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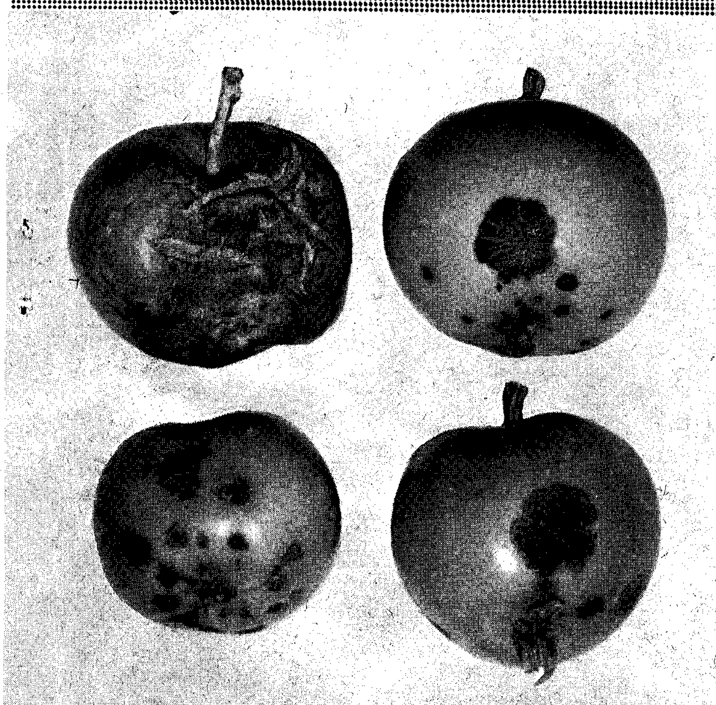
Canadian Plant Disease Survey

Compiled and Edited by D. W. Creelman



PLANT RESEARCH INSTITUTE
RESEARCH BRANCH
Canada Department of Agriculture

CANADIAN PLANT DISEASE SURVEY

Volume 42 December, 1962 Number 4

CONTENTS

SCREENING OF POTATO FUNGICIDES IN 1962[1]

L. C. Callbeck[2]

The fungicides listed below were compared for efficiency in controlling potato late blight, Phytophthora infestans (Mont.) de Bary, in the Screening Test at Charlottetown in 1962.

1. Aarado-Supra -- Copper oxycarbonate.
   Source: Imported from Europe by Green Cross Products, Montreal.
   Concentration: 2.5 pounds/80 Imperial gallons.

2. Delan-Copper -- Dithianon and copper oxychloride.
   Source: E. Merk, Darmstadt, Germany.
   Concentration: 2/3 quarts/80 gal.

3. Difolatan -- N-(1,1,2,2-tetrachloroethylsulfenyl)-cis-Δ-cyclohexene-1,2-dicarboximide.
   Source: California Chemical Company, Richmond, Calif., U.S.A.
   Concentration: 1.0 pound/80 gal.

4. Dithane A-40 -- Nabam powder + zinc sulphate.
   Source: Rohm and Haas Company of Canada, Limited, West Hill, Ont.
   Concentration: 1.0 pound + 1.5 pounds/80 gal.

5. Dithane M-45 -- Zinc ion and maneb. Mn, 16%; Zn, 2%.
   Source: Rohm and Haas Company of Canada, Limited, West Hill, Ont.
   Concentration: 1.0 pound/80 gal.

6. EPS 203/1 -- A copper product (confidential).
   Source: Fisons Pest Control Limited, Chesterford Park Research Station, nr. Saffron Walden, Essex, England.
   Concentration: 4.0 pounds/80 gal.

7. F 328 -- 3,3^1-ethylenebis (tetrahydro-4,6-dimethyl-2H-1,3,5-thiadiazine-2-thione.
   Source: DuPont of Canada Limited. Montreal, P.Q.
   Concentration: 1.0 pound/80 gal.

8. Manzate + Thylate -- Maneb + thiram.
   Source: DuPont of Canada Limited, Montreal, P.Q.
   Concentration: 0.75 + 0.75 pounds/80 gal.

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[1] Contribution No. 116, Experimental Farm, Research Branch, Canada Department of Agriculture, Charlottetown, Prince Edward Island.

[2] Plant Pathologist.

9. MCOM -- 35% maneb; 25% Cu as copper oxychloride; 0.3% Hg as phenyl mercury chloride.
   Source: Green Cross Products, Montreal.
   Concentration: 2.5 pounds/80 gal.

10. Miller 658 -- Copper-zinc-chromate. Cu, 29.6%; Zn, 20.4%; Cr, 9.7%.
    Source: Miller Chemical and Fertilizer Corporation, Baltimore, Md. U.S.A.
    Concentration: 1.5 pounds/80 gal.

11. Polyram-Combi -- Zinc activated polyethylene thirame disulphide.
    Source: A German product introduced by Niagara Brand Chemicals, Burlington, Ont.
    Concentration: 1.0 pound/80 gal.

12. TD 225 -- A confidential product.
    Source: Pennsalt Chemicals of Canada Limited, Vancouver, B.C.
    Concentration: 0.4 pints/80 gal.

13. Bordeaux mixture, 8-4-80. Included annually as a standard treatment.

The plots were planted by hand on June 5, exactly 50 Green Mountain seed pieces being dropped in each 50-foot row. Each plot was 4 rows wide x 50 feet long and 14 plots (one for each treatment and an unsprayed control) were laid out in each of 4 ranges. Single rows of potatoes were planted as borders and buffers. All data were taken from the two center rows.

The treatments were applied with a tractor-sprayer unit which delivered approximately 120 gallons per acre at a pressure of 375 pounds per square inch. The nozzles were so arranged on the boom that each row received a 4-nozzle application, 2 nozzles being directly over the plants and 2 being on drop pipes. Insects were controlled by spraying all rows with Thiodan, three treatments being applied during the season.

The fungicides were applied on July 19, 28, August 6, 14, 21, 28, September 4, 10. Thus 8 treatments were given, the mean interval being 7.6 days. On September 21 the experiment was terminated by spraying the plants with the top killer Reglone. The tubers were harvested, graded, examined for blight rot, and weighed on October 4 and 5.

The 1962 test of fungicides was carried out under extremely severe disease conditions, the weather being almost constantly favourable to the development and spread of *Phytophthora infestans*. During the July-September period a measurable amount of rain fell on 44 days to give a total of 16.38 inches. In addition, there were eleven days in which trace amounts were observed. This precipitation was exceeded but once in this area, the July-September period of 1942 having had about 4 inches more. However, July and August of 1942 were not so wet as the same months in 1962, September of the earlier year showing a fall of over 12 inches of which 2.53 inches and 6.45 inches fell on the 21st and 22nd of the month.

The 1962 season was also very humid, the lowest mean weekly relative humidity being 81.4 per cent. There were three weeks in which the mean relative humidities were over 90 per cent, the highest being the week of July 8-14 which showed a mean of 95.1 per cent. The mean for the three-month period was 86.4 per cent or considerably higher than normal.

Because of the frequent rains it was impossible to make applications of fungicides on a regular schedule and no time table could be set up and adhered to. It is probable, too, that the rains played a major role in the performances of the fungicides, those with poor adhesive ability being washed from the foliage at the greatest rate.

The following examples will illustrate the manner in which rains interfered with spray applications. The third spray, applied on August 6, was followed by recorded precipitations on August 7, 8, 9, 10, 11, (12th, a trace), 13, a total of 2.11 inches. It was fine in the morning of August 14 and the fourth application was made; but later in the day clouds moved in and a 0.51 inch fall occurred. A rain of 2.10 inches was recorded for August 20 and the fifth application was postponed until the 21st, the morning of that day being sunny and dry. However, a 0.35 inch rain came in the afternoon. The treatments applied on August 28 were followed by a total of 0.63 inches of rain on August 29 and 30. Four days of rain (1.86 inches) followed the last application which was made on September 10.

The first blight lesions were found in some of the unsprayed border and buffer rows near the end of July and on August 1 the disease was present in all these rows and in the control plots. The plants in these rows and plots were completely defoliated at the beginning of September.

The rapid build-up of late blight on the untreated plants, the long periods of abundant sporulation, and the frequently wet condition of the plants provided an extremely severe test for the fungicides. The result was that all sprayed plots became infected. Under these conditions, the worst in many years, some fungicides did rather well.

Defoliation readings were taken at regular intervals, and mean defoliations, expressed as percentages, are given for selected dates in Table 1. Data on yield and tuber rot are presented in Table 2.

Table 1 - Percentage of defoliation.

Treatment	Aug. 24	Sept. 4	Sept. 12	Sept. 17
Dithane M-45	3	12	15	20
Manzate + Thylate	5	19	22	30
Dithane A-40	5	20	22	30
F 328	4	19	23	30
Difolatan	7	27	47	55
Polyram-Combi	9	29	40	55
EPS 203/1	8	31	44	60
MCOM	7	32	42	60
Bordeaux	8	30	39	65
Delan-Copper	7	37	52	75
Aarado-Supra	9	42	55	85
Miller 658	12	46	64	90
TD 225	33	93	100	100
Check	70	100	100	100

Table 2 - Effect of treatments on yield and rot.

Treatment	Total bu/ac	Smalls bu/ac	Rot bu/ac	No. 1 bu/ac	% Rot
Dithane M-45	390.0	42.3	18.2	329.5	4.7
Dithane A-40	385.2	35.4	33.0	316.8	8.5
Manzate + Thylate	354.8	49.0	25.3	280.5	7.2
F 328	349.3	39.6	44.0	265.7	12.6
Difolatan	311.4	51.2	13.8	246.4	4.4
Bordeaux	317.7	57.9	15.6	244.2	4.9
MCOM	320.1	54.4	40.2	225.5	12.6
Polyram-Combi.	309.1	39.9	49.5	221.7	16.0
Delan-Copper	302.0	54.5	28.6	218.9	9.5
EPS 203/1	301.4	50.0	38.5	212.9	12.8
Aarado-Supra	269.0	47.3	30.8	190.9	11.4
Miller 658	261.3	50.1	31.9	179.3	12.2
TD 225	166.1	61.0	22.6	82.5	13.6
Check	162.6	58.8	26.2	77.6	16.1
S.D. 5%	33.6			40.5	6.3
S.D. 1%	45.0			54.2	8.4

EXPERIMENTAL FARM, CANADA AGRICULTURE, CHARLOTTETOWN, P.E.I.

