

INDIANA PLANT DISEASES, 1928¹MAX W. GARDNER and E. B. MAINS²

This is the tenth³ of a series of annual summaries of the plant disease situation in the state. No claim for completeness is made.

The weather for the 1928 season, as shown in the graphs in figure 1, was characterized by a cool dry spring, very frequent and heavy rains and cool weather during June, cool dry weather in September and a warm October. Conditions were favorable for very severe epiphytotics of apple scab, rust, blotch, fire blight

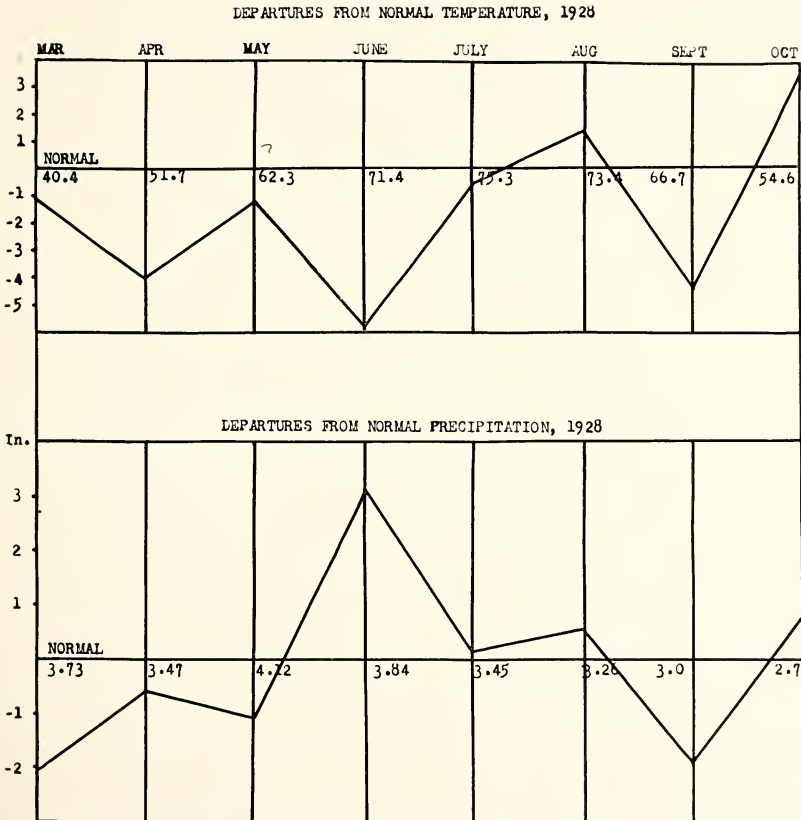


Fig. 1—Departures from normal temperature and precipitation in Indiana in 1928 based on monthly averages supplied by J. H. Armington in Climatological Data.

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²The writers wish to acknowledge the cooperation of C. T. Gregory, W. E. Leer, J. F. Trost, H. E. White, M. McCown, F. P. Cullinan, H. D. Brown, Leslie Pierce, and H. F. Dietz.

³Proc. Ind. Acad. Sci. 1919: 135-156, 1921; 1920: 187-208, 1921; 1923: 163-211, 1924; 1924: 297-313, 1925; 1925: 237-257, 1926; 1926: 231-247, 1927; 1927: 411-426, 1928; 1928: 143-157, 1929.

and bitter rot, barley scab, sugar beet leaf spot, cabbage black leg, cantaloupe leaf blight, cherry leaf spot, *Diplodia* ear rot of corn, bacterial spot of peach, raspberry anthracnose, *Septoria* leaf spot of tomato and wheat scab. The early summer weather was too cool to favor the *Fusarium* wilt diseases.

DISEASES ARRANGED ALPHABETICALLY BY HOSTS

Alfalfa. Leafspot caused by *Pseudopeziza medicaginis* was widespread. Rust (*Uromyces medicaginis*) was noted in the fall.

Apple. In central and southern Indiana the dry weather lasting until the full bloom period checked early scab infection but the almost incessant rainfall during the next six weeks caused heavy infection and made the petal-fall and two-weeks spray applications all-important in scab control. The importance of the petal-fall spray was demonstrated in tests on the Winesap and Stayman varieties near Mitchell in which the percentage of infection was greatly reduced in trees receiving both pink and petal-fall sprays as compared with those receiving only the pink spray. Among the varieties proving susceptible this season were Golden Delicious and Turley. Severe leaf infection was noted on the McIntosh variety on June 29. The margins and tips of the young leaves were killed and were covered with a greenish velvety layer of the conidia and conidiophores of the scab fungus. Although the Grimes variety is considered somewhat resistant, a grower near Laurel reports much trouble with scab on this variety.

