U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF PLANT INDUSTRY—BULLETIN NO. 226.
B. T. GALLOWAY, *Chief of Bureau.*

A PLANT-DISEASE SURVEY IN THE VICINITY OF SAN ANTONIO, TEXAS.

BY

FREDERICK D. HEALD AND FREDERICK A. WOLF,
Experts.

ISSUED JANUARY 24, 1912.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1912.

BUREAU OF PLANT INDUSTRY.

Chief of Bureau, BEVERLY T. GALLOWAY.
Assistant Chief of Bureau, WILLIAM A. TAYLOR.
Editor, J. E. ROCKWELL.
Chief Clerk, JAMES E. JONES.

COTTON AND TRUCK-CROP DISEASES AND SUGAR-PLANT INVESTIGATIONS.

SCIENTIFIC STAFF.

W. A. Orton, *Pathologist in Charge.*

H. A. Edson and J. B. Norton, *Physiologists.*
W. W. Gilbert, L. L. Harter, H. B. Shaw, and F. J. Pritchard, *Assistant Pathologists.*
C. F. Clark, G. F. Miles, Clara O. Jamieson, and Ethel C. Field, *Scientific Assistants.*
E. C. Rittue and Joseph F. Reed, *Assistants.*
F. A. Wolf, W. B. Clark, and H. W. Wollenweber, *Experts.*

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., June 5, 1911.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 226 of the Bureau series the accompanying manuscript entitled "A Plant Disease Survey in the Vicinity of San Antonio, Texas," submitted with a view to publication by Mr. W. A. Orton, Pathologist in Charge of Cotton and Truck-Crop Diseases and Sugar-Plant Investigations.

This bulletin gives the results of work done by the authors, Dr. Frederick D. Heald, professor of botany, University of Texas, and Mr. Frederick A. Wolf, tutor in botany, University of Texas. The work was undertaken at the request of Mr. C. S. Scofield, Agriculturist in Charge of Western Agricultural Extension, who desired a preliminary survey of the plant diseases of this region to be made as a part of the work of the San Antonio Experiment Farm.

Respectfully,

Wm. A. Taylor,
Acting Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

PLATES.

TEXT FIGURES.

B. P. I.—685.

A PLANT-DISEASE SURVEY IN THE VICINITY OF SAN ANTONIO, TEXAS.

INTRODUCTION.

During the summer and fall of 1909 and the winter and spring of 1910 a plant-disease survey was made of a portion of Texas in the vicinity of San Antonio. The object of this work was to determine the diseases which were prevalent with a view to a later and more detailed investigation of those which are either new or imperfectly known.

The emphasis has been placed upon the diseases of plants due to bacteria, fungi, or other parasites, but environmental factors have not been overlooked. The field is an exceedingly fruitful one, since but little has been published concerning the parasitic fungi or plant diseases of this part of the country. Besides the report of Jennings (34),[1] issued some years ago, and a short list by Cooke (9), but few scattered records of Texas fungi exist. It will not be surprising, then, if a detailed examination of a restricted area should show many new and interesting forms.

The work outlined in this report was carried out by the writers, with headquarters at the University of Texas. Acknowledgment is here made of the helpful suggestions of Mr. W. A. Orton. Mrs. F. W. Patterson, and Miss E. C. Field, of the Department, have very kindly assisted in working over the doubtful specimens and in the determination of most species which appeared to be new, with the exception of the Uredinales, which were submitted to Mr. F. D. Kern, Lafayette, Ind. Several specimens were also referred to Prof. C. H. Peck, Albany, N. Y. In addition, the senior writer visited the herbaria at Washington and the New York Botanical Garden in order to compare our material with their collections which are rich in type specimens.

Specimens have been deposited in the herbarium of the University of Texas, at Austin, while duplicates, including type specimens,

[1] The serial numbers in parentheses used in this bulletin refer to the index to literature, pp. 107–108.

have been placed in the herbarium of pathological collections, Bureau of Plant Industry, Washington, D. C. New species have been described as such in different numbers of Mycologia.

TERRITORY COVERED BY THE SURVEY.

The territory covered by this survey is included within a circle having a radius of 100 miles from San Antonio. One trip was made to the south of this region, and collections were made at Falfurrias and Alice, outside of the territory described. The accompanying map (fig. 1) shows the territory studied, and all of the points at which collections were made are indicated by name and solid black circle. It will be observed that more attention was paid to the eastern and southeastern portions of the territory than elsewhere. The explanation for this will be evident by reference to the discussion of crops, native vegetation, and topography of the region.

PHYSIOGRAPHY AND SOILS.

The region studied occupies the coastal plain of Texas in the south and east and extends into the Edwards Plateau and Llano country in the northwest. It is traversed diagonally, beginning in the northern part, by the Colorado, Guadalupe, San Antonio, Medina, Frio, and Nueces Rivers, most of which rise in the edge of the Edwards Plateau and cross the coastal plain to the gulf. A gradual rise characterizes the elevation from the low coastal prairie in the southeast to the rough mountain country of the Edwards Plateau in the northwest. Table I shows the elevations for different stations.

TABLE I.—*Elevation for principal stations.*

Less than 250 feet.	250 to 500 feet.	500 to 1,000 feet.	Over 1,000 feet.
Beeville, 225.	Flatonia, 465.	Austin, 598.	Blanco, 1,350.
Cuero, 177.	Gonzales, 299.	Georgetown, 750.	Boerne, 1,412.
Hallettsville, 235.	Luling, 418.	Hondo, 901.	Fredericksburg, 1,742.
Victoria, 187.	Runge, 308.	New Braunfels, 720.	Kerrville, 1,650.
		Sabinal, 964.	Llano, 1,040.
		San Antonio, 701.	
		San Marcos, 588.	
		Uvalde, 937.	

The region under consideration includes part of the three units of the coastal plain. In the extreme southeastern portion, in Victoria, Goliad, and Bee Counties, may be found the interior border of the coast prairie region, which is flat, low lying, and generally treeless, with the exception of the river valleys. In parts of this area the

mesquite and other timber is encroaching upon the prairies where its natural spread is not held in check by agricultural development.

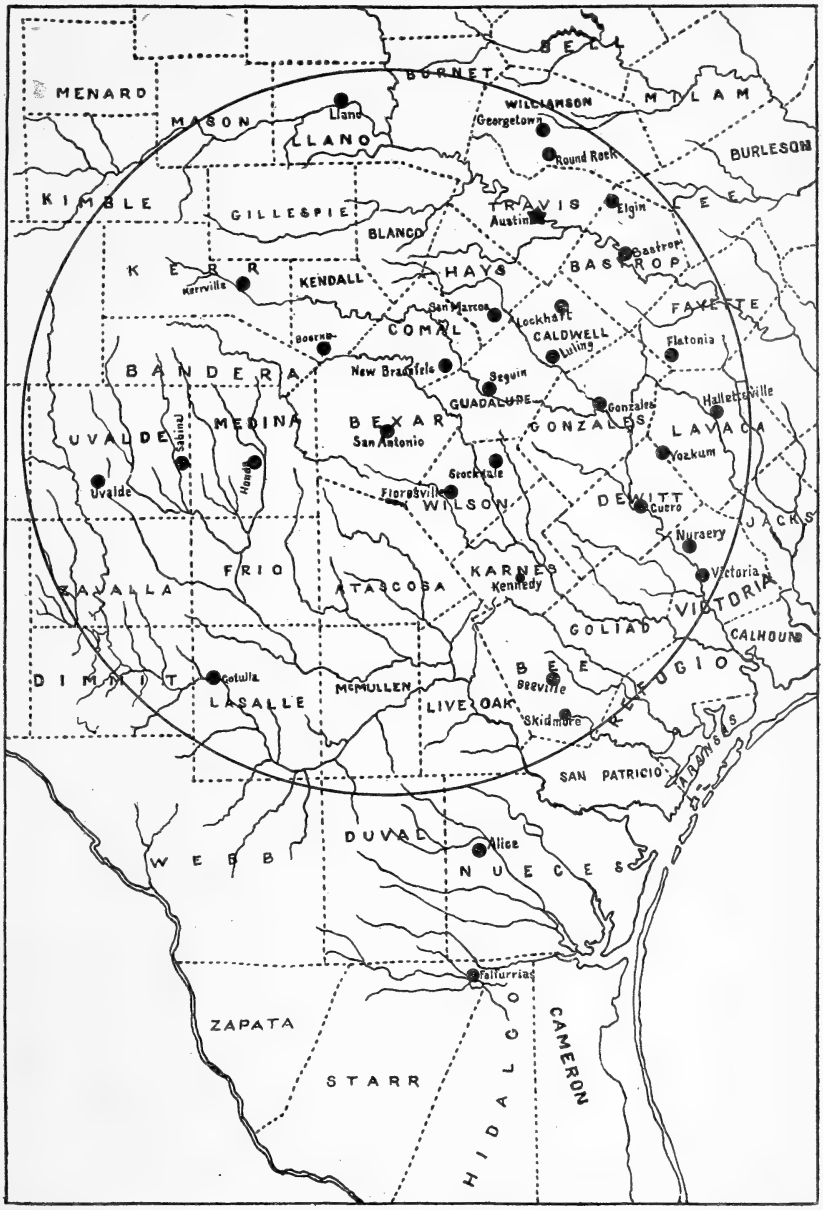


FIG. 1.—Map of a part of the State of Texas, showing the territory covered and places visited in connection with the plant-disease survey.

The prevailing soils in this area except in the bottom lands are stiff, waxy clays, generally with an impervious clay subsoil, and

ranging in color from black to chocolate. They are of residual origin.

The coast prairie region is succeeded by the Tertiary forested area, which extends from Bastrop County in the northeast to the southwest. It includes a considerable part of the post-oak lands of the lignitic belt. The region is much more hilly than the coast prairies, and the rise in elevation is gradual. The southern portion is level or only slightly rolling and less forested than the more hilly northern part.

The soils in this area are mainly residual, varying according to the character of the underlying formation. In various localities may be found sands and sandy loams well adapted to truck crops, as in portions of Bastrop, Caldwell, Gonzales, and Wilson Counties. Clays and clay loams may also be found, while rich alluvial soils occur along the river valleys.

A narrow extension of the rich Cretaceous prairies of northern Texas extends southward through Williamson, eastern Travis, Hays, Comal, and Bexar Counties. The typical soil is black and waxy, derived from the underlying Cretaceous chalks, clays, and marls. The land is exceedingly fertile and produces good yields of cotton and corn when there is sufficient rainfall.

The region investigated includes a small part of the Llano country, in the northwest along the Colorado and Llano Rivers and north of the Edwards Plateau. The region is rough and hilly, with low mountains, the elevations ranging from 1,000 to 1,800 feet. The underlying rocks are largely granite. In many places they are sparsely covered with soil, but the valleys in many localities have fertile soils suitable for the culture of a variety of crops.

The northwestern portion of the region south of the Llano country is occupied by the southern extension of the Edwards Plateau. The region extends west and northwest from the Balcones escarpment, a line of cliffs or hills which terminate abruptly just west and north of a line connecting Austin, San Antonio, and Uvalde. In contrast to the Llano country, the region is essentially a limestone country and is rough and rugged, being cut by the rivers which have their source in this region. The rivers which cross the area under investigation either originate in the Edwards Plateau or rise at the base of the escarpment. The Edwards Plateau is poorly adapted to agriculture, since it is a rugged, hilly country, with scant soil in many places and a rainfall which ranges from 20 to 25 inches.

CLIMATOLOGY.

RAINFALL.

The rainfall of the territory under investigation decreases progressively from the eastern border to the northwest and southwest, reaching the lowest limit in the southwest. The average annual rainfall in Lavaca County in the extreme eastern portion of the section is more than 30 inches, while at Llano, in the low mountain country in the northwest, the average annual rainfall is only about 22 inches. In the extreme southwestern portion some localities report as low an average as 20 inches or somewhat less.

TABLE II.—*Annual precipitation for 1909 in the region of San Antonio, Tex.*

Stations.	Total precipitation.	Departure from normal.	Stations.	Total precipitation.	Departure from normal.
	Inches.	*Inches.*		*Inches.*	*Inches.*
Austin	20.57	−13.78	Kerrville	26.02	− 3.83
Beeville	30.81	+ 1.25	Luling	21.26	− 7.93
Blanco	24.13	− 5.31	Marble Falls	21.14	.....
Boerne	25.76	− 6.11	New Braunfels	19.66	−10.45
Cuero	23.43	−10.66	Rossville	16.59	.....
Falfurrias	25.42	.....	Runge	18.94	−11.29
Flatonia	28.42	.....	Sabinal	19.34	.....
Fredericksburg	21.86	− 6.52	San Antonio	14.92	−11.91
Georgetown	19.68	−15.79	San Marcos	29.81	− 1.51
Gonzales	24.53	.....	Taylor	20.72	−14.75
Hallettsville	31.93	− 1.22	Uvalde	18.19	.....
Hondo	17.54	−10.53	Victoria	33.58	− 2.96

Table II shows that the total rainfall for the year varied from 14.92 inches at San Antonio to 33.58 inches at Victoria. All stations except Beeville show less rainfall than normal, the departure varying from about 4 to 15 inches in the greater portion of the territory.

For the year 1909 only a narrow strip of territory about 25 miles in width, occupying the extreme southeastern portion, had a rainfall slightly over 30 inches. (See fig. 2.) The greater part of the territory north of Bexar County had a rainfall of 20 to 30 inches, while a strip 25 or 30 miles wide lying just west of the more humid southeastern portion had a rainfall similar to the northern half. In a small area at the extreme north in Williamson County the rainfall was only 10 to 20 inches. The extreme west and the entire southwest had a rainfall of 10 to 20 inches with the exception of a small part of Zavalla and Dimmit Counties, where it dropped to less than 10 inches. From the above it may be seen that about one-half of the entire area had a total annual precipitation ranging from 10 to 20 inches.

TEMPERATURE.

Table III shows an average mean temperature for the year ranging from 66.1° in the low mountain country of the Edwards Plateau to 72° in the southern portion.

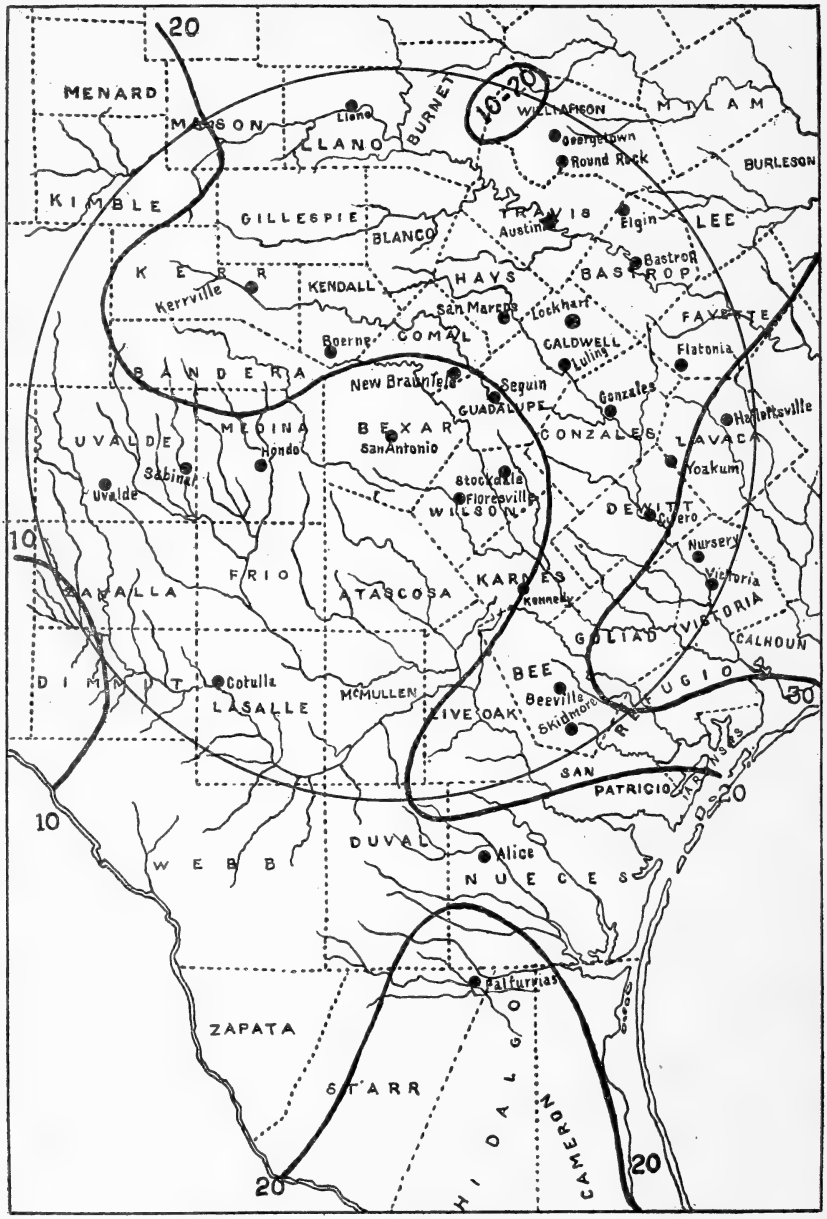


FIG. 2.—Map of that part of the State of Texas presented in figure 1, showing the rainfall for 1909.

TABLE III.—*Maximum, minimum, and mean temperatures for 1909 in the region of San Antonio, Tex.*

Station.	Maximum.		Minimum.		Mean.
	Date.	Temperature.	Date.	Temperature.	
		°F.		°F.	°F.
Austin	Aug. 19	102	Jan. 11	19	67.9
Beeville	...do....	106	...do.....	23	72.0
Blanco	Aug. 18	107	Jan. 12	14	66.1
Boerne	Aug. 19	109	Feb. 16	14	67.5
Cuero	Aug. 20	109	Jan. 12	21	71.2
Falfurrias	Aug. 18	107	Feb. 16	23	74.1
Flatonia	...do....	107	Jan. 12	18	70.5
Fredericksburg	...do....	104	...do.....	11	66.8
Georgetown	...do....	112	...do.....	16	67.4
Hallettsville	Aug. 20	104	Jan. 11	20	71.0
Hondo	Aug. 18	108	.....	.....	.....
Kerrville	Aug. 19	105	Feb. 16	11	66.6
Luling	Aug. 18	105	Jan. 12 Feb. 15	19	69.5
New Braunfels	Aug. 19	105	Jan. 12	19	69.5
Rossville	...do....	108	Dec. 19	20	72.1
Sabinal	Aug. 4	110	Jan. 12 Feb. 16	21	72.0
San Antonio	Aug. 20	107	Jan. 12	20	70.3
San Marcos	Aug. 18	105	...do.... Feb. 15	19	68.4
Taylor	...do....	109	Jan. 12	15	68.0
Uvalde	...do....	110	Jan. 13 Feb. 16	21	71.6
Victoria	...do....	101	Feb. 15	22	71.0

The month of August was marked by excessive heat, some localities showing a temperature as high as 110° to 112° F. The continuance of the high temperature for several days following or subsequent to the maximum recorded was general for the entire territory. The continued high temperatures and the lack of the customary amount of rainfall caused a very considerable decrease in crop yields. Throughout the area cotton did not make half a crop, many fields of corn were a total failure, and other vegetation suffered in a corresponding degree.

EVAPORATION.

The relative total evaporation for the vicinity of San Antonio is high, with a rate between that of a desert center and a deciduous forest.

Table IV shows the average daily evaporation in inches for the year 1909, and the first three months in 1910, at the San Antonio Experiment Farm. The data were obtained from Mr. C. S. Scofield, who recorded the daily evaporation from an open-air tank.

TABLE IV.—*Average daily evaporation at San Antonio Experiment Farm.*

Month.	Evaporation.	Average for—	Month.	Evaporation.	Average for—
1909.	*Inch.*		1909.	*Inch.*	
January	0.103	Entire month.	October	0.182	Entire month.
February	.149	Do.	November	.127	Do.
March	.188	Do.	December	.092	Do.
April	.235	26 days.[1]			
May	.237	Entire month.	1910.		
June	.331	First 27 days.	January	.090	First 24 days.
July	.357	Last 25 days.	February	.103	Last 26 days.
August	.274	First 30 days.	March	.191	Entire month.
September	.241	Entire month.			

[1] No records for Apr. 17, 18, 19, 20.

CROPS AND NATIVE VEGETATION.

The climatological character of the San Antonio area excludes certain crops which are extensively grown in more northern localities and in regions of greater rainfall, but makes possible the culture of some crops which are characteristic of semitropic conditions.

FRUITS.

Apple orchards conducted on a commercial scale are excluded. In a few localities small numbers of trees are to be found in family orchards which generally appear to be seriously affected with black-rot. In the sheltered valleys in the low mountain country to the northwest the most favorable conditions for the growth of apples are found. Several nurseries in the territory grow large quantities of apple stock for shipment to old Mexico, Arizona, and the Pecos country in Texas. The young trees in the nursery were unusually exempt from diseases.

Pears are more successfully grown than apples, but commercial orchards are rare. Most of the small pear orchards have been very seriously neglected, and it is not surprising to find them affected with such diseases as black-rot and bitter-rot. With proper care and cultivation pears could be more extensively grown, since they are much freer from fire-blight than in the more humid coast country.

Peaches are common in the eastern half of the territory and are grown to some extent in the sheltered valleys to the west and northwest. The crop for 1909, however, was a complete failure, owing to the severe freezes of the previous winter. The sudden drops in temperature following warm periods which had started vegetative activity killed many peach trees. This condition will explain the rarity of such diseases as brown-rot and peach freckle (*Cladosporium carpophilum*), which are very abundant when there is an average crop. The entire absence of the peach leaf-curl which is so common farther north may be noted. Present records give only a single

instance of this disease in Texas, and that from the northern part of the State (34). The die-back appears to be the most serious disease.

Apricots are grown to some extent where peaches are found, but are rather rare. Plums are not uncommon, but they are grown less than peaches. The crop for 1909 was a failure, and this will explain why the common brown-rot is not reported. The failure of the crop is not, however, the explanation for the absence of "plum pockets," since this disease appears to be absent during normal seasons. Black-knot was not found in any of the localities visited, either on wild or cultivated species. No cherries are grown in this territory, and apparently the only portions of the State where they can be successfully grown are the Panhandle country, the Llano Estacado, and portions of the Red River Valley.

Persimmons are not uncommon, especially in the eastern half of the territory. The various Japanese varieties do well, but the limited demand has prevented their extensive planting. Figs are grown throughout the eastern and more humid portion of the region, although more favorable conditions are found in the humid coast country extending from Beaumont to Brownsville. In many localities visited the fig trees were killed back to the ground by the severe winter, but they generally sprouted up again from the roots. Most of the trees which were not killed failed to produce fruit on account of the abnormally dry season. In many places the half-ripened fruit dried up on the tree. For this reason no information is at hand concerning the prevalence of fig diseases which attack the fruit. Citrus fruits are grown to a limited extent in the extreme southeastern portion, in Victoria and Bee Counties, while some nurseries farther north are growing large quantities of *Citrus trifoliata* stock which is used for the propagation of the Satsuma orange, the variety most commonly grown. Most of the plantings of citrus varieties are only a few years old (33). The date palm is planted to some extent in the citrus-fruit territory, but none of the trees are more than a few years old.

Grapes are quite generally grown throughout most of the territory, and adapted varieties do well when properly cared for. The black-rot is generally prevalent and is apparently responsible for many of the failures which are attributed to drought. Strawberries can be grown in most of the region in sufficient quantity for home consumption, but the main strawberry region lies to the east in the more humid section. In much of the drier portion of this area the plants die out during the long dry period of the summer unless specially protected or grown under irrigation. Blackberries are grown to some extent, but they are relatively rare as compared with dewberries, which are extensively grown throughout the entire area.

Raspberries, currants, and gooseberries are practically unknown in any part of the area studied.

The pecan is a common nut crop in favorable localities. It is native throughout the area, and many large trees may be found along the fertile valleys of the Llano, Colorado, Guadalupe, and Nueces Rivers. Most of the crop is obtained from the natural growth, but some groves have been planted along the river valleys where the rich, deep soil is adapted to their growth.

TRUCK CROPS.

The main truck-growing section of the State lies farther to the east, in Smith, Cherokee, Anderson, Henderson, Rusk, and Angelina Counties, or in the Brownsville district to the south, but nearly all kinds of truck crops are grown to some extent throughout the territory. In nearly all of the localities west of the ninety-eighth meridian truck crops grown without irrigation are uncertain, and most of the localities in the western half of the region do not supply even a sufficient quantity for home consumption.

The principal truck crops which are grown extensively for shipment to northern markets are potatoes, watermelons, and onions. La Salle County produces large quantities of onions, but Webb County, just to the south and beyond the limits of our area, has a much larger acreage. Watermelons are grown commercially in the sandy soils of Bastrop County and in smaller quantities in many other sections. Most of the home gardens have an abundance of okra and peppers and other common vegetables, such as peas, beans, lettuce, radishes, and eggplants. The Kentucky Wonder bean is grown more extensively than any of the wax-podded varieties, and the black-eyed pea (*Vigna unguiculata*) is common in the vegetable garden, being frequently substituted for the less hardy Phaseolus varieties. Cabbage and spinach are grown on a commercial scale in several localities from Austin southward. Spinach is marketed throughout the entire winter even as far north as Austin. The tomato is a common crop in all of the irrigated sections, but produced a light yield during 1909 on account of the excessive heat in the early part of the season, followed by a long period of drought. The greater number of the irrigated truck patches suffered heavy losses from nematodes, and tomatoes were more seriously affected than any other crop. Cucumbers and squashes are quite generally grown, the main varieties of squash being the cushaw and the small bush varieties (cymlings). Asparagus is rare, the only large field observed being at Austin. Its limited culture is apparently due to the lack of demand for this article in the local markets.

FIELD CROPS.

Cotton and corn constitute the main field crops throughout all of the agricultural portion of the region. The western half of the area contains but a small acreage adapted to these crops, and only small yields are obtained even in the more fertile valley lands. In the black-land regions of Williamson County, eastern Travis County, and much of Hays and Comal Counties may be found continuous fields of cotton and corn, with but little land devoted to forage or other crops. Oats is the principal small grain, but wheat is grown to some extent in the more elevated sections of the west and northwest. But little rice is now planted in this area. In recent years the limits of the rice-growing country have been gradually pushed more into the coast region or into the more humid territory to the east.

FORAGE CROPS.

The semiarid conditions which prevail throughout the greater part of the area make the different sorghum varieties the principal crops cultivated for forage. Cane, Kafir corn, and milo maize are extensively grown. In the region surrounding Austin, especially to the north and east, may be found extensive meadows of Johnson grass. Cane and Johnson grass are the most common kinds of hay on the local markets. Alfalfa is grown only to a very limited extent in any portion of the region. In a few localities it is grown without irrigation, but under irrigation it is a very profitable crop, some fields yielding as high as 7 to 8 tons per acre. In some localities in the southern part of the region a number of weedy grasses are cut for hay. Among these may be mentioned *Panicum texanum*, *Echinochloa colona*, and *Eleusine indica*. In some places the weedy grasses grow so abundantly in cornfields that a crop of hay is obtained following the harvesting of the corn. The western half of the area is devoted very largely to stock raising, and many of the 300 species of Texas native and introduced grasses may be found within the territory studied. The most important of the native species are *Bulbilis dactyloides*, *Bouteloua curtipendula*, and various species of Bouteloua and Andropogon. In certain portions of the more eastern part pastures of Bermuda grass are common, and in some places bur clover (*Medicago arabica*) furnishes valuable winter and early spring forage in the same pastures. Bermuda grass is the only species used extensively for lawns.

NATIVE GROWTH.

The greater portion of the territory lying west of the Colorado and west of a line connecting Austin, San Antonio, and Uvalde is

a part of the low mountain country of the Edwards Plateau. A general idea in regard to the character of the vegetation may be obtained from the following quotation (4):

> Its structure and habits indicate that it is a xerophytic or dry-climate vegetation; but though this is true of it as a whole, conditions vary enough to give in some places, as in well-watered and sheltered canyons, a relatively luxuriant growth, while in other situations, as upon stony, arid slopes, there is the scantiest vegetation.

One of the most characteristic features of this area is the extensive cedar brakes along the Colorado from Austin to the northwest and along the upper waters of the Llano, Guadalupe, Medina, Nueces, and Frio Rivers.

The greater part of the region lying south of a line connecting Uvalde, San Antonio, and Skidmore is more level country, much of which was formerly occupied by extensive, open grasslands, but which now shows over much of the territory dense thickets of mesquite, cat's-claw, haujilla, huisache, whitebrush, platyopuntias, cylindropuntias, and similar types of vegetation (5 and 8).

It will thus be seen that the most productive portion of the territory lies largely to the east of a line connecting Austin, San Antonio, and Skidmore, which includes the southern extension of the blackland prairie and the timber belt of east Texas and extends through the Fayette Prairie to the edge of the coast prairie on the southeast.

RELATION OF DISEASES TO ENVIRONMENTAL FACTORS.

The direct relationship between the environmental factors, both edaphic and climatological, and the presence or absence of diseased conditions of the vegetation is very evident. No one condition due, perhaps, to the character of the soil is more noticeable than chlorosis. It affects practically the entire vegetation, being more evident in the truck fields, nurseries, and peach orchards. No appreciable effect on cotton and corn was noted. Since this chlorotic condition is limited very largely to the Cretaceous prairies and the lime soils of the Edwards Plateau, it is probably a lime chlorosis (38). It is known, too, that continued droughts cause plants to become chlorotic. This would explain in part the greater prevalence of this condition during the past year.

The downy and powdery mildews, which are quite common in the States farther north, are much less evident. The intense sunlight and the high temperatures are no doubt responsible for this. The spores of certain members of the Peronosporaceæ are known to germinate with difficulty in daylight and to exist only in shaded places where the temperatures are excessive. The amount of sunlight can be indicated and partially appreciated from the fact that the actual number of clear or partly cloudy days ranged during 1909 from

203 to 324 and the cloudy days from 41 to 162 (6) in various parts of the territory.

Injury to truck crops and nursery stock was especially severe where irrigation was practiced. Nematodes, which thrive best with an abundant supply of moisture, caused the formation of galls and the consequent improper functioning of the root system. While injury from this source is very general over the territory, it is more pronounced in irrigated fields. In similar places Rhizoctonia was abundantly present on potatoes, tomatoes, okra, and eggplants.

The excessive drought together with the high temperatures produces a languid condition in the aerial parts of the vegetation and thus renders them more susceptible to the attacks of fungi. This would account for the prevalence of leaf-inhabitating fungi, of which the genus Cercospora is an abundant representative. While it is not known that any correlation exists between the presence of this genus and high temperatures, yet it seems more than a coincidence, since Cercospora diseases are not nearly so abundant in the Northern States even in arid places or during seasons of drought.

PLAN OF THE WORK.

The collections for this survey were begun in the fall of 1908. These were entirely in the immediate vicinity of Austin, as were those of a part of the following season. The greater part of the work, of necessity, was performed in the months of July, August, and September, 1909, with a less amount during the succeeding months of that year. Then again, in the spring of 1910 a very considerable proportion of time was given to the field work.

Attention was given primarily to the diseases of cultivated plants, with an attempt to cover all the varieties of field, truck, nursery, and orchard crops. As much time as was possible was given to the consideration of greenhouse and ornamental plants, with reasonable emphasis upon shade and forest trees. The natural vegetation could not be entirely left out of account, however, because of the fact that the same organism may be the cause of diseased conditions in both wild and cultivated forms.

Notes on the symptomatology from field conditions were carefully made in the field at the time of collection. The value of accurate observations in the field in regard to the symptoms attending the progress of the various diseases can not be overestimated. Actual determinations of the causal organism would have been impossible in many instances without them.

Many of the facts which must be incorporated in our future pathologies can not be obtained from dry herbarium specimens, but must be recorded in the field while the patients are still alive and not after they are dead and have been stored away in herbarium sepulchres (30).

Within a few days after the collections were made a preliminary diagnosis was made in the laboratory and the notes were completed, accompanied by drawings and actual measurements when it was deemed advisable. In working over the material at a later date it was occasionally found necessary to change the previous determination. The time available permitted only a limited amount of culture work.

It is not to be supposed that the list is by any means complete. The territory, comprising over 30,000 square miles, is too large to be covered in the time which has been devoted to the work. In view of the diversity of crops grown in the various sections and the fact that similar crops may reach the same stage of maturity over a very considerable range at the same time, and that it has not been possible to make the work continuous throughout an entire year, the incompleteness will be properly emphasized. Enough, however, has been done to be very suggestive and indicative of the profitableness of further work.

DISEASES OF FRUIT TREES.

APPLE.

Black-rot (*Sphaeropsis malorum* Pk.).—This is the most common and serious disease of the apple (*Malus sylvestris* Miller) in this section. The foliage of the young plants in the nurseries was abundantly spotted and many twigs and limbs of the trees in orchards were seriously affected or entirely dead.

Specimens collected: Austin, 460, 1270, 1911; Kerrville, 1598; Boerne, 1651, 1652; Nursery, 2552; Stockdale, 2626; Gonzales, 2659, 2660.

Crown-gall (*Bacterium tumefaciens* Erw. Sm. and Townsend).—Trees about 8 years old were found seriously affected in one locality. A chlorotic condition preceded the death of the tree in each case.

Specimens observed: Llano, 1772.

Leaf-spot (*Cercospora mali* Ell. and Ev.).—The spots caused by this fungus are circular or subcircular, 2 to 5 mm. in diameter, silver gray on the upper surface with a narrow brown border, while on the under surface they are of a uniform brown. Badly affected leaves turn yellow and fall from the trees, or they may show extended brown areas of dead tissue in which the gray spots are quite conspicuous. The conidial tufts are very abundant and conspicuous on the gray centers of the upper surface, showing as minute black specks; they are inconspicuous on the brown ground of the under surface, but are fairly abundant. It may be noted that the original description characterizes the fungus as "epiphyllous" (18), while a careful examination of our specimens reveals the fact

mentioned above. The range in size of the spores may be extended from 60 to 70 by 2 to 2.5 μ to 30 to 75 by 2 to 3 μ.

Specimen collected: Gonzales, 2660.

Powdery mildew (*Podosphaera leucotricha* (Ell. and Ev.) Salm.).—Apparently this disease is not common in this territory. The perithecia were abundant on the stems and leaves of the shoots growing from the base of trees.

Specimen collected: Austin, 1273.

APRICOT.

Die-back (*Valsa leucostoma* (P.) Fr.).—Pustules are formed on the apricot (*Prunus armeniaca* L.) just beneath the outer bark. At maturity these heaps rupture the bark and are exposed. While it has been reported on several species of the genus Prunus, Rolfs (42) mentions its occurrence also on the apricot. Our specimens show only the *Cytospora* stage.

A small orchard of plums, peaches, and apricots at Round Rock was seriously affected with this disease. The trees were about 8 years old. Some had been completely killed, while others were in a badly crippled condition.

Specimen collected: Round Rock, 2424.

Shot-hole (*Cylindrosporium padi* Karst).—The symptoms are the same as for the cherry "shot-hole," the foliage becoming perforated with circular openings.

Bacteria were present in abundance in the dead tissue of the spots, and were apparently responsible for the shot-hole effect. Only a few spores of the fungus were present.

Specimens collected: Austin, 1441; Nursery, 2551.

DATE PALM.

Smut (*Graphiola phoenicis* (Moug.) Poit.).—The smut of the date palm (*Phoenix dactylifera* L.) is confined to the leaves. It produces small protuberances, the sporocarps, on both surfaces. The entire leaflets or considerable portions from the tips downward may be brown and dead in case of severe infections. The sporocarps are dark gray or black, 0.2 to 0.8 mm. in diameter; when mature they rupture and extrude a mass of pale chocolate-brown spores. (Pl. VIII, fig. 1.)

An examination of the herbaria at Washington and at the New York Botanical Garden shows that it has previously been collected in Florida, Georgia, California, and Texas, and in conservatories in various Northern States. It has presumably been introduced from the Mediterranean countries where it is not uncommon (26).

Specimens collected: Beeville, 1849; Victoria, 2525; Falfurrias, 2453.

FIG.

Die-back (*Diplodia sycina* Mont. var. *syconophila* Sacc.).—Trees of the fig (*Ficus carica* L. var.) on which this disease is present have dead branches sometimes extending well down toward the trunk.

Underneath the bark, and often breaking through, are densely aggregated, black pycnidia, 350 to 400 μ in diameter, containing oval to elliptical, brown, two-celled spores, 18 to 35 by 9 to 14 μ.

Specimens collected: Beeville, 1843, Luling, 2242.

Leaf-blotch (*Cercospora fici* Heald and Wolf, 32).—This trouble appears late in the summer, forming large angular or irregular spots on the leaves. The spots are dirty brown above with a darker border and uniformly yellowish brown below. They vary in size from 1.5 to 10 mm., and when confluent may exceed this measurement. The conidiophores are borne in dense fascicles on the upper surface, 24 by 4 μ, and are dilute brown. The conidia are clavate, brown, 60 to 180 by 3 to 4.5 μ, and many septate. (Pl. II, fig. 8.)

The disease was very abundant in several localities, involving half the leaf surface and causing the leaves to fall.

