NOTEWORTHY PLANT DISEASES IN CANADA, 1968

W. L. Seaman[1]

This summary is based on reports to the Canadian Plant Disease Survey from plant pathologists in the CDA, provincial departments of agriculture, and universities. Only the apparently important diseases observed in 1968 are reported here; further details concerning these and less prevalent diseases not mentioned are available from CPDS files and will be summarized for later publication. For additional information on the prevalence of tree diseases, especially of commercial plantations, see Annual Report of the Forest Insect and Disease Survey. 1968. Forestry Branch, Can. Dep. Fisheries & Forestry. 141 p.

At ports of entry in 1967–68, plant pests detected by CDA Plant Protection inspectors on plants, plant products, and soil entering Canada included 173 interceptions of material containing fungi, bacteria, or viruses. Eleven of these were of plant quarantine importance. Also, 485 interceptions contained nematodes, of which 398 were of quarantine significance and 5 were new records to Canada.

British Columbia

In 1968 plant diseases were of relatively minor economic importance. Those that caused the greatest concern were collar rot of apple, pear, and cherry; powdery mildew of fruit trees; bacterial and coryneum blights of apricot and peach; godronia canker and mummy berry of blueberry; bacterial and botrytis fruit rot of raspberry; leaf roll of potato; clubroot of crucifers; and root rot of Lawson's cypress.

Lower Fraser Valley--The 1967–68 winter was milder than usual and snowfall was liaht. The growing season was one of the wettest in recent years and during the 7–month period March–September only May had below–average rainfall. Despite the heavy precipitation, temperatures during this period were satisfactory for growth, and hours of sunshine were above–average during most of the season. All crops produced heavy yields, but harvesting conditions were often difficult, particularly for hay and grain. The first killing frost in farming districts occurred on October 16, and severe cold in December was expected to have prevented the overwintering of the aphid vectors of a number of viruses.

The heavy rainfall in early July resulted in considerable fruit loss from *Botrytis cinerea* (gray mold) in raspberry and in the first picking of highbush blueberry, but overall the incidence of foliar diseases was surprisingly low. While berry rot caused by gray mold and by powdery mildew continue to cause losses in strawberries and raspberries in B.C., trials at Agassiz in 1968 indicated that several fungicides will provide good control of pre- and postharvest rot of strawberry fruit. The systemic fungicide benomyl was more effective than sulfur in controlling powdery mildew on foliage and it also provided protection up to 8 weeks beyond the last spray (see Freeman & Pepin, CPDS 48:120-123). However, at Abbotsford, evidence was obtained that postharvest applications of fungicides for control of powdery mildew in 'Northwest' strawberry may not result in increased yield the following year. Although benomyl, and sulfur applied in July–September 1967 reduced leaf area infection to 19-25%, yields in 1968 were no greater than in unsprayed plots showing 91% average leaf area infection (see Freeman & Pepin, CPDS 49:139). Tomato ringspot virus has been observed in raspberries in B.C. since 1961. Studies at Agassiz have shown that the plant vigor and fruit yield of infected plants of the cultivar 'Fairview' were severely reduced in the first and second years of a plantation, and plants showed a rapid decline in the third year. In some years symptoms may be confused with winter injury. Three other cultivars showed more tolerance to the disease. For details and for a discussion of the terminology used for this and similar conditions see Freeman & Stace–Smith, Can. J. Plant Sci. 48:25-29. The mummy berry disease of highbush blueberry incited by *Monilinia vaccinii-corymbosi* has been an increasing problem in the lower Fraser Valley for the past several years. However the results of fungicide trials showed that treatment with ferbam gave the greatest increase in yield; the systemic benomyl also increased yield and appeared to be effective in reducing the incidence of infected fruit (see Pepin & Ormrod, CPDS 48:132-133). Growers who are practising chemical control are experiencing a return to normal yields.

Bipolaris iridis (Oudemans) Dickinson and *Heterosporium iridis* were reported on bulbous iris (*Iris xiphium*) at Richmond, B.C. *Bipolaris iridis* is a pathogen of iris in Europe, but this is the first report of the fungus in North America. Losses of 15%were experienced in the affected field (see Straby & Shoemaker, CPDS 48:152).

At Lulu Island, the *Monilinia* or shoot blight stage of *Sclerotinia oxycocci* was reported on cranberry for the first time in B.C. Young plantings are often attacked by foliar pathogens which seem to disappear with maturity of the plants. Cotton ball, caused

[1] Research Station, Canada Department Of Agriculture, Ottawa, Ontario.

by the same fungus, affects a small percentage of fruit in initial, fruiting years but it, too, tends to disappear.

The root-knot nematode, Meloidogyne sp., continued to be a problem in carrot production in the Fraser Valley, and leaf spot incited by Trichothecium roseum was reported for the first time in greenhouse-grown cucumber in the Fraser Valley. However basal rot of onion incited by Fusarium oxysporum f. cepae was less prevalent than in many years, and pink root, white rot, and smut were also less common than usual. Losses from blotchy ripening of tomatoes were above average.

Dieback, apparently caused by a Nectria sp., affected about 30% of container-grown plants of Skimmia japonica. Verticillium dahliae severely affected 1- and 2-year-old trees of Acer platanoides in a nursery at Chilliwack. Xanthomonas hyacinthi was reported for the first time in many years in B.C. in hyacinths grown from U.S.-produced bulbs. Angular leaf spot caused by Septoria azaleae caused severe defoliation of container-grown azaleas in a nursery at Langley. This is a new record of this disease in B.C.

