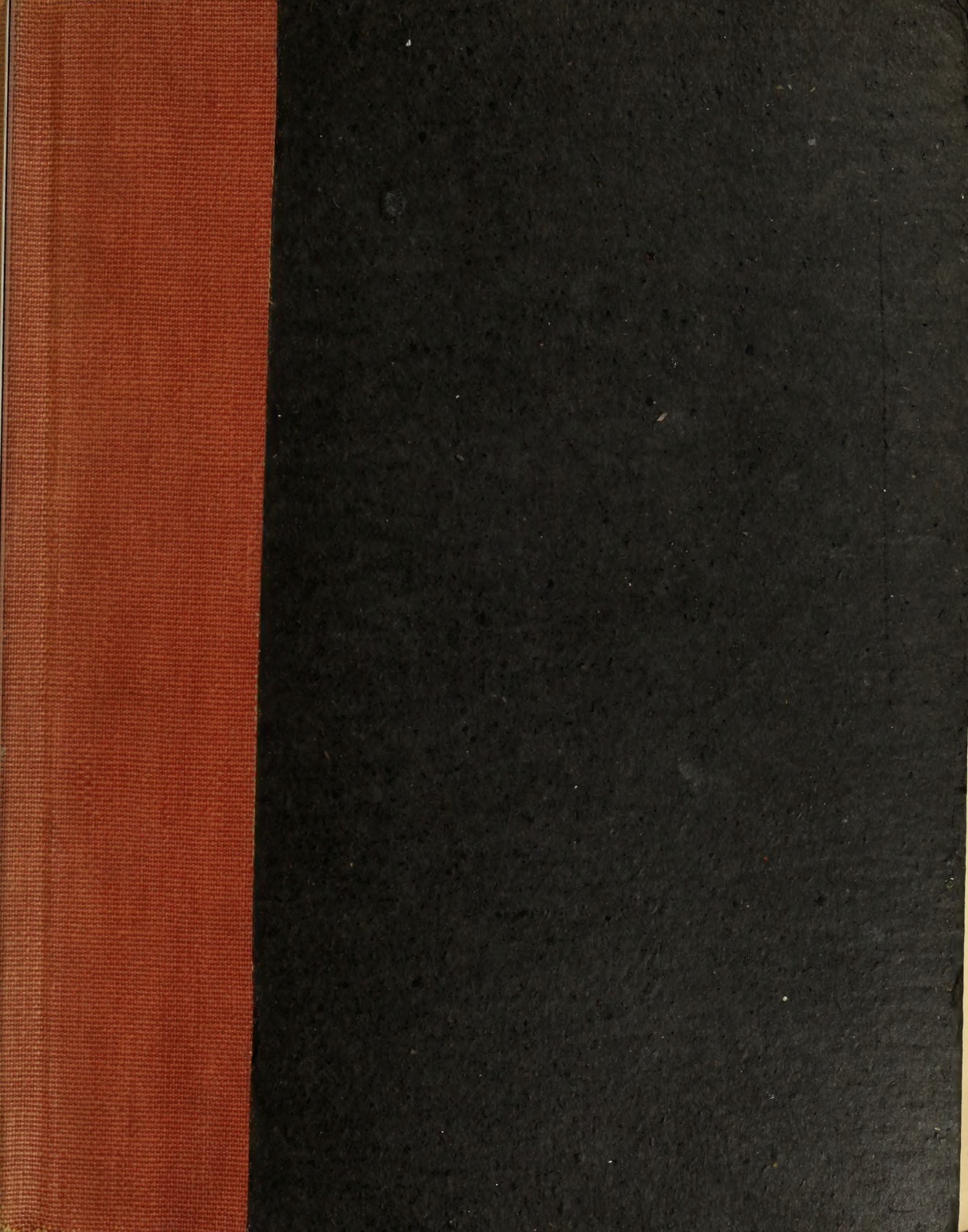
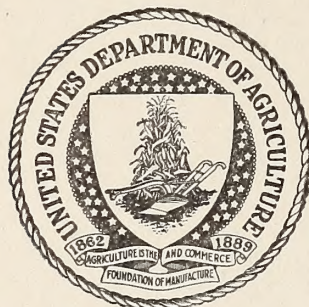


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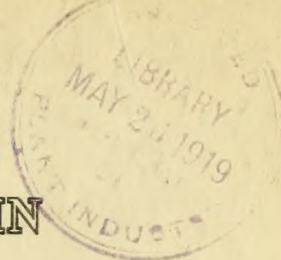


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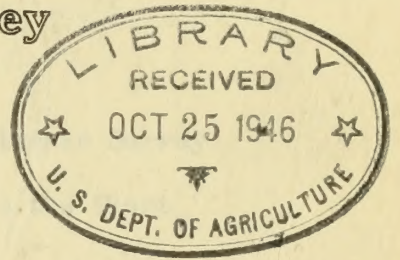
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THE PLANT DISEASE BULLETIN

Issued By

The Plant Disease Survey



SUPPLEMENT 1

Summary of Plant Diseases in the United States
in 1918 - Diseases of Fruit Crops.

May 15, 1919

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

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SUPPLEMENT I

Summary of Plant Diseases in the United States

in 1918 - Diseases of Fruit Crops

July 15, 1918

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE



SUMMARY OF PLANT DISEASES IN THE UNITED STATES IN

1918

A summary of the data obtained by the Plant Disease Survey during 1918 will be issued in parts as supplements to the Plant Disease Bulletin as follows:

Supplement I Diseases of fruit crops.

Supplement II Diseases of field and vegetable crops.

Supplement III Diseases of field and vegetable crops (continued).

Supplement IV Diseases of cereal and forage crops.

Supplement V Diseases of fiber crops, forest trees, ornamental and miscellaneous plants.

The information on which this summary is based was furnished largely by collaborators of the Plant Disease Survey. Many valuable notes were also contributed by field assistants of the Plant Disease Survey, and by other plant pathologists both in the states and in the Department of Agriculture.

For the most part the summary is of 1918 data only, but in the case of some diseases the records of previous years, particularly of 1917, have been utilized, and in certain instances the information from all past survey reports has been abstracted.

PLANT DISEASE SURVEY

1918

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SUMMARY OF PLANT DISEASES IN THE UNITED STATES IN 1918

DISEASES OF FRUIT CROPS

Prepared by

L. R. Hesler* and R. J. Haskell

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DISEASES OF POME FRUITS

APPLE

Scab caused by Venturia inaequalis (Cke.) Wint.

Scab was generally less prevalent and destructive in the United States in 1918 than in 1917. It should be remembered however that 1917 stands out rather prominently as a "scab" year along with 1904, 1905, 1908 and 1910, so that in spite of the fact that the disease was relatively less damaging in 1918 than the year preceding, the reports indicate that in the northeast quarter of the country considerable loss was incurred. On the whole, 1918 may be said to have been an average year for apple scab. Apparently the disease was very troublesome in local areas in Missouri and Illinois and was more prevalent than usual in Virginia. It occurred in moderate amounts in the northeast and only to a slight extent in Oregon and Washington. The percentage of the crop injured varies from 1/5 of 1% to 75%, while actual losses range from less than 1% to 10%.

It is the unanimous opinion of collaborators that where scab occurred to a less extent than in 1917, the weather was unfavorable for the fungus. It was relatively dry at the time for primary infections in the spring, except in certain Appalachian and Mississippi Valley states already noted. Later rains however furnished conditions favorable for late infections which occurred rather commonly. Had the weather been more favorable generally for early infections, there would doubtless have been an unusual outbreak.

The earliest recorded appearance of scab is reported from Oregon by C. E. Owens, on April 4. It appeared some two weeks earlier than usual in

*Temporary field assistant, Plant Disease Survey, Feb. 1, 1919 to May 1, 1919.

Illinois where H. W. Anderson found abundant infection April 28. Dates of first reports in other states follow:-

April 4.....	Oregon	June.....	Tennessee
April 23.....	Arkansas	June 14.....	Minnesota
April 28.....	Illinois	June 24.....	Connecticut
May 20.....	Pennsylvania	July.....	Vermont
May 24.....	Georgia	July 9.....	New Hampshire

It is of interest to note, for comparison, that the earliest previous date of appearance of scab which has been reported to the Survey Office is April 5, 1905 by A. D. Selby, Ohio.

A composite list of the most susceptible varieties for 1918 includes: Fameuse, McIntosh, Wealthy, Winter Banana, Northern Spy, Ben Davis, Virginia Beauty, Red Astrachan, Yellow Transparent, Early Harvest, Transcendent and Siberian Crab. This list corresponds closely to those of previous years.

Lime-sulfur is still relied on by most apple growers in the United States. Where other diseases occur, like bitter rot, bordeaux is used in late applications. Dusting is reported by states as follows:-

- Massachusetts: Limited trials have been made by growers but they are not as enthusiastic over dust as spray. Not used commercially.- Osmon.
- New York: Limited tests in Wayne County gave inconclusive results. The cost of dust was considerably greater in one orchard.- Hesler.
- New Jersey: Station workers regard the efficiency of dusting as uncertain.- Massey.
- Pennsylvania: Dust not a great improvement over check. Bordeaux mixture and lime-sulfur gave excellent control.-Orton.
- Delaware: Cost of dusting and spraying about equal. Not efficient for blotch or scab or other minor difficulties.-Manns.
- Virginia: "We believe dusting a safe practice for the codling moth application on apple, but would hesitate to recommend it for the control of fungous diseases, particularly for bitter rot and for regions where scab is troublesome."- Fromme.
- West Virginia: Dust not very successful. Bordeaux controls scab.- Giddings.
- Arkansas: Orchards dusted 4 to 6 times showed about as much scab as those that were untreated.- J. W. Roberts.
- Illinois: In general, dust, as used by growers and by station men in experiments, is not as satisfactory as the regular spray for the control of scab but may be used on all except the most susceptible varieties. Dust was successful, however, in the control of codling moth. Dusting is out of the question in the southern part of the state where blotch is prevalent.- H.W.Anderson.
- Michigan: Dusting inconclusive, checks clean.- Coons.
- Wisconsin: Dust reduced scab 50%, while liquid reduced it 80%. Dust can be more rapidly applied than liquid, but since dust is not as efficient as liquid for the control of scab, there is need of more experimental work to be done before we feel that we can give it our endorsement.- Vaughan.

Minnesota: Dust promising. - Stakman.

Washington: Dusting not used experimentally by the Station. Growers claim that sulfur dust is as satisfactory in the control of apple powdery mildew as liquid spray in the Yakima Valley. - Heald.

Oregon: On account of the unusually dry season scab was very inconspicuous and there was no opportunity for spraying. Codling moth not as well controlled by dust as by spray, although dust produced fairly good results. Dusting more expensive than spraying but this is somewhat compensated for by a saving in time and wages. Spraying is required for dormant applications which are necessary for certain insects and diseases in Oregon. The spray-gun nozzle is coming into great favor, particularly in the Hood River Valley. In this valley wind interferes with dust operations. - Barss.

Dry lime-sulfur, as put out by the Sherwin-Williams Company, was reported as follows:

Maine: In 1916 dry lime-sulfur was slightly less efficient in scab control than were dilutions of home-made, liquid concentrates. In 1917 however the dry material was plainly more efficient. It produced more fruit russetting in 1917 but the previous year it gave less. The percentage of merchantable apples were in favor of the dry lime-sulfur both seasons. - Morse (In Maine Agr. Exp. Sta. Bul. 271: 125, 1918)

New York: Tests made in 1918 indicate that dry lime-sulfur, if used at double the strength recommended on the label, is about as effective as commercial lime-sulfur solution for apple scab. - Hesler

Wisconsin: Dry lime-sulfur gives very satisfactory returns in comparison to the liquid material. - Vaughan.

Fire blight caused by Bacillus amylovorus (Burr.) de Toni.

During the season 1918, fire blight had its usual wide range over the United States. It was reported from regions as far north as upper Vermont, Montana and Washington, and as far south as Georgia, Texas and New Mexico, with positive occurrence reported from thirty-four states.

Fire blight on apple was not generally more prevalent than normal last year (1918) and, as usual, was of less importance than such other common diseases of the apple as scab and bitter rot. In some states however it was severe and more prevalent than usual. It was common, although less prevalent than usual, in the Rocky Mountain region, Ohio, northern Illinois, Mississippi and Delaware; the disease was more prevalent than usual in Connecticut, New Jersey, Pennsylvania (portions), Tennessee, Wisconsin, Nebraska, western Illinois, and western Kentucky. The disease was also reported as severe in Iowa and Georgia, moderate to slight in most other states.

The percentages of apple trees injured ranged from 2% to 25% by states. In Georgia often 50% of the new shoots blighted. The average percent of trees injured, using figures from seven states, is 14%. Actual losses range from less than 1% in Massachusetts to 40-50% in Kentucky. The average percent of

loss for nine states making estimates is about 6.7%. In western Illinois 90% of the Jonathans in some orchards lost their blossoms through blight.

Twig blight seems to have been the prevailing form of fire blight on apple in many sections of the country. This was particularly true in Connecticut, Massachusetts, Georgia, Ohio, western New York, Tennessee, central and western West Virginia. In Ohio Professor Selby attributes the unusual twig blight to an outbreak of "tissue penetrating insects". Cankers are given special mention from Minnesota and Nebraska; collar blight was general in Massachusetts and Pennsylvania, and in the latter state more serious than usual. Blossom blight was apparently worst in western Illinois, Massachusetts, and the lower Hudson Valley, New York. Fruit blight was important in Georgia and occurred to a limited extent in western New York. Selby states that in Ohio some cases of blight started on the leaf-border.

