INDIANA PLANT DISEASES, 1925.[1]

MAX W. GARDNER,[2] Purdue University.

This is the seventh of a series of annual summaries[3] of the plant disease situation in Indiana. No claim for completeness is made.

The weather conditions of this season are summarized graphically in figure 1. The warm April favored fire blight of apples and the drouth in April and May greatly reduced the severity of apple scab, rust, and blotch, cherry leaf spot, and wheat stem rust. The hot weather of June and early July favored to some extent the Fusarium wilt diseases. Frequent rains during the summer combined with the very heavy rainfall and high temperature in September resulted in severe losses due to Septoria leaf spot and early blight of tomatoes, cantaloupe leaf blight, watermelon anthracnose, peach brown rot, and apple bitter rot.

The late frost in May killed most of the homegrown tomato plants and resulted in the use of over 100,000,000 southern grown plants in Indiana. The early freeze in October ruined many apples on the trees, and sweet potatoes not yet dug. High winds in the spring necessitated replanting of many onion fields in the Kankakee Valley a month late and the delayed maturity of these fields combined with the very wet fall weather resulted in heavy losses due to fungus discoloration of the outer scale.

Alfalfa.—Leaf spot caused by *Pseudopeziza medicaginis* was widespread. J. L. Weimer found the leaf blotch caused by *Pyrenopeziza medicaginis*, the bacterial blight caused by *Pseudomonas medicaginis*, and the root rot[4] caused by *Aplanobacter insidiosum* near Lafayette, and crown wart[5], caused by *Urophlyctis alfalfae* near Madison, Indiana. This is the first record of crown wart east of the Rocky Mountains. Mains reported rust (*Uromyces medicaginis*) serious in the fall.

Apple.—Scab, caused by *Venturia inaequalis*, was not serious because of the dry weather in April and May. The first fruit infection was noted May 15, at Vincennes. Good control with sulphur dust

[1] Contribution from the Botanical Department, Purdue University Agricultural Experiment Station.

[2] The writer wishes to acknowledge the co-operation of H. S. Jackson, E. B. Mains, G. N. Hoffer, C. T. Gregory, J. B. Kendrick, C. L. Burkholder, F. P. Cullinan, C. E. Baker, H. D. Brown, Monroe McCoun, F. C. Gaylord, C. L. Porter, Harry Dietz, B. A. Porter, and Leslie Pierce.

[3] Gardner, Max W. Indiana plant diseases, 1919. Proc. Ind. Acad. Sci. 1919: 135-156. 1921. Indiana plant diseases, 1920. Same 1920: 187-208. 1921. Indiana plant diseases, 1921. Same 1923: 163-201. 1924. Indiana plant diseases, 1922. Same 1923: 202-211. 1924. Indiana plant diseases, 1923. Same 1924: 297-313. 1925. Indiana plant diseases, 1924. Same 1925: 237-257. 1926.

[4] Jones, Fred Reul. A new bacterial disease of alfalfa. Phytopath. 15:243-244. 1925.

[5] Weimer, J. L. Crown wart of alfalfa in Indiana. Phytopath. 15:807. 1925.

"Proc. Ind. Acad. Sci., vol. 36, 1926 (1927)."

applied at weekly intervals was reported by Mr. Howard Johnson, an orchardist at Mooresville.

Blotch, caused by *Phyllosticta solitaria,* was much less serious than usual because of the dry weather in May. The first fruit infection was noted June 11, in Knox and Lawrence counties. While tests made by Kohl at Lafayette showed that all infection occurred between five and eight and one-half weeks after petal-fall, spray tests[6] on the Duchess

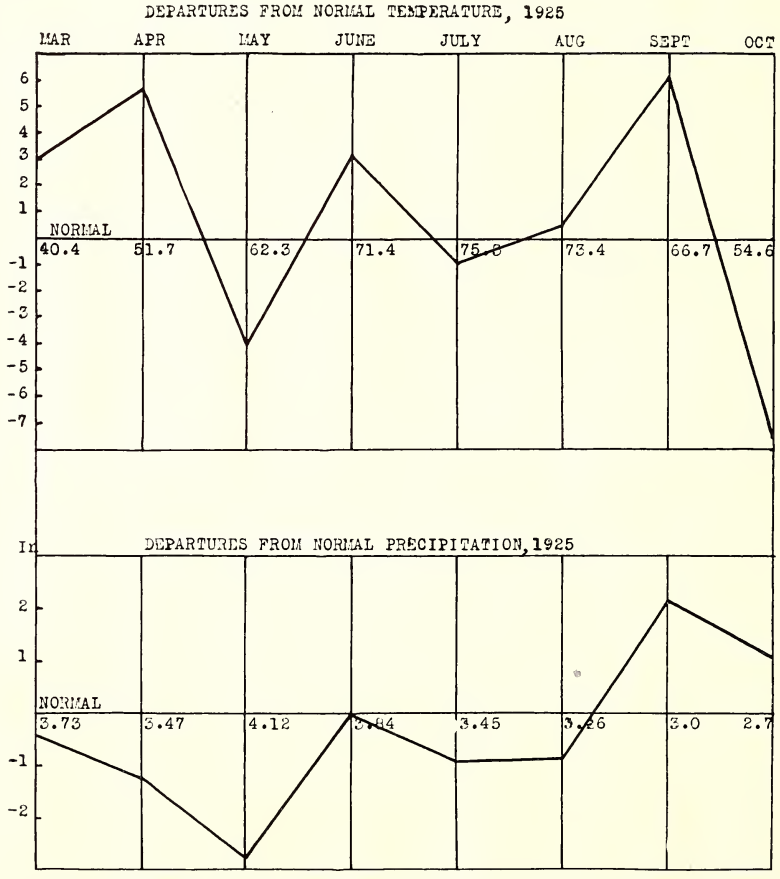

Fig. 1. Departures from normal temperature and precipitation based on monthly averages supplied by J. H. Armington in Climatological Data.

variety at Mitchell showed that the 2-, 4-, and 6-weeks spray schedule was fully effective and that an 8-weeks spray was superfluous. In addition to varieties previously listed as susceptible, infection was noted on Baldwin fruit and on both twigs and fruit of the Cortland variety.

