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BLUE MOLD OF TOBACCO

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THE PLANT DISEASE REPORTER

MYCOLOGY AND PLANT DISEASE REPORTING SECTION

Crops Research Division Plant Industry Station, Beltsville, Maryland

BLUE MOLD OF TOBACCO

Hilde McGrath and Paul R. Miller

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INTRODUCTION

The blue mold, or downy mildew, disease of cultivated tobacco (Nicotiana tabacum L.), caused by Peronospora tabacina Adam, has had a long and colorful career. It might be pertinent to begin the discussion of this disease with a review of its history and of how it got its name.

In 1863 De Bary (33) reported a fungus in Europe on henbane (Hyoscyamus niger L.) which he named Peronospora hyoscyami d By. Then, in 1885 when Farlow (37) was traveling in California he observed a fungus growing on the leaves of a native plant, Nicotiana glauca Grah., around San Diego. Although this was a common roadside plant from San Diego to Los Angeles and Santa Barbara, Farlow could not find it at Santa Barbara. He did not have opportunity to observe farther south; therefore it is possible that it might have occurred even as far south as Mexico. After microscopical examination the disease was determined to be caused by Peronospora hyoscyami and was characterized by large grayish-black spots on both sides of the leaves, up to 2 inches or more in diameter, with an irregular but sharply limited circumference. No oospores had yet been found in the species. Farlow expressed a fear that the disease might be transferred to a related genus, such as Hyoscyamus niger, and be carried north of the limit where N. glauca might grow but where N. tabacum is cultivated. In May-August of this same year of 1885 Harkness (45) reported a fungus on the leaves of N. bigelovii at Reno, Nevada which was identified as P. sordida Berk. Later, in 1914, P. sordida was also identified as the cause of a serious tobacco seedbed disease outbreak in Victoria, Australia (at the time this Australian record was the only one of this species observed on N. tabacum) (104). According to Stevenson and Archer (95), who in 1940 identified as P. tabacina Adam a fungus on N. attenuata Torr. west of Reno Hot Springs, Nevada, both the disease on N. bigelovii in 1885 and the one on cultivated tobacco in Australia in 1914 were also caused by the same fungus, the one causing the mildew on cultivated tobacco in the United States.

In Argentina in 1891 Spegazzini (87) reported a new species of Peronospora on living leaves of Nicotiana longiflora Cav. in the Palermo woods near Buenos Aires, collected on December 17, 1888. He described the species, including both conidia and oospores, and named it P. nicotianae Speg. He again reported its occurrence on N. longiflora near La Plata in the springs of 1891-95 and on N. sylvestris in September and October 1897 (88). In 1901 he observed P. nicotianae on a third host, living leaves of N. alpina, between Las Cuevas and Puente del Inca, in Mendoza in the Andes in March (89). Hauman-Merck (46) in 1915 and Hauman and Parodi (47) in 1921 wrote that the fungus described by Spegazzini on different native Nicotiana species appeared to be somewhat rare and of no economic importance in the areas mentioned in Argentina.

In 1923 Gäumann (38), according to Adam (3), "apparently without having had access to all the material, considered that the species of Peronospora recorded on Nicotiana spp., including N. tabacum, should be referred to P. nicotianae Speg."

In Victoria, Australia, in 1900 McAlpine (62) reported finding Peronospora hyoscyami on N. suaveolens Lehm. and also noted that N. glauca, which had been imported from America, was susceptible to attack. Also in Victoria, but 25 years later, Adam (1) publishing on control of the "Peronospora disease" affecting cultivated tobacco, reported the disease on both N. tabacum and N. suaveolens. According to Angell and Hill (10) in 1932 N. suaveolens is the original host of tobacco downy mildew in Australia. If one assumes that this host is a native plant, then the fungus also may be assumed to be native. However there are two other possibilities: either that the fungus was introduced with some species of Nicotiana, probably from South America; or that both N. suaveolens and the fungus were introduced together and the fungus then spread to cultivated tobacco. The first record of downy mildew from Australia was reported in 1890 from Queensland, although tobacco had been grown in that country for about 60 years previous to that date. Angell and Hill also found that the blue mold fungus attacked seedlings of the following Nicotiana species: angustifolia, atropurpureum, calicyflora, paniculata, campanulata, sylvestris, nudicaulis, repanda, caudigera, triangophylla, chinensis, glutinosa, acuminata, langsdorfii, laterina, and bigelovii. They concluded, therefore, that most, and perhaps all, species of Nicotiana were susceptible, but that Hyoscyamus niger was not susceptible. Also, they reported that the causal organism did not seem to fit descriptions of either P. hyoscyami or P. nicotianae, although it resembled the latter more than the former, and might possibly be a new species of Peronospora.

In 1933 Adam tried to resolve the nomenclature difficulty by the study of a Peronospora species on tobacco in Australia, which morphologically was very similar to both P. hyoscyami and P. nicotianae. He named this species P. tabacina Adam. Under artificial conditions this fungus was able to infect N. longiflora, the natural host of P. nicotianae; however it would not infect Hyoscyamus niger. He based his classifications chiefly on differences in the epispore and on oospore size.

In the United States in 1934 Wolf et al. (108) concluded that since it seemed quite unlikely that there were two species of Peronospora on Nicotiana, it seemed preferable at that time to regard the pathogen on cultivated tobacco as identical with P. nicotianae. In the following year, after the paper by Clayton and Stevenson (27), Wolf reversed this decision and accepted the name P. tabacina. Wolf et al. (108) increased the host range of the disease by observing symptoms on seedlings of tomato (Lycopersicum esculentum), pepper (Capsicum annuum), and eggplant (Solanum melongena), when these species were grown near tobacco seedbeds or in the same seedbeds with diseased tobacco seedlings.

At this period of investigation half of the problem had been solved. Adam had proved that the disease on tobacco could not be caused by P. hyoscyami, since that fungus would not attack Hyoscyamus niger, but there was still dissension as to whether the tobacco fungus should be called P. nicotianae or P. tabacina. The answer was given in 1935 by Clayton and Stevenson, who were the first actually to compare material from the Spegazzini herbarium with Adam's and Wolf's results. They concluded, among other things, that inasmuch as Spegazzini claimed that his conidia formed zoospores, and since the conidia of the tobacco fungus in this country have been germinated under many conditions and have never formed zoospores, it would not be advisable to call the tobacco fungus P. nicotianae. To quote, "P. tabacina, as described by Adam, on the other hand, fits our organism in all essential particulars; hence, the use of this name is recommended" (27). P. tabacina is the name now accepted by both Australian and American pathologists for tobacco downy mildew.

Three interesting cases of tobacco mildew occurring outside of the United States and Australia have been reported since 1935. In 1939 Wolf (106) reported receiving some diseased tobacco leaves sent to him in September 1938, collected in the State of Rio Grande do Sul, Brazil (an area not far distant from Buenos Aires, Argentina, where Spegazzini made his P. nicotianae collections). Sporangiophores were characteristic of Peronospora and within the leaf tissues Wolf identified glabrous oospores, which could not be distinguished in appearance from those of P. tabacina. He therefore identified the pathogen as P. tabacina and decided that both this species and P. nicotianae must exist in South America. The method of introduction into Brazil was unknown.

The second case involved a very serious attack occurring in the spring of 1939 on tobacco seedlings in the Lerma Valley (Province of Salta) and Perico (Province of Jujuy), Argentina (43). This was the first time that the disease had been found in Argentina since Spegazzini's time. For identification, diseased leaves were sent to the mycology section of the Spegazzini Institute of the National University of La Plata. The fungus appeared to be P. nicotianae, but there was some doubt as to identity as no oospores could be found on which to base the differentiation of P. nicotianae from P. tabacina. Identification rested on conidial size and on the size and shape of the sterigma of the conidiophores.

In the third instance, blue mold appeared for the first time in Cuba (48) during December 1957. It first occurred near Havana, over an extended acreage of "green-wrappers" type of tobacco. With much favorable weather during January 1958 -- overcast, rainy, a minimum of 59° F and a maximum of 71° F -- blue mold spread over a distance of approximately 100 miles. In the areas especially of Cuban cigar wrapper tobacco production the losses were high. In Havana Province where the disease first appeared there was considerable reduction in the normal production of green-wrappers. It remains to be seen whether blue mold will continue to be a serious problem on the island.

HISTORY OF THE DISEASE IN AUSTRALIA

Although it is patently impossible to trace the origin of a disease of such long-standing, it is now generally conceded that downy mildew is endemic to Australia. It is distributed throughout the tobacco-growing States of Queensland, New South Wales, Victoria, Western Australia, and South Australia. As far back as 1891 Cooke (30) reported the disease as being a "close ally of the dreaded mould of the potato disease," referring, of course, to late blight of potato, caused by another downy mildew fungus, Phytophthora infestans, which is also a Phycomycete and a close relative of the Peronosporas. In that same year the Agricultural Gazette of New South Wales (11) described the tobacco disease as a "blight.....closely allied to the notorious 'potato blight' ..., and is doubtless one of the most serious diseases of the tobacco plant." In 1911 Smith (84) said that blue mold had without doubt been the worst enemy of tobacco in Victoria and in 1914 (85) that blue mold "is possibly the greatest hindrance to quick development of the tobacco industry in Victoria." The first record of the disease in Western Australia was a disastrous outbreak on 14 August 1930 (73, 74) at Manjimup on plants growing on two adjoining properties. In South Australia in 1925 there was one instance of blue mold damage to fully grown tobacco leaves (78), but by 1935 such heavy losses were being sustained that some old growers temporarily ceased their tobacco production (39, 40, 41).

In addition to occurring on cultivated tobacco, downy mildew also is found commonly on Nicotiana suaveolens and other wild tobacco species, which serve as alternative hosts for the parasite. The prophecy of the early forecaster (11) who in 1891 declared about the disease that "It will grow worse and worse, year by year, unless means are taken to prevent it " was remarkably accurate. For downy mildew has grown worse, year by year, until today, about 65 years later, it has become the most widespread and serious disease of tobacco in Australia.

Tobacco downy mildew was considered such an important disease that in 1929 the Australian Government assigned cooperatively to Australian Tobacco Investigation and the Economic Botany Division of the Council for Scientific and Industrial Research (C.S.I.R.) the task of undertaking to learn the life history, the methods of over-wintering, and the processes of primary infection of the causal fungus (15). Work was begun in January 1929 and a staff for blue mold study has been maintained by the C.S.I.R. ever since. In 1934, at the unanimous request of producers associations, the government passed the Tobacco Growers Protection Act, aimed at eradication of all old tobacco plants in the field (40, 41). The provisions of this legislation will be discussed under the heading "Cultural Practices."

HISTORY OF THE DISEASE IN THE UNITED STATES

Downy mildew first made its appearance in the United States in four widely separated seedbeds of cigar wrapper tobacco in Gadsden County, Florida in the latter part of March 1921. By the beginning of April it had been reported from a number of seedbeds in the adjoining Georgia County of Decatur. Before the end of the growing season the disease had spread over all of the cigar wrapper area in the Florida-Georgia district. With the aid of pathologists from the United States Department of Agriculture (81, 82, 83) the disease was eradicated by burning diseased plants and by drenching seedbeds with formaldehyde solution. A weak Bordeaux mixture, 2-2-50, was recommended as a spray for healthy leaves. After this initial outbreak blue mold did not appear again until 10 years later, when it broke out with even greater vehemence than before, originating in the same Florida-Georgia area where it had first appeared in 1921. Before we discuss the spread of the disease from 1931 to the present it is advisable to spend a little time in consideration of how the disease happened to appear on cultivated tobacco in the United States, including the possibilities either that it was introduced into the country or that it is endemic.

A great deal of conjecture has arisen since 1921 in an attempt to explain the presence of this disease in North America. Regardless of the fact that all theories are still conjecture and probably must necessarily remain so, the evidence for both endemism and introduction from an extra-territorial source will be given for the record.

The case for endemism is rather strong and is based on various collections and observations by qualified investigators, principally Farlow's (37) collection on Nicotiana glauca in California, Harkness's (45) collection on N. bigelovii in Nevada, and Smith and McKenney's (81) report of the identification of Peronospora sp. in 1906 on cultivated tobacco seedlings at Halletsville, Texas. Since none of this material had oospores it is not possible to be certain of identification. However, in 1940 Stevenson and Archer (95) identified P. tabacina on N. attenuata collected in Nevada. In the spring of 1941 Godfrey (42) reported slight early damage on pepper seedlings and also a downy mildew on wild N. repanda in the lower Rio Grande Valley. The causal organisms in both cases were subsequently identified as P. tabacina by J. A. Stevenson and E. E. Clayton. Then, in 1947 Wolf (107) identified P. tabacina which was occurring on several native Nicotiana species in Texas and Mexico, particularly on N. repanda. The sporangia and oospores were identical with those of the downy mildew on cultivated tobacco. Further, in 1949 Shaw (80) reported the collection in Washington State of a downy mildew on N. attenuata, by J. D. Menzies at Prosser, Benton County, in the summer of 1946. This specimen, identified as P. tabacina, contained oospores and is another reason for supposing that the earlier collections in the western United States were also P. tabacina. In view of his own and Shaw's collections and identifications, Wolf was of the opinion that the wild N. repanda, which grows profusely in the citrus and truck crop growing region of the lower Rio Grande Valley, was the source of inoculum for the outbreaks on tobacco in the Florida-Georgia areas in 1921 and again in 1931, and remained a potential reservoir of inoculum for the future. Thus it is suggested that P. tabacina is endemic to southern Texas and parts of northern Mexico, and that the gradual increase in tobacco acreage in the East has allowed the pathogen to progress from native wild western hosts to the more susceptible cultivated tobaccos of the East. This concept must take into account the dissemination by wind of the air-borne sporangia from the Rio Grande Valley to the tobacco areas of the East, a distance of about 1000 miles. The only fact that does not support the supposition of endemism to the Pacific Coast is the fact that one of the hosts, namely N. glauca, is not a native plant but was introduced from Argentina.

When downy mildew first appeared in 1921 several guesses were immediately advanced to explain its presence. Burger and Parham (18) thought that because almost all seedbeds affected exhibited the same symptoms at the same time, it was quite probable that the disease had existed, though undetected, in Florida for many years prior to the first general outbreak on tobacco. Government pathologists Smith and McKenney (81) considered three sources. They admitted the possibility that California and Texas might prove to be the original inoculum source, but did not try to follow up on the idea. They largely discounted introduction on infested seed in view of the fact that tobacco growers in the affected area either raised their own seed or imported only small amounts of seed from reliable Connecticut planters. The third avenue of approach was introduction from a foreign country.

Smith and McKenney believed that it was at least conceivable that the disease had been imported into the country on mats used in baling tobacco, such mats being brought into Florida from Sumatra. This seemed to be a natural starting place in tracking down the origin of the disease, particularly since the mats arrive second-hand after use on East Indian tobacco and also since it is known that certain insects have gained access into the United States in such a manner. Palm (69) hastened to refute such a claim. According to him the chances of infection from such a source are negligible when one considers the facts. The mats are manufactured from sedge grass in the plains of South Borneo, where apparently there is no tobacco cultivation. Then they are sent either directly to the United States or indirectly there by way of Holland. If the latter is the case, the mats first go to Java or Sumatra in the Dutch East Indies, where they are used for baling tobacco. After baling every package is disinfected for 48 hours with carbon dioxide and bales then go to Holland. The author knows of no genuine species of Peronospora having ever been found in the Dutch East Indies. During storage in Holland, while awaiting auction sales, tobacco from the Dutch East Indies might occasionally come into contact with tobacco from other countries, but the chance of contamination by resting spores which may adhere to the bales is very small. The only possibility remaining is contamination during shipping. Normally, every precaution is taken to store Sumatra and Java tobacco in rooms well separated from other cargo, chiefly to try to exclude contamination by the cigarette beetle Lasioderma; thus tobacco from other tropical countries such as British North Borneo, China, and British India also would be excluded.

DISTRIBUTION AND SPREAD

After its appearance in the Gadsden-Decatur area of Florida-Georgia in 1921, where losses were not over 5 percent (12), downy mildew was not again observed in this country until 1931, when it showed up first in the same region. This time it was much more severe and eventually spread to four additional States (90, 94), including the flue-cured areas of North Carolina and Virginia, and as far north as the air-cured regions of southern Maryland. It was also found for the first and only time in Louisiana, in St. James Parish. The disease may have been in South Carolina also that year; verbal reports make it probable, but there were no published reports on its occurrence there (66). Despite prevalence of the disease in 1931, actual losses were slight owing to the confining of losses to seedbeds; and since growers had planted in excess of their requirements, commercial damage was far below the original estimate. The year 1932, on the other hand, was an epidemic one. Blue mold appeared early in the season in a seedbed at Tifton, Georgia. Soon it was reported from Florida and by the end of the season it extended its range to include South Carolina and Lancaster County, Pennsylvania, in addition to all of the States that had been invaded in former years (with the exception of Louisiana). There was a material reduction of the crops in Georgia and the Carolinas (91, 94), chiefly due to a shortage of transplants. Yield reduction in South Carolina that year was about 40 percent (17). Although the disease was destructive in 1933, it was not nearly so severe as in 1932 (92). Again it was common in Florida, Georgia, and South Carolina, and recurred in southern Maryland and in Lancaster County, Pennsylvania. But it spread farther into the burley area of central Virginia and was discovered for the first time in burley tobaccos in western North Carolina, southwestern Virginia and eastern and middle Tennessee. This was the first year for Tennessee. Apparently, also, this was a first record for the disease west of the mountains of North Carolina, eastern Tennessee, and western Virginia (94).

With the exception of the discovery of blue mold for the first time in 1936 in Kentucky, in a location not far from the Tennessee sites, the years 1934, 1935, and 1936 were characterized by a decrease in severity and in range of the disease. Losses in Florida in 1936 were confined principally to the cost of resetting about 5 percent of plants in the field (44).

In 1937 blue mold developed to epidemic proportions, as it had in 1932. In Florida about 25 percent of plants in beds were killed. The disease spread throughout the entire tobacco-growing region of Kentucky, was more prevalent in Tennessee, and once again appeared in western Virginia and western North Carolina, after an absence of 3 years. In Georgia, North Carolina and South Carolina practically every seedbed observed was affected and damage was high. In Georgia 60 to 80 percent of all plants were killed (26, 64). The mortality rate in South Carolina was greater than in Florida but much less than in Georgia. And in North Carolina there was more killing of plants than in South Carolina. This year marked the first occasion of destructive losses in the fields, rather than in just seedbeds or under shade. Blue mold appeared for the first time in Indiana and in the Connecticut Valley region of Connecticut and Massachusetts. In Connecticut it was not noticed until the late seedbed season when it caused considerable seedbed damage; and then in June it spread to the fields. However, hot weather in July caused the disease to disappear (4).

Figure 1 shows the distribution of blue mold in the eastern United States in 1921 and from 1931 through 1937.

Blue mold was comparatively mild in 1938. Although about 25 percent of the plants in Georgia were killed (26), in Florida the disease appeared later and did less damage than the previous year and there was no acreage reduction of flue-cured and cigar types tobacco (53). Blue mold was prevalent in the Old Belt of Virginia and North Carolina. It was found for the first time in Essex County in the Old Belt of Canada and was reported also for the first time in Miami County, Ohio.

In general, 1939 was a worse year than 1938 but not nearly so bad as 1937. In Florida infection came rather early and caused more damage than in the previous year (54) and in Georgia 50 percent of the plants were killed (26). In the years 1938-39-40 Massachusetts and Connecticut again felt the impact of blue mold, which reached the northern section of the tobacco-growing area, Franklin County, Massachusetts in 1938. In 1939 and 1940 Connecticut was affected in epidemic proportions. The Connecticut Experiment Station at Windsor estimated field losses in Connecticut on shade tobacco to be $100,000 in both years (5, 93).

Although blue mold has been found rather generally distributed each year since 1931 on tobacco in the Georgia-Florida area, in the Tennessee-Kentucky area it was not widespread until 1937 and from then until 1944 became less and less important until, in 1944, only two cases were observed or reported in this area. Valleau (97) believed that this would suggest that the fungus is not capable of maintaining itself north of the Georgia-Florida area for any indefinite period.

Annual losses for the years 1939 through 1946 were slight. There was considerable variation in distribution and severity, with no single really serious year until 1947, when winter temperatures in most localities favored development of the disease. However, in 1945 and 1946 the southern Ontario region of Canada had epidemic years. In 1945 the burley dark tobacco types of the old tobacco district of Essex and Kent Counties had at least 95 percent seedbed infection and there was some acreage reduction of burley either because plants were killed in the bed or because transplanting was postponed to allow for seedling recovery. In

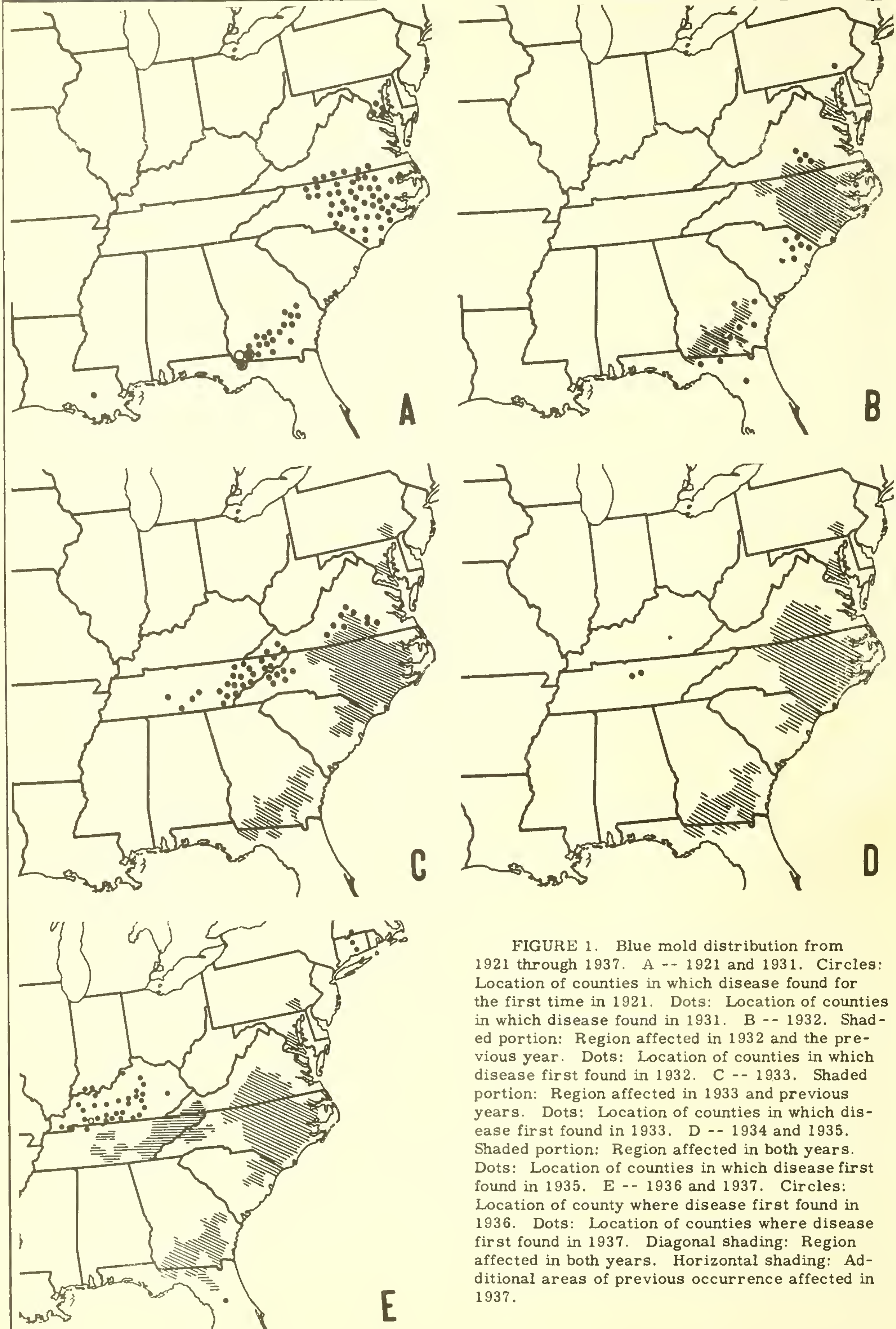

FIGURE 1. Blue mold distribution from 1921 through 1937. A -- 1921 and 1931. Circles: Location of counties in which disease found for the first time in 1921. Dots: Location of counties in which disease found in 1931. B -- 1932. Shaded portion: Region affected in 1932 and the previous year. Dots: Location of counties in which disease first found in 1932. C -- 1933. Shaded portion: Region affected in 1933 and previous years. Dots: Location of counties in which disease first found in 1933. D -- 1934 and 1935. Shaded portion: Region affected in both years. Dots: Location of counties in which disease first found in 1935. E -- 1936 and 1937. Circles: Location of county where disease first found in 1936. Dots: Location of counties where disease first found in 1937. Diagonal shading: Region affected in both years. Horizontal shading: Additional areas of previous occurrence affected in 1937.

1946 there was some spread to the field (96). In 1947 downy mildew came early to Florida, but owing to prompt application of fungicides little damage was done (56). Severity varied in seedbeds in Georgia, North Carolina, Virginia, Maryland, Tennessee, Kentucky, and Pennsylvania. The disease appeared in the field in South Carolina and was identified for the first time in July in Wisconsin, in a field of half-grown tobacco near the northern border of Dane County. A seedbed survey disclosed traces of infection on old plants which often were not too typical of blue mold; hence, it is possible that the disease had been present in Wisconsin before 1947 but had not been correctly identified (52).

From 1947 up to now blue mold has not been a major problem in this country either in the seedbed or in the field, owing principally to the use of protective fungicides. Although the disease was widespread in Florida in 1948, it usually occurred in isolated, scattered areas. In Georgia the overall plant loss was probably less than 3 percent. Blue mold damage was slight in 1949 except for a severe year in the Carolinas and Virginia. Although there was general distribution of the disease, on the whole 1950 was a mild year. The following year was also a light year. Average reduction in acreage yield ranged from 0 to 3 percent. Connecticut, on the other hand, had a loss of 10 percent of the value of the crop, or about √$2,000,000 (68) in shade tobacco fields. The disease reached epidemic proportions in 1951 also in Ontario, Canada. The mildew, though general, was well controlled with fungicides in 1952. Although blue mold was widespread throughout the greater part of the tobacco-growing regions in 1953, plants were plentiful and there was practically no measurable damage. In 1954 North Carolina experienced the worst outbreak of blue mold in its history in the field and considerable damage was done in many fields in all stages of growth. The next 3 years, 1955-57, could be called light seasons, with a minimum of loss.

EPIDEMIOLOGY

January Temperatures

Damage from blue mold appears to be related both to earliness of infection and to temperature. In temperature observations over the years since 1931, when the disease first appeared to stay, a marked correlation had been noted between blue mold damage and late winter conditions, particularly January temperatures. Miller (66) in 1937 observed that in the peak years of infection, namely 1932, 1933, and 1937, the disease pattern in the southernmost tobacco-growing States of Florida, Georgia, South Carolina, North Carolina, and Virginia followed rather closely the deviations above normal of the corresponding January temperatures. In 1949 Miller and O'Brien (67) pointed out the correlation between the high mildew severity and high January temperatures in two additional peak years, 1947 and 1949. In 1956 the chart was extended to include the years 1950-1956. Thus, Figure 2 illustrates in graphic form just how closely disease incidence follows mean January temperatures in the over-all period of 1931-1956 in five southern U. S. locations. Although this relationship is not fully understood, one can assume that the warmer temperatures stimulate germination of the overwintering oospore at an early date which, in turn, allows for earlier infection and a build-up of inoculum and, consequently, of the disease potential. While a correlation of this nature cannot be considered a scientific foundation upon which to base forecasts, still it has displayed a very high percentage of accuracy and on this basis it is interesting to speculate on the outcome of a disease such as blue mold for, say, the current 1958 season. Because of the below-normal January temperatures that prevailed this year in the southern tobacco region, the prognosis is for late development of the disease and negligible damage. In addition, it must be borne in mind that even when subsequent temperatures during the growing season are favorable for development of the disease, actual damage usually is slight. Even in years when the high January temperatures approach the disease-initiating optimum of 62°F, unusually high temperatures during the growing period would modify the January temperature effect and might even be sufficient to nip an impending epidemic in the bud.

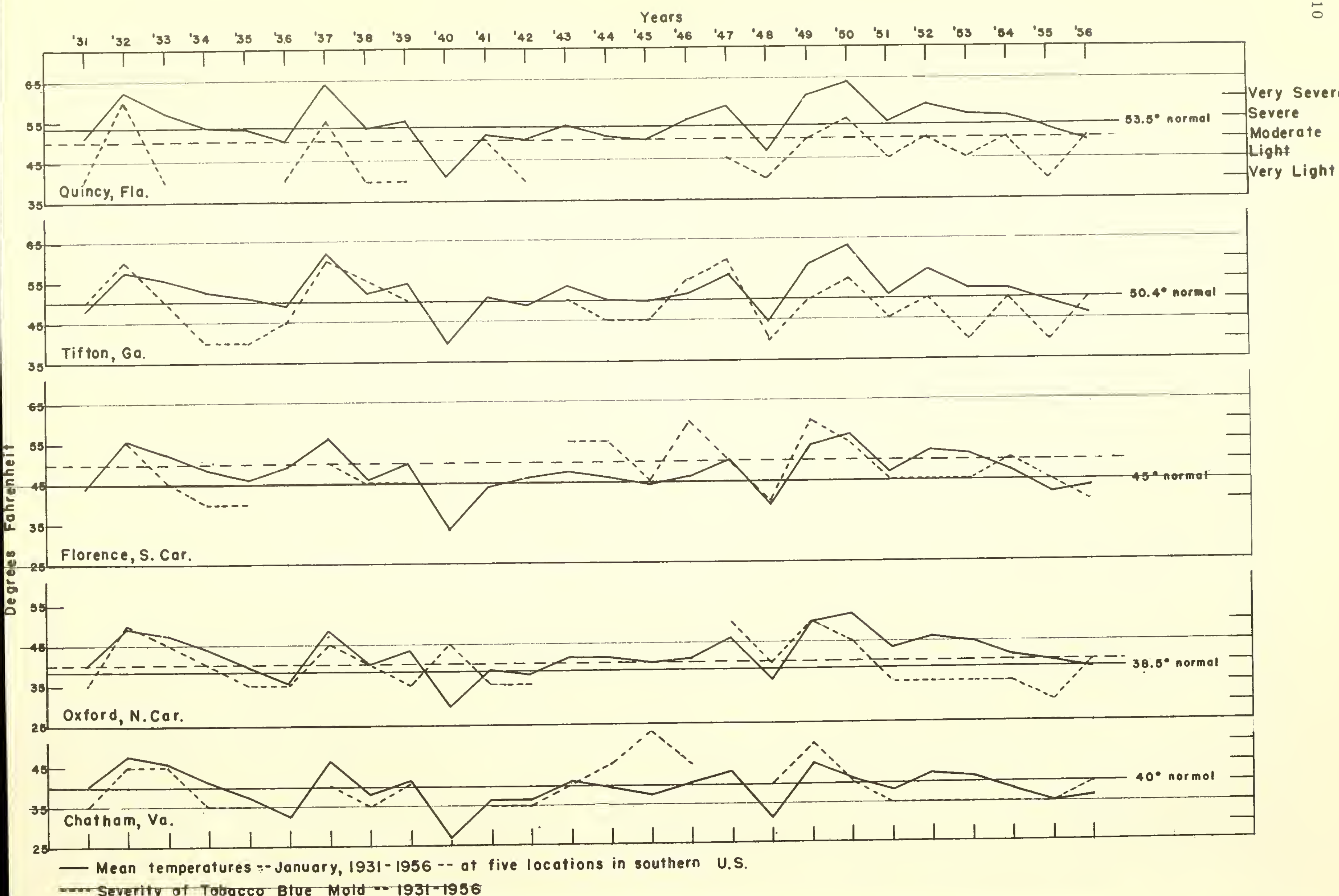

Figure 2. BLUE MOLD IN RELATION TO JANUARY TEMPERATURES

Source of Inoculum and Method of Dissemination: United States and Canada

In the United States and Canada both spore types of *Peronospora tabacina* can act as the source of inoculum. Primary infection usually is caused by the thick-walled overwintering oospores, while secondary infection results from germination of the thin-walled summer spores, called sporangia or conidia. sporangia spores

Under the heading "History of the Disease in the United States" a brief mention has already been made of the possibility that Texas served as the first source of inoculum for the blue mold outbreaks in 1921 and 1931 in the southeast. This theory came about in the following way. In early March 1947 Wolf (107) visited the lower Rio Grande Valley of Texas to observe blue mold on the wild tobacco species *Nicotiana repanda*. He found the fungus to be very common and at that time it was fruiting abundantly, which seemed to him confirmation that this region was the source of the disease in Georgia and Florida in 1921 and again in 1931, and that it would remain a potential source for the future. To follow up this idea, Valleau (98), in an effort to ascertain whether this same area in Texas could serve as an inoculum source for the Tennessee-Kentucky tobacco region as well, also visited this Texas area the following month, between April 17 and 30, 1947. At this time tobacco plants in Tennessee and Kentucky were far enough along to develop infection if given a source of inoculum. Valleau found, however, that the fungus had ceased sporulating on *N. repanda* in Texas, no doubt because of gradual increases in temperature between March and April. For this reason, and also because of the fact that blue mold had never been found in his area until 1936, Valleau quite logically concluded that it was unlikely that the Tennessee-Kentucky area would ever be subject to spore showers from the West and that the obvious explanation was that inoculum came from the southeast. He carried this a step further and said that if blue mold could be either eradicated from or greatly reduced in Georgia it would probably disappear from the Tennessee-Kentucky districts. This is a reasonable assumption when one remembers that the disease only became prevalent in the Tennessee-Kentucky area in 1937, following a general spore shower, and then it all but disappeared between 1938 and 1944. According to Valleau (99) there is evidence that in Kentucky the fungus cannot maintain itself year after year by oospores alone. After a spore shower the disease gradually disappears in succeeding years. Build-up of inoculum by oospores alone is slow and seldom results in an epiphytotic; consequently, the disease becomes less and less important as the fungus slowly dies out. Valleau (97) also explains that the unimportance of the disease in the Tennessee-Kentucky area from 1931-1937, when it was general in southeastern United States, is evidence that this area is not in a direct line of spread of spore showers from the South.

Some consideration has been given to the theory that the fungus might have migrated from the wild host *N. repanda* in the West to other wild hosts in the Gulf States. At the end of spring, when *N. repanda* dies in Texas, oospores may form in the leaves and pass the summer in dried leaf litter on the soil surface. These oospores are then able to infect the new rosette leaves of the host in late fall, thereby creating a continuous cycle of infection. There is no reason to believe that this happens in the southeast. The pathogen has never been found on a wild host east of the Mississippi. If such were the case, blue mold would have appeared before 1921, it would have appeared between 1921 and 1931, and the Perique area of Louisiana would have been affected more than just once. In the southeast the only known sources of primary infection in the spring are oospores that overwinter in dead leaves on the soil surface in beds used the previous year or the conidial stage of the fungus that overwinters on live tobacco plants, either suckers in the field or volunteer plants in old seedbeds. Plants living through the winter as a result of suckering have never been a major problem in this country. Volunteer plants sometimes do survive the winter in old seedbeds in the far South. During the winter of 1931-32 the fungus was found growing and sporulating on volunteer plants in Georgia; however, this is not very common. Most primary infection is the result of germination of one or a few oospores that have overwintered on the soil surface of old beds, the beds being used again the next season after either only disking or other shallow preparation. If, however, beds are plowed there should be no carry-over, because oospores must be on or near the surface in order to initiate infection. Although the fungus does overwinter on volunteer plants in southern States such as Florida, Georgia, and North Carolina, especially in mild winter years, farther north this does not seem to be true. In Connecticut, for example, the cold winters do not permit survival of host plants. Here primary infection results chiefly from oospores and very possibly also from spore showers blown from more southern States.

Primary Infection--Oospores: The relation of January temperatures to earliness of primary attack has already been discussed. Weather throughout the growing season is the limiting factor determining the progress and severity of the disease. Primary infection may occur regardless of rainfall. Dixon et al. (35) report that ideal conditions exist during or right after a period of warm weather, when temperatures have remained for several days at or above 50° F and when the lower leaves of the seedlings come in contact with the soil.

Primary infections are localized to one or at most to two or three spots in an occasional seedbed. Although thousands of oospores are formed, only an infinitesimal percentage is viable. This will be taken up in a later section. Oospores are believed to constitute the principal source of primary infection in the United States for several good reasons. First, the initial outbreak of the disease in a locality almost always occurs in old seedbeds (16, 34, 100, 101, 105). Second, there is always a lapse of about 2 weeks between the time infection is apparent in old beds and its first appearance in new beds (35, 100, 105, 109), and the fungus has been found sporulating on plants in old bed sites 7 to 19 days earlier than it developed in any new bed sites located nearby (34). Third, Dixon et al. (34) and Wolf et al. (109) in spore-trap experiments have shown that infections often develop before sporangia can be collected from the air in a given locality.

Primary infection in Canada is believed to have resulted from oospores in only a few years since blue mold first appeared in that country in 1938. A mild outbreak in the second season, 1939, apparently originated from oospore infection (29), as did also the limited infection in 1948 (96). Stover and Koch say that owing to the low incidence of overwintering oospores in Ontario it is not likely that a sufficiently high inoculum potential could arise from this source to create an epidemic.

Primary Infection--Conidia: Primary infection may also result from spore showers. As already mentioned, Valleau believed that the disease could not be maintained in the Tennessee-Kentucky area by oospores alone, but is dependent upon spore showers from the South. This probably is true also for the Carolinas and Virginia, with spores being blown in from the Florida-Georgia area. Maryland outbreaks, as well, are usually from such a source. Farther north, where oospore overwintering is not so common as in the South, spore showers account for much primary infection. Anderson (4) thinks that the first appearance of the disease in the Connecticut Valley resulted from wind-blown spores from Pennsylvania or States farther south. Subsequent outbreaks in Connecticut probably arose from overwintering oospores.

In 1952 Hyre (51) studied wind-dissemination of conidia as a means of primary infection. In an experiment to test long-distance spread of P. tabacina spores he grew a bed of tobacco on the University of Delaware Experiment Farm. Every possible sanitary measure was taken to preclude contamination by oospores of the seedlings, soil, seedbed covers, and seed. Blue mold developed. There was no tobacco cultivation within a radius of 20 miles, and the nearest tobacco beds (which were infected) were 20 air miles away in Pennsylvania and more than 20 miles away in Maryland. Hyre concluded that wind had borne the fungus spores over this distance of at least 20 miles to cause primary infection.

In Canada blue mold made its first appearance in 1938, the year that it spread to Ohio. In 1936 the disease came to Kentucky, where it became serious in 1937, spreading on into Indiana. Stover and Koch think it more than likely that the 1938 outbreak in Canada was the result of spore showers from Kentucky or Ohio, the tobacco-growing region of the latter State being only 125 miles southwest of Essex County, Ontario. A study of air currents during the critical period May-July revealed that the southerly winds in Ontario were of sufficient frequency to carry spores from the Ohio-Kentucky area to Ontario. Weather conditions were not favorable for development and spread of the disease in 1938, however. Between 1939 and 1944 the inoculum reservoir of the disease in Ohio-Kentucky declined and in Ontario the disease was unimportant, the isolated outbreaks being attributed to overwintering of the fungus in Ontario. Then, in 1945 the disease became epidemic throughout Ontario, and in 1946 it was nearly as bad. Correlatively, Ohio in 1945 experienced its worst blue mold year on record, and the same was true for Kentucky in 1946. Undoubtedly Canadian infection came from these two States. An abundant source of inoculum, plus favorable weather conditions, caused the disease to reach epiphytotic proportions. Another favorable year for development of blue mold was 1947; reduced damage this year was the result of widespread and effective use of the fungicide ferbam. To paraphrase Stover and Koch, widespread occurrence of the disease in Canada depends first upon the likelihood of primary infection by spore showers from the United States. To determine this likelihood it is necessary to know the distribution and severity of the disease in Kentucky and then, on the basis of wind direction and velocity, to estimate the chances of a spore shower. If the source of inoculum and wind conditions prove favorable, the second step is to evaluate the importance of weather to spore viability, infection, and subsequent disease development.

Secondary Infection: Once primary infection has become established in an area, climatic conditions including rainfall, temperature, humidity, dew, and wind become all important in determining secondary infection and spread. Normally the number of sporangia borne on primarily infected plants is rather small. After secondary infection, however, the amount of inoculum increases to such a degree that within 10 to 14 days nearby beds will show infection. At the end of another week the amount of inoculum arising from these scattered beds is sufficient to cause a general outbreak, which in still another week may reach epiphytotic proportions by including all seedbeds within an area of several hundred square miles.

The causal organism of tobacco downy mildew requires coolness and moisture to complete its life cycle. The production and spread of sporangia may occur under the following types of conditions: low temperatures (40° -50° F) following a period of warm humid weather (23); continued cloudy rainy weather, especially when accompanied by winds (101); cool weather and plants wet with dew during much of the night and often late into the day (17); long periods of saturation when sky is overcast (35); very humid weather, followed by relatively warm days and cool nights (52). The disease is retarded by heavy rains and by warm sunny weather, but light rains favor development and apparently frost does not kill the spores (101).

Sporangia are formed early in the morning between daybreak and sunrise but usually only live a few hours if infection has not been initiated. They stick to the hands and clothing and are easily disseminated by wind. In fact, Clayton and Gaines (24) state that "At times the spores are carried long distances, as much as 50 to 75 miles or more; hence no seedbed in an affected area is likely to escape the disease, although some will be infected sooner than others."

In controlled temperature experiments in 1933 Clayton and Gaines (22) got good sporulation at temperatures ranging from 50° -65° F with an optimum near 60° -62°. There was no sporulation when the minimum remained about 70°, regardless of the maximum. In 1945 they found sporulation to be most abundant with a night temperature of 60° F preceded by a higher day temperature (25). In 1936 Dixon et al. (35) conducted extensive experiments on optimum sporulation conditions. They found that between the range of 42° and 63° F sporulation is abundant, with greatest production around 56°. Only a few spores were formed at temperatures below 42° or above 63°, and few or none above 68° or below 36°. Work reported from Virginia in 1938 agreed with these findings (101). However, in temperature-humidity studies in South Carolina in 1935 Armstrong and Sumner (17) obtained abundant sporulation at temperatures over the maximum named by Clayton and Gaines. On test plants maintained at 70° F and even a few degrees higher, sporulation was abundant. Today the optimum for sporulation and infection is considered to be about 62° F.

In most of the tobacco-growing regions of the United States temperature and humidity conditions favorable to the disease usually prevail throughout the seedbed period. However, in most years after seedlings are transplanted to the field, the temperatures soon become too high for the fungus to live, which probably accounts for the fact that blue mold in this country is primarily a seedbed disease and only becomes a hazard to plants in the field in years of unseasonable weather brought on by exceptionally late seasons. Such conditions are more apt to occur in northern tobacco regions than in southern ones, an example being the severe epiphytotic in Connecticut shade tobacco fields in 1951. Severe field outbreaks are the exception and normally northern regions conform to the general blue mold pattern. Anderson (4) says that even though the early seedbed weather in Connecticut may be too cold for development of the fungus, temperatures over most of the seedbed period favor the disease; then later, after transplanting, temperatures rise high enough to be prohibitive to further fungal development.

Source of Inoculum and Method of Dissemination: Australia

Downy mildew of tobacco is a far more serious disease in Australia than it is in the United States. While in our country the disease is confined principally to seedbeds and infection is limited almost entirely to leaves, in Australia most damage is done in the field and the disease is often systemic throughout the plant.

Climatic conditions favoring disease development appear to be similar to those in the United States. The production and spread of sporangia have been reported to occur under the following types of conditions: overcast or drizzly weather with reduced day temperatures for a period exceeding 24 hours (76); warm, humid daytime conditions and rather cold air temperatures at night, or fairly rapid alternations of warm, humid, and cold weather (75); severe outbreak often occurs during periods of dull, showery, and humid weather, or a succession of fogs or heavy dews (61); appearance in the seedbed usually follows a period of excessive rainfall (13, 14); cold changes followed by muggy weather are conducive to the disease (84).

It is difficult to separate primary from secondary infection because the disease exists the year round, not just in the growing season (49). It has long been known that blue mold attacks the two wild species Nicotiana glauca and N. suaveolens. These species are widely distributed throughout Australia and consequently may be found wherever tobacco is cultivated.

Overwintering of the Fungus: The fungus may overwinter as oospores in dead plants, on living plants such as volunteers growing in sheltered places that remain cool or moist, or as mycelium in some part of the plant not killed by winter frosts.

Oospores are comparatively rare, but do sometimes occur (14, 31). In 1925 Adam found what seemed to be oospores in pieces of the bract present in seed heads of tobacco plants. During harvesting these pieces are mixed with seed and the disease is often perpetuated in this way.

The most common form of overwintering is as mycelium in wild hosts and in old tobacco plants which are not completely killed either by frost or by eradicative measures such as plowing after harvesting. In 1931 Adam (2) reported "Everything points to these old plants with blue mould being sources of infection in spring rather than diseased as result of infection in spring." In 1929 Darnell-Smith (32) indicated that, provided the weather is not too cold, tobacco plants may survive for 2 years, and that once a plant becomes infected it remains a potential source of infection. He cited the example of an infected plant that produced spore crops in November, the next March, and again the following November, even though the plant had been held in isolation. Angell and Hill (10) demonstrated the persistence of the disease in stems of plants remaining in the field over the winter; suckers arising from them in the spring showed blue mold symptoms, including sporulation of conidia, when the leaves were only a few inches high. Even if all of the aerial portion of the plant was killed by frosts, microscopic examination of sections of the shoots arising from underground dormant buds displayed the presence of the blue mold mycelium growing intercellularly in the young shoot tissues (50).

Although in the United States blue mold has never been demonstrated to be seed-borne, infested seed is a common source of inoculum in Australia. In experiments to test the seed-borne nature of the disease in 1929 Angell (7) grew seed from Australian sources and used as checks seed from North America. The Australian seed produced infected seedlings while the checks remained healthy until they were artificially infected by conidia from the diseased Australian seedlings. This work was followed up by Angell and Hill (10), who in 1932, upon examination of the ovules and seed produced in capsules taken from plants that had the fruiting bodies of the fungus on the flowers and capsules, found the typical coenocytic mycelium of the blue mold fungus.

In addition to infection by oospores and mycelium there is also the possibility that conidia may cause primary infection. Angell and Hill (8, 9) showed by experimental means that conidia may remain alive up to 2 months if kept cool and moist and about 5 weeks over fused calcium chloride in desiccators.

Spring Infection: Spring infection has been pretty well covered in the previous section on overwintering. The conditions affecting dissemination and spread of conidia by wind and rain are comparable with the United States. No area of any of the tobacco-growing States of Australia is free of the disease and, in contrast to the fluctuating pattern of the disease in the United States, blue mold in Australia is nearly always severe every year, although the degree of severity varies.

Effect of Temperature on Field Occurrence

Table 1 gives long-term mean temperatures and total precipitation for six locations in the United States and one location in Australia.

It will be noted that generally for each month of the growing season there is a difference of about 10 degrees in the mean maximum and mean minimum temperatures between the United States and Australia. Table 1 also indicates that the mean maximum temperatures in Australia do not rise much above 82° F, which apparently permits blue mold to continue to cause infection in the field throughout the season. In the United States, on the other hand, the mean maximum temperatures usually are high enough to inhibit the fungus from developing in the field. It would appear that when blue mold in the United States has become serious in the field temperatures have usually averaged 5 to 10 degrees below normal for the area involved. Perhaps this temperature-disease relationship can serve as a basis for predicting the occurrence and severity of blue mold in the field.

Table 1. AVERAGE TEMPERATURES AND RAINFALL FOR TOBACCO-GROWING REGIONS OF THE UNITED STATES AND AUSTRALIA.

Mo.	Hartford, Conn.			Chatham, Va.			Oxford, N. Car.			Florence, S. Car.			Tifton, Ga.			Quincy, Fla.			Canberra, Australia			Mo.
	1921-1950			8-year period prior to 1931		1931-1952	11-year period prior to 1931		1931-1952	1921-1950			9-year period prior to 1931		1931-1952	21- and 22-year period beginning 1931 (21)	(22)	1931-1952	14-year period			
	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	Mean Max.	Mean Min.	Total Ppt.	
Jan.	36.1	17.9	3.15	48.4	27.9	3.63	49.3	28.4	3.55	56.3	36.3	2.85	61.7	40.2	3.50	65.3	43.2	3.46	53.9	34.0	1.77	Aug.
Feb.	37.9	18.2	2.57	54.0	31.9	2.86	53.2	32.6	2.99	58.0	37.2	3.30	64.9	43.0	3.64	66.8	43.4	4.04	60.3	36.6	1.61	Sept.
Mar.	47.4	27.0	3.81	59.5	36.5	3.73	61.7	37.8	3.65	66.9	43.8	3.54	68.5	46.7	5.01	72.0	48.4	5.75	65.5	41.4	2.59	Oct.
*Apr.	59.9	36.0	3.56	69.2	44.1	3.42	69.8	45.4	3.79	75.2	51.6	3.67	78.7	54.7	4.31	78.4	54.2	4.71	71.0	45.6	2.11	Nov.
May	72.3	47.0	3.66	78.2	52.6	3.77	77.0	53.0	3.89	83.2	59.3	3.78	84.4	60.9	3.40	86.4	61.6	4.30	78.6	50.8	2.18	Dec.
June	80.9	56.8	3.62	83.7	61.1	3.75	85.1	62.6	4.52	90.4	67.6	4.88	88.8	68.0	4.11	90.7	68.3	5.20	82.6	54.0	1.75	Jan.
July	85.6	62.0	3.56	88.8	66.4	4.75	88.1	66.2	5.63	91.1	70.6	6.45	90.0	70.1	6.50	90.4	70.0	7.06	82.6	53.7	2.07	Feb.
Aug.	82.9	59.9	3.54	87.2	64.4	4.54	86.2	64.2	4.88	89.7	68.8	4.78	90.4	64.0	5.42	90.2	69.9	6.69	75.4	49.8	2.10	Mar.
Sept.	75.5	52.1	3.44	81.8	59.4	4.37	82.5	60.7	3.69	86.1	64.4	4.28	88.4	67.2	3.44	87.6	66.4	4.49	66.8	42.8	1.87	Apr.
Oct.	64.8	41.0	2.80	69.5	45.9	2.62	70.6	46.5	2.56	76.5	51.6	2.27	78.4	55.9	1.91	82.1	56.7	2.23	57.7	37.3	2.86	May
Nov.	51.4	31.2	3.48	58.3	36.9	3.05	59.4	37.4	3.16	65.7	41.4	2.28	68.1	46.0	1.96	72.0	46.5	2.58	52.2	34.0	1.72	June
Dec.	39.0	20.2	3.29	49.6	31.0	3.37	51.6	31.1	3.18	56.8	36.1	3.25	63.1	40.3	3.40	65.9	42.8	3.98	51.5	31.7	1.46	July

*The 5 months enclosed in the box represent the growing season for tobacco.

ETIOLOGY

Oospores

According to Clayton and Stevenson (28) oospore size varies so greatly that it is of little taxonomic value other than to indicate the range for the genus, which is about 20μ to 60μ.

Because of the difficulty of finding oospores and, once having found them, of trying to make them germinate, very little is known about the factors involved in their formation and germination. Wolf and his colleagues (108, 109) have done most of the experimental work on this phase of blue mold; so the following information is based on their two papers. Oospores are formed within dead tissues and mature 4 to 7 days after death of the cells. A germ tube forms and enters the leaf either through the stoma or by penetrating directly through the epidermis, becoming intercellular mycelium with digitate haustoria that penetrate into the cells. In oospore-germination experiments, when pieces of decaying diseased leaves that had been collected in the spring and kept intermittently in cold storage and in the laboratory were macerated and put in drops of water on slides, a few oospores were seen to form germ tubes. In another experiment one portion of similar diseased material was air-dried and kept in the laboratory and the other portion was mixed with sand in a porous earthen vessel and buried in soil of an old bed. During the winter and spring of the following year samples were tested periodically in water drops to allow for germination at temperatures of 36° to 75° F. Less than a dozen oospores were seen to germinate in the tests which included several thousand oospores. When an oospore begins to germinate its contents become granular. The contents of the newly forming germ tube appear brown and granular at first, but as the tube elongates the contents become less densely colored. Length of the tube is about four times the diameter of the oospore. This is the only record of observed oospore germination in Peronospora tabacina.

In 1953, however, Person and Lucas (71) observed what at the time they believed to be oospore germination, not by germ tube, but by the development of sessile zoosporangia, which in turn produced motile zoospores. Later (72) they discovered that what they had seen had not been germinating oospores, but rather that the supposed zoosporangia attached to the oospores were actually a species of soil-inhabiting chytrid, Phlyctochytrium, that was parasitizing the spores. While this was rather a disappointing discovery to make, still it opens up a new field of investigation, namely, how important a role the chytrid might have in oospore germination.

Conidia

Blue mold conidia are ellipsoid, or egg-shaped, are very faintly violet tinted and, according to Clayton and Stevenson, are very variable in size. The range of means is 17μ to 28μ long by 13μ to 17μ broad. Like the conidiophores and oospores, the conidia have no distinctive morphological characters to aid in species determination.

The life cycle of the pathogen, including germination, penetration, incubation, infection, and sporulation, takes about a week. The sporangia or conidia form early in the morning and are completely mature by sunrise. They appear chiefly on the underside of the leaves, being borne on dichotomously branched conidiophores which emerge through the stomata. Waggoner and Taylor (102) experimented with a Hirst spore trap set 18 inches above the ground in a Connecticut tobacco bed. In one test they collected their first spores in quantity on a sunny, windy day at 4:30 a. m., with no spores after 8:30 a. m. On cloudy days spores first appeared at 6 a. m., and a maximum was reached between 9 and 10 a. m. Spore formation is favored by temperatures ranging from about 42°-63° F. As has been stated before, conidia are short-lived, usually remaining viable for only a few hours, and being killed by sunlight. Favorable conditions for infection are present if leaves remain wet for 2 to 3 hours after sunrise, for conidia must lodge on a film or drop of water to germinate.

If conditions remain favorable the sporangial cycle may be repeated in rapid succession. Clayton and Gaines (25) found that leaf infection by conidia was favored by 64° to 75° F. After penetration, the coenocytic mycelium grows intercellularly in the parenchyma of the leaf and also in the phloem region of the vascular bundles, forming haustoria which penetrate the cell walls (10). Within a week conidiophores, greatly branched, appear through the lower stomata and occasionally through the upper leaf surface just before dawn. Apparently invaded cells stay alive until sporangia are formed. Meanwhile the mycelium has thoroughly permeated all infected tissue, which results in eventual death of all cells in the vicinity, ordinarily after two or more spore crops have been produced. In the United States this necrosis is confined to the leaf tissue, but in Australia more often than not the mycelium sends out hyphae from the leaf into the phloem, growing toward the center of the plant. When this axis is reached, hyphae grow both downward toward the root and upward toward the growing point to produce a systemic invasion of the whole plant. This is the mycelium that overwinters in any part of the tobacco plant left alive at the end of the growing season, thus creating a continuous source of inoculum.

SYMPTOMS

In the Seedbed

The very earliest symptoms in the seedbed are usually not very noticeable. If the weather is dry symptoms resemble nitrogen starvation. There is a slight yellowing of the tips of the leaves and small indefinite light spots may form on the under leaf surface. Later, leaves may become irregularly puckered or cupped and sometimes become twisted so that the lower surface is facing upward. If the weather is wet conditions are favorable for the disease to develop and there is rapid spread throughout the bed. Yellow spots appear on the leaves, which begin to darken and take on a water-soaked appearance. These spots may coalesce to form larger infection areas, on the under surface of which usually may be found the dense felt of "mold" which may be white, slightly bluish, or grey. This mold or mildew represents the fruiting bodies of the fungus and usually appears in the early morning but disappears later in the day; or it may not appear at all if the weather is dry. Severe leaf symptoms resemble scalding such as would result from the application of hot water or a toxic chemical like formaldehyde. Later the leaves dry up and flatten out into strings that lie on the surface of the soil. If beds have been closed, these other symptoms often are accompanied by the pungent odor of vegetable matter that has attained an advanced stage of decay, an odor not unlike that given off from potato plants rotting as a result of infection by late blight. On the other hand, if the blue mold attack is not very severe, very often tobacco seedlings will survive it, the symptoms will disappear, and after a sufficient period for recovery the plants can safely be set in the field.

In Australia seedbed symptoms are very similar, except that if wet weather favors the disease the fungus often goes on to attack leaf veins, either the subsidiary veins or both subsidiary veins and the midrib. Symptoms appear as dark-brown discoloration of the veins, visible from the under side of the leaf. Extreme attack of the midrib may even extend into the internal tissues of the stalk, causing sunken dark-brown blotches on the fleshy stalks.

In the Field

In this country field attacks are scattered and ordinarily are of relatively little economic importance except sometimes in peak blue mold years, when the disease becomes epiphytotic in the field as well as in the seedbed.

In the field entire leaves are not killed by the disease. The first sign of trouble is usually the appearance on the upper side of the lower leaves of yellowish indefinite spots about 1/2 to 1 inch in diameter. These spots often enlarge by coalescing, giving a more well-defined blotched area, often accompanied by leaf puckering, that soon begins to necrose and turn brown. When necrosis is complete these areas become papery and fall out, leaving ragged holes in the leaf that resemble either worm injury or Paris green burning. Leaf spotting is ordinarily confined to the lower leaves, being most severe on the sand lugs, many of which are discarded at harvesting. However, under severe disease conditions spotting may extend to leaves higher up on the plant. For example, Conners (29) tells us that in 1945, when the disease was severe in field tobacco in the old belt of Ontario, even the uppermost leaves of badly attacked plants were spotted. These spots differed from those on lower leaves in that they were bright yellow and did not become necrotic, indicating that infection was halted before the fungus was able to reach the fruiting stage. Person and Garriss (70) reported that during 1954, the worst blue mold year in the field that the State of North Carolina has ever experienced, leaf spotting extended up the plant frequently to the seventh and the eighth leaf and occasionally up to the fourteenth. On severely infected plants infection was heaviest on the bottom three to four sand lug leaves; many of these leaves exhibited 30 to 50 large necrotic spots and the entire area of some leaves was covered by as many as 70 lesions. In many fields this first priming of sand lugs, which represents 3 to 5 percent of the dollar value of the crop, was a total loss.

Despite an occasional scattered outbreak such as the one just described blue mold damage in the field in this country is not important in comparison with damage in the seedbed. In Australia a very different situation exists. In the early days of tobacco cultivation in Australia the disease was confined mainly to the beds, but now, except in Western Australia, where it has remained chiefly a seedbed disease, practically all injury results from field infection. There are two types of field infection: localized leaf infection, called "spot mold"; and systemic infection, which may spread throughout the entire plant. Leaf infection symptoms resemble those in the United States. Leaves are infected progressively from the base of the plant upward. If the infection is very severe it spreads into the vascular tissue of the veins and ultimately may include either the stem or the roots or both. The ribs and stem show a dark discoloration and in the stem infection appears in the outer layers of the woody conducting tissue and in the inner layer of the "bark". Systemic infection sometimes kills the plant outright, but more often it causes a slow growth that results in stunting and uneven stands and leaf of inferior quality.

See Figure 3, A and B, for an illustration of symptoms on the tobacco plant. Figure 3B, provided by Dr. Howard E. Heggestad, has not been published previously.

CULTURAL PRACTICES

Plant Bed Management

Good cultural practices alone will not control blue mold once it has become established in a bed, but they can go a long way in helping to keep the disease out of the beds in the first place and in keeping it under control once it has arrived.

The following suggestions concerning good plant bed management represent the consensus of opinion of a majority of the people who have investigated the problems involved.

