generally from rendering the fruit unmarketable. Fruit blemishes and cracking are often followed by secondary pathogenes producing a soft rot. Underdeveloped fruit is commonly found, resulting from leaf infection, defoliation, and cankers. An indirect loss that is difficult to estimate is associated with the devitalizing effect upon the tree for the succeeding year's crop, because of the leaf and twig infection.

The highest estimated loss is reported from Kentucky, and it is obvious in consulting Table 79 that because of the larger crop, the total loss for the state will be materially more than last year.

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Initial infections reported by collaborators

Reports on the first appearance of the disease are of little importance unless it is designated as fruit or leaf infection on a specified variety. Reports on the main, rather than the initial, infection, are doubtless of more importance. Careful data on this subject should prove of general importance for the blotch region. The reports on the fruit infection of apple blotch occur between the period extending from May 20 to June 26 with the majority of reports indicating infection during the first two weeks in June.

Walton and Orton³ report upon experiments in southern Pennsylvania as follows:

"Bagging experiments on unsprayed Smith Cider trees in Adams County prove that infection by Phyllosticta solitaria started very early in the spring of 1922. Young apples bagged continuously from May 23 (17 days after petal fall) until August showed 64% blotch, indicating that initial infection occurred prior to May 23. Infection on petioles and leaves was just noticed on the bagging date (May 23) but was not noted on the unbagged fruit until June 13 when the largest spots measured 4mm. in diameter. Because of the slow development of the disease, these spots must have been visible for at least a week prior to this date. This brings the time of probable initial infection on fruit at least 10 days prior to the time usually recommended for applying the first spray."

The time of initial infection will vary considerably on different varieties, since the twigs of many varieties showing fruit susceptibility are not attacked. This fact has a fundamental bearing on the spray schedule. It was observed in Delaware that while the initial infection upon fruit was found June 7, the greatest injury to fruit occurred during July, which month was characterized by an abnormally heavy precipitation.

Weather relations

In the blotch region temperature conditions were generally higher than last year during the spring and early summer, and rainfall was rather well distributed and generally favorable for development and dissemination of the fungus. Gardner reported that weather conditions in Indiana were favorable for blotch during April, May, and June in the blotch regions and temperatures were above normal for the period March to June, inclusive.

Dissemination

Infected nursery stock appears to be an important source to guard against through which blotch may become further established, particularly in the northern sections of our fruit belt. Gardner states that cankers in abundance have been found on apple seedlings imported from Kansas by nursery-men. Cankers have been found commonly on apple nursery stock of susceptible varieties and even on Grimes. Evidence of the spread of the disease by nursery stock is accumulating.

Varietal susceptibility

The following data indicate the varieties of apples reported by collaborators showing blotch infection:

New Jersey: Severe on Smith Cider (Cook, Sept. 1)

Pennsylvania: Smith Cider, Baldwin, Jonathan, Krauser. Spreads late in the season from Smith Cider. (Thurston)

Delaware: Smith Cider, Northwestern Greening, Wealthy, Hero, York Imperial, Transcendent, White Doctor, Rhode Island Greening, Jefferis, Pewaukee, Red Astrachan, Oldenburg (Dutchess), and Transparent. (Adams.)

Virginia: Limbertwig, Shockley, Northwestern Greening, Ben Davis, Smith Cider, Paradise Sweet, Yellow Newton, York Imperial; no infection on Stayman or Winesap. (Fromme.)

West Virginia: Northwestern Greening, Oldenburg (Dutchess), Baldwin, Stark, Rome Beauty, Ben Davis, Esopus (Spitzenburg). (Giddings.) Crab Apple (Sheldon.)

Kansas: Ben Davis is badly blotched. Commercial men don't feel that combat is entirely satisfactory. (Stockdyk.)

Kentucky: Ben Davis, Rome Beauty, Maiden Blush showed severe infection; King David, Arkansas Black, Jonathan, Wealthy, Winesap, and Stayman less infection. (Valleau.)

Tennessee: Transparent, Early Ripe, Winesap, Stayman - resistant; Ben Davis, Early Harvest, Oldenburg. (Hesler.)

Arkansas: Ben Davis, Grimes, Oliver, Missouri Pippin, Limbertwig, Maiden Blush. (Elliot.)

Indiana: Fruit infection: Winesap, Esopus, Winter Maiden Blush, Wealthy, Indiana Favorite, White Pippin, Jersey Black, Smokehouse, Gideon, Salome, McAfee, Lawver, Kinnaid, Akin, Benoni. Canker infection: Wealthy, Grimes, Rome, Willow Twig, Missouri Pippin, Oldenburg (Dutchess), Transparent. (Gardner.)

Apple blotch control

One of the new features in blotch control is the emphasis on canker eradication. "The abundance of cankers on the trunks and limbs of young trees of such varieties as Dutchess and Transparent and the ease with which these can be cut out with a knife has led to extensive cooperative tests in Knox County, Indiana, aiming at complete eradication of blotch from young orchards by (1) canker excision, and (2) application of the blotch sprays at petal fall, 2, 4, and 6 weeks. Results of first season very encouraging." (Gardner.) Gardner and Jackson² further report that cankers on young trees of such varieties as Oldenburg can be easily cut out with a sharp knife in early spring without injury to the underlying cambium. Healing occurs rapidly and no wound dressing

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is necessary. There is little danger of reinfection if all of the discolored bark is removed and if the cut is made at least a centimeter in advance of the visible margin of the canker, particularly on each side. The application of blotch sprays in nurseries and the use of blotch-free stocks and scions is much to be desired.

Additional reports on blotch control indicate the efficiency of Bordeaux mixture as well as commercial lime sulphur.

New Jersey: Experiment with commercial lime sulphur for blotch control is reported as follows from the Department of Plant Pathology. The location and variety concerned are not mentioned nor data upon yield counts.

Spray schedule: (1) Dormancy, (2) April 18, (3) May 8, (4) May 16, (5) May 26, (6) June 14, (7) July 24.

Block 1: Regular spray schedule

Block 2: Accessory spray June 26

Block 3: Accessory spray June 26, July 6

Block 4: Accessory spray June 26, July 6, and 24.

Results of apple spraying: (percentages)

	<u>Clean</u>	<u>Salable</u>	<u>Unsalable</u>
Block 1	7.6	49.1	43.2
Block 2	3.3	51.6	17.0
Block 3	53.8	38.5	11.3
Block 4	52.8	33.4	13.3

Delaware: Perfect control of foliage and fruit was secured with Bordeaux mixture 4-4-50 strength at the pink, petal fall, and 1, 2, and 3 weeks after petal fall on a block of Dutchess (Adams).

Ohio: The thorough going work of the apple growers applying the spray control developed by the Extension Service under Prof. F. H. Beach, has shown complete success, even with such susceptible varieties as Smith Cider and Mann. (Selby).

Beach¹ recommends a 3-5-50 Bordeaux on varieties like Ben Davis and Smith Cider at 2, 4, and 6 weeks after petal fall. Dormant pruning to open up dense portions of the tree and to eliminate dead and cankered wood, and spring application of nitrate of soda fertilizer is also recommended.

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APPLE - Bitter rot

Not cited:

Freiermuth, W. Blister canker and apple blotch. Bien. Rep. Kansas State Hort. Soc. 36 (1920-21) : 140-145. 1922. Practical suggestions for control.

Bitter rot caused by Glomerella cingulata (Stonem.) S. & von S.

In 1922 bitter rot appeared to be confined principally to the Atlantic and North Central group of states except in Tennessee, Missouri, and Arkansas.

There are no indications of a general epiphytotic but the increased prevalence in Delaware, Maryland, Tennessee, South Carolina, and Missouri indicate regional outbreaks of infection. In Figure 40 are summarized the data from collaborators on the prevalence of bitter rot as well as the estimated percentage losses for the seasons 1922 and 1921. Reports do not indicate that any increased prevalence is associated with hold-over cankers due to last year's neglect of spraying. High temperatures and abundant rainfall are usually found associated with the severe occurrence of bitter rot. In some instances early seasonal outbreaks of the disease are checked because of subsequent drouth. The regional outbreaks are reported to be associated with very favorable climatic conditions. It is peculiar to this disease that the period during which the fruit may become subject to infection is longer than is the case with blotch or rust, lasting from June to harvest time throughout the bitter rot belt. Because of this fact, regional treatments for control will be different. It would prove of special interest if reports would include data regarding recommendations and general practices for the preventing of outbreaks of bitter rot.

Dates of first appearance of bitter rot in 1922 according to collaborators.

June 7	Harrison	Arkansas
June 12	Columbia	Tennessee
June 16	Newark	Delaware
June 27	Bedford County	Virginia
June 27	Ross	Ohio
July	Elberfeld	Indiana
July		Massachusetts
July 22	Stonefort	Illinois
July 26	East Kingston	New Hampshire
July 28	Corinth	Mississippi
August 2	Ulster County	New York
September 1	Westville	Connecticut

Weather conditions are, no doubt, correlated with the initial appearance of this disease as indicated in collaborators' reports.

Delaware: Bitter rot was very severe following the excessive rainfall in July. (Adams.)

West Virginia: This is the first season that bitter rot has appeared in any appreciable quantity in the important fruit growing counties of eastern West Virginia in my observations in the last

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nine years. (Berg.)

Tennessee: Report indicates a high temperature with wet weather early and dry later. Period of greatest injury, July 1-15 and September 1-15. (Hesler).

Arkansas: Moist, warm weather. Infection started early and looked serious, but was checked by drouth. (Elliott).

Indiana: August, September, and October period of greatest injury. Heavy local rains July 23 and 30 accompanied by high temperature started the trouble. (Gardner.)

Fig. 40. Estimated percentage losses from bitter rot, 1922 compared to 1921.

Table 85. Comparative prevalence of bitter rot in 1921 and 1922.

Amount of bitter rot, 1922	States reporting
More than 1921	Conn., N.Y., N.J., Del., Md., Va., Tenn., S.C., Miss., Ind.
Same as in 1921	N.H., Mass., Pa., Ga., La., Ark., Texas, Ill., Mich., Iowa.
Less than 1921	W. Va., Ky., N.C., Ohio, Mo.

Varietal susceptibility

No extensive data was submitted this year upon susceptibility but the following notes on varietal infection were supplied:

Massachusetts: Most common on summer varieties (Osmun).

New York: A very large loss was sustained in one Ulster County orchard on Greening variety - \$1,600. (Chupp).

New Jersey: In one orchard of Gravensteins examined in Monmouth County, 50% of the fruit was a total loss. (Department of Plant Pathology).

APPLE -- Bitter rot

Delaware: Maiden Blush, Yellow Transparent, Chenango, Nero, Stark, Rome, Stayman, Wealthy, Grimes, Banana. (Adams).

Virginia: Yellow Newton, York Imperial, Winesap, Black Twig, Ben Davis. (Fromme).

Bedford County: York Imperial, Winesap, Yellow Newton, Ben Davis, Black Twig, Cannon, Stayman, Paradise Sweet. (R. H. Hurt).

Tennessee: Early varieties heavily infected. In some cases these early infected varieties were left on trees and furnished source for later varieties which also rotted. Jefferis and York Imperial, very susceptible. (Hesler).

Arkansas: Grimes, Ben Davis, King David, Jonathan. (Elliott).

Indiana: Grimes, Stayman, Rome. (Gardner).

Bitter rot control

Very meager notes are submitted regarding control measures. It would prove of special interest if collaborators would submit more data on this subject.

Delaware: Orchardists who failed to apply a July spray had severe infection. The July spray is recommended during the first week of the month, which is important for codling moth, bitter rot, apple blotch, sooty blotch, fruit spot, etc. Dusting with copper arsenate dusts failed to control in orchards observed. (Adams).

Indiana: An orchard sprayed 7 times, 5 with Bordeaux mixture 4-6-50, failed to control bitter rot on Grimes, Stayman, and Rome, because of failure to spray until the last part of July. The difficulty is that Bordeaux mixture russets Grimes badly, so cannot be used. Growers in southern Indiana prefer to take a chance on bitter rot rather than spoil their fruit with the spray. (Gardner).

Blister canker caused by Nuzmularia discreta Tul.

Blister canker was reported in 1922 from practically the same regions as in the past years and in addition, as having been found for the first time in Wisconsin. There is no indication of the disease being on a general increase except in Illinois. Gardner in Indiana states that severe drouth favored destructiveness of this disease. The nature of the injury is generally reported as trunk and branch infection and Elliot reports heart rot in Arkansas. The estimated percentages of loss are given as follows: New York, none; Arkansas, 2%; Indiana, 1%; Illinois, 1.5%; and Kansas, 2%. The range of infection is usually local and in most instances associated with mature and neglected trees. Occurrence reported upon old trees from Delaware, Indiana, and Missouri. Kansas reported practically every orchard has infected trees. Some orchards show 50% damage (Stokdyk). In Ohio blister canker has

APPLE - Blister canker.

been observed in most counties visited outside the Baldwin area, but appears to be rather less frequent than in earlier years (Selby). Illinois reports prevalence through most of the state and seems to be increasing in abundance. (Tehon).

Varietal susceptibility is reported by states as follows:

Ben Davis:	New York, Ohio, Indiana, Illinois, Kansas.
Yellow Transparent:	Delaware, Ohio.
Red Astrakan:	Delaware.
Rome Beauty:	Ohio
Grimes Golden:	Indiana.
Missouri Pippin:	Kansas.

No data has been submitted on the result of any control measures initiated.

Literature.

- Anderson, H. W. Orchard practice for the control of blister canker of apple trees. Illinois Agr. Exp. Sta. Circ. 258: 16 p. illus. May, 1922.
- Freienmuth, William. Blister canker and apple blotch. Bienn. Rep. Kansas State Hort. Soc. 36 (1920-21): 140-145. 1922. Practical suggestions for control.

Black rot caused by Physalospora cydoniae Arnaud (Sphaeropsis malorum (Berk.) Pk.)

Black rot was reported from the same general region as last year, particularly east of the Mississippi, which section always experiences losses in contrast to the western fruit belt where the disease is of rare occurrence or minor importance.

The prevalence and estimated percentage losses are, generally, much less than in 1921, when black rot was second in importance to scab in actual loss caused. The lower importance of the disease in 1922 is no doubt correlated with the more favorable spring temperatures for tree growth and with thorough spraying. Shoot growths were killed in many sections in 1921 by the spring freezes and spraying was generally neglected with the result that leaf and twig infection became seriously established. Thorough spraying in 1922 materially assisted in checking infection from the favorable hold-over from the preceding season. In certain years it is not uncommon to find serious leaf infection following seasons when fire blight has been prevalent.

Nature of injury from black rot

The nature of the injury this year is reported under three types: viz., leaf infection, twig cankers, and fruit rot (secondary). Leaf infection is prevalent in neglected orchards and closely associated with dead twigs where the fungus has over-wintered, and was generally observed during the latter part of April and the first part of May. Fruit rot follows insect, frost, and spray injury, as well as scab and blotch infection of the apple. Reports of the market inspection service show decay due to black rot ranging from 2 to 20%, from small spots to complete decay.

APPLE - Black rot

Table 86. Relative prevalence of black rot in 1922

Amount of black rot, 1922	States reporting
More than normal	N.H., Conn., N.Y., Pa., Tenn., Ark.
Normal	Vt., Mass., N.J., Md., Ga., Ind., Ill., Mich., Wis., Minn., Iowa
Less than normal	W. Va., Va., Ky., S.C., Miss., La., Texas, Okla., Ohio, Mo.

Fig. 41. Estimated percentage loss from black rot in 1922.

Delaware: Leaf spotting most prevalent on Yellow Transparent. This is usually associated with infected twigs where the fungus has over-wintered. (Adams).

Virginia: Chiefly fruit rot following arsenical injury at calyx end, also some twig infection. (Fromme).

West Virginia: About usual amount observed so far on fruit. Better spraying generally than last year, apparently reduced damage following worm injury, but considerable infection locally due to frost injury at calyx. Leaf spot exceedingly heavy in some places. (Sherwood).

Arkansas: The leaf spot form of this disease was more severe in Arkansas when I made observations in June than I have ever seen it any year in the fourteen years that I have been working on apple diseases. It was particularly severe on trees weakened by scale. (J.W.Roberts).

Ohio: The spore discharge of black rot was noted to be coincident with that of apple scab. Serious defoliation reported from southern Ohio. (Thomas).

Indiana: In well kept young orchards cankers are absent. Black rot occurred commonly as a fruit rot following blotch on Northwestern Greening, Oldenburg (Dutchess), and Ben Davis, and following scab.

APPLE - Black rot

Typical calyx end rot noted on Ben Davis, October 20. Much shallow bark infection on Ben Davis trees in orchards in Miami County, abundant source of infection for fruit. (Gardner).

Illinois: Present so far mostly as leaf spot. Unusually abundant where treatment has been neglected. In many orchards 60% of the leaves on the trees are infected with a reduction of leaf surface varying from 5-30%. More serious southward. (Tehon.)

Varietal susceptibility

Massachusetts: Baldwin, Greening, Northern Spy, especially susceptible. (Osmun).

New York: Ulster County - Baldwin, Ben Davis, Jonathan, Esopus (Spitzenburg). (Chupp).

Delaware: Yellow Transparent, Williams, Red Astrachan, July (Fourth of July). More prevalent upon the fruit of early varieties. (Adams).

Maryland: Williams and Red Astrachan. (Jehle).

Tennessee: Ben Davis very susceptible to fruit rot (60% end rot). Delicious resistant to rot. (Hesler)

Ohio and Illinois: Crab Apple.

Gardner submits the following observations of varietal susceptibility in an orchard in Morgan County, Indiana, October 10.

<u>Variety</u>	<u>Leaf spot</u>	<u>Fruit spot</u>
Northwestern Greening	Severe	Severe
Stark	Slight	Slight
Winter Maiden Plush	Slight	Slight
Wealthy	Severe	Slight
Grimes	Slight	Slight
Benoni	Slight	-
Chenango	Severe	-
Yellow Transparent	Severe	-
Maiden Blush	Slight	-
Ben Davis	Severe	Severe
Jonathan	Severe	Severe
Indiana Favorite	Severe	-
York Imperial	None	Medium

Frog eye and black rot control

Very little data has been submitted with reports on the control measures this season. Under normal conditions in well kept orchards the orchard spraying program keeps this disease in check.

APPLE - Black rot

Massachusetts: Usual spray schedule holds disease in check. (Osmun).

Tennessee: The pink spray seems important to head off first infections. (Hasler).

Indiana: Neither scab nor blotch sprays seem to prevent frog-eye. On Northwestern (5-25%) abundant frog-eye spots occurred at Knightston - as much on trees sprayed with Bordeaux mixture as on control. Frog-eye spot rather abundant on young Oldenburg (Dutchess) trees in Knox County, June 1, that had been thoroughly sprayed for blotch with Bordeaux mixture at petal fall, 2, 3, and 6 weeks applications. (Gardner).

Rust caused by Gymnosporangium juniperi-virginianae Schw.

The distribution of cedar rust in 1922 conformed to areas from which it has previously been reported. There was a general increase in abundance in the North and South Atlantic states, indicated by the greater economic importance as compared with the past few years.

Fig. 42. Disease prevalence compared with an average year and dates of first appearance of cedar rust on apple in 1922.

APPLE - Cedar rust

The estimates of loss in the North Atlantic states are as a whole greater than those of the preceding year. In this section climatic conditions were generally favorable during April and May for the maturing of cedar apples as well as infection upon the apple. Table 87 gives the departures from the normal temperature and rainfall for these two months, together with percentage losses, in the states reporting the disease. It appears obvious that the increase in prevalence may be correlated with favorable conditions of temperature as well as of precipitation, although some collaborators mention only the latter.

Table 87. Departures from the normal temperature and rainfall for April and May, 1922, in states where cedar rust occurs.

State	: Estimated : percentage : loss	:	Departure from normal			
			Temperature		Rainfall	
			April	May	April	May
New Hampshire	: t	:	+0.5	+0.9	:: +0.29	: +1.08
Massachusetts	: t	:	+1.0	+3.0	:: -1.01	: +1.28
Connecticut	: .5	:	+1.5	+3.6	:: -1.17	: +1.22
New York	: 4.	:	+1.2	+3.2	:: +0.14	: -0.24
New Jersey	: 1.	:	+1.5	+2.6	:: -1.08	: -0.04
Pennsylvania	: t	:	+1.4	+2.7	:: -0.50	: -0.54
Delaware	: 1.5	:)			::	:
Maryland	: 1.5	:)	+1.4	+1.8	:: -1.44	: -0.48
Virginia	: 10.	:	+2.5	+1.0	:: -1.19	: +0.38
West Virginia	: 1.5	:	+2.9	+1.8	:: -0.37	: -0.22
South Carolina	: t	:	+2.1	+0.2	:: +2.14	: +2.31
Ohio	: .5	:	+2.6	+3.3	:: +1.32	: +1.11
Indiana	: .1	:	+2.6	+4.3	:: +2.61	: -0.50
Illinois	: .5	:	+2.1	+3.8	:: +1.64	: -0.64
Wisconsin	: t	:	+0.1	+6.1	:: +1.05	: -0.40
Minnesota	: t	:	+0.1	+5.9	:: -0.15	: -0.35
Kansas	: .5	:	+0.3	+1.0	:: +2.40	: +0.07
Kentucky	: 1.	:	+3.6	+2.3	:: +0.30	: -0.08
Tennessee	: t	:	+3.6	+1.5	:: +0.84	: +0.57
Mississippi	: t	:	+3.7	+1.1	:: -0.23	: +1.34
Louisiana	: t	:	+3.5	+1.2	:: -0.49	: +2.45
Arkansas	: t	:	+2.3	+1.6	:: +0.76	: -0.12
	:	:	:	:	::	:

The stage of growth of the trees should also be considered in determining variations in prevalence. Phenological data, particularly on certain susceptible varieties, would provide a more definite and exact basis for correlations. It will be noted from Fig. 42 that in most of the states where rust was more abundant than usual infection appeared during the first part of May. At this time the trees are just beginning to develop foliage. Petal fall would occur about the middle of April and infection probably take place during the latter part of April and the first part of May, according to information supplied by collaborators.

The heaviest loss - 10% - from cedar rust was reported from Virginia. Fromme stated that the disease was epiphytotic wherever cedars and apples occurred in proximity, and that fruit infection was unusually prevalent and found to some extent on all varieties. (Pl. Dis. Bul. 6:75. Aug. 15, 1922).

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The distribution of the disease in Virginia is indicated on the accompanying map.

Fig. 43. Prevalence and distribution of cedar rust in Virginia, 1922. Some interesting data on fruit infection in the state are given in table 88.

Table 88. Data on fruit infection of apple varieties with cedar rust in Virginia, 1922.

*Frederick County :			#Bedford County		
Number	Percent fruit	Variety	Number	Percent fruit	
orchards:	infection (av):		orchards:	infection (av)	
10	3.2	Den Davis	3	0.3	
		Black Twig	3	t	
		Cannon	3	t	
		Delicious	1	0.6	
		Grimes	1	0	
1	1	Northwestern Greening			
		Paradise Sweet	1	0	
1	1.5	Sheepnose			
2	0.2	Stayman	1	0.4	
1	1.5	Winesap	14	t	
		Yellow Newtown	7	0.6	
17	4.4	York Imperial	9	0.7	
32	3.5	Total and average	43	0.3	

* Data collected by F. J. Schneiderhan; number of fruits counted 200-500

Data collected by R.H. Hurt; number of fruits counted 500 in each orchard.

West Virginia also reports more fruit injury than usual. Twig infection was reported on Jonathan in Indiana, and was said to be severe on Yellow Bellflower in Missouri.⁵

Very few reports of observations upon infection of red cedars were submitted in 1922, although it is important that careful data upon occurrence on this host, as well as on the apple, be obtained. Snell says that in Rhode Island galls on red cedars were not only very abundant but unusually large this spring.

Dates of earliest recorded appearance of cedar rust, 1922

1. Telial horns on red cedar

April 2 - - - - - Anna, Ill.

? April 10 - - - - - Chattanooga, Tenn.

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- April 25 - - - - - Hancock Co., Ind.
 May 27 - - - - - Minnesota
2. Pycnia on apple
 May 17 - - - - - Tennessee
 May 18 - - - - - Olney, Ill.
 June 14 - - - - - Minnesota
3. Not differentiated (probably on apple)
 May 6 - - - - - West Virginia
 May 10 - - - - - Winchester Co., Va.
 May 13 - - - - - Walhalla, S.C.
 May 16 - - - - - Harrison Co., Ind.
 May 23 - - - - - Adams Co., Pa.
 May 24 - - - - - Bridgeville, Del.
 May - - - - - Fayetteville, Ark.
 June 6 - - - - - Wabaunsee, Kans.
 June 8 - - - - - Jackson Co., Mo.
 June 13 - - - - - Ulster Co., N.Y.
 June 15 - - - - - Washington Co., Ill.
 June 16 - - - - - Worcester Co., Mass.
 June 20 - - - - - Mt. Carmel, Conn.
 July 6 - - - - - Hamilton Co., Ohio
 August 15 (about) - - - - Vermont

Varietal susceptibility

The information listed in table 89 was contributed by Valteau, who comments as follows:

"The records were taken on the 22nd of August and represent fairly definitely the relative resistance of the varieties reported if they are properly named. It is a young orchard, only about 10 years old, and as a consequence all of the varieties had not been checked up because they had not yet fruited. The distribution of diseased trees throughout the orchard, I think, indicates clearly that the possibility of infection was practically identical for all the varieties."

This is an extensive list and affords an exceptionally important basis for observations on varietal susceptibility in future years.

Table 89. Amount of infection of apple varieties with cedar rust, as reported from the Kentucky Agricultural Experiment Station Orchard, 1922.

Amount of infection			
Slight	Moderate	Heavy	Very heavy
Akin	Hubbardston	Benoni	Esopus
Arkansas Black	Imperrambo	Bayard	Pryor
Early Melon	Lady Sweet	Bellflower	Rome Beauty
Grimes	Paradise Sweet	Blythe	Senator
Golden Delicious	Rambo	Cox Orange	Wealthy
Golden Winesap	Romanite	Fall Beauty	
Missouri Pippin	Stark	Fallawater	

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Amount of infection			
Slight	Moderate	Heavy	Very heavy
New Zealand Spy	: Smokehouse	: Jonathan	:
Northern Spy	: Winter Banana	: Lewis S. & H.	:
Pewaukee	: Yellow Horse	: Marita	:
Red June	:	: Minkler	:
Roman Stem	:	: Mother	:
Rail's Genet	:	: Nero	:
Sutton	:	: Opalescent	:
Summer Pearmain	:	: Pipers Fall Beauty:	:
White Pearmain	:	:	:
Wilson's Red June	:	:	:
York Imperial	:	:	:
:	:	:	:

No injury from cedar rust was observed on the following varieties: Alexander, Astrachan, Albemarle Pippin, Bonum, Buckingham, Baldwin, B.K. Ben, Ben Davis, Champion, Cheese, Chenango, Charlamoff, Delicious, Domine, Dartmouth, Excelsior, Early Harvest, Early Colton, Early Strawberry, Fanny, Fall Winesap, Fall Pippin, Florence, Golden Russet, Gold (crab), Gilbert Winesap, Giant Genitan, Gravenstein, Golden Sweet, Hackworth, Henry Clay, Huntsman, Hyde King, Hyslop, Ingram, Jefferis, King, Kinnard, King David, Liveland Raspberry, Limbertwig, Lowry, Lowell, Lancingsburg, Mann, Mammoth Black Twig, Milan, Maiden Blush, McIntosh, Northwestern Greening, Ortley, Oldenburg, Paducah, Pirmate, Porter, Paragon, Reid's Early, Russet, Rhode Island Greening, Red Canada, Smith's Cider, Salome, Stayman, Star, Sweet Bough, Transcendent, Virginia Beauty, Willow Twig, Walbridge, Whitney, Windsor, Winesap, White Pippin, Wagener, Weisner, William's Favorite, Wolf River, Yellow Transparent.