CO-OPERATIVE SEED TREATMENT TRIALS -- 1962[1/]

J.E. Machacek and H.A.H. Wallace[2/]

Abstract

Thirty seed treatments were tested in 1962 against common bunt of wheat (mixed *Tilletia foetida* (Wallr.) Liro and *T. caries* (DC.) Tul.), oat smut (mixed *Ustilago avenae* (Pers.) Rostr. and *U. kolleri* Wille), covered smut of barley (*U. hordei* (Pers.) Lagerh.) and against seed rot of flax caused by a complex of soil-borne and seed-borne microorganisms. Three of the treatments were later set aside for the time being, as it appeared that the lot of wheat seed used was too sensitive to their action. As in several previous years, most of the materials received for testing were organic mercury compounds and about two thirds of them were liquids.

Materials and Methods

Kinds of seed used in trials

Wheat bunt trials	- Variety Red Bobs. Seed artificially contaminated (1:200, by weight) with mixed spores of *Tilletia tritici* and *T. foetida*.
Oat smut trials	- Variety Vanguard. Seed naturally contaminated by mixed loose and covered smut.
Barley smut trials	- Variety Plush. Seed naturally contaminated by covered smut.
Flax seed-rot trials	- Variety Redwood. About 40% of seed cracked during threshing.

Treatment No.	Descriptions of Products
1	Control - seed not treated.
2	A powder containing 3% mercury as methyl mercury pentachlorophenolate. Obtained from Green Cross Insecticides, Winnipeg, Man.

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[1] Contribution No. 127 from the Canada Department of Agriculture Research Station, Winnipeg, Manitoba.

[2] Principal Plant Pathologist and Associate Plant Pathologist, respectively, Plant Pathology Laboratory.

Treatment No.	Descriptions of Products
3	A powder containing 40% aldrin and 2% mercury as mixed phenyl mercury acetate and ethyl mercury chloride. Obtained from Allied Chemical Services, Calgary, Alberta.
4	A powder containing 3.2% mercury as ethyl mercury p-toluene sulfonanilide. Obtained from I.E. duPont de Nemours, Wilmington, Delaware.
5	A powder containing 50% tetrachlorotetrahydrothiophene dioxide. Obtained from Diamond Alkali Company, Gainesville, Ohio.
6	A powder containing 75% tetrachlorotetrahydrothiophene dioxide. Obtained from Diamond Alkali Company, Gainesville, Ohio.
7	A powder containing 70% p-dimethyl amino benzene diazosodium sulfonate. Obtained from Chemagro Corporation, Kansas City, Mo.
8	A powder containing 4.5% mercury as phenyl mercury urea. Obtained from Leytosan (Canada) Ltd., Winnipeg, Manitoba.
9	A powder containing 50% of 5-chloro-4-phenyl-1, 2-dithion-3-one. Obtained from Green Cross Insecticies, Winnipeg, Manitoba.
10	A liquid containing 1.5% mercury as methyl mercury dicyandiamide. Obtained from Chipman Chemicals Ltd., Winnipeg, Manitoba.
11	A liquid containing 1.5% mercury as methyl mercury benzoate. Obtained from N.V. Aagrunol Chemical Works, Groningen, Holland.
12	A liquid containing 1.75% mercury as methyl mercury benzoate. Obtained from N.V. Aagrunol Chemical Works, Groningen, Holland.
13	A liquid containing 2.35% mercury as mixed methyl mercury 2, 3 dihydroxypropyl mercaptide and methyl mercury acetate. Obtained from I.E. duPont de Nemours, Wilmington, Delaware.

Treatment No.	Descriptions of Products
14	A liquid containing 4.70% mercury as mixed methyl mercury 2, 3 dihydroxypropyl mercaptide and methyl mercury acetate. Obtained from I.E. duPont de Nemours, Wilmington, Delaware.
15	A liquid containing 6.0% sodium ethyl mercury salicylate. Obtained from Eli Lilly Co., Indianapolis, Indiana.
16	A liquid containing 30% aldrin and 1.43% mercury as phenyl mercury acetate. Obtained from Gallowhur Chemical Canada Ltd., Montreal, Quebec.
17	A liquid containing 3.58% mercury as phenyl mercury acetate. Obtained from Gallowhur Chemical Canada Ltd., Montreal, Quebec.
18	A liquid containing 18.6% heptachlor and 7.39% pentachloronitrobenzene. Obtained from Green Cross Insecticides, Winnipeg, Manitoba.
19	A liquid containing 25.3% heptachlor and 0.36% mercury as methyl mercury 8-hydroxyquinolinate. Obtained from Green Cross Insecticides, Winnipeg, Manitoba.
20	A liquid containing 1.5% of methyl mercury benzoate. Obtained from Green Cross Insecticides, Winnipeg, Manitoba.
21	A liquid containing 2.0 lbs. heptachlor per Imp. Gal. and 0.4% mercury as methyl mercury dicyandiamide. Obtained from Chipman Chemicals, Winnipeg, Manitoba.
22	A liquid containing 4.2% mercury as phenyl mercury acetate. Obtained from Nuodex Products of Canada, Toronto, Ontario.
23	A liquid containing 1.25% mercury as methyl mercury 8-hydroxyquinolinate. Obtained from Ortho Agricultural Chemicals, Vancouver, B.C.
24	A liquid containing 4.2% mercury as methyl mercury 8-hydroxyquinolinate. Obtained from Ortho Agricultural Chemicals, Vancouver, B.C.

Treatment No.	Descriptions of Products
25	A liquid containing 1.5% mercury as methyl mercury dicyandiamide. Obtained from Morton Chemical Company, Woodstock, Illinois.
26	A liquid containing 25% heptachlor and .37% mercury as methyl mercury dicyandiamide. Obtained from Morton Chemical Company, Woodstock, Illinois.
27	A liquid containing 1.25% mercury as methyl mercury 8-hydroxyquinolinate. Obtained from the Shell Oil Company of Canada, Toronto, Ontario.

Experimental Results

The field data collected in 1962 are summarized in Table 1. They show that for wheat, DAC-649 WP 75, Hercules 3944, and Liquid Dual Purpose Bunt-No-More gave inadequate control of bunt. One product, DAC- 649 WP 50, gave only moderate control of this disease. In oats and barley, all products except two, Dexon 70% WP and Liquid Dual Purpose Bunt-No-More, gave satisfactory control of smut. In flax, there was a variable response to treatment, eleven products giving satisfactory control of seed rot, eight giving moderate control, and seven unsatisfactory control. In this trial with flax the germination was considered satisfactory when it exceeded 68.3%, moderately satisfactory within the range 64.5 to 68.2%, and unsatisfactory below 64.5%.

Table I. Co-operative Seed Treatment Trials - 1962 (Summary of data from 5 stations for wheat, 10 stations for oats, 11 stations for barley, and 10 stations for flax)

Treat-ment No.	Abbreviated name for seed dressing	Dose (oz./bu.)				Smut (%)			Germination (%)
		Wheat	Oats	Barley	Flax	Wheat	Oats	Barley	Flax
1	Check (dry, untreated seed)	0.00	0.00	0.00	0.00	11.0	10.6	17.1	59.8
2	Aagrunol 473	0.50	0.50	0.50	1.50	0.1	0.1	0.1	66.6
3	ACS AM Dual Purpose Seed Dressing	2.00	1.40	1.40	5.00	0.6	0.1	0.1	68.5
4	Ceresan M	0.50	0.50	0.50	1.50	0.1	0.0	0.3	66.8
5	DAC-649 WP 50	0.50	0.50	0.50	1.50	2.5	0.1	0.2	54.6
6	DAC-649 WP 75	0.50	0.50	0.50	1.50	3.5	0.1	0.1	53.6
7	Dexon 70% WP	1.00	1.00	1.00	1.00	0.0	5.0	13.6	68.2
8	Half-ounce Leytosan	0.50	0.50	0.50	1.50	0.2	1.0	0.2	67.7
9	Hercules 3944	0.50	0.50	0.50	1.50	5.7	0.2	0.5	51.5
10	Agrosol (1962)	0.75	0.75	0.75	1.50	0.0	0.0	0.1	69.8
11	Aagrunol LSV 150	0.75	0.75	0.75	1.50	0.0	0.0	0.0	69.8
12	Aagrunol LS 175	0.75	0.75	0.75	1.50	0.0	0.0	0.0	68.6
13	Ceresan PL	0.50	0.50	0.50	1.50	0.0	0.0	0.1	71.2
14	Ceresan 2 PL	0.25	0.25	0.25	0.75	0.0	0.1	0.2	71.4
15	Elcide 70	0.75	0.75	0.75	1.50	0.1	0.6	0.2	71.1
16	Gallodual	2.66	1.90	1.90	6.66	0.2	2.7	0.2	56.2
17	Gallotox	0.75	0.75	0.75	1.50	0.0	2.3	0.1	68.6
18	Liquid Dual Purpose Bunt-No-More	2.66	1.90	1.90	6.66	5.5	7.8	17.0	54.6
19	Liquid Merlane	2.66	1.90	1.90	6.66	0.1	0.2	0.5	58.8
20	Liquid Mercury	0.75	0.75	0.75	1.50	0.0	0.0	0.0	72.1
21	Liquid Mergamma	3.00	1.88	1.88	7.50	0.1	0.0	0.1	60.4
22	Nuodex 65	0.75	0.75	0.75	0.50	.1	3.5	0.5	67.8
23	Ortho LM Seed Protectant	0.75	0.75	0.75	1.50	0.0	0.0	0.0	70.2
24	Ortho LM Seed Protectant Concentrate	0.25	0.25	0.25	0.75	1.3	2.2	1.0	66.6
25	Panogen 15	0.75	0.75	0.75	1.50	0.0	0.0	0.1	71.7
26	Pandrinox	2.12	2.12	2.12	4.00	0.1	0.0	0.0	65.3
27	Shell Liquid Mercury	0.75	0.75	0.75	1.50	.1	0.0	0.0	67.9
	Least significant difference (5%)					1.6	4.8	3.4	3.8

Acknowledgments

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STORAGE OF TREATED MOIST GRAIN[1]

W.P. Campbell[2]

The storage of chemically treated moist seed grain is of considerable concern when seed is cleaned and treated at commercial plants because the need for spreading the work load over several months necessitates long storage periods for some of the treated grain. Also treated grain cannot be marketed or fed to livestock so must be held over until the next planting season, one year hence. In years when the harvest season is wet, the seed is often tough, if not damp, when it is placed in storage.