In the United States: Since the disease may be carried in the soil of the beds in the form of overwintering oospores, it is desirable, if possible, to select new bed sites every year. Beds should not be located on swampy land or near woods which create shade. An ideal location would be on eastern or southern slopes, to allow for protection from north and west winds and for maximum sunshine throughout the day. Soil must have good air drainage and ventilation, to permit fast run-off of water from soil and from leaves of plants. Valleau (99, 100) says that in Kentucky a system that works very well is to sow the beds after setting to a summer legume cover crop, which should be plowed under (not disked) in the fall. If neither of these two methods is feasible and the same beds must be used year after year for tobacco alone, there are certain elementary precautions that must be taken to prepare the bed for seeding. The beds must be sterilized, either with steam, by burning thoroughly, or by treatment of the soil with chemicals such as methyl bromide. If the seedbed is not to be used the next year, after transplanting it should be disked thoroughly or some other method should be used to destroy any hold-over plants that might seed and produce volunteers. This last recommendation is one of a list of items in a scheme for blue mold eradication presented at the Tobacco Disease Council meeting in Richmond, Virginia in January 1955. This scheme was adopted as a resolution and then was sent to the directors of the Florida and Georgia Agricultural Experiment Stations for any action which those States might wish to take.

Ever since blue mold became a threat to the tobacco-growing industry, it has been a common practice in southern tobacco States such as North Carolina to overplant seedbeds to ensure sufficient seedlings for a crop; where 50 square yards used to be planted for each acre to be set, it is now normal to plant 100 square yards per acre. Seeding of such "excess yardage" is probably a very good form of insurance for the grower, but such a precaution does not preclude the need for other methods of control. In spite of extra seedbed space, if conditions are right it is just as easy for downy mildew to wipe out 100 square yards as 50 square yards of young plants. When this happens growers must resort to buying seedlings from other growers, and in bad mildew years there are usually not enough to go around.

Seedbeds may be of any desired length but should be narrow to facilitate spraying, dusting, watering and weeding. Some growers recommend 4 yards or less while others maintain they should not be over 1 or 2 yards wide. Width depends upon a number of factors, the principal one being the type of equipment to be used in treating the beds. Once the bed has been prepared, the next consideration is seed. Although blue mold has not been found to be seed-borne in this country, it is a safety measure to use seed from healthy plants. Seed should be sown during the period recommended for a given area; however, beds should not be started excessively early, as such beds provide plants on which the disease can multiply and spread at an early date.

After plants emerge they must be protected from cold and wind by covers. However, it is important to know when the covers can be removed with safety. Removing covers during the day serves a two-fold purpose: it allows sunshine to harden the seedlings, and it reduces relative humidity in the beds. It is extremely important to keep relative humidity as low as

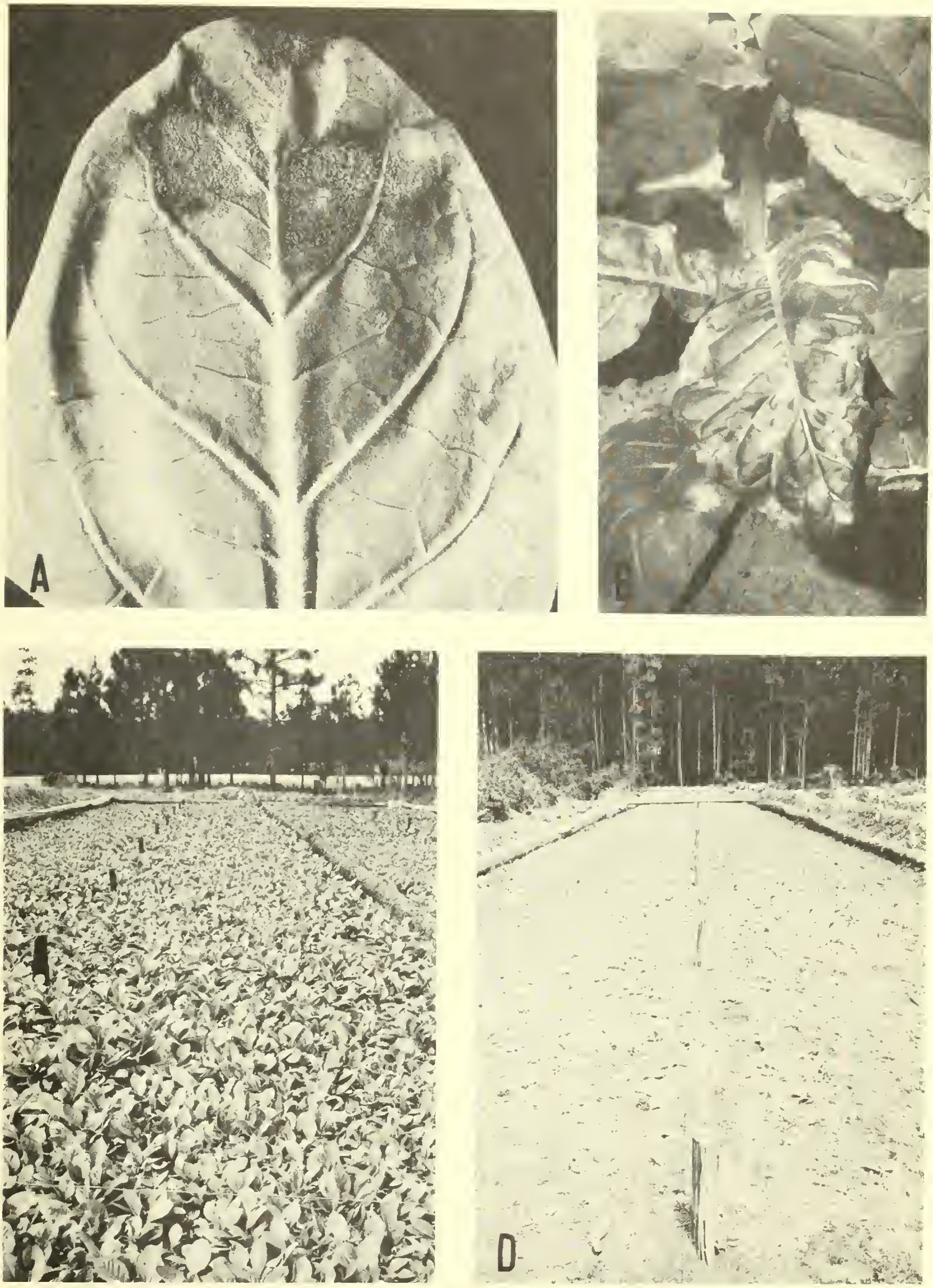

FIGURE 3. Symptoms and control of blue mold of tobacco. A -- Lower leaf surface view showing the "mold" growth characteristic of the disease. B -- Leaf spot phase of blue mold on shade grown cigar wrapper type tobacco. C -- Sprayed bed, which produced plants at the rate of about 40,000 per 100 square yards. D -- Unsprayed bed, which produced less than 1000 plants per 100 square yards. (Photographs taken from Tobacco Section, Crops Research Division, Beltsville, Maryland)

possible and leaves as dry as possible. In humidity experiments Armstrong and Sumner (17) obtained pretty good control of blue mold on larger plants by using forced-air ventilation--that is, by using a small electric fan to force air over a heating unit and then into the bed. Attempting to control humidity by such artificial methods is impractical because the impossibility of preventing dew formation on small plants makes them particularly vulnerable to infection. Maximum sunlight would seem to be the ideal solution. The importance of relative humidity in promoting infection is illustrated by infection of Perique tobacco in Louisiana. In 1931, when tobacco in St. James Parish was hard hit by blue mold, growers had covered their seedbeds with Palmetto leaves for protection from the cold. As a result humidity was kept high and the disease spread more rapidly than it might have under ordinary growing conditions (36).

Heat treatment of beds has been tried as a control measure, but has proved too expensive, requires too much labor, and does not work very well on small plants. Armstrong and Sumner found that minimum night temperatures of 88° F and above (that is, 88° to 93°) controlled the disease partly, but not completely. Clayton and Gaines (25) managed to stop sporulation with minimum temperatures of 70° and above; however, plants grown with reduced light, due to heavy shading in the greenhouse, sporulated freely at temperatures as high as 80°. Thus it would appear that there are too many factors modifying the effect of high temperatures to make temperature control practicable.

When plants are up in the beds it is good practice to water in the forenoon so the plants can dry off before night. Also, watering should be kept to a minimum because leaves should be kept as dry as possible and relative humidity as low as possible. If blue mold does appear in a bed the application of small amounts of nitrate of soda usually will promote recovery of the plant by stimulating rapid new growth of secondary roots near the base of the stem. On the other hand, too much of this chemical will make the plants too watery and succulent and consequently more susceptible. Improper application may even cause more damage than the disease itself (65).

Plants should never be set out in the field until they show definite signs of recovery, such as the formation of new roots, but there should be no delay in setting out as soon as the tobacco is large enough, has recovered from the disease, or both. After transplanting, any old plants in the beds should be completely destroyed.

In Australia: In Australia the same cultural practices are recommended with a few modifications and additions.

The problem of finding disease-free seedbeds is acute as the disease is not only widespread during the regular growing season but also exists many times over the whole year. If possible tobacco should not follow tobacco in a field, but should be rotated with other suitable crops. Beds should be isolated and should be sown in relays at intervals of every 2 to 4 weeks from August to November, so that some of the beds will miss the critical time for the moist season (13, 84). Soil should be fairly sandy and well drained and raised above the general ground level to prevent excess water from coming in contact with plants (60). Although it is difficult to keep beds sterile they should be treated before seeding by one of the following methods: steam at 100 pounds' pressure for 1/2 hour; burning for at least 4 hours with a wood fire; application of water with formalin at the rate of 1 gallon of formalin to 50 gallons of water (73).

Blue mold in Australia is often seed-borne; thus it is of primary importance either to use seed from guaranteed healthy plants or to treat the seed for about 5 minutes in absolute alcohol before sowing to kill any spores that may be adhering to them. In spite of the employment of the most rigid sanitary measures, it is often impossible to get a sufficient supply of disease-free plants for setting out. In fact, just before the discovery of the benzol gas treatment for seedbeds the Victorian Department of Agriculture arranged with the Department of Agriculture of New Zealand to have seedlings grown at Auckland and then shipped to Victoria when ready for setting out. This system proved not only to be very expensive but it was also a failure, as the plants usually became contaminated anyway.

Whenever infected plants are found in a seedbed they should be pulled up, roots and all, and burned, and after transplanting any plants remaining in a bed should be thoroughly destroyed. In Australia stress is also placed on the spread of the disease within a bed and between beds by people who carry spores on their clothing. For this reason visitors should not be allowed in any beds and workers should be very careful of contamination from this source. Insects, too, may be an important factor in disease dissemination. It has been demonstrated that the tobacco leaf miner, Phthorimaea operculella Zell. [=Gnorimoschema operculella Zell.], may transmit the spores, and it is possible that other insects also serve as vectors (61).

Other cultural practices such as allowing young plants plenty of air and sunlight, trying to keep beds warm enough so that they do not fall below 45° F, reducing watering to a minimum, delay of transplanting until seedlings show signs of recovery, and the use of narrow beds about a yard in width are the same as those reported in the United States.

Field Sanitation

When blue mold appears in the field there is not much that can be done in the way of sanitation except for removal and destruction of diseased plants and the plowing under or cutting down of all plants remaining after harvest so that suckers from the field crop cannot go into winter. This precaution was considered so imperative in Australia that in 1934 a new regulation was added to the Tobacco Growers Protection Act requiring the occupier of any land on which self-sown tobacco plants are or shall be growing to destroy completely all tobacco plants by fire or burial every year before the 31st day of July (40). Plowing is not considered entirely satisfactory since in some cases plants are covered by soil which protects them from frost and enables them to survive the winter. It is also necessary in Australia to destroy any plants of the native tobacco, Nicotiana suaveolens, or other wild tobacco such as N. glauca, which may be growing in a tobacco region. And, as with cultivated tobacco, the roots must be completely destroyed to be sure that no part of the plant remains alive which might harbor the mycelium of the fungus.

FUNGICIDES

Fumigation with Gases

In the latter part of 1934 and in early 1935 Dr. H. R. Angell of the Council for Scientific and Industrial Research of Australia was largely responsible for the perfection of a technique for blue mold control, which consisted of treating tobacco plant beds with vapors from benzol, an aromatic hydrocarbon distillate of coal tar. In the fall of 1935 extensive experiments were begun in the United States to test the efficacy of benzol. The benzol treatment consists of placing liquid benzol, at the end of the day, inside the beds in suitable glass or metal containers such as shallow pans or troughs (either with or without wicks) that are raised above the plants. Then the bed is covered with a heavy muslin material and the benzol allowed to evaporate during the night. The vapor, which is about twice as heavy as air, drifts down onto the plants, penetrates the leaves and kills the fungus, thereby acting as a curative rather than as a preventive measure.

In 1937 McLean et al. (63) in North Carolina confirmed the efficiency of the benzol method of treatment. They found that if lubricating oil were added to the benzol the partial vapor pressure was lower, rate of evaporation was less (owing to the higher viscosity of the mixture), and the concentration of vapor resulting was just right for inhibition of infection by the downy mildew organism but not high enough to injure the tobacco seedlings. Thus, the oil added the margin of safety necessary to make the benzol treatment "foolproof". Benzol was tried to a limited extent during the 1937 season, but was more widely employed during the next few years.

In 1938 Lunn and Mattison (59) reported from South Carolina that benzol completely checked downy mildew after it appeared in the beds. They did not recommend its use too highly, however, since it had a number of disadvantages. The technique is expensive and hard to handle. Benzol vapor is very flammable, it may be poisonous to humans, and if the benzol is splashed on plants it will either kill portions of the leaves or the entire plant. A great deal of labor is required to fill the evaporating pans every night and to remove the heavy muslin covers every morning and put them on again at night for the first three or four consecutive nights and then about twice a week during the period that blue mold remains active. Although the vapor produces a good bit of wilting in the middle of the day, the tobacco does not sustain any permanent harmful effects. Another advantage is that benzol vapor kills flea beetles and other insects which spread the disease within and between beds. Florida, Virginia, Connecticut, and Maryland reported the same general results. In Maryland benzol was considered impractical because the highly explosive nature of the material made it too dangerous to work with (103).

In 1939 a better method of fumigation was developed, when it was discovered that fumes given off from the evaporation of the solid white crystals of paradichlorobenzene (PDB), called "Paracide" or "Parabacco" commercially, are just as effective as benzol in controlling blue mold. The crystals are spread out on board shelves or in wire baskets built around the sides of the bed or they are scattered on the surface of a thin cotton tobacco cloth stretched 8 to 14 inches above the ground, just over the top of the plants. This is done at sundown and then the entire bed is covered by a heavy, wet, gastight, muslin cover and the crystals allowed to vaporize during the night. In cooler weather more crystals are required as evaporation is slowed down by lower temperatures. The use of PDB was an improvement over benzol because the material was easier to handle, there was no danger of damage from spillage, application was faster since the necessity for liquid-evaporating containers was eliminated, and the crystals themselves were relatively cheap. The PDB crystal method was particularly welcomed in Connecticut, where the usual copper oxide sprays had not given satisfactory control, and so this treatment was commonly used there for a few years. The subsequent development of Fermate and other excellent protective fungicides has resulted in the gradual replacement by dusts and sprays of gases which, in comparison, are too cumbersome to use and constitute an unnecessarily expensive control precaution. However, PDB fumigation is still recommended for eradicating the fungus when it is already in the beds, if the grower has the right set-up and equipment for gassing airtight beds.

In Australia the situation is quite different. There, sprays of any type have not proved adequate for blue mold control and the benzol vapor treatment alone is advised for seedbed treatment (77).

Sprays and Dusts

When comparing sprays and dusts with gases it must be remembered that while gases act as eradicatives that can kill the fungus after it has infected the host, sprays and dusts, on the other hand, act as preventives and must be applied to the host plant before the disease appears.

When blue mold was first discovered in the United States Bordeaux mixture was recommended as the spray to use, partly because it was being used to some extent in Australia and partly because Bordeaux was the panacea usually suggested for the treatment of any new plant disease, particularly when nothing better was known. In the early 1930's, then, Bordeaux mixture was used, on and off, along with other tested fungicides, in strengths of 2-2-50, 3-3-50, 3-4 1/2-50, and 4-6-50 and it gave partial to good control depending upon many factors, the main one being whether it was correctly applied. It was fairly fungicidal in action, but too many sprayings often resulted in severe damage to the tobacco plant and in order to get "adequate control" it was necessary to obtain complete coverage of both leaf surfaces. "Adequate control" at that time meant that the development of the disease was delayed 1 or 2 weeks, because of delayed sporulation of the pathogen, and that usually when blue mold did appear the Bordeaux mixture minimized the severity of damage. However, in the case of a really severe infection, this fungicide was wholly unsatisfactory. In Florida it frequently caused an abnormal amount of stunting and retarded growth and it was found that Bordeaux mixture, as well as other copper-containing salts, interferes with the formation of secondary roots, probably as a result of the accumulation of the chemical around the base of the stem at the soil surface. In Australia Bordeaux formulas commonly used were 2-2-40, 2-2-50, and 4-4-40, as well as 3-3-50 Bordeaux mixture plus calcium caseinate, the latter to be used as a field spray.

Other fungicides used during this early period which gave a fair degree of control were red copper oxide-oil emulsion, colloidal copper, copper-soap, calcium monosulfide (Cal-Mo-Sul), lime-sulfur, and cuprous oxide and benzoic acid used with cottonseed oil. Most of these materials shortened the disease period, allowing for earlier transplanting, but none had any curative value. In 1938 in Queensland, Australia colloidal copper was fairly effective in the warmer parts of the State, but in the cooler parts the volatile gas method worked better; therefore it was recommended that a combination of the two systems by employed -- gases during cool, rainy spells, and sprays during warm sunny days. In this same year no sprays of any description did any good in Connecticut, while in Georgia red copper oxide gave rather fair control.

The development of the benzol and PDB fumigation techniques in the middle and late 1930's did much to bridge the gap between the hopelessly inadequate control job done by the aforementioned sprays and dusts and the excellent results afforded by certain organic materials, the first of which was tested in 1942. By 1938 the chief recommended controls for blue mold in the United States and Australia were spraying or dusting with red copper oxide or colloidal copper, and fumigation by the then recently perfected benzol method. In Australia sprays were far superior to dusts. Neither sprays nor dusts eliminated the disease, but they did reduce it to a point where it did little or no damage. In general, they seemed to give better control in the southern than in the northern tobacco regions of the United States, and even up to the early

1940's in Connecticut and Massachusetts the greater percentage of growers were still using the safe and sure gases.

The year 1942 ushered in a new era in fungicides for blue mold control. In May of that year Anderson (6) published results of extended greenhouse experiments on organic fungicides. He found that ferric dimethyl dithiocarbamate gave 95 to 100 percent control. And Kincaid (55) in Florida reported similar success with this new material in trials at Quincy, which resulted in excellent control, a little better than that with cuprous oxide-cottonseed oil emulsion. Another material, tetrachloro-para-benzoquinone, also gave good control, about equal to the cuprous oxide spray. (See Figure 3, C and D, for an illustration of the protection obtained with good organic sprays.)

Within a few years many other organic fungicides, a few of which proved to be very effective in blue mold control, were developed. They are as follows:

Common Name	Trade Names	Chemical Name
1. ferbam	Fermate Karbam Black Nu Leaf Ferradow Niagara Carbamate	ferric dimethyl dithiocarbamate
2. zineb	Dithane Z-78 Parzate zineb	zinc ethylene bisdithiocarbamate
3. nabam	Parzate	disodium ethylene bisdithiocarbamate
4. ziram	Zerlate	zinc dimethyl dithiocarbamate
5.	Bismate	bismuth subsalicylate
6. maneb	Manzate Dithane M-22	manganous ethylene bisdithiocarbamate

Table 2 shows the organic fungicides used in the various tobacco-growing States of the United States and in Ontario, Canada from 1945 through 1951.

From 1951 to the present the organics have continued to give satisfactory control, and particularly since 1948, when blue mold control was implemented by the establishment of a USDA Warning Service which notifies farmers in advance when to expect the disease in their vicinity. The two most widely used fungicides in the United States today for blue mold control are ferbam and zineb. These are the two chemicals most highly recommended by the United States Department of Agriculture.

Since about 1954 antibiotics have been investigated as a means of blue mold control. The degree of control seems to have been variable. Generally, streptomycin sulfate formulations at the rate of 200 parts per million have given good results. This material has been extensively and successfully used in the burley-growing sections of Tennessee, Virginia, and western North Carolina for the simultaneous control of both blue mold and wildfire.

In Australia the fungicide picture is very different. As already mentioned, the benzol treatment is used almost exclusively in the seedbeds. And in the fields it is very difficult to control blue mold with sprays because there must be timely and effective coverage of both top and bottom leaves of new foliage, which is naturally expanding rapidly at this stage of growth (76).

RESISTANT VARIETIES

During an attempt in 1934-1935 to breed a flue-cured variety of tobacco resistant to blue mold, about 1000 seed collections of Nicotiana tabacum varieties were obtained from Mexico, Central America, and parts of South America (20, 21). All of these were tested with disappointing results, in that not only was a very low level of resistance found, but when some resistance did appear it was usually associated with other undesirable characters that made it unusable. Resistance apparently is dependent upon many genes and repeated attempts in both Australia and the United States to find resistance within the cultivated commercial species have convinced investigators that there is no N. tabacum variety that possesses sufficient resistance to hope to obtain satisfaction from intraspecific hybridizations.

Breeding work in more recent years has centered around interspecific crosses. As far

Table 2. ORGANIC FUNGICIDES USED TO CONTROL BLUE MOLD OF TOBACCO IN THE UNITED STATES IN THE YEARS 1945-1951, AND IN CANADA IN 1947 AND 1948.

States or Province	Material	Formula or dosage	Percent or number growers using	Results	Remarks
1945					
Fla.	Fermate D[a]	20%	----	Good	
	Fermate D	10%, containing 1% zinc sulfate	----	Good	As good in station tests as the 20% D.
Va.	Fermate S[b]	----	----	----	Preferred over cuprous oxide-oil because application less difficult.
1946					
Conn.	Fermate	Fermate now used by all large growers and most small ones. In experiments at the Station Fermate dust gave as good control as the spray.			
Fla.	Fermate D	20% in talc	----	Good	Continues to give satisfaction.
	zineb D	10% in talc	----	Good	Even better than Fermate.
Ky.	Fermate D	15% Fermate, 85% Pyrophyllite	----	Excellent	In Experiment Station beds.
	Fermate S	----	----	Excellent	
S. Car.	Fermate D	15% Fermate, 85% Pyrophyllite	----	Excellent	Approximately 20 tons of dust used by growers this season.
Va.	Fermate D Fermate S	At least 90% of growers who used Fermate reported beneficial results. Over 50% of growers in flue-cured areas and about 25% in dark and burley areas sprayed with Fermate. All very much pleased with results and plan to use next season.			
1947					
Fla.	Fermate D	20% in talc	----	Good	Same as for 1946.
	zineb D	10% in talc	----	Good	
Ga.	Fermate D	----	----	----	Twice the usual amounts needed because of prolonged attack; shortage of fungicides in Georgia this year.
	Fermate S	----	----	----	
	bismuth subsalicylate	----	----	----	
Md.	Fermate D	----	----	Good	Fermate scarce.
	Fermate S	----	----	Good	
N. Car.	Fermate S	----	----	----	
	bismuth subsalicylate S with alcohol spreader	----	----	Good	
	Dithane-14 S	----	----	----	Caused severe damage to plants.
Ontario, Canada	Fermate S	----	----	----	Very scarce.
	bismuth subsalicylate S	----	----	----	500 lbs packaged as trial for flue growers.
Pa.	bismuth subsalicylate	----	----	----	Used only in limited amounts; Fermate very scarce.
	Dithane Z-78	----	----	----	
S. C.	Fermate D & S	----	----	----	In short supply.
1948					
Conn.	Fermate S	1-50	90	Excellent	
	Dithane Z-78	1-48	1	Good	
Fla.	Fermate D	20% in talc	75	Satisfactory when used as recommended; 3 times/wk;	
	Parzate D	10% in talc	Tests	infection too slight to judge results.	
Ga.	Fermate D	15%	----		
	Fermate S	4-100	82	Almost perfect commercial control with sprays and dusts.	
	bismuth subsalicylate S Dithane Z-78 S Dimole (Fermate-salicylic acid mixture)		3	----	
Ky.	Prepared to use Fermate S or D or Dithane Z-78 D	----	----	----	Very little used because of very mild attack.
Md.	Fermate D	15%	70	Excellent	
	Fermate S	2, 4-100	5	Excellent	
	Other organics	----	Trace	----	Mostly tests; results variable, mostly good.
Mass.	Fermate D	20%	5	Good	PDB used occasionally along with Fermate to eradicate fungus from infected beds.
	Fermate S	2-100	75	Good	
N. Car.	Fermate D Fermate S Dithane Z-78	15% 4-100 3-100	46	Excellent	Excellent where applied properly.
Ontario, Canada	Fermate D	Mfr.	25	Good	PDB 3 lbs/100 sq yds also gave good results when used properly.
	Fermate S	2-40	65	Good	
	Benzyl salicylate (aerosol bomb)	----	Less than 1	Uncertain	Minor injury.
Pa.	Fermate S	----	65 or more	----	15% sprayed with Bordeaux 8-4-100 or fixed copper spray (2 lbs Cu/100 gals).
S. Car.	Fermate D	15%	95	Good to excellent	In tests Dithane Z-78 and Karbam Black show promise of being as good as Fermate. Parzate, though effective, has caused some injury to plants.
Tenn.	Fermate D	15%	Some	----	
	Fermate S	2-4-100	Most	Fair	
Va.	Fermate D	15%	10	Good	
	Fermate S	3-100	50	Good	
	Parzate D & S	----	Trace	Good	
W. Va.	Fermate D	----	40	Good	
	Fermate S	2-100	40	Good	
Wis.	Fermate S	----	7 farms	----	Used in experimental spraying; disease not found in survey of tobacco area.

State or Province	Material	Formula or dosage	Percent or number growers using	Results	Remarks
1949					
Conn.	Fermate S	----	95	Almost perfect	
Fla.	Fermate D	----	75	----	
Ga.	Fermate D	----	----	----	Considerable damage when diluents other than talc or Pyrophyllite used.
Mass.	Iron carbamate spray or sprinkle	----	----	----	
N. Car.	Fermate and Dithane Z-78	----	----	----	
S. Car.	Fermate	----	----	----	
1950					
Conn.	Fermate D	----	----	Occasional growers using reported satisfaction.	
	Fermate S	Start with 1-50, increase to 2	95	Almost perfect where applied twice a week. Fermate now standard in this State. Dithane just as good but growers are in habit of using Fermate.	
Fla.	Fermate D	20%	50	Good	Applied 3 times/wk, from 15-35 lbs/acre.
	Dithane Z-78 D	10%	20	Good	Dithane Z-78 and Parzate have
	Parzate D	10%	10	Good (some injury)	slightly better physical properties than Fermate.
Ky.	Fermate S	----	Very small	----	Not much needed, mild year. Disease gradually reducing in injury from year to year as it did between 1937-1944.
N. Car.	Fermate S	4-100	22	Good	All fungicides gave satisfactory con-
	Dithane Z-78 S	3-100	1	Good	trol when properly used. There is
	Parzate S	3-100	few	Good	a strong trend toward use of dusts
	Fermate D	15%	32	Good	instead of sprays.
	Dithane Z-78 D	10%	6	Good	Talc or Pyrophyllite recommended
	Parzate D	10%	1	Good	by Agricultural Extension Service as filler with dust.
Pa.	Copper and Fermate S	8-4-100 2 lbs	85	Good	
	Zerlate or Parzate	----	5	Fair	
S. Car.	Fermate D	15%	about 50	Good	
	Z-78 D	10%	few	Good	
	Parzate D	10%	few	Good	
	Fermate S	4-100	few	Good	
	Z-78 S	3-100	few	Good	
	Parzate S	3-100	few	Good	
	5379 & 5400 S	1-100	None	Good	New experimental fungicide from Carbide & Carbon Chemical Corp.
Tenn.	zineb D	5%	2	Good	Good control with both ferbam and
Greenville	ferbam D	10%	5	Good	zineb at Experiment Station. Zineb
Knoxville	zineb D	5%	1	Good	dust preferred as could be applied
Greenville	ferbam S	2-50	10	Good	faster than spray and with less labor.
	ferbam S	3-100	10	Excellent	Prepared Fermate dusts not gen-
Knoxville	zineb S	3-100	1	----	erally available. Few use PDB with good results.
Va.	ferbam D	15%	10	Excellent	
	ferbam S	3-100	80	Excellent	
1951					
Fla.	ferbam D	15.6%	40	Good	Excellence of zineb results probably
	zineb D	6.5%	40	Excellent	due to better coverage. Applied 3 time/wk using from 15 to 35 lbs/acre.
Md.	Fermate D	15%	50	Good	Hot dry weather starting soon after
	Fermate S	2-100	50	Good	initial infection stopped disease, preventing serious losses.
N. Car.	Fermate D	15%	30	Good	Attack later than usual. In Border
	Dithane Z-78 or Parzate D	10%	5	Good	Belt most of crop was set before the disease became active.
	Fermate S	4-100	27	Good	
	Dithane Z-78 or Parzate S	3-100	3	Good	
Tenn.	Fermate D	10%	25	Excellent	
	Dithane D	5%	5	Good	
	ferbam D	10%	15	Good	
	zineb D	5%	15	Good	
	Fermate S	4-100	40	Excellent	
	Dithane S	3-100	5	Good	
	ferbam S	76%, using 5 tbs/gal	Est. 20	Good	
	zineb S	65%, using 2 1/2 tbs/gal	Very few	----	
Va.	ferbam D	10%	15	Excellent	Weather conditions mostly favorable
	zineb D	6%	few	Excellent	for control of blue mold; plenty of
	ferbam S	3-4/100	75	Excellent	plants.
	zineb S	2-100	few	Excellent	

[a] D = dust
[b] S = spray

back as 1936 Smith-White et al. (86) tested 100 species collections for resistance and found that greatest resistance was found in native Australian species, the one showing the most promise being N. debneyi Domin. During the war period the results of several species crosses for blue mold resistance were lost owing to absence of some of the staff, but in 1948 the blue mold breeding program was reopened under the supervision of Harold W. Lea and at present species hybrids with blue mold resistance are being selected from an extensive collection (58). Also, the Commonwealth Scientific and Industrial Research Organization at Canberra has conducted extensive experiments, under the direction of O. H. Frankel, for the past 2 years on the blue mold problem.

The following is an extract from the Annual Report for 1956-1957 of the Commonwealth Scientific and Industrial Research Organization: "TOBACCO INVESTIGATIONS (a) Genetics: In the breeding programme for resistance to blue mould work has been concerned with the location and transfer of resistance to commercial varieties of tobacco. Hybrids have been obtained with N. goodspeedii, N. excelsior, N. debneyi, and N. megalosiphon. Backcrosses from N. goodspeedii and N. debneyi to N. tabacum are showing considerable promise, one line in particular combining high field resistance with large leaves, although the leaf is unsuitable for curing.

"In addition an attempt is being made to induce resistance in a commercial variety by chemical mutagens or radiation, combined with testing by artificial inoculation. Thirty-five thousand first generation plants from X-irradiated seed or ultraviolet treated pollen all proved highly susceptible. Testing of second generation plants is now in progress" (79).

In the United States Clayton (19) reported in 1945 that resistance to blue mold is greatly dependent upon the age of the plants. He found that N. debneyi became resistant after 3 to 4 weeks. In 1949 Kincaid (57) reported that as a result of interspecific crossing of N. tabacum (commercial cigar-wrapper tobacco variety Rg) with N. debneyi (highly resistant to downy mildew, black root rot) eventually progenies were obtained which, though not resistant to downy mildew in the plant bed, did have some resistance to leaf spotting in the field. This seemed to be due to a quality which they had in common with N. debneyi, namely, that instead of collecting in drops on the leaves, moisture spreads over the leaf surface as a thin film of water which dries quickly. It was discovered that Chileno Correntino, an introduced variety from Argentina, also has this characteristic, allowing for the possibility that this variety may have originated from a N. tabacum x N. debneyi cross.

According to Clayton (20) there are indications that transfer of resistance from a species like N. debneyi, which is distantly related to N. tabacum, "once established in the tobacco genome, can be used far more rapidly and with fewer complications involving type, yield, and quality, than is the case with any resistance found within the cultivated species."

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MYCOLOGY AND PLANT DISEASE REPORTING SECTION, CROPS RESEARCH DIVISION, BELTSVILLE, MARYLAND

THE PLANT DISEASE REPORTER

Issued By

CROPS RESEARCH DIVISION

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UNITED STATES DEPARTMENT OF AGRICULTURE

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1957

Supplement 251 November 15, 1958

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Crops Research Division serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

MYCOLOGY AND PLANT DISEASE REPORTING SECTION

Crops Protection Research Branch   Plant Industry Station, Beltsville, Maryland

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1957

Compiled by Nellie W. Nance

Plant Disease Reporter
Supplement 251   November 15, 1958

Some 1956 reports on plant diseases are included in this summary which were not published when the 1956 summary was completed. Otherwise this summary includes important diseases of 1957, compiled for the most part from reports to the Mycology and Plant Disease Reporting Section and from articles in Phytopathology. Reports listed in the tables are not usually noted again in the text.

WEATHER OF 1957. General Summary. -- Wet weather in the central and lower Great Plains and Far Southwest, areas where disastrous drought in 1956 climaxed a 5- to 7-year dry period, was the outstanding feature of 1957. The blessings of rain were marred locally, however, by damaging floods and destructive storms.

Drought left the Plains and Southwest only to reappear in the Northeast where hot, dry weather during summer and early autumn cut crop production, created a high fire hazard several times, and reduced many municipal water supplies to the extent that drastic restrictions were necessary.

With adequate precipitation outside the Northeast, the absence of any widespread destructive freezes in spring and autumn, and generally favorable temperatures during the growing season, total crop production was next to the highest on record.

Severe storms took their usual toll. The most destructive single storm was Audrey, the only hurricane to enter the mainland of the United States during 1957. Tornadoes were again reported in record-breaking numbers, but fortunately deaths and losses were less than in some other years. The blizzard or snowstorm in the Southwest on March 22-25 was the worst winter storm. Hail damage was less than usual.

PRECIPITATION. --Precipitation for 1957 was well above normal in most of the nation. Deficiencies resulting in serious drought occurred only in the Northeast, particularly along the north Atlantic coast.

Deficiencies for the year ranged up to 25 percent in the Northeast, and several stations had their driest year on record, including Trenton, N. J., 28.79 inches and Hartford, Conn., 32.26 inches. In contrast, excesses for the year ranged up to 50 percent or more in the lower two-thirds of the area from the Rocky Mountain region to the Appalachians and in some sections of the Southeast. The following stations reported their greatest annual precipitation on record: Grand Junction, Colo., 15.69 inches; Lander, Wyo., 21.89; Cairo, Ill., 72.98; Shreveport, La., 67.23; Memphis, Tenn., 76.85; Knoxville, Tenn., 61.49. Many other stations from the central Rockies to the lower Appalachians reported their wettest year on record. 1957 was much the wettest year on record in Arkansas, with 22 stations reporting new annual records and Newhope measuring 98.55 inches for the greatest annual total ever reported in Arkansas.

At the end of 1956 severe drought extended from the middle Mississippi Basin through the central and lower Great Plains into the Far Southwest, and moisture was needed in California, southern Georgia, and most of Florida.

January precipitation replenished topsoil moisture in California and the southeastern Great Plains and eased the drought in Utah, southwestern Colorado, western New Mexico, and in Arizona. In most of the latter State streamflow was above normal at the end of the month. Heavy rains in southeastern Kentucky and nearby areas of the Virginias during the last 10 days of the month caused the worst floods at some points in nearly 100 years. Damage was in the millions of dollars. February rains brought further drought relief to Texas and Oklahoma, and beneficial amounts fell in Florida's citrus belt, but more was still needed in northern Florida and southern Georgia. Spring precipitation was above normal all over the country. March was especially wet in the central and lower Great Plains where some streams were flowing again for the first time in months, and topsoil was either replenished or greatly improved. Heavy rains in the Pacific Northwest improved ranges but caused some flooding in western Oregon. Heavy rains in April again soaked the Great Plains, and widespread floods occurred in Texas the last 10 days of the month. During May, another wet month except in some northern and eastern sections, floods occurred in Texas, Oklahoma, Arkansas, and south-central Kansas. By the end of May, moisture was adequate to excessive in the 1956 drought area and adequate elsewhere except in the Northeast.

Summer rainfall, spotty as usual, generally was adequate for growing crops except in the Northeast. Heavy June rains in the midcontinent area caused near record floods along several streams in the central Great Plains and in the upper Mississippi Basin, and prolonged flooding along the Red River in Louisiana. Late in June thousands of acres of crops were damaged or destroyed by floods along the Sioux and Vermillion Rivers in South Dakota, and up to 11 inches of rain from eastern Kansas to central Indiana caused more flooding and additional property and crop losses.

In early July the most damaging flood of record occurred along the Wabash and White Rivers in Indiana. On the 12th and 13th of July 6 to 10 inches of rain in the Chicago area caused the loss of 9 lives and heavy property losses. Numerous flash floods occurred during the second week of July in a belt extending from Kansas to Michigan. Texas and Oklahoma had very little rain in July and August, which was in great contrast to heavy rains of the 3 previous months, and both States needed more rain at the end of the summer. August rainfall was light in most of the country, but heavy amounts were recorded in the upper Mississippi Valley, parts of the Great Lakes region, Nebraska, and parts of the Rocky Mountain region. Dry, hot weather during August caused some crop decline in Kansas and Missouri.

Autumn precipitation was heavier than normal in most of the country. September was particularly wet in Oregon and northern California, the eastern Great Plains, and the South. Rainfall in the South totaled up to 20 inches or more and set several new records. Tropical storms contributed much to the total rainfall in the South during September, Debbie on the 7th bringing up to 9 inches to northwestern Florida and 2 to 4 inches to nearby areas and Esther, September 18-19, producing up to 5 inches or more from southeastern Louisiana to northern Florida. October precipitation was unusually heavy in parts of Texas and most of the Far West. It was one of the wettest Octobers on record in the Far Southwest. Heavy rains caused serious flooding in central Texas on October 12, and along most streams of the State's Gulf drainage area during the third week. November was unusually wet in the western Great Plains, the South, the upper Mississippi Valley, and Maine. Early in November more floods occurred in Texas, and during the third week widespread flooding occurred from Texas eastward and in the lower Ohio River drainage basin. Wet weather delayed cotton and corn harvests in the South and Midwest.

December was wet in the Northeast, the Ohio and middle Mississippi Valleys, the Great Lakes region, Oregon, and extreme southern Florida, but the month's precipitation was below normal elsewhere.

NORTHEASTERN DROUGHT. --The northeastern drought, serious during the growing season along the coast from southern Maryland to southern New England, began in January and did not completely end until December. Precipitation in this coastal area was only about 50 percent of normal for January, February, and March.

April precipitation was above normal owing to generous rainfall the first half of the month, but much above normal temperatures and almost no precipitation at all the second half created a high forest fire hazard in New England with numerous fires occurring in Massachusetts, New Hampshire, and Maine.

Although rains on May 14 and 15 relieved the fire hazard in New England and monthly totals were above normal in some interior sections, May rains were less than 50 percent of normal from southern New England to Virginia with some sections experiencing drought by the end of month. Rains on June 6 and 7 furnished some relief to developing drought conditions in Maryland and Virginia, but the month's rainfall was only 50 percent of normal or less in New Jersey, extreme southeastern New York, and southern New England.

July rainfall generally was less than 50 percent of normal from southern New England to the Carolinas, and severe drought gripped Rhode Island, southeastern Massachusetts, parts of Connecticut, New Jersey, extreme southeastern Pennsylvania, Delaware, central and eastern Maryland, and much of eastern Virginia. In the lower Appalachian region where July rainfall also was less than 50 percent of normal, signs of drought were showing up. The dry spell continued until August 25-26. Rains at that time improved pastures and furnished sufficient moisture for fall seeding, but came too late to help many crops.

Good rains fell in most of the East during September, but they were too light from southern

Maryland northward to bring more than slight relief. At Providence, R. I., the period January through September with only 17.71 inches of precipitation was the driest such period there since earliest records in 1832. The last week of September was almost rainless, and the forest fire hazard again become high in New England where numerous woods and brush fires were reported. In some parts of New England streamflow and ground water levels were unusually low and many wells dry. Soil moisture was short in nearly all sections of southern New England, and pastures were declining rapidly at the end of the month. Early October rains relieved the forest fire hazard, and monthly totals, normal or above, were sufficient to improve topsoil moisture; but, wells and streams remained low. November moisture, above normal along the coast and totaling 2 to over 4 inches either replenished or maintained ample topsoil moisture, but water shortages remained serious in some sections.

December rains, well above normal throughout the Northeast with totals ranging from 3 to 12 inches, further improved soil moisture and replenished water supplies that had been short since May in some sections. In New Jersey reservoir levels were raised 10 to 14 feet.

SNOWFALL. --In January many stations in the central Valley and along the central and southern coast of California had some snowfall for the first time in many years. Monthly totals were much above normal in the Rocky Mountains and Northeast.

February snowfall was much below normal nearly everywhere. March snowfall, below normal in most areas, was notable mainly for some heavy falls in the northern Great Plains and upper Mississippi Basin during a blizzard on the 14th and 15th, and near record amounts in the southwestern Great Plains from the 22d through the 25th. April snowfall was unusually heavy in most northern areas between the Rocky Mountains and the Appalachians.

Some unusually early snows fell in central areas during October, and on November 17 to 19 heavy falls were recorded from the southwestern Great Plains to the upper Mississippi Valley. December snowfall was below normal.

TEMPERATURE. --Areas with average temperatures above and below normal for the year were about equal, with extreme departures ranging from 2° or more above in the Northeast to 2° or more below in the central Great Plains.

January weather in much of the North was the coldest in many years and greatly reduced the peach crop in the Northeast and Pacific Northwest. The following February was abnormally mild in virtually the entire Nation, with average temperatures the highest of record in the Far Southwest while monthly maxima set new records at many stations from Yuma, Ariz., to Jacksonville Fla., and northward to Columbus, Ohio, and Wilmington, Del.

Spring (March, April, May) temperatures averaged about normal, although April was relatively cool in the western Plains. During a cold snap from March 6 to 11, freezing extended into the Florida Everglades and caused some local crop damage. On April 7-15, another cold period, temperatures fell to record low levels for the season in the lower Great Plains where 30° recorded at Fort Worth, Tex., on the 13th was the latest freeze and lowest temperature ever recorded there in April. East of the Rockies summer heat prevailed during the latter half of the month. A freeze on May 17 in the Northeast caused some local crop damage.

Average summer temperatures were relatively cool in the Pacific Northwest and Great Basin, but unusually hot in the drought area along the northeastern coast. In the latter area temperatures occasionally neared record highs in June and July.

Autumn temperatures averaged above normal in the Northeast and along the west coast and below in most of the remainder of the country. October was relatively cool nearly everywhere, and a cold snap from the 24th to the 29th reduced temperatures to record low levels for the season in many southern areas east of the Rockies where some stations reported their first freeze of the season about a month earlier than normal. November was among the coldest such months of record in Texas and the Great Basin. Elsewhere, temperatures averaged about normal for the month, but were characterized by frequent and sometimes sharp changes.

December was relatively mild except in Florida where average temperatures were slightly below normal. It was among the mildest Decembers on record in northern areas. Nevertheless, a major outbreak of cold air on the 10th to the 13th brought freezing deep into the South, and low readings in Florida on the 12th and 13th, approximating those of December 1934 and January 1940, caused extensive crop damage.

STORMS AND UNUSUAL WEATHER PHENOMENA

TORNADOES. --These storms, setting new records for the greatest number in a single year (924) and for a single month (May, 230), accounted for 191 deaths, and about $75 million damage.

Major outbreaks occurred as follows:

Southern regions. --January 22; April 1-8, 21-25; June 8 and 28; October 15-16; November 7.

Midwest. --May 14; December 18.

North-central regions. --May 20; June 13-14 and 20.

Northeast. --June 18-19.

The year's worst tornado moved through the Kansas City, Mo., suburbs on May 20, killing at least a score of persons, injuring nearly 200, and damaging property to the extent of millions of dollars. Other well known cities hit during the year included Dallas and Austin, Tex., Springfield, Ill., and Fargo, N. Dak. The Fargo tornado, described as the worst in the history of North Dakota, killed 10, injured over 100, and destroyed property valued in millions of dollars on June 20.

HURRICANES. --Only one of these storms entered the mainland of the United States. Audrey, on June 27-29, moved from southwestern Louisiana to Lake Ontario, but lost hurricane strength soon after leaving Mississippi. Deaths totaled 390 and property losses over $150 million.

HAIL. --Losses were about $62 million, the least since 1953. Hail caused damage in the neighborhood of a million dollars on August 2 at Cheyenne, Wyo.

Wind and hail in the Northern Great Plains and upper Mississippi Valley on July 2-4 were responsible for property and crop losses of millions of dollars. In western South Dakota at 8 p.m. July 2, hailstones up to 16 inches in circumference were reported and a few young livestock were killed. In the extreme southeastern part of the same State from 11 p.m. of the 3d to 1 a.m. of the 4th, one of the most destructive hailstorms in the history of the State devastated an area 8 miles wide from Freeman, S. Dak., to Hawarden, Iowa; stones reached baseball size, cattle were bruised, several hogs killed, and bark stripped from trees.

SHOWER OF FROGS AND FISH. --This latest phenomenon occurred at Magnolia Terminal near Thomasville, Ala., according to a story in the "Thomasville Times" of that city on the 3d of July 1957. The story related that little fish fell by the thousands on Friday morning, the 28th of June 1957, during a rainstorm. The fish, many still alive, were found between crossties on the railroad tracks, and residents filled containers with bass, bluegill, bream, and other species. Some crayfish and tiny frogs also fell. The story was confirmed by reliable observers. A tornado, suspected to have occurred in southwestern Alabama before 8 a.m., the 28th, may have been responsible for the event. The above account is the latest documented testimony to these rare phenomena.

INJURY BY HAIL. --On the 23d of June 1957, a few miles west of Fort Stockton, Tex., 21 persons caught without shelter were injured by hailstones ranging up to baseball size.

BLIZZARDS. --The most destructive storm of this type occurred March 22-25 in the western Great Plains from Wyoming to New Mexico. This storm, reaching blizzard proportions in many sections, was among the worst on record for so late in the season. It took a heavy toll of livestock, and damaged power and communication lines.

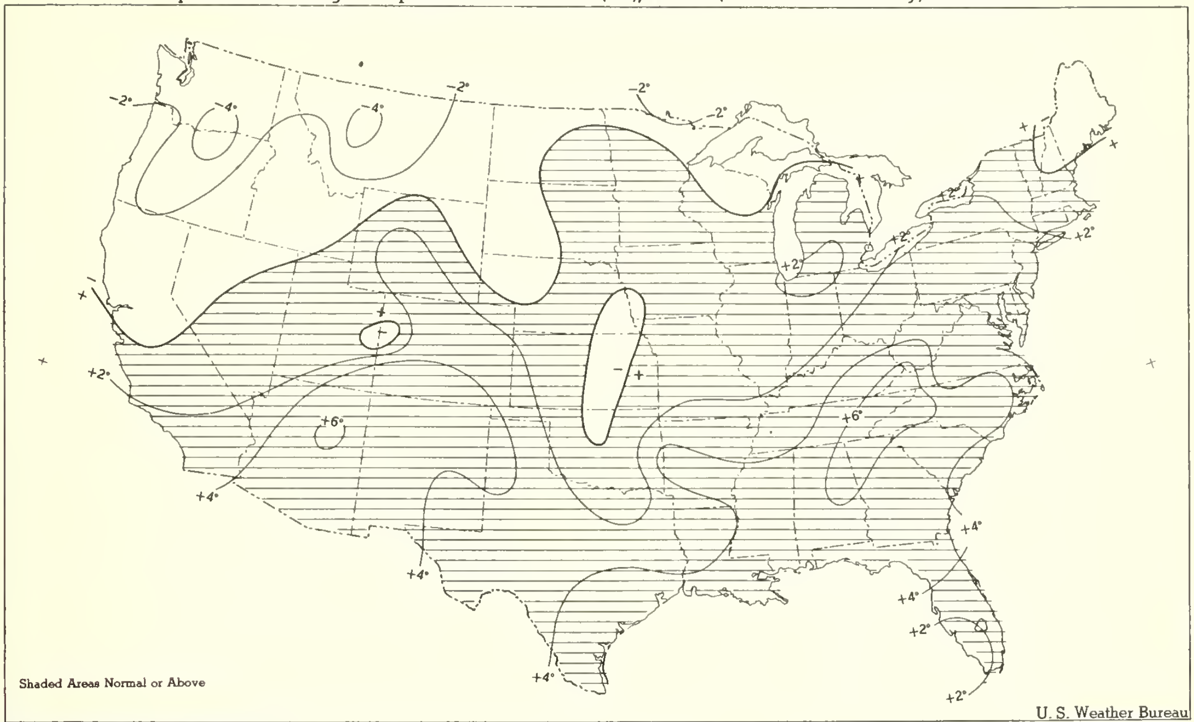
Another blizzard occurred in eastern and south-central Colorado on April 1-2 when up to 50 inches of snow fell in the mountains, causing hundreds of thousands of dollars damage.

WINDS OTHER THAN HURRICANES AND TORNADOES. --These winds were responsible for about 200 deaths and property damage of more than $40 million. On November 21-22, Santa Ana winds in southern California were responsible for hundreds of thousands of dollars damage and for brush fires spreading over 28,000 acres. (From U. S. Department of Commerce Weather Bureau Climatological Data, National Summary, Annual 1957, Vol. 8 (13); 1-3).

The maps on pages 43, 44, 45, 46, show the temperature and precipitation for the winter 1956-1957, spring, summer and fall, of 1957. (From U. S. Department of Commerce Weather Bureau, Weekly Weather and Crop Bulletin, Volume 44, 1957).

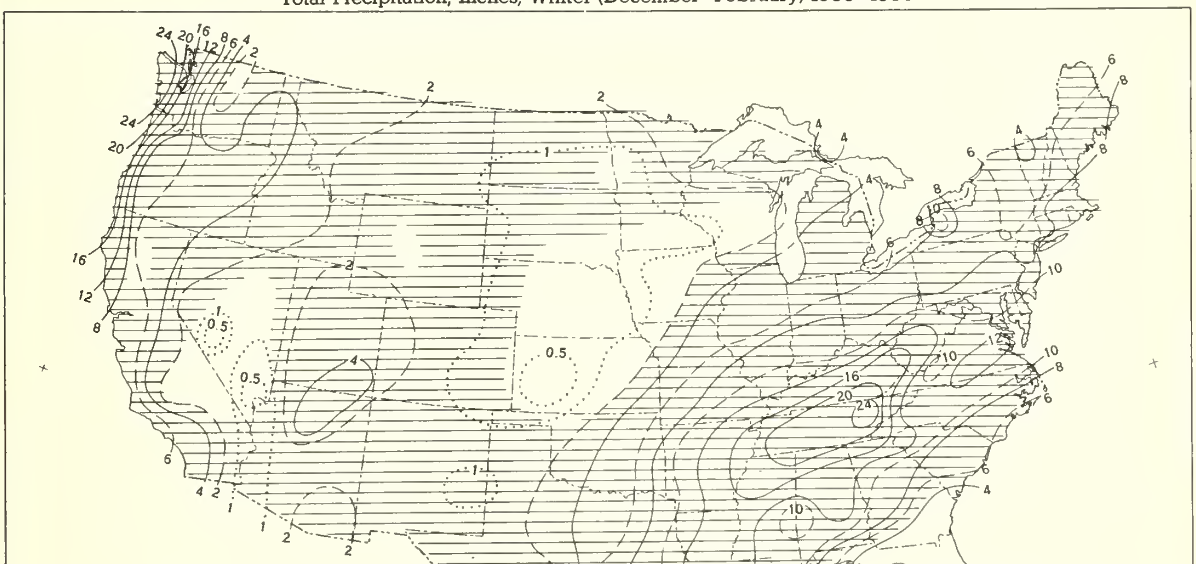
TEMPERATURE AND PRECIPITATION

Departure of Average Temperature from Normal (°F.), Winter (December–February) 1956–1957



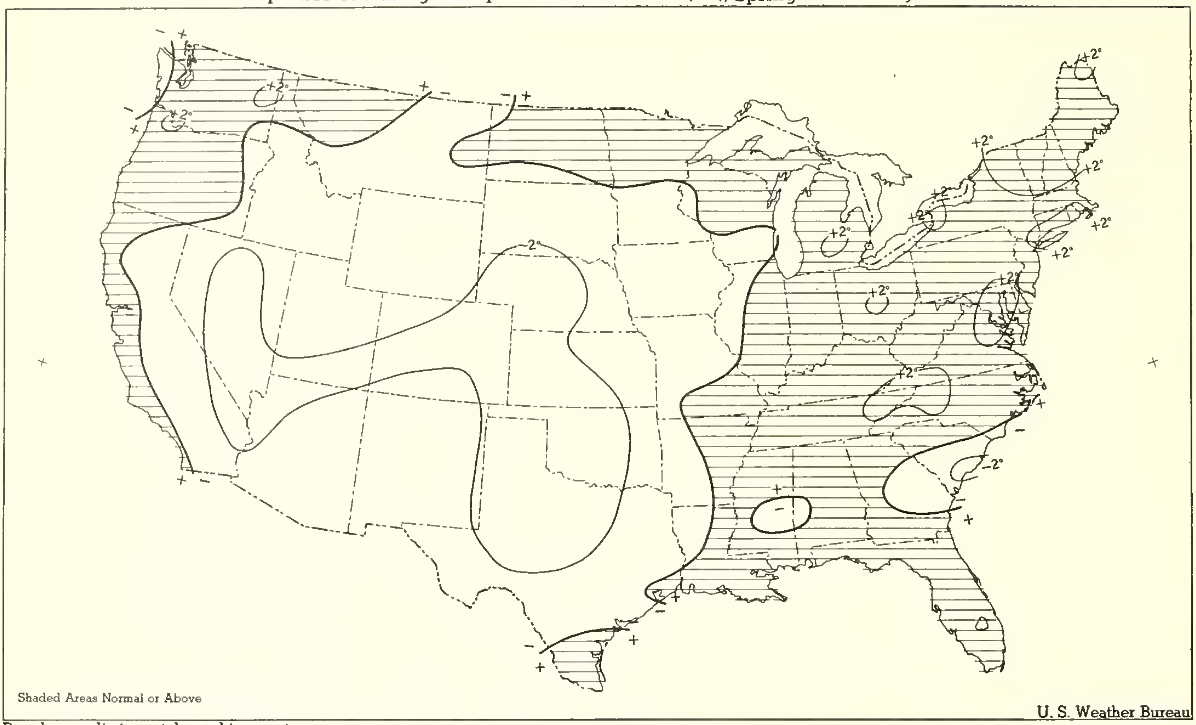
Based on preliminary telegraphic reports

Total Precipitation, Inches, Winter (December–February) 1956–1957



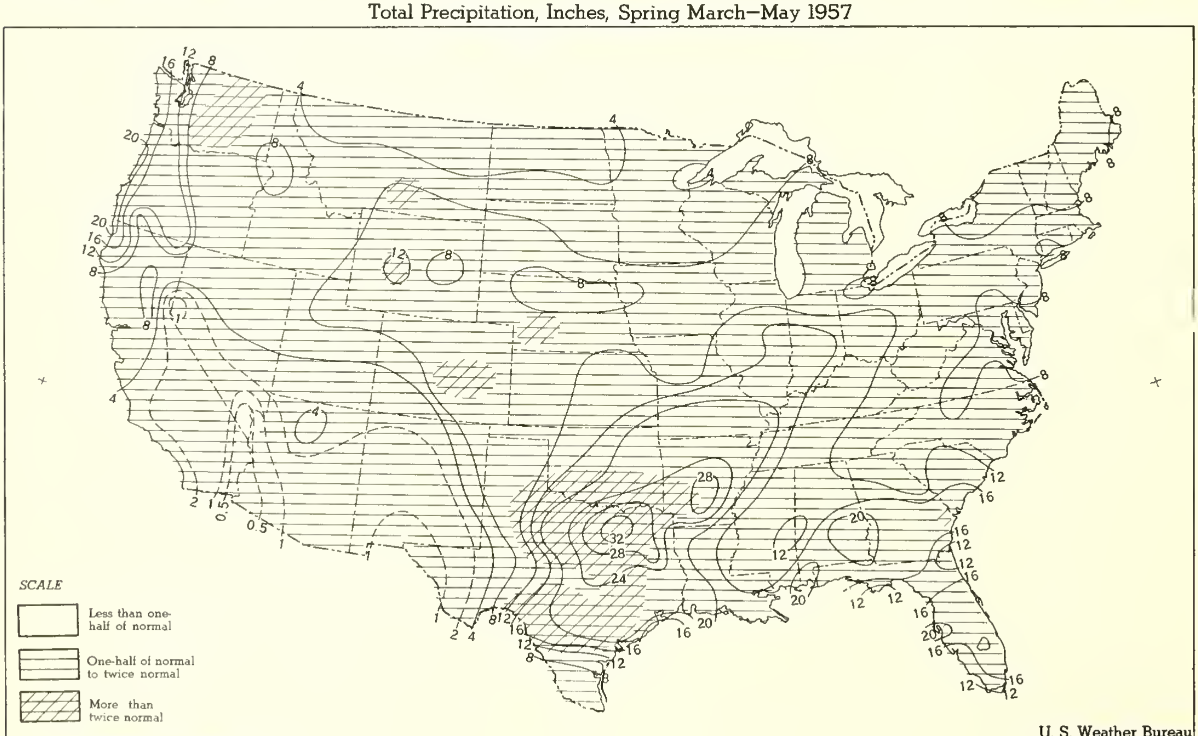
Based on preliminary telegraphic reports

Departure of Average Temperature from Normal (°F.), Spring March–May 1957



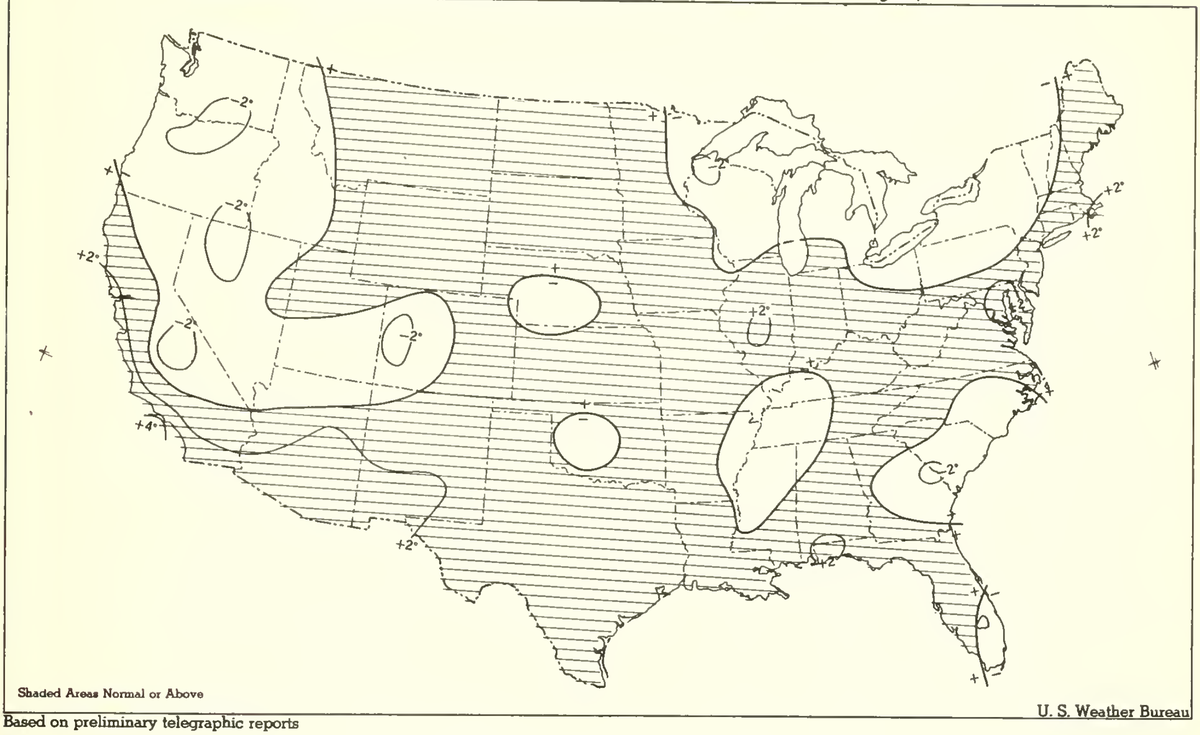
Based on preliminary telegraphic reports