A large number of varieties is reported by various collaborators as showing infection, but, owing to duplication with the list in table 89, only the following additions are mentioned: Connecticut - Twenty Ounce; New York-Boiken; Delaware - Crimson Beauty, Strawberry, July (Fourth of July); Indiana-Indiana Favorite, flowering crab; New York, Ohio, Illinois, and Minnesota - crab apple. According to Hesler, the variety Yates is resistant in Tennessee.

Control of cedar rust

Few reports were received regarding any specific control measures. Spraying is reported as unsatisfactory in Delaware and Missouri¹. According to Adams, neither lime-sulfur nor Bordeaux mixture used in the delayed dormant, pink, petal-fall, or seven-day applications had any noticeable effect on the amount of the disease on apple trees in Delaware.

Reports on the progress of red cedar eradication in Illinois² and Virginia⁴ have been published. The following remarks on the results of eradication or upon the relation of the disease to red cedars are interesting. (See also Pl. Dis. Bul. 6, 1922).

West Virginia: Results of red cedar eradication are excellent and show very effective control (Giddings)

Kentucky: In Boyd County this year four trees (Rome) were almost defoliated with the rust. In early August the foliage was yellow

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with the rust spots. No cedar trees could be found closer than 60 rods and these were on the opposite side of a hill. The few apples on the trees were covered with rust. (Magill, Nov. 1)

South Carolina: I have not seen any bad infestations during the last three seasons. This seems odd, as the cedar is abundant and "cedar apples" are common. (Ludwig)

Arkansas: This would have been a disastrous disease this year but for the fact that nearly all cedars had been cut in the orchard district. (Elliott)

Indiana: Defoliation resulted in complete loss of crop in side of orchard next to cemetery containing 300 red cedars. Burkholder reports one bad infection due to cedars one mile away. No rust in Ben Douglas' orchard in Brown County - cedars removed. (Gardner)

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Fire blight caused by Bacillus amylovorus (Eurr.) Trev.

Fire blight was generally reported as more prevalent in 1922 than usual. Blossom and twig infection were the types most commonly occurring but in some instances fruit infection and collar blight were serious, and root rot and leaf blight were also reported.

In a number of states reporters said it was more abundant than they had ever before observed it. This was the case in Vermont, Arkansas (Becker), southwestern Michigan (Bregger), and Missouri (Cardinell) while in Massachusetts it was more common than for years, according to Osmun. Delaware reported more blight than there had been in the past three years, and in Maryland, West Virginia, and Ohio, it was said to be more prevalent than during the two years preceding. The following quotations are typical of the collaborators' reports.

Vermont: Never as abundant in my thirteen years (Lutman)

Connecticut: Not serious at all; death of young twigs in early summer and conspicuous injury. At least average amount. (Clinton)

New York: Prevalent wherever apples are grown. Very important. Second only to scab. (Chupp)

Fig. 44. Prevalence of fire blight compared with the $\frac{\text{average year}}{\text{last year}}$ and estimated percentage loss.

APPLE - Fire blight

Tennessee: General, but of slight importance except locally, (as blossom blight). (Hesler)

Mississippi: Twig blight, no doubt, is responsible for poor or practically barren yields in many parts of the state. Many large trees bloom profusely and then blight back. Can be found in almost every orchard in the state. (Neal)

Texas: Epidemic. Appeared early as blossom blight and is quite severe at present (July 15) as twig blight, in spite of dry weather. Crop practically total failure. (Taubenhaus).

Arkansas: Fire blight was generally severe in all sections of the state. Growers everywhere report that the low, fertile lands show more blight, both on apples and pears. (Woolsey).

Montana: We have considerable blight infection all over the state this year. It has been on the increase for the past two years, but this year it is assuming serious proportions. (Shovell).

Idaho: More. Very serious in neglected orchards. More important in the northern portion of the state. (Hungerford).

The local epidemics in the various states were generally favored with moist, cool weather. Rains were more equally distributed during April, May, and June than in 1921. In some sections several successive days of rain were associated with the outbreak of the disease. In some instances it was observed that although cool weather was favorable to blight where established, it also lessened the activity of insects as disseminating agents.

Dates of first appearance

It is generally found that infection first appears during the months of April, May, and June, and occasionally in July. Infection this season was, for the most part, observed during the months of May and June. Temperature and moisture are the determining factors in the appearance of blight, while its destructiveness and spread are decided by others, including the presence of new growth, permanence of favorable weather conditions, and abundance and activity of disseminating agencies.

The greater prevalence of the blossom blight type of injury indicates a range of infection associated with the blossoming period and cool, moist weather, in the group of Atlantic states. Twig infection usually follows severe blossom infection and the new growth becomes susceptible to infection up to the time of completed growth. Severe blossom infection with favorable climatic conditions persisting will pave the way for serious twig infections. The new succulent shoot growth is subject to infection for a period of probably eight weeks. Fruit infection is quite dependent upon twig infection, and its susceptibility probably extends over a similar length of time.

Varietal susceptibility

Susceptible varieties reported by collaborators, for the most part, are the same as those in previous seasons. The early varieties, along with Jonathan, are most consistently reported. The early apple varieties illustrate a group susceptibility of special interest. Is the problem concerned

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with succulent initial growth completed over a shorter growing period, compared with later varieties?

The following list gives the varieties which were reported from more than one state as affected in 1922:

- Jonathan: New York, New Jersey (severe), Delaware, Kentucky⁷ (very susceptible), Arkansas (Jonathan suffered most), Indiana, Illinois, Michigan, Missouri³ (especially on Jonathan), Kansas (seemed most susceptible), Montana⁸ (very seriously infected this year), Colorado.
- Yellow Transparent: New York, Delaware, West Virginia (very susceptible), Kentucky⁷ (very susceptible), Tennessee (very susceptible as usual), Indiana, Illinois.
- Wealthy: New York, Kentucky⁷ (susceptible), *Wisconsin, Montana⁸.
- Alexander: New York, Michigan, Montana⁸ (most seriously infected)
- Esopus (Spitzenburg): New York, Washington^{5,6}, Oregon^{1,5} (most seriously affected as usual)
- York Imperial: Delaware, Virginia (most blossom blight on Yorks and Pippins), Kentucky⁷ (more resistant than some), Tennessee (unusually susceptible this year)
- Greening: New York, Michigan.
- Oldenburg (Dutchess): Indiana, Michigan.
- Newtown: New York, Washington⁵ (rare), Oregon¹ (some twig blight)
- Rome Beauty: Kentucky⁷ (susceptible), Montana⁸ (one of most seriously infected)
- Winesap: Virginia (little), Kentucky⁷ (somewhat resistant), Indiana.
- McIntosh: New York (seemed very resistant), Montana⁸.
- Ben Davis: Kentucky⁷ (somewhat resistant), Arkansas.
- Sweet varieties: Vermont (very susceptible), New York.

In addition, a number of varieties were reported from only one state:

<u>Benoni</u> : Illinois	<u>Rhode Island Greening</u> : Delaware
<u>Delicious</u> : New York	<u>Siberian Crab</u> : Michigan
<u>Early varieties</u> : Missouri ³	<u>Star</u> : New Jersey (severe)
<u>Fall Pippin</u> : New York	<u>Stayman</u> : Kentucky ⁷ (somewhat resistant)
<u>Gano</u> : Montana ⁸	<u>Summer Queen</u> : Kentucky ⁷ (susceptible)
<u>Genitan</u> : Colorado	<u>Sweet Bough</u> : New York
* <u>Golden Delicious</u> : Kentucky ⁷	<u>Tolman</u> (Tolman Sweet): Michigan
<u>Grimes</u> : West Virginia	<u>Tompkins King</u> (King of Tompkins): Washington ⁵ (next to Esopus)
<u>Hoover</u> : Tennessee (among most susceptible)	<u>Transcendent Crab</u> : Montana ⁸
<u>King</u> : New York	<u>Twenty Cunce</u> : New York
* <u>McMahon</u> : Wisconsin	<u>Willow</u> (Willow Twig): Indiana
<u>Maiden Blush</u> : Arkansas	<u>Winter Banana</u> : Kentucky ⁷ (susceptible)
<u>Northern Spy</u> : Montana ⁸	<u>Wolf River</u> : New York
<u>Ortley</u> : Washington ⁵ (rare)	
<u>Pippin</u> : Virginia (see York)	

(*Wisconsin: source of infection in commercial orchards.

Kentucky: one tree affected, variety supposed to be immune)

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Control of fire blight

In many cases it has been stated that fire blight on apples is most destructive in the vicinity of pears or the Transcendent crab or other extremely susceptible apple varieties. Because of this situation, eradication of these susceptible hosts is being considered or has already been undertaken in several states. About the most extensive of those already started is the Weston fire blight control project in Wisconsin. Vaughan states that the Transcendent crab was taken out of 36 square miles in Dunn County, where the farm orchards were almost completely cleared of this variety. Chambers⁴ reports on this Weston fire blight control project as follows:

"Of the seventy or more farmers visited, some 2,000 trees were listed of which 109 were crab apples and the majority of the Transcendent variety. The Weston Orchard Company had given the project a good start by the removal of all of their crab apple trees, about 300 in number. Every owner of one of the susceptible trees made a definite promise to remove them by spring.

"Among the most susceptible varieties of apples which we urged destroyed rather than to attempt to prune, were the Yellow Transparent and McMahon. While the Wealthy is a susceptible variety, overwintering cankers do not occur on it to a serious extent, and since it is the best adapted variety for this section, one of the objects of the work was to protect it from repeated reinfection. The Northwestern Greening, on the other hand, seems less susceptible to the disease."

Shovell⁸ reported that in Montana it was planned to put on a program to eradicate, if possible, the Alexander, Transcendent, and Jonathan varieties.

According to Becker², blossom blight was extremely severe in the northwestern apple belt of Arkansas, causing numerous complaints from the growers, who asked that the State Plant Board undertake the eradication of fire blight in that section by requiring the destruction of the pear trees. Winfrey¹⁰, also, states that in Arkansas the close proximity of pear trees was held to be directly responsible for the presence of fire blight in apple orchards. No instance was observed where appreciable damage occurred if the apples were a mile or more away from the pears. On the other hand, Swingle⁹, of the Montana Experiment Station, does not consider pear trees to be a menace to the apple industry. He thinks that they are no more liable to blight infection than apples, and that the disease is more easily controlled on pear trees because the light-colored bark permits more thorough cutting-out of infection. Another statement of interest in this connection is that of County Fruit Inspector, Mills, of Klickitat County, Washington, who said, according to Childs⁵, that he had not found any pear trees affected by blight, while adjoining Esopus (Spitzenburg) apple trees were so seriously damaged as to require taking out, and other apple varieties were also infected. The disease was found on wild hawthorne and on service berry, and it was thought that the removal of the native host plants would be necessary in one section of this county before effective control could be obtained.

Regarding the relation of insects to the disease, it was observed in Delaware that very few insects were active during the blossoming period because of cool weather. Bees in particular were very inactive. While fire blight was established about two weeks later, there was no evidence of its dissemination by insects.

APPLE - Fire blight

Literature (see also under pear blight)

Cited:

1. Barss, H.P. Pl. Dis. Bul. 6: 67. Aug. 1, 1922
2. Becker, Geo. G. Pl. Dis. Bul. 6: 65. Aug. 1, 1922
3. Cardinell, H. A. Pl. Dis. Bul. 6: 66. Aug. 1, 1922
4. Chambers, E. L. The Weston fire blight control project.
Rept. Wisconsin State Hort. Soc. 52: 47-51. 1922
5. Childs, Leroy. Pl. Dis. Bul. 6: 67-68. Aug. 1. 1922.
6. Fisher, D. F. Pl. Dis. Bul. 6: 33. July 15, 1922
7. Magill, W.W. Pl. Dis. Bul. 6: 154. Nov. 15, 1922
8. Shovell, W. L. Pl. Dis. Bul. 6: 72. Aug. 15, 1922
9. Swingle, D.B. Pear and apple blight in Montana. Montana
Agr. Exp. Sta. Circ. 98: 10 pp. Aug. 1921
10. Winfrey, Geo. W. Pl. Dis. Bul. 6: 64. Aug. 1, 1922

Collar rot (cause undetermined)

A collar rot upon Grimes Golden is reported from Ohio, Indiana, and Illinois. In Illinois, according to Anderson, other varieties than the Grimes Golden show some type of disease, but rarely; 10% of Grimes Golden over 13 years old are affected.

Fruit spot caused by Phoma pomi.Passer.

Fruit spot was reported as considerably increased in prevalence in Massachusetts, New Jersey, Delaware, and Ohio. Thomas states that in Ohio this disease is demanding more attention from year to year, apparently rivalling scab occasionally in loss caused in some orchards. The disease was also reported from Connecticut, New York, Pennsylvania, West Virginia, Arkansas and Iowa.

In many instances a slight infection of fruit spot is overlooked. Owing to the usual superficial symptoms, many orchardists under-estimate the importance of this disease. The loss due to it is often high because of unmarketable fruit resulting from heavy infection. During the average normal season, however, very little fruit spot is reported, particularly where thorough summer spraying has been conducted. The losses reported as due to fruit spot in 1922 are: Massachusetts, 1%; New York, trace to 1%; West Virginia, trace; Arkansas, one-half per cent.

The disease generally makes its appearance during July and August, when it is also most commonly reported. Favorable weather conditions, particularly favorable rains, are associated with the increased prevalence of fruit spot in 1922. There is evidence that conditions favoring fruit spot are also favorable to cloud (sooty blotch and fly speck). In Delaware it was consistently observed that the two diseases occurred under similar conditions upon the lower inside fruit, and that the appearance of both was associated with excessive rainfall in July.

There have never been any extensive reports on the relative susceptibility of apple varieties to fruit spot. The disease is often overlooked on red varieties because of its inconspicuousness, particularly where the infection is at the blossom end. In the following list are given the varieties most

APPLE - Fruit spot

often reported in 1922 as affected, with the states reporting them:

Jonathan: New York, Pennsylvania, Delaware, Arkansas, Ohio.
Grimes: Pennsylvania, Delaware, Arkansas, Ohio
Baldwin: Massachusetts, Connecticut, New York
Ben Davis: New York, Delaware, Ohio
Greening: Connecticut, New York
Mann: New York, Ohio.
Rome Beauty: Delaware, Ohio
King David: Delaware, Arkansas

In addition, several varieties were reported affected from only one state, as follows:

Connecticut: Gravenstein
New York: Pippin, Delicious, Newtown
Delaware: White Doctor, Winesap, Smokehouse, Northern
 Spy, Maiden Blush, Langford, Fallawater, Gilpin
 (Carthouse), Brandywine, Stark, Lilly (of Kent),
 Paragon
Arkansas: Collins

The disease was ordinarily reported as unimportant or not severe except in unsprayed or poorly sprayed orchards or trees. In Connecticut, spraying, or dusting with Saunder's dust gave much better control than lime-sulfur dust, according to Clinton. Chupp states that in New York the application of a late summer lime-sulfur spray is very effective. In Delaware fruit spot became serious in orchards not sprayed during July, and a report from Ohio (Thomas, Sept. 10) states it was first found only in orchards where no mid-July spray was applied. Infection was said to be most prevalent on the fruit on the lower inside branches of the trees, poorly covered by sprays, in Delaware and Arkansas.

Anthracnose caused by Neofabraea malicorticis (Cord.) Jackson

Anthracnose was reported from the northwestern apple belt as of slight prevalence. In Oregon it was severe where control measures are not emphasized, damage to trees in some places being estimated at 35% by the Lane County Inspector. Spraying with Bordeaux mixture once before the fall rains gives perfect control, and as a result of control campaigns, the situation is no longer menacing (Barss). In Washington it was less frequently reported than usual, due probably to unfavorable climatic conditions (Dana).

Recent literature:

White, E. W. Apple tree anthracnose or black spot canker control.
 Scient. Agr. 2: 186-191. illus. Feb. 1922.
 Control of anthracnose, or black spot canker.
 Better Fruit 16⁸: 7, 21; 9⁹: 12, 18, 19. 1922

APPLE - European canker

European canker caused by Nectria galligena Bres.

This disease was reported from New York (several counties), Washington, and Oregon. According to K. P. Earss, the disease is present throughout western Oregon, but causes no appreciable damage on most commercial varieties. (See also Pl. Dis. Bul. 6: 75-76. Aug. 1, 1922)

Zeller, of Oregon, reports as follows upon varietal susceptibility: Red Check Pippin (bad), Bismark, Delicious, Pennock, Bellflower, Esopus, Northern Spy, Greening, and Newtown (slight).

Nectria galligena and N. coccinea may both be present in the same locality and no doubt are more widely distributed than reported. Zeller¹ has recently reported that the two fungi are distinct morphologically as well as in their parasitic virulency and physiology.

Recent literature:

1. Zeller, S. M. Morphological differences between Nectria galligena Pres. and N. coccinea (ditissima). (Abstract) Phytopath. 12: 442. Sept. 1922.

Averna-Sacca, Rosario. O cancro (Nectria ditissima Tul.) da macieira e da pereira. Bol. Agr. Sao Paulo 22: 272-288. Sept./Oct. 1921.

Wiltshire, S. P. Canker control trials. Jour. Bath, West & South Co. Soc. V, 16: 269-272. 1922.

Powdery mildew caused by Podosphaera leucotricha (E.&E.) Salm.

Powdery mildew on apple was not so severe as usual in the Pacific Northwest. However, it appeared in greater abundance than normal in several of the eastern states.

<u>More</u>	<u>Same</u>	<u>Less</u>
Virginia	New York	Pennsylvania
West Virginia	Kentucky	Delaware
Tennessee	Idaho	Ohio
Arkansas	Oregon	Indiana
Illinois		Washington
		California

Virginia: Powdery mildew was more prevalent than I have seen it previously. The injury is slight as a rule, but it caused some uneasiness among the growers and some injury, especially when blossom buds were attacked. (Fromme).

Washington: Powdery mildew is almost entirely controlled this year. It has been very unfavorable for the fungus - hot, dry weather almost from the start, and then nearly everybody sprayed for it. A few orchards at higher elevations reported serious infection, but that is all. One man who uses an overhead sprinkling system

APPLE - Powdery mildew

of irrigation has about the worst case. (Fisher).

Oregon: Not as bad as last year on the whole. Nevertheless very severe in some orchards, resulting in worse damage on susceptible varieties like Jonathan than scab this year. (Barss).

Delaware, New York, West Virginia: (See Pl. Dis. Bul. 6:15, 35. 1922)

Infection was most commonly observed to affect the growing shoots. In Virginia the disease was reported on leaves, blossoms, and young apples. Injury of young trees was commonly reported. In Kentucky some 2-3 year old trees of Rome Beauty were nearly defoliated (Magill).

Varieties that were affected were reported as follows by collaborators:

Jonathan: Pennsylvania, Delaware, West Virginia,
Oregon, New York

Rome Beauty: Pennsylvania, Kentucky, New York.

Ben Davis: Pennsylvania, Tennessee.

Stayman: Pennsylvania, Delaware, West Virginia.

Grimes Golden: Pennsylvania.

Yellow Transparent: Delaware

The greater prevalence of the disease upon nursery stock and in young orchards is associated with neglect in spraying. Serious epidemics of the disease were reported as being checked by dry weather. Sulphur dust gave good control on young trees of Rome Beauty and Jonathan in New York (Chupp). Spraying with Bordeaux mixture was reported effective in Kentucky (Magill). In Oregon spraying alone, as for scab, is not sufficient for control in average seasons (Barss). Fisher emphasizes the value of lime-sulphur in the pink stage along with careful pruning for thorough control in Washington.

References

Cited:

1. Fisher, D. F. Apple powdery mildew. Proc. Ann. Meet. Washington State Hort. Assoc. 15: 46-52. (1920)

Not cited:

- Allen, W. J. Orchard experiments. Spraying trials at Glen Innes experiment farm. Agric. Gaz. New South Wales 33: 113-119. 1922.
- Fisher, D. F. Lessons from the 1921 mildew epidemic. Proc. Wash. State Hort. Soc. 17 (1921) : 162-171. 1922.
- Nordmann. Der apfelmehltau und seine bekämpfung. Deut. Obstkalend. 63: 202-203. June 1922.

APPLE - Crown gall

Crown gall caused by Bacterium tumefaciens EFS & Towns.

Crown gall, while not reported as on the increase, is considered very important in many states east of the Mississippi.

The hairy-root type of infection was commonly reported upon nursery stock. In some instances systemic infection was also reported. Several observations were reported of root rots following crown gall infection upon mature trees and thus causing serious loss with bearing trees. The following estimated percentages of loss were reported: Texas, 1.5%; Arkansas, 1%; Illinois, none; Arizona, less than 1%.

The following comments from collaborators show more definitely the situation in various states.

Massachusetts: Frequent on nursery stock. (Osmun).

New York: Found on Northern Spy and Dutchess. (Chupp).

Delaware: Hairy-root stage is found with young stock. Weakening of mature apple trees found prevalent in some sections. (Adams).

Tennessee: Early Harvest, Rome Beauty, Northern Spy, very susceptible. (Hesler).

South Carolina: Associated with Xylaria root rot. Reported to have caused a 1% loss in some nurseries. (Ludwig).

Mississippi: A very serious trouble on nursery stock in the state. (Neal).

Texas: A case of an apple tree affected with crown gall was noticed in which the galls were found to cover not only the roots, the trunk, and the limbs, but infection worked up and attacked even the terminal buds. Pseudomonas tumefaciens was present in all galls as proved by isolation work. (Tauberhaus).

Ohio: In most instances infection can be traced to introduced nursery stock which was infected. (Thomas).

Illinois: Chiefly on young trees and generally distributed throughout state. (Tehon).

Wisconsin: Twenty percent prevalence in one block of Wealthy in spite of mercuric-chloride sterilization. (Vaughan).

Iowa: Prevalent in nurseries: Estimated loss of 25%. (Melhus)

Arizona: Present in practically all of the apple districts of the state. The occurrence of large galls on trees recently planted points to imported nursery stock. Older trees die suddenly when the fruit is about half mature, especially where the water supply is not abundant. (Brown).

APPLE - Crown gall

The future in the control problem, from a knowledge of the survey reports, is directly concerned with nursery practices. It would appear that losses in future plantings could be reduced by improving nursery practices and strengthening the present nursery inspection service.

Melhus and Maney¹ in their study of control of crown gall on apple grafts in the nursery, state that "Fungicides which go into solution slowly, such as lead arsenate and Bordeaux mixture, have a much less injurious effect on the callousing process..... The use of Bordeaux mixture (8-8-50) with or without lead arsenate, reduced the percentage of crown gall about 66% over the checks, and nearly 50% over the mean percent of crown gall in all checks in the Wealthy variety."

Wormald and Grubb² report on experiments conducted at the East Malling Research Station, England with Paradise (layered) apple stocks as follows:

"(1) Cutting the shoots with a knife gives rise to smaller galls than tearing them from the stool.

"(2) Covering the cut surfaces at the base of the stocks with a protective layer, e.g., Stockholm tar or grafting wax, reduces the number and size of the basal galls.

"(3) Galls on the stem above the base, and root-galls, may be largely prevented by careful handling and planting, so as to avoid unnecessary injuries."

Literature cited

1. Melhus, I. E. and T. J. Maney. A study of the control of crown gall on apple grafts in the nursery. Iowa Agr. Exp. Sta. Res. Bul. 69: 159-172. July 1921.
2. Wormald, H. and N. H. Grubb. Notes on the control of nursery stock against crown gall. Gard. Chron. III, 71: 198. April 22, 1922.

Sooty blotch and fly speck caused by Phyllachora pomigena (Schw.) Sacc. and Leptothyrium pomi (Mont. & Pr.) Sacc.

Similar climatic conditions are favorable to the prevalence of these two fungi which are generally reported together. In some instances sooty blotch is reported earlier than the fly speck. Sooty blotch is more conspicuous in its development and very pronounced upon light colored varieties of apples.

Prevalence compared with average year

<u>More</u>	<u>Same</u>	<u>Less</u>
Maine	Connecticut	Pennsylvania
Massachusetts	New Jersey	South Carolina
New Hampshire	Virginia	Indiana
New York	Kentucky	Wisconsin
Delaware	Ohio	
West Virginia	Illinois	
Missouri	Kansas	

APPLE - Sooty blotch and fly speck

The precipitation was above normal during August for Maine, New Hampshire, and New York. In Delaware the disease became established during July, for which month the rainfall was above normal. It is generally found that the disease becomes prevalent during protracted rainy periods and may be checked as suddenly as it appears with a period of dry weather. The diseases are usually reported during the period from July to harvest. According to Chupp, many orchards in Ulster County, New York, showed 20 to 75% infection with from 8 to 10% of the apples ruined, which means a loss of \$10,000.

The following varieties of apples have been reported by collaborators as showing infection this year:

Connecticut: Gravenstein and Baldwin. (Clinton).

New York: Wolf River and Greening. (Chupp.)

New Jersey: Paragon, Stark, Greening, and Stayman. (Department of Plant Pathology).

Kentucky: Grimes, Mann, Delicious, Ben Davis, Winesap and Stayman. (Valleau).

Indiana: Winter Maiden Blush, Wealthy, Grimes, Jonathan, Indiana Favorite, York Imperial, and Maiden Blush. (Gardner)

The market inspection reports indicate that sooty blotch is more common than fly speck. In basket and barrel shipments 10 to 75% of sooty blotch and fly speck is often reported. The following observation made by F. R. Perry was the only instance of apparent development under storage conditions: "Shipped almost clean apples from Batavia, New York to Ithaca. On arrival when barrels were opened, the fruit was covered with sooty blotch that had evidently developed during shipment."

The usual apple spraying program will hold the disease in check. Increased prevalence was generally associated with failure to apply late sprays. Moist and shaded areas are associated with greater prevalence and the lower and innermost fruit is most commonly infected.

Root rots caused by various fungi.

Collaborators have submitted reports principally upon those rots associated with Xylaria sp. and Armillaria mellea (Fr.) Quelet. No apparent increase in prevalence over past years has been reported, but there appears to be a consistent loss of trees because of root rot pathogens. In many instances the primary cause is difficult to determine.

Black root rot caused by Xylaria sp.

New York: Follows winter injury or other weakness. Always important. It is impossible to say what part the Xylaria sp. plays in the killing of the trees. Many trees die each year, on the roots of which are Xylaria. (Chupp).

APPLE - Root rots

South Carolina: Discovered for the first time in northwest corner of state. Killing several trees just coming into bearing. Complicated with crown gall but apparently the more important of the two. (Judwig).

Illinois: In isolated spots in various northern sections. In one orchard causing serious injury to three year old trees. (Anderson).

In addition to the above states, West Virginia, Kentucky, and Arkansas also reported it.

Armillaria root rot caused by Armillaria mellea (Fr.) Quelet

Very few reports were submitted this year. Where no particular attempt is made to determine the prevalence, the nature of the disease is not such as to find many orchardists recognizing it in the various stages of development. Ohio, Wisconsin, Iowa, and Idaho reported the disease. In New York this fungus is found on the roots of many dying apple trees, but probably freezing or excess of water was the original cause. (Chupp).

Literature, not cited

Frank, Arthur. The mushroom root rot. Bi-Month. Bul. Wash. Agr. Exp. Sta. 9: 83-84. Jan. 1922.

Root rot caused by Hypoboloma appendiculatum (Bul.) Karst.

Observed by A. L. Pierstorff growing on the roots of dying trees in an orchard in New York.

Root rot caused by Ozonium omnivorum Shear

Taubenhaus reports this trouble prevalent in the black lands of Texas and estimates a 3% loss for the state. Observed to be on the increase in Arizona where Brown estimates the loss in that state at close to 1%. (Pl. Dis. Bul. 6: 106,134. 1922)

Root rot (cause not determined).

Kentucky: Common with Winesap in low, wet land. In Boyd County this year an 8 year old orchard of Jonathan and Stayman had a 5% loss, mostly Jonathan trees. Land was cleared 10 years ago, very few stumps remaining. (Magill).

Indiana also reports an undetermined root rot.

Bitter pit (Stippen, Baldwin spot) - non-parasitic

Bitter pit was of more than normal prevalence, particularly in the states east of the Mississippi, and in certain sections serious loss was experienced. The prevalence compared with the average year was reported as follows:

APPLE - Bitter pit

<u>More</u>	<u>Less</u>	<u>Same</u>
New York	Arkansas	Massachusetts
Virginia	Colorado	Connecticut
Ohio		Delaware
Indiana		Idaho
Michigan		Washington

Estimated percentage loss was reported as follows: New York, 1-3%; Virginia, 3%; and Arkansas, trace.