Rhizoctonia was present in all potato fields inspected and leaf roll affected 16 of 62 fields. In the Pemberton area blackleg was the most important problem, occurring in 40% of the fields inspected. On Vancouver Island 37% of the fields examined contained symptoms of secondary leaf roll. Early blight was unusually noticeable in many 'Netted Gem' fields but incidence was very low. Blackleg was more prevalent than in 1967, and rhizoctonia affected 91% of the fields inspected. Yield trials with potato stock freed from viruses X and S indicated a yield advantage of about 10% for virus-free stock.

Cariboo and Central [illegible] conditions [illegible] very unusual in 1368. Potato crops were planted in May under ideal conditions but the weather turned very cool and wet following emergence, and in mid-June a frost killed the plants back to ground level but did little permanent damage. Wet weather continued through July and August, and another frost on August 7 caused considerable foliage damage. Despite the poor growing conditions yields were reasonable, but tubers were affected by an above-average incidence of sclerotia of Rhizoctonia solani. Witches' broom was found in almost every field, and the 'Norland' and 'Norgold Russet' varieties were severely affected.

Southern interior valleys--The 1967-68 winter was mild, with an extreme low of 3F; temperatures were below 10F on 4 days, and below 20F on only 20 days.. Snowfall was much less than normal, causing temporary fears that there would be a shortage of irrigation water for the 1968 season. There was no winter damage to fruit trees. However the abnormally warm weather in February, March, and early April led to the early swelling of buds, and a cold night on April 13 (19-23F in various districts) caused considerable killing of blossom buds of stone fruits. In the early southern districts, crops of cherry, apricot, and peach were substantially reduced.

There were several prolonged wet periods in May and June, providing apparently ideal conditions for apple scab infections. However there was remarkably little foliage or fruit infection by Venturia inaequalis, presumably because most growers responded promptly to broadcast spray warnings with fungicide applications. In the Kootenays, sprays were required to reduce rotting of strawberry fruit.

After a series of relatively mild winters, powdery mildews continued to increase in severity, especially on apple, but also fairly seriously on Anjou pear, and on sweet and sour cherries.

After normal hot dry weather throughout July and early August, a prolonged period of cool, wet weather began August 11. Cherries matured in dry weather with no splitting or subsequent fruit rotting, but peaches, plums, and apricots had abnormally high incidence of brown rot caused by Monilinia fructicola in the Kootenays, and coryneum blight caused fruit lesions on peach. Some brown rot also occurred on apricot and peach in the Okanagan. Special late-season protective sprays were applied for apple scab and Gloeosporium fruit rots in some districts. In the Kootenays there was considerable pinpoint scab.

Several harvest disorders of fruits appeared to be related to seasonal weather conditions. Prune shrivel was severe, making harvesting impracticable in many orchards. Bartlett pears had considerable pink-end, and late peach varieties bore soft insipid fruits. Prune shrivel is believed to be favored by alternating hot, dry and cool, wet periods; and pear pink-end and soft peach by cool weather preceding harvest.

A record crop of 5500 tons of grapes with unexpectedly high sugar content was harvested, and no disease problems were experienced other than the need for the application of fungicides to control mildew on susceptible varieties; the variety V-37034 was most susceptible.

Tomatoes grew well in July, but the harvest was seriously reduced because of the high incidence of fruit rots caused by Alternaria solani and Colletotrichum coccodes, beginning in late August. Basal bulb rot of onion incited by Fusarium oxysporum f. cepae was unusually severe in many onion plantings.

Crown rot caused by Phytophthora cactorum affected MM104 apple rootstocks in several orchards in the Okanagan Valley, while foliage infection of apple was common, and late season infection with apple scab appeared as pin-point scab and later as storage scab in the same area. Virus-incited leaf pucker caused severe symptoms on 'McIntosh' apples in the Summerland-Kelowna region following lower than normal temperatures during the blossom period early in May. Similarly the virus-incited ring russeting and wrinkle in 'Yellow Newtown' were moderately severe, the former causing downgrading of fruit. The graft transmission of the causal agent of wrinkle was established.

Twig dieback from fireblight occurred in one apple orchard where overhead sprinkler irrigation was used and light late-season infection appeared in some pear orchards. Fireblight has been very rare in this area in recent years. However high-density plantings of dwarf apple trees combined with overhead irrigation provide conditions favorable for the development of such serious diseases as anthracnose, European canker and fireblight. In one such planting in the Osooyos area, Erwinia amylovora, affected the six most important varieties of dwarf apple stock, while nearby standard-sized trees were free from symptoms of fireblight.

Shrivelling of Italian prune fruit was a serious problem in the Okanagan and Kootenay Valleys for the first time in more than 10 years. This condition, which affects fruit near the stem end, was especially serious in late varieties and is believed to be associated with the occurrence of cool weather in the late ripening period near the end of August.

The use of copper-oil paints on perennial cankers of apple caused by Gloeosporium perennans has apparently been effective in preventing extension of the cankers, and the use of Botran treatment appeared to effectively control fruit rot of peach caused by Sclerotinia fructicola and Rhizopus sp.

Bacterial canker of stone fruits caused by Pseudomonas sp. was recorded for the first time in orchard fruits in B.C. and appeared in many plantings. Trees may have been predisposed to infection by the severe frosts of April 13. Bacterial colonies similar to those of Pseudomonas syringae were isolated from cankers on peach and cherry limbs showing symptoms of dieback in several orchards in the Okanagan and Similkameen Valleys. However, despite repeated attempts, the pathogenicity of these colonies was not established. The widespread outbreaks are believed to be associated with a series of mild winters and with spring frost in April.

A filamentous virus apparently unrelated to the previously reported virus from the sweet cherry cultivar 'Lambert' was isolated from one field planting of the cultivar 'Stella'; no symptoms were apparent in infected trees in the orchard.

Most potato crops were affected by Alternaria solani but the amount of blackleg (Erwinia atroseptica) declined from 1967, appearing only in crops grown from imported seed. Rhizoctonia was present in all fields but caused little damage and harvested tubers were clean. Leaf roll affected only a few crops, a great improvement over previous years.