It is not easy to determine what set of weather conditions is regarded as "favorable" or "unfavorable". In most cases no indication was made in the reports as to the type of weather conditions prevailing; only the words "favorable" or "unfavorable" were used in such cases. In other instances the word "unfavorable" was supplemented by "dry", "hot and dry", "cool and dry". Evidently the temperature factor is not wholly agreed on, although all who commit themselves state that "dry" weather is "unfavorable" to blight. A few reporters venture an opinion on the influence of temperature. Possibly moisture is a more limiting factor than temperature. There are probably other factors which influence outbreaks of blight.

The general, relative prevalence of twig blight may be correlated with heavier rainfall later in the season. It was comparatively dry, generally, at blossoming and there was slight prevalence of blossom blight. It is interesting to note that in western Illinois wet weather prevailed at blossoming and a heavy blossom infection by B. amylovorus was observed in some orchards.

The following varieties are listed as susceptible: Spitzenberg (Conn., Oreg.), Jonathan (Ill., Mo., Oreg.), Transcendent (Minn., Mo., Wisc.), Wealthy (Mo., Wisc.), Greening (Minn.), Alexander (N. Y.), Twenty Cunce (N. Y.), Siberian Crabs (N. D., S. D.), Grimes (Oreg., Pa.), King (Oreg.), Ben Davis (Pa.), York Imperial (Pa.), Stayman (Pa.), Yellow Transparent (W. Va.), summer varieties (Ohio).

In South Dakota Dutchess types were said to be resistant.

Dates of first recorded appearance of fire blight on apple:

March.....	Tennessee	June 4.....	Minnesota
April 1.....	Mississippi	June 6.....	Kansas
May 1.....	Georgia	June 10.....	Massachusetts
May 6.....	Pennsylvania	June 15.....	Vermont
May 8.....	Oklahoma	June 15.....	Montana
May 10.....	Virginia	June 20.....	Connecticut
June.....	Wisconsin	June 29.....	New Hampshire

Since twig blight prevailed, it is not surprising that the above dates are mostly after blossoming time.

It appears, from reports, that in a few states no control measures are taken against fire blight on the apple. In other states the cutting-out method is employed. In Oregon many growers fight the disease successfully, but it is worst wherever the growers are not alert. In Minnesota the opinion is that pruning for blight on apple is on the increase. In Pennsylvania, Orton says of collar blight: "Cleaning away the soil from the collar in the spring has apparently been beneficial in Franklin County. This appears to allow the

cankers to dry out and favors callus formation." In Wisconsin, Vaughan reports the use of B. G. Pratt's Scalecide and desires advice of its use elsewhere.

A matter of historical interest is that fire blight was found for the first time in Douglas County, Oregon, according to the collaborator's statement.

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

The range of bitter rot was slightly restricted in 1918 as compared with previous years. Fewer reports of its occurrence around the margin of the "bitter rot belt" have come to the Office, and it did comparatively slight damage in Arkansas and Virginia where it is often so destructive. In 1918 it was negligible in Massachusetts and New Jersey, where it is never a serious factor in apple growing, and it was likewise rare in Illinois, Missouri and Oklahoma where in some years it becomes very destructive. The exceptionally dry weather is held responsible for the relatively light occurrence of bitter rot in these latter states. The disease was abundant as usual however in the apple regions of South Carolina, Georgia, southeastern Alabama, and Tennessee.

In South Carolina the unsprayed fruit showed 75% rot. In Georgia losses were in some cases heavy and in northern Alabama the disease was quite severe. Heavy losses in states of this region are not exceptional. In years when the weather is favorable to the fungus (warm and moist) bitter rot is both frequent and abundant in practically all apple localities south of the line of the Ohio River.

During the years 1917 and 1918, the following data on varietal susceptibility have been received:-

- 1917 Conn. - Early varieties most susceptible
- Mo. - Susc. - Huntsman, Grimes, Jonathan
- N. Y. - " - Chenango
- Pa. - " - Grimes, Summer Rambo
- Resistant - Stayman, Wagoner, Williams Early Red
- Va. - Susc. - Yellow Newtown, Ben Davis
- Resistant - Stayman, York Imperial
- 1918 Mo. - Susc. - Bismarck

In northern states like New York and Connecticut, doubtless temperature is a factor limiting the disease to early varieties (Chenango, etc.). In Virginia, Fromme suggests that the supposed "immunity" of the York Imperial may be due to the fact that this variety is grown in regions where bitter rot is not prevalent.

Dates of appearance: 1917

June	Alabama	Aug.....	Arkansas
July 1	Virginia	Aug. 20.....	New York
July 10.....	Illinois	Sept. 12.....	Pennsylvania
July 28.....	N. Car.	Oct. 10.....	Ohio.

1918

May 15.....	Georgia	July.....	Tennessee
June.....	Missouri	Aug. 20.....	Massachusetts
June.....	Oklahoma	Aug. 20.....	Virginia

The need for closer observation as to the dates of first appearance is apparent. In general the disease is expected to put in its appearance in warm, rainy weather. Doubtless a comparative study of weather conditions in bitter rot states in epidemic and non-epidemic years would reveal some interesting correlations. Likewise a comparison of climatic conditions (moisture and temperature) prevailing in regions in which the disease is abundant on the one hand, and rare or absent on the other, would show interesting and valuable data.

Blister canker caused by Nummularia discreta Tul.

The range of blister canker apparently has not been increased during the past year (1918). It was reported from Missouri in 1903 and has consistently been reported to the Office from the central west and the Ohio valley. It is most abundant in three rather distinct regions: - (1) western Iowa and eastern Nebraska; (2) southwestern Missouri and northwestern Arkansas; (3) along the Ohio river. It also occurs to a slight extent as far south and west as New Mexico and Texas, southeast in South Carolina, northeast in New Hampshire, and central northwest in Michigan and Wisconsin. So far, it is unknown on the Pacific Coast. Possibly climatic conditions there are unfavorable to the fungus.

The disease is most serious in the three regions already described, and in these areas it ranks as one of the most destructive of their apple troubles. In Arkansas 10% of the trees were reported as injured in 1912; the following year 30% were affected, and it has been important there in other years. In 1918 the disease was reported from Kansas as second in importance only to blotch. Heavy losses are incurred also along the Missouri and Ohio Rivers. In other sections it is common but does less injury. In Ohio there was an apparent spread of the fungus between 1910 and 1915. In 1917 the report came from Virginia that the disease, while present in scattering areas, is becoming more prevalent. In all regions only woody parts are affected. Trees 15 years or older are affected more than younger trees, although Manns reports blister canker on nursery stock in 1913 from Delaware.

The weather relations of N. discreta seem to offer an interesting field of study. In 1915, Reed of Missouri, stated that the disease was relatively scarce owing to the unfavorable season, and he remarked that "a wet season seems unfavorable to this canker." (See also work of Gloyer: Ohio Agr. Exp. Sta. Circ. 125.)

The Ben Davis variety is commonly susceptible, as indicated by the reports from New York, Pennsylvania, West Virginia, Illinois, Iowa and Nebraska. It affects also the Gano and Fameuse (Iowa), Grimes and Willow Twig (Illinois), Sutton (New York) and other varieties. Very often neglected trees suffer more than others.

Excision methods have been used with success in Ohio and Pennsylvania. First reports of the disease came from Nebraska in 1906, Michigan 1911 and South Carolina 1916. It is known however, that Schweinitz collected the fungus in the eastern United States in 1834.

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

This disease apparently occurs only in the eastern half of the U. S. and in Santa Fe County, New Mexico. It was moderate in most states, except in Virginia and southern Pennsylvania and Illinois. In Pennsylvania 25% injury is

reported from the eastern portion, being most injurious on trees in low soils where the humidity is higher. In Virginia it was unusually severe, many trees having been completely defoliated by August; the injury is rated at 50%. In Illinois, black rot was reported as not serious on July 1, but by November 15 was very serious, especially where codling moth was not controlled. It gave little trouble where codling moth was controlled. The fungus followed injuries produced by the larvae of this insect. This phenomenon is not uncommon elsewhere in some years.

All three forms of the disease (fruit rot, leaf spot, and canker) are not always abundant in any given region. Black rot was especially reported from Georgia, Illinois, New Jersey, Tennessee and West Virginia, and in Ohio it appeared as blossom-end rot; leaf spot from Alabama, Connecticut, Missouri, New York (lower Hudson Valley), Ohio, Pennsylvania, Tennessee, Virginia and West Virginia; canker, Minnesota and New York.

Susceptibility of varieties seems to depend on the nature of the injury. In Pennsylvania and New York, Baldwins and Chenango are especially susceptible to leaf spot although Ben Davis and others are also susceptible to this form of the disease in these states. In New York, Twenty Ounce are particularly susceptible to canker. In West Virginia, Ben Davis suffered worst from black rot.

Leaf spot appeared on the following dates:

1918 - May 10, Pennsylvania

July 1, Connecticut

9, Virginia

1917 - July 2, Ohio.

Canker treatment does not seem to be generally practiced. Spraying for leaf spot gave good results in West Virginia, whereas dust gave only fair control. The control of codling moth in Illinois has already been mentioned as having an important bearing on black rot control. In some states the disease requires no special treatment.

Blotch caused by Phyllosticta solitaria E. & E.

This disease appears to remain limited to the eastern half of the United States - west in Nebraska and Kansas, south in Texas and southern Mississippi, and north as far as northern Pennsylvania. It is rare or unknown in areas farther northward, although it was found in one nursery in Wabasha County, Minnesota, in 1917. In 1918, it was very severe in southern and eastern Arkansas, southeastern Missouri, eastern Kansas, Illinois and southeastern Pennsylvania. In the last-named state it was more prevalent than usual, and Orton believes it to be on the increase and fast becoming one of the most serious apple diseases in the state. It is moving northward. In Ohio it is also said that it threatens to become one of the most serious of the apple diseases. In Virginia, Fromme received more reports of its occurrence than in any previous season. Blotch is likewise on the increase in West Virginia, although heavy damage is not yet the rule.

Heaviest losses come about by injury to the fruit. In Illinois, serious cracking of fruit resulted from blotch, coupled with peculiar weather conditions. In Pennsylvania, lesions occurred not only on fruit but on leaf-petioles with consequent defoliation. Leaf-spot was especially mentioned in reports from Delaware and South Carolina. Twig cankers are doubtless general; Selby notes that cankers are frequent wherever fruit blotch occurs in Ohio.

The Ben Davis is generally the most susceptible variety. Other susceptible varieties were reported as follows: Stark, Mann, Rome, Grimes (Ohio), Northwestern Greening (Ohio, Missouri), Arkansas Black (Oklahoma, Missouri), Gano (Oklahoma),

Smith Cider (Pennsylvania, New Jersey), Maiden Blush (Pennsylvania, Missouri), Early Colton, White Pippin, Wealthy, Early Harvest, Yellow Transparent (Missouri), Genet and Cooper Early White (Nebraska). Varieties more or less resistant:- Winesap and Jonathan (Oklahoma), Stark (Pennsylvania), York Imperial (Virginia), Milan and Winter Winesap (Missouri). It will be noted that Stark appears relatively susceptible in Ohio but relatively resistant in Pennsylvania; perhaps in the latter state the Stark is merely "less susceptible" and may be transferred to the susceptible group.

Blotch appeared unusually early in Ohio; ordinarily sprays applied July 15 will control, but in 1918 the disease was found June 7. It was reported elsewhere as follows:-

May..... Missouri, Oklahoma	June 13..... Kansas
June 8..... Illinois	July 2..... Virginia
June 10..... Georgia	July 9..... Pennsylvania

The early appearance of blotch in Ohio calls for a revision in the generally recommended spray schedule. Bordeaux is the fungicide used largely, and in general, where properly applied, is satisfactory. Blotch was more severe in dusted and unsprayed orchards than in sprayed orchards of Arkansas (Roberts, U. S. Dept. Agr.). In Illinois, the susceptible Ben Davis, even in many sprayed orchards showed 80% blotch and 10-35% loss of fruit. Evidently spraying is not invariably dependable in that state.

Rust caused by Gymnosporangium Juniperi-virginianae Schw.

Apple rust occurred widely but on the whole moderately, over the eastern half of the United States in 1918. It was most prevalent and severe in Virginia, southwestern Arkansas, western Iowa and eastern Nebraska. It was also troublesome in southwestern Wisconsin and Tennessee. The disease was reported from Colorado although apparently was not observed elsewhere in the Rocky Mountain region. It was found as far south as northeastern Texas and southwestern Mississippi. It occurred as far north as North Dakota. Rust was less prevalent than usual in Connecticut and Pennsylvania, and in West Virginia it was the mildest it had been since 1909.