New York: In Ulster County by far the worst disease attacking apples this year. Several counts indicate general injury of 75% of the Baldwin fruit. Half of this was unmarketable, resulting in a loss of approximately \$70,000. (Chupp).

Virginia: Varied greatly in different orchards and more general in the southern valley. Especially prevalent where fruit was oversized. (Fromme)

Ohio: Fruit on light bearing trees show greatest injury. (Thomas)

The injury was reported this year on the following varieties: York Imperial, Grimes, Baldwin, Ben Davis, and Stayman.

Literature.

- Adams, J. F. Some apple diseases not controlled by spraying. Trans. Penin. Hort. Soc. 35 (1921): 77-81. illus. 1922.
Herbert, D. A. Bitter pit in apples: the crushed cell theory. Phytopath. 12: 489-491. Oct. 1922 (Dec.) No. 10.

Water core (non-parasitic).

Reports have been submitted only from four states as follows: New York: Most common on Greening and early varieties of Red Astrachan, Wealthy, and Yellow Transparent. (Chupp). Delaware: Common with early apples, particularly Yellow Transparent. Apparently associated with several days of continuous rains just before harvest. (Adams). Indiana: Found on Northwestern Greening. (Gardner). Kansas: Reported on York Imperial. (Stokdyk).

Jonathan spot (non-parasitic)

Only seven states have reported Jonathan spot: New York: There is a great variation between different plantings. It appears much more frequently on the hill slopes than in the valleys. (Chupp). Ohio: Thought to be most marked on trees having slight crop. (Thomas). Illinois: Not at all serious this season in most localities. (Anderson and Tehon). Wisconsin, Colorado, Iowa, and Idaho were reported as having but slight prevalence.

Blue mold rot caused by Penicillium expansum (Lk.) emend. Thom.

Probably the most important rot from the standpoint of storage and transportation. Injury in the form of bruises, mechanical and insect injuries, usually paves the way for the fungus. Occasionally it follows infection by other fungi. An unusual amount of rot is reported from Illinois. In orchards with scab and fruit rot it seemed to have been much worse. Barnum reports upon a stem-end infection by this fungus found in California on the Yellow Bellflower and Yellow Newtown. The fungus invades the fruit through the stem as proved by inoculation of stems of healthy apples with cultures of the fungus isolated from decayed fruit. The rot is retarded in cold storage although it makes some progress at a temperature of 45° F. and at room temperature the decay is rapid.

The Bureau of Agricultural Economics supplies the most extensive information upon the prevalence of this rot. Because of its general prevalence, the loss of fruit from this rot is, no doubt, underestimated.

Table 90. Losses from blue mold rot of apples, as shown by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, 1922.

ECONOMICS, 1922.							
Origin of shipment	: Percentage of			Origin of shipment	: Percentage of		
	: decay				: decay		
	:No.cars: Percent:				:No.cars: Percent		
	:	:	:		:	:	:
Arkansas	:	2	: 2-5	Pennsylvania	:	2	: 2
California	:	1	: 2	Tennessee	:	1	: 2
Colorado	:	3	: 1-15	Virginia	:	4	: 2-3
Idaho	:	3	: 13-20	Washington	:	5	:25-35
	:	17	: 1-9		:	36	:10-20
Illinois	:	1	: 30		:	331	: 1-9
	:	7	: 1-4		:	:	:
Indiana	:	1	: 3	West Virginia	:	6	: 1-8
Maryland	:	2	: 2-3	Wisconsin	:	1	: 3
Michigan	:	3	: 2-12	Canada	:	3	: 1-3
Missouri	:	2	: 3	Unknown	:	5	:10-27
Montana	:	1	: 1-5		:	16	: 1-7
New York	:	51	: 1-10		:	:	:
Oregon	:	4	: 15-27	Total number cars	:	:	:
	:	39	: 1-10	with blue mold rot:	:	547	:

Literature cited

1. Barnum, C. C. Stem end rot of apples. Science N.S. 55: 707-708. June 30, 1922.

Miscellaneous fruit rots and leaf spots

Pink rot caused by Cephalothecium roseum Cda. - This fungus, usually associated with scab infection, was reported as of less prevalence, in spite of the favorable season for apple scab. In New York a crop of Boiken apples, after being in storage ten days, was 30% spoiled by this disease. It was

APPLE - Fruit rots and leaf spots

said to be general in New Jersey, following scab infection. In Virginia infection was associated with scab as well as cedar rust on Pippins, while fruit was still on trees. (Schneiderhan). In Ohio it was reported very rare in spite of the wide-spread occurrence of scab on apples. (Selby).

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt. More of this disease was reported by collaborators. This may be associated with a greater production of early apples compared with last year. The disease was reported from the following states, principally upon early varieties of apples: Vermont, Massachusetts, Connecticut, New Jersey, Delaware, West Virginia, Ohio, Indiana, Illinois, Wisconsin, and Iowa. Red Astrachan was reported as severely affected in Massachusetts and Delaware, and one occurrence on unsprayed Esopus fruit in transit was recorded in Indiana.

Delaware: Very prevalent on Red Astrachan. Clusters of ripened fruit completely rotted upon trees. In one instance injury from rose chafer allowed for greater injury from rot.

Ripe rot caused by Phytophthora cactorum Schroet. What was thought to be this fungus was reported from Pennsylvania on growing fruit of the Ewalt variety. (Thurston). In this connection Lafferty and Pettybridge¹ describe a "rot occurring in apples in Ireland which was found to be caused by a species of Phytophthora which proved to be P. syringae Klebahn, and not P. cactorum Schroet., a species that has been recorded several times as the cause of a similar rot in apples and pears in other countries. The economic significance of the rot does not appear to be great. Supporting heavily laden, drooping branches with props and attention to orchard hygiene are suggested as preventive measures."

Dry rot caused by Alternaria sp. Associated with arsenical injury on fruit in Ohio (Thomas).

Spongy dry rot. From Massachusetts reported common in storage. (Osmun).

A list of fungi was submitted by Dana from Washington associated with apple rots, Dothichiza, Fusarium, Penicillium, Alternaria, Phoma or Phyllosticta, Rhizopus, Botrytis, and Cephalosporium.

Leaf spot caused by Cercospora mali E. & E. is again reported from Texas by Taubenhaus.

Reference

1. Lafferty, H. A. and G. H. Pettybridge. On a Phytophthora parasitic on apples which has both amphigynous and paragynous antheridia; and on allied species which show the same phenomenon. Sci. Proc. Royal Dublin Soc. 17: 29-43 Aug. 1922.

Miscellaneous bark cankers

Bark canker caused by Myxosporium corticolum Edgerton was reported from Connecticut by Clinton.

Apple canker caused by Fusicoccum pyrorum n. sp. is reported from New York by Chupp. Produces cankers on otherwise weakened trees. About 100 Duchess of Oldenburg apple nursery trees were killed by this disease. It also

caused cankers on Twenty Ounce that had been weakened by winter injury. (Chupp, C. and G. L. Clapp. *Fusicoccum* canker on apple. *Phytopath.* 13: 225-230. May, 1923.

Cytospora canker caused by Cytospora sp. Often associated with winter injury and reported from New York, Colorado, and Washington. This fungus has also been associated with species of the genus Valsa as the perfect state. (F. L. Stevens. An apple canker due to *Cytospora*. Illinois Bul. 217.)

Pox canker caused by Leptosphaeria coniothyrium (Fckl.) Sacc. (*Coniothyrium fuckelii* Sacc.) Reported for the first time from Ohio. Appears to be practically the same organism as that which causes blight in raspberries (Young).

Canker caused by Septobasidium retiformis^E? According to Taubenhaus apple and pear trees in Texas are frequently destroyed by a superficial fungus, Septobasidium retiformis.

Heart rots caused by Polyporus sp. In neglected orchards and especially general and severe in Wyoming County, New York. (Chupp).

Heart rot caused by Fomes igniarius (L.) Gill. was reported from Connecticut by Clinton.

Miscellaneous non-parasitic diseases

Measles. Reported on Delicious from Kansas. From West Virginia, Sherwood writes, "This trouble is increasing and is apparently causing a considerable damage in certain sections in southeastern counties. Many samples have been sent to the office and I have observed the trouble frequently."

Canker. Reported by Taubenhaus from Texas as follows: "A new canker disease of apple and pear limbs has been met with in many orchards of east Texas. Repeated culture work did not produce any organisms whatsoever. The disease is characterized by deep cracking and dying of the bark and limbs and may be mistaken for the canker of fire blight. The trouble is believed to be due to some physiological nature not as yet clearly understood."

Sunburn canker was reported from Texas by Taubenhaus as follows: "Apple orchards, the trees of which are exposed to too much sunlight are frequently noticed to have the outer bark dead and badly cracked. This condition seems to be confined to the outer epidermis and does not penetrate or touch the cambium layer."

Sun scald. In Virginia sun scald was observed more prevalent, particularly upon York Imperial (Schneiderhan). In Delaware a hot burning wind on May 19 caused considerable injury in certain sections of Sussex County. Young tender foliage was badly burned on Yellow Transparent and fruit scald was observed upon Nero and Grimes Golden. (Adams).

Drought spot. Found in sections of Idaho where there was an insufficient amount of water and in the drier non-irrigated regions (Hungerford).

Drought injury due to hot dry weather in June, August, and September was a limiting factor in most sod orchards in Indiana, causing reduction in size, prematuring, and dropping of the fruit, and bitter pit in some varieties. Grimes Golden, Winesap, Ben Davis, and Jonathan in sod orchards were affected. (Gardner). It was also reported on Staymans in Virginia (Schneiderhan, Pl. Dis. Bul. 6: 133. Oct. 15, 1922).

Rosette. Reported from Delaware, Arizona, Idaho, and Washington. Not as prevalent and serious as last year.

Lenticel proliferation. Associated with excessive moisture in Ohio. (Thomas).

Growth cracks. Reported prevalent on July (Fourth of July) in Delaware and associated with excessive moisture. (Adams).

Wind injury. High sustained winds June 12, 13 caused foliage injury in Massachusetts, in many cases killing most of the foliage on one side of the tree. (Osmun).

Imperfect pollination. Owing to cold rains during blooming period H. H. Swain considers this as chief factor in a 40-75% reduction of a full crop in Indiana (Gardner). Adams in Delaware reports as follows: "Considerable of the so-called 'June Drop' was the result of failure in pollination. Weather conditions were too cold for activity of bees and many growers fully appreciated the loss of fruit because of this fact. Many apples were very irregular in form and on being cut open were found to be imperfectly fertilized. This condition was very common with the Yellow Transparent variety. Apples showing this irregular growth were also found to be more commonly russeted."

Winter injury

Clinton reports severe injury to fruit and shade trees by broken branches, prevalent in the northern part of Connecticut.

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 Rosa, J. T. Relationship of water retaining capacity to hardiness. Proc. Amer. Soc. Hort. Sci. 18 (1921): 165-169. (1922).
 Winter injury of apple roots. New Hampshire Sta. Bul. 203 (1922) pp. 14-16.

Spray injury

Spray injury continues to be reported as one of the many important problems in the production of marketable fruit. If only one factor were always concerned, the problem would be easy to solve and our many inconsistent results would not exist. Spray injury is not always associated with any one consistent cause and as a result must be diagnosed carefully in each individual instance because of the numerous limiting factors. The injury takes various forms, such as russetting, fruit blemishes, burning of leaves, and dropping of fruit. The following account is based upon reports by collaborators and for the most part is concerned with spray injury caused by Bordeaux mixture or lead arsenate.

Copper injury is usually associated with excess moisture because of heavy rains following a protracted dry period. The following report is by J. W. Roberts of the Office of Fruit Disease Investigations.

"There was a moderate amount of spray injury, particularly Bordeaux injury, in the northwest Arkansas orchards. It was not, however, unusually

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severe, although it must be remembered that in years when leaf spot is especially prevalent it is often impossible to tell the difference between Bordeaux injured leaves and leaves infected with Sphaeropsis. This is particularly true later in the season. In the vicinity of Maryland and Virginia there has been considerable spray injury due usually to over spraying. Most of the over spraying was due to the use of spray guns. The injury consisted of leaf spotting, leaf burning, and russet fruit and in extreme cases the leaves were so badly burned and the fruit pedicels so badly injured by the spray that there was a heavy defoliation and heavy dropping of fruit. The spray gun, unless very carefully used may cause a great deal of spray injury."

Delaware: Copper injury prevalent this season in the form of leaf spotting, russetting and spotting of fruit. Copper dust injury observed on Jonathan, Grimes, and Transparent. In addition to the varieties reported last year showing copper injury, the following were observed this season. (Adams).

<u>Variety</u>	<u>Leaf</u>	<u>Fruit</u>
Transparent	Severe	Slight
Red Astrachan	Severe	Severe
McIntosh	Severe	Slight
Stark	Slight	Slight
Nero	Slight	Slight

Ohio: Copper injury is reported more prevalent than last year. (Thomas).

Arsenical injury was reported from Delaware, Ohio, and Washington. In Delaware it was reported as a leaf spotting on Jonathan and Yellow Transparent. (Adams). Thomas, in Ohio, associated the injury with burning of leaves, blossom end injury and breakdown in fruit.

Fernald and Bourne¹ have recently reported their studies of injury to foliage by arsenical spray. The activities of climatic conditions appeared to be correlated with the injury.

"A special investigation was made on the effects of temperature, humidity, and light as affecting injury, and the authors found that with reliable arsenicals properly made, mixed, and applied, injury results from the combination of these factors. Neutral lead arsenate proved the safest of the materials used in clear weather, and in most cases it was even better than many of the others in cloudy weather. Clear weather spraying is said to be safer than cloudy weather and indications were observed that spraying at high temperatures can be done if the humidity is low, or at high humidities if the temperature is low." (Abstract. Exp. Sta. Rec. 47. Nov. 1922)

In Virginia spray injury to both fruit and foliage is common but is rarely of a severe type. Foliage burning has followed cold injury and scab in many cases (Fromme).

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- Knight, H. H. Injuries to the fruit of the apple by agencies other than insects. New York (Cornell) Agr. Exp. Sta. Bul. 410: 491-496. pls. 8. 1922.

Dusting versus spraying apples.

Dusting versus spraying continues to be a project of experimentation and is of increasing interest and importance to orchardists. The following publications give data concerning the results of experiments conducted during 1921.

- Britton, W. E., M. P. Zappe, and E. M. Stoddard. Experiments in dusting versus spraying on apples and peaches in Connecticut in 1921. Connecticut State Sta. Bul. 235: 207-236. 1922.
- Dutton, W. C. and S. Johnston. Comparative dusting and spraying of apples and pears. Michigan Agr. Exp. Sta. Bul. 115: pp. 7-20. 1922
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Orchard disease surveys

Three reports have been submitted on results of surveys in the orchard sections of Virginia and Illinois. The information presented in these reports is sufficiently condensed to present strikingly the importance of orchard pests in certain localities.

The following table (Table 91) shows the apple disease situation in counties of the southern third of Illinois where most of the commercial crop is produced. While these field observations were not made wholly on commercial plantings, they are of interest as showing the degree of infection in that region. The presence of such infective material indicates partly the effectiveness of careful spraying and cultural practice, since as a rule the lesser percentages of infection have been found in commercial plantings; and it indicates as well the tremendous influence unsprayed and uncared-for plantings may have in preserving a disease and supplying a continuous possibility

for new infections. (Tehon).

Table 91. Field notations on five important apple diseases in Illinois - Showing degree of infection

County	: Plotch	: Fire Blight	: Scab	: Rust	: Blister Canker
Marion	:*, s	:t,s	: s,l	:s	:h
Clinton	:t,l,l,tt	:t	:*,m	:	:t,*,t
St. Clair	:	:t,t	:t	:	:
Monroe	:v	:	:s	:h	:
Washington	:t,t	:	:t,t,t	:t,s	:
Jefferson	:m,t,t,t,s,*	:t,t,*,*	:t,t,*,*,t	:t,t,t,*,v	:t,t,*,*
	:m,*,t	:	:	:	:
Wayne	:s,m,v	:*,*	:s,*,l	:l,h,*,v	:v,m,m
Edwards	:v,v,v,v	:t,t,l	:s,*,s,v	:	:s,t,t,*
Wabash	:v,s,h,v,t,v	:l,s,t,m	:v,l,h,v	:	:m,m
White	:v,s,v,v,v	:l,t,t	:m,t	:*,t,t	:*,m
Hamilton	:m	:t,*	:*,*	:	:*
Franklin	:v,v,v,v,v,t	:t,t,m,h,t,l	:*,m,v	:h,v,v,m,*,*,h	:m,t,h,v
	:m,h,m	:*,t	:	:t	:
Randolph	:v	:m	:s	:v	:
Madison	:m,h,v,v,v,v	:m,m,m,m,m,h	:v,m,v,v,v	:m,t,v	:v,m,m
Williamson	:v,t,m,v	:t,t	:v,t,v	:v,t,l	:m
Saline	:v,v,v,v,v,v	:h,l,l,l,l	:m,h,m	:v,l,t,t	:m,m,m,*
Gallatin	:v,v,v	:v,m,m,m	:*	:*	:
Hardin	:t	:m	:m,m	:	:t
Pope	:v,t,v	:t,l,m	:h,m	:m	:
Johnson	:t,t,v,v,v,v	:m,l,l,l,l,t	:l,v,m,m,t	:m,h,v,*,v	:t,m,m,t,m,t
	:v,v,v	:	:	:	:
Union	:v,v,v,v	:t,m,l	:m,m,m,m,s,s	:m,s,s,s	:t,m,h,t,m
Alexander	:v,t	:m,*	:t	:m	:
Pulaski	:v,v	:l,l	:t,v	:t,t,t	:
Massac	:v,v,v	:h,*,s	:s,v,m	:m,t	:m,m

(*-occurrence: t-trace (to 2%): l-light (2-10%): m-moderate (10-25%):
h-heavy (25-40%): s-severe (40-60%): v-very severe (60-100%))

Virginia apple disease survey data, 1922.

Table 92. Frederick County data by F. J. Schneiderhan from 32 orchards including 17 of York Imperial, 10 of Ben Davis, 2 of Stayman, 1 of N.W. Greening, 1 of Winesap, and 1 of Sheepnose. The number of fruits counted in the different orchards ranged from 200 to 500. All data are for fruits.

Variety	: Scab	: Rust	: Bitr: Blo: Blk.: Cloud: Bitr: Spray
:	: Rot: tch: rot :	: pit: burn	
York	:%inf. orchards :100	:100	:24 :6 :90 :30 :80 :65
Imperial	:max. %infection: 56	: 9	: 2 :4 :10 :54 :25 : 5
	:ave. %infection: 20.7	: 4.4	: 0.2:0.2: 2.1: 5 : 4.6: 1.1
	:	:	:
Ben	:%inf. orchards :100	:100	: 0 :0 :70 :10 :70 : 50
Davis	:max. %infection: 70	: 9	: 0 :0 :11 :15 : 8 : 11
	:ave. %infection: 35.8	: 3.2	: 0 :0 : 4.4: 1.5: 2.7: 2

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Variety	: Scab	: Rust	: Bitr: rot	: Blotch	: Black: rot	: Cloud	: Bitr: pit	: Spray burn
Stayman : % inf. orchards	: 100	: 50	: 0	: 0	: 100	: 50	: 100	: 50
: Max. % infection	: 86	: 0.5	: 0	: 0	: 2	: 37	: 2	: 0.5
: Ave. % infection	: 70	: 0.2	: 0	: 0	: 2	: 18	: 1.5	: 0.2
:	:	:	:	:	:	:	:	:
N. West : % infection	: 60	: 1	: 0	: 100	: 13.3	: 1	: 0	: 0
Greening:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:
Winesap : % infection	: 62	: 1.5	: 0	: 0	: 1.5	: 0	: 0	: 0
:	:	:	:	:	:	:	:	:
Sheep : % infection	: 20.5	: 1.5	: 0	: 1.5	: 4	: 0.5	: 2	: 0
Nose	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:
Summary : % inf. orchards	: 100	: 97	: 12	: 10	: 91	: 30	: 72	: 53
All var.: max. % infection	: 86	: 9	: 2	: 100	: 11	: 54	: 25	: 11
: ave. % infection	: 31	: 3.5	: 0.1	: 3.3	: 3.2	: 4.3	: 3.4	: 1.2

The importance of scab in this section will be seen by the fact that the percentage of fruit affected with scab (31) is greater than the combined total of all other causes of defects (19 per cent).

Fly speck was found in only one orchard on Winesap, the percentage of affected fruits being only 1.

Table 93. Bedford County data by R. H. Hurt. Data are from 43 orchards including 14 of Winesap, 9 of York Imperial, 7 of Yellow Newtown, 3 of Ben Davis, 3 of Black Twig, 3 of Cannon, and 1 each of Grimes, Stayman, Delicious, and Paradise Sweet. Data are fruits alone, 500 fruits being counted in each orchard.

Variety	: Scab	: Rust	: Bitr: rot	: Blotch	: Fly speck	: Cloud	: Bitter pit
:	:	:	:	:	:	:	:
York : % inf. orchards	: 22	: 89	: 67	: 44	: 33	: 11	: 100
Imperial : max. % infection	: 1	: 1.6	: 2	: 1	: 2	: 4	: 5
: ave. % infection	: 0.2	: 0.7	: 0.5	: 0.3	: 0.5	: t	: 1.7
:	:	:	:	:	:	:	:
Winesap : % inf. orchards	: 100	: 7	: 93	: 0	: 71	: 57	: 86
: max. % infection	: 74	: 0.4	: 5	: 0	: 35	: 38	: 7
: ave. % infection	: 15	: t	: 1.2	: 0	: 6.2	: 4.6	: 2.2
:	:	:	:	:	:	:	:
Yellow : % inf. orchards	: 100	: 71	: 100	: 86	: 43	: 14	: 100
Newtown : max. % infection	: 90	: 3	: 7	: 2	: 0.6	: 1	: 2
: ave. % infection	: 14.7	: 0.6	: 2	: 0.7	: 0.2	: 0.1	: 1.3
:	:	:	:	:	:	:	:
Ben : % inf. orchards	: 33	: 67	: 33	: 100	: 0	: 33	: 100
Davis : max. % infection	: 1	: 0.6	: 1	: 64	: 0	: 1	: 1
: ave. % infection	: 0.3	: 0.3	: 0.3	: 26.6	: 0	: 0.3	: 0.7
:	:	:	:	:	:	:	:
Black : % inf. orchards	: 100	: 33	: 67	: 0	: 67	: 33	: 100
Twig : max. % infection	: 88	: 0.2	: 3	: 0	: 90	: 0.6	: 3
: ave. % infection	: 31.8	: t	: 1.7	: 0	: 30.3	: 0.2	: 1.9

Variety	:	Scab	Rust	Bitr rot	Blotch	Fly speck	Cloud	Bitr pit
Cannon	: % inf. orchards	: 0	: 33	: 100	: 0	: 100	: 100	: 33
	: max. % infection	: 0	: 0.2	: 1	: 0	: 2	: 1	: 0.2
	: ave. % infection	: 0	: t	: 0.8	: 0	: 0.9	: 0.8	: t
Grimes	: % infection	: 0	: 0	: 0	: 0	: 0.2	: 0	: 0.4
Stayman	: % infection	: 0	: 0.4	: 0.4	: 0	: 0	: 0.2	: 2
Delicious	: % infection	: 0	: 0.6	: 0	: 0	: 0	: 0	: 1
Paradise	: % infection	: 2	: 0	: 1	: 25	: 0	: 0	: 2
Sweet	: -----	: -----	: -----	: -----	: -----	: -----	: -----	: -----
Summary	: % inf. orchards	: 67	: 47	: 79	: 33	: 51	: 37	: 91
All var.	: max. % infection	: 90	: 3	: 7	: 64	: 90	: 38	: 7
	: ave. % infection	: 9.6	: 0.3	: 1.1	: 2.6	: 4.3	: 1.6	: 1.6

Collated by F. D. Fromme

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PEAR

Blight caused by Pacillus amylovorus (Burr.) Trev.

There was apparently a much greater prevalence of fire blight than reported the past two years. In California the disease incidence was reported to be greater than any previous year in the past ten (Hagle). In Canada the disease appeared more serious than during the past four or five years in the Province of Ontario (Howitt).

The initial injury has been reported as blossom blight followed with twig blight. In some sections late infections of twig blight only were observed.

The loss for the country as a whole was considerably more than reported during the past two years.

The following comments indicate the economic importance and prevalence in some states. (For other reports see Pl. Dis. Bul. 6: 32, 33, 119, 120, 121, 154. 1922).

Vermont: Pear blight unusually common everywhere. It seems to have spread largely this summer as the infection is only present in this year's growth. (Lutman).

Massachusetts: Apple more generally and severely affected than pear. (Osmun).

New York: The most important fruit disease in the state. In fruit and trees killed in Ulster and Orange Counties the loss is approximately \$200,000. (Chupp).

Florida: This disease is the most common and the most destructive of the pear in this state. It is the cause of all the abandoned orchards. It is reported from every section where the pear is grown. (Burger).

Estimated percentage loss from fire blight for 1922 by states:

New Hampshire	Trace	South Carolina	50%	Illinois	5%
Vermont	3%	Kentucky	65%	Wisconsin	Trace
Connecticut	5%	Tennessee	Trace	Arizona	1%
New York	18%	Louisiana	40%	Idaho	2%
Delaware	3%	Arkansas	60%	Washington	Trace
Maryland	8%	Ohio	3%	California	15%
West Virginia	5%				

Reports are submitted indicating that fire blight in pear is directly concerned in the increased prevalence of fire blight in apple. In consulting Fig. 44 and Fig. 45 it is observed that fire blight of pear is slightly more extensive than reported for the disease on apple. While the same climatic conditions are conducive to the disease on both hosts, there is not sufficient evidence to warrant any correlation on the basis of the information submitted. Several comments on this question have been presented favoring both sides of the problem. For details see under apple.

Barss reports the presence of the disease on service berry and other pomaceous hosts in sections of the Willamette Valley, Oregon, but states that it is rare in orchards.

Varietal susceptibility was reported as follows:

New York: Percentage trees killed in Ulster County - Clapps Favorite 13%, Bosc 9%, and Bartlett 5%. (Chupp).

Georgia: Fire blight is most serious at this time. The Oriental strains, which are the most immune, are dying badly this year. On trees which have had the blighted limbs cut out this summer new infections started. We have several Chinese pears two to three years old, supposed to be immune to blight and so far none has shown up on them. (J. H. Miller).

Mississippi: Sand pears are only variety that is resistant. (Neal).

Indiana: Resistance of Kieffers observed July 26. (Gardner).

Michigan: (Southwest). The variety Kieffer is withstanding the disease in most cases, showing only a slight amount of twig blight, but more susceptible varieties such as the Clapp's Favorite are suffering infections even on the larger branches. (J. T. Bregger).

PEAR - Fire blight

Control measures reported have been concerned with campaigns of eradication and securing resistant varieties and are essentially the same as the following recommendations made by M. F. Barrus.

"Individual attempts to control fire blight of pears, apples and quinces are usually unsuccessful, because of the ease with which the fire blight bacteria can be carried from place to place by insects. If an entire community where pears are grown would attempt to carry out the known control measures, the disease could be kept from doing serious damage. A considerable degree of control can be obtained in isolated orchards.

"The methods to be employed are the removal of all holdover cankers during dormant season; patrol of orchard during the growing season to remove all blighted twigs, spurs, or suckers as soon as the disease is evident; disinfection of all cut surfaces and pruning tools used with a solution made by using one part corrosive sublimate and one part mercuric cyanide to 500 parts of water; maintenance of a spraying program that will keep insects under control." (M. F. Barrus. New York State Coll. Agr., Depts. Plant Path. and Entom. Weekly News Letter. May 8, 1922).