The literature is somewhat contradictory. Some reports state that certain mercurial seed dressings protect moist grain in storage from damage by storage molds, and there are other reports of phytotoxicity under similar conditions. Most of the independent studies have been done in Sweden, where workers seem to be reconsidering their original theories on phytotoxicity. Gadd (2) suggested that the damage resulting from mercurial seed dressings may be due to a failure on the part of the chemicals to kill all of the Penicillium spores, thus permitting the fungus to recolonize as the effect of the treatment diminishes during storage. He also found evidence of phytotoxicity characterized by the seedling symptoms typical of mercury poisoning with overdoses of the dressing at high moisture levels. Roth (4, 5) and Ebner (1) found that large overdoses of mercury were phytotoxic to barley and sugar beets and that, at high moisture levels, the mercurials were ineffective against certain organisms, chiefly Penicillium and Aspergillus spp. Gadd(2) found that tetramethylthiuramdisulfide was much more effective than mercury against these molds, and that when added to the mercury compounds it gave good protection under moist conditions. However, there are many papers that disclaim that mercurial seed dressings are phytotoxic or fail to protect seed at high moisture levels.

Because of the contradictions in the literature, and because we were asked to make recommendations, it was decided to investigate the problem under our local conditions.

Materials and Methods

In April, 1960 two mercurial seed dressings, methoxyethyl mercury acetate (MEMA) and methyl mercury dicyandiamide (Panogen 15), were chosen for tests involving Thatcher wheat, Rodney oats and Husky barley. The seed used was Registered No. 1 from the 1959 crop. The grain was treated in one bushel lots and then divided into 1,000 gram samples. The barley originally contained 11.0% moisture and the wheat and oats 13.1% each. Samples of barley were adjusted to 13.1, 14.5, 16.0

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[1] Contribution No. 117 from the Plant Pathology Laboratory, Research Branch, Canada Department of Agriculture, Edmonton, Canada.

[2] Present Address: Scientific Information Section, Research Branch, Canada Department of Agriculture, Ottawa, Canada.

and 18.0% moisture by the addition of distilled water and samples of oats and wheat were similarly adjusted to 14.5, 16.0 and 18.0% moisture. After storage for several days in sealed flasks to allow the water to become evenly distributed through the seed the moisture levels were determined with a moisture meter used by the Board of Grain Commissioners Inspection Office, Edmonton (Canadian aviation electronics (Halross)). Two hundred grams were then withdrawn from each flask and placed in sealed glass containers at 2°C. The main lots were stored at 15°C. No further moisture determinations were made.

After the moisture levels of the grain were adjusted, samples were planted in soil in the greenhouse and the percentage emergence was recorded two weeks after planting. Samples of the material stored at 15°C were withdrawn and planted every two weeks for two years. The samples stored at 2°C were planted every three months.

Results

After storage at 2°C for two years, none of the seed had deteriorated appreciably regardless of treatment or moisture level; nor was there any evidence of an increase in the fungal flora during this period.

Barley stored at 15°C (Plate 1) and treated with Panogen did not exhibit any signs of damage until 35 weeks after treatment and then only in the sample containing 18% moisture. The seed in this sample was completely dead by the 80th week. The lot containing 16% moisture did not store as well as the dry grain (13.1% and 14.5% moisture) but was still about 80% germinable after two years. The dry samples germinated as well two years after treatment as they did when the fungicide was first applied. The treatment with Mema gave essentially the same results. The untreated sample with 18% moisture did not deteriorate quite as rapidly as the treated ones but the difference was not significant from the practical standpoint.

At the 18% moisture level germinability of oats (Plate 2) in both treatments and in the untreated control, began to decrease 10 to 12 weeks after application of the chemicals and within 80 weeks the seed in all three samples were dead. The treated samples with 16% moisture began to show signs of damage after 45 weeks whereas the control sample began to deteriorate after 25 weeks. At the end of two years all three lots showed 20 to 30% germination. The dry samples, whether treated or not, did not exhibit any loss of viability within two years.

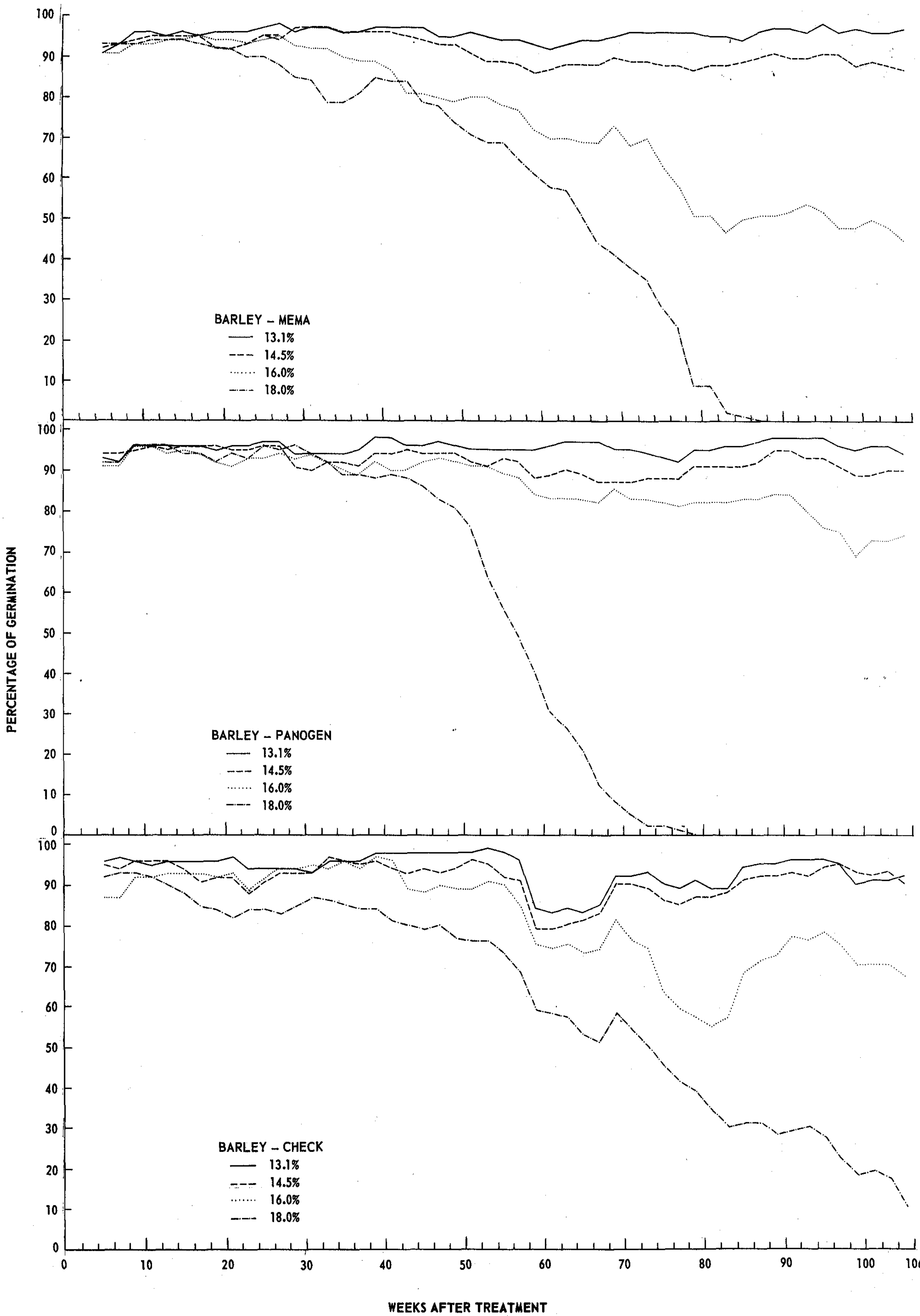
Legend

Plate 1- Percentage germination of barley at 2-week intervals following treatment. *

Plate 2- Percentage germination of oats at 2-week intervals following treatment. *

Plate 3- Percentage germination of wheat at 2-week intervals following treatment. *

* Top graph is for samples treated with "Mema" center graph is for samples treated with "Panogen" and the bottom graph is for untreated seed.