Specimens collected: Victoria, 2501; Cuero, 2593 (type specimen); Flatonia, 2711; Hallettsville, 2784.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—Both mature trees in the orchard and cuttings in the nursery are affected. Sometimes the roots near the surface of the ground are abundantly covered with the galls. On the older trees it is productive of no apparent injury.

Specimens collected: Beeville, 1848; Nursery, 2555.

Root-rot (*Ozonium omnivorum* Shear).—This trouble was observed in two nurseries in which it was very common and productive of serious loss among the cuttings.

Specimens collected: New Braunfels, 1678; Beeville, 1851.

Rust (*Physopella fici* (Cast.) Arth.).—The circular yellowish-brown sori about 1 mm. in diameter are produced in great numbers on the lower surface of the leaves. This disease appears in such abundance in late summer as to cause the yellowing of the leaves and much defoliation.

Specimens collected: Austin, 458; Falfurrias, 2458.

Rusty-leaf (*Cercospora bolleana* (Thm.) Speg.).—Small yellowish-brown spots 1 mm. or less in diameter appear on the foliage. The spots are more prominent and more yellow on the under surface than on the upper. When the spots are abundant a considerable amount

of yellowing of the foliage results. This fungus is responsible for much early defoliation of fig trees. (Pl. II, fig. 7.)

Specimens collected: Austin, 1907; Luling, 2243; Seguin, 2320; Georgetown, 2363; Victoria, 2333; Cuero, 2601; Stockdale, 2643; Gonzales, 2674; Hallettsville, 2787.

ORANGE AND LEMON.

Damping-off (*Phoma* sp.).—This is the most serious trouble of the young plants of *Citrus trifoliata* L. in the nursery. Often a large percentage of the plants will be yellow or completely dry and dead. Near the ground level will be found a sunken area, 12 to 19 mm. long, on which are black dots, the pycnidia. These pycnidia are 150 to 200 μ in diameter and the spores are 5 to 7 by 3 μ. Several plants in the row may be dead and the adjacent plants apparently unaffected. The manner in which the fungus gains entrance is not known. Where the ground has been allowed to remain wet in low places the loss is greatest.

It is not possible definitely to assign this Phoma to any of the many species of Phoma described as occurring on citrus hosts.

Specimens collected: On *Citrus trifoliata* L.—Beeville, 1847; Floresville, 2855.

Leaf-spot (*Cercospora aurantia* Heald and Wolf, 32).—This fungus forms large spots, 6 to 10 mm. in diameter, and suborbicular except when they are marginal. They are dark brown in color with a lighter brown center, and are surrounded by a region of yellow which fades out into the green of the leaf. The conidiophores are formed on the under surface in small groups, brown, septate, 100 to 180 by 5 to 6 μ, showing plainly the points of attachment of the conidia. The conidia are dilutely colored, clavate, 75 to 135 by 4 to 5 μ, and many septate. (Pl. I, fig. 8.)

Specimen collected: On *Citrus aurantium sinensis* L.—Falfurrias, 2446 (type specimen).

Twig-blight (*Diplodia aurantii* Catt.).—The ends of the branches are killed and the black pycnidia which are formed beneath the bark at length protrude.

Specimens collected: On *Citrus trifoliata* L.—Nursery, 2546; Falfurrias, 2447.

Twig-blight (*Sphaeropsis malorum* Pk.).—This fungus has been found on blighted twigs and less frequently on the leaves of *Citrus trifoliata* L. The trouble was observed at the Austin station in a hedge which stood adjacent to some apple trees which were very seriously infected with black-rot.

Specimen collected: On *Citrus trifoliata* L.—Austin, 1324; Cuero, 2596; Falfurrias, 2447; Gonzales, 2677; Nursery, 2544.

Wither-tip (*Colletotrichum gloeosporioides* Penz.).—Both leaves and twigs are attacked. The leaves form brown areas which become

somewhat grayish when the epidermis has been ruptured by the protruding acervuli.

The twigs may be killed back from the tip or along one side, causing the branches to be angular. Some trees were observed on which the disease had worked well down on the trunk.

Specimens collected: (1) On *Citrus limonum* Risso.—Austin, 1443. (2) On *C. aurantium sinensis* L.—Beeville, 1846 (doubtful).

PEACH.

Crown-gall (*Bacterium tumefaciens* Erw. Sm. and Townsend).—Just to what extent this trouble is present on the peach (*Amygdalus persica* L.) is not known. It was observed in two places only.

Specimens collected: Uvalde, 1939; Round Rock.

Die-back (*Valsa leucostoma* (P.) Fr.).—This is the most widely distributed and most serious trouble of the peach. (See also plum and apricot.) The entire tree may be killed or only the smaller branches. Orchards were observed in which nearly all the trees were dead, giving them a very characteristic silvery appearance. The bark is elevated in wartlike nodules covering dark-brown or black pustules. These at length are exposed on the surface. Our specimens show only the Cytospora stage.

Specimens collected: San Antonio, 1368, 3170; Kerrville, 1594, 1596; Boerne, 1644; Beeville, 1825; Elgin, 1873; Bastrop, 2038; Lockhart, 2080; San Marcos, 2122; Seguin, 2288; Round Rock, 2423; Victoria, 2521; Nursery, 2557; Stockdale, 2625; Gonzales, 2670; Flatonia, 2731; Yoakum, 2756.

Freckle (*Cladosporium carpophilum* Thm.).—This disease is general wherever the peach is grown, but was collected only a few times, since the peach crop was almost a complete failure in our territory.

Specimens collected: Austin, 1440; Beeville, 1838; Elgin, 1892; Georgetown, 2362.

Rust (*Tranzschelia punctata* (P.) Arth.).—The rust of the peach shows on the upper surface of the leaves as definite, circular, or subcircular, yellow spots which average about 1 mm. in diameter. The color of the spot on the under surface is the same, but the center of each is occupied by a minute yellowish-brown sorus.

This rust is abundant on peach foliage in some localities and causes defoliation in the latter part of the growing season.

Specimens collected: Austin, 202, 210, 454, 468; San Marcos, 2100; Nursery, 2560.

Shot-hole and leaf-spot (*Bacterium pruni* Erw. Sm.).—This disease is characterized in its typical condition by small, irregular or angular, purplish-brown spots, 2 to 5 mm. in diameter, which are crowded full of bacteria. In some of our collections the spots are less angular and

lack the purple coloration, and the leaves show more or less chlorosis, but only bacteria were found in the dead spots. The diseased tissue frequently drops out, leaving perforations with dead marginal tissue. Rorer (43) has recently shown that the bacterium on the peach is probably identical with the one on the fruit and leaves of the plum, and we have collected the bacterial spots of both hosts from adjacent trees.

Specimens collected: San Antonio, 1365, 1399; Kerrville, 1592; Beeville, 1863; Elgin, 1888; Uvalde, 1933; San Marcos, 2101; Nursery, 2553; Gonzales, 2671.

Twig-blight.—In one locality peach trees were badly blighted, but no indication of die-back was observed. The dead twigs and branches showed an abundance of erumpent pustules which we have referred to *Fusarium sarcochroum* (Desm.) Sacc. It is not probable that this fungus was responsible for the disease.

Specimen collected: Falfurrias, 2456.

PEAR.

Bitter-rot canker (*Glomerella rufomaculans* (B.) Spaul. and Von Schr.).—The cankers caused by this fungus on the pear (*Pyrus communis* L.) have been found in both young and old orchards, and the disease is responsible for a considerable amount of injury. The specimens collected represent rather young twigs, and the cankers show as circular, elliptical, or irregular areas, 1 to 3 cm. long, or they may girdle the twig. In the young stages of development the bark is yellowish brown and slightly tumid and at length cracks away around the margin of the spot, leaving the dead bark more or less isolated. As the spots become older, more or less irregular ruptures are formed; these ruptures are frequently concentrically disposed, while the whole spot becomes somewhat sunken. Only the conidial stage of the fungus was found.

Specimens collected: Kerrville, 1599; Nursery, 2570; Gonzales, 2666; Flatonia, 2714.

Black-rot (*Sphaeropsis malorum* Pk.).—This disease has been observed to cause the characteristic cankers on the branches and the rotting of the fruit.

Specimens collected: Boerne, 1650; Austin, 2219; Georgetown, 2399(a); Nursery, 2572; Stockdale, 2629; Hallettsville, 2786.

Crown-gall (*Bacterium tumefaciens* Erw. Sm. and Townsend).—Collected in an orchard 6 or 8 years old, where about 75 per cent of the trees were dead.

Specimen collected: Llano, 1771.

Fly-speck (*Leptothyrium carpophilum* Pass.).—Minute black specks appear on the fruit, rendering it unattractive.

Specimens collected: Cuero, 2599; Hallettsville, 2794.

Fire-blight (*Bacillus amylovorus* (Burr.) Trev.).—This trouble is rather common in our territory and is responsible for a very considerable amount of damage to the pear trees, blackening the leaves and twigs.

Specimens collected: Austin, 1319; Brenham, 1460; Boerne, 1657; Elgin, 2001; Lockhart, 2081; San Marcos, 2123; Nursery, 2571; Cuero, 2600; Stockdale, 2628; Flatonia, 2713; Hallettsville, 2785.

Leaf-blight (*Cercospora minima* Tracy and Earle.)—This fungus produces irregular angular areas 1 to 10 mm. or more in diameter, brown or sometimes showing a grayish color in older portions, and frequently bounded by the principal veins. Spots may be few in number, or they may be sufficiently abundant to coalesce and nearly cover the leaf. Affected leaves frequently show a considerable amount of chlorosis, and many fall from the tree. In several localities the pear trees were nearly defoliated by this disease.

Specimens collected: Victoria, 2511; Nursery 2541; Cuero, 2605; Gonzales, 2707; Flatonia, 2712; Hallettsville, 2775; Falfurrias, 2454.

Leaf-spot (*Fabraea maculata* (Lev.) Atk.).—These spots are grayish brown, circular, and about 2 to 4 mm. in diameter. The black pycnidia are sparsely present on the upper surface.

Specimens collected: Austin, 364; New Braunfels, 1705; Llano, 1761; Stockdale, 2630.

Rust-spot (*Gymnosporangium* sp?).—These are the Phyllosticta-like infections of a rust. Small circular spots about 2 or 3 mm. in diameter are formed. They are brown with a very dark border and a central dark cluster of spermagonia.

Specimen collected: New Braunfels, 1689.

PERSIMMON.

Black leaf-spot (*Cercospora fuliginosa* Ell. and Kellerm.).—Affected leaves of the persimmon (*Diospyros* sp.) show circular or subcircular spots, 1 to 5 mm. in diameter, on the upper surface black with yellow border; on the under surface purplish black with indefinite border. With maturity of spots the centers on both surfaces may become brown or gray. In some cases the leaves turn yellow and fall, while in others extended brown, dead areas may be produced before the leaf is cast.

Our specimens differ from the original description only in the size of the spots (1 to 2 mm.).

Specimens collected: On *Diospyros kaki* L.—New Braunfels, 1706; Georgetown, 2361; Victoria, 2537; Stockdale, 2642. All specimens except 2361 are immature infections.

Leaf-spot (*Cercospora kaki* Ell. and Ev.).—The spots caused by this fungus (16) are yellowish brown below, with a very dark, almost black border, angular, 2 to 5 mm. in diameter or occasionally larger, the veins frequently marking the edge of the spot. On the upper surface the spots are darker brown with definite dark border, the center becoming grayish and showing numerous black conidial tufts. The affected leaves become chlorotic and fall.

The conidial tufts are epiphyllous, very abundant, almost black, and are composed of a dense aggregate of dark-brown, septate hyphæ, which extend 30 to 45 μ above the leaf surface and produce an aggregate having the appearance of a pseudoparenchyma for an equal distance below the leaf surface. Spores densely fasciculate, olivaceous, nearly straight, 3 to 5 septate, slightly clavate, cells sometimes two guttulate, 45 to 60 by 3 to 4 μ. (Pl. VII, fig. 3.)

Our specimens differ from the type in the size and character of the conidiophores and the colored, definitely septate spores.

The disease was very abundant in the localities where it was observed.

Specimens collected: On *Diospyros kaki* L.—Gonzales, 2651; Hallettsville, 2778.

Leaf-spot and fruit-rot (*Phyllosticta biformis* Heald and Wolf, 32).—The Mexican persimmon is affected by a fungus which produces black pycnidia in clusters upon the upper surface of the leaves. At first they are surrounded by the green tissue, but later a dark-margined spot 2 to 5 mm. in diameter is formed which is grayish with the black pycnidia distinctly visible. The pycnidia show on the fruit as minute pustules or slightly sunken spots, but are not very evident on account of the dark color of the fruit.

The pycnidia on the leaves are globose, 150 μ in diameter, ostiolate, and produce an abundance of hyaline, densely granular spores, 6 by 9 μ. (Pl. V, fig. 8.) The pycnidia on the fruit are much more flattened, are covered by the very thick epidermal wall, and contain spores similar to those on the leaf except that they are dilute brown in color. (Pl. V, fig. 9.)

Specimens collected: On *Diospyros texana* Scheele—Llano, 1739; Austin, 1548, 2896 (type specimen).

PLUM.

Bacterial leaf-spot (*Bacterium pruni* Erw. Sm.).—This is very probably the same organism which has been described in this report as occurring on the peach. It produces on the plum (*Prunus* spp.) irregular dark areas which sometimes show somewhat of a shot-hole effect. This diseased tissue, however, is crowded with bacteria.

Specimens collected: Uvalde, 1934; San Marcos, 2132.

Bacterial twig-canker.—The first indication of the disease on the twigs is the swollen longitudinal ridges of the cortex. In cross section this ridge shows numerous radial rifts extending outward to just below the epidermis. Eventually these radial rifts extend outward through the epidermis, and open longitudinal slits are produced. Bacteria are abundantly present in the cankered tissue. This may be the same organism which attacks the leaves and fruits. It has been previously reported (29) on the twigs. This is a very general trouble of the plums of this section. (Pl. VIII, fig. 3.)

Specimens collected: San Antonio, 1400; Austin, 1433; Seguin, 2290.

Die-back (*Valsa leucostoma* (P.) Fr.).—The symptomatology is identical with a trouble described under the same name as occurring on the peach. This, too, is present to a very considerable extent.

Specimens collected: Austin, 1439; Kerrville, 1597; Beeville, 1862; Seguin, 2285; Round Rock, 2422; Victoria, 2522; Stockdale, 2627; Gonzales, 2669.

Leaf-spot (*Phyllosticta congesta* Heald and Wolf, 32).—On the upper surface of the leaf are very numerous brown areolæ bounded by the veins of the leaf. The lower surface may not be discolored. These minute spots, 0.5 to 0.8 mm. in diameter, fuse. Each contains at its center a single black pycnidium 50 to 125 μ in diameter. The pycnidia contain globular or slightly oval clear spores 6 to 9 μ in diameter.

Specimen collected: Boerne, 1554 (type specimen).

Rust (*Tranzschelia punctata* (P.) Arth.).—The sori are frequently so abundant as to make the leaf seem uniformly chocolate brown. In one orchard the trees were very seriously affected.

Specimens collected: Austin, 450, 467; Cuero, 2595.

Shot-hole (*Cylindrosporium padi* Karst.).—This is the most general trouble of the plum, producing brown, circular areas which drop out, giving the "shot-hole" effect.

Specimens collected: Austin, 449, 1279, 1431; San Antonio, 1387; Brenham, 1461; Kerrville, 1593; Boerne, 1655; New Braunfels, 1704; Llano, 1758; Beeville, 1839, 1850; Elgin, 1882; Bastrop, 2039; Luling, 2244; Seguin, 2291; Georgetown, 2364; Round Rock, 2404; Victoria, 2508; Nursery, 2550; Cuero, 2598; Stockdale, 2620; Gonzales, 2672; Flatonia, 2734; Hallettsville, 2781.

Silver-twig.—The bark on the twigs becomes silvery in appearance. It is found to be infested with the brown septate filaments of a fungus, which grow just beneath the epidermis. The surface cells are raised so as to admit air, thus producing the silvery coloration.

Specimen collected: Falfurrias, 2457.

DISEASES OF SMALL FRUITS.

BLACKBERRY.

Leaf-spot (*Septoria rubi* Westd.).—This disease was observed in only two localities, as the blackberry (*Rubus* sp.) is not commonly cultivated in this section. The foliage was very copiously spotted.

Specimens collected: Llano, 1765; Floresville, 2857.

DEWBERRY.

Leaf-spot (*Septoria rubi* Westd.).—This fungus produces on the dewberry (*Rubus* sp.) purple-margined, grayish-centered spots, 1 to 2 mm. in diameter. It is abundantly present everywhere on both wild and cultivated forms.

Specimens collected: Austin, 375, 1268, 1318; San Antonio, 1364, 3150; Brenham, 1464; Boerne, 1658; New Braunfels, 1693; Luling, 2271; Seguin, 2323; Georgetown, 2360; Victoria, 2514; Gonzales, 2675; Flatonia, 2728.

Leaf-spot (*Cercospora rubi* Sacc.).—Large, brown, irregularly outlined areas characterize this disease. It is perhaps as generally present as the other leaf-spot and as destructive.

Specimens collected: Elgin, 1871; Bastrop, 2058; San Marcos, 2116; Luling, 2246; Round Rock, 2411; Victoria, 2504; Nursery, 2554; Cuero, 2594; Flatonia, 2728; Yoakum, 2763; Hallettsville, 2782.

GRAPE.

Black-rot (*Guignardia bidwellii* (Ell.) Viala and Ravaz).—This is the most common and most destructive disease of the grape (*Vitis* spp.). On the leaves it produces conspicuous, circular, brick-red spots, 2 to 8 mm. in diameter. Embedded in these areas are the black pycnidia. It also occurs very abundantly on the fruit, and in several cases observed the crop was a total failure, leaving dry, wrinkled mummies in place of the normal fruits. It was observed on several varieties of cultivated grapes, among them Thompson's Seedless and the Mission, also on several wild species, as *Vitis cinerea* Engelm., *V. candicans* Engelm., and *V. monticola* Buckl.

Specimens collected: Austin, 1276, 1326, 1412, 1560, 3056, 3062; San Antonio, 1336, 1391; Brenham, 1463; Hempstead, 1499; Kerrville, 1622; Boerne, 1645; Beeville, 1815, 1834, 1835; Bastrop, 2047; Luling, 2231, 2255; Georgetown, 2382; Round Rock, 2405; Gonzales, 2665; Flatonia, 2717; New Braunfels, 1696; Elgin, 1880; Lockhart, 2084; Yoakum, 2758; Hallettsville, 2776.

Downy mildew (*Plasmopara viticola* (B. and C.) Berl. and De T.).—A white, downy coating is produced in spots on the under surface of the affected leaves. It is not at all common in this section, having been observed but once.

Specimen collected: Austin.

Leaf-spot (*Cercospora viticola* (Ces.) Sacc.).—This fungus causes the formation of large, dark-brown, almost black, spots on the upper surface of the leaf which show below as much fainter brown areas. They are somewhat circular in outline and 2 to 10 mm. in diameter. (Pl. VIII, fig. 2.) The conidia formed on the lower leaf surface are clavate, more or less curved, brown, and 42 to 60 by 5 to 7 μ. (Pl. III, fig. 8.)

It becomes very abundant in the late summer, causing the leaves to be badly spotted and producing considerable defoliation. The disease is present on both wild and cultivated forms.

Specimens collected: Austin, 251; Tyler, 1551; Boerne, 1645; New Braunfels, 1695; Llano, 1762; Beeville, 1864; Bastrop, 2027; San Marcos, 2108; Luling, 2250; Seguin, 2306; Victoria, 2513; Nursery, 2561; Cuero, 2591; Stockdale, 2633; Gonzales, 2657, 2692; Flatonia, 2732; Hallettsville, 2777, 2791, 2793; Floresville, 2852.

Sooty mold (*Fumago vagans* (?) P.).—The upper leaf surface is coated over with a black, sooty covering. Observed in only a single locality.

Specimen collected: Luling, 2263.

STRAWBERRY.

Leaf-spot (*Mycosphaerella fragariae* (Tul.) Lindau).—When the spots first appear on the leaves of the strawberry (*Fragaria* sp.) they are brownish or reddish, becoming circular, 3 to 6 mm. in diameter, with a dead white or grayish center and a broad, purplish margin.

Specimens collected: Austin, 1314; Beeville, 1845.

DISEASES OF TRUCK CROPS.

ASPARAGUS.

Blight (*Cercospora asparagi* Sacc.).—On the cladophylls and branches of asparagus (*Asparagus officinalis* L.) diffuse grayish-brown spots are produced. Densely clustered over these areas are dark fascicles of conidiophores and conidia. Large branches, especially on the older parts of the plant, are killed.

Specimens collected: Victoria, 2505; Floresville, 2853.

Rust (*Puccinia asparagi* DC.).—The rust of asparagus was observed in only one locality. This can be explained by the fact that asparagus is rarely cultivated in the territory covered by this survey.

Specimens collected: Austin, 383, 1916, 2946.

BEAN.

Anthracnose (*Colletotrichum lindemuthianum* (Sacc. and Magnus) Briosi and Cav.)—The anthracnose is generally prevalent on beans

(string or snap bean, *Phaseolus vulgaris* L.) throughout our territory. Only a few specimens were collected, since the bulk of our field work was done after most of the crop had been harvested. Records from pickings in one garden (Golden wax) in Austin were obtained with the following result: Picking May 17, no anthracnose; May 21, 4.35 per cent; May 26, 100 per cent.

The rapid increase between May 21 and 26 was favored by an abundance of rain.

In some localities the Kentucky Wonder, a climbing variety with green pods, is seriously affected. The foliage is little affected by this disease, but bacterial blight is often present and may be erroneously diagnosed as anthracnose.

Specimens collected: Austin; San Antonio, 1395; Llano, 1764.

Stem anthracnose (*Colletotrichum caulicolum* Heald and Wolf, 32).—A destructive disease of the Kentucky Wonder bean, observed in a single locality, was found to be due to this fungus. A superficial examination of the affected field showed a considerable number of plants which were completely dead, others were dying, while still others that were less affected exhibited more or less chlorosis of the foliage. An examination of the root system showed it to be in normal condition, while the only deviation from normal in the foliage was the marked chlorosis.

An examination of the stems showed that brown, depressed cankers were present an inch or more above the ground level. The cankers were longitudinally elongated (20 to 40 mm.), more or less irregular, rough and frequently somewhat fissured or open. On the chlorotic plants the canker occupied one side of the stem, on the plants that were dying the stem was nearly girdled, and on all dead plants examined the canker had completely encircled the stem. (Pl. VI, fig. 8.)

Acervuli do not occur on the young cankers, but nearly mature or complete cankers show a few which are visible to the naked eye as small black specks (Pl. VI, fig. 8 (*a*), while they become much more abundant on the stems of plants which have been dead for a few days.

Acervuli scattered, black when mature, low convex, 150 to 250 μ in diameter (Pl. VI, fig. 6); setæ abundant, brown, septate, blunt pointed or sometimes tapering, 60 to 120 by 3.5 to 4 μ; conidiophores nearly half the length of the setæ, cylindrical, hyaline, generally one or two septate; spores falcate, hyaline, granular, and 18 to 30 by 3.5 to 4 μ. (Pl. VI, fig. 7.)

Two species of Colletotrichum have previously been reported as occurring on Phaseolus species. *Colletotrichum lindemuthianum* (Sacc. and Magnus) Briosi and Cav. is the cause of the common

anthracnose. It may be noted that this species is still retained under the genus Gloeosporium by Lindau (37), since the production of setæ is of such rare occurrence. It is known to attack seeds, pods, leaves, and stems. *Colletotrichum lagenarium* (Pass.) Ell. and Hal., has been reported as occurring on different species of beans by two different writers (28 and 50). The report rests on the assumption by Halsted that the two above-mentioned species are identical.

The identity of these two species is not considered sufficiently established (37), so they must still be treated as separate. A comparison of our species with the two mentioned may be made as follows:

TABLE V.—*Comparison of characters of species of Colletotrichum.*

Characters.	C. caulicolum.	C. lindemuthianum.	C. lagenarium.
Conidiophores.	30 to 60 by 3 μ	45 to 50 μ	15 to 20 by 3 to 5 μ.
Spores	Falcate, pointed, 18 to 30 by 3.5-4 μ.	Oblong, straight or slightly curved, rounded ends, 15 to 19 by 3.5 to 5.5 μ.	Ovate oblong, often inequilateral, rounded ends, 16 to 18 by 5.6 μ.
Setæ	Abundant, terete, generally blunt pointed.	Few or absent, terete, fusoid	Few or absent, terete, fusoid.

A comparison of the above characters will make it plain that our specimens represent a new species, which has been described in Mycologia (32).

Specimen collected: Uvalde, 1963 (type specimen).

Bacterial blight (*Bacterium phaseoli* Erw. Sm.).—This disease is common on the foliage of both string and Lima beans, but the symptomatology is somewhat different in each. On the leaves of string beans it causes extended, brown, dead areas which appear near the margin or tip and advance into the leaf, or the original foci may be removed from the margin and so cause a conspicuous spotting which is generally accompanied by more or less chlorosis. On the Lima bean the progress of the disease is often marked in the same way, but frequently small circular or somewhat irregular reddish pustules are present. These pustules are found filled with an abundance of bacteria. This symptom has been observed by the senior writer, in Nebraska, and a somewhat similar condition is reported by Clinton (7). A bacterial rot of the pods, due to the same organism which affects the leaves, and affecting both green-podded and yellow-podded varieties, has been observed. It appears first as small watery or pellucid areas along the sutures, which spread and give an opportunity for the inroads of fungi. This bacteriosis of the pods is especially favored by frequent and abundant rains.

Specimens collected: (1) On *Phaseolus vulgaris* L.—San Antonio, 1406 (leaves and pods); Austin, 1427; Stockdale, 2641. (2) On *P. lunatus* L.—Austin, 1540; San Antonio, 1784; Uvalde, 1932.

Chlorosis.—In one truck garden Kentucky Wonder beans were found suffering from chlorosis to a marked extent. The plants were decidedly chlorotic and had made only a stunted growth. The roots were sound, and neither fungous nor bacterial lesions could be found on the aerial portions. A general examination of the field showed, however, that the hypocotyls extended 4 to 6 inches below the surface of the ground. This abnormal length was due to deep planting with subsequent ridging of the rows to provide irrigation furrows between rows. It seems probable that this abnormal depth of the roots, combined with excessive irrigation was the cause of this trouble.

Specimen observed: Uvalde, 1965.

Leaf-spot (*Cercospora canescens* Ell. and Martin).—A leaf-spot disease of the Lima bean caused by the above fungus was observed in a single locality. The spots are subcircular or angular, 1 to 5 mm., with a gray center surrounded by a narrow, definite, reddish-brown border, slightly less pronounced upon the under surface. The spots are isolated, either few or abundant, and do not cause chlorosis to any extent. (Pl. IX, fig. 3.)

Conidiophores are equally abundant on both surfaces, densely cespitose (Pl. II, fig. 5), brown below, becoming hyaline tipped, several septate, irregular, nodose in distal portion, 60 to 105 by 3 to 4.5 μ; spores hyaline, slender club shaped, straight or curved, one to many septate, 100 to 210 by 3 to 4.5 μ, or sometimes as short as 30 μ and rarely equaling 6 μ in diameter. (Pl. II, fig. 6.)

Six different species of Cercospora have been described as affecting the various species of Phaseolus. The sizes of the spores of these species are as follows: *Cercospora phaseolina* Speg., 20 to 45 by 3 to 3.5 μ; *C. phaseolorum* Cke., 40 to 50 by 4 μ; *C. columnaris* Ell. and Ev., 40 to 60 by 5 μ; *C. cruenta* Sacc., 60 to 80 by 4 μ; *C. canescens* Ell. and Martin, 100 to 120 by 5 to 6 μ; *C. olivascens* Sacc., 130 to 150 by 4 to 4.5 μ.

It may be noted that our specimens show a size of spore different from that recorded for *C. canescens* Ell. and Martin, but an examination of the specimens in the herbarium of the New York Botanical Garden shows that they should be referred to this species.

Specimen collected: Georgetown, 2365.

Powdery mildew (*Erysiphe polygoni* DC.).—This fungus forms a dense white coating on the leaves causing them to become yellow and dry. A crop grown in September was a total loss, and the June crop was seriously affected in the one locality where it was observed.

Specimen collected: San Antonio, 3149.

Root-rot (*Ozonium omnivorum* Shear).—This trouble caused the death of a large portion of a plat of snap beans in a truck garden in a single locality. Black-eyed peas occupied an adjacent plat, and the disease affected portions of both, beginning at the end and advancing to form a distinct semicircular area, about half of the semicircle being occupied by each species.

Specimen collected: Uvalde, 1944.

Root-rot (*Rhizoctonia* sp.).—A few plants of "frijole" beans in an irrigated field were affected with this disease.

Specimen collected: On Brack ranch, 30 miles west of Cotulla, 2185.

Rust (*Uromyces appendiculatus* (P.) Lk.).—This disease was observed in an irrigated truck garden, and also in the University garden at Austin. The maximum development of the trouble was not reached till after most of the crop had been harvested, so that only a small amount of loss resulted.

Specimens collected: Uvalde, 1947, 1948; Austin, 3129.

BEET.

Leaf-spot (*Cercospora beticola* Sacc.).—The presence of the subcircular, dry, pallid blotches on the leaves of the beet (*Beta vulgaris* L.) was very commonly observed. The disease was not, however, sufficiently abundant to cause a great amount of injury.

Specimens collected: Austin, 369, 1322, 1429, 3042; San Antonio, 1876, 3177; New Braunfels, 1716; Sabinal, 1967; Georgetown, 2366.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—This trouble was quite common, especially in irrigated gardens or low moist ground, but was not serious.

Specimens collected: Austin, 3137; San Antonio, 3148.

CABBAGE.

Leaf-spot (*Cercospora blowami* B. and Br. (?)).—The fungus which is the cause of this leaf-spot on the cabbage (*Brassica oleracea capitata* L.) produces pale, subcircular areas 1 to 5 mm. in diameter surrounded by a slightly raised, faintly purple border. Conidial tufts amphigenous, more conspicuous in the center of the spots. Conidiophores densely tufted, pale brown, sparingly septate, 60 to 120 by 4 to 4.5 μ. Conidia long-clavate, tapering, straight or much curved, hyaline or faintly smoky, many septate, 3 to 5 by 100 to 270 μ. Our specimens are somewhat doubtfully referred to this species, since the published descriptions include no information concerning size of conidiophores or spores, and the original specimens showed no

spores (10). Present only on languid leaves and not sufficiently abundant to cause any material injury.

Specimen collected: Georgetown, 2367.

CARROT.

Rhizoctonia root-rot (*Corticium vagum* B. and C. var. *solani* Burt.).—The roots of the carrot (*Daucus carota* L.) become covered by white, ropy strands of the fungus. No serious rotting was observed to result.

Specimen collected: San Antonio.

CASABA.

Sooty mold (*Fumago vagans* (?) P.).—The mycelium on casaba (*Cucumis melo* L.) forms a black or brown sooty crust on the leaves, most abundant on the upper surface. Plant lice were abundant on the foliage.

Specimen collected: New Braunfels, 1725.

CUCUMBER.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—Vines of the cucumber (*Cucumis sativus* L.) which were affected remained stunted and later were killed. In one field about one-third of the plants were dead by the time they should have been bearing.

Specimens collected: Austin, 3138; San Antonio, 3146.

EGGPLANT.

Fruit-rot (*Gloeosporium melongenae* Ell. and Hals.).—The fruits of the eggplant (*Solanum melongena* L.) affected with fruit-rot show brown, sunken areas over which are scattered the black acervuli. With the progress of the disease the fruits are completely rotted.

Specimens collected: Austin, 1906; Uvalde, 1943.

Fruit-rot (*Colletotrichum* sp.).—On the diseased areas are very dense aggregates of black acervuli, varying in diameter from 100 to 250 μ. Brown, taper-pointed, septate setæ, 100 to 150 by 5 μ project profusely from all parts of the acervulus. The conidiophores are slightly club shaped, 12 to 15 by 3 to 4 μ, and the spores are 30 to 36 by 3 to 4 μ, clear, guttulate, falcate, frequently blunt on one end. This has not been definitely associated with any described species and may represent a new species. *Gloeosporium melongenae* was also present on the same fruits, which were completely destroyed by the combined action of the two fungi.

Specimens collected: Austin, 1915, 2430.

Root-rot (*Rhizoctonia* sp.).—The plants which are affected remain dwarfed for a time and then wilt and die. The stems up to the ground level and a little above are sunken and have little wartlike nodules. The loss was quite serious in an irrigated garden where it was observed.

Specimen collected: San Antonio, 1329.

GLOBE ARTICHOKE.

Leaf-spot (*Cercospora obscura* Heald and Wolf, 32).—The presence of this disease on the globe artichoke (*Cynara scolymus* L.) is made manifest by the circular gray spots, varying in diameter from 1 to 2 mm., which appear on the upper surface of the leaf in great numbers. Each spot has a faint brown border, with the tufts of conidiophores on the upper surface. Since the lower surface of the leaf is covered by a silvery tomentum the spots appear as slightly darker areas.

The conidiophores are in groups of from four to seven, epiphyllous, nonseptate, varying in length from 50 to 80 μ, and in width from 4 to 5 μ, brown, with a hyaline tip. The conidia are cylindrical in shape, 40 to 74 by 3 to 4 μ, three to four septate, dilutedly colored, and straight or curved. (Pl. III, fig. 6.)

Specimen collected: Beeville, 1861 (type specimen).

MUSKMELON.

Anthracnose (*Colletotrichum lagenarium* (Pass.) Ell. and Hals).—The appearance of large, dead, brown patches on the leaf of the muskmelon (*Cucumis melo* L.) marks the presence of this fungus.

Specimen collected: Beeville, 1827.

Leaf-blight (*Alternaria brassicae* (B.) Sacc. var. *nigrescens* Pegl.).—Large brown spots are formed on the foliage, attaining 1 cm. in diameter. When numerous the leaves turn brown and curl. It was observed to be sufficiently abundant in one field to cause a very serious loss, and has been reported to be a very destructive blight south of our territory.

Specimens collected: Austin, 1425, 3136; Hallettsville, 2904.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—This trouble was observed in an irrigated garden where the plants remained stunted for a time, and at length succumbed. The crop was an entire loss. (Pl. IX, fig. 2.)

Specimens collected: San Antonio, 1327; Austin, 3135.

OKRA.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—This disease is common on okra (*Abelmoschus esculentus* Moench.), but was observed to be the cause of serious loss only in an irrigated garden.

Specimens collected: San Antonio, 1394; Llano, 1770; Stockdale, 2631; Yoakum, 2768.

Root-rot (*Ozonium omnivorum* Shear).—Observed in a single locality where the plants were stunted and chlorotic.

Specimens collected: New Braunfels, 1711, 1712.

Root-rot (*Rhizoctonia* sp.).—This fungus caused the destruction of the smaller roots and the constriction of the stem at the ground level.

Specimen collected: San Antonio, 1330.

PARSLEY.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—This trouble was observed on parsley (*Petroselinum sativum* Hoffm.) in a single locality.

Specimen collected: San Antonio, 3144.

Root-rot (*Ozonium omnivorum* Shear).—This diseased condition is characterized by the same symptomatology as when this fungus is present on other herbaceous hosts.

Specimen collected: San Antonio, 3143.

PARSNIP.

Rhizoctonia root-rot (*Corticium vagum* B. and C. var. *solani* Burt).—The white strands of fungous filaments surround the roots of the parsnip (*Pastinaca sativa* L.), but do not cause any material loss.

Specimen collected: San Antonio.

PEA.

Powdery mildew (*Erysiphe polygoni* DC.).—This fungus forms a white coating on the leaves and pods of the pea (*Pisum sativum* L.), causing them to become brown and dry. It is probably quite common throughout the territory.

Specimen collected: Austin, 3130.

PEPPER.

Anthracnose (*Colletotrichum nigrum* Ell. and Hals.).—The fruit of the pepper (*Capsicum annuum* L.) sometimes shows large, brown, sunken areas. The black acervuli are either scattered over the diseased spot or zonately arranged.

Specimen collected: Uvalde, 1951.

Bacterial leaf-spot.—The leaves have small, elevated, brown spots from 0.5 to 1 mm. in diameter. The leaf tissue between them is more or less chlorotic. Each pustule is crowded full of bacteria. No record has been found of a pepper disease due to these organisms.

Specimen collected: Uvalde, 1950.

Fruit-spot.—The sweet pepper is very commonly spoiled by the formation of large, dry, brown, more or less sunken areas on the side exposed to the sun. An Alternaria was found to be present, but inoculations into healthy fruits failed to reproduce the spots. This would suggest that the trouble is physiological and that the fungus associated with it is merely a saprophyte.

Specimens collected: Austin, 1536; San Antonio, 1783; New Braunfels, 1683.