That canker eradication in young orchards effects a successful con-

[6] Gardner, Max W., Greene, Laurenz, and Baker, Clarence E. Spraying tests for the control of apple blotch. Trans. Ind. Hort. Soc. 1925: 134-147. 1926.

trol of the blotch disease is indicated by the fact that in two young Oldenburg orchards (Simpson orchard, Vincennes) in which the eradication campaign was commenced in 1922, test plots from which the 4-weeks and 6-weeks sprays were omitted this season remained free from infection. In one orchard 21 trees were left unsprayed and on July 10, 5,758 apples on or under these trees were examined and no blotch was found. In the other orchard, 87 trees were left unsprayed and an examination of all the fruit (9,274 apples) on these trees revealed no blotch lesions whatever. While this was a mild blotch year, abundant infection occurred in unsprayed Oldenburg trees and these results are considered highly significant of two facts, (1) that canker eradication is feasible and worth while, and (2) that there is little or no long distance spread of blotch infection.

In one Indiana nursery, Dietz found blotch infection on stock grafted on French seedlings but the cankers were confined to the portions above the graft and hence were of domestic origin.

Black rot, caused by *Physalospora malorum*, was less prevalent than usual and was as a rule secondary to scab or blotch lesions, insect injury, hail injury, and growth cracks. Some calyx-end infection was observed. Leaf infection was observed as early as April 23, on Transparent and Rome. Dietz found the black rot fungus as a secondary invader of fire blight lesions in nursery stock.

Fire-blight was more serious in southern Indiana than it was in 1924 but not as bad as in 1923. It became conspicuous the first week in May and was most destructive on Jonathan and Transparent. Blossom blight was noted on Grimes and Stayman and was reported severe on the King variety in LaPorte County. McCown found leaf and fruit infection on Rome in Perry County. The leaf invasion had occurred through the petioles and had apparently progressed out along the veins. In the block of young Oldenburg trees in Knox County to which blight seems to be carried from a neglected pear orchard about a mile distant, very little fire blight was noted this year, perhaps because the pears blossomed two weeks before the Oldenburg trees rather than simultaneously with them as in 1924.

Rust (*Gymnosporangium juniperi-virginianae*) was much less prevalent than in 1924, probably because of the dry spring. The disease was reported from five counties in the southern end of the state. Leaf infection was observed on Jonathan, Rome, and Stayman, and calyx-end fruit infection of Rome and Delicious was found.

Bitter rot, caused by *Glomerella cingulata*, was worse than usual owing, probably, to the rather frequent rains in the late summer and early fall. So far as is known this disease has been a serious factor only in southern Indiana, and in only a few commercial orchards.

The first lesions were observed July 6, by B. A. Porter in Knox County. The disease was very destructive as early as the first week in August, and occurred on Jonathan, Grimes, Transparent, Gano, Collins, Ortley, and Ben Davis. In one mildly infected orchard, bitter rot was confined to four trees, three Grimes and one Ben Davis. In such cases the growers usually pick the diseased fruit from the tree as soon as it is noticed. Despite careful search, cankers as a source of infection have not been found.

In a badly infected Grimes tree in Knox County, some of the fruits showed large lesions at the stem end and it was found that the fungus in such cases sometimes grows up through the fruit pedicel into the twig. The bitter rot fungus was cultured from the basal end of such pedicels. The fungus may thus gain entrance to the twig, and in addition may prevent normal abscission of the fruit with the result that the rotted fruit or mummy remains hanging in the tree as a source of infection for the next year. Schneiderhan[7] in Virginia has pointed out the importance of such pedicel infection and has found that even when such fruits do drop off the pedicel is apt to remain attached to the twig and serve as a source of future infection.

The rot caused by *Phytophthora cactorum* was found in fallen fruit under a few Grimes trees in the same low area in an orchard at Lafayette in which the disease occurred in 1921 and 1923. The first infection was noted July 25. Powdery mildew was reported from Gibson County.

Because of the high rainfall in September, sooty blotch (*Phyllachora pomigena*) was very serious in unsprayed orchards and in commercial orchards where the fungicide was omitted from the later sprays on light varieties such as Grimes.

A shallow surface spotting of Grimes fruit in cold storage, which is caused by an apparently undescribed fungus, has been found by C. E. Baker in the 1924 and 1925 crops grown at Bedford when the fruit was taken out of storage in February or March. The lesions were irregularly circular, slightly sunken, light brown spots, 5 to 15 millimeters in diameter, with an indistinct margin and a silvery area at the center due to the presence of air under the epidermis. Cross-sections showed that about 10 to 12 cell layers under the epidermis were involved, the cells being brown and collapsed. Tissue plantings made both seasons have yielded the same slow-growing fungus characterized by grayish-white, fluffy aerial mycelium at the center of the colony in which are found under the microscope numerous simple hyphal loops or coils of uniform size, and compound hyphal strands. The hyaline, elliptical spores accumulate in small heads or groups on the ends of the short, simple sporophores. In cornmeal agar, this fungus actively dissolves the starch. Successful inoculation was obtained not only through wounds but also by placing fragments of agar colonies upon the unbroken surface of the fruit. In the latter case brown lesions appeared about the lenticels under the agar and from these lesions the fungus was reisolated. Sections of these lesions showed the abundant mycelium freely penetrating the host cells.