In addition to these methods Swingle³ recommends that in Montana no more tillage or irrigation be given during the first part of the growing season than is absolutely necessary for the production of the crop, in order to prevent the formation of a large amount of succulent growth. The green apple aphid, which is

PEAR - Fire blight

stated to be the most important carrier of blight infection after the bees stop working in the orchards, should be kept under control. The most important measure, however, is the use of resistant varieties. If the variety desired is susceptible, it should be topworked on a body and roots of one which is resistant and not likely to sprout.

According to J. P. Martin¹, the honey bee has been definitely proved to be a carrier of blight infection, but its value in the orchard as a pollenizing agent is so great that it would be unwise to try to control the disease by keeping it out, especially since other insects are also carriers. It is more practical to prevent contamination of the insects by destruction of holdover cankers during the winter months. The following quotation gives the results of control measures used in New York:

"Groups of farmers are beginning to co-operate in eradication. They remove all old diseased trees and cankers in the winter, then twice a week in summer patrol the pear orchard, removing any twigs showing signs of the disease. This is fairly successful." (Chupp)

A new host, Prunus triloba var. plena, has been reported² for Bacillus amylovorus. The organism isolated was inoculated into other known susceptible hosts for comparison with other strains, with identical results.

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PEAR - Scab

Scab caused by Venturia pyrina Aderh.

In 1922 there were only five states reporting pear scab as more prevalent than the average year.

Table 94. Prevalence of pear scab compared with the average year.

More: Vermont, Connecticut, New York, Pennsylvania, Delaware, Michigan
Same: New Hampshire, Massachusetts, New Jersey, Maryland, West Virginia, Georgia, Ohio, Indiana, Illinois, Wisconsin
Less: Washington, Oregon

Estimated reductions in yield have been given as follows: Vermont, 5%; Connecticut, 1%; New York, 6%; Pennsylvania, 12%; Maryland, 1%; West Virginia, trace; Tennessee, trace; Ohio, 2%; Illinois, trace; Wisconsin, trace; and Washington, .5%.

Dates of first observation

Ohio	April 25	New York	June 12
Indiana	May 23	Illinois	July 19
Wisconsin	June		

Varietal susceptibility

Flemish Beauty	Connecticut, New York, Massachusetts
Clapps Favorite.....	Connecticut
Seckel	New York

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PEAR - Leaf blight

Leaf blight caused by Fabraea maculata (Lév.) Atk.

Leaf blight was reported as more prevalent than during the average year in New Jersey, Delaware, Maryland, and Illinois. In Maryland and Delaware the increase in prevalence is to be associated with neglect of spraying because of frost injury. There was said to be less leaf blight than usual in Connecticut, New York, West Virginia, Ohio, and Indiana. The estimated percentage loss by states was reported as follows: Connecticut, 1%; Delaware, 5%; Maryland, 5%; West Virginia, Illinois, Kentucky, and Tennessee, a trace. In Delaware the disease has been the most serious disease of pear the past two years. Because of frost injury, spraying has not been generally practiced. Infected leaves collected March 25 showed mature ascospores 5 days later under laboratory conditions. Leaf infection in the field was first observed June 26 and fruit infection August 9.

In Delaware good control was secured with early applications of Bordeaux mixture up to July. Where the second codling moth or July spray was omitted the disease became prevalent because of the heavy rains throughout July. Complete defoliation occurred by the end of July in neglected orchards (Adams). The following results of experimental spraying were reported from New Jersey by the Department of Plant Pathology.

Spray schedule: (1) Dormancy; (2) Cluster-bud, April 6; (3) Petal fall, April 25; (4) Seven days after petal fall, May 2; (5) May 11; (6) June 6, (7) August 10.

Treatments:

- Block 1. Commercial lime sulfur as per schedule.
 " 2. Self-boiled lime sulfur as per schedule.
 " 3. Self-boiled. Omit 4.
 " 4. Commercial lime sulfur. Omit 4.
 " 5. Commercial lime sulfur. Omit 4 and 5.
 " 6. Commercial lime sulfur, as per schedule.
 " 7. Commercial lime sulfur. Omit 4, 5, and 6.

Table 95. Results of pear spraying and effect of spray treatment on the fruit in New Jersey (Dept. Plant Pathology).

	Results of pear spraying		
	Clean	Diseased	Russeted
	(percent)	(percent)	(percent)
Check	4.5	95.5	4.6
Block 1	90.9	8.1	76.2
" 2	59.5	40.5	9.0
" 3.	32.6	67.4	8.1
" 4	71.7	28.3	13.8
" 5	56.1	43.9	10.2
" 6	88.0	12.0	47.5
" 7	78.8	21.0	55.5

PEAR - Leaf spot

Leaf spot caused by Mycosphaerella sentina (Fr.) Schröt.
(Septoria pyricola Desm.)

Leaf spot was reported from New York, Delaware, Florida, Ohio, Illinois, Michigan, and Kansas. In New York the Bosc, Seckels, and Bartlett varieties were susceptible in the order named, while only an occasional infection was found upon Kieffers, according to Chupp.

Miscellaneous diseases (parasitic)

Sooty blotch caused by Phyllachora pomigena (Schw.) Sacc. Observed in Ulster County, New York as rendering pears unsalable in several orchards. This was the worst disease affecting fruit of pear in Ulster County this year. (E. V. Shear). In Delaware the prolonged wet periods in July with neglected orchards favored prevalence. (Adams).

European canker caused by Nectria galligena Bres. Present throughout western Oregon. Occasionally bad in certain varieties. Susceptibility as far as determined runs in the following order for the varieties observed: D'Anjou, Bosc, Howell, Surprise, and Bartlett. (Barss).

Powdery mildew probably caused by Podosphaera leucotricha (E. & E.) Salm. Present in Hood River Valley and western Oregon generally. In Hood River County reported as quite abundant particularly on fruit of D'Anjou where proper sprays have not been applied. Some varieties like Bartlett are practically unaffected. (Barss).

Twig blight caused by Monilia sp. Rather severe in California on variety Madeline (early unimportant variety); also found on Bartlett but rare. (Horne).

Root rot caused by Ozonium omnivorum Shear. Very prevalent in Texas, estimated reduction in yield 10%. (Taubenhaus).

Heart rot, cause undetermined. Present in trees that have been injured slightly in nearly all orchards. (Chupp).

Canker caused by Septobasidium retiformis, reported from Texas - see apple.

Black rot caused by Physoctenophora cydoniae Arnaud. Reported as a fruit rot from Indiana and Illinois.

Crown gall caused by Bacterium tumefaciens EFS & Towns. Reported from Washington. (Dana).

Corticium stevensii has been under observation at Satsuma, Florida for several years on a few pear trees. Damage negligible. (J. R. Winston).

Miscellaneous diseases (non-parasitic)

Foliage scalding - Washington; alarmingly severe in many cases, affecting Bartlett most severely, and Kieffer and D'Anjou in same situation not at all. (Dana, Pl. Dis. Bul. 6: 122. Oct. 1, 1922).

Bitter pit - Reported from Oregon and Washington.

Black end - Probably drouth trouble. Reported from Washington and Oregon. (Barss, Pl. Dis. Bul. 6: 142. Nov. 1, 1922).

Black leaf or soursap, probably a seasonal injury - Reported from California. Severe generally in shallow soils with dense subsoils, especially where very dry, last year. Heavy losses of young trees in dead and much injured trees. (Horne).

Physiological canker - Same as described for apple in Texas. (Taubenhaus).

PEAR - Miscellaneous

Blossom blight (uncertain). Drouth injury and swollen tips are reported only from Washington by Dana.
Spray injury.

Oregon: Lime sulfur russet slight this year even on susceptible varieties like Bosc and Comice. In Josephine County injury was noticeable where spraying was done on hot days. (Barss).

Recent literature

Dutton, W. C. and S. Johnston. Comparative dusting and spraying of apples and pears. Michigan Sta. Spec. Bul. 115 (1922) pp. 7-20, figs. 4.
 Kazui, Masatoshi. Nashi byôgaichû kufo yobo reki (Spray calendar for control of disease and insect injuries of sand-pear), Byôchu-gai Zasshi (Jour. Plant Prot.) 9: 34-38. Jan. 1922.

Frost injury

In some sections frost injury was more severe upon the pear than apple.

Vermont: Percent of crop injured, 1.5. (Lutman).

New York: Fruit was badly russeted and cracked. (Chupp).

Delaware: An estimated reduction of 70% in the crop as the result of frost injury. (Adams).

Ohio: Very serious in some sections. (Thomas).

QUINCE

Fire blight caused by Bacillus amylovorus (Burr.) Trev.

The same prevalence compared with the average year was reported for Connecticut, Pennsylvania, West Virginia, Virginia, Texas, and Illinois. In New York it is considered the most important disease of the host and in Ulster County about 25% of the trees were killed. (Chupp). It was reported troublesome locally on quince in Pennsylvania. (McCubbin). In West Virginia and Delaware it was reported important but the host is not grown commercially to any extent. The estimated reduction in yield for New York was 8% (Chupp) and for Texas 1% (Taubenhaus).

Leaf blight caused by Fabraea maculata (Lev.) Atk.

No increased prevalence was observed for this disease during the year. Reports of its occurrence were submitted from Massachusetts, Connecticut, Delaware, Virginia, South Carolina, Ohio, Indiana, and Illinois. Leaf infection causing serious weakening through premature defoliation was most generally reported. Only infection on fruit in the market was reported from Virginia and Indiana. An estimate of 8% reduction in yield was reported for New York (Chupp) and 1% for Delaware (Adams).

QUINCE - Rust, Miscellaneous diseases

Rust caused by Gymnosporangium germinale (Schw.) Kern
(G. clavipes Cke. & Pk.)

Reported from New Hampshire, Massachusetts, Connecticut, New York, Delaware, Pennsylvania, and Ohio. Fruit infection only was reported in 1922, although in some seasons serious infection of the growing shoots occur. In Ulster County, New York severe infection was found in one orchard. Twenty-five percent of the fruit destroyed. (Chupp). Increased prevalence was reported in Pennsylvania. Several reports of severe infection were received from Dauphin, Cumberland, Southampton, and Adams Counties. (Thurston). In Northampton County the infestation immediately surrounding Wind Gap apparently runs from 70 to 90% infection. (Broadbent).

Miscellaneous diseases

Black rot caused by Physalospora cydoniae Arnaud was reported from Massachusetts, Connecticut and Ohio.

Fruit spot caused by Phoma pomi Passer. was reported from Connecticut and Indiana.

Powdery mildew caused by Podosphaera oxyacanthae (DC.) De Bary. First report of disease in Illinois: "Our accession number 6023 contains leaves of quince affected by a powdery mildew, which we take to be Podosphaera oxyacanthae. This collection is especially interesting since it is the first record of the disease on this host in Illinois and also because of the fact that all of the leaves on the four trees examined showed a very uniform and heavy coat of mildew with an abundance of mature ascocarps. The collection is from Vermillion in Edgar County on August 30, 1922." (Tehon).

DISEASES OF STONE FRUITSPEACH

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

Brown rot of peach, as usual, was most destructive in the commercial plantations in the East and particularly in the Atlantic States. The only states reporting an increase in prevalence compared with the average year were Massachusetts, West Virginia, Kentucky, and Arkansas, while Maryland and Illinois reported less. Since the crop was not reduced by frost injury to the same extent as last year, it is natural to expect that the losses in bushels would be much greater because of the increased production. The losses in the states reporting were much greater than last year, except in Tennessee, Georgia, Louisiana, Texas, and Washington.

Economic importance

Reports generally state that the greatest loss in fruit rot occurred in orchards where spraying or dusting was neglected or not thoroughly conducted. Thus, while brown rot on the fruit was very serious in unsprayed plantings in Georgia, in commercial orchards it was well controlled, according to McHatton, who states also that "The control of the curculio has improved and the brown rot is not so prevalent" (July 1). J. W. Roberts reported that in the Fort Valley district spraying was general and "the fruit was more free from rot than it has been for several years" (July 7). In this section there was considerable brown rot in some of the early varieties at harvest time, according to John C. Dunegan, but little on the later varieties in most orchards. Delaware reports the disease as of "minor importance in sprayed orchards." In Maryland, according to Jehle, brown rot was "severe on all unsprayed fruit," but on "sprayed trees was well controlled." Giddings reported that in West Virginia, "General lack of spraying on peaches results in heavy loss." In Mississippi, according to Neal, the usual spraying schedule holds the disease in check, but where it had not been followed brown rot was severe. In Arkansas the disease was said to be very severe in unsprayed orchards. In Ohio there was considerable rot in unsprayed orchards, but it was well controlled where properly sprayed, according to Thomas. Indiana reported it as "serious only in unsprayed orchards and on fruit affected with sunscald." Stokdyk stated that in Kansas no loss occurred where trees were properly sprayed. Although blossom blight and twig blight were unusually severe in Illinois there was not much damage from fruit rot, according to Anderson, due partly to the dry summer, and partly to efficient control of the curculio. In Oregon the disease occurred in the western part, but was rare or absent east of the Cascades, according to Barss. In Kentucky it was said to be "the most troublesome disease of the peach, especially in farm orchards where they do not have the spray equipment." In South Carolina blossom blight early in the season was followed by cankered and blighted twigs and fruit rot, although there was perhaps somewhat less than usual of the last due to dry weather, according to Ludwig. The disease was reported as causing considerable damage in some parts of Florida, according to Burger, but the loss as a whole was slight.

Dates of first appearance

April	(blossom blight)	Illinois	Collinsville, Madison County
June 26	(fruit rot)	"	Hoodville, Hamilton County
April 10	(blossom blight)	So. Carolina	Clemson College
May 11	(fruit rot)	" "	" "
April 24		Georgia	
May 10		New York	Nassau County
May 19		Indiana	Franklin County
June		Mississippi	Columbus
June		Arkansas	Fayetteville
June 1		Virginia	Jonesville
June 5		Kentucky	
June 7		Delaware	Bridgeville
June 7		Pennsylvania	
June 21		Ohio	Washington County
July 11		Kansas	Montgomery County
July 14		Connecticut	Wallingford

PEACH - Brown rot

Fig. 46. Estimated percentage loss from brown rot in 1922.

Mature apothecia were reported February 28 in Georgia and April 12 in Delaware. According to the results of studies made by W. N. Ezekiel², "Under natural conditions apothecia may develop in the spring following inoculation," and cold is probably a factor influencing their production, which may be inhibited, even if development has already begun, by burying the mummies below the surface of the soil.

Weather relations

Favorable temperature with rainy periods were conducive to the greater prevalence of blossom blight in the southern peach belt. McClintock³ stated (August) that in Georgia the excessive rains were "especially conducive to the development of brown rot, starting first with the blossoms, and continuing on the fruit in both the green and mature stages." Dunegan, however, reported that the lack of rain "was very favorable to the successful harvesting of such varieties as Hiley and Elberta, "in the Fort Valley district. Gardner said that the high temperatures in Indiana were favorable to the disease. In Illinois Tehon accounts for serious blossom blight by citing the moist spring weather, while fruit rot, on the other hand, was held in check by the dry hot summer. A wet July in Maryland, Delaware, and New Jersey was very favorable for the fruit rot. In Marion County, Oregon, the disease "started up after a few August rains but was checked immediately by warm dry days which held through most of the picking season," according to Barss.

The following report by Dunegan refers to the Fort Valley district of Georgia:

"Blossom blight was most prevalent during the period from March 26 to 30, a period of comparatively high temperature and humidity. A drop in temperature and decrease in humidity on March

PEACH - Brown rot

31 apparently stopped the rapid spread of the fungus and prevented the damage from reaching serious proportions. On April 19, following a heavy rain storm, old blighted Carman blossoms were observed to be covered with fresh spore tufts. During rainy weather there was pronounced gumming at the base of blighted blossoms."

Varietal susceptibility

Connecticut: Worst on early varieties. (Clinton).

New Jersey: Particularly bad on Carman and Champion. (Department of Plant Pathology).

Pennsylvania: Bad on Elberta, which is usually fairly resistant, in Adams County. (Walton).

Delaware: Belle of Georgia and Hale varieties appeared very susceptible in some sections. (Adams).

Kentucky: Red Bird variety especially susceptible and unless sprayed will seldom mature a crop. (Magill).

Tennessee: Hale susceptible. Elberta and Bracket resistant. (Hesler).

Georgia: Blossom blight was noted in varying degrees of severity upon the following varieties: Red Bird, Carman, Uneida, Georgia Belle, Early Rose, Yellow Hiley, and Elberta. (Dunegan).

Kansas: Early varieties most susceptible. Amsden variety very susceptible. (Stokdyk).

Control of brown rot

It has already been mentioned that in nearly all cases the disease was reported as important only in unsprayed or improperly sprayed orchards. The effect of the control of curculio on that of brown rot was noted in Georgia and Illinois. In the following quotations are given some of the methods used or recommended in various states:

New York: Blossom blight is the type of injury that should be avoided by a timely application of the proper fungicides. It would seem advisable, therefore, that the pre-blossom spray (or dust) be applied this season. Lime-sulphur 1 to 50, or 80 to 10 sulphur arsenate dust is recommended for peaches when the blossoms show pink. (New York State College of Agr. Weekly News Letter, April 17, 1922).

Delaware: Sulphur dust and self-boiled lime sulphur have given equally good control this season. (Adams).

Maryland: On sprayed (self-boiled and atomic sulphur) trees the disease was well controlled. A few are dusting. (Jehle).

Ohio: In orchards sprayed with self-boiled lime sulphur or with lime sulphur glue, the rot is held in good control. The importance of a spray two to three weeks before harvesting is very apparent, and this is the first year that such practice is being generally followed in certain peach districts of the state. (Thomas).

The following results were secured by Snapp(4):

"Data from two years' work in Mississippi and one year's work in Georgia show the liquid spray to be somewhat superior to the dust for the control of the curculio under heavy infestations, but for brown rot and scab control the two methods of pest control gave about equal results. The 80-5-15 dust formula gave practically as effective control of curculio, brown rot, and scab yearly as the 80-10-10 or other dust formulas containing more arsenate of lead. An application of arsenate of lead when seventy-five percent of the petals were off and another four weeks before the fruit is due to ripen in addition to the treatments when the calyces were shedding and again in two weeks is strongly advised, especially in latitudes where two generations of the curculio occur."

Dutton and Johnston(2) in Michigan have published results on the control of brown rot on peaches and plums:

"A report is given of experiments carried on for the control of brown rot of peaches and plums in which lime-sulphur solution and sulphur dust were compared. The results of the experiments were considered satisfactory, and fruit from dusted trees held for several days after harvest showed much less rot than fruit from check trees. In 1921 the experiments consisted of the use of sulphur dusted on the trees, and while there was but little brown rot on certain varieties of peaches the development of rot subsequent to harvest was less on the fruit that had been treated." (Abstract from Exp. Sta. Rec. 47. Oct. 1922).

Recent literature

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3. McClintock, J. A. Peach tree cankers. Amer. Fruit Growers Mag. 42^o: 12. Aug. 1922.
4. Snapp, Oliver I. Dusting vs. spraying for the control of the curculio, brown rot, and scab of peaches. (Abstract) Phytopath. 12: 250-252. May 1922.

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PEACH - Brown rot, Leaf curl

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Brown rot, Sclerotinia cinerea Schroet., its appearance, cause, and control. New Zealand Jour. Agr. 25: 83-93. Aug. 1922.

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Harrison, T. H. Notes on the occurrence in New South Wales, Australia of the perfect stage of a Sclerotinia causing brown rot of fruits. Reprinted from Jour. & Proc. Roy. Soc. New South Wales 55: 215-219. Feb. 7, 1922.

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Snapp, O. I., W. F. Turner, and J. W. Roberts. Controlling the curculio, brown rot, and scab in the peach belt of Georgia. U. S. Dept. Agr., Dept. Circ. 216. 30 p. May 1922.

Leaf curl caused by Exoascus deformans (Berk.) Fekl.

The commercial peach belt in the East includes thirty-four states of which twenty have reported the presence of leaf curl during 1922. The disease was generally reported as more prevalent than last year, but somewhat less than during the epidemic in 1920.

The following list indicates the prevalence of leaf curl as compared with the average year, as reported by collaborators:

More: Ohio, Tennessee, Michigan, Illinois, Arkansas, Missouri, Oklahoma, Washington
Same: Massachusetts, New York, Pennsylvania, Georgia, Mississippi, Kentucky, Indiana, Oregon, California
Less: Connecticut

Connecticut: Inconspicuous, considerably less than usual. (Clinton).

New York: Reports from Orleans, Wayne, Columbia, Orange, Ulster, Seneca, and Chautauqua Counties show increased prevalence, particularly in poorly sprayed or unsprayed orchards.

Pennsylvania: Reports more numerous than last year, but is generally considered as not very serious. (Thurston).

PEACH - Leaf curl

Delaware: Prevalent in neglected orchards or when dormant spray was applied too late. (Adams).

Maryland: Leaf curl bad in places where they did not spray or did not apply spray properly. (Jehle).

Kentucky: Prevalent all over state - about as usual. (Valleau).

Tennessee: Observed early in April; very abundant this year. Most cases of spraying done too late. (Hesler).

South Carolina: Present. Loss apparently not very great. (Ludwig).

Georgia: Generally distributed as usual. Serious in some orchards where late, cold snaps were experienced. Had little effect upon the general crop. (McHatton).

Mississippi: Not nearly so common this season as last. Damage very slight at the experimental orchard. (Neal).

Ohio: Leaf curl has been uncommonly severe on susceptible varieties over the whole of Ohio. In the lake shore region serious defoliation has been reported where delayed dormant or any late application of lime sulphur for scale control has been relied upon. The losses promise to be quite serious and may serve to fix standards in time of application. (Selby).

Effects of defoliation due to leaf curl are still in evidence in many orchards in Ottawa County. In such orchards the crop is a complete loss and there can be little hope for many of the trees surviving the winter. (Thomas, September 1).

Illinois: Peach leaf curl is very severe on unsprayed orchards. One orchard at Lilly, which was sprayed in March showed a very heavy infestation of leaf curl. We received some specimens the other day of the leaf curl on fruit about a half an inch in diameter. (Anderson, June 12).

Michigan: Due to wet spring, spraying commonly neglected or put on late. Curl is common. Defoliated trees seen everywhere in fruit section. Correspondence on this disease has been unusually heavy from all parts of the state. Would estimate loss as more than average, perhaps reducing crop value 5-10% in the non-commercial orchards, and by first figure in commercial orchards, where better care of trees has allowed leaf replacement to go on more rapidly. Crop prospects at present good. (Coons, July 1).

Missouri: This has been a very bad season for peach leaf curl, no doubt because of the cold, wet spring. In some cases the leaf curl appears everywhere the trees have been sprayed. (Hopkins, July 5).

Kansas: Unusually severe in southeastern Kansas. In unsprayed orchards will cause loss of 35% or more. Sprayed orchards fairly well controlled. General throughout state. (Stokdyk, July 1).

PEACH - Leaf curl

Washington: Prevalent and doing considerable damage in commercial orchards in the Snake River section of eastern Washington. Very prevalent in home orchards in western Washington although no accurate estimate of losses can be made. (Dana).

Oregon: General over the state. Apparently less severe than last year. (Barss).

California: General, but damage apparently not great in cases observed. On the increase. (W. S. Fields).

Table 96. Showing estimated percentage loss from peach leaf curl as reported by collaborators in 1922.

State	Percentage loss	State	Percentage loss
Massachusetts	2	Ohio	5
Connecticut	1	Indiana	.5
New York	6	Illinois	2
Pennsylvania	2	Michigan	2
Maryland	1.5	Iowa	2
West Virginia	t	Missouri	6
Kentucky	6	Kansas	10
South Carolina	t	Idaho	t
Georgia	.5	Washington	.5
Arkansas	2	Oregon	3

Dates of earliest appearance of disease observed by collaborators

April, Fayetteville, Ark.	April 28.... Strausburg, Mo.
April 4..... Clemson College, S. C.	May 3..... Lyons, Kansas
April 10.... Illinois	May 10..... Dover, Delaware
April 22.... Stillwater, Okla.	May 14..... Agricultural College, Miss.
April 25.... Rocky Mount, W. Va.	May 16..... Allen County, Ohio
April 27.... Knox County, Ind.	May 29..... Tioga County, N. Y.

Control

The greater prevalence in the majority of instances is associated with poorly timed applications of the dormant spray. In some instances inclement weather interfered with spraying, while many growers entirely neglected to spray.

Delaware: Thoroughly controlled with dormant spray. (Adams).

Arkansas: Dormant spray effective. (Elliott).

Ohio: Delayed applications of fungicide resulted in very severe losses in Port Clinton district. (Thomas).

Idaho: San Jose scale spray controls it. (Hungerford).

PEACH - Leaf curl

Oregon: Perfect control with Bordeaux applied in time. Much spraying done from December to middle of February with excellent results. More concerted spray campaign last winter than usual. Results splendid. (Barss).

Washington: Dana¹ in a recent bulletin states that Bordeaux mixture 3-3-50 formula has given good results in some localities, but the 4-5-50 or 5-5-50 strength is more generally recommended. In a few localities even better protection has been obtained with a still stronger spray (6-6-50 or even 8-8-50). Lime-sulfur gives satisfactory control and has some advantage because of its value in the control of San Jose scale.

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Results from 1916 to date.

Dutton, W. C. and S. Johnston. Dry lime sulphurs and similar materials for controlling apple scab and peach leaf curl. Michigan Sta. Spec. Bul. 115: 51-54, 1922.

Scab caused by Cladosporium carpophilum Thüm.

Scab was reported principally in the states east of the Mississippi or within the limits of commercial peach production. It was in general about as prevalent as usual, except in the following states which reported an increased prevalence, Massachusetts, New Jersey, Virginia, Mississippi, Arkansas, and Kansas. The short crop last year and general neglected spraying do not appear to be correlated with the prevalence this year. Rainy weather during the ripening period was most concerned in the prevalence of scab upon the fruit. In Maryland, scab was unusually severe in unsprayed orchards, causing fruit to crack and making conditions favorable for rot. Even in sprayed orchards much scab developed. (Temple and Jehle). In Virginia the unusual prevalence was associated with failure to spray early enough (Fromme). Around Bowling Green in Kentucky this season peach trees not sprayed were infected with scab to such an extent that the fruit brought \$1.75 per bushel while fruit from scab brought \$2.75. Similar results were observed around Louisville. (Magill). Generally distributed in Georgia and in commercial orchards 5-10% infection, while in uncared for plantings from 80-100% infection. (McHatton). Neal reports it present on twigs and leaves of nursery stock in Mississippi. Much more severe than usual and on all unsprayed fruit in Arkansas. (Elliott). Very prevalent throughout Ohio and the leaf spot disease associated with a Cladosporium, thought to be the same organism, has caused serious defoliation in many orchards. (Thomas). Infected nursery stock

PEACH - Scab

was observed being used in Jefferson County, Indiana. (Gardner). Illinois reports show the disease is not serious from a commercial standpoint but quite prevalent this season - more than I have ever seen before, usually in unsprayed orchards. (Anderson). Present generally in unsprayed orchards in Kansas. Seedling peaches badly affected, causing 50% of them to be worthless. (Stokdyk).

The infection this year was most commonly reported on the fruit. The most serious infections were found in the farm orchards or orchards where spraying had been neglected. The estimated percentage loss this year by collaborators is given in Table 97.

Table 97. Estimated percentage loss from peach scab in 1922.

State	: Percent loss	:: State	: Percent loss
Massachusetts	: t	::	:
Connecticut	: 2	:: Tennessee	: 1
New York	: 1-2	:: Georgia	: 3
Delaware	: 3	:: Mississippi	: 1.5
Maryland	: 2	:: Louisiana	: 2
Virginia	: 3	:: Texas	: 1
West Virginia	: t	:: Arkansas	: 3
Pennsylvania	: 2	:: Ohio	: 3
Kentucky	: 30	:: Illinois	: t
		:: Kansas	: 5

Dates of earliest recorded appearance, 1922.

April 12 Perry County, Indiana	July Newton, Mississippi
May Van Buren, Arkansas	July 19..... Hamilton County, Ohio
June 21..... Bridgeville, Delaware	August 14... Yatesville, Connecticut

The early varieties were observed commonly affected. In Ulster County, New York during July and August considerable was found on Elberta peaches. Carman and Champion varieties were noticeably less affected. In Nassau County scab on Early Crwafords was practically uncontrolled. (Chupp). Fruit infection was especially severe on Belle of Georgia in Arkansas. (Elliott).