Blotch, caused by *Phyllosticta solitaria*, was even worse than in 1927, a bad blotch year. By means of potted healthy trees placed under a badly diseased tree, Kohl found at Mitchell, that infection occurred during each of the 23 rain periods between 8 days and 10½ weeks after petal fall (May 9) and that, although none occurred during the rains of May 11 and 15, a trace occurred on May 5, four days before petal fall. Similarly he found that at Lafayette infection occurred during 22 out of the 23 rains between 4 days and 9½ weeks after petal fall (May 14). On the large green fruit of the Tulpehocken variety the smaller blotch lesions and the margins of the larger ones were conspicuously reddish or purplish in color. Infection was noted on fruit of the Golden Delicious and Early Harvest varieties, and on Grimes fruit on trees adjacent to badly cankered trees of other varieties.

Frog-eye leaf spot, caused by the black rot fungus (*Phylospora malorum*), was found very severe in July in an orchard near Mitchell on Stayman trees not receiving sprays after the pink application, while very little was present on trees receiving a petal-fall spray of lime sulphur and Bordeaux at 2, 4, and 6 weeks after petal fall. Bad leaf infection also occurred on the lower limbs of Jonathan trees. In Orange County much frog-eye infection was found surrounding rust lesions. Black rot of the fruit was very destructive in orchards near Lafayette. In October black rot pycnidia containing spores were found at Vincennes in a dead fruit spur and in a current season fire blight canker sent in from Greenfield.

Rust (*Gymnosporangium juniperi-virginianae*) was more prevalent on the foliage than has been observed during the past ten years. In July very heavy foliage infection was observed on the Jonathan, Rome, Grimes and Early Harvest varieties in unsprayed orchards. Whole trees had a conspicuous yellowish cast and many leaves were being killed by the lesions. Excellent resistance was shown by Delicious and Ben Davis trees in such orchards. Infection was not nearly as bad in sprayed orchards but much infection occurred on sprayed Rome and Jonathan trees. Fruit infection was noted on Rome, Jonathan, Stayman,

and Winesap varieties near Mitchell, and leaf infection was rather abundant on trees of the latter two varieties not receiving a petal-fall spray. Leaf infection occurred on the Golden Delicious variety.

Fire blight, caused by *Bacillus amylovorus*, was very prevalent and destructive this year, although there was not as much blossom infection as in 1926, and was reported from 16 counties. The last week in May blighting of the late bloom on Jonathan was noted at Paoli, and blight was found by McCown near Columbus, Vincennes and Pekin on Jonathan, Maiden Blush and Transparent. McCown also found infection in Jonathan fruit near Paoli early in June. Twig blight was conspicuous on Jonathan in Knox and Vanderburg counties, was found on Rome near Mitchell, and was reported by McCown on Golden Delicious.

Bitter rot, caused by *Glomerella cingulata*, was very destructive in the southern end of the state and was recorded from four commercial orchards, including the orchard in Warrick County where it has occurred for many years and where it caused nearly a total loss. In one large orchard in Knox County bitter rot caused a total loss of the Grimes crop, and in another orchard caused a heavy loss in Grimes and Jonathan and considerable loss in Rome, Ben Davis and Tulpehocken, while the Winesap variety escaped infection to a remarkable extent. A careful search in both of these orchards failed to reveal any bitter rot cankers or other original sources of infection. Bitter rot was reported on the Golden Delicious variety in Brown County.

A grower in Perry County with his orchard along the Ohio River failed to control bitter rot on Grimes and Jonathan in the low-lying part of his orchard near the river with a schedule of Bordeaux sprays which had furnished protection in previous years. The sprays were applied May 21-26, June 19-21, July 25-27, Aug. 10-12, and Aug. 25-27. The strength of copper sulphate was increased from one pound (per 50 gal.) in the first spray to two pounds in the third and three in the fourth. In a letter he states: "I think the chief difficulty lay in the time that elapsed between the second and third cover sprays. * * * Bitter rot had showed up on two trees by the middle of July, and workmen were ordered to pick these trees but failed to do so until I was applying the August 10 spray. By that time bitter rot was sweeping all Grimes and Jonathans and we had picking crews go over both five different times in an effort to check the spread; but we lost about 30 per cent of the Grimes and 50 per cent of the Jonathans. This bottom orchard lies on a bench 300 yards from the Ohio River and 40 feet above low water stage. Heavy dews and fogs keep the trees wet until the middle of the morning most days during the late summer and autumn. In my orchard on the hill top 275 feet above the river we had only a touch of bitter rot on Grimes, less than 3 per cent being affected. On these Grimes we used only the weak Bordeaux (1-3-50) in the later sprays."

Sooty blotch (*Glocodes pomigena*) was much more severe than usual this year and was found on Rome, Winesap, Grimes, Jonathan, Stayman, and Golden Delicious. In spray tests at Lafayette, Zaring found that considerable protection was afforded by the scab sprays. This would suggest that sooty blotch infection may occur rather early in the season. Phytophthora rot was found on young Grimes fruit on the lower limbs in an orchard near Paoli by McCown on June 18.