Bitter pit was worse than usual in southern Indiana and caused rather heavy losses especially in Stayman and Delicious. Because of the late rains there was also much loss due to growth cracks in the stem cavity in Stayman fruit. A late frost (May 25) caused a peculiar internal necrosis near the calyx end in Grimes and Golden Delicious. The necrotic tissue occupied a rather thin plane parallel to and 1 to 2 mm. under the skin and resulted in marked lop-sidedness of the fruit.

[7] Schneiderhan, F. J. Apple disease studies in northern Virginia. Va. Agr. Exp. Sta. Bul. 245: 1-35. 1926.

There was a disastrous blossom-drop in the Winesap variety in southern Indiana. On July 25, severe hail injury occurred near Paoli and observation of the behavior of injured fruit in storage later showed that as a rule no rot developed in the hail bruises unless the epidermis was broken.

Bean:—Bacterial blight, caused by *Bacterium phaseoli*, was found to be a serious limiting factor in the rather extensive commercial canning crop in Floyd County in July. The variety grown was Burpee's Stringless Greenpod, and abundant infection occurred on leaves, stems, and pods. Observations in Mains' variety plots at Lafayette showed infection in 45 of the 49 varieties represented.

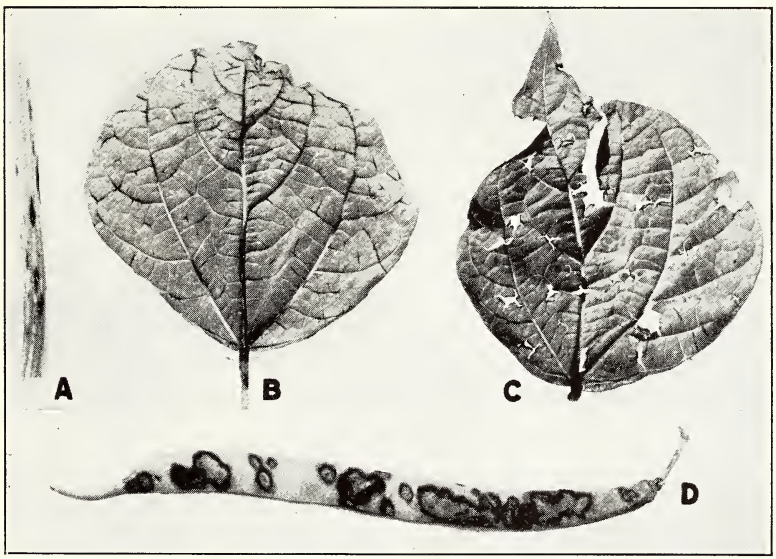

Fig. 2. Bean anthracnose. A.—Stem lesions. B.—Upper surface of leaf showing linear anthracnose lesions along the veins. C.—Leaf torn and shattered about the lesions probably as a result of growth stresses. D.—Pod lesions.

Mosaic occurred in only a small percentage of the commercial crop in Floyd County, but was very destructive in home gardens and occurred in 48 of the varieties in Mains' plots. Anthracnose, caused by *Colletotrichum lindemuthianum*, was found in a field at Lafayette where overhead irrigation was used (fig. 2). Fusarium wilt was noted killing Kentucky Wonder plants in gardens in July.

Beet:—Leaf spot, caused by *Cercospora beticola*, and Rhizoctonia root rot were noted in gardens. Beet seed imported by a beet sugar company was incubated in a damp chamber and on many of the seeds sporophores of a Coprinus developed (fig. 3), a phenomenon previously recorded by Buller.[8]

[8] Buller, A. H. Reginald. Researches on fungi 3: 308. 1924.

Blackberry:—Leaf spot, caused by *Mycosphaerella rubi,* was noted in Floyd County, and orange rust (*Gymnoconia interstitialis*) in Orange County.

Buckwheat:—Greenhouse inoculation tests with *Ramularia anomala* have been successful on a number of buckwheat varieties and on *Polygonum convolvulus,* but failed on *P. virginianum, P. pennsylvanicum,* and *Rumex sp.* The incubation period was about two weeks. The spores germinated promptly in water mounts.

In field plots a bacterial spot disease of buckwheat was found on August 12. The spots were irregularly circular and 2 to 3 mm. in diameter with a brick-red to madder-red (Ridgway) center and a narrow halo about the margin, yellowish when viewed from above and watersoaked when viewed from below (fig. 4). In microscopic mounts bacteria oozed in abundance from the cut edges of the lesions.

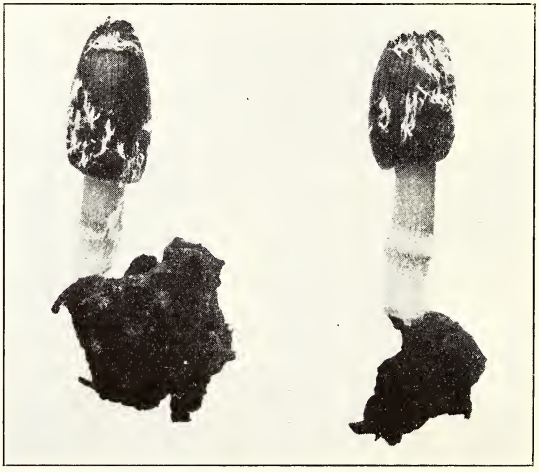

Fig. 3. Coprinus sporophores produced from beet seeds incubated in moist chamber.