Alberta

Southern Alberta--Lack of snow cover during a short period of very low temperatures in late December 1967 resulted in moderate to severe winterkilling of alfalfa and turf grasses. Damage to alfalfa and turf from the low-temperature basidiomycete was also severe, and pink snow mold incited by Fusarium nivale was widespread on lawns in the Lethbridge, Calgary, and Edmonton areas. However damage from pink snow mold on turf and on winter wheat was much less than in 1967, presumably because of a lighter snow cover. Above-normal temperatures and below-normal precipitation from January to March favored the survival of volunteer winter wheat and many fields were retained as crop. Most of these volunteer crops yielded poorly because they were heavily infected with wheat streak mosaic virus, and they served as sources of infection for nearby fields of spring wheat.

The spring and early summer were cooler than normal, precipitation was normal, and winds were light. Damage from root diseases was less than usual; early blight of potatoes was not unusually severe and late blight was not reported. Powdery mildew, however, was more severe than usual on some crops.

Crown bud rot of alfalfa incited by Rhizoctonia solani, Fusarium roseum, anh Ascochyta imperfecta [Phoma medicaginis] was widespread; in 35 fields examined in the Lethbridge area, 10-30% of the shoots on affected crowns were destroyed, causing an estimated yield loss of 20%. In the same area, losses from Corynebacterium insidiosum of approximately 10% were recorded in one-third of the alfalfa fields examined, and a similar loss was estimated from the stem nematode, Ditylenchus dipsaci, in about 12% of the fields.

Losses ranging from trace to 65% and averaging about 2% occurred in flax in the Bow Island-Foremost area; severe dieback of tops affected approximately half of the fields in the area. The cause of the dieback was not determined.

Because of the cool-season grain crops matured later than usual and heavy rains in September further delayed harvesting until a dry period in late October and early

November. The heavy rains 'delayed seeding of winter wheat and unseasonably cold weather in the fall retarded growth, virtually eliminating the opportunity for fall infection by wheat streak mosaic virus.

Browning root rot of barley and wheat was evident in southern Alberta for the first time in a number of years; isolates resembling Pythium tardicrescens were obtained from many of the affected roots.

A Pythium sp. closely related to P. ultimum was associated with a 70% reduction in emergence of rye in a field near Lethbridge in July 1968 and may have been responsible for the occasionally poor emergence of rye in southern Alberta (see Harper et al., Can. J. Plant Sci. 49:531-533).

Central and northern Alberta--In northern Alberta, early plantings of potatoes in cool dry soils were affected by poor germination, seed piece decay, and an unusually high incidence of rhizoctonia. Dry weather continued through July and was followed by above-normal precipitation during August and September. Erwinia atroseptica was present in 38% of the fields inspected but was absent or present only in trace amounts in Elite plots. Rhizoctonia occurred in all districts and was more severe than in 1967; 24% of the fields were affected. The prevalence of leaf roll increased in the area as compared with 1967, occurring in almost 33% of the fields.

Powdery mildew [Erysiphe graminis] was more prevalent than usual on spring and winter wheat in central Alberta and in the Peace River area. Basal glume rot caused by Pseudomonas atrofaciens and common root rot were also widespread in wheat, as was halo blight, incited by Pseudomonas coronofaciens in oats. Head discoloration from superficial black molds and head blight were very prevalent in cereal crops, and frost injury to wheat, oats, and barley was also widespread following heading.

On barley, Pyrenophora teres was more prevalent than usual, particularly in central Alberta. Studies on the movement of P. teres [Drechslera teres] from infested barley straw and seed indicated that straw was the more important source of inoculum in Alberta and that little long-distance spread of the disease occurred (see Piening, Can. J. Plant Sci. 48:623-625). Rhynchosporium secalis was also destructive in barley, and damage from birds was widespread.

A survey of anthracnose of cereals incited by Colletotrichum dematium carried out in Alberta in 1963 and reported in 1968 indicated that the disease was most prevalent in north-central Alberta and was most severe on crops grown in soils low in organic matter. Anthracnose was found on wheat, oats, barley, and rye and was most severe on oats (see Harder & Skoropad, CPDS 48:39-42).

Pyrenophora bromi (stat. conid. Drechslera bromi) was reported in almost all fields of brome in central Alberta. Drechslera tritici-repentis was isolated by W.B. Berkenkamp from plants of Bromus inermis showing symptoms indistinguishable from those caused by Pyrenophora bromi. The causal organism was identified by R.A. Shoemaker and was successfully inoculated to brome.

A stem eyespot of seed crops of creeping red fescue (Festuca rubra subsp. rubra) incited by Phleospora idahoensis Sprague was described for the first time in Canada in the Beaverlodge area. The disease affected stems, sheaths, and inflorescences and was more severe in sheltered rolling parkland and cleared bush than in open prairie. The eyespot was first noticed in two fields in 1967, but the causal agent was not identified. In 1968, spores of P. idahoensis were detected on plants in only 2 of 20 affected fields. The fungus is potentially seed-borne, and preliminary estimates suggested that seed yield could be reduced by as much as 50% (see Smith et al., CPDS 48:115-119).

All alfalfa fields examined in central Alberta in 1968 were affected by Pseudopeziza trifolii and P. jonesii. In rape, white rust caused by Albugo cruciferarum was prevalent throughout the area and Alternaria brassicae was present in trace amounts.

In a nursery at Devon, collar rot attributed to Phytophthora syringae seriously damaged about 20% of young apple trees imported from B.C.