BARLEY - MEMA
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14.5%
16.0%
18.0%
BARLEY - PANOGEN
13.1%
14.5%
16.0%
18.0%
BARLEY - CHECK
13.1%
14.5%
16.0%
18.0%
PERCENTAGE OF GERMINATION
WEEKS AFTER TREATMENT
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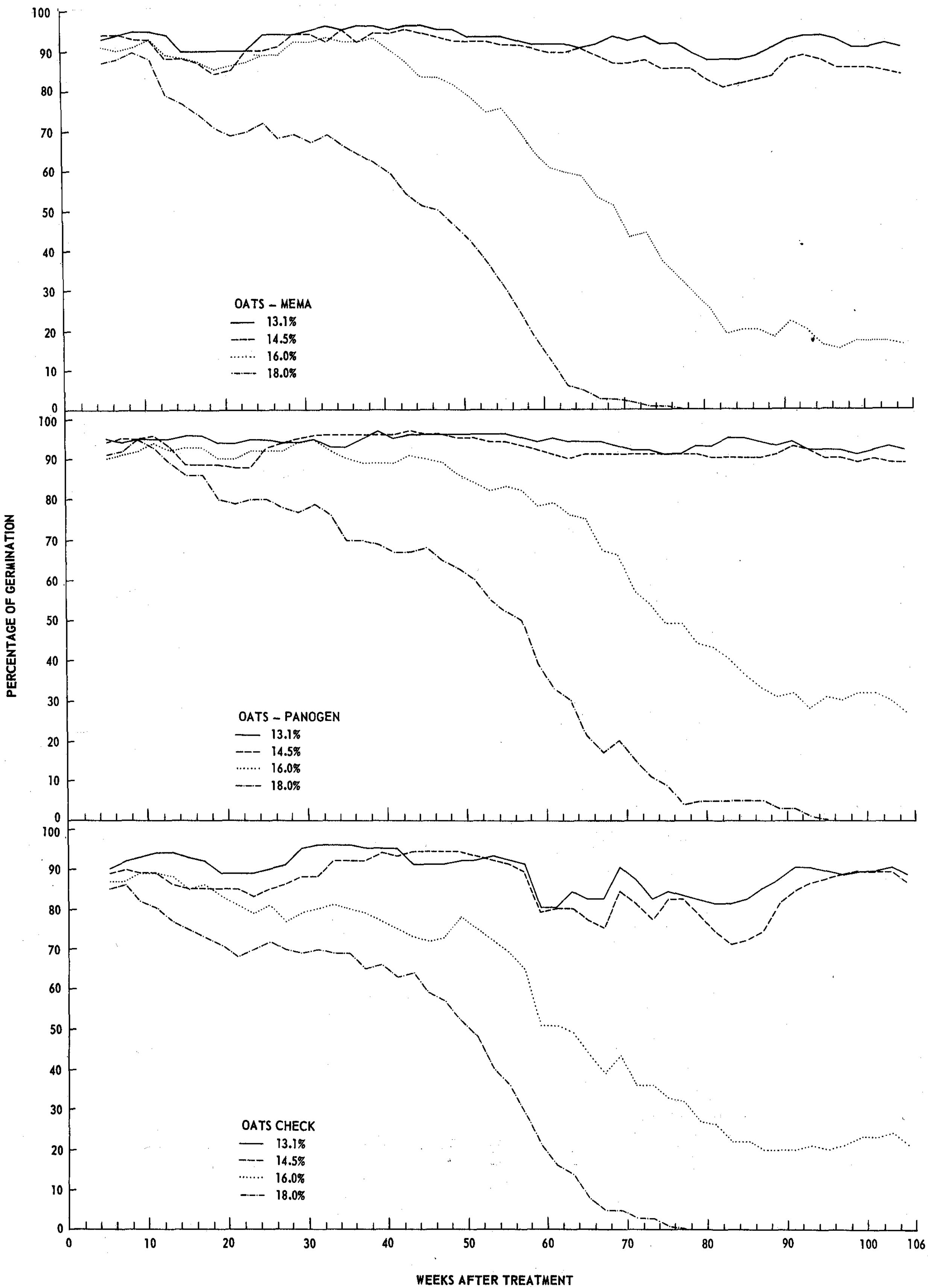
0 10 20 30 40 50 60 70 80 90 100


OATS – MEMA
13.1%
14.5%
16.0%
18.0%
OATS – PANOGEN
13.1%
14.5%
16.0%
18.0%
OATS CHECK
13.1%
14.5%
16.0%
18.0%
PERCENTAGE OF GERMINATION
WEEKS AFTER TREATMENT
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80
90
100
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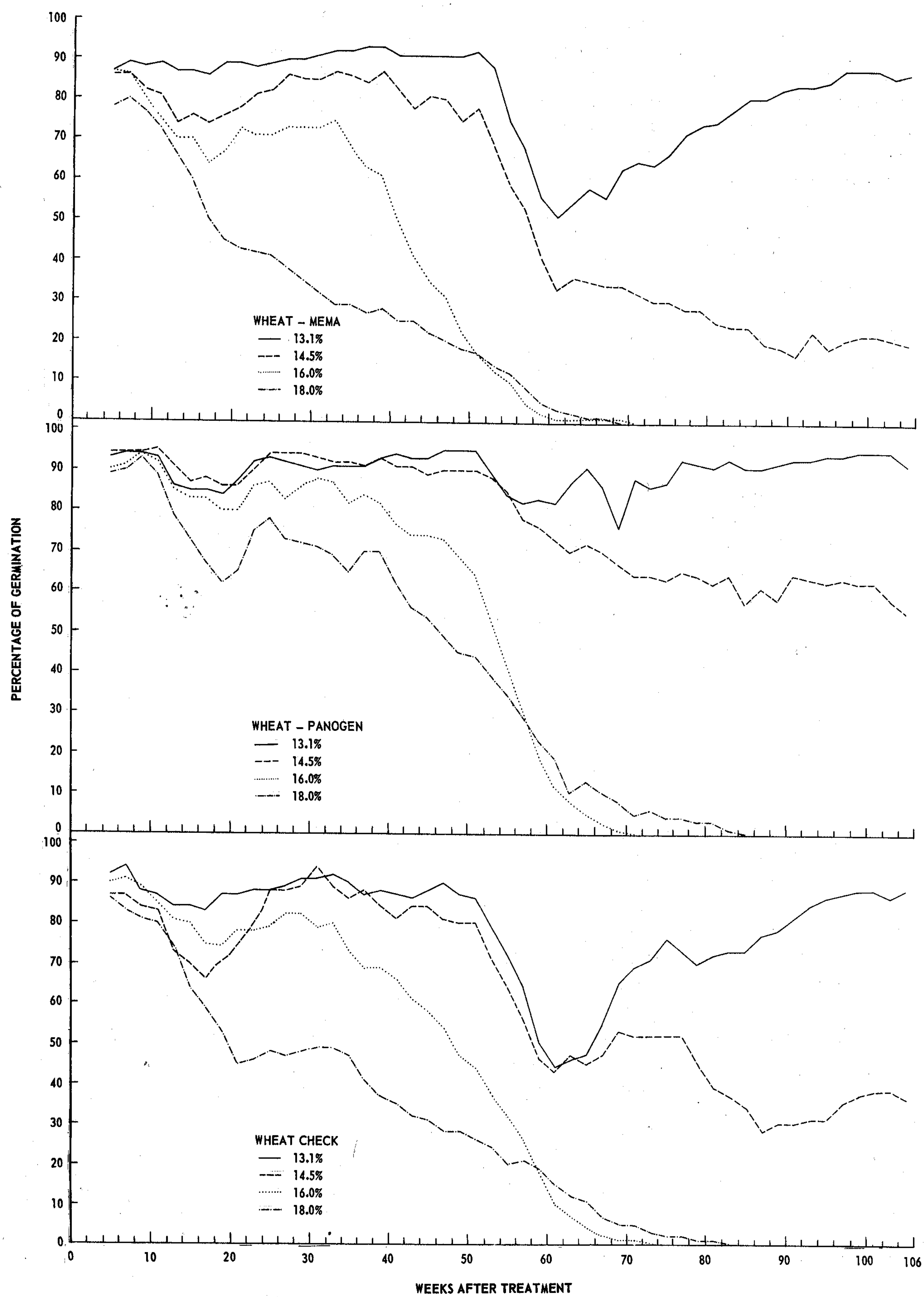

PERCENTAGE OF GERMINATION
WHEAT - MEMA
13.1%
14.5%
16.0%
18.0%
WHEAT - PANOGEN
13.1%
14.5%
16.0%
18.0%
WHEAT CHECK
13.1%
14.5%
16.0%
18.0%
WEEKS AFTER TREATMENT

Wheat (Plate 3) suffered more severely than oats or barley under the conditions of the experiment. At the 18% moisture level all three samples began to deteriorate after only 12 weeks of storage. The samples containing 16% moisture showed signs of damage within 35 to 40 weeks. The seed in all of the samples at the 16% and 18% moisture levels were dead within 70 weeks. Within two years the wheat with 14.5% moisture was reduced to about 50% viability regardless of treatment. The wheat stored with 13.1% moisture germinated as well after two years as it had at the beginning of the test. Wheat, whether treated or not, was found to be very sensitive to high greenhouse temperatures during the summer months, as demonstrated by depressions in all of the curves centred around the 15th and 60th weeks.

The onset of deterioration in germinability of all three species whether treated with a fungicide or not, was accompanied by a strong development of fungi (largely Aspergillus and Penicillium spp.) on the seeds.

Discussion

Sealing small samples of grain in glass jars following treatment with fungicide is admittedly not strictly comparable to farm storage of treated seed, but the exposure to toxic vapors is considered to be just as severe, if not more so (Koehler and Bever) (3). Thus any damage occurring in these experiments that might be attributable to the chemical seed dressing should be at least as severe as that found under farm conditions. It is however, possible that large piles of damp seed may be more readily damaged by heating. From the results then, it can be concluded that since the treated lots of seed did not deteriorate any faster than the controls, even at 18% moisture, the loss in germinability was probably not due to phytotoxicity of the seed dressings used. Also, since the samples possessing poor viability were also the ones severely infested with storage fungi, whether treated or not, it is probably that loss of germinability was caused by attack by these microorganisms, from which the mercurial dressings failed to protect the seed. This agrees with the suggestion of Gadd (2).

It seems safe, therefore, to store grain treated with mercurial seed dressings for at least two years provided the sample is dry enough to store that long if not treated. Or conversely, grain that is too wet to store, if treated with mercurial seed dressings, will likely not store safely even if not treated.

It should also be mentioned here that further work to be published later indicates that seed dressings containing insecticides may be phytotoxic, even at recommended rates of application, if the grain is stored for more than a few weeks. In this case increasing the moisture level has been found to increase phytotoxicity. The same is true of fungicides if used at rates in excess of those recommended.

Acknowledgement

The author wishes to express his thanks to Mr. Harold Alexander, Grain Inspector-in-Charge of the Office of the Canadian Board of Grain Commissioners, Edmonton, Alberta, and his staff for assistance in determining the moisture levels of the grain samples used.