Leaf-spot (*Cercospora capsici* Heald and Wolf, 32).—Leaves infested with this fungus form spots 1 to 7 mm. in diameter, mostly circular or subcircular. The spots are raised on the upper surface, brown at first, later becoming grayish brown. They are margined by a very definite darker zone, outside of which is a more or less extended halo of yellow. Where the spots are abundant, the leaves become chlorotic, then wilt and fall. The conidiophores are borne on both surfaces, brown, grouped in clusters of 10 to 15, 30 to 60 by 4.5 to 5.5 μ, and are occasionally septate. The conidia are borne on the tips, are dilutely brown, 75 to 125 by 4 to 5 μ, clavate, generally straight, and several septate. (Pl. IV, fig. 7.)

Specimen collected: Cuero, 2592 (type specimen).

POTATO.

Early blight (*Alternaria solani* (Ell. and Martin) J. and G.).—This was observed to be abundant on the potato (*Solanum tuberosum* L.) in several localities, producing large, irregular, brown spots.

Specimens collected: San Antonio, 1402, 3145; Kerrville, 1601; Austin, 3134.

Rhizoctonia disease (*Corticium vagum* B. and C. var. *solani* Burt).—The stems are cankered and have the characteristic pustules. The tubers also are very frequently destroyed, especially in irrigated gardens, during a rainy period. (Pl. X, fig. 2.)

Specimen collected: San Antonio, 3147.

Scab (*Oospora scabies* Thax.).—Observed in a single locality.

Specimen collected: San Antonio, 1402a.

RADISH.

Powdery mildew (*Erysiphe polygoni* DC.).—The leaves of the radish (*Raphanus sativus* L.) at first are covered with a powdery coating, becoming chlorotic and at length entirely dry.

Specimen collected: Cotulla, 2931.

SPINACH.

Leaf-spot (*Cercospora beticola* Sacc.).—This fungus on spinach (*Spinacia oleracea* L.) forms numerous subcircular areas, 1 to 3 mm. in diameter, with a slightly raised margin. The dark, amphigenous conidiophores cause the larger part of the diseased area to be brown. No record has been found of the occurrence of a Cercospora on this host, but as the symptomatology and size of conidiophores and spores are similar to *C. beticola*, and as the hosts are closely related, it is in all probability the same species.

Specimen collected: Austin, 3039.

SQUASH.

Anthracnose (*Colletotrichum* (?) *nigrum* Ell. and Hals.).—This fungus was found on squash (*Cucurbita* spp.) in the same field with the Colletotrichum, which was attacking sweet peppers, and agrees with it morphologically. From this it may be inferred that it is probably the same. On the fruits are formed numerous dark acervuli, often concentrically arranged.

Specimen collected: On cymling (*Cucurbita pepo* L.)—Uvalde, 1941.

Fruit-rot (*Botrytis cinerea* P.).—In one field the young fruits were seriously affected with this fungus. It apparently starts on the decaying flower and in a few days the entire fruit is destroyed and covered by a black, fungous growth. (Pl. X, fig. 3.)

Specimen collected: On cymling (*Cucurbita pepo* L.)—Austin.

Leaf-spot (*Macrosporium* sp.).—Rounded dry areas surrounded by an area of yellow are formed on the leaves. The center may become grayish with age. We were not able definitely to associate the fungus with any given species.

Specimen collected: On cushaw (*Cucurbita moschata* Duch.)—Beeville, 1840.

Leaf-spot (*Cercospora cucurbitae* Ell. and Ev.).—Rounded brown spots 1 to 4 mm. in diameter, becoming whitish with an elevated border, appear on the foliage. The characters of the conidiophores and conidia agree with the original description (17), except in size, the conidiophores being sometimes 150 μ long and the conidia reaching 300 μ and being plainly multiseptate.

Specimen collected: On cushaw (*Cucurbita moschata* Duch.)—Hempstead, 1498.

Rhizoctonia root-rot (*Corticium vagum* B. and C. var. *solani* Burt).—A very considerable loss in an irrigated field was due to this fungus, the entire root system being destroyed.

Specimen collected: On cymling (*Cucurbita pepo* L.)—San Antonio, 3151.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—This was observed in only two localities, but it is probably quite widely distributed.

Specimens collected: On cymling (*Cucurbita pepo* L.)—New Braunfels, 1685; San Antonio, 3152.

SWEET POTATO.

White-rust (*Albugo ipomoeae-panduranae* (S.) Swingle).—This fungus on the sweet potato (*Ipomoea batatas* (L.) Poir.) produces clusters of white pustules on the under surface of the leaves. In young infections the leaves show yellow spots on the upper surface, and as the disease progresses the tissue becomes brown and dead. In severe infections the leaves may show considerable chlorosis in the young stages and in later stages extended brown areas which have been killed.

Specimens collected: San Antonio, 1781; Llano, 1752; Beeville, 1821; Elgin, 2015; Uvalde, 1953; Nursery, 2562; Yoakum, 2765.

Root-rot.—According to the reports of gardeners, root-rot is very prevalent and destructive in certain localities. All field work was done previous to the harvesting of the crop, and no specimens were obtained, hence it is impossible to say which of the various rot-producing fungi are prevalent.

TOMATO.

Leaf-spot (*Septoria lycopersici* Speg.).—This trouble on the tomato (*Lycopersicon esculentum* Mill.) was observed to be especially serious in seed beds. The young leaves become thickly covered with small angular spots having a grayish center and a darker colored border. The disease was not so serious on mature plants.

Specimens collected: Austin, 370, 1307; Llano, 1766; Uvalde, 1952, 1956; Nursery, 2556.

Rhizoctonia disease (*Corticium* sp.?).—The symptomatology is very much the same as in diseases of other hosts caused by the same organism.

Specimens collected: San Antonio, 1380, 3142; Austin, 3139.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—Probably this is a very general trouble. In several large fields about one-third of the plants had been killed and the others were so stunted that the crop was a complete failure. This is the most serious trouble on tomatoes in the irrigated truck gardens. (Pl. IX, fig. 1.)

Specimens collected: San Antonio, 1328, 3141; Llano, 1769; Beeville, 1842; Elgin, 2011; Uvalde, 1949; Austin, 3132.

TURNIP.

Downy mildew (*Peronospora parasitica* (P.) De By.).—The oldest leaves of the affected turnip plants (*Brassica rapa* L.) were dry and

dead, while those higher up on the plant were chlorotic either entirely or in part. Such leaves are copiously downy white on the lower surface. This disease was very abundant in a truck garden, the only place where it was observed.

Specimen collected: Austin, 3040.

Powdery mildew (*Erysiphe polygoni* DC.).—This fungus causes the characteristic white appearance of the leaves, which at length become yellow and dry.

Specimen collected: Cotulla, 2930.

WATERMELON.

Blossom-end blight and rot.—A very common and destructive disease of the watermelon (*Citrullus vulgaris* Schrad.) is characterized by the blighting and atrophy of the blossom end of the fruit followed by the rotting of the entire fruit. The blossom end turns brown, dries more or less, and remains smaller than the remainder of the fruit. (Pl. X, fig. 1.) The trouble may begin very soon after the blossom stage and the affected fruit may never reach any considerable size, or the trouble may begin later and the fruit may reach nearly normal size before it is destroyed. In some cases observed it was impossible to find any fungus present in the blighted portion, but in the majority of cases the fruit was invaded by a Fusarium which transformed the melon into a soft, rotting mass.

The Fusarium present comes to the surface on the side of the melon in contact with the soil, and in specimens kept in a damp atmosphere conspicuous pinkish spore tufts are produced over the surface. Only macroconidia, 18 to 24 by 3 μ, falcate, and two septate, have been observed.

The definite etiology of this disease is not known, and it can only be suggested that the blighting is due first to the excessive transpiration at times when root activity is not sufficient to meet the loss, and that the fungus gains an entrance into the dead tissue and then spreads throughout the remainder of the fruit.

This is the most serious trouble of the watermelon and is generally prevalent. The loss may be from 25 to 75 per cent in many cases. The very general prevalence of this disease is such that a more detailed investigation should be undertaken.

Specimens collected: New Braunfels, 1690; Austin, 1870; Beeville, 1817 (collections do not represent the prevalence).

Leaf-spot (*Cercospora citrullina* Cke.).—The oldest leaves of the plant are the first to show these circular spots, 2 to 4 mm. in diameter.

Each is bordered by a dark-brown or purplish zone beyond which is an area of faint yellow. The mature spots have grayish centers.

Specimens collected: Hempstead, 1487; Beeville, 1816; Luling, 2245; Victoria, 2338; Alice, 2494; Nursery, 2545; Stockdale, 2634; Flatonia, 2733; Yoakum, 2764; Hallettsville, 2903.

Sooty mold (*Capnodium* (?)).—The stems, petioles, and leaves become covered over with a sooty, black coating, more abundant on the older parts of the plant. On the late crop in some localities it results in the death of the entire plant. Probably the injury is mostly due to plant lice and the fungus is merely secondary. Dark-brown pycnidia 90 to 120 μ are formed on the surface. The spores are clear, elongated, 5 to 6 by 3 μ, and stream out in tortuous, rope-like strands.

Specimens collected: Elgin, 2000; Bastrop, 2048; Cotulla, 2202.

DISEASES OF CEREALS.

BARLEY.

Covered smut (*Ustilago hordei* (P.) Kellerm. and Swingle).—This smut was present in considerable quantities in barley (*Hordeum* sp.) grown near San Antonio in 1909.[1]

Loose smut (*Ustilago nuda* (Jens.) Kellerm. and Swingle).—Barley is not grown as a field crop in the territory covered by this survey, and this material was collected from a plat on the University campus. The brown spore masses occur on the spikelets, which fall away, leaving only the naked rachilla.

Specimens collected: Austin, 3099, 3118.

Rust (*Puccinia graminis* P. var. *hordei* Freeman and Johnson).—This rust was prevalent on barley near San Antonio in 1909.[1]

CORN.

Rust (*Puccinia sorghi* S.).—This disease on corn (*Zea mays* L.) is quite general in its distribution but was not observed to be sufficiently abundant to cause any serious loss except in one field of late corn at Flatonia.

Specimens collected: Austin, 1557; Kerrville, 1584; Boerne, 1649; New Braunfels, 1679; San Antonio, 1782; Elgin, 1893; San Marcos, 2102; Gonzales, 2676; Flatonia, 2719; Yoakum, 2751.

Smut (*Ustilago zeae* (Beckm.) Ung.).—No loss of any consequence can be attributed to smut, as it was rarely found in abundance. At Uvalde a field of corn was observed which had 40 to 50 per cent of the ears destroyed, but in all other localities smut was rare.

Specimens collected: Austin, 1450; Kerrville, 1583; New Braunfels, 1709; Uvalde, 1962; Hondo, 1997; Cotulla, 2216; Seguin, 2299; Flatonia, 2720.

[1] Notes from E. C. Johnson, Bureau of Plant Industry, U. S. Dept. of Agriculture.

OATS.

Crown-rust (*Puccinia coronata* Cda.).—Rust on oats (*Avena sativa* L.) was not uncommon, but most of our field work was completed after harvest time. Collected from a single locality.

Specimen collected: San Antonio, 1389.

Stem-rust (*Puccinia graminis* P. var. *avenae* Eriks. and Henn.).—Also collected in a single locality.

Specimen collected: San Antonio, 1359.

Smut (*Ustilago avenae* (P.) Jens.).—The loose smut of oats is not uncommon in this territory. Extensive loss has been reported from some sections. Fields were observed with 10 to 15 per cent of the heads destroyed. Inquiry revealed the fact that seed treatment is not practiced to any great extent.

Specimens collected: Austin, 1001, 3117; San Antonio, 1358; San Marcos, 974.

RYE.

Leaf-rust (*Puccinia rubigo-vera* (DC.) Wint. var. *secalis* Carl.).—Rye (*Secale cereale* L.) is not generally grown in this region. Leaf-rust was abundant on plats at the San Antonio Experiment Farm in 1908 and 1909.[1]

WHEAT.

Floret sterility (*Stemphylium tritici* Patterson).—This disease was found abundantly in 1909 on the leaves and sterile spikelets of wheat (*Triticum aestivum* L.) near San Antonio. It is closely associated with rusts in causing floret sterility of wheats.[1]

Leaf-rust (*Puccinia rubigo-vera* (DC.) Wint. var. *tritici* Carl.).—This rust is abundant on wheat almost every year in the locality of San Antonio and was especially prevalent in 1908 and 1909.[1]

Leaf-spot (*Cladosporium graminum* Cda.).—This causes brown to black spots on the leaves of wheat and is often found in sterile florets. It was abundant in the San Antonio region in 1908 and 1909.[1]

Loose smut (*Ustilago tritici* (P.) Jens.).—The dusty olive-brown spore masses appear on the heads or spikelets, destroying them entirely and leaving only the naked rachis.

Specimen collected: Austin, 3115.

Stem-rust (*Puccinia graminis* P. var. *tritici* Eriks. and Henn.).—Wheat is not extensively grown in this section, but the rust was found abundantly present on it wherever it was grown.

Specimens collected: San Antonio, 1366; Kerrville, 1602.

Stinking smut (*Tilletia tritici* (Bjerk.) Wint.).—Found sparingly near San Antonio in 1909.[1]

[1] Notes from E. C. Johnson, Bureau of Plant Industry, U. S. Dept. of Agriculture.

DISEASES OF FORAGE CROPS.

ALFALFA.

Leaf-spot (*Cercospora medicaginis* Ell. and Ev.).—This disease on the leaves of alfalfa (*Medicago sativa* L.) shows as dark-brown, circular or subcircular areas, 1 to 5 mm. in diameter. The spots on a single leaflet may vary in number from one to nine and with a predominant size of 2 to 3 mm. When the spots are few in number each is surrounded by an indefinite zone of yellow, and when abundant the entire intervening areas become yellow. Many of the affected leaflets fall from the plant, thus producing considerable defoliation.

This disease was first reported from College Station, Tex., in 1891 (20), and has been reported more recently from New York (49).

Specimens collected: San Marcos, 2103; Victoria, 2528; Gonzales, 2700.

Leaf-spot (*Pseudopeziza medicaginis* (Lib.) Sacc.).—Observed only in a single locality, at which place it was very abundant in an irrigated field.

Specimen collected: San Marcos, 970.

Root-rot (*Ozonium omnivorum* Shear).—This disease is caused by the same fungus which produces the well-known root-rot of cotton. It was observed only in a single field, where it caused a loss of 25 to 30 per cent.

Specimen collected: Beeville, 1841.

Rust (*Uromyces medicaginis-falcatae* (DC.) Wint.).—This disease causes the formation of minute circular or elongated pustules of a reddish-brown color. The epidermis is ruptured and the spore mass is surrounded by the irregular lacerated remains. Only uredo pustules have been observed in our specimens and these are more abundant on the under surface than upon the upper surface of the leaflets (27). Freeman does not mention the occurrence of the pustules upon the upper surface of the leaflets. A single leaflet may show 20 to 60 pustules and still retain its green color in portions not occupied by the pustules, while others having a lesser number of pustules may show considerable yellowing. The disease does not cause serious damage since only a slight degree of defoliation results. It is apparently the least injurious of the three leaf diseases in this territory.

Specimens collected: Collins's Garden, San Antonio, 1390; Brack ranch, Cotulla, 2204.

COWPEA.

Leaf-spot (*Cercospora vignae* Racib.).—This is probably the most common disease of the cowpea (*Vigna unguiculata* (L.) Walp.) in this territory. It produces on the foliage large, circular, brown spots

1 to 2 cm. in diameter. The spots are most commonly isolated, but they may become confluent and irregular. With the abundant production of conidiophores and conidia the areas become dirty gray in color. It causes a serious defoliation of the plants. It was originally described from Java (41), and no mention has been found of its occurrence in this country. (Pl. I, fig. 1.)

Specimens collected: Austin, 1543, 2428; Beeville, 1826; Elgin, 1889, 2006; Uvalde, 1946; Victoria, 2529; Nursery, 2549; Cuero, 2604; Gonzales, 2673; Flatonia, 2730; Yoakum, 2767; Floresville, 2854; Hallettsville, 2902.

Leaf-spot (*Cercospora cruenta* Sacc.).—The large, indefinite, vague spots which this fungus produces characterize the disease. The tissue on the upper leaf surface is paler green or somewhat chlorotic, and the profuse production of conidiophores and conidia on the lower surface renders it dirty gray in color. The spots are largely confluent, often involving the entire leaf and causing its destruction. (Pl. I, fig. 2.)

Specimens collected: Beeville, 1860; Luling, 2259, 2260; Flatonia, 2729; Yoakum, 2752; Austin, 3131.

Root-rot (*Ozonium omnivorum* Shear).—The symptomatology of this disease is the same as that of the cotton root-rot.

Specimens collected: Beeville, 1837; Uvalde, 1945.

Rust (*Uromyces appendiculatus* (P.) Lk.).—This trouble was observed in only one locality where it was not the cause of any serious loss.

Specimen collected: Luling, 2260.

PEANUT.

Leaf-spot (*Cercospora personata* (B. and C.) Ell.).—This disease on the peanut (*Arachis hypogaea* L.) is so common on the mature plants that farmers consider it time to harvest when the leaves are badly spotted. The spots are chestnut brown, beginning as minute specks and increasing to about 4 mm., often, however, to as large as 10 mm. The margin of the spot is yellowish, paling out into the green of the leaf. The conidiophores are present on both surfaces, being more abundant below. The conidia are frequently 100 μ in length. In the original description (14) the fungus is said to be hypophyllous and the conidia may reach a maximum of 50 μ. (Pl. III, fig. 9.)

Specimens collected: Brenham, 1465; Elgin 2019; Luling, 2235; Nursery, 2566; Stockdale, 2624; Hallettsville, 2905.

DISEASES OF WILD AND CULTIVATED GRASSES.

BERMUDA GRASS.

Leaf-spot (*Helminthosporium giganteum* Heald and Wolf, 32).—This disease on Bermuda grass (*Capriola dactylon* (L.) Kuntze) is characterized by the presence of numerous yellowish or pale straw-colored spots, 0.5 to 1 mm. wide by 1 to 4 mm. long, longitudinally elongated, and with a narrow brown border. The spots are generally absent from the leaf sheath, and when numerous they may become confluent on the laminæ and thus cause somewhat extended dead areas.

The conidiophores are dark brown, many septate, 9 to 12 by 200 to 400 μ, with a slightly bulbous base (Pl. VII, fig. 6); the spores are elongated, cylindrical, with slightly tapering ends, five septate, pale brown, densely granular contents, 15 to 21 by 300 to 315 μ. (Pl. VII, fig. 7.)

Specimen collected: Falfurrias, 2440 (type specimen).

CRAB-GRASS.

Gray-spot (*Piricularia grisea* (Cke.) Sacc.).—Circular or slightly elongated spots appear on crab-grass (*Syntherisma sanguinalis* (L.) Dulac). These spots are dirty yellow or grayish in color, 1 to 5 mm. in diameter, with prominent purple borders. Very frequently the areas are confluent so that the entire leaf tip becomes dry.

Specimen collected: Uvalde, 1936.

Rust (*Uromyces* sp.).—Observed in but a single locality. Affected leaves showed an abundance of sori.

Specimen collected: Falfurrias, 2490.

FEATHER GRASS.

Balansia blight (*Balansia hypoxylon* (Pk.) Atk.).—This fungus on feather grass (*Stipa leucotricha* Trin.) destroys the entire spike, forming around the vascular tissue of the spikelets a pseudosclerotium which is grayish or bluish black on the outside, whitish within, and 4 to 15 mm. in length. (Pl. XI, fig. 1.) The black pulvinate stromata project prominently from this sclerotium. These stromata contain the flask-shaped perithecia. This blight is quite common during the last part of April and the first part of May. When this species was made the basis of a study by Atkinson (2) the host plant of the Texas material was undetermined.

Specimen collected: Austin, 3071.

Smut (*Ustilago hypodytes* (Schl.) Fr.).—The internodes of the inflorescence beginning at their bases are enveloped for the greater part of their length by a dusty, dark-brown spore mass, and the spikelets are destroyed.

Specimens collected: Austin, 2950, 3098.

GRAMA GRASS.

Rust (*Puccinia jamesiana* (Pk.) Arth.).—This rust on grama grass (*Bouteloua* sp.) was observed in a single locality, where it was not abundant.

Specimen collected: Falfurrias, 2481.

JOHNSON GRASS.

Leaf-blight (*Helminthosporium turcicum* Pass.).—The diseased areas on Johnson grass (*Andropogon halepensis* (L.) Brot.) are dark purple, often almost black, from 5 to 10 mm. in diameter, and are elongated parallel to the veins. They are frequently flattened on the side of the veins and show a pronounced zonation. These spots become confluent, resulting in the death of the leaf tips.

Specimens collected: Bastrop, 2024; Luling, 2232; Elgin, 2010; San Antonio, 1409; Sabinal, 1983; Austin, 3036. (The last three are mixed infections, Colletotrichum being present.)

Leaf-blight (*Septoria pertusa* Heald and Wolf, 32).—The diseased areas are elongated parallel to the veins and are 1 to 2 cm. in length without a definite margin. The brownish center is surrounded by a yellow zone which pales out into the green. These areas become confluent so that whole leaves are dry and yellowish brown in color. The flask-shaped pycnidia are very abundant on both surfaces and protrude by a short papilla. (Pl. VI, fig. 16.) The conidia are clear, straight, or slightly curved, slightly clavate, 60 to 75 by 3 μ, guttulate, and are extruded so abundantly as to make a white coating. (Pl. VI, fig. 17.)

Specimens collected; Luling, 2270; Flatonia, 2722 (type specimen).

Leaf-spot (*Cercospora sorghi* Ell. and Ev.).—No definitely limited spots are produced by this fungus. The affected areas are reddish purple with a tinge of red along the border. The production of conidiophores and conidia renders the center of these areas somewhat brown.

Specimens collected: Flatonia, 2741; Hallettsville, 2800; Gonzales, 2668. (Immature specimens, Colletotrichum being also present.)

Leaf-spot (*Colletotrichum lineola* Cda. var. *halepense* nov. var.).—This fungus on the leaf blades produces circular or slightly elongated spots which have an average length of about 2 mm., but may reach 5 mm. or more in length. The spots have a bright-red border with a

gray or dirty-yellow center, bearing a central cluster of black acervuli. The acervuli are on both surfaces and few in each spot. The spores are falcate, acute pointed, hyaline, 20 to 27 by 4 to 5 μ, and frequently show one to three large granules. The conidiophores are short, 15 μ long, and nonseptate. The setæ are pointed, with slightly bulbous base, 1 to 2 septate, and reach 75 μ in length. (Pl. VI, fig. 15.) Our specimens agree with *C. lineola* Cda. in size of spores and setæ and with *C. andropogonis* Zimm.[1] in symptomatology.

One field was observed where the disease was sufficiently developed to cause the death of the grass.

Specimens collected: Round Rock, 2410 (type specimen), 2427; Falfurrias, 2441, 2727; Yoakum, 2753; Floresville, 2844; Austin, 3036.

Rust (*Puccinia purpurea* Cke.).—This rust occurs so abundantly on the leaves that they are purple, the color being caused by the closely clustered, elongated sori which rupture the epidermis on both leaf surfaces.

Specimen collected: Austin, 121.

JUNGLE RICE.

Gray-spot (*Piricularia grisea* (Cke.) Sacc.).—Circular or oval yellowish areas with purple margins appear on the blades of jungle rice (*Echinochloa colona* (L.) Link). These spots are from 1 to 5 mm. in diameter and become grayish below. The intervening tissues are killed and the leaf tips become dry. (See under "Crab-grass.")

Specimen collected: Uvalde, 1938.

PANICUM.

Black-blotch (*Phyllachora graminis* (P.) Fckl.).—The leaves of Panicum (*Panicum* spp.) become infested with black, shining, stromatic blotches. These are small, mostly less than 1 mm. in diameter, and often confluent. The affected leaves become brown between these spots.

Specimens collected: Austin, 859; Elgin, 1895.

Gray-spot (*Piricularia grisea* (Cke.) Sacc.).—Small elongated or lenticular spots are formed. They are grayish brown with a brown border, and are most abundant toward the tip of the leaf. Chlorosis accompanies this spotting, and large parts of the leaves turn brown.

Specimen collected: On *Panicum texanum* Buck.—Kennedy, 2834.

[1] Dr. Zimmerman, to whom duplicates of our specimens were sent, reports that they are identical with *C. andropogonis* Zimm. Edgerton, who is making a careful study of the Colletotrichums, is of the opinion that *C. lineola* Cda., *C. andropogonis* Zimm., *C. cereale* Manns, and *C. falcatum* Went. may be identical.

REED-GRASS.

Leaf-spot (*Hendersonia arundinacea* (Desm.) Sacc.).—This fungus produces brown, elongated spots on the leaves of reed-grass (*Phragmites vulgaris* (Lam.) B. S. P.). The spots are 1 to 2 cm. in length, most commonly confluent, causing the drying of the leaves. The upper surfaces of the affected areas at maturity become grayish with a brown margin.

Specimen collected: San Marcos, 2109.

SAND BUR.

Smut (*Sorosporium syntherismae* (Pk.) Farl.).—This smut destroys the complete inflorescence of the sand bur (*Cenchrus* sp.).

Specimen collected: Skidmore, 2807.

SILVER BEARD-GRASS.

Black-blotch (*Phyllachora graminis* (P.) Fckl.).—This parasite on silver beard-grass (*Andropogon argyraeus* Schult.) produces on the leaves black, shining blotches. The spots are small, oblong, prominent, sometimes confluent, with a rugulose surface. The fructification is not mature until the leaves are dead and decaying.

Specimens collected: Austin, 297, 356.

Smut (*Tolyposporella brunki* (Ell. and Gall.) Clint.).—The leaf sheaths inclose a black, powdery mass of spores, which has taken the place of the inflorescence.

Specimen collected: Austin, 1727.

SORGHUM.

Bacterial blight (*Bacillus sorghi* Burr.).—This trouble is very generally present on all the varieties of sorghum (*Andropogon sorghum* (L.) Brot.) grown in this section, such as milo maize, Kafir corn, and cane. It produces on the leaves elongated purplish or dark-brown patches quite commonly confluent, so that large portions of the leaf are discolored. Many of the specimens represent mixed infections of Colletotrichum spots and bacterial blight.

Specimens collected: Boerne, 1653; New Braunfels, 1691, 1701; Sabinal, 1968; Hondo, 1993; Bastrop, 2020; Lockhart, 2067; Cotulla, 2161, 2203; Seguin, 2298; Stockdale, 2612; Flatonia, 2723; Floresville, 2848.

Head-smut (*Sphacelotheca reiliana* (Kuhn.) Clint.).—The head-smut is not uncommon on the various varieties of sorghum, but is not so generally abundant as the kernel smut.

Specimens collected: San Antonio, 1794; Uvalde, 1926; Bastrop, 2051; San Marcos, 2104; Seguin, 2292; Victoria, 2350; Stockdale, 2636; Gonzales, 2701; Hallettsville, 2799.

Kernel smut (*Sphacelotheca sorghi* (Lk.) Clint.).—The smut was present in the majority of fields examined.

Specimens collected: New Braunfels, 1700; Llano, 1750; San Antonio, 1795; Uvalde, 1925; Sabinal, 1978; Hondo, 1991; Bastrop, 2052; Luling, 2249; Seguin, 2294; Victoria, 2500; Gonzales, 2702.

Leaf-blight (*Helminthosporium turcicum* Pass.).—Very large irregular areas frequently appear on the leaves. They are usually brown with a narrow border of reddish purple. Quite commonly they have a tendency to be formed on the leaf margin or to advance from the leaf tip, so that large portions become involved. Isolated central spots may be found. An Alternaria was very commonly associated with this fungus.

Specimens collected: Sabinal, 1971; Luling, 2237; Falfurrias, 2493; Stockdale, 2638.

Leaf-spot (*Colletotrichum lineola* Cda.).—This disease is characterized by the formation of numerous oval spots, 1 to 5 mm. in length, with pink center and reddish-purple border, which becomes red on the outer border. The pink centers show the black acervuli in groups, or even a single acervulus, but in many cases acervuli may be entirely absent. The spots may become very abundant and confluent and kill the leaf generally from the tip back. The dead portion turns brown and the affected spots show as darker areas. (Pl. XI, fig. 2.) The disease was very abundant and severe in some localities.

Acervuli black, amphigenous; setæ 75 to 150 by 4.5 to 6 μ, base enlarged, very dark throughout, many septate, pointed and generally showing a marked constriction at some point above the base; basidia short, 15 to 20 by 3 to 6 μ, hyaline (Pl. VI, fig. 13); spores falcate, hyaline, granular or guttulate, and 20 to 30 by 4 to 6 μ (Pl. VI, fig. 14).

Our specimens are doubtfully referred to *C. lineola*. They are similar to many of the specimens which American mycologists have assigned to this species. It seems, however, that *C. lineola* Cda. and *C. andropogonis* Zimm. have not been clearly differentiated. (See footnote under "Johnson grass," p. 52.)

Specimens collected: Skidmore, 2806; Victoria, 2349; Nursery, 2564; Kerrville, 1586; Beeville, 1865; Gonzales, 2703; Yoakum, 2754.

DISEASES OF FIBER PLANTS.

COTTON.

Angular leaf-spot (*Bacterium malvacearum* Erw. Sm.).—The angular leaf-spot of cotton (*Gossypium herbaceum* L.) was observed in the great majority of fields examined. Pellucid spots were observed on

the bolls in several cases either in connection with anthracnose or distinct from it, which are probably due to the same bacterium.

Specimens collected: San Antonio, 1410; Boerne, 1637; Beeville, 1822; Elgin, 1883; Bastrop, 2045; Lockhart, 2066; San Marcos, 2094; Sabinal, 1974; Hondo, 1994; Luling, 2240; Seguin, 2301; Georgetown, 2386, 2387; Round Rock, 2414; Victoria, 2348; Nursery, 2543; Cuero, 2584; Stockdale, 2613; Gonzales, 2680; Flatonia, 2726; Yoakum, 2759; Hallettsville, 2797; Falfurrias, 2436, 2438.

Anthracnose (*Glomerella gossypii* (South.) Edgerton, 12).—The anthracnose of the cotton bolls is not very abundant in this territory. Bolls were collected which showed only one or two small sunken anthracnose spots, while others were nearly completely covered. No fields were observed where the disease was sufficiently abundant to cause any material injury.

Specimens collected: Bastrop, 2050; Lockhart, 2079; Luling, 2280; Seguin, 2331; Victoria, 2517; Stockdale, 2639; Gonzales, 2708; Yoakum, 2772.

Leaf-spot (*Cercospora gossypina* Cke.; *Sphaerella gossypina* Atk.).—Only the Cercospora stage of this fungus was observed. The spore size ranges from 70 to 150 by 3 to 4 μ, which is in excess of the measurements recorded by Saccardo (45). This disease is not as abundant in this territory as the angular leaf-spot and affected leaves are not as seriously injured.

Specimens collected: Sabinal, 1973; Luling, 2261; Victoria, 2344; Alice, 2495; Nursery, 2573; Gonzales, 2661; Flatonia, 2715; Skidmore, 2801; Kennedy, 2840.

Leaf-spot (*Macrosporium* sp.?).—A leaf-spot of cotton was obtained in a single locality which differed from the angular leaf-spot or the Cercospora spot. It is characterized by the presence of numerous brown spots, 3 to 5 mm. in diameter, which show more or less concentric zonation. The tissue adjacent to the spots is frequently colored a pronounced purple. The fungus present is apparently a Macrosporium, but the spores are much larger than those of *Macrosporium nigricantium* described by Atkinson (1).

The spores of our species are 90 to 150 by 12 to 16 μ, long-stipitate, the stipe equaling the body of the spore in length; spore cells uniseriate or muriform, constricted at cross partitions, body cells 4 to 7, pale brown.

Specimen collected: Nursery, 2542.

Texas root-rot (*Ozonium omnivorum* Shear).—The common root-rot of cotton is prevalent throughout the entire extent of this territory. In some fields 25 to 75 per cent of the plants were killed. In this connection it may be noted that the same fungus has been collected on the following hosts in addition to cotton: Alfalfa, althæa, bean, black locust, cowpea, fig, okra, parsley, and umbrella China tree.

Specimens collected: Boerne, 1633; Beeville, 1823; Elgin, 1884; Bastrop, 2035; Lockhart, 2068; San Marcos, 2095; Sabinal, 1966; Hondo, 1992; Luling, 2238;

Seguin, 2295; Georgetown, 2388; Victoria, 2342; Cuero, 2583; Stockdale, 2646; Gonzales, 2683; Flatonia, 2727; Yoakum, 2760; Hallettsville, 2798; Falfurrias, 2450, 2466; Alice, 2497; Skidmore, 2499.

Root-rot.—This is a new disease, which is characterized by the dying of the affected plants, the dead plants exhibiting much the same general appearance as in the case of the well-known Texas root-rot. The patches may be small or they may reach nearly an acre in extent. A few plants may persist within the affected areas. At the circumference of the area of dead plants may be found living plants which are affected with the disease, but have not yet succumbed. These diseased plants show frequently a slight chlorosis of the foliage and a diseased condition of the root; others that are affected will show about normal foliage, and the only indication of the presence of the disease is the abnormal condition of the root. Many of these affected plants may wilt down and die in the course of a few hours.

The roots of diseased plants show a marked constriction at the crown, and the root remains apparently smaller from that point downward. An examination of the surface shows many delicate brown hyphæ aggregated in strands or making loosely interwoven masses; numerous small wartlike pustules also appear on the main root as well as on the branches. These wartlike nodules are sclerotal aggregates of fungous tissue which are slightly protruding from the cortex (Pl. XI, fig. 3).

The mycelium shows some Rhizoctonia characters, and fruits were found in the field in two cases, which may be connected with the fungus present. The systematic position of the fungus has not yet been determined, but cultural work is in progress which should throw light upon its relationship. The cultures up to the present time have failed to produce spores upon any media, but cultural characters show that the fungus is not a Rhizoctonia.

Specimens collected: Falfurrias, 2433, 2434, 2466.

Rust (*Aecidium gossypii* Ell. and Ev.).—The spots produced by this fungus show on the upper surface of the leaf as circular or subcircular areas, 3 to 5 mm. in diameter, with reddish-purple or dark-brown centers, slightly depressed and surrounded by a narrow zone of yellow or orange. The under surface of the spot is slightly hypertrophied and contains numerous cluster cups, 150 to 260 μ in diameter, which have a bright yellow or orange color. From one to three or four spots occurred on a single leaf. While the fungus was general throughout the fields where it was observed, it was not abundant, and caused but little injury. This fungus was first reported from California (22) and no records of its occurrence in other parts of the United States have been found.

Specimens collected: Falfurrias, 2435, 2452.

Sore-shin (*Corticium vagum* B. and C. var. *solani* Burt).—No field notes are at hand regarding the extent of the losses caused by this organism upon the young plants. It is probably generally present and the cause of a very considerable loss in warm, rainy springs.

Specimen collected: Austin, 2895.

DISEASES OF TREES AND SHRUBS.

ALTHÆA.

Root-rot (*Ozonium omnivorum* Shear).—The fungus which causes this trouble on althæa (*Hibiscus syriacus* L.) is the same as the one which produces the root-rot of cotton. The attendant symptoms are essentially similar. The disease was observed only in nurseries, where it killed all the plants in certain sections of the nursery rows.

Specimens collected: Austin, 1924; New Braunfels.

ASH.

Leaf-spot (*Cercospora fraxinites* Ell. and Ev.).—The spots caused by this fungus on the leaves of ash (*Fraxinus* spp.) are subcircular or somewhat irregular, dark gray above, with many minute black heaps of conidia and conidiophores, and are margined by a zone of brown fading out into the green tissue which may show a certain amount of chlorosis; the affected areas are pale brown below with a slightly darker, definite margin, and show fewer and less conspicuous conidial tufts. The spots are 4 to 10 mm. in diameter. Sometimes they are confluent, causing larger dead areas along the margins of the leaflets or removed from the margin. It is stated in the original description of this species (16) that the spots are 3 to 4 mm. in diameter, but the agreement of spore measurements and other characters indicate that our species is *C. fraxinites* Ell. and Ev.

At the time specimens were collected, September 1, little or no defoliation had resulted, but nearly all leaves were affected, each leaflet showing 1 to 13 spots.

Specimen collected: Victoria, 2340.

Leaf-spot (*Cylindrosporium viridis* Ell. and Ev.).—On the upper surface of the leaf the numerous spots are dark purple in color, ranging in diameter from 1 to 4 mm. with a definite margin. The affected areas are more dilute on the under surface, often brownish, and concealed in part by the abundant heaps of white or pinkish spores. The acervuli are immersed, globular or somewhat flattened, 150 μ or less in diameter, and become erumpent only on the lower surface.

According to the original description (19) the acervuli are from three to six in number on each spot and open above. The spores

are cylindrical, fusoid, 30 to 36 by 3 to 4 μ. This measurement of width is in excess of the original description (2.5 μ).

Where the spotting is abundant the leaves become yellow and fall.

Specimen collected: Gonzales, 2652.

Leaf-spot (*Septoria submaculata* Wint.).—As a result of the attacks of this fungus definitely margined spots 1 to 2 mm. in diameter are formed. In the early stages they are circular and purple with a whitish center; later they become brown and angular, 3 to 4 mm. in diameter and are limited by the veins of the leaf.