At Fort Saskatchewan, Alta., approximately 20 square miles of white spruce and jackpine stands were affected by emission of chlorine gas. Noticeable differences in susceptibility to injury were evident among trees in the area, ranging from no noticeable effects to death. Poplars in the area were defoliated but apparently recovered. Canker caused by Septoria musiva was widespread and destructive in poplar in central Alta.

Saskatchewan

In southeastern Saskatchewan very early seeding into cold, dry soil resulted in delayed and uneven emergence. Deep seeding, soil drifting, frost damage, and common root rot also affected stands of seedlings.

The average disease rating for common root rot of wheat, caused by Cochliobolus sativus and Fusarium spp., for the nine Sask. crop districts was 7.9, comparable to the 1967 rating but below that of many of the preceding years. The highest rating (10.9) was recorded in District No. 3, the lowest (6.2) in No. 5. The prematurity blight symptom of infection by Fusarium culmorum caused damage in a few areas, particularly on heavy land. In barley, common root rot was most severe in Crop Districts 6-9; the

average rating for the province was 9.8, with a range of 1.6 to 29.6%.

Take all, caused by Gaeumannomyces graminis, was present in trace amounts in 12 of 50 wheat fields examined in Crop Districts 8 and 9, although incidence reached 36% in one field.

Stem rust was not found in any of the 220 wheat fields examined during the annual wheat disease survey, and the incidence of leaf rust was trace–light in 65 of 222 wheat fields: Crop Districts 4 and 9 were free from leaf rust. The development of stem rust in western Canada was retarded by the cool, wet season and although spore showers of Puccinia graminis were detected in Saskatchewan as early as July 9, the total number of urediospores detected was the lowest since 1961.

Speckled leaf blotch caused by Septoria avenae f. sp. triticea affected 42 of 222 wheat fields and loose smut, though light, was more prevalent in durum than in common wheat. "Green rust", the superficial growth of Alternaria and Cladosporium, was common in some areas.

The importance of the photosynthetic area of tissues above the flag–leaf node in determining the yield of wheat was confirmed in greenhouse tests in Saskatchewan (see Simpson, Can. J. Plant Sci. 48:253-260). Knowledge of the contribution of specific leaves or other plant tissues to yield in field–grown crops should greatly facilitate the development of methods for assessing the effects of foliage diseases on yield.

In the northeastern crop district of Saskatchewan black stem caused by Phoma medicaginis was the most prevalent and the most severe disease of alfalfa in 1968. Common leaf spot caused by Pseudopeziza trifolii f. sp. medicaginis-sativae was also found in most fields but caused little damage.

The first evidence of significant amounts of seed infection of rape by Leptosphaeria maculans in western Canada were obtained in 1968. The collection of the "Brassica" strain of this pathogen on 'Echo' turnip rape at Maidstone marked a considerable western extension of the range of this strain.

Pseudomonas lachrymans was widespread on cucumber and caused severe damage. In potato fields the incidence of Rhizoctonia solani was less than usual (19% of fields inspected). Leaf roll occurred in about 23% of the fields, blackleg in 16%.

Prolonged wet weather beginning in late July favored the development of fire blight in apple, and some plantings were heavily attacked.

Cytospora chrysosperma caused severe dieback to poplar in shelterbelts and plantations throughout southern Saskatchewan.

Manitoba

In Manitoba the 1968 growing season was one of the wettest on record, with cool temperatures prevailing throughout. Leaf rust of wheat was first found in Manitoba on June 12 following a spore shower detected June 1–6. However, leaf rust developed slowly until late in the season and most of the crop escaped damage. The cultivar 'Manitou' remained highly resistant to Puccinia recondita at most rust nurseries across Canada. Stem rust urediospores were first detected in spore traps in Manitoba and Saskatchewan on July 9 and the first rust appeared in field plots on July 23. Stem rust developed slowly in western Canada probably because of the unusually cool, wet weather that prevailed throughout the summer, and the total number of spores trapped was the lowest since 1961. Races C18 and C20 of P. graminis f. sp. tritici accounted for 91% of all physiologic races detected in 1968. Stem rust was unusually light in most rust nurseries across Canada except in those in the barberry area of eastern Ontario, where infection was particularly heavy on rye.

Stem rust of oats did not appear in western Canada until the crop neared maturity and losses, therefore, were negligible. Race C10 of Puccinia graminis f. sp. avenae accounted for about 80% of the isolates identified in western Canada and about 20% of those in eastern Canada. In eastern Ontario races C8 and C9, long associated with barberry areas, again predominated, accounting for approximately 64% of the isolates. All three of these races pose a threat to the varieties of oats now grown in Canada.

In contrast to the relatively light infections of the other cereal rusts, development of crown rust of oats in western Canada was the heaviest in recent years. In most years yield reductions from crown rust occurred only if rust developed before the plants headed. In 1968, however, the cool growing season delayed maturity of the crop and provided suitable conditions for development of rust. Therefore, although infection did not usually occur until after heading, appreciable damage was experienced in farm fields, and losses of 20–27 bushels per acre occurred in experimental plots in Manitoba. The predominant physiologic races of Puccinia coronata f. sp. avenae in western Canada differed markedly in virulence from those in eastern Canada. For more information on cereal rusts in Canada in 1968, see articles by Fleischmann, Martens, Green, and Samborski, CPDS 48:99-111.

The unusually frequent rains that occurred in Manitoba in June and July contributed to the most severe outbreak on record of bacterial black chaff of wheat caused by Xanthomonas translucens. In southern Manitoba in late July 100% infection and up to 20% leaf area involvement was found in fields of 'Manitou' spring wheat and up to

50% leaf area in durum. By August 1 the disease was more widespread and yield losses were thought to have been substantial. X. translucens f. sp. undulosa and f. sp. cerealis were involved (see Hagborg, CPDS 8:112).