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CABBAGE MOSAIC VIRUS FOUND IN IMPORTED CABBAGE HEADS[1]

J.P. MacKinnon[2]

A number of cabbage heads from a carload of United States cabbage were received at this Station in the spring of 1961. The outer leaves of these heads were black and internal black spotting was present in some of them when they were cut. This condition made them unsightly for sale and several were unfit for table use because of the internal injury. I did some routine virus tests on a sample of these diseased heads and found that cabbage mosaic virus was present. These tests are described together with the symptoms resulting on the test plants and a note on the importance of the finding in relation to the spread of this virus.

About 20 lesions were removed from one of the diseased outer leaves of one of the heads and ground in a mortar with 10 drops of water. This extracted juice was rubbed on 2 leaves of each of 3 young rape seedlings previously dusted with carborundum. About 2 weeks later, a severe systemic mottle developed on the leaves of one of the inoculated plants (Fig. 1A). This rape plant provided inoculum for further virus tests.

Infective juice from a leaf of the rape was rubbed on leaves of each of 3 healthy seedlings of rape, cabbage, tobacco, and *Nicotiana glutinosa* L., as previously described for cabbage. All of the inoculated plants became infected. Systemic mottle symptoms developed on rape, cabbage, and *N. glutinosa* (Figs. 1A, B, and C), and small, dark, local lesions appeared on the inoculated leaves of tobacco. These results indicated cabbage mosaic virus (1) but further transmission tests were made with aphids.

Cabbage mosaic virus is transmitted superficially on the stylets of aphids (nonpersistent) (1) and does not move within the insect's body as do the persistent viruses. I made tests with green peach aphids (*Myzus persicae* (Sulz.)) to determine whether or not this virus was of the persistent or nonpersistent type. Large virus-free aphids reared on health rape plants were placed on an excised infected rape leaf for 48 hours. Afterwards, 5 aphids were transferred to each of 3 rape and 3 cabbage seedlings and left for a further 48 hours. Other aphids made probes lasting less than a minute into an infected leaf and 5 of these were placed on each of 3 other healthy seedlings of rape and cabbage.

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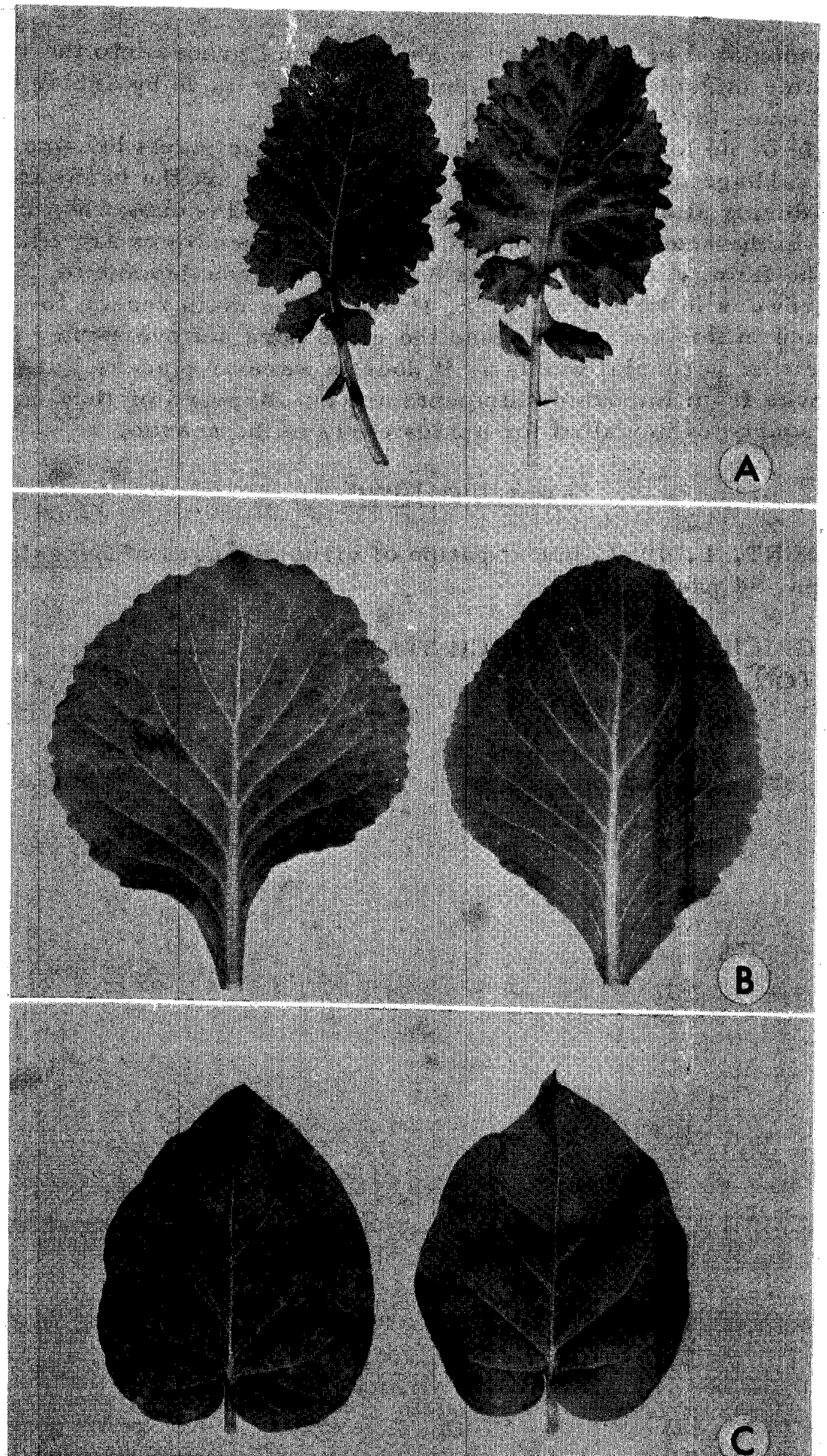

Fig. 1. A. Rape leaf at right infected with cabbage mosaic virus.
B. Cabbage leaf at left infected with cabbage mosaic virus.
C. Nicotiana glutinosa L. leaf at left infected with cabbage mosaic virus.

All plants inoculated by aphids that made only brief probes into the virus source become infected, but no transmissions were made by aphids that fed on the source for longer periods.

Little or no loss in yield occurs when cabbage plants became infected with cabbage mosaic virus late in the season, but the heads may be affected during storage. The greatest loss in yield occurs when infection takes place in the seed bed or soon after the young seedlings are transplanted in the field. As yet this virus has not been troublesome to vegetable growers in New Brunswick. Probably the main reason for its nonprevalence in this area is because the virus does not overwinter in garden debris or perennial weeds as it does in warmer places. But, if infected leaves from imported shipments are not disposed of they could serve as a source of inoculum for aphids early in the season.

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CONTROL OF STORAGE ROT OF STRAWBERRY PLANTS[1]

K.M. Graham[2], M.P. Harrison[3] and Chesley E. Smith[3]

Abstract

A five-minute dip in the commercial fungicide Thylate (tetramethylthiuram disulphide), at a dosage of 1 oz per gallon of water, was sufficient to keep strawberry plants of the varieties Redcoat and Grenadier free from fungal decay during a period of six months in storage at 28°F. Dyrene (2-4-dichloro-6-0-chloroanilino-S-triazine) was not quite as effective when the 50% wettable powder was used at the same dosage. Erad (phenyl mercuric acetate) was severely phytotoxic at 10 ml per gallon although it also completely eliminated fungi from the roots. Profuse growth of fungi was observed on the water-immersed controls. An undetermined species of low-temperature Rhizoctonia was consistently associated with the storage rot.

Introduction

On the Eastern seaboard of the U.S. and Canada the placing of strawberry plants in cold storage for spring planting is a common practice. The advantages of this procedure are three-fold: plants can be dug late in the fall when farm work is not pressing; plants are available at any time during spring when the weather becomes favourable for setting them out; the stored plants are not retarded after planting as is often the case with plants dug late in spring. Plants are usually dug after dormancy begins in late October or November. They are packed in bunches of 25 plants each and wrapped in polyethylene and stored for a period of six months at temperatures of from 28-30°F.

Losses due to rot during storage may be as high as 10 per cent. A number of fungi may be associated with root lesions. Plants dug earlier in September break down in storage apparently much more readily than those dug in late November just before the first snowfall.

The purpose of this investigation was to develop a pre-storage treatment which would reduce or eliminate losses due to the action of fungi and secondary organisms.

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Materials and Methods

On November 29, 1961, 200 freshly-dug plants of each of the varieties Redcoat and Grenadier were obtained from the propagation plots of the Horticulture Branch, N.B. Department of Agriculture. These were tied by elastic bands in bundles of 25 plants and treated in lots of 50 plants by a 5-minute total immersion in the following:

1. Thylate (tetramethylthiuram disulphide): 1 oz per gallon of water.
2. Dyrene (2,4-dichloro-6-0-chloroanilino-S-triazine): 1 oz per gallon of water.
3. Erad (phenyl mercuric acetate): 10 ml per gallon of water.
4. Water.

These fungicidal preparations were made up at twice the recommended concentrations in the hope of obtaining a heavy residue and an eradicant action on any fungi present on the surface of the leaves and roots of the plants.

After treatment the bundles were allowed to drain and each of them was placed in a polyethylene sleeve which was then tied at both ends with "Twist-ems" and stored immediately at 28°F.

On May 24, 1962, approximately six months after the plants had been put into storage, they were thawed at 38°F and examined for the presence of fungus growth. They were then transplanted to flats of unsterilized soil and left for one month outside the greenhouse. A final count of the survivors was taken on June 27, 1962.

Results and Discussion

Table 1. Effect of fungicidal treatment on growth of fungi on strawberry plants stored for 6 months at 28°F.