On the upper surface are black pycnidia, embedded in the leaf tissue. The spores are 20 to 30 by 1 to 2 μ, hyaline and cylindrical.

Although the leaves were abundantly spotted, no defoliation was seen.

Specimen collected: Austin, 1546.

BLACK HAW.

Leaf-spot (*Hendersonia foliorum* Fckl. var. *viburni* Sacc.).—This fungus produces angular spots, 2 to 5 mm. in diameter upon the leaves of the black haw (*Viburnum prunifolium* L.) The pycnidia are sparsely scattered over the upper surface of the spots which are gray or dirty yellow with a darker border. The spots may be few in number on each leaf, or as many as 15.

Specimen collected: Austin, 331.

BLACK LOCUST.

Leaf-spot (*Cylindrosporium solitarium* Heald and Wolf, 32).—This disease of black locust (*Robinia pseudacacia* L.) is characterized by the presence of minute brown spots upon the leaflets. In the early stages of the disease the leaflets have their normal green color, and the spots show as circular areas, 0.5 to 1 mm. in diameter, which have a pale-brown center and a narrow, darker brown border, surrounded by a faint zone of chlorotic tissue. As the disease progresses the entire leaflet turns to a bright-yellow color with the exception of narrow zones of pale green which persist around the circumference of the brown spots. In this stage the spots show an outer zone of green, a middle zone of dark brown, and a central area of light-brown or grayish tissue. (Pl. XIII, fig. 4.) Affected leaflets may show from 1 to 40 spots, and these are generally isolated, although they may be somewhat clustered. The leaflets fall soon after they assume the yellow color and sometimes even before the complete chlorotic stage has been reached. In many cases considerable defoliation results.

Each spot shows one and occasionally two acervuli, which occupy the middle of the light-brown, central area. A straight or curved mass of spores may be seen extruded from the acervulus, which is immersed in the tissue of the under surface. The spores are 45 to 60 by 3 to 4 μ, 3 to 6 septate, generally slightly curved, nearly cylindrical but sometimes tapering, and hyaline. (Pl. VI, fig. 4.)

The disease was observed during the season of 1908 in a much more severe form than in 1909. In all cases it was observed only on nursery trees which were badly crowded.

Specimens collected: Austin, 459, 1909 (type specimens); Georgetown, 2354.

Root-rot (*Ozonium omnivorum* Shear).—This disease was found in a nursery where it had destroyed a small group of young trees (5 or 6 years old). The disease had spread across all of the rows and when observed was advancing along the rows. Roots removed from the soil showed the characteristic yellowish-brown filaments.

Specimen collected: Georgetown, 2351.

BOX.

Leaf-blight (*Macrophoma candollei* (B. and Br.) Berl. and Vogl.).—The leaves of box (*Buxus sempervirens* L.) become entirely dry, with scattered black pycnidia 250 to 300 μ in diameter on both surfaces. The conidia are 36 to 40 by 10 to 11.5 μ, hyaline, and densely granular.

Specimens collected: New Braunfels, 1666; Georgetown, 2357.

BOX ELDER.

Leaf-spot (*Gloeosporium negundinis* Ell. and Ev.).—As a result of the attack of this fungus on box elder (*Acer negundo californicum* (T. and G.) Sarg.), circular or subcircular straw-colored spots 3 to 5 mm. in diameter are formed. Most commonly they are so abundant as to result in the formation of larger dead areas, due to the fusion of spots. The yellow color is more pronounced on the under surface.

The acervuli are 125 to 200 μ in diameter, brown or blackish, and more abundant on the upper surface. The spores are oval, guttulate, and 15 to 20 by 5 to 7 μ. *G. negundinis* Ell. and Ev. on the twigs of the box elder, as determined from measurements of spores from specimens in the mycological herbarium of the Bureau of Plant Industry, shows a range of spore size from 5.9 to 6.6 by 16.5 to 19 μ.

Specimen collected: Lockhart, 2060.

Leaf tip-blight (*Septoria marginata* Heald and Wolf, 32).—The tips and margins of the leaves are killed, the dead areas being brick red, light brown to straw colored, or nearly gray in some cases, and confined to a narrow zone at the leaf tip or margin, or extending

back until nearly the whole leaflet is involved. The advancing edge of the affected area is bordered by a narrow zone of yellow.

The pycnidia are very abundant, brown or black, on both surfaces, in surface view subcircular or somewhat irregular, 87 to 140 μ, flask shaped, with a slightly protruding ostiole. Spores clear, 40 to 60 by 2.5 to 3 μ, straight or slightly curved, three to several septate.

The spore measurements are identical in size with *Cylindrosporium negundinis* Ell. and Ev. (21), and the fungus was first referred to this species by the writers, since the extrusion of the spores from the pycnidia simulated acervuli in external appearance. An examination of type specimens shows that the two species are distinct.

This disease results in considerable defoliation, giving the tree the appearance of having suffered from drought.

Specimens collected: Beeville, 1859; Lockhart, 2060; San Marcos, 2113 (type specimen); Luling, 2279; Seguin, 2286; Austin.

BUCKEYE.

Leaf-blight (*Phyllosticta aesculi* Ell. and Martin).—Leaves of the buckeye (*Aesculus octandra* Marsh) affected by this fungus have large marginal areas of yellowish-brown or brown tissue with a region of yellow toward the advancing edge so that the spots are not definite margined. The pycnidia are very numerous on the lower surface and few on the upper surface. In the original description (24) they are said to be hypophyllous. They are minute, measuring from 40 to 50 μ, dark, and contain an abundance of oblong, hyaline spores 3 to 4 by 1 μ.

Apparently it is the cause of a complete defoliation of the trees in the middle of summer. It was collected in only two localities, but it was observed in several other places.

Specimens collected: Seguin, 2307; Austin, 3128.

BUMELIA.

Leaf-spot (*Cercospora lanuginosa* Heald and Wolf, 32).—This disease on *Bumelia lanuginosa* Michx. first appears as indefinite-margined dark-brown spots on the upper surface of the leaf. At length these areas become 1 to 3 mm. in diameter, irregular in outline, with a definite brown margin and a grayish center. Owing to the woolly coating on the lower leaf surface, the leaf spots show through only faintly as brown spots. Scattered over the upper surface of the spot are very dense clusters of conidiophores, 15 μ in length. The spores are cylindrical to slightly clavate, pale smoky, 45 to 54 by 5 μ, and three to four septate. (Pl. II, fig. 2.)

Specimens collected: Luling, 2222 (type specimen); Flatonia, 2742.

Leaf-spot (*Phyllosticta bumeliifolia* Heald and Wolf, 32).—This causes the formation of definite, pale-brown spots on the leaves. These spots vary in diameter from 3 to 6 mm. when circular or subcircular, but often the areas have fused so that much larger, irregular spots are produced. The color is less intense on the lower surface. Numerous black pycnidia, ranging from 125 to 150 μ, open to the upper surface. The spores are globular, granular, with one or more guttulæ, 9 to 15 μ in diameter. In severe cases half of the leaf tissue may be involved.

Specimens collected: Austin, 1549 (type specimens); 3032.

Sooty mold (*Fumago vagans* (?) P.).—The interlacing filaments give the effect of a black crust on the entire upper surface of the leaf.

Specimen collected: Austin, 253.

BUTTONBUSH.

Leaf-spot (*Ramularia cephalanthi* (Ell. and Kellerm.) Heald).—This fungus on the buttonbush (*Cephalanthus occidentalis* L.) produces numerous circular, brown spots 0.5 to 2 mm. in diameter, surrounded by a narrow, slightly elevated, darker brown border, which is in turn surrounded by a zone of bright red, 1 to 2 mm. wide, irregular margined, and fading out into the green. The spots are uniformly brown on the under surface. Conidia are produced only when the brown centers become somewhat gray. The spots may be very abundant and become confluent, causing the death of large areas of the leaf, or considerable chlorosis may precede the browning.

The size of the spores and the general symptomatology indicate that the fungus is *Cercospora cephalanthi* Ell. and Kellerm. (23), but the formation of the spores in chains (Pl. V, fig. 4) places it with Ramularia. Our specimens show spores which are apparently mature, 18 to 30 by 3 μ, and hyaline or faintly smoky. The change in size and color given for mature specimens (17) is probably based on the examination of a true Cercospora.

Specimens collected: Uvalde, 1930; Cotulla, 2148.

Leaf-blight (*Cercospora perniciosa* Heald and Wolf, 32).—When this disease is present the entire foliage of the tree is seriously affected. Isolated spots are about 1 cm. in diameter, reddish brown, with a darker border. Often the spots have narrow rings of this darker brown tissue, rendering them zonate.

Most commonly these spots are irregular in outline, as the diseased areas have fused, causing a large part of the leaf to become dry. The lower surface of the leaf is much more dilutely colored. On the upper surface the profusion of conidiophores and conidia renders the spots grayish. The conidiophores are densely fasciculate, clear or dilutedly colored, 40 to 50 by 3 to 4 μ. The spores are clavate,

guttulate, 45 to 105 by 3 to 4 μ, and obscurely septate. (Pl. III, fig. 3.)

Where the disease has been observed the trees were almost entirely deprived of their leaves.

Specimens collected: Victoria, 2539 (type specimens); Austin, 2869.

CAPE JASMINE.

Sooty mold (*Fumago vagans* (?) P.).—The upper surface of the leaves of the Cape jasmine (*Gardenia jasminoides* Ellis) is entirely covered by a black, filmy crust. Plant lice were also present.

Specimen collected: Austin, 216.

CATALPA.

Leaf-blight.—Nursery trees and older trees of catalpa (*Catalpa* sp.) are frequently sufferers from a severe leaf-blight in which a species of Cercospora probably plays a secondary part. In some cases irregular, dead, brown areas occur along the margin and extend downward between the prominent radiating veins; or isolated brown spots, small or of considerable size, may occupy a similar position. In some spots the Cercospora may be mingled with an Alternaria, or Cercospora may be the only fungus present, and in one case Alternaria with little or no Cercospora was observed. In the specimens which showed the most severe development of the disease, with large dead areas involving in some cases nearly half of a leaf, much concentric zonation was characteristic; scattered over the brown, dead areas were numerous subcircular gray or white spots, 1 to 2 mm. in diameter, which produced central conidiophore tufts on both surfaces.

Conidiophores densely clustered, brown, becoming lighter toward the apex, few septate, irregular nodose tips, 60 to 75 by 3 to 4 μ, with occasional individuals of double the average length. Spores slender clavate, straight or only slightly curved, hyaline, few to many septate, and 42 to 130 by 3 to 4.5 μ.

The Cercospora on our specimens differs from *Cercospora catalpae* Wint., especially in having much longer and more slender spores, and also by producing amphigenous conidial tufts, but they should probably be referred to this species.

In the territory covered by this report the species of catalpa make a poor and frequently crippled growth and the foliage shows the effect of excessive transpiration in the early part of the season. The position and characteristics of the dead areas indicate that the trouble is largely physiological and that the fungi present find an easy growth in the dead or languid tissues.

Specimens collected: New Braunfels, 1674, 1681; Luling, 2239; Falfurrias, 2464.

CAT'S-CLAW.

Rust (*Ravenelia versatilis* (Pk.) Diet.).—The affected leaflets of cat's-claw (*Acacia greggii* A. Gray) have minute (scarcely large enough to be noticeable) brown pustules surrounded by chlorotic tissue. The leaflets become yellow and drop off.

Specimen collected: Uvalde, 1957.

CEDAR.

Cedar rust (*Gymnosporangium exiguum* Kern).—This is a new species of Gymnosporangium which has recently been described from Texas (35). Previous to the formation of telia on the cedar (*Juniperus sabinoides* Nees) the presence of the infected twigs can be detected only by the brown or yellow cast of the scale leaves. The minute chestnut-brown telia are formed in the month of March or early in April, and protrude from between the scale leaves. (Pl. XVIII, fig. 2.) The affected twigs are killed and are later cast from the tree. The fungus is frequently present in sufficient quantity to give the tree a marked scorched appearance after the telia have matured and disappeared.

Specimens collected: Austin, 754, 855.

Cedar-apples (*Gymnosporangium* (?) *globosum* Farl.).—This species of Gymnosporangium produces brown galls varying in size from minute globular enlargements to somewhat nodose structures an inch or more in diameter. The gall is similar to that produced by *G. juniperi-virginianae*, but shows marked depressions between the telial areolæ. The telia are flattened rather than terete, and show pointed truncate or notched apices.

Our specimens were sent to Mr. F. D. Kern, Purdue University, Lafayette, Ind., who referred them to *G. globosum* Farl. The specimens show no indication of a perennial character, and in this respect appear to be quite similar to *G. juniperi-virginianae*, but the spores are similar to those of *G. globosum*.

Specimens collected: Austin, 497, 666, 758, 854.

Whitening of the cedar (*Cyanospora albicedrae* Heald and Wolf).—The mountain cedar is frequently attacked by a fungus (31) which produces extended white patches upon the bark of trunk or branches and upon the surface of branches or twigs which have apparently been corroded by the action of the fungus. The white areas may completely encircle the branches, or they may be confined to one side. Darker oval nodules, 1 to 2 mm. long by about 1 mm. wide, containing the perithecia, are scattered over the whitened areas. Each nodule contains one or more perithecia, which open to the surface by excentrically located ostioles. On the bark these nodules are flat-

tened, while on the twigs from which the cortex has been corroded they stand out more prominently, owing to the fact that the surrounding wood tissue has been more corroded than the wood tissue which constitutes the stromatic nodule. The stromatic nodules on the decorticated twigs are also more nearly black, while those on the bark are dark gray.

This fungus is so constantly present on the mountain cedar that the occurrence of white patches on the bark has been given as one of the characteristics of this species of cedar (3). The fungus which causes this trouble has been under investigation by the writers for some time, and it seems probable that it represents a new and undescribed species and genus. A more detailed consideration has been published in Mycologia.

A study of the affected cedars under field conditions indicate that the fungus is a true parasite. Affected trees frequently show a large quantity of dead decorticated twigs and branches.

Specimens collected: Austin, 306, 1434, 2865. Coextensive with the distribution of the mountain cedar.

COTTONWOOD.

Leaf-spot (*Septoria musiva* Pk.).—Numerous small, angular areas are formed on the leaves of the cottonwood (*Populus deltoides* Marsh), which are brown, but may become grayish. The pycnidia, containing hyaline, curved spores 30 to 35 μ long, appear on the upper surface.

Specimens collected: Lockhart, 2076; San Marcos, 2117.

Leaf-spot (*Septoria populicola* Pk.).—This species differs mainly from the above in the fact that the pycnidia open on the lower surface and the spores are 60 to 75 by 3 to 4 μ. The amount of defoliation is only slight.

Specimens collected: Austin, 413, 1426, 1432, 2910; Victoria, 2339; Gonzales, 2656.

Rust (*Melampsora medusae* Thm.).—Observed only in a single locality, where it was causing no serious damage.

Specimens collected: Austin, 162, 414.

CRAPE MYRTLE.

Leaf-spot (*Cercospora lythracearum* Heald and Wolf, 32).—Circular to subcircular indefinite-margined areas appear on the foliage of the crape myrtle (*Lagerstroemia indica* L.). These spots, varying in size from 2 to 8 mm., are uniformly yellowish brown below and dark brown above with a zone of limiting yellow tissue paling out into the green tissue.

The conidiophores are densely clustered, 15 to 20 by 3 μ, continuous, diluted brown in color, and are present on both surfaces, mostly epiphyllous, however. The spores are 30 to 42 by 3 μ, 4 to 5 septate, clavate or subcylindrical, and dilutedly colored. (Pl. I, fig. 6. See also "Pomegranate".)

Specimen collected: Austin, 466 (type specimen).

Leaf tip-blight.—This trouble begins as a drying of the leaf tips, which become brownish in the dead portions. An extended zone of chlorotic tissue gradually fading into the green marks the advancing edge. The entire leaf may become dry and fall, exhibiting all the appearances of a physiological trouble. Three fungi (*Phyllosticta lagerstroemia* Ell. and Ev., *Pestalozzia guepini* Desm., and *Cercospora lythracearum* Heald and Wolf) were present.

Specimens collected: Beeville, 1857; Flatonia, 2748; Luling, 2254.

DOGWOOD.

Leaf-spot (*Cercospora cornicola* Tracy and Earle).—Very abundant, indefinite-margined, irregular, brown spots are formed on the foliage of the dogwood (*Cornus* sp.). The margin is quite commonly purplish. The entire foliage becomes seriously affected.

Specimens collected: Austin, 351; San Antonio, 1778; San Marcos, 2107; Seguin, 2304; Victoria, 2534; Gonzales, 2706; Flatonia, 2749; Hallettsville, 2788, 2795.

ELDERBERRY.

Leaf-spot (*Cercospora catenospora* Atk.).—The spots on the leaves of elderberry (*Sambucus canadensis* L.) caused by this fungus are yellow at first, becoming gray with age. They are rounded or elongated in the direction of venation and 3 to 6 mm. in greatest length. They are often so numerous as to be confluent, resulting in the chlorosis and subsequent fall of the foliage.

Specimen collected: San Marcos, 2114.

ELM.

Blight.—The small-leaved elms (*Ulmus* spp.) frequently show a blight or scald of the foliage which is characterized by the death of the leaf tips. The dead, brown area advances downward until the whole leaf may be involved. The brown area is generally bordered by a zone of chlorotic tissue. In some cases the dead areas are not terminal or marginal, but show as definite spots. This is true for our specimens of *Ulmus crassifolia.* In some cases an Alternaria is present, but it is not sufficiently constant to be definitely connected with the disease.

Specimens collected: (1) On *Ulmus alata* Michx.—Gonzales, 2699; Kennedy, 2823. (2) On *U. crassifolia* Nutt.—New Braunfels, 1719.

Leaf-scab (*Gnomonia ulmea* (Sacc.) Thm.).—Elm leaves affected with this fungus show minute spots scattered over the surface. These spots, which are 1 to 3 mm. in diameter, show on the upper surface a central cluster of small black pustules surrounded by a border of dead tissue, white or gray in color; or the black pustules may be somewhat concentrically arranged. In the early stages of development the spot will not be noticeable on the under surface, but in the later development the under surface shows a definite brown area of dead tissue opposed to the white zone of the upper surface. In this stage the epidermis of the under surface is elevated in numerous pustules and ruptured to some extent by the protruding beaks of the perithecia. The late fall collections show only immature perithecia. The white zone bordering the perithecial pustules is caused by the accumulation of large quantities of crystals in the epidermal cells (Pl. XIII, fig. 1).

In many of the collections, especially upon the late collections of *Ulmus alata*, a Coniothyrium is present. The pycnidia of this fungus may be present on either surface of the spots and produce an abundance of oval, brown spores 3.5 to 4 by 6 μ. It is possible that this represents a pycnidial stage of the Gnomonia, but proof of a definite connection must be obtained by cultures. It may be noted in this connection that a Phoma-like pycnidium has been observed in connection with Phomatospora (25), a genus belonging to the Gnomoniaceæ.

Some specimens of *Ulmus alata* show a third type of fruit. These fruits show as minute erumpent papillæ scattered abundantly over the under surface, while the upper surface shows a marked yellow punctate appearance. The spores produced are two to three septate, 21 to 39 by 4 μ, and hyaline. These spores may be the only form present on the leaves at a given time, or they may be found in connection with the perithecial stage of Gnomonia. These spores and pycnidia show a marked similarity to *Phleospora ulmi* (Fr.) Wallr. (36), and it seems probable that they represent a stage in the life history of our Gnomonia, since Klebahn (36) has proved a similar connection between *Phleospora ulmi* (Fr.) Wallr. and *Mycosphaerella ulmi*, another genus of the Sphæriales.

Specimens collected: (1) *Ulmus alata* Michx.—Austin, 255, 256, 338; Llano, 1749. (2) *Ulmus crassifolia* Nutt.—New Braunfels, 1675; Uvalde, 1928; Seguin, 2312; Elgin, 1874. (3) *Ulmus americana* L.—Round Rock, 2419.

Leaf-spot (*Cylindrosporium tenuisporum* Heald and Wolf, 32).—The small-leaved elm is affected by a leaf-spot which shows as brown circular or slightly irregular areas, 2 to 10 mm. in diameter, generally with a gray center and a narrow yellow border. The under surfaces of the spots are more uniformly brown and show minute black specks,

the acervuli of the fungus. In a few cases the acervuli may be found on the upper surface.

The spores are very narrow, cylindrical, hyaline, continuous, straight or slightly curved, 15 to 24 by 0.75 to 1 μ.

Specimen collected: On *Ulmus crassifolia* Nutt.—Austin, 307 (type specimen).

Mistletoe (*Phoradendron flavescens* (Pursh.) Nutt.).—The small-leaved elm (*Ulmus crassifolia*) is one of the many trees attacked by mistletoe.

Specimen collected: On *Ulmus crassifolia* Nutt.—Llano, 1737.

Powdery mildew (*Uncinula* sp.).—Powdery mildew was collected in a single locality on the cork-winged elm (*Ulmus alata*). It was found only in the conidial stage and was not abundant. Since two species of Uncinula have been described for this host, a definite specific determination can not be made.

Specimen collected: On *Ulmus alata* Michx.—Llano, 1753.

ENGLISH IVY.

Anthracnose (*Colletotrichum gloeosporioides* Penz. var. *hederae* Pass.).—Irregular, brown, raised, definite-margined areas are formed on the leaves of the English ivy (*Hedera helix* L.). Often they are confined to the tips of the lobes, but at times they are central. The acervuli are formed abundantly over the entire diseased areas.

Specimens collected: San Antonio, 1403; Gonzales, 2685; Flatonia, 2747.

Leaf-blight (*Phyllosticta concentrica* Sacc.).—This disease begins on the leaf tips or centrally and results in the formation of dark-brown, dead areas which may extend until the whole leaf is involved. Some spots have a blackish tinge, due to the numerous pycnidia, which in some cases are arranged so as to show concentric zonation. The spores are ovoid, 10 by 7 μ, hyaline, guttulate, and embedded in a mucilaginous matrix. This blight in one locality was observed to have destroyed about half the foliage; so it is the cause of serious harm.

Specimens collected: Austin, 1313; New Braunfels, 1667; Stockdale, 2637.

Leaf-spot (*Ramularia hedericola* Heald and Wolf, 32).—Large irregular spots, grayish brown above and brown below, appear on the leaves. The margin of the diseased area is elevated, with the fungus fruits on the upper leaf surface. Conidiophores 60 to 120 by 4 μ, septate. Conidia clear, 9 to 15 by 2.5 μ. (Pl. V, fig. 5.)

Specimen collected: San Marcos, 2130 (type specimen).

EUONYMUS.

Anthracnose (*Colletotrichum griseum* Heald and Wolf, 32).—This is one of the most common diseases of *Euonymus japonicus* Thunb. for this region. It forms on the leaves indefinite-margined, yellow blotches 1 to 4 mm. in diameter. These increase in size until the diseased areas are sometimes 8 to 10 mm. across; a definite, brown, elevated border is formed, and the center of the spot becomes gray. Scattered over this gray area are numerous black acervuli, either zonate or more or less scattered, usually concentrically arranged. Often the spots are marginal, or the disease may apparently work back from the tip of the leaf. (Pl. XII, fig. 2.)

The twigs and larger branches are also affected, resulting in the formation of gray cankers 1 to 8 mm. in diameter.

These gray patches drop away, leaving the brown, cankered area exposed. The acervuli are immersed, varying in shape from globular to quite flat, 250 to 300 μ in diameter, the margin of the opening being set with numerous brown setæ, 40 to 60 by 5 μ, quite uniform in diameter or sometimes taper pointed. (Pl. VI, figs. 1, 2.) The spores are straight or only slightly curved, hyaline, densely granular, or with several guttulæ, 14 to 17 by 4 μ, and rarely marked by a single transverse septum which does not divide the cell into equal halves. (Pl. VI, fig. 1.)

Specimens collected: Austin, 1280 (type specimen); San Antonio, 1404; Lockhart, 2110; Georgetown, 2353, 2376.

Leaf-spot (*Exosporium concentricum* Heald and Wolf, 32).—This fungus produces on the leaves circular areas 0.5 to 2 cm. in diameter which may show concentric zonation. This zonation is due to concentric regions of brown and grayish yellow. The acervuli are confined to the grayish-yellow regions. In other cases the spots may be uniformly grayish yellow with a narrow brown border. Usually only one spot is present on each leaf, but occasionally there are several, which fuse. (Pl. XII, fig. 1.) The affected leaves may show considerable yellowing beyond the diseased areas, and in severe cases much defoliation follows.

The acervuli, 100 to 150 μ in diameter, are dark and either concentrically arranged or scattered. They are at first covered and at length protrude, causing that portion of the leaf to become grayish because the rupture of the epidermis has admitted the air. The spores are nearly hyaline, clavate cylindrical, 25 to 45 by 2.5 to 3 μ, one to several septate. (Pl. VII, fig. 5.)

Specimens collected: San Marcos, 2129; Georgetown, 2375; Austin, 2867 (type specimen).

HACKBERRY.

Leaf-spot (*Cylindrosporium defoliatum* Heald and Wolf, 32).—The common hackberry of this region (*Celtis laevigata* Willd.) is quite generally affected with a serious leaf blight which first produces irregular gray blotches 1 to 2 cm. in diameter. These blotches sometimes coalesce and involve a large part of the leaf. (Pl. XIV, fig. 1.) In early stages of the disease the adjacent leaf tissue may remain green, but later a considerable amount of yellowing is produced, and the affected leaves fall from the tree.

The acervuli are amphigenous, but more abundant upon the upper surface, 60 to 75 μ, immersed. (Pl. VI, fig. 10.) The spores accumulate on the surface of the leaf, where they are visible as minute white tufts. The spores are hyaline, cylindrical, straight, or curved, 30 to 42 by 3 to 3.5 μ, and three to five septate. (Pl. VI, fig. 9.) This species is clearly distinct from *Cylindrosporium celtidis* Earle, which has been described as forming small spots on *C. laevigata* in Alabama (11).

Specimens collected: (1) On *Celtis laevigata* Willd.—New Braunfels, 1673; Austin, 1728, 1905 (type specimen); Elgin, 1890; Bastrop, 2049; Lockhart, 2073; San Marcos, 2099; Cotulla, 2180; Luling, 2256; Seguin, 2317; Georgetown, 2377; Victoria, 2509; Cuero, 2578; Stockdale, 2615; Gonzales, 2689; Flatonia, 2709; Yoakum, 2771. (2) On *Celtis reticulata* Torr.—Beeville, 1855; Sabinal, 1975.

Leaf-spot (*Ramularia celtidis* Ell. and Kellerm.).—Very numerous small white spots form on the leaves. They are circular in outline and about 2 mm. in diameter. The margin is brown or yellow and slightly raised.

Specimens collected: (1) On *Celtis reticulata* Torr.—Austin, 464; Beeville, 1814; Luling, 2265; Gonzales, 2690; Kennedy, 2835. (2) On *C. laevigata* Willd.—Austin, 1539; Lockhart, 2062; Georgetown, 2355; Hallettsville, 2779.

Mistletoe (*Phoradendron flavescens* (Pursh.) Nutt.).—This parasitic plant is present on the hackberry throughout the territory covered by this survey. It is often so abundant that the winter aspect makes the tree appear in full foliage.

Powdery mildew (*Uncinula polychaeta* B. and C.).—The mycelium forms a white, felty coating on both leaf surfaces, generally forming patches and not covering the entire leaf.

Specimens collected: On *Celtis reticulata* Torr.—Austin, 415; Georgetown, 2392; Cuero, 2587.

HAWTHORN.

Blotch (*Hendersonia foliorum* Fckl.).—On the leaves of the hawthorn (*Crataegus* spp.) large, brown, irregular blotches appear, and on these blotches black dots (the pycnidia) are formed. Each

pycnidium contains brown spores, 15 by 6 μ, and three septate. It is probably merely associated with a physiological languor, coming in as a saprophyte.

Specimen collected: Gonzales, 2698.

Leaf-spot (*Cercospora crataegi* Heald and Wolf, 32).—This fungus causes the formation of large, dark-brown, irregular areas from 5 to 10 mm. or more in diameter. The spots are darker above than below, and when as many as 20 to 25 in number are confluent, involving large areas, with chlorotic tissue surrounding them. The upper surface is broken by the numerous brown tufts of conidiophores and conidia. The conidiophores are closely aggregated, 24 to 30 by 5 to 6 μ, brown and nonseptate. The conidia are clavate, straight or curved, 120 to 180 by 5 to 7 μ, many septate with prominent guttulæ. (Pl. IV, fig. 2.)

Specimen collected: Gonzales, 2697 (type specimen).

Rust (*Gymnosporangium globosum* Farl.).—The cluster cups of this rust were found abundantly present on the leaves and twigs of *Crataegus crus-galli* L. (See under "Cedar.")

Specimens collected: Austin, 1312, 1444 (cluster cups).

Rust (*Gymnosporangium* sp.).—Several species of Crataegus have been found whose leaves are covered by reddish-yellow areas, with a group of black spermagonia at the center.

Specimens collected: Elgin, 2009; Lockhart, 2069.

HEMP TREE.

Leaf-spot (*Cercospora viticis* Ell. and Ev.).—Irregular, suborbicular, rusty spots, 2 to 4 mm. in diameter are formed on the hemp tree (*Vitex agnus-castus* L.). The margin of the area is elevated and darker, with a paler center as the spots become old.

Specimen collected: Nursery, 2569.

JAPANESE IVY.

Leaf-spot (*Phyllosticta labruscae* Thm.).—The spots produced on the Japanese ivy (*Psedera tricuspidata* (Sieb. and Zucc.) Rehder) by this fungus are subcircular, 5 to 8 mm. in diameter, reddish brown, with a narrow dark border. The black pycnidia open to the upper surface.

Specimen collected: Austin, 3103.

LILAC.

Leaf-blight (*Cercospora macromaculans* Heald and Wolf, 32).—This blight on the lilac (*Syringa* sp.) is characterized by the pres-

ence of large, brown, dead patches 1 cm. or more in diameter, which are more or less irregular and either central or marginal. The center of the spots is frequently gray, and sometimes an evident zonation is exhibited, due to the concentric arrangement of the dark conidial tufts.

Conidiophores amphigenous, densely fasciculate, many septate, dark brown, 60 to 75 by 6 μ; spores slender clavate, tapering gradually to the end, few to many septate, hyaline, 70 to 187 by 2.8 to 3 μ. (Pl. I, fig. 7.)

This blight causes the death of many leaves and much defoliation.

Specimens collected: Austin, 463, 1910; Kerrville, 1603 (type specimen).

Powdery mildew (*Microsphaera alni* (Wallr.) Wint.).—The lilac is only rarely used in this region as an ornamental shrub, and so the mildew is not common.

Specimen collected: Austin, 1308.

LIPPIA.

Leaf-spot (*Cylindrosporium lippiae* Heald and Wolf, 32).—This fungus produces on lippia (*Lippia ligustrina* (Lag.) Britton) three to four circular spots 2 or 3 mm. in diameter to each leaf. The spots have gray centers with narrow brown borders edged with a tinge of yellow, and show in the center numerous white conidial tufts.

Acervuli amphigenous, 30 to 100 μ in diameter, more on the upper surface; spores hyaline, straight or generally curved, continuous or one to three septate, 24 to 54 by 3 μ, nearly cylindrical. (Pl. VI, fig. 5).

Specimen collected: Llano, 1756 (type specimen).

MAGNOLIA.

Leaf-spot (*Coniothyrium olivaceum* Bon. var. *grandiflorae* Sacc.).—This fungus on the magnolia (*Magnolia grandiflora* L.) occurs on circular or subcircular, definite-margined spots, 1 to 5 mm. in diameter, which are yellowish brown above with a narrow limiting zone of darker brown and uniformly brown on the under surface, but of a darker shade. There may be from a few to a dozen or more spots to each leaf, but the fungus is not responsible for any defoliation.

The pycnidia are on the lower surface and are uniform in color with the spot, and consequently are not visible to the naked eye. They are globular, 100 μ in diameter, which is much less than the recorded size (300 to 350 μ), but the spores are of similar dimensions.

Specimen collected: Georgetown, 2374.

MAPLE.

Leaf tip-blight (*Gloeosporium* sp.?).—The maple (*Acer saccharinum* L.) is not indigenous to this section, and occurs only rarely

under cultivation. This leaf disease causes a browning of the tips of the lobes. The acervuli are sparsely present on the lower surface. We were unable definitely to associate this fungus with any of the ten species described as occurring on species of Acer.

Specimens collected: Victoria, 2520; Flatonia, 2716.

MESQUITE.

Anthracnose (*Gloeosporium leguminum* (Cke.) Sacc.).—The pods of the mesquite (*Prosopis glandulosa* Torr.) are quite generally affected by a Gloeosporium, which produces irregular slightly sunken areas on one side of the pods or completely encircling them. The spots show numerous black acervuli, which are generally aggregated and frequently confluent on a gray ground, and the whole area is surrounded by a narrow zone of brown. Seriously affected pods fall from the tree before they reach maturity.

Specimens collected: Austin, 17; San Antonio, 1360; Beeville, 1796; Elgin, 1891; Uvalde, 1961; Hondo, 1996; Bastrop, 2046; Lockhart, 2061; San Marcos, 2096; Cotulla, 2184; Luling, 2253; Seguin, 2314; Stockdale, 2609; Gonzales, 2662; Floresville, 2843.

Blight.—The affected leaves in the early part of the growing season show a pronounced yellow color on the upper surface, while large numbers of minute yellowish heaps cover the under surface. The affected leaves soon fall, and by midsummer they have entirely disappeared. Thus far it has been impossible to associate the trouble with any known organism.

Specimens collected: San Marcos, 926; Austin, 1065.

Galls.—The large limbs and smaller branches of the mesquite sometimes show abnormal enlargements which are frequently globular or sometimes elongated and sometimes greatly exceed the diameter of the branch on which they are produced. (Pl. XV, figs. 2 and 3.) Specimens have been obtained ranging from 1 to 8 or 10 inches in diameter. The gall is produced by an abnormal growth of the wood, and cross sections of galls always show small brown specks where the wood cells are more or less disintegrated. These are distributed throughout the entire woody region.

These galls are not of insect origin, and cultural work attempted has as yet failed to connect either bacteria or fungi with the disease, although both have been obtained.

Specimens collected: Austin, 1294; Llano, 1746; Beeville, 1858; Cotulla, 2218; Runge, 2923.

Mistletoe (*Phoradendron flavescens* (Pursh.) Nutt.).—The American mistletoe is not uncommon on the mesquite. In some regions

having a scarcity of forage it is pruned from the trees and fed to cattle.

Specimens collected: Llano, 1737; Cotulla, 2183; Luling, 2277; Seguin, 2297.

Leaf-blight (*Cercospora prosopidis* Heald and Wolf, 32).—This disease is characterized by the presence of irregular, angular, brown patches which occupy one side of the midrib of the leaflets or extend across the whole leaflet and are generally bounded by a narrow, brown border. The spots may be either terminal or removed from the apex of the leaflets, and they frequently advance until the whole leaflet is killed or drops from the tree. In some cases it is very abundant and causes considerable defoliation. Its greatest development may be found in the dense mesquite thicket.

The conidiophores are amphigenous, densely fasciculate, uniformly brown, continuous, 18 to 30 by 3 to 4 μ; spores straight, cylindrical to slightly club shaped, brownish, 20 to 70 by 4 to 5 μ, and one to many septate. (Pl. III, fig. 2.)

Specimens collected: Uvalde, 1959 (type specimen); Luling, 2264; Falfurrias, 2468; Gonzales, 2663; Kennedy, 2824; Floresville, 2847.

Powdery mildew (*Erysiphe* sp. ?).—The young mesquites are frequently affected with powdery mildew, but it is rare on older trees. It produces no apparent injury and is abundant only near the end of the growing season. Immature perithecia were found in one locality, but all other collections represent only the conidial stage. Salmon in his monograph does not record a powdery mildew for this host, hence the specific determination can not be made.

Specimens collected: Austin, 200, 2917; Beeville, 1867; Uvalde, 1960; San Marcos, 2091; Cotulla, 2172; Luling, 2278; Seguin, 2315; Farfurrias, 2491; Cuero, 2579; Stockdale, 2610; Gonzales, 2684; Skidmore, 2815; Kennedy, 2837; Floresville, 2841; Hallettsville, 2900.

Rust (*Ravenelia arizonica* Ell. and Ev.).—This rust is very inconspicuous, producing a few minute brown sori on both surfaces of the leaflets. There was no other discoloration of the leaves in the specimens collected. Specimens obtained from a single locality.

Specimen collected: Falfurrias, 2492.

MULBERRY.

Die-back (*Myxosporium diedickei* Syd.).—The branches of young mulberry plants (*Morus* spp.) in the nursery rows were covered with whitish or pink pustules protruding through the epidermis. The terminal portions of the twigs had apparently been killed by this fungus.

Specimen collected: On *Morus alba* L.—Georgetown, 2359.