The fruit spot and rot, caused by *Sporotrichum malorum*,⁴ was found in March in stored Grimes fruit grown at Lafayette in 1928. Core-mold was noted

⁴Gardner, Max W. *Sporotrichum* fruit spot and surface rot of apple. *Phytopath.* 19: 443-452. 1929.

in Stayman fruits. Bitter pit was observed on Grimes, Stayman, and Ben Davis in Knox County.

Apricot. Twig lesions of the scab fungus (*Cladosporium carpophilum*) were observed near Bedford.



Fig. 2.—Fusarium wilt of aster. Diseased plant at right, healthy plant at left.

Aster. Aster wilt caused by *Fusarium conglutinans* var. *callistephi* was much more prevalent around Lafayette than in 1927. In one planting of the Department of Botany, 52 out of 511 plants or over 10 per cent of the plants were killed by wilt (Fig. 2). It also was received from Johnson County. Mosaic, or yellows, was also of more than usual prevalence (Fig. 3). In one planting in Lafayette about 6 per cent of the plants were severely infected. Rust (*Coleosporium solidaginis*) appeared in late summer and caused considerable defoliation in some cases. Dusting with sulphur was found to be very effective in controlling this disease.⁵

⁵Mains, E. B. Control of the rusts of ornamentals by sulphur. Trans. Ind. Hort. Soc. 1928: 167-172. 1929.



Fig. 3—Effect of the virus disease, mosaic or yellows, on aster blossoms. Three diseased (at left) and one healthy blossom. The blossoms on affected plants are stunted in their development and often lopsided.

Barley. Scab caused by *Gibberella saubinetii* was very prevalent and destructive. The wet weather during June when barley was blossoming favored spread of the disease. The loss from this disease for Indiana was estimated as 20 per cent. Numerous complaints concerning difficulty in feeding infected barley were received. Considerable difference in susceptibility of varieties was noted. The hooded varieties as a group showed the most infection.⁶

Stripe, caused by *Helminthosporium gramineum*, was noted but no cases of severe infection were reported. The spot blotch, caused by *Helminthosporium sativum*, was very prevalent in the barley variety nursery at Lafayette where it caused considerable defoliation in the most susceptible varieties.

Covered smut (*Ustilago hordei*) showed about the usual prevalence and the loss from this disease was estimated to be about 1 per cent. Leaf rust, *Puccinia anomala*, was only locally abundant. Susceptible varieties at Lafayette showed 100 per cent infection. A number of varieties, especially strains of Coast, Luth, Oderbrucker, Odessa, Arequipa, Juliaca, Lynch, and Heil's Hanna, were resistant. Stem rust, *Puccinia graminis*, was less prevalent than in previous years and caused little or no loss. Ergot, caused by *Claviceps purpurea*, was noted in a few heads in the leaf rust nursery at Lafayette.

Bean. Bacterial blight, caused by *Bacterium phaseoli*, was widespread but not as serious as usual, presumably because of the low average temperatures. Mosaic was very prevalent and, together with blight, is responsible for most of the very heavy disease loss in this crop. Because of the cool weather and frequent rains, anthracnose (*Colletotrichum lindemuthianum*) was more common than usual. It was recorded from seven counties. Rust (*Uromyces appendiculatus*) was recorded from three counties in the fall. Angular leaf spot caused by *Isariopsis griseola* was found at Lafayette in July. In greenhouse inoculation tests with spore suspensions from pure cultures of *Isariopsis griseola*, 40 commercial varieties of beans were used and all proved susceptible. Some resistance was shown by the Kentucky Wonder variety. Cowpeas proved to be immune.

Beet. Leaf spot, caused by *Cercospora beticola*, occurred in gardens and in August was found very destructive in sugar beet fields in Grant County. One of these fields was on a farm where beets had never been grown before.

⁶A more detailed account of this situation is given by Mains, Vestal and Curtis elsewhere in these Proceedings. See page 101.

Blackberry. Orange rust (*Gymnoconia peckiana*) was found prevalent and conspicuous in May in plantings near Lafayette.

Blue grass. Rust (*Puccinia epiphylla*) was found very prevalent in a few lawns in West Lafayette in October. It apparently was not causing much damage.

Cabbage. Gregory reported yellows, caused by *Fusarium conglutinans*, less prevalent and black leg, caused by *Phoma lingam*, more prevalent than usual. Black rot, caused by *Bacterium campestre*, was found in Grant County in September.

Cantaloupe. Leaf blight, caused by *Macrosporium cucumerinum*, was found serious in Knox and Vanderburg counties in August. Bacterial wilt was reported from Lagrange County.

Carnation. Rust (*Uromyces caryophyllinus*) was noted in a number of greenhouses. The varieties, White Matchless, Surprise, and Harvester, were noted to be remarkably free from rust while such varieties as Super Supreme, Enchantress Supreme, Pink Enchantress, White Enchantress and Early Dawn were heavily rusted. A leaf spot of carnations caused by *Bacterium woodsii* (Fig. 4) was received from a greenhouse at Richmond where it was reported to have caused considerable loss especially in the variety White Matchless.