In most states the disease was of slight importance. From West Virginia where it is sometimes damaging, comes the report that rust was unimportant because of the unfavorably low temperature occurring at periods when moisture conditions properly prevailed. Taking the country as a whole, if it can be said that rust was less prevalent than usual, it seems that unfavorable weather and cedar-destruction are responsible for the reduced importance of the disease. The following table gives injury and loss estimates:-

	<u>Injury</u>	<u>Loss</u>
Georgia-----	5%	small
Kentucky-----	-----	2%
Minnesota-----	-----	Less than 1%
Pennsylvania-----	5%	1.5%
South Carolina-----	-----	2%
Tennessee-----	10%	2%
Texas-----	-----	slight
Virginia-----	-----	\$350,000 50% on York Imperials
West Virginia-----	-----	2%

Although not a large number of collaborators emphasize the nature of injury and loss, it is of interest to note that leaf infections were especially reported from Pennsylvania, New York and Tennessee. From Canada, comes the report that, while no rust occurred in 1918, only a few leaves were found affected in five years.

Varietal susceptibility to rust

<u>Most susceptible</u>		<u>Observed on</u>
Iowa.....	Wealthy, Ben Davis	Connecticut... Wealthy, Banara
Missouri.....	Jonathan, Rome	New York..... York Imperial, Twenty
New Jersey....	Wealthy	Cunce, Opalescent,
Pennsylvania..	York Imperial	Wealthy, Belleflower,
Virginia.....	York Imperial, Ben Davis	Hubbardston.
		South Dakota.. Only trees with "blood"
		of <u>Pyrus ioensis</u> (West-
		ern Crab).
<u>Most resistant</u>		
Virginia.....	Winesap, Stayman, Delicious,	Wisconsin..... Wealthy
	Missouri Black Twig	

Dates of first report in 1918:

March 30.....	Mississippi	July ?.....	Wisconsin
May 1.....	Georgia	July 18.....	Pennsylvania
May 15.....	Minnesota	July 23.....	Connecticut
June 10.....	Tennessee		

Cedar eradication is practiced in Virginia, West Virginia, Wisconsin and Nebraska. In the last-named state a general movement is on foot to eradicate red cedars in the apple regions in the southeastern portion of the state. Spraying is reported successful in Tennessee in the control of apple rust.

Northwestern anthracnose caused by Neofabraea malicorticis (Cord.) Jackson.

The northwestern anthracnose of apple was reported for 1918 from Washington, Oregon and Nevada. In addition to the states it has been reported previously to the Office from Idaho and Nebraska. Very recently however, it has been determined that the reports from Nebraska (which came to the Office in 1906 and 1917) were incorrect. Apparently then the disease does not occur east of Latah County, Idaho. Although the fungus is present in the apple regions of eastern Washington, western Nevada and western Idaho, it does most damage west of the Cascade Mountains, in the states of Washington and Oregon. In the Willamette, Hood River and Rogue River valleys, it has been serious for several years. In 1918 a survey of five counties in Oregon showed that it was most prevalent in Benton County.



Fig. 1 Occurrence of Neofabraea on apple as reported by collaborators. Summary of all reports.

So far as known the fungus does not occur in any of the apple regions of the middle west or east. Probably weather conditions are not favorable, or possibly it is a mere matter of the non-introduction of the fungus.

Anthracnose has been said to be the most serious apple disease in the northwest. At any rate it is a close competitor of scab. Estimates of losses are difficult to prepare owing to the nature of the injury produced. The chief damage comes through the formation of cankers on the limbs. Young trees may thus be killed. In addition, the fruit may be rotted in the field or in storage. In 1911, there was considerable loss through rotting in storage. Early fall rains favored infections which occurred prior to picking.

It seems clear, from reports, that outbreaks are favored by rainy weather in the fall. In 1907 the disease was prevalent owing to cool damp weather the preceding autumn. Again early fall rains in 1910, 1912 and 1916 resulted in abundant infections which were conspicuous in 1911, 1913 and 1917 respectively. In the Willamette Valley, Oregon, the disease was especially bad in 1917. This is reported to be traceable to a laxity of fall spraying owing to the high cost of copper sulfate. In 1918 statements came from the Pacific Coast that the disease was serious where fall spraying is not practiced, and that it is negligible where the orchards are properly sprayed.

The range of the disease also indicates a close relationship to weather. The fungus is prevalent west of the Cascade Mts., where the rainfall is heavy, but is neither frequent nor abundant east of these mountains where rainfall is relatively light (see map).

The disease is less serious in Oregon on Newtown and Gano than on other varieties, but all sappy varieties like Esopus Spitzenberg and Baldwin are highly susceptible.

Fall spraying is satisfactory. Strong bordeaux is advised, 6-6-50, (1) just after picking, (2) about 2-3 weeks later. An application before picking is advised when weather becomes wet.

In general the situation is as follows:- the disease has done and may still do considerable damage. But fall spraying seems to have brought the trouble under control. Its occurrence eastward should be sought.

Root rots caused by: *Armillaria mellea* (Fries) Quel.
Clitocybe monadelpha
Ozonium omnivorum Shear
Xylaria spp., etc.

The apple root rot situation in the United States is not well understood. In the Pacific Coast region it seems clear that *Armillaria mellea* is the chief, if not the only, disturbing factor. In the Mississippi Valley, southern Texas and the Virginia section *Clitocybe monadelpha* is reported. In Arkansas, *Armillaria mellea* is also reported, and it has been found in Ohio and Pennsylvania. The black root rot fungus, or fungi, (*Xylaria* sp. or spp) has been observed in North Carolina, Virginia, Massachusetts, New York, Indiana and Illinois. Its parasitism is yet to be demonstrated in the last four states. In Texas and New Mexico, *Ozonium omnivorum* is prevalent. It possibly occurs elsewhere according to literature.

In several states the cause of apple root rot is not known; possibly several kinds occur. This meager state of knowledge is admitted from Ohio, Pennsylvania, New York and New Mexico, and doubtless other states might properly be added to the list.

Bitter pit (Non-parasitic)

This disease occurred in the Pacific Northwest and the New England States in 1918. It also occurred in Ohio where it was more severe than in 1917. In Massachusetts, New York and Oregon it was generally prevalent but caused slight loss except on the Baldwin. In Oregon, 50% injury was observed in individual cases.

Previous records indicate the occurrence of bitter pit in all the important apple sections of the United States, except the Ozark Region. In the irrigated sections of Washington it is very prevalent on certain varieties. Its abundance elsewhere, seems dependent on a peculiar set of weather conditions not altogether understood. In 1917 Selby reported that a light crop and abundant moisture favored bitter pit in southeastern Ohio. In the same year Barss reported that a long dry summer favored the trouble in Oregon.

The Baldwin is the most generally susceptible variety. The Northern Spy also suffers commonly. In Washington it is prevalent on Grimes, Black Twig and Belleflower. In Pennsylvania the Ben Davis, King David and York Imperial, in addition to Baldwin and Grimes, are susceptible.

Fruit spot caused by Phoma pomii Passer.

In 1918 Phoma fruit spot occurred in New England and the Ohio Valley. In years past the disease has also been reported from Texas, the Ozark Region, Indiana, Michigan and the Appalachian Region. The only report of its occurrence in the West is from Idaho in 1913. In 1916, it attracted attention for the first time in Virginia. In many states the disease is neither frequent nor abundant and losses are often confined to certain varieties. The disease is most common in southeastern New York, Connecticut, Massachusetts and New Hampshire. In 1918, however, it was generally much less prevalent than in 1917 or other years. It is most severe when rains are abundant in midsummer and late-summer seasons. Weather conditions prior to the last of June seem to have little influence. In this connection dates of appearance, as reported, follows:

Aug. 11, 1907	..... New Hampshire	Aug. ? 1911	.... Pennsylvania
Aug. 14, 1908	..... New Hampshire	Sept. 12, 1917	... Pennsylvania
Aug. 20, 1918	..... Connecticut	Sept. 15, 1916	... Virginia
Aug. 21, 1909	..... Pennsylvania	Oct. 1, 1910	.... Maine
Aug. ? 1908	..... Pennsylvania	Oct. ? 1912	.... Ohio
Aug. ? 1910	..... Pennsylvania	Oct. 15, 1917	.... New York

The disease doubtless appears in some states earlier than the dates recorded. For example it has been seen in July in New York but no such early records happen to be on file in this Office.

The Belleflower is uniformly susceptible. Light colored seedling fruits are also very frequently affected. Other varieties especially susceptible are reported as follows:

Baldwin	Greenville	Northern Spy
Jonathan	Ben Davis	King
Virginia Beauty	Grimes	Yellow Newtown
Newtown Pippin	King David	Rhode Island Greening

It has been observed on several other varieties, notably Tolman. In Connecticut, Russett was most resistant in 1916.

Midsummer sprays are reported as satisfactory. Infections may begin in June and continue into September.

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

Most prevalent in Washington and Oregon. It was also reported from California, Nevada, Colorado, New Mexico, Texas, Arkansas, Illinois, Indiana, Wisconsin, South Carolina and New Hampshire. From Ohio, Selby reports apple mildew as due to Sphaerotheca pannosa, while in West Virginia, Sheldon reports Podosphaera oxycanthae on apple.

In Washington, powdery mildew in 1918 was very prevalent in the irrigated section of the central and western portions of the state, where it is one of the most serious of apple diseases. The damage there is mostly due to a reduction in the vitality of the tree and prevention of fruit bud formation. In the Yakima Valley, atomic sulfur and iron sulphide is generally used but in the Wenatchee Valley lime sulfur has been preferred. Growers claim that sulfur dust is as satisfactory as liquid for its control in the Yakima Valley (Heald). None of the sulfur sprays can be used after hot weather starts in these regions of intense sunlight because of the severe fruit burning which always results.

Jonathan spot (Cause debated)

During the years 1917 and 1918 Jonathan spot was reported from Washington, Illinois, West Virginia, New Jersey and Delaware. According to literature it occurs elsewhere. It develops on late-picked fruit and in storage. Other varieties besides the Jonathan are liable to show this or other similar spots. From Washington a "Jonathan freckle" is reported (1918) and is said to be distinct from Jonathan spot. In New Jersey, both Jonathan spot and blossom-end rot are attributed to *Alternaria* sp.

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

Soft rot was reported from various apple regions of the United States and Canada in 1918. In Illinois, Anderson reports *P. expansum* as causing 20% loss in cellar storage; data regarding cold storage are difficult to obtain since storage men are reluctant to give out such information. In transit to cities east and southeast market inspectors report 5-26% infection.

Crown gall caused by Bacterium tumefaciens Sm. and Towns.

Crown gall apparently occurs all over the United States. In 1918 it was reported from New York in the northeast, southern Georgia, Alabama, Texas and New Mexico, and the Pacific northwest. It is apparently more injurious in the south than elsewhere. According to reports it was especially important in Texas, Arkansas, Alabama and Georgia. Most damage is done to nursery stock, although orchard trees in some regions suffer considerably. In New Mexico, Werkenthin found the disease on 10-12 year old trees and states that such trees do not hold their fruit well. In Alabama numerous galls were found (1917) on the trunks of old trees. Aerial galls were again reported prevalent from Alabama in 1918. From Texas 3% loss is reported; from Pennsylvania 5% injury, and it was especially bad in a block of young trees bought from a New York state nursery. Galls had been cut

off to disguise trouble. Various types of lesions, such as galls, (root and aerial), and hairy root were reported.

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

This disease was reported in 1918 as occurring in New York, New Jersey, Delaware, Ohio, Illinois, Iowa and Washington, where it appeared in usual amounts. Between the years 1904 and 1918 inclusive, brown rot on apple has been reported to the Office from all the chief apple regions of the country. However definite reports of it from the following apple states have never been received: New Hampshire, Vermont, Massachusetts.

Brown rot is clearly one of the minor diseases of the apple, although highly destructive on stone fruits. In no apple region is the disease known to be a factor in apple production. This is probably due to the fact that fall and winter apples, which constitute the bulk of this fruit grown in the United States, ripen in the cooler seasons of the year. The fungus has a relatively high optimum temperature and is most destructive on ripe or ripening fruits. Whenever early apples are grown brown rot occurs to some extent, due no doubt to the favorable conditions of warmer temperature at ripening. According to reports, heaviest losses have been incurred in Delaware. Losses may occur in the orchard, in transit and in storage. In 1918 shipments from Delaware to Indianapolis, Indiana, all varieties were affected in transit. The Yellow Transparent showed 7% rot; dark early varieties showed 25% as opposed to 15% on light red varieties. In a shipment from Ohio to the same market brown rot for one car varied from 4% to 30%, average 8%. The disease is a storage trouble in Washington and elsewhere. Losses are recorded as early as 1904, from Arkansas, Iowa, Missouri, New Mexico and in subsequent years from many other states. The disease has not been reported to the Office as affecting leaves and bark.

A few years ago the brown rot fungus in America, on whatever host, was called S. fructigena. More recently it has been shown that the brown rot fungus in the United States is S. cinerea. Both species occur in Europe; the species fructigena more common on pome fruits (although known on stones), and the species cinerea more common on stone fruits (but known on pomes). The question still remains to be further investigated: - Does Sclerotinia fructigena occur in the United States?

Apothecia on apple have apparently not been reported in American literature. In 1914, however, C. R. Orton, Pennsylvania, reported to the Office that they occurred abundantly May 7, on Wolf River and Red Astrachan.

Brown rot is reported on the following varieties:- Wolf River, Red Astrachan, Yellow Transparent, Chenango, Wealthy, Genet.

Special spraying for orchard control is never practiced, so far as known. It would apparently be necessary only on early (summer and fall) varieties in a warm, wet season.

The disease is sometimes called black-rot because under certain conditions a black mummy is produced. It should not be confused with black-rot caused by Physalospora cydoniae which produces also both black and a brown rot.