Cabbage:—The Fusarium yellows was not as serious as usual, probably because most commercial growers are using resistant strains. Black leg, caused by *Phoma lingam,* was found in Marion County. An Alternaria spot was found on PeTsai cabbage near Indianapolis, in August.

Carrot:—Leaf spot caused by *Cercospora apii carotae* was worse than usual in Indianapolis market gardens.

Celery:—The Fusarium yellows was less severe than usual. The yellows-resistant variety developed by Coons and Nelson in Michigan proved resistant in Indiana. Early blight, caused by *Cercospora apii,* and late blight, caused by *Septoria apii,* were very serious. Gregory reported the latter to be a limiting factor in the crop at Goshen, where spraying with Bordeaux proved very necessary.

Cherry:—Leaf spot, caused by *Coccomyces hiemalis*, was much less prevalent than usual, owing, probably, to the drouth in April and May. Brown rot, caused by *Sclerotinia fruticola*, was worse than usual.

Clover:—Mosaic occurs throughout the state. Mains found it in four strains of red clover and in *Trifolium arvensis*, *T. subterraneum*, *T. incarnatum*, and *T. resupinatum* in his experimental plots. It was most severe in the last two species listed, and was seed-borne in *T. resupinatum*. Powdery mildew was abundant throughout the state late in the summer.

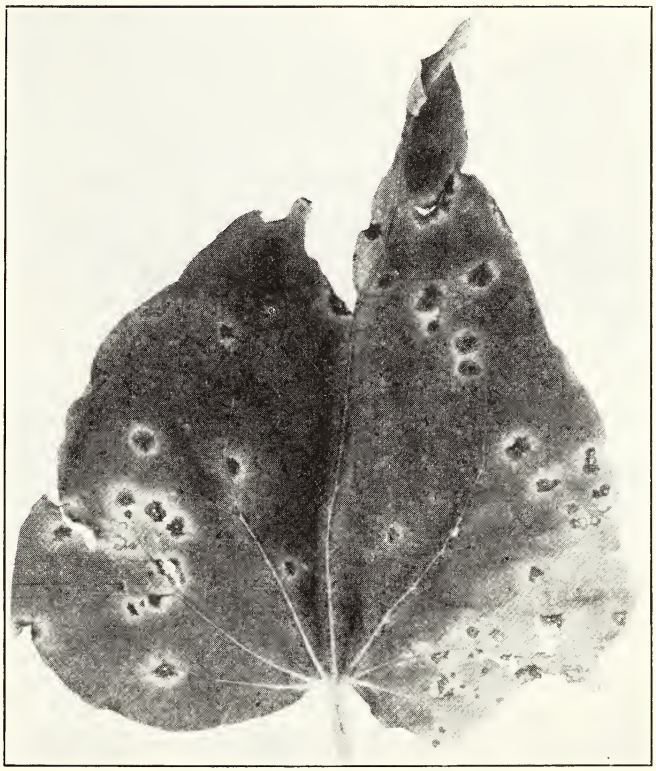

Fig. 4. Bacterial spot of buckwheat.

Bacterial spot, due to *Bact. trifoliorum*, was of common occurrence and was noted by Mains on 29 strains of red clover in his experimental plots. He also noted that alsike clover and one strain of red clover from Finland remained free from infection.

Corn:—Hoffer estimated the losses this year at 3 per cent for Fusarium ear rots, 5 per cent for Gibberella and Fusarium root and stalk rots, and 0.25 per cent for smut (*Ustilago zeae*). Rust (*Puccinia sorghi*) was widespread and bacterial wilt due to *Aplanobacter stewartii* was found in a few fields.

Cowpea:—Cladosporium spot, or scab, caused by *Cladosporium vignae*, was found on the Large Blackeye, Progressive White, and Columbia varieties and on Asparagus bean (*Vigna sesquipedalis*). It is of interest to note that Wingard found this disease on the Blackeye variety in Virginia in 1918 (letter from F. D. Fromme) and that Adams found it on the Clay variety in Delaware in 1921 (letter from J. F. Adams). Bacterial spot due to *Bact. vignae* was found in Knox and Lawrence counties as well as in experimental plots at Lafayette. Leaf spot, due to *Cercospora cruenta*, was noted in the experimental plots.

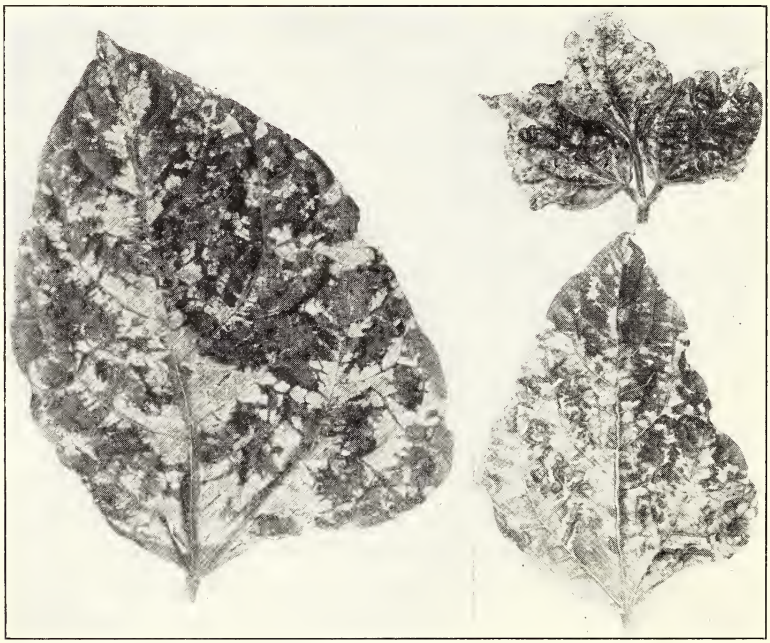

Fig. 5. Cowpea mosaic.