Control of peach scab

New Jersey: Good control of scab with sulfur dust, 80-10-10

Delaware: Dusted and sprayed orchards showed equally good control. Infection most prevalent at stem end. (Adams).

Georgia: Controlled in commercial orchards by spray. (McHatton).

Ohio: Easily controlled by sprays in general use; severe only where thorough spraying is not done.

Kansas: Sprayed orchards fairly well controlled. (Stokdyk).

PEACH Scab, Bacterial spot

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- Snapp, Oliver I. Dusting vs. spraying for the control of curculio, brown rot, and scab of peaches. (Abstract). Phytopath. 12: 250-251, 1922.
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- Stanford, H. R. Control of peach scab. Month. Bull. Dept. Agr., California. 11: 765-774. Oct. 1922.
- Disease noted as increasing in occurrence in peach-growing districts of southern California in past two or more years; same complaint has come from other parts of state.

Bacterial spot caused by Bacterium pruni EFS.

There was no general increase of bacterial spot for the commercial peach-growing section in the East, but in several states it was of serious economic importance and is constantly on the increase. It should be mentioned that it is often very difficult to tell bacterial spot from spray injury and sometimes it is impossible when only a few leaves are submitted late in the season. The distribution of the disease is indicated in the following list showing the prevalence compared with the average year.

More: Connecticut, Delaware, Kentucky, South Carolina, Mississippi Indiana
Same: New York, New Jersey, Maryland, Virginia, Louisiana, Texas, Arkansas, Illinois, Kansas
Less: Georgia, Ohio, Missouri, Arizona.

Delaware: The most prevalent and important disease in peach production. Leaf and twig infection were the most important symptoms and 50-75% defoliation was common in many orchards. This year's observations indicated that most severe infection occurred with trees growing in light sandy soils. (Adams).

Indiana: We are inclined to believe that most of the canker trouble is due to Bacterium pruni, followed by other organisms. There is also quite an abundance of scab in the canker stage, but ordinarily there is no difficulty in identifying the scab cankers; but after the first season it is not at all easy to identify Bacterium pruni cankers. We are coming to feel in Indiana that Bacterium pruni is by far the most serious peach disease with which we have to deal, because of its defoliating effect upon the tree and because of the extreme difficulty in controlling it. Brown rot and leaf curl can be controlled, but Bacterium pruni is a real problem. (Gardner).

PEACH - Bacterial spot

Other states: Pl. Dis. Bul. 6: 36, 98, 107. 1922. Collaborators have submitted the following estimates of reduction in yield for 1922:

New York	1.5%	Texas	1%
Delaware	5%	Arkansas	1%
Maryland	None	Indiana	3%
South Carolina	2%	Illinois	2%

The first appearance of the disease was reported as follows by the collaborators:

Louisiana	March	Delaware	May 24
Indiana	April 27	Illinois	June 10
Arkansas	May	Virginia	June 15
Mississippi	May 10	Connecticut ...	June 20
South Carolina	May 11	Ohio	July 12
Missouri	May 19	New York	July 20

Varietal susceptibility is reported principally for the Hale and Elberta. Burkholder reports the Champion as resistant in Indiana, while in New York Chupp reports it worst on Champion and Belle of Georgia in Ulster County.

Illinois: In our variety orchard at Urbana, representing about 50 varieties, the Hale and Elberta were the only ones showing any appreciable loss from shot hole and few other varieties were infected. Hale seems to be more susceptible than Elberta in most orchards. At the University farm the percent of fruit infection on these varieties was about equal. (Anderson).

Control of bacterial shot hole

The greater prevalence of the disease is usually associated with under-nourished trees, although recommended methods of treatment are not always giving the desired results. More satisfactory and thorough methods of control must apparently be developed for certain sections.

Delaware: The dormant spray had practically no effect in control of disease this season. The following results were secured on a block of Elberta. Applications of manure (10 pounds to tree) with two later applications of nitrate of soda (2 pounds each) gave practical control. A 7-6-5 fertilizer supplemented with 2 pounds nitrate of soda gave the next best results. These treatments were superior to two applications of nitrate of soda and a 4-4-2 fertilizer at the rate of 300 pounds to the acre. The orchard was located on a light sassafras type of soil. (Adams).

South Carolina: This seems to have been quite widespread this season and in some places to have caused considerable defoliation. My observation on some nitrate treated and check plots this season leads me to believe that fertilizer with nitrate does not induce greater resistance. It does stimulate leaf production, though, so that the same loss of tissue due to the spots or to defoliation is not so

PEACH - Bacterial spot, rust, blight

serious to the fertilized trees. A better control measure is needed but fertilization is worth while. Seemed to be worse early in the season this year. (Ludwig).

Indiana: Disease worst this year since 1913 and believe it is more serious after a mild winter. (Burkholder).

Nitrate of soda 3-5 pounds per tree applied ten days to two weeks before bloom gave same control. (Cullinan).

Literature, not cited

Anderson, H. W. A survey report of the bacterial shot-hole of peach. Trans. Illinois State Hort. Soc. 55: 137-144. 1921.

Rust caused by Puccinia pruni-spinosae Pers.

This disease is reported from the southern states in the peach belt, but not of economic importance. It was reported from South Carolina, Georgia, Florida, Louisiana, and Texas. It was generally observed to appear late in the season. Ludwig states that if infestation was as severe early in the season as at the close, considerable damage would probably be done, but infestation does not usually become severe till the leaves are nearly ready to drop.

The alternate hosts for this heteroecious rust are species of Hepatica, Anemone, and Thalictrum. According to the data in the North American Flora (7: 151-152, 1907), the alternate host, a species of Anemone, has been listed only from Louisiana for the states reporting the disease this year.

Blight caused by Coryneum beijerinckii Oudem.

The disease was much less prevalent than during the average year and was reported from Ohio, Colorado, Idaho, Washington, and Oregon. In Washington it was very much reduced over the amount in normal years and actual losses in commercial orchards were small. (Dana). Barss reports the following situation in Oregon:

"General throughout western Oregon. Twig and bud damage last winter about average. Dry spring weather has resulted nearly everywhere in apparent absence of fruit spotting thus far. Easily controlled by early fall spray of Bordeaux but so much neglected that in some sections unsprayed trees may suffer 35% damage."

Black mold rot caused by Rhizopus sp.

This rot was very consistently observed by the market inspectors and its prevalence on the basis of market reports was more extensive than brown rot. The rot was reported by Stokdyk from Kansas, and Anderson reports as follows from Illinois:

"My observations during the past three years lead me to believe

PEACH - Black mold, yellows, rosette, little peach, root knot

that in the absence of serious brown rot in the field, *Rhizopus* rot is the cause of most of the loss in transit and market. The amount of this rot found in shipped peaches this year is about ten times greater than brown rot. It spreads through the baskets very rapidly."

Examination of 100 cars of peaches by the food products inspectors of the Bureau of Agricultural Economics between the dates of July 3 and October 15, 1922, showed black mold rot in amounts varying from a trace to as high as 65% of the load. These peaches came from the following states: California, Colorado, Georgia, Idaho, Illinois, Maryland, Michigan, New York, North Carolina, Oregon, Utah, Virginia, and Washington.

Yellows (cause unknown)

Yellows continues to be observed in the same regions from which it has been reported in the past five years. There is apparently no progressive increase in its prevalence according to collaborators' reports. Intensive surveys conducted in Pennsylvania by McCubbin have revealed the specific importance of the disease and the success of eradication campaigns in reducing the amount. In New York, since the growers are very careful to remove trees as soon as yellows are plainly visible, the disease has never been important, according to Chupp. In Pennsylvania, McCubbin reports that in 1922 2.5% of 440,000 trees were affected compared with 4.4% in 1921, largely in the same orchards. Collaborators report the disease from the following states: Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, and Ohio.

Recent literature

Cook, M. T. The dissemination of peach yellows and little peach. *Phytopath.* 12: 140-142. Mar. 1922 (June).

Rosette (cause unknown)

Rosette was reported only from Florida and Georgia this year. In Georgia, according to McHatton, the disease is distributed throughout the state, but is more serious in the Piedmont section.

Little peach (cause unknown)

Little peach was reported from New Jersey and Delaware.

Root knot caused by Heterodera radicicola (Greef) Müll.

Root knot was reported from South Carolina, Mississippi, Texas, and Georgia. Ludwig estimates a five percent reduction in yield in South Carolina. In Mississippi the disease is very common and serious on nursery stock. One nursery near Meridian revealed at least 75% infection. On the whole this disease is a very serious problem for the nurserymen in many localities of the state. (Neal).

PEACH - Root knot, miscellaneous diseases, powdery mildew

McClintock has given the following progress report on the control of root knot:

"Experiments conducted by the writer at the Georgia Experiment Station during the past three years have shown the possibilities of root-knot control through the use of resistant plants. Various plants have proven resistant to the root-knot nematode, the most recent addition to the list being a seedling peach. Seed of this peach have been planted to determine whether the factor of resistance is seed transmitted in the case of this peach. As data are collected a report will be made relative to this point, and in the meantime workers should watch for resistant individuals among various plants which are infested by root-knot nematodes."

Miscellaneous parasitic diseases

Crown gall caused by Bacterium tumefaciens EFS & Towns. The disease was reported from South Carolina, Georgia, Florida, Texas, Ohio, and Arizona. In South Carolina, Ludwig observed 15-20% of the trees in a 7-year old orchard seriously affected. In Arizona 5-7% of the crop was injured. (Brown). In Ohio the Early Crawford was observed to be a susceptible variety. (Thomas).

Die back associated with Valsa leucostoma Fr. Generally associated with weakened trees as the result of winter injury or weakened, undernourished trees. Reported from South Carolina, Georgia, Ohio, Indiana, and Kansas.

Powdery mildew caused by Sphaerotheca pannosa (Fries) Lévl. persicae Woronichine. This disease was of slight prevalence this season and generally considered of slight economic importance. Collaborators reported it from the following states: New York, Delaware, Texas, Missouri, Washington, and Oregon. Leaf and twig infection was more prevalent than usual but not rated important. (Adams). Reported general in western Oregon, but losses not large. (Barss).

Shot hole caused by Cercospora circumscissa Sacc. Reported from Ohio and Michigan. Thomas states that he is uncertain whether one or more organisms are concerned in producing shot hole disease in Ohio.

Wilt caused by Verticillium albo-atrum Reinke & Berth. Observed on five commercial varieties in New Jersey. Disease did not appear in 1922 in orchards where it was noted in 1921. (Haenseler).

Frosty mildew caused by Cercospora persicae Sacc. This disease appeared on the leaves about the time they began to shed normally, but caused no damage in Florida. (Tisdale).

Root rot caused by Clitocybe sp. and Armillaria sp. Elliott reported 5% reduction in yield because of these pathogenes.

Root rot caused by Ozonium ornivorum Shear. Reported common in the southern part of Arizona. (Brown).

Root rot (not determined). A condition causing premature death of trees and destructive in "sassafras" section (Brown County), Indiana. (Gardner).

Miscellaneous non-parasitic diseases.

Phony peach. This disease, previously observed and reported by Neal from Georgia, is being investigated by L. M. Hutchins of the Office of Fruit Disease Investigations. A typical case of the so-called "phony" disease was observed this season in Clarke County, Mississippi, August 15. (Neal).

+ CIRCUMSCISSA

PEACH - Miscellaneous non-parasitic diseases.

Sun scald. Gardner in Indiana reports sun scald "worse where Bacterium pruni had caused defoliation, exposing fruit to sun. Spots on upper, exposed surfaces of fruit, usually near stem. Killed area surrounded by red halo. On unsprayed as well as sprayed trees, hence not spray burn." Anderson reports from Illinois as follows: "Numerous orchardists south of Carbondale report serious loss due to a peculiar condition of the fruit. This shows as a dark sunken spot from one-fourth to one-half inch in diameter near the stem and on the upper surface. Gum often exudes. The flesh is dry immediately below the lesion but not far into the pulp. Found almost exclusively in poorly nourished orchards, while the cause has not been definitely established it is supposed to be due to a few very hot days the latter part of June."

Split pit. Reported from Washington, causing some loss in a number of commercial orchards. Not confined to certain trees or locations. (Dana).

Chlorosis. Reported from Texas by Taubenhaus. A possibly similar condition reported as rosette or yellows from Washington by Dana is commented upon as follows: "A very serious case of rosette involving all the trees in a ten acre block of young trees planted after older trees had been removed came to our attention from Wawawai on the Snake River. The fertility of the soil was evidently run down in the old orchard before its removal, making its effect on young orchard planted later." (Dana).

Frost injury. The extent of injury in the commercial peach belt was considerably less than last year. The injury was very local in some sections and associated with "frost pockets." Georgia, Florida, and Alabama show less production than last year which is apparently because of frost injury. The following comment is from the Bureau of Markets and Crop Estimates, Semi-Monthly Crop Notes 1922^o: 1. May 5, 1922.

"Stone fruits were not damaged much in New Jersey, but in Delaware and western Maryland, peaches were quite severely injured. In Virginia about half of a full crop of peaches is expected, but they are said to be killed in the Lake Erie district of Ohio."

Spray injury. Reported from Connecticut, New York, Delaware, and Illinois. Clinton reports the injury is mostly in the form of "shot hole" in Connecticut. Atomic sulphur and lime sulphur are two of the sprays used with injury, also some dust injury. Adams reports in Delaware that "Spray injury on peaches has been more prevalent than upon apples this season. Copper sulphate, 6% strength was used as a delayed dormant upon a block of Elberta and Belle of Georgia varieties. The injury resulted in producing a die-back effect on all the last season's growth. The injury was most severe in the upper parts of trees since the spray was directed from a tower on the spray tank. The Belle of Georgia was most susceptible to the toxic spray while the Elberta showed little reaction. The 80-10-10 dust in late applications has caused prevalent burning or scorching of fruit. Atomic sulphur and arsenate of lead in greater proportions than recommended produced serious leaf injury, resulting in defoliation."

Illinois: An unusual amount of foliage burn resulted from all sprays applied early in the season. Dry lime sulphur was used in many orchards but did not appear to cause more injury than the self-boiled. (Anderson).

PEACH - General references

Recent literature

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PLUM AND PRUNE

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

There was a general increase reported in the Atlantic states, while in the Middle West and Pacific states the prevalence was the same or less. In many sections the loss was said to be due to fruit rot resulting from neglected spraying. Blossom and twig blight were of very slight prevalence, according to the reports by collaborators. The following list indicates the prevalence of the disease as compared with the average year.

- More - Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Delaware, Maryland, Texas, Wisconsin.
- Same - Connecticut, West Virginia, Ohio, Illinois, Arkansas, Iowa, Kansas.
- Less - South Carolina, Minnesota, Oregon

Table 98. Showing estimated percentage reduction in yield, as reported by collaborators:

State	:Estimated : :percentage:: :reduction : :in yield ::	State	: Estimated : : percentage:: : reduction : : in yield ::	State	:Estimated :percentage :reduction :in yield
Vermont	: 15	Maryland	: 6	Illinois	: 5
Connecticut	: 15	West Virginia	: 5	Minnesota	: 1.5
New York	: 12	South Carolina	: 4	Iowa	: 20
Pennsylvania	: 40	Texas	: 10	Kansas	: 5
Delaware	: 2	Arkansas	: 20	?	:
	:		:		:

PLUM AND PRUNE - Brown rot

Vermont: Much more than normally. Very few will take the trouble to spray or remove the old mummies. (Lutman).

Massachusetts: Prevalent throughout the state and causing considerable damage. (Osman).

Pennsylvania: General throughout the state. Most reports indicate heavy losses, running as high as 50-60%. (Thurston, Sept. 30).

Illinois: More abundant this year than last. In some cases a blossom blight with twig cankers has occurred this year, similar to our previous reports for peach. (Tehon, Aug. 1).

North Dakota: We have had one case of brown rot called to our attention this year. This is the first report I have had during the past four seasons, and, as far as I know, it is not on record here as having occurred in other seasons. Specimens and cultures showed the typical conidia. (Weniger).

Oregon: Present but not as serious as usual in extent of damage this year. Dry weather started early in the season and very little continued rain was present through the ripening and harvest period. Some losses, however, occurred locally in western Oregon following fall rains. (Barss).

Observations of earliest occurrence, reported by collaborators in 1922.

April 4 ... Kansas	June 22 Jefferson County, Ill.
May 10 Nassau County, N. Y.	June 22 Galax, Virginia
May 23 Lucas County, Ohio	June 30 Southington, Conn.
May 29 Minnesota	July 14 Westminster, S. C.
June 9 Grant County, Ind.	August 1 Vermont
June 15 ... Newark, Delaware	August 15 Marion, N. Dak.
June 20 ... Cobb, Wisconsin	

Observations upon the appearance of apothecia and ascospore discharge were reported from several states. In Delaware mature apothecia were observed April 10. (Adams). Thomas reports brown rot infection of plums was noted to occur earlier than usual this year in Ohio. The first ascospore discharge was observed April 26, this being followed by serious blossom blight. Apothecia were first observed May 5 in Minnesota and twig blight observed May 29.

Varietal susceptibility

Clinton reports the Climax and Shiro very susceptible in Connecticut. Blossom blight was especially marked in Ohio on certain American hybrids, such as Sapa, Ohta, Hanska, etc. (Thomas). Vaughan reports that in Wisconsin, where there was more than the average amount of brown rot, more European plums were bearing than usual. The soft plums, some of which are highly susceptible, are seldom grown commercially in Oregon. (Barss).

From the results of their studies on the effects of brown rot on plums, Willaman and Sandstrom conclude that in the field an important factor in resistance is the thickness of the skin. Varieties showed not only different rates of rot-

PLUM AND PRUNE - Brown rot

ing, but the character of growth of the fungus differed as to amount of fruiting, which was in general greater on the surface of the fruits of susceptible varieties.

Control

Dutton and Johnston¹ have recently reported on the results of spraying and dusting in Michigan for 1920 and 1921.

Literature

Cited

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2. Willaman, J. J. and W. M. Sandstrom. Biochemistry of plant diseases. III. Effect of Sclerotinia cinerea on plums. Bot. Gaz. 73: 287-307. April, 1922.

Not cited

- Willaman, J. J. and F. R. Davison. Biochemistry of plant diseases. IV. Proximate analysis of plums rotted by Sclerotinia cinerea. Bot. Gaz. 74: 104-109. Sept. 1922.
- Wormald, H. Further studies of the "brown rot" fungi. I. Ann. Bot. 36: 305-320. pl. 13-14. July 1922.

Pockets caused by Exoascus pruni (Berk.) Fockl. and E. communis Sad.

Plum pockets was reported from four more states than last year, and the information submitted indicates a greater prevalence than usual in 1922. Collaborators reported the disease from New York, Maryland, West Virginia, Texas, Illinois, Iowa, and Kansas. Dr. J. W. Roberts, Office of Fruit Disease Investigations, states:

"The complaints concerning this disease have been more numerous than usual. Specimens have been received from Kansas, Nebraska, and Idaho. This disease has long been very destructive to the wild plums in Nebraska and Kansas."

In New York more than the average number of specimens were received for identification at the laboratory, according to Chupp. There was more than usual in Illinois where it was very serious locally and especially abundant in the southeastern section. (Tehon). In Wisconsin there were many reports from central and northern counties. European varieties were little diseased, but Americana and hybrid varieties were most affected. (Vaughan). It was very common and destructive in Iowa. (Melhus). In Missouri the disease has been especially severe on the wild goose plum and quite a number of specimens have been sent in. (Hopkins). Goss reports a very heavy infection of plum pockets this year in Nebraska. In North Dakota heavy infection was observed on Prunus americana, Prunus pumila, and Prunus virginiana. A five percent loss of fruit

PLUM AND PRUNE - Pockets, leaf blight

was estimated on these hosts. (Weniger).

The estimated reduction in yield for states was reported by collaborators as follows: Illinois and Kansas 1%, Iowa 3%, Texas .5% and New York, Maryland, and West Virginia a trace.

Dates of first appearance, according to collaborators

May 12 Brunswick, Missouri	May 29 Minnesota
May 19 Riley, Kansas	June 1 Prairie du Sac, Wis.
May 25 Butler County, Ohio	June 6 Otsego County, N. Y.
May 29 Shelby County, Indiana	

Leaf blight caused by Coccomyces prunophorae Higgins

Leaf blight of plums was reported from Vermont, Massachusetts, Connecticut, New York, Arkansas, Ohio, Illinois, Minnesota, Kansas, and Oregon. In general, it was not severe. In Massachusetts it was generally present causing serious loss of foliage, especially on European varieties. (Osman, Aug. 1). In New York it was said to be general, and important in some orchards. (Chupp). Leaf spotting was reported throughout Illinois and was slightly more prevalent than the average year. (Tehon). In Minnesota heavy infections were observed on the University Farm, and light to moderate infections in the Minnetonka fruit-growing district (Department of Plant Pathology). In Oregon the disease was reported by Barsa as follows:

"Reported as slight in general as compared with previous years. Showed up according to fruit inspector Van Trump south of Salem late in the season, in some orchards causing considerable damage. Spraying with Bordeaux reported as of considerable benefit. Early and prolonged dry weather conditions starting soon after bloom undoubtedly checked the disease at the start of the season."

Dates of first observation, 1922

June 13 Clinton County, Ill.	July 11 Montgomery Co., Kans.
June 22 Chautauqua County, N. Y.	July 12 Hamilton County, Ohio
June 23 Minnesota	September 10 Vermont

Literature

Dutton, W. C. and S. Johnston. Leaf spot control on cherries and plums. Michigan Sta. Spec. Bul. 114: 46-50. 1922.

Bacterial spot caused by Bacterium pruni EFS

Bacterial spot was apparently much less prevalent on plum than on peach. The range of distribution on the two hosts is the same, but much fewer reports of its occurrence on plum are received from the states in the commercial peach belt.

According to J. W. Roberts, it is very severe on Japanese plums but seldom reported. It has been an important factor in wiping the Japanese plum out

PLUM AND PRUNE - Bacterial spot, black knot

of commercial planting in the South. The disease is established in west Florida where it was reported as quite severe this spring. (Burger). Taubenhause reported it as causing a one percent loss in Texas. It was reported general throughout Illinois where the injury due to it is confined almost entirely to the leaves. (Tehon). The following additional states reported the occurrence of bacterial spot of plum: New York, Delaware, Ohio, Indiana, Wisconsin, Iowa, and Kansas.

Black knot caused by Plowrightia morbosa (Schw.) Sacc.

The occurrence of black knot on plum as it has been reported by collaborators is coextensive with the host. Dr. J. W. Roberts (Office of Fruit Disease Investigations) states that, "If one may judge by inquiries received, this disease has been more than usually severe during 1921 and 1922." Collaborators reported it from Massachusetts, Connecticut, New York, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Illinois, Wisconsin, and Colorado. In New York carefully pruned and sprayed trees are usually free from the knots. (Chupp). Thurston states that it is very abundant but not more serious than usual in Pennsylvania. It is reported as probably the worst trouble of plums in West Virginia. (Giddings). Thomas in Ohio reports that general knowledge of control of black knot renders its spread less than in former years.

Miscellaneous diseases

Blue mold rot (Penicillium), Rhizopus rot (Rhizopus) and gray mold rot (Botrytis) - Heavy losses to plums and prunes in storage and transit occurred because of these rots.

Scab caused by Cladosporium carpophilum Thüm. Reported from Illinois, Wisconsin, Minnesota, and Kansas. Anderson reports its first observation in Illinois where it is common on some kinds, but absent on most of the important commercial varieties. Reported August 8 on fruit at Waterloo, Wisconsin and also found in wild plums near Madison by Dr. Bensaudou. (Vaughan).

Sooty blotch and fly speck - Fly speck (Leptothyrium pomi) was observed on fruit of neglected trees at Houston, Delaware, August 9. (Adams).

Sooty blotch, caused by a fungus apparently the same as that on apple, was identified by J. W. Roberts on plums from the vicinity of Washington, D. C. The specimens were rather badly affected. Roberts states that the disease is occasionally found on plums, especially those maturing late.

Rust caused by Puccinia pruni-spinosae Pers. was reported from Louisiana and Texas.

Bacterial gummosis, cause not determined. Observed in California. Horne states that it is an "imperfectly understood disease difficult to diagnose in many cases, especially difficult in twig and bud forms." Trunk injury is found on many varieties. The disease is less severe on plum than on apricot. It occurs on almond, cherry, and perhaps all stone fruits.

Rosette, cause not determined. Dana in Washington reports "one very serious case of rosette on Burbank plum was observed in the Snake River section. The trees were just coming into bearing, having been set in a block from which old peach trees had been removed."

Yellows, cause unknown. Observed by Dye on a plum tree next to affected peach trees at Rochester, Monroe County, New York.

Crown gall caused by Bacterium tumefaciens EPS & Towns - Reported from Indiana and Arizona. George reports it very serious in one orchard near Glendale, Arizona.

PLUM AND PRUNE - Miscellaneous

Chlorosis - said to be due to too much lime in the soil. Reported from Texas.

Silver leaf - a species of *Stereum* seemingly secondary but associated with silver leaf, reported August 15 from Sturgeon Bay, Wisconsin. (Vaughan).

Frost injury - reported locally severe in West Virginia and Delaware but causing no serious damage.

Cork spot - cause not determined. What appears to be the same trouble is reported from Illinois and Kentucky. Anderson states that in Illinois "a number of samples of plums have been received showing a corky area on the upper face. This area extends to the seed and is usually depressed at the surface sometimes showing convolutions. It was observed in the University orchard and was confined to two or three varieties."

Valleau reported a trouble which he designated as "hard flesh spots" in Kentucky, as follows: "A disease of plums has been noticed the past season in the Experiment Station orchard, especially on Omaha plum. It results in depressions on the surface of the fruit which are bluish in color. The flesh under the depression is hard and shrunken. This condition extends usually to the pit, although in some other varieties the diseased tissue may be a smaller mass just under the skin. The spot does not seem to spread. When plums are cooked which have only a mild case, the diseased tissues remain as a hard ball of tissue often attached to the pit. The same disease was noticed several years ago on two or three *Prunus Americana* x *P. triflora* hybrids at the Minnesota fruit breeding farm. It is not a spray injury as it has been seen on unsprayed trees. Only *triflora* or *triflora* hybrids have so far been seen which are affected."

Gum spot and internal browning - causes not determined, apparently connected with the very hot and dry growing season, were reported from Oregon (Barss, Pl. Dis. Bul. 6: 143. 1922).

Top soursap - cause not determined. Reported by Horne from California as "severe generally on very porous soils and on shallow soils. Growers believe in some localities that trees on Myrobalan root have suffered more than on peach root in these soils."

Spray injury - reported by Dana from Washington.

Mistletoe was reported by Brown in Arizona as occurring in "two specimens of yellow egg plum that were found attacked by *Phoradendron flavescens*. The hosts were growing in the Aravapai and San Pedro Valleys near cottonwoods heavily laden with the mistletoe."

CHERRY

Leaf spot caused by *Coccomyces hienalis* Higgins

There was a general increase in the prevalence of leaf spot of yellow leaf of cherry, particularly in the commercial cherry region of the lower Lake states. Weather conditions were particularly favorable for the establishment of the disease this spring. It is usually found that conditions favorable to epidemic outbreaks of this disease are quite similar to those favoring apple scab. Defoliation, and the resultant undersized fruit, weakening of the trees making them more subject to winter injury, and loss of next year's blossom buds were reported as due to severe infestation by this fungus. Gardner observes that in Indiana Gummosis, devitalization of trees, and borer attack are associated with premature defoliation caused by this disease. Very severe on all unsprayed trees.

CHERRY - Leaf spot

The prevalence of the disease compared with the average year as reported by collaborators in 1922:

More :	Connecticut, New York, Pennsylvania, Maryland, Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, Kansas
Same:	Massachusetts, Delaware, Virginia, West Virginia, Arkansas, Missouri
Less:	Oregon

The following estimates of the percentage reduction in yield were reported by collaborators: 25, Ohio; 15, Kentucky; 19, Pennsylvania; 8, Maryland; 5 to 7, New York; 6, Iowa; 5, Arkansas, Indiana, Kansas; 1, Delaware; trace, West Virginia, Illinois.