Total Precipitation, Inches, Spring March–May 1957



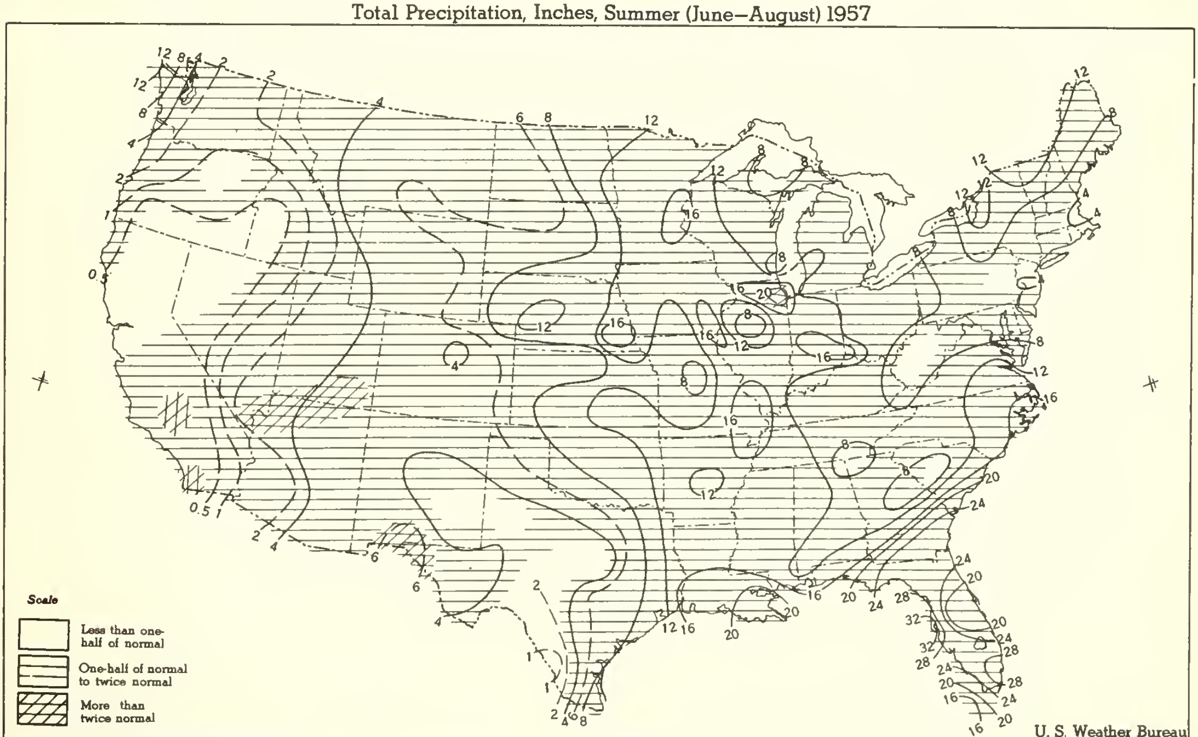
Based on preliminary telegraphic reports

Departure of Average Temperature from Normal (°F.), Summer (June–August) 1957

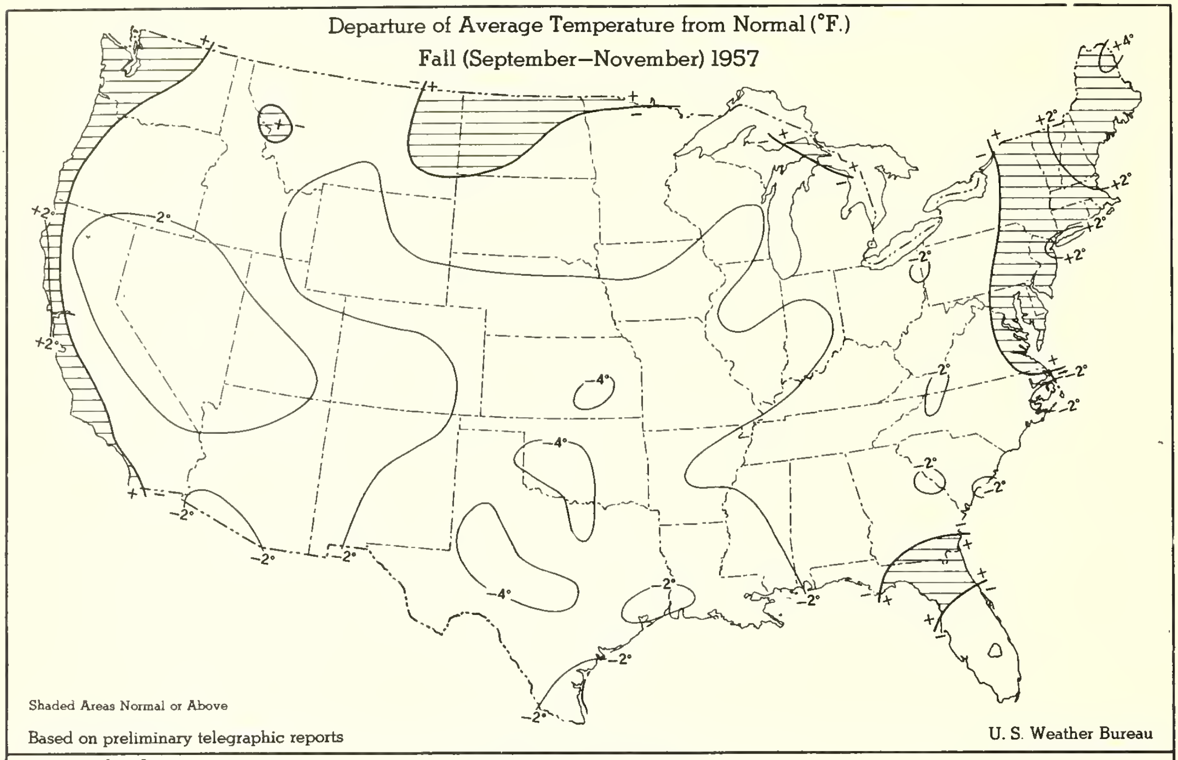


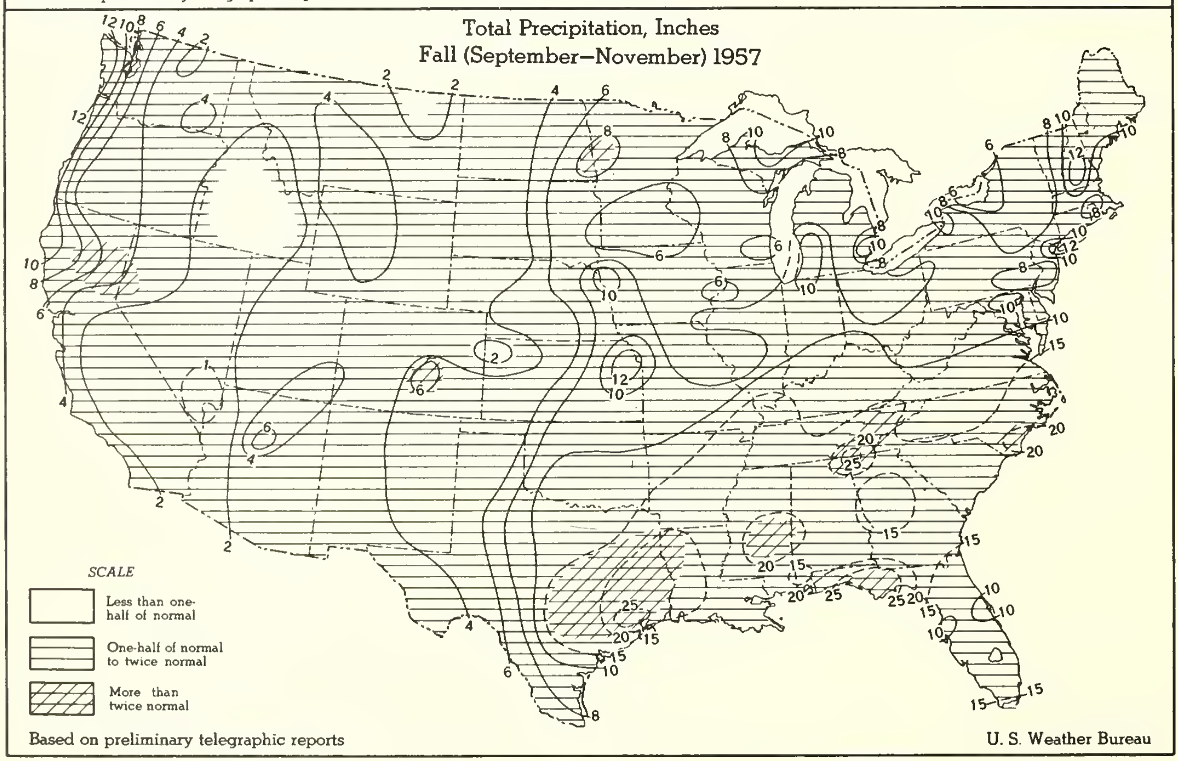
Based on preliminary telegraphic reports

Total Precipitation, Inches, Summer (June–August) 1957



Based on preliminary telegraphic reports





(From Weekly Weather and Crop Bulletin National Summary, Volume 44, 1957)

Table 1. Diseases reported in States where they had not been found or reported on a particular host until 1957[1].

Host Disease	Where found	Remarks
TRITICUM AESTIVUM (WHEAT) *Puccinia striiformis* (*P. glumarum*) (Rust)	Kansas	Found on Kansas wheat for the first time in history (PDR 42: 726).
ZEA MAYS (CORN) *Puccinia polysora* (Rust)	Arkansas	During the summer of 1957 specimens were sent in from Poinsett and Crawford Counties (PDR 42: 402).
FICUS CARICA (FIG) *Physopella fici* (Rust)	Arkansas	During the summer of 1957, fig leaves heavily infected with rust were collected from Ashley and White Counties (PDR 42: 402).
FRAGARIA spp. (STRAWBERRY) *Macrophomina phaseoli* (*Botryodiplodia phaseoli*) (Charcoal rot)	Illinois	Plants collected from Centralia area of south-central Illinois, September 29, 1957. Its importance on strawberry has not been fully evaluated (PDR 42: 107).
FRAGARIA spp. (STRAWBERRY) Aster yellows (Virus)	Michigan	Found in a field near Keeler in 1957 (PDR 42: 72).
MALUS SYLVESTRIS (APPLE) *Cephalosporium carpogenum* (Cephalosporium rot)	Pennsylvania	Fruits were taken from storage, where they had been placed immediately after harvest. First report from Pennsylvania (PDR 42: 156).
PRUNUS DOMESTICA (PRUNE) Prune dwarf (Virus)	West Virginia	Observed during the growing season of 1947 (PDR 42: 202)
PRUNUS PERSICA (PEACH) Peach mosaic (Virus)	West Virginia	Observed on Elberta peach and an unknown variety (PDR 42: 202).

[1] See also Neely, Dan. Diseases of woody hosts new to Illinois. PDR 42: 711.

Table 1. (Continued)

Host Disease	Where found	Remarks
CHLORIS VERTICILLATA Ascochyta brachypodii SETARIA LUTESCENS Cercospora setariae BOUTELOUA GRACILIS Cochliobolus bouteloua SPOROBOLUS NEGLECTUS Helminthosporium giganteum ERAGROSTIS PILOSA Helminthosporium kusanoi PANICUM SCRIBNERIANUM Septoria tandilensis ELYMUS VIRGINICUS Ustilago macrospora	Kansas	This study was made during 1956 and 1957. Seven fungi previously unreported for Kansas, were found associated with grass diseases (PDR 42: 346).
DACTYLIS GLOMERATA (ORCHARD GRASS) Corynebacterium rathayi (Rathay's disease)	Virginia	Specimens collected near Upperville May 22, 1957. Severe infections were observed in Fauquier and Loudoun Counties (PDR 41: 598).
CAMELLIA JAPONICA (CAMELLIA) Sclerotinia camelliae (Petal blight)	Texas	Specimen was received from Longview, Texas. Texas has no quarantine against the importation of potted camellias. Balled or potted camellia plants have been imported from California on many occasions (PDR 41: 547).
MUSA sp. (ORNAMENTAL BANANA PLANT) Radopholus similis (Burrowing nematode)	Louisiana	Appears to be the first report on this host in Louisiana. Other reports from sugarcane roots, and from Pothos and Philodendron in two nurseries (PDR 41: 814).
PHORADENDRON FLAVESCENS (MISTLETOE) Cercospora struthanthi (Leaf spot)	Florida	Found December 18, 1957 on the campus of the University of Florida (PDR 42: 272).
CATALPA SPECIOSA (Western catalpa) Verticillium albo-atrum (Verticillium wilt)	Kansas	Apparently the first report on this host in Kansas (PDR 41: 1054).

Table 1. (Continued)

Host Disease	Where found	Remarks
CERCIS CANADENSIS (REDBUD) *Verticillium albo-atrum* (Verticillium wilt)	Kansas	This is the second State record in the United States, the other being from Illinois (PDR 41: 1053).
PICEA SITCHENSIS (SITKA SPRUCE) *Lophodermium filiforme* (Needle cast)	Oregon	Plantations of 25-year-old Sitka spruce growing in the Coast Range have in recent years shown considerable dropping of two-year-old needles. The disease was mostly brought in on the planting stock (PDR 41: 650).
ULMUS spp. (ELM) *Ceratocystis ulmi* (Dutch elm disease)	Kansas	Found in Kansas City, Kansas on October 18, 1957, from two trees in Wyandotte County, and one tree in Johnson County. First record from Kansas, although it has been reported from Kansas City, Missouri (PDR 42: 402).
ULMUS AMERICANA (MOLINE ELM) *Verticillium albo-atrum*** (Verticillium wilt	Kansas	This is the second report of this disease on Moline elm in the United States, the other being from Illinois (PDR 41: 1053).
NICOTIANA TABACUM (TOBACCO) *Pseudomonas angulata* (Angular leaf spot)	Florida	Observed during May and June 1957 in fields of flue-cured tobacco growing near Newberry. Severe in one field. First report of angular leaf spot in State, though *P. tabacum* has been known to occur (PDR 41: 804).
ALLIUM CEPA (ONION) *Sclerotium cepivorum* (White rot)	New York	Found in two muckland onion fields near Florida, New York in June 1957. Appears to be first report from this State (PDR 41: 814).
BETA VULGARIS (SUGAR BEET) *Heterodera schachtii* (Sugar beet nematode)	South Dakota	Sugar beet roots contained many cysts and a high larval population density was found in the soil (PDR 42: 280).
CUCUMIS SATIVUS (CUCUMBER) *Cercospora citrullina* (Cercospora leaf spot)	North Carolina	During the summer of 1957 Cercospora leaf spot was observed in the field in North Carolina. It has been observed in seven counties (PDR 41: 794).

Table 1. (Continued)

Host Disease	Where found	Remarks
CUCURBITA MAXIMA (BLUE HUBBARD SQUASH) Xanthomonas cucurbitae (Bacterial leaf spot)	Washington	This is a seed-borne bacterial cotyledon spot of squash (PDR 42: 425).
CUCURBITS (CUCUMBER) (SQUASH) (WATERMELON) Pseudoperonospora cubensis (Downy mildew)	Illinois	A severe epiphytotic of downy mildew developed on the fall crop of cucumber and squash in southern Illinois. It also attacked leaves and stems of watermelon (PDR 42: 554).
LYCOPERSICON ESCULENTUM (TOMATO) Sclerotinia stem rot (Sclerotinia sclerotiorum)	Louisiana	This disease was discovered April 5, 1957 at the Plaquemines Parish Experiment Station. Weather conditions were favorable for the development of the disease (PDR 41: 643).
RADICULA ARMORACIA (HORSERADISH) Rhizoctonia solani (Rhizoctonia rot)	Connecticut	Locally grown horseradish roots developed a firm, fibrous, odorless rot in storage (PDR 42: 554).

Table 2. Diseases found or reported in this country for the first time in 1957=*; diseases found on new hosts=**, (see also footnotes[1-5]).

Host	Where found	Remarks
ORYZA SATIVA (RICE) Gibberella fujikuroi* (Bakanae disease)	Texas	At the Rice Pasture Experiment Station at Beaumont diseased rice seedlings scattered throughout the field showed symptoms similar to those of the bakanae disease in Japan. First report of this disease in the United States (PDR 41: 860).
ORYZA SATIVA (RICE) Hoja blanca* (white leaf)	Florida	Found for the first time in the U.S. near Belle Glade in September 1957. Causal agent possibly an insect-transmitted virus. All of the U.S. long-grain varieties and the common short-grain varieties were susceptible (PDR 41: 911).

Table 2. (Continued)

Host Disease	Where found	Remarks
GLYCINE MAX (SOYBEAN) Phytophthora sojae M. J. Kaufmann & J. W. Gerdemann (Root and stem rot)	Illinois Indiana Missouri North Carolina Ohio	The fungus appears distinct from previously described species of Phytophthora, and the name Phytophthora sojae n. sp. was proposed. (Phytopath. 48: 201).
STENOTAPHRUM SECUNDATUM (ST. AUGUSTINE GRASS) Puccinia stenotaphri* (Rust)	Florida	Found around the Lake Okeechobee area. Disease fairly prevalent but damage to grass seemed negligible. 1st rept. in this country (PDR 41: 650).
AEGILOPS CYLINDRICA (GOATGRASS) Tilletia contraversa** (Dwarf bunt)	Utah	Specimens were collected near Nephi, during the summer of 1955. With this addition the known host range now includes ten genera (PDR 42: 18).
LAMIUM AMPLEXICAULE (HENBIT DEADNETTLE) LUPINUS ALBUS (WHITE LUPINE) SESBANIA MACROCARPA (HEMP SESBANIA) Soybean cyst nematode** (Heterodera glycines)	Tennessee	L. amplexicaule is a member of the Labiatae and the first host reported outside of the Leguminosae. This host range is extended as a result of a series of tests in the greenhouse (PDR 42: 194).
PHLEUM PRATENSE (TIMOTHY) Puccinia poae-nemoralis** (Rust)	Wyoming	Collected in the summer of 1957 in the Grand Teton National Park. This report appears to be the first on this host (PDR 42: 533).
CITRUS LIMONIA (LEMON) Hemicycliophora sp.** (Ectoparasitic nematode)	California	Found parasitizing Rough Lemon roots in the Coachella Valley of Southern California (PDR 41: 1016).
PRUNUS CERASUS (SOUR CHERRY) Midleaf necrosis (Virus)	Oregon	Described as a new virus of stone fruits by J. A. Milbrath. Infected trees were markedly smaller in size and less vigorous than healthy trees. It has been observed in several commercial orchards in Oregon (Phytopath. 47: 637-640).
PRUNUS LYONII (CATALINA CHERRY) Coryneum beijerinckii** (Shot hole)	California	In the spring of 1956, at Fresno, a planting of Catalina cherry was found to be severely affected by a shot hole disease. The disease was found in several other locations in the State following this outbreak (Phytopath. 47: 532).

Table 2. (Continued)

Host Disease	Where found	Remarks
PRUNUS PENSYLVANICA (PIN CHERRY) Monilinia vaccinii-corymbosi** (Mummy berry)	Michigan	First report on this host (PDR 42: 71).
VACCINIUM AUSTRALE (BLUEBERRY) Armillaria mellea** (Root rot)	Michigan	First report on this (PDR 42: 71).
ABELIA CHINENSIS (ABELIA) Cercospora sp. ** (Cercospora leaf spot)	Illinois	Found near Vienna, Johnson County, on August 13. First report on this host (PDR 41: 904).
HYACINTHUS ORIENTALIS (HYACINTH) Botrytis hyacinthi** (Gray mold)	Washington	Has been found twice, in 1949 and 1956 in restricted locations. The acreage devoted to hyacinths in western Washington is small, but has been increasing during the past few years. Since climatic conditions are so favorable for Botrytis development in this area, the establishment of B. hyacinthi, should it occur, would undoubtedly be a retarding factor in the production of hyacinth bulbs in Washington (PDR 42: 534).
MALVA spp. (MALLOW) Malva yellow vein mosaic* (Virus)	California	An apparently unrecorded but widespread virus disease. It has been mechanically transmitted. The green peach aphid is a vector. The disease may be identical with the one reported on Malva plants in Europe (PDR 41: 1006).
CORNUS NUTTALLII (WESTERN FLOWERING DOGWOOD) Fusicladium sp. *	Oregon	An apparently undescribed disease affecting western flowering dogwood has been under observation for three springs in the Williamette Valley (PDR 41: 810).
ELAEAGNUS ANGUSTIFOLIA (RUSSIAN OLIVE) Verticillium albo-atrum** Verticillium wilt)	Kansas	First report on this host (PDR 41: 1053)

Table 2. (Continued)

Host Disease	Where found	Remarks
HEBE BUXIFOLIA Fusarium oxysporum f. hebae R. D. Raabe (Fusarium wilt)	California	A serious, previously unreported disease that results in the death of infected plants was found recently in a nursery in the San Francisco Bay area (Phytopath. 47: 532).
JUGLANS REGIA (PERSIAN WALNUT) Erwinia nigrifluens E. E. Wilson, M. P. Starr & Joyce A. Berger (Bark canker)	California	An apparently undescribed disease of Persian walnut was found in the Sacramento Valley in 1955. It does not seem to be prevalent in other parts of the State (Phytopath. 47: 669).
PHOTINIA GLABRA Entomosporium maculatum**	Louisiana	First report of this fungus on this host, but the disease is common on another species of Photinia in California (PDR 41: 643).
PHOTINIA SERRULATA Cercospora photinia-serrulatae L. Anzalone, Jr. & A. G. Plakidas (Cercospora leaf spot)	Louisiana	Nurserymen in Louisiana have had difficulty for several years in growing salable plants mainly because of this previously undescribed species of Cercospora (Phytopath. 47: 515).
POPULUS TREMULOIDES P. GRANDIDENTATA and HYBRIDS Plagiostoma populi Cash & Waterman	Massachusetts	A new species of Plagiostoma associated with a leaf disease of hybrid aspens. Severe outbreak occurred in 1954 (Mycologia 49: 756-760).
TEUCRIUM FRUTICANS (BUSH GERMANDER) UMBELLULARIA CALIFORNICA (CALIFORNIA LAUREL) JUNCUS LESEURII (SALT RUSH) Meloidogyne hapla** (Root-knot nematode)	California	Found in localities that have never been under cultivation. Both of these plants are native to California soils which would suggest that M. hapla may also be native to the State (PDR 41: 770).
GOSSYPIUM (COTTON) New virus disease	Texas	Symptoms were found on almost all the 5000 Deltapine and Empire cotton plants in the greenhouse at Brownsville. The virus was transmitted by grafting to healthy Empire plants but not, apparently, by seed (PDR 41: 726).

Table 2. (Continued)

Host Disease	Where found	Remarks
SESAMUM INDICUM (SESAME) *Verticillium albo-atrum*** (Verticillium wilt)	New Mexico	*V. albo-atrum* caused a severe wilt of sesame growing in infested soil at the Agricultural Experiment Station. This is apparently the first published record of the disease on sesame in the United States (PDR 41: 803).
APIUM GRAVEOLENS (CELERY) *Colletotrichum* sp. (Anthracnose)	Florida	A new disease of celery in Florida is described. Tribasic copper sulfate provided excellent control. The causal fungus was similar to *C. truncatum* (R. S. Cox. PDR 41: 790).
BRASSICA RAPA (TURNIP) *Verticillium albo-atrum*** (Verticillium wilt)	Kansas	Apparently the first record on this host (PDR 41: 1053).

[1] Costa, A. S. and James E. Duffus. Observations on lettuce mosaic in California. PDR 42: 583. Studies with the lettuce mosaic virus showed that its host range included a number of previously unreported weed hosts, which may serve as an additional source of virus for lettuce growing in nearby areas.

[2] Coursen, B. W., R. A. Rohde and W. R. Jenkins. Additions to the host lists of the nematodes *Paratylenchus projectus* and *Trichodorus christiei*. Of 101 plant species and varieties tested, 89 were found to be hosts of the pin nematode, *P. projectus*. The known host range of the stubby-root nematode, *T. christiei*, was extended with the addition of 66 more plant species and varieties. PDR 42: 456.

[3] Hooper, B. E. Plant-parasitic nematodes in the soils of southern forest nurseries. PDR 42: 308. New host records are reported for *Meloidodera floridensis*, *Pratylenchus brachyurus*, *Tylenchorhynchus claytoni*. An undescribed species of *Tylenchorhynchus* was found parasitizing *Pinus elliottii*.

[4] Meiners, J. P., and J. R. Hardison. New host records for dwarf bunt in the Pacific Northwest. II. PDR 41: 983-985. 1957. Seven grass species, infected with the dwarf bunt fungus, *Tilletia contraversa* in the Pacific Northwest were reported as additions to the world list of grass hosts for dwarf bunt. For the first time in North America dwarf bunt was found on *Agropyron repens*.

[5] Rogerson, Clark T. Diseases of grasses in Kansas: 1956-1957. PDR 42: 346. Twenty-one new Kansas host records were obtained.

GENERAL

E. B. Cowling has presented a partial list of fungi associated with decay of wood products in the United States (PDR 41: 894).

Frank P. McWhorter and W. C. Cook reported the hosts and strains of pea enation mosaic virus in Oregon (PDR 42: 51).

R. R. Nelson reported results of preliminary studies on the host range of witchweed, Striga asiatica, made in North Carolina mainly to determine whether the form of the parasite present in the United States and that in the Eastern Hemisphere differ or are similar in host specificity (PDR 42: 376).

The "most probable number" method for estimating populations of plant pathogenic organisms in the soil was reported by Otis C. Maloy and M. Alexander in New York. The method has been adapted to the estimation of populations of two plant pathogenic fungi, Fusarium solani f. phaseoli and Thielaviopsis basicola, in the soil. Good agreement was observed between estimates of populations based on plate counts of the spore suspensions used to infest sterile soil and estimates made by the "most probable number" method (Phytopath. 48: 126).

In New Jersey, Reed A. Gray reported the translocation of antibiotics in plants (Phytopath. 48: 71).

The antibiotic Cytovirin was effective against several plant viruses in tests reported by Reed A. Gray (PDR 41: 576).

J. D. Panzer and R. D. Beier, at Fort Detrick, Maryland, described an improved method of using a tent for field inoculation of test plants (PDR 42: 172).

N. R. Gerhold and R. D. Barmington, at the Colorado A & M Agricultural Experiment Station, described a planter for use on experimental plots. For plant pathological investigations, they pointed out, it is important that seeding rates be adequate and uniform when evaluating seed treatment, soil treatments and variety trials. Since present day commercial planters will not do precision work on small experimental plots, they devised this planter to serve such needs (PDR 41: 227).

In Missouri, M. N. Rogers reported a small electrical hygrometer for microclimate measurements. This remote reading instrument removes almost negligible quantities of moisture from the air during operation and may be used in still air or in small inclosed spaces. Full details regarding its construction, calibration, and use are given (PDR 41: 897).

In the Crops Research Division, at Beltsville, Maryland, E. B. Lambert reported a technique for transferring inoculum through a flame, devised to reduce contamination during the transfer of cultures into wide mouth bottles. The cotton plugs should be moistened generously with water spray before the transfers are begun (PDR 41: 903).

In an inoculation technique described by J. D. Panzer and others at Fort Detrick, Maryland, inoculum is dispersed by means of an explosive charge coupled to an electrical ignition device. A clock adapted so that an electrical contact would be made every hour for a period of 24 hours enables the investigator to make field or greenhouse inoculations during his absence. This method has proven successful for greenhouse inoculation and should be adaptable for field inoculations during periods of darkness and during adverse weather conditions (PDR 41: 225).

J. A. West recommended some changes in recovery techniques for the burrowing nematode, Radopholus gracilis, in Florida (PDR 41: 600).

A. L. Taylor and others described a new technique for preliminary screening of nematocides in the laboratory. Tests are reproducible within reasonable limits and comparisons with standard chemicals can be made (PDR 41: 530).

R. P. Esser described an improved technique for handling nematode samples from Baermann funnels (PDR 41: 269).

B. B. Stoller described a method of separating and concentrating nematodes from field samples. He remarked that since nematodes destroy an estimated 10 percent of the nation's crop annually, it is to be expected that considerable effort would be spent in developing tests for detecting, separating, and concentrating nematodes in soil samples (PDR 41: 531).

G. K. Parris reported that the cause of decline of turf grass, ornamentals, cotton, and pecan in Mississippi is often demonstrated to be due to attack by plant endo- and ectoparasitic nematodes, including Tylenchorhynchus spp., Trichodorus spp., Rotylenchus spp., Criconemoides spp., Hoplolaimus spp., Xiphinema spp., Paratylenchus spp., and Pratylenchus spp. (PDR 41: 705).

John P. Hollis has given specifications for ideal nematocides (PDR 42: 291).

D. Davis and S. Halmos reported the effect of gibberellin on plant disease (PDR 41: 890).

DISEASES OF CEREAL CROPS

Results of the 1956-57 small grain disease surveys in South Carolina were reported by R. W. Earhart (PDR 41: 863).

Diseases of small grains observed in Georgia during the 1956-57 season were reported by Luther L. Farrar and U. R. Gore (PDR 41: 986).

C. O. Johnston and M. D. Huffman pointed out evidence of local antagonism between the organisms causing oat crown rust, Puccinia coronata var. avenae, and wheat leaf rust, P. recondita (P. rubigo-vera tritici) (Phytopath. 48: 69).

H. H. McKinney described a method for maintaining soil-free naturally infectious cultures of soil-borne viruses of wheat mosaic and of oat mosaic (PDR 41: 254). McKinney and others reported that studies on natural inoculation with soil-borne wheat and oat viruses and on chemical control and carry-over suggest a microscopic soil inhabitant as vector for these viruses (PDR 41: 256).

Strains of the cereal yellow-dwarf virus, differentiated by means of the apple-grain and the English grain aphids, were reported by H. V. Toko and G. W. Bruehl (Phytopathology 47: 536).

The host range of two strains of the cereal yellow-dwarf virus was reported by G. W. Bruehl and H. V. Toko (PDR 41: 730).

Thomas C. Allen Jr. reported that barley yellow dwarf virus is widely distributed. Since it has been described so recently only a limited amount of research has been done to determine the presence of strains of this virus. Upon inoculation of 31 cereal varieties with barley yellow-dwarf isolates, varietal differences in symptom expression were noted. The capacity of the virus to cause stunting and discoloration of the hosts was used to differentiate strains. No evidence of natural mixtures was found in the 16 strains described (Phytopath. 47: 481).

D. M. Stewart and others reported physiologic races of Puccinia graminis in the United States in 1957. Twenty-seven races and subraces of wheat stem rust (Puccinia graminis var. tritici) were identified in 1059 isolates obtained from 668 uredial collections. Race 15B comprised 32 percent of the isolates. From 415 collections of oat stem rust (P. graminis var. avenae), 522 uredial isolates were identified. Race 7 comprised 59 percent of the isolates. A new subrace, provisionally designated as 13A, was isolated from a uredial collection made in New York. This is the most virulent culture of oat stem rust now known in the United States and can attack commercially grown varieties of oats with all three types of stem-rust resistance (PDR 42: 881).

S. M. Pady and C. O. Johnston reported cereal rust epidemiology and aerobiology in Kansas in 1957. The long, cool, moist spring of 1957 in Kansas was marked by the third heaviest recorded epiphytotic of leaf rust (Puccinia recondita) and by moderately heavy infections of stem rust (P. graminis tritici) of wheat and crown rust (P. coronata) of oats. Stripe rust (P. striiformis) was found on Kansas wheat for the first time in history. Heavy spore showers, frequent rains, and favorable temperatures resulted in extensive rust development with leaf rust causing an estimated loss of 10 percent, stem rust of wheat 3 percent, crown rust of oats 5 percent, and stem rust of oats 1 percent (PDR 42: 726).

Laurence H. Purdy reported results of seed treatment tests using some of the new fungicides for control of oat loose smut (Ustilago avenae) and barley covered smut (U. hordei) in in the Pacific Northwest (PDR 42: 233).

Nematode genera found in the vicinity of small grain roots in Georgia were listed by L. L. Farrar. Pratylenchus sp. was most frequently observed (PDR 41: 703).

AVENA SATIVA. OATS: S. S. Ivanoff and others reported oat diseases in Mississippi. Fungus diseases on oats in Mississippi developed to unprecedented proportions during the 1956-1957 season, as a result of very favorable conditions of temperature, moisture, and relative humidity (PDR 42: 520).

In the Florida Agricultural Experiment Station nursery at Quincy, H. H. Luke and others reported that heavy infection of oats by Erysiphe graminis var. avenae did not severely reduce grain yield when the attack was arrested by hot weather before the early heading stages. Forage yield, however, was reduced by 40 to 50 percent. All Red Rustproof types proved highly resistant; Victorgrain appeared to carry one or more genes for resistance (PDR 41: 842).

Puccinia coronata var. avenae, crown rust, over the years has been the most serious disease of oats in the major oat growing regions in the United States, and the only practical means of control has been through the development of resistant varieties. Landhafer races of crown rust were widely reported in 1957, according to M. D. Simons and others, who discussed sources and means of developing resistance to meet the potential threat (PDR 41: 964). M. D. Simons described four new races of crown rust and listed the races identified in the United States in 1957 (PDR 41: 970).

Puccinia graminis var. avenae, stem rust. J. A. Browning reported that eight strains from the World Collection of Oats appeared to be new sources of resistance to the common oat stem rust races 7, 7A, and 8, and also to the rare but potentially important races 6 and 13A. The combined resistance of these oat strains to these five races indicated they may contain one or more new genes for stem rust resistance (PDR 42: 948).

A. L. Hooker compared various techniques for inoculating oat plants with Septoria avenae and described methods of measuring varietal reaction to infection (PDR 41: 592). Three hundred sixty-one oat varieties or new experimental selections were artificially inoculated with S. avenae in replicated experiments at Madison, Wisconsin in 1957, according to A. L. Hooker. The oat strains varied widely in degree of infection. Several had low disease scores (PDR 42: 20).

Red leaf (virus). A new oat disease called red leaf has appeared recently in Maine and threatens to become a major problem in oat production, according to C. A. Blackmon. Grain yield and quality are adversely affected when the plants are infected in early stages of growth. None of the old or new varieties grown in Maine appear resistant to the disease. The virus is transmitted by the apple-grain aphid (Rhopalosiphum prunifolia) to oats, barley and wheat. Other insects transmitting this disease are corn aphids, English grain aphids, grass aphids and greenbugs (Maine Farm Research 5(2): 18. July 1957).

R. W. Earhart reported that "yellow chlorosis" was found in seven of the Piedmont Counties of South Carolina. The leading variety currently being grown in the State appears to be peculiarly susceptible to this particular chlorosis (PDR 42: 279). According to W. P. Byrd, R. W. Earhart, and E. B. Eskew the cause has not been determined. Under greenhouse conditions they reproduced the symptoms by growing susceptible oat plants in soil that had been artificially infested with Helminthosporium spp. isolated from plants showing this particular chlorosis (PDR 42: 517-520). A similar chlorosis, reported from Georgia under the name "yellow leaf" by L. L. Farrar and U. R. Gore, was considered to be due to a virus (PDR 41: 986-987).

HORDEUM VULGARE. BARLEY: Ustilago nuda, loose smut. J. G. Moseman and D. A. Reed studied the effects of vernalization on the incidence of loose smut on different varieties of barley (PDR 42: 744).

At Kansas State College, R. E. Hampton and others described a method for determining the presence of the stripe mosaic virus in barley seed lots by means of greenhouse testing under optimum temperatures and light intensities for symptom expression. The technique described would be satisfactory for the elimination of heavily infected seed lots during certification (PDR 41: 735).

ORYZA SATIVA. RICE: E. P. Van Arsdel and others reported that the use of colored smoke to indicate movement of air in a rice paddy offered considerable promise in relating the spread of fungus spores to paths of air movement (PDR 42: 721).

Piricularia oryzae, blast. R. J. Volk and others reported results of a quantitative study of the relationship between the silicon content of leaves of Caloro rice and their susceptibility to infection by P. oryzae. They found silicon content and susceptibility to be related inversely. The susceptibility of each leaf is greatest as it emerges; with advancing age the susceptibility diminishes until virtually complete resistance is attained. Both the silicon content and the degree of susceptibility of the leaf at any moment are related to the amount of silicate in the roots. (Phytopath. 48: 179). V. E. Green, Jr. reported observations on fungus diseases of rice in Florida 1951-1957. He stated that of the fungus diseases affecting rice in Florida during the past 7 years, only blast was serious (PDR 42: 624).

R. P. Kahn and J. L. Libby reported the effect of environmental factors and plant age on the infection of rice by Piricularia oryzae. Greenhouse-grown plants were more susceptible than field-grown plants of the same age (Phytopath. 48: 25).

SORGHUM spp. SORGHUM: R. W. Leukel and O. J. Webster summarized results of the 1957 sorghum seed-treatment tests (PDR 41: 992).

Sphacelotheca sorghi, kernel smut. C. H. Hsi reported that although studies have repeatedly shown that environmental conditions influence infection of sorghum by the covered-kernel smut fungus during the pre-emergence period, the relationship between post-emergence conditions and infection is as yet insufficiently understood. Under drouth conditions in eastern New Mexico in 1953, the time of post-emergence irrigation was observed to have affected the amount of infection. Early irrigations resulted in considerably more disease than did late irrigations. High temperatures following planting resulted in less smut than did moderate temperatures, regardless of soil-moisture conditions existing before or after emergence (Phytopath. 48: 22).

TRITICUM AESTIVUM. WHEAT: H. R. Powers, Jr. studied conditions associated with the unusually severe attack of powdery mildew, Erysiphe graminis f. sp. tritici, on winter wheat in the Southeast during 1956-57 (PDR 41: 845).

Circumstances accompanying unusual prevalence of stripe rust, Puccinia striiformis (P. glumarum) on wheat, from south to north in the Great Plains region including even some States where it had not been noticed previously, are described in reports by M. C. Futrell, from Texas; H. C. Young, Jr. and L. E. Browder, Oklahoma; S. M. Pady and others, Kansas; J. M. Daly, Nebraska; J. G. Hennen, South Dakota; E. A. Lungren, Colorado; and J. R. Vaughn, Wyoming (PDR 41: 955).

In Colorado, L. J. Petersen and others pointed out that the collection of urediospores of Puccinia graminis tritici, P. recondita, and other rusts in adequate quantities frequently presents a problem to plant pathologists. They described two spore collecting devices: one, a wheel-mounted, gasoline-powered pump unit, the other, a portable electric vacuum cleaner unit powered by two flash light batteries. These are capable of collecting several hundred milligrams of urediospores per hour (PDR 41: 973). In the October 1957 report of the Plant Disease Warning Service it was noted that cereal rusts were becoming established in parts of the southern United States and northern Mexico. These infections result from spores blown southward from the spring wheat area of the United States and Canada and from any rust which survived the hot, dry summer months in these southern regions. From these early infections on volunteer cereals, the rusts could spread to recently emerged seedlings of the 1958 crop and to susceptible wild grasses. Those infections surviving the winter would provide rust inoculum for northward spread by spring winds.

Puccinia graminis tritici, stem rust. Infection type reaction of several wheat varieties to stem rust was altered by spraying with DDT, in experiments discussed by K. R. Bromfield and R. G. Emge in Maryland (PDR 42: 354). R. G. Hacker and J. R. Vaughn reported on 1957 field tests of cycloheximide derivatives for control of black stem rust at the Wyoming Experiment Station. The tests resulted in excellent control, with mean yields as much as 60 percent higher than those of non-treated checks. The degree of control was related directly to the amount of material applied (PDR 42: 609).

Puccinia recondita (P. rubigo-vera tritici), leaf rust. In 218 collections of this pathogen on wheat received at the Kansas Agricultural Experiment Station in 1956 from 22 States, 23 races were identified. Physiologic race 122 was the most abundant and widely distributed race, displacing race 5 which had been most prevalent for many years. Races 11 and 1 were the most important ones in the northwestern area, and race 11 was also abundant in Texas. As usual, race 58 was the most abundant one in the area around the Great Lakes (C. O. Johnston, PDR 41: 853).

According to W. C. Haskett and C. O. Johnston, one or two spray applications of certain fungicides reduced infection by both leaf and stem rust of wheat in experiments conducted in Kansas during a 3-year period. Fungicides are not recommended for large scale control but could be used to protect seed wheat fields (PDR 42: 5).

In Illinois, H. M. Hilu and Wayne M. Bever reported inoculation, oversummering, and suscept-pathogen relationship of Septoria tritici on Triticum species (Phytopath. 47: 474).

Laurence H. Purdy summarized the 1957 seed treatment tests for control of common bunt (Tilletia caries and T. foetida) of winter wheat in the Pacific Northwest for the year 1957. Relatively good control of seed-borne and soil-borne common bunt was obtained in all tests with the HCB formulations and in three of the five types of tests with PCNB (PDR 41: 976). In the Pacific Northwest, E. L. Kendrick and C. S. Holton reported that pathogenic specialization in Tilletia caries and T. foetida is the major factor contributing to the problem of controlling smut by growing resistant varieties. Upwards of 500 collections of smut, representing 3 crop years, were tested during the period 1954 through 1957, and only two new races were identified (PDR 42: 15).

Tilletia contraversa, dwarf bunt, in winter wheat occurs sporadically in almost all of the wheat-growing areas of the Pacific Northwest. The soil-surface application of hexachlorobenzene in localized areas of heavy infestation has been found to control dwarf bunt of winter wheat effectively, particularly if the application is made 4 weeks after emergence, according to L. H. Purdy (PDR 41: 916).

In Indiana, a culture of loose smut (Ustilago tritici) maintained at Purdue University since 1938 is distinct from the previously described races. T. A. Gaskins and others have designated this race 20. Because of its narrow host range, this race is not of economic importance (PDR 41: 975). In Texas, D. E. Weibel reported studies on the control of loose smut of wheat (PDR 42: 737).

Viruses. A. H. Gold and others concluded that the electron microscope is an important aid in determining virus relationships in wheat and other monocots (PDR 41: 250).

Barley stripe mosaic (virus). T. J. Army and others compared the phosphorus content of healthy plants with that of plants infected with the barley stripe mosaic in eight spring wheat varieties in Montana (PDR 42: 747).

Mosaic (virus). W. H. Sill, Jr. and C. L. King reported an epiphytotic of soil-borne wheat mosaic in winter wheat in Kansas. Approximately 347,000 acres of wheat were diseased. Estimated losses were 2,082,000 bushels, worth approximately $3,950,000. Estimates of loss in diseased fields varied from 5 to 12 bushels per acre. In all tests in infested soil the highly resistant variety Concho was first in yield even though badly lodged (PDR 42: 513).

Wheat streak mosaic (virus). G. W. Bruehl and H. H. Keifer, reporting observations on this disease, stated that its erratic appearance in Washington over a wide area indicated the existence of an unknown grass host (or hosts) where the virus and the mite persist in trace amounts. So far this disease has been of minor importance, but its existence in the State poses a constant threat. The ability of the mite to "come from nowhere" and thoroughly infest and infect 180 acres of wheat, as in Spokane County in 1957, illustrates the potential danger from wheat streak mosaic in Washington (PDR 42: 32).

ZEA MAYS. CORN: In North Carolina, as a result of germination tests, T. E. Smith and J. P. Bailes found that the rolled-towel cold test method was valuable in estimating seed corn vitality (PDR 42: 734).

At the University of Wisconsin, captan proved superior to arasan for corn seed treatment in tests reported by Paul E. Hoppe (PDR 41: 857).

In Minnesota, J. E. DeVay and others reported methods of testing for disease resistance in the corn disease nurseries at St. Paul and gave results of comparisons of 110 lines of corn for resistance to diseases important in the North Central Region (PDR 41: 699).

In experiments conducted at Madison, Wisconsin in 1957 Paul E. Hoppe investigated correlation between germination obtained in laboratory cold tests of seed corn and the subsequent stands in the field. The results showed a high correlation between laboratory and field results, provided further evidence that laboratory cold tests enable the detection of inferior seed quality that is not so apparent in standard germination tests, and indicated exceptional field responses to good seed treatment (PDR 42: 367).

Bacterium stewartii, bacterial wilt. In J. J. Natti's trials of seed treatment with various antibiotics to control bacterial wilt of corn no material gave effective control without causing injury to seedlings (PDR 42: 953).

A bacterial stalk rot (Erwinia sp.) has been observed following extensive overhead irrigation of corn at several locations in North Carolina, according to Arthur Kelman and others. The causal organism can also cause a pith decay of tobacco, soft rot of potato tubers, carrots, squash, cucumbers, cabbage and onions (PDR 41: 798).

Merle E. Michaelson reported that stalk rot of corn caused by Diplodia zeae and Gibberella zeae reduced yielding ability of corn from 3 to 18 percent over a 3-year period. Yields varied with the variety of corn, the pathogen, the number of infections, the part of plant infected, and the year. Stalk rot was greater in smutted plants and in plants with leaves removed prior to inoculation than in the controls. There was more rot in corn grown in the greenhouse at 85° than at 65°F. Corn was most susceptible to stalk rot when inoculated just before time of pollen production and thereafter (Phytopath. 47: 499).

Helminthosporium spp., leaf diseases. In Indiana, P. R. Jennings and A. J. Ullstrup made a histological study of three leaf diseases of corn caused by species of Helminthosporium that occur throughout most of the eastern half of the United States as well as in other corn-producing areas of the world. Northern corn leaf blight, Helminthosporium turcicum, and southern corn leaf blight, Cochliobolus heterostrophus (H. maydis), are of appreciable economic importance. Race I of H. carbonum, which causes Helminthosporium leaf spot, is the most virulent of these pathogens, but it is of minor practical consequence because only a few inbred lines are susceptible and resistance is governed by a single dominant gene (Phytopath. 47: 707).

Helminthosporium maydis, southern corn leaf blight, became abundant in localized areas in south central Indiana by August 15. In early September the disease was found 25 miles north of Lafayette, which is the northernmost point that the disease has ever been observed to occur naturally in the State (A. J. Ullstrup, PDR 42: 373).

Helminthosporium turcicum, northern corn leaf blight, was widely distributed in southern Indiana by the first week in September. Observations in some of the same fields made in early October showed a marked increase in severity of the disease. This probably had little effect on the yield, since most corn was fully mature by the end of September (A. J. Ullstrup, (PDR 42: 373).

Puccinia polysora, southern corn rust, was present in four counties in Indiana in 1957. This report made by A. J. Ullstrup is the second of the occurrence of southern rust in Indiana and the first record of the development of the telial stage of the fungus in the State (PDR 42: 373). This rust on field corn was found for the first time in the Everglades area of Florida in May 1957. Above normal rainfall and high temperatures during April and May in the Belle Glade area produced favorable conditions for its development in 1957 (PDR 41: 856). During the summer of 1957 field corn specimens infected with P. polysora were sent in from Poinsett and Crawford Counties in Arkansas. Identification of the rust as P. polysora was made by George B. Cummins of Purdue University. Judging from the location of the counties in which it was found and other observations on prevalence of rust on corn throughout the State it is likely that P. polysora was rather widely distributed within the State (J. L. Dale, PDR 42: 402).

R. R. Nelson's investigations on the growth and development of witchweed (Striga asiatica) indicated that soil type and soil temperature will be among the important limiting factors in the potential spread of this phanerogamic parasite (PDR 42: 152).

Ustilago maydis, smut. An estimate of the incidence of corn smut and of the effects of the disease on yields in Indiana in 1957 was reported by T. A. Gaskin and A. J. Ullstrup. Incidence was judged to be average or slightly less than average. An estimated loss of 0.41 percent in a 230-million bushel crop, would amount to about 943 thousand bushels (PDR 42: 374).

ZEA MAYS var. SACCHARATA: SWEET CORN: Bacterium stewartii, bacterial wilt. Streptomycin, Terramycin, tetracycline, indoleacetic acid, 2, 4, 5-trichlorophenoxyacetic acid, and sodium borate applied in water solutions or suspensions to Golden Bantam sweet corn seeds reduced the severity of Stewart's bacterial wilt on the subsequent seedlings. Generally, the most effective concentrations in reducing wilt produced phytotoxic symptoms on the seedlings (L. E. Williams, PDR 41: 919).

Pythium graminicola obtained from diseased roots of Wisconsin 23 sweet corn grown in southern California caused a root rot on five varieties of sweet corn in greenhouse experiments. In the field root rots occurred primarily on the early-maturing varieties when grown in late summer. (D. C. Erwin and J. W. Cameron, PDR 41: 988).

Wheat streak mosaic (virus) was reported to have occurred in epiphytotic proportions in sweet corn in southwestern Idaho. Tests of selected strains of the F_1 hybrid Golden Cross Bantam and related inbreds revealed a wide variation in susceptibility. It seems probable, therefore, that resistant strains can be developed, according to A. M. Finley (PDR 41: 589).

DISEASES OF FORAGE AND COVER CROPS

Observations reported by E. A. Curl and H. A. Weaver indicated that sprinkler irrigation favors occurrence of diseases of forage crops in the Southeast (PDR 42: 637).

A survey was made of winter-injury to forage crops in Alaska and Yukon in 1956, according to J. B. Lebeau and Charles E. Logsdon. The low-temperature pathogens isolated were Sclerotinia borealis, Plenodomus meliloti, Typhula idahoensis and an unidentified basidiomycete, the principal snow-mold pathogen in western Canada. This basidiomycete had not previously been found elsewhere. Many additional organisms were noted, including several Fusarium spp. Much of the winter-killing of herbaceous plants in Alaska and Yukon was caused by these fungi, but it was noted that Medicago falcata survived the winter conditions better than any other forage crop (Phytopath. 48: 148).

Nematodes associated with Minnesota crops, identified from soil samples from fields of alfalfa, flax, peas, and soybeans, were reported by D. P. Taylor and others. Most commonly identified were species of the genera Xiphinema, Tylenchorhynchus, Helicotylenchus, Paratylenchus, and Pratylenchus. In addition nematodes of the genera Aphelenchoides, Aphelenchus, Criconemoides, Ditylenchus, Heterodera, Hoplolaimus, Meloidogyne, Boleodorus, Neotylenchus, Nothotylenchus, Psilenchus, Rotylenchus, Trichodorus, and Tylenchus, were found (PDR 42: 195).

GRASSES

Wild grasses as possible alternate hosts of "hoja blanca" (white leaf) disease of rice were reported by V. E. Green, Jr. and J. R. Orsenigo in Florida. Symptoms were noted particularly in Echinochloa crusgalli, E. colonum, E. walteri, Brachiaria plantaginea, Panicum capillare, Oryza sativa (var. red rice), and were especially conspicuous in Sacciolepis striata (PDR 42: 342).

In Pennsylvania, Samuel W. Braverman reported leaf streak, due to Scolecotrichum graminis, of orchardgrass, Dactylis glomerata, timothy, Phleum pratense, and tall oatgrass, Arrhenatherum elatius. This organism causes a foliar disease of numerous grasses throughout the United States, South America and Europe. Several experiments involving cross inoculations to orchardgrass and timothy indicated that S. graminis from orchardgrass is pathogenic only to that host whereas S. graminis from timothy is pathogenic to both orchard grass and timothy (Phytopath. 48: 141).

At the Washington State College a host range study of two Washington strains of cereal yellow-dwarf virus showed that many grasses are hosts, but that considerable variation in host range exists, both between the Washington strains and in comparison with the host range reported in California. Examples of these variations in host range are smooth brome (Bromus inermis), immune to both Washington strains, susceptible in California; timothy (Phleum pratense), susceptible to both Washington strains, immune in California; and Poa spp., susceptible to one Washington strain, immune to the other (G. W. Bruehl and H. V. Toko, PDR 41: 730).

DIGITARIA SANGUINALIS. CRABGRASS: Ustilago syntherismae, smut. Plants of large crabgrass were observed to be infected with this smut at several locations in Indiana. Timothy A. Gaskin investigated the life cycle of the fungus and described the disease symptoms on the crabgrass (PDR 42: 735).

PASPALUM DILATATUM. DALLISGRASS: Claviceps paspali, ergot, is an omnipresent disease of Dallisgrass in the South, according to Homer D. Wells and others. It is a limiting factor in the commercial production of Dallisgrass seed in the United States. Burning dormant Dallisgrass stubble seems to be effective for inactivating ergot sclerotia. This should aid in producing an early seed crop of Dallisgrass in the southeastern United States (PDR 42: 30).

POA PRATENSIS. BLUEGRASS: Helminthosporium sativum was found to be the principal disease organism affecting bluegrass turfs in eastern Nebraska in 1956. The symptoms of the disease were found to vary greatly with temperature and moisture. Results from greenhouse studies and the findings from surveys of diseased lawns suggest that control might be gained through fungicidal sprays and employment of those cultural operations that permit the greatest amount of drying of the foliage without being harmful to the maintenance of a fine turf (Phytopath. 47: 744).

STENOTAPHRUM SECUNDATUM. ST. AUGUSTINE GRASS: Piricularia grisea, gray leaf spot, is very destructive in Florida during the summer months, particularly during periods of heavy rainfall and high humidity, according to Isaac Malca M. and J. H. Owen (PDR 41: 871).

LEGUMES

CORONILLA VARIA. CROWN VETCH: Cercospora rautensis. During June 1957, many fungi, including some pathogens, were found to be associated with crown vetch in central Pennsylvania. Cercospora appeared to be the most damaging. The species was tentatively identified as C. rautensis (J.H. Graham & K. E. Zeiders, PDR 41: 925).

CROTALARIA SPECTABILIS. RATTLE-BOX: In Florida, H. W. Ford and Chancellor I. Hannon questioned the advisability of using C. spectabilis as a cover crop in the burrowing nematode (Radopholus similis) eradication program because it was found to harbor the nematode (PDR 42: 461).

GLYCINE MAX. SOYBEAN: K. W. Kreitlow and others compiled a bibliography of viruses infecting soybean (PDR 41: 579).

Corynespora cassiicola, root and stem rot, was found to cause a previously undescribed disease of soybean in Nebraska in 1954. Field surveys and experiments suggested that a soil temperature above 19° to 21°C arrests the development of the disease before it causes any appreciable damage. The pathogen overwinters on infected roots and stems and can survive in infested, unsterilized soil for at least 2 years. Incidence was highest in fields where soybean had been planted for 2 successive years (M. G. Boosalis and R. I. Hamilton, PDR 41: 696).

Heterodera glycines, soybean cyst nematode, has been found in six States. Since this nematode threatens soybean production in infested areas, resistance to it would be of great value to growers, according to J. P. Ross and C. A. Brim. During the spring of 1957 approximately 2800 selections and varieties of soybean were evaluated for resistance by means of a double-row planting method. The results indicated that resistance to the soybean cyst nematode is available within our present soybean germ plasm (PDR 41: 923).

S. G. Lehman reported that four new races of the downy mildew fungus (Peronospora manshurica) were obtained from collections of infected soybean seed harvested in North Carolina. The new races are designated 3A, 5, 5A, and 6. The reaction of 37 varieties of soybean to each of these new races was determined (Phytopath. 48: 83).

Bud blight caused by tobacco ringspot virus. Ringspot was transmitted from tobacco to soybean and from soybean to soybean by Melanoplus differentialis and by a mixture of M. mexicanus and M. femur-rubrum. The length of time the grasshoppers fed on healthy soybean plants had a marked effect on percentage of plants infected. Because of their feeding habits and the manipulation necessary to obtain 1.2 percent infection of soybean plants, grasshoppers are not considered to be important vectors of tobacco ringspot (J. M. Dunleavy, Phytopath. 47: 681).

John Dunleavy reported that a previously undescribed virus disease, similar to bud blight, was observed on soybean in 1955 and 1956. Cross-protection tests and a study of host range showed that it was not due to tobacco ringspot virus. The virus occurred on Setaria viridis and Melilotus alba near fields with infected soybean plants. Its host range was the same as that of cucumber mosaic-virus, with the exception of certain members of the Leguminosae, when tested on 28 genera of plants in 12 families. The virus was transmitted through seed of soybean in three separate tests (Phytopath. 47: 519).

LOTUS CORNICULATUS. BIRDSFOOT TREFOIL: Charles R. Drake reported diseases of birdsfoot trefoil observed in six southeastern States in 1956 and 1957. Rhizoctonia foliage blight proved the most damaging (PDR 42: 145).

LUPINUS spp. LUPINES: According to M. K. Corbett, the principal virus disease of blue, yellow and white lupines grown for seed and forage in the southeastern United States is caused by strains of bean yellow mosaic virus. The main field sources of the virus in northern Florida are the sweetclovers that grow as perennials (Phytopath. 48: 86).

LUPINUS ANGUSTIFOLIUS. BLUE LUPINE: The discovery of resistance to the gray leafspot disease (Stemphylium solani) in strains of blue lupine was reported by Ian Forbes, Jr., and others. An artificial greenhouse inoculation technique is described which appears to be satisfactory for use in breeding forage varieties carrying resistance to gray leafspot (PDR 41: 1037).

MEDICAGO SATIVA. ALFALFA: Kirk L. Athow reported that the seedling stands from Arasan-treated and untreated seed of 64 lots of alfalfa and 61 lots of red clover were compared in field plantings. The stands of approximately 14 percent of the alfalfa lots and 5 percent of the red clover lots were significantly increased by seed treatment. Lots germinating poorly were benefited no more than were the better germinating lots. The highest yields were usually obtained at the heavier seeding rates (Phytopath. 47: 504).

Observations on the influence of weather conditions upon severity of some diseases of alfalfa and red clover were reported by D. A. Roberts. Black stem, Ascochyta imperfecta, and northern anthracnose, Kabatiella caulivora, caused relatively heavy losses of first-harvest hay in central New York when rainfall during the preceding autumn had been adequate to insure abundant production of inoculum, when at least 0.01 in. of rain fell during each of 18 days in May, and when mean temperatures were near or above normal during March, April and May. These diseases caused relatively little crop loss if there had been no more than 12 days in May with measurable rainfall, even when other conditions favored disease development. When mean temperatures were not higher than 28°, 41°, and 51°F in March, April, and May, respectively, the Pseudopeziza leafspots of both alfalfa and red clover were particularly mild, and none of the four diseases studied was very destructive (Phytopath. 47: 626).

Ditylenchus dipsaci, stem nematode, is a serious pest of alfalfa in many of the irrigated valleys of the Pacific coast and intermountain areas of the West. Damage to alfalfa by this nematode varies from year to year, but it always curtails production of hay. Severe infection often causes death of the plants. Varietal reaction was noted (O. F. Smith, Phytopath. 48: 107).

Severe damage from bacterial stem blight (Pseudomonas medicaginis) occurred in Missouri, apparently following frost injury from a statewide late freeze, April 11-14, 1957 (M. D. Whitehead and E. L. Pinnell, PDR 41: 876).

"Alfalfa dwarf" or "Pierce's disease of grape" (virus). See under VITIS spp., GRAPE.

TRIFOLIUM PRATENSE. RED CLOVER: C. M. Leach reported sclerotia of Typhula trifolii, a parasite of grasses, found mixed with Idaho-grown seed of Trifolium pratense. It is possible that the sclerotia were threshed from grasses growing with the clover (PDR 42: 383).

Five physiologic races of Uromyces trifolii var. fallens were distinguished in collections from 14 locations in the northern United States. This constitutes the first record of physiologic specialization within U. trifolii var. fallens. Individual red clover plants were used as differentials to separate races after it was determined that commercial varieties were unsuitable for this purpose. The varieties Common Oregon and Purdue were completely susceptible to the four races tested on them, whereas Altaswede, Pennscott, and several other varieties were heterogeneous for resistance and susceptibility (R. T. Sherwood, Phytopath. 47: 495).