Variety	Treatment	No. of mouldy plants out of total of 50	No. of survivors* out of total of 50
Grenadier	Thylate	3	42
"	Dyrene	7	28
"	Erad	0	0
"	Water	50	17
Redcoat	Thylate	8	46
"	Dyrene	40	47
"	Erad	0	2
"	Water	50	37

*The numbers of survivors were counted 1 month after they had been taken out of storage and planted in flats of unsterilized soil.

Table 1 shows the number of mouldy plants in each treatment and also the number of survivors of each treatment after the plants had grown in unsterilized soil for 1 month subsequent to storage. The plants subjected to treatment by Thylate had the best appearance. The leaves were green and turgid, the roots bore only a trace of fungus growth and the laterals were intact. Those treated with Dyrene also appeared to be quite viable. Treatment with Erad apparently killed the roots and the leaves and petioles were also quite brown although fungus growth was not observed. Profuse growth of fungi was present on the water-dipped controls.

The number of survivors of each treatment could, in the case of the variety Grenadier, be correlated with the number of plants free from mould upon coming out of storage. However, Redcoat, a more robust variety, showed equal survival rates in the Dyrene and Thylate treatment although the number of mouldy plants in the Dyrene treatment was 5 times that in the Thylate.

The use of twice the recommended quantity of fungicides in making up the preparations was perhaps excessive but it does point up the relative innocuity of Thylate and Dyrene in comparison to the phytotoxicity of Erad. In justice to the latter fungicide, further trials should be conducted with lower concentrations.

The fungus growth on the water-immersed controls was examined and isolations were attempted. A species of *Rhizoctonia* capable of growing at temperatures below the freezing point was apparently dominant. Two strains isolated were both capable of growing over the surface of frozen rye-meal agar. One also made considerable growth at room temperature (70-75°F) while the other ceased vegetative growth at 70°F. and formed only sclerotia. Other fungi identified in the lesions on strawberry crowns and roots were species of *Botrytis*, *Fusarium*, *Cylindrocarpon* and *Gloeosporium*. All isolates were capable of good growth at 35-40°F. It would be of interest to assess their pathogenicity at temperatures approximating those of the soil during the winter.

It has been estimated that 1000 fall-dug plants could be treated with the most efficient fungicide Thylate at a cost of 60 cents. If the percentage of survival of plants is increased to the extent of 10%, then this expense would not be excessive. Further refinements of the storage process, such as the prevention of drying of crowns before they are placed in storage and better packaging may reduce losses even further.

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THE OCCURRENCE OF AERIAL CROWN GALL OF GRAPE VINES IN THE NIAGARA PENINSULA OF ONTARIO[1]

G.C. Chamberlain[2]

Introduction

Aerial crown gall of the grape, caused by *Agrobacterium tumefaciens* (E.F. Smith & Town.) Conn, has been a disease of infrequent occurrence in the Niagara peninsula. It was reported in 1940 (2) and again in 1952, (3). In 1960 it occurred commonly on the hybrid variety Seibel 10878, recently planted in commercial vineyards. Other varieties infected were Seibel 8357, Seibel 7053, Agawam, Niagara, and Veeport. Two *vinifera* varieties, Pinot Blanc and Gamay, growing in experimental plantings were also infected. The first infections were noted in early July, 1960. However, it was not until March, 1961, on the completion of pruning operations, that much of the infection was observed and its prevalence fully realized.

Field Observations

A survey to determine the extent of the infection was made in 18 plantings of Seibel 10878 in the spring of 1961. The disease was found in 11 of these vineyards, principally on younger vines up to seven years of age. The incidence was very low in vineyards on heavy soil but ranged from a trace to as high as 70 per cent in those on lighter soils where there was evidence of high vigor of growth. The highest incidence was encountered in a vineyard planted following an asparagus crop that had

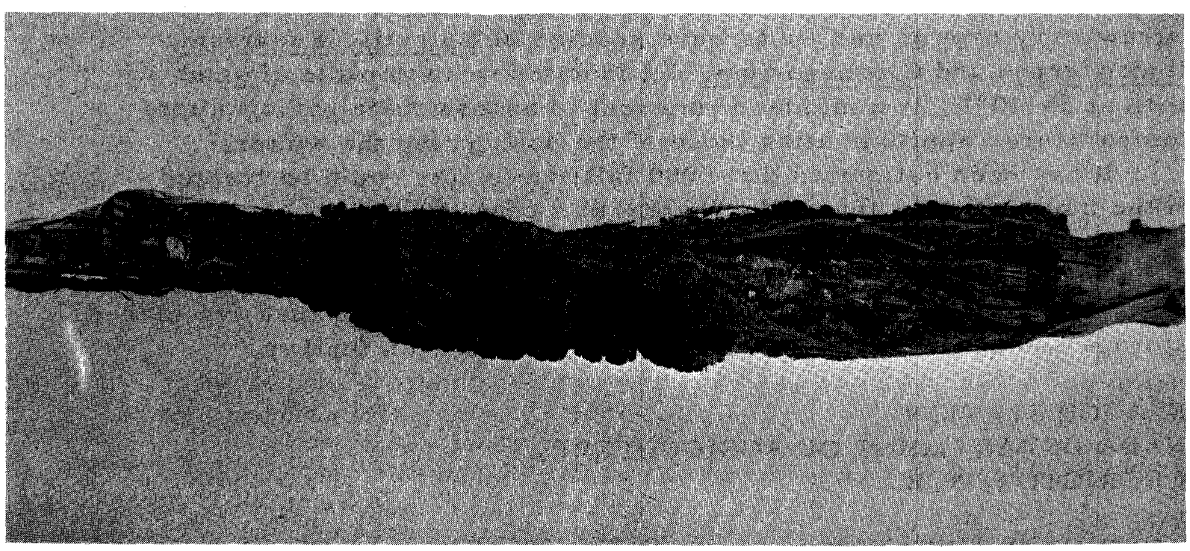

Figure 1 - Aerial crown gall on Pinot Blanc 6 year old vine.

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received heavy annual applications of fertilizers. Consequently, the nutrient level was high and vine growth was excessive; a petiole analysis of the vines showed a high amount of nitrogen, (1.24 ppm) a condition that favors the development of the disease (5). The average incidence in five of the vineyards was 24%.

Galled areas were found mostly on the lower trunk and generally measured 5 to 8 inches in length and 1 to 2 in width. Sometimes the galled areas ran together and extended 1/3 to 2/3 the length of the trunk (Figure 1). They consisted of abundant small galls in ridges, in clumps, or as large warty outgrowths. The galls at first, when they were pale cream in color and soft, closely resembled callus tissue. Later they enlarged, turned dark, and became very hard. Affected vines were stunted with pale to chlorotic foliage. The weight of wood was found to be reduced by as much as one-half. The more severely infected vines showed a deep cracking in the stalk followed by desiccation, dieback, and eventual death.

Growers were advised to cut off affected vines and, when possible, to select sucker growth from below the galled area as replacements. In a 3-year old block of 200 Seibel 10878 vines, 53 infected vines were so treated. An inspection, a year later, revealed that in 49 cases satisfactory renewal canes had been established and appeared normal and free from gall. Four renewed canes were weak and of doubtful value. Twelve infected vines in this planting were left for further observation. By March, 1962, two of the vines were dead, four were cracked with wood dried out and could be expected to die or support only a weak growth. The remaining six appeared to show normal vigor. In 1961 three of the vines showed a slight advance in the extent of the galled areas. No instance of new infection occurred in the block.

Observation was made in 1961 on 8 infected 6-year old Pinot Blanc vines and 12 infected 4-year old Gamay. Six of the former died and two survived but were seriously weakened. In the Gamay row two vines died, five showed a slight advance of the galled area, and five appeared to be normal in vigor and showed no active gall. In this row of 47 vines one new instance of infection was recorded. Pinot Blanc was much more susceptible to the effect of gall than the other varieties.

The infection enters the vine through cracks and fissures on the stem (4). These may result from low winter temperatures, freezing and thawing in the early spring, late frosts, rapid bark expansion (growth cracks), and the like. In a few instances, infection followed cracking of young stems caused by twisting the cane when tieing. Galls were also found in nursery plantings on vines injured close to ground level by a mechanical weeding device.

Discussion

Environmental conditions are important in predisposing vines to infection. The development of the present outbreak did not appear to be related to injury induced by low temperature as the preceding winter was moderate and subzero temperatures were not recorded. Two other possibilities are suggested as contributing to the widespread occurrence of the disease. An unusual feature of the winter was the heavy snowfall in February and March, 1960, totalling 46 5/8 inches and the periods of light freezing and thawing in those months. The lowest temperature, 2°F was recorded on March 9. Such environmental conditions may have caused the injuries necessary for infection. The second and more likely possibility is that in April, the month when vegetative activity commences, ample soil moisture remaining from the snow coverage combined with frequent warm showers and moderate temperatures to favour an abundant flow of sap. Especially important was a warm spell, accompanied by showers in the period April 20 to 25, when the temperature reached 80°F on two successive days. It can reasonably be assumed that on the lighter and warmer soils these conditions favoured a rapid surge of sap (1) and increased pressure, sufficient to induce bark splitting (growth cracks) on younger vines. Frequent heavy showers in May served to splash and spread the bacteria onto the vine stalks and to provide favorable moisture relations for infection.

Conclusion

In 1960 it was clearly evident that younger vines of the vinifera and hybrid varieties, particularly Seibel 10878, were highly susceptible to aerial crown gall. This must be considered a weakness of the variety when favorable conditions for development of the disease are experienced. According to the Ontario Department of Agriculture fruit census of 1956, Seibel 10878 represents 3.2 per cent of the total vines grown in the Niagara area and it has since increased.

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THE OCCURRENCE OF RED STELE IN STRAWBERRIES GROWN IN COASTAL BRITISH COLUMBIA

Hugh A. Daubeny[1] and H.S. Pepin[2]

The presence of red stele, caused by Phytophthora fragariae Hickman, in commercial fields of strawberries in coastal British Columbia has been known for over 15 years (4). Furthermore, it has been observed that the disease is a limiting factor to strawberry growth in some fields. Most of the observations, however, have been of a casual nature; the extent and severity of the disease not being known. To remedy this situation a number of commercial fields in the Lower Fraser Valley on the mainland and on the Saanich Peninsula of Vancouver Island were surveyed for the disease during the January to April period of 1961 and 1962. Samples were taken throughout the fields with particular attention being paid to low, poorly drained, areas. The fields which did not show the presence of red stele received especially careful sampling. The following table summarizes the information obtained in this survey:

Table 1. Occurrence of red stele in strawberry varieties in coastal B.C.