New York: Very severe on all unsprayed trees. (Chupp).

Pennsylvania: The cherry leaf spot appears to be epiphytotic throughout central and southeastern Pennsylvania, causing considerable defoliation. (Thurston, June 27).

Virginia: Leaf spot is general and severe on unsprayed trees. One hundred percent infection and 10% defoliation noted July 14. Many people believe it is natural for the cherry to lose its leaves in midsummer. (Fromme, July 19).

Ohio: Defoliation of cherry trees very common early in August. In southern Ohio many trees blossomed the second time late in August. Fifty-seven reports have come to us this year. (Thomas).

Indiana: The worst cherry disease. Generally distributed in state and early rains very favorable to disease. (Gardner).

Illinois: Cherry leaf spot is very prevalent and causing almost complete defoliation on the sour cherries throughout southern Illinois. It is also generally prevalent in all parts of the state where I have been. I think it would be safe to say that it is general throughout the state and unusually severe. (Anderson).

Michigan: Worst in years. Crop loss in Grand Traverse and surrounding counties so far as salable fruit of size is concerned, total in some orchards. Spraying careless or neglected. College spraying experiments have given perfect control in that region. Trade papers estimate loss in yield in cherry district at 10%. Local papers estimate loss at 25%. Higher figure seems probable from appearance of majority of orchards seen from road on recent trip through northern section. In Berrien County loss slight. In Van Buren County loss extremely heavy. Dust has given good control with Morello in Grand Traverse County. (Farrand).

CHERRY - Leaf spot, brown rot

Earliest appearance of disease, according to collaborators. 1922.

May	Fayetteville, Arkansas	June 13	Clinton County, Illinois
May 19....	Bloomfield, Missouri	June 15	New Castle, Delaware
May 27....	Montgomery County, Ohio	June 25	Ulster County, New York
June 6 ...	Madison County, Indiana	June 27	Pennsylvania
June 6 ...	Wabaunsee, Kansas	July 14	Bedford, Maryland
June 8 ...	Madison, Wisconsin	July 22	Stamford, Connecticut

Varietal susceptibility

The following varieties were observed severely affected in New York: Richmond, Montmorency, and Morello. (Chupp). Prevalent on sweet and sour cherries in Delaware. (Adams). Burkholder reports the disease was not well controlled in the Wragg and Morello by sprays in Indiana.

Control measures

Clinton states that lime sulphur and Bordeaux mixture gave good results in control in spraying experiments in Connecticut. In Ulster County, New York both dusting and spraying have given good control of cherry leaf spot with a small difference in favor of spraying. Observations in Onondaga Co., N. Y., show that the disease was most abundant in orchards that did not receive the petal fall application and one at the time the shucks were coming off. Apparently the shuck spray was the critical one. Clean cultivation noticeably helps in its control in Indiana, according to Burkholder. Vaughan reports satisfactory control in Wisconsin with three sprays of Bordeaux mixture 3-3-50 but lime sulphur was not so successful. In Kansas either Bordeaux mixture or lime sulphur controls it satisfactorily if applied at right time. (Stokdyk). Johnston¹ and Dutton, as the result of experiments during 1920 and 1921, in Michigan, report, "lime-sulphur solution, Bordeaux mixture, sulphur dust, and dehydrated copper sulphate dust being used. On the cherry trees, the results on the whole show that Bordeaux mixture ranked highest in leaf-spot control, but caused many of the leaves to fall. Lime sulphur ranked second, and the dust applications a little lower than the lime sulphur."

Literature

1. Dutton, W. C. and S. Johnston. Leaf spot control on cherries and plums. Michigan Sta. Spec. Bul. 115: 46-50. 1922.

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

The prevalence of brown rot compared with the average year was reported as follows: More - Connecticut, New York, Pennsylvania, and Indiana; average - Delaware, Arkansas, Ohio, Wisconsin, Iowa, Kentucky, Tennessee, and Oregon; less - West Virginia, Illinois, and Kansas. The most general injury was in the form of fruit rot. Blossom and twig blight were of slight prevalence. In New York brown rot on blossom pedicels of cherries was more general and severe than usual. (Chupp) In Orleans and Monroe Counties, N. Y. the rot was very severe on sweet cherries. (Smith and Pierstorff). Barss reports the blossom blight as common in western

CHERRY - Brown rot, Miscellaneous

Oregon but causing slight damage in most sections. In the Umpqua Valley it was reported about the same as last year, injuring up to 10% of the bloom. The percentage loss by states as reported by collaborators is as follows:

Connecticut	15	West Virginia ...	5	Indiana	t
New York.....	8	Kentucky	10	Illinois ...	1
Pennsylvania ...	10	Tennessee	5	Wisconsin ...	t
Delaware	2	Arkansas	4	Washington ..	.5
Maryland	3	Ohio	2		

Dates of first occurrence of disease observed by collaborators. 1922.

March 24 ...	Pratt, Kansas	June 15....	New Castle Co., Dela..
May 1	Wayne County, N. Y.	June 22	West Hartford, Conn.
May 25	Crawford County, Ohio	July 3	Edwards County, Ill.
June	Fayetteville, Ark.	July 15....	Sturgeon Bay, Wis.
June 1	Knox County, Indiana		

Control of brown rot

In Connecticut neither dusting nor spraying was very effective. (Clinton). In New York it is deemed advisable that the pre-blossom spray (or dust) for the prevention of brown rot blossom blight of cherries should be applied at a stage of development corresponding to that in peaches when this application is recommended. Lime-sulphur 1-50 or 90-10 sulphur arsenate dust is recommended for peaches when the blossoms show pink in that state. In Oregon, Barss reports that Bordeaux applied as the blossoms open was very beneficial.

Miscellaneous diseases

Powdery mildew caused by Podosphaera oxyacanthae (Fr.) De Bary. The usual average prevalence was reported from Vermont, West Virginia, Ohio, Indiana, Illinois, Iowa, and Kansas. Lutman stated that it was more common in Vermont than he had ever seen it before. It was reported more or less general in Ohio. Melhus estimated a 3% reduction in yield for Iowa.

Black knot caused by Plowrightia morbosa (Schw.) Sacc. Reported from New York, West Virginia, Ohio, Minnesota, and Idaho. It is generally distributed in West Virginia and one of the worst troubles with sour cherries, causing a reduction in yield estimated at 5%.

Crown gall caused by Bacterium tumefaciens EFS & Towns. Reported by Dana from Washington.

Bacterial gummosis caused by Bacterium cerasi Griffin - reported from Washington, and Oregon. "Reported from all over western Oregon. Apparently as bad or worse than last year. Some orchards in Lane County reported free from trouble; others damaged up to 15 or 20%. Cate reports that many large limbs are being affected in Ashland district where the disease appears worse than last year in many places. None reported from east of Cascades." (Barss).

Scab caused by Cladosporium carpophilum Thüm. Reported from Iowa by Melhus.

CHERRY - Miscellaneous; APRICOT - Brown rot

Root trouble, cause not determined. In Chautauqua County, New York many complaints of root troubles on cherries are being received. Winter injury and root rot are both probably prevalent. (Palmer).

Fruit rot, caused by fungus not determined. Reported by Dana from Washington.

Imperfect pollination. Thomas in Ohio reports upon imperfect pollination that is similar to reports by several investigators on apples. "Because of the continued cool wet period at the time cherries were in full blossom which resulted in very limited activities of bees, there is a surprisingly large number of cases of imperfect pollination resulting in a heavy dropping of fruit. These hollow or bladdery fruits are characteristic in having no seed."

Spray injury. Clinton reports injury where lead arsenate and nicotine sulphate were used on cherries in Connecticut, although lilac and tulip trees sprayed at the same time were not injured.

Frost injury was reported by collaborators from Delaware and Washington, and Adams estimates a 20% reduction in yield for Delaware. In Washington Dana reports that the injury assumed the form of a shot-hole type on the leaves. According to "Weather, Crops, and Markets" the April freeze caused loss to cherries in New England, Pennsylvania, Maryland, Delaware, Kentucky, West Virginia, Ohio, Indiana, and Illinois.

Winter injury was reported from Ohio and Washington. Dana has reported injury largely due to severe winter of 1919-20 becoming apparent during the present season and showing up in severe form in the Snake River and Columbia River Valleys. Anderson reports that in Illinois a number of cherry trees in various parts of the state died very suddenly this year from an unknown cause, possibly winter injury.

Literature

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APRICOT

Brown rot caused by Sclerotinia cinerea (Bon.) Schröt.

The presence of fruit rot was reported from two states in the East - New York and Connecticut. In the Pacific Coast states there was a general increased prevalence reported from California and Oregon. The injury was for the most part in the form of blossom and twig blight. Fields reported that the fungus did much damage in Santa Clara Valley this year and was present also in other localities in California. Barss stated that in Douglas County, Oregon (not a large crop) blossom and twig blight were bad, worse than last year, causing about 50% loss, according to the County agent. In Hood River and Wasco Counties, which are the chief apricot sections, twig and blossom blight were very severe in some localities and orchards.

Literature

Rudolph, B. A. Apricot brown rot control. Calif. Agr. Exp. Sta. Corr. to Circ. 238 (2) p. June, 1922.

Other diseases

Blight caused by Coryneum beijerinckii Cudem. -Only two reports were received on this disease, although it is known to be present in other states. In Idaho it is considered the most important apricot disease and the spotting of fruit in the markets was quite common this year. (Hungerford). The disease was reported from Douglas and Josephine Counties, Oregon as abundant, producing about 5% loss. All varieties were reported affected. (Barss).

Shot hole caused by Cylindrosporium padi Karst. - reported from Texas. (Taubenhaus).

Bacterial spot caused by Bacterium pruni EFS - First report for Illinois; found twice (Saline and Massac Counties) in the extreme southern part of state. First observed July 22 at Carrier Mills, Saline County.

Crown gall caused by Bacterium tumefaciens EFS & Towns. - Reported to cause 2 to 5% loss in Arizona. (Brown).

Frost injury - Apricots were seriously injured by the frosts in California during the second week in April. No reports are available on injury in other sections in the commercial apricot sections of the West. The following account appeared in the California Citrograph 7: 263. June, 1922:

"Several deciduous fruit crops in both northern and southern California were seriously damaged by cold weather during the first two weeks of April, according to recent reports.

"As a result, the season's apricot crop will be very materially reduced in all sections, it is stated. Added to a loss by dry rot for this fruit in the central part of the state, the frost damage will probably cut down the estimates on the apricot crop for this year by one-half."

Scab caused by Cladosporium carpophilum Thüm. Fruit infection observed in July at Wallingford, Connecticut (Clinton); and an estimated reduction in yield of 1% was reported for Texas. (Taubenhaus).

Root knot caused by Heterodera radiculicola (Greef) Müll. Reported as common in Arizona. (George).

Literature

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DISEASES OF SMALL FRUITS

GRAPE

Frost injury

Injury to grapes occurred during the latter part of April and the first week in May. Very little information was submitted by collaborators and most of the information has been obtained through the monthly summary in "Climatological Data" for April and May. The injury was most prevalent in some of the Atlantic and Lake states and the Pacific Coast states. In New York during April and on May 1 frost damage was considerable. Grapes in Chautauqua County were injured to the extent of 25%. Observations in Delaware show that frost injury on grape was less severe than last year. The greatest loss was experienced in low sections. It was observed in the Dover section that growers practicing early cultivation experienced the greatest loss through freezing of buds. Adjacent vineyards where cultivating was done after bud opening showed no frost injury. (Adams). During the last two weeks in April frosts and freezing temperatures occurred on several days doing considerable damage in limited areas to grapes in Indiana. April frosts did some damage to grape vines in the northern and central portions of California.

Black rot caused by Guignardia bidwellii (Ellis) : V. & R.

Because of the reduced setting of fruit last year due to frost injury many vineyards were not thoroughly sprayed. As a result, the disease became serious favoring an increased wintering over of the fungus. With favorable weather conditions a general epidemic could be predicted, but failed to materialize except in the northeastern states as a group. The relative prevalence compared with the average year is indicated in the following list.

More - New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Illinois, Wisconsin, Arkansas, Texas, Kansas.
Same - New Jersey, West Virginia, Virginia, South Carolina, Georgia, Florida, Mississippi, Louisiana, Indiana, Missouri, Iowa, Minnesota.

The disease was most important as a fruit rot but serious leaf and twig infection was reported in some sections. Weather conditions were favorable for its early appearance on the fruit and infected fruit was generally observed during the month of July.

Collaborators reported the following percentage reduction in yield:

New Hampshire	t	Tennessee	20	Ohio	5
Connecticut	20	South Carolina ..	12.5	Indiana	2
New York	2	Georgia	10	Illinois ...	3
Pennsylvania	5	Mississippi	5	Wisconsin ..	5
Delaware	5	Louisiana	t	Minnesota ..	t
Maryland	10	Texas	8	Iowa	5
Kentucky	25	Arkansas	8	Kansas	2
		West Virginia	20		

Observations on the earliest occurrence of the disease according to collaborators:

April 10 ... Perry County, Ohio	July 7 Allen County, Ind.
May Fayetteville, Ark.	July 9 Shelton County, Conn.
May 1 Clemson College, S. C.	July 12 Montgomery County, Kans.
June Agricultural College, Miss.	July 13 Massachusetts
June 2 Dakota County, Minn.	July 13 Abingdon, Virginia
June 9 Dover, Delaware	July 17 Monroe, Wisconsin
June 9 St. Clair County, Ill.	July 22 Dover, New Hampshire
June 9 Washington County, Mo.	August 15 .. Vermont
July 1 Ulster County, New York	

Control of black rot

It is apparent that thorough control was not secured this year because of failure to correctly time the early application. Early applications of Bordeaux mixture 4-4-50 gave partial control in Delaware. (Adams). Black rot is controlled by careful spraying with Bordeaux mixture in Mississippi, but must be thorough and timely for successful control. (Neal). Failure to secure thorough control in Indiana was attributed to difficulty of making Bordeaux mixture stick in the fruit clusters. (Gardner).

Downy mildew caused by Plasmopara viticola (B. & C.) Berl. & de Toni

The occurrence of the disease was not reported from as many states east of the Mississippi as in the case of black rot. The prevalence was normal for the most part. Leaf infection was the most general symptom and fruit infection was reported only from New York, Tennessee, Ohio, Illinois, and Kansas.

The estimated reduction in yield for 1922 was reported by collaborators as follows: New York, .5%; Maryland, 4%; Kansas, 3%; and a trace in Illinois and Iowa.

Earliest observations on the occurrence of the disease as reported by collaborators.

June 3 Logan County, Ohio	July 1 Wright County, Minn.
June 9 Clair County, Illinois	July 7 Newcastle, Dela.
June 20 Clemson College, S. C.	July 31 Oconto, Wis.
June 22 Cos Cob, Connecticut	August 8 Crawford, Kansas
July Tompkins, New York	

In New York the disease was found on the Delaware variety near Ithaca, and in Westchester County, Niagara and Agawam were affected while Concord in the same vineyard was healthy. (Chupp). The Fern Madsen variety was not as susceptible as others in Kansas. (Stokdyk).

Literature

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GRAPE - Mildew, Anthracnose

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- Vogolino, Pietro. Servizio di segnalazione degli attacchi della Plasmopara viticola, nel 1921, nelle province di Torino, Cuneo, Novara. Nuovi Ann. Min. Agr. Italy 2: 72-80. March 1922.

Anthracnose caused by Gloeosporium ampelophagum (Pass.) Sacc.

No unusual outbreak of the disease was reported this year and was said to be of economic importance only in Maryland, South Carolina, and Arkansas. The distribution of the disease was extended to one additional state, the first occurrence being reported for Minnesota. The disease was of greater prevalence than usual in Pennsylvania, South Carolina, and Ohio. About the usual prevalence compared with the average year was reported by collaborators from Maryland, Florida, Louisiana, Arkansas, Michigan, and Kansas, while there was slightly less in Wisconsin. The following estimated reductions in yield were reported: Maryland, trace; South Carolina, 3%; and Arkansas, 1%.

Literature

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- Manuel. H. L. Black spot or anthracnose. Agric. Gaz. New South Wales 32: 581-582. 1921.

Powdery mildew caused by Uncinula necator (Schw.) Burr.

No increased prevalence compared with the average year was observed. Collaborators report the occurrence of the disease from New York, Pennsylvania, Maryland, West Virginia, Arkansas, Ohio, Illinois, Wisconsin, Iowa, and Arizona. The following varietal susceptibility was observed in a vineyard in Monroe County, New York: Concords and Wordens, no infection; Catawbus, 25% infection; and 100% infection on a variety of red grape. (Chupp). Not as serious as last year in Illinois. Appeared late in the season and has caused little, if any, damage. (Anderson). The following estimated reductions in yield were reported: New York, 5 to 10%; Maryland, 1%; and Arkansas and Iowa, a trace. For the control of the disease in California, Bioletti(1) recommends the application of sulphur when young runners are out 10 or 12 inches or less (in interior valley); a second sulphuring at blooming time; and a third, if needed, when mildew threatens the fruit in midsummer. The first sulphuring should be very thorough, and the sulphur used must be very fine and free from grit. It is best to control mildew early, as summer dusting at high temperatures may produce sulphur burn of foliage.

GRAPE - Powdery mildew, Fruit rots

Literature cited

1. Bioletti, F. T. Make mildew scarce. Assoc. Grow. 3(6): 7, 18. June 1922.

Fruit rots in transit

The following three tables indicate the prevalence of fruit rots occurring in transportation as reported by inspectors of the Bureau of Agricultural Economics at points of destination. No attempt is made to present the data available from inspectors where a mixture of several rots are established. The reports indicate that the most prevalent combination is that of blue mold rot with gray mold rot. Judging from the number of carloads affected, relative importance of the rots would be: blue mold rot, gray mold rot, Rhizopus rot.

Table 99. Amounts of blue mold rot in shipments of grapes as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, August 7 - October 31, 1922.

Origin of shipment	:No. of : cars	: Range of : percent- : with : age of : decay	: Origin of : shipment	:No. of : cars	: Range of : percent- : with : age of : decay
California	: 65	: 50-100	:: New York	: 24	: 1-10
	: 59	: 20-45	:: Unknown	: 12	: 50-95
	: 276	: 1-18	::	: 10	: 15-30
Michigan	: 11	: 1-18	::	: 22	: 1-12
New York	: 1	: 60	::	:	:
	:	:	::Total No. cars	: 480	:
	:	:	::	:	:

Table 100. Amounts of gray mold rot in shipments of grapes as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, July 31 - December 29, 1922.

Origin of shipment	:No. of : cars	: Range of : percent- : with : age of : decay	: Origin of : shipment	:No. of : cars	: Range of : percent- : with : age of : decay
California	: 23	: 50-95	:: North Carolina	: 1	: 2
	: 35	: 20-45	:: Pennsylvania	: 1	: 2
	: 272	: 1-18	:: Unknown	: 3	: 50-95
Michigan	: 4	: 2-12	::	: 8	: 20-40
New York	: 5	: 30-65	::	: 15	: 2-18
	: 5	:	::	:	:
	:	:	::Total No. cars	: 372	:

GRAPE - Fruit rots, Miscellaneous diseases

Table 101. Showing amounts of Rhizopus rot in shipments of grape as indicated by examination of cars at destination by inspectors of the Bureau of Agricultural Economics, August 7 - December 7, 1922.

Origin of shipment	No. of cars with decay	Range of percent- age of decay	Origin of shipment	No. of cars with decay	Range of percentage of decay
California	2	20-30	Unknown	1	95
	51	1-10		2	2-25
Illinois	1	3			
Michigan	2	2-90	Total No. cars	59	

Miscellaneous diseases

Crown gall caused by Bacterium tumefaciens EFS & Towns.- Reported in only a few vineyards in New York. One vineyard in Orange County with nearly every one of 200 vines affected. (Chupp). Selby states that it is frequent upon grape in Ohio, but is guarded against where grape cuttings are grown.

Dead arm caused by Cryptosporiella viticola (Red.) Shear - Reported from New York, Ohio, Indiana, Michigan, and Kansas. Generally reported as only locally important.

Ripe rot caused by Melanconium fuligineum (Scrib. & Viala) Cav. - Of local importance in Delaware and observed on the Niagara and Agawam varieties, September 9. (Adams). Increased prevalence was reported for Mississippi. The rot was very severe on white grapes in many localities. The affected fruit usually hardens and hangs on the vine. (Neal). From Missouri, A. S. Rhoades of the Missouri Fruit Station reported as follows:

"Occurring on Moore's Early and Concord despite unusually dry summer, and even in spite of thorough spraying for black rot in one vineyard."

Leaf spot caused by Cladosporium viticolum Ces. - Slightly prevalent in Louisiana. (Edgerton).

Texas root rot caused by Ozonium omnivorum Shear. - An estimated loss of 5% reported from Texas. (Taubenhaus).

Rust caused by Physopella vitis (Thüm) Arth. - The disease was reported from only one place in Florida this year. The infection was slight but the varieties showed differences in susceptibility. (Burger).

Root rot caused by Clitocybe spp. - Reported by A. S. Rhoades from Missouri: "Of great importance in low-lying or poorly drained parts of vineyards where but a few or even the majority of the vines in these parts may be affected. It is a rather slow working root rot. In badly affected vines accompanied by a drying up of the leaves and fruit and general death of the vines shortly before the ripening period."

General references

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GRAPE - STRAWBERRY, Frost injury

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Howitt, J. E. Two diseases new to Ontario. Scient. Agr. 3: 189.

January, 1923. No. 5. Pink root of onion and white rot of grapes.

Faes, Henry, and M. Staehlin. Le coitre de la vigne (Coniothyrium diplodiella) ou maladie de la grêle. Ann. Agr. Suisse 23: 189-202. 1922.

Gard, Mederic. L'apoplexie de la vigne et les formes resupinees du Pomes ignarius (L.) Fries. Rev. Vitic. 56: 201-204. March 16, 1922. Also Bull. Soc. Path. Veg. France 9: 22-28. Illus. Jan./Mar. 1922.

STRAWBERRY

Frost injury

The spring freezes during the latter part of April and first part of May were quite destructive to strawberries in many of the Atlantic states, upper Ohio Valley, and Appalachian section. The earlier varieties were more generally affected. The injury resulted in killing of blooms or partial injury so that the ripened fruit was misshapen. In Bridgeville, Delaware, April 20, the Superior variety was affected to the extent of 70%, while Kellogs Premier, Success, and Mascot were more resistant. (Adams).

Leaf spot caused by Mycosphaerella fragariae (Schw.) Lindau

Leaf spot is generally reported from all the important commercial strawberry producing sections. The disease, according to all reports, is apparently established wherever the host is grown. Serious losses are occasionally reported and weather conditions were particularly favorable for infection during the spring months in many of the Atlantic states. The most severe occurrences were reported from Illinois and Minnesota.

Illinois: Worse than I have ever seen it before. Probably due to the wet spring. Caused serious foliage loss in many patches. Dry weather seems to have checked it. Most growers burn old patches at this time and new patches are not suffering. (Anderson).

Minnesota: Early in June heavy infections were found on old beds but only very light infections on the new beds. At the present time leaf spot is becoming much more serious, and in many cases the leaves are so badly spotted that the vines are dying; particularly heavy infections have been found in Goodhue and Isanti Counties. (Section of Plant Pathology).

STRAWBERRY - Leaf spot, Leaf scorch

Losses were reported as follows: New York, 5%; Louisiana, 1%; Arkansas, Texas, Illinois, Wisconsin, trace; and Iowa 5%.

Table 102. Dates of first appearance, according to collaborators, 1922.

State	Date	Locality
Vermont	May 1	
Connecticut	May 26	Union
New York	June 2	Chautauqua
Delaware	June	Bridgeville
Mississippi	May 6	Lauderdale
Louisiana	January	Hammond
Ohio	May 24	Portage County
Indiana	May 9	Daviess County
Illinois	June 9	O'Fallon
Minnesota	May 27	Ramsey County
Missouri	May 19	Bloomfield

Many varieties of strawberries are being grown which show considerable resistance to the disease. Clinton reports the Lupton as very susceptible in Connecticut. The following observations were reported by Chupp in New York: Marshall and Glen Mary most susceptible varieties in Monroe County. In Chautauqua County the Dunlap and Aroma were more susceptible than the Gibson or Nick Ohmer, while infection was prevalent on the Dunlap in Chemung County. Hesler reports the Aroma as resistant and Gandy and Klondike as susceptible in Tennessee. Aroma seems to be more resistant than Klondike in Arkansas also, according to N. E. Stevens. The Klondike is not so severely injured as other varieties in Louisiana. (Edgerton). Severe injury was observed on the William Felt, and Gibson in Illinois. The disease was not serious on the Dunlap and Burrill, and the Aroma was resistant. (Anderson and Colby). Barss reports the disease as more abundant than usual in Lane County, Oregon on the New Oregon variety. Clark Seedling is reported free in the same district. In Clatsop County the Ettersburg 121 appears more affected than other common sorts.

The spraying of commercial fields is not generally practiced for the control of the disease, but collaborators report this year that growers are spraying for the disease in Mississippi and Ohio, while spraying in nurseries is conducted in Michigan.

Leaf scorch caused by Mollisia earliana (E. & E.) Sacc.

Stone (1) has recently reported on his studies of leaf scorch of the strawberry. The disease has been associated with various species of fungi, particularly in the imperfect stage. The following list of synonyms is presented: Peziza earliana E. & E., Phyllosticta potentillae Desm., Leptothyrium dryadearm Desm., Septoria potentillarum Fück., Gloeosporium potentillae (Desm.) Oud., Marsdenia potentillae (Desm.) Fisch., Marsdenia fragariae Sacc., Ascochyta fragariae Auct., Ascochyta colorata Auct. *MARSSONIA*

STRAWBERRY - Leaf scorch

It was determined that the fungus overwinters as the imperfect state on the green leaves wherever mulched. On the dry leaves there is also produced an ascigerous stage.

Marssonina fragariae was reported from Louisiana, "More common than ordinary leaf spot, not as much this year as last." (Edgerton).

Marsonia potentillae was reported for the first time as occurring in Wisconsin, according to Vaughan, who says that not all varieties were equally affected.

Ascochyta fragariae Sacc. was reported from Connecticut, where Clinton says it is severe on Glen Mary; Missouri, where it occurred locally and did not cause much damage; and New York. Regarding this fungus, Chupp says: "Dr. Stone says this is the same as his Mollisia but the spots certainly do not look anything alike, nor do the fruit bodies which I mounted."

Mollisia earliana was reported from Illinois: "Has continued to be serious on the University variety plantings on varieties introduced from Michigan. Has not been observed elsewhere in the state." (Anderson); and from Michigan: "Damage with some varieties greater than with ordinary leaf spot. Associated with Dendrophoma in one patch. Loss certainly under 1%; no control practiced in the largest area." (Coons). The leaf scorch was quite prevalent in eastern North Carolina this season, according to Wolf, who says: "The conidial stage of the organism which we have is a Marssonina rather than an Ascochyta. A survey of 150 acres near Chadbourne gives a loss of 30% or between \$125 and \$175 per acre this year. The disease occurred everywhere in the eastern counties, much more severely on Klondyke than Missionary, our two leading varieties. The state's crop was approximately 1000 cars, so you can see this leaf scorch cut in heavily."

Varietal susceptibility

Stone, as the result of field studies, arranges the common varieties in the following order:

<u>Very susceptible</u>	<u>Moderately susceptible</u>	<u>Slightly susceptible</u>
Clyde	Senator Dunlop	New Williams
Glen Mary	Ruby	Portia
Doctor Burrill	William Belt	Parson's Beauty
Pokomoke		Enhance
		Vanoise
		Joe

He says also that "control measures have not been worked out for this disease, but it is reasonable to suppose that it can be checked by using the same measures used to control leaf spot."

Literature

Cited

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Phytopath. 12: 375-380. Aug. 1922.