Eye-spot (*Cercospora moricola* Cke.).—This fungus produces circular or subcircular spots 3 to 7 mm. in diameter on the leaves. The center is tan colored, with a very dark outer zone and outside of this a halo of yellowish brown, paling out into the green. (Pl. XIII, fig. 2.) The conidiophores, densely tufted, pale yellow, 20 to 25 by 3 to 3.5 μ, are on the lower surface. The conidia are clavate, 30 to 75 by 4 to 4.5 μ, slightly colored, two to eight septate, guttulate. (Pl. IV, fig. 6.) This is a common disease on both wild and cultivated forms.

Specimens collected: On *Morus rubra* L.—Llano, 1747; Luling, 2273; Seguin, 2282; Victoria, 2512; Nursery, 2558, 2568; Stockdale, 2607; Hallettsville, 2796.

Leaf-spot (*Cercospora missouriensis* Wint.).—Large, orbicular, dark-brown spots are formed on the leaves. They vary in size from 3 to 7 mm. and usually have a slightly darker border. The conidiophores are borne on the lower surface in dense tufts.

This species is listed by Saccardo (44) under *C. pulvinulata* Sacc. and Wint.

Specimens collected: On *Morus rubra* L.—Austin, 465, 469; Beeville, 1844; Falfurrias, 2459; Cuero, 2597; Floresville, 2842.

Leaf-spot (*Cercosporella mori* Pk.[1]).—This diseased condition of the foliage is characterized by the formation of irregular, circular or angular spots 1 to 8 mm. in diameter. The areas are brown in color, with a darker border. A conspicuous cushionlike cluster of white or pinkish conidia is extruded near the center, or they may be scattered over the surface of the spots. These acervuli are for the most part on the under surface of the leaf, and are 50 to 100 μ in diameter. The conidiophores are faintly smoky. The conidia are slightly clavate, several septate, hyaline, 35 to 75 by 3 to 4 μ. (Pl. VII, fig. 8.)

Specimens collected: On *Morus alba* L.—New Braunfels, 1684, 1721; Beeville, 1832; Seguin, 2330; Austin, 3184.

OAK.

Ball moss (*Tillandsia recurvata* L.).—This lives epiphytically on the oak (*Quercus* spp.) throughout the entire range except the extreme western and northwestern portions covered by this survey. It is quite commonly considered as parasitic, since it occurs so abundantly and is so apparent on dead trees. Death is probably due to shading of the foliage in addition to edaphic and climatic factors.

Leaf-spot (*Marsonia quercus* Pk.).—The spots, 1 to 2 mm. in diameter, are whitish or grayish brown above and brown below. The areas are often bordered by a narrow purplish zone.

Specimens collected: Elgin, 2008; Victoria, 2502; Stockdale, 2644; Flatonia, 2735.

[1] This fungus has been determined as *Cercosporella mori* nov. sp. by Prof. C. H. Peck, to whom specimens were sent for identification.

Spanish moss (*Dendropogon usneoides* (L.) Raf.).—This epiphyte forms long pendent festoons and is very commonly distributed. It is most abundant, however, along the watercourses, while the ball moss is more abundant on the higher ground.

Tar-spot (*Rhytisma erythrosporum* B. and C.).—Thin, black blotches, usually about 4 mm. in diameter, but sometimes as large as 8 mm., are formed on the upper surface of the leaves of the live oak. (Pl. XIII, fig. 3.)

Specimens collected: On *Quercus virginiana* Mill.—Austin, 176, 496, 547, 2936.

OLEASTER.

Leaf-spot (*Cercospora elaeagni* Heald and Wolf, 32).—In this disease the leaves of the oleaster (*Elaeagnus* sp.) show on the upper surface an abundance of circular or subcircular spots 1 to 2 mm. in diameter with a definite brown border and a whitish or brown center. The spots are inconspicuous on the under surface on account of the dense, silvery tomentum. There is generally some yellowing beyond the spot and in many cases a pronounced yellowing of the whole leaf.

Conidiophores amphigenous, densely fasciculate, dark brown, 40 by 3.5 to 4 μ, more abundant on the upper surface; spores clavate, straight or slightly curved, nearly hyaline, 28 to 150 by 2.5 to 4 μ, and one to several septate. (Pl. IV, fig. 4.)

Specimen collected: On imported host (species not known)—Floresville, 2861 (type specimen).

OSAGE ORANGE.

Blight (*Sporodesmium maclurae* Thm.).—No definite spots are produced on the foliage of the Osage orange (*Toxylon pomiferum* Raf.). The under surface acquires a diffuse dirty-brown coloration, not so abundant, however, on the upper surface. Considerable chlorosis accompanies this disease, and a subsequent defoliation results. (Pl. V, fig. 6.)

Specimens collected: Austin, 1922; Seguin, 2319.

Cottony leaf-spot (*Ovularia maclurae* Ell. and Langl.).—This leaf disease is characterized by the cottony appearance of the lower surface of the affected areas. The upper surface of the spots is circular to irregular, rusty brown, and they vary in size from 3 to 10 mm.

Specimen collected: Gonzales, 2694.

PECAN.

Leaf-blight (*Septoria caryae* Ell. and Ev.).—Some of the trees of the pecan (*Hicoria pecan* (Marsh.) Britt.) in the vicinity of Austin show a large amount of leaf-blight characterized by the presence of large, irregular, chestnut-brown areas on the under surface of the

leaflets, while the upper surface is somewhat paler. The minute black pycnidia are very numerous on the under surface, but are absent from the upper surface. It may be noted that the description of Saccardo (47) gives the pycnidia as amphigenous. There is also a considerable amount of yellowing of the leaf tissue adjacent to the spots, and more or less defoliation results.

Specimens collected: Austin, 238, 2908.

Leaf-spot (*Clasterosporium diffusum* Heald and Wolf, 32).—This fungus produces circular or irregular, indefinite-margined, brown spots, 5 to 10 mm. in diameter, which are uniformly brown on both surfaces of the leaflets.

The fungus produces dark-brown hyphæ which run throughout the dead tissue, or creep over either surface of the affected area, or are sometimes aggregated to produce clusters of erect conidiophores. Spores curved-clavate, many septate, brown, 45 to 135 by 4 to 5 μ. (Pl. VII, fig. 4.)

Specimens collected: Victoria, 2536; Gonzales, 2695 (type specimen); Yoakum, 2770; Hallettsville, 2783.

Scab (*Fusicladium effusum* Wint.).—This disease first produces minute brown spots on the under surface of the leaflet which increase in size until they reach 3 to 5 mm. in diameter. The spots are circular or subcircular, and in severe infections they may become confluent. In the earlier stages the spots are confined to the lower surface, but finally the leaf tissue is killed and the spot becomes dark brown on the upper surface. It does not show the velvety appearance of the under surface, since the conidiophores are entirely hypophyllous. The scab spots occur also on the petioles.

Specimens collected: Kerrville, 1570; Uvalde, 1927; Seguin, 2309.

POISON OAK.

Rust (*Pileolaria toxicodendri* (B. and Rav.) Arth.).—The small chocolate-brown sori are formed in abundance on the upper surface of the leaves of the poison oak (*Rhus toxicodendron* L.).

Specimen collected: Austin, 347.

POMEGRANATE.

Leaf-spot (*Cercospora lythracearum* Heald and Wolf, 32).—This fungus on the pomegranate (*Punica granatum* L.) produces angular—more or less rounded—brown spots with an indefinite margin below, 1 to 4 or 5 mm. in diameter, sometimes larger. Exceedingly dense aggregates of conidiophores are present on both surfaces, 20 to 30 by 3 μ, clear or only faintly yellowish; conidia clavate, 30 to 56 by 3 to 3.5 μ, clear, septate. (Pl. I, fig. 5.)

This is apparently the same species of Cercospora which we have described as causing a leaf spot of crape myrtle (p. 64), a closely related host, and the difference in the conidiophores is no more than might be expected from growth upon different hosts.

Specimens collected: Beeville, 1829; Falfurrias, 2472; Victoria, 2510, 2515; Cuero, 2589; Flatonia, 2738.

PRICKLY ASH.

Rust (*Aecidium xanthoxyli* Pk.).—Cluster cups were found on the leaves of prickly ash (*Zanthoxylum clava-herculis* L.); especially abundant in the vicinity of Austin.

Specimens collected: Elgin, 1872; Austin, 3114.

Sooty mold (*Fumago vagans?* P.).—This forms a sooty coating on the foliage.

Specimen collected: Austin, 419.

PRIVET.

Leaf-spot (*Cercospora adusta* Heald and Wolf, 32.)—This forms on the privet (*Ligustrum* spp.) dark-brown areas involving large spots, frequently extending from the tip downward or from the margin inward. Rarely are the spots removed from the margin. The older diseased parts become very dark and the newer, brown, with a gradual shading out into the chlorotic tissue. Conidiophores 100 to 150 by 4 to 5 μ, brown and septate, appear on both surfaces in small clusters. The conidia are densely granular, clear, multiseptate, and 85 to 160 by 3 to 4 μ. (Pl. III, fig. 1.)

Alternaria is abundantly present on the spots, probably as a saprophyte.

Specimens collected: On *Ligustrum ovalifolium* Hassk.—Falfurrias, 2471 (type specimen); Floresville, 2851.

Leaf-spot (*Cercospora ligustri* Roum.).—Somewhat circular or irregular spots, sometimes as large as 7 mm., are formed. They are brown with a grayish center above and brown below. The margin is purplish or darker brown. (Pl. XV, fig. 1.)

Specimen collected: On *Ligustrum japonicum* Thunb.—Austin, 1316.

Leaf-spot (*Phyllosticta ovalifolii* Brun.).—Small circular brown spots 2 or 3 mm. in diameter, with a darker margin, occur on the leaves. The black pycnidia are few in each area.

Specimen collected: On *Ligustrum ovalifolium* Hassk.—San Antonio, 1405.

REDBUD.

Leaf-spot (*Cercospora cercidicola* Ell.).—In the beginning small brown spots appear on the leaves of the redbud (*Cercis occidentalis* Torr.). These spots become 2 to 4 mm. in diameter, angular, dark brown above and brown below, with a region of yellow tissue sur-

rounding each spot. The leaves become badly spotted, and defoliation results.

Specimens collected: Kerrville, 1621; Austin, 1913; Georgetown, 2397.

RETAMA.

Sooty mold (*Dimerosporium parkinsoniae* Heald and Wolf, 32).—The leaves and smaller twigs and even the smooth bark of larger branches of retama (*Parkinsonia aculeata* L.) are sometimes covered with patches made up of dense aggregates of brown, septate hyphæ. The conidia are dark brown, one to four celled, and also muriform. (Pl. VII, fig. 2.) The asci are eight spored, 45 to 50 by 12 to 15 μ; spores hyaline, two celled, lower cell smaller, both biguttulate, and 15 to 18 by 4 to 6 μ. (Pl. VII, fig. 1.)

Specimens collected: Austin, 455; Seguin, 2311 (type specimen); Gonzales, 2658; Hallettsville, 2901.

SUMAC.

Leaf-spot (*Cercospora rhoina* Cke. and Ell.).—Circular or irregular brown or dark-brown, almost black, spots, 3 to 5 mm. in diameter, are formed on the leaves of sumac (*Rhus copallina lanceolata* Gray). They have a tendency to be marginal and extend inward, the outline being angular, due to the veins of the leaf.

Specimens collected: Austin, 218; Georgetown, 2399.

SWAMP CYPRESS.

Leaf-blight (*Pestalozzia funerea* Desm.).—In this disease the leaflets of the swamp cypress (*Taxodium distichum* (L.) Rich.) turn brown. Beginning at the tips, they become brown throughout, or show somewhat grayish, with an abundance of black acervuli. The foliage of affected trees was badly blighted. In one collection showing similar symptoms the Pestalozzia was not present, but an Alternaria species was found, so it may be possible that the Pestalozzia is only a secondary factor in producing the disease.

Specimens collected: Victoria, 2535; Gonzales, 2678.

SYCAMORE.

Blight (*Gloeosporium nervisequum* (Fckl.) Sacc.).—This blight, which is characterized by the formation of dead areas beginning at the margin of the leaf or the tips of the lobes and spreading throughout the leaf, is very destructive to the sycamore (*Platanus occidentalis* L.) in the more humid portion of this territory, but rare in the western and southwestern portion.

Specimens collected: Tyler, 1550; New Braunfels, 1723; Bastrop, 2056; San Marcos, 2118; Georgetown, 2371; Flatonia, 2710; Hallettsville, 2774; Falfurrias, 2470.

Leaf-blight (*Phleospora multimaculans* Heald and Wolf, 32).—Definite, irregular, circular or angular spots, dark brown or purple, and 1 to 3 mm. in diameter, are produced upon the upper surface of the leaves. They frequently show a brown center, and on the under surface the spot is brown throughout with a darker brown border. The spots frequently become confluent and produce dirty-brown, extended, dead areas. The spots may be very numerous, and in nurseries much defoliation results. (Pl. XIV, fig. 2.)

The pycnidia are hypophyllous; spores nearly cylindrical, straight or curved, hyaline, 30 to 50 by 3.5 to 5 μ, and two to three septate, sometimes four septate (Pl. V, fig. 7). (See also Walnut.)

Specimens collected: Austin, 1398, 1535; Brenham, 1462; New Braunfels, 1682 (type specimen); Llano, 1767; Victoria, 2503; Gonzales, 2655; Floresville, 2858.

SYMPHORICARPOS.

Powdery mildew (*Microsphaera diffusa* Cke. and Pk.).—Both the conidial and perithecial condition were abundantly present on *Symphoricarpos orbiculatus* Moench where this was observed. Causes little apparent injury.

Specimen collected: Austin, 1311.

TREE-OF-HEAVEN.

Shot-hole (*Cercospora glandulosa* Ell. and Kellerm.).—This disease on the tree-of-heaven (*Ailanthus glandulosa* Desf.) forms circular spots 1 to 3 mm. in diameter, brown, becoming gray above, with an elevated margin. The whitish conidial tufts are very conspicuous on the lower surface. The entire diseased area at length drops out, producing on the leaves a "shot-hole" effect.

Specimens collected: New Braunfels, 1698; Austin, 2862.

TRUMPET CREEPER.

Leaf-mold (*Cercospora sordida* Sacc.).—On the lower surface of the leaf of trumpet creeper (*Tecoma radicans* (L.) Juss.) a diffuse, indefinite, brown or olivaceous coating is formed. This shows on the upper surface as a slight chlorosis of the tissue.

Specimens collected: Bastrop, 2023; Victoria, 2519.

Leaf-spot (*Septoria tecomæ* Ell. and Ev.).—The diseased areas are purplish throughout in the earlier stages of their development, 2 to 3 mm. in diameter, and with an indefinite outline. Later a minute, central, grayish patch is formed in which the pycnidia are produced.

Specimen collected: Austin, 1317.

TULIP TREE.

Leaf-blight (*Gloeosporium liriodendri* Ell. and Ev.).—The leaves of the tulip tree (*Liriodendron tulipifera* L.) may show extended, dead, brown patches which involve part or the whole of the leaf lobes, advancing from the tips or margins. The spots are light brown and darker at the advancing edges. *Gloeosporium liriodendri* is present, but it is impossible to say whether it is the entire cause of the blight.

Specimens collected: New Braunfels, 1680; Seguin, 2281.

Leaf-spot.—The leaves of the tulip tree in one locality showed a definite spotting which indicates a fungous trouble, although no fungus spores were found. The spots are irregularly circular, 4 to 8 mm. in diameter, dark brown or black, surrounded by a broad zone of yellow which fades out without a definite boundary. On the lower surface the spots are less pronounced and more of a purplish-black color. The affected leaves may show only a few spots or as many as 25, and in some cases extensive, dead, brown areas may be produced.

Specimen collected: Georgetown, 2370.

UMBRELLA CHINA TREE.

Root-rot (*Ozonium omnivorum* Shear.).—This was found on an umbrella China tree (*Melia azedarach* L.) in a nursery where the root-rot had killed the young trees of black locust in an adjacent plat.

Specimen collected: Georgetown, 2352.

VIRGINIA CREEPER.

Leaf-spot (*Cercospora pustula* Cke.).—This fungus produces on the Virginia creeper (*Psedera quinquefolia* (L.) Greene) dark-brown, purple, or almost black spots, subcircular or angular, 1 to 2 mm. in diameter or smaller, and generally surrounded by a zone of yellow. Colors are more dilute on the under surface.

The conidiophores are epiphyllous, fasciculate in rather sparse groups, continuous, 35 to 45 by 4 μ, uniformly yellowish brown; spores smoky, clavate, straight or curved, 28 to 72 by 4 μ, and two or three septate. (Pl. III, fig. 5.) Differs from *C. ampelopsidis* in having smaller spores, and epiphyllous conidiophores.

Specimens collected: Austin, 1277; New Braunfels, 1669.

Leaf-spot (*Phyllosticta ampelopsidis* Ell. and Martin).—Definite, circular, brown spots, 1 to 5 mm. in diameter, with a darker border, are characteristic of this trouble.

Specimens collected: Austin, 1547; New Braunfels, 1670.

WALNUT.

Leaf-spot (*Phleospora multimaculans* Heald and Wolf, 32).—The spots on the leaves of the walnut (*Juglans* sp.) produced by this fungus average about 1 mm. in diameter, are subcircular, dark brown with a darker border on the upper surface, and about a uniform brown on the under surface. The spots may be few in number, or they may be so numerous as almost completely to cover the leaf. It is very severe in some cases and causes much defoliation.

The pycnidia are hypophyllous, 30 by 45 μ; the spores are generally curved, hyaline, nearly cylindrical, 20 to 40 by 3 to 3.5 μ, and one to three septate. (Pl. V, fig. 11.) The general symptomatology and the close relationship of the hosts indicate that this is the same species as described on the sycamore (p. 79), although there are slight morphological differences.

Specimens collected: (1) On *Juglans nigra* L.—Austin, 1538, 2426; Victoria, 2337; Stockdale, 2621; Gonzales, 2682; Flatonia, 2721 (type specimen); Falfurrias, 2460. (2) On *Juglans regia* L.—Austin, 366; Falfurrias, 2461.

WILD CHINA TREE.

Leaf-spot (*Cylindrosporium griseum* Heald and Wolf, 32).—Very numerous grayish or whitish, circular or slightly angular spots are produced on both surfaces of the leaflets and the rachis of the wild China tree (*Sapindus drummondii* Hook. and Arn.) The spots vary in size from 1 to 5 mm. with a predominating size of 1 to 2 mm. and show more prominent veins owing to the shrinking of the tissue. They may become confluent and cause extended dead areas (Pl. XIX, fig. 1).

The acervuli are amphigenous, more abundant on the upper surface, and are located immediately over the prominent veins (Pl. VI, fig. 12); they may be nearly circular in outline or much elongated along the veins, pale when young, becoming darker with age. The spores are cylindrical, slightly curved or sometimes straight, hyaline, 90 to 135 by 3 to 4.5 μ, and seven to nine septate (Pl. VI, fig. 11).

Specimens collected: Kerrville, 1588; Llano, 1757 (type specimen); Bastrop, 2026; San Marcos, 2098.

Powdery mildew (*Uncinula circinata* Cke. and Pk.).—The mycelium of the fungus forms a very effuse coating, most abundant on the lower surface. The leaves first become yellow and later dry and brown. The scattered perithecia are produced on the lower surface, dark brown in color, 150 to 180 μ in diameter, with clear appendages about equal in length to the diameter of the perithecium. The asci are elongated 65 to 70 by 25 to 30 μ, containing six to eight ascospores 15 to 18 by 9 to 12 μ. This species is somewhat doubt-

fully referred to *U. circinata.* Salmon records it for species of Acer only.

Specimens collected: Austin, 315, 441.

WILLOW.

Leaf-spot (*Cercospora salicina* Ell. and Ev.).—Dark-brown, irregular, more or less confluent areas from 3 to 8 mm. in diameter are present on the leaves of the willow (*Salix* sp.). The greater part of the leaf becomes involved.

Specimens collected: New Braunfels, 1724; Victoria, 2530; Falfurrias, 2462; Floresville, 2856.

Rust (*Melampsora bigelowii* Thm.).—The yellow sori appear on the foliage, upon the under surface of the leaves.

Specimens collected: Austin, 83, 237.

WISTARIA.

Leaf-spot (*Phyllosticta wistariae* Sacc.).—This fungus on the wistaria (*Kraunhia* sp.) causes circular grayish or brown spots 2 to 5 mm. in diameter, with a narrow purple border. Pycnidia are not abundant, and on some of the spots a species of Alternaria is present. Affected leaves showed considerable chlorosis.

Specimen collected: Austin, 1304.

DISEASES OF ORNAMENTAL PLANTS.

BALSAM-APPLE.

Leaf-blight (*Ramularia momordicae* Heald and Wolf, 32).—In the early stages of this disease the leaves of the balsam-apple (*Momordica balsamina* L.) show irregular blotches of yellow. As the disease advances, circular to subcircular yellowish-brown areas, varying from 1 to 10 mm. in diameter, with a more or less evident zonation, are formed on the upper side of the leaf. On the lower surface these areas become depressed with a ridged margin and are dark brown in color, due to the abundance of conidiophores and conidia. The conidiophores, aggregated in tufts of 8 to 14, are 30 to 45 by 4 to 5 μ in size and brown in color. The spores are cylindrical, hyaline, 42 to 65 by 4 to 5 μ, and 1 to 5 septate. (Pl. V, fig. 1.) The spots are often so numerous as to be confluent, causing the leaves to curl and become dry. Much defoliation results.

Specimen collected: Falfurrias, 2482 (type specimen).

BEGONIA.

Bacterial leaf-spot (*Bacillus pyrocyanus* P. and D.) (?).—The first appearance of this trouble on the leaves of the begonia (*Begonia* sp.)

can be noted by the presence of purplish areas 1 to 2 mm. in diameter. These spots become depressed, often show concentric zonation, and increase in size to 4 to 8 mm., with a wide area of yellow, dead tissue around them. The yellow areas may fuse, thus involving a large part of the leaf, so that it is completely destroyed. (Pl. XVII, fig. 2.) This is probably the same disease that occurs in France, although it was not observed to attack the stems but only the leaves (40). The disease was observed in only a single locality, on greenhouse plants. No cultural work with the organism was attempted.

Specimens collected: San Antonio, 1411, 3176.

CANDYTUFT.

Dodder (*Cuscuta indecora* Choisy).—This parasite was observed on the candytuft (*Iberis* sp.) in only a single locality where it had spread to a considerable extent.

Specimen collected: San Antonio, 1372.

CANNA.

Leaf-blight.—A very serious leaf disease of the canna (*Canna indica* L.) appears at first as minute yellowish spots which become from 5 to 10 mm. in diameter, with brown centers. When isolated they are subcircular in outline, but when abundant they coalesce so that large irregular areas are involved. The brown parts show alternating concentric rings of lighter and darker areas of brown. Examination reveals no evidence of either fungi or bacteria, yet the trouble is apparently of fungous origin. In severe cases the entire leaf or leaf tip becomes dead and brown.

Specimens collected: New Braunfels, 1672, 1710.

CARNATION.

Root-rot (*Fusarium* sp.?).—This root disease was observed on the carnation (*Dianthus caryophyllus* L.) both in the greenhouse and in an irrigated garden. The smaller roots are destroyed and the larger ones become badly disintegrated.

Considerable loss results among young plants.

Specimens collected: San Antonio, 1385; Austin, 1914.

Rust (*Uromyces caryophyllinus* (Schrk.) Schrt.).—This fungus was collected in a greenhouse in a single locality. The brown sori were formed on the leaves and stems, but were not sufficiently abundant to cause serious harm.

Specimens collected: Austin, 2941, 3059.

CASTOR BEAN.

White leaf-spot (*Cercospora ricinella* Sacc. and Berl.).—On the foliage of the castor bean (*Ricinus communis* L.) this fungus causes the formation of small circular spots from 1 to 2 mm. in diameter. These spots are gray on both surfaces and have a well-defined, raised, purple margin. When the spots are abundant the leaves become yellow.

Specimens collected: Falfurrias, 2443; Flatonia, 2737; Hallettsville, 2780; Austin, 2921.

CENTURY PLANT.

Blight (*Stagonospora gigantea* Heald and Wolf, 32).—The disease begins on the tips or margin of the leaves of the century plant (*Agave americana* L.) and advances toward the base. (Pl. XVI, fig. 1.) The diseased tissue becomes dry, gray, and zonate, marking the periodic growth of the fungus. The pycnidia are on both leaf surfaces, covered at first, and at length protruding. They vary from 500 to 600 μ in diameter. (Pl. XVI, fig. 2.) The spores are large, hyaline, cylindrical, and slightly clavate, densely granular and frequently with many guttulæ, three septate and 72 to 115 by 13 to 15 μ. (Pl. V, fig. 3.) Our species differs from *S. macrospora* (Dur. and Mont.) Sacc., principally in having much larger spores, and also larger pycnidia.

This disease was very serious, blighting the plants in all the localities where it was observed.

Specimens collected: Austin, 1283 (type specimen); San Antonio, 1377; Boerne, 1648.

CHINA ASTER.

Stem-rot (*Fusarium* sp.?).—This fungus on the China aster (*Callistemma chinensis* (L.) Skeels) was the cause of a very considerable loss in the one locality in which it was observed. The young plants in the benches remain without any apparent growth for a time, then wither and die, with a serious disintegration of the stem near the ground.

Specimen collected: Austin, 1445.

CHRYSANTHEMUM.

Leaf-spot (*Septoria chrysanthemi* Allesch.).—This leaf-spot of chrysanthemum (*Chrysanthemum stipulaceum* (Moench) W. F. Wight) has been collected twice from greenhouses. In some cases it causes a considerable amount of defoliation, especially on the lower part of the plant.

Specimens collected: Austin, 380; Georgetown, 2368.

Root-knot (*Heterodera radicicola* (Greef) Mül.).—Observed in only a single locality. Affected plants were much dwarfed.

Specimen collected: Austin, 1921.

COLUMBINE.

Leaf anthracnose (*Gloeosporium aquilegiae* Thm.).—Large marginal spots, usually irregular in outline, are formed on the leaves of the columbine (*Aquilegia* sp.). These diseased areas are yellowish brown in color with a brown border and often a yellowish zone toward the advancing edge of the affected tissue. The lower surface shows the same colors except that they are more dilute. On the upper surface are numerous little dots, the acervuli. Observed in greenhouses only.

Specimens collected: Beeville, 1866; Austin, 2864.

CYCAS.

Blight (*Ascochyta cycadina* Scalia).—The leaflets of *Cycas revoluta* Thunb. turn yellow at the tips, and as the trouble advances the older diseased portions become brown. The pycnidia, black and more or less scattered, form on the upper surface. Observed in a single locality where it was abundantly present and apparently the cause of considerable injury.

Specimen collected: Beeville, 1852.

DAISY.

Dodder (*Cuscuta indecora* Choisy).—This was observed on the daisy (*Chrysanthemum* sp.) in a garden at San Antonio.

Specimen collected: San Antonio, 1664.

Leaf-spot (*Cercospora chrysanthemi* Heald and Wolf, 32).—The diseased areas are raised above and sunken below, and vary in size from 2 to 10 mm. They have very definite elevated borders, are subcircular or irregular in outline and brown in color, becoming grayish with age. The conidiophores, present on both surfaces, are densely fasciculate, brown, septate, 45 to 75 by 4 μ. The conidia are clavate, 40 to 120 by 4 μ, many septate, and dilutedly colored. (Pl. III, fig. 4.)

When the spots are abundant the leaf becomes brown between the diseased areas.

Specimen collected: San Antonio, 1659 (type specimen).

ELEPHANT'S-EAR.

Leaf-spot.—On the upper surface of the leaves of elephant's ear (*Colocasia esculenta* (L.) Schott.) the spots are circular in outline, 5 to 15 mm. in diameter, with a brown center and a surrounding zone

of yellow, shading out into the green tissue without a definite boundary. On the lower surface the spots are more definite in outline, with a brown center, surrounded by a yellowish-brown area with often a zone of diffuse white bordering the spot. This zone is 1 to 2 mm. wide, and probably marks the advance of the fungus. Only sterile fungous filaments were found. The affected leaves become chlorotic.

Specimen collected: New Braunfels, 1668.

FOUR-O'CLOCK.

White-rust (*Albugo platensis* (Speg.) Swingle).—This species of white-rust has been found on the common four-o'clock (*Mirabilis jalapa* L.). Sori were very abundant on the leaves which turned brown and shriveled, while those in which the disease was not so far advanced showed a marked chlorosis. Wilson (51) does not record this species for the four-o'clock, although it is common on other species of the Allioniaceæ.

Specimens collected: Austin, 3019, 3101.

GERANIUM.

Bacterial leaf-spot.—Geraniums (*Pelargonium* sp.) have been found to suffer in the greenhouse from what is apparently a bacterial spot. The affected leaves show numerous subcircular, brown or somewhat pellucid areas which are crowded full of bacteria. With the advance of the disease the intervening leaf tissue turns brown, and extensive dead, wrinkled areas result which show the original foci as darker spots scattered over the dead portions. Affected leaves generally show more or less chlorosis and may fall before they turn brown. (Pl. XVII, fig. 1.) Young plants in the same house were affected with a stem-rot which was probably also of bacterial origin.

Specimens collected: Austin, 374, 474, 1920.

HOLLYHOCK.

Leaf-spot (*Cercospora althaeina* Sacc.).—The numerous small circular or angular spots 1 to 5 mm. in diameter produced on the leaves of the hollyhock (*Althaea rosea* (L.) Cav.) by this fungus are reddish brown with a darker border and often a lighter center. The entire area is raised on the upper surface and depressed on the lower.

Specimen collected: Austin, 1904.

IRIS.

Leaf-blight (*Heterosporium gracile* (Wallr.) Sacc.).—This blight on the iris (*Iris* sp.) produces an abundance of spots which make their

appearance first on the distal portions of the leaves. The young spots show a yellow center surrounded by a zone of watery tissue. The older spots which have produced tufts of conidiophores are circular or elliptical, reaching 3 to 8 mm. in length, and show a gray center surrounded by a zone of brown, bordered by a narrow, watery area. The fungus is much more abundant toward the tips of the leaves and proceeds downward, the terminal portions of the leaves often becoming brown and dead, with the more or less zonate spots still conspicuous. In serious infections the leaf tissue turns yellow in advance of the fungus, and many leaves may be completely killed.

Specimens collected: On Peace variety—Austin, 457, 1323, 1436.

MAY-APPLE.

Rust (*Kuehneola hibisci* (Syd.) Arth.).—This rust on the May-apple (*Malvaviscus drummondii* T. and G.) produces very abundant, almost punctiform sori upon the under surface of the leaves and causes more or less browning of the upper surface.

Specimen collected: Austin, 372.

MEXICAN BLUEBELL.

Leaf-mold (*Cercospora nepheloides* Ell. and Holw.).—Diffuse olive-green patches appear on the leaves of the Mexican bluebell (*Eustoma russellianum* (Hook.) Griesb.) At first these patches are more or less circular, gradually spreading over large portions of the leaf, with considerable chlorosis. In the advanced stages of the disease the conidiophores and conidia have become evenly distributed over the brown, dead tissue.

Conidiophores 30 to 42 by 3 to 4 μ, brown, in dense fascicles; conidia 30 to 60 by 3 to 4 μ, brown, clavate, several septate. (Pl. II, fig. 3.) Both leaf surfaces are equally attacked, the lower leaves being most affected.

Our specimens agree with *C. nepheloides* Ell. and Holw. on *E. silenifolium* Salisb. No published descriptions of this species have been found, and the determination was made by a comparison of our specimens with one issued by S. B. Parish under the above name, labeled "Santa Barbara, Cal., Sep. '94."

Specimen collected: Austin, 1556 (type specimen).

PERIWINKLE.

Dodder (*Cuscuta indecora* Choisy).—This parasite on periwinkle (*Vinca rosea* L.) had run rampant in a garden.

Specimen collected: San Antonio, 1663.

ROSE.

Cane canker (*Coniothyrium fuckelii* Sacc.).—On the rose (*Rosa* spp.) canes or stems brown, sunken patches, 1 to 4 or 5 cm. in length, are formed. The stem may be girdled as the filaments extend through the cortex. Sometimes the open cankers are not so evident, the fungus being more diffuse. The pycnidia are formed just beneath the epidermis, at length protruding.

Specimens collected: Austin, 1282; San Antonio, 1384.

Dodder (*Cuscuta indecora* Choisy).—This was present in a garden where it had grown on several other hosts.

Specimen collected: San Antonio, 1374.

Leaf-blotch (*Actinonema rosae* (Lib.) Fr.).—This fungus has been observed in gardens and nurseries and produces a considerable amount of defoliation, especially in the nurseries.

Specimens collected: Austin, 20, 379, 1278, 1919, 2939; Victoria, 2336; Stockdale, 2640; Falfurrias, 2463.

Leaf-spot (*Cercospora rosicola* Pass.).—The spots produced by this fungus are circular, 1 to 5 mm. in diameter, with a pronounced purple border and a brown or grayish center. More or less yellowing of the foliage and defoliation occur when the spots are abundant.

Specimens collected: Austin, 371, 381, 1442; Brenham, 1456; Seguin, 2328; Georgetown, 2373; Victoria, 2524; Gonzales, 2687.

Powdery mildew (*Sphaerotheca humuli* (DC.) Burr. and *S. pannosa* (Wallr.) Lev.).—The first of these is the greenhouse form and is not so common as the latter. Early in the summer roses are very commonly completely defoliated by the ravages of *S. pannosa*.

Specimens collected: (1) (*S. humuli*)—San Antonio, 1370. (2) (*S. pannosa*)—Austin, 1275, 2940.

Rust (*Phragmidium disciflorum* (Tode) James).—The æcial stage was so abundantly present that the leaves were very conspicuously chlorotic above, while the orange-colored æciospores covered the lower surface.

Specimens collected: Austin, 3119; San Antonio, 3181.

STANDING CYPRESS.

Powdery mildew (*Sphaerotheca humuli* (DC.) Burr.) (?).—This mildew was very abundant in one locality where standing cypress (*Gilia rubra* (L.) Heller) was cultivated in large beds. The lower leaves were attacked first and many were completely killed. No perfect fruits were found. The mildew showed an abundance of a species of Cicinnobolus.

Specimens collected: Austin, 1309, 1437.

SWEET ALYSSUM.

Dodder (*Cuscuta* sp.?).—Sweet alyssum (*Konia maritima* (L.) R. Br.) infested with dodder was found in one locality. Not flowering.

Specimen collected: San Antonio, 1372.

SWEET PEA.

Dodder (*Cuscuta indecora* Choisy).—This parasite was present on the sweet pea (*Lathyrus odoratus* L.) and also on several other kinds of plants growing near.

Specimen collected: San Antonio, 1375.

VIOLET.

Leaf-spot (*Alternaria violae* Gall. and Dorsett).—This disease occurs on the leaves of the violet (*Viola odorata* L.), commencing with small yellowish spots. The spots are somewhat circular, 1 to 5 mm. in diameter, and become yellowish white at maturity. They frequently spread so that large areas are involved.

Specimens collected: San Antonio, 1383, 1662, 3180; Uvalde, 1964.

Leaf-spot (*Cercospora violae* Sacc.).—Numerous small pale spots are formed on the leaves. They vary in size from 1 to 3 mm., and are margined by a zone of brown.

Specimens collected: Beeville, 1856; Austin, 1917; Lockhart, 2131; Seguin, 2329; Victoria, 2334, 2523; Georgetown, 2372; Cuero, 2577; Flatonia, 2739; San Antonio, 3178.

ZINNIA.

Leaf-spot (*Cercospora atricincta* Heald and Wolf, 32).—This disease on the leaves of the zinnia (*Crassina elegans* (Jacq.) Kuntze) is characterized by the presence of irregular, angular, gray spots with a brown border. When the spots are abundant this border is narrow and the spots are small, 1 to 2 mm. in diameter. When they are few they may be 4 mm. in diameter, with a broad marginal zone of purplish or dark brown. The conidiophores are found on both surfaces in small groups, brown in color, septate, 45 to 70 by 3.5 to 4.5 μ.

The conidia are dilute brown, many septate, clavate, 100 to 200 by 4 to 4.5 μ. (Pl. I, fig. 4.)

This is quite common in gardens.

Specimens collected: San Antonio, 1381, 1660; Victoria, 2506 (type specimen).

DISEASES OF WILD PLANTS.

ARROW LEAF.

Leaf-spot (*Cercospora sagittariae* Ell. and Kellerm.).—This disease on the arrow leaf (*Sagittaria* sp.) is characterized by the presence of grayish-brown, circular, or subcircular spots, 2 to 10 mm. in diameter, with a darker border and exhibiting more or less concentric zonation. In some cases adjacent foci become confluent, thus involving larger areas of the leaf. Some chlorosis is frequent in badly affected leaves.

Conidiophores on both surfaces, in clusters of 2 to 5, brown, straight, continuous or one septate, 6 by 60 μ; spores straight or curved, tapering, club shaped, four to five septate, contents homogeneous or distinctly two guttulate, hyaline, or faintly smoky, 120 to 140 by 5.5 to 8 μ. (Pl. IV, fig. 1.)

Our specimens differ from *C. sagittariae* Ell. and Kellerm. in the size of the spores, which are recorded as 60 to 80 by 3 to 4 μ (15).