For the first time, mosaic was very prevalent in our experimental plots. Apparently it was introduced with newly acquired seed. It was characterized by a very conspicuous light and dark green pattern on the leaves combined with the puffy areas on the young leaves (fig. 5). Mosaic occurred in 20 varieties of cowpeas and in *Vigna sesquipedalis* and *V. catjang*. The least infection was found in the cowpea varieties, Columbia and Early Buff.

Cucumber:—Bacterial wilt, due to *Bacillus tracheiphilus*, and mosaic were not as severe as usual. Anthracnose (*Colletotrichum lagenarium*) was noted in Floyd County.

Eggplant:—Moisaic was noted on eggplants grown near mosaic tomatoes.

Gooseberry:—Anthracnose (*Pseudopeziza ribis*) was found at Vincennes.

Grape:—Downy mildew (*Plasmopara viticola*) was found rather serious in an Indianapolis market garden in August. Crown gall was sent in from Mooresville.

Horseradish:—Leaf spot, caused by *Cercospora armoraceae*, was found in Floyd County.

Jerusalem artichoke:—A powdery mildew was noted at Lafayette.

Kohlrabi:—Yellows, due to *Fusarium conglutinans*, was found at Vincennes, causing one-sided yellowing of the leaves, defoliation, and stunting. Incubation of specimens proved that the fungus was present in the vascular bundles.

Lima bean:—Bacterial blight, due to *Bact. phaseoli*, and bacterial spot, due to *Bact. vignae*, were noted in Floyd County. Mosaic was observed at Lafayette.

Muskmelon:—Leaf blight, caused by *Macrosporium cucumerinum* (previously attributed to *A. brassicae nigrescens*), was the most serious disease of the crop in southern Indiana. The leaves were killed prematurely, many melons failed to ripen, and such as did mature were poor in quality. Bacterial wilt and mosaic were not as severe as usual.

Onion:—Botrytis rot occurred rather commonly in storage, as did also bacterial soft rot. Much of the Botrytis infection, which on the yellow onions showed up in storage as a large circular black spot on the side of the bulb, apparently followed freezing injury to the outer scale.

Owing to the high winds in the Kankakee Valley in the spring which blew out the recently planted seed and drifted the muck soil like snow, many fields had to be replanted and hence the crop did not mature before the cool, wet weather of fall. The freeze in October seriously injured the crop in some sections. Inspection of such a crop in a Jasper County storage house in the late fall showed that there was much loss due to fungous discoloration of the outer scales. There was much black mold (*Aspergillus niger*), blotch (*Macrosporium sp.*), and "silver spot" (*Penicillium sp.*) on both yellow and red varieties. The blotch is characterized by numerous narrow, black, longitudinal rifts in a greenish area. The silver spot takes the form of a row of small, circular, silver patches along a vein, and on each of these a Penicillium species sporulated when specimens were incubated in a moist chamber.

Parsnip:—The leaf spot due to *Cercospora pastinacae* was very prevalent. This fungus was erroneously designated as a Cercosporella in the 1921 and 1922 reports. A trouble closely resembling a mosaic disease was noted in August.

Peach:—Bacterial spot, due to *Bact. pruni*, was much less prevalent than usual, in fact did not become at all abundant until late in the summer. Scab, caused by *Cladosporium carpophilum*, was noted on Krummel fruit in the fall and cankers were abundant on the 1924 twigs in many orchards. Leaf curl, caused by *Exoascus deformans*, was serious only in unsprayed trees.

Brown rot, due to *Sclerotinia fruticola,* was found prevalent on the fruit of unsprayed Champion trees in Orange County in July. In a commercial orchard of the Krummel variety in Knox County, this disease caused a loss in September estimated by the owner at 1,500 bushels or $4,500. This orchard had been well sprayed and most of the brown rot infection occurred in the abundant growth cracks which were the result, presumably, of a late fertilizer application and of the high rainfall in September. These cracks constituted open wounds of such recent origin that the sprays afforded no protection. There was evidence of twig infection as a result of the fungus growing up through the peduncle of the rotted fruits.

According to Pierce, another very important contributing factor in this brown rot attack was the presence, scattered through this orchard, of a number of seedling trees. These trees are usually not well sprayed and their worthless fruit, which in this case matured well in advance of the commercial variety, were rotted by the brown rot fungus, and afforded a reservoir of infection for the later-maturing commercial crop. Worthless seedling trees occur very commonly in commercial orchards and constitute a dangerous and entirely unnecessary brown rot hazard.

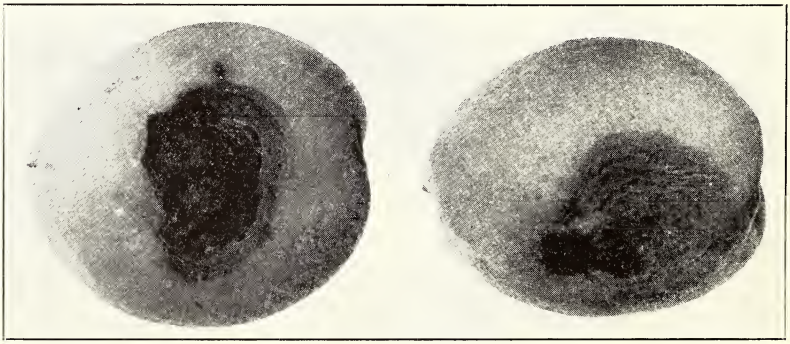

Fig. 6. Rot of peaches caused by the apple black rot fungus. Infection followed hail injury.