Effect of seed treatment and weather conditions upon severity of some red clover diseases, see under alfalfa.

TRIFOLIUM REPENS var. LADINO: LADINO WHITE CLOVER: R. A. Kilpatrick reported the fungi isolated from Ladino white clover seeds in New Hampshire. The objectives of this study were to determine the fungi associated with insect-injured seeds, and the kinds and relative prevalence of fungi isolated from Ladino white clover seeds harvested from plants heavily infected with different leaf and petiole diseases (PDR 42: 142).

Marmor trifolii, red clover vein mosaic virus. Symptoms produced in Ladino clover and in other susceptible legumes by one virus from Ladino clover in New York indicated that it is the red clover vein mosaic virus. This apparently is the first report of the natural occurrence of this virus in Ladino white clover (D. A. Roberts, PDR 41: 928).

K. W. Kreitlow and others reported the effect of virus infection on yield and chemical composition of Ladino clover. Greenhouse and field data indicated that virus infection could reduce the yielding ability of Ladino clover from 23 to 55 percent. More detailed chemical analyses are necessary to determine the effect of virus infection on various chemical constituents. The need for obtaining resistant plants was stressed (Phytopath. 47: 390).

DISEASES OF FRUIT CROPS

CITRUS spp. CITRUS: L. J. Klotz reported controlling diseases of Citrus and subtropical fruits. Together with some general notes on the preparation of fungicides this article contains a useful table of bacterial and fungus diseases and physiological disorders of citrus, against which sprays are applied in California. Also tabulated are the fungicide formulations, time of application, coverage per tree, and crops involved, including date palm and Fuerte avocado pear (Calif. Citrogr. 42: 220-222, 1957).

Maneb in combination with oil caused severe injury to grapefruit according to F. E. Fisher in Florida (PDR 42: 266).

S. Z. Berry reported results of a quantitative and qualitative study of the effects of a mixture of ethylene dichloride and trichlorethane gas on three citrus fruit pathogens, Diplodia natalensis, Phomopsis citri, and Penicillium digitatum (PDR 42: 102).

A fruit rot was found in Louisiana citrus groves during the late summer and fall of 1957. As far as could be determined, according to N. L. Horn and others, this is the first report of Oospora sp. causing a fruit rot of citrus in the field in Louisiana (PDR 42: 264).

In California, L. J. Klotz and T. A. DeWolfe described techniques for isolating Phytophthora spp., pathogenic to citrus (PDR 42: 675).

W. A. Feder and others reported that nearly 400 varieties, species, and relatives of citrus, screened between 1953 and 1957, were found to be susceptible to damage by the burrowing nematode, Radopholus similis, the primary cause of spreading decline (PDR 42: 934).

L. J. Klotz and others stated that biphenyl vapor controls Rhizoctonia solani, damping-off, of citrus in California but is not useful where other organisms are involved (PDR 42: 464).

Observations reported by B. G. Chitwood and W. Birchfield indicated that several nematodes, including the citrus-root nematode, Tylenchus semipenetrans, found on citrus roots in Florida are native to Florida soils (PDR 41: 525).

Greasy spot, cause not definitely determined, of citrus has now become of economic importance in every citrus-growing area in Florida according to W. L. Thompson and others. Two applications of captan were effective in controlling the disease (Florida Hort. Soc. Proc. 69: 98-104, 1957).

Psorosis (scaly bark). P. W. Moore and Edward Nauer reported that a nine year study of seven older orange orchards indicated that advance of psorosis may be faster than is generally believed. The disease can take a bearing tree out of production faster than replants can be brought into production. The orchards studied were in the Azusa district of Los Angeles County, California (Calif. Agr. 11(6): 11. June 1957).

Stubborn disease of citrus is probably caused by a graft-transmissible virus. Blue albedo has generally been considered to be one symptom of the disease in grapefruit. However, appearance of the symptom during fruit sizing experiments in California, using growth regulator sprays, makes its connection with stubborn disease problematical (J. B. Carpenter and H. Z. Hield, PDR 42: 63).

Tristeza (virus). Injury and loss of citrus trees due to tristeza in an Orange County grove in Florida was reported by M. Cohen (Florida Hort. Soc. Proc. 69: 19-24. 1957). The suppression of tristeza virus symptoms in Mexican lime seedlings by heat treatment was reported by P. R. Desjardins and others in California. Heat treatment at 40° C resulted in the suppression of tristeza symptoms on the leaves that developed during treatment of infected Mexican lime seedlings. Results of similar treatment of healthy seedlings indicated that the increase in growth during treatment of infected plants was due to the effect of the treatment on the virus rather than on the host (PDR 41: 230). The effect of heat treatments on tristeza and psorosis viruses in citrus was discussed by T. J. Grant. Hot water treatments of citrus budsticks infected with tristeza and psorosis viruses have not proved satisfactory for securing virus-free bud sources. Some branches on the new growth that developed during exposure of infected plants in a high-temperature chamber appeared to be free from tristeza and psorosis viruses, even though old leaves and stem tissues of the treated plants still contained virus. (PDR 41: 232).

Seedling yellows and tristeza. In California, seedling yellows virus has not been encountered in sweet orange or other citrus known to have been naturally infected with tristeza (quick decline) virus. Recent studies show that the causal virus of seedling yellows is carried by by plants of Meyer lemon, Satsuma orange, and other citrus varieties known to be infected with tristeza virus and believed to have been cariers of the virus when originally imported to the United States. Work is in progress to determine if the seedling yellows reaction is caused by a virus distinct from tristeza virus, as suggested by Fraser, or if it is a strain of the latter (James M. Wallace, (PDR 41: 394).

Wood pocket. E. C. Calavan reported that wood pocket recurs in lemon and seedless lime trees grown from buds or grafts from diseased sources, but appears to be nontransmissible to healthy trees. It is probably not infectious and may be due to an unstable chimera (variegated sport). Possible relationships to virus diseases were discussed. None except chance association has been found. However, seed-perpetuated pitting suggesting xyloporosis occurs in semi-dense Lisbon seedlings as well as in occasional seedlings from various other lemon sources. Wood pocket generally is most severe in desert areas and least severe in coastal areas. Bacteria and fungi invade lesions but do not cause wood pocket. Control depends on the use of wood pocket-free sources (California Citrograph 42: 300, June 1957).

CITRUS AURANTIFOLIA. LIME: H. J. Reitz and L. C. Knorr reported presence of the Rangpur lime disease in Florida and discussed relationship between the causal virus and the exocortis virus (PDR 41: 235).

CITRUS AURANTIFOLIA X FORTUNELLA spp. LIMEQUAT: A disease of limequat trees characterized by yellowing of the veins of the leaves has been found in California, and described by L. G. Weathers. The causal agent is readily transmitted from citrus to citrus by grafting (PDR 41: 741).

CITRUS SINENSIS. SWEET ORANGE: Bark pitting of sweet orange is not a reliable symptom of the presence of the tristeza virus according to Farid Nour-Eldin and J. F. L. Childs (PDR 41: 1011).

FRAGARIA spp. STRAWBERRY: The strawberry plant certification program in Arkansas was outlined by J. P. Fulton and Carter Seymour. The aim of the program is to make available to growers plants that are free from plant-borne pathogens (PDR 41: 749).

Recent occurrences of summer dwarf (Aphelenchoides besseyi) were recorded in strawberry plantings in Arkansas, according to D. A. Slack and others. Aberrant symptoms of the disease were observed on plants in the field and greenhouse. Field development was most striking during late fall rather than mid-summer. The problem is rather more general than local since diseased plants originated in Arkansas, Tennessee, Oklahoma, Missouri and Maryland (PDR 41: 398).

Observations on the effect of fungicides on gray mold (Botrytis cinerea) and leaf spot (Mycosphaerella fragariae) and on the chemical composition of strawberry plant tissues were reported by R. S. Cox and J. P. Winfree in Florida (PDR 41: 755).

O. D. Morgan and W. F. Jeffers reported effects of fumigation and heat treatments on root knot (Meloidogyne hapla) and black root rot (Pratylenchus sp.) of strawberry (PDR 41: 825).

Results of a survey to determine the prevalence and distribution of nematodes associated with strawberry roots in the United States were reported by A. J. Braun. Pratylenchus spp. were the most prevalent of the parasitic forms. In the southern States Xiphinema, Tylenchorhynchus, and Helicotylenchus were encountered more frequently than other genera (PDR 42: 76).

Mycosphaerella fragariae, leaf spot, in Michigan plantings has been sporadic through the years. However, epidemics may occur, as in 1957. During 1957, several facts were observed about this disease. Many Michigan growers are not familiar with the disease since most of the old major varieties are resistant. Several of the new varieties and selections were evaluated as susceptible. A comparison of temperature and rainfall for the area indicated favorable conditions for an epidemic. A new fungicide, Cyprex (70% n-dodecylguanidine acetate) gave exceptional control while Tri-Basic copper was only partially effective and resulted in some injury (J. H. MacNeil and others, Michigan Quart. Bull 40 (8): 581-588, Feb. 1958). Unusually severe occurrence of strawberry leaf spot in commercial plantings in Arkansas apparently was associated with above-average rainfall early in the season, according to J. L. Dale and J. P. Fulton (PDR 41: 681).

Phytophthora fragariae, red stele. R. H. Fulton reported that several plants of the Fairland variety received for diagnosis showed typical symptoms of the red stele disease. Since Fairland has been considered a red stele-resistant variety it was assumed that a physiological race pathogenic to Fairland was present in the field. This is the first known infection of Fairland by P. fragariae (PDR 42: 71). Under controlled conditions chloropicrin was very effective in eradicating P. fragariae from infested soil, according to W. F. Jeffers in Maryland. Several other fungicidal materials were ineffective. Under field conditions none of the materials tested resulted in complete eradication of the red stele fungus, but methyl bromide and chloropicrin at relatively low rates gave a high degree of control (PDR 41: 415).

Stephen Wilhelm reported a bud rot of strawberry caused by Rhizoctonia solani. The disease, which kills the terminal buds in scattered small or large groups of plants in the winter and spring rainy seasons, has recently been serious on the coast of California. The disease may be spread in infected nursery plants (PDR 41: 941).

In Washington, D. M. McLean reported an unusual occurrence of Sclerotinia sclerotiorum on ripening strawberry fruit in experiment station plots during 1957. This is the first report of the fungus on strawberry fruit in Washington (PDR 41: 1057).

Viruses. P. S. Jorgensen has devised an insert petiole-graft technique for transmission of strawberry viruses. Some viruses that have successfully been transmitted by this method are: the yellow edge component, a virus tentatively identified as mottle, an undescribed virus tentatively named necrotic shock, and complete xanthosis complex from commercial production plantings (PDR 41: 1009).

A screenhouse provides highly satisfactory conditions for the production of virus-free foundation strawberry stocks, according to J. B. Smith and Geo. M. Darrow. They described the plan and its use. About 25 screenhouses are now in use by strawberry plant propagators in the United States (PDR 41: 573).

In Arkansas F. G. Rorie reported investigations which showed that the aphid Capitophorus minor readily transmitted nonpersistent virus isolates from commercial strawberry plants to Fragaria vesca indicator plants. No evidence of transmission of persistent viruses was obtained (PDR 41: 683).

J. P. Fulton reported that aster yellows virus disease is common but not damaging in Arkansas strawberry fields; he described field symptoms of aster yellows and some other conditions that might be confused with it (PDR 41: 521).

MALUS SYLVESTRIS. APPLE: In Maine, M. T. Hilborn and others suggested that under some conditions, sprays combining glyodin and lead arsenate may cause injury such as foliage burning or russetting in McIntosh apple as a result of the upsetting of the iron-manganese ratio in the leaves (PDR 42: 776).

Gloeosporium perennans, the anthracnose fungus, which causes bull's eye rot or target spot of apple fruit, is usually most common in North Central Washington, according to C. C. Chollet and Roderick Sprague. Their experiments indicated that maneb was about as effective as ziram for control and could be used in the same way (PDR 42: 499).

Podosphaera leucotricha, powdery mildew. Roderick Sprague evaluated results of spray trials at Wenatchee, Washington in 1957 (PDR 42: 100). In experiments reported by A. B. Groves and others, it was concluded that control of powdery mildew of apple with Karathane (2-(1-methylheptyl)-4, 6-dinitrophenyl crotonate and isomers) is best achieved with small amounts applied at frequent intervals (PDR 42: 252).

Venturia inaequalis, scab. Cyprex (n-dodecylguanidine acetate) was found by Dwight Powell and others in Michigan to be equally effecitve at all concentrations. It produced 99 percent control as compared with no control on untreated trees. Other materials ranged from 45 to 57 percent effective (PDR 42: 493).

In Missouri, five previously unreported disorders of pome fruits were recorded by A. F. Posnette and D. F. Millikan. These disorders and the virus diseases they resemble are chat fruit, rough skin, and rubbery wood on apple, and vein yellows and red mottle on pears (PDR 42: 200).

PERSEA AMERICANA. AVOCADO: Hot water treatment of infected avocado seeds killed the root rot fungus Phytophthora cinnamomi without injury to the seed in experiments reported by R. D. Durbin and others. Root rot has become the most important disease of this crop in California (PDR 41: 678).

PHOENIX DACTYLIFERA. DATE PALM: Roy W. Nixon observed considerable differences in tolerance of Graphiola leaf spot, Graphiola phoenicis, among date palm varieties in Texas (PDR 41: 1026).

PRUNUS spp. PLUM: J. D. Kirkpatrick and others reported that in a field study of 685 5-year old Stanley plum trees propagated on Myrobalan rootstock (Prunus cerasifera), 190 trees wilted and collapsed or showed stages of collapse during the 1957 growing season. This collapse may be explained by what appears to be differential winter injury to cambium and xylem tissues about the bud union area. It appears that some factor may induce or aggravate susceptibility to winter injury in the tissues in the area of the bud-union (PDR 42: 65).

PRUNUS spp. SWEET AND SOUR CHERRY: Agrobacterium tumefaciens, crown gall. In Oregon, Ira W. Deep reported that pre-planting treatments with the antibiotic preparations streptomycin sulfate, Agri-mycin, and Terramycin were tested for control of crown gall of Mazzard cherry seedlings. All three preparations significantly reduced the incidence of infection, but Terramycin was by far the most effective. Certain non-phytotoxic treatments with Terramycin were significantly more effective than a standard Semesan Bel treatment. Chemotherapeutic activity was indicated since the incidence of infection in the inoculated control was significantly higher than in trees treated in 400 ppm of Agri-mycin for 1 hour (PDR 42: 476).

A new spray material, n-dodecylguanidine acetate (Cyprex), gave good control of cherry leaf spot (Coccomyces hiemalis) in Michigan tests reported by Donald Cation (PDR 41: 1029).

In Oregon, J. A. Milbrath reported midleaf necrosis, a virus disease of cherry. Infected trees were markedly smaller in size and less vigorous than healthy ones, but fruit on them developed normally. An Olivet sour cherry and a Bing sweet cherry were found carrying the midleaf necrosis virus without symptoms. The disease was also observed in commercial sour cherry orchards in Oregon. Cherry midleaf necrosis is proposed for the common name of the disease and cherry midleaf necrosis virus for the causal virus (Phytopath. 47: 637).

J. A. Milbrath also reported the effect of some sour cherry viruses on growth of young orchard trees (Phytopath. 47: 655).

"Pfeffingerkrankheit" or rosette (virus) was reported as a serious orchard problem in sour cherries in Pennsylvania by F. H. Lewis. The symptoms suggest that this is the same disease previously described as rosette in Canada and Pfeffingen disease in Switzerland (PDR 42: 563). Rosette was also reported in West Virginia on sour cherry by R. E. Adams and K. J. Kessler, Jr. (PDR 42: 568).

PRUNUS ARMENIACA. APRICOT: Ring pox (virus). No symptoms of apricot ring pox virus developed on seedlings of Wenatchee Moorpark apricot grown from seed from infected trees at Hemet, California and the virus was not detected in them by indexing (L. C. Cochran and E. C. Calavan, PDR 41: 690).

PRUNUS PERSICA. PEACH: J. C. Dunegan and R. A. Wilson reported evidence indicating that soils treated with DDT lose toxicity for peach trees after some years (PDR 42: 262).

Emil F. Guba summarized several season's observations on the relation between control of peach canker and the infection cycle of the pathogen (Fusicoccum amygdali) (PDR 42: 481).

A preliminary survey of nematodes found on peaches in New Jersey included samples from 19 orchards. The following list shows the nematode genera found and the number of orchards in which they occurred: Pratylenchus 11, Xiphinema 11, Aphelenchoides 5, Ditylenchus 4, Longidorus 2, Tylenchorhynchus 2, Criconemoides 2, Aphelenchus 2, Tylenchus 1, and Hoplolaimus 1 (H. A. Thomas, PDR 41: 526).

Taphrina deformans, leaf curl, was effectively controlled in California by fall applications of ziram and ferbam, in experiments reported by Harley English (PDR 42: 384).

Embryonic abortion (virus). R. E. Adams reported that in the spring of 1957 intensive observations and studies were begun in a planting of Freeland peaches in West Virginia. Despite the young age of this planting it has shown decline, poor yield of marketable fruit, and severe brown rot incidence for several years. This is apparently a new disease of peach. Symptoms observed were described and evidence was presented to show that the disease is transmissible by grafting. The disease was tentatively designated embryonic abortion (PDR 42: 203).

In California, W. H. Keith and J. A. Traylor reported results of some soil treatments for elimination of peach yellow bud mosaic virus from soil (Phytopathology 47: 537).

PYRUS COMMUNIS. PEAR: B. A. Friedman and M. J. Ceponis reported diseases (blue mold (Penicillium), gray mold (Botrytis), and bull's-eye (Neofabraea)) in lots of pears shipped from the Pacific Northwest to New York City (PDR 41: 567).

Erwinia amylovora, fire blight. The active annual fireblight control program in the Medford, Oregon pear growing district paid dividends during the 1957 growing season. Weather conditions were favorable for development and spread of the disease, nevertheless, although fireblight was the most severe it had been for 15 years, the growers' control program prevented what could have been a widespread outbreak. Each year growers are encouraged to remove hold-over cankers whenever noticed, and to apply blossom sprays (C. B. Cordy and I. C. MacSwan, Western Fruit Grower 12: 31, Feb. 1958).

RUBUS spp. BLACKBERRY: Elsinoë veneta, anthracnose, in central Oklahoma was controlled by a single delayed dormant spray (Bordeaux 8-8-100) but neither yield nor fruit size was increased as a result of control (F. B. Struble and L. S. Morrison, PDR 41: 766).

VACCINIUM CORYMBOSUM. HIGH BUSH BLUEBERRY: Monilinia vaccinii-corymbosi, mummy berry, is still considered the most important fungus disease of the cultivated high bush blueberry in Michigan, according to R. H. Fulton. The prevention of apothecial formation from the fallen nummified blueberries effectively controlled the reestablishment of the fungus on young, tender shoots. It was shown that eradicant soil treatments with calcium cyanamid dust were superior to protective foliar spray treatments. Calcium cyanamid (Aero calcium cyanamid 57 percent, special grade), as used in these studies did not injure the plant nor destroy the desired acidity of the soil. (Michigan Quart. Bull. 40(3): 491-497, Feb. 1958).

VITIS spp. GRAPE: Phomopsis viticola, dead-arm. Best control of dead-arm disease of grapevines in California resulted from a dormant spray of sodium arsenite followed by a foliar spray of captan applied to the new growth, according to observations reported by T. S. Pine (PDR 41: 822).

Leaf roll (virus). Fruit and foliage symptoms of grape leafroll indicated that it is identical with the virus disease known for several years in California as White Emperor disease. Symptoms of leafroll are similar to those of brunissure, rougeau, flavescence, and potassium deficiency. The use of virus-infected stocks or buds in propagating new vines appears to be the principal method by which the disease is spread in California (A. C. Goheen, F. N. Harmon and J. H. Weinberger, Phytopath. 48: 51).

Pierce's disease (virus) according to J. M. Crall and L. H. Stover, from extensive tests on Carrignane vines, is a major factor in the decline of bunch grapes in Florida. The vectors Oncometopia undata and also Homalodisca triquetra and H. insolita, separately or together, are more efficient than Carneocephala flaviceps (Phytopath. 47: 518). Wm. B. Hewitt and others reported occurrence of Pierce's disease (virus) in the vicinity of Meridian, Mississippi. In inoculations the virus produced symptoms typical of alfalfa dwarf and of Pierce's disease of grape as they are known in California. The disease was also observed on grape in Alabama and Georgia (PDR 42: 209). According to Hewitt Pierce's disease virus probably is native to the Gulf Coastal Plain areas of the United States (Wm. B. Hewitt, PDR 42: 211).

"Alfalfa dwarf" or "Pierce's disease" (virus). W. N. Stoner reported that in 1956 and 1957 abnormalities were observed in alfalfa and grape in Rhode Island which closely resembled the symptoms induced by infections of the virus Morsus suffodiens. In comparison marked similarities indicated that M. suffodiens may be present in Rhode Island and that a widely distributed leafhopper, Draeculacephala antica, may be an insect vector, should the virus be proven to occur in the State (PDR 42: 573).

DISEASE OF NUT CROPS

P. W. Miller reported the incidence of nut diseases in Oregon in 1957 (PDR 41: 1057).

CARYA ILLINOENSIS. PECAN: R. H. Converse reported that seven protectant spray materials were used in a field test for the control of scab (Fusicladium effusum) on pecan nuts. Dyrene gave excellent control of the disease. None of the five dithiocarbamates tested gave significantly better control than ziram; however, maneb provided somewhat more uniform control than the four other dithiocarbamates (PDR 42: 390).

Evidence for the existence of physiologic specialization in the pecan downy spot fungus (Mycosphaerella caryigena) was reported by R. H. Converse in Oklahoma (PDR 42: 393).

JUGLANS REGIA. PERSIAN WALNUT (ENGLISH WALNUT): P. W. Miller reported recent studies on the effectiveness of Agri-mycin 100 and Agri-mycin 500 for the control of walnut blight (Xanthomonas juglandis) in Oregon. In 1957 the disease was epidemic in many localities (PDR 42: 388).

PRUNUS AMYGDALUS. ALMOND: Pseudomonas syringae, bacterial blast, a newly recognized disease of almonds in the Sacramento Valley, California, was reported by Harley English and others (Phytopathology 47: 520).

DISEASES OF ORNAMENTALS AND MISCELLANEOUS PLANTS

T. A. Gaskin reported weed hosts of Meloidogyne incognita in Indiana (PDR 42: 802).

The effectiveness of Mylone 85W for control of the citrus nematode, Tylenchus semipenetrans, Phytophthora spp., and a number of weeds, when applied with different amounts of water was reported by R. C. Baines and others. Mylone showed good stability in moist soil and moved downward when water was applied at periods up to 72 hours (PDR 42: 876).

In Florida, Wray Birchfield and H. M. Van Pelt reported results of tests with heat treatments for control of spiral (Helicotylenchus multicinctus) and root-knot (Meloidogyne incognita) nematodes on ornamental plants (PDR 42: 451).

V. H. Young and others reported results of tests for control of root-knot, (Meloidogyne spp.) spiral (Helicolylenchus spp.), and meadow (Pratylenchus spp.) nematodes in potted ornamentals with V-C 13 Nemacide (75% of O-2, 4-dichlorophenyl O, O-diethyl phosphorothioate) (PDR 41: 271).

CHENOPODIUM ALBUM. PIGWEED OR LAMB'S QUARTER: Of six selections of this weed tested for susceptibility to the sugar-beet nematode (Heterodera schachtii), one was found to be moderately infected while five were found not to be infected as determined by development of females on the roots. This seems to indicate that there are at least two races of this plant species. Males developed to maturity on five of the selections and were in relatively large numbers on one of these five, suggesting further heterogeneity within these selections (PDR 42: 184).

CHRYSANTHEMUM spp. CHRYSANTHEMUM: Viruses. The use of various varieties of chrysanthemum and of petunia and cineraria as indicator plants to distinguish between eight mosaic and two rosette viruses of chrysanthemum was reported by Philip Brierley and F. F. Smith (PDR 42: 752).

CUSCUTA spp. DODDER: Colletotrichum destructivum on Cuscuta epithymum and C. campestris. In greenhouse tests in Oregon Colletotrichum parasitized both species of Cuscuta, but not alfalfa. According to C. M. Leach this fungus has potentialities for biologically controlling dodder in alfalfa (PDR 42: 827).

GARDENIA AUGUSTA. GARDENIA: A dieback of Belmont gardenias in Pennsylvania greenhouses was described and attributed to root smothering resulting from overwatering (Philip Brierley and Paul Lorentz, PDR 42: 986).

GLADIOLUS spp. GLADIOLUS: R. F. Bozarth and M. K. Corbett stated that identification of the tomato ringspot virus (Annulus zonatus) as the cause of stunt or stub head disease of gladiolus constitutes the first report of natural infection with this virus in Florida (PDR 42: 217).

HYDRANGEA MACROPHYLLA. HYDRANGEA: Philip Brierley obtained virus-free hydrangeas from tip cuttings of heat-treated ringspot-affected stock plants (PDR 41: 1005).

PELARGONIUM spp. PELARGONIUM: In Michigan, A. Kivilaan and R. P. Scheffer reported factors affecting development of bacterial stem rot, Xanthomonas pelargonii. A high percentage of commercially available pelargonium stocks carry this organism in a latent form. Twenty-six percent of 600 plants of six varieties, kept under conditions favoring disease development but precluding disease spread, developed stem rot within 3 months. X. pelargonii did not attack plants outside the geranium family. The disease was favored by high temperatures. Mineral nutrient levels below and above optimum for growth favored disease development (Phytopath. 48: 185).

RHODENDRON spp. AZALEA: Colletotrichum sp. An apparently new leaf-spotting and defoliating disease of azaleas (hybrids of Rhododendron spp.) was described and named "azalea anthracnose". The disease, which affects both the Indica and Kurume groups of azaleas, has occurred in severe epidemics every summer since 1954 in several nurseries in southeastern Louisiana. The cause of the disease was found to be a species of Colletotrichum typical of the conidial stage of Glomerella cingulata. Over-wintered fallen leaves serve as the source of conidial inoculum the following spring and summer. Both copper and organic fungicides were found effective in controlling the disease (P. D. Stathis and A. G. Plakidas, Phytopath. 48: 256).

S. A. Sher reported the effect of nematodes on azaleas. Tylenchorhynchus claytoni, Trichodorus christiei, Tylenchus sp., and Ditylenchus sp. are often found around poorly growing azalea plants in southern California (PDR 42: 84).

ROSA spp. ROSE: G. J. Stessel has given results of tests with eleven fungicides for control of gray mold (Botrytis sp.) in Rhode Island. Effective chemicals were Vancide 51 (sodium dimethyldithiocarbamate), Kromad, and Mycostatin (PDR 42: 396).

In California, S. A. Sher reported a disease of roses caused by a root-lesion nematode, Pratylenchus vulnus (Phytopath. 47: 703).

A. F. Schindler reported poor growth of roses in commercial greenhouse beds infested with the fungus, Lepiota morgani (PDR 42: 713).

VIOLA spp. PANSY AND VIOLET: Colletotrichum violae-tricoloris, anthracnose, is occasionally destructive to pansy and violet, according to P. J. Lloyd and D. F. Crossan. Maneb and zineb at 2 pounds per 100 gallons of water applied as protectants will control the disease. Of eight varieties of pansy and two of Viola cornuta, the Cornuta Chantreyland, a viola variety, showed marked resistance (PDR 42: 86).

DISEASES OF SHRUBS AND TREES

Leaf diseases of trees occurring in Illinois during 1957 were reported by J. M. Ferris and others. Incidence was high because of excessive precipitation and mild temperatures during the spring and early summer (PDR 41: 1051).

Ernest Wright in Oregon reported studies on the influence of temperature and moisture on severity of damping-off caused by Fusarium spp., Pythium ultimum, and Rhizoctonia solani on American elm (Ulmus americana), Siberian elm (Robinia pseudoacacia), and desertwillow (Chilopsis linearis), all of which were found to be susceptible to damping-off (Phytopath. 47: 658).

Ross W. Davidson and Thomas E. Hinds reported that studies of heart rot in mature timber at high elevations revealed several wood-decaying fungi not previously reported as infecting living trees. Corticium radiosum, white butt rot, was most frequently isolated from subalpine fir (Abies lasiocarpa). A brown pocket rot beneath basal wounds in this same species was caused by Helicobasidium corticioides. The most frequently isolated fungus from main stem decay in quaking aspen (Populus tremuloides) was identified as Cryptochaete polygonia. Peniophora luna, which was previously reported as the cause of a top or trunk rot in lodgepole pine (Pinus contorta), fruits abundantly in the areas where this tree grows (Phytopath. 48: 216).

H. H. Thornberry at the University of Illinois reported a method for isolating virus-like particles from woody plants showing symptoms of elm phloem necrosis, peach X-disease, and cherry ring spot (Phytopath. 48: 15).

ACER spp. MAPLE: P. P. Pirone reported that a survey was made to determine the cause of death of more than 300 Norway maples (A. platanoides) and swamp maples (A. rubrum) growing in city streets in New York and Atlantic Highlands in New Jersey, which were thought to have been injured by escaping gas. Sporophores of Ganoderma lucidum were present on the trunk bases or roots of nearly 20 percent of the dead trees, and they were also found on living trees on which the branches above the invaded area of trunk were either dead or bore undersized leaves (Bull. Torrey Bot. Club 84(6): 424-428, 1957).

AGLAONEMA SIMPLEX. CHINESE EVERGREEN: In Florida, glebal masses of Sphaerobolus stellatus on Chinese evergreen foliage prevented sale of the plants, although it was not detrimental to the plants (PDR 41: 537).

ALBIZZIA JULIBRISSIN. MIMOSA: G. F. Weber described seasonal progress of symptoms of mimosa vascular wilt, Fusarium oxysporum f. perniciosum, in Florida. The spread of the disease in the State would be devastating, in view of the current popularity of this conspicuously flowering, rapidly growing tree (PDR 41: 640).

The mimosa tree proved to be susceptible to some species of root-knot nematodes (Meloidogyne spp.) in inoculation experiments conducted by A. F. Schindler in Maryland (PDR 42: 315).

The presence of root-knot nematodes (Meloidogyne spp.) increased incidence of Fusarium wilt (F. oxysporum f. perniciosum) of mimosa trees in experiments reported by D. L. Gill (PDR 42: 587).

CASTANEA DENTATA. CHESTNUT: Recent observations on the American chestnut in North Carolina showed that twigs killed by Endothia parasitica afforded a source of infection of of the young coppice growth. Cankers were formed at the point of contact of the killed twigs and young healthy sprouts. All of several isolations from the margin of infection gave pure cultures of the fungus (W. Birchfield and G. F. Weber, PDR 41: 359).

CASTANEA MOLLISSIMA. CHINESE CHESTNUT: Glomerella cingulata, blossom-end rot, on Chinese chestnut was reported by M. E. Fowler and F. H. Berry. Removal of the infected trees seems to offer the best control for the disease (PDR 42: 91).

CASTANEA PUMILA. ALLEGHENY CHINKAPIN: This native chinkapin and two exotic oak species, Quercus brutia and Q. lusitanica proved to be susceptible when inoculated with the oak wilt fungus(Ceratocystis fagacearum) under nursery conditions (T. W. Bretz, PDR 41: 368).

CRATAEGUS spp. HAWTHORNE: Fabraea maculata, leaf blight. In 1957 the same sprays were applied to the same trees as in 1956 in Pennsylvania. No injury was observed on any variety in 1957. Once again branches of Paul's scarlet hawthorn sprayed with zineb showed only traces of leaf blight while in spite of the extremely dry summer the unsprayed branches were almost completely defoliated (L. P. Nichols, PDR 42: 713).

JUNIPERUS spp. JUNIPER: Phytophthora cinnamomi. In Oregon, there is strong evidence that two varieties of junipers, probably J. sabina tamariscifolia and J. chinensis sargenti, are susceptible to this fungus. (L. B. Loring and Harriet Smithson, PDR 41: 815).

JUNIPERUS VIRGINIA. REDCEDAR: According to F. E. Caveness the root-lesion nematode, Pratylenchus penetrans, was recovered from eastern redcedar in the Nebraska National Forest at Halsey, Nebraska (PDR 41: 1058).

LIQUIDAMBAR STYRACIFLUA. SWEETGUM: E. R. Toole of the Southern Forest Experiment Station reported Botryosphaeria ribis as a cause of twig canker of sweetgum. The fungus, however, appears to be a weak pathogen, and so far seems harmful only to shaded or weakened twigs and branches (PDR 41: 808).

PINUS spp. PINE: Additional studies on the effect of different biocides on growth of seedling pines and on incidence of mycorrhizae were reported by J. G. Palmer and Edward Hacskaylo (PDR 42: 536).

Black root rot (cause unknown). A survey was conducted during the summer of 1956 covering sixteen nurseries in the States of Alabama, Florida, Georgia, Louisiana, Mississippi and North Carolina to determine the prevalence of black root rot in the southern forest nurseries. Root rot was found in four out of sixteen nurseries visited. In one nursery in Mississippi over 40 percent of the seedlings were lost. In another in Louisiana nearly 300,000 seedlings were lost, or approximately 2 percent of the total crop. Fumigation with methyl bromide at several nurseries not only controlled root rot but controlled weeds and increased the size and vigor of the seedlings as well. Vapam also gave good control in test treatments (C. S. Hodges, Jr. Proc. Asso. Southern Agr. Workers, 54th Annual Convention, Birmingham, Alabama, Feb. 1957).

Cold injury. George F. Weber described symptoms observed on young slash pine trees (P. elliotii) in Florida, probably due to cold injury (PDR 41: 494).

Galls, cause unknown. L. I. Cohen and C. W. Waters reported some observations on an undescribed disease of ponderosa pine (P. ponderosa) twigs. Galls growing on ponderosa pine near Missoula, Montana were examined and described (Jour. Forest. 55(7): 515-517. 1957).

Cronartium ribicola, blister rust. D. M. Stewart reported factors affecting local control of blister rust on eastern white pine (P. strobus) in Minnesota (Jour. For. 55 (11): 832-837). Virgil D. Moss found that application of cycloheximide to the surfaces of cuts made when trunk cankers were cut out increased the effectiveness of this excise trunk canker method of controlling blister rust on western white pine (P. monticola). Later he added that fuel oil was found to be a very satisfactory carrier for the cycloheximide (PDR 41: 709, 42: 703).

Fomes annosus, root rot, has been identified as the cause of extensive mortality in a plantation of shortleaf pine (P. echinata) in Washington County, Missouri, where it was first observed in November 1956. Through 1957, about 10 percent of the plantation trees had died and additional losses from this cause can be expected in the future according to T. W. Jones and T. W. Bretz (PDR 42: 988).

Experiments in Louisiana, reported by Thomas Hansbrough and J. P. Hollis showed that soil fumigation to control nematodes in nursery soil improved both yield and quality of loblolly pine (Pinus taeda) seedlings (PDR 41: 1021).

POPULUS DELTOIDES. COTTONWOOD: Cystospora chrysosperma is commonly associated with cottonwoods and willows. In the Great Plains area during the drought years of the mid-thirties, it was particularly abundant on cottonwoods in shelterbelts. Published evidence definitely indicates that C. chrysosperma is not a virulent parasite but attacks trees of declining vigor. Ernest Wright presented observations which tend to confirm this statement (PDR 41: 892).

PSEUDOTSUGA TAXIFOLIA. DOUGLAS-FIR: Cytospora kunzei, pitch-girdle canker, according to Ernest Wright, is a secondary disease that commonly affects conifers weakened by drought, fire, insects, or any unfavorable environmental condition. Precipitation since 1940 has returned to near normal in the eastern Rocky Mountains, and it is thought that pitch-girdle cankers on Douglas-fir are much less common than in former years (PDR 41: 811).

Adelopus gaeumanni and Rhabdocline pseudotsugae causing needle cast, have become a serious problem in Douglas fir plantations in Vermont. The trees are unsightly in spots and would not be acceptable as top quality Christmas trees. Until a control for the diseases is found, it is not advisable to plant Douglas fir in Vermont (W. R. Adams, Vermont Farm and Home Science 3(2): 10-11, October 1957).

QUERCUS spp. OAK: Ceratocystis fagacearum, oak wilt (See also under Castanea pumila). The number of dead oaks occurring in 1572 naturally infected oak wilt sites was contrasted with those occurring in an equal number of randomized, apparently non-diseased, plots. The data are interpreted to mean that, in West Virginia, the finding of two or more dead trees will, in a majority of cases, indicate that the dead trees were killed by oak wilt sometime in the past (W. H. Gillespie and F. W. Craig, PDR 42: 268). A study on the relation of precipitation to mat formation by C. fagacearum reported by John S. Boyce, Jr., showed that in western North Carolina in 1957 a great deal more mat formation occurred on summer-felled trees following a wet autumn than occurred the previous year after a comparatively dry one. It was found that a spray applied about March 15 in western North Carolina would reduce insect infestation of mats during the spring months (PDR 41: 948). Results of transmission experiments conducted under natural forest conditions supported the theory that certain sap-feeding insects are vectors of the oak wilt fungus, C. fagacearum. Three hundred sixty-nine insects were caught in baited traps over wounds on 92 of 235 oak trees located near sources of oak wilt inoculum in the forest. Three of the 92 trees became infected and wilted (PDR 42: 538). The small oak bark-beetle (Pseudopityophthorus minutissimus) has transmitted the oak wilt disease in tests using cages in a nursery in Howard County, Missouri, according to W. B. Buchanan (PDR 41: 546). In Missouri the mortality rate for wilt-diseased trees was greater for red oaks than for white oaks, according to observations reported by T. W. Jones (PDR 42: 552). The length of time to appearance of foliage symptoms of oak wilt was longer in root-inoculated than in trunk-inoculated trees in experiments reported by W. L. Yount in Pennsylvania (PDR 42: 548). J. S. Boyce, Jr. and W. A. Stegall, Jr., reported observations on wilt detection in Tennessee in 1957 (PDR 42: 707). T. W. Bretz and T. W. Jones reported the known distribution of oak wilt in the United States through 1957 (PDR 42: 710).

ULMUS spp. ELM: Ceratocystis ulmi, Dutch elm disease. Man is largely responsible for the long-distance transporting of infested beetles responsible for the spread of the Dutch elm disease in Wisconsin, according to George E. Hafstad (PDR 42: 893). In Maryland, Curtis May, J. G. Palmer and E. Hacskaylo reported in vitro inhibition of C. ulmi by acetone extracts from leaves or stems of some species of higher plants. Acetone extractions were made of the leaves or the stem of 31 varieties and species of shade trees and other plants. Extracts from 21 kinds inhibited growth of C. ulmi, the bio-assay fungus. Extracts from 10 kinds, including Ulmus americana, U. pumila, and U. carpinifolia v. Christine Buisman, lacked an inhibitory fraction (PDR 42: 399).

DISEASES OF SPECIAL CROPS

AGARICUS CAMPESTRIS. MUSHROOM: The fungicide pentachloronitrobenzene (PCNB) at 250 ppm or higher concentration applied 24 hours after casing soil had been put on delays production and limits yield of mushrooms. If the material is applied after harvest of the first break concentrations as high as 1000 ppm do not affect yield adversely (R. N. Goodman, PDR 42: 444).

ARACHIS HYPOGAEA. PEANUT: In Virginia, K. H. Garren and G. B. Duke summarized a 3-year investigation of the effect of various culture methods on the incidence of peanut stem rot caused by Sclerotium rolfsii. The use of two cultural practices resulted in increased yields. There was a consistent inverse relation between stem rot and yield, and it was assumed that these yield increases resulted from control of stem rot (PDR 42: 629).

BETA VULGARIS. SUGAR BEET: In California, A. M. Golden found that emergence of the sugar beet nematode (Heterodera schachtii) from cysts was stimulated by diffusates of leaves, as well as of roots, of the sugar beet (PDR 42: 188).

Meloidogyne incognita var. acrita, root-knot nematode. Control by soil fumigation of root-knot nematodes affecting sugar beet production in California was reported by Bert Lear and D. J. Raski. Broadcast applications of D-D (1,3-dichloropropene and 1,2-dichloropropane) EDB (ethylene dibromide), Telone (1,3-dichloropropene), and Nemagon (1,2-dibromo-3-chloropropane) resulted in good root-knot nematode control and increased sugar yields (PDR 42: 861).

C. W. Bennett and J. E. Duffus described a rosette disease of sugar beet caused by a graft-transmissible virus in California. The disease has been observed annually over a period of several years, and is recognized only on sugar beet (PDR 41: 1001).

Incidence of savoy (virus) in relation to the variety of sugar beets and to the proximity of sugar beets and to the proximity of wintering habitat of the vector, Piesma cinerea, was discussed by G. H. Coons and others. If the disease were to become serious, the possibility of effective control by breeding for savoy resistance was suggested (PDR 42: 502).

GOSSYPIUM spp. COTTON: The sixth report of the Committee on Cotton Disease Losses, of the Cotton Disease Council, lists the estimated losses to the cotton crop from diseases in 1957 (PDR 42: 169).

Results of preliminary experiments with gibberellic acid for treatment of cotton seed were discussed by D. R. Ergle and L. S. Bird (PDR 42: 320).

The efficacy of various fungicides, calcium salts, growth regulators and antibiotics, when mixed with the covering soil, for control of the cotton seedling disease complex is borne out by the results of further tests reported by C. D. Ranney and L. S. Bird (PDR 42: 785).

J. B. Sinclair gave results of screening tests with various fungicides for control of Rhizoctonia damping-off (R. solani) of cotton seedlings (PDR 41: 1059).

D. C. Erwin and H. T. Reynolds reported results obtained from seed treatment with Thimet (O,O-dimethyl S-(ethylthiomethyl) phosphorodithioate), alone or in combination with other materials, to control Rhizoctonia solani and Pythium debaryanum (PDR 42: 174).

GOSSYPIUM BARBADENSE. EXTRA-LONG-STAPLE COTTON: Meloidogyne incognita acrita, root-knot nematode. Harold W. Reynolds discussed the economic importance and methods of control of the cotton root-knot nematode on extra-long-staple cotton and reported the results of a field-scale fumigation experiment. A highly significant increase in yield of cotton was secured with preplanting soil fumigation. Effective control measures practiced in the Southwest were crop rotation, summer fallow and soil fumigation (PDR 42: 944).

HIBISCUS CANNABINUS. KENAF: Meloidogyne incognita, root knot nematode. Soil fumigation experiments by T. E. Summers and C. C. Seale indicated that the use of the fumigant chloropicrin may result not only in effective control of the nematodes that cause severe damage to kenaf in Florida, but also in a significant increase in fiber yield (PDR 42: 792).

LINUM USITATISSIMUM. FLAX: Aster yellows (virus). Although aster yellows has been observed in the Midwest for more than 25 years this is the first time that it has become prevalent and destructive in commercial flax fields in Minnesota. In recent years from a trace to 1 or 2 percent infection has been common in many fields in Minnesota. In 1957 infection varied from a trace to 30 percent and 20 percent was not uncommon. The disease was widespread throughout the entire State, and in North and South Dakota as well. The recent outbreak is attributed to the high numbers of the insect vector, Macrosteles fascifrons. This virus is neither seedborne nor mechanically transmitted (R. A. Frederiksen and J. J. Christensen, PDR 41: 994).

Curly top (virus). A disease present in experimental flax tests in Texas the past three seasons and in some commercial fields in 1957 has been identified as curly top, according to I. M. Atkins and others. Recent studies have shown that the beet leafhopper (Circulifer tenellus), the only known vector for the curly top virus, has moved into Central Texas. No variety tested is immune or even highly resistant (PDR 41: 995).

MENTHA PIPERITA. PEPPERMINT: Control of Verticillium albo-atrum presents a difficult problem which is aggravated by the existence of the pathogen within the host and its survival in the soil, according to R. C. Goss in Indiana. Good commercial control of the disease was obtained from soil treatment with CBP-55 (PDR 42: 177).

NICOTIANA TABACUM. TOBACCO: Bacillus aroideae, black leg. O. D. Morgan reported an unusual occurrence of black leg in tobacco plant beds and fields in Maryland. The hollow stalk disease has occurred a number of times in Maryland and is widespread but infrequently found. Bed rot and black leg have been found separately on rare instances in Maryland, but this is the first time they have been found together on the same farms and causing moderate losses to the grower (PDR 42: 318).

Peronospora tabacina, blue mold or downy mildew. Reports received by the Plant Disease Warning Service stated that blue mold occurred in Florida, Georgia, North Carolina, South Carolina, Virginia, Maryland and Pennsylvania during 1957. The disease occurred in many plant beds, causing slight to occasionally severe damage. A high percentage of growers used fungicide treatments for prevention of the disease. This is probably the explanation for the generally mild attacks. In November, blue mold made an out-of-season appearance in one Tift County field of volunteer tobacco plants. Dissemination by atmospheric turbulence of spores of P. tabacina was reported by P. E. Waggoner and G. S. Taylor. An understanding of the influence of weather upon the spread of fungi pathogenic to crop plants is one of the important problems in agricultural meteorology. The number of spores disseminated per lesion in the field and the hour of dissemination are critical. These facts are fundamental in the appraisal of risk of disease loss, in the forecast of multiplication of pathogens, and in the design of disease control measures. The hourly concentration of air-borne spores of P. tabacina has been measured above known numbers of tobacco blue mold lesions and is reported in this article (Phytopath. 48: 46).

Pseudomonas tabaci, wildfire. Studies on control in burley tobacco plant beds were continued at the Mountain Research Station in North Carolina, along the same general lines followed in 1955 and 1956. Excellent control resulted from four weekly spray applications of either streptomycin sulfate or streptomycin nitrate (Luther Shaw and G. B. Lucas, PDR 41: 939).

P. M. Miller and G. S. Taylor reported superior control of tobacco stunt nematodes (Tylenchorhynchus claytoni) with a nematocide mixture. In plots fumigated with 12 gallons per acre of Dorlone (a mixture containing 19% ethylene dibromide (EDB) and 75 percent 1, 3-dichloropropene) the average plant height of shade tobacco was 84 percent greater than that of plants in untreated plots (Phytopath. 48: 264).

OCIMUM BASILICUM. SWEET BASIL: In California, on land planted to sweet basil S. A. Sher and others obtained good control of root knot nematodes (Meloidogyne incognita acrita) from chisel applications of methyl bromide (PDR 42: 288).

SACCHARUM OFFICINARUM. SUGARCANE: Ratoon stunting disease (virus), first reported as occurring in Louisiana in 1951, has been causing serious losses in all sugarcane-growing areas, according to R. H. Stover. The disease is caused by a virus that is easily transmitted mechanically. All varieties were 100 percent infected, and the recently released ones were rapidly becoming infected. Highly significant losses in tonnage per acre occurred in both the cane and stubble crops in yield trials with old and new varieties. Control of the disease with hot air is now being used on a commercial scale in Louisiana. Results have shown that after the disease is eliminated from it a variety regains some if not all of its former yielding capacity. Results support the belief that the gradual decline in yield that has occurred throughout the world may be due to the ratoon stunting disease (Phytopathology 47: 535). R. J. Steib and I. L. Forbes reported Johnson grass and corn as carriers of the virus of ratoon stunting disease of sugarcane. Since Johnson grass may, under field conditions, act as a carrier of the virus, which may also be spread by implements from shoots produced by old rhizomes, treated seed cane and its progeny should be planted in areas free from Sorghum halepense (Sug. Bull., N. Orleans 35 (23: 375, 379, 1957).

DISEASES OF VEGETABLE CROPS

Root knot (Meloidogyne incognita acrita) control in vegetable crops using D-D (1, 3-dichloropropene; 1, 2-dichloropropane) and EDB (ethylene dibromide) with and without vermiculite as a carrier was reported by N. N. Winstead and others in North Carolina. In all cases the nematocides, irrespective of method of application, gave satisfactory control of root knot (PDR 42: 180).

Philip J. Leyendecker and M. Baxter Jones reported aster yellows and curly top virus diseases on vegetables in New Mexico. The aster yellows incidence ranged from 38 to 63 percent. Curly top was so severe on spinach that variety tests were abandoned (PDR 42: 42).

ALLIUM CEPA. ONION: Results of tests with fungicides for control of onion diseases in Florida were summarized by R. S. Cox. The most common disease in the field was purple blotch (Alternaria porri) (PDR 41: 789).

G. D. Lewis and others found that rootknot nematodes (Meloidogyne spp.) reproduce in infected onions (PDR 42: 447).

ASPARAGUS OFFICINALIS. ASPARAGUS: Zineb was the most effective of several fungicides tested by M. B. Linn and K. R. Lubani for control of asparagus rust (Puccinia asparagi) (PDR 42: 669).

BRASSICA OLERACEA, var. BOTRYTIS. BROCCOLI, CAULIFLOWER: Control of downy mildew, Peronospora parasitica, of broccoli with antibiotics and fungicides was reported by J. J. Natti in New York. Copper-zinc and copper-manganese were the most effective fungicides, but caused some injury. Manzate and Spergon SL were the most promising on the basis of control without injury (PDR 41: 780).

Plasmodiophora brassicae, club root. In experiments on the control of clubroot of cauliflower, Leo Campbell used fungicides added to the transplanting water or mixed with the soil in strips. In the first method, in comparison with untreated checks, zineb reduced clubroot development and increased the yield of tops, whereas Terraclor reduced disease development and increased yield. Each of the other fungicides gave excellent control of the disease but did not increase yields significantly. In the second method clubroot development was reduced and the yield of tops increased compared with untreated checks. This treatment also gave excellent control of annual weeds (Phytopath. 47: 518).

BRASSICA OLERACEA var. CAPITATA: Plasmodiophora brassicae, clubroot, is one of the more important diseases of crucifers on Long Island, New York, according to R. C. Cetas. The application of 1 quart of V. P. M. (31 percent sodium methyl dithiocarbamate) per 100 square feet as a drench resulted in good weed control and almost perfect control of clubroot of Chinese cabbage in naturally-infested fields. Other experiments also proved satisfactory (PDR 42: 324). Griseofulvin is effective in controlling club root when applied as a soil treatment. Zinc glass frit reduced the amount of disease but lithium salts were ineffective when applied as soil treatments (Saul Rich, PDR 41: 1033).

CAPSICUM sp. PIMIENTO PEPPER: Spraying pimiento peppers with a mixture of streptomycin and basic copper sulfate provided best overall control of bacterial spot (Xanthomonas vesicatoria) and ripe rot (Vermicularia capsici) in 1957, according to W. A. Chandler. Control of bacterial spot was also obtained in 1956 and 1957 with basic (Tri-basic) copper sulfate alone and with Dyrene (2, 4-dichlo-6-(o-chloranilino)-s-triazine) (PDR 42: 652).

CAPSICUM FRUTESCENS: PEPPER: (Mosaic virus). In Delaware, D. F. Crossan and E. M. Rahn reported the development and evaluation of resistant pepper varieties and selections by means of artificial inoculation in the field with tobacco mosaic virus. Three resistant varieties or selections were considered superior to California Wonder, with respect to yield (PDR 42: 48).

CUCURBITS. CUCUMBER, MELON, SQUASH: Certain insecticide-fungicide combination treatments were more effective than the same fungicides used alone as cucurbit seed protectants in tests reported by J. J. Natti and others in New York (PDR 42: 127).

Colletotrichum lagenarium, anthracnose. The effect of seed treatment on development of anthracnose in watermelon seedlings was reported by Robert Aycock. The study was designed to determine the efficiency of various fungicidal preparations against seed-borne anthracnose spores and their effect on seedling emergence and survival when applied to non-infested seed, and also the influence of various fungicidal rates and methods of application on incidence of disease and injury (PDR 42: 134).

Erysiphe cichoracearum, powdery mildew. According to S. S. Ivanoff in Mississippi, hyperplastic symptoms on greenhouse-grown watermelon fruits, in the form of pimples, warts, and similar intumescences, were found to be caused by powdery mildew, probably Erysiphe cichoracearum. A preliminary test has shown that fungicidal dips may be of help should the disease prove to be of economic importance (Phytopath. 47: 599).

S. D. Van Gundy and J. C. Walker reported the relation of temperature and host nutrition to occurrence of angular leaf spot (Pseudomonas lachrymans) of cucumber in Wisconsin. Six isolates of P. lachrymans from widely separated geographical areas were found to be similar in pathogenicity and cultural characteristics (Phytopath. 47: 615).

Temperature and temperature-light effects on the concentration of squash mosaic virus in leaves of growing cucurbits was reported by John B. Bancroft. The concentration of the virus in leaves of pumpkin and squash plants grown under various conditions of light and temperature was measured spectrophotometrically (Phytopath. 48: 98).

IMPOMOEA BATATAS. SWEETPOTATO: In preliminary tests reported by L. J. Kushman and G. B. Ramsey dipping sweetpotato roots in a solution of Dowicide A (sodium o-phenylphenoxide) or borax gave good control of decay during marketing (PDR 42: 247).

Fusarium oxysporum f. batatatis, stem rot or wilt. E. M. Hildebrand and others reported an investigation which sheds light on the cultural identity and pathogenic behavior of the sweetpotato stem rot or wilt disease. A total of 36 cultural units or combinations thereof were tested 3 years in succession on the three varieties Tinian, Triumph, and Porto Rico. In all 3 years the virulent parent and single-spore progeny strains of the fungus behaved essentially alike in degree and range of infection (PDR 42: 112).

L. R. Krusberg and L. W. Nielsen planted Porto Rico sweetpotatoes in soil naturally infested with Meloidogyne incognita acrita to study the pathogenesis of this nematode in sweetpotato. Nematode feeding stimulated the formation of several atypical tissues: giant cells, "abnormal xylem", hyperplastic parenchyma, and cork. Young plants heavily infected had small roots and tops; the roots had numerous cracks (Phytopath. 48: 30).

Internal cork (virus). Freeing sweetpotato varieties from cork virus by propagation with tip cuttings was reported by E. M. Hildebrand (Phytopath. 47: 452). The internal cork virus was transmitted by the aphid Myzus persicae in experiments reported by H. W. Rankin and and J. H. Girardeau, Jr. in Georgia (PDR 42: 581).

W. J. Martin quoted descriptions and recorded the results of a literature review of mosaic of sweetpotato and related virus diseases (PDR 41: 930).

LACTUCA SATIVA. LETTUCE: B. A. Friedman reported the results of a compilation of 726 inspections, or approximately 76 percent of all rail shipments of western-grown lettuce on the Pittsburgh, Pennsylvania market during the first 6 months of 1957. Only 6.2 percent of the carlot shipments were reported free of disease. Decay was found in 83.3 percent of the inspections, and averaged 6.7 percent in affected cars or 5.6 percent in all cars (PDR 42:250).

R. G. Grogan reported the association of Olpidium with the big-vein disease of lettuce Phytopath. 48: 292).

Orobanche ramosa, broomrape, the clandestine root parasite of many herbaceous plants, causes serious losses in lettuce and tomato in the Alvarado area of California, according to Stephen Wilhelm and others. Attempts to kill its minute seed in soil have been successful only by fumigation with methyl bromide (Phytopathology 47: 537).

LYCOPERSICON ESCULENTUM. TOMATO: The uptake and movement of cycloheximide acetate-2-C^{14} into tomato plants has been examined and results reported by A. J. Lemin and W. E. Magee. These experiments suggested that cycloheximide acetate may be absorbed intact through the roots of the tomato plant, but that it derives its antifungal activity from free cycloheximide released in the plant (PDR 41: 447).

Recent developments on the control of foliar diseases (Botrytis cinerea, Phytophthora infestans, Stemphylium solani, and Xanthomonas vesicatoria) of tomato in south Florida were reported by R. S. Cox and N. C. Hayslip (PDR 41: 878).

Cladosporium fulvum, leaf mold, was reported on field grown tomatoes in Connecticut in plots of Sioux tomatoes planted at the Mt. Carmel Farm on a piece of land which had not been in tomatoes for at least 25 years (Saul Rich, PDR 41: 1058).

Fusarium oxysporum f. lycopersici, wilt. Vapam was not effective as a soil treatment for control of the tomato Fusarium wilt fungus in tests reported by A. G. Plakidas in Louisiana (PDR 41: 778).

Soil fumigation with methyl bromide gave excellent control of broomrape (Orobanche ramosa) a flowering plant), a serious pest of tomato fields in California, in experiments reported by Stephen Wilhelm and others (PDR 42: 645), see also under LACTUCA SATIVA.

LYCOPERSICON ESCULENTUM. TOMATO: Phytophthora infestans, late blight. In the 1957 season, late blight of potato and tomato was reported to the Plant Disease Warning Service from many States and from Canada. In Wisconsin, late blight of tomato made very little headway during July and August. However, cooler nights with heavy dews and fog and some rain changed the picture by the end of September, when blighted vines could be found in home gardens and most commercial areas showed from light to very severe infections. In 20 locations in six North Central States, Hoopeston, Illinois was the only station where blight did not appear as forecast because of a continuous rigorous control program. In general late blight was found earlier in the North Central Region in 1957 than last year and occurred in epiphytotic proportions in southern Minnesota, Illinois, Indiana, northern Minnesota, North Dakota, central Nebraska, western Nebraska and in Wisconsin. In South Carolina, late blight was introduced into most commercial fields on infected transplants. A total of 32 periods was favorable for sporulation with a total of 9.54 inches of rainfall. The disease spread was rapid and most fields were severely damaged.

J. B. Sinclair and others reported from Louisiana that greater total yields of marketable tomatoes were obtained with various organic fungicides and combinations than with copper, but that effectiveness for control of late blight could not be determined because of lack of natural infection in the experimental plots (PDR 41: 657).

Verticillium albo-atrum, wilt. In Wisconsin, L. V. Edington and J. C. Walker reported studies on the influence of soil and air temperature on Verticillium wilt of tomato. Each factor had a significant effect, but soil temperature was more influential (Phytopath. 47: 594).

D. Davis and S. Halmos studied the effect of air moisture on the predisposition of tomato to bacterial spot, Xanthomonas vesicatoria, in New Jersey (PDR 42: 110).

E. E. Butler and others observed tomato fruit pox, cause unknown, in green-wrap fields in California. In some fields approximately 75 percent of the vines bore fruit with pox symptoms. Little information is available concerning the distribution and importance of the disease in the United States (PDR 42: 850).

PHASEOLUS LIMENSIS. LIMA BEAN: R. E. Wester and others described a freezing technique for preserving sporulating lima bean downy mildew (Phytophthora phaseoli) infections in a viable condition. The fungus has been kept at Beltsville, Maryland, in a viable condition at -10°F for more than 100 days without any reduction in pathogenicity (PDR 42: 413). In Tennessee, E. L. Felix pointed out the advantages of standard 5-day units in forecasting plant diseases. R. A. Hyre found the 5-day mean as accurate as the widely employed 7-day mean and adopted it in the correlation and forecasting of downy mildew (Phytophthora phaseoli) in lima bean (PDR 41: 223).

PHASEOLUS VULGARIS. BEAN: R. N. Goodman and W. M. Dowler reported the absorption of streptomycin by bean plants as influenced by growth regulators and humectants (PDR 42: 122).

Fusarium solani f. phaseoli, root rot. In Idaho, five different genera of fungi were isolated from bean plants affected with root rot. All of the isolates that were demonstrated to be prime pathogens were identified as F. solani f. phaseoli. This organism is capable of entering plants by direct penetration, through the stomata on the hypocotyl, and through wounds (Paul Chatterjee, Phytopath. 48: 197).

M. M. Afanasiev and E. L. Sharp reported results of various bactericidal sprays on control of halo blight (Pseudomonas phaseolicola) disease of garden bean. In conclusion they stated that Bordeaux and Agri-mycin 100 ppm gave the best results in controlling halo blight (PDR 42: 1071).