Specimens of *Sagittaria lancifolia* L. are affected with the same Cercospora, which is not perfectly developed, since the spores are 50 to 80 by 3.5 to 5 μ, indistinctly septate, more nearly straight, and hyaline. The general symptomatology is similar.

Specimens collected: (1) On *Sagittaria lancifolia* L.—Collins's Gardens, San Antonio, 1386 (represents young infections with immature spores). (2) On *S. platyphylla* (Engelman) Sm.—New Braunfels, 1676; San Antonio, 3164; San Marcos, 2121 (shows mostly immature spores and imperfectly developed spots). (3) On *Sagittaria* sp.?—Lockhart, 2064 (has but few mature spots).

BLUEBONNET.

Powdery mildew (*Erysiphe polygoni* DC.).—The stem, leaves, and pods of the bluebonnet (*Lupinus texensis* Hook.) are covered by the powdery white network of fungous filaments. Affected plants are paler green, with yellow-margined leaves, some of which are dry.

Specimen collected: Austin, 3126.

BLUET.

Rust (*Aecidium oldenlandianum* Ell. and Tracy).—The affected leaves of the bluet (*Houstonia angustifolia* Michx.) show considerable chlorosis. Nearly all leaves are attacked, so that affected plants are rendered conspicuous by their yellow color. The yellowish cluster cups containing the orange-colored æciospores open to the lower surface of the leaves.

Specimens collected: Austin, 2947, 2951.

BOERHAVIA.

White-rust (*Albugo platensis* (Speg.) Swingle).—Blisterlike elevations, each of which contains a white, powdery mass of spores, are

formed on the upper surface of the leaf of the Boerhavia (*Boerhavia* spp.). This disease is very widely distributed, but apparently causes little injury.

Specimens collected: San Antonio, 1371, 3175; New Braunfels, 1697; Bastrop, 2033; Lockhart, 2075; Cotulla, 2135; Seguin, 2318; Victoria, 2527; Nursery, 2574; Cuero, 2590; Stockdale, 2608; Gonzales, 2686; Kennedy, 2832.

BROOMWEED.

Rust (*Aecidium chrysopsidis* Ell. and Anders.).—On the stems and leaves (much more abundantly on the stems) of the broomweed (*Gutierrezia texana* (DC.) Torr. and Gray) are whitish or yellowish pustules, the cluster cups. They form in such numbers on the main stems and branches that these parts become brown and are killed.

This rust has been described (13) as occurring on *Gutierrezia euthamia* Torr. and Gray and is probably the same as the one on this species, although no note of the fact has been found.

Specimens collected: Victoria, 2538; Gonzales, 2679.

BULL NETTLE.

Leaf-spot (*Septoria jatrophae* Heald and Wolf, 32).—This causes the formation of very characteristic, brown, circular areas on the leaves of the bull nettle (*Jatropha stimulosa* Michx.). These spots vary in size from 1 to 5 mm. and are frequently somewhat irregular in outline. At first they are dark brown with a darker, almost black, border. Later the centers become tan and sometimes gray, but always with a definite dark margin. The pycnidia are 120 to 150 μ, brown and immersed wholly in the leaf tissues. The spores are rod shaped or slightly clavate, hyaline, 40 to 50 by 3 μ and few septate.

The spots frequently are so abundant that they fuse, causing the drying of large portions of the leaf.

Specimen collected: Austin, 2429 (type specimen).

CAROLINA CLOVER.

Rust (*Uromyces elegans* B. and C.).—The minute brown sori appear abundantly on the lower surface of the leaflets of Carolina clover (*Trifolium carolinianum* Michx.).

Specimen collected: Austin, 3060.

COCKLEBUR.

Leaf-spot (*Cercospora xanthicola* Heald and Wolf, 32.)—This fungus produces upon the leaves of the cocklebur (*Xanthium* spp.) numerous circular or subcircular spots, 0.5 to 2 mm. (1 mm. average size) in diameter, with dirty-gray or brownish centers surrounded by a nar-

row darker border. The number of infections on a single leaf may reach as high as 400 to 600, in which case the leaf shows more or less chlorosis, but frequently the spots are less numerous and the leaf shows little or no deviation from the normal color.

Conidiophores amphigenous, fascicles of 3 to 8, hyaline tipped, irregular-nodose for two-thirds the length, continuous or rarely septate, 3 to 3.5 by 60 to 100 μ. Spores 105 to 135 by 3 μ and reaching the length of 245 μ in some cases, very slender club shaped, tapering gradually from the base, generally somewhat curved, hyaline, and obscurely septate except in the basal portion. (Pl. II, fig. 4.)

Specimens collected: Luling, 2236; Georgetown, 2383 (type specimen); Nursery, 2567; Cuero, 2588; Gonzales, 2705; Yoakum, 2755; Hallettsville, 2790; Kennedy, 2836; Austin, 2871.

Rust (*Puccinia xanthi* S.).—The rust of the cocklebur is very common, producing numerous circular or slightly irregular spots on the leaves (minute to 1 cm. in diameter), pale yellow and sunken on the upper surface, dark brown with narrow yellow border on the under surface, and somewhat hypertrophied. Old spots frequently show gray centers on the under surface.

Specimens collected: Austin, 1413, 1545; Beeville, 1800; Lockhart, 2065; San Marcos, 2088; Hondo, 2251; Luling, 2241; Seguin, 2302; Georgetown, 2381; Victoria, 2343; Gonzales, 2664; Kennedy, 2822; Floresville, 2849.

CONVOLVULUS.

White-rust (*Albugo ipomoeae-panduranae* (S.) Swingle).—The white, blisterlike spots on the convolvulus (*Convolvulus hermanioides* Gray) were present on all parts of the plant. This disease is not recorded (51) as occurring on this species.

Specimens collected: Austin, 311, 814, 1265.

CORAL BEAD.

Leaf-spot (*Cercospora menispermi* Ell. and Holw.).—On the foliage of this climbing vine (*Cebatha carolina* (L.) Britton) very abundant dark-brown spots are present, 2 to 5 mm. in diameter. The margin of the spot pales out from a raised border which is almost black. With age the centers of the diseased areas become grayish. The spores are generally clavate, sometimes cylindrical, from 30 to 60 by 5 to 6 μ, brown, three to five septate.

No defoliation results.

Specimens collected: Sabinal, 1987; Bastrop, 2036; San Marcos, 2089; Luling, 2230; Seguin, 2313; Round Rock, 2409; Gonzales, 2681; Floresville, 2846.

CRANE'S-BILL.

Downy mildew (*Rhysotheca geranii* (Pk.) Wilson).—Very conspicuous, definite, downy, white areas are formed on the lower sur-

face of the leaves of the crane's-bill (*Geranium carolinianum* L.). They may be small and isolated or may involve the entire surface. In the earlier stages the upper surface of the foliage becomes yellow, but finally the entire leaf becomes dead and dry.

Specimen collected: Austin, 2938.

CROTON.

Dodder (*Cuscuta indecora* Choisy).—This was very abundant on the plants of croton (*Croton* spp.) in a single locality.

Specimen collected: San Antonio, 1373.

Rust (*Bubakia crotonis* (Cke.) Arth.).—In this species of rust the sori are very abundant. In the majority of specimens collected the uredinia are more abundant than the telia. In some the telia are much more abundant than the uredinia, and occur on both surfaces of the leaves and on the petioles and stems. The telia on the leaves are black, swollen cushions, still covered by the epidermis, 0.5 to 1 mm. in diameter and very abundant, causing the edges of the leaf blade to roll upward and inward. The telia on the stems may be similar in size to those on the leaf surfaces, but they are generally much larger and may form elongated cushions 3 to 10 mm. in length, which are confined to one side of the stem or completely encircle it. When uredinia only are present the leaves may also be curled and rolled, and the sori are frequently surrounded by a narrow zone of yellow. Our collections represent various other species of Croton in addition to *C. texensis* (Kl.) Muell. Arg.

Specimens collected: Luling, 2258; Georgetown, 2380; Round Rock, 2418; Falfurrias, 2442, 2489; Victoria, 2526; Cuero, 2582; Stockdale, 2647; Flatonia, 2736; Yoakum, 2757; Skidmore, 2817; Austin, 2907. All except 2907 represent uredinia only.

CROWNBEARD.

Leaf-spot (*Cercospora fulvella* Heald and Wolf, 32).—This disease on the crownbeard (*Verbesina texana* Buckl.) is characterized by the presence of irregular, yellowish-brown areas, 5 to 10 mm. in diameter, which sometimes become confluent, causing the death of larger areas. The color is more dilute and the spots less definite on the under surface. The conidiophores are epiphyllous or sometimes amphigenous, fasciculate, brown, septate, 45 to 150 by 4 to 5 μ; spores clavate, straight, dilutedly colored, 40 to 60 by 4 to 5 μ, three to four septate. (Pl. III, fig. 7.)

Specimen collected: Austin, 406 (type specimen).

Leaf-spot (*Phyllosticta verbesinae* Heald and Wolf, 32).—This fungus produces numerous gray or whitish subcircular spots, 1 to 3 mm. in diameter and surrounded by an indefinite darker zone which

fades out into the green. The pycnidia are numerous, epiphyllous, 36 to 45 μ in diameter; the spores are oval or elliptical, 4 to 6 by 2.5 to 3 μ.

Specimen collected: Seguin, 2310 (type specimen).

Rust (*Puccinia cognata* Syd.).—Punctiform telia and uredinia are produced upon the under surface of the leaves. Common.

Specimens collected: Austin, 178, 346, 361.

DAYFLOWER.

Rust (*Uromyces spegazzinii* (De T.) Kern. nov. comb.).—Observed in only one locality, where it was very abundant on the dayflower (*Commelina virginica* L.).

Specimen collected: Austin, 232.

DOCK.

Dodder (*Cuscuta indecora* Choisy).—Observed on dock (*Rumex berlandieri* Meisn.) in a low, moist field, where it had grown over other plants.

Specimen collected: San Antonio, 1776.

EVENING PRIMROSE.

Powdery mildew (*Erysiphe polygoni* DC.).—Found on the evening primrose (*Oenothera laciniata* Hill) in only a single locality.

Specimen collected: Austin, 1051.

EUPHORBIA.

Rust (*Uromyces euphorbiae* Cke. and Pk.).—The rust is very common on the euphorbias (*Euphorbia* spp.) of this section, forming on the leaves very abundant brown, circular pustules.

Specimens collected: San Antonio, 1397, 3174; Austin, 1420, 1908, 3102; Lockhart, 2077.

FALSE DANDELION.

Rust (*Puccinia pyrrhopappi* Syd.).—The sori are produced profusely on the stems, leaves, and involucres of the false dandelion (*Sitilias multicaulis* (DC.) Greene). This rust was observed to be exceedingly abundant in and about Austin, where it caused the death of the plants.

Specimens collected: Austin, 1073, 1264, 2948, 3061; Hempstead, 1515.

FIREWEED.

Leaf-spot (*Cercospora vernoniae* Ell. and Kellerm.).—This fungus on the fireweed (*Vernonia* spp.) produces irregular, rounded, or angu-

lar spots, 2 to 5 mm. in diameter, brown or grayish in color, with a slightly darker border, frequently surrounded by a zone of yellow. Sometimes the spots become confluent, causing the death of the leaves.

Specimens collected: Austin, 1558; Seguin, 2324; Georgetown, 2378.

Rust (*Coleosporium vernoniae* B. and C.).—Minute yellow pustules are very abundant on the lower surface of the leaves and cause a yellow, punctate appearance of the upper surface.

Specimen collected: Austin, 345.

FLEABANE.

Leaf-spot (*Septoria erigerontea* Pk.).—This disease on the fleabane (*Erigeron canadensis* L.) appears as distinct spots, 1 to 2 mm. in diameter, with a grayish center and brown border on the leaves, most abundantly on the lowermost. The black pycnidia show very plainly in the grayish center. The spores are 24 to 78 μ in length, which is in excess of the original description (39).

Specimen collected: Austin, 3033.

GAURA.

Rust (*Uromyces gaurinus* (Pk.) Long.).—The cluster cups on gaura (*Gaura coccinea* Pursh.) appear on both surfaces of the leaves and are so numerous that the leaves are destroyed.

Specimens collected: Austin, 2945, 3000.

GIANT RAGWEED.

Dodder (*Cuscuta indecora* (?) Choisy).—Found in only a single locality, where it was growing abundantly on the giant ragweed (*Ambrosia trifida* L.), as well as several other hosts.

Specimen collected: San Antonio, 1777.

Powdery mildew (*Erysiphe cichoracearum* DC.).—The collections of this fungus include only conidiospore specimens.

Specimens collected: San Marcos, 949; San Antonio, 3155.

Rust (*Puccinia xanthi* S. var. *ambrosiae* B. and Rav.).—This variety is quite similar to the rust on the cocklebur, but the sori are more abundant and generally smaller.

Specimen collected: Austin, 1415.

GOLDENROD.

Leaf-spot (*Cercosporella reticulata* Pk.).—Numerous brown spots with indefinite margins appear on the leaves of the goldenrod (*Solidago* spp.). The spots are often confluent and the leaf tips may become brown, the tissue adjacent to the areas being killed.

Specimen collected: Elgin, 2007.

GROUND-CHERRY.

Leaf-spot (*Cercospora physalicola* Ell. and Barthol.).—This fungus on the ground-cherry (*Physalis* sp.) produces circular brown spots 3 to 10 mm. in diameter, which show a marked concentric zonation. It was found on only the lower leaves which were more or less shaded.

Conidiophores amphigenous, few in each cluster, 130 to 150 by 5 μ, several septate. Spores 60 to 130 μ or reaching 188 by 4 to 5 μ, five to many septate, nearly hyaline. (Pl. IV, fig. 5.)

Our specimens differ from the type in having longer conidiophores, amphigenous instead of epiphyllous, septate instead of continuous, and larger, more numerously septate spores.

Specimen collected: New Braunfels, 1715.

HORSE NETTLE.

Leaf-spot (*Cercospora atro-marginalis* Atk.).—This disease appears on the leaves of the horse nettle (*Solanum carolinense* L.) as circular or somewhat angular dark-brown spots from 3 to 5 mm. in diameter. These spots frequently are concentrically zonate, with a dark margin. The conidiophores are densely fascicled and show as brown heaps when aggregated.

Specimen collected: Gonzales, 2667.

HYDROCOTYLE.

Leaf-spot (*Cercospora hydrocotyles* Ell. and Ev.).—Very numerous reddish-brown spots are produced on the leaves of hydrocotyle (*Hydrocotyle* spp.). They are circular or slightly angular, and 1 to 3 mm., mostly 2 mm., in diameter. The leaf tissue between the spots is at first yellow, turning brown, with the fungous foci darker. The conidia vary from 30 to 80 by 3 to 3.5 μ, exceeding the size given in the original description (16), which measurement is 30 to 40 by 3 μ.

Specimens collected: On *H. umbellata* L.—Von Ormy, 1117; San Antonio, 3165. On *H. verticillata* Nutt.—Georgetown, 2384.

Rust (*Puccinia hydrocotyles* (Lk.) Cke.).—The rust appears on the leaves of *H. umbellata* as minute circular brown pustules, often so closely clustered as to give the leaves a brown color and cause their death.

Specimen collected: On *H. umbellata* L.—Von Ormy, 1117.

INDIAN MALLOW.

Rust (*Puccinia heterospora* B. and C.).—This rust on the Indian mallow (*Abutilon texense* T. and G.) produces circular telia 0.5 to 3

mm. in diameter on the lower surface and punctiform telia above. Old or mature telia generally show a gray center.

Specimens collected: Austin, 24, 1421, 2884, 3113; San Antonio, 3160.

INDIGO PLANT.

Dodder (*Cuscuta* sp.).—The dodder was observed on the indigo plant (*Indigofera leptosepala* Nutt.) in only a single locality.

Specimen collected: Boerne, 1639.

KNOTWEED.

Leaf-spot (*Cercospora polygonacea* Ell. and Ev.).—This disease on the knotweed (*Polygonum* spp.) appears as suborbicular spots, 2 to 3 mm. in diameter, reddish brown above with a darker, raised margin and a dark zone of tissue beyond the elevated border. Areas become brown below and adjacent tissue becomes yellow.

Specimen collected: Cuero, 2586.

Powdery mildew (*Erysiphe polygoni* DC.).—Both leaf surfaces have a white, felty covering, due to the interlacing mycelium and the summer spores.

Specimens collected: San Marcos, 943; San Antonio, 1363, 3173; Austin, 3116.

Rust (*Puccinia polygoni-amphibii* P.).—The minute reddish-brown sori open to the under surface. Frequently they cause chlorosis and death of the leaves.

Specimen collected: San Marcos, 942.

MALLOW.

Leaf-spot (*Cercospora malachrae* Heald and Wolf, 32).—Circular or subcircular spots are produced upon the leaves of the mallow (*Malachra capitata* L.). They are 1 to 4 mm. in diameter, with yellowish-gray centers on which the conidial tufts are evident, surrounded by a dark-purple border. The spots are slightly less pronounced upon the under surface.

The conidiophores are amphigenous, in fascicles of few to a dozen, brown with slightly paler tips, nodose extremities, 90 to 120 by 4 to 5 μ, and several septate; conidia clavate, hyaline, slender pointed, 100 to 210 by 4 to 5 μ, many septate. (Pl. IV, fig. 3.) This species of Cercospora seems to be distinct from the many described for different species of the Mallow family. It agrees most nearly with *C. polymorpha* Bubák.

Specimen collected: Victoria, 2347 (type specimen).

MINT.

Powdery mildew (*Erysiphe galeopsidis* DC.).—Only the conidial stage of this mildew was observed on mint (*Stachys drummondii* Benth.).

Specimen collected: San Marcos, 947.

MORNING-GLORY.

Leaf-spot (*Phyllosticta ipomoeae* Ell. and Kellerm.).—The leaves of the morning-glory (*Ipomoea* spp.) develop conspicuous brown spots with a narrow dark margin. They are suborbicular and about 4 mm. in diameter, becoming grayish with age. A few black pycnidia are embedded in these areas.

Specimens collected: Austin, 378; Seguin, 2316; Victoria, 2507.

Rust (*Puccinia cassipes* B. and C.).—Both the cluster cups and teleutospores are abundantly present, often on the same leaves or stems.

Specimens collected: Austin, 192, 198, 330; San Marcos, 2105; Victoria, 2345, 2346; Flatonia, 2724.

White-rust (*Albugo ipomoeae-panduranae* (S.) Swingle).—White, blisterlike elevations are formed on the leaves and stems. When sufficiently abundant the foliage is apparently uniformly white. (Pl. XVIII, fig. 1.)

This trouble is very generally distributed. The wild morning-glories are common weeds in the cultivated fields and are affected by the same white rust which attacks sweet potatoes.

Specimens collected: Austin, 120, 420, 1305, 1306; New Braunfels, 1671; Sabinal, 1979; Lockhart, 2071; Seguin, 2296; San Marcos, 2093; Georgetown, 2369; Round Rock, 2415; Elgin, 1879; Flatonia, 2725; Stockdale, 2623; Gonzales, 2693; San Antonio, 3167.

MUSTARD.

White-rust (*Albugo candida* (P.) Rouss.).—The characteristic white, blisterlike heaps of conidia occur on both surfaces of the leaves of mustard (*Brassica nigra* (L.) Koch.), causing them to become yellow and dry.

Specimen collected: Austin, 3072.

NYMPHAEA.

Leaf-spot (*Phyllosticta orontii* Ell. and Martin).—The diseased areas on *Nymphaea advena* Soland are straw colored and several centimeters in length, generally elongated in the direction of the

veins, and concentrically zonate. The lines marking the zones are slightly elevated and darker.

Specimens collected: Georgetown, 2385; Von Ormy, 1162.

PARTHENIUM.

Rust (*Puccinia xanthi* S. var. *ambrosiae* B. and Rav.).—The sori, produced on the lower surface of parthenium (*Parthenium hysterophorus* L.), are characteristically brown and aggregated in circular patches. The spots show a yellowish-brown coloration on the upper surface.

Specimen collected: Kennedy, 2838.

PEPPERGRASS.

Downy mildew (*Peronospora parasitica* (P.) De By.).—This fungus on the peppergrass (*Lepidium virginicum* L.) causes the under surface of the leaves to appear downy white in small spots or extended areas, while the upper surface of the diseased spots is pale yellow.

Specimen collected: Austin, 2952.

PIGWEED.

Leaf-spot (*Cercospora brachiata* Ell. and Ev.).—The spots on the pigweed (*Amaranthus* spp.) are first dark brown, becoming grayish brown, subcircular or irregularly rounded, 3 to 5 mm. in diameter. They become very abundant, causing the leaves to curl and dry.

Specimen collected: On *A. spinosus* L.—Kennedy, 2827.

White-rust (*Albugo bliti* (Biv.) Kuntze).—The formation of the white pustules on the under surface of the leaves marks the presence of this fungus.

Specimens collected: (1) On *A. albus* L.—Austin, 376. (2) On *A. retroflexus* L.—Austin, 1315; San Marcos, 2092; Uvalde, 1935; Luling, 2229; Victoria, 2516; Stockdale, 2635; San Antonio, 3179. (3) On *A. spinosus* L.—Llano, 1760; Lockhart, 2059; Falfurrias, 2448.

POKEWEED.

Leaf-spot (*Cercospora flagellaris* Ell. and Martin).—Circular or slightly irregular brown spots 2 to 5 mm. in diameter appear on the foliage of the pokeweed (*Phytolacca americana* L.). The spots have a dark-brown, elevated border and they become grayish when older. Frequently they are abundantly formed on the leaf tips, resulting in the drying of the affected portions. In some localities affected plants were completely defoliated and dead.

Specimens collected: Austin, 336; Brenham, 1458; New Braunfels, 1722; Elgin, 1885; Bastrop, 2025; San Marcos, 2115; Cuero, 2603; Stockdale, 2622; Gonzales, 2696; Flatonia, 2744; Yoakum, 2769.

PRICKLY PEAR.

Anthracnose (*Gloeosporium* sp.).—The prickly pears (*Opuntia* spp.) of this region are frequently attacked by this fungus, which produces generally circular or subcircular depressed areas, with grayish centers densely covered with minute black acervuli which become less abundant toward the periphery, which is limited by a zone of brown. The spots are most commonly 1.5 to 2.5 cm. in diameter, but they may be much larger in some cases. The isolated spots may coalesce and cause the complete death of a stem segment. The diseased area always extends completely through the stem segment, and the old dead tissue may persist or it may fall out. In all cases of spots of the average size mentioned the advance of the fungus is limited by a development of corky tissue at the periphery of the area. This same fungus produces on young fronds, under favorable conditions of temperature and moisture, a severe rotting, and the fungus may advance through an entire segment in a few days, starting from a single center of infection, and thus leave the segment brown and completely dead. In this stage an abundance of pale acervuli is generally produced at the center of the infected area. In such cases the frond is chlorotic some distance beyond the advance of the fungus, and there is frequently a marked gummy exudation from the spot.

Specimens collected: Austin, 562; Llano, 1773; Hondo, 2252; Georgetown, 2393; Round Rock, 2406.

Black-spot (*Perisporium wrightii* B. and C.).—This fungus produces superficial black spots, generally circular in outline and 5 mm. to 1 cm. in diameter, on the stem segments. They may be few in number, or they may be sufficiently abundant to coalesce and nearly cover the surface. The black color is due to the large numbers of spore fruits or perithecia. No instances have been observed where the fungus was causing any material injury.

Specimens collected: Austin, 1293; Elgin, 1875; Round Rock, 2408.

Scald (*Hendersonia* (?) *opuntiae* Ell. and Ev.).—Probably the most general and the most severe disease of the prickly pear is what is popularly called "sun scald" in this territory. The whole surface of the older fronds becomes covered with a yellowish-brown, scaly growth of a corky character. In this scaly growth may be seen numerous minute black specks, the fruits of the fungus. Large plants may be killed, but the fungus remains superficial and the injurious effect is apparently due to the corky covering which cuts off the light in part and prevents the aeration of the underlying tissue. The network of dark-brown fungous filaments may be found just beneath the epidermal layer and also to some extent deeper down and inclosed in the corky layers.

The pycnidia are produced at the openings of the stomatal chimneys, and an aggregate of hyphæ generally closes the opening. The spores are pale brown, straight or slightly curved, two to three septate, and 25 to 30 by 3 μ.

A species of Rhabdospora may sometimes be associated with the trouble, but it is apparently of secondary importance.

Specimens collected: Austin; Falfurrias, 2467; Round Rock, 2407.

PURSLANE.

White-rust (*Albugo portulacae* (DC.) Kuntze).—This species of white-rust has been found on two different species of Portulaca.

Specimens collected: (1) On *Portulaca oleracea* L.—Beeville, 1811; Bastrop, 2028; Luling, 2248; Cuero, 2585; Stockdale, 2632. (2) On *Portulaca lanceolata* Eng.—Falfurrias, 2439.

RAIN LILY.

Rust (*Puccinia cooperiae* Long).—On the leaves of the small rain lily (*Cooperia drummondii* Herb.) are formed oval or elliptical brown sori, often very abundantly aggregated.

Specimen collected: Austin, 493.

RIVINA.

Leaf-spot (*Cercospora flagellaris* Ell. and Martin).—The general symptomatology of this disease on *Rivina laevis* L. is the same as the leaf-spot of the pokeweed (p. 99). Since it also agrees in size of conidiophores and conidia, it is very probably the same fungus, the hosts being related.

Specimens collected: Austin, 303, 1419.

RUELLIA.

Rust (*Puccinia ruelliae* (B. and Br.) Lagerh.).—On *Ruellia tuberosa* L. an abundance of sori are produced, punctiform to 1 mm. in diameter, mostly upon the upper surface of the leaves.

Specimens collected: Austin, 34, 412, 439; Beeville, 1797.

SAGE.

Rust (*Puccinia farinacea* Long).—Minute, rounded, brown sori are formed on the upper surface of the leaves of sage (*Salvia farinacea* L.).

Specimen collected: Austin, 349.

SENNA.

Leaf-spot (*Ramularia cassiaecola* Heald and Wolf. Syn.—*Cercospora occidentalis* Ell. and Kellerm.)—This fungus on senna (*Cassia*

sp.) first forms diffuse brown spots, circular, indefinitely margined, 1 to 5 mm. in diameter, and frequently bordered by a zone of yellow.

In severe infections the entire leaflet may turn yellow, with the exception of the brown spots on which the fungus is located.

The conidiophores are amphigenous, but more abundant on the under surface, closely fasciculate, brown, continuous except in the aggregated basal portion, and 24 to 30 by 3 to 4.5 μ; the spores are 45 to 150 by 3 to 5 μ, olivaceous, nearly cylindrical, 1 to 5 septate, and when mature frequently guttulate. (Pl. V, fig. 2.)

An examination of Ravenel's specimens of *Cercospora occidentalis* and also of Ellis's collections of this species shows that they should have been referred to the genus Ramularia. Since there is already a valid *R. occidentalis*, the specific name can not be retained.

Specimens collected: On *Cassia occidentalis* L.—Beeville, 1868; Cuero, 2580; Stockdale, 2611; Yoakum, 2750; Hallettsville, 2773.

Rust (*Ravenelia longiana* Syd.).—The sori are formed on the lower surface of the leaves.

Specimen collected: On *Cassia roemeriana* Scheele—Llano, 1751.

SMILAX.

Leaf-spot (*Cercospora smilacina* Sacc.).—This is the most common leaf disease of the smilax (*Smilax bona-nox* L.). The foliage becomes thickly spotted with subcircular, reddish areas, with brown margins.

Specimens collected: New Braunfels, 1702; Llano, 1748; Elgin, 1876; Uvalde, 1929; Bastrop, 2037; Lockhart, 2063; Cotulla, 2179; Luling, 2226; Seguin, 2305; Georgetown, 2398; Round Rock, 2416; Gonzales, 2704; Flatonia, 2743; Yoakum, 2762; Hallettsville, 2792.

Leaf-spot (*Phyllosticta smilacis* Ell. and Ev.).—The diseased areas are conspicuously reddish brown or brown, circular or subcircular, and vary from 2 to 8 mm. in diameter. They have a very pronounced dark-brown border. The black, immersed pycnidia, 150 μ in diameter, are either scattered or peripheral and on both surfaces. Generally, however, they are on only one surface of a given spot. The spores are nearly spherical or slightly elongated, clear, granular, 10 to 14 by 7 to 9 μ. The spores in our specimens are smaller than in the type (15 to 20 by 7 to 9 μ).

Specimens collected: Austin, 360; Boerne, 1656; Round Rock, 2412, 2413; Hallettsville, 2789.

Rust (*Puccinia smilacis* S.).—The upper surface of the leaf is densely spotted with yellowish or brown circular spots from 1 to 2 mm. in diameter. On the under surface small brown sori have broken through the epidermis.

Specimens collected: Austin, 23; San Marcos, 2090.

SUNFLOWER.

Leaf-spot (*Cercospora pachypus* Ell. and Kellerm.).—Irregular, angular spots, 1 to 5 mm. in diameter, becoming dark brown, are formed on the foliage of the sunflower (*Helianthus* spp.). These areas fuse and, accompanied by more or less chlorosis, the leaves are killed.

Specimen collected: Hondo, 1989.

Powdery mildew (*Erysiphe cichoracearum* DC.).—Upon the upper side of the leaves appear conspicuous white patches, often covering the greater part of the leaf surface. Only the conidial stage was observed.

Specimen collected: San Antonio, 3159.

Rust (*Puccinia helianthi* S.).—The rust sori are formed in abundance on both wild and cultivated forms, frequently so as to render the under surface quite brown.

Specimens collected: San Antonio, 1357, 1388, 1392, 1780, 3162; Seguin, 2300; Cuero, 2576; Flatonia, 2718.

TICK TREFOIL.

Rust (*Uromyces hedysari-paniculati* (S.) Farl.).—The yellowish-brown sori on tick trefoil (*Meibomia* sp.) are very numerous on the lower surface of the leaves and sparse on the upper surface.

Specimen collected: Austin, 343.

TROMPILLO.

Dodder (*Cuscuta* sp. ?).—This parasite on the trompillo (*Solanum elaeagnifolium* Cav.) was not flowering, and consequently could not be identified.

Specimen collected: Bastrop, 2029.

Nematode leaf-curl (*Tylenchus* sp.).—This is quite common, causing the leaves to be curled and much hypertrophied. (Pl. XVIII, fig. 3.)

Specimens collected: Austin, 1262; Kennedy, 2833.

VINCETOXICUM.

Leaf-mold (*Cercospora bellynckii* (Westd.) Sacc.).—An olivaceous, brown, diffuse coating is formed on the leaves of vincetoxicum (*Vincetoxicum* spp.). The description (46) of the fungus states that it occurs on the lower leaf surface, but our specimen shows conidiophores on both surfaces. In other characters the agreement is satisfactory.

Specimen collected: Austin, 312.

Rust (*Puccinia gonolobi* Rav. and B.).—The sori are present on both stems and leaves. On the stems they are so numerous as to form a black crust. On the leaves they are scattered and on the lower surface.

Specimens collected: Austin, 334, 335, 1449.

VIRGIN'S-BOWER.

Leaf-blight (*Phleospora adusta* Heald and Wolf, 32).—This trouble on the virgin's-bower (*Clematis drummondii* T. and G.) is very general and very severe. The foliage has large, irregular, brown areas, generally beginning on the leaf tips. The entire leaves become dry and brown and more or less curled in the advanced stages of the disease.

The pycnidia are hypophyllous, 30 to 45 μ in diameter and sparse. The spores are cylindrical, hyaline, 18 to 36 by 3 to 3.5 μ, and one to three septate. (Pl. V, fig. 10.)

Specimens collected: New Braunfels, 1699; Austin, 1726 (type specimen); Llano, 1734; Beeville, 1833; Sabinal, 1976; Hondo, 1998; Bastrop, 2021; Seguin, 2303; Georgetown, 2390; Gonzales, 2654; Kennedy, 2825.

Rust (*Puccinia tomipara* Trel.).—Groups of yellowish-white cluster cups appear on the foliage in the spring and late fall. The telia and uredinia are reported as occurring on *Bromus* spp., but no collections have been made in our territory.

Specimens collected: Austin, 309, 438, 1424.

WATER CRESS.

Leaf-blight (*Cercospora nasturtii* Pass.).—The leaves of water cress (*Radicula nasturtium-aquaticum* (L.) Britten and Rendle) infested with this fungus show circular to subcircular straw-colored or dirty-yellow spots varying in size from 1 to 5 mm. There is generally more or less concentric zonation. The diseased plants are stunted and show a purple coloration of the foliage.

The conidiophores are continuous, 45 to 60 by 3.5 μ, and clear-tipped. The conidia are 65 to 115 by 3.5 μ, several septate, hyaline, and granular. (Pl. II, fig. 1.)

Specimen collected: Austin, 1448.

WATER WILLOW.

Leaf-spot (*Cercospora diantherae* Ell. and Kellerm.).—The affected leaves of water willow (*Dianthera americana* L.) show numerous gray or brown spots, 1 to 4 mm. in diameter, surrounded by a darker border. Extended areas of the leaf tissue may be killed and the

spots show as lighter areas in a dark ground. In the earlier stages of the disease a considerable degree of chlorosis may be exhibited.

Specimens collected: Austin, 64, 2870.

WILD GOURD.

Leaf-spot (*Cercospora cucurbitae* Ell. and Ev.).—Dirty-yellow, subcircular or angular spots, 2 to 7 mm. in diameter, are produced on the wild gourd (*Cucurbita foetidissima* H. B. K.) by this fungus. The spores are 57 to 173 μ in length. This range of size is different from that given in the original description (48) (100 to 120 μ).

Specimens collected: New Braunfels, 1717; Llano, 1754; Elgin, 1877; Lockhart, 2086; Austin, 359, 1923; Sabinal, 1984; Luling, 2269; Seguin, 2289; Floresville, 2845; San Antonio, 3161.

WILD TOBACCO.

Leaf-spot (*Cercospora nicotianae* Ell. and Ev.).—This fungus on the leaves of wild tobacco (*Nicotiana repanda* Willd.) forms subcircular areas 5 to 10 mm. in diameter. Because of the production of conidiophores and conidia on both surfaces, the center of the affected areas is brown with a lighter border.

Specimen collected: Austin, 3034.

WIND FLOWER.

Rust (*Tranzschelia cohaesa* (Long) Arth.).—The densely aggregated cluster cups, yellowish or dilutedly brown, appear on the lower surface of the foliage of the wind flower (*Anemone caroliniana* Walt.). The margins of the cups show quite commonly four recurved rays. This rust is very common and very abundant during March.

Specimens collected: Austin, 2935, 2944.

Smut (*Urocystis anemones* (P.) Wint.).—The brownish-black pustules are formed on the stems, petioles, and leaf blades. These pustules are covered at first and vary in size from very small to 2.5 or 5 cm. in length when on the stems.

Specimen collected: Austin, 2942.

WOOD SORREL.

Smut (*Ustilago oxalidis* Ell. and Tracy).—The seeds of the wood sorrel (*Oxalis stricta* L.) are replaced by a mass of brown spores, and when the capsule dehisces these spores are forcibly ejected in clouds.

Specimens collected: Austin, 1261, 1263.

YUCCA.

Blight (*Cercospora floricola* Heald and Wolf, 32).—This disease produces on the yucca (*Yucca rupicola* Scheele) elongated grayish or brownish patches, which become darker with age and spread over the main scape, the flower pedicels, and the outer divisions of the perianth. The creamy-white outer perianth segments may be completely covered with the conidial tufts, which cause them to turn nearly black and to shrivel more or less. (Pl. XIX, fig. 3.) The fungus may spread over the whole segment from the tip downward. The perianth divisions may be attacked before the flower opens and the flower bud completely blighted (Pl. XIX, fig. 2), or the flower may expand to full size and open in a normal way, but blight completely a little later. In the locality where the disease was prevalent fruit formation did not take place.

Conidiophores in dense fascicles of many short, brown, continuous filaments, 30 to 45 by 5 to 6 μ; spores generally straight, cylindrical, or slightly clavate, hyaline or faintly colored, 18 to 69 by 5 to 5.5 μ, and one to five septate, commonly three septate. (Pl. I, fig. 3.)

Specimen collected: On *Yucca rupicola* Scheele—Austin, 1438 (type specimen).

Leaf-spot (*Pestalozziella yuccae* Karst. and Har.).—Grayish lenticular areas, 4 to 10 mm. in length, are produced on the leaves. Protruding through the epidermis are dark pustules, the acervuli containing oblong clear spores with four hairs at the apex.

Specimen collected: On *Yucca rupicola* Scheele—Austin, 1530.

Leaf-blight (*Kellermannia yuccogena* Ell. and Kellerm.).—The affected leaves become straw colored, the dead area advancing downward from the tip or showing as a narrow zone along the margin. The advancing edge of the dead area is generally bordered by a narrow zone of brown. Our observations indicate that this species of fungus is not strictly parasitic, but that it finds its entrance first into leaves which have been scorched by prairie fires.

The pycnidia are very abundant on both surfaces, showing as minute black specks, 345 to 500 μ in diameter. Spores hyaline, two celled, 33 to 45 by 9 to 10.5 μ, each with a colorless appendage from the end, 15 to 30 μ long.

Specimen collected: On *Yucca filamentosa* L.—Sabinal, 1988.