Fig. 4—Lesions on stem and leaves of carnation caused by *Bacterium woodsii*.

Celery. Late blight, caused by *Septoria apii*, occurred late in the season in Noble County.

Cherry. Leaf spot, caused by *Coccomyces hiemalis*, was very destructive and in Orange County was found causing defoliation as early as the middle of July. It was reported from seven counties. Powdery mildew (*Podosphaera oxycanthae*) was sent in from Pike County and was noted in Grant County in July.

Clover. Powdery mildew was widely prevalent on red clover.

Corn. Trost reported smut (*Ustilago zeae*) somewhat more prevalent than in 1927, and estimated the losses due to ear rot caused by *Gibberella saubinetii* at 1 per cent, and to the ear rot caused by *Diplodia zeae* at 10 per cent. Trost found the black bundle disease, caused by *Cephalosporium acremonium*, on barren strains of corn and attributed a 1 per cent loss to the cob rot caused by *Basisporium gallarum*. Drechsler found root infection at Lafayette caused by species of *Pythium*. Trost found leaf blight of sweet corn caused by *Helminthosporium turcicum* and G. M. Smith found bacterial wilt common in the Golden Bantam variety of sweet corn.

Cowpea. Bacterial spot, caused by *Bacterium vignae*, was found in experimental plots at Lafayette on June 30 and was also found in two other localities. In five small experimental plots planted with seed collected from mosaic plants in 1926, six out of 139 plants of the Arlington variety showed mosaic on June 21 and none was noted in the other four plots representing the Groit, Early Black, and Columbia varieties and the closely related species catjang, nor in plots of other varieties. On June 30, 19 of the Arlington plants showed mosaic and on August 16, 79 showed the disease, while none was found elsewhere except for two plants in a plot of the Cream Chowder variety. A rather large number of cowpea plants were exposed to natural infection, comprising in addition to the varieties mentioned above, Early Red, New Era, Early Buff, Taylor, Victor, Iron, Brabbam, Red Ripper, Black, Clay. This failure of mosaic to spread was in sharp contrast to its extensive spread in our plots in 1925 and 1926.

Cucumber. Bacterial wilt was observed in Grant County in August and in Marion County in September. Angular leaf spot, caused by *Bacterium lachrymans*, was sent in from Fulton County in July and was observed in Grant County in August. Anthracnose was found on fruits in a commercial greenhouse in June.

Currant and Gooseberry. Leaf spot, caused by *Mycosphaerella grossulariae*, was noted in July in Grant County.

Flowering Almond. One case of severe twig blighting of flowering almond (*Prunus glandulosa*) was found in a garden in West Lafayette. This apparently was due to the fire blight organism, *Bacillus amylovorus*, which had spread from nearby infected apple trees.

Gourd. Severe mosaic was noted in a garden in Lafayette. The infected plants were dwarfed and finally killed by the disease.

Grape. Downy mildew (*Plasmopara viticola*) was sent in from Montgomery County in August and black rot, caused by *Guignardia bidwellii*, from Washington

County in July. Specimens of anthracnose (*Sphaceloma ampelinum*) showing abundant lesions on green fruit, pedicels, and peduncles were sent in from two vineyards in Huntington County in mid-August.

Hollyhock. Leaf spots caused by *Ascochyta althaeina* and *Cercospora althaeina* caused considerable defoliation in gardens in Lafayette. Rust (*Puccinia malvacearum*) was moderately severe. It was found that dusting with sulphur would control this rust.

Horse radish. Leaf spot, caused by *Cercospora armoraceae*, was sent in from Decatur County in August.

Iris. The diseases of Iris have been discussed in detail elsewhere.⁷ The soft rot of Iris, caused by *Bacillus carotovorus*, was noted on the varieties, Blue Jay, Nibelungen, Quaker Lady, Queen Caterina and Purple King, at Lafayette. One of the English irises, Rosa Bonheur, was completely destroyed and the species, *Iris laevigata*, *I. spuria*, *I. halophila* and *I. setosa*, showed rotting following borer infestation. Sclerotial rot caused by *Sclerotium delphinii* was severe on the varieties Lent A. Williamson, Blue Boy, Dalila and Pallida Dalmatica. Leaf spot caused by *Didymellina iridis* was especially prevalent. The varieties, Florentina Alba, Monsignor, Fairy, Ballerine, Queen Caterina, Queen Alexandra,



Fig. 5—*Lilium tenuifolium* infected with *Phytophthora cactorum*. Infection occurred near the surface of the ground resulting in the collapse of the infected portion and breaking over of the plant.

⁷Mains, E. B. Observations concerning diseases of iris and tulips. Proc. Ind. Acad. Sci. 38 (1928): 93-102. 1929.