The trouble is reported to be more prevalent when apples stand near plums or peaches (Iowa, New Jersey).

European canker caused by Nectria galligena Bres.

To date the European canker has been reported as occurring in 1918 in Connecticut, New York, Pennsylvania, Ohio and Oregon. Records of the Office show that it also occurs elsewhere (see below). The earliest report comes from Connecticut in 1903. In 1907 it was first noted in New Hampshire and subsequently elsewhere as follows:- California (1908), Ohio and Washington (1911), Minnesota and North Carolina (1912), Maine (1913), Indiana and Pennsylvania (1915 ; but at this time cankers fifteen years old were observed), Massachusetts, New York and Oregon (1917). (But earlier records of its occurrence in New York are available in the herbarium at Ithaca.)

The disease is common in Maine (in some parts of the state), New Hampshire and Massachusetts but it is not a serious factor in apple-growing in these or other states.

European canker is a minor disease of the apple in the United States. The percentage of trees injured in any state is low, although isolated cases are on record where a large number of trees in an orchard were affected. Such cases are reported from North Carolina (1912), Pennsylvania (1915) and elsewhere. Only limbs are known to be affected.

Little data are at hand regarding conditioning factors. Clinton, 1917, believes that in Connecticut possibly the prevalence is correlated with winter injury. Barss, 1917, found the canker seriously affecting Red Cheek Pippin eight years old, while Newtowns and Spitzenberg standing beside hardly showed one typical case. In Massachusetts neglected trees are frequently infected.

The proper name of the fungus appears to be N. galligena Bres., although N. ditissima Tul., is more commonly used. The latter is saprophytic (see Phytopath. 3 : 35. 1913.).

Sooty blotch and Fly speck
caused by Leptothyrium pomi and Phyllachora pomigena.

In most eastern states this disease in 1918 was either as common as for the average year, or less than usual. It seems to have been worse in West Virginia than elsewhere. In 1917 the disease was abundant in Kentucky, Maryland, Pennsylvania and Virginia. In 1918 it was general in northern Alabama, especially on late apples. In Ohio (1917) Selby reported it as especially common on "aphis" apples. On occasions when the disease has been troublesome, late rains have favored. Shaded fruit, as well as fruit on trees in low or poorly drained soil, suffer worse. In Nebraska (1918) it was severe, locally at least on Oldenburg, Maiden Blush, Missouri Pippin and Genet, and moderate on Jonathan. In North Carolina (1917) green colored varieties suffered most. In Virginia (1917) all varieties were affected.

Late sprays were used in 1918 in Ohio. In West Virginia Bordeaux gave excellent control, although sulfur dust gave practically no control.

There is still doubt in minds of the collaborators as to whether or not sooty blotch and fly speck are the same. Investigations on this matter are under way in one of the states.

Winter injury caused by low temperatures.

The winter of 1917-1918 proved exceptionally injurious to apple as well as other fruit trees. Severe injury was reported to apples from all of the New England states, New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois,

Michigan, Wisconsin and Minnesota; and slight to moderate injury was reported from West Virginia and Kansas. As in the case of peaches, the trees, especially the older ones, went into the winter in an immature condition which rendered them more susceptible to freezing injury.

The injury was manifested in different ways depending on its severity. In many places in the more northern states trees were killed outright. Sometimes the trees leaved out in the spring and then twigs, branches, or the entire trees would die. It was common during the summer to find trees with a sickly yellow foliage. Dwarfed leaves and spurs were reported from Ohio. Much injury was reported to crotches and branches as well as to trunks. In New York and Pennsylvania root killing was reported and injury to the spurs, as shown by a browning of the sap wood and pith, was general in some states. This may be related to the unusually heavy blossom and fruit drop that was reported from New York, Ohio, and West Virginia.

The losses were extremely heavy. In Maine, where the trouble is reported as being the worst since 1906-07, thousands of Baldwin trees were killed and many more so severely injured that they were made practically worthless. In Minnesota 10% of the trees were said to be injured. In New York it is estimated that the crop was reduced by at least 50% because of winter injury. In Vermont from 10-15% of the total number of trees were reported killed and many more (15-25%) were injured.

Trees in undrained localities were more seriously affected than others according to reports from Ohio, New York, Indiana, and Illinois. Melchers of Kansas reported the trouble most serious in the valleys, and Coons in Michigan states that trees in exposed locations were most commonly affected. It seems to be the consensus of opinion of collaborators that the old trees and those that produced a crop in 1917 were more affected than young trees or older ones that were not productive the year before.

The following list of common varieties, arranged in order in which they were most affected, is given for New York: Baldwin (worst), Rhode Island Greening, Tompkins King, Hubbardston, Fall Pippin, Twenty Ounce, Ben Davis, Wealthy, Fameuse, McIntosh, and Oldenburg. The Baldwin was most susceptible according to reports from Maine, New Hampshire, Vermont, New York, Pennsylvania, Ohio and Indiana. The following varieties were also said to be especially affected: Stayman Winesap in Ohio, York Imperial in Pennsylvania, Rhode Island Greening in Vermont and New York, and Ben Davis in Indiana. Grimes Golden was among the varieties least affected in Indiana. (For fuller discussion of the winter injury situation see peach, page 24.)

Water-core (Non-parasitic)

In 1918 water-core was most common on certain varieties, having been recorded on Early Harvest, Tolman, Wealthy, Yellow New Town, Fall Pippin, York Imperial, Oldenburg, Sweet Bough, Yellow Transparent, Pound Sweet.

In 1914 Selby suggested as treatment the practice of prompt picking and low nitrogen supply.

Drought injury (Non-parasitic)

Apple fruits suffered from drought in several states in 1918. Irregular shaped apples often developed as a result of the death of local areas in the flesh. Coons, of Michigan, reports that tissue at the blossom-end suffered especially; he reports the trouble on many varieties. Selby states that drought "break-

down" in Ohio is similar to the Jonathan and Baldwin spots; on the surface it suggests water core. The trouble is noticeable only after enlargement by growth is checked and other parts have developed about it. He reports it as most severe on Northwestern Greening, Stark, York Imperial, and has also found it on Wealthy, Duling, Baldwin, Gano and Grimes. The disease was much more prevalent in Ohio in 1918 than in 1917, owing to the dry hot weather during the latter part of the summer. Giddings reports that many apples were injured by drought in West Virginia. It was also common in Massachusetts, especially on Baldwins, and reports of it also come from Washington and Oregon.

Cracking (Non-parasitic)

A very dry summer followed by a heavy rain and continued wet weather the latter part of August and in September resulted in severe bursting and cracking of apples in southern Illinois. Stayman cracked worst. Alternaria and Physalospora cydoniae followed cracking. -H. W. Anderson.

Late frost injury.

Late frosts caused a small amount of russeting on apples in Connecticut. It was reported July 31. Frost injury is also reported from Washington, where blistering of the leaves occurred. Late frosts greatly reduced set in Kentucky.

Hail injury

Hail injury was reported from Iowa, Connecticut and Vermont. The injury was severe in several parts of Iowa. In Connecticut the trouble was local and injured fruit and young twigs of early varieties.

Sun Scald

This trouble was reported from a few states, (West Virginia, Kansas, Ohio, North Dakota, and Connecticut). Apparently both fruit and limbs were injured.

Scald (Non-parasitic) and Decay (Parasitic)

Scald followed by decay (commonly caused by Penicillium) was reported from several points by Markets Inspectors.

Melhus reports in Iowa that apples in warm storage were injured in such a manner as to show a cloudy or fired appearance beneath the cuticle. Clinton also reports scald in storage in Connecticut.

Spray injury

Reported from Pennsylvania (arsenical), New Jersey, Ohio (arsenical). Russeting of fruit from the use of Pyrox and Bordeaux was common in Pennsylvania.

Pox canker caused by Leptosphaeria coniothyrium (Fckl.) Sacc.

This canker was reported in the spring and summer of 1918 from Kansas where it seemed to be alarmingly prevalent in Doniphan County, the Chief fruit

growing section of the northeastern part of the state. This is the first report of the disease from Kansas. H. H. Haymaker and L. E. Melchers furnish the following memorandum concerning it: "The disease was found in Doniphan County, affecting mainly the trees from two to five or six years old. About 3% of the young trees in orchards in the above counties have died and perhaps 10% of all young trees are affected. The cankers are from one-half inch to three inches in extent and are brownish, reddish, or yellowish in color. It has been found that the fungus that causes the disease is the same as that on raspberry, and that the canker is worst in orchards where raspberries are growing either between the rows of apple trees or in the vicinity. In Sedgwick and Reno Counties, where a search was made for the disease, none could be found, undoubtedly because of the scarcity or absence of raspberries. The disease was collected also in Jefferson, Wabaunsee and Sumner Counties, but was rare in those places."

Miscellaneous rots of fruits.

Alabama - Storage rots exceedingly severe.

Illinois - Botrytis rot noticed but not serious.

Ohio - Obscure rot under investigation. May be referred to Stevens and Hall's *Alternaria* rot.

Washington - Miscellaneous rot fungi reported (*Penicillium*, *Alternaria*, *Botrytis*).

New York - *Phytophthora cactorum* was found causing rot on Rhode Island Greening in the orchard.

New Jersey - *Cephalothecium roseum* reported.

Other diseases

Silver leaf caused by *Stereum purpureum* reported from Maine, always associated with winter injury (Morse). Reported also from Washington (Heald and Dana).

Leaf spot caused by *Cercospora mali* reported from Bexar and Guadalupe Counties, Texas, where the disease is unimportant.

Leaf spot caused by *Phyllosticta pyrina* was reported as common in New Jersey (M. T. Cook).

Cankers on limbs and trunk apparently associated with winter injury or root disease very prevalent in Pennsylvania. Cause undetermined.

Canker due to *Coniothyrium fuckelii* reported from Minnesota by Bisby.

Rough bark disease was reported as a minor trouble from Washington.

Cytospora canker reported from New Mexico. In Montana *Cytospora leucostoma* is reported to have been found apparently following winter injury and bacterial blight.

Brown bark spot, a spotting of limbs, reported from Washington as caused by "poor soil".

Surface canker caused by *Myxosporium corticolum* reported from Ohio. It is common in New York.

Soil trouble - Werkenthin (New Mexico) reported the prevalence of a trouble due to gypsum or soil exhaustion.

Coniothecium scab - Reported from Washington.

Chlorosis - Reported from New Mexico, where it is present in some parts of most every orchard in the Mesilla and Pecos Valley.

June drop - Chief trouble in Connecticut; especially severe on winter varieties.

Spot necrosis - Reported from western Washington; due to intermittent irrigation.

Cork - Noticed extensively on King in Oregon.

Rosette - One report from eastern Washington. Cause unknown.

Fasciation - Reported from southeastern Washington.

Dieback - Reported from many sections of Georgia. Pestalozzia developed in plates in several cases.

Alkali injury - Three reports from central Washington. Causes severe chlorosis.

Sap rot - In Ohio, where Schizophyllum commune followed winter injury.

----- ? - Septobasidium retiforme reported from Alabama where it is general. Also found on haw and pecan. In Mississippi Thelephora pedicillata is reported but is unimportant.

Collar rot - Reported from Ohio

Smallpox - Reported from Ohio.

Frog-eye - Abundant locally in West Virginia. Caused by Illosporium malifoliorum.

Bark galls - Reported from Washington. Cause uncertain.

Pimple disease - Reported from Ohio.

Measles - Local in Pennsylvania. Smith Cider appears to be most susceptible.

PEAR

Fire blight caused by Bacillus amylovorus (Burr.) de Toni.

In 1918, fire blight had its usual occurrence over the United States. As a rule it was less abundant than in 1917 although it was more severe in Connecticut, and local areas in the South. In Canada it was worse than in average years.

The disease in question is still of considerable importance. In Georgia 50% loss for the state is recorded; in New Jersey 15% injury; in Mississippi 15% injury.

As with apples, twig blight was the most prevalent form of the disease. Blossom blight, however, was especially noted in Massachusetts, Pennsylvania and New Jersey.

The early wet summer is held responsible for blight appearing worse than usual in Canada. In Pennsylvania fair weather at blooming is said to have favored blossom-blight, while later rains prolonged the growth and infection by the organism was easy. Dry weather is correlated with the lesser prevalence in Arkansas, Texas and Oregon (See apple data).

Sand pears showed marked resistance in Alabama. Bartletts more resistant in Connecticut but susceptible in New Mexico; Kieffers were resistant in New Mexico but susceptible in Alabama. Sheldon, Clapp, Flemish, and King Charles are also reported among the susceptible pears, while Anjou Seckel and Garber are resistant.

The dates of the first reported appearance of the disease correspond to the time when twig infection rather than blossom infection would be expected. They follow: -

March	Tennessee	May 10.....	Virginia
March 26	Mississippi	May 28.....	Pennsylvania
April	Louisiana	June 9.....	Connecticut
April 1 (approx)	Georgia	July 17.....	New Hampshire

Scab caused by Venturia pyrina Aderh.

Pear scab was generally less abundant during 1918 than the year previous. A light crop and dry weather seem to have been responsible for this condition. The disease was common, however, in some of the eastern states.

Leaf spot caused by Mycosphaerella septina (Fr.) Schrot. (=Septoria pyricola).