STRAWBERRY - Powdery mildew, Fruit rots

Powdery mildew caused by Sphaerotheca humuli (Fr.) Burr.

Powdery mildew was considered of minor importance during the season of 1922. The protracted rainy periods during June and July in the Atlantic group of states would seem to have been favorable to the disease. However, none of the reports received from Connecticut, New York, Illinois, Washington, and Oregon indicate any increased prevalence.

Fruit rots

Rot caused by Rhizopus nigricans Ehr. The greatest loss in marketing berries is associated with the Rhizopus and Botrytis rots. Barss in Oregon reports, "Practically no rot this year, while last year it was common in western Oregon. Dry conditions have prevailed practically without interruption through the period of development and berry harvest." Mature fruit rotted badly in Ulster County, New York (E. V. Shear). Anderson reports it important only in the market in Illinois. Rhizopus rot was reported from Minnesota, but was said to be less common than Botrytis rot.

Rot caused by Pezizella lythri (Desm.) Shear and Dodge. Edgerton considers the disease is one of the most important fruit rots in the field and estimates a 3 to 5% reduction in yield for Louisiana.

Rot caused by Sclerotinia libertiana Fekl. Observed at Poplar Bluff, Missouri, causing severe damage and estimated reductions in yield of 75% locally where found. (Page).

Gray mold rot caused by Botrytis sp. Observations upon this disease were more extensive than last year. Clinton reports increased prevalence in Connecticut, where the stems and berries of the Premier variety were rotted considerably while the Chesapeake was not as seriously infected. Osmun reports the rot has been prevalent and the damage rather large in Massachusetts. Continued wet weather during the ripening season was undoubtedly responsible for the condition. Observations in Ulster County, New York show the disease is second in importance, causing estimated loss of \$2,000. The green fruit, pedicels, and ripening berries affected. (E. V. Shear). In Minnesota, "The only reports of mold on strawberries were received from Ramsey County from beds in which the fruit was not picked early and was not over-ripe. In a few such cases, infection ran as high as 50%." Minnesota reported Botrytis rot as much more common than Rhizopus. In addition the disease was reported from Florida, Ohio, Illinois, and Missouri.

Literature

Stevens, N. E. Rots of early strawberries in Florida and southern California. Amer. Jour. Bot. 9: 204-211. April 1922.

Root rot (cause undetermined)

Several reports were submitted regarding root rot of strawberry plants. No data regarding the cause was given. Species of Fusarium and Rhizoctonia have been reported in past years and occasionally the crown borer or root worm is found associated, but no investigations have brought forth any consistent cause of the trouble. In some sections the problem is of increasing economic im-

STRAWBERRY - Root rot, Other diseases

portance and should receive intensive investigation. W. J. Morse of Maine had reports of plants suddenly dying in the field without any apparent cause.

In Ulster County, New York two growers sprayed strawberry plots to kill the adults of the strawberry root worms. In one of these plots a serious amount of root rot was found. (E. V. Shear). The disease was very serious in many patches in Illinois. This disease frequently causes entire patches to die out. No organism except *Rhizoctonia* found. No insects present. (Anderson). Hungerford in Idaho reports a root and crown rot of unknown cause from several sections, both this year and last. It was serious in Bingham County. Symptoms of the disease appear to be a general stunting and yellowing of the foliage. It causes the death of the outer leaves, and in extreme cases the entire plant succumbs.

Other diseases

Leaf spot caused by *Dendrophoma obscurans* (E. & E.) And. Reported abundant in southern Illinois. (Anderson). Its occurrence was also reported from Louisiana, Michigan and Missouri.

Root rot caused by *Corticium vagum solani* Burt. Reported especially severe on account of dry summer in Washington. (Dana).

Stem rot caused by *Sclerotinia* sp. Observed June 6 at LaFayette, Indiana. (Gardner).

Yellows, cause not determined. Reports from Illinois and Minnesota indicate the presence of chlorosis which has not been determined as to its infectious or non-infectious nature. Anderson in Illinois states, "We observed a similar disease on another variety. I believe I reported this under 'mosaic'. It was different from the 'yellows' observed this year in that the leaves were more curled and not so yellow." The Department of Plant Pathology reports as follows for Minnesota, "A very serious yellowing has appeared on strawberries this year. It is much more severe on some varieties than on others. It is apparently of the mosaic type, although its infectious nature has not been demonstrated. The disease is under investigation."

Nematode (*Tylenchus dipsaci*) (Kühn) Bastian). McKay(1) has reported the following data on the distribution of the infestation on wild strawberry in Oregon.

"During 1921 the leaf and stem-infecting nematode, *Tylenchus dipsaci* (Kühn) Bastian, was found on wild strawberry plants in the vicinity of Siltcoos Lake in western Lane County. During the two previous seasons this pest has been encountered on cultivated strawberries and also on clover in the same general locality. Considerable interest was, therefore, attached to the occurrence of the disease on the wild plants, and a co-operative survey was arranged with several agencies participating to determine the approximate distribution of the disease in the coast regions of the state considered most apt to show the malady. To date the disease has been found on wild strawberry plants in four counties, namely, Lincoln, Lane, Douglas, and Coos. In Lincoln County the diseased area found was very small, being only a few square yards in extent, and located a few yards from the ocean. In Lane County diseased plants were found scattered over the area about a mile in width and two miles long, all within one-half miles of the beach. The diseased plants found in Douglas County are really an extension of the infested area in Lane County and were found only a short distance over the county line. In Coos County diseased plants were found in an area extending

STRAWBERRY, RASPBERRY.- Other diseases

back one-half mile from and along the beach for two and one-half miles. In this case the limits of infestation have not been determined. The survey is being continued."

Slime mold (Fuligo sp.) In Kansas many inquiries have been received in regard to this organism. No damage reported of any consequence. (White).

Recent literature on miscellaneous diseases

Cited

1. McKay, M. B. Distribution of Tylenchus dipsaci on wild strawberry in Oregon. (Abstract) Phytopath. 12: 445-446. Sept. 1922.

Not cited

Lees, A. H. Red plant disease of strawberries. Jour. Bath, West & South Co. Soc. V, 16: 183-184. 1922.

RASPBERRY

Anthracnose caused by Plectodiscella veneta Burkholder
Gloeosporium venetum Spog.

Anthracnose was apparently generally distributed in the middle western and northeastern states. It was reported from Onondaga and Chautauqua Counties, New York on the Columbia variety, and was quite severe on black caps in Chautauqua County. A loss of 2-3% was estimated for the state. (Chupp). In Ohio it is "a widely distributed trouble most common upon black caps but also affecting red raspberries and blackberries. A serious disease but probably causes less loss than cane blight, as it seems to spread more slowly." (Young). In Indiana it was reported severe in black caps. One grower in Fountain County reported a 40% loss. Estimated loss of 10% for state. (Gardner). Common and fairly severe in Michigan. (Coons). Anthracnose and crown gall associated causes dying out of many plantations in Illinois. (Anderson and Tchon). The disease was also reported from Connecticut, Pennsylvania, Delaware, Maryland, West Virginia, Arkansas, Minnesota, Iowa (8% loss), North Dakota, Kansas (5% loss), and Colorado.

Reports of successful control from Wisconsin with two sprays of lime-sulphur, a delayed dormant, 1-10 and just before bloom 1-40. (Vaughan). In Illinois controlled to some extent by two sprays. Delayed dormant and when young shoots are 6-8 inches high. (Anderson and Tchon).

Literature

Coons, G. H. Michigan raspberry diseases. Quart. Bul. Mich. Agr. Exp. Sta. 4: 138-141. May 1922.

RASPBERRY - Crown gall, Cane blight

Crown gall caused by Bacterium tumefaciens EFS & Towns.

Crown gall is one of the most important diseases on the host where it is important commercially in the East.

New York: Crown gall is a common disease of the Columbian variety in Chautauqua County. Losses in yield were very noticeable in several plantings this year due, apparently, to crown gall. (Pankin). Chupp reports the disease in six counties and estimates a 2-3% reduction in yield for New York.

Indiana: Reported severe on the Red Miller variety. (Gregory).

Illinois: Colby states that, "Crown gall is the limiting factor in red and black raspberry culture in many sections of Illinois. This disease coupled with anthracnose has put many growers out of business the last few years. These diseases are being spread still more widely by nursery stock, much of which is infected. Three percent reduction in yield is estimated in Illinois. (Anderson and Tchon).

Michigan: Coons (1) states that in Michigan "From time to time growers have called attention to serious losses brought about by crown gall. It is a typical nursery disease and diseased plants not only get worse but are infectious to other plants. Moreover soil infestation with the crown gall organism occurs and an area where the disease is introduced becomes unsafe for berries."

In addition to these reports, collaborators have reported the disease from Massachusetts, Connecticut, Delaware, West Virginia, Ohio, Wisconsin, Minnesota, Iowa, and Missouri.

Literature

Cited

1. Coons, G. H. Michigan raspberry diseases. Quart Bul. Mich. Agr. Exp. Sta. 4: 138-141. May 1922.

Cane blight caused by Leptosphaeria coniothyrium (Fckl.) Sacc.

In St. Lawrence County, New York cane blight was reported on the following varieties: Plumb Farmer, Black Caps, and Columbian Purple. In Monroe County, New York it is very serious on the black caps, causing a 5 to 10% injury, and in Chautauqua County it was very common. (Chupp).

It was generally prevalent and very serious in all parts of Ohio, affecting both the red and the black varieties, but more commonly reported upon the former. It is a serious menace to the raspberry growing industry. (Young). In Michigan Coons (1) states that, "The fungus kills whole canes by girdling, and wilted branches with dried up fruit are a familiar sight in every black-cap patch. The fungus is everywhere and gets in at every cut or scratch in the canes."

Collaborators report the disease from Massachusetts, New Jersey, West Virginia, Arkansas, Indiana, Kansas, Idaho, and Washington.

RASPBERRY - Cane blight, Blue-stem

Literature

Cited

1. Coons, G. H. Michigan raspberry diseases. Quart. Bul. Mich. Agr. Exp. Sta. 4: 138-141. Illus. May 1922.

Eastern blue-stem of black raspberry (cause undetermined)

The blue-stem disease of black raspberry is known now to be widely distributed in Ohio, Michigan, New York, and Maryland, and is probably also present in most other localities where black raspberries are commercially cultivated. In addition to these states it is reported in 1922 for the first time from Connecticut (Clinton) and Illinois (Colby). Rankin reports the disease common in black and purple varieties on the Experiment Station grounds at Geneva, New York. Vaughan reports a 10% infection in one planting at Madison, Wisconsin. In Illinois Colby states that, "Eastern blue-stem as recently described by R. B. Wilcox has been found in black raspberry plantations about Peoria and bids fair to become a serious menace to the black raspberry industry there. One grower stated that he secured his plants from a Michigan nursery when the plantation was established four or five years ago."

This disease has recently been described by R. B. Wilcox. He has reported it on the following varieties of black raspberries: Hoosier, Cumberland, Plum Farmer, Kansas, Munger, Ohio, and Gregg. The Kansas seems to possess the greatest resistance. The disease has not been recognized on red raspberries, the Japanese wine-berry or on Eldorado or Erie blackberries. Several features of the disease point strongly toward the probability that it is of the mosaic type. The destruction of diseased plants and use of disease free nursery stock, set as far as practical from diseased plantations, is of importance for initial control measures.

Literature

Cited

1. Wilcox, R. B. Eastern blue-stem of the black raspberry. U. S. Dept. Agr. Dept. Circ. 227, 12 p. June 1922.

Mosaic and leaf curl, cause undetermined

Mosaic and leaf curl of the cultivated red raspberry have been reported upon by Rankin and Hockey (1) after two years spent in a preliminary investigation. A review of the literature is presented, together with descriptions of the symptoms and discussions of economic importance, dissemination, varietal susceptibility, and control measures. Dr. C. L. Shear, U. S. Department of Agriculture, considers that "The mosaic disease is probably found on red raspberries wherever they are cultivated east of the Mississippi River. It is also very common on wild plants which I have observed in Maine, New Hampshire, and New York, the past season." In New York, according to Rankin, "Mosaic is the most common and destructive disease of red raspberries in the central and eastern part of state. The disease is extremely common. The variety Perfection, universally

RASPBERRY - Mosaic and leaf curl

grown in Ulster and Orange Counties, is being abandoned. The percentage infection is so high that no attempt was made to select disease free plants of this variety. New plantings of disease-free foundation stock of other varieties are being made this fall in these counties. Losses due to mosaic, even in young plantings, have caused a condition where the annual crop did not return the expense. In some cases the grower has lost money. Due to this condition many plantings have been plowed out in the last two years."

Reports of the disease were also received from collaborators in Vermont (loss 1-2%), Connecticut, Massachusetts, Delaware, Wisconsin, Minnesota, Idaho, Ohio, and North Dakota.

Considerable importance is attached to varietal susceptibility to mosaic. Clinton observed the disease in Connecticut mostly on the red varieties, worst on Cuthbert, also bad in Marlboro and June, while Erskine Park was little affected. E. V. Shear in New York reports the order of susceptibility as follows: Perfection, Empire, Donboro, Rochester, Constant, Cuthbert, Antwerp, Ontario, Latham, Erskine Park, Florence, and Victory. Rankin and Hockey (1) give the following list of red and purple varieties that have been found affected by mosaic: Abundance, Brighton, Brilliant, Columbian, Count, Cuthbert, Dr. Reider, Eaton, Empire, Golden Queen, Haymaker, Herbert, Highland Hardy, Idaho, June, King, Louboro, Marlative, Marlboro, Marldon, Minnetonka, Newman No. 1, Newman No. 23, Newman No. 24, Ontario, Royal Purple, Ruby, Segrist, St. Regis.

Leaf curl is reported from Connecticut for the first time and was previously confused with mosaic under yellows. (Clinton). Leaf curl, according to observations and reports, is rarely found in New York, only a few specimens having been seen. (Rankin). This disease was reported also from Maryland, Michigan, Wisconsin, and Minnesota.

Literature

Cited

1. Rankin, W. H. and J. F. Hockey. Mosaic and leaf curl (yellows) of the cultivated red raspberry. *Phytopath.* 12: 253-264. June 1922.

Not cited

Coons, G. H. Michigan raspberry diseases. *Quart. Bul. Mich. Agr. Exp. Sta.* 4: 138-141. May 1922.

Other diseases

Leaf spot caused by Mycosphaerella rubi Roark (Septoria rubi Westd.) - One of the most common leaf spot diseases of this host and generally prevalent. Collaborators have reported it from Connecticut, New York, Delaware, Ohio, Indiana, Illinois, Michigan, Minnesota, Iowa, and Colorado.

Spur blight caused by Mycosphaerella rubina (P. K.) Jacq. - Was reported from Massachusetts, New York, and Minnesota. Newhall(1) reports, "The imperfect stage of Mycosphaerella rubina (P. K.) Jacq. has been proved to be a normal part of the life cycle of this pathogene. In the latitude of southern Minnesota and New York the perithecia mature in the spring and discharge their spores by the middle of June. Mature pycnidia have been found in primary cane

RASPBERRY - Other diseases

lesions the last week of June and in leaf spots the first week of July. This phoma stage plays an important role in initiating secondary cycles throughout the remainder of the growing season. The connection between the perithecial and pycnidial stages of Mycosphaerella rubina has repeatedly been demonstrated in single spore cultures on Melilotus stems. Furthermore, suspensions of asco-spores inoculated into young raspberry canes likewise gave characteristic lesions in which the Phoma stage developed."

Orange rust caused by Gymnoconia interstitialis (Schlecht) Lagerh. - In most sections the disease is reported of little economic importance on this host. It was reported from New York, Ohio, Illinois, Minnesota, and California.

Powdery mildew caused by Sphaerotheca humuli (DC.) Burr. - Reported from New York and Minnesota. Rankin observed in New York what was probably this species causing a dwarfing of the tips of the green canes in several varieties of red and purple raspberries at Geneva. From 30 to 50% of the tips of the canes are affected. The leaves are very small, crumpled and often mottled. Only the conidial stage was found. The disease became evident during August.

Blue stem caused by Acrostalagmus caulophagus Lawrence - Reported from New York and Michigan. Rankin reports the disease as "common in Dutchess County and at Geneva. It seems to spread very rapidly or else the sets from diseased canes are already diseased when they are planted. From the present conditions observed and according to growers' statements, this disease has ruined the black raspberry industry in Dutchess County. Very few plantings remain." The organism was isolated by C. L. Shear during the summer from Michigan material.

Rust caused by Kuehneola uredinis (Link) Arth. (K. albida Magn.). - "This rust is very common on several varieties of red and purple raspberries at Geneva, N. Y. The older leaves are often killed. Uredinia are common on the petioles but are not found on the canes. Very little, if any, damage results." (Rankin).

Rust caused by Phragmidium imitans Arthur. - Reported from Washington.

A cane blight and a bacterial blight, not determined, were reported from Washington by Dana.

Fruit rot caused by Botrytis sp. - Reported from Connecticut and in car shipments from Washington and Michigan.

Rhizopus rot and blue mold rot, as well as gray mold rot, are often associated in the rotting of fruit in transit.

Winter injury - Reported from New York, Illinois, Iowa, and Washington. Anderson writes from Illinois, "The condition of the raspberries in the state is a matter of considerable concern. Large patches are dying out and almost all plantations show considerable injury from some cause. The plants are weak and died back during the winter. A great many of them are showing yellow leaves and whitening from the tip down. The fruit is drying up on the bushes. I feel reasonably certain that this general decline of the raspberries is due to weather conditions rather to any specific disease or group of diseases."

Literature on other raspberry diseases.

Cited

1. Newhall, A. G. The importance of the Phoma stage of Mycosphaerella rubina causing spur blight of raspberries. (Abstract).
Phytopath. 13: 44-45. Jan. 1923.

Not cited

- Coons, G. H. Michigan raspberry diseases. Michigan Sta. Quart. Bul.
4(4): 138-141. 1922.

RASPBERRY, BLACKBERRY - Anthracnose

Cunningham, G. H. Hypholoma rot, Hypholoma fasciculare Fr. New Zealand Jour. Agr. Jan. 20, 1922.

Rabbas. Die rutenkrankheit der himbeerstraucher. Nachrichtenbl. Deut. Pflanzenschutzd. 2: 42. June 1922.

BLACKBERRY

Anthracnose caused by Plectodiscella veneta Burkholder

This disease is not uncommon wherever the host is grown. It is generally prevalent and many growers underestimate the damage because of failing to realize the importance of all the symptoms. It caused unusual damage in Illinois. Very prevalent leaf infection on midribs, causing crinkling of leaf surface. (Anderson). Tehon estimates a 3% reduction in yield for Illinois. Reported from New York (loss 1-3%), Delaware, Arkansas, Ohio, Iowa, Kansas (5% loss), and Idaho.

Crown gall caused by Bacterium tumefaciens EFS & Towns

A very serious disease in some sections but no extensive prevalence reported. Intensive surveys would, no doubt, reveal greater amounts of crown gall than realized in commercial plantings and nurseries. It is one of the limiting disease factors in Wisconsin and worse than ever in Monroe County. (Vaughan). More prevalent than reports indicate in Washington. (Dana). Prevalent in Texas, causing a 2% loss. (Taubenhaus). Important only in occasional plantings in New York. (Chupp).

Rusts caused by Gymnoconia interstitialis (Schlecht.) Lagerh.
and Kunkelia nitens (Schw.) Arth.

No unusual prevalence of these rust diseases was reported by collaborators this season. They were very common on wild blackberries but not serious in the average commercial plantings. The Early Harvest was found susceptible, while the Snyder appeared most resistant in Illinois. (Anderson and Tehon).

Elliott reports a 5% loss in Arkansas. Orange rust was observed for the first time in the Salt River Valley, Arizona. (George). There has been very little of it even on the wild hosts the past two seasons in Delaware. (Adams). Collaborators also report one or both of these diseases from Massachusetts, West Virginia, New York, Ohio, Indiana, Wisconsin, Iowa, Missouri, Kansas, and Washington.

Leaf spot caused by Mycosphaerella rubi Roark (Septoria rubi Westd.)

Generally prevalent wherever host is cultivated and particularly prevalent on the wild host. A 1% loss is estimated in Texas and Illinois. Reported this year by collaborators in New York, Delaware, Louisiana, Iowa, and Arizona.

Rust caused by Kuehneola uredinis Arth. Large planting at La Grange, Kentucky completely infected this fall. First appearance in the patch. Not on wild blackberry in the vicinity of patch. (Valleau). Observed locally in Illinois. (Anderson).

Leaf spot caused by Cercospora bliti. Collected at Etherton, Jackson County, Illinois, August 21, and first report for state. (Tehon).

Blue-stem caused by Acrostolagmus caulophagus Lawrence. This blue-stem disease was found in one planting in Dutchess County, New York. It kills the bushes quickly. (E. V. Shear).

Mosaic. Observed in one field in Dutchess County, New York. (E. V. Shear).

Double blossom caused by Fusarium rubi Winter. Very prevalent on dewberry and wild blackberry in Delaware. (Adams), also reported common in Louisiana. (Edgerton).

Winter injury. Reported from New York and Washington.

CURRANT

Anthracnose caused by Pseudopeziza ribis Klebahn - Generally prevalent in Ohio because of favorable weather conditions, causing premature defoliation. (Young). Prevalent in the eastern part of Massachusetts and a serious disease in some sections. (Osmun).

Cane blight caused by Botryosphaeria ribis Gross. & Duggar "Plantings showed varying amounts of the disease in Ulster County, New York but nowhere was it of much importance. Black currants and the Fay variety were most affected." (E. V. Shear). Said to be an important disease in New Jersey, West Virginia and Illinois.

Leaf spot caused by Cercospora angulata Wint. - Important in Iowa, 5% loss. (Melhus).

Leaf spot caused by Septoria ribis Desm. - Stevens County, Minnesota.

Leaf spot caused by Mycosphaerella grossulariae (Fr.) Lind. - Very prevalent in Ulster County, New York. During July many fields were entirely defoliated. (Shear). A loss of 1-3% was estimated for the crop in New York. (Chupp). Reported causing a 5% loss in Iowa. (Melhus, and prevalent in Massachusetts. (Osmun).

Chlorosis - Probably a winter injury, observed in Connecticut. (Clinton).

Root rot caused by Fomes ribis (Schw.) Gill. - Indiana. (Gardner).

Literature on currant diseases

Lees, A. H. The influence of reversion (nettle leaf) on successful black currant growing. Jour. Bath, West & South Co. Soc. V, 16: 180-182. 1922.

_____ The association of black currant mite (*Eriophyes ribis*) with reversion disease. Jour. Bath, West & South Co. Soc. V, 16: 237-241. 1922.

_____ Leaf character in reverted black currants. Ann. Appl. Biol. 9; 49-68. Ap. 1922.

_____ Reversion in black currants. Gard. Chron. III, 72: 65. July 1922.

GOOSEBERRY

Anthrachnose caused by Pseudopeziza ribis Klebahn - The gooseberry disease in Illinois, causing defoliation early in the season. The Oregon Champion variety much more susceptible than Downing." (Colby and Anderson). "Severe outbreak according to reports in Indiana." Gardner. More on English variety than on native varieties." (Young).

Leaf spot caused by Sphaerotheca mors-uvae (Schw.) B. & C. - Illinois and Idaho.

Rust caused by Puccinia grossulariae Lagh. - This rust has a wide geographic range and apparently from the numerous reports was very prevalent this season. It is not indicated by collaborators whether the disease was on cultivated varieties of gooseberry. In Massachusetts the disease was general throughout the state and the outbreak was much more severe than previously recorded. (Osmun). Collaborators report the disease from Connecticut, New York, Minnesota, Iowa, and North Dakota.

Literature on gooseberry diseases

Garbowski, L. La lutte contre le blanc du groseillier (Sphaerotheca mors uvae Berk. et Curt.). Bul. Soc. Mycol. France 38: 98-99. Aug. 1922.

CRANBERRY

Reports were received on cranberry diseases from collaborators only in Washington and Wisconsin. Field diseases were of the average occurrence, but fruit rots were much more prevalent apparently. General conditions of the harvested crop are reported by N. E. Stevens and H. F. Bain of the U. S. Department of Agriculture.

"Regarding the cranberry disease situation in Massachusetts and New Jersey during the year 1922, I regret to report that the losses after picking, due to fungous rots, were the worst during the last five years and, as nearly as can be learned from reliable sources, worse than any other year since 1914. One large grower in New Jersey who keeps accurate records, reported that 21% of his entire crop was lost from fungous diseases. This means 21% of the berries picked were discarded at the time the berries were sorted and packed.

"Our culture work showed 12 different fungi to be present, all of which had been previously reported on the cranberry. The two most important causes of loss in storage were Fusicoccum putrefaciens and Glomerella rufomaculans vaccinii." (Stevens).

"Fungous rots of cranberries in the Pacific Coast region during the season 1922 were of much less importance than usual, if reports of growers may be accepted for past experience. In the field there was practically no loss caused by fungi. Rosebloom, caused by Exobasidium oxycocci was fairly abundant, but apparently did not affect the yield.

"Losses in storage were greater. In individual cases as high as 50% of the berries in storage decayed by December 1. The average loss was considerably less than this, however.

"Culture studies showed that all the common eastern storage fungi

CRANBERRY

are present on the Pacific Coast. Endrot, caused by Fusicoccum putrefaciens, apparently caused at least 50% of storage loss in 1922. Sporonema oxycocci and Phomopsis rank next in order. Sclerotinia oxycocci was generally present but not serious." (Bain).

Hard rot caused by Sclerotinia oxycocci Wor. - Found at harvest time as hard rot of muddy gray colored mature berry at Mather, Wisconsin. Tip wilt form not seen this season. Has been found at Mather in previous years. (Meade). Observed producing mummies, soft rot of fruit, and blight of uprights in Washington. (Heald and Dana).

Early rot caused by Guignardia vaccinii Shear - Reported as a rot of fruit in storage, Pacific County, Washington. (Heald and Dana).

End rot caused by Fusicoccum putrefaciens Shear - Causing a rot in storage, Pacific County, Washington. (Heald and Dana).

Bitter rot caused by Glomerella cingulata vaccinii Shear - Causing a rot of fruit in storage, Pacific County, Washington. (Heald and Dana).

Red leaf spot caused by Exobasidium vaccinii (Pck.) Nor. Spotting and dropping of leaves, Pacific County, Washington. (Heald and Dana). Meade also reports it present in Wisconsin.

Rosebloom caused by Exobasidium oxycocci Rostrup - Reported killing laterals and uprights in Pacific County, Washington. (Dana).

Leaf smudge caused by Venturia compacta - Caused spotting and dropping of leaves, Pacific County, Washington. (Heald and Dana).

Storage rots caused by Sporonema sp., Pestalozzia sp., and Anthostomella destruens Shear - Reported in Pacific County, Washington. (Heald and Dana).

False blossom, cause not determined. - Reported by Meade from Wisconsin.

Blight, associated with cool nights in Wisconsin. (Meade).

Literature

Bergman, H. F. Observations on the effect of water-raking on the keeping quality of cranberries. Amer. Jour. Bot. 9: 245-252. May 1922. No.5

MULBERRY

The disease of fruit described by Siegler and Jenkins (1) as caused by Sclerotinia carunculoides n. sp. was reported from South Carolina and Texas. Ludwig states that the disease continues to turn up in Florence County, South Carolina. It destroys the entire crop of berries where it is present. Taubenhaus (2) is conducting studies in germination of sclerotia and methods of infection.

Blight caused by Cercospora sp. (probably C. moricola Cke.). Observed affecting the leaves and twigs in Florida. In one case noted, the tree was about killed. This fungus was found on the young leaves. (Burger).

Texas root rot caused by Ozonium omnivorum Shear - Prevalent in Texas and causing a 10% loss. (Taubenhaus).

Literature cited

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DISEASES OF SUB-TROPICAL FRUITSCITRUS FRUITS

Frost injury

The January freeze in California caused serious loss to citrus. Brown (Bur. Mark. & Crop Est. Div. Letter 3: 31. Febr. 2, 1922) states:

"It seems practically certain that the damage to oranges and lemons will be at least 25 to 50% of the crop. The lowest temperatures were encountered along the Foothills Boulevard at Redlands, San Dimas, and Pomona, and the least damage occurred at Corona and Riverside.