Quaker Lady, and *Viola grandiflora*, were outstanding for restricted development of the disease. Rust (*Puccinia iridis*) was noted severe on *Iris halophila*, *I. xiphioides*, *I. missouriensis*, and *I. setosa* while none was noted on a number of other species nor on the varieties of bearded iris.

Lettuce. In a patch of head lettuce grown with overhead irrigation near Lafayette, drop caused by *Sclerotinia libertiana* was very destructive in June and downy mildew (*Bremia lactucae*) was very abundant.

Lily. A stalk blight of coral lily, *Lilium tenuifolium*, was found in a garden in West Lafayette in May, 1928. Infection apparently occurred at or below the ground level, the disease spreading upward and causing the stalks to become soft and fall over (Fig. 5). The fungus was isolated and sent to Dr. Charles Drechsler who identified it as *Phytophthora cactorum*.

Lima bean. Bacterial spot, caused by *Bacterium vignae*, was sent in from Dearborn County in June and was observed near Vincennes in July.

Narcissus. Fusarium bulb rot (Fig. 6) was found by Dietz in bulbs shipped into Indiana from Ohio.

Oats. The loose smut of oats caused by *Ustilago avenae* occurred to some extent in most fields. The loss from this disease was estimated at 3 per cent for 1928. Stem rust (*Puccinia graminis*) was less prevalent than in previous years and caused but little loss. On July 14, Leer found stem rust appearing on oats. The heaviest development was noted in the western part of the state between Terre Haute and Rensselaer and eastward to Wabash, Marion and Anderson. Crown rust (*Puccinia coronata*) was less prevalent than in previous seasons but was usually present to some extent in most fields. The loss for the state was estimated at 1 per cent.

The scab of oats, caused by *Gibberella saubinetii*, was unusually severe. While it was not as uniformly prevalent on oats as on barley and wheat, it



Fig. 6—Fusarium bulb rot of narcissus. White mycelium of the fungus is conspicuous between the darkened and rotted scales and in the cavity at the center of the bulb.

was very severe locally. A number of farmers in the vicinity of Liberty, Union County, were unable to feed their oats to hogs, horses and mules on account of scab. One man alone had 3,200 bushels which could not be fed. A somewhat similar situation occurred in Clinton County. The loss from this disease was estimated at 3 per cent.

Halo blight, caused by *Bacterium coronafaciens*, was found to some extent throughout the state, the most serious case being reported from a farm near Mulberry, Clinton County. A leaf spot apparently caused by *Helminthosporium avenae* was found causing considerable defoliation in variety plots on the University farm east of Lafayette.

Pansy. A leaf spot of pansy apparently caused by *Cercospora violae* was noted in several gardens in West Lafayette. This disease became prevalent during hot weather in July and caused severe defoliation.

Pea. Fusarium wilt was serious near Tipton in June. Dr. M. B. Linford, specialist in pea diseases, found *Ascochyta* foot rot prevalent in fields about Plymouth, a new territory for this crop, and near Rochester, a region where peas have been grown for a long period. Near Rochester he also found Fusarium wilt and the root rot caused by *Aphanomyces euteiches*.

Peach. Leaf curl, caused by *Exoascus deformans*, was prevalent in unsprayed trees but not as serious in commercial orchards as in 1927, perhaps because it was a late spring and growers were able to apply the dormant spray before the buds started to swell. In experimental plots at Vincennes, Pierce obtained excellent control with a Bordeaux-oil spray on November 26 preceding, and no control with oil alone or with oil plus copper sulphate. Scab, caused by *Cladosporium carpophilum*, was reported worse than usual this year. Fruit infection was observed in Knox, Marion, and Lawrence counties.

Bacterial spot, caused by *Bacterium pruni*, was observed in Knox, Orange, Lawrence, and Vanderburg counties, and was even more destructive than in 1927, causing very severe fruit infection and early defoliation. Furthermore numerous twig lesions were formed on the current season growth differing quite distinctly from the leaf scar arsenic cankers in location and shape. The bacterial lesions were more elongated and more irregular in shape and if located at a leaf scar usually extended out from one side of the scar rather than being centered about it. When these cankers were shaved off, cut up in a drop of water on a slide, and examined microscopically, a vigorous oozing of masses of bacteria was easily observed along the cut edges. These lesions were found in Knox county in abundance as early as July 16. Pierce⁸ and Roberts obtained a good control of this disease at Vincennes with a zinc sulphate-lime spray. On July 16, two instances were observed in which the disease was much worse on the foliage of young plantings than in old orchards immediately adjacent. In one orchard it was observed that the Krummel variety seemed somewhat resistant to leaf infection as compared with the Hale variety.

Apothecia of the brown rot fungus (*Sclerotinia fructicola*) were found by Pierce at Vincennes under a seedling tree on April 3, where none had been visible the previous day. By April 6, the varieties Hale, Elberta, and Hiley were in full bloom and Pierce counted 19 clusters of apothecia under the

⁸Pierce, Leslie. Control of peach bacterial spot. Trans. Ind. Hort. Soc. 1928: 120-124. 1929.

seedling tree and ascertained that the ascospores were ready to germinate. On May 18, after a prolonged rain period, Pierce found the fungus sporulating profusely on blighted leaves and blossoms and on small twigs where blighted blossoms had been attached. On June 5, he observed fruit infection. However, in spite of these abundant sources of infection, Pierce found very little brown rot when the crop was harvested.