INDEX TO LITERATURE.

1. Atkinson, G. F. Black rust of cotton: A preliminary note. Botanical Gazette, vol. 16, 1891, p. 62.
2. ——— The genera Balansia and Dothichloe in the United States, with a consideration of their economic importance. Journal of Mycology, vol. 11, 1905, p. 250.
3. Bray, W. L. Forest resources of Texas. Bulletin 47, Bureau of Forestry, United States Department of Agriculture, 1904, p. 54.
4. ——— Timber of the Edwards Plateau of Texas. Bulletin 49, Bureau of Forestry, United States Department of Agriculture, 1904, p. 14.
5. ——— Distribution and adaptation of the vegetation of Texas. Bulletin 82, University of Texas, 1906, p. 73.
6. Bunnemeyer, B. Texas section of the climatological service of the Weather Bureau. Annual summary. 1909.
7. Clinton, G. P. Twenty-seventh annual report, Connecticut Agricultural Experiment Station, 1903, p. 307.
8. Cook, O. F. Change of vegetation on south Texas prairies. Circular 14, Bureau of Plant Industry, United States Department of Agriculture, 1908.
9. Cooke, M. C. The fungi of Texas. Annals, New York Academy of Science, vol. 1, 1878, pp. 177–187.
10. ——— Fungoid pests of cultivated plants, 1906, p. 80.
11. Earle, F. S. New species of Fungi Imperfecti from Alabama. Bulletin, Torrey Botanical Club, vol. 24, 1897, p. 29.
12. Edgerton, C. W. The perfect stage of the cotton anthracnose. Mycologia, vol. 1, 1909, pp. 115–119.
13. Ellis, J. B., and Anderson, F. W. New species of Montana fungi. Botanical Gazette, vol. 16, 1891, p. 48.
14. ——— and Everhart, B. M. Enumeration of the North American Cercosporæ. Journal of Mycology, vol. 1, 1885, p. 63.
15. ——— ——— Supplementary enumeration of the Cercosporæ. Journal of Mycology, vol. 2, 1886, p. 1.
16. ——— ——— Additions to Cercospora, Gloeosporium, and Cylindrosporium. Journal of Mycology, vol. 3, 1887, pp. 13–22.
17. ——— ——— Additions to Ramularia and Cercospora. Journal of Mycology, vol. 4, 1888, pp. 1–7.
18. ——— ——— New species of fungi from various localities. Journal of Mycology, vol. 4, 1888, p. 116.
19. ——— ——— New and rare species of North American fungi. Journal of Mycology, vol. 5, 1889, p. 155.
20. ——— ——— New species of fungi from various localities. Proceedings of the Academy of Natural Sciences of Philadelphia, 1891, p. 91.
21. ——— ——— New west American fungi. Erythea, vol. 2, 1894, p. 25.
22. ——— ——— New west American fungi. Erythea, vol. 5, 1897, pp. 6–7.
23. ——— and Kellerman, W. A. Kansas fungi. Bulletin, Torrey Botanical Club, vol. 11, 1884, p. 121.

24. Ellis, J. B., and Martin, G. New fungi. Journal of Mycology, vol. 2, 1886, p. 130.
25. Engler, A., and Prantl, K. Natürlichen Pflanzenfamilien, I (I), 1897, p. 448.
26. Fischer, Ed. Beitrag zur Kenntniss der Gattung Graphiola. Botanische Zeitung, vol. 41, 1883, p. 752.
27. Freeman, G. F. Diseases of alfalfa. Bulletin 155, Kansas Agricultural Experiment Station, 1908, p. 326.
28. Halsted, B. D. Nineteenth annual report, New Jersey Agricultural Experiment Station, 1898, pp. 318–319.
29. Heald, F. D. Nineteenth annual report, Nebraska Agricultural Experiment Station, 1905, pp. 32–33.
30. ——— Field work in plant pathology. Plant World, vol. 10, 1907, p. 106.
31. ——— and Wolf, F. A. The whitening of the mountain cedar (*Sabinia sabinoides* (H. B. K.) Small). Mycologia, vol. 2, 1910, pp. 205–212.
32. ——— ——— New species of Texas fungi. Mycologia, vol. 3, 1911, pp. 5–22.
33. Hume, H. H. Citrus fruits in Texas. Bulletin 3, n. s., Texas Department of Agriculture, 1909.
34. Jennings, H. S. Some parasitic fungi of Texas. Bulletin 9, Texas Agricultural Experiment Station, 1890, pp. 23–29.
35. Kern, F. D. Studies in the genus Gymnosporangium. Bulletin, Torrey Botanical Club, vol. 35, 1908, pp. 508–509.
36. Klebahn, H. Untersuchungen über einige Fungi Imperfecti und die zugehörigen Ascomycetenformen. Jahrbücher für Wissenschaftliche Botanik, vol. 41, 1905, p. 498.
37. Lindau, G. Die pflanzlichen parasiten. Volume 2 of Sorauer's Handbuch der Pflanzenkrankheiten, 3d ed., 1906, pp. 420, 426.
38. Molz, E. Untersuchungen über die Chlorose der Reben. Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, pt. 2, vol. 19, 1907, pp. 461, 563, 715, 788.
39. Peck, C. H. Report of the Botanist. Twenty-fourth annual report on the New York State Museum of Natural History, 1872, p. 87.
40. Prilleaux, E. E., and Delacroix, G. Maladies bacillaires de divers végétaux. Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Paris, vol. 118, 1894, pp. 668–671.
41. Raciborski, M. Pflanzenpathologisches aus Java. Zeitschrift für Pflanzenkrankheiten, vol. 8, 1898, p. 66.
42. Rolfs, F. M. Die-back of the peach trees. Science, vol. 26, 1907, pp. 87–90.
43. Rorer, J. B. A bacterial disease of the peach. Mycologia, vol. 1, 1909, pp. 23–27.
44. Saccardo, P. A. Sylloge Fungorum, vol. 4, 1886, p. 474.
45. ——— Sylloge Fungorum, vol. 4, 1886, p. 441.
46. ——— Sylloge Fungorum, vol. 4, 1886, p. 450.
47. ——— Sylloge Fungorum, vol. 10, 1892, p. 358.
48. ——— Sylloge Fungorum, vol. 10, 1892, p. 634.
49. Stewart, F. C., French, G. T., and Wilson, J. K. Troubles of alfalfa in New York. Bulletin 305, New York (Geneva) Agricultural Experiment Station, 1908, pp. 397–398.
50. Wehmer, C. Pilzkrankheiten von Kulturpflanzen in der Provinz Hannover. II. Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, pt. 2, vol. 6, 1900, p. 57.
51. Wilson, G. W. Studies in North American Peronosporales—IV. Host index, Bulletin, Torrey Botanical Club, vol. 35, 1908, pp. 543–554.

DESCRIPTION OF PLATES.

All drawings show a magnification of 417 diameters unless otherwise indicated.

PLATE I. Species of Cercospora from various hosts, No. 1. Fig. 1.—Three spores of *Cercospora vignae* Racib. on cowpea (*Vigna unguiculata* (L.) Walp.). Fig. 2.—Three spores of *C. cruenta* Sacc. on *Vigna unguiculata* (L.) Walp. Fig. 3.—Conidiophores and spores of *C. floricola* Heald and Wolf on *Yucca rupicola* Sheele; also three spores above. Fig. 4.—Conidiophores and spores of *C. atricincta* Heald and Wolf on zinnia (*Crassina elegans* (Jacq.) Kuntze). Fig. 5.—Conidiophores and spores of *C. lythracearum* Heald and Wolf on pomegranate (*Punica granatum* L. and Var.). Fig. 6.—Conidiophores and spores of *C. lythracearum* Heald and Wolf on crape myrtle (*Lagerstroemia indica* L.). Fig. 7.—Conidiophores and spores of *C. macromaculans* Heald and Wolf on *Syringa* sp. Fig. 8.—Conidiophores and spores of *C. aurantia* Heald and Wolf on orange (*Citrus aurantium sinensis* L.).

PLATE II. Species of Cercospora from various hosts, No. 2. Fig. 1.—Conidiophores and spores of *Cercospora nasturtii* Pass. on water cress (*Radicula nasturtium-aquaticum* (L.) Britten and Rendle). Fig. 2.—Conidiophores and spores of *C. lanuginosa* Heald and Wolf on *Bumelia lanuginosa* (Michx.) Pers. Fig. 3.—Conidiophores and spores of *C. nepheloides* Ell. and Holw. on Mexican blue-bell (*Eustoma russellianum* (Hook.) Griesb.). Fig. 4.—Conidiophores and spores of *C. xanthicola* Heald and Wolf on *Xanthium* sp. Fig. 5.—Diagram of a portion of a cross section of leaf showing abundance and distribution of conidial tufts of *C. canescens* Ell. and Martin on the Lima bean (*Phaseolus lunatus* L.) × 73. Fig. 6.—Conidiophores and spores of *C. canescens* Ell. and Martin on the Lima bean (*P lunatus* L.). Fig. 7.—Spores of *Cercospora bolleana* (Thm.) Speg. on the fig (*Ficus carica* L.). Fig. 8.—Conidiophores and spores *Cercospora fici* Heald and Wolf on the fig (*F. carica* L.).

PLATE III. Species of Cercospora from various hosts, No. 3. Fig. 1.—Conidiophores and spores of *Cercospora adusta* Heald and Wolf on California privet (*Ligustrum ovalifolium* Hassk.). Fig. 2.—Conidiophores and spores of *C. prosopidis* Heald and Wolf on mesquite (*Prosopis glandulosa* Torr.). Fig. 3.—Conidiophores and spores of *C. perniciosa* Heald and Wolf on buttonbush (*Cephalanthus occidentalis* L.). Fig. 4.—Conidiophores and spores of *C. chrysanthemi* Heald and Wolf on *Chrysanthemum* sp. Fig. 5.—Conidiophores and spores of *C. pustula* Cke. on Virginia creeper (*Psedera quinquifolia* (L.) Greene). Fig. 6.—Conidiophores and spores of *C. obscura* Heald and Wolf on globe artichoke (*Cynara scolymus* L.). Fig. 7.—Conidiophores and spores of *C. fulvella* Heald and Wolf on crownbeard (*Verbesina texana* Buckl.). Fig. 8.—Spores of *C. viticola* (Ces.) Sacc. on *Vitis* sp. Fig. 9.—Conidiophores and spores of *C. personata* (B. and C.) Ell. on the peanut (*Arachis hypogaea* L.).

PLATE IV. Species of Cercospora from various hosts, No. 4. Fig. 1.—Conidiophores and spores of *Cercospora sagittariae* Ell. and Ev. on *Saggitaria* sp. Fig. 2.—Conidiophores and spores of *C. crataegi* Heald and Wolf on hawthorn (*Crataegus* sp.). Fig. 3.—Conidiophores and spores of *C. malachrae* Heald and Wolf on mallow (*Malachra capitata* L.). Fig. 4.—Spores of *C. elaeagni* Heald and Wolf on *Elaeagnus* sp. Fig. 5.—Conidiophores and spores of *C. physalicola* Ell. and Barthol. on ground-cherry (*Physalis* sp.). Fig. 6.—Conidiophores and spores of *C. moricola* Cke. on red mulberry (*Morus rubra* L.). Fig. 7.—Conidiophores and spores of *C. capsici* Heald and Wolf on pepper (*Capsicum annuum* L.).

PLATE V. Various genera of Fungi Imperfecti on different hosts. Fig. 1.—Conidiophores and spores of *Ramularia momordicae* Heald and Wolf on the balsam-apple (*Momordica balsamina* L.). Fig. 2.—Conidiophores and spores of *R. cassiaecola* Heald and Wolf on senna (*Cassia occidentalis* L.). Fig. 3.—Spores of *Stagonospora gigantea* Heald and Wolf on century plant (*Agave americana* L.). Fig. 4.—Spores of *Ramularia cephalanthi* (Ell. and Kellerm.) Heald on buttonbush (*Cephalanthus occidentalis* L.). Fig. 5.—Conidiophores and spores of *R. hedericola* Heald and Wolf on English ivy (*Hedera helix* L.). Fig. 6.—Spores of *Sporodesmium maclurae* Thm. on Osage orange (*Toxylon pomiferum* Raf.). Fig. 7.—Pycnidium and spores of *Phleospora multimaculans* Heald and Wolf on the sycamore (*Platanus occidentalis* L.). Fig. 8.—Section of a pycnidium of *Phyllosticta biformis* Heald and Wolf on leaf of Mexican persimmon (*Diospyros texana* Sheele). × 73. Fig 9.—Section of a pycnidium of *P. biformis* Heald and Wolf from the fruit of *D. texana* Sheele. × 73. Fig. 10.—Section of a pycnidium and spores of *Phleospora adusta* Heald and Wolf on virgin's-bower (*Clematis drummondii* T. and G.). Fig. 11.—Section of a pycnidium and spores of *P. multimaculans* Heald and Wolf on walnut (*Juglans* sp.).

PLATE VI. Species of Colletotrichum, Cylindrosporium, and Septoria on various hosts. Fig. 1.—Group of spores of *Colletotrichum griseum* Heald and Wolf on *Euonymus japonicus* Thunb. Fig. 2.—Portion of the acervulus of *C. griseum* Heald and Wolf on *E. japonicus* Thunb. Fig. 3.—A single acervulus showing distribution of setæ of *C. griseum* Heald and Wolf. × 73. Fig. 4.—Spores of *Cylindrosporium solitarium* Heald and Wolf on black locust (*Robinia pseudacacia* L.). Fig. 5.—Spores of *Cylindrosporium lippiae* Heald and Wolf on *Lippia ligustrina* (Lag.) Britton. Fig. 6.—Acervulus of *Colletotrichum caulicolum* Heald and Wolf on bean (*Phaseolus vulgaris* L.) ×73. Fig. 7.—Conidiophores, conidia, and setæ of *C. caulicolum* Heald and Wolf. Fig. 8.—Distribution of acervuli (*a*) of *C. caulicolum* on stem of bean (*Phaseolus vulgaris* L.). Natural size. Fig. 9.—Acervulus of *Cylindrosporium defoliatum* Heald and Wolf on the hackberry (*Celtis laevigata* Willd.). Fig. 10.—Depressed acervulus bearing spores with two septate spores of *C. defoliatum* Heald and Wolf on *C. laevigata* Willd. Fig. 11.—Spores of *C. griseum* Heald and Wolf on wild China tree (*Sapindus drummondii* Hook. and Arn.). Fig. 12.—A small portion of a leaf showing acervuli (*a*) of *C. griseum* Heald and Wolf on the veins of *S. drummondii* Hook. and Arn.). × 73. Fig. 13.—Setæ, conidiophores, and conidia of Colletotrichum on sorghum (*Andropogon sorghum* (L.) Brot.). Fig. 14.—Spores of Colletotrichum on *A. sorghum* (L.) Brot. Fig. 15.—Portion of the acervulus and a group of spores of Colletotrichum on Johnson grass (*A. halepensis* (L.) Brot.). Fig. 16.—Several pycnidia of *Septoria pertusa* Heald and Wolf on Johnson grass (*A. halepensis* (L.) Brot.). × 73. Fig. 17.—A single pycnidium of *S. pertusa* Heald and Wolf. (*a*, Ostiole and protruding spores; *b*, a group of four spores.)

PLATE VII. Fungi from various hosts. Fig. 1.—Asci and spores of *Dimerosporium parkinsoniae* Heald and Wolf on retama (*Parkinsonia aculeata* L.). Fig. 2.—Three forms of conidiospores of *D. parkinsoniae* Heald and Wolf. Fig. 3.—Section through a conidial tuft of *Cercospora kaki* Ell. and Ev. on persimmon (*Diospyros kaki* L.). Fig. 4.—Conidiophores and conidia of *Clasterosporium diffusum* Heald and Wolf on pecan (*Hicoria pecan* (Marsh.) Britt). Fig. 5.—Section through a sporodochium of *Exosporium concentricum* Heald and Wolf on *Euonymus japonicus* Thunb. Fig. 6.—Conidiophores of *Helminthosporium giganteum*, Heald and Wolf on Bermuda grass (*Capriola dactylon* (L.) Kuntze). Fig. 7.—One of the spores of *H. giganteum* Heald and Wolf on Bermuda grass (*C. dactylon* (L.) Kuntze). Fig. 8.—Section through an acervulus of *Cercosporella mori* Pk., showing the conidiophores and conidia on mulberry (*Morus alba* L.).

PLATE VIII. Fig. 1.—Leaflet of the date palm (*Phoenix dactylifera* L.), showing numerous pustules of *Graphiola phoenicis* (Moug.) Poit. Fig. 2.—Leaf of grape (upper surface), showing numerous dark blotches due to *Cercospora viticola* (Ces.) Sacc. Fig. 3.—Bacterial twig-canker of the plum (*Prunus* sp.).

PLATE IX. Fig. 1.—The roots of a tomato plant (*Lycopersicon esculentum* Mill.) deformed by nematodes (*Heterodera radicicola* (Greef) Mül.). Fig. 2.—Root-knot of muskmelon (*Cucumis melo* L.) due to *Heterodera radicicola* (Greef) Mül. Fig. 3.—Leaves of the Lima bean (*Phaseolus lunatus* L.) affected with leaf-spot due to *Cercospora canescens* Ell. and Martin.

PLATE X. Fig. 1.—Young watermelons (*Citrullus vulgaris* Schrad.) affected with blossom-end blight and rot. Fig. 2.—Potato (*Solanum tuberosum* L.) with nodules formed by Rhizoctonia. Fig. 3.—A young cymling (*Cucurbita pepo* L.) almost destroyed by *Botrytis cinerea* P.

PLATE XI. Fig. 1.—*Balansia hypoxylon* (Pk.) Atk. on the inflorescence of feather grass (*Stipa leucotricha* Trin.). Fig. 2.—Portion of a leaf of sorghum (*Andropogon sorghum* (L.) Brot.) affected with blight due to *Colletotrichum lineola* Cda. Fig. 3.—Roots of cotton (*Gossypium herbaceum* L.) affected with root-rot due to a new species of sterile fungus.

PLATE XII. Fig. 1.—Leaves of *Euonymus japonicus* Thunb., showing the characteristic spotting caused by *Exosporium concentricum* Heald and Wolf. Fig. 2.—Leaves of *E. japonicus* Thunb., showing spots due to *Colletotrichum griseum* Heald and Wolf.

PLATE XIII. Fig. 1.—Leaf of winged elm (*Ulmus alata* Michx.) affected with scab due to *Gnomonia ulmea* (S.) Thm. Fig. 2.—Leaf of red mulberry (*Morus rubra* L.), showing eye-spot due to *Cercospora moricola* Cke. Fig. 3.—Tar-spot on the live oak (*Quercus virginiana* Mill.) due to *Rhytisma erythrosporum* B. and C. Fig. 4.—Leaflets of black locust (*Robinia pseudacacia* L.), showing the characteristic spotting due to (*Cylindrosporium solitarium* Heald and Wolf.

PLATE XIV. Fig. 1.—Leaves of the hackberry (*Celtis laevigata* Willd.), blighted by *Cylindrosporium defoliatum* Heald and Wolf. Fig. 2.—Leaf of the sycamore (*Platanus occidentalis* L.), blighted by *Phleospora multimaculans* Heald and Wolf.

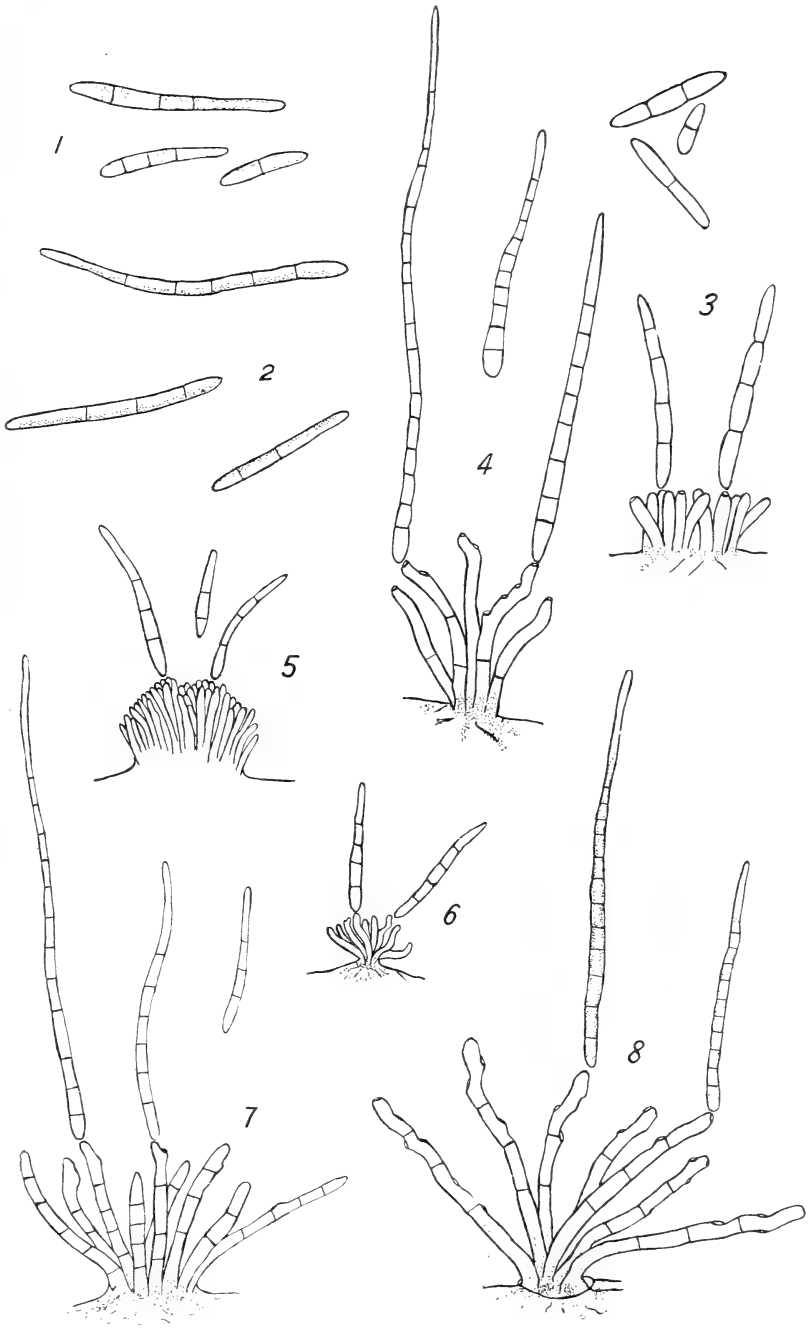
PLATE XV. Fig. 1.—Leaf of the Japanese privet (*Ligustrum japonicum* Thunb.) affected with leaf-spot caused by *Cercospora ligustri* Roum. Fig. 2.—Small branch of mesquite (*Prosopis glandulosa* Torr.), showing three galls of possible bacterial origin. Fig. 3.—A single large gall on a small branch of mesquite.

PLATE XVI. Fig. 1.—Portion of a leaf of century plant (*Agave americana* L.) affected with blight due to *Stagonospora gigantea* Heald and Wolf. Fig. 2.—Portion of the margin of the same leaf slightly enlarged, showing the distribution of numerous pycnidia.

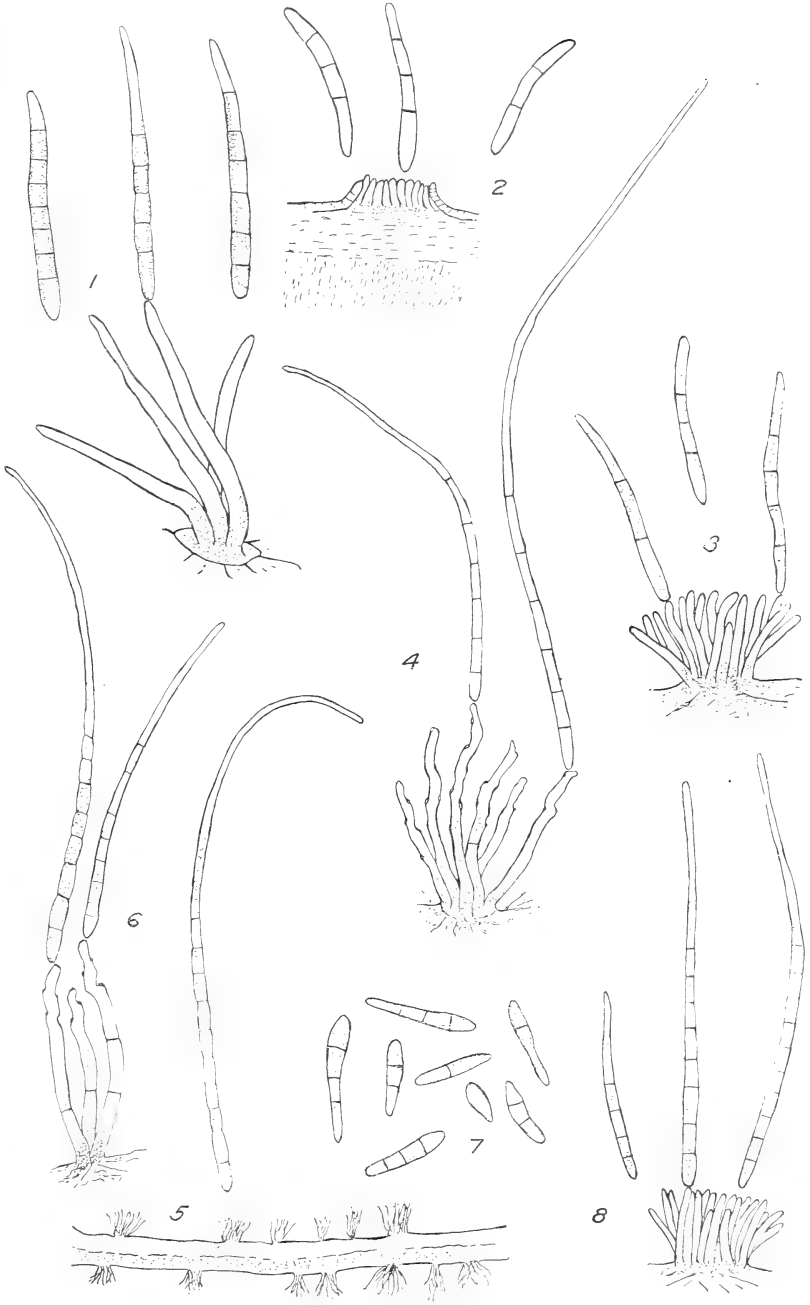
PLATE XVII. Fig. 1.—Leaves of geranium (*Pelargonium* sp.) affected with bacterial blight. Fig. 2.—Leaf of *Begonia* sp. affected with bacterial blight.

PLATE XVIII. Fig. 1.—A leaf of wild morning-glory (*Ipomoea* sp.) from the under surface, showing the abundant sori of the white-rust (*Albugo ipomoeae-panduranae* (S.) Swingle). Fig. 2.—A small branch of the mountain cedar (*Juniperus sabinoides* Nees.), showing the gelatinous sori of *Gymnosporangium exiguum* Kern. Fig. 3.—Leaf-curl of the trompillo (*Solanum elaeagnifolium* Cav.), due to the presence of nematodes (*Tylenchus* sp.).

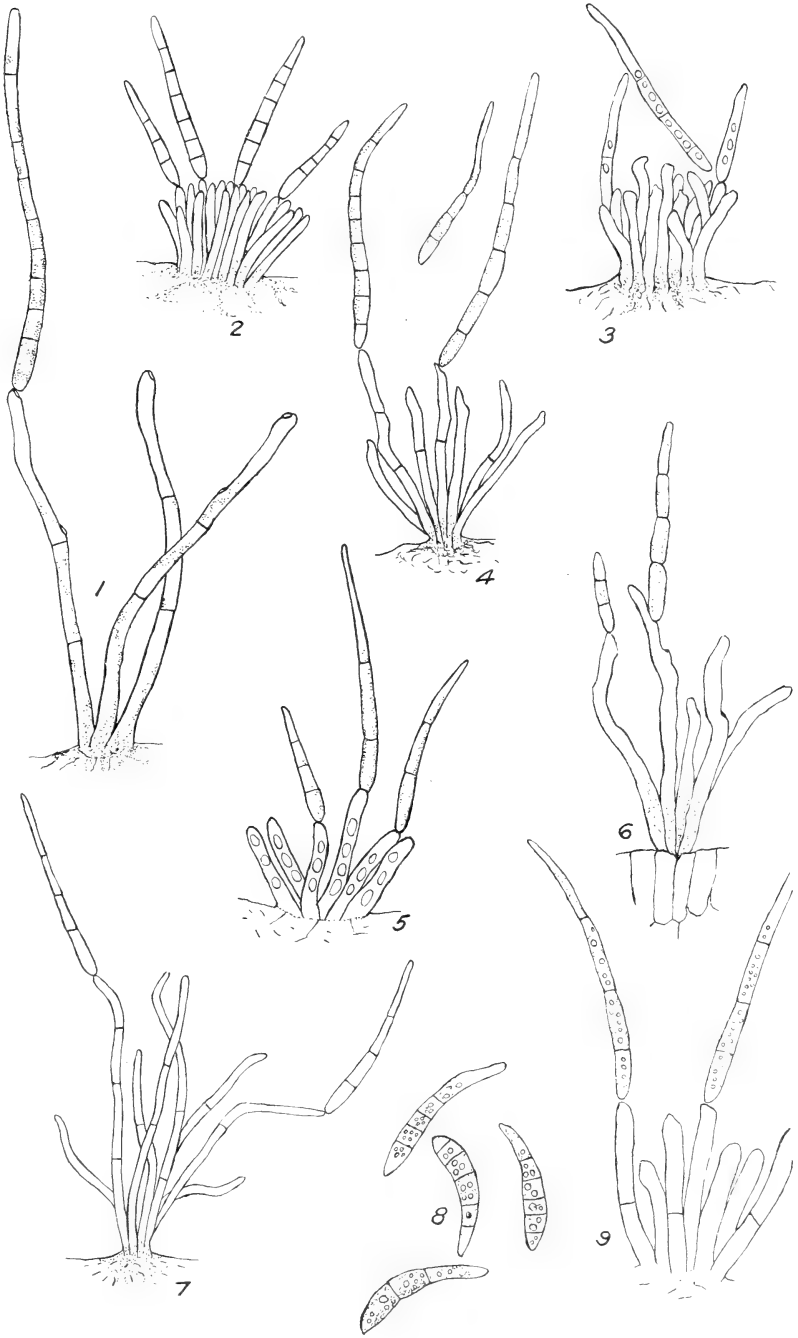
PLATE XIX. Fig. 1.—Leaflet of the wild China tree (*Sapindus drummondii* Hook. and Arn.) affected with *Cylindrosporium griseum* Heald and Wolf. Fig. 2.—Buds of *Yucca rupicola* Scheele blighted by the attacks of *Cercospora floricola* Heald and Wolf. Fig. 3.—Small portion of the inflorescence of *Y. rupicola* Scheele with flowers blighted by *Cercospora floricola* Heald and Wolf.



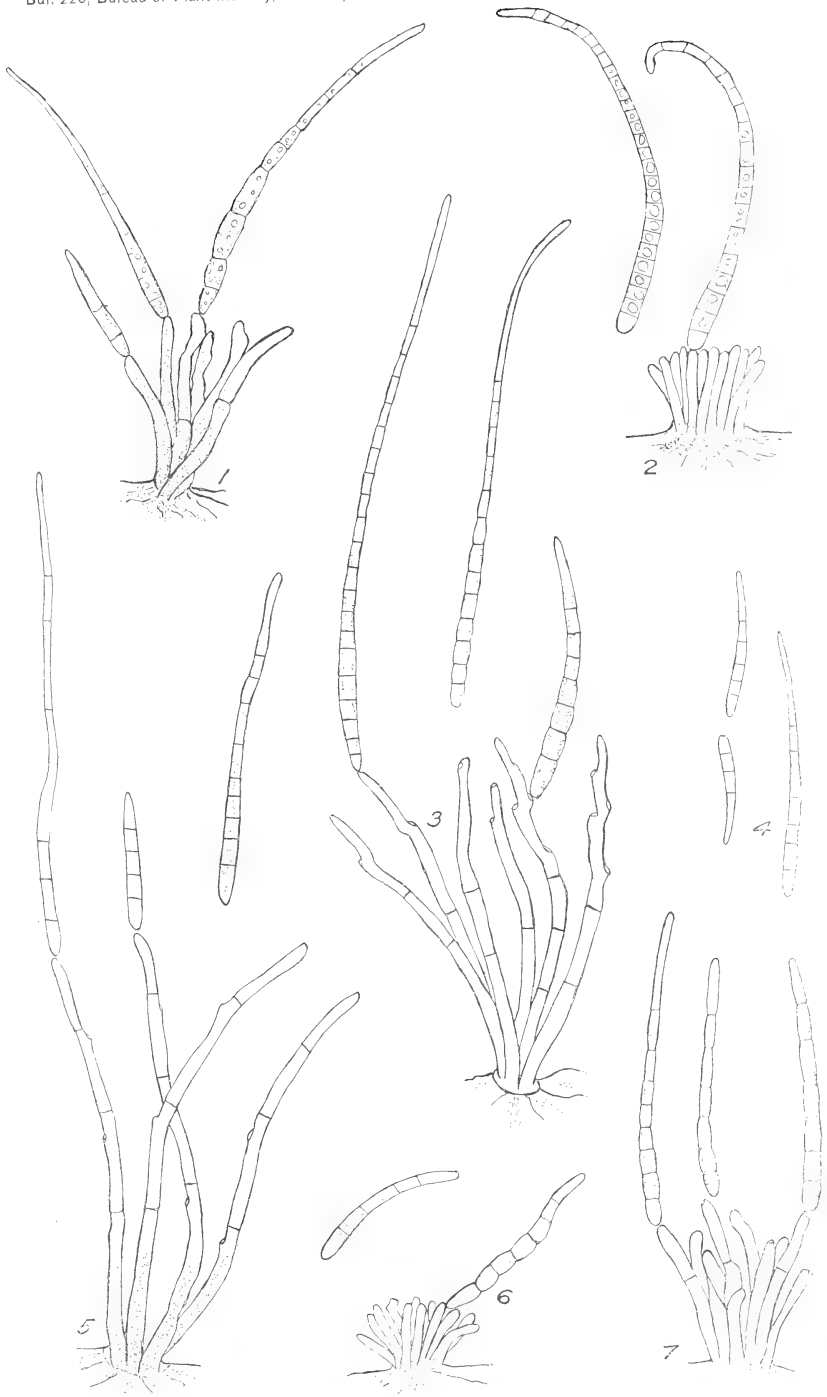
SPECIES OF CERCOSPORA FROM VARIOUS HOSTS, NO. 1.



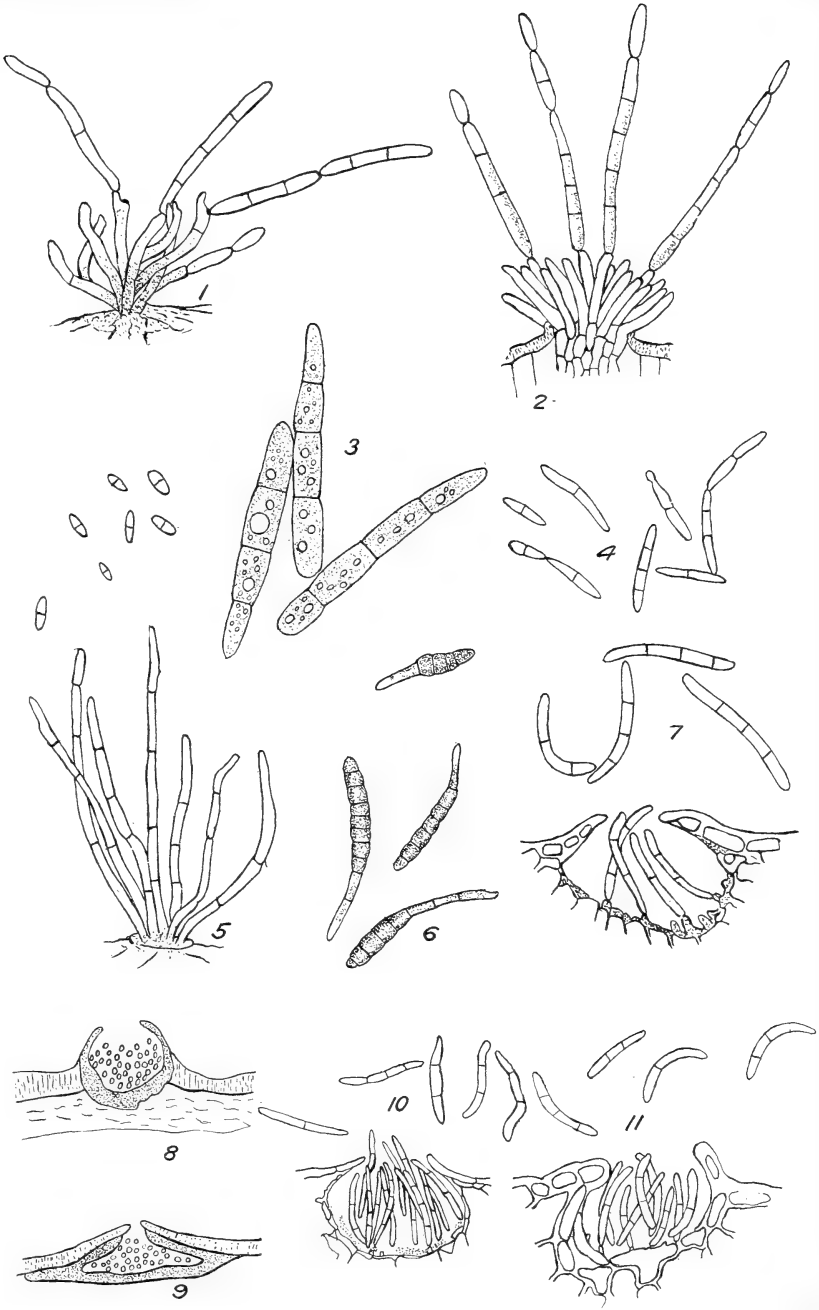
SPECIES OF CERCOSPORA FROM VARIOUS HOSTS, NO. 2.