Common, but not very destructive, in New York, Ohio and New Jersey. Locally destructive in Pennsylvania. Trace in Kansas. In 1917 it was also reported from Alabama, Massachusetts, Michigan, Nebraska, Ohio, Maryland and New Hampshire.

Black rot caused by Physalospora cydoniae Arnaud.

In 1918 this disease occurred in Arkansas, Oklahoma and Ohio.

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

This disease was reported in 1918 from Canada, Missouri and New Jersey. In previous years it has been found commonly in Missouri, Ohio, Georgia, Pennsylvania, Maryland and Iowa. It has also been noted in Washington, Nebraska, Alabama, Michigan, North Carolina, Virginia, West Virginia, Delaware, New York and Rhode Island. Most damage seems to occur in nurseries on seedlings. Defoliation sometimes occurs. Lime sulfur or Bordeaux controls the disease in New Jersey and Georgia.

Crown gall caused by Bacterium tumefaciens Sm. & Towns.

Reported in 1918 from New Mexico, Ohio and Pennsylvania. Previously reported from Massachusetts, Maryland, Kentucky, Mississippi, Arkansas, Idaho, Washington and Oregon.

Winter injury caused by low temperatures.

Winter killing of pear trees was reported from New York and Washington. In New York the trees were most severely injured in Oswego and surrounding counties where many orchards were nearly killed out. Both old and young trees suffered in this state and the varieties were affected in the following order: Dutchess, Angouleme (Dutchess), Bosc, Bartlett, Clairgeau, Seckel, Clapp's Favorite and Anjou. The hardiest variety was Flemish Beauty, although Anjou and Clapp's Favorite were not much affected.

Other diseases

Canker - Owens reported a rough bark canker from Oregon. In some places it did considerable damage. Cause not determined.

Red leaf - Prevalent on Kieffer in New York.

Hail injury - Local in Connecticut.

Brown blotch - Reported from New Jersey; less than usual.

Drought injury - Reported from Ohio and Washington.

Leaf spot caused by Phyllosticta pyrina - Reported from Ohio.

Frost injury - Reported from Washington.

Root rot caused by Ozonium omnivorum - Less than usual in Texas; drought seems unfavorable.

Brown rot caused by Sclerotinia cinerea - Pears were rotted in transit by this fungus, from Florida to New York and Philadelphia. From 25-75% infection in three cars (July 8 and 15). A brown rot blossom blight (caused by Sclerotinia) was reported from Washington.

Rots caused by miscellaneous things - Reported from Washington.

Winter injury - See general discussion.

Septobasidium pedicellatum - Common in Louisiana, but does slight injury.

QUINCE

Fire blight caused by Bacillus amylovorus (Burr.) de Toni.

Fire blight was quite injurious to quinces in 1918. It was reported especially from the northeastern part of the United States; New Hampshire, Massachusetts, Connecticut, New York, New Jersey, West Virginia, Ohio, Alabama and Nebraska. It was also said to be very abundant in Ontario, Canada in 1918.

Reports indicate that it was more prevalent than usual in New England, while in Ohio it was apparently less prevalent.

Ten to fifteen percent injury to the trees is reported from New York and two percent loss from Massachusetts. (See Fire blight of apple, page 3, and pear, page 18, for further information.)

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

Reported from New York, Ohio, Illinois, and Missouri. H. W. Anderson reported complete defoliation of 1400 trees in an orchard at Bloomington, Illinois, August 3. The trees had started to send out new shoots and the second crop of leaves was becoming badly diseased. In New York more or less occurred in most quince orchards.

Rust caused by Gymnosporangium clavipes Cooke and Peck.

Rust was more or less prevalent in northeastern United States as shown by reports from New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Ohio, and South Carolina. In no case was it of any particular economic importance.

Other diseases.

Black rot caused by Physalospora cydoniae Arnaud (= Spheropsis malorum Peck) was reported from New Jersey (very common), Ohio and West Virginia.

Ozonium omnivorum was reported by J. J. Tauberhaus as causing a root rot of Japan Quince (Cydonia japonica) at Waco, Texas. The plant was dying from the disease.

Crown gall caused by Bacterium tumefaciens was reported from Ohio and Texas.

Powdery mildew caused by Podosphaera sp. was reported by Heald and Dana from Washington.

Winter injury was reported from New York. The injury took the form of a killing back of the twigs thus reducing the bearing surface. The killing of entire trees was rare.

DISEASES OF STONE FRUITS

PEACH

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

Brown rot occurred in most states in the eastern half of the country in 1918. A slight amount was also reported from northwestern Oregon. In some sections the peach crop was greatly reduced by the cold winter (1917-1918), and in such localities while there were fewer fruits to rot yet the disease added to the loss already incurred by low temperature. Brown rot was worst in the Gulf States and the Chesapeake Bay peach areas. A considerable amount of loss was incurred in transit.

Heaviest losses are reported from the lower half of Delaware, Georgia, (where brown rot is the most important peach disease), Mississippi, Pennsylvania, South Carolina. In some more northerly states brown rot apparently is potentially destructive, since it is abundant in unsprayed orchards, breaking out when the weather is favorable. In the South, of course, the higher temperatures favor the fungus and make control more difficult. Twig blight is reported from New Jersey, South Carolina and Pennsylvania; blossom blight from Delaware; leaf injury from South Carolina. Fruit rot was the prevalent and important form of injury. In the northern peach belt early varieties are usually affected more than late varieties, owing to the more favorable temperature at ripening of the former. In Pennsylvania, however, early and late varieties are equally susceptible. In Georgia all kinds are reported susceptible. In 1918 late varieties suffered most in Mississippi.

The disease is controllable in Georgia, Mississippi, New Jersey and Tennessee by spraying. In West Virginia sulfur dust was found quite effective against scab and brown rot (see Giddings: W. Va. Agr. Exp. Sta. Bul. 167). In Delaware, Manns states that "dusting has been very efficient on peaches. ----- I think more will take advantage of it in the peach industry here". Virginia - "We feel satisfied that dusting can replace spraying for all peach work except the dormant spray". -- Fromme. New Jersey - Good results from dusting peaches - Massey. Georgia - Dusting peaches in 1918 was very satisfactory - J. W. Roberts.

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

The range of peach leaf curl over the United States in 1918 was general, but in most peach sections it was much less important than usual. In the Great Lakes belt only traces of the disease could be found even on unsprayed, most susceptible varieties. Dry spring weather, at bud-opening, is an obvious cause

for this comparative scarcity. In some of the northern states winter injury to buds and twigs appears also to have been a factor in the scarcity of curl. Selby mentions this condition for Ohio. In local areas around the Chesapeake Bay, however, curl was abundant, and in southwestern Virginia and portions of Pennsylvania outbreaks, although local, were severe. There was considerable curl also in local areas in South Carolina, Georgia and western Oregon. In some counties in Pennsylvania 25% of the trees showed curl, and in South Carolina and Georgia 10% injury to trees is reported.

Although unsprayed orchards suffered worse than properly sprayed ones, varietal susceptibility was marked in regions where the disease was prevalent. In Virginia Fromme noted the usual high susceptibility of Elberta and Garman (about 95% of the leaves heavily affected) while the Early Crawford was comparatively resistant (showing 5-10% leaf infection). Selby remarks that Chinese varieties, notably Elberta, are most susceptible in Ohio.

Curl appeared in states, by dates, as follows:

March 15.....	Georgia	May 1	Ohio
April	Tennessee	May 16	West Virginia
April 25	Pennsylvania	May 28	Connecticut
May 1 (about)	Arkansas		

Scab caused by Cladosporium carpophilum Thum.

In 1918 peach scab occurred as usual in the South, being widespread in South Carolina, Georgia, Alabama, Mississippi and Arkansas. It was also reported from Florida and Louisiana. In all these sections scab was observed in the orchard as well as in transit. In southeastern Pennsylvania it was very prevalent, but elsewhere in northern states the disease was less prevalent than usual. This was due, in part at least, to the light crop.

Losses and injury from peach scab were reported as follows: Georgia (50% injury in some orchards), Illinois (some in markets, none in orchards), Mississippi (20-30% injury, probably 10% loss), Oklahoma (slight), Pennsylvania (5% loss for state; 10-100% injury in southeastern portion, less elsewhere), South Carolina (bad) and Tennessee (10% injury).

Scab was observed in Florida March 12, and in Pennsylvania March 25.

Early peaches suffered most in Georgia and Virginia; late varieties suffered most in Ohio (Heath and Salway) and South Carolina. In Mississippi, seedlings are especially susceptible.

Spraying appears to be successful generally, since collaborators report that the disease does no damage where sprays are applied for it, and worst where not sprayed. Dust controlled scab satisfactorily in West Virginia in 1918. Manns reports the successful use of dust for peaches in Delaware. (See under brown rot.)

Yellows, Rosette, Little-peach (cause unknown)

Yellows was reported in 1918 as severe in West Virginia (2-3% injury), Virginia, and Pennsylvania (5% loss). It was also reported from Ohio, New York, Massachusetts, Connecticut, New Jersey and Tennessee.

Rosette was reported as causing slight injury in Georgia.

Little-peach was reported from Pennsylvania and New Jersey.

Black spot caused by Bacterium pruni E. F. S.

Black spot seems to have had approximately its usual range over the eastern half of the United States but was much less severe than usual. It was reported as common in certain sections of Arkansas causing considerable damage; quite common in Delaware and New Jersey; abundant on wood in Louisiana; prevalent in southern and southeastern Pennsylvania doing heaviest damage (sometimes 100% infection) in Adams county. Elsewhere the disease was reported as "less than usual", "none observed", etc. In 1917 black spot was the most serious peach disease in Oklahoma and was also very common in Arkansas, Maryland, New Jersey, Delaware, North Carolina and Michigan. C. R. Orton reports Salway as most susceptible in Pennsylvania.

Dates of appearance: - 1917, July 11 (North Carolina), July 14 (New York), August 23 (Ohio). 1918, June 16 (Pennsylvania).

The application of nitrate of soda is reported as giving good control in Arkansas.

The earliest record of the disease at the Office was supplied by R. I. Smith who observed black spot in severe form in Stewart county, Georgia, in 1906.

Coryneum blight caused by Coryneum Beijerinckii Oudem.

The Coryneum blight was first reported to this Office by Pierce in 1906. Subsequently almost annual notices of it have been sent from California, Oregon, Washington and, since 1912, from Idaho and Utah. In 1909 and 1910 it was reported from Mississippi, and at various times from Indiana (1910), Ohio (1911), New Jersey (1912), and Massachusetts (1915-1918). Its occurrence in the east seems doubtful in some cases, and further investigations appear necessary to fully establish the range of the disease.

Heaviest losses have occurred in California, Oregon and Washington. In the Willamette Valley of Oregon, it was serious on twigs in 1918. In this state it was also very serious in 1909; in 1910 and 1911 it was less serious; in 1912 and 1913 it broke out heavily again, and Jackson stated (1913) that it was fast becoming the most serious disease of peach in Oregon. In 1912 there was 50-75% injury in Utah, and in 1913 it injured 25% of the peaches in some cases.

The fungus is favored by rainfall. Prolonged spring rains favor fruit blight. Twig and bud blight may be prevalent after fall rains, but fruit blight may subsequently be uncommon if the spring and summer remain dry. In 1917 twig injury was serious after the wet season in 1916. The same year however the blight was rare on fruit because of the dry season in 1917.

Fall spraying with bordeaux controls twig and bud blight, while spring and summer sprays with lime-sulfur (self-boiled) control fruit blight.

Powdery mildew caused by Sphaerotheca panrosa (Fr.) Lev.

Powdery mildew was reported from Oregon, Washington, Utah, Ohio and Pennsylvania. Nowhere was it reported serious. Previously reported from Colorado, Indiana, Maryland, Michigan, Missouri, Nebraska, New Jersey, New York, South Carolina, Tennessee, Virginia, West Virginia, Massachusetts, Idaho, and New Mexico. Heald reports that growers in the Columbia River section (Washington) claim that dust is as satisfactory as liquid in control work.

Die-back caused by Valsa leucostoma Fr.

Reported from Arkansas (associated with frost injury), Georgia (general), Alabama (common in neglected orchards), New Jersey (occasional) and Ohio.

Root knot caused by Heterodera radicicola (Greef.) Mull.

Nematode injury was reported from Georgia. Most complaints came from the southern portion of the state. Berry says: "It was observed that when root knot infested nursery stock was planted in the heavy red clay soils, the nematodes disappeared". Root knot has previously been reported from Florida (first in 1904) and North Carolina (first in 1915).

Winter injury (non parasitic).

The severe winter of 1917-1918 caused more damage to peach trees in the United States than has been experienced in many years. In many places, especially in the more northern peach states, older trees made a late fall growth. The cold weather came early, and the trees went into the winter in an unripe condition. Added to this was the fact that the winter was unusually severe and long continued. This combination of conditions resulted in heavy losses from winter killing.

The months of December and January, when the injury probably took place, were unusually cold in all but the extreme western states. The average daily departure below the normal over the entire eastern half of the United States was large, running as low as -14° in many places. Zero was attained during these two months in all states except Florida, Louisiana, California, Washington and Nevada. The coldest weather of the two months centered about Lake Champlain in the East and the Dakotas in the West. The lowest temperature for December was recorded December 31 from Northfield, Vermont, where the thermometer registered -41°F. , the lowest ever recorded for New England. The lowest temperature for January was -38°F. , recorded at Havre, Montana. February was not especially cold. In most places the month averaged slightly warmer than normal.