Uromyces phaseoli typica, rust. Experiments conducted at the Florida Sub-Tropical Experiment Station indicated that improved control of rust of pole beans was obtained when maneb was added to sulfur dusts. Spraying with maneb two or three times before the fields were staked was a valuable adjunct to the dusting program (R. A. Conover, Fla. Hort. Soc. Proc. 69: 247-250, 1957). The effect of rust on bean plants is defoliation which progresses fairly rapidly after infection becomes general. Since, however, the rust does not appear on pea beans until late, that is when the pods are maturing, little or no damage is caused to the plant. In fact it is considered an advantage, according to W. H. Burkholder, to have the disease appear at this time of year in New York dry bean fields, when the grower wants his beans to ripen rapidly to avoid an early frost (PDR 41: 1036). W. J. Zaumeyer reported that treatment of lower surfaces of bean leaves with either oligomycin or anisomycin gave better protection against infection by U. phaseoli var. typica than did treatment of upper surfaces (Phytopathology 47: 539).

In California, cross-protection between the bean rust fungus, Uromyces phaseoli typica, and tobacco mosaic virus (TMV) was demonstrated in bean leaf tissue. TMV-infected bean leaves showed a resistance to rust (apparently due to inhibition of urediospore germination); rusted bean leaves showed a resistance to TMV infection. Aqueous diffusates from urediospores sprayed on bean leaves protected against both rust infection and the formation of TMV local lesions in the leaves (E. M. Wilson, Phytopath. 48: 228).

Weather injuries. Observations during the past 3 1/2 years have convinced R. S. Cox that wind damage results in greater losses to many vegetable crops in the Everglades and surrounding areas year in and year out than any other single factor. Effects on snap bean are described. The name suggested for this physiological effect is wind-whip (PDR 41: 795).

PISUM SATIVUM. PEA: Purple blight (?nutritional). W. T. Schroeder and others pointed out that purple blight may develop on plants at any stage of growth, but injury is greatest when the disorder occurs early and results in a blighted plant with no pods or very few, small pods. Although purple blight has occurred in 10 of the 14 years since it was first observed, the disorder is sporadic in occurrence and may not develop in the same area 2 years in succession Phytopath. 48: 264).

RAPHANUS SATIVUS. RADISH: Red Globe type radish roots showed infections of Peronospora parasitica in the field in Connecticut this year. In spite of the very dry summer, a few infections showed up early and were later spread by irrigation. The losses in the second planting, with the beginning of cooler weather, were as high as 75 percent of the radishes harvested on some farms (PDR 41: 1058).

SOLANUM MELONGENA. EGGPLANT: In Michigan, C. L. Burton and D. J. deZeeuw concluded that seed transmission of the eggplant wilt (Verticillium albo-atrum) is very unlikely (PDR 42: 427).

SOLANUM TUBEROSUM. POTATO: Alternaria solani, early blight. Increased incidence of early blight in southeastern Idaho for the past 5 years is associated with wider use of sprinkler irrigation, according to J. W. Guthrie. During 1957 complete defoliation of the plants occurred in many fields totalling about 3000 acres. In every instance the fields were irrigated by sprinklers (PDR 42: 246).

Corynebacterium sepedonicum, ring rot. It is apparent that ring rot prevalence has varied considerably from year to year without evidence of consecutive build-up over a period of years, according to G. H. Starr in Wyoming. If seed is to be kept free from ring rot, all known control measures will have to be followed (Amer. Potato Jour. 34: 268). Results of experiments conducted in Maine by Reiner Bonde and Barbara Johnson seemed to indicate that during the process of cutting seed potatoes, streptomycin sulfate, when combined with a number of disinfectants and other chemicals, may have an additive effect on ring rot control (PDR 42: 781).

Erwinia atroseptica, blackleg. Harry C. Fink reported that potato seed-piece treatment with streptomycin-fungicide mixtures did not control blackleg rot in field tests although it had given promising results in laboratory trials (PDR 42: 965).

Heterodera rostochiensis, golden nematode. Encysted golden nematode larvae placed in the centers of bales of burlap bags were killed by di-electric heat in experiments reported by W. F. Mai in New York (PDR 42: 449).

Phytophthora infestans, late blight (see also under tomato). Reiner Bonde, R. A. Hyre, and Barbara Johnson reported that a forecast and warning service was conducted for late blight of potato in Aroostook, Maine for the third successive year. The estimated average foliage blight was about 1 percent. This small amount of blight was quite accurately reflected by both the rainfall-temperature and the relative humidity-temperature methods of predicting blight. The lack of infection of potato cull piles and the good spraying program carried out by most of the potato growers in Maine were big factors in the small amount of late blight infection in the County in 1957 (PDR 41: 936). In Maine, studies were made by Reiner Bonde and Barbara Johnson on the additive effect of Agri-mycin used with different fungicides in the control of late blight (PDR 42: 330).

In trials reported by R. A. Young and W. J. Tolmsoff effectiveness of Vapam soil treatment for controlling Verticillium wilt (Verticillium albo-atrum) carried over into the succeeding year (PDR 42: 437).

Haywire (virus). R. E. Webb and E. S. Schultz reported possible relation between haywire of potato and big bud (virus) of tomato. Their results indicated that haywire of potato in Nebraska may be caused by the tomato big bud virus (PDR 42: 44).

Knobby tuber disease (? virus). This disease was first observed in experimental fields of the variety Katahdin at Aroostook Farm, Presque Isle, Maine in 1951. The disease is sometimes tuber-transmitted but some plants from affected tubers appear to recover. The cause of the disease is not known but it may be a virus similar to that causing spindle tuber (Amer. Potato Jour. 34: 227-229).

VIGNA SINENSIS: COWPEA: Fusarium oxysporum f. tracheiphilum, wilt. W. W. Hare reported that the Mississippi Crowder, a new variety of cowpea, is highly resistant to Race 1 and tolerant to Races 2 and 3 of F. oxysporum f. tracheiphilum (Phytopath. 47: 565).

MYCOLOCY AND PLANT DISEASE REPORTING SECTION, CROPS PROTECTION RESEARCH BRANCH, CROPS RESEARCH DIVISION, BELTSVILLE, MARYLAND

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ROOTROT AND RELATED LITERATURE

AN ANNOTATED BIBLIOGRAPHY, 1957

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Crops Protection Research Branch — Plant Industry Station, Beltsville, Maryland

ROOTROT AND RELATED LITERATURE

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Prepared by the following members of the staff, Science Service Laboratory, Harrow, Ontario.

L. W. Koch, Officer-in-Charge
H. R. Boyce, Head, Entomology Section
A. A. Hildebrand
C. D. McKeen
W. B. Mountain
Z. A. Patrick
R. N. Wensley
N. J. Whitney

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We have prepared the following annotated bibliography from references appearing in periodicals published in 1957. The purpose is to facilitate rootrot research and emphasise its importance as a distinct entity in plant pathology. We also hope that this list will help investigators avoid unnecessary duplication of effort in searching the literature. It is our intention to repeat this work at least one more year. In the meantime, we invite your comments.

-- The Authors

CONTENTS

ACTINOMYCETES

See also 81, 509

1. ALLEN, J. D. The development of potato skin-spot disease. Ann. Appl. Biol. 45: 293-298. 1957.
   In Kerr's Pink (var.) humid conditions, both before and after infection by Oospora pustulans, increase the incidence of the disease.

2. BOYD, A. E. W. Field experiments on potato skin-spot disease caused by Oospora pustulans Owen & Wakef. Ann. Appl. Biol. 45: 284-292. 1957.
   Potato varieties vary from susceptible to highly resistant. The efficacy of an organo-mercury dip treatment at lifting time was confirmed.

3. DOUGLAS, R. J. and C. L. SAN CLEMENTE. Some observations on the metabolism of Streptomyces scabies. Can. J. Microbiol. 3: 905-910. 1957.
   This research was developed with a view towards a possible explanation of the pathogenic activities of Streptomyces scabies on a biochemical basis. It was found that in the presence of the dye 2,6-dichlorophenol indophenol crude extracts of alumina-ground or of sonically disrupted mycelium of Streptomyces scabies catalyzed dehydrogenase reactions with the substrates succinate, citrate, malate, and glutamic acid.

4. JOHNSON, GESTUR and LAWRENCE A. SCHAAL. Chlorogenic acid and other orthodihydricphenols in scab-resistant Russet Burbank and scab-susceptible Triumph potato tubers of different maturities. Phytopathology 47: 253-255. 1957.
   Concentration of chlorogenic acid and the total o-dihydricphenols was much higher in periderm of tubers of the scab-resistant variety Russet Burbank than in that of tubers of the scab-susceptible variety Triumph. Greatest difference between the varieties was found at the stage in which the tubers were growing most rapidly.

5. LITZENBERGER, S. C. and J. A. STEVENSON. A preliminary list of Nicaraguan plant diseases. Plant Dis. Reptr. Suppl. 243. 1957.
   Reports Streptomyces (Actinomyces) scabies on potatoes.

6. MENZIES, J. D. Control of potato scab by a scab-suppressing factor in certain soils. Phytopathology 47: 528. 1957.
   Certain soils of the Yakima Valley, Washington, have a suppressing effect on potato scab. A striking reduction in the incidence of scab in a heavily infested soil was obtained by adding 1 percent by weight of scab-suppressing soil plus 1 percent by weight of chopped alfalfa hay.

7. PLANT QUARANTINE ANNOUNCEMENTS: CYPRUS. F.A.O. Pl. Prot. Bull. 5: 177-179. 1957.
   With reference to importation (a) if the shipment of tubers contains more than 10 percent of the tubers with more than 10 percent of the surface affected by common scab (Actinomyces scabies), the consignment will be subject to disinfection, treatment, destruction, or re-exportation (b) the crop producing the seed potatoes must have been located at least 2 kilometers from any place where potato wart or ring rot (Corynebacterium sepedonicum) has occurred at any time.

ANTIBIOTICS

See also 415, 422

8. ABO EL DAHAB, M., and C. E. COX. Studies of certain nutritional requirements of Chloromycetin-resistant, Chloromycetin-susceptible, pathogenic and non-pathogenic isolates of Pseudomonas solanacearum. (Abstr.) Phytopathology 47: 1. 1957.
   Strains showing varying degrees of resistance to the antibiotic were isolated from a tobacco and a tomato strain of Pseudomonas solanacearum by prolonged incubation with chloromycetin and were found to show variations in nutritional requirements. No correlation was found between pathogenicity

and chloromycetin resistance and no differences in nutritional requirements were found between strains of differing pathogenicity.

9. ANDRÉN, F. and B. OLOFSSON. Kombinerat betnings- och besprutningsförsök mot ringröta på Potatis. (Combined disinfection and spraying experiments against potato ring rot.) Växtskyddsnotiser, Stockholm, 21: 26-27. 1957. (Rev. Appl. Mycol. 36: 784-785. 1957.)

Potatoes infected by ring rot (Corynebacterium sepedonicum) were immersed for one hour in Acti-dione (100 mg/liter). These were planted out in plots (100 in each) and sprayed three times with Acti-dione (25 ppm). About 3 weeks before lifting, the haulms in half of the plot were killed with 10 percent sulfuric acid. Immersion in the antibiotic reduced the incidence of ring rot on an average by some 45 percent, but neither spraying with Acti-dione nor haulm-killing was effective by itself.

10. ARK, PETER A. and W. S. SIBRAY. Efforts to control crown gall of roses with antibiotics. Plant Dis. Reptr. 41: 449-451. 1957.

Some control of crown gall (Agrobacterium tumefaciens) of roses was obtained in cuttings with 2-hour streptomycin dips containing 500 and 600 ppm. No satisfactory control was shown by streptomycin dusts up to 2000 ppm. Tetracycline (100 ppm) was effective to a degree on certain rose varieties.

11. CARTER, H. P., and J. L. LOCKWOOD. Lysis of fungi by soil microorganisms and fungicides including antibiotics. Phytopathology 47: 154-158. 1957.

A photometric method was used to determine changes or density of mycelium. A comparison was made of the lytic action of certain streptomycetes, of antibiotics, and of fungicides. The first showed the greatest lytic action, lysing both living and dead mycelium.

12. CARTER, H. P., and J. L. LOCKWOOD. Lysis of fungi by Streptomyces isolates and fungicides. (Abstr.) Phytopathology 47: 5. 1957.

Zones of lysed mycelium were produced around Streptomyces colonies that developed when soil suspensions were sprayed on agar media containing cultures of Glomerella cingulata, Helminthosporium sativum, Fusarium oxysporum f. lycopersici, Rhizoctonia solani, Verticillium albo-atrum and others. Streptomyces isolates lysed both living mycelium and mycelium killed by heat and chloroform, whereas fungicides lysed only living mycelium.

13. CRAVERI, R. and G. GIOLITTI. An antibiotic with fungicidal and insecticidal activity produced by Streptomyces. Nature 179: 1307. 1957.

Dilutions of "flavensomycin" isolated from Streptomyces tonaschiensis, in the region of 0.05 μgm/ml are active against Saccaromyces among yeasts and Penicillium among the filamentous fungi.

14. EPPS, WILLIAM M. Control of potato seed piece decay in South Carolina 1952-1956. Plant Dis. Reptr. 41: 148-150. 1957.

Streptomycin treatment, either liquid dips or dusts, of the freshly cut seed resulted in good control of seed piece decay (caused by Erwinia atroseptica and E. carotovora) as measured by the effect of treatment on the stands and yields obtained.

15. GATTANI, M. L. Studies on the control of damping-off of safflower with antibiotics. Plant Dis. Reptr. 41: 160-164. 1957.

Out of five antibiotics tested for the inhibition of five root-rotting fungi in vitro, Acti-dione, patulin and filipin gave promising results. As Acti-dione and patulin proved to be phytotoxic to safflower seeds and seedlings, filipin was used for studies on the control of the damping-off phase of the root rot of safflower caused by an unidentified species of Pythium in Alberta. Seed treatment of safflower with different concentrations of filipin for varying periods did not control the disease.

16. KEYWORTH, W. G. Streptomycin for control of silvering disease, Corynebacterium

betae, of red beet. Ann. Appl. Biol. 45: 215. 1957.
Streptomycin treatment of seed considerably reduced this disease in the field.

17. LOGSDON, CHARLES E. The effects of certain antibiotics on potato production and ring rot control in Alaska. (Abstr.) Phytopathology 47: 22. 1957.
Agri-mycin 100 at 1000 ppm gave good control of potato ring rot in the field and in storage. At the same time it decreased yields considerably. Agritracin had no effect on the disease.

18. MILLER, PAUL R. (compiler). Tests with antibiotics for control of rose crown gall. Agr. Chem. 12: 57-58. 1957.
Practices that result in root injuries are important factors in infection. The paper discusses precautionary measures to be taken during transplanting as well as a program of antibiotic dip treatments for prevention.

19. SMITH, GLENN E. Inhibition of Fusarium oxysporum f. lycopersici by a species of Micromonospora isolated from tomato. Phytopathology 47: 33. 1957. Phytopathology 47: 429-432. 1957.
A conidial and mycelial suspension of Micromonospora sp. was mixed with warm agar in Petri dishes. Fusarium oxysporum f. lycopersici was completely inhibited when transferred to this agar 1 day or more later. When added to potato-dextrose agar, a 50 percent dilution of a crude filtrate of the Micromonospora sp. inhibited F. oxysporum f. lycopersici.

20. SMITH, J. DREW. The use of griseofulvin against dollar spot and Fusarium patch diseases of turf. Ann. Appl. Biol. 45: 206-208. 1957. (J. Sci. Food Agr. 8: Abstracts ii-131. 1957.)
Application of griseofulvin in aqueous solution at 220-880 $\mu g/ml$ to turf decreased the extent of dollar spot and Fusarium patch in proportion to the amount applied in tests in which the disease was started by inoculation with liquid cultures. In practical tests on bowling greens griseofulvin (wettable powder) showed some protective activity against dollar spot infection.

21. THORNTON, H. G. Report of the Rothamsted Experimental Station for 1956, 280 p., 1957. (Rev. Appl. Mycol. 36: 816. 1957.)
Evidence was obtained of a fungistatic substance (or substances), destroyed by heat, that inhibits spore germination in soil.

22. VERONA, O. and P. GAMBOGI. Intorno all'azione antimicotica della nistatina. I. Azione su Aspergilli, Penicilli e funghi fitopatogeni. (On the antifungal action of nystatin. I. Action on Aspergillus, Penicillium, and phytopathogenic fungi.) Ann. Sper. agr., N.S. 11: 193-209. 1957. (Eng. summary) (Rev. Appl. Mycol. 36: 543-544. 1957.)
Nystatin, an antibiotic substance present in the mycelium of Streptomyces noursei, used in the form of a therapeutic preparation mycostatin, retarded or inhibited the growth of 24 species of Penicillium, and 11 of Aspergillus, as well as of numerous phytopathogenic fungi. It did not appear to be toxic to the aerial parts of plants. Application via the roots growing in solutions in some cases slightly retarded the growth of the underground parts and (when the application was heavy) of the aerial parts.

23. WHITE, N. H. Antibiosis in plant pathology. Aust. J. Sci. 19: 7-9. 1957. (Rev. Appl. Mycol. 36: 775. 1957.)
Attention is drawn to the need for a wider but nevertheless precise concept of "antibiosis", especially in relation to plant diseases. There are apparently three ways, depending on their source, in which antibiotics may modify the pathogen-host relationship. Thus, the pathogen may secrete a substance antagonistic to the host; the latter may produce a substance injurious to certain of its pathogens; and micro-organisms may secrete substances antibiotic to a given pathogen, thereby influencing the incidence and severity of the disease which it causes. Evidence supporting the existence of each of these

types of antibiotic action is summarized from 25 contributions to the literature.

24. WRIGHT, J. M. and J. F. GROVE. Production of antibiotics in soil. V. Breakdown of griseofulvin in soil. Ann. Appl. Biol. 45: 36-43. 1957. (J. Sci. Food Agr. 8: Abstracts ii-123. 1957.)

When added to a garden loam griseofulvin disappeared rapidly after an initial lag. A Pseudomonas sp. increased in soil after addition of griseofulvin.

BACTERIA

See also 7, 8, 9, 10, 14, 16, 17, 18, 74, 180, 181, 182, 187, 189

25. AVIGAD, G. and D. S. FEINGOLD. Fructosides formed from sucrose by a Corynebacterium. Arch. Biochem. Biophys. 70: 178-184. 1957.

The predominant glycosidic linkage was of the type 2 beta: 6, the branch linkage 2 beta: 1, and the basal chain length 15. 1^F-beta-fructosylsucrose was the major oligosaccharide formed during levan synthesis from sucrose by the Corynebacterium sp.

26. BAKKER, MARTHA. Bacterieverwelkingsziekten van anjers. (Bacterial wilt diseases of carnations.) Tijdschr. PlZiekt. 63: 20-21. 1957. (Rev. Appl. Mycol. 36: 589. 1957.)

Carnation bacterial wilt disease in the Netherlands has been attributed to Pseudomonas caryophylli. The disease in Denmark has now been attributed to Erwinia carotovora f. sp. dianthicola. The above paper differentiates between these two.

27. BINOT, NOELLE. Les parasites et ennemis des dahlias. (Diseases and pests of dahlias.) Jardins de Fr. 4: 153-159. 1957. (Rev. Appl. Mycol. 36: 763. 1957.)

Mentioned inter alia are infections by Corynebacterium fascians, Agrobacterium tumefaciens, Erwinia cytolytica (E. carotovora), and Pseudomonas solanacearum.

28. BONDE, R. and J. S. GELCHELL. Survival of ring-rot bacteria in wet potato pulp from the starch factories. Amer. Potato J. 34: 133-135. 1957.

Ring-rot bacteria (Corynebacterium sepedonicum) in wet potato pulp from a starch factory will mostly die in storage after 3 to 7 days but a few may survive for as long as 17 days at 40° F. Temperatures of 50° to 55° were less favorable for survival.

29. BURKE, DOUGLAS W. Bacterial wilt of pinto beans on soils of different types and cropping histories. Plant Dis. Reptr. 41: 671-673. 1957.

Wilt caused by Corynebacterium flaccumfaciens or C. flaccumfaciens var. aurantiacum was much less on clay loam than on sandy loam, possibly because of suppressive action of competitive microflora upon the pathogen in the finer textured soil.

30. COX, R. S., V. J. CARROLL, and R. A. BENEDICT. Studies on the etiology and control of the radish pit disease. (Abstr.) Phytopathology 47: 7. 1957.

Radish pit, a storage and transit disease, is a serious threat to the radish industry in Florida. Constant association of bacteria with lesions and control with antibiotics suggested a bacterial etiology. Control was obtained following (among others) a 5-minute dip treatment with Terramycin at 40 ppm.

31. ERDMAN, LEWIS W., HERBERT W. JOHNSON, and FRANCIS CLARK. Varietal responses of soybeans to a bacterial-induced chlorosis. Agron. J. 49: 267-271. 1957.

Certain soybean varieties developed a chlorosis when inoculated with selected strains of Rhizobium japonicum while other soybean varieties showed normal growth when similarly treated. Soybean varieties showing chlorosis after inoculations with selected strains of R. japonicum failed to show chlorosis when grown in association with other Rhizobia. The evidence is substantial that bacterial-induced chlorosis in soybeans is linked to varietal susceptibility.

32. GARBER, E. D. and SUSAN G. SHAEFFER. Free histidine content of turnip varieties and their resistance to histidine requiring mutants of Erwinia aroideae. J. Bact. 74: 392-395. 1957.

A correlation was found between resistance in turnip and a relatively low histidine concentration. Where this correlation broke down the authors explained it on the basis of the expression of an amine antaorganism or inhibition.

33. GOTTLIEB, DAVID, MICHELINA ROMOLI, and MARIO RÓGERS. Alfalfa wilt in Chile. Plant Dis. Reptr. 41: 1041-1044. 1957.

A widespread wilt disease of alfalfa in Chile was shown to be similar to bacterial wilt of alfalfa caused by Corynebacterium insidiosum. The amount of damage was greatest in old fields. All commercial varieties of alfalfa being grown showed symptoms of the wilt. The ultimate aim is to breed varieties of alfalfa resistant to the wilt which are suited to Chilean conditions.

34. GYLLENBERG, H. G. Seasonal variations in the composition of the bacterial soil flora in relation to plant development. Can. J. Microbiol. 3: 131-134. 1957.

At the beginning of the season the soil flora was different from that of the rhizosphere. However, it was successively changed, and became, toward the end of the season, similar in composition to the rhizosphere population. This change was due to the development of roots and to a migration from the rhizosphere into the soil.

35. HARRISON, D. E. Bacterial wilt of potatoes caused by Pseudomonas solanacearum E. F. S., including a comparison of Victorian and other strains of the organism with the ring rot bacterium, Corynebacterium sepedonicum (Spiek and Kotth.) Skapt. and Burk. Thesis. Austral. Inst. Agric. Sci. J. 23: 160. 1957.

36. ḤUSAIN, A. Mode of pathogenesis of the Granville wilt bacterium, Pseudomonas solanacearum. Ann Arbor, Mich. Univ. Microfilms Pub. 21: 894. 1957. (Diss. Abst. 17: 1649-1650. 1957)

The highly pathogenic strain (F_1) caused rapid wilting and death of host plants, the weakly pathogenic strain (B_2) did not induce wilting but caused yellowing and stunting, and the virulent strain (B_1) produced no external symptoms. Preliminary chemical analysis of the wilt-inducing substance from culture filtrate indicated that it was a complex polysaccharide. Pectic and cellulytic enzymes increase the severity of wilting by disorganization of vascular tissue.

37. LAMBINA, V. A. Distribution of soil bacteria decomposing vegetable protopectin on the fields with grass-crop rotation. Mikrobiologiya 26: 66-74. 1957.

Bacteria of the protopectin age group were present in the rhizosphere and the root systems of ordinary winter wheat, clover, timothy grass, oats, flax, potatoes, cabbage, peas, and tomatoes.

38. LAPWOOD, D. H. Studies in the physiology of parasitism. XXIII. On the parasitic vigour of certain bacteria in relation to their capacity to secrete pectolytic enzymes. Ann. Bot., London N.S. 21: 167-184. 1957. (Rev. Appl. Mycol. 36: 458. 1957.)

The failure of nonpathogenic bacteria to attack normal potato tissue was attributed to their slower rates of growth and enzyme production, which allow the tissues sufficient time for protective suberization.

39. LIHNELL, D. Några olika potatissorters förhållande till ringröta. (The reaction of some different potato varieties to ring rot.) Växtskyddsnotiser, Stockholm, 21 (2): 28-30. (Rev. Appl. Mycol. 36: 785. 1957.)

Tested 14 varieties to ring rot (Corynebacterium sepedonicum). The type wilting in the infected plants was variable but in the final analysis it was nonspecific. The tubers were lifted and, from time to time, examined in storage for symptoms of ring rot. The results were variable. Most varieties were severely infected, exceptions being Alpha, Elsa, Anna, and President. In variety Stockholm, bacteria penetrated the hilum and entered the vascular ring and also entered directly into the flesh.

40. MURANT, A. F. and R. K. S. WOOD. Factors affecting the pathogenicity of bacteria to potato tubers. I. Ann. Appl. Biol. 45: 635-649. 1957.

The effect of potato extracts on the growth of four species of bacteria, one pathogenic (Erwinia aroideae) and three nonpathogenic (Pseudomonas syringae, Pseudomonas sp., and Flavobacterium sp.), and on the properties of their culture filtrates, was studied. It was shown that in some respects the pathogen Erwinia aroideae, and the three nonpathogens, behaved differently in vitro; these differences, if they occurred in vivo, could account, in part at least, for differences in pathogenicity. The factors which are probably important are the rates at which these organisms grew and produced macerating enzymes.

41. MURANT, A. F. and R. K. S. WOOD. Factors affecting the pathogenicity of bacteria to potato tubers. II. Ann. Appl. Biol. 45: 650-663. 1957.

Rates of suberization of the outer cells and of periderm development, or the addition of growth-regulating substances, had little effect on rotting. The water content of the tissues greatly affected the pathogenic capabilities of the very weak pathogens, Pseudomonas sp., Flavobacterium sp., and Pseudomonas syringae. The nonpathogenic bacteria caused active rots when the outer surfaces of tubers were sealed with vaseline. Temperature was important. Moisture was of real importance in pathogenicity of one of the nonpathogenic (weakly pathogenic) bacteria.

42. PHILIPSON, M. N. and I. D. BLAIR. Bacteria in clover root tissue. Can. J. Microbiol. 3: 125-129. 1957.

This paper reports bacteria (five kinds) that were isolated from the inner tissue of apparently healthy clover roots.

43. PLANTESYGDOMME I DANMARK 1954. ÅRSOVERSIGT SAMLET VED STATENS PLANTEPATOLOGISKE FORSØG, LYNGBY. (Plant diseases in Denmark 1954. Annual report compiled by the State Phytopathological Experiment Station, Lyngby.) Tidsskr. Planteavl. 60: 553-611. 1957. (Rev. Appl. Mycol. 36: 513. 1957.)

Infection of potatoes by Erwinia atroseptica was more severe than for many years, with incidence up to 10 percent.

44. SCHUSTER, M. L. and D. W. CHRISTIANSEN. An orange-colored strain of Corynebacterium flaccumfaciens causing bean wilt. Phytopathology 47: 51-53. 1957.

Although it primarily attacks above ground parts of the plant, this bacterium, C. flaccumfaciens var. aurantiacum n. var., is able to attack through the roots also. Attempts to create wilt symptoms by application of a bacterial suspension to the soil produced diverse effects, depending on whether sterilized or nonsterilized soil was used. Infection occurred in nonsterilized soil but not in sterilized soil.

45. STARR, G. H. and L. R. FINA. Effect of temperature on bacterial inoculum from ring-rot-infected tubers as shown by staining tests and by inoculum studies. Amer. Potato J. 34: 94-96. 1957.

A suspension of potato ring-rot bacteria (Corynebacterium sepedonicum) kept at 38° F could be used for inoculating tubers after 48 hours without much loss of viability, whereas at 83° F it deteriorated rapidly after 10 hours and induced no ring-rot symptoms.

46. TSUJITA, M. and C. MATSUI. Studies on the lysogenicity of Pseudomonas solanacearum with special reference to the new type phage produced from a doubly lysogenic strain. Jap. J. Genet. 32: 113-123. 1957. (In English).

Some doubly lysogenized S-9 (T-c200) bacteria liberate phage with a new type of host range. By infection with both S-9 and T-c200 phage, nonlysogenic S-IX bacteria can be changed into doubly lysogenic S-IX (S-9 T-c200) forms. In the doubly lysogenic bacterial strain thus formed, the new type of phage is also produced. It is concluded that recombination occurs only at the time the doubly lysogenic state is initiated.

CHYTRIDS

47. HEY, A. Zur Rassenanalyse des Kartoffelkrebses (Synchytrium endobioticum (Schilb.)) Perc. (On the racial analysis of potato wart, Synchytrium endobioticum (Schilb.)) Perc.) Z. PflKrankh. 64: 425-457. 1957. (Rev. Appl. Mycol. 36: 781. 1957.)
Independent physiologic races (besides the so-called "normal" type) now total five in the German Democratic Republic.

48. SYNCHYTRIUM ENDOBIOTICUM (SCHILB.) PERC. POTATO WART DISEASE IN EUROPE AND THE MEDITERRANEAN BASIN IN 1956. Paris, European and Mediterranean Plant Protection Organization XI: 9 pp. 1957.
A general review of the potato wart disease situation in Europe in 1956 is followed by notes on its occurrence in the various countries considered separately.

49. ULLRICH, JOHANNES. Physiologic specialization of Synchytrium endobioticum. F.A.O. Pl. Prot. Bull. 5: 181-187. 1957.
Occurrence and spread of new biotypes; biotype analysis; resistance to biotypes; physiologic characteristics of new biotypes; phytosanitary measures.

50. WALKER, J. Two chytrid diseases of subterranean clover in New South Wales. Aust. J. Sci. 19: 207. 1957. (Rev. Appl. Mycol. 36: 702. 1957.)
From the Biological Branch, New South Wales Department of Agriculture, Sydney, the author reports the occurrence on the same subterranean clover plants of galls caused by Synchytrium aureum and Physoderma trifolii.

CONTROL

See also soil fungicides, etc.

Control -- Crop Manipulation

51. DEEMS, R. E. Black root of sugar beets as influenced by various cropping sequences and their associated mycofloras. Diss. Abstr. 17: 956. 1957.
Strikingly different mycofloras developed during one season's cropping of lucerne, maize, oats, blue-grass/rye-grass mixture, or sugar beets, following two seasons of sugar beets. Fungi were different in frequency of isolation, but in general the same kinds were isolated from all soils. Control of black root in sugar beets could be correlated with the occurrence of groups of specific saprophytic fungi, e.g., increase of total penicillia, P. funiculosum, series Thom, P. janthinellum, series Thom, and P. rugulosum Thom were associated with decreasing black root, and of Acrostalagmus spp. and Gliocladium roseum (Link) Thom with increasing black root. The isolation procedures and the possible importance of the mycofloras associated with the different crops are discussed.

52. HANSEN, L. R. and K. AASTVEIT. Forgrødeforsøk på fotsykesmittet jord. (Crop rotation experiments on foot-rot infected soil.) Norsk. Landbr. 1957, 7: 139, 142; 8: 157-159. 1957. (Rev. Appl. Mycol. 36: 520-521. 1957.)
A study to determine the effect of the preceding crops in a rotation on the incidence of Ophiobolus graminis and Cercosporella herpotrichoides on Norrøna wheat and Domen barley. Both suffered heavy yield reductions when preceded by the same cereals. Neither fungus attacked Blenda oats and this crop may therefore be recommended as a forerunner of wheat or barley

53. MENON, S. K. and LANSING E. WILLIAMS. Effect of crop, crop residues, temperature, and moisture on soil fungi. Phytopathology 47: 559-564. 1957.
Mycofloras of soil were different after four successive croppings of

alfalfa, corn, oats, or wheat. Highest numbers of colonies of Penicillium funiculosum series and P. purpurogenum series, for example, were isolated from corn soil. The mycofloras of soil cropped to corn and oats were different from soils amended with the residues of these crops. It appears that the crop plant is a decisive factor influencing soil mycofloras. The mycofloras associated with different crops appear to be characteristic; therefore, the use of crop sequences is an effective and practical method of altering soil mycofloras.

54. WILLIAMS, W. A. and D. RIRIE. Production of sugar beet following winter green manure cropping in California. I. Nitrogen nutrition, yields, diseases and pest status of sugar beet. Proc. Soil Sci. Am. 21: 88-92, 92-94. 1957.

The green manure and fertilizer treatments had no effect on stands, but reduced the incidence of dry rot canker.

55. YOUNG, ROY A. and W. J. TOLMSOFF. Cultural and chemical treatments for control of the early maturity disease of potatoes. (Abstr.) Phytopathology 47: 38. 1957.

The disease was partially but not effectively controlled by applying optimum quantities of nitrogen fertilizers, by crop sequences involving cereals as a preceding crop, and by seed-piece treatment with dichlone or Semesan Bel. Soil treatment with 190 pounds of Vapam per acre was extremely effective in 1955.

Control -- Miscellaneous

56. DURBIN, RICHARD D., E. F. FROLICH, and G. A. ZENTMYER. Hot-water treatment of avocado seed for the eradication of Phytophthora cinnamomi. Plant Dis. Reptr. 41: 678-680. 1957.

Avocado root rot caused by Phytophthora cinnamomi has become the most important disease of this crop in California. Using seed treated with hot water at 120° to 125° F for 30 minutes eliminates the possibility of introducing the pathogen into the nursery on seed, even though it might have been originally infected.

57. GARREN, K. H. and G. B. DUKE. The peanut stem rot problem and a preliminary report on interrelations of non-dirting weed control and other practices to stem rot and yield of peanuts. Plant Dis. Reptr. 41: 424-431. 1957.

Infection of groundnuts by Sclerotium rolfsii was less and yield greater when "non-dirting" weed control was practised than when weeds were smothered by throwing soil on the crop. PCNB applied as a soil drench at 12 pounds per acre 10 weeks after planting reduced aboveground infection and damage to pods and kernels. Deep burial of surface litter in an infested field reduced stem rot and increased yield in Virginia Bunch 46-2.

58. HILBORN, M. T., PAUL R. HEPLER and G. F. COOPER. Effect of polyethylene mulch on soil-borne pathogens of lettuce. (Abstr.) Phytopathology 47: 245. 1957.

Both black and white polyethylene mulches gave good control of slime rot (Pseudomonas sp.). Neither mulch affected the distribution or size of the root system, the date of maturity, or the size or weight of the head.

59. IVANOFF, S. S. Factors relating to the water-soak method of plant disease control. (Abstr.) Phytopathology 47: 525. 1957.

In studies on the effect of the water-soak method on the control of fungi on unshelled peanuts and of seedling blight of oats (Helminthosporium sativum), the most important factor in disease control seemed to be the removal from the substratum (seed coats, glumes or shells), through the process of diffusion, of nutrients necessary for germination and growth of the pathogens. The healthiest seedlings were those produced from seeds soaked in salt water or in sea water.

60. LLOYD, P. J. and D. F. CROSSAN. Irrigation and disease control: tomato anthracnose and potato seed-piece decay. (Abstr.) Phytopathology 47: 452. 1957.

In potato seed piece decay (caused by Erwinia carotovora) seed pieces were cut and treated before planting with various chemicals. In untreated rows, irrigation gave a lower stand. All chemical treatments gave a significantly better stand than did the check (untreated) only under irrigated conditions.

61. MACHACEK, J. E. Prevalence of Helminthosporium sativum, Fusarium culmorum and certain other fungi in experimental plots subjected to various cultural and manurial treatments. Can. J. Pl. Sci. 37: 353-365. 1957.

Sixty-two genera of micro-fungi were found in the soil of experimental plots during a 7-year period of sampling. The total for two parasitic fungi (Helminthosporium sativum and Fusarium culmorum) usually associated with common root rot of cereals, was only 0.5 percent. Variation in soil temperature and rainfall during the soil-sampling period did not affect the number of fungus colonies that appeared on the dilution plates; neither did crop rotation nor soil fertilization. However, the location of a plot in the experimental field did affect the number of colonies of two species of Penicillium, and the pattern of their occurrence, although different for each fungus, was consistent from year to year.

62. RISHBETH, J. and A. G. NAYLOR. Fusarium wilt of bananas in Jamaica. III. Attempted control. Ann. Bot. 21: 598-609. 1957.

Soil disinfection by fumigants was unpromising. Flood-fallowing is not practicable in the West Indies. Addition of lime, phosphate and potash separately or in combination had little or no effect, while nitrogen often caused an earlier appearance of wilt. Green manures and compost were also ineffective.

63. ROISTACHER, CHESTER N., K. F. BAKER and J. G. BALD. Hot water treatment of gladiolus cormels for the eradication of Fusarium oxysporum f. gladioli. Hilgardia 26: 659-684. 1957.

Heat therapy of gladiolus cormels was found to be a practical commercial means of securing pathogen-free planting stock. Thermal inactivation temperatures of dormant cormels of six varieties and their pathogens are indicated.

FUNGI

64. ARNDT, C. H. Temperature as a factor in the infection of cotton seedlings by ten pathogens. Plant Dis. Reptr. Suppl. 246. 1957.

Cotton seeds naturally infested by or artificially inoculated with ten fungi were grown in culture at 18°, 21°, 24°, 30°, 33°, and 36° C. The temperature range through which the several fungi infected the seedlings was noted and recorded and the characteristics of the lesions produced by the several fungi are described.

65. BALD, J. G. and PHILIP A. CHANDLER. Reduction of the root rot complex on Croft lilies by fungicidal treatment and propagation from bulb scales. Phytopathology 47: 285-291. 1947.

After nematodes and Rhizoctonia solani Kuehn were eliminated, F. oxysporum Schlecht., Pythium ultimum Trow, and bacteria were isolated from diseased plants. Inoculation tests indicated the occurrence of pathogenic and nonpathogenic clones of R. solani and F. oxysporum. A clone of P. ultimum was also pathogenic. Except where mites and nematodes were involved, these three organisms appeared mainly responsible for the rotting and discoloration of underground plant parts of field and greenhouse lilies. A balance seems to exist between P. ultimum and F. oxysporum as root rot pathogens. In the field, the environment favors Pythium; forcing conditions in the greenhouse are sometimes more favorable for Fusarium.

66. BUXTON, E. W. Report of the Rothamsted Experiment Station for 1956, 280 pp., 1957. (Rev. Appl. Mycol. 36: 816. 1957.)

Several fungi were isolated from roots of sugar beets affected with "docking disorder". Of eight fungal species inoculated to beet seedlings in compost adjusted to pH levels of 5.3, 6.5, and 8, only Fusarium oxysporum and Pythium caused damage. Symptoms were more pronounced in acid than in alkaline soils.

67. ELAROSI, HUSSEIN. Fungal associations. I. Synergistic relation between Rhizoctonia solani Kühn and Fusarium solani Snyder and Hansen in causing a potato tuber rot. Ann. Bot. N.S. 21: 555-567. 1957.

Rhizoctonia solani and Fusarium solani caused extensive rotting of potato tubers when the two were used together in inoculations and when R. solani was inoculated first. A synergistic relationship was found between these fungi.

68. ELAROSI, HUSSEIN. Fungal associations. II. Cultural studies on Rhizoctonia solani Kühn, Fusarium solani Snyder and Hansen, and other fungi, and their interactions. Ann. Bot. N.S. 21: 569-585. 1957.

After being used by Rhizoctonia a potato mash medium gave better growth of Rhizoctonia and Fusarium than it did when the medium was initially used by Fusarium. The range of pH values suitable for Rhizoctonia growth was narrower than that for Fusarium, optimum values being 5.9 for the former and 7.8 for the latter. A study of various carbon sources showed that poor growth of Rhizoctonia was obtained when pectin was used as the sole source of carbon. Both the extract of Fusarium mycelium, grown on vitamin-free medium, and the Fusarium-spent medium, stimulated the growth of Rhizoctonia on vitamin-free medium.

69. ERWIN, DONALD C. Fusarium and Verticillium wilt diseases of Cicer arietinum. (Abstr.) Phytopathology 47: 10. 1957.

A Fusarium sp. was proved to be the incitant of a wilt disease of Cicer arietinum in California, characterized by yellowing of foliage and necrosis of xylem tissue. Verticillium albo-atrum was also pathogenic to C. arietinum.

70. GOULD, C. J. Turf diseases in western Washington in 1955-1956. Plant Dis. Reptr. 41: 344-347. 1957.

Both Fusarium nivale and Corticium fuciforme caused dead patches in golf course greens.

71. GRAHAM, J. H., V. G. SPRAGUE and R. R. ROBINSON. Damping-off of ladino clover and lespedeza as affected by soil moisture. Phytopathology 47: 182-185. 1957.

Rhizoctonia solani, Pythium debaryanum, and the Fusarium roseum group were found to respond differently to temperature and moisture in regard to their capacities for causing damping-off in ladino and lespedeza.

72. HAWN, E. J. Studies on crown bud rot of alfalfa in southern Alberta. Diss. Abstr. 17: 939-940. 1957.

Crown bud rot of lucerne is widespread in irrigated stands in Alberta. The main advance of the disease in each year occurs during the first month of active growth, being most pronounced in 2- and 3-year stands. Temperatures above 16°C arrest the development of the disease. The most pathogenic isolates to crown buds were Rhizoctonia solani, Fusarium avenaceum, F. acuminatum, and Ascochyta imperfecta, in descending order. Brassicol and 8-hydroxyquinoline sulfate gave partial control in the field for a short time.

73. HENDERSON, MOIRA E. K. Metabolism of methoxylated aromatic compounds by soil fungi. J. Gen. Microbiol. 16: 686-695. 1957. (Rev. Appl. Mycol. 36: 665. 1957.)

Species of Haplographium, Hormodendrum, and Penicillium utilized both p-monomethoxybenzoic acids and p-monohydroxybenzoic acids before the m or o forms. Penicillium sp. formed p-methoxyphenol from p-methoxybenzoic acid. It is suggested that the ability of these soil fungi to demethylate compounds in which the methoxyl group is attached to the benzene ring may have some bearing on the transformation of lignified plant materials in the soil.

74. HUBERT, F. P. Diseases of some export crops in Indonesia. Plant Dis. Reptr. 41: 55-63. 1957.

Slow decline often affects clove trees in Central Sumatra and threatens the clove industry of central Java. Cultures of a Phytophthora sp. were obtained from the roots of infected trees. Foliage symptoms were often absent until the disease in the root system was well advanced. Root rots of rubber, tea, cacao, coffee, quinine, sugarcane, tobacco, and coconut are caused by Phytophthora, Corticium, Ganoderma, Fomes, Rosellinia, and Armillaria. "Blackleg and hollow stock", reportedly caused by Erwinia (Bacillus) aroideae (Towns.) Holland, is listed as a bacterial disease of Java tobacco.

75. KNORR, L. C., R. F. SUIT and E. P. DUCHARME. Handbook of citrus diseases of Florida. U. of Florida Agr. Exp. St. Bull. 587. 1957.

Damping-off is caused by any one of several species of fungi, including Phytophthora spp. In the case of foot rot caused by Phytophthora parasitica and P. citrophthora, which are found in the soil, lesions may occur below ground. A root rot with which Diplodia is associated causes the decline of trees in wet, heavy soil.

76. LEYENDECKER, PHILIP J. and ROY M. NAKAYAMA. 1956 Plant disease summary for New Mexico. Plant Dis. Reptr. 41: 53-54. 1957.

Phytophthora capsici Leonian, which is important primarily as a pathogen of the fruit of chile, also can girdle the main stem at the ground line, causing complete collapse and death of plants. Fusarium wilt (F. oxysporum f. batatas) of sweet potato was quite severe in a commercial planting of the Kendee variety. Wilt (Verticillium albo-atrum) caused a 7 percent reduction in yield of upland cotton and a 25 to 75 percent loss of okra. Seedling diseases (Rhizoctonia, etc.) on cotton accounted for a loss of 2 percent of the crop.

77. LITZENBERGER, S. C. and J. A. STEVENSON. A preliminary list of Nicaraguan plant diseases. Plant Dis. Reptr. Suppl. 243. 1957. (Rev. Appl. Mycol. 36: 683. 1957)

Fusarium vasinfectum and Verticillium albo-atrum are reported on cotton.

78. MOREAU, MIREILLE. Le dépérissement des oeillets. (Carnation wilt.) Encycl. mycol. 30, viii + 308 pp., Paris, Paul Lechevalier. 1957. (Rev. Appl. Mycol. 36: 762-763. 1957.)

Examination of affected carnations showed that nearly 100 species of fungi could be found therein, including saprophytes. Important parasites are Phialophora (Verticillium) cinerescens, Fusarium oxysporum, F. roseum, Alternaria dianthi, Phytophthora cactorum, Rhizoctonia (Corticium) solani, and R. bataticola (Macrophomina phaseoli).

79. SACKSTON, W. E. Diseases of sunflowers in Uruguay. Plant Dis. Reptr. 41: 885-889. 1957.

Black root rot caused by Sclerotium bataticola was found to affect a few plants in many fields. Fusarium oxysporum was isolated from the roots of many plants killed by root rot. In a few cases it was the only organism isolated; in many cases it was intimately associated with Sclerotium bataticola.

80. SPRAGUE, RODERICK. Fungi isolated from roots and crowns of pear trees. Plant Dis. Reptr. 41: 74-76. 1957.

Representatives of many genera are tabulated alphabetically.

81. STARR, G. H. et al. 1957 Potato handbook. Disease control issue. 79 pp. Potato Association of America, New Brunswick, New Jersey. 1957.

Contains sections on (a) ring rot (Corynebacterium sepedonicum) by G. H. Starr, (b) common scab (Streptomyces scabies) by W. J. Hooker, and (c) Verticillium wilt (V. albo-atrum) by J. G. McLean and R. V. Akeley.

82. TOLBA, M. K. and A. L. SALIM. Rhizoctonia damping-off of some vegetables in Iraq. Nature 179: 1358-1359. 1957.

Isolations from damped-off seedlings of cabbage, cauliflower, cucumber, vetch, and peas, yielded the pathogenic fungi Rhizoctonia solani, Pythium intermedium, and Fusarium sp.

83. WRIGHT, ERNEST. Influence of temperature and moisture on damping-off of American and Siberian elm, black locust, and desertwillow. Phytopathology 47: 658-662. 1957.

Black locust is highly susceptible to Pythium ultimum. Desert willow appears to be particularly susceptible to Rhizoctonia solani. No consistent relation was observed between the growth rates of damping-off parasites in vitro and apparent virulence at the same temperatures in damping-off tests.

84. ZOGG, H. Über die Beeinflusung von Pathogenität und Wachstum pflanzlicher Parasiten. I. Wirkung der Vorkultur auf verschiedene Fusskrankheitserreger bei Getreide. (On the factors affecting pathogenicity and growth of plant parasites. I. Effect of previous culture on various foot rot agents of cereals.) Phytopath. Z. 28: 423-426. 1957. (English summary) (Rev. Appl. Mycol. 36: 641. 1957.)

Cultures of various fungi causing foot rot of cereals in Switzerland were tested for their pathogenicity to wheat after 4 to 6 years' growth on various media. Culture on 2 percent malt agar followed by nutrient solution for a short period resulted in a marked decrease of the disease, but full virulence was restored in most cases by transference to straw.

Fungi -- Alternaria

85. LEVISOHN, IDA. Antagonistic efforts of Alternaria tenuis on certain root-fungi of forest trees. Nature 179: 1143-1144. 1957.

Two strains of Alternaria tenuis, isolated from forest nursery arable soils and found to be antagonistic to ectotrophic mycorrhiza of forest trees, were grown in mixed cultures on a synthetic medium with mycorrhizal fungi. Several were inhibited. It is suggested that the antagonism of A. tenuis to mycorrhiza-formers may be correlated with the poor growth of young trees not forming true mycorrhizal associations but having a profusion of pseudomycorrhizal infections.

Fungi -- Aphanomyces

86. SCHNEIDER, C. L. Studies on the pathogenicity and host range of the sugar beet black root fungus, Aphanomyces cochlioides Drechs. Diss. Abstr. 17: 735. 1957. (Rev. Appl. Mycol. 36: 804. 1957.)

In greenhouse inoculations of sugar beets at the University of Minnesota, zoospores were found to be the most suitable type of inoculum. Of the 94 plant species, representing 31 families, inoculated in the greenhouse and laboratory, 30 became infected. Greenhouse and field tests showed that none of the garden beet, mangel, or chard varieties was immune or more resistant than sugar beet varieties developed for black-root resistance. Minor differences on the respective hosts were observed among some 40 single-spore isolates from Michigan, Minnesota, Montana, and Ohio which were studied in relation to physiological specialization.

87. SCHNEIDER, C. L. Viability of Rhizoctonia and Aphanomyces cultures kept under mineral oil and sealed with Parafilm. (Abstr.) Phytopathology 47: 453-454. 1957.
Eleven of 15 cultures of Aphanomyces cochlioides 7 to 7 1/2 years old were viable.

Fungi -- Centrospora

88. SRIVASTAVA, S. N. S. Centrospora acerina on carrot. Plant Path. 6: 113. 1957.
Licorice rot of carrots, caused by Centrospora acerina (Hartig) Newhall, developed on carrots left in a garden near Edinburgh, Scotland, over winter. This is the first record of the fungus in Scotland.

Fungi -- Ceratocystis

89. HILDEBRAND, E. M. Testing sweetpotatoes for black rot resistance. Plant Dis. Reptr. 41: 661-670. 1957.
The resistance of 300 sweet potato seedling selections and unknowns to three virulent cultures of the black rot fungus Ceratocystis fimbriata Ell. & Halst. was determined.

Fungi -- Colletotrichum

90. MacNEILL, BLAIR H. Colletotrichum atramentarium in field tomatoes. Plant Dis. Reptr. 41: 1032. 1957.
Recently, the presence of Colletotrichum atramentarium has been noted in tomatoes in the field in southern Ontario. The fungus was found to be able to make at least limited systemic invasion of its tomato host.

Fungi -- Fusarium

See also 495, 496, 497, 502, 503, 505, 507, 517

91. ARMSTRONG, G. M. and JOANNE K. ARMSTRONG. Celery yellows Fusarium causes wilt of peas. (Abstr.) Phytopathology 47: 2. 1957.
Cross inoculation of peas and celery with Fusarium apii and F. oxysporum f. pisi races 1 and 2 showed the last two to be pathogenic only to peas while F. apii infected both. F. apii lost pathogenicity on one variety of peas (Thomas Laxton) during one year but not on the susceptible Golden Self-Blanching variety of celery.

92. ATKINS, JOHN G. First report of the bakanae disease of rice for U.S.A. and preliminary studies on growth stimulation by cultural filtrates. Plant Dis. Reptr. 41: 860-862. 1957.
Diseased rice seedlings observed at the Rice Pasture Experiment Station, Beaumont, Texas, showed symptoms that were similar to those described for the bakanae disease in Japan. Fusarium sp. was isolated. Symptoms similar to those observed in the field were produced in controlled tests. Cultures of the fungus added to soil containing sprouted seeds produced up to 77 percent increase in the height of rice seedlings, the response presumably being due to gibberellic acid or a similar chemical.

93. BAKER, RALPH. The height of invasion of two pathogens in carnation stems. (Abstr.) Phytopathology 47: 516. 1957.
Results indicated that Fusarium roseum f. cerealis, in contrast to F. oxysporum f. dianthi, is not likely to be carried in carnation cuttings.

94. BUXTON, E. W. Some effects of pea exudates on physiologic races of Fusarium oxysporum. Brit. Mycol. Soc. Trans. 40: 145-154. 1957.
Exudates from pea cultivars, Onward, Alaska, and Delwich Commando, which differentiate between three physiologic races of Fusarium oxysporum, differently affected spore germination in the three races, depressing the germination of races to which they were resistant more than that of the ones

to which they were susceptible.

95. BUXTON, E. W. In Report of the Rothamsted Experimental Station for 1956, 280 pp. 1957. (Rev. Appl. Mycol. 36: 815. 1957.)

The results of comprehensive investigations in England on wilt of peas caused by Fusarium oxysporum f. pisi are summarized. The studies included investigations on resistance and susceptibility of varieties, effect of herbicides added to infested soils, the rhizosphere populations and root exudates from pea varieties with different susceptibilities to the three physiologic races of the pathogen, etc. The evidence obtained indicated that roots of pea varieties resistant to F. oxysporum f. pisi either secrete substances that prevent race 1 spores from germinating or stimulate the production of a soil microflora exerting this effect.

96. COLLINS, R. P. and R. P. SCHEFFER. Systemic factors in Fusarium wilt of tomato. (Abstr.) Phytopathology 47: 6. 1957.

As early as 2 days after inoculation with Fusarium oxysporum f. lycopersici, leaves from infected plants had higher respiration than did disease-free controls. Since leaves were not invaded by the fungus, the findings demonstrate systemic toxemia.

97. DIMOND, A. E. and MALCOLM E. CORDEN. Reduction and promotion of the development of Fusarium wilt of tomato by gibberellic acid. (Abstr.) Phytopathology 47: 519. 1957.

Gibberellic acid (GA) accelerated the growth of tomato plants for 2 weeks after application, but untreated plants eventually became as tall as treated ones. Treatments did not affect root development. After its growth effect had disappeared, GA continued to affect resistance of tomato plants to Fusarium wilt. GA had no effect on growth of Fusarium in culture in the range from 1 to 20 ppm.

99. HARE, W. W. Inheritance of resistance of Fusarium wilt in cowpeas. (Abstr.) Phytopathology 47: 312-313. 1957.

In breeding trials with cowpea for resistance to Fusarium oxysporum f. tracheiphilum (F. bulbigenum var. tracheiphilum), the results indicated that resistance to races 2 and 3 depends on two dominant genes.

100. HOOD, JOHN R. and ROBERT N. STEWART. Factors affecting symptom expression in Fusarium wilt of Dianthus. Phytopathology 47: 173-178. 1957.

Root-dip and stem-wound inoculation with Fusarium oxysporum f. dianthi induced symptoms of carnation Fusarium wilt more quickly than did inoculation by infestation of the soil. Approximately 1500 fungus bodies per ml of inoculum were needed to induce symptoms when inoculation was by the root-dipping method. Existence of three pathogenic races of the pathogen was established by tests on 11 commercial varieties of carnations.

101. MORGAN, O. D. Mimosa wilt spreading in southern Maryland. Plant Dis. Reptr. 41: 51-52. 1957.

Cultures of a fungus from vascular tissues of Albizzia julibrissin in three areas showed a Fusarium associated with the disease. Symptoms indicate that the disease is caused by F. oxysporum f. perniciosum Hepting.

102. NAIR, P. N. and T. KOMMEDAHL. The establishment and growth of Fusarium lini in flax tissues. (Abstr.) Phytopathology 47: 25. 1957.

Seedlings of Punjab flax were immersed in spore suspensions of Fusarium lini. Hyphae were found to have entered root hairs and were abundant in both xylem and phloem, but only phloem tissues were disintegrated.

103. OSTAZESKI, STANLEY A. and J. W. GERDEMANN. Effect of methods of soil infesta-

tion on the pathogenicity of three fungi associated with red clover root rot. (Abstr.) Phytopathology 47: 26. 1957.

The pathogenicity of Fusarium solani, F. oxysporum, and Gliocladium roseum on red clover seedlings was tested by comparing five methods of incorporating the test organisms with the soil.

104. PATEL, P. N. et al. Fusarium wilt of Cumin. Curr. Sci. 26: 181-182. 1957. (Rev. Appl. Mycol. 36: 727. 1957.)

Fusarium oxysporum f. cumini, n. f., causes serious losses on cumin in India.

105. RAABE, ROBERT D. Fusarium wilt of Hebe buxifolia. (Abstr.) Phytopathology 47: 532. 1957.

Fusarium oxysporum f. hebae n. f. causes a previously undescribed wilt of Hebe buxifolia in California.

106. RISHBETH, J. Fusarium wilt of bananas in Jamaica. II. Some aspects of host-parasite relationships. Ann. Bot. N.S. 21: 215-245. 1957.

The possible mode of action of various factors on wilt diseases is discussed, and the importance of vigorous root growth in promoting host resistance is emphasized.

107. STOVER, R. H. Ecology and pathogenicity studies with two widely distributed types of Fusarium oxysporum f. cubense. (Abstr.) Phytopathology 47: 535. 1957.

The banana wilt Fusarium occurs as two cultural and physiological types, designated yellow and non-yellow. Only the yellow type was highly virulent, causing 80 percent disease on tomato cuttings versus 10 percent for non-yellow cultures. Infection of field plants following artificial inoculation depended on high concentrations of spores in contact with roots.

108. VENKATA RAM, C. S. Fusarinic acid production by Fusarium orthoceras in vitro. Experienta 13: 284. 1957.

In a study at Madras, India, on 23 species of Fusarium, the secretion of fusarinic acid by F. orthoceras was demonstrated by biological methods and paper chromatography.

109. WILLET, J. R. and L. BÉRCZY. Penwortelziekte bij koffie. (Tap-root disease of coffee.) Bergcultures 26: 115, 117-119. 1957. (Rev. Appl. Mycol. 36: 644. 1957.)

Fomes lignosus and species of Rhizoctonia, Fusarium, and Diplodia contribute to the decline of coffee trees in East Java through secondary infection of the roots, after the trees have already been injured by adverse environmental conditions.

Fungi -- Fusarium -- Resistance

110. BAKER, RALPH. Comparative studies on the resistance of ten carnation varieties to Fusarium stem rot. (Abstr.) Phytopathology 47: 3. 1957.

Miller's Yellow and William Sim varieties of carnation were compared to determine their resistance to Fusarium roseum f. cerealis. When these varieties were inoculated immediately after "striking" or transplanting and later rated for disease severity, no consistent differences in susceptibility were noted. In further tests, rooted cuttings of the two varieties were inoculated at intervals from none to 24 days after transplanting. Miller's Yellow was still susceptible 24 days after transplanting, whereas William Sim was moderately resistant 4 days after transplanting.

111. CORDEN, M. E. and A. E. DIMOND. Relation of plant-growth regulating properties of naphthalene aliphatic acids to their activity in inducing disease resistance. Phytopathology 47: 518. 1957.

A series of naphthalene-substituted aliphatic acids having chain lengths of 2 or 4 carbons varied in growth-regulating properties and in ability to induce resistance to Fusarium wilt of tomato. Root elongation is inhibited.

112. McCLELLAN, W. D. and R. L. PRYOR. Susceptibility of gladiolus varieties to Fusarium, Botrytis and Curvularia. Plant Dis. Reptr. 41: 47-50. 1957.
Resistance to disease caused by the above fungi is not controlled by the same genes.

113. SCHEFFER, R. P. Analysis of Fusarium resistance in tomato by grafting experiments. Phytopathology 47: 328-331. 1957.
Tomato plants were approach grafted in pairs, and tops were inoculated through scion spurs with bud cell suspensions of Fusarium oxysporum f. lycopersici. Resistance or susceptibility of scions was not changed by the resistance or susceptibility level of stocks.

114. SCHEFFER, R. P. Grafting experiments with Fusarium wilt resistant and susceptible tomato plants. (Abstr.) Phytopathology 47: 30. 1957.
Susceptible and highly resistant tomato plants were approach grafted in pairs. When graft unions were firm, the top of one plant and the bottom of the other in each pair were severed, and bud cell suspensions of Fusarium oxysporum f. lycopersici were introduced through spurs of scions. Combinations used were susceptible scion on resistant stock, susceptible scion on susceptible stock, etc. The data obtained are evidence against the theory that susceptibility depends on root-produced factors.

115. THEIS, THOMAS, and F. A. JIMINEZ. A vanilla hybrid resistant to Fusarium root rot. Phytopathology 47: 579-581. 1957.
Attempts to develop high quality disease-resistant (to Fusarium batatatis var. vanillae) plants have been made by crossing Vanilla planifolia and V. phaeantha (resistant). Further backcrossing to V. planifolia is necessary.

116. WAGGONER, PAUL E. and A. E. DIMOND. Altering disease resistance with ionizing radiation and growth substances. Phytopathology 47: 125-130. 1957.
In comparative studies of the effects of X-radiation and growth substances upon resistance to Fusarium wilt of tomato, shoot irradiation decreased resistance of highly susceptible, multiple-gene-resistant, and single-gene-resistant, tomatoes.