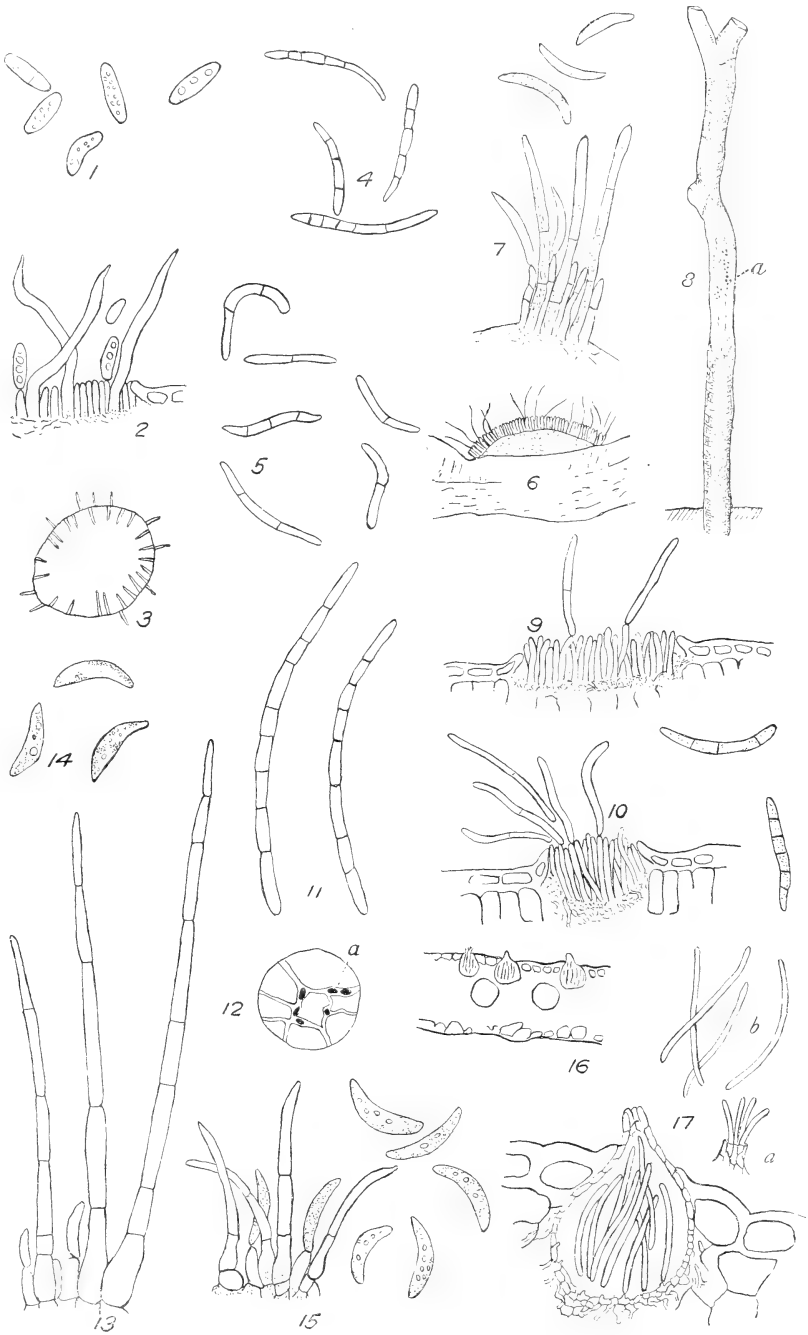
SPECIES OF CERCOSPORA FROM VARIOUS HOSTS, NO. 3.



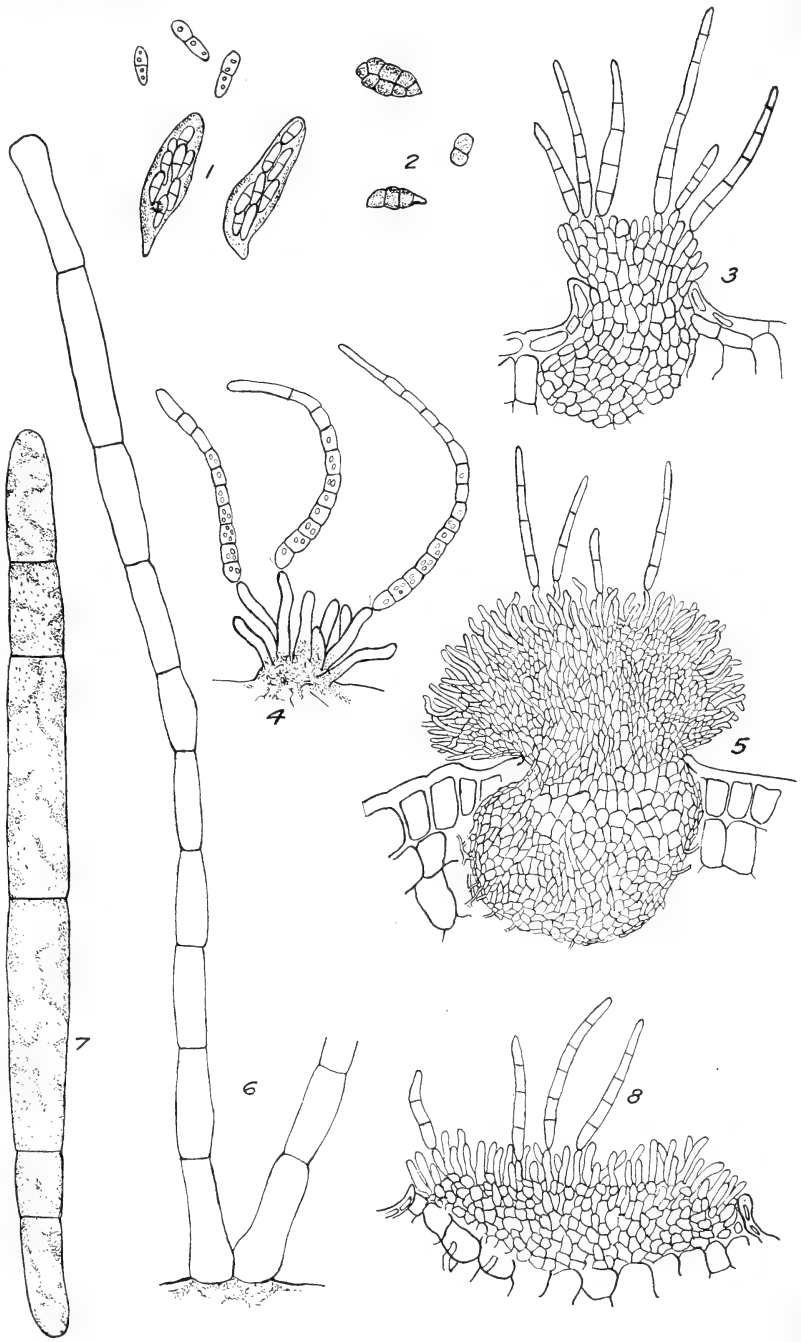
SPECIES OF CERCOSPORA FROM VARIOUS HOSTS, NO. 4.



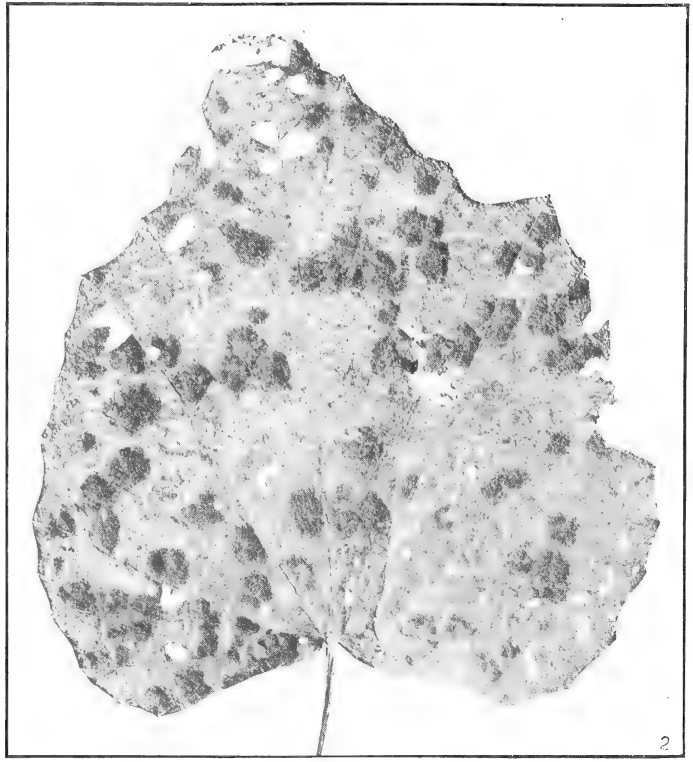
VARIOUS GENERA OF FUNGI IMPERFECTI ON DIFFERENT HOSTS.



SPECIES OF COLLETOTRICHUM, CYLINDROSPORIUM, AND SEPTORIA ON VARIOUS HOSTS.



FUNGI FROM VARIOUS HOSTS.



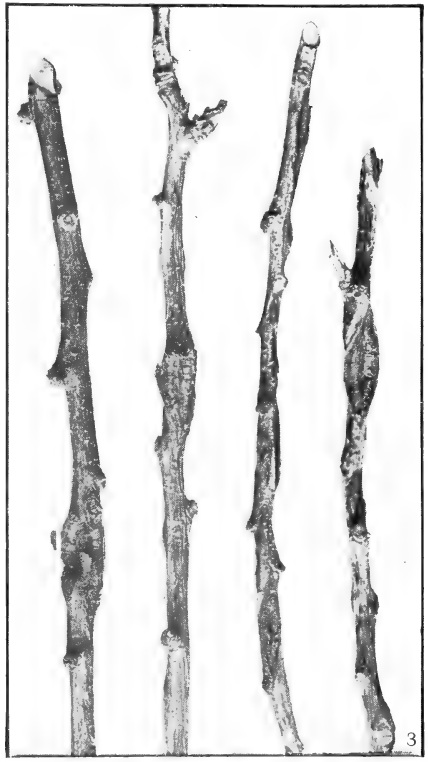
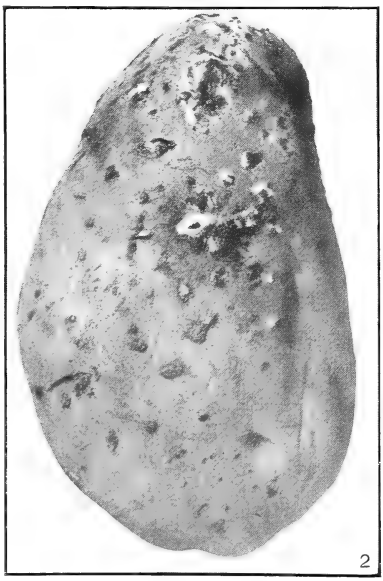


FIG. 1.—LEAFLET OF THE DATE PALM, SHOWING NUMEROUS PUSTULES OF GRAPHIOLA PHOENICIS.
FIG. 2.—LEAF OF GRAPE, SHOWING NUMEROUS BLOTCHES DUE TO CERCOSPORA VITICOLA.
FIG. 3.—BACTERIAL TWIG-CANKER OF THE PLUM.

FIG. 1.—ROOTS OF TOMATO PLANT DEFORMED BY NEMATODES.
FIG. 2.—ROOT-KNOT OF MUSKMELON DUE TO NEMATODES.
FIG. 3.—LEAVES OF LIMA BEAN, SHOWING LEAF-SPOT DUE TO CERCOSPORA CANESCENS.



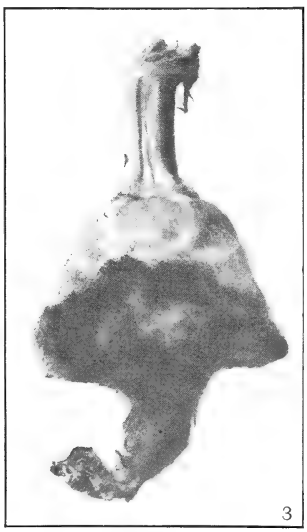


FIG. 1.—YOUNG WATERMELONS AFFECTED WITH BLOSSOM-END BLIGHT AND ROT.
FIG. 2.—TUBER OF POTATO, SHOWING NODULES FORMED BY RHIZOCTONIA.
FIG. 3.—CYMLING ALMOST DESTROYED BY BOTRYTIS CINEREA.

FIG. 1.—INFLORESCENCE OF FEATHER GRASS ATTACKED BY BALANSIA HYPOXYLON.
FIG. 2.—PORTION OF A LEAF OF SORGHUM AFFECTED WITH BLIGHT DUE TO COLLETOTRICHUM LINEOLA.
FIG. 3.—ROOTS OF COTTON AFFECTED WITH ROOT-ROT DUE TO A NEW SPECIES OF STERILE FUNGUS.

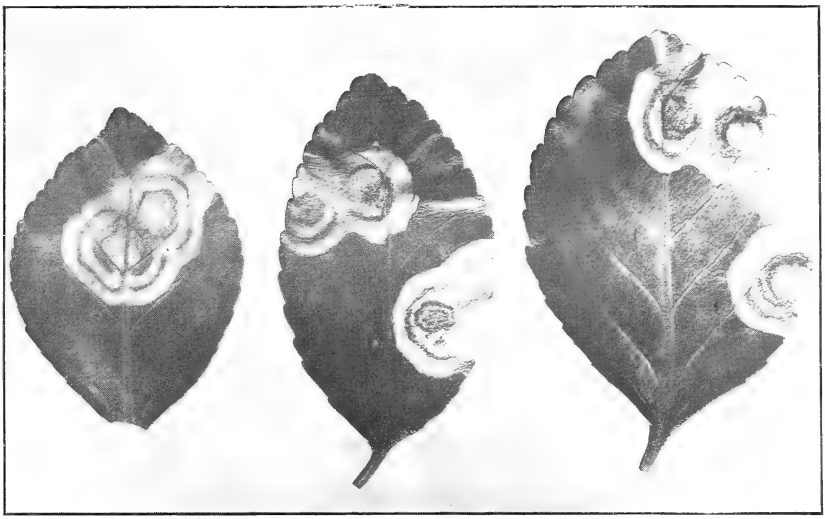
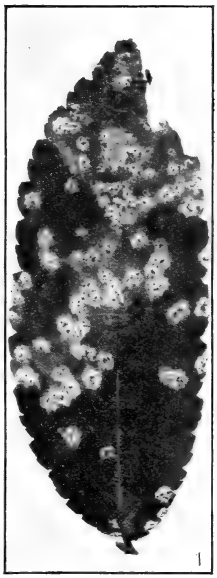
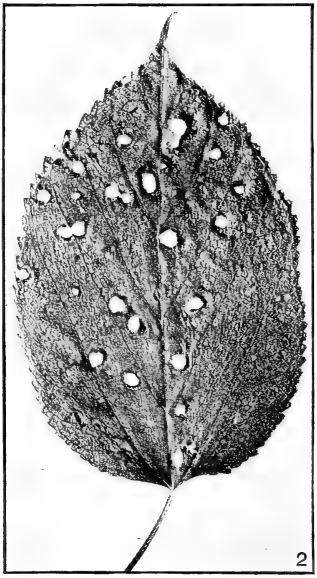


FIG. 1.—LEAVES OF EUONYMUS, SHOWING THE CHARACTERISTIC SPOTTING CAUSED BY EXOSPORIUM CONCENTRICUM.

FIG. 2.—LEAVES OF EUONYMUS, SHOWING SPOTS DUE TO COLLETOTRICHUM GRISEUM.





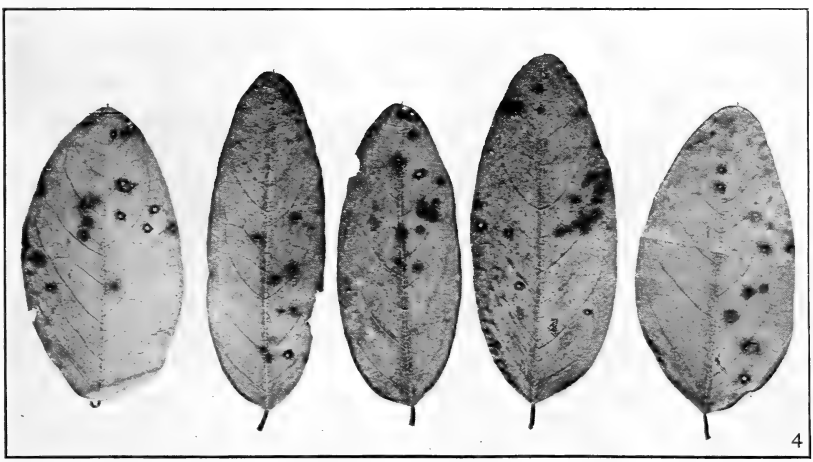


FIG. 1.—LEAF OF WINGED ELM AFFECTED WITH SCAB DUE TO GNOMONIA ULMEA.
FIG. 2.—LEAF OF RED MULBERRY, SHOWING EYE-SPOT DUE TO CERCOSPORA MORICOLA.
FIG. 3.—LEAF OF LIVE OAK, SHOWING TAR-SPOT DUE TO RHYTISMA ERYTHROSPORUM.
FIG. 4.—LEAFLETS OF BLACK LOCUST, SHOWING THE CHARACTERISTIC SPOTTING DUE TO CYLINDROSPORIUM SOLITARIUM.

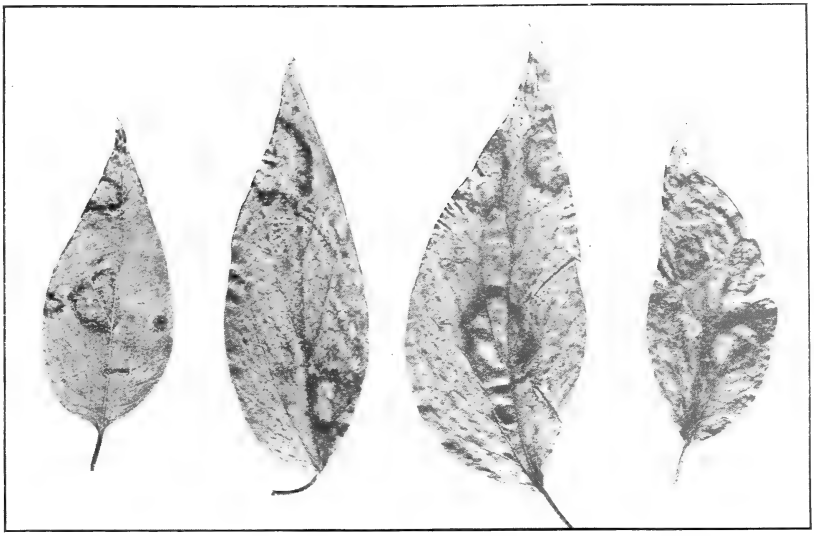


FIG. 1.—LEAVES OF THE HACKBERRY BLIGHTED BY CYLINDROSPORIUM DEFOLIATUM.

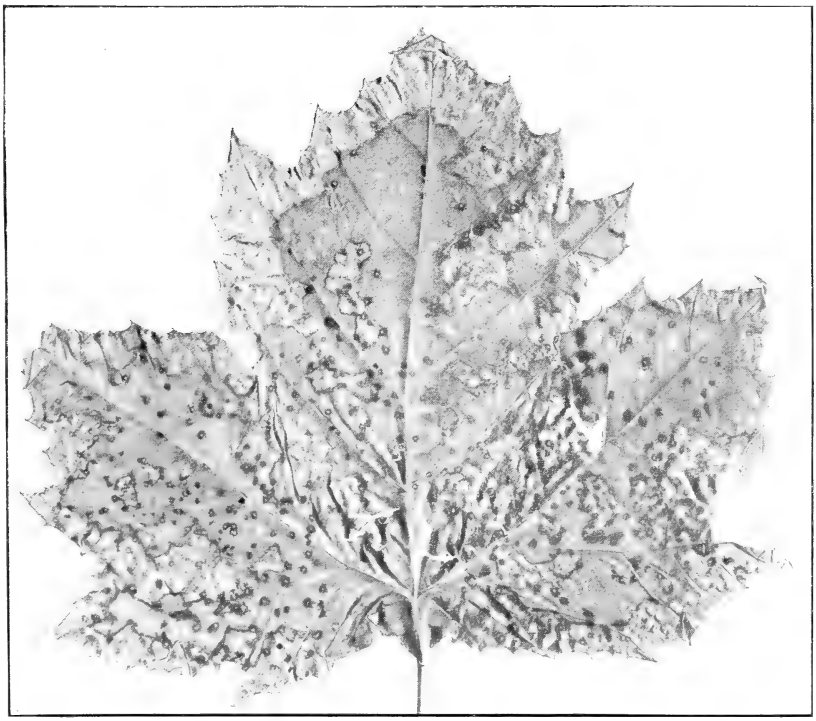


FIG. 2.—LEAF OF THE SYCAMORE BLIGHTED BY PHLEOSPORA MULTIMACULANS.

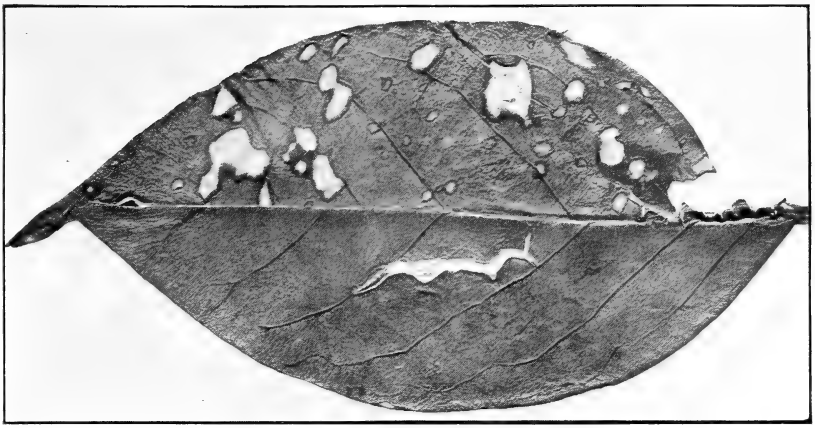


FIG. 1.—LEAF OF THE JAPANESE PRIVET AFFECTED WITH LEAF-SPOT DUE TO CERCOSPORA LIGUSTRI.

FIG. 2.—SMALL BRANCH OF MESQUITE, SHOWING THREE GALLS OF POSSIBLE BACTERIAL ORIGIN.

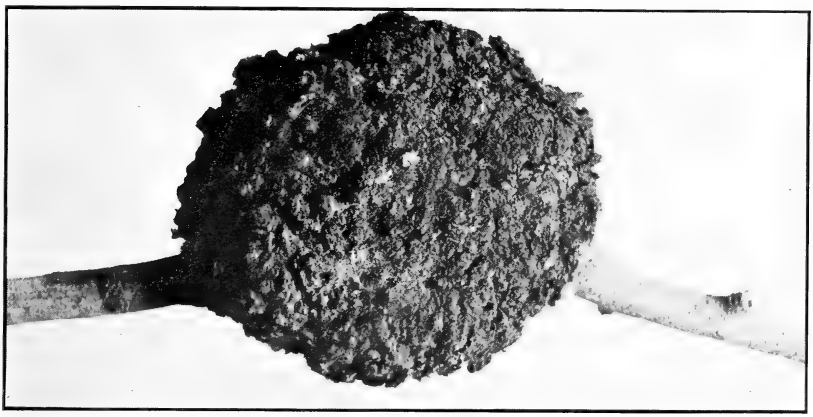


FIG. 3.—A SINGLE LARGE GALL ON A SMALL BRANCH OF MESQUITE.

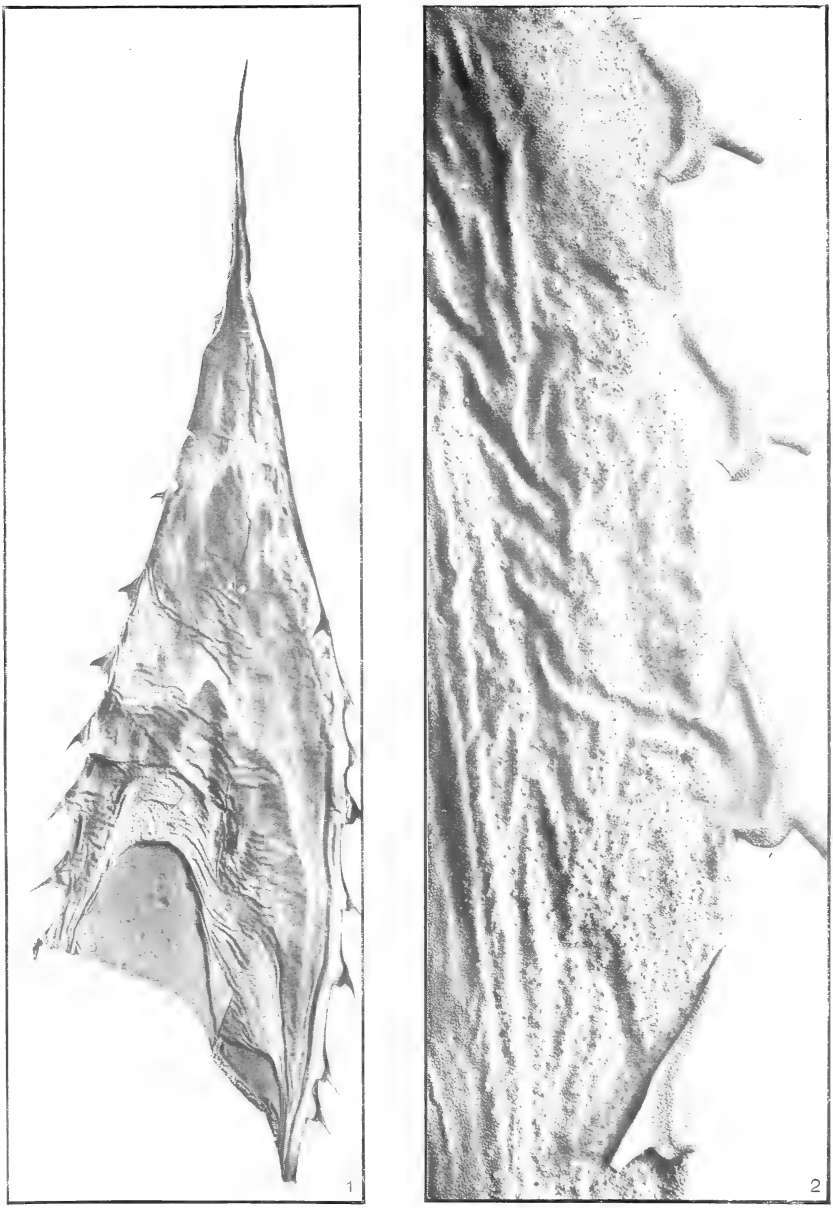


FIG. 1.—PORTION OF LEAF OF CENTURY PLANT AFFECTED WITH BLIGHT DUE TO STAGONOSPORA GIGANTEA.

FIG. 2.—MARGIN OF SAME LEAF SLIGHTLY ENLARGED, SHOWING THE DISTRIBUTION OF PYCNIDIA.

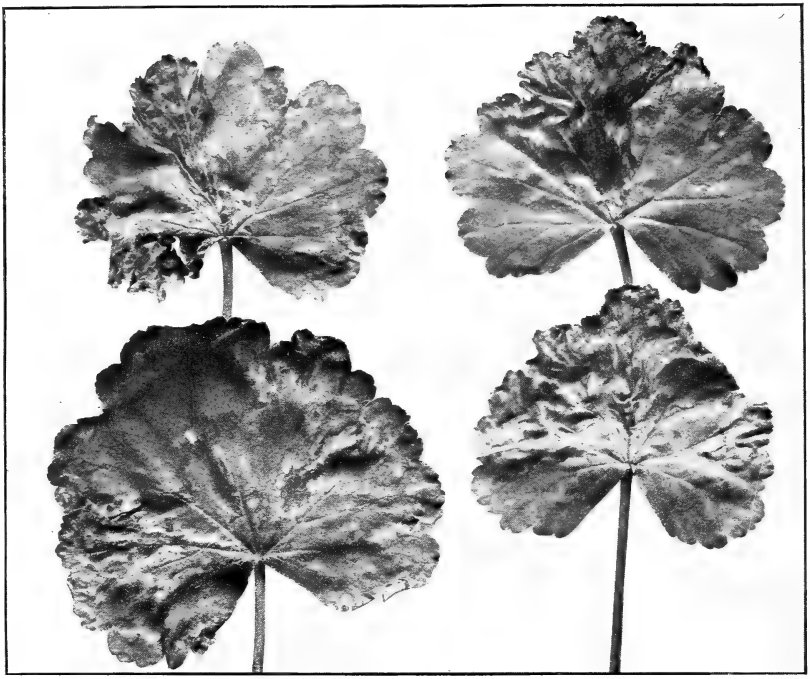


FIG. 1.—LEAVES OF GERANIUM AFFECTED WITH BACTERIAL BLIGHT.

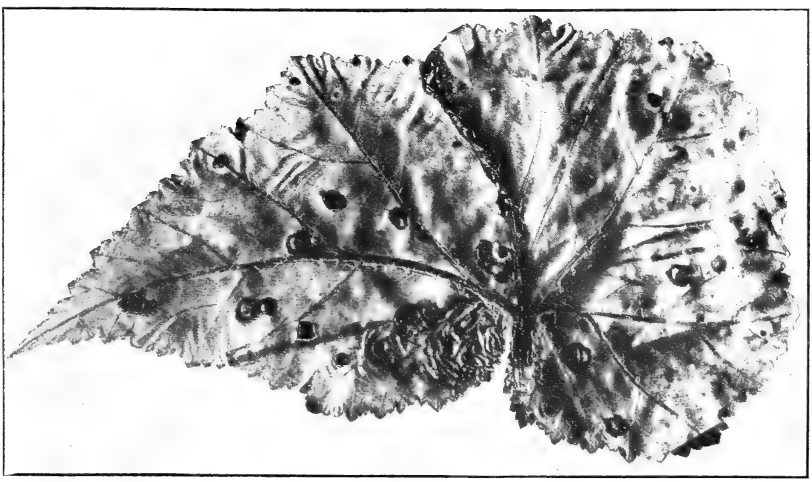
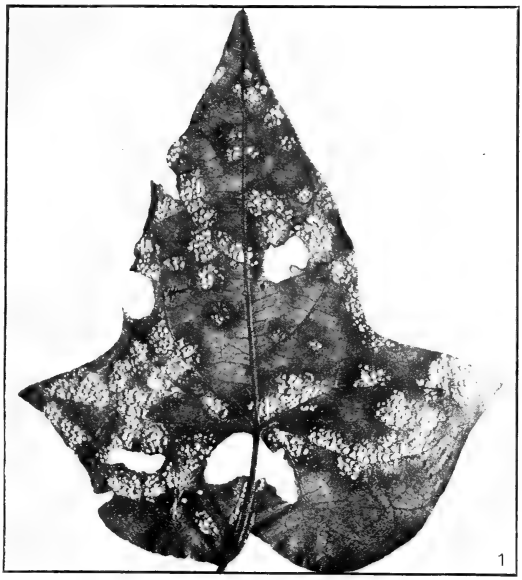
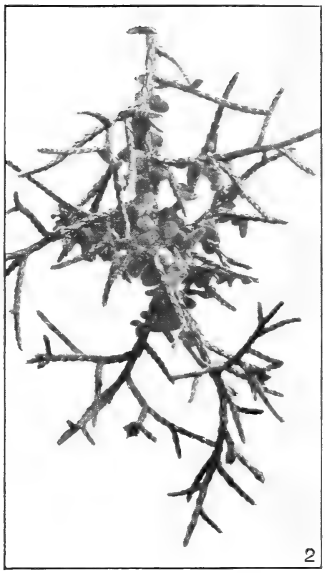


FIG. 2.—LEAF OF BEGONIA AFFECTED WITH BACTERIAL BLIGHT.





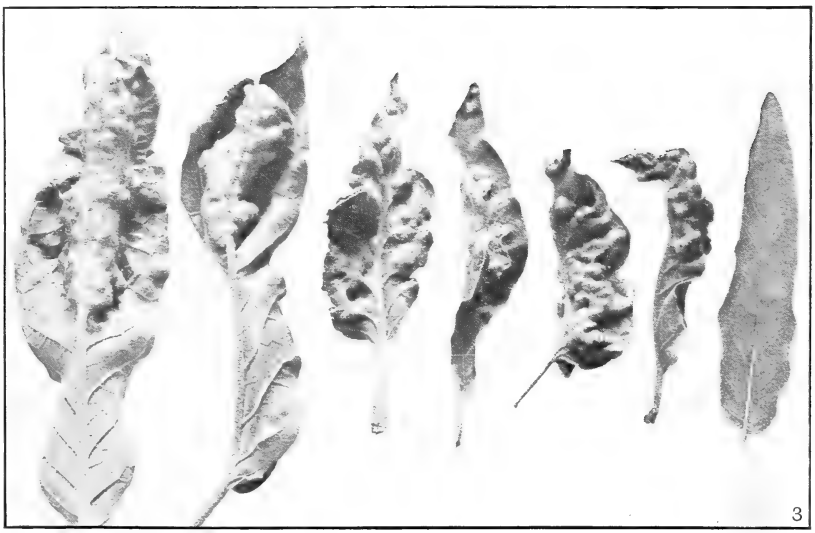


FIG. 1.—LEAF OF WILD MORNING-GLORY ATTACKED BY ALBUGO IPOMOEAE-PANDURANAE.
FIG. 2.—SMALL BRANCH OF MOUNTAIN CEDAR, SHOWING THE GELATINOUS SORI OF GYMNOSPORANGIUM EXIGUUM.
FIG. 3.—LEAF-CURL OF TROMPILLO DUE TO NEMATODES.

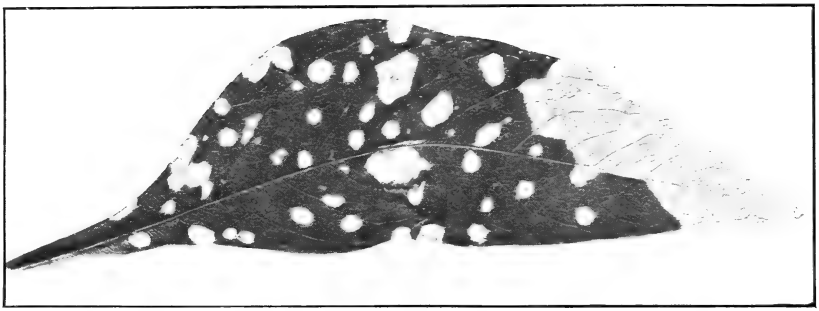


FIG. 1.—LEAFLET OF THE WILD CHINA TREE AFFECTED WITH CYLINDROSPORIUM GRISEUM.

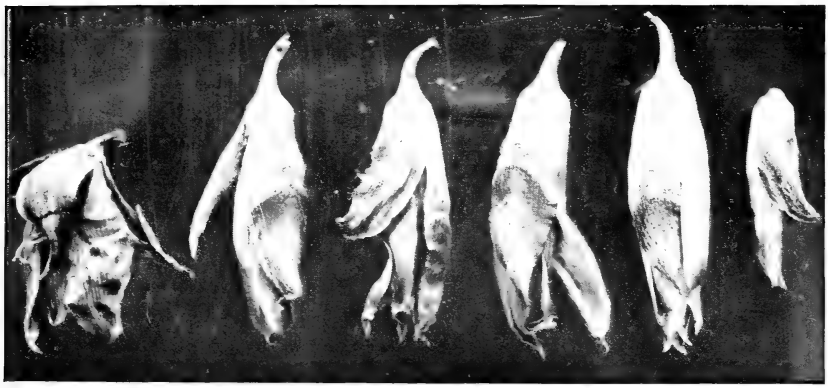


FIG. 2.—BUDS OF YUCCA BLIGHTED BY CERCOSPORA FLORICOLA.

FIG. 3.—INFLORESCENCE OF YUCCA BLIGHTED BY CERCOSPORA FLORICOLA.

INDEX.

100833°—Bul. 226—12——9