Estimates of yield loss from disease are often based upon experiments in which diseases are prevented or partially controlled by the repeated application of fungicides. However little information has been published on the effects of the fungicides themselves on yield in the absence of disease. For the results of one such study, with oats, see Martens et al., Can. J. Plant Sci. 48:425-427.

Light frost caused serious damage to early planted sunflower in the Carberry area. Puccinia helianthi and Septoria helianthi affected all fields examined but caused little damage. However moderate to severe infections of Verticillium dahliae were reported in most fields, where the cultivar 'Commander' usually sustained more damage than 'Peredovik'. Rust pustules were also less abundant on 'Peredovik' than on 'Commander'. Head and stalk rot caused by Sclerotinia sclerotiorum were present in all sunflower fields examined, with head rot predominating; the prolonged cool, wet weather favored the continued production and discharge of ascospores, which infected the young heads but apparently not the stalks.

Blackleg, incited by Erwinia atroseptica, was the most prevalent disease of potato and the chief cause of rejection in fields grown for certification. Rhizoctonia solani affected 46% of the stolons of most fields examined in southern Manitoba and severe infection of tubers was observed in most fields in the Morden-Winnipeg areas. Verticillium albo-atrum was isolated from wilted potato plants near Winkler in a field containing approximately 25% affected plants. [illegible] Cephalosporium spp., [illegible] sp., and Volutella sp. were also [illegible] with [illegible] plants. The last three fungi are new records on potato for Manitoba. Freezing temperatures in mid-August caused yield loss in some areas (see Hoes & Zimmer, CPDS 48:153).

Frost damage to flax was conspicuous in the Carberry and Dauphin areas, where yield losses of 5-10% were estimated in several fields. Aster yellows was also widespread in flax, and Melampsora lini was found in many fields in southern Manitoba, where cool wet weather apparently contributed to the development of rust (see Hoes & Kenaschuk, CPDS 48:153).

Most field peas showed general infection by Mycosphaerella pinodes and Pseudomonas pisi. Mycosphaerella blight was rated moderate or severe in 15 of 20 fields examined, and bacterial blight in 13 of 20.

Meloidogyne hapla Chitwood, the northern rootknot nematode, was found in field-grown cucumbers for the first time in Canada, in a field near Winkler. Roots of volunteer plants of flax and other weeds growing in the affected field were also infected; flax represents a new host record for this nematode in Canada (see Zimmer & Walkof, CPDS 48:154).

Dead and dying elms at Winnipeg showed symptoms similar to those of Dutch elm disease, but Ceratocystis ulmi was not detected. The condition in most of the trees examined was attributed to an environmental or physical disturbance. Verticillium dahliae was isolated from 5 of 100 affected trees and V. albo-atrum from one. Black leaf spot caused by Gnomonia ulmea was very common and severe in southeastern Manitoba.

Ontario

In the major winter wheat producing areas of Ontario, winter killing caused appreciable damage only in Middlesex and Simcoe counties. Total winter and spring damage in the 1967 fall-planted crop of 400,000 acres was estimated at about 11%. However the average yield of 42 bushels/acre was second only to the record year of 1966 (44 bu/acre), and, despite a reduction of more than 11% in acreage, the total production was estimated at only 4% below the 1967 level. Wheat spindle streak mosaic was observed in 32 of 35 winter wheat fields examined in Essex Co. and in 35 of 55 fields in Kent Co. The average percentages of plants infected were 52% and 39%. In about one quarter of the fields all plants were infected by the soil-borne virus. Yield loss from the disease was estimated at 10% when all plants were infected. Assuming an average of 50% infected plants in the two counties in 1967 and 1968, losses were about 5% per year or 2.2 bushels per acre (see Gates, CPDS 49:58-59).

Seeding of spring grains was virtually completed by June 1, germination, development and quality of the crops were good to excellent, and record yields for the province were experienced.

In some areas, above-average winter kill was reported in 1967-seeded fields of hay, clover, and alfalfa, but little damage was experienced in established fields. Production was above average, although the quality of the first cutting was affected by adverse weather conditions.

In most areas corn was planted early, but cool wet weather early in the growing season retarded growth and maturity. Record productions of both shelled and fodder corn were experienced on a total acreage of approximately 1.42 million acres (65% shelled corn). Kernel red streak of corn was first described in Ontario in 1964 (CPDS 45:92-93) and has since been found to be widespread and

severe in Essex and Kent counties, but it has not been found as far east as Ottawa. Experiments at Harrow and Ottawa have indicated that the condition was caused by a strain of the eriophyid mite Aceria tulipae that has become adapted to corn in southern Ontario and parts of the mid-western U.S. (see Slykhuis et al., Can. J. Plant Sci. 48:411-418). In 1968 the condition was found in the Harrow-St. Thomas areas, but incidence was much lower than in the previous few seasons. Crazy top incited by Sclerophthora macrospora caused stunting and leaf proliferation of the inflorescences of corn in a number of fields in Essex and Kent counties. This downy mildew has not been reported previously on corn in Canada, although it was apparently observed in one field in Kent Co., Ont., in 1946. The fungus has also been reported from wheat in N.B. In 1968 the disease in corn was clearly associated with flooded portions of fields and was prevalent in similarly affected areas of the U.S. Midwest. Yellow leaf blight of corn incited by Phyllosticta sp. was first detected on corn in 1967 in southwestern Ontario and was more widely distributed in 1968. The pathogen is regarded as a weak parasite that is unlikely to do much damage unless plants are weakened by factors inducing physiological stress and leaves above the ear become infected. Eyespot of corn incited by Kabatiella zeae is also a new record for Canada; it caused little damage in variety trials at St. Thomas and Brantford in 1967 and 1968. For descriptions of crazy top, yellow leaf blight, and eyespot in Ontario, see Gates & Mortimore, CPDS 49:128-131.