Dr. L. M. Hutchins, specialist in peach virus diseases, visited a number of the orchards in the Vincennes region and found no peach yellows, rosette, little peach or phony disease.

Pear. Fire blight, caused by *Bacillus amylovorus*, was very destructive this season and was reported from seven counties. The fire blight in the young Bartlett orchard in Putnam County mentioned in our last year's report was cut out early this spring and although this was a bad blight season, only a very few limbs became infected. In a well isolated orchard such as this, it may be possible to control the disease.

Plum. Black knot, caused by *Plowrightia morbosa*, on the Blue Damson variety was sent in from Hendricks County on April 3 and the perithecia contained ascospores which apparently were mature. Specimens were also received from Brown and Marion counties. Fruits of the Abundance variety bearing lesions of bacterial spot, caused by *Bacterium pruni*, were sent in from Warsaw on July 21.

Potato. Black leg, caused by *Bacillus phytophthorus*, occurred in the early crop in Orange County.

Quince. Fire blight, caused by *Bacillus amylovorus*, was sent in from Marion County.

Radish. Black root, caused by *Aphanomyces raphani*, was sent in from Hendricks County on July 3. A new bacterial spot disease, of which the causal organism closely resembles that of tomato bacterial spot,⁹ has been found near Lafayette and in Grant County. Other hosts found susceptible in inoculation tests include cabbage, brussels sprouts, kale, cauliflower, mustard, turnip, tomato, pepper and tobacco. Transmission with radish seed was demonstrated. It seems fairly certain that the radish seed pod lesions illustrated in our 1925 report (p. 241) were attributable to this disease.

Raspberry. Anthracnose (*Plectodiscella veneta*) lesions were observed near Lafayette on new canes on May 25. In midsummer the disease was abundant on the upper parts of the plants including pedicels and in October very late infection was evidenced by the abundance of small lesions on the tips of the canes. Leaf spot, caused by *Mycosphaerella rubina*, was observed in Grant County in July and August. Orange rust (*Gymnoconia interstitialis*) was observed in May on a few red raspberries in a row adjacent to badly infected blackberries. Crown gall, caused by *Bacterium tumefaciens*, was sent in from Parke County. Conspicuous mosaic was found abundant in a plant of the Cumberland variety at Lafayette on May 21 and was also noted in red varieties. Leaf curl was observed on the Cumberland and Plum Farmer varieties at Lafayette on May 25.

⁹ White, Harold E. and Gardner, M. W. Bacterial spot of radish and turnip. Abs. in *Phytopathology* 19: 97. 1929.

The red variety, St. Regis, has shown marked freedom from virus diseases in a commercial planting near Lafayette.

Rose. Powdery mildew (*Sphaerotheca pannosa*) was noted on the variety Dorothy Perkins and was responsible for defoliation and blasting of flower buds. Black spot, caused by *Diplocarpon rosae*, was fairly common and caused severe defoliation in a few cases.

Rye. Scab, caused by *Gibberella saubinetii*, was the most severe disease of rye in Indiana in 1928. While this disease was not as prevalent on rye as on barley and wheat it caused a loss estimated at 5 per cent for the state. Ergot, caused by *Claviceps purpurea*, was found to a varying extent in rye fields and a loss in yield of 1 per cent was estimated for the state. Anthracnose, caused by *Colletotrichum cereale*, was less severe than in previous years.

The leaf rust of rye (*Puccinia dispersa*) was less severe than in previous years. The severe winter of 1927-1928 greatly reduced the amount of rust which overwintered and the rust was not generally prevalent until late in the season. On June 30 Leer reported leaf rust in Tippecanoe, Clinton, Hamilton, Jasper, Lake, Howard, Wabash, Miami, Huntington, Allen, and Dekalb counties and on July 7 in Boone, Marion, Henry, and Rush counties. Stem rust (*Puccinia graminis*) was less prevalent than in previous years and caused little or no loss.

Snapdragon. Rust (*Puccinia antirrhini*) was noted in several gardens in West Lafayette. In variety tests of the Department of Botany, susceptible varieties such as Nelrose, Gotelind, and Maralda were so severely rusted that most of the plants were dead by the end of the summer. Selections are being developed which are very resistant. Dusting with sulphur has controlled this disease (l.c.⁵).