Variety	Fields examined	Fields with red stele	Fields without red stele	Severity
British Sovereign	25	24	1	moderate to severe
Siletz	22	8	14	trace to moderate
Puget Beauty	13	11	2	moderate to severe
Northwest	14	10	4	moderate to severe
Marshall	5	3	2	moderate
Surecrop	1	1	--	moderate

The British Sovereign variety is susceptible to most races of the red stele organism, so the fact that it was moderate to severe in all but one of the fields examined is not surprising. The field which showed no evidence of red stele had no previous record of the disease.

Siletz is the standard variety for red stele resistance in the Pacific Northwest (1). The fact that it was found to be susceptible in eight of the fields examined emphasizes the need for finding varieties with greater resistance. In six of the fields in which Siletz was not affected, red stele was found in other varieties. This suggests the presence of at least one race of P. fragariae to which Siletz is resistant.

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Northwest (3) is highly susceptible to red stele. In the fields of the variety in which red stele was not found, there was no indication, from the reaction of other varieties, that the causal organism was present.

Puget Beauty was released as a variety showing some resistance to red stele (3). Recently, however, it has not been recommended for its resistance. In the six fields in which the variety was found to be free of the disease, red stele was found in other varieties. This suggests the presence of at least one race of *P. fragariae* to which Puget Beauty is resistant.

Marshall is not considered to be a resistant variety (3). Its apparent resistance in two fields in which red stele was present in other varieties is of interest and deserves further study.

Surecrop is the most red stele-resistant variety used for commercial planting in the eastern United States (2). Its susceptibility in the one commercial field in which it is grown in B.C. suggests the presence of a race or of races of *P. fragariae* not common in the east.

It is obvious, from the survey, that the incidence of red stele in commercial strawberry fields of coastal B.C. is widespread. Future surveys will endeavour to determine the distribution of specific races.

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PYTHIUM ROOT ROT OF WHEAT IN SASKATCHEWAN[1)]

T.C. Vanterpool[2)]

Browning root rot of wheat (*Pythium* spp.), after a virtual absence of about 20 years, has again appeared in Saskatchewan and was a cause of some concern in June, 1962, on the crop following summerfallow (4). The trouble was most generally present and conspicuous in the south of the province, particularly on the heavy soils.

The disease shows up as large brown areas in the fields because of the yellowing and browning of the outer two to four leaves, brought about by root-infecting fungi. Affected roots are brown at their tips. With the onset of warm weather and good growing conditions the crop often shows striking recovery. In 1962, shortly following the onset of browning root-rot systems, many fields became heavily infected with *Drechslera tritici-repentis* (Died.) Shoem., the yellow leaf spot fungus, which appeared to be favoured by the slightly moribund condition of the yellowed outer leaves.

Browning root-rot was one of the major root diseases of wheat in the twenties and early thirities. It was shown (1, 2) to be caused primarily by several species of *Pythium* in soil low in available phosphorus and low in organic matter. Its virtual disappearance (4) was attributed to the general use of mineral phosphatic fertilizers and the incorporation of the wheat straw in the soil following the advent of the combine method of harvesting and the practice of trash fallow in place of bare fallow. In addition, the wheat varieties now commonly grown are slightly more resistant to the disease than was Marquis. Grain yields are reduced by one to several bushels per acre and maturity is slightly delayed.

The last outbreak of browning root rot of any consequence was during the last World War when there was a shortage of fertilizer distributor attachments and a consequent reduction in the use of phosphatic fertilizers (4). Its reappearance in moderate amounts in 1962 is attributed to a decrease in the use of fertilizer during the last few years by many farmers who considered the further outlay of money to be a luxury or, at least, not a necessity when they could not dispose of their wheat stocks because of reduced sales and the quota system. However, with the prospect of increased wheat sales to foreign countries there was an increase in the acreage sown to wheat in 1962. An increased demand for phosphate fertilizer followed and a shortage of this product resulted. In addition, the exceptionally dry summer of 1961 kept the mineralization of organic matter, including phosphorus, at a level below the minimum requirements for the crop. There is also evidence that a dry period in May, such as prevailed in 1962, followed by good June rains favored the onset of the disease. At this time also, a lawn

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[1]Financial assistance for survey for this work was given by the Saskatchewan Agricultural Research Foundation.

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of Merion bluegrass (*Poa pratensis* L.) at Saskatoon was found to be severely damaged by *Pythium arrhenomanes* Drechsl., one of the most virulent species of *Pythium* attacking wheat. The return to the normal use of phosphatic fertilizers on wheat should again reduce browning root rot to negligible proportions.

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VEGETABLE DISEASES ON MUCK SOILS IN THE MONTREAL AREA IN 1962

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A survey of the plant diseases which occur on the most important vegetable crops grown on muck soils of the Montreal area has been carried out each year since 1959. The aim and scope of this annual survey and the methods used have been described (2). The information obtained on the distribution and intensity of the diseases encountered in 1962 are presented in Tables 1-4.

Table 1. Diseases observed in the Ste-Clotilde region

CROP	DISEASES	REMARKS
CARROT (7 fields)	Alternaria leaf blight (Alternaria dauci)	*Sl. to mod. in 4 fields
	Cercospora leaf blight (Cercospora carotae)	Tr. to mod. in 4 fields
	Aster yellows (aster yellows virus)	Tr. in 1 field
	Root-knot nematode (Meloidogyne hapla)	Tr. to sev. in 4 fields
CABBAGE (1 field)	Clubroot (Plasmodiophora brassicae)	Sev. in 1 field
CELERY (5 fields)	Late blight (Septoria apii-graveolentis)	Sev. in 1 field
	Pink rot (Sclerotinia sclerotiorum)	2 plants in exp. plots
	Mosaic (virus)	1 plant in exp. plots
	Aster yellows (aster yellows virus)	Tr. in 2 fields
	Root-knot nematode (Meloidogyne hapla)	Sl. in 1 field
LETTUCE (7 fields)	Downy mildew (Bremia lactucae)	Tr. to sl. in 4 fields
	Drop (Sclerotinia sclerotiorum)	Tr. to sl. in 4 fields
	Bottom rot (Rhizoctonia solani)	Tr. to sl. in 3 fields
	Mosaic (virus)	Tr. in 2 fields
	Aster yellows (aster yellows virus)	Tr. in 4 fields
ONION (3 fields)	Blast (Botrytis squamosa)	Mod. in 2 fields
	Downy mildew (Peronospora destructor)	Sl. in 2 fields
POTATO (3 fields)	Late blight (Phytophthora infestans)	Tr. in 3 fields
RADISH (2 fields)	Downy mildew (Peronospora parasitica)	Sl. in 2 fields

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* Disease index: Trace - 1 - 10 percent affected plants
Slight - 10-29 percent affected plants
Moderate - 30-59 percent affected plants
Severe - 60-100 percent affected plants

Table 2. Diseases observed in the Sherrington region

CROP	DISEASES	REMARKS
CARROT (4 fields)	Root-knot nematode (Meloidogyne hapla)	Sl. in 2 fields
CELERY (9 fields)	Late blight (Septoria apii-graveolentis)	Sl. in 5 fields
	Bacterial blight (Pseudomonas apii)	Tr. to sl. in 4 fields
LETTUCE (1 field)	Aster yellows (aster yellows virus)	Tr. in 1 field
ONION (9 fields)	Blast (Botrytis squamosa)	Sl. in 2 fields
	White rot (Sclerotium cepivorum)	Sl. in 3 fields
	Root-knot nematode (Meloidogyne hapla)	Tr. in 3 fields
POTATO (3 fields)	Early blight (Alternaria solani)	Tr. in 1 field
	Magnesium deficiency	Sl. in 1 field

Table 3. Diseases observed in the Napierville region

CROP	DISEASES	REMARKS
CARROT (2 fields)	Alternaria leaf blight (Alternaria dauci)	Tr. in 2 fields
ONION (3 fields)	Blast (Botrytis squamosa)	Sl. in 3 fields
	Purple blotch (Alternaria porri)	Tr. in 1 field
	Fusarium basal rot (F. oxysporum f. cepae)	Tr. in 3 fields
	Root-knot nematode (Meloidogyne hapla)	Tr. in 1 field
POTATO (1 field)	Early blight (Alternaria solani)	Tr. in 1 field
	Late blight (Phytophthora infestans)	Tr. in 1 field
	Rhizoctonia (Rhizoctonia solani)	Sl. in 1 field

Table 4. Diseases observed in the Farnham region

CROP	DISEASES	REMARKS
CARROT (2 fields)	Alternaria leaf blight (Alternaria dauci)	Tr. in 1 field
	Aster yellows (aster yellows virus)	Tr. in 2 fields
	Calcium deficiency	Tr. in 1 field
ONION (5 fields)	Fusarium basal rot (F. oxysporum f. cepae)	Sl. in 2 fields
	Aster yellows (aster yellows virus)	Tr. in 1 field
	Root-knot nematode (Meloidogyne hapla)	Sl. in 1 field
	Calcium deficiency	Tr. in 2 fields
POTATO (2 fields)	Late blight (Phytophthora infestans)	Tr. in 1 field

The general characteristics of the 1962 observations may be summarized as follows: most of the diseases appeared about one month later, and the intensity of the diseases observed in July and August was less severe, than in 1961. It was not possible to visit all the stations in September as was done in 1961, therefore, disease intensities, as shown, may be lower than they might have appeared in September.

The intensity of leaf blights of carrot (Alternaria dauci and Cercospora carotae) varied from one region to another; being much more severe at Ste-Clotilde. Neither of the diseases were observed at Sherrington and only Alternaria blight was observed at Napierville and Farnham.