In a commercial orchard of the Early Elberta variety in Lawrence County, severe hail injury to the fruit occurred late in July and on August 4 it was found that about 5 per cent of the wounded fruits were affected with a firm, dry, sunken rot in which the tissue involved was tough and black (fig. 6). Pycnidia and spores resembling those of *Sphaeropsis malorum* were found on some of the lesions. Tissue plantings from the advancing face of the rot lesion yielded a fungus which, when inoculated into apples, produced a typical black rot with pycnidia and spores of *Sphaeropsis malorum.* Thus it appears that the hail-injured peaches were attacked by the apple black-rot fungus.

There was some Rhizopus rot of the fruit in the orchard of the Krummel variety mentioned above. In early spring spray tests it was found that weak Bordeaux caused shot hole lesions in the leaves, yellowing, and premature defoliation.

Pear:—Fire blight, due to *Bacillus amylovorus*, was very destructive in the spring. Leaf spot, due to *Mycosphaerella sentina*, was abundant on unsprayed trees.

Pepper:—Mosaic was prevalent in market gardens.

Plum:—Brown rot, due to *Sclerotinia fruticola*, and black knot, due to *Plowrightia morbosa*, were common on door-yard trees.

Potato:—The situation with respect to leaf roll and mosaic remains as stated for 1924[9]. Blackleg, caused by *Bacillus phytophthorus*, was the cause of rather serious losses in the early crop (Cobblers and Ohios) in certain fields in southern Indiana. Gregory found that most of this infection occurred in fields planted from the same trainload of Minnesota seed tubers. Fusarium wilt was noted in the Cobbler and Bliss varieties in June. Scab, caused by *Actinomyces scabies*, and black scurf (*Rhizoctonia solani*) were rather prevalent.

Fig. 7. Radish stem and pods showing lesions with which an Alternaria was associated.

Quince:—Fire blight, due to *Bacillus amylovorus*, occurred in La-Porte County.

Radish:—Black root, due to *Aphanomyces raphani* Kendrick,[10] was serious in gardens in Lafayette. Downy mildew (*Peronospora parasitica*) was found on seed pods in August and white rust (*Cystopus candidus*) was noted on the leaves in the fall. Small black lesions were noted on the leaves, peduncles, and seed pods, with which an Alternaria was associated (fig. 7). An unmistakable mosaic occurred in October

[9] Gardner, Max W. Potato and tomato diseases. Trans. Ind. Hort. Soc. 1924: 124-132. 1925.

[10] Kendrick, James B. Radish black-root caused by *Aphanomyces raphani* n. sp. Abs. in Phytopath. 17:43. 1927.

on a number of varieties in an experimental plot at Lafayette. The mottling and puffy, dark green areas on the leaves were typical mosaic symptoms, and in addition there was some necrosis along the veins.

Raspberry:—Anthracnose (*Plectodiscella veneta*) is the limiting factor in commercial black cap plantings. Dietz reports that the delayed dormant spray is being used in nurseries with good results, an important step towards checking the disease at its source. Crown gall at the nodes along the canes was found on black raspberries at Elkhart. Powdery mildew was noted on the leaves of red raspberries at Lafayette. Leaf curl is very destructive in the black varieties.

Soybean:—Bacterial blight, caused by *Bact. glycineum*, was of general occurrence. Mosaic was observed in the Midwest variety in Floyd and Lawrence counties and occurred in a number of varieties in experimental plots at Lafayette. Leaf drop accompanied by necrotic symptoms in the shape of streaks along the leaf veins, blotches on the stem, and blighting of the growing tip occurred only in the Lexington variety. Dunfield, a variety commonly grown and one increasing in popularity in Indiana, seems to be rather resistant to mosaic.

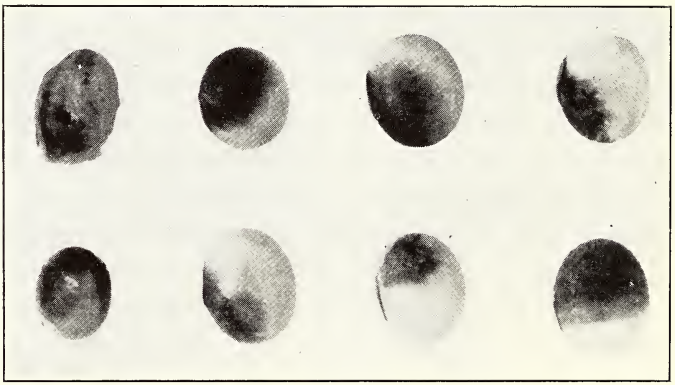

Fig. 8. Purple seed stain of soybean caused by a species of Cercospora. (Enlarged).

The purple seed stain noted in 1924 occurred again this year in various parts of the state and was very objectionable to growers who desired seed certification (fig. 8). This trouble has been found to be due to the presence of the mycelium of a Cercospora between the layers of the seed coat. The fungus has been cultured from surface-sterilized, discolored seeds and likewise from cotyledons invaded, it is thought, during the process of germination. It seems very likely that this disease is identical with the purple speck[11] disease reported in Japan and caused by *Cercospora kikuchii*.

Strawberry:—Leaf spot caused by *Mycosphaerella fragariae* was coexistent with the crop, and leaf blotch caused by *Mollisia earliana* was found in Floyd County.