Soybean. Downy mildew (*Peronospora manshurica*) was found for the first time. It was first noted on Aug. 14 in the Manchu variety at Lafayette, and was later noted in Grant and Knox counties. Apparently the disease was only of



Fig. 7.—Yellowish lesions of downy mildew (*Peronospora manshurica*) on soybean leaves (var. Manchu). This disease was found for the first time in Indiana this year.

slight economic importance. Leaf spot, caused by *Septoria glycines*, was sent in from Jasper County. Bacterial spot, caused by *Bacterium glycineum*, was noted at Lafayette and in Knox County. Mosaic was observed in the Manchu variety at Lafayette.

Spinach. Downy mildew (*Peronospora effusa*) was found rather destructive in Grant County on May 22 in a canning crop field in which spinach was grown the previous year.

Strawberry. Leaf spot, caused by *Mycosphaerella fragariae*, was observed in Tippecanoe and Grant counties.

Sweet potato. Gregory reported stem rot, caused by *Fusarium batatatis*, prevalent and destructive in Knox County and black rot, caused by *Sphaeronema fimbriatum*, in Sullivan County.

Tomato. Leaf spot, caused by *Septoria lycopersici*, was extremely widespread and destructive in the canning crop because of the frequent rains. The disease was recorded from 14 counties. The disease was observed in plant beds in Orange and Grant counties and was found severe in certain fields as early as June. Additional evidence of its introduction with southern-grown plants was obtained. As a result of a field survey involving 1991 acres made by Mr. L. E. Breithaupt and the canning companies yield records on this acreage, Prof. H. D. Brown estimated the total loss in the state caused by early infection of leaf spot to be over \$100,000 this year. In dusting tests¹⁰ in Grant County, it was found that poor control was obtained with as few as three applications of copper lime.

Early blight, caused by *Alternaria solani*, was found prevalent in plant beds in Grant County and became generally prevalent in the field. The collar rot effect of this disease was observed in August, and the fruit spot and stem-end rot in September. In general the foliage injury by this disease appears to be worse on the poorer soils. Fusarium wilt was not serious, probably because of the low average temperatures. It was sent in from Jackson County in July and was found in Grant County in August.

Mosaic was much less prevalent than usual. A few plants representing peculiar types of what may be virus diseases were noted in Grant County in August. In one type the plants were stunted and non-fruitful and the leaflets were narrow, erect, stiff, and slightly yellowish. In another type the plants were stunted and barren with curled petioles and necrotic surface lesions near the base of each petiole. Samson was not able to transmit these abnormalities by juice inoculation.

Leaf mold (*Cladosporium fulvum*) was very serious in greenhouses. Anthracnose (*Gloeosporium phomoides*) was found on the late set of fruits in Grant County. Buckeye rot, caused by *Phytophthora parasitica*, was noted in a greenhouse crop.

Bacterial spot, caused by *Bacterium vesicatorium*, was rather prevalent on the early set of fruit. A few cases of bacterial canker, caused by *Aplanobacter michiganense*, were found in Rush and Marion counties in southern-grown plants. In a greenhouse crop, serious injury resulted from cyanide fumigation of plants previously dusted with copper lime dust.

¹⁰Gardner, Max W., Samson, R. W., and Cochran, L. C. Dusting tests for the control of tomato diseases, 1927 and 1928. Proc. Ind. State Veg. Growers Assoc. 1929: 11-25. 1929.

Tulip. The Botrytis blight or fire disease caused by *Botrytis tulipae* was very prevalent (1.c.7). It was favored by wet weather and tulips in some gardens in Lafayette showed severe infection, especially when planted in partially shaded places. Sclerotia of this fungus were noted on bulbs shipped in from Holland.

Turnip. An undescribed bacterial spot disease was found on turnips in Grant County on July 26. The organism was also found to be the cause of a spot disease of radish, previously described. Powdery mildew (*Erysiphe polygoni*) was observed in Grant County in September.

Wheat. The severe winter of 1927-1928 resulted in a greatly reduced acreage of winter wheat, the acreage being 900,000 as compared with 1,782,000 in 1927¹¹. As a result considerable winter wheat was replaced by other crops.

The wet weather during and following the blossoming of wheat in late May and June was very favorable to the development of scab caused by *Gibberella saubinetii*. The spread of the fungus from initial infections from ascospores was rapid and in susceptible varieties often the whole head was filled with the fungus. Conditions apparently were especially favorable for perithecial formation and before harvest the heads of many varieties were covered with the black perithecia. There were noticeable differences in the susceptibility of varieties especially in spring wheats. The varieties Norka, Progress, Resaca, and especially Illinois No. 1 were outstanding for resistance¹². Illinois No. 1 showed only 17-19 per cent of kernels infected while Federation in nearby rows had 96 per cent of infected kernels. The loss in yield for the state was estimated at 15 per cent.

Loose smut of wheat (*Ustilago tritici*) was less prevalent than in 1927. The severe winter killing probably was a factor in reducing the proportion of smutted plants since Tapke¹³ and others have shown that infected plants are more subject to winterkilling. It could be found to some extent in most fields and the loss was estimated at 0.5 per cent. Bunt, due to *Tilletia laevis*, was also much less prevalent than in 1927, the loss being estimated at 0.5 per cent.