Production of flue-cured tobacco, estimated at 205 million lb was second only to the record year of 1966. Quality was good and there were no losses from frost damage. Damping-off was the most common seedbed disease of flue-cured tobacco, and the recommended fungicide treatment was not always effective and was phytotoxic at high concentrations. Cool, wet weather in early spring favored development of black root rot incited by Thielaviopsis basicola in a number of greenhouses where sterilization procedures were not carried out properly, and some farms experienced considerable losses. Alternaria leaf spot was present throughout the tobacco-growing area, but damage was not usually severe. Sore-shin from Rhizoctonia solani infection was more severe than in most seasons, but losses from early-season damage were reduced by replanting. Weather fleck from air pollutants caused severe losses throughout southwestern Ontario, particularly near Lake Erie, where the severity of damage was comparable to that experienced in 1957. The cultivars 'Virginia 115' and 'Delcrest 66' were less severely affected by weather fleck' than 'Hicks Broadleaf' Bell 15', and 'White Gold'

While the total acreage in fruit production decreased slightly in 1968 to 77.9 thousand acres, the value of the principal fruit crops increased by almost 10% to $36.4 million. Compared to 1967 figures, production of the more important fruit crops showed declines for grapes (16%), cherries (38%), and pears (20%) and showed increases for apples (2%), plums (48%), and peaches (32%). The development of the yellow-leaf symptom characteristic of infection by sour cherry yellows virus in sour cherry was favored by a warm pre-bloom period followed by cool post-bloom temperatures in the Niagara Peninsula. Incidence of trees with yellows symptoms was high in most sour cherry orchards in the area. In three 15-yr. old test orchards 2, 11, and 22% of the trees were affected and, of these, 49%, 67%, and 64% showed symptoms for the first time.

This first report in North America of strawberry latent ringspot virus in sweet cherry was based on the serological identification of the virus from a tree at St. Catherines by W.R. Allen.

In the Niagara Peninsula bacterial canker of sweet cherry caused by Pseudomonas sp. has become a serious problem in some orchards. In a 10-year-old orchard of 330 trees 40% were damaged beyond hope of recovery and 70% had slight to moderate cankers affecting the main and secondary branches.

Prunus stem pitting disease, which is causing severe losses in peach orchards in southern Pennsylvania and adjacent states was found in one sour cherry orchard in the Niagara Peninsula in late fall; symptoms were found in five trees, one of which was dead. The disease was not found, however, in any of 250 peach trees examined in 10 orchards in the area.

Peach canker incited by Valsa spp. is widespread in orchards throughout the Niagara Peninsula and constitutes a serious threat to the peach industry in the area.

The vegetable acreages in Ontario reached approximately 121 thousand acres because of increases in acreage planted to processing crops of sweet corn, cucumbers, and green peas. Of the three most important vegetable crops, field tomato acreage and production declined by about 10% from 1967 levels: sweet corn acreage increased by 15% but production rose by only 6.5%. However, a 10% increase in acreage of green peas was accompanied by a 48% increase in production and a 56% increase in farm value. Similarly carrots showed an 80% increase in production on a 12% larger acreage, but the farm value of the crop declined by 50% due to a collapse in price.

A serious outbreak of an early wilt and "rusty root" condition caused extensive damage to carrots in the Bradford Marsh muck soil area north of Toronto. A similar condition was noticed in the same area in 1962 and 1965, but the etiology of the

condition has not been diagnosed nor has a control method been devised (see Fushtey & Filman, CPDS 48:150).

In a survey of market gardens near Ottawa conducted by P.K. Basu, stemphylium leaf spot and early blight incited by Alternaria solani caused severe foliage damage in tomato but fruits were only lightly affected. Plasmodiophora brassicae is established in many fields in the Plantagenet area, where it is a limiting factor in the production of cabbage and other crucifers. Pyfhium-incited damping-off was a problem in onion seedbeds, and severe damage from downy mildew caused by Peronospora destructor resulted in the total loss of a number of fields. Water logging and bacterial soft rot were problems in lettuce in the Cyrville area. Cucumber mosaic virus, Pseudomonas lachrymans and Fusarium [illegible] sporum f. melonis were the most prevalent diseases of cucumber. In one cucumber field near Cyrville an attempt was made to relate the percentage of leaves affected by fusarium wilt to yield. Based on counts made in randomly selected sampling units comprising approximately 5%of the area of each row, it was estimated that 58%of the leaves of the cultivar 'Market-more' were affected by wilt, while only 8.2% of an apparently resistant cultivar showed symptoms of the disease. Yield in bushels of 'Market-more' was only 12% of that of the more resistant cultivar.

Fusarium poae (Pk.) Wr. was identified as a pathogen of peas growing in infested field plots at Ottawa. In root inoculation tests, isolates of the fungus caused severe wilting and necrosis of beans and peas and chlorosis and stunting of soybean. Isolates of Canadian origin also affected barley and corn but not wheat or oats (see Bolton & Nuttall, Can. J. Plant Sci. 48:161-166). Plasmodiophora brassicae and Xanthomonas campestris were the most important pathogens of crucifers in southern Ont. (see Reyes, CPDS 49:56-57).

Xanthomoras phaseoli affected 5 of 21 Foundation plots of field beans in southwestern Ontario. X. phaseoli var. fuscans was absent from Foundation seed but was still prevalent in registered and commercial fields. Sclerotinia sclerotiorum was present in most field examined, but damage was much less severe than in 1967 (see Wallen, CPDS 48:27-28). Widespread damage from bronzing has been reported in white beans in southwestern 'Ontario since 1961. Symptoms of the bronze-colored necrotic stippling of young fully-expanded leaves and pods, followed by chlorosis and abscission, have been described as bronzing, sunscald, russet, and rusting. Controlled studies and field observations have indicated that air-borne oxidants, notably ozone, are responsible for the phytotoxic reaction of beans in this region (see Weaver & Jackson, Can. J. Plant Sci. 48:561-568).