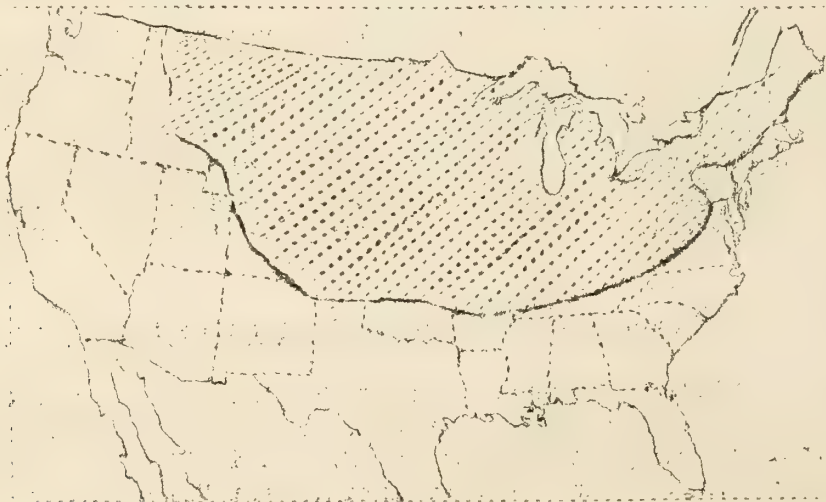


Fig. 2. Area where -10°F. or lower was attained during January 1918.

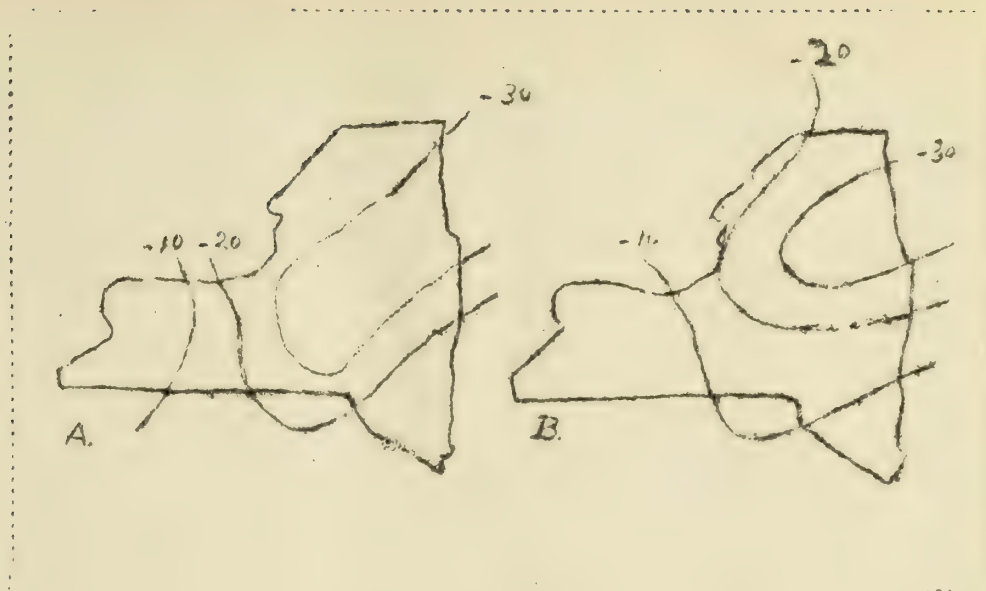


Fig. 3. Lines of lowest temperature in New York, A. December 1917, B. January 1918. The severity of the injury to peaches varies directly with the lowest temperature.

Killing of the wood of peach trees was reported from all states and regions north of the line indicating the temperature of 10° below zero in January (Fig. 2) and freezing of the buds occurred to a considerable extent south of that line. Thus Tennessee reported killing of many trees in the west, with a fair crop in the middle and a good crop in the eastern part of the state. Virginia reported very severe injury in the southwestern section, in Pennsylvania the most damage was done in the central and northern parts, and New York reported trees in the Hudson River Valley as least affected.

The injury varied from freezing of fruit buds to killing of entire trees. Along the southern border of the affected area injury to the buds and branches was most common but further northward the killing of the wood became more frequent until in the northern peach producing states whole orchards were ruined. In most states all gradations of injury from bud to trunk killing were reported depending on the locality of the state in which the trees grew.

Losses resulted in various ways, - (1) killing of trees, (2) killing back of branches, (3) killing of buds and so preventing set of fruit. In Indiana thousands of trees were reported killed and many more thousands damaged. In Michigan many whole orchards were ruined, necessitating the removal of all the trees. In Ottawa County, the largest peach growing center of Ohio, about 90% of the bearing trees of above four years of age were destroyed. New York reported 16% of the trees killed in twelve peach growing counties. Many farm orchards in Illinois had all of the trees killed. In Massachusetts from 5-50% of the trees were reported killed or badly damaged. In the northern and central counties of Pennsylvania 25% or more of the trees were severely injured.

A comparison of the production of peaches in 1918 with that in 1917 probably represents roughly the amount of loss in the 1918 crop from winter injury. The figures also indicate the states in which the heaviest losses occurred:-

Production of Peaches in bushels (000 omitted) 1917 and 1918.

	<u>1918</u>	<u>1917</u>		<u>1918</u>	<u>1917</u>
N. H.	0	47	Mo.	0	890
Mass.	9	145	Neb.	0	0
R. I.	2	20	Kans.	0	121
Conn.	15	268	Ky.	110	1,034
N. Y.	1,167	2,244	Tenn.	840	900
N. J.	792	871	Ala.	3,142	1,830
Penn.	1,210	1,440	Miss.	1,386	375
Del.	284	647	La.	615	478
Md.	600	975	Texas	2,041	2,352
Va.	578	800	Okla.	303	1,150
W. Va.	850	608	Ark.	260	840
N. C.	1,035	1,541	Colo.	754	1,200
S. C.	1,064	1,130	N. Mex.	85	60
Ga.	6,746	4,716	Ariz.	58	60
Fla.	264	122	Utah	11,000	900
Ohio	348	496	Nev.	15	6
Ind.	92	592	Idaho	80	165
Ill.	78	364	Wash.	1,130	504
Mich.	248	744	Oreg.	118	250
Iowa	0	30	Calif.	11,570	14,151

In New York a special survey was made by members of the Plant Pathology and Pomology Departments of the College of Agriculture with the object of investigating the extent of winter injury to fruits and the various phenomena connected with it.

The following summary of the situation as regards peaches has been furnished by H. H. Whetzel and L. R. Hesler:

"Bearing peach trees in the lake belt from Williamson in Wayne County east were largely killed out. Young trees and a few old orchards which did not bear heavily in 1917, came through in fairly good condition. Practically no fruit buds survived in this section however. From Rochester west along the lake there was some set of fruit especially in the Irondequoit section and in Niagara County. The trees from Williamson west while not usually killed were generally more or less injured. There was in some cases severe killing back of the twigs, some blackening of the body sap wood and as the season advanced there was evident a sickly yellow tinge in the foliage of most orchards.

"The peach trees in the Hudson Valley and along Cayuga Lake were severely injured but many came through and leafed out. None blossomed and while some orchards will recover, many are dead or so badly injured as to be worthless. The trees in many peach orchards have already been pulled out and many others will be removed this fall or next spring. The peach industry of the state has sustained a severe blow."

It will be noticed that the area of most severe injury, from Williamson east, corresponds with that where the lowest temperatures for December and January were lower than 10° below zero (Fig. 3). During those months a wide range of temperatures existed in different parts of the state.

In general the older trees, especially those that bore a heavy crop in 1917, suffered most. This was reported as being the case in New York, Indiana Illinois and Ohio. In Indiana this is thought to be because the older trees made

the older trees made a late second growth while the younger and more vigorous growing trees matured normally.

Reports from a number of states show that the injury was worst where trees were growing under unfavorable conditions. In New York it was worst on poorly drained soils; in Indiana and Illinois trees in the river bottoms or trees that were devitalized from various factors were reported as most affected.

No marked differences in varietal susceptibility were reported from any state although there were indications in Ohio that Lemon Free and Smock were slightly more hardy than Elberta.

Other diseases

Rust caused by Puccinia pruni-spinosae (= Tranzschelia punctata) (Texas) Previous to 1918 it was reported from Arkansas, California, Florida, Maryland, Mississippi, Alabama, Iowa, Louisiana, Missouri, South Carolina, North Carolina, Ohio, Oklahoma, Porto Rico).

Rot caused by Rhizopus - (Market inspection of peaches from Georgia).

Drought injury - (Nebraska)

Frost injury - Late spring frosts (Virginia)

Die-back - Complication of causes (Georgia)

Root rot - caused by Armillaria mellea (Oregon, Arkansas), and Clitocybe monadelphus (Arkansas), caused by Ozonium omnivorum (Texas), cause ? - (New Mexico).

Wood rots - (Arkansas)

Canker, apparently not Monilia - (Connecticut).

False mildew - caused by Cercosporella persicae - (Ohio; previously reported from Arkansas, Delaware, Florida, Alabama, Maryland, Michigan, Missouri, North Carolina, South Carolina, Virginia, Washington, West Virginia, Alabama).

Gummosis - (Mississippi, Washington); caused by Bacterium cerasi - (Oregon)

Chlorosis - (Texas).

PLUM

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

As in the case of brown rot of peach the disease was reported from states in the eastern half of the United States including Nebraska and Kansas. It was also reported from Washington and Oregon. It was apparently most abundant in the states along the Atlantic coast from Georgia north to New York and New Jersey.

The heaviest losses were reported from Georgia and South Carolina where 30% of the fruit was said to have been lost in each state. The next largest loss is reported from Pennsylvania where it was estimated that 20% of the plums were destroyed. In New York from 10-25% reduction in yield is recorded, and in Connecticut, Massachusetts, Virginia and Minnesota, 4, 2, 5 and 1% losses were reported respectively. In Ontario, Canada, W. A. McCubbin reported that a survey of plum orchards showed almost 8% orchard loss and about 8% loss in sale, making a total of at least 15%.

The dates of first appearance as reported by collaborators were:-

April 24.....	New York (on blossom)	July.....	Oklahoma
April 25.....	Mississippi	July 31....	Pennsylvania
May 6.....	Virginia	Aug. 5.....	Connecticut
June 15.....	Georgia	Aug.....	Wisconsin
June 20.....	Minnesota		

Spraying for brown rot does not seem to be practiced to any great extent in Pennsylvania and New York, and probably the same is true in many other states. It is reported as giving good results where used in New York, and South Carolina. (For information on occurrence of brown rot on other hosts see apple and peach pages 13 and 21.)

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

This disease was frequently observed in many states in the eastern United States in 1918. It was abundant and severe, however, only in small, local areas. It was reported as especially destructive on wild species of Prunus in Arkansas and Connecticut. In Oregon it was reported only on wild cherry.

Pockets caused by Exoascus pruni Fokl. * Taphrina communis (Sad.) Gies.

Plum pockets were reported from the following states, most of which are in the northern part of the country:—New York, New Jersey, Pennsylvania, West Virginia, Ohio, South Carolina, Arkansas (prevalent on wild plums), Minnesota, Iowa, Kansas, Montana, and Washington.

The disease was worst in Montana and Minnesota. In Montana it was by far the most serious plum disease. It was reported that practically all the American plums in unsprayed orchards were lost because of pockets, and that the growing of this variety of plum has been brought to a standstill because of this trouble and a leaf gall mite (Montana Agr. Exp. Sta. Bul. 123:167-188, 1918).

In Minnesota the disease was general, causing about 1% loss. In some orchards it was observed as being so serious that nearly all the fruit on some trees was destroyed.

Since Prunus americana seems to be especially susceptible to pockets it is possible that the reason for the disease being worst in the north central west section is because Americana is the variety that is principally grown.

Leaf curl caused by Taphrina sp.

This disease, reported from Montana as being caused by Taphrina decipiens, caused considerable loss in some orchards where no spraying was done.

Leaf spot caused by Coccomyces prunophorae Higgins.

This leaf spot was reported from Massachusetts, New York, Pennsylvania, South Carolina, Ohio, Minnesota, Iowa, and Oregon. It was apparently most common in the eastern states and in Oregon. In general it did not cause much if any damage although it was estimated as affecting 25% of the leaves in Pennsylvania. Massachusetts reports severe injury to Japanese varieties. Spraying or dusting is reported as giving good results in New York.

Black spot caused by Bacterium pruni E. F. S.

Reported in 1918 from Pennsylvania, New Jersey, Arkansas, South Carolina, Texas, southern Illinois, and southeastern Missouri. The disease seemed to be worst in the south central part of the country. Texas reported 4% loss.

Crown gall caused by Bacterium tumefaciens Sm. & Towns.

Reported from Ohio and Washington.

Scab caused by Cladosporium carpophilum Thum.

Scab was reported from Pennsylvania, Missouri and Minnesota. The loss was small in all cases except in Pennsylvania where 2% loss was estimated. The blue varieties appeared to be most susceptible in Lancaster County of that state.

Powdery mildew caused by Podosphaera oxycanthae (Fries) De Bary

Reported in slight amounts from Pennsylvania, Ohio and Minnesota.

Winter injury

Reported as slight in New York, Ohio and Washington, apparently not injured nearly so much as peach, or apple. (See peach, page 24 and apple, page 14 for further data.)