Leaf rust, caused by *Puccinia triticina*, was also much less prevalent than in previous years. The winterkilling of wheat greatly reduced the overwintering of the fungus in the wheat so that the numbers of centers of infection were greatly reduced and the rust developed slowly. Leaf rust was noted by K. D. Doak in southern Indiana on June 15, the incidence varying from 30 to 100 per cent. The wheat was in the milk to soft dough stages. Only a trace was noted by Leer in northern Indiana on June 30, when wheat was in the milk stage. At Lafayette on July 5 only a moderate infection was present except upon very susceptible varieties such as Little Club which showed 100 per cent infection. Leer reported only a moderate infection in northern Indiana at the time of harvest. The loss from this disease was estimated at 1 per cent.

Stem rust (*Puccinia graminis*) was less prevalent than in 1927. Leer found an occasional infected plant in Allen and Wabash counties on June 27. Late plants in fields thinned out by winterkilling and replanted with oats and other crops in some cases showed considerable infection in July. At harvest Leer reported only a trace in most parts of the state, the most occurring in the central third of the state.

¹¹Borum, C. J. and Justin, M. M. Annual Crop Summary for 1928. Ind. Crops and Livestock No. 39. 1928.

¹²Dickson, J. G., E. B. Mains and Helen Johann. Progress report on cereal scab development during the season of 1928. Phytopath. 19:108. 1929.

¹³Tapke, V. F. Influence of varietal resistance, sap acidity, and certain environmental factors on the occurrence of loose smut in wheat. Jour. Agr. Research 39:313-339. 1929.

The speckled leaf blotch of wheat caused by *Septoria tritici* was more prevalent than in previous years and caused considerable defoliation of susceptible varieties. Marquillo was especially susceptible and Illinois No. 1 was rather resistant. A slight amount of ergot, caused by *Claviceps purpurea*, was noted in the leaf rust nursery at Lafayette. A variety of Chinese wheat, C. I. 6223, showed the most ergot infection.

Miscellaneous. The following diseases or parasitic fungi were found, all near Lafayette unless otherwise specified: Leaf spot on bittersweet (*Celastris scandens*) caused by *Ramularia celastris*; rust (*Kuehneola uredinis*) on wild blackberry; *Piricularia grisea* on bottle grass (*Setaria viridis*) (by Dr. C. Drechsler); *Microsphaera alni* on coral berry and honeysuckle; *Epichloe typhina* on grass from Jennings County, June 13; fire blight, caused by *Bacillus amylovorus*, on English hawthorn (*Crataegus oxyacanthae*) in Marion County; bacterial leaf spot, caused by *Bacterium malvacearum*, on *Morus alba* var. *pendula*; *Albugo ipomoea-panduranae* on wild morning glory; *Phytophthora paeoniae* on peony (Tippecanoe and Knox counties); leaf spot, caused by *Cercospora rhoina*, on *Rhus typhina*; *Sphaerotheca humuli* on *Rhus canadensis*; sycamore anthracnose; rust (*Melampsora humboldtiana*) on basket willow (Putnam County).

During the wet weather of May and June a serious damping off of seedlings and blighting of a number of ornamentals occurred in a garden in West Lafayette. Parts of plants, such as the leaves, in contact with the ground were invaded and infection spread from these to the rest of the plant often causing death. The disease apparently was caused by a species of *Rhizoctonia*. Calendula, California Poppy, Canterbury Bells, Peachleaf Campanula, Forget-me-not, Foxglove and *Anchusa capensis* were all severely infected.

SUMMARY

The diseases found to be of outstanding economic importance in 1928 were apple scab, blotch, rust, and bitter rot, barley scab, beet leaf spot, cantaloupe leaf blight, cherry leaf spot, oat scab, peach bacterial spot, raspberry anthracnose, rye scab, tomato leaf spot (*Septoria*), and wheat scab.

Parasitic organisms or diseases not previously reported present in the state, at least in this series, were *Bacterium woodsii* on carnation, *Basisporium* cob rot of corn, *Phytophthora cactorum* on lily, *Fusarium* bulb rot of narcissus, bacterial spot of radish and turnip, *Peronospora manshurica* on soybean, *Aplanobacter michiganense* on tomato, and *Bacillus amylovorus* on flowering almond and *Crataegus oxyacanthae*.

Observations of more than passing interest were the susceptibility of the Golden Delicious, a new variety of apple, to scab, blotch, rust, fire blight, and bitter rot, greater severity of apple bitter rot in valley as compared with higher part of an orchard, evidence for early infection by apple sooty blotch, deleterious effect of scab on feeding qualities of barley and oats, abundance of twig lesions of peach bacterial spot, presence of *Plowrightia* ascospores in plum black knots on April 3, late fall infection of raspberry anthracnose and freedom of St. Regis variety from virus diseases, scab resistance of certain wheat varieties, and severity of *Rhizoctona* damping-off of seedlings of ornamentals.