Damage to certain market gardens, hay, and cereal crops as well as to trees and shrubs from air-borne fluoride and sulfur dioxide occurred in the Port Maitland area of Haldimand Co., Ont., the years 1962-67. Testimony and recommendations contained in the report of a public inquiry into the problem pointed out deficiencies in methods of assessing damage from air pollutants in agricultural crops and in providing sound advice to counter rumor. Evidence showed that real economic loss was also suffered by a number of market gardeners outside the area affected by air-borne pollutants, when, because of exaggerated and ill founded publicity, they were unable to sell their produce (see Hall, G.E. [Chairman]. 1968. Report of the committee appointed to inquire into and report upon the pollution of air, soil, and water in the townships of Dunn, Moulton, and Sherbrooke, Haldimand County. Frank Fogg, Queen's Printer for Ontario, Toronto. 355 p.).

A minor extension of the. known distribution of Dutch elm disease was made with the discovery of infected trees on St. Joseph Island, just north of the international boundary in the south-central part of the Sault Ste. Marie District. Incidence of the disease was particularly high in those areas where damage from Ceratocystis ulmi was recognized prior to 1961. In these areas, viz. the districts of Kemptville, Tweed, Lindsay, Lake Simcoe, Lake Huron, and Lake Erie, and most of the Pembroke District and the southern half of the Parry Sound District, the average incidence of the disease was 54% and mortality 15%.

Incidence of Gymnosporangium juniperi-virginianae was high on leaves and fruits of apple in southeastern Ontario. Field observations in eastern Ont. have indicated that air-borne basidiospores produced on Juniperus virginiana have an effective range of at least 15 miles, about twice the distance of previous estimates (see Parmelee CPDS 48:150-151). In southern Ontario roadside trees, particularly sugar maples, continued to decline, and roadside plantings of most species of pine also showed heavy dieback and mortality in numerous locations in Ontario.

Quebec

Low soil moisture levels and below normal precipitation delayed early growth in the spring and many pastures suffered from drought. Rainy weather and cool temperatues followed in June, when frost damage occurred in field crops and small fruits in the Gaspe-Lower St. Lawrence and Abitibi-Temiscamingue regions. Quality and yields of all crops varied greatly across the province; drought conditons continued in the Quebec and Lake St. John districts, but most areas received

abundant rainfall throughout the remainder of the growing season. Yields of vegetables, small fruits, and apples were generally satisfactory.

Unusually heavy rainfall in July was associated with the widespread and relatively severe incidence of carrot blights caused by Alternaria dauci and Cercospora carotae in all fields examined in the muck soil area south of Montreal. Botrytis leaf speck and purple blotch caused by Alternaria porri were also common on onion. The occurrence of leaf speck symptoms without the subsequent development of leaf blight suggested that Botrytis cinerea was the dominant pathogen in onion in 1968, whereas the extensive blighting associated with leaf speck in this area in 1967 was characteristic of infection by B. squamosa. Drop, incited by Sclerotinia sclerotiorum, and aster yellows affected most field of lettuce examined in the area. Late blight was extensive and severe in early crops of potatoes examined in early August but was less severe in later varieties (see Simard et al., CPDS 48:124-127).

Bacterial ring rot, incited by Corynebacterium sepedonicum, continued to increase in prevalence in potato (9.5% of fields inspected). Mosaic was the second most important cause of rejection in Quebec potato fields; the increase in prevalence was probably due to a late infestation of aphids in 1967. Early blight and blackleg each affected about 45% of 703 fields inspected. Rhizoctonia solani affected 15% of the fields. an increase over 1967 but less than in 1966. Late blight affected only 5% of fields compared with 29% in 1967; infection was widespread late in the season but caused little damage. Tuber losses of 5-10% occurred in unsprayed fields, and tuber rot was found in 20% of the bins inspected. Storage rot from Fusarium coeruleum destroyed about 90% of 4 carlots of 'Superior' potatoes shipped from New Brunswick in late 1968.

The results of tests reported in 1968 indicated that two races of Pseudomonas phaseolicola were responsible for an epiphytotic of halo blight in beans (Phaseolus vulgaris) in the Ste. Martine area of Quebec in 1966. Of the pathogenic isolates, 87% were of race 2, the remainder of race 1. The source of inoculum was evidently infected Idaho-grown seed (see Wallen, CPDS 48:97-98).

Yellowing, reddening, and stunting of oats, resembling symptoms of P and K deficiency were widespread in eight counties. Blast was severe in parts of Kamouraska Co.

Moderate to severe damage to strawberry plantations from late frost occurred generally throughout the lower St. Lawrence region. Green petal was again prevalent in strawberry plantings in Bellechasse Co., where infection was generally light (5-10%) in first-year plantings, but was more damaging (up to 100% infection) in older plantations. Late-spring frosts caused 20-80% loss in a few fields in Kamouraska Co.

Dutch elm disease is found throughout the range of white elm in Quebec, except in the Abitibi Region and the Gaspe Peninsula; no change in its distribution in Que. was observed in 1968.

Severe damage to 'Quint' apples from infection by Gymnosporangium juniperi-virginianae occurred in Kamouraska Co.

New Brunswick

Dutch elm disease was found at 12 new locations in 1968. Within the known range of the disease in the province about 14% of the trees examined showed symptoms. At Fredericton, since the disease was first found in 1961, an average of 9 trees per year have been located and removed, but in 1968 33 were removed. As of 1968, the disease was not known to occur in N.S. or P.E.I.