[11] Matsumoto, T. and Tomoyasu, R. Studies on purple speck of soybean seed. Ann. Phytopath. Soc. Japan 1 (6) : 1-14. 1925.

Sweet potato:—Fusarium stem rot (or yellows), scurf, caused by *Monilochaetes infuscans*, and black rot, caused by *Ceratostomella fimbriata*, were noted in Knox County. An early freeze in the fall injured the keeping qualities of the roots not yet harvested.

Tobacco:—Blackfire, due to *Bact. angulatum*, and mosaic were found in Floyd County.

Tomato:—As in 1924, the worst disease during the 1925 season was leaf-spot, due to *Septoria lycopersici*, probably because of the frequent rains during the latter part of the season. Furthermore, the low temperatures of July and August retarded the crop so that the effects of the disease were more serious. During the hot weather of September there was much sun scald injury of the exposed fruits on the plants defoliated by leaf-spot.

In the opinion of many growers, early blight, caused by *Alternaria solani*, was more destructive than Septoria leaf spot. Certainly it became serious much earlier and was equally as prevalent. In fact early blight was more prevalent than had been noted during the preceding six years. It was especially bad in Hancock, Orange, and Morgan counties in early August. Specimens from Morgan County showed abundant and conspicuous lesions on stems, petioles, leaves, peduncles, calyces, and young green fruits. Calyx lobes were killed and on these were found numerous spores of the fungus. On the young fruits were numerous, very small, black, circular, raised spots. Larger lesions were commonly found later in the season, especially about the stem end, and so situated as to suggest that they had resulted from calyx infection. In one case the mycelium was found penetrating through the pericarp and into the neighborhood of the seeds. In fact the mycelium was found among the hairs on the surface of the seeds, an excellent arrangement, it would seem, for seed carriage of the fungus.

In central Indiana, Fusarium wilt was not very destructive this year, probably because of the low temperatures of July and August. The hot weather in June was favorable to the disease and it assumed serious proportions in southern Indiana, especially in Gibson County.

Mosaic was widespread in the field crop and the more serious double-virus or streak type was common in greenhouses. As Vanterpool[12] has shown, the streak type of mosaic is due to the presence of two viruses, that of typical tomato mosaic and a virus from potatoes. Our observations and tests indicate that only one of these viruses, viz., that of typical tomato mosaic, is carried in the perennial weeds such as Physalis, and that the other virus involved may frequently be found in apparently healthy as well as in mosaic potato plants. Thus, potatoes constitute a distinct disease menace to tomatoes. Greenhouse growers especially should guard against the possible infection of their tomato crop by the potato virus from volunteer plants or sprouted tubers and from insects that might have come from potato fields. Potatoes should not be stored in rooms or pits connecting with greenhouses, nor should potato tubers be used as poisoned bait for sow bugs in greenhouses used for tomatoes.

[12] Vanterpool, T. C. Streak or winter blight of tomato in Quebec. Phytopath. 16: 311-331. 1926.

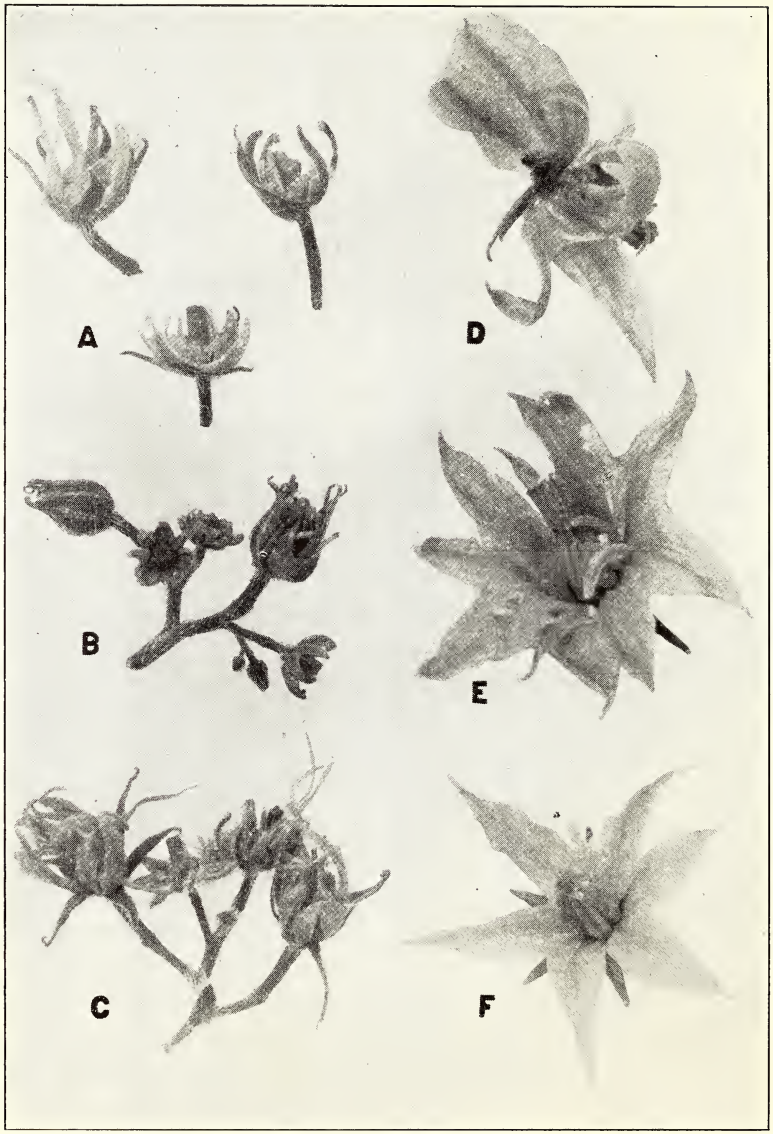

Fig. 9. Effect of fern leaf mosaic on tomato blossoms. A, B, C.—Blossoms opened prematurely and abnormally; corolla lobes long and twisted; styles enlarged. D.—Dorsal view of flower showing extremely irregular corolla and much reduced calyx. E.—Flower showing accessory corolla whorl. F.—Normal flower.