Internal brown spot caused by drought

Considerable loss to prunes was reported from the Willamette Valley, Oregon, and Clarke County, Washington. As high as 25% affected fruits were counted on a tree, and one or two cases were reported in which the entire crop dropped on account of drought injury. A leaf roll thought to be due to the same cause was also reported general throughout Oregon.

Other diseases

A wilt disease of plums suspected as being caused by Lasiodiplodia triflorae was reported as general in northern Georgia. Ninety percent of the trees were affected in some orchards.

Silver leaf. Specimens showing symptoms that resembled this disease were received at Pullman, Washington, from Clarke County.

Sunscald was reported from four different counties in Ohio.

Root rot caused by Armillaria mellea reported from Texas.

Blight caused by Coryneum beijernickii reported from Washington.

Rust said to be caused by Tranzschelia punctata reported from Nebraska.

Little plum reported from New Jersey.

CHERRYBrown rot caused by Sclerotinia cinerea (Bon.) Schrot.

Brown rot occurred commonly in the eastern part of the country and on the Pacific Coast. In New York and Oregon at least blossom blight resulted in the most damage. Reports of occurrence were received from New York, New Jersey, Pennsylvania, Ohio, South Carolina, Tennessee, Georgia, Missouri, Arkansas, Washington, Oregon and Canada. Losses of 3% in Pennsylvania, 25% in South Carolina, and 10% in Ontario, Canada were reported.

Mr. D. F. Fisher contributes the following report for the lower Willamette Valley, Oregon, where the disease caused about 30% reduction in yield. "As a blossom blight it was found only on low bottom land. Orchards in the hills were practically free from infection. Infection corresponded with the prevalence of apothecia. No control measures followed by the growers. In general season was unfavorable for the disease." (See, also, brown rot of peach and plum, pages 21 and 27.)

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

Reported from Maine, New York, Pennsylvania, Tennessee, West Virginia, South Carolina, Ohio and Arkansas. A doubtful report was also received from Washington.

The losses from this disease do not appear to be great in commercial orchards. The most damage is done to scattered and neglected trees. Sweet cherries are more affected than sour cherries in New York. (See plum, page 28 for further data.)

Leaf spot caused by Coccomyces hiemalis Higgins=Cylindrosporium padi Karst.

Reported from Massachusetts, Connecticut, New Jersey, Pennsylvania, West Virginia, Georgia, Mississippi, Wisconsin, Missouri, and Canada. Reports indicate that in general the disease was not so severe as usual, altho for the most part this was probably due to weather conditions, still in some instances it was due to the increased employment of control measures. In some places considerable damage was done but this was mostly confined to rather small localities so that the total amount of injury to the crop was relatively small. Since no reports were received from the Pacific Coast in 1917 it is judged that the disease was of only minor importance in that region.

Bacterial gummosis caused by Bacterium cerasi Griffin.

Reported from Oregon and Washington. C. E. Owens contributes the following report of conditions in Oregon: "Present in Douglas, Jackson, Josephine, Lane and Benton Counties but doing more damage in Benton County. It occurs to a greater or less extent wherever cherries are grown but is most serious in the Willamette Valley, probably because climatic conditions are more favorable for its development there. The worst case was noted at Brownsville in Linn County where a nine-year old orchard which had originally contained 624 trees had but 128 trees left, due to gummosis. Another serious case was noted in the Milton-Freewater district where 50 trees were lost from an orchard originally containing 186 trees, a loss of over 26%."

Powdery mildew caused by Podosphaeria oxycanthae (Fries.) De Bary

Reported from New York (commonly present in unsprayed orchards), West Virginia (occasional, especially on sprouts in Monongalia County), Ohio, Wisconsin (observed only at Madison in July), Missouri (not common, loss very small).

Crown gall caused by Bacterium tumefaciens Sm. & Towns.

Reported from Ohio (Two counties), Oregon (not common) Washington (locally).

Witches' broom caused by Excascus cerasi (Fckl.) Sadeb.

Reported from Connecticut (occasional), Washington (reported from Pierce and Lewis Counties in the west), Oregon (general in the Willamette Valley but doing only little damage, most prevalent in neglected orchards).

Winter injury (non-parasitic)

Cherry trees were generally injured throughout the northern part of the United States during the winter of 1918. Reports of the injury have been received from New York, New Jersey, Ohio, Washington and Canada, but it is probable damage occurred in a good many other states. The most detailed information available on the subject is that from New York where a special survey was made by Chandler, Whetzel and Hesler. The following report has been contributed by these men: "Sweet cherry trees throughout the state, except in most protected areas, appear to have suffered seriously. A majority of them are either dead or so severely hurt as to make their recovery doubtful. In some sections, notably in the Hudson Valley they appear to have suffered but little. The dying of the limbs in the upper part of the tree after the leaves came out was the prevailing symptom. The crop of fruit on sweet cherries was generally very light, apparently due to the injury to the wood as the fruit either did not set well or fell prematurely. Sour cherries showed little injury to wood but in spite of the heavy bloom the set was not always good and premature falling of half-grown fruits was very common."

Other Diseases

A Root rot caused by Armillaria or Clitocybe was reported as fairly common in parts of Arkansas. Armillaria root rot is also reported from Ohio. Cercospora circumscissa was reported from Ohio and Michigan. According to E. F. Woodcock this was the most destructive foliage disease with which cherry growers had to contend. The severe winter of 1918 so weakened the trees that they were in a condition to be readily injured by the fungus. 46% injury to foliage was evident in the orchards visited; this injury considerably reduced the yield and quality of fruit.

Fire blight caused by Bacillus amylovorus was reported from New Mexico.

A bacterial canker of undetermined cause is reported as causing 25% loss in an orchard of Windsor sweet cherries visited in Erie County, Pennsylvania. It is thought that the disease is the same as the western cherry canker.

Gummosis of a non-parasitic nature was reported from several parts of Washington.

Valsa leucostoma is reported as more prevalent than usual in Ohio.

APRICOT (See also peach).

Blight caused by Coryneum beijerinckii was reported from Washington and Oregon.

Scab caused by Cladopsorium carpophilum Thum. was reported from Oklahoma (very slight), Texas (unimportant), and California.

Shot hole caused by Coccosporium sp. was reported from Massachusetts and Texas.

Brown rot caused by Sclerotinia cinerea reported from Ohio and California.

Gummosis (non-parasitic) and frost injury were reported from Washington.

DISEASES OF SMALL FRUITSGRAPE

Downy mildew caused by Plasmopora viticola (B. & C.) Berl. & De Toni.

Downy mildew was comparatively rare in 1918. In the Chautauqua Belt of New York none was found, and only a trace found in the Keuka Lake region (New York). Slight amounts were found in Nevada, Texas, the Atlantic Coast states, Minnesota and Ohio. In West Virginia it was abundant on wild grapes although rare on cultivated farms. In Pennsylvania it appeared later than usual (July 10), owing to delayed rains.

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

Powdery mildew apparently was less abundant in 1918 than for several years. Reported present, but causing slight injury, in Oregon, Arkansas, Georgia, South Carolina and a few northeastern states. Reported August 1 from Oregon, August 24 from Georgia and September 7 from Pennsylvania.

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

Reported from Pennsylvania south to Alabama, and from Louisiana north as far as Minnesota. Nowhere does it appear that black rot was serious, although most common in Missouri, New Jersey and West Virginia. In Ohio, although the most serious grape disease, it was less abundant than usual. In Pennsylvania leaf infection was heavy whereas fruit infection was very light. It was found in Georgia June 24, Missouri July 13, and Minnesota Aug. 5.

Crown gall caused by Bacterium tumefaciens Sm. & Towns.

This disease was reported from various parts of the United States in 1918. In Kansas, it was the most destructive disease of grape, although the loss was not over 3%. In Oregon it was locally serious on certain varieties. Elsewhere, it was reported as occasional and limited.

Anthracoſe caused by Gloeosporium ampelophagum Sacc.

Not reported from new territory. Occurs over eastern half of United States, usually causing only slight damage. In Missouri it was reported as having been more or less associated with black rot.

Other diseases and injuries

Ripe rot caused by Glomerella cingulata - (New Jersey)

Leaf spot caused by Cercospora viticola - (Ohio)

White rot caused by Coniothyrium diplodia - (Ohio)

Root rot caused by Dematophora necatrix - (Ohio), caused by Ozonium omnivorum - (Texas).

Lightning injury - (New York ?, Connecticut).

Bitter rot caused by Melanconium fuligineum (New Jersey)

Necrosis caused by Cryptosporella viticola - Fusicoccum viticolum - (New Jersey, New York, Ohio, Pennsylvania).

Sun scorch - (Porto Rico).

STRAWBERRY

Rhizopus rot caused by Rhizopus nigricans

Reported in the field and in transit from several important strawberry states. Weather conditions seem to have controlled the amount of rot in the patch, while the condition of the berries before shipment and the condition in cars factored in the rotting en route. In one case it was reported that large berries rotted much more than small ones. From 15% to 75% rot in single cars not uncommonly observed. "Leaking" commonly mentioned in reports.

Gray mold rot caused by Botrytis (cinerea?)

Reports indicate that Botrytis rot was not serious in fields except where it was cloudy and rainy toward ripening. Observations cover eastern and southern United States. No reports of it from the Pacific Coast. In Canada it was serious, reducing the whole crop by at least 10% (McCubbin).

Leaf blight caused by Mycosphaerella Fragariae (Schw.) Lindau.

Apparently leaf blight, or leaf spot, occurs wherever the strawberry grows but serious injury is not common, according to 1918 reports. In some cases a considerable percentage of leaves showed infection but damage to the crop was not appreciable. An interesting case was reported from Michigan by Woodcock:- two fields showed 10% and 20% of the leaf area decreased by spotting, but there was no evident decrease in yield.

Dates when first observed:- May 22, Georgia, Minnesota; May 20, Pennsylvania; June, Wisconsin.

The Klondike was very susceptible in Florida and Texas but resistant in Louisiana. The Missionary was resistant in Florida (locally). In Missouri the Aroma is more resistant than the Candy.

Generally little or nothing is done to control the disease in home gardens. In Hammond, La., the diseased leaves are stripped from plants at setting; in Iowa, cutting and burning vines immediately after harvest is practiced. The disease has only recently made its appearance in Iowa.

Other Diseases

Powdery Mildew caused by Sphaerotheca humuli - (Canada, Missouri, Nebraska, New Hampshire, New Jersey, New York, Pennsylvania, Ohio).

Rot caused by Phyvarum cinereum - (Nebraska); Diachea leucopoda - (Louisiana); Patellina - (Arkansas).

Anthracoze caused by Gloeosporium sp. - (Massachusetts).

Leaf Spot caused by Marssonina potentillae - (New Jersey); cause ? new - (Florida).

Rhizoctonia sp. - (Washington).

RASPBERRY

Anthracoze caused by Plectodiscella veneta Burkholder
(=Gloeosporium venetum Speg.)

Reported from Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, Minnesota, Missouri, Arkansas, Kansas and Washington. It was a common disease in these states and in some places was destructive. Losses were reported as follows:

Minnesota - about 1%, New York - 5%, Ohio - 20% near Cleveland.

Black raspberries were reported as usually more susceptible than red varieties in New York.

Yellows (cause unknown).

Yellows was reported from Maine, Massachusetts, New York, Pennsylvania, Ohio, Illinois, Michigan and Minnesota. Possible losses of 1 or 2% of the raspberries in Massachusetts and 25% of the red varieties in New York are estimated.

The disease was first noticed as follows:

May 16 - Pennsylvania, June 12 - New York, June 28 - Minnesota.

Red varieties are susceptible and blackcaps resistant in New York.

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

This disease was reported from Massachusetts, New Jersey, Pennsylvania, Ohio, Michigan, Arkansas, Kansas, Washington and Ontario, Canada. It is said to have caused from 1 to 2% loss in Massachusetts and 15% locally in Pennsylvania. It was reported as severe in Arkansas and severe generally near Cleveland, Ohio, causing as much as 20% reduction in yield. The fungus was found causing a canker of young apple trees in Kansas. (See apple, page 16).

Spur blight caused by Mycosphaerella rubina (Pk.) Jacz.

Reported from Pennsylvania, Wisconsin (general, as usual), Minnesota (general, rather more than last year), and Washington.

A loss of 2% is estimated for Minnesota. In this state the King and Guthbert varieties are reported susceptible and the Minnesota as resistant.

Other Diseases

Crown gall caused by Bacterium tumefaciens Sm.&Townsh. - Common. In 1918 it was reported from Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Minnesota, Washington, and Ontario, Canada.

Leaf spot caused by Septoria rubi Westd. - Reported in slight amounts from New York, New Jersey, Wisconsin, Missouri and Kansas.

Rust caused by Gymnoconia interstitialis (Schl.) Lag. - Reported from various states in northeastern United States and Canada. (See blackberry).

Armillaria mellea - Reported from Washington.

Wilt thought to be caused by Verticillium sp. - Reported by Chas. Chupp as common in Schenectady County, N. Y. The organism seems to be the same as the one on eggplant.

Botrytis - Reported by N. E. Stevens on fruit growing near Albany, N. Y., (July 25) and in Androscoggin County, Me. (August). Reductions in yield of 20% and 10% were estimated.