Nova Scotia

In Kings Co., Gloeosporium album canker killed a number of 1-yr-old 'King' apple trees, and dieback from coral canker caused by Nectria cinnabarina affected several orchards of 'Spy' and 'McIntosh' apples. Dieback and cankering are becoming increasingly important in N.S., where a number of varieties, but particularly 'McIntosh', are affected.

New infections of bacterial canker incited by Pseudomonas mors-prunorum have not been reported for 2 years in N.S., and most of the infected sweet cherry trees in the two orchards in Kings Co. where the pathogen was first found in 1965 have died. Shot hole caused by Higginsia hiemalis was generally light in cherry orchards in the Annapolis Valley but defoliation of 5% of a 10-acre block of sour cherry trees occurred at Bear River.

Botrytis cinerea fruit rot, powdery mildew, and leaf spot diseases caused by a number of fungi were prevalent in strawberry plantations, but red stele incited by Phytophthora fragariae was not found in commercial plantings. However a severe epiphytotic of red stele occurred at the CDA Research Station., Kentville. In field trials, the most widely grown cultivars 'Redcoat' and 'Sparkle' showed no resistance to the disease. However, the USDA introduction 'Sunrise' and the CDA introduction 'Guardsman' showed some tolerance to the races of P. fragariae present in the field at Kentville (see Gourley & Graig, CPDS 48:93-94). Root rot, involving a complex of causal agents, and the nematode Pratylenchus penetrans reduced one stand at Kentville by 50%.

Losses to strawberry plants in cold storage were negligible during the 1967–68 storage period. Losses of 0 to 1.1% were recorded in the same storages in which severe losses of up to 26% from Typhula sp. were experienced in 1966–67. The improvement in control of mold in 1968 was attributed to adequate spacing of crates and rapid cooling of the plants to -1.1C within 15 days of being placed in storage (see Lockhart, CPDS 48:128-129).

In cranberry bogs at Aylesford, Diaporthe vaccinii fruit rot caused 14% damage and speckle, incited by Guignardia vaccinii & Gibbera compacta, about

Up to 35% of carrot plants in fields in Cumberland Co. were affected by aster yellows, but incidence was much less in King's Co., where insecticides were applied for control of leafhoppers. Reddish brown spots or blotches of unknown etiology affected carrot roots grown in mineral soils in Kings Co.; lesions penetrated the tissues to a depth of 1/8 inch.

Crater rot incited by Rhizoctonia solani and brown heart caused by boron deficiency affected a number of fields of rutabaga. The dry weather in July and August was thought to have contributed to the development of brown heart. Septoria cucurbitacearum affected all plants severely in fields of squash that had been planted to this crop continually for several years.

Cob rot associated with an unidentified bacterium affected sweet corn in two areas; infection occurred at the base of the cob, gradually spreading up the sheath; affected kernels retained their shape, turned white and became filled with a milky white bacterial suspension.

Corynebacterium michiganense caused moderate losses from bacterial canker in several greenhouses; the pathogen was believed to have been introduced in infected seed.

Fusarium wilt of peas was less prominent in the Kentville area, following severe damage in 1967.

Seedling blight caused by Cochliobolus sativus affected 54% of plants in one field of 'Herta' barley in Kings Co. and 10% of plants in test plots at the Sheffield Farm. In test plots powdery mildew affected all plants of 'Gaines' winter wheat and 'Selkirk' spring wheat. Pseudomonas sp. caused severe damage to oats at several locations where symptoms resembled those of bacterial stripe incited by Ps. striafaciens.

Prince Edward Island

Although January and February were colder than normal, snow cover prevented sufficient frost penetration to kill all potato tubers overwintering in the soil, and consequently volunteer plants were a problem in many seed potato fields. Cool weather in May and June retarded growth, and a frost in early June severely set back most crops of 'Irish Cobbler'. Heavy rains in June provided adequate moisture for later crops despite a very warm, dry July. Precipitation, 0.48 inches, was the lowest on record for the month. Total precipitation from May to September was about 2.3 inches below normal and about 9 inches less than in 1967.

The cool weather early in the season provided conditions favorable for development of Rhizoctonia solani, which was more prevalent than usual in the growing crop, and black scurf was very common on the tubers, especially in the fields that were topkilled early and left for several weeks before harvest. Because of the generally dry season, common scab incited by Streptomyces scabies was more prevalent than usual and caused severe damage in a number of fields. Late blight, caused by Phytophthora infestans, was virtually absent throughout the season. Blackleg, caused by Erwinia atroseptica, and spindle tuber were the two chief causes of crop rejection. The incidence of blackleg showed a considerable decrease from 1967, but. the prevalence of spindle tuber, mosaic, leaf roll, and verticillium wilt increased. Because of the warm dry soil conditions during the latter part of the season, it was expected that fusarium storage rot might be a problem in some lots of potatoes, especially those from lighter soils.

Newfoundland

Mastigosporium rubricosum occurred generally on Dactylis glomerata at the Research Station, St. John's, a new report for Newfoundland. Powdery mildew also affected wheatgrass, and moderate levels of Selenophoma donacis var. stomaticola occurred in timothy at the Station. Pink snow mold incited by Fusarium nivale affected 2–5% of the grass on golf greens at St. John's. Leaf scald caused by Rhynchosporium orthosporum affected all canary grass plants examined at the Research Station; 10–15% of the leaf area was affected; this is a new report to the CPDS of this pathogen on Phalaris. Gymnosporangium sp. severely affected juneberry (Amelanchier sp.) in the St. John's area; 50-80% of the fruit and 50% of the leaves were affected.

Acknowledgments

The cooperation of plant pathologists and other specialists in providing the information summarized here is gratefully acknowledged. H.N.W. Toms, M.F. Welsh, F.R. Harper, R.D. Ledingham, T. R. Davidson, J. Santerre, and C.O. Gourley compiled many of the reports from cooperators in their respective areas.