A study of the effects of the filiform or fern-leaf type of mosaic on the floral anatomy showed that the calyx lobes were sometimes strap-shaped, sometimes two-lobed, sometimes reduced in number to as low as two (fig. 9). The corolla lobes might be of unequal length or size

and might be increased in number, and the corolla tube might be longer than normal or divided clear to the base with the lobes linear or strap-shaped. In some cases there was on accessory whorl in the corolla. The flowers were sometimes irregular and showed a tendency to open prematurely before the corolla was developed. There was a tendency toward incomplete union in the compound style with prominent ridges corresponding to its component parts and sometimes with the stigmatic surfaces at different levels. Sometimes there were two ovaries in the flower, and frequently stamen filaments and corolla lobes were found caught and held fast between the folds of the ovary wall. The extreme reduction of the leaves is illustrated in figure 10. Where the leaflets were reduced to mere midribs there was often a tendency for the latter to be twisted.

Fig. 10. Effect of fernleaf mosaic on tomato leaf. Leaflets reduced almost to bare midribs, some of which are twisted.

Leaf mold (*Cladosporium fulvum*) was serious in greenhouses. Fruit invasion was observed. Bacterial spot, caused by *Bact. vesicatorium*, was worse than usual and was found in the group of counties consisting of Hancock, Henry, Madison, Tipton, and Howard. Anthracnose (*Gloeosporium phomoides*) was worse than usual, owing to the heavy rainfall in September, and proved very objectionable to canners because, being rather inconspicuous, it was easily overlooked on the sorting belt and hence increased the mold count in the pulp. Rhizoctonia soil rot was serious in the canning crop in Madison County, producing a brown, con-

centrically ringed lesion at the point where the fruit touched the soil. This lesion usually cracks radially and the tough, brown, rotted tissue is known among the canners as core rot. The frosty white hymenium is often produced on the surface of the fruit and extends out over the sound tissue far beyond the periphery of the lesion. Buckeye rot, due to *Phytophthora terrestris*, was found in Indianapolis market gardens in August and was destructive in certain greenhouses.

In the canning crop, blossom-end rot and growth cracks were not serious this year, but sun scald and fungous rots were worse than usual. Early in July a number of cases of lightning injury were observed in fields in Tipton County.

Turnip:—A very destructive outbreak of mosaic following an aphis infestation occurred in an experimental plot at Lafayette. The affected plants were greatly stunted and the roots practically worthless.

Velvet bean:—Bacterial spot, due to *Bact. vignae*, and mosaic occurred in experimental plots.

Watermelon:—Anthracnose (*Colletotrichum lagenarium*) was much worse than usual and was found killing the vines in Lawrence County late in July. Fusarium wilt was reported from Jefferson County. One plant showing mosaic symptoms was found.

Miscellaneous:—Aster yellows, which Kunkel has found to be transmitted only by a certain leaf-hopper and to have a wide host range, was not at all common as compared with last year. The Fusarium wilt was more prevalent, however.

A peculiar disease of Delphiniums consisting of a thickening and malformation of the leaves and failure to blossom properly proved very troublesome and is suspected to be a virus disease.

Geranium bacterial spot, caused by *Bact. erodii*, was noted, and an unmistakable mosaic disease was found by Gregory.

Dietz found the bacterial disease of gladiolus, due to *Bact. marginatum*, rather widespread in the state, and Drayton of the Canada Department of Agriculture found hard rot caused by *Seporia gladioli* and a Sclerotium dry rot in corms from northern Indiana.

Iris leaf spot due to *Didymellina iridis* and a Sclerotium rot were serious at Lafayette.

A thread blight of a small black oak sapling was found at Lafayette in October. The fungus appeared to be a Rhizoctonia. The whitish or tan mycelium grew from the soil up along the stem, out along the petioles, and spread in a mat over the lower surface of the basal third of each leaf blade, killing the leaf blade tissues.

Snapdragon rust (*Puccinia antirrhini*) was destructive in greenhouses and gardens. A very slight infection of sycamore anthracnose was noted. Unmistakable mosaic diseases were noted on *Helianthus strumosus* and *Anchusa officinalis*. *Phyllachora graminis* was observed on *Hystrix hystrix* and *Elymus virginicus*. A Cercospora leaf spot was found on Ampelopsis and *Entyloma australe* was found on *Physalis subglabrata*.

SUMMARY.

The diseases of outstanding importance this season were apple fire blight and bitter rot, cantaloupe leaf blight, celery late blight, peach brown rot, potato black leg, tomato Septoria leaf spot and early blight, and watermelon anthracnose.

The diseases or parasitic organisms not previously reported for the state, at least in this series, include: bacterial root rot of alfalfa, surface rot of apple, bacterial spot of buckwheat, geranium mosaic, Sclerotium dry rot of gladiolus, kohl rabi yellows (*Fusarium conglutinans*), Rhizoctonia thread blight of black oak, onion blotch (Macrosporium) and silver spot (Penicillium), radish mosaic and Alternaria spot, and raspberry powdery mildew.