Mosaic - Reported by E. W. Olive as severe on certain forms in the lower Hudson Valley, N. Y.

A leaf curl of uncertain cause - Reported by W. A. McCubbin as widespread and often causing serious losses in Ontario, Canada. A survey showed about 7% of the plants to be diseased.

A rust said to be caused by Phragmidium imitans - Reported by F. D. Heald and B. F. Dana from Washington.

Sphaerotheca humuli - Reported from Minnesota.

Winter injury - Reported from Vermont (25% stalks killed), New York, and Canada (10% crop killed).

BLACKBERRY

Orange rust caused by Gymnoconia interstitialis (Schlecht.) Lagerh. and Kunkelia nitens

It is apparent that these rusts are confused in some states. Kunkel states that the long-cycled blackberry rust (Gymnoconia interstitialis) is more common in the north and in cooler mountainous regions along the Atlantic Coast. The short-cycled rust (Kunkelia nitens) is the prevailing species in the south. Of course both species overlap and both are found in West Virginia and north as far as the latitude of New York. In Maine, Dr. Kunkel has not found the short-cycled form. Data relative to the range and occurrence of these two species are still meager from several parts of the United States. In 1908 rusts of blackberries were reported from the following states: - Maine, Vermont, Massachusetts, New York, New Jersey, Pennsylvania, West Virginia, Tennessee, Georgia, Alabama (wild blackberry), Mississippi, Texas, Oklahoma, Arkansas, Ohio, Minnesota, Missouri, Kansas, Washington. Dr. Kunkel is anxious to receive specimens of blackberry and raspberry rust from any source, particularly from the Pacific Coast and the Rocky Mountain states. Material in condition for spore-germination is especially desired.

Leaf spot caused by Septoria rubi Westd.

Reported from New Jersey, Pennsylvania, West Virginia, Ohio, Texas, Missouri, Kansas and Minnesota. In no state was it said to cause any special loss.

Other diseases.

Anthracose caused by Plectodiscella veneta Burkholder = Gloeosporium venetum Speg. - Reported from New Jersey, Pennsylvania, Ohio, Texas and Washington.

Crown gall caused by Bacterium tumefaciens - Reported from Ohio, Texas, Oregon and Washington. No serious losses reported.

Yellow late rust caused by Kuehneola albida (Kuehn.) P. Magn. - Reported from Hammond County, La., on variety Wilson.

Cane blight caused by Leptosphaeria coniothyrium (Fckl.) Sacc. - Reported from Ohio and Washington.

Winter injury - Common in some of the northern states. Vermont reported a loss of 25% of the canes.

CURRENT

Rust caused by Cronartium ribicola Fisch. von Waldh.

This rust was reported to the Survey by collaborators from Maine, Massachusetts, Connecticut (on red, yellow and black currants), and New Jersey. A report from Ontario, Canada, indicates a reduction in yield in many places where the plants were badly attacked in previous years. The above states however report the injury to currants to be very slight. (See white pine blister rust in later report for further information.)

Leaf spot caused by Mycosphaerella grossulariae (Fr.) Lind.

Leaf spot was reported from Massachusetts (general, very slight damage), New York (common, first observed June 10 in Orange County), New Jersey (very common), Pennsylvania (first observed May 15 in Erie County), Ohio, Missouri (rather severe where observed), and Minnesota (trace).

Anthracose caused by Pseudopeziza ribis Klebahn.

Reported in 1918 from Massachusetts (1/2% loss), New York (slight), Ohio, Minnesota (trace), and Washington.

Other diseases.

Cane blight caused by Botryosphaeria ribis Grossenbacher & Duggar - Reported as very destructive in the southern part of New Jersey and severe locally in parts of Virginia. It was also reported from Stark County, Ohio.

31
Powdery mildew caused by Sphaerotheca mors-uvae (Schw.) B. & C. - Reported from Minnesota and Ontario, Canada. In Ontario it caused considerable damage to new growth in the few plantations where it occurred.

Nectria cinnabarina - Reported on currants in Minnesota and Ohio.

Angular leaf spot caused by Cercospora angulata Winter - Reported as occurring in small amounts in Minnesota.

GOOSEBERRY (See also currant).

Anthracnose caused by Pseudopeziza ribis, was reported from New Jersey and Minnesota.

Leaf spot caused by Mycosphaerella grossulariae (reported as Septoria ribis) occurred in New York, New Jersey, Ohio and Minnesota.

Powdery mildew caused by Sphaerotheca mors-uvae reported from New York, Washington, and Oregon (general but not so serious as usual).

Rust said to be caused by Puccinia ribis was reported from Ohio and Minnesota.

Rust caused by Oronartium ribicola reported from Connecticut. (See, also, currant, page 36 and pine in later report.)

Nectria cinnabarina reported from Minnesota (trace).

DISEASES OF SUBTROPICAL FRUITS

CITRUS

Scab caused by Cladosporium citri Masee.

Reported from Florida (about normal prevalence, traces in most every orange and grapefruit orchard, striking examples of high relative susceptibility of sour orange (Citrus aurantium) as compared with sweet orange and grapefruit), Alabama (scattered and slight on Satsuma), Porto Rico (caused heavy losses as usual) and Santo Domingo (heavy infection on sour orange. The disease will cause a serious handicap to grapefruit culture should it be taken up). Scab was found in one car of Florida grapefruit affecting 18% of fruit, also noted in one car of oranges which were probably of foreign origin.

Wither tip caused by Colletotrichum gloeosporioides Penz.

Wither tip was reported from Florida, Porto Rico, Mississippi and Texas. In Florida it was more prevalent than usual owing to the weakened condition of the trees which resulted from severe winter, and dry late spring and early summer. In Porto Rico it was common in all its forms but no serious outbreaks were reported.

Melanose caused by Phomopsis citri Fawcett.

Melanose was reported from Florida (about as usual) and Porto Rico (on grapefruit, known to occur in two groves). As a stem end rot it was more prevalent than usual in Florida, developing abundantly in some places. (See table I for losses in shipment.)

Foot rot caused by Phytophthora terrestris Sherb.

Foot rot was reported as occurring as usual in Florida. Sour stocks are mentioned as being immune. A similar disease was reported as being prevalent in a few groves in Porto Rico where it is being overcome by the use of resistant sour stocks.

Blue mold rot caused by Penicillium sp.

Blue mold rot has doubtless been greater than usual, partially because of careless handling of fruits by inexperienced help. The losses from this rot were large, being only exceeded by stem end rot. The accompanying table shows the percentages of rot found in Citrus inspected at various markets in the United States from May 1, 1918 to December 31, 1918.

Table I. Percentages of blue mold rot, caused by Penicillium sp., and stem end rot caused by Diplodia sp. and Phomopsis citri, as found by market inspection at various northern markets.

Source	Orange				Grapefruit				Lemon			
	No. cars inspected.	No. cars	% rot	No. cars	% rot	No. cars inspected.	No. cars	% rot	No. cars	% rot	No. cars	% rot
Alabama	1	1	15	-	-	-	-	-	-	-	-	-
Calif.	13	13	18	1	32	-	-	-	-	-	5	12
Florida	115	8	52	10	42	41	3	23	1	38	-	-
		35	18	11	16		11	6	7	15	-	-
		18	5	13	4				7	5	-	-
		61	18	34	19		14	9	15	14		
Source unknown	6	1	48	-	-	6	1	3	-	-	-	-
		1	9	-	-							
Italy	-	-	-	-	-	-	15	-	-	-	11	20
											5	7
Total and Av.	135	77	19	35	19	47	15	9	15	14	16	9

Other diseases and injuries.

Black rot or blossom end rot caused by Alternaria citri - Reported by H. E. Stevens as being unusually prevalent in Florida. In some cases considerable injury was reported. The disease heretofore has not been considered serious.

Fruit rot of grapefruit and orange caused by Diplodia natalensis Evans - Caused heavy losses as usual to harvested fruit in Porto Rico. (See also Table I).

Blossom end rot of orange caused by Fusarium sp. - Reported from Porto Rico as less prevalent than usual.

Rust of breadfruit caused by Uredo artocarpi Arth. - Reported by Stevenson from Porto Rico.

Frenching or mottle leaf - Reported from Florida (unusually prevalent in some orchards) and Porto Rico (very prevalent).

Scaly bark caused by Cladosporium herbarum, var. citricolum Fawcett - Reported from Florida and Porto Rico.

Black melanose, cause unknown - Reported from Florida and Texas.

Sooty mold - Reported as prevalent in Brevard County, Florida.

Leaf spot caused by the parasitic alga Cephaleuros virescens - Reported from Porto Rico.

Pink disease caused by Corticium salmonicolor B. & Br. - Reported from Porto Rico.

Brown rot caused by Pythiacystis citrophthora - Noted in five lots of Italian lemons, four cars averaging about 4% infection; the other car containing 38% decay. One car of California oranges averaged 15% brown rot.

Gray mold, probably due to a species of Botrytis - Reported as causing serious decay in a car of California oranges, complete decay ranged from 50% to 90%, most affected oranges being totally decayed.

PINEAPPLE

Fruit rot caused by Thielaviopsis paradoxa (De Seyn) v. Hohn.

Table II. Losses to pineapple from fruit rot caused by Thielaviopsis paradoxa as shown by inspection of cars by the Bureau of Markets, 1918.

Origin of shipment	No. of cars inspected	No. of cars with fruit rot	Percent affected fruit	Remarks as to seriousness of decay
Florida	4	3	1 car 100%	Total decay, a slimy mass.
			1 " 12-75%	190 crates - 75% total decay,
				127 crates - 12-15% total decay
				and 15-18% decayed spots.
			1 " 40%	Decay in spots which made stock
				worthless
Cuba	17	17	5 " 40-90%	From 5 to 20% complete decay in
				each car, balance in spots.
			4 " 10-25%	Mostly complete decay in each car.
			8 " ----	From 2 to 3 completely decayed
				fruit in each crate.
Origin unknown	7	6	3 " 60-95%	35-40% worthless in 2 cars, 60%
				worthless in third car.
			2 " 18-30%	Affected fruit worthless.
			1 " 8%	-----
Total	28	26	Average 48%	

According to J. A. Stevenson Thielaviopsis paradoxa occurs practically all over Porto Rico on pineapple and sugar cane. All pineapples become affected if they are allowed to come to full maturity. Since the commercial crop is picked and shipped green, however, by far the greatest loss occurs after the fruit has left the Island. The conditions in the holds of the vessels in which the fruit is shipped, are extremely favorable for infection, with the result that much fruit rots aboard ship and during the later processes of transportation and marketing. As will be seen from the foregoing table the amount of rot in pineapples arriving at northern markets is enormous. A high percentage of decay can be counted on in almost every car.

FIG

Rust caused by Physopella fici (Cast.) Arth. = Uredo fici Cast. was reported from Florida (about as usual) and Texas. J. A. Stevenson also reported it on the few fig trees that are able to exist in Porto Rico and Santo Domingo.

The disease has been reported to the Survey Office in the past as follows - North Carolina (1908), Georgia (1915), Florida (1907, 08, 14, 17), Alabama (1908, 12, 13, 14, 16), Mississippi (1909, 10, 16), Louisiana (1907-1916), Texas (1908, 09, 13-17).

Anthracoïse caused by Glomerella cingulata (Stoneman) Sp. & Von S. was reported from Louisiana (occasional and slight) and Texas.

DISEASES OF NUTS

PECAN

Scab caused by Fusicladium effusum Wint.

Scab was reported as general in South Carolina, Georgia, Florida, Alabama, Mississippi and Louisiana. It seemed to be less serious in Louisiana than in the other states. In South Carolina 50% of the crop was reported injured and 10% lost while in Georgia 1-2% reduction in yield is reported.

In Georgia and Mississippi the Van Dieman variety was reported as most susceptible. Mobile, Delmas (90% infected) and Georgia Grant were also susceptible in Georgia, while Foucher and Pabst were less so.

Rosette (non-parasitic).

Rosette was general and serious in South Carolina and Georgia, and of slight importance locally in Florida, Alabama, Louisiana and Arkansas.

In South Carolina it is said to be the worst pecan disease affecting about 10% of the trees and probably causing a loss of nearly 3%. In Georgia 50% of the trees are often affected in individual groves. The loss for the state, however, is not great.

The relation of the occurrence of the disease to shallow soils underlaid with hard pan is very evident in Georgia. The benefit of using barnyard manure is also clearly shown in numerous instances in that state.

Powdery mildew caused by Microsphaeraalni (Wallr.).

Reported from South Carolina, Georgia, Florida and Alabama as common but causing slight or no loss, According to G. L. Peltier the budded varieties seem to be becoming more susceptible to mildew.

Other diseases.

Black pit, an apparently non-parasitic trouble, is reported from Georgia by J. B. Berry on Schly and Delmas varieties. The hull and shell split lengthwise and the kernel turns black and dries up. A 5% loss of the above varieties is estimated in Georgia.

Die back caused by Botryosphaeria berengeriana De Not was reported as less prevalent than usual in Florida.

Winter injury was severe in parts of Mississippi. It is probable that there was considerable in other states also.

WALNUT

Bacterial blight caused by Bacterium juglandis was reported from Oregon by H. P. Barss as follows, - "Rather lighter attacks than usual, but in many plantings this year the disease caused a loss of a quarter or more of the crop. No section of the state seems free of the disease."

One record of its occurrence on English Walnut in Virginia is also at hand.