117. WALKER, J. C., R. H. LARSON and G. S. POUND. Badger ballhead, a new cabbage resistant to yellows and mosaic. Phytopathology 47: 269-271. 1957.
Badger ballhead is a new cabbage variety, homozygous for monogenic resistance to yellows incited by Fusarium oxysporum f. conglutinans (Wr.) Snyd. & Hans. The variety is also moderately resistant to mosaic, incited by the combined activity of turnip virus 1 and cauliflower virus 1.

Fungi -- Helminthosporium

118. CHINN, S. H. F. and R. J. LEDINGHAM. Studies on the influence of various substances on the germination of Helminthosporium sativum spores in soil. Can. J. Bot. 35: 697-701. 1957.
106 substances were studied for their effect on the germination of conidia of Helminthosporium sativum in soil. Spores usually germinated when substances from groups composed of natural products were included in the substrate. When wheat straw and roots of wheat plants were added to the soil the conidia did not germinate.

119. CLARK, R. V. and J. G. DICKSON. The relation of temperature to disease development by Helminthosporium sativum on barley. (Abstr.) Phytopathology 47: 6. 1957.
Seedling blight and root rot developed severely at temperatures ranging

from 8° to 28° C. Maximum development usually occurred at 20°. Considerable shifting in the reaction of the isolates and in the response of the varieties occurred within the replicates of an experiment and between experiments in the development of the seedling blight and root rot.

120. HRUSHOVETZ, S. B. Effect of amino acids on the virulence of Helminthosporium sativum to wheat seedlings. Phytopathology 47: 261-264. 1957.

Progressive attenuation of the virulence of Helminthosporium sativum through six successive transfers was affected by adding 0.1 percent of any one of the amino acids, alanine, arquinine, histidine, isoleucine, leucine, methionine, serine, threonine, and tryptophane, to Czapek's agar medium upon which the pathogen had been cultured before it was used in making soil inoculum.

121. SKOROPAD, W. P. and D. C. ARNY. The influence of amino acids on the growth of two strains of Helminthosporium gramineum. Phytopathology 47: 249-252. 1957.

Two strains of Helminthosporium gramineum that showed marked differences in pathogenicity on certain barley varieties were grown on liquid media containing various amino acids and amides (known to be present in barley seedlings), either singly or in combinations. Responses to combinations of several amino acids indicated that certain ones, even though present in relatively small amounts, could exert considerable influence on the growth of the fungus strains. The amino acid nutrition of the fungus appears to be of potential importance in relation to its pathogenicity.

Fungi -- Idriella

122. NELSON, PAUL E. Pathogenicity of Idriella lunata on strawberry. Phytopathology 47: 438-443. 1957.

Idriella lunata was isolated from the roots of strawberry plants in areas where root degeneration was extensive.

Fungi -- Olpidium

123. OSTERWALDER, A. Olpidium in Wurzeln von Erica gracilis Salisb. (Olpidium in roots of Erica gracilis Salisb.). Z. PflKrankh. 64: 328-331. 1957.

The species of Olpidium recently reported as causing damage to the roots and sometimes death of Erica gracilis plants in Switzerland has been identified as O. brassicae. The root rot is controlled by the use of steam-sterilized soil, pots, and implements.

Fungi -- Ophiobolus

124. TURNER, E. M. The effect of some amino acids on the growth of two varieties of Ophiobolus graminis. J. Gen. Microbiol. 16: 531-533. 1957.

In the study of the amino acid requirements of Ophiobolus graminis, the type variety and variety avenae, growth with aspartic acid was equal to or almost as good as growth with hydrolysed casein. Growth was strongly inhibited by lysine and threonine. O. graminis var. avenae was inhibited by cystine and cysteine, but the type variety of O. graminis made good growth with both, indicating a difference in their metabolism and possibly correlated with their differing pathogenicity.

Fungi -- Phytophthora

See also 209, 291

125. APPLE, J. L. Pathogenic, cultural, and physiological variation within Phytophthora parasitica var. nicotianae. Phytopathology 47: 733-740. 1957.

More than 200 isolates were collected from 55 North Carolina counties, from nine other States, and from four foreign countries. Most of these isolates were compared in inoculation tests and in culture.

126. BORDA, SEGUNDO ALANDIA and FRANK H. BELL. Diseases of warm climate crops in Bolivia. F.A.O. Pl. Prot. Bull. 5: 172-173. 1957.

The most destructive disease of citrus in the country as a whole is gummosis (Phytophthora sp.). P. cinnamomi has recently been isolated from the roots of dying avocado trees and it is therefore assumed that this fungus is the usual cause of avocado wilt in Bolivia.

127. ERWIN, DONALD C. and BILL W. KENNEDY. Studies on Phytophthora root rot of alfalfa. (Abstr.) Phytopathology 47: 520. 1957.

Phytophthora cryptogea causes a very serious disease of alfalfa in California. In the greenhouse the fungus induced the highest amount of root rot of seedlings at controlled soil temperatures of 22° and 27° C, very little occurred at 17°, and none at 32°. Zoospores appeared to be superior to mycelium or any other type of inoculum in tests of the resistance of alfalfa varieties.

128. FERNANDEZ, ROSENADA M. Enfermedad prieta del tabaco en Cuba. (Tobacco disease prieta in Cuba.) Agrotecnia 12: 32-36. 1957. (Tobacco Abstr. 1: 493. 1957.)

Prieta (Phytophthora parasitica var. nicotianae) is reported from Candelaria, Pinar del Rio. Symptoms and control are discussed.

129. GREGG, MARY. Germination of oospores of Phytophthora erythroseptica. Nature 180: 150. 1957.

Germination of comparatively young spores of Phytophthora erythroseptica has been obtained following passage through the digestive tract of the garden snail, Helix aspersa.

130. HERR, LEONARD J. Factors affecting a root rot of soybeans incited by Phytophthora cactorum. (Abstr.) Phytopathology 47: 15-16. 1957.

Young plants were more susceptible than older plants. Pathogen-free filtrates of culture solutions were not toxic to soybeans.

131. HERR, L. J. Nutritional studies of an isolate of Phytophthora cactorum inciting a root rot of soybeans in Ohio. (Abstr.) Phytopathology 47: 16. 1957.

Thiamin is required for growth. The nitrogen requirements of the fungus differed depending on whether sucrose or cellulose was used as the carbon source.

132. HOLLIDAY, P. and W. P. MOWAT. A root disease of Piper nigrum L. in Sarawak caused by a species of Phytophthora. Nature 179: 543-544. 1957.

The fungus was isolated from the cortical region of main roots and stems of dying plants. The term foot rot is proposed for the disease.

133. JARVIS, W. R. Host parasite relations. 4th Ann. Rept. Scottish Horticultural Inst., p. 33, 1956-57. 1957.

As part of the study of host-parasite relations in the strawberry red-core disease, the nutrition of physiological races of Phytophthora fragariae was examined. Growth in culture of these races was indistinguishable except when certain phenolic compounds, including analogues of strawberry root constituents, were added to the media. In particular, the races differed in ability to use caffeic acid, d-catechin and pyrocatechol. Differences in growth rate of races in the various media could not be correlated with the rate of utilization of phenols or the rate of appearance of phenolic oxidation and auto-oxidation products in the media.

134. KAUFMANN, M. J. and J. W. GERDEMANN. Root and stem rot of soybeans caused by a species of Phytophthora. (Abstr.) Phytopathology 47: 9. 1957.

The disease occurs on soybean plants of all ages. The fungus appears to be closely related to Phytophthora megasperma. Reactions of soybean varieties may be determined rapidly by stem inoculation. Resistance is controlled by a single dominant gene.

135. KERR, A. Red core disease of strawberries. J. Dept. Agr. S. Aust. 60: 354-356. 1957.

First report of the disease (Phytophthora fragariae) in Australia.

136. NEWTON, W. The growth of Phytophthora species as influenced by para-aminobenzoic acid. (Abstr.) Phytopathology 47: 530. 1937.

The growth of Phytophthora parasitica (from tomato) and of P. parasitica var. nicotianae (from tobacco) was markedly inhibited by p-aminobenzoic acid at concentrations as low as 20 ppm in oatmeal-dextrose broth shake cultures. The growth of P. cactorum (from apple) was also strongly inhibited by 80 ppm but not by lower concentrations. In contrast, 100 ppm had little effect upon the growth of P. infestans (from potato).

137. OXENHAM, B. L. Diseases of pineapple. Qd. Agric. J. 83: 13-26. 1957. (Rev. Appl. Mycol. 36: 478-479. 1957.)

Top or heart rot, caused by Phytophthora cinnamomi and less commonly by P. parasitica, is stated to be serious on flat or poorly drained land. Crop rotation is advisable.

138. POWELL, N. T. and C. J. NUSBAUM. Pathogen-suscept relations of Phytophthora parasitica var. nicotianae in roots of certain tobacco varieties and Nicotiana spp. (Abstr.) Phytopathology 47: 27-28. 1957.

Cytological studies were made of infections by the black shank fungus in roots of suscepts representing a wide range of resistance levels. All strains of the pathogen readily entered the roots of each suscept, but there were marked differences in the extent of cortical penetration by different strains on any one host.

139. ROTH, LEWIS, EDWARD J. TRIONE and WILLIAM H. RUHMAN. Phytophthora-induced root rot of native Port-Orford-cedar. J. Forest. 55: 294-298. 1957.

In 1952, Phytophthora lateralis, which had damaged Port Orford cedar (Chamaecyparis lawsoniana) planted outside its native habitat for more than a decade, was discovered in Coos Bay, Oregon, near the heart of the native cedar range. Infection spread rapidly, reaching the north and south limits of the commercial cedar range within 2 years.

140. SCHMIDLE, A. Über Infektionsversuche an Apfelbäumen mit Phytophthora cactorum (Leb. et Cohn) Schroet., dem Erreger der Kragenfäule. (On inoculation experiments on apple trees with Phytophthora cactorum (Leb. & Cohn) Schroet., the agent of collar rot.) Phytopath. Z. 28: 329-342. 1957. (Rev. Appl. Mycol. 36: 473-474. 1957.)

Report from the Horticultural Institute, Heidelberg, Germany, on the results of inoculation experiments with Phytophthora cactorum on apple trees, using four strains from collar rot lesions on the same host, one from a branch necrosis of apricot, and two from decayed strawberry fruits. The pathogenicity of the apricot isolate was fully equal to that of the apple strains, one of those from strawberry was of comparable virulence, while the effects of the other were much milder.

141. TRIONE, E. J. and L. F. ROTH. Aerial infection of Chamaecyparis by Phytophthora lateralis. Plant Dis. Reptr. 41: 211-215. 1957.

Root rot of Chamaecyparis lawsoniana caused by Phytophthora lateralis has increased greatly along the southwest coast of Oregon and is now epiphytotic. In the summer of 1954, aerial infections caused by the fungus were found on the foliage. The known hosts of P. lateralis are in the genus Chamaecyparis (Port Orford cedar).

142. VAARTAJA, O. The susceptibility of seedlings of various tree species to Phytophthora cactorum. Bi-m. Prog. Rept. Div. For. Biol., Dept. Agr. Can. 13 (2): 2. 1957. (Rev. Appl. Mycol. 36: 795. 1957.)

Phytophthora cactorum was shown to be potentially pathogenic to four species each of pine and spruce, two of larch, one of birch, and to elm.

143. ZECK, W. Untersuchungen über Infektionsverhältnisse bei der Phytophthora-Knollenfäule und über deren Beeinflussbarkeit durch Kupferdüngung. (Studies on infection relations in the Phytophthora tuber rot and on its amenability to influence by copper fertilizing.) Phytopath. Z. 29: 233-265. 1957.

From studies in Germany it was concluded that infection is caused by spores which are formed on the leaves and washed down into the soil on to the tubers. The nature and intensity of infection depend on the state of maturity of the tubers, young ones being more readily attacked at the "eyes", lenticels, and probably through the still labile cork layer. Neither in pot nor in field experiments did soil amendments with up to 500 or 800 kg copper sulphate per ha. effect a significant reduction of tuber infection.

Fungi -- Phytophthora -- Resistance

144. BERNARD, R. L. et al. Inheritance of resistance to Phytophthora root and stem rot in the soybean. Agron. J. 49: 391. 1957.

Resistance is controlled by a single dominant gene.

145. HEGGESTAD, H. E. and W. B. LAUTZ. Some results of studies on resistance to tobacco black shank. (Abstr.) Phytopathology 47: 452. 1957.

Variation in pathogenicity was observed between isolates of the fungus (Phytophthora parasitica var. nicotianae).

146. JOHNSON, HERBERT W. Soybean breeding research. Soybean Digest 17 (11): 60, 62. 1957.

The inheritance of resistance to Phytophthora root rot has been determined and a crossing program designed to transfer the resistance to varieties best adapted to the area and to develop new varieties is well along.

147. LAUTZ, W. Resistance to black shank of 51 species of Nicotiana and of 13 interspecific hybrids. Plant Dis. Reptr. 41: 95-98. 1957.

None proved immune, some were highly, others moderately resistant, etc.

148. REID, R. D. New strawberry variety "Redgauntlet". 4th Ann. Rept. Scottish Hort. Res. Inst., pp. 41-42, 1956-57. 1957.

Redgauntlet is resistant to some of the ordinary races of Phytophthora fragariae, but is less resistant than Talisman to some of the specialized races which attack existing resistant varieties such as Climax.

149. REID, R. D. Strawberry breeding. 4th Ann. Rept. Scottish Hort. Res. Inst., p. 34, 1956-57. 1957.

Intensive testing and selection of seedlings for resistance to red core (Phytophthora fragariae) has been continued and a large number of additional crosses made. Seedlings that survive the initial laboratory and field tests and show promise of horticultural merit are selected for fruiting trials. Field tests show that many seedlings which escape infection in the greenhouse become infected in the field.

Fungi -- Pythium

150. ERWIN, D. C. and JAMES W. CAMERON. Susceptibility of five sweet corn varieties to Pythium graminicola. Plant Dis. Reptr. 41: 988-990. 1957.

Pythium graminicola Subr., obtained from diseased roots of Wisconsin 23 sweet corn grown in southern California, incited a root rot on five varieties of sweet corn in greenhouse experiments. In the field root rot from natural infection occurred primarily on the early maturing varieties when grown in late summer.

151. HAMPTON, RICHARD O. Host specificity in Pythium graminicolum. (Abstr.) Phytopathology 47: 14. 1957.
Isolates of Pythium graminicolum Subr. obtained from corn, wheat, barley, rye, and Setaria, were tested on a variety of hosts. There were tendencies toward host preferences among the isolates.

152. HINE, RICHARD B. Growth repression of pear trees planted following plum. (Abstr.) Phytopathology 47: 524. 1957.
Root development of seedlings in soil from affected orchard was poor and there were numerous lesions on the feeder roots. Pythium isolates that proved to be pathogenic to pear roots were consistently recovered from the lesioned areas.

153. NEWHOOK, F. J. A Pythium disease of pear trees. N. Z. J. Sci. Tech. Sect. A. 38: 533-538. 1957.
The fungus attacks phloem of trunks, of leaders, and occasionally of branches.

Fungi -- Rhizoctonia

154. ERWIN, D. C. and BILL W. KENNEDY. The relationship of Rhizoctonia solani to a root disease of flax. (Abstr.) Phytopathology 47: 520. 1957.
Rhizoctonia solani was isolated from affected areas of the tap and lateral roots of flax. The evidence indicates that Rhizoctonia may damage flax roots under certain conditions in the field.

155. McWHORTER, FRANK P. Association between Rhizoctonia and yellow coloration of Easter lily bulbs. Phytopathology 47: 447-448. 1957.
Treatment with PCNB of stem bulblets of Easter lily planted in soil known to contain Rhizoctonia solani resulted in the production of yearling bulbs free from the yellow pigmentation normally found in their scales. On the yellowed scales of other bulbs examined the extent of yellowing was found to be correlated with the degree to which R. solani was present.

156. REYNOLDS, HAROLD W. and R. G. HANSON. Rhizoctonia disease of cotton in presence or absence of the cotton root-knot nematode in Arizona. Phytopathology 47: 256-261. 1957.
The presence of the cotton root-knot nematode, Meloidogyne incognita acrita, affects the incidence of post-emergence damping-off caused primarily by Rhizoctonia solani. A direct correlation exists between the two.

157. THEIS, T., R. H. FREYRE and W. C. KENNARD. Pellicularia filamentosa on Tephrosia vogelii and Cajanus indicus in Puerto Rico. F.A.O. Pl. Prot. Bull. 5: 159-160. 1957.
During 1956 plots of Tephrosia vogelii at Mayaguez, Puerto Rico, were attacked by Pellicularia filamentosa, which caused defoliation and death of the young parts of the stems. Adjoining plots of pigeon peas were attacked by the same fungus. Control was obtained by spraying twice weekly with Bordeaux mixture and zinc bisdithiocarbamate (zineb) alternately until the advent of dry weather.

Fungi -- Sclerotium

158. LAVEE, B. A physiological effect of triethanolamine on the development of Sclerotium rolfsii Sacc. Nature 180: 1494. 1957.
The effect of triethanolamine on Sclerotium rolfsii in culture was indicated to be a fungistatic one. When sclerotia that failed to germinate after 8 1/2 days on media containing high concentrations of triethanolamine

(3840 ppm) were transferred to control media they developed into normal cultures but with a slightly lower production of new sclerotia in comparison with the control cultures. It is concluded that triethanolamine is not an inert solvent as commonly assumed.

159. LEWIS, G. D. White rot of onion in New York. Plant Dis. Reptr. 41: 814. 1957.
White rot of onion caused by Sclerotium cepivorum Berk. was found in two muckland onion fields near Florida, New York, in June 1957. Approximately 30 percent of the plants in the affected area were destroyed.

160. SNYDER, W. C. and H. N. HANSEN. A Sclerotinia sp. (Imp. Sclerotium) with limited antifungal activity. (Abstr.) Phytopathology 47: 33. 1957.
This Sclerotium sp., isolated from dead or dying underground stems and roots of cereals, does seem to have interesting biologic properties in that it shows competitive or antagonistic action towards certain plant pathogens and rapidly invades sterilized soil.

Fungi -- Verticillium

161. CHILTON, JOHN E. Sesame (Sesamum indicum L.), a host for Verticillium albo-atrum Reinke & Berth. Plant Dis. Reptr. 41: 803. 1957.
This is apparently the first published record of Verticillium wilt of sesame in the United States (New Mexico).

162. EDGINGTON, L. V. and J. C. WALKER. Influence of soil and air temperature on Verticillium wilt of tomato. Phytopathology 47: 594-598. 1957.
The optimum temperatures for growth in culture of three "dauermycelial" and of three pseudosclerotial isolates of Verticillium albo-atrum were 22° and 24° C, respectively. All three "dauermycelial" isolates incited marked symptoms on tomato plants at soil temperatures of 20° or 24° combined with air temperatures of 16°, 20°, or 24°; symptoms were less severe at these soil temperatures when the air temperature was 28° than when it was lower.

163. ENGELHARD, ARTHUR W. Host index of Verticillium albo-atrum Reinke & Berth. (including Verticillium dahliae Kleb.). Plant Dis. Reptr. Suppl. 244. 1957.

164. GREEN, RALPH J. The vertical distribution of Verticillium albo-atrum in muck soils and its control. (Abstr.) Phytopathology 47: 522. 1957.
Studies of the vertical distribution of Verticillium albo-atrum in muck soils revealed a pattern completely different from that found in mineral soils.

165. HOLMES, F. W. Verticillium wilt of dogwood. (Abstr.) Phytopathology 47: 17. 1957.
Verticillium albo-atrum obtained from a dying dogwood tree (Cornus florida L.) proved to be pathogenic to elm, maple, and dogwood. This is the first report of this fungus as causing a disease of dogwood.

166. ISAAC, IVOR. The effects of nitrogen supply upon the Verticillium wilt of Antirrhinum. Ann. Appl. Biol. 45: 512-515. 1957.
The ability of isolates of Verticillium albo-atrum, V. dahliae, V. nigrescens, V. nubilum, and V. tricorpus to penetrate the Antirrhinum plant, even when wounded, was reduced if the medium or soil were deficient in nitrogen.

167. ISAAC, IVOR. Verticillium wilt of Brussels sprout. Ann. Appl. Biol. 45: 276-283. 1957.
A wilt disease of Brussels sprouts caused by Verticillium dahliae Kleb. is described. Field observations, corroborated by experiment, indicate that the disease is more severe in a wet than in a dry season. Evidence indicates that the V. dahliae from Brussels sprouts is a distinct physiological strain.

168. ISAAC, IVOR. Wilt of lucerne caused by species of Verticillium. Ann. Appl. Biol. 45: 550-558. 1957.

A wilt disease of lucerne caused by species of Verticillium is described; in 28 areas in England and Wales the pathogen was V. albo-atrum; in one area it was V. dahliae. Manurial trials showed that the incidence of wilt induced by V. albo-atrum was very severe under all soil conditions tested, whereas V. dahliae is a virulent pathogen only to plants in soil rich in superphosphate.

169. Le TOURNEAU, DUANE. The production of oligosaccharides by Verticillium albo-atrum. (Abstr.) Phytopathology 47: 527. 1957.

Analyses for sucrose, glucose, fructose and unknowns were made by paper chromatography.

170. Le TOURNEAU, DUANE, J. G. McLEAN and J. W. GUTHRIE. Effects of some phenols and quinones on growth in vitro of Verticillium albo-atrum. Phytopathology 47: 602-606. 1957.

In tests involving liquid cultures of Verticillium albo-atrum the quinones were generally more inhibitory than were the phenols. Chlorination of the quinones increased their effectiveness as inhibitors.

171. PEGG, GEORGE F. A hyaline variant of Verticillium albo-atrum pathogenic to tomato plants. Phytopathology 47: 57-58. 1957.

A hyaline variant of Verticillium albo-atrum pathogenic to tomato plants is described. On 5 percent maize meal agar this fungus formed aerial ropes of hyphae bearing simple or verticilliate conidiophores. There is a marked similarity between this strain and V. intertextum Isaac & Davies.

172. ROGERSON, CLARK T. Verticillium wilt in Kansas. Plant Dis. Reptr. 41: 1053-1054. 1957.

The host range of Verticillium wilt is extended to include western catalpa, Moline elm, redbud, Russian olive, and turnip.

173. ROSS, J. P. Free amino acids and amides in healthy and Verticillium-infected peppermint and chrysanthemum plants. (Abstr.) Phytopathology 47: 29. 1957.

Paper-partition chromatography was used to determine the free amino acids in leaf and stem extracts of plants infected with Verticillium albo-atrum and of healthy checks.

174. SACKSTON, W. E., W. C. McDONALD and JOHN MARTENS. Leaf mottle or Verticillium wilt of sunflower. Plant Dis. Reptr. 41: 337-343. 1957.

The disease was first recognized in Manitoba in 1948. The causal organism, Verticillium albo-atrum, is soil borne and apparently can survive and attack sunflowers even after successive grain crops.

175. TOLMSOFF, W. J. and R. A. YOUNG. Relation of inoculum potential of Verticillium albo-atrum to development and severity of wilt in potatoes. (Abstr.) Phytopathology 47: 536. 1957.

Although the use of Vapam (sodium N-methyldithiocarbamate dihydrate) resulted in control of the disease, incidence of infection was not affected. Severity of symptoms, time of plant death, and tuber yield were related to amount of inoculum.

176. WELTZIEN, H. C. Untersuchungen über das Vorkommen der Luzernevertizilliose und weiterer Luzerneerkrankungen in Südwestdeutschland. (Studies on the occurrence of verticilliosis and other diseases of lucerne in south-west Germany.) NachrBl. dtsch. PflSchDienst (Braunschweig), Stuttgart, 9: 42-45. 1957. (Rev. Appl. Mycol. 36: 530-531. 1957.)

Verticillium infection has been at least an essential factor in the markedly diseased condition of lucerne in several districts in southwest Germany, over the period 1954 to 1956, which has caused almost total loss of the seed crop. The progressive build up of infection there has now made it uneconomic to maintain a lucerne crop for more than 3 years.

177. WILHELM, STEPHEN. Determining the inoculum potential of Verticillium in soil and predicting subsequent wilt losses in strawberry. (Abstr.) Phytopathology 47: 37. 1957.

Because wilt losses in strawberry due to Verticillium reflect largely the previous susceptible crop or weed history of the land, a method of foretelling possible losses prior to planting of strawberries would be of great practical value. The previously described technique of estimating inoculum potential by determining an arbitrary infection index of soil samples proved useful.

INOCULUM POTENTIAL
See 175, 177

INSECTICIDES AND HERBICIDES
See also 471

178. RICHARDSON, LLOYD T. Effect of insecticides and herbicides applied to soil on the development of plant diseases. I. The seedling disease of barley caused by Helminthosporium sativum P. K. & B. Can. J. Pl. Sci. 37: 196-204. 1957.

It was found possible to separate nine insecticides and ten herbicides into four groups on the basis of their effects on the growth of barley seedlings and on the development of root rot infection. Their effects ranged from none at all to either increased or decreased severity of infection.

METHODS AND TECHNIQUES

179. CARTER, H. P. and J. L. LOCKWOOD. Methods for estimating numbers of soil microorganisms lytic to fungi. Phytopathology 47: 151-154. 1957.

When an agar medium containing a 2- to 4-day-old fungus culture prepared by seeding the agar with conidia was sprayed with a soil suspension, colonies of soil microorganisms surrounded by lytic zones appeared on the agar in from 2 to 3 weeks. These organisms were predominantly members of the genus Streptomyces.

180. CORMACK, M. W., R. W. PEAKE and R. K. DOWNEY. Studies on methods and materials for testing alfalfa for resistance to bacterial wilt. Can. J. Pl. Sci. 37: 1-11. 1957.

Several methods for inoculation of alfalfa with the bacterial wilt organism in the greenhouse and field are described. Also some factors affecting host-parasite relations are mentioned.

181. DOWSON, W. J. Isolation of soft rot bacteria on Weiringa's pectate gel. Nature 179: 682. 1957. (Rev. Appl. Mycol. 36: 458. 1957.)

The preparation of a pectate gel medium for the detection of the potato black leg organism (Pectobacterium carotovorum) (Erwinia carotovora) is described.

182. FAHRAEUS, GUSTA. The infection of clover root hairs by nodule bacteria studied by a simple glass slide technique. J. Gen. Microbiol. 16: 374-381. 1957.

A simple glass slide technique for continuous microscopical observation of growth and infection of root hairs of clover seedlings is described. The earliest infection of the root hairs of white clover inoculated with nodule bacteria was observed to take place within 48 hours of inoculation on 4-day-old seedlings.

183. FENWICK, D. W. Some experiments on the vacuum distillation of potato root diffusate. Nematologica 2: 277-284. 1957.

It is concluded that vacuum distillation of potato root diffusate is a practical method of decreasing its volume for storage. With a decrease in volume to 10 percent the loss of active principle was only about 10 percent.

184. JOHNSON, H. G. A method for determining the degree of infestation by pea root-rot organisms in soil. (Abstr.) Phytopathology 47: 18. 1957.

Root rot indexes for field soils were established by testing them in the laboratory. The index is useful as an estimate of the hazard of planting peas in the field.

185. JOHNSON, L. F. Effect of antibiotics on the numbers of bacteria and fungi isolated from soil by the dilution-plate method. Phytopathology 47: 630-631. 1957.

Streptomycin and eight other antibiotics were added singly to Martin's peptone-dextrose agar containing rose bengal. Streptomycin at 30 μg/ml inhibited bacterial colonies effectively. Others most effective in inhibiting soil bacteria at low concentrations were the polycyclines.

186. MUELLER, K. E. and L. W. DURRELL. Sampling tubes for soil fungi. Phytopathology 47: 243. 1957.

Centrifuge tubes, after being bored, were wrapped spirally with Koroseal electrical tape, nearly filled with nutrient agar, plugged with cotton, and autoclaved. In the field, a flamed needle was pushed through the tape and perforations to allow entrance of fungal hyphae. After being embedded in the soil for 4 to 6 days, the tubes were collected and taken to the laboratory for isolation purposes.

187. NOVÂKAVÂ, JARMILA. A new method of isolation of blackleg-pathogens from diseased plants. Phytopath. Z. 29: 72-74. 1957. (Rev. Appl. Mycol. 36: 662-663. 1957.)

An adaptation of Stapp's method of serum preparation is described, which was used in a serological drop technique for the differentiation of the potato black-leg pathogen, Erwinia atroseptica, from saprophytic bacilli, e.g., Escherichia, Bacillus mycoides, and B. subtilis.

188. REILING, T. P. and T. H. KING. Correlation between pea root rot in commercial fields with greenhouse determinations of soil infestation. (Abstr.) Phytopathology 47: 28. 1957.

Greenhouse determination for root rot of peas showed a high correlation with root rot incidences in field crops grown later. Yield is inversely related to the amount of root rot.

189. RICHARDSON, LLOYD T. Quantitative determination of viability of potato ring rot bacteria following storage, heat, and gas treatments. Can. J. Bot. 35: 647-656. 1957.

A method for determining quantitatively the viability of Corynebacterium sepedonicum was developed for use in eradication studies on bacterial ring rot of potatoes.

190. SCHMITTHENNER, A. F. and L. E. WILLIAMS. Injection-infestation technique for studying root rot pathogens. (Abstr.) Phytopathology 47: 30. 1957.

A method involving injections with a hypodermic syringe and transplanting to sand-inoculum mixtures was found satisfactory for rapidly screening the root-rotting potential of a large number of fungus isolates including representatives of the following genera: Fusarium, Pythium, Rhizoctonia, and Phytophthora.

191. TYNER, L. E. Effect of moisture in partial-sterilization procedures. (Abstr.) Phytopathology 47: 536. 1957.

Propyline oxide was added at different rates to samples of barley seed containing varying amounts of water. Bacteria were not eliminated by any treâtment and fungi were destroyed only in the seed to which water had been added. Reduction in the number of colonies of fungi varied directly with the amount of water added to the seed and with the temperature applied.

192. ZOGG, H. Studien über die biologische Bodenentseuchung. I. Einfluss der Bodenmi-

kroflora auf Ophiobolus graminis Sacc. (Methodik). (Studies on the biological disinfection of the soil. I. Influence of the whole soil microflora upon Ophiobolus graminis Sacc. (Method).) Phytopath. Z. 30: 315-326. 1957.

A method is described that allows an estimation of the biological activity of a soil microflora in relation to elimination of root rot parasites, especially of Ophiobolus graminis on wheat after some weeks or months.

MYXOMYCETES

193. AYERS, G. W. Races of Plasmodiophora brassicae. Can. J. Bot. 35: 923-932. 1957.

Six races of Plasmodiophora brassicae have been distinguished on the basis of pathogenicity to different hosts of cultivated and wilt crucifers.

194. COLHOUN, JOHN. A technique for examining soil for the presence of Plasmodiophora brassicae Woron. Ann. Appl. Biol. 45: 559-565. 1957.

The technique is described.

NEMATOCIDES

195. BRADBURY, F. R. et al. The nematicidal properties of azides. Ann. Appl. Biol. 45: 241-250. 1957.

The use of sodium azide and organic acid azides for the control of potato root eelworm has been investigated; in suitable conditions they were effective both in greenhouse tests and field trials. The biological activity of azides has been shown to arise from liberation of undissociated hydrozoic acid. The acid is liberated in effective quantities only in acid soils, but in such soils it is decomposed with formation of nitrogen.

196. BROTHERS, SHELBY L. and J. R. CHRISTIE. Some greenhouse tests with the nematicides PRD and ORD. Plant Dis. Reptr. 41: 772-777. 1957.

Two prospective nematocides were tested. These were PRD (3,4-dichlorotetrahydrothiophene 1,1-dioxide) and ORD (an isomer of PRD). The nematocidal efficacy of PRD compared favorably with that of Nemagon (1,2-dibromochloropropane), was somewhat better than that of ORD and considerably better than that of V-C 13 (O-2,4-dichlorophenyl-O, O-diethyl phosphorothioate). Both chemicals were phytotoxic, PRD somewhat more so than ORD.

197. FENWICK, D. W. Preliminary studies on the effect of ethylene dibromide fumigation on the hatchability of Heterodera rostochiensis (Woll.). Nematologica 2: 242-249. 1957.

The data suggest that fumigation of cysts with ethylene dibromide, in addition to reducing their hatchability, also affects the form of the hatching curve by increasing the time necessary to attain the point of inflection. In all cases, the greatest effect was obtained by fumigation at 30° C rather than at lower temperatures. The greater decrease in hatchability when cysts are tested some months after treatment suggests that the action of the chemical persists long after treatment.

198. HARRISON, MARTIN B. Fumigation of encysted golden nematode eggs and larvae under controlled environmental conditions. Phytopathology 47: 610-613. 1957.

Relation of relative humidity and temperature to effectiveness of various fumigants.

199. HARRISON, MARTIN B. A new approach to the evaluation of nematocides for the control of the golden nematode. (Abstr.) Phytopathology 47: 523. 1957.

In the testing of compounds as nematocides against Heterodera rostochiensis, the technique has been modified so that data on phytotoxicity may be taken simultaneously with counts of female nematodes. The efficacy of the compound is established by a count of the immature females that develop on the roots at the periphery of the soil ball.

200. HOLLIS, J. P. A statistical study of nematode populations in soil fumigation experi-

ments. (Abstr.) Phytopathology 47: 524. 1957.

Methods to provide data on population dynamics and ecology of common plant parasitic nematodes are described. These consist of counting various populations of plant parasitic nematodes, transforming the low numbers to $\sqrt{X + 0.5}$ and to log (X + 1); high numbers to $\sqrt{X}$ and log X. Transformed data were studied in 290 analyses of variance with I.B.M. facilities. Significant intraseasonal fluctuations and crop-season reductions occurred in 41.5 and 55.4 percent of analyses, respectively.

201. KLEIN, H. H. and C. C. ALLISON. A rapid method of screening of nematocides in the greenhouse. (Abstr.) Phytopathology 47: 21. 1957.

Four-day old Green Prolific cucumber seedlings are transplanted into the chemically treated and untreated root-knot nematode (Meloidogyne spp.) infested soils. Root knot severity is assayed 7 days after seedlings are transplanted and is determined on the basis of the percentage of root system knotted.

202. LEAR, BERT. Soil fumigation for nematode control. Agr. Chem. 12 (8): 40-43. 1957.

This is a good general review followed by a discussion of the use of 1,2-dibromo-3-chloropropane, sodium N-methyl dithiocarbamate, and a fumigant consisting almost entirely of dichloropropene. The author then discusses row placement applications, split dosage applications, postplanting sidedress applications, and water applications. The author concludes by discussing new application equipment, including constant head with metering soil and ground wheel driven metering pump.

204. MANZELLI, M. A. and V. H. YOUNG, Jr. Tolerance of plants to V-C 13 Nemacide. Plant Dis. Reptr. 41: 195-200. 1957.

This paper presents data on the tolerance of treated plants or plant seeds to various concentration levels of V-C 13 Nemacide (O-2,4-dichlorophenyl O, O-diethyl phosphorothioate).

205. PEACOCK, F. C. The effect of chemical treatments on root knot nematodes in the Gold Coast. Empire J. Expt. Agr. 25: 99-107. 1957.

D-D mixture lasted only one crop following injection, whereas ethylene dibromide and tetrachlorobutadiene showed effects on a second screening crop.

206. SCHULDT, P. H. and H. BLUESTONE. Nematocidal properties of 3,4-dichlorotetrahydrothiophene-1,1-dioxide (PRD). Boyce Thompson Inst. Contrib. 19: 63-75. 1957.

207. TAYLOR, A. L., JULIUS FELDMESSER and W. A. FEDER. A new technique for preliminary screening of nematocides. Plant Dis. Reptr. 41: 527-530. 1957.

The technique described in the article is so designed that very small amounts of the chemicals are required and the test can be reproduced within reasonable limits so that a comparison of the toxicity of the test chemical and that of a standard chemical can be made.

208. YOUNG, B. H. The activity of V-C 13 type nematocide. Assoc. South. Agr. Workers Proc. 54: 222-223. 1957.

Chemical control of nematodes in the soil has been obtained with a non-fumigant type nematocide known commercially as V-C 13 Nemacide. The active ingredient is O-2,4-dichlorophenyl, O-O-diethyl phosphorothioate. This chemical possesses very little volatility and is relatively stable after application, therefore its residual life in the soil is of long duration. It appears to be non-phytotoxic at recommended rates. Plant parasitic nematodes controlled include dagger, lance, meadow, root-knot, spiral, sting, stubby, and stylet. Root knot can be controlled for 3 years, other nematodes for from 1 to 2 years.

Nematocides -- Fruits

209. BAINES, R. C. et al. Control of the citrus nematode and Phytophthora spp. by Vapam. Plant Dis. Reptr. 41: 405-414. 1957.

The citrus nematode, Tylenchulus semipenetrans, was effectively controlled when 274 to 475 pounds of Vapam per acre were applied in 6 to 12 surface inches of water in basins. The treatments also decreased the number of saprophytic fungi in the soil. Both Phytophthora citrophthora and P. parasitica were killed by 400 pounds of Vapam per acre applied in 5 to 6 surface inches of water in basins on sandy loam soils. Control of the citrus nematode and brown rot fungi together was unsatisfactory under field conditions.

210. BAINES, R. C. and J. P. MARTIN. Fumigants for citrus nematode. Calif. Agr. 11 (6): 13-15. 1957.

211. BAINES, R. C. Results with Vapam to control nematodes, fungi. Calif. Citrogr. 42: 192, 202, 204, 206-209. 1957. (Rev. Appl. Mycol. 36: 584. 1957.)

Tests were conducted in California on seven methods of applying Vapam for the control of citrus brown rot (Phytophthora spp.). On fine sandy loam a reduction of approximately 56 percent in the number of fungi in the top 2 feet of soil was obtained by 300 pounds of Vapam per acre applied in water by furrows or sprinklers, but P. syringae was not affected. Effects varied according to method of application. Application of the chemical in surface water appears to hold some promise for control of Phytophthora spp. but it has yet to be seen how long the effects of a treatment endure.

212. DAVIDSON, J. H. and C. E. DIETER. Give your cherries a good start; fumigate before you plant. Am. Fruit Grower West. Ed. 77 (9): 10-11. 1957.

In soils where good cultural conditions have been followed and poor cherry growth occurs, soil fumigation as a preplanting treatment should be tried. Small areas can be treated with odorized methyl bromide. Large areas can be treated with ethylene dibromide, using a chisel type applicator as either an over-all or a 8- to 10-foot wide band treatment, the soil being sealed after treatment by cultipacking.

213. MORGAN, O. D. and W. F. JEFFERS. The effect of fumigation and heat treatment on root-knot nematode and black root rot of strawberries. Plant Dis. Reptr. 41: 825-831. 1957.

Treatment of Robinson variety of strawberries with 1,2-dibromo-3-chloropropane at 68 and 136 pounds of 25 percent material per acre, following a fall treatment with 60 gallons of D-D (1,3 dichloropropene; 1,2 dichloropropane) per acre, gave excellent control of root knot nematode (Meloidogyne). The low rate was as effective as the high rate. A fall treatment with two 30-gallon applications of D-D 10 days apart gave unsatisfactory control of root knot. Control of the black root rot complex with all treatments was inconclusive.

214. MORGAN, O. D. The effect of various control measures on two parasitic nematodes of strawberry. (Abst.) Phytopathology 47: 452. 1957.

Treatment against Meloidogyne hapla and a species of Pratylenchus showed Nemagon to be effective.

215. SUIT, R. F. and E. P. DuCHARME. Searching for better control of spreading decline. Sunshine State Agr. Res. Rept. 2 (2): 7. 1957.

216. VUITTENEZ, A. Lutte preventive contre le court-noué de la vigne par la désinfection chimique du sol avant plantation. (Preventive control of court-noué of the vine by chemical disinfection of the soil before planting.) C. R. Acad. Agric. Fr. 43: 185-186. 1957.

Compared with control plants (height 80 cm), the mean heights of the treated plants were: DD, 185 cm; methyl bromide-carbon tetrachloride-dichloroethane mixture, 131 cm; carbon disulfide, 135 cm. The best treatments were not only effective for the virus disease court-noué but also were highly active against nematodes.

Nematocides -- Mechanism of Action

217. CALL, F. The mechanism of sorption of ethylene dibromide on moist soils. J. Sci. Food Agr. 8: 630-639. 1957.

The purpose of this work was to study in more detail the sorption of ethylene dibromide on soils.

218. CALL, F. Soil fumigation. IV. Sorption of ethylene dibromide on soils at field capacity. J. Sci. Food Agr. 8: 137-150. 1957.

Sorption of ethylene dibromide was studied in the presence of air on 20 different soils at moisture contents corresponding to field capacity. The soils ranged from coarse sands through silts and clays to heavy peats. All isotherms were linear and the sorption coefficient (slope of the isotherm) could be correlated with surface area, with organic matter content, with moisture content, and less closely with clay content.

219. CALL, F. Soil fumigation. V. Diffusion of ethylene dibromide through soils. J. Sci. Food Agr. 8: 143-150. 1957.

The diffusion of ethylene dibromide vapor through soils of different types has been studied. Both unsteady-state and steady-state coefficients agree with theoretical values calculated from known soil properties. Blocked pores are an important factor in the steady-state but not in the unsteady-state, and sorption of vapor on the soil has a great influence on the unsteady-state coefficient only.

220. CALL, F. Soil fumigation. VI. The distribution of ethylene dibromide round an injection point. J. Sci. Food Agr. 8: 591-596. 1957.

It is concluded that diffusion is the most important factor controlling distribution. The concentration-time products (C.T.) have been calculated at various distances from the injection point and an L.D.-50 range has been derived from the C. T.-distance curves. These L.D.-50 ranges were found to have a linear relationship with the soil porosity for all soils at two temperatures.

221. GORING, C. A. I. and C. R. YOUNGSON. Factors influencing nematode control by ethylene dibromide in soil. Soil Sci. 83: 377-389. 1957.

Major variation in nematode control occurs in the vertical but not in the horizontal direction. Gravity had little or no influence on the degree of control obtained. The rate of diffusion of ethylene dibromide decreased when porosity was decreased by soil compaction, but ultimate nematode control was not affected. Increase of soil moisture from 7.5 to 20 percent resulted in increased control. The addition of 5 percent steer manure or oak leaf mold caused considerable decrease in control. Control was improved with increased depths and closer spacing of injections.

222. HOLLIS, J. P., M. J. FIELDING, and E. J. WEHUNT. Action of fumigants on nematodes as related to nematocide specifications. (Abstr.) Phytopathology 47: 524. 1957.

Actions of four fumigants on populations of five genera of plant parasitic nematodes were analysed in 22 field tests. The effectiveness of the several nematocides varied directly with vapor pressure in initial nematode kills (after 2 weeks) and inversely with vapor pressure in reducing populations (all season). In respect of capacity of populations for recovery after treatment the genera tested ranked as follows: weak -- *Tylenchorhynchus*; moderately weak -- *Pratylenchus*; strong -- *Trichodorus*, *Tylenchus*, and *Psilenchus*.

223. SCHULDT, PAUL H., H. P. BURCHFIELD and HENRY BLUESTONE. Stability and movement studies on the new experimental nematocide 3,4-dichlorotetrahydrothiophene-1, 1-dioxide in soil. (Abstr.) Phytopathology 47: 534. 1957.

In moist soil in a closed jar at an initial concentration of 100 μg/g PRD had a half-life at pH 6.5 of 20 days at 32° C, 45 days at 22° and 115 days at 10°. PRD persisted in dry soil three times as long as in moist soil. It is sensitive to alkali. As long as PRD remains in soil, it moves downward as a result of rainfall and upward during drying periods.

224. TORGESON, D. C., D. M. YODER and J. B. JOHNSON. Biological activity of Mylone breakdown products. (Abstr.) Phytopathology 47: 536. 1957.

Mylone (3,5-dimethyltetrahydro-1,3,5,2H-thiadiazine-2-thione) hydrolyzes soon after it has been applied. It was believed that the hydrolysis products or a combination of them were responsible for the fungicidal, nematocidal, and herbicidal properties of the compound. Among the materials identified were methylisothiocyanate, formaldehyde, hydrogen sulfide, and monomethylamine. None of these products when used alone at proper concentrations was sufficiently fungicidal to inhibit Pythium sp. in soil. Either a combined fungicidal effect, or the recombination of these materials into an active fungicide is indicated.

Nematocides -- Other Crops

225. ENDO, B. Y. and J. N. SASSER. The effectiveness of various soil fumigants for control of the soybean cyst nematode. (Abstr.) Phytopathology 47: 9. 1957.

Report on relative effectiveness of doses of D-D, Dowfume W-85 (1,2-dibromoethane), methyl bromide, Nemagon (1,2-dibromo-3-chloropropane), and Telone (1,3-dichloropropene).

226. GOOD, J. M. and S. A. PARHAM. Control of sting nematodes on upland cotton by soil fumigation. (Abstr.) Phytopathology 47: 312. 1957.

Yields of Plains cotton, a wilt-resistant variety, were significantly greater in 1956 in plots fumigated with Dowfume W-40 (41 percent 1,2-dibromoethane), Nemagon, Dorlone (78 percent dichloropropenes; 19 percent 1,2-dibromoethane), or D-D. Average seed cotton yields were 1606, 1565, 1026, 885, and 203 pounds per acre for plots treated with the chemicals named, in that order, plus the check.

227. HANSBROUGH, THOMAS, and JOHN P. HOLLIS. The effect of soil fumigation for the control of parasitic nematodes on the growth and yield of loblolly pine seedlings. Plant Dis. Reptr. 41: 1021-1025. 1957.

The results of this study indicate that the practice of soil fumigation for nematode control offers considerable promise for increasing the production and improving the quality of loblolly pine seedlings in nurseries infested with certain parasitic nematodes.

228. JENSEN, HAROLD J. and CHESTER E. HORNER. Peppermint decline caused by Longidorus sylphus can be controlled by soil fumigation. (Abstr.) Phytopathology 47: 18. 1957.

D-D, Dowfume W-85, and Nemagon were all effective.

229. LOWNSBERY, B. F. and S. A. SHER. Soil fumigation for control of the root lesion disease of walnuts. (Abstr.) Phytopathology 47: 527-528. 1957.

Pressure-chisel machine applications of D-D, Dowfume W-85, and Nemagon at walnut planting sites in three California orchards heavily infested with Pratylenchus vulnus have resulted in satisfactory growth of California black and Paradox hybrid walnut replants. Neither of these root stocks had grown satisfactorily at untreated control sites. Duration of benefits of preplanting fumigation is uncertain because soil populations of root lesion nematodes returned to pretreatment levels in two seasons.

230. MORGAN, O. D. Control of Fusarium wilt and root knot nematode of tobacco with soil

fumigants. Plant Dis. Reptr. 41: 27-32. 1957.
Three tests for control of root knot nematode (Meloidogyne spp.) also gave definite control of Fusarium wilt. Yields were increased markedly in the three tests by use of ethylene dibromide at 5 gallons to the acre. A split treatment of EDB at 2.5 - 2.5 gallons per acre, used in one of the tests, also showed control of Fusarium wilt and increased weight of tobacco over the controls, as did D-D at 20 gallons per acre.

231. PADEN, W. R. and J. A. RILEY. Yield response of cotton on Lakeland sand from fumigation with D-D. Assoc. South. Agr. Workers Proc. 54: 73-74. 1957.
Tests in South Carolina have shown that on soils commonly infested with the various species of nematodes the yields of cotton can be greatly increased through soil fumigation. Following fumigation the cotton plant tends to develop a larger root system and is, therefore, better able to withstand drouth conditions.

232. SHER, S. A. Response of roses to field fumigation for lesion nematode. (Abstr.) Phytopathology 47: 31. 1957.
Fumigation for Pratylenchus vulnus on poorly growing roses was carried out with a number of soil fumigants. The average dry weight in grams from each treatment and the checks was as follows: Chloropicrin at 33 gallons per acre, 82; Dowfume W-85 at 8 gallons per acre, 71; D-D at 40 gallons per acre, 70; Vapam injection at 40 gallons per acre, 59; Vapam drench at 40 gallons per acre, 39; check, 30.

233. YOUNG, V. H. Jr., A. M. SOMERVILLE Jr. and J. L. CARNES. Nematode control in potted ornamentals with V-C 13 Nemacide. Plant Dis. Reptr. 41: 271-277. 1957.
Root-knot, spiral and meadow nematodes in boxwood, Japanese holly, and privet.

Nematocides -- Vegetables

234. DARLING, H. M. Control of the potato rot nematode in Wisconsin. (Abstr.) Phytopathology 47: 7. 1957.
Ethylene dibromide has given the most promising results. Split application (plow sole) of this chemical at a total rate of 6 gallons an acre (4 gallons on the first and 2 gallons on the second) were made in the spring and fall. The fall application gave control approaching eradication.

235. MINZ, G. Experiment on control of root-knot nematodes. (In Hebrew) Hassadeh 37: 415-416. 1957.
Successful control of root-knot nematodes prior to planting spring tomatoes was obtained by use of D-D, ethylene dibromide, and Nemagon.

236. NIELSEN, L. W. and J. N. SASSER. The relationship of nematocides, dosage, carrier, and soil types to the control of root-knot in sweetpotato. (Abstr.) Phytopathology 47: 314. 1957.
Dowfume W-85 and D-D were applied for control of Meloidogyne incognita acrita in sweetpotatoes. Application was at 0, 1/2, 1, and 2 times the recommended dosages of 10 gallons per acre for D-D and 4 1/2 gallons per acre for Dowfume W-85. Fumigants were applied in two forms: liquids and impregnated vermiculite. The fumigants carried on vermiculite were more effective at the lower dosages than comparable liquid treatments, but they affected yields adversely at the high dosage. This was most serious in heavy soil.

237. OVERMAN, A. J. and D. S. BURGIS. Fungicidal, herbicidal and nematocidal effects of fumigants applied to vegetable seedbeds on sandy soil. Proc. Fla. hort. Soc. 69: 250-255. 1957. (Rev. Appl. Mycol. 36: 633. 1957.)
From soil fumigation treatments carried out at Bradenton, Florida, it was concluded that the addition of Nemagon or D-D to the allyl alcohol drench gave a soil treatment that was effective as a fungicide, a nematocide,

and a herbicide. Vapam and Crag Mylone were also effective in all three categories.

238. STONE, L. E. W. Observations on the control of potato-root eelworm (Heterodera rostochiensis Wollenw.) under glass by D-D and solubilized p-m cresol. Ann. Appl. Biol. 45: 256-260. 1957.

D-D injected at 400 pounds per acre into light loam in two glasshouses in Wiltshire killed 93.9 and 91.5 percent of the eelworm population, respectively, in the 0.9 inch soil layer. Combined treatments, using solubilized cresols as a surface seal instead of water, increased the kill in the 0.3 inch soil layer, but a higher degree of kill here is still required.

NEMATODES

See also 156

239. APEL, A. and L. KÄMPFE. Beziehungen zwischen Wirt und Parasit im Infektionsverlauf von Heterodera schachtii Schmidt in kurzfristigen Topfversuchen. I. Infektionsgang bei verschiedenen Wirtspflanzen. Nematologica 2: 131-143. 1957.

The normal source of invasion and development of beet eelworm in sugar beet, summer turnip rape, swede rape, and white mustard was studied during the first 21 days of plant growth. There were no appreciable differences in the time of appearance of the different larval stages in the different host plants. Among other things which contribute to a high larval density is relatively slow growth in root length.

240. BAUSERMAN, H. M. and R. F. OLSON. Nematode cyst hatch rate as influenced by fractions of beet root juice. Am. Soc. Sugar Beet Technol. J. 9: 387-392. 1957.

241. BIRCHFIELD, W. The burrowing nema situation in Florida. J. Econ. Ent. 50: 562-564. 1957.

A general review covering the organism Radopholus similis under the topics: taxonomy and description; life cycle and pathogenicity; host plants and geographic distribution. The disease (spreading decline) is discussed under economic importance, research and control.

242. BIRCHFIELD, WRAY. Observations on the longevity without food of the burrowing nematode. Phytopathology 47: 161-162. 1957.

The burrowing nematode (Radopholus similis) was not recovered from infested soil and roots after 4 months when placed 3 feet under the ground surface or in temperature tanks maintained at 74° to 76° F. It survived about 66 days at room temperature on water agar and in water.

243. BOSHER, J. E. and W. NEWTON. Pratylenchus penetrans in clonal apple stocks. (Abstr.) Phytopathology 47: 4. 1957.

Dissemination of Pratylenchus penetrans in the roots of apple stocks is favored by the use of layering methods used in propagating clonal stocks. Conspicuous root injury and reduced growth in 2-year-old stocks were associated with populations of Pratylenchus exceeding 80 per gram of roots. Soil fumigation by injection of Nemagon at rates of 10 to 40 gallons per acre in the root zone of 2-year-old apple stocks significantly reduced total nematode populations but did not completely eliminate Pratylenchus.

244. BRAUN, ALVIN J. and J. A. KEPLINGER. Nematodes -- are they a limiting factor in grape production in New York? Farm Res. 23 (1): 9. 1957.

Nematodes found associated with grape roots included Xiphinema, Helicotylenchus, Pratylenchus, Paratylenchus, Criconemoides.

245. BROWN, E. B. Lucerne stem eelworm -- a serious threat to lucerne growing. Agriculture (London) 63: 517-528. 1957.

246. BURMAN, J. H. and J. JENKS. Our invisible allies in the soil; minute soil fungi that

prey upon eelworms. Mother Earth 9: 857-863. 1957.

247. CAPSTICK, C. K., D. C. TWINN and J. S. WAID. Predation of natural populations of free-living nematodes by fungi. Nematologica 2: 193-201. 1957.
Fungal predation on nematodes of the forest litter.

248. CARROLL, J., J. McKAY and M. HANNIGAN. Propagation of eelworm-free stocks of strawberry runners. Roy. Dublin Soc. Econ. Proc. 4: 75-82. 1957.

249. CHAPMAN, RICHARD A. The effects of aeration and temperature on the emergence of species of Pratylenchus from roots. Plant Dis. Reptr. 41: 836-841. 1957.
Because of the long period of time that roots must be kept before they are exhausted of nematodes, some means of aeration is essential if frequent changes of water or washings are to be avoided. Of the methods tried here, passing air through jars and agitation on a shaker were the most effective.

250. CHITWOOD, B. G. and W. BIRCHFIELD. Citrus-root nematode, a native to Florida soils. Plant Dis. Reptr. 41: 525. 1957.
Tylenchulus semipenetrans has been found on the roots of the native climbing hempweed (Mikania batatifolia) in several places where no record of cultivation is known.

251. CHITWOOD, B. G. and R. P. ESSER. Pathogenicity tests involving Meloidodera floridensis, a nematode associated with slash pine. Plant Dis. Reptr. 41: 603-604. 1957.
Meloidodera floridensis reproduced and increased itself on Pinus elliotti seedlings without apparent injury to the roots or tops.

252. CHRISTIE, J. R. The yellow disease of pepper (Piper), and spreading decline of citrus. Plant Dis. Reptr. 41: 267-268. 1957.
The author here stresses the great similarity of yellows disease of pepper, Piper nigrum, on the island of Banka (where the stand of 22 million trees has been reduced to 2 million) and spreading decline of citrus in Florida. There is little doubt that in both cases the causal agent is the burrowing nematode Radopholus similis.

253. CLARKE, O. F., R. C. BAINES and P. W. MOORE. Mulches show no effect in controlling nematodes. Calif. Citrog. 42: 499. 1957.

254. COLBRAN, R. C. The strawberry root knot nematode. Qd. Agr. J. 83: 256-258. 1957.

255. CRALLEY, E. M. The effect of seeding methods on the severity of white tip of rice. (Abstr.) Phytopathology 47: 7. 1957.
White tip caused by Aphelenchoides oryzae was much less severe when rice was seeded in water than when it was drilled. It would appear that water seeding of rice offers a simple and practical method for the control of white tip.

256. DONCASTER, C. C. Growth, invasion, and root diffusate production in tomato and black nightshade inoculated with potato root eelworm. Nematologica 2: 7-15. 1957.
The results of the experiments show a logical relationship between hosts and parasite (Heterodera rostochiensis). Each year, plant growth was reduced by eelworm attack, but to a lesser degree in the unfavorable host plant, black nightshade (Solanum nigrum).

257. DROPKIN, VICTOR H. and GEORGE C. MARTIN. The inhibition of hatching of nematode eggs under moisture stress. (Abstr.) Phytopathology 47: 519. 1957.
Solutions of various salts and of dextrose at a molar concentration equivalent to a potential osmotic pressure of 15 atmospheres prevented emergence of larvae from eggs of Meloidogyne spp. and Heterodera

rostochiensis. The response of nematode eggs to moisture stress is probably an important factor in the distribution and infectivity of plant parasitic nematodes.

258. DUNN, E. Cereal root eelworm. Scottish Agr. 36: 146-148. 1957.
Includes distribution and economic effect of Heterodera major (particularly in Scotland), life cycle, symptoms, and host range.

259. DUNNETT, J. M. "Embedded cysts" in relation to the utilisation of potato root eelworm resistance. Roslin. Scot. Plant Breeding St. Ann. Rept. pp. 50-56. 1957.
Certain populations of the potato root eelworm develop on clones of the host which in general are resistant to the nematode. The significance of the "occasional" cysts which arise on the roots of these resistant plants has been discussed previously. This paper draws attention to the development on the tubers of resistant plants of cysts which develop in situ and thus may be described as "embedded cysts".

260. DUNNETT, J. M. Variation in pathogenicity of the potato root eelworm (Heterodera rostochiensis Woll.) and its significance in potato breeding. Euphytica 6: 77-89. 1957.
An eelworm population has been found which has overcome the resistance of certain clones of Solanum tuberosum subsp. andigena used as a source of resistance.

261. ELLENBY, C. An investigation into the possibility of parthenogensis in the potato root eelworm Heterodera rostochiensis Wollenweber. Nematologica 2: 250-254. 1957.
From the data presented the author concludes that parthogenesis does not normally take place.

262. EPPS, J. M. Soybean cyst nematode found in Tennessee. Plant Dis. Reptr. 41: 33. 1957.
Heterodera glycines found in Lake County, western Tennessee.

263. FARRAR, LUTHER L. Plant parasitic nematode genera found in the vicinity of small grain roots in Georgia. Plant Dis. Reptr. 41: 703-704. 1957.
A total of 87 samples was collected from 48 counties throughout the State. Parasitic nematodes were observed in each sample. Pratylenchus sp. was the most frequently observed.

264. FASSULIOTIS, GEORGE. Role of the male in reproduction of the golden nematode. (Abstr.) Phytopathology 47: 11. 1957.
It appears that the definite shape of the female is not dependent on fertilization and that the golden nematode, Heterodera rostochiensis, is not capable of parthenogenesis.

265. FASSULIOTIS, GEORGE. X-ray studies on the golden nematode, Heterodera rostochiensis. (Abstr.) Phytopathology 47: 520. 1957.
Cysts of the golden nematode were irradiated with dosages of 5, 10, 20, 40, 80, 160 and 360 kr. There was no effect on emergence at the five lower levels. At 160 kr. hatching was delayed 7 days. At 360 kr. only 15 percent of larval emergence occurred. Infectivity of larvae was inversely proportional to the dosage. No mature females were recovered from roots inoculated with larvae receiving 360 kr.

266. FEDER, WM. A. and JULIUS FELDMESSER. Additions to the host list of Radopholus similis, the burrowing nematode. Plant Dis. Reptr. 41: 33. 1957.
Pot tests indicate the following to be additional hosts of the burrowing nematode: carrot, beet, bean, tomato, squash, corn, White Dutch clover, pea, pepper, okra, radish, cantaloupe, broccoli, watermelon, rye, Bahia grass, Bermuda grass, carpet grass, alfalfa.

267. FEDER, WILLIAM A. and JULIUS FELDMESSER. Observations on the absence of an internal microflora of surface-sterilized Radopholus similis. (Abstr.) Phytopathology 47: 11. 1957.

Radopholus similis was cleaned by soaking groups of 25 nematodes for 5 minutes in mercuric chloride 1/1000, followed by three serial washings in sterile distilled water. Such nematodes were fully infective when placed on citrus roots. No bacteria or fungi grew from cleaned nematodes placed intact on various agar media or cut aseptically after placement on the agar. The agar media used were potato-dextrose nutrient, potato-dextrose peptone, and yeast extract.