"Growers and shippers held a meeting Saturday afternoon, January 21, and agreed not to pick, pack, or ship any oranges from Los Angeles County until February 6. Other counties took similar action, but I understand that a few cars were shipped out of Riverside which were picked since the frost; so the inspectors will do well to be on the lookout for frost injury in California oranges."

Kaufman (1), Agricultural Statistician of the California co-operative crop reporting service, states that the loss of oranges by the January freezes amounted to 16,000 cars or 7,200,000 boxes. The orange crop estimate as of May 1, 1922, is 78% of normal compared with 92% last year. The lemon crop is estimated at 66% of a normal crop, compared with 90% last year.

Investigations on the prevention of frost damage in California were reported in the United States Department of Agriculture Official Record, Jan. 4, 1922:

"During the present frost season in southern California investigations are being conducted and temperature surveys made by the Weather Bureau, under the direction of Floyd D. Young, in the vicinity of Pomona, San Bernardino, and Corona. These investigations intimately concern the question of artificial heating of orchards, not only in California but in other districts as well. That such work is appreciated by the local growers is evidenced by their hearty co-operation. The season during which there is danger of frost advances progressively northward, and it is planned to utilize the force now in the vicinities above mentioned in more northern districts during the latter part of the season.

"In the work conducted last year a number of interesting facts were developed. Perhaps the most interesting were found in the vicinity of Pomona, where very marked inversions of temperature were observed. In one instance the temperature 40 feet above the ground was 15° higher than at the surface. It appears that conditions of this kind are most marked in the smaller valleys which are more or less inclosed by hills. Results obtained by such investigations become of special value in their application to heating methods employed for protecting growing fruit. The heat from the fire is nearly all expended in raising the temperature of the air within the 40-foot layer. In other words, the warmer upper air acts as a roof, which stops the ascent of the heated air.

"The experience of some growers shows that the temperature of an orchard may be raised as much as 5° or 6° on the average with an amount of firing that will not entail a prohibitive expense, and it has been

CITRUS - Frost injury, Canker

demonstrated that firing in certain localities at least is an economic and practical business proposition."

Literature

Cited

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Not cited

Anonymous. (Editorial) The California freeze. Citrus Industry 3(2): 13. Febr. 1922.

_____ Handling of frozen trees and fruit discussed by lemon men. California Citrograph 7: 148-149, 178.

_____ Effect of cold wave of 1922 compared with that of 1913. California Citrograph 7: 138, 172-173. March 1922.

Canker caused by Bacterium citri (Hasse) Jehle

An outbreak of citrus canker was discovered May 20, 1922, in a grapefruit orchard in an isolated section near Davie, Florida. As soon as specimens of the infected leaves were received at Gainesville, the State Plant Board force and department co-operators were sent to the spot and arrangement made for destroying the diseased grove. A corps of 25 experienced canker men were sent by the Florida Plant Board, with equipment for uprooting and turning all the infected trees. Infection was found on eight properties in the locality.

The following statement (2) indicates the progress during the year in the eradication in the vicinity of Davie:

"The outbreak of canker that took place in Broward County in June is under control and the cankered trees are being burned as fast as found. In May 585 trees were found to be infected and were destroyed, in June - 168, July - 28, and August - 34. Nine properties are affected and are under strict quarantine."

In addition to the outbreak of the disease in Florida, observations show a serious increased prevalence in Louisiana. In the southern part of the state citrus canker has spread very rapidly this season as there have been insufficient funds for eradication work. (Edgerton). This situation is of special importance particularly to the citrus industry and eradication work in Mississippi and Florida. In Mississippi, Miles reports that an infection was found at Agricola, George County. The tree was destroyed and no additional infection was found during intensive scouting of the surrounding territory.

Literature

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CITRUS - Canker, Scab

Anonymous. Again conquering canker. Florida Grower 26(14): 10. Sept. 30, 1922.

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du Toit, P. J. Annual report of the Secretary for Agriculture, year ended 30th June, 1922. Jour. Dept. Agr. South Africa 5: 480-517. Dec. 1922.

Scab (causal fungus not yet determined)

The results of several years investigation of citrus scab, particularly under Florida conditions, has been published by J. R. Winston (1). This disease is second in importance to melanose and stem-end rot caused by Phomopsis citri, is of foreign introduction and attacks many citrus species. It occurs in India, China, Formosa, Japan, Hawaii, Paraguay, Brazil, Canal Zone, Yucatan, West Indies, Canary Islands, South Africa, and the citrus growing regions of the Gulf States, but as yet it has not become established in California or Arizona.

Florida: In Groves - Citrus scab has not been serious for several years due to dry weather prevailing during periods of infection in March and April. Perhaps less prevalent on spring bloom fruit than in 1921. Quite prevalent on summer bloom fruit every year. Very little spraying was needed for control.

In Nurseries - Scab continues to be the most serious nursery disease. At least as prevalent as in 1921. Scab on the most susceptible varieties can be controlled commercially by applications of Bordeaux-oil emulsion about once a month. (J. R. Winston).

Prevalent on grapefruit, Satsuma oranges, rough lemon and sour orange stock. It is very common in the nurseries affecting the stock. This spring (1922) was hot and dry, so very little scab showed up. However, during the latter part of May and the first of June when the summer rains began it became serious. During the rainy season the temperature at night is rather low, falling down to 65° to 63° F. It seems therefore that scab is correlated with low temperature and high humidity as recently pointed out by Fawcett. (Burger).

Louisiana: Very common; high percentage of injury and considerable loss on Satsumas. First report April 26. (Edgerton).

Varietal susceptibility among the commercial species and varieties grown under Florida conditions is reported by Winston (1) as follows:

Extremely susceptible - sour orange (Citrus aurantium), lemon (C. limonia), calamondin (C. mitis), and tangelo (a tangerine-grapefruit hybrid)

Quite susceptible - grapefruit and shaddock (C. grandis); the King orange, tangerine, mandarin orange and Satsuma orange, all of the kid-glove group of oranges (C. nobilis), and the citrange (a hybrid of Poncirus trifoliata and the tangerine)

Rarely attacked - sweet or round oranges (C. sinensis), and kumquats (Fortunella spp.)

Apparently immune - Mexican or Key lime (C. aurantifolia), and the Royal and Triumph grapefruits (supposed to be hybrids of the orange and grapefruit)

Regarding the susceptibility of varieties of grapefruit, which is "the commercial type of citrus most affected by scab in Florida," Winston states that

"Such grapefruit varieties as the Duncan, Walters, Pernambuco, Leonardi, and Foster are susceptible to infection in about equal degree. Hall (Silver Cluster) is much more susceptible and the Marsh considerably less so than the above varieties, and these two can frequently be recognized in mixed plantings simply by the relative proportion of scab present. The Royal and Triumph varieties have never been observed by the writer to be infected."

Commercial control is secured with timely applications of plain Bordeaux mixture as well as Bordeaux mixture plus oil emulsion either in the nursery or in the orchard.

Literature

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- Also in Flor. Grow. 25(7): 5, 26. Feb. 18, 1922.

Melanose caused by Phomopsis citri Fawcett

J. R. Winston of the Office of Fruit Disease Investigations makes the following statement on melanose in Florida.

"Melanose is gradually becoming established in the groves which

CITRUS - Melanose, Stem end rot

are getting around twelve or fifteen years of age, particularly up and down the rich country in Florida. It seems that this disease does not amount to much before trees are twelve or fifteen years old, when dead wood becomes a considerable factor. Then melanose usually sets in irrespective of the locality in which the trees are growing. The disease was probably 10% more widespread and 15 to 20% more serious than in 1921. The twigs killed back by drought in March and April and dead fruit proved to be fertile sources of infection later. First infections of consequence occurred when the rains set in in May. Infection on spring bloom fruit much more serious than on crop from summer bloom. Gross financial loss was from 10 to 15% more than in 1921."

According to Burger very little melanose showed up this spring in Florida. However, when the rains began the June fruit and the June flush of growth were badly affected with the disease. He has recently made a preliminary report on melanose and stem end rot of citrus fruits (1).

Literature

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Not cited

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Winston, J. R. and J. J. Bowman. Commercial control of citrus melanose. U. S. Dept. Agr. Dept. Circ. 259: 1-8. Mar. 1923.

Stem end rot caused by Phomopsis citri Fawcett and Diplodia natalensis Ev.

J. R. Winston gives the following account of stem end rot in 1922 in Florida;

"Stem end rot is becoming more generally distributed throughout the citrus growing section of Florida. It occurs in all sections where melanose is found in quantity and in some localities where melanose is not prevalent. Stem end rot is becoming more serious annually. At least 60% of the citrus fruit crop is infected potentially with one or the other of these fungi.

"Bordeaux oil emulsion applied at the proper times seems to reduce stem end rot.

"Shipping fruit pre-cooled or under refrigeration is becoming more popular, resulting in appreciably less decay than would occur if fruit were shipped without being chilled.

"Gross loss from the disease in 1922 about the same as in 1921."

CITRUS - Fruit rot, Withertip, Anthracnose, Blast

Fruit rot caused by Phomopsis californica Fawcett

A new disease recently described by Fawcett (1) in California has been found on fruit of lemons causing decay, and in the bark of lemon trees affected with shell bark. The decay is of very slow development. The fungus has probably occurred in California for a long time, but has been overlooked because of its slight importance in causing decay of the fruit.

Literature

1. Fawcett, H. S. A new Phomopsis of citrus in California. Phytopath. 12: 419-424. Sept. 1922.

Anthracnose and wither-tip attributed to Colletotrichum gloeosporioides Ponz.

Burger reports that in Florida wither-tip "was severe last spring. During the fall there was a severe storm lasting several days and it is the opinion of many growers that the wither-tip was caused primarily by the storm. This disease was also reported from several nurseries during the summer before the storm." J. R. Winston states that wither-tip was about 10% more prevalent than in 1921, while anthracnose, which occurs for the most part on grapefruit, was about the same. The following comment on the disease appeared in the California Citrograph 7: 226. May 1922:

"Wither-tip, a disease of citrus trees, which has been more or less prevalent in Florida and Cuba, but which is seldom of any commercial importance in California, is more common this season in this state than for many years."

Blue mold rot caused by Penicillium spp.

Winston reports that blue mold rot in general has been considerably more prevalent than in 1921, particularly so during the fall of 1922 in Florida.

Blast caused by Bacterium citriputae C. O. Sm.

A. L. Chaffin states that "in California citrus blast, a new disease of citrus fruit, has cut our yields in half during the past six years." The following account of the outbreak of citrus blast in southern California is by J. E. Coit (California Citrograph 7: 242. May, 1922).

"Very recently the writer discovered the citrus blast disease on orange trees in the foothills near Pasadena. Further investigation showed that the disease was fairly well distributed through a belt including groves at the higher elevations from Sierra Madre westward as far as the Devil's Gate region.

"It has been most serious in the northern counties, particularly in Butte, Tehama, and Sacramento. This present case is the first to be reported south of the Tehachepi.....

CITRUS - Blast, Foot rot, Blossom-end rot

"The bacteria develop and spread during cool, rainy weather and it is interesting to note that the present outbreak seems to be confined chiefly to localities where the rainfall during the past winter has been in the neighborhood of thirty inches, and where frequent showers have been the rule for the past few weeks. This similarity of winter climatic conditions between the Altadena-Sierra Madre section and Butte County is believed to be largely accountable for the present outbreak. Whether the disease will cause serious damage will no doubt depend on weather conditions during April. With dry, warm weather the disease may tend to disappear, but with frequent showers, defoliation of the trees and serious killing back of the twigs may result."

Foot rot ,cause not reported

"Foot rot was reported as serious in several old groves as well as nurseries in Florida. From one nursery specimens were collected and the fungus Phytophthora terrestris Sherb. was isolated. In the nursery it occurred during the rainy season and in that part where the soil was poorly drained." Burger. Winston considers it about as prevalent as in 1921 in Florida and says that "it occurs for the most part on old seedling sweet orange, but is not uncommon on budded trees on a susceptible root."

Blossom-end rot associated with several fungi

Winston states that the blossom-end rot was "more prevalent during the fall of 1922 than for several years in Florida. It occurred principally on the Navel, Blood, and Pineapple orange varieties in the central part of the state. Satisfactory preventive or control measures not known."

Miscellaneous parasitic diseases

Scaly bark and nailhead rust attributed to Cladosporium herbarum var. citricolum Fawcett. Florida - "On the west coast scaly bark seems to be worse. However, it was reported from other districts and the nursery inspectors have reported it from several nurseries." (Burger). "Nailhead rust prevalent in about the same degree as in 1921. Of minor importance." (Winston).

Psorosis (cause undetermined) - "Common on sweet oranges and tangerines. Occurs on other species in Florida also." (Winston). Fawcett recently reported on studies of the disease in California(2) and George reports a similar disease from Arizona on orange and grapefruit.

Brown rot gummosis caused by Pythiacystis citrophthora Sm. & Sm. Arizona - "Found frequently on grapefruit where cultural practices are careless. It is common on stems of orange trees, never observed on fruit." (George). (See also reference (2)).

Gummosis, cause undetermined. Florida - "Especially severe on lemons, but occurs to a limited extent in other species. Prevalent on about the same degree as in 1921. Treatments unsuccessful." (Winston). Burger states that "Gummosis was reported from many old groves in the state. Cultures were made of the material sent in and two fungi were isolated, Phomopsis citri Fawcett and Diplodia sp."

CITRUS - Miscellaneous diseases

Lime wither-tip caused by Gloeosporium limetticolum Clausen. - "Considerably less prevalent on fruit in Florida than in former years, due to exceedingly dry weather while fruit was in a susceptible condition. The twig blight form quite prevalent during the summer and fall months." (Winston).

Septobasidium pedicellatum (Schev.) Pat. - "Slightly more prevalent than in 1921. This or a very similar organism is reported to be killing twigs in certain sections of the central part of the state, but I have not seen such a case." (Winston).

Die-back, cause not determined. - Florida "A very serious disease. The specimens came from old as well as young trees. It was also found in the nurseries." (Burger). "About 10% more widespread and about 10% more serious than in 1921, particularly 'ammoniation.' Bluestone applied as a fertilizer usually acts as a corrective." (Winston).

Damping off, cause not determined. Florida - "This trouble was reported from several citrus seed beds where they had kept the soil too wet. After the amount of water was controlled the disease disappeared." (Burger).

Blight, cause unknown, was reported serious in Florida. - "Along the East Coast the disease seems to be serious. The growers, while losing one to two percent of their trees annually, have become so accustomed to the disease that they think little of the seriousness of it. From all quarters of the state reports continually come in showing that blight is present and growers are sustaining a constant loss from this disease. The blight does not attack the young trees but takes trees after they come into bearing." (Burger).

Sooty mold caused by Meliola sp.- Generally prevalent in Louisiana. (Edgerton).

Miscellaneous non-parasitic diseases and injuries

Mottle leaf, undetermined. - "Much more prevalent than in 1921 in Florida. Deep and excessive cultivation seems to induce chlorosis in dry seasons. Many cases apparently due to excess lime in soil or soil unfit for citrus culture." (Winston).

Spray injury. - "Oil burn much more prevalent in Florida than in former years, degree of injury ranging from slight to severe. Sulphur sunburn somewhat more prevalent than in former years, degree of injury about the same as in 1921. Injury following the applications of Bordeaux-oil emulsion reported from many sections of the state. For the most part this was not of special importance. It seemed to be more of an oil burn rather than Bordeaux injury." (Winston).

"Star melanose, apparently a form of Bordeaux injury, has been observed in many groves only on trees sprayed with Bordeaux mixture. On leaves for most part. Damage negligible." (Winston).

Recent literature on miscellaneous citrus diseases

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CITRUS - Miscellaneous - FIG - Rust

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Very susceptible to diseases, especially canker.
- Reed, H. S. Observations on the citrus industry in Mexico. California Citrogr. 7: 140. March 1922.
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First found August 1922, probably present for some years. Probably will not become important as weather conditions usually unfavorable.
- Winston, J. R. and W. W. Yothers. Bordeaux oil emulsion spray. Citrus Ind. 3 (1): 14-15. Jan. 1922.

FIG

Rust caused by Physopella fici (Cast.) Arth.

In 1907 Arthur (North American Flora) reported the distribution of this rust from South Carolina to Texas; including at that time the following states: South Carolina, Florida, Alabama, Mississippi, Louisiana, and Texas. In figure

FIG - Rust, Black smut

103 the present known distribution of the rust is indicated. The disease was reported this year from Florida, Louisiana, and Texas. Trees were defoliated because of the disease, but not resulting in any apparent injury in Louisiana. (Edgerton). Burger states that the disease was very ~~common~~ this season in Florida.

Fig. 103. Showing present known distribution of fig rust caused by Physopella fici.

Black smut caused by Aspergillus niger v. Tiegh.

Reported on figs in market in Washington. (Dana). Smith and Phillipps (1) have recently reported their investigations on this disease.

Literature

Cited

1. Smith, Elizabeth H., and Elith H. Phillips. Fig smut studies. (Abstract) Phytopath. 12: 442. Sept. 1922.

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Smith, E. H. and E. H. Phillips. Studies of the so-called "smut" of white fig varieties. Mo. Bul. Calif. St. Dept. Agr. 11: 755-758. Oct. 1922.

Other diseases

Anthracnose caused by Glomerella cingulata (Stonem.) S. & von S. Locally important in Jackson and Harrison Counties. Mississippi. (Meade).

Leaf spot, probably caused by Cercospora bolleana (Thüm.) Sacc. Reported from South Carolina and Texas.

Leaf blight caused by Rhizoctonia microsclerotia Matz. Quite prevalent in Florida and in some places caused considerable damage. (Burger). Taubenhaus reports the disease was found for the first time in Friendswood, Texas, in 1919. "The disease was first described by Matz and found by him in Florida. This trouble has been found for the first time by the writer at Friendswood, Texas, in 1919. The disease first appeared on the tree and in a short interval has practically affected every tree in that orchard which consisted of over fifty trees.

Experiments in spraying with Bordeaux mixture 4-4-50 seemed to effect perfect control."

Limb blight caused by Corticium lactum (Karst.) Bres. Reported from Mississippi, Florida, and Louisiana. In Florida the disease was quite prevalent. Several specimens have been sent in to the office indicating that the disease exists all over the state. (Burger).

Canker caused by Macrophoma fici Alm. & S. Reported from Texas by Taubenhaus.

Canker caused by Tubercularia fici. Reported locally severe in Louisiana. (Edgerton).

Canker caused by Diplodia sycina Mont. var. syconophila Sacc. Taubenhaus in Texas reports on the disease as follows: "A serious limb canker of the fig was found to be very prevalent during the years of 1919-1920, and 1921. The organism is readily isolated, grown in pure culture, and artificial inoculations carried out, and the disease reproduced. The causal organism corresponds to Diplodia sycina Mont. var. syconophila Sacc. mentioned by Heald and Wolf. The Diplodia canker is distinct and different from the one caused by Macrophoma fici, Tubercularia fici, Corticium lactum, Botrytis cinerea, and Sclerotinia libertiana."

Root knot caused by Heterodera sp. "In Arizona root knot on young fig trees was reported to this laboratory for the first time this year, although D. C. George states that the trouble has been prevalent in the Salt River Valley for some time. Specimens sent in came from the vicinity of Phoenix." (Brown).

DATE

Leaf spot caused by Graphiola phoenicis (Mong.) Poit. Reported from Texas and Arizona. Taubenhaus reports that "the two varieties most susceptible are Phoenix dactylifera and Phoenix canariensis. In pure culture it resembles yeast colonies. Successful inoculations were only obtained on young tender foliage.

Leaf spot caused by Exosporium palmivorum Sacc. Reported prevalent but unimportant in Texas. (Taubenhaus).

AVOCADO

Black spot caused by Colletotrichum gloeosporioides Penz. Reported prevalent on leaf and fruit in Florida. The leaves affected with the disease are brownish-yellow at the tip. (Burger). Winston states it was more prevalent than in 1921 in Florida and favored by the exceptionally wet fall.

Scab. In Florida, Burger states, "This disease is caused by a fungus which cannot be distinguished morphologically from the fungus causing citrus scab. The fungus causing citrus scab has gone under the name of Cladosporium citri Mass. This fungus is not a Cladosporium, but, on account of the inability to produce good fruiting bodies, it has not been able to be classified. Some diseased leaves were sent in which were badly infected with Pestalozzia sp."

Literature

OLIVELiterature

Kinman, C. F. Olive growing in the southwestern United States. U. S. Dept. Agr. Farmers' Bul. 1249. p. 43. 1922.

Smith, C. O. Pathogenicity of the olive knot organism on hosts related to the olive. Phytopath. 12: 271-278. June 1922.

MANGO

Stem end rot caused by Diplodia natalensis Ev. Somewhat less prevalent than in 1921 in Florida. (Winston).

Tear stain caused by Colletotrichum gloeosporioides Penz. was very prevalent in unsprayed groves while anthracnose and blossom blight were less prevalent than in 1921. (Winston).

Die-back, cause not determined. Florida - Symptoms show die-back of young twigs similar in appearance to the die-back of citrus. (Burger).

Bloom drop, cause unknown. Burger reports, "There were many inquiries concerning the means to prevent the bloom from dropping. Specimens were sent into the laboratory but no one fungus could be found which was thought to be responsible for this. It is believed that it is a physiological trouble."

Literature

Averna Sacca, Rosario. Macrophoma sp. Bol. Agr. Sao Paulo 23: 82-84. Mr./Ap. 1922.

PERSIMMON

Leaf spots associated with Phyllosticta sp. and Alternaria sp. - Reported from Florida. (Burger).

Rot caused by Rhizopus sp. Taubenhaus reports in Texas that, "Japanese persimmons frequently rot on trees in the orchards due to Rhizopus nigricans. This disease is quite common during wet weather and may result in a total loss of the fruit on the tree. Artificial infections may be readily obtained by introducing spores of the fungus into punctures made in the healthy fruit on the trees."

GUAVA

Anthracnose caused by Gloeosporium psidii. This disease was reported from several sections in Florida. In some places considerable loss was sustained. (Burger).

Soft rot caused by Rhizopus sp. was found on shipped guavas during the the past summer in Florida. (Burger).

CITRUS - Other diseases

LOQUAT

Scab caused by Fusicladium dendriticum (Wolbr.) Fcl. var. eriobotryae Scab. Prevalent in Florida but damage is not very great. (Burger).

Blight caused by Bacillus amylovorus (Burr.) Trev. Many places in Florida have this most serious of all diseases of this tree. The blight was reported from several localities. (Burger).

Literature

Anonymous. Fruit tree diseases and their treatment. So. African Fruit Grow. 9: 325, 327, 329. Nov., Dec., 1922. Scab or Fusicladium of the loquat; leaf-blight of the loquat.

Putterill, V. A. Plant diseases in the Western province. IV. Jour. Dept. Agr. So. Africa 4: 332-337. Apr. 1922. Two diseases of the loquat (Fusicladium or scab; Entomosporium blight).

BANANALiterature

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Zeman, V. Bacteriosis del bananero. Bol. Camara Agr. Costa Rica 2: 23-32. Feb. 1922.

POMEGRANATELiterature

Averna Sacca, Rosario. Megalnectria coespitosa Speg. Bol. Agr. Sao Paulo 23: 79-82. Mr./Apr. 1922.

AVERRHOA. CARAMBOLALiterature

Welles, Colin G. Cercospora leaf spot of Averrhoa carambola. Philipp. Jour. Sci. 19: 747-751. pl. 1-2. Dec. 1921.

PECAN - Scab

DISEASES OF NUTSPECAN

Scab caused by Fusicladium effusum Wint.

Scab was generally reported in the Gulf states. It was not very severe this season in South Carolina where Ludwig estimated a 2% loss. In Georgia it was not so bad as the last two years. (Bullard). In Florida it was one of the ~~commonest diseases~~ of the pecan. (Burger). Neal reports that, "Scab was serious again this season along the Gulf Coast, in the Delta counties, and in many localities in the central eastern part of Mississippi. In many groves where susceptible varieties are planted, the crop was a total failure as a result of scab. A number of the large growers in the state are equipping themselves with power sprayers, and are spraying for scab control." In Louisiana it was common and the cause of considerable loss in some varieties. (Edgerton). It was said to be very prevalent in Texas, and was reported from Arkansas.

Wight reports the following varieties especially susceptible in Georgia: Georgia Giant, San Saba, Delmas, and Van Deman. In Mississippi Neal reports the Delmas, Pabst, and Schley as susceptible. The Stuart, Tocho, Frotscher, Russell, and Moneymaker are resistant. Success is reported as scabbing in some localities.

Demaree (1) reports that while work on scab control experiments in 1922 has not progressed far enough yet to formulate a standard spray schedule, the results obtained so far indicate that spraying for scab on susceptible varieties is profitable. In some cases unsatisfactory control is due to the fact that spraying is not attempted until scab has become thoroughly established in the orchard; if spraying is continued for several years until the number of sources of infection is reduced, results will be probably entirely satisfactory. Bordeaux mixture has been found to be the most effective spray yet used as a scab preventive, but because of the danger of foliage injury, after the disease is once under control its use may be limited at least to the first two applications, which are the most important ones, and lime-sulphur solution substituted for the later ones. Bordeaux 4-6-50 was more effective than 3-6-50 and caused no more foliage injury.

The cumulative benefit of spraying is due to the fact that it prevents the formation of the spots on the twigs in which the pecan scab fungus mainly hibernates during the winter, and thus largely eliminates the sources of initial spring infection.

Literature

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PECAN - Rosette, Other diseases

Rosette (cause undetermined)

Rosette was said to be generally distributed in South Carolina, where two instances of considerable damage occurred. A 3% loss was estimated by Ludwig. Neal reports the disease as becoming common in many of the southern counties in Mississippi. Collaborators also report rosette from Georgia and Florida. Several publications have appeared recently discussing the cause of the disease.

Literature

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Bul. 1038: 1-42. 1922.

Weaver, Walter. Pecan rosette. Proc. Nat. Nut. Grow. Assoc.
20(1921): 67-72. 1922.

Other diseases

Powdery mildew caused by Microsphaera alni (Wal.) Salm. - Reported from South Carolina and Florida.

Crown gall caused by Bacterium tumefaciens EPS & Towns. - Taubenhaus states, "As a rule the pecan is not subject to crown gall, at least judging from the scarcity of specimens received of this disease. However, in one instance, some fifteen trees in one orchard growing in the same row were all found to have suddenly died, and when pulled out, showed typical crown gall.

Brown leaf spot caused by Cercospora fusca Rand. Two reports in South Carolina. (Ludwig).

Anthracnose caused by Glomerella cingulata (Stonem) S. & Von S. Prevalent in some sections in small amounts, Florida. (Burger).

Hypochnus sp. associated with a disease affecting pecans near Bluefield, Florida. There was slight damage this past season. (Burger).

Black pit cause unknown. Increased prevalence reported in Mississippi and causing a 20% loss. "Black-pit, a disease, an apparently physiological trouble, was very destructive all over Mississippi the past season. After the nuts attained considerable size the husk tissues became black and somewhat pitted, and finally resulted in heavy shedding. Demaree attributes this condition to dry weather the year previous, but although possible, this theory is uncertain." (Neal).

Nursery leaf blight caused by Phyllosticta caryae Peck. Common in many nurseries but not serious in Mississippi. (Neal).

PECAN, WALNUT, ALMOND

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WALNUT

Blight caused by Bacterium juglandis (Pierce). EFS. - "Prevalent in the Willamette Valley, Oregon, but less severe than last year, although some individual trees are going to lose all their nuts due to insect-borne infections. Rain infections appear to be far less than usual because rains ceased before much walnut foliage was out." (Barss). Promme reported its occurrence in Virginia.

Canker caused by Nectria sp. - Associated with winter injury in Orleans County, New York. (Chupp).

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ALMOND

Crown gall caused by Bacterium tumefaciens EFS. & Towns - Maricopa and Gila Counties, Arizona; common, injury less than 1%. (Brown).

Root knot caused by Heterodera radiculicola (Greef) Müll. - Common in Maricopa County, Arizona. (George).

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