268. FELDMESSER, JULIUS and WM. A. FEDER. Survival of Radopholus similis in field soil subjected to drying and to elevated temperatures. (Abstr.) Phytopathology 47: 11. 1957.

Radopholus similis survived after 27 hours in one test in which soil moisture fell from 3.0 to 0.9 percent, and soil temperatures were over 100° F for 12 hours with a high of 115° during that period.

269. FENWICK, D. W. Red ring disease of coconuts in Trinidad and Tobago. Report, London: Colonial Office, 55 pp. 1957.

The disease is caused by Aphelenchoides cocophilus. It appears to be soil-borne, with entry through the roots and then into the base of the tree.

270. FERRIS, J. M. Effect of soil temperature on the life cycle of the golden nematode in host and nonhost species. Phytopathology 47: 221-230. 1957.

Soil temperature had a marked effect on the life cycle of Heterodera rostochiensis in the three host species of Solanum studied; in the single nonhost species of Solanum studied temperature had only a slight effect. Fewer larvae penetrated any of the species at 85° F than at either 65° or 75°. At 85° no larvae developed beyond the second stage in any of the hosts. Periods at 85° for longer than 5 days caused degeneration of the nematodes that had developed.

271. FERRIS, VIRGINIA R. and BENJAMIN M. SIEGEL. Electron microscopy of golden nematode cyst wall. Nematologica 2: 16-18. 1957.

An exocuticle and an endocuticle are visible in electron micrographs of ultra thin sections of golden nematode cyst wall. More detail can be seen in the endocuticle than has been reported from light microscope studies. Details of the exocuticle described from light microscope observations are not imaged in the electron microscope.

272. FRANKLIN, MARY T. Note on the nomenclature of the cereal root eelworm. Nematologica 2: 149-151. 1957.

In current literature the cereal root eelworm is referred to sometimes as Heterodera major, sometimes as H. avenae. This disagreement as to its correct scientific name is bound to lead to confusion. Following the principles laid down at the meeting of the International Commission on Zoological Nomenclature held in Paris in July 1948, it is clear that the name major, although given later than avenae, is the correct specific name because avenae was not published together with an adequate "indication".

273. GEORGHIOU, G. P. Records and notes on the plant parasitic nematodes of Cyprus. Cyprus Dept. Agr. Tech. Bull. TB-3, 5 pp. 1957.

274. GOFFART, H. Bemerkungen zu einigen Arten der Gattung Meloidogyne. Nematologica 2: 177-184. 1957.

Species of Meloidogyne that have been found in Germany are

M. hapla and M. arenaria subsp. thamesi. M. javanica was also found in roots sent for examination. Some perineal patterns are described which previously had not been correctly identified. They belong to the arenaria and incognita groups. M. hapla is of frequent occurrence in the field and attacks many weeds.

275. GOLDEN, A. MORGAN. Occurrence of Radopholus gracilis (Nematoda: Tylenchidae) in the United States. Plant Dis. Reptr. 41: 91. 1957.

Radopholus gracilis was found in soil and certain root samples from monocotyledonous plants growing in moist soil along the edge of the Pajaro River near Watsonville, California.

276. GOUGH, H. C. The pea root eelworm. Agr. Rev. 2 (11): 44. 1957.

277. HAASE, W. Feste Mietenplätze zur Minderung der Kartoffelnematoden -- Verschleppung! Deut. Landwirt. 8: 399-400. 1957.

278. HEGGE, A. H. Soybean cyst nematode in Missouri. Plant Dis. Reptr. 41: 201. 1957.

Nine fields have been found to be infested with Heterodera glycines to date, all within 1 to 5 miles of the Mississippi River.

279. HESLING, J. J. The hatching response of Heterodera major (O. Schmidt) to certain root diffusates. Nematologica 2: 123-125. 1957.

The experiments indicate that the hatching of Heterodera major is not due to the stimulus of root diffusate, although the possibility of an ephemeral stimulant being produced by the roots remains as a possibility.

280. HESLING, J. J. Heterodera major O. Schmidt 1930 on cereals -- a population study. Nematologica 2: 285-299. 1957.

The susceptibility of three cereals, i.e., the effect of the eelworm on them, appears to be greatest in oats, followed by wheat and barley. The number of new cysts may be expressed as a percentage of half the original number of larvae and this percentage is termed "cyst-efficiency" by the author. The "cyst-efficiency" was found to be low in all of the tests, thus for this nematode there seems to be a great wastage of larvae which do not become cysts. The reason for this is not known.

281. HOLLIS, JOHN P. Cultural studies with Dorylaimus ettersbergensis. Phytopathology 47: 468-473. 1957.

The nematode was cultured in water-agar inoculated with a series of microorganisms. It was found that the nematode inserted its spear and fed on vegetative cells of the algae (blue-green and green), on cysts of the protozoan, and on conidia of the fungus. Feeding involved the forcible removal of protoplasm from the cell and its duration in an individual cell was determined by the type of microorganism attacked. The nematode fed also on other nematodes.

282. HOLLIS, JOHN P. Microbial host range of Dorylaimus ettersbergensis. (Abst.) Phytopathology 47: 16. 1957.

Dorylaimus ettersbergensis feeds parasitically in water-agar cultures on globose cells of a blue-green alga (Chroococcus sp.), green algae (Chlorella vulgaris and Tetraedron sp.), a protozoan (Drepanomonas sp.), and a fungus (Cephalothecium sp.). The two algae proved to be the most effective hosts.

283. HOLLIS, JOHN P. and TITUS JOHNSTON. Microbiological reduction of nematode populations in water-saturated soils (Abstr.) Phytopathology 47: 16. 1957.

Populations of Tylenchorhynchus martini and T. acutus were related inversely to the amount of flooding and rainfall in rice and soybeans, respectively, in soil fumigation tests. The effect of microorganisms in water-saturated soils was demonstrated experimentally.

284. HORN, A. VON. Rübenbau und Rapszwischenfrucht. Zucker 10: 351-352. 1957.

285. JENKINS, W. R. and COURSEN, B. W. The effect of root-knot nematodes, Meloidogyne incognita acrita and M. hapla, on Fusarium wilt of tomato. Plant Dis. Reptr. 41: 182-186. 1957.

Some relationship other than merely providing an entry for the fungus exists between Fusarium oxysporum f. lycopersici and Meloidogyne hapla and M. incognita acrita in the Fusarium wilt of tomato. In both semi-resistant and resistant varieties, the incidence of wilt was greater in the presence of the nematode.

286. JENKINS, W. R. et al. Nematodes associated with crop plants in Maryland. U. of Md. Agr. Expt. Sta. Bull. A-89. 1957.

A state-wide survey for the occurrence of plant parasitic nematodes, involving more than 1200 collections, showed the most frequently occurring genera to be: Aphelenchus, Ditylenchus, Pratylenchus, Tylenchorhynchus, and Tylenchus.

287. JENSEN, HAROLD J., LINDSAY B. LORING and JORER LEWIS. Sugar beet nematode found in the Ontario-Nyssa area of Oregon. Plant Dis. Reptr. 41: 201. 1957.

Heterodera schachtii. This is the larger of the two major areas producing sugar beets in Oregon.

288. JOHNSTON, TITUS. Further studies on microbiological reduction of nematode population in water-saturated soils. (Abstr.) Phytopathology 47: 525-526. 1957.

Tylenchorhynchus martini was added to a rice field soil and incubated at moisture levels of 11, 25, 50, 75, and 100 percent field capacity and at saturation. Survival was highest between 40 and 60 percent and lowest at 11 percent and saturation. A species of Clostridium produced a toxic principle that killed nematodes in from 15 seconds to 2 minutes. Activity of the substance was partially reduced by filtration, by agitation for 15 minutes, and by heating at 100° C for 15 minutes. Anaerobic bacteria may be a factor in the reduction of nematode populations in water saturated soils.

289. JONES, F. G. W. Soil populations of beet eelworm (Heterodera schachtii Schm.) in relation to cropping. III. Further experiments with microplots and with pots. Nematologica 2: 257-272. 1957.

The results of a rotational experiment in microplots containing Chatteris soil are given together with some criticisms of the layout. Further results are given of the effects of beet and other host plants on the beet eelworm population of three sets of microplots containing soil from Oxlode, Spalding and Cantley, and of a separate experiment employing large pots. Increase in beet eelworm population occurred in the Chatteris and Spalding soil, a decrease in Oxlode soil and no change in the Cantley soil.

290. JONES, H. L. Battle in the citrus grove. Am. Fruit Grower West. Ed. 77 (2): 15, 51-52. 1957.

291. KINCAID, RANDALL R. and NATHAN GAMMON. Effect of soil pH on the incidence of three soil-borne diseases of tobacco. Plant Dis. Reptr. 41: 177-179. 1957.

Test crops of tobacco have been grown under shade in soil adjusted to five different pH levels. Blackshank (Phytophthora parasitica var. nicotianae) varies directly with pH, differences being highly significant. Root knot (Meloidogyne spp.) and coarse root (Pratylenchus sp.) varied inversely with soil pH, differences being significant.

292. KONDO, T. On the seasonal fluctuation of the population density of Meloidogyne incognita acrita in the sweetpotato field. (In Japanese.) Botyu-Kagaku 22: 144-149. 1957.

293. KOSKI, J. T. The burrowing nematode in Florida. Assoc. South Agr. Workers Proc. 54: 142-143. 1957.

Radopholus similis. A general discussion of the burrowing nematode problem.

294. KRADEL, J. Kartoffelnematode bedroht unseren Kartoffelanbau. Mitschurin Bewegung 6: 652-657. 1957.

295. KRUSBERG, L. R. and L. W. NIELSEN. The influence of root-knot nematodes on the growth of Porto Rico sweetpotato. (Abstr.) Phytopathology 47: 21. 1957.

A demonstration that Meloidogyne incognita acrita stunts sweetpotato.

296. LEWIS, FREDA J. and W. F. MAI. Survival of encysted eggs and larvae of the golden nematode to alternating temperatures. (Abstr.) Phytopathology 47: 527. 1957.

Sterilized soil infested with golden nematode (Heterodera rostochiensis) cysts was maintained air dry and at seed bed moisture in 1-pint containers. Both soils were shifted from one temperature to another (-5° and 75° F) at intervals of 1, 3, 7, 14, and 28 days for a period of 169 days. Viability of the cyst contents was tested at the end of the test period. In dry soil, viability was similar following all treatments. In moist soil, greater losses in viability resulted from alternating temperatures than from constant temperatures. Some individuals survived all of the treatments.

297. LINDHARDT, K. Ditylenchus dipsaci in gardening. (In Danish) Horticultura 11: 123-127. 1957.

298. LINDHARDT, K. The sugar beet nematode. (In Danish) Landbonyt 11: 416-418. 1957.

Heterodera schachtii.

299. LORDELLO, LUIZ GONZAGA E. Dalias e nematodeos. Chacaras e Quintais 95:493. 1957.

A species of Meloidogyne on dahlia tubers is reported and symptoms are described.

300. LORDELLO, L. G. E. A note on nematode parasites of red anthurium (Anthurium andraeanum Lind.) with a description of Rotylenchus boocki n. sp. Nematologica 2: 273-276. 1957.

Samples of diseased roots of stunted plants of red anthurium (Anthurium andraeanum) were attacked by Meloidogyne inornata, Helicotylenchus nannus, and an undescribed form of Rotylenchus. A description of Rotylenchus boocki n. sp. is given in this paper.

301. MAI, W. F. et al. Nematode genera found in New York State orchards. Plant Dis. Reptr. 41: 402-404. 1957.

Potentially pathogenic nematodes appear to be widely distributed throughout the orchard soils of New York State. In some orchards the evidence is strong that attack by Pratylenchus penetrans is an important factor in the decline of cherry and to a lesser extent of apple trees.

302. MAI, W. F. and K. G. PARKER. Nematodes cause serious root disease of cherry and other tree fruits in western New York. N. Y. State Hort. Soc. Proc. 102 Ann. Meeting 77-81. 1957.

303. MARTIN, G. C. Four kinds of root-knot nematode. Rhodesia Agr. J. 54: 324-326. 1957.

304. MEAD, HOWARD. One-year leys on clover-sick land. Plant Path. 6: 90-91. 1957.

In the area of the Northumberland and Durham coalfield farmers have been puzzled by "white hay" (hay without legumes) which has been shown to be due to killing of the clover plants by the bulb and stem nematode (Ditylenchus dipsaci). It was decided to put in tests using legumes

considered to be eelworm-resistant. The tests show that the use of alsike and big-leaved white clover can contribute substantially to hay yields on infested land.

305. MILES, H. W. Crop protection. Nature 179: 1339-1340. 1957.
During the symposium, a number of reports on control of eelworms were presented. It was reported that even an efficient nematocide such as DD may give results that vary from place to place depending upon the nature of the soil. The main factor appears to be the water content. This report was in reference to the potato root eelworm. With regard to anguilluline eelworms in nursery stock, flower crops and carrots, DD was the most reliable nematocide. Ethylene dibromide was very effective against root knot eelworm under glass. It was noted that the use of sodium methyl dithiocarbamate appeared to be very promising.

306. MILLER, P. R. (Compiler). Plant disease situation in the United States: summer dwarf nematode disease of strawberry in Arkansas. F.A.O. Pl. Prot. Bull. 5: 174-175. 1957.

307. MINTON, NORMAN A. and ELDON J. CAIRNS. Suitability of soybeans var. Ogden and twelve other plants as hosts of the spiral nematode. (Abstr.) Phytopathology 47: 313. 1957.
Helicotylenchus nannus was found to multiply on the roots of soybean plants in addition to 12 other kinds of plants. In the case of soybean, the effects of the nematode included reduction in root weight.

308. MINZ, G. Free living plant parasitic and possible plant-parasitic nematodes in Israel. Plant Dis. Reptr. 41: 92-94. 1957.
This paper covers 22 genera of nematodes derived from 44 plant species and surrounding soil obtained from localities scattered throughout the country. In addition a number of non-parasitic nematodes are also listed at the end of the paper.

309. MIUGE, S. G. (On the physiological specificity of the bulb nematode Ditylenchus allii Beij.) (Russian) Zool. Zhur. 36: 620-622. 1957.

310. MOUNTAIN, W. B. and H. R. BOYCE. Parasitic nematodes in relation to the peach replant problem in Ontario. (Abstr.) Phytopathology 47: 313. 1957.
Pratylenchus penetrans appears to be the only nematode which can be correlated with the occurrence of the problem. Soil fumigation with D-D was effective and gave almost complete control of the nematode for at least 2 years. Commercial peach nurseries are infested with P. penetrans.

311. MULVEY, R. H. Susceptibilities of cultivated and weed plants to the sugar-beet nematode, Heterodera schachtii Schmidt, 1871, in southwestern Ontario. J. Helminth. 31: 225-228. 1957.
Included in the test were 90 plants involving 18 families. It was found that some plants withstood the attack of the nematodes better than others. Cabbage, turnip, broccoli, cauliflower and Brussels sprouts, although heavily attacked, showed good growth. Mangel, red beet, rutabaga, sugar beet and leaf beet (Swiss chard) showed progressively poorer growth each year.

312. NOLTE, H. W. and A. DIETER. Nematoden an Baumschulgewächsen in Mitteldeutschland. Nematologica 2: 63-67. 1957.
An investigation of nematodes associated with decline of nursery stock including Robinia, Caragana, Prunus, Laburnum, Sambucus, Rosa, Syringa, Larix, Pinus, Picea is reported. Parasitic nematodes in the families Tylenchidae and Dorylaimidae were encountered.

313. NORTON, DON C. Radopholus gracilis in a dry subhumid environment. Plant Dis. Reptr. 41: 599. 1957.

Radopholus gracilis has been reported to occur in extremely moist places and most of the plants with which the nematode has been associated are hydrophytes. In September 1956, R. gracilis was found associated with the roots of Virginia wild rye (Elymus virginicus var. glabriflorus) growing in a clay loam upland slope in the rolling plains of Archer County, Texas. The present finding is in a distinctly more xeric habitat than previously reported.

314. ONIONS, T. G. Emergence of larvae from sealed cysts of the potato root eelworm, H. rostochiensis Wollenweber. Nature 179: 323-324. 1957.

It has been shown previously that hatching of eggs contained in the cysts is not random; eggs near the cyst wall tend to hatch sooner than eggs nearer the center of the mass. It also appeared that the position of eggs in relation to either of the two natural openings, the neck and vulva, was without influence on the hatching distribution. This report confirms this conclusion, for it is now shown that sealing either of the openings has no detectable effect on the distribution. Moreover emergence from cysts with only one effective opening appears to take place as rapidly as from normal cysts.

315. OOSTENBRINK, M. Nematoden in Verband met de Vruchtbaarheid van de Grond. Openbare les Uitgesproken bij Openlijke aan Vaarding van het Lectoraat in de Nematologie aan de Landbouwhoogeschool te Wageningen op 28 Maart 1957.

316. OTEIFA, BAKER A. and DAWOOD M. EL-GINDI. Effect of irrigation frequency and size of tomato seedlings on root knot index. Plant Dis. Reptr. 41: 605-607. 1957.

The effect of irrigation frequency and size of tomato seedlings on root knot (Meloidogyne sp.) index were determined under field conditions in Egypt. Heavy irrigation increased the amount of nematode injury. The effect of seedling size did not significantly affect root knot.

317. PARRIS, G. K. Screening Mississippi soils for plant parasitic nematodes. Plant Dis. Reptr. 41: 705-706. 1957.

The cause of decline of turf grass, ornamentals, cotton, and pecan in Mississippi is demonstrated to be often due to attack by plant endo- and ectoparasitic nematodes, including species of the genera Tylenchorhynchus, Trichodorus, Rotylenchus, Criconemoides, Hoplolaimus, Xiphinema, Paratylenchus, and Pratylenchus.

318. PEA ROOT EELWORM. Gt. Brit. Min. Agr. Fisheries and Food Adv. L. 462. 1957.

Heterodera göttingiana.

319. PEACOCK, F. C. Plant parasitic eelworms. Outlook on Agriculture 1: 188-196. 1957.

A general discussion of nematodes in relation to plants. The study of eelworms has rapidly become an important branch of plant pathology. Many species are now known to be serious parasites of cultivated plants in tropical as well as temperate lands, and our knowledge of eelworm biology has steadily advanced. However, attempts at control by breeding resistant plants or by chemical or other measures have met with limited success, and a practical answer to the problem has yet to be found.

320. PEACOCK, F. C. Studies on root knot nematodes of the genus Meloidogyne in the Gold Coast. Part II. The effect of soil moisture content on survival of the organism. Nematologica 2: 114-122. 1957.

In laboratory and greenhouse experiments, root knot larvae and egg masses were shown to be highly susceptible to death by desiccation. Egg masses were also somewhat intolerant of excess moisture. Where nematodes were protected by plant material both these extremes had less effect. The initial moisture content for survival appeared to be 3 to 4 percent (10 to 13 percent of saturation).

321. PETERS, B. G. Plant parasitic nematodes. Nature 179: 902-903. 1957.
In a symposium held by the Linnean Society, various types of association between plants and nematodes were discussed. Population studies on cyst-forming nematodes, resistance in potato to the potato root nematode, and the interrelation of the leaf nematode Aphelenchoides ritzemabosi and the bacterium Corynebacterium fascians in producing cauliflower disease were also discussed.

322. RANKIN, H. W. The influence of nematodes on the wilt infection of okra. Assoc. South Agr. Workers Proc. 54: 223. 1957.
Ten selections of okra, when subjected to growth conditions including checks and all combinations of two species of nematodes and Fusarium vasinfectum reacted as follows: Out of a possible stand of 300 plants the various treatments gave the final following results -- checks, 265 plants; Fusarium vasinfectum alone, 255 plants; Pratylenchus leiocephalus alone, 247 plants; P. leiocephalus plus F. vasinfectum, 193 plants; Meloidogyne incognita acrita, 73 plants; M. incognita acrita plus F. vasinfectum, 52 plants.

323. RASKI, D. J. New host records for Meloidogyne hapla including two plants native to California. Plant Dis. Reptr. 41: 770-771. 1957.
The host range of Meloidogyne hapla is extended by the addition of bush germander, Teucrium fructicans; California laurel, Umbellularia californica; and salt rush, Juncus leseurii. The last two plants are native to California and their locations suggest that M. hapla may also be native to this State.

324. RICHARDS, C. D., E. S. PLISSEY and M. T. HILBORN. Occurrence of plant parasitic nematodes in Maine. Plant Dis. Reptr. 41: 1019-1020. 1957.
Five hundred twenty-two soil samples from commercially important crops were examined. Plant parasitic nematodes were found in 41 samples. Pratylenchus, Paratylenchus, Meloidogyne, and Aphelenchoides are reported.

325. RILEY, R. and V. CHAPMAN. Chromosomes of the potato root eelworm. Nature 180: 662. 1957.
Preliminary examination shows that Heterodera rostochiensis is cytologically distinct from an unidentified species of Heterodera and from a species of a related genus, Meloidogyne incognita, both of which have been reported to have 16 chromosomes.

326. RHODE, R. A. and W. R. JENKINS. Host range of a species of Trichodorus and its host-parasite relationships on tomato. Phytopathology 47: 295-298. 1957.
Damage to roots is caused by decreased cell multiplication rather than by mechanical destruction of cells.

327. SAUER, M. R. and J. E. GILES. Effects of some field management systems on root knot of tomato. Nematologica 2: 97-107. 1957.
The effects of four systems of field management on Meloidogyne javanica were studied over three seasons. Growing of susceptible tomatoes in the same soil for several years gave uniform severe infestation. Growing of nematode-resistant tomatoes gave good yields but did not reduce the nematode population sufficiently for susceptible crops. Clean fallow for 3 years reduced the infestation significantly. Summer fallow with a winter cover crop of barley gave the same results as clean fallow.

328. SCHINDLER, A. F. Parasitism and pathogenicity of Xiphinema diversicaudatum, an ectoparasitic nematode. Nematologica 2: 25-31. 1957.

The author concludes that the nematode is a plant parasite and is pathogenic in that it causes abnormal galling of root tissues and inhibits growth. It is concluded that Xiphinema diversicaudatum is a serious problem in greenhouse rose production. Another factor, either biological or chemical, is also responsible for some stunting similar in effect to the lower concentrations of Xiphinema used in the experiments.

329. SCHINDLER, A. F. and A. J. BRAUN. Pathogenicity of an ectoparasitic nematode, Xiphinema diversicaudatum, on strawberries. Nematologica 2: 91-93. 1957.
The authors conclude that this nematode is a pathogen of strawberries and when present in sufficient numbers may seriously inhibit their growth.

330. SHANDS, W. A. Jr. and H. W. CRITTENDEN. The influence of nitrogen and potassium on the relationship of Meloidogyne incognita acrita and soybeans. (Abstr.) Phytopathology 47: 454: 1957.
Nitrogen and potassium influenced the relationship of the nematode and soybeans. There was a general increase in penetration of Anderson (resistant variety) and in the amount of galls on Adams (susceptible) and Wabash (moderately susceptible), with an increase of both nitrogen and potassium.

331. SHER, S. A. A disease of roses caused by a root-lesion nematode, Pratylenchus vulnus. Phytopathology 47: 703-706. 1957.
A disease of roses demonstrated to be caused by the root-lesion nematode, Pratylenchus vulnus Allen & Jensen, is characterized by stunted chlorotic plants with necrotic root systems that are smaller than normal. Root-lesion nematode disease was reproduced in rose cuttings grown in field soil in the greenhouse, and it was eliminated by fumigation of the soil prior to planting. Artificial infestation of soil with P. vulnus caused the disease. Leaves from infested plants were lower in iron, copper, and potassium than were control plant leaves.

332. SKOTLAND, C. B. Biological studies on the soybean cyst nematode. Phytopathology 47: 623-625. 1957.
It is suggested that four to five generations of Heterodera glycines could develop in North Carolina in one growing season. Viability of eggs and larvae in cysts is drastically reduced by desiccation.

333. SLACK, D. A. et al. Summer dwarf of strawberry. Plant Dis. Reptr. 41: 398-401. 1957.
Recent occurrences of summer dwarf (Aphelenchoides besseyi) were recorded in strawberry plantings. Aberrant symptoms of the disease were observed on plants in the field and greenhouse. Field development was most striking during late fall rather than in midsummer.

334. SOUTHEY, J. F. Observations on Heterodera cacti Filipjev et Sch. Stekhoven and Meloidogyne spp. on imported cactus plants with a list of new host records. Nematologica 2: 1-6. 1957.
A complete list of recorded hosts is given. Species of Meloidogyne found included M. incognita, M. incognita var. acrita, and M. arenaria. The morphology of Heterodera cacti is considered. It is thought that these nematodes should be regarded as important pests of cactus plants because of the damage they do to the roots. Control suggestions are given.

335. SOUTHEY, J. F. Observations on races of Ditylenchus dipsaci infesting bulbs. J. Helmin. 31: 39-46. 1957.
The author tested the host range of three strains of this nematode (tulip race, narcissus race, and hyacinth race). The results are discussed, particularly in interpreting the characteristics of a true host.

336. SPEARS, J. F., S. C. BALCOMBE and G. HEMERICK. Detection of Heterodera glycines in North Carolina. (Abstr.) Phytopathology 47: 33. 1957.

Symptoms of soybean cyst nematode disease were visible on snap-bean and soybean foliage 6 weeks after planting where cyst count prior to planting was from 5 to 200 cysts per pound of soil; at 1 cyst per pound, symptoms 12 weeks after planting; at 1 cyst in 10 pounds, no symptoms. Under favorable conditions for growth symptoms included stunting and yellowing with chlorosis beginning distally on the foliage. Roots of diseased plants were small, dark, odorless, with few or no nodules, and cysts were plainly visible on such roots.

337. STANILAND, L. N. The swarming of rhabditid eelworms in mushroom houses. Plant Path. 6: 61-62. 1957.

A phenomenon, which is perhaps best described as swarming, has been observed on several occasions recently in mushroom houses in Dorset. Vast numbers of rhabditid eelworms (Rhabditis sp.) have been observed on the surface of the peat casing, the nematodes being grouped into club-like masses containing up to 100 individuals. Grouped thus they are easily seen with the naked eye. The eelworms most frequently swarm near doors or electric lights. The masses were found to react very strongly to tactile stimuli.

338. STEM AND BULB EELWORM ON NARCISSI, HYACINTHS, AND RELATED BULBS. Gt. Brit. Min. Agr. Fisheries and Food Adv. L. 460. 1957.

A general advisory leaflet containing a description and life history of Ditylenchus dipsaci, a discussion of the narcissus race and the hyacinth race, examples of weed hosts, means of spread and control measures.

339. A STUDY OF THE INCIDENCE OF NEMATODES IN SUGAR BEET PRODUCTION. Sugar Beet Development Foundation, Fort Collins, Colorado. 1957.

Samples of soil and of sugar beets were collected from 35 counties in the States of California, Colorado, and Michigan. Twenty-two genera and species of plant parasitic nematodes were found parasitic on or associated with sugar beet crops. Five species of nematodes were found directly parasitizing sugar beet roots (Heterodera schachtii, Meloidogyne incognita acrita, M. hapla, M. javanica, and Nacobbus batatiformis).

340. TARJAN, A. C. Observations on Ecphyadophora tenuissima de Man, 1921. Nematologica 2: 152-158. 1957.

Nineteen females and five males from five locations in Florida and from Ruurlo, Holland, have been studied. The nematodes were obtained from soil and roots of Valencia orange on rough lemon, pasture grass roots, sugar cane roots and soil, tomato soil, and Juniperus silicicola roots and soil.

341. TAYLOR, D. P. Plant parasitic nematodes. Minn. Farm & Home Sci. 14 (3): 5, 9. 1957.

A preliminary survey of Minnesota crops showed 19 genera and 40 species of plant parasitic nematodes to be present.

342. THOMAS, H. ALLEN. Some initial findings on nematodes on peaches in New Jersey. Plant Dis. Reptr. 41: 526. 1957.

Samples were made from 19 orchards, many of them old or declining. The list shows the nematode genera found and the number of orchards in which they occurred: Pratylenchus, 11; Xiphinema, 11; Ditylenchus, 4; Longidorus, 2; Tylenchorhynchus, 2; Criconemoides, 2; Aphelenchus, 2; Tylenchus, 1; Hoplolaimus, 1.

343. THOMASON, IVAN J. Influence of soil temperature on reproduction of Meloidogyne spp. (Abstr.) Phytopathology 47: 34-35. 1957.

Three species of Meloidogyne were tested, M. hapla, M. incognita acrita, and M. javanica. All species reproduced at 20°, 25° and 20° C. Reproduction of M. hapla at 35° was extremely limited and inconsistent. Populations of M. incognita acrita and M. javanica were reduced markedly at 35° although one population of M. javanica did reproduce well at this temperature.

344. THOMASON, IVAN J. and S. A. SHER. Influence of the stubby root nematode on growth of alfalfa. Phytopathology 47: 159-161. 1957.

Alfalfa plants were severely stunted when grown in the greenhouse in soil infested with the stubby root nematode, Trichodorus sp. Dry weight of plants grown in infested soil was significantly reduced. Lateral root development also was reduced. Soil fungi present in stunted alfalfa roots from Trichodorus-infested soil did not cause reduction in growth of alfalfa.

345. THORNE, G. Plant parasitic nematodes in soil biology. Proc. Soil Sci. Soc. Am. 1957, 21: 1-2. 1957.

A general discussion in which the author discusses the effect of nematodes upon early American agriculture, the damage nematodes are causing today, the effect nematodes may have on the experimental results of other workers, and control through soil fumigation.

346. THORNE, G. W. Nematodes. What's New in Crops and Soils 9 (7): 11-13. 1957.

347. VAN GUNDY, S. D. The first report of a species of Hemicycliophora attacking citrus roots. Plant Dis. Reptr. 41: 1016-1018. 1957.

Hemicycliophora sp. an ectoparasitic nematode, was found parasitizing Rough lemon roots in the Coachella Valley of Southern California. The nematodes were associated with distinctive galls at the distal portion of the terminal and lateral roots.

348. VAN WEERDT, L. G. Studies on the biology of Radopholus similis (Cobb) 1893, Thorne 1949. Part I. Plant Dis. Reptr. 41: 832-835. 1957.

Inoculations of Rough lemon seedlings with burrowing nematodes from boxwood, calathea, ginger lily, banana, pothos, and citrus were for the most part unsuccessful; whereas inoculations of boxwood, calathea, ginger lily, banana, and pothos with burrowing nematodes obtained from these hosts and citrus were successful. Other evidence is also presented to show that cross-inoculations are not always successful, which suggests the existence of races. Citrus is a relatively poor host for the burrowing nematode in terms of population build-up.

349. VIGLIERCHIO, D. R. and B. F. LOWNSBERY. Effect of tomato seedlings on larvae of Meloidogyne hapla. (Abstr.) Phytopathology 47: 536-537. 1957.

An increase in the rate of larval emergence takes place from egg masses of Meloidogyne hapla exposed to excretions of radicles of germinating seeds of Rutgers tomato in sand or water. This hatching stimulus is much less pronounced than that induced by the hosts of some of the species of Heterodera, but it is statistically significant and evident within 24 hours. The apparent directional movement of larvae of Meloidogyne, as noted previously, may well be a reaction to a chemotactic agent emanating from the roots of tomato seedlings.

350. WALLACE, H. R. The stimulatory properties of some organic substances on cysts of the beet eelworm, Heterodera schachtii Schmidt. Ann. Appl. Biol. 45: 251-255. 1957.

There was no significant difference between the rates of larval emergence in glutamic acid, galactinol, inositol and water; the rate of larval emergence in beet diffusate, on the other hand, was significantly higher. Studies of larval emergence in carbohydrates suggest that the cyst population used in the experiments was heterogeneous, consisting of two types of cyst that have different reactions to stimulation at different concentrations. The significance of root exudates in relation to beet eelworm is discussed.

351. WEISCHER, B. Die Wirkung ionisierender Strahlen auf die Entwicklung von Heterodera rostochiensis und H. schachtii. Nematologica 2: 300-305. 1957.

Cysts of the potato root eelworm and the beet eelworm were irradiated by radium for different times up to 196 hours. The radiation dose was 400 r/h (r = Roentgen). Compared with data for other animals in the literature, the nematodes showed a remarkable resistance to the rays. Treatment of less than 72 hours had no apparent effect. After longer exposure, the hatching of larvae from the cysts of the beet eelworm was reduced, whereas in the potato root eelworm many more larvae hatched from the irradiated cysts. The development of larvae from both species was retarded and rate of reproduction reduced.

352. WHITLOCK, LEIGH S. The burrowing nematode found on ornamental banana plants at Baton Rouge, Louisiana. Plant Dis. Reptr. 41: 814. 1957.

This nematode has previously been reported from Louisiana, from sugar cane roots and from Pothos and Philodendron in two ornamental nurseries.

353. WILLIAMS, T. D. Development of isolated female larvae of the potato-root eelworm (Heterodera rostochiensis Woll.). Nature 180: 1000. 1957.

The experiment was undertaken to determine whether Heterodera rostochiensis could reproduce in the absence of males (i.e. parthenogenesis or syngonism). One hundred single-larva inoculations were set up. In two instances, single developing females were seen. These cysts did not pass through the distinctive yellow stage and no eggs were found when the cysts were opened. These results agree with those of other workers, to the effect that parthenogenesis does not occur.

354. WILSON, J. D. A distribution pattern of root-knot nematode infestation on muck-grown carrots. Down to Earth 13 (1): 4-7. 1957.

The author found that the degree of root-knot nematode infestation can vary widely within the same field, which suggests the need for replicating nematode control studies. Plots for fertilizer, insecticide, fungicide, and weed killer studies should be relatively nematode-free for best results, since these pests may seriously affect yield and plant growth. Sequence of crops on land has an effect on nematode populations and rotations may offer a supplement to chemical control practices.

355. WINNER, CHRISTIAN. Über die aktivierende Wirkung von Aminoacridinen auf Heterodera schachtii. Nematologica 2: 126-130. 1957.

Some amino-acridines were investigated for their hatching activity on eggs of Heterodera schachtii. Stimulation of Heterodera larvae within the cysts by some of the substances tested cannot be explained by the surface activity or redox-potentials of the compounds. The stimulating effect is not restricted to 9-amino-acridines. Results are discussed with regard to the possible mechanism of activation by chemical stimulus.

356. WINSLOW, R. D. and T. D. WILLIAMS. Amoeboid organisms attacking larvae of the potato root eelworm (Heterodera rostochiensis Woll.) in England and the beet eelworm (H. schachtii Schm.) in Canada. T. Pl. Ziekten 63: 242-243. 1957.

Amoeboid organisms have been found attacking Heterodera rostochiensis in England and H. schachtii in Canada. In both cases the attacks occurred under laboratory conditions on larvae emerging from cysts in water or in root leachate in glass containers. The organisms appear to be very similar to the nematode-hatching organism Theratromysea weberi (Zwillinberg 1953). In the specimens described in the present paper some differences are observed from the behaviour of T. weberi.

357. WINSLOW, R. D. and R. A. LUDWIG. Studies on hatching stimulation in the beet nematode, Heterodera schachtii Schmidt. Can. J. Bot. 35: 619-634. 1957.

Sugar beets produced more active leachate under "short" day and moderate temperatures than under long day and more extreme temperatures. Stimulatory leachates were produced from various parts such as tops alone, roots alone, and various portions of the root of young rape seedlings. Sugar beet leachate was concentrated 20- to 40-fold, by vacuum distillation, without obvious loss of activity, frequently with apparent gain. Further concentration caused precipitation of active material.

358. WINSTEAD, N. N. and C. B. SKOTLAND. Eradicant treatments for narcissus bulbs and gladiolus corms harboring soybean nematode cysts. Phytopathology 47: 65-69. 1957.

The customary hot water and formaldehyde treatments for controlling bulb and stem nematodes of narcissus and gladiolus also controlled *Heterodera glycines*. Soaking gladiolus corms for 15 minutes in a solution of Na 2:4:5-trichlorophenate (85%) containing 3 pounds per 100 gallons was also effective.

359. WOOD, F. C. and J. B. GOODEY. Effects of gamma-ray irradiation on nematodes infesting cultivated mushroom beds. Nature 180: 760-761. 1957.

The irradiation dose necessary to inactivate the reproduction of *Ditylenchus destructor* and a species of *Rhabditis* appears to lie between 48, 000 and 96, 000 rep, more than twice as great as the 10, 000 and 20, 000 r. other workers found to inactivate cysts of the potato root nematode.

360. ZINOV'EV, V. G. (Enzymatic activity of the nematodes parasitizing plants.) In Russian. Zool. Zhur. 36: 617-620. 1957.

Nematodes -- Resistance

361. BARHAM, W. S., and N. N. WINSTEAD. Inheritance of resistance to root-knot nematodes in tomatoes. Am. Soc. Hort. Sci. Proc. 69: 372-377. 1957.

362. BINGEFORS, S. Studies on breeding red clover for resistance to stem nematodes. Sweden. Lantbrhögsk. Inst. f. Växtodlingslara. Vaxtodling. 8, 123 pp. 1957.

363. DIJKSTRA, J. Symptoms of susceptibility and resistance in seedlings of red clover attacked by the stem eelworm Ditylenchus dipsaci (Kühn) Filipjev. Nematologica 2: 228-237. 1957.

In this paper the results of a detailed study of symptoms associated with resistance and susceptibility in red clover are considered. When susceptible seedlings are inoculated, symptoms include abnormal swelling at the growing point, at the base of the cotyledon stalks, and at the top of the hypocotyl. Inoculated resistant plants showed no swellings, but brown stripes and some distortion. It was shown that multiplication of eelworms occurs only in the swollen (i. e. susceptible) plants.

364. DROLSOM, P. N., E. L. MOORE and E. E. CLAYTON. Resistance to two Meloidogyne species in breeding lines of flue-cured tobacco. (Abstr.) Phytopathology 47: 312. 1957.

Results to date from greenhouse studies indicate high resistance to *Meloidogyne incognita* and to *M. incognita acrita*, and susceptibility to *M. arenaria*. Results were inconclusive with respect to *M. hapla* and *M. javanica*.

365. FORD, H. W. Citrus rootstock selections tolerant to the burrowing nematode. Florida St. Hort. Soc. Proc. 69: 44-51. 1957.

366. GRIFFITHS, D. J., J. H. W. HOLDEN and J. M. JONES. Investigations on resistance of oats to stem eelworm, Ditylenchus dipsaci Kühn. Ann. Appl. Biol. 45: 709-720. 1957.

A study of some 250 forms of oats revealed new sources of resistance in cultivated and wild species. New sources of resistance in the cultivated species of Avena sativa were found only in winter types, and in the other hexaploid species in forms belonging to A. byzantina and the winter wild oat A. ludoviciana. The inheritance of reaction to stem eelworm in crosses involving Grey Winter and susceptible types depended on a single factor pair with resistance dominant.

367. HARE, W. W. Inheritance of resistance to root-knot nematodes in pepper. Phytopathology 47: 455-459. 1957.

Resistance to two species of Meloidogyne is controlled by a single dominant gene.

368. HUTTON, E. M. and L. B. BEALL. Root-knot nematode resistance in two pasture species of Phaseolus. J. Aust. Inst. Agr. Sci. 23: 158. 1957.

369. JONES, F. G. W. Resistance-breaking biotypes of the potato root eelworm (Heterodera rostochiensis Woll.). Nematologica 2: 185-192. 1957.

This paper reports tests carried out to confirm the occurrence of biotypes of the potato root eelworm capable of producing numerous cysts upon resistant clones of Solanum tuberosum subsp. andigena and upon resistant seedlings bred from crosses of these clones with varieties of S. tuberosum subsp. tuberosum.

370. NELSON, R. R. Resistance in corn to Meloidogyne incognita. (Abstr.) Phytopathology 47: 25-26. 1957.

Corn inbreds and single crosses were tested for their reaction to the root-knot nematode Meloidogyne incognita. Certain inbreds appeared to have some resistance, others were highly susceptible (based on production of galls) whereas still other inbreds appeared to possess tolerance since heavy galling was combined with no loss in root weight.

371. PEACOCK, F. C. Studies on root-knot nematodes of the genus Meloidogyne in the Gold Coast. Part I. Comparative development on susceptible and resistant host species. Nematologica 2: 76-84. 1957.

The development of the root-knot nematode on a number of hosts in the Gold Coast was studied and the host/parasite relationship compared. The life-cycle of the most advanced individuals on tomato and cowpea is 28 days, at soil temperatures of 26° to 31° C; on maize, soya, and tobacco the life cycle occupied 33 days but individual variation was considerable.

372. ROSS, J. P. and C. A. BRIM. Resistance of soybeans to the soybean cyst nematode as determined by a double row method. Plant Dis. Reptr. 41: 923-924. 1957.

During the spring of 1957, approximately 2800 selections and varieties of soybean were evaluated for resistance by means of a double row planting method. The results of the test indicate that resistance to the soybean cyst nematode is available within present soybean germ plasm. There is evidence that biological races within Heterodera glycines exist since resistant soybean varieties developed in Japan were found to be susceptible when planted in North Carolina.

373. SHARPE, R. H. Okinawa peach resists root knot nematodes. Sunshine St. Agr. Res. Rept. 2 (1): 18. 1957.

374. SHEPHERD, A. M. Development of beet eelworm, Heterodera schachtii Schmidt, in the wild beet, Beta patellaris. Nature 180: 341. 1957.

It was suggested previously that, while the roots of the resistant species of wild beet, Beta patellaris, are invaded by larvae of the beet eelworm, Heterodera schachtii, no further development occurs beyond an early larval stage. It has now been found that not only does a large proportion of the larvae which enter the roots of B. patellaris develop to the intermediate or third larval stage, but also that a small percentage develop to maturity, becoming males.

375. TANAKA, I. (Resistance of tobacco seedlings to root-knot nematodes.) In Japanese. Kyushu. Agr. Res. 1957: 67-68. 1957.

376. THOMASON, IVAN J. and PAUL G. SMITH. Resistance in tomato to Meloidogyne javanica and M. incognita acrita. Plant Dis. Reptr. 41: 180-181. 1957.

A tomato line (HES 4857) derived from a cross of Lycopersicon esculentum x L. peruvianum was found to be highly resistant to the root knot nematode, Meloidogyne incognita acrita. Resistance is governed by a single dominant gene. An F_3 line (54N6) from a backcross of HES 4857 x commercial tomato was resistant to M. javanica and M. incognita acrita.

Nematodes -- Taxonomy

377. ALLEN, M. W. A review of the nematode genus Trichodorus with descriptions of ten new species. Nematologica 2: 32-62. 1957.

Trichodorus primitivus (de Man 1880) is redescribed and ten new species of Trichodorus are described, including the species first reported to cause stubby root disease in Florida.

378. ANDRASSY, I. Aphelenchoides citri n. sp., ein neuer Wurzelparasit der Zitrone. Nematologica 2: 238-241. 1957.

The species is reported on the roots of a young lemon tree. Tails very long and filiform, males unknown.

379. ANDRASSY, I. Deladenus aridus n. sp. und ein Wiederfund von Deladenus saccatus Andrassy, 1954. Nematologische Notizen 5. Opuscula Zoologica 2: 3-8. 1957.

The paper contains a description of Deladenus aridus together with an emended description of D. saccatus and a key to the species of this genus.

380. ANDRASSY, I. Thornia gubernaculifera n. sp., ein neuer Susswassernematode aus Ungarn. Nematologische Notizen 6. Opuscula Zoologica 2: 9-14. 1957.

The new species is a fresh water form.

381. CHITWOOD, B. G. and W. BIRCHFIELD. A new genus, Hemicriconemoides (Criconematidae:Tylenchina). Proc. Helminth. Soc. Wash. 24: 80-86. 1957.

Hemicriconemoides wessoni on roots of Myrica cerifera; H. biformis on roots of Quercus virginiana; H. floridensis on roots of Pinus elliotti and Ilex glabra.

382. CHITWOOD, B. G. A new species of Xiphinemella Loos, 1950, (Nematoda) from Florida. Proc. Helminth. Soc. Wash. 24: 53-56. 1957.

Found around roots of Spanish oak, red maple, and the fern Pteris aquilina var. latiuscula.

383. CHITWOOD, B. G. Two new species of the genus Criconema Hofmänner and Menzel, 1914. Proc. Helminth. Soc. Wash. 24: 57-61. 1957.

Criconema decalineatum on fig roots; C. spinalineatum on Manila grass roots.

384. CHITWOOD, B. G. and A. C. TARJAN. A redescription of Atylenchus decalineatus Cobb, 1913 (Nematoda:Tylenchinae). Proc. Helminth. Soc. Wash. 24: 48-52. 1957.

Obtained from roots of cranberry, native persimmon, sugarcane, and a citrus grove.

385. FRANKLIN, MARY T. Aphelenchoides composticola n. sp. and A. saprophilus n. sp. from mushroom compost and rotting plant tissues. Nematologica 2: 306-313. 1957.

The two species of Aphelenchoides herein described as new have been shown to have clear morphological differences. A. composticola is also clearly distinguishable from A. parietinus by its greater length, smaller relative width, and the number of lines on the lateral field. A. saprophilus is extremely close to A. parietinus. There are differences in the shape and curvature of the female tail, the relative length of egg, and the absence of males in A. parietinus.

386. GOODEY, J. B. Hoplolaimus proporicus n. sp. (Hoplolaiminae:Tylenchida). Nematologica 2: 108-113. 1957.
New species recovered from decayed roots of seedlings of the oil palm (Elaeis guineensis) suffering from the disease known as "blast".

387. LORDELLO, LUIZ GONZAGA E. Two new nematodes found associated with soybean roots. Nematologica 2: 19-24. 1957.
Carcholaimus formosus n. sp.; Dorylaimus bauruensis n. sp.; in Brazil.

388. LUC, MICHEL. Radopholus lavabri n. sp. (Nematoda, Tylenchidae) parasite du riz au Cameroun français. Nematologica 2: 144-148. 1957.
This new species was found on the roots of rice plants in the French Cameroons (West Africa). A description with illustrations is given of the new species.

389. LUC, M. Tylenchulus mangenoti n. sp. (Nematoda - Tylenchulidae). Nematologica 2: 329-334. 1957.
The description of Tylenchulus mangenoti n. sp. confirms the opinion of Raski (1957) as to the close relations between the genera Tylenchulus and Trophotylenchulus. The presence of a functional anus is noted in the females of Tylenchulus mangenoti and the author suggests that the anus and the posterior part of the alimentary canal, though difficult to perceive in the females of other Tylenchulidae, may nevertheless be functional.

390. MULVEY, ROLAND H. Taxonomic value of the cone top and the underbridge in the cyst-forming nematodes Heterodera schachtii, H. schachtii var. trifolii, and H. avenae (Nematoda:Heteroderidae). Can. J. Zool. 35: 421-423. 1957.
Distinct morphological differences in the cone top and underbridge of the cysts seem to separate Heterodera schachtii, H. schachtii var. trifolii, and H. avenae.

391. PAESLER, F. Beschreibung einiger Nematoden aus Champignonbeeten. Nematologica 2: 314-328. 1957.
A new subgenus, four new species of nematodes and a new variation of the superfamilies Rhabditoidea, Tylenchoidea, and Aphelenchoidea are described. Because it is new for Germany Deladenus obesus Thorne is redescribed. In a comparison of Ditylenchus destructor from potatoes and Ditylenchus sp. from mushrooms, the existing morphological differences are demonstrated.

392. RASKI, D. J. Trophotylenchulus and Trophonema, two new genera of Tylenchulidae N. Fam. (Nematoda). Nematologica 2: 85-90. 1957.
The description of two new genera: Trophonema in the subfamily Sphaeronematinae, but differing from Sphaeronema primarily in the shape of the females; and Trophotylenchulus in the subfamily Tylenchulinae. The type species are Trophonema arenarium (Raski, 1956) n. comb. (synonym Sphaeronema arenarium Raski, 1956) and Trophotylenchulus floridensis n. sp.

393. SANWAL, K. C. The morphology of the nematode Radopholus gracilis (De Man, 1880) Hirschmann, 1955, parasitic in roots of wild rice, Zizania aquatica L. Can. J. Zool. 35: 76-92. 1957.
The anatomy of the nematode is described, the description being based chiefly on the study of living specimens and intravital staining with methylene blue and neutral red. The nematodes appear to be adapted to an

aquatic environment and seem to be unaffected by low temperatures and low oxygen content in their habitat.

394. TAYLOR, D. P. and W. R. JENKINS. Variation within the nematode genus Pratylenchus, with the descriptions of P. hexincisus, n. sp. and P. subpenetrans, n. sp. Nematologica 2: 159-174. 1957.

Pratylenchus hexincisus was recovered from the roots of corn. It possesses six incisures in the lateral field and one striation on the lip region. P. subpenetrans was recovered from the roots of pasture grasses. P. subpenetrans most closely resembles P. penetrans but can be separated mainly on its smaller size, longer post-uterine branch, and vestigial ovary tissue posterior to the vulva.

Nematodes -- Technique

395. DARLING, H. M., L. R. FAULKNER and P. WALLENDAL. Culturing the potato rot nematode. (Abstr.) Phytopathology 47: 7. 1957.

Large, pure populations of the potato rot nematode have been obtained in two ways. A modified White's nutrient agar medium was used to culture host tissue, upon which the nematode developed. Populations were also raised in cultures of 37 species of 15 genera of fungi. Individual cultures have been kept this way since 1954.

396. DROPKIN, VICTOR H. A method for determination of the infectivity of Heterodera rostochiensis larvae. Nematologica 2: 72-75. 1957.

A bioassay system for the measurement of the ability of nematode larvae to enter plant roots is likely to be useful in many ways. A simple procedure in which larval entry is complete within 48 hours is described. Exposures to single larvae yield results comparable to exposures to groups of 25 larvae. Infectivity declines as larvae are stored in water. No correlation between motility and infectivity of stored larvae was found.

397. ELLENBY, C. and A. B. GILBERT. Cardiotonic activity of the potato-root eelworm hatching factor. Nature 180: 1105-1106. 1957.

398. ESSER, R. P. An improved post Baermann funnel technique. Plant Dis. Reptr. 41: 269-270. 1957.

Water is drawn from the Baermann funnel into the centrifuge tube and allowed to sediment for 15 to 20 minutes. The tube is placed under a dissecting microscope, nematodes are drawn from bottom of the tube with a pipette and discharged onto a slide and examined directly, or a 22 x 40 cover slip is added and sealed. Excess water under the clover slip should be evaporated before sealing.

399. FORD, H. W. A source of controlled vacuum for pipetting nematodes. Plant Dis. Reptr. 41: 89-90. 1957.

The apparatus described applies a constant controllable suction while the tip of the pipette is under water.

400. JOHNSON, R. P. C. An improved cyst counting tray. Plant Path. 6: 75. 1957.

An improvement on the Fenwick counting tray, made out of 1/4-inch white Perspex.

401. KIRKPATRICK, J. D. and W. F. MAI. A new staining technique for in situ observation of Pratylenchus penetrans and other endoparasitic nematodes. (Abstr.) Phytopathology 47: 526. 1957.

A method has been developed whereby various stages of endoparasitic nematodes can be clearly differentiated from root and other host tissues. A procedure is outlined whereby the nematodes and eggs are seen to be deep blue to green in colorless tissue. The colors will fade, but can be reconstituted by immersion in the dye.

402. MILLER, PATRICK M. Cheap disposable filters for nematode surveys. Plant Dis. Reptr. 41: 192. 1957.

Filters are simply constructed of 5-ounce paper cups and Scottie paper facial tissues. The bottom is cut out of the cup leaving the rim for strength. The Scottie is made up into a filter pad, pressed over the bottom of the cup and fastened in place by a rubber band. This eliminates the cumbersome and time-consuming use of Baermann funnels.

403. MILLER, PATRICK M. A method for the quick separation of nematodes from soil samples. Plant Dis. Reptr. 41: 194. 1957.

A modification of the Caveness-Jensen centrifugal flotation method whereby the supernatant liquid is filtered through a 325-mesh screen instead of allowing the nematodes to settle.

404. MURPHY, P. W. and C. C. DONCASTER. A culture method for soil meiofauna and its application to the study of nematode predators. Nematologica 2: 202-214. 1957.

The difficulties and requirements of successful laboratory culturing of the meiofauna are discussed as well as some of the older culture methods. A new technique has been developed by the senior author. The second author has found it to be particularly useful for studying predators of some nematodes. The culture chamber consists of a sintered-glass micro-immersion filter with a sunk disk and a cover glass lid. It is attached by rubber tubing to a syringe. The system is filled with water and when the plunger is depressed, it is possible to irrigate the cell when necessary. There is a discussion of some predators of Heterodera.

405. NICHOLAS, W. L. A technique for obtaining axenic cultures of Rhabditid nematodes. J. of Helminth. 31: 135-144. 1957.

Two methods of setting up axenic cultures of species of Rhabditinae are described. Both methods depend upon the killing and superficial sterilization of gravid females with a chemical sterilizing agent and their transference to an innocuous medium containing antibiotics. The young worms which hatch from the eggs contained in the dead female worms are then collected aseptically. In one method merthiolate is used and in the other hydrogen peroxide.

406. STOLLER, B. B. An improved test for nematodes in the soil. Plant Dis. Reptr. 41: 531-532. 1957.

Essentially this is a modification of Miller's method of extracting nematodes from soil. The modification is the use of plastic tubes into which the nematodes descend and will remain alive for considerable time.

407. TARJAN, A. C. and H. W. FORD. A modified aceto-osmium staining method for demonstration of nematodes in citrus root tissues. Phytopathology (Abstr.) 47: 34. 1957. Stain Technology 32: 171-174. 1957.

A technique for observing nematodes in citrus feeder roots containing suberin is described. Citrus roots are immersed for 2 hours at 52° C in a solution of distilled water, 16 parts; 10% acetic acid, 10 parts; 2 percent aqueous osmium tetroxide, 2 parts. The blackened roots are washed, then bleached in 10 to 30 percent hydrogen peroxide at 32° C until the color lightens. After several washings in water, roots are dehydrated in ethanol in a graded series. Roots are then cleared in methyl salicylate at 52° C.

408. WEST, J. A. Recommended changes in recovery techniques for burrowing nematode. Plant Dis. Reptr. 41: 600-602. 1957.

It is recommended that the roots be submerged in water during the circulation period. This water incubation method offers many possibilities for increased recovery of burrowing nematodes from citrus roots. The incubation period can be reduced by several days.

NUTRITION

Nutrition -- Hosts

See also 166

409. FEZER, K. D. Factors that influence survival of red clover, with special reference to root rots. Diss. Abstr. 17: 939. 1957.

Fungi isolated from diseased red clover plants were, in decreasing order of frequency, Fusarium solani, F. oxysporum and Gliocladium sp. Their development is favoured by reduced plant vigour and short-day conditions. Disease is least severe when levels of both available potassium and available phosphorus are so low that the plant growth is limited, but is increased when only one of these elements is deficient. Methyl bromide fumigation imparts slightly longer life to plants.

410. TAPER, C. D. et al. Magnesium, calcium, and boron nutrition of the strawberry in relation to blackroot disease. Can. J. Pl. Sci. 37: 167-173. 1957.

All plants growing in a culture solution containing 0.5 ppm of boron developed both a foliar symptom characteristic of boron toxicity and certain symptoms characteristic of strawberry blackroot disease. The fact that typical foliar symptoms of boron toxicity were in all cases accompanied by certain characteristics of blackroot disease, namely, necrosis of crown and roots, seems to suggest that the latter, in this instance, were also symptomatic of boron toxicity.

Nutrition -- Organisms

See 32, 73, 84, 120, 121, 124, 131, 133, 136

SOIL FUNGICIDES

See also 11, 12

411. ABEYGUNAWARDENA, D. V. W. and R. K. S. WOOD. Effects of certain fungicides on Sclerotium rolfsii in the soil. Phytopathology 47: 607-609. 1957.

Excellent control was obtained when sodium dehydroacetate or captan, alone or with formalin, was used as a drench, but growth of seedlings following treatment with captan was considerably retarded. Chloropicrin as a fumigant was as good as these soil drenches. The materials were also tested as dry dusts mixed with infested soil.

412. BROOK, M. and C. G. C. CHESTERS. The growth of Botrytis cinerea Pers., Fusarium caeruleum (Lib.) Sacc. and Phoma foveata Foister in the presence of tetrachloronitrobenzene isomers. Ann. Appl. Biol. 45: 498-505. 1957.

The linear growth of all three fungi used in culture was reduced in the presence of vapour from any of the 3 isomers of TCNB. The isomers were fungistatic but not fungicidal.

413. COCKERILL, J. Experiments in the control of damping-off at the nursery, Orono, Ontario. Forest. Chron. 33: 201-204. 1957.

Soil acidification treatments using ferrous sulfate and sawdust mulch were proved to be ineffective in controlling damping-off. Soil fumigation using methyl bromide reduced pre-emergence losses but failed to provide adequate protection during a period of severe infection.

414. CRAM, W. H. and O. VAARTAJA. Rate and timing of fungicidal soil treatments. Phytopathology 47: 169-173. 1957.

Four rates of weekly drenches of Orthocide 75 (75 percent captan) and Tersan (75 percent thiram) and various timing schedules of Tersan applications were tested. Damping-off caused mainly by the inoculum fungus and partly by the natural Pythium flora in soil was largely controlled by the weekly application of 0.1 gm per square foot of either fungicide. For certain trees the optimum rate was 0.5 gm rather than 0.1 gm.

415. GARRETT, S. D. Effect of a soil microflora selected by carbon disulphide fumigation on survival of Armillaria mellea in woody host tissues. Can. J. Microbiol. 3: 135-149. 1957.

The author concluded that carbon disulfide directly damaged at least the peripheral mycelium of Armillaria mellea in the woody host tissues, and so facilitated invasion by Trichoderma viride and/or other fungi, thus, in the main, supporting Bliss's hypothesis to the effect that A. mellea is killed not by direct fungicidal action but through the agency of T. viride, which is relatively tolerant of the fumigant.

416. GOVINDARAO, P. and J. SUBBAIAH. Field testing of fungicides. Ind. Phytopathology 10: 50-54. 1957. (Tobacco Abstr. 2: 444. 1958)

Seven fungicides were tested for their efficacy in controlling the post-emergence damping-off disease caused by Pythium aphanidermatum. All of the fungicides except M.S. Bayer proved superior to the controls in three out of four experiments. None of the fungicides tested was found to be phytotoxic to the seedlings of chili and tobacco.

417. McCALLAN, S. E. A. and L. P. MILLER. Effect of fungicides on oxygen consumption and viability of mycelial pellets. Contr. Boyce Thompson Inst. 18: 483-495. 1957. (Rev. Appl. Mycol. 36: 708. 1957.)

Mycelial pellets of Alternaria oleracea, Aspergillus niger, Monilinia fructicola, and Myrothecium verrucaria obtained from shaken cultures were treated with various fungicides and the effect on oxygen consumption and viability observed. The uptake of fungicides and their effect on viability were also determined.

418. MALMUS, N. Zur Frage der Verhütung der Auswinterung durch Kleekrebs. (On the question of the prevention of winter injury by clover rot.) Pflanzenschutz 9: 107-109. 1957. (Rev. Appl. Mycol. 37: 99. 1958.)

Tests were made of various soil treatments for the control of Sclerotinia trifoliorum. Best results were obtained with the use of brassicol super at 35 kg./ha., a yield increase of 80 percent being obtained.

419. MEULI, L. J. Treatment of fungus-infected soil with haloketones. U.S. Pat. 2,802,768 (to Dow Chemical Co., August 13, 1957.) (Chem. Abstr. 52: 1958.)

Fungicides such as 1-chloro-2-butanone at the rate of 5 to 50 parts, by weight, per million parts soil were found to be effective against Fusarium solani, Pythium spp., and Rhizoctonia solani. Similarly, 1-bromo-2-butanone, 1-bromo-4-methyl-2-pentanone, and 1 chloro-4-methyl-2-pentanone were effective in promoting seedling emergence.

420. MILLER, LAWRENCE P. and S. E. A. McCALLAN. Toxic action of metal ions to fungus spores. Agricultural and Food Chemistry 5: 116-122. 1957.

Silver is taken up rapidly by fungus spores, so that germination can be completely inhibited after a contact time of 1 minute or less. Only mercury, and to a lesser extent copper, offer serious competition. Silver has a marked effect on the permeability of spores. Copper, zinc, and cadmium reduce germination appreciably only after some hours of contact with the spores. Materials move inward and outward more readily with spores than was supposed.

421. MILLER, P. M. and E. M. STODDARD. Importance of fungicide volatility in controlling soil fungi. (Abstr.) Phytopathology 47: 24. 1957.

Ceresan M (7.7 percent N-(ethylmercuri)-p-toluenesulfoanilide) and o-nitrochlorobenzene were highly effective in a volatile state against all fungi used. PCNB was moderately effective against Botrytis cinerea and Rhizoctonia solani but not against Fusarium or Thielavia basicola.

422. PALM, E. T. and ROY A. YOUNG. The compatibility of certain organic fungicides and

antibiotics in treatment mixtures as indicated by stability and phytotoxicity. Plant Dis. Reptr. 41: 151-155. 1957.

The fungicidal activity of various chemicals tested was not reduced significantly after aqueous mixtures of the fungicides and antibiotics had aged for 1 week. After the same interval both the fungicidal and bactericidal activities of maneb were significantly reduced. Terramycin was found to possess sufficient bactericidal potentiality to suggest further testing for control of bacterial ring rot of potatoes.

423. STRECKER, B. Untersuchungen über die Einwirkung von organischen Fungiziden auf Bodenpilze. (Studies on the action of organic fungicides on soil fungi.) Z. PfKrankh. 64: 9-35. 1957. (Rev. Appl. Mycol. 36: 273-274. 1957.)

The effect of five dithiocarbamates, four nitrobenzate derivatives, malachite green, and Ceresan, on 11 species of parasitic and saprophytic soil fungi was investigated. Most of the tests were made with poisoned nutrient substrates. The effect of the fungicides appeared to be dependent on the structure of the substances and on the physiological condition of the fungi used.

Soil Fungicides -- Cereals

424. ATKINS, J. G., E. M. CRALLEY and S. J. P. CHILTON. Uniform rice seed treatment tests in Arkansas, Louisiana and Texas, 1955-56. Plant Dis. Reptr. 41: 105-108. 1957.

Considerable variation in relative performance of the various fungicides was encountered in the tests. Certain of the non-mercurials such as Arasan SFX, Delsan AD, and Phygon XL, gave consistent stand increases.

425. EVATT, N. S. and J. G. ATKINS. Chemical control of straighthead in rice. Plant Dis. Reptr. 41: 103-104. 1957.

Straighthead of rice was significantly reduced by the application of Feralum at 1000-2000 pounds per acre.

426. HANSING, E. D. Effect of seed treatment with fungicides and with combinations of fungicides and insecticides on emergence and control of covered kernel smut of sorghum in 1956. (Abstr.) Phytopathology 47: 523. 1957.

Average emergence of non-treated seed was 46 percent. Materials used were Panogen 15, Ceresan M, Arasan SFX, Panoram 75, Captan 75, etc. Complete control of smut was obtained with above seed treatments. Higher emergence was obtained with combinations of fungicides and insecticides than with their fungicide counterparts alone.

427. JACQUET, P., CURT LEBEN and D. C. ARNY. Organic acids and the control of two seedling blights by the water-soak methods. Phytopathology 47: 377-378. 1957.

Ceresan M was effective against blights of oats infected with *Helminthosporium victoriae* and blights of barley seed infected with *H. sativum* when applied at the rate of 0.5 ounces per bushel. The effect of a synthetic mixture of organic acids was dependent on concentration, pH, length of soaking period, and temperature. For oats and barley several combinations were effective.

428. MILLER, PAUL (compiler). Uniform rice seed treatment tests in the southern rice-growing states, 1955-56. Agr. Chem. 12: 57-58, 113, 114-115. 1957.

In general, each of the fungicides tested increased emergence. Certain materials, however, gave higher stand increases more consistently than others. The materials recommended for seed treatment of rice include Arasan, Phygon XL, Ceresan M, Yellow Cuprocide, Spergon SL, and Dow 9B.

429. PURDY, LAURENCE. Differential response of dwarf bunt to seed and soil surface treatment with hexachlorobenzene. Plant Dis. Reptr. 41: 916-918. 1957.

In the Pacific Northwest the soil-surface application of hexachlorobenzene in localized areas of heavy infestation will effectively control dwarf bunt (Tilletia contraversa) of winter wheat.

430. PURDY, LAURENCE H. The mode of action of hexachlorobenzene as a seed treatment to protect against soil-borne fungi that cause common bunt of wheat. (Abstr.) Phytopathology 47: 28. 1957.
When treated seed is planted in infested soil, the HCB vapor produces a zone around the germinating seed that is free of the smut fungi (Tilletia spp.). With growth, the seedling passes through the zone containing vaporized HCB into the unprotected zone and there becomes infected.

Soil Fungicides -- Cotton

431. BIRD, L. S., C. D. RANNEY and G. M. WATKINS. Evaluation of fungicides mixed with the covering soil at planting as a control measure for the cotton seedling-disease complex. Plant Dis. Reptr. 41: 165-173. 1957.
No single fungicide or mixture of fungicides gave good results in all locations and all soil types. The better treatments reduced attack by Rhizoctonia solani and Pythium spp. but not Fusarium spp. The results suggest that the fungicide treatments conditioned the soil microflora so as to encourage a more rapid development of Fusarium spp.

432. ERWIN, D. C., W. P. SAPPENFIELD and ROBERT KORSTEN. Effect of some fungicides on seedling diseases of cotton in the irrigated desert valleys of southern California. Plant Dis. Reptr. 41: 324-329. 1957.
Row treatments with various fungicidal chemicals induced a higher percentage of emergence and survival of plants than no treatment but the results due to treatments did not differ statistically from each other. It was concluded that differences due to fungicides in some field tests were obscured because of variation which could be attributed to environmental factors.

433. SINCLAIR, J. B. Laboratory and greenhouse screening of various fungicides for control of Rhizoctonia damping-off of cotton seedlings. Plant Dis. Reptr. 41: 1045-1050. 1957.
Seventeen fungicides, alone or in combination, were screened in the laboratory and greenhouse to test their ability to control Rhizoctonia solani on cotton seedlings. Those fungicides used alone showing the most promise were the Omadine derivatives (2-pyridinethione 1-oxide; the zinc, manganese, and disulfide derivatives), PCNB, captan, and nabam. The combined fungicide treatments showing the most promise were: captan in combination with either PCNB or the zinc salt of Omadine; nabam in combination with Mylone or zinc sulfate, and PCNB in combination with Mylone.

434. WHITEHEAD, MARVIN D. and NORMAN E. BROWN. In-the-furrow application of fungicides for the control of cotton seedling disease -- damping-off and nub-root. Plant Dis. Reptr. 41: 419-423. 1957.
The fungicide treatments captan, nabam, PCNB plus nabam, and nabam plus zinc sulfate gave higher plant populations that produced yields more than two-fold that of the untreated plots.

Soil Fungicides -- Evaluation

435. DARBY, J. F. In Annual Report of the Agricultural Experiment Stations, Florida for the year ending June 30, 1956, pp. 148-155. (Rev. Appl. Mycol. 36: 809. 1957.)
In seed-bed tests against unspecified damping-off and root rots, an allyl alcohol-DD-formaldehyde formula at 40-40-150 was better than the 25-40-100 formula, and 4 1/2 gallons per acre of 83 percent emulsifiable EDB was satisfactorily substituted for DD. In addition UF Concentrate-85 containing 25 percent urea and 60 percent formaldehyde was as effective as 37 percent formaldehyde in equal amounts. Mixtures of allyl alcohol

(40 gallons per acre) and Vapam (50 and 75 gallons per acre) gave outstanding control.

436. DREXEL, R. E. Stabilized dithiocarbamate fungicidal compositions. U.S. Patent 2,797,181 (to E. F. duPont de Nemours. June 25, 1957). (Chem. Abstr. 51: 13306. 1957.)
A 3 percent solution of Na methyldithiocarbamate containing Na OAC as stabilizer sprayed onto plowed fields several days before planting tobacco was effective in controlling damping-off organisms and Phytophthora infestans.

437. FAWCETT, C. H., D. M. SPENCER and R. L. WAIN. Investigation on fungicides. II. Aryloxy- and arylthio-alkanecarboxylic acids and their activity as fungicides and systemic fungicides. Ann. Appl. Biol. 45: 158-176. 1957. (Rev. Appl. Mycol. 36: 709. 1957.)
In general, the arylthio-derivatives were more fungicidal than their aryloxy-analogues in plate tests for fungistatic effect on six fungi and as systemic fungicides against Botrytis fabae on broad beans and Alternaria solani on tomatoes. Most of the compounds were unsatisfactory both as external and as systemic fungicides.

438. FORSBERG, J. L. The fungicidal effect of some halogenated dinitrobenzenes on Curvularia lunata and Fusarium oxysporum f. gladioli. (Abstr.) Phytopathology 47: 12. 1957.
Curvularia was much more resistant to the chemicals than was Fusarium. Against both fungi the fluorine-containing compounds were much more fungicidal than were the other compounds.

439. HARTZFELD, EARL G. Terraclor, a new soil fungicide. Agr. Chem. 12: 30-33. 1957.
Terraclor, the active ingredient of which is pentachloronitrobenzene, is recommended for control of a number of soil-borne diseases including those of strawberries, mushrooms, tomatoes, beans, and ornamentals. Its vapor pressures are negligible thus accounting for the good residual action. Terraclor is compatible with insecticides and fungicides with pH of 7 or below.

440. HOWARD, F. L. and BARBARA C. CORMIER. Halogen-aceto compounds as fungicides. (Abstr.) Phytopathology 47: 525. 1957.
Twenty-five nonmetallic fungicides of potential value in plant pathology were disclosed in a study of 35 compounds. The influence of molecular structure on fungitoxicity was evident.

441. MAHAPATRA, G. N. Synthesis of isomeric bromothiazolylamines and the use of their mercurated derivatives as fungicides and bactericides. J. Am. Chem. Soc. 79: 988-990. 1957. (Rev. Appl. Mycol. 36: 656. 1957.)
In this report of assays of synthesized and mercurated bromothiazolylamines for their activity against Piricularia oryzae, the phenylthiazolylamines containing bromine in the thiazole nucleus are stated to be the most potent, inhibiting sporulation completely at a concentration of 30 ppm. All the tri- and a few dibromo derivatives with a bromine atom in the thiazole nucleus showed slightly enhanced toxicity to the fungus. All the mercurated compounds exerted a powerful fungicidal effect.

442. SOIL FUMIGATION WITH VAPAM. Agr. Chem. 12: 47, 119. 1957.
A general description of the methods of application and extent of use of Vapam to date. At present it is useful for application to ornamental, vegetable seed-bed, turf, and nursery soils. Application methods include feeding into irrigation systems, shallow injection techniques, row placement, and broadcasting by means of a sprinkler system.

443. TORGESON, D. C., D. M. YODER and J. B. JOHNSON. Biological activity of Mylone breakdown products. (Abstr.) Phytopathology 47: 536. 1957.

It was believed that the hydrolysis products or a combination of them were responsible for the fungicidal, nematocidal and herbicidal properties of the compound. Among the materials identified were methylisothiocyanate, formaldehyde, hydrogen sulfide, and monomethylamine. None of these materials alone was sufficiently fungicidal to inhibit Pythium sp. in soil.

444. VASIL'EVSKY, A. P. and I. V. KLIMOVICH. Use of the preparation NIUIF-2 (granosan) in horticulture. Bull. Bot. Gdn. Moscow 1957, 27: 89-94. 1957. (Rev. Appl. Mycol. 36: 539. 1957.)

Experiments at the Central Botanical Garden of the U. S. S. R. Academy of Sciences showed that granosan can be used effectively in horticulture. Wet seed treatment is carried out by submerging seed in a 1:1000 suspension for 1 to 2 minutes, while for dry treatment 2 to 4 gm granosan are required per kg seed. Gladiolus corms are submerged in a 1 to 50 suspension for 30 minutes, left to dry for 2 hours, and then planted. Methods are also described for disinfecting heaps of humus soil.

445. ZENTMYER, G. A. and J. L. ERSPAMER. Vapam as a soil fumigant and as a chemotherapeutant. (Abstr.) Phytopathology 47: 38-39. 1957.

With dosages of 200-250 ppm Vapam at 3 to 4 gallons per square foot, kill of Phytophthora cinnamomi was obtained to the depth of sampling (24 inches), with no recovery of the fungus 9 months to 1 year after treatment in some cases. Tree injury was appreciable even at lower dosages in some cases, particularly on weak trees, and was severe when temperatures were high at the time of or following treatment.

Soil Fungicides -- Forage Crops

446. ATHOW, KIRK L. The effect of seed treatment on seedling stand and forage yield of alfalfa and red clover. Phytopathology 47: 504-506. 1957.

No statistically significant differences in yield were found between treated (Arasan or Vancide 51) and untreated alfalfa and red clover seed planted in each of 4 years in plots at seeding rates of 2 to 12 pounds per acre. The seedling stand of approximately 14 percent of the alfalfa lots and 5 percent of the red clover lots were significantly increased by seed treatment.

447. HASKETT, W. C., E. D. HANSING and E. L. SORENSEN. Chemical control of damping-off in alfalfa cuttings. (Abstr.) Phytopathology 47: 15. 1957.

The most satisfactory control was obtained by Captan 50W and by stem sterilization. Treatment with Captan 50W resulted in healthy plants, no toxic effects, and a slight adverse effect on nodulation. Vancide 51 and Dithane D14 effectively controlled damping-off but induced chlorosis, suppressed normal root development, and prevented nodulation.

448. JOHNSON, HOWARD W. Effect of seed and soil treatments on alfalfa hay yields. (Abstr.) Phytopathology 47: 18. 1957.

Neither seed nor soil treatments with fungicides proved beneficial in alfalfa culture at this location.

Soil Fungicides -- Fruit

449. JEFFERS, WALTER F. Soil treatments for control of the red stele disease of strawberries. Plant Dis. Reptr. 41: 415-418. 1957.

Under field conditions none of the chemicals used resulted in complete eradication of the red stele fungus but methyl bromide and chloropicrin at relatively low rates gave a high degree of control.

450. WAGNON, H. KEITH and J. A. TRAYLOR. Results of some soil treatments for elimination of peach yellow bud mosaic virus from soil. (Abstr.) Phytopathology 47:

537. 1957.

Soil from the root zone of YBM-affected peach trees at different depths was treated with the chemicals Nemagon, carbon bisulfide, Vapam, methyl bromide, and DD, and with steam. YBM showed in 25 of 57 seedlings that grew in untreated lower soil. No YBM showed in the 425 seedlings that grew in the treated soil or in the 38 seedlings that grew in the untreated upper soil.

451. WILHELM, STEPHEN. Chloropicrin gives promising control of Verticillium wilt in strawberry. (Abstr.) Phytopathology 47: 37. 1957.

Chloropicrin was outstanding in fungicidal properties against Verticillium at 3 ml per square foot injected 6 inches deep into soil with moisture content optimal for planting.

Soil Fungicides -- Laboratory Tests

452. KENDRICK, J. B. Jr. and G. A. ZENTMYER. Laboratory evaluation of chemicals as potential soil fungicides. (Abstr.) Phytopathology 47: 20. 1957.

Of approximately 800 compounds tested in the past 2 years, very few that showed activity in agar tests were also effective in soil. Nitrosomethyl carbamate, nitrile, and thiocyanate derivatives showed promise as soil fungicides. PCNB was specifically effective at 10 ppm as a fungistat against Rhizoctonia, Sclerotinia, and Sclerotium; sodium N-methyldithiocarbamate (Vapam) was generally effective at 10 ppm as a fungicide. Captan, thiram, chloranil, dichlone, and metallic salts of dithiocarbamates were not highly active as soil fungicides.

453. ZANARDI, D. Prove di laboratorio sull' efficacia antifungina di alcuni anticrittogamici. (Laboratory tests of the antifungal efficacy of certain fungicides.) Notiz. Malatt. Piante 39: 67-71. 1957. (Rev. Appl. Mycol. 36: 707. 1957)

Soil in which plants had been attacked by various fungi, Sclerotium cepivorum, Fusarium spp., and Peronospora parasitica, was placed in Petri dishes and treated with various non-copper-containing fungicides. The best results were given by amicina (quinosol 20 percent) which completely controlled fungi and bacteria, followed by Vapam, completely fungicidal but only partly bactericidal, nabam, zineb and PCNB in that order, the last named not being particularly active against fungi or bacteria.

Soil Fungicides -- Ornamentals

454. ALEXANDER, PAUL M. Etiology and control of poinsettia root and stem rot. Phytopathology (Abstr.) 47: 1. 1957.

Rhizoctonia solani and a Pythium sp. were the only organisms found to be pathogenic. Captan, Terraclor and zineb were effective as sand drenches but ineffective as soil drenches. Semesan and Pano-Drench 4 were equally effective as sand or soil drenches. Ferbam as a sand drench discolored the roots and was ineffective when used as a soil drench.

455. AYCOCK, ROBERT. Soil treatments reduce decay of Dutch iris bulbs. Research & Farming, North Carolina Agr. Expt. Sta. 16: 9. 1957.

Terraclor 75 percent wettable powder (75 percent pentachloronitrobenzene) applied broadcast, in a band in the centre of the row and as a surface drench; and Captan 50 percent applied broadcast proved effective. Row treatments using Terraclor were particularly promising.

456. MAGIE, R. O. Annual Report of the Agricultural Experiment Stations, Florida, for the year ending June 30, 1956. 1957. (Rev. Appl. Mycol. 36: 811. 1957.)

When Vapam, Crag Mylone and Terraclor were mixed in the row by rototiller at 100, 150, and 200 pounds per acre in a field heavily infested with Stromatinia disease of gladiolus (Sclerotinia gladioli), Crag Mylone was most effective in controlling root rot and gave the highest quality flowers. Terraclor and Crag Mylone produced the heaviest corms. Flooding of the soil for 2 months in summer was almost as effective as chemical treatment combined with flooding for 2 weeks, and treatment with Vapam plus Terraclor or Crag Mylone plus Terraclor at 100 pounds active ingredient per acre mixed well with moist soil 2 weeks before planting was as effective as flooding. In controlling Fusarium wilt (Fusarium oxysporum f. gladioli) Crag Mylone at 100 and 200 pounds per acre was significantly better than Vapam at the same concentration.

457. SCHOLTEN, G. Wortelrot bij Cyclamen. (Root rot of cyclamen.) Tijdschr. PlZiekt. 63: 30. 1957. (Rev. Appl. Mycol. 36: 587, 1957.)
In comparative inoculation experiments with Cylindrocarpon radicicola and Thielaviopsis basicola only the former caused collapse of the plants. The incidence of C. radicicola was reduced during two seasons by immersion of the root clumps in solutions of captan or thiram.

458. STODDARD, E. M. A Fusarium rot of geraniums and its control. Plant Dis. Reptr. 41: 536. 1957.
Control of both the Fusarium and the bacterial black leg was obtained by using soil drenches containing a mixture of 250 ppm oxyquinoline sulfate and 200 ppm streptomycin.

Soil Fungicides -- Special Crops

459. KAR, K. and D. D. SRIVASTAVA. Fungicidal treatment of sugarcane setts. Indian Sugar 7: 333-334. 1957. (Rev. Appl. Mycol. 37: 111. 1958.)
In experiments at different locations several fungicides proved ineffective against red rot (Glomerella tucumanensis). In an exploratory trial the incidence of smut (Ustilago scitaminea) was reduced from 6.2 to 0.9 and 1.1 percent by 7-minute suspension of the setts in 0.25 percent perenox or 1 percent agrosan, respectively, before planting in furrows contaminated with spore powder from freshly collected "whips".

Soil Fungicides -- Technique

460. GARBER, R. H. and L. D. LEACH. The use of chemical indicators in the study of distribution of row-treatment fungicides. (Abstr.) Phytopathology 47: 521. 1957.
The authors used radioactive rubidium 86, an oil-soluble safranin dye, and a fluorescent dye. Radio-autographs made from soil profiles taken from the rubidium-sprayed rows indicated where the material was located.

461. KUHFUSS, K. H. Beitrag zur Methodik der Fungizidprufung von Nass- und Trockenbeizmitteln. (Contributions to the technique of the fungicidal assay of liquid and dry preparations.) Phytopath. Z. 28: 281-284. 1957. (Rev. Appl. Mycol. 36: 482. 1957.)
The author developed a method for the assay of fungicides based on a combination of Forsberg's and Jake's (Chron. Bot. 4: 515. 1938) in which cotton threads are used as carriers of the chemicals and nutrient agar for the fungus, using Phoma lini and Botrytis cinerea on malt agar plates at 26° C. The zones of inhibition produced by 0.3 percent germisan solution and germisan dust were visible after 3 days' incubation, the former giving a much wider zone.

462. THOMAS, W. D. Jr. A soil-column apparatus for the study of soil fungicides. (Abstr.) Phytopathology 47: 535. 1957.
The apparatus consists of a glass tube to one end of which are attached three glass hooks. Soil is added to the tube to any desired depth. Small filter-paper discs impregnated with a spore-mycelial suspension of the test fungus may be placed at any position in the soil column. Fungicides may be mixed with the soil and leached into the cup with water. Paper discs may

then be transferred to agar.

Soil Fungicides -- Tobacco
See also 230

463. LAUTZ, W. Treatment of black root rot infested soil with Vapam, chlorobromopropene, and allyl bromide. Plant Dis. Reptr. 41: 174-176. 1957.

The black root rot disease (Thielaviopsis basicola) was controlled effectively by allyl bromide, Vapam, and chlorobromopropene, and eliminated by allyl bromide and Vapam at two stronger concentrations.

464. MILLER, P. (compiler). Control of Fusarium wilt and root-knot nematode of tobacco. Agr. Chem. 12: 52-55. 1957.

Of the treatments, ethylene dibromide at 5 gallons per acre in fields 1, 2 and 3, and 2.5 gallons split treatment in field 3, gave best results, followed by DD and control. In field 1, where wilt was light, the increase in weight was due to control of root knot (Meloidogyne sp.), whereas in field 2 the weight increase was due to control of the root knot-Fusarium wilt complex.

465. MORGAN, O. D. The control of black shank of tobacco with various soil drenches and their effect on the tobacco plant. (Abstr.) Phytopathology 47: 452. 1957.

Fifty chemicals were screened in the laboratory and greenhouse against Phytophthora parasitica var. nicotianae over a period of four years. Field trials were inconclusive but in greenhouse trials certain chemicals proved to be consistently effective.

466. ORTIZ, G. and L. E. VALDERRAMA. Efectos del producto Vapam 4S(metil-ditiocarbamato de sodio anhidro) en el control de la enfermedad de la "Dormidera" del tabaco. (Effect of the product Vapam 4S in the control of the tobacco disease "Dormidera".) Agr. Trop. 13: 479-482. 1957. Spanish. (Tobacco Abstr. 1: 492. 1957.)

Tobacco plants treated with a solution of 1 liter Vapam to 10 liters water had a mortality of 17.8 percent; with a solution of 1:3 a mortality of 55.5 percent and control plants a mortality of 83.3 percent when infected with Granville wilt (Pseudomonas solanacearum).

Soil Fungicides -- Turf

467. COUCH, H. B. and HERBERT COLE Jr. Chemical control of melting out of Kentucky bluegrass. Plant Dis. Reptr. 41: 205-208. 1957. (Abstr.) Phytopathology 47: 6. 1957.

Acti-dione, Kromad, Omadine, captan, and Terramycin all gave significant reductions in intensity of the leafspot phase of the disease. Acti-dione caused a temporary retardation in growth.

Soil Fungicides -- Trees

468. VOLGER, CHRISTIANE. Über Bekämpfungsmöglichkeiten pilzparasitärer Keimlingskrankheiten unserer Nadelbäume. (On the possibilities of combating seedling diseases of our conifers caused by parasitic fungi.) Allg. Forstz. 12: 114-116. 1957. (Rev. Appl. Mycol. 36: 797. 1957.)

The most helpful line of approach to the problem is considered to be prophylactic, consisting of simple measures to protect the seedlings from any delay in growth and from physiological weakening. In the tests with chemical disinfectants the most effective seed dressing was tripomol, a Dutch preparation based on thiram, and the fungicidal action of which persisted for 11 weeks. Zineb proved useful as a spray but was ineffectual as a seed protectant. Dusting with brassicol gave good results in a seedbed experiment on Douglas fir.

Soil Fungicides -- Vegetables
See also 55, 237

469. ANDREN, F. Bekämpningsförsök mot klumprotsjuka. (An experiment in the control of club root disease.) Växtskyddsnotiser, Stockholm, 21 (2): 34-35. 1957. (Rev. Appl. Mycol. 36: 802. 1957.)

Excellent control of club root (Plasmodiophora brassicae) on Brussels sprouts is reported from Farentuna, Sweden, where 25 kg brassisan was strewn over an area of about 400 square meters and worked into the soil before planting.

470. BRAUER, H. O. and R. W. RICHARDSON. El chile. Indicaciones generales para su cultivo. (Chilli. General directions for its cultivation.) Foll. Divulg. Secret. Agric. Mex. 23: 26 pp. 1957. (Rev. Appl. Mycol. 36: 745. 1957.)

On pages 17-24 of this publication reference is made to the principal nursery diseases of chilli in Mexico, which are damping-off (Pythium spp.) and root rot (Rhizoctonia spp.). Pythium is controlled by Arasan 50 percent or Semesan 30 percent, each at 12.5 gm per 10 liters water; Rhizoctonia spp. by yellow copper oxide or zerlate at 18 and 24 gm, respectively.

471. BREMER, H. Zur Behandlung von Bohnensaatgut mit kombinierten Beizmitteln. (On the treatment of bean seed with combined dressings.) Anz. Schadlingsk, 30: 84-85. 1957. (Rev. Appl. Mycol. 37: 128. 1958.)

Of the various fungicide-insecticide combinations tested for the seed treatment of beans (Phaseolus vulgaris), captan and COBH, each with dieldrin, gave the best growth, and organic mercury with lindane the poorest. Certain insecticides had an effect even in the absence of insect attack, apparently due to action on micro-organisms, the poor results with lindane and the increase of infection by Rhizoctonia crocorum associated with the use of aldrin probably being explainable in this way. COBH with mercury gave good control of Colletotrichum lindemuthianum, 86 healthy seedlings developing from 100 infected seeds as compared with only 29, all infected, in the untreated.

472. BROOK, M. Tetrachloronitrobenzene as a fungicide. Trans. Brit. Mycol. Soc. 40: 164-165. 1957. (Rev. Appl. Mycol. 36: 603. 1957.)

When used to control dry rot of potatoes (Fusarium caeruleum) tecnazene may retard sprouting.

473. CAMPBELL, LEO. Control of club root of cauliflower. (Abstr.) Phytopathology 47: 518. 1957.

Zineb reduced club root (Plasmodiophora brassicae) development 90.3 percent and increased yield of tops 360 percent. Terraclor (75 percent PCNB) reduced club root development 91.1 percent and increased yield 257 percent. Fungicides were (1) added to transplanting water, (2) mixed into soil in strips. Best results were obtained with method (2).

474. COX, R. S. Control of diseases in the celery seedbed. Proc. Fla. Hort. Soc. 69 (1956): 242-244. 1957. (Rev. Appl. Mycol. 36: 631. 1957.)

Methyl bromide and chloropicrin were outstanding as soil fumigants in control of common root diseases in celery seedbeds in Florida, caused by Fusarium sp., Pythium sp. and Rhizoctonia (Corticium) solani.

475. DAVISON, ARLEN D. and JOHN R. VAUGHN. Effect of several antibiotics and other organic chemicals on isolates of fungi which cause bean root rot. Plant Dis. Reptr. 41: 432-435. 1957.

Reports results of screening tests with various established and experimental organic chemicals, including antibiotics, against isolates of bean root rot fungi.

476. DRANSFIELD, M. The effects of tetrachloronitrobenzene on the soil microflora. Trans. Brit. Mycol. Soc. 40: 165. 1957. (Rev. Appl. Mycol. 603. 1957.)

Five percent tetrachloronitrobenzene used at 1/2 ounce per square yard against Botrytis cinerea on lettuce, had no effect on the microflora of the soil. At ten times this rate the number of species of fungi was reduced and the number of bacteria was markedly increased. The fungicide decreased the resistance of lettuce to damping-off by Pythium.

477. FOLSOM, D. Verticillium wilt of potato in relation to fungicides added to the fertilizer. Am. Potato J. 34: 1-5. 1957. (Rev. Appl. Mycol. 36: 613. 1957.)

Eight fungicides were tested as fertilizer admixtures for the control of Verticillium albo-atrum on Kennebec potatoes. Field results were not promising for any of the preparations tested. Only HD-160 reduced wilt but it also caused stunting.

478. FREEMAN, T. E. and E. C. TIMS. Fungicidal drenches for pink root control in shallots. Phytopathology 47: 12. 1957.

By means of Forsberg's string method 44 fungicides were tested in the laboratory for their ability to kill the pink root fungus (Pyrenochaeta terrestris) in culture. Seven fungicides were effective at rates that would be practical to use on a field basis. All fungicides except maneb were organic mercury compounds.

479. HAGEDORN, D. J. Field and laboratory tests of seed protectants for canning peas. Phytopathology 47: 70-72. 1957.

Towel and cold chamber tests appeared to be more precise than the tank tests. KF467 and the various Phygon preparations were generally the most effective from 1949 through 1952. Orthocide was superior in 1953.

480. HOUGHLAND, G. V. C. and LILLIAN C. CASH. Carry-over effects of PCNB applied to the soil for control of potato scab. Am. Potato J. 34: 85-88. 1957. (Rev. Appl. Mycol. 36: 662. 1957.)

Experiments at Beltsville confirmed the effectiveness of PCNB as a soil fungicide for control of potato scab (Streptomyces scabies). Effects were greatest in the first season after application, infection increasing by 3 to 5 times during the following season when no further applications were made. Not more than 150 pounds per acre should be applied in the row.

481. KENDRICK, J. B. Jr., A. O. PAULUS and J. DAVIDSON. Control of Rhizoctonia stem canker of lima bean. (Abstr.) Phytopathology 47: 19-20. 1957.

The disease was controlled in the field by seed furrow spray and dust applications of a mixture of PCNB and captan. Treated plots 4 weeks from seeding and treating had an average reduction of 71.5 percent in number of infected plants, an 82.4 percent reduction in infection severity, and almost complete control of post-emergence damping-off, with no evidence of phytotoxicity in treated plots.

482. LEACH, L. D. and W. S. SEYMAN. Localized fungicide placement for control of garlic white rot. (Abstr.) Phytopathology 47: 527. 1957.

Fungicides were applied as wettable powders or solutions sprayed into the furrow containing the garlic cloves, at 10 pounds actual fungicide per acre. PCNB gave good protection.

483. PLAKIDAS, A. G. Vapam ineffective against Fusarium wilt of tomato. Plant Dis. Reptr. 41: 778-779. 1957.

Vapam at a concentration of 1 quart per 3 gallons of water was applied with a sprinkling can at the rate of 1 quart per 64 square feet. Although apparently complete control of nematodes was obtained from the treatment no control of fusarial wilt of tomato was obtained.

484. RICH, SAUL. Griseofulvin, lithium salts, and zinc glass frit for control of cabbage club root. Plant Dis. Reptr. 41: 1033-1035. 1957.

Griseofulvin was found to be effective in controlling club root (Plasmodiophora brassicae) when used as a soil treatment. Zinc glass frit reduced the amount of disease but lithium salts were ineffective when applied as soil treatments. No correlation was found between severity of clubbing and height of plant.

485. ROSSER, W. R. Control of club root of Brassicae. Plant Path. 6: 42-44. 1957.

A trial on the control of club root (Plasmodiophora brassicae Wor.) by the use of griseofulvin, etc. Griseofulvin and cadmium chloride both gave a poor control of the disease. The weight of green matter resulting from the use of either compound was significantly lower than that obtained by the use of mercuric chloride.

486. SCHMIDT, TRUDE. Unter welchen Krankheiten leiden unsere Salatkulturen und wie bekämpfen wir die Erreger? (From what diseases do our cultivated lettuces suffer and how do we control the causal organism?) Pflanzenarzt 10: 62-63. 1957. (Rev. Appl. Mycol. 36: 746. 1957.)

Rot of lettuce caused by Sclerotinia sp. is controlled in Austria by brassicol at 30 to 40 gm per square meter.

487. WENZL, H. and R. KREXNER. Untersuchungen über die Wirking der Saatgutbeizung bei Rübe. (Studies on the effect of seed treatment in beet.) PflSch-Ber. 18: 119-170. 1957. (Rev. Appl. Mycol. 36: 803. 1957.)

In the main experiments notable results were obtained only where early-sown seed encountered conditions causing crust development at the soil surface or otherwise discouraging growth. Organic mercury-lindane preparations proved best, exhibiting combined activity against blackleg, wireworm, and Cercospora infection of the seed.

488. WILLIAMS, P. H. and JUDITH HACK. The effect of certain soil treatments on Didymella stem rot of tomatoes. Part I. Glasshouse experiments. Ann. Appl. Biol. 45: 304-311. 1957.

In soil treated with formalin and subsequently inoculated, the number of diseased plants was about half that in steamed soil. Steamed soil remained susceptible to infection by Didymella lycopersici for 4 months.

489. WILSON, J. D. Initial and subsequent control of radish yellows by various treatments during eight successive plantings. (Abstr.) Phytopathology 47: 538. 1957.

Only three of the 20 compounds used in 40 different treatments were still giving good control in the last (eighth) planting, made about 130 days after treatment. Of the three, chloropicrin was the most durable and effective, followed in turn by Mylone and Vapam.

TOXINS AND OTHER SUBSTANCES OF BIOTIC ORIGIN

Toxins -- of Microbial Origin and Affecting Plants

See also 96, 108, 170

490. CURTIS, ROY W. Survey of fungi and actinomycetes for compounds possessing gibberellinlike activity. Science 125: 646. 1957.

Approximately 1000 fungus and 500 actinomycetes (unidentified), that were obtained from the soil by routine plating-out procedures, were involved. It was concluded that the production of the gibberellins by fungi and actinomycetes is not widespread.

491. CURTIS, ROY W. Translocatable plant growth inhibitors produced by Penicillium thomii and Arachniotus trisporus. Plant Physiol. 32: 56-59. 1957.

Penicillium thomii and Arachniotus trisporus were found to produce translocatable plant growth inhibitors when cultured on corn steep-cerclose medium. When one of the primary leaves of bean plants was treated with the culture filtrates the leaves were inhibited on the side of the treated leaf.

492. DE, P. K. and L. N. MANDAL. Physiological diseases of rice. Soil Sci. 84: 367-376. 1957.

Symptoms are discoloration of leaves, stunted growth, and damaged root system. The evidence obtained does not support the view that the physiological disease of rice, as observed in normal soils, is due either to lack of oxygen, or to an accumulation of ferrous iron or production of hydrogen sulfide in soil.

493. DIENER, T. O. and M. L. WEAVER. A Penicillium causing wilt in peach and pear seedlings. (Abstr.) Phytopathology 47: 519. 1957.

The Penicillium species, isolated from Lovell peach roots, caused wilting of seedlings. The organism was not parasitic but produced a wilt-inducing toxin.

494. EARHART, R. W. Comparison of two techniques for evaluating pathogenicity of Helminthosporium cultures. (Abstr.) Phytopathology 47: 8. 1957.

Two recently developed techniques in which the water-soluble toxins produced by pathogenic organisms are substituted for the active organism are being used to measure pathogenic activity.

495. GÄUMANN, E. Über Fusarinsäure als Welketoxin. (On fursarinic acid as a wilt toxin.) Phytopath. Z. 29: 1-44. 1957. (Rev. Appl. Mycol. 36: 736. 1957.)

This is a detailed review and discussion of fusarinic acid in relation to certain wilt diseases of plants, with special reference to Fusarium bulbigenum var. lycopersici on tomato.

496. GÄUMANN, E. Fusaric acid as a wilt toxin. Phytopathology 47: 342-357. 1957.

Fusaric acid is synthesized by at least six parasitic and facultative parasitic species of the Hypocreaceae. The action spectrum of fusaric acid extends from bacteria to flowering plants and is therefore far wider than that of the pathogens themselves.

497. GÄUMANN, E. and W. LOEFFLER. Über die Wirking von Fusarinsäure auf dis Wasserpermeabilitat der Markzellen von Tomatenpflanzen. (On the action of fusarinic acid on the water permeability of pith cells of tomato plants.) Phytopath. Z. 28: 319-328. 1957. English summary. (Rev. Appl. Mycol. 36: 503-504. 1957.)

It is reported that increasing concentrations of the toxin not only enhance the intensity of the disturbance of permeability but change its direction. Two phases in the modification of permeability can be detected. They are related to fusarinic acid concentration.

498. GIBBERELLIC ACID EFFECT ON PLANT DISEASES AMONG REPORTS AT A. P. S. MEETING AT STANFORD. Agr. Chem. 12: 58, 107. 1957.

There is little likelihood that gibberellic acid will prove valuable in the direct control of plant diseases. In tests with tomatoes, treatment of the plants with from 5 to 20 ppm of the acid stimulated growth for almost 2 weeks. The low concentration reduced the severity of Fusarium wilt disease; the high concentration increased its severity.

499. JOHNSTON, P., R. R. ROMANKO and H. E. WHEELER. Association of the reactions to the crown rust fungus and to Helminthosporium victoriae in oat selections. Phytopathology 47: 18. 1957.

Treatment of more than 150 bushels of oats from varieties susceptible to Helminthosporium victoriae with a toxin produced by this fungus has yielded a large number of resistant selections.

500. LUDWIG, R. A. Toxin production by Helminthosporium sativum and its role in pathogenicity. Phytopathology 47: 22. 1957.

The invasion of cereal seedlings by Helminthosporium sativum is facilitated by toxic substances that the fungus produces. The growth of cereal seedlings is strongly inhibited by the toxins. Plants treated with the toxin develop many of the symptoms of the disease and are highly susceptible to invasion by the fungus.

501. LUDWIG, R. A. Toxin production by Helminthosporium sativum and its significance in disease development. Can. J. Bot. 35: 291-303. 1957.

A loose correlation was found to exist between toxin production and pathogenicity in a limited number of Helminthosporium strains.

502. MIRCHINK, T. G. (On fungi causing toxicity of podsolized soil of various cultivation grades.) (Microbiology) 26: 78-86. 1957. (In Russian, English summary). (Rev. Appl. Mycol. 37: 23-24. 1958.)

Undercultivated turf-podsol soils were characterized by their high toxicity caused by toxic species of fungi. The most toxic organisms were Penicillium cyclopium, P. nigricans, P. paxilli, and P. jantinellum. Toxic fungi are capable of excreting toxins directly into soil on addition of small quantities of organic matter.

503. NAEF-ROTH, STEPHI. Über die parasitogenen und toxigenen Veränderungen der Atmungsintensität bei Tomaten. (On the parasitogenic and toxigenic changes of respiratory intensity in tomatoes. Z. PflKrankh. 64: 421-426. 1957. English summary. (Rev. Appl. Mycol. 36: 792. 1957.)

The author summarizes and discusses the results of studies on the changes in the respiration rate of tomatoes induced by infection with Fusarium (bulbigenum var.) lycopersici and the action of its toxins, fusaric acid and lycomarasmin. Reference is further made to the literature on several other diseases characterized by increased respiration.

504. ORSENIGO, M. Estrazione e purificazione della cochliobolina, una tossino prodotta da Helminthosporium oryzae. (Extraction and purification of cochliobolin, a toxin produced by Helminthosporium oryzae.) Phytopath. Z. 29: 189-196. 1957. (Rev. Appl. Mycol. 36: 715. 1957.)

A new toxin, cochliobolin, has been isolated and crystallized from culture filtrates of Helminthosporium oryzae. It appears as a crystalline white powder, m.p. 180-182° C, scarcely soluble in water, but completely soluble in chloroform and acetone. Cochliobolin is very toxic to rice seedlings, inhibiting the growth of roots and coleoptiles at very low concentration. Preliminary trials indicate that the inhibition results from severe alterations of the plasma.

505. PAQUIN, R. and E. R. WAYGOOD. The effect of Fusarium toxins on the enzymic activity of tomato hypocotyl mitochondria. Can. J. Bot. 35: 207-218. 1957.

Lycomarasmin and fusaric acid, two toxins produced by Fusarium oxysporum f. lycopersici, inhibit the succinoxidase and cytochrome oxidase activity of the mitochondria at a concentration of 10^{-2}M. The role of toxins in Fusarium wilt of tomatoes is discussed.

506. PRINGLE, R. B. and A. C. BRAUN. The isolation of the toxin of Helminthosporium victoriae. Phytopathology 47: 369-371. 1957.

The biologically active material appears to be polypeptide in nature. The isolated toxin inhibits the growth of susceptible oat roots at a concentration of 0.01 μg per ml.

507. SADASIVAN, T. S. and L. SARASWATHI-DEVI. Vivotoxin and uptake of ions by plants. Curr. Sci. 26: 74-75. 1957. (Rev. Appl. Mycol. 36: 695. 1957.)

A disturbance in ionic uptake was observed in cotton plants grown in soil inoculated with Fusarium vasinfectum. It is suggested that the loss in semi-permeability of the cells of apparently healthy susceptible plants may be due to the action of vivotoxins, but the amount of toxin is insufficient to produce visual symptoms.

508. SELMAN, I. W. and G. F. PEGG. An analysis of the growth response of young tomato plants to infection by Verticillium albo-atrum. Ann. Appl. Biol. 45: 674-681. 1957.

Infection of seedling tomatoes with Verticillium albo-atrum checked growth but did not result immediately in leaf yellowing. Localized wilting occurred in some plants 2 weeks after the check to growth was evident. Eight weeks after inoculation, dry weights of leaf, stem, and root were decreased by 72, 70, and 65 percent, respectively. Plants in which two-thirds of the root system had been killed by crushing were placed in contact with mycelium in soil. This initial root injury did not significantly affect the growth of infected plants. The data accord with a toxic theory of damage to infected plants, but the slow development of chlorosis and wilting symptoms in the young plants suggested a greater tolerance of the toxin than is found in older plants.

509. STILLE, B. Schädigungen an Pflanzenwurzeln durch Kulturfiltrate von Mikroorganismen. (Injuries to plant roots by culture filtrates of micro-organisms.) Arch. Mikrobiol. 26: 71-82. 1957. (Rev. Appl. Mycol. 36: 777. 1957.)

Experiments were carried out to determine the influence of culture filtrates of some plant pathogenic fungi, i.e., Alternaria solani, A. tenuis, Pythium debaryanum, and Fusarium oxysporum, and numerous nonparasitic micro-organisms on the roots of young Lepidium sativum, flax, pea, and wheat plants. A high proportion of the filtrates caused severe or at least distinct injury even after an exposure of only 2 hours. The damage was readily recognizable on application of the tetrazolium test since the affected portions of the roots lose, to a greater or lesser extent, the capacity for formazan production which is characteristic of intact material. The loss is accompanied by failure to make further growth, so that the future of the plants is decided by the regenerative activity of the remaining roots.

510. SUBBA-RAO, N. S. In vivo detection of gibberellic acid in "foot-rot" infected rice (Oryza sativa L.). Proc. Indian. Acad. Sci. Sect. B, 45: 91-94. 1957. (Rev. Appl. Mycol. 36: 724. 1957.)

A chromatographic method for qualitative and quantitative determination of gibberellic acid in Fusarium moniliforme-infected rice plants is described. The results indicate a greater accumulation of gibberellic acid in shoots than in roots of the rice plant susceptible to the fungus.

511. TALBOYS, P. W. The possible significance of toxic metabolites of Verticillium albo-atrum in the development of hop wilt symptoms. Trans. Brit. Mycol. Soc. 40: 415-427. 1957. (Rev. Appl. Mycol. 37: 177. 1958.)

The intensity of the toxin-induced syndrome in hop shoots placed in culture filtrates of Verticillium albo-atrum was not related either to the pathogenicity of the fungus strain or the the wilt tolerance of the hop variety.

512. WHALEY, W. G. and J. KEPHART. Effect of gibberellic acid on growth of maize roots. Science 125: 234. 1957.

Gibberellic acid was added to nutrient solutions in which excised apical 10-mm segments of maize roots were grown for 24 hours. The primary roots of one line were unaffected by the gibberellic acid at the concentration (0-20 μg). Those of the other line and of the hybrid were significantly stimulated by the acid in 10 μg per ml.

Toxins -- of Plant Origin and Affecting Micro-organisms

See also 4, 94, 97, 173

513. BARTON, R. Germination of oospores of Pythium mamillatum in response to exudates from living seedlings. Nature 180: 613-614. 1957.

Oospores of Pythium mamillatum on glass fibre tapes were stained in phenolic rose bengal and buried for 3 days in garden soil beneath 2- to 5-day-old turnip seedlings. Germination by germ-tube formation occurred in scattered areas on each tape, suggesting stimulation in proximity to the roots. Oospores in soil without seedlings did not germinate. Oospores were stimulated by germinating turnip seeds in distilled water in Petri dishes, even when the seedlings and tapes were separated by filter paper. When turnip seedlings were grown for 7 days in water the exudate solution, concentrated by freeze-drying, was shown to increase germination.

514. BECK, S. D. and J. F. STAUFFER. The European corn borer Pyrausta nubilalis and its principal host plant. III. Toxic factors influencing larval establishment. Ann. Ent. Soc. Am. 50: 166-170. 1957.

Corn plant tissues contain two or more toxic chemicals which inhibit the growth of a number of insects, fungi, and bacteria.

515. COLEY-SMITH, J. R. and C. J. HICKMAN. Stimulation of Sclerotium germination in Sclerotium cepivorum. Nature 180: 445. 1957.

Sclerotia of the fungus germinated 60 to 92 percent in soil containing onion seedlings, while germination of 0 to 15 percent was obtained in soil without onions. Germination was 100 percent when sclerotia were placed in contact with any part of onion roots which had been previously damaged by needle pricking. The addition of water extracts of roots of onion, shallot, and leek also had a marked stimulatory effect on the germination of sclerotia in soil. No germination occurred, however, with extracts of cabbage, brussels sprouts, or barley roots, or when distilled water alone was used.

516. EBERHARDT, F. and P. MARTIN. (The problem of root excretions and their importance in the mutual relationships between higher plants.) (English summary) Z. PflKrankh. 64: 193-205. 1957.

The liberation of fluorescent compounds by roots of Lolium, Nigella, and Papaver seedlings was studied by means of paper chromatography. It was concluded that true root secretions play only a minor part in the mutual interactions of plants growing in association with one another.

517. JACKSON, R. M. Fungistasis as a factor in the rhizosphere phenomenon. Nature 180: 96-97. 1957.

Conidia of Gliocladium roseum and Paecilomyces marquandi (on glass slides coated with 2 percent agar, 0.5 percent peptone) were unable to germinate when introduced into fresh fertile soil, but when pea seedling roots came into contact with the slides the conidia germinated. Similar results were obtained with conidia of Fusarium solani. The stimulation of germination in previously inhibited fungus spores is probably due to a root exudate, and would contribute to the relative abundance of fungi on and near roots as compared with in soil at a distance from roots.

518. KERR, A. and N. T. FLENTJE. Host infection of Pellicularia filamentosa controlled by chemical stimuli. Nature 179: 204-205. 1957.

The stimulation of Pellicularia filamentosa by exudates from radish seedlings was investigated. The only strain of the organism that showed a marked response to the exudate was the one that was pathogenic to radish. It was concluded that the attachment to, organization on, and penetration of a host by the radish strain is governed by the nature of the cuticle surface, and by a diffusible substance excreted onto the surface by the underlying cells.

519. KUC, J. A biochemical study of the resistance of potato tuber tissue to attack by various fungi. Phytopathology 47: 676-680. 1957.
Cephalothecium roseum and Myrothecium verrucaria, nonpathogenic to potato tubers, are inhibited by extracts of potato peel. M. verrucaria, however, is capable of rotting peeled tuber and is not inhibited by extracts of incubated tuber tissue, either inoculated or noninoculated.

520. LOOMIS, R. S., S. D. BECK and J. F. STAUFFER. The European corn borer, Pyrausta nubilalis and its principal host plant. V. A chemical study of host plant resistance. Plant Physiol. 32: 379-385. 1957.
A corn borer-inhibitory substance, 6-methoxy-2(3)-benzoxazolinone, was isolated from corn plants. This substance also had antifungal properties (inhibited Penicillium chrysogenum.)

521. MENON, R. and L. SCHACHINGER. Die Rolle des Phenols bei der Widerstandsfahigkeit von Tomatenpflanzen gegen Infektionen. (The role of phenol in the resistance of tomato plants to infections.) Ber. dtsch. bot. Ges. 70: 11-20. 1957. (Rev. Appl. Mycol. 36: 504. 1957.)
The content of polyphenoloxidase in tomato leaves and shoots is increased after infection with Fuarium lycopersici, and is greater in resistant than in non-resistant varieties. Infection increases the total phenol content of resistant, but not that of non-resistant varieties. It was concluded that the phenols cannot be responsible for wilting. Only one phenol was detected by paper chromatography.

522. NUTMAN, P. S. Studies on the physiology of nodule formation. V. Further experiments on the stimulating and inhibitory effects of root secretions. Ann. Bot. N.S. 21: 321-327. 1957.
The influence of root secretions on the nodulation of clover and lucerne in agar culture is examined. Root secretions are shown to have two effects: nodulation of the seedling is induced at an earlier stage (stimulation), but takes place at a reduced rate (inhibition).

523. SPENCER, D. M., J. H. TOPPS and R. L. WAIN. Fungistatic properties of plant tissues. I. An antifungal substance from tissues of Vicia faba. Nature 179: 651-652. 1957.
Segments of the stems and roots of broad bean were found to exert a marked inhibitory effect on the growth of Aspergillus niger. The properties of the antifungal extract indicated that the substance is phenolic but not a tannin. Some evidence was obtained that the substance is not present in intact broad bean plants but is produced in the tissues in response to wounding. The greatest activity occurred in the lower part of the stem and the upper segments of the primary root.

524. VIRTANEN, A. I., P. K. HIETALI and O. WAHLROOS. Antimicrobial substances in cereals and fodder plants. Arch. Biochem. and Biophys. 69: 486-500. 1957.
The active factor in the pressed juice of green rye seedlings was isolated and identified as 2(3)-benzoxazolinone. It had strong antifungal activity against Fusarium nivale and Sclerotinia trifoliorum. An antifungal factor was isolated from young wheat plants and maize plants, and was found to be 6-methoxy-2(3)-benzoxazolinone. Antifungal factors were isolated from alfalfa and red clover and that in clover was found to be an aromatic phenol. In potato leaves chlorogenic acid inhibited Phytophthora infestans. Antifungal activity was found in all the cultivated plants examined.

Toxins -- of Plant Origin and Affecting Plants

525. BORNER, H. and B. RADEMACHER. (Self-incompatibility of flax.) Z. Pfl. Ernahr. Dring 76: 123-132. 1957.
Flax grown in nutrient solution in which flax has previously been grown exhibits at 26 days a decrease in shoot dry weight and root and shoot length.

No pathogenic microorganisms appear which could explain the results.

526. FORSTER, RITA. (Influence of tannins on germination and growth of higher plants.) Beitr. Biol. Pflanz. 33: 279-311. 1957. (Chem. Abstr. 51: 14026 (a). 1957.)
Root growth of Sinapis was more strongly inhibited than that of Lepidium; the action of gallic acid was four times greater than that of tannin.

527. HIRAYOSHI, I., S. KURODA and K. NISHIKAWA. (Growth-inhibiting substance produced by plants. I. Biological tests on the inhibitory substance extracted from water culture media.) Kagaku (Science) 27: 92-93. 1957. (Chem. Abstr. 51: 14905 (d). 1957.)
Water culture medium used for Lactuca sativa, Solanum lycopersicum, and S. melongena was concentrated and fractionated into acidic, phenolic, and neutral fractions. The fractions inhibited the germination of certain seeds.

528. JONES, M. B., J. W. FLEMING and L. F. BAILEY. Cyanide as a growth-inhibiting substance in extracts of peach leaves, bark and flower buds. Proc. Am. Soc. hort. Sci. 69: 152-171. 1957.
Extracts from buds collected at different times of the year caused inhibition of elongation in pea sections. Different amounts of cyanide were recovered from peach buds, twig bark, leaves, and root bark. The inhibition caused by extracts from the first three of these was comparable to that caused by a sodium cyanide solution containing an equal amount of CN, and that caused by the extract from peach root bark was greater than that induced by the sodium cyanide solution. Removal of CN from the extracts resulted in loss of inhibition induced.

529. KOMMEDAHL, THOR. Quack grass can be toxic to crop seedlings. Down to Earth 13: 4-5. 1957.
Quack grass rhizomes, foliage and seeds can be toxic to alfalfa and flax seedlings and to a lesser degree to wheat, oat, and barley seedlings.

530. KOMMEDAHL, T. and J. B. KOTHEIMER. The role of quack grass in root rots of cereals. (Abstr.) Phytopathology 47: 21. 1957.
Seedling stands of barley, oats, wheat, and corn were reduced substantially following inoculation in the greenhouse with species of Curvularia, Fusarium, Gibberella, and Helminthosporium that were isolated from rhizomes of quack grass. The addition of ground autoclaved rhizomes to soil increased severity of damage.

531. KOMMEDAHL, T., A. J. LINCK and J. V. BERNARDINI. The toxic effect of quack grass on growth of alfalfa. (Abstr.) Phytopathology 47: 526. 1957.
The addition to soil of dried rhizomes from quack grass resulted in severe stunting and chlorosis of alfalfa seedlings, reduction in stand of alfalfa, and delay in germination of alfalfa seeds.

532. Le TOURNEAU, D. and H. G. HEGGENESS. Germination and growth inhibitors in leafy spurge foliage and quack grass rhizomes. Weeds, New York, 5: 12-19. 1957.
Aqueous extracts of Euphorbia esula foliage and Agropyron repens rhizomes inhibited root growth of pea and wheat seedlings germinated in Petri dishes.

533. MANN, H. H. and T. W. BARNES. Report of the Rothamsted Experimental Station for 1956. 280 pp. 1957. (Rev. Appl. Mycol. 36: 816. 1957.)
Pot experiments suggest that "sick" clover soils indicate the presence of a toxic substance, and addition of 10 percent animal charcoal to such soils results in normal growth of clover.

534. MARTOSH, L. (Influence of a metabolite of the cotyledons on the growth of seedlings of leguminous plants.) Fiziol. Rastenir 4: 150-158. 1957. (Chem. Abstr. 51: 16744 (i). 1957.)

Experimental evidence confirms the opinion that trypaflavine is an inactivator of nucleic acid. Introduction of 400 γ of trypaflavine after 3 days of germination of the seed strongly slows down stem growth, inhibits lateral root formation, and causes a decrease in the dry weight of separate parts of the plants.

535. MASSART, L. (Inhibitors of germination of sugar-beet roots and other dry fruit and seeds.) Biokhimiya 22: 417-420. 1957.

Sugar-beet roots contained p-hydroxybenzoic, vanillic, p-coumaric, and ferulic acids. These acids, particularly the last two, impeded the germination of Lepidium sativum.

536. MIYAMOTO, T. Germination inhibitor in sugar-beet seed balls. Michigan Agr. Expt. Sta. Quart. Bull. 39: 578. 1957.

The seed coats of sugar beet and beet spinach contained sufficient oxalic acid to inhibit germination. It is unlikely that NH_3 is the active inhibitor.

537. NEWTON, W. The utilization of single organic nitrogen compounds by wheat seedlings and by Phytophthora parasitica. Can. J. Bot. 35: 445-448. 1957.

d-alanine and the optical isomers of leucine exerted toxic effects on wheat seedlings growing under aseptic conditions.

538. RADEMACHER, B. Die Bedeutung allelopathischer Erscheinungen in der Pflanzenpathologie. (The significance of allelopathic phenomena in plant pathology.) Z. PflKrankheit. 64: 427-439. English summary. (Rev. Appl. Mycol. 36: 774. 1957.)

Over 100 contributions to the literature were consulted in this survey of allelopathy (defined as the influence exerted by one plant on another by metabolic products, either emerging from the living plant or released by its dead residues) in relation to non-parasitic disorders.

539. SIEGEL, S. M. Growth- and enzyme-inhibiting properties of bean seed extracts. Plant Physiol. 32: 151-152. 1957.

Seed coat components may act as growth inhibitors and it is possible that phenols present either interfere directly with protein synthesis or are first converted into highly toxic quinonoid substances by endogenous tissue peroxidase. Tests with flax seed show inhibition of germination, root elongation, fresh weight increase, protein synthesis and peroxidase and phenolase formation. Root discoloration was observed and some of the seed coat phenols were found to serve as peroxidase substrates.

540. STENLID, GORAN. A comparison of the toxic effects of some sugars upon growth and chloride accumulation in young wheat roots. Physiologia Plantarum 10: 807-823. 1957.

From the studies it was difficult to decide if the sugars (galactose, mannose) are really toxic or only unsuitable as a carbon source, as the roots are dependent on externally supplied carbohydrates. Root growth in young wheat seedlings grown in nutrient solution (in the dark) is inhibited 50 percent by mannose, galactose, glucosamine, and 2-disoxy-D-glucose.

541. WARING, P. F. and H. A. FODA. Growth inhibitors and dormancy in Xanthium seed. Physiol. Plantarum 10: 266-280. 1957.

Seeds of Xanthium pennsylvaniarum contain two water-soluble growth inhibitors, which can be separated by paper chromatography. These inhibitors do not occur in other parts of the plant. The inhibitors accumulate during development of the embryo and disappear rapidly during germination.

VIRUS

542. HARRISON, B. D. Studies on the host range, properties, and mode of transmission of beet ringspot virus. Ann. Appl. Biol. 45: 462-472. 1957.

An apparently undescribed mechanically transmissible virus, beet ringspot virus (BRV), has been found to occur naturally in Scotland in sugar beet, turnip, swede, potato and many kinds of weed plants. When sugar beet seedlings were grown in virus-containing soil, BRV was first detected in their roots. Soils from five localities were found to contain BRV.

543. SMITH, FRANK H. and FRANK P. McWHORTER. Anatomical effects of tomato ringspot virus in Vicia faba. Am. J. Bot. 44: 470-478. 1957.

The cucumber strain of tomato ringspot virus causes necrosis of the inoculated leaves of Vicia faba. From these infected leaves the virus moves into the stem and downwards into the roots. As the necrosis progresses downward it follows the vascularization but does not at first involve the conducting tissues. Instead, the necrosis progresses downward in the parenchyma tissue external to the phloem, then spreads laterally through the pith and cortex. Necrosis proceeds downward and laterally in the cortex of the radicle. The virus increases the susceptibility of V. faba roots to soil fungi. Species of Pythium and Fusarium may invade and destroy the root tips before the tips are killed by the virus.

SENIOR AUTHOR INDEX
(numbers refer to entries)

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SUPPLEMENT 253

INDEX TO SUPPLEMENTS 250-253, 1958

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Crops Research Division serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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Supplement 253

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Index to Supplements, 1958

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Supplement 250. Blue mold of tobacco, pp. 1-35. June 15, 1958. By Hilde McGrath and Paul R. Miller. This includes the history of the disease in Australia and the United States, distribution and spread, epidemiology, etiology, symptoms, cultural practices, fungicides, resistant varieties, and 200 literature citations and references.

Supplement 251. Some new and important plant disease occurrences and developments in the United States in 1957, pp. 39-79. November 15, 1958. Compiled by Nellie W. Nance.

Supplement 252. Rootrot and related literature, an annotated bibliography, 1957, pp. 82-158. December 15,1958. December 15, 1958. Prepared by L. W. Koch, H. R. Boyce, A. A. Hildebrand, C. D. McKeen, W. B. Mountain, Z. A. Patrick, R. N. Wensley, and N. J. Whitney.

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SUBJECT INDEX

ERRATA

On page 69, last paragraph, read RHODODENDRON spp., instead of RHODENDRON spp.

CROPS RESEARCH DIVISION