Late blight of celery (Septoria apii-graveolentis) was observed in only one field in the Ste-Clotilde region and in 5 fields at Sherrington. It appeared that the same transplants were used in all the fields where the disease was observed in the Sherrington region.

Late blight of potato (Phytophthora infestans), and downy mildew (Peronospora destructor) and blast (Botrytis squamosa) of onion, reached epidemic proportions in fields where no fungicide was applied and in disease observation gardens, during September.

The acreage of muck soil infested with the root-knot nematode (Meloidogyne hapla) is still increasing. Some growers have to fumigate their fields in order to grow carrots. Root-knot damage on onion, celery, and lettuce was observed for the first time on muck soils in Quebec.

Aster yellows (aster yellows virus) was more prevalent this year than in 1961. The disease was observed on lettuce, carrot, celery, and onion. The development of aster yellows was related to a heavy population of six-spotted leaf-hopper throughout the growing season. It is the first record of the disease on onions in Quebec.

Bacterial blight of celery (Pseudomonas apii) reported for the first time on muck grown celery in 1961 (2), was observed again this year at Sherrington in 4 fields of the variety Utah 10-B. It could not be determined if the transplants were already infected when set out.

Fusarium basal rot of onion (Fusarium oxysporum f. cepae) is increasing in fields seeded to onion for 3 or more consecutive years. Rotation must be adopted on such infested fields.

An outbreak of downy mildew of radish (Peronospora parasitica) developed this year for the first time at Ste-Clotilde.

White rot of onion (Sclerotium cepivorum) was observed for the first time on muck soils in Quebec. The disease was found in 3 fields at Sherrington. Whether or not the disease was seedborne could not be determined. These onions were started from seed and not from sets. The disease was previously reported on garlic received from Thetford Mines, Que., by Leblond in 1961 (1).

It is suggested that the rainfall in June may be an important factor involved in the delayed build-up of inoculum and the consequent late appearance of the diseases in muck soil districts during 1962.

Outbreaks of vegetable diseases occurring late in the growing season are usually not as destructive as those occurring in the early part of the season. Therefore, a forecast of disease occurrence made from rainfall in June should enable a better timing of fungicidal applications and permit more effective and more economical control.

Since the rainfall in June may be an important factor in the time of appearance and severity of vegetable diseases in muck soils, it should be taken into account in the timing of visits to observe diseases at the stations in each of the four regions of the muck soils of the Montreal area. If the month of June is dry, as it was in 1962, the survey should be continued into September, If the rainfall is abundant in June, as it was in 1961, the survey should be initiated earlier, and should be continued as long as necessary, depending on conditions during July and August.

It is hoped that observations obtained from the survey will supplement those obtained from disease observation gardens (3) and will help to understand the factors involved in disease development of vegetables in muck soils.

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COMPARING TWO METHODS OF FORECASTING LATE BLIGHT OF POTATO IN THE MONTREAL AREA IN 1962

Thomas Simard[1]

Abstract

The methods developed by Hyre and Wallin respectively were investigated for a third year at several localities in the Montreal area. The two methods were in close agreement on forecasting the first occurrence of blight. However, further development of the disease was more accurately reflected by Wallin's method in the muck soil districts. On muck, foliage growth is luxuriant and dew deposits and high relative humidity are frequent toward the end of the growing season. It is suggested that under these conditions Hyre's method should be supplemented by Wallin's method for more accurate results.

Introduction

This study was started in 1960 for the purpose of establishing a Spray Warning Service mainly for the potato growers in the muck soil district south of Montreal. In both 1960 and 1961, the two methods under investigation reflected quite well the potato blight situation in the area where they were used. (4, 5).

Methods and Procedure

The two methods used in this study were developed by Hyre and Wallin respectively (2, 3) and have already been described in an earlier paper (5). The criteria of Hyre's method are 10-day cumulative rainfall and temperatures. Those of Wallin's method, relative humidity and temperature expressed as "severity values" of secondary infections of *Phytophthora infestans*.

The two methods were used concurrently in the four following districts of the muck soil area south of Montreal: Ste-Clotilde, Sherrington, Napierville (St-Blaise) and Farnham (Ste-Sabine). Hyre's method alone was used at the two stations on mineral soil: L'Assomption and Lennoxville, respectively north and east of Montreal.

Again this year, observations on blight occurrence and development were made mainly in unsprayed potato plots of the susceptible variety Green Mountain maintained in "disease observation gardens" located in the four muck soil districts mentioned above. These gardens were established for the first time in 1961 (8) and were found quite useful for that purpose. The key devised by the British Mycological Society (1) was used for measuring blight on foliage.

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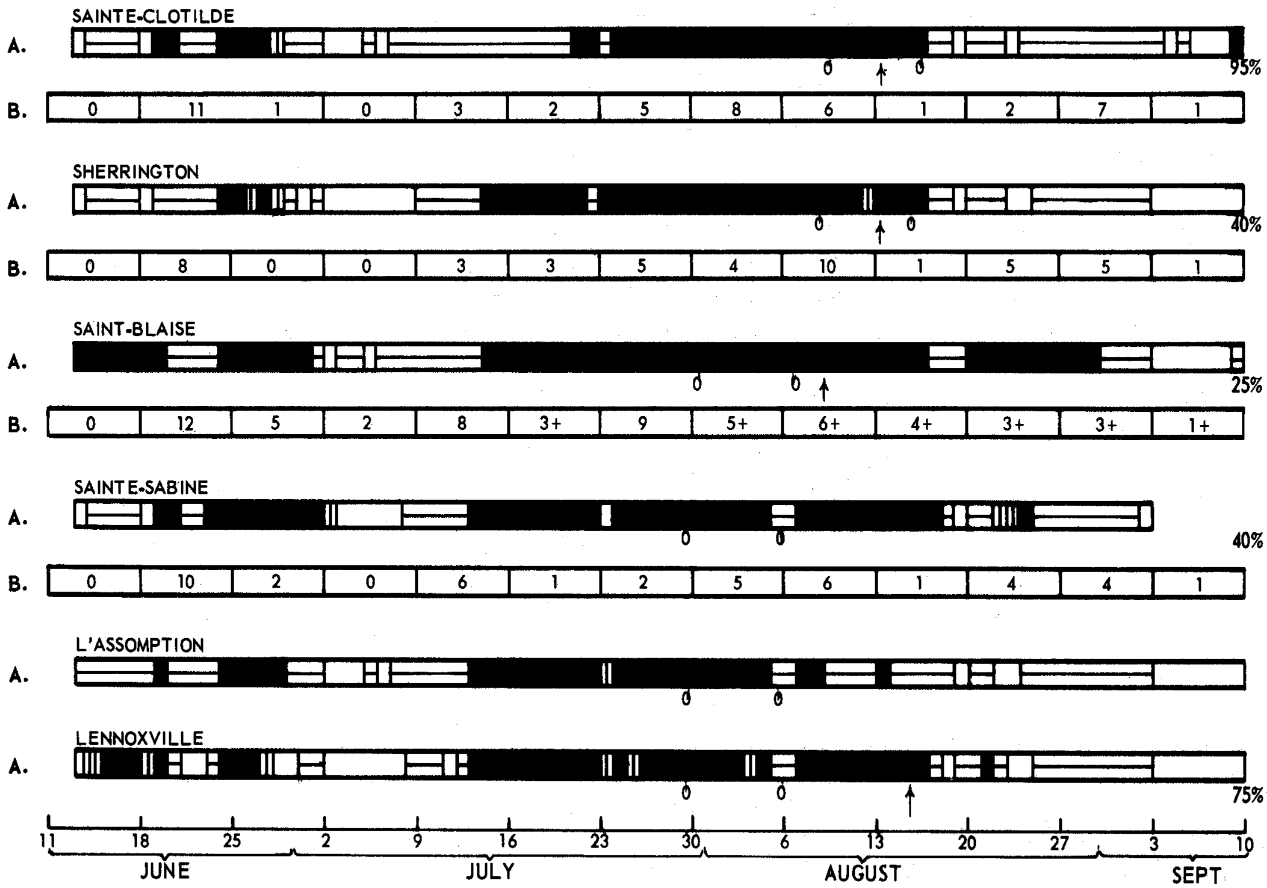

LEGEND: A. HYRE'S METHOD

TEMPERATURE FAVOURABLE

RAINFALL FAVOURABLE

BOTH FAVOURABLE

NEITHER FAVOURABLE

B. WALLIN'S METHOD [5] WEEKLY CUMULATED SEVERITY VALUES

0---0 FIRST BLIGHT EXPECTED ↑ FIRST BLIGHT OBSERVED

% - AMOUNT OF BLIGHTED FOLIAGE

FIGURE 1. OCCURENCE AND DEVELOPMENT OF LATE BLIGHT OF POTATO ACCORDING TO THE CRITERIA OF TWO METHODS OF FORECASTING.

Results and Conclusions

The experimental forecasts and observations on blight development are summarized in Figure 1. According to Hyre's method, the first occurrence of blight was forecast at all localities for the first two weeks of August. At all localities, except Ste-Sabine and L'Assomption, the disease was first detected at the time it was expected. At Ste-Sabine, 40% of the foliage was blighted on September 10, indicating that the disease must have started there at about the time it was predicted. At L'Assomption, no visible amount of blight was observed on foliage though traces of tuber rot were reported at digging time. This indicates that blight, after establishing itself as predicted, had been checked in its spread by the dry spell of the second half of August and that a certain amount of blight had been revived by the rainy weather which prevailed in all districts in September.

The first blight occurrence was also accurately forecast by Wallin's method, if favourable periods occurring before the last week of June are ignored as the results of 1961 suggested (5, 7). Figure 1 shows that in 1962 the two methods were in almost perfect agreement on this point. Further development of the disease was however, better reflected by Wallin's method. The high incidence of foliage blight on September 10 can best be explained by the high cumulated "severity values" recorded by the hygrothermograph in the latter part of August, since at about all localities the amount of rainfall in the same period was too low to be blight favourable according to Hyre's criteria.

This is in agreement with an opinion expressed in an earlier paper (6) on the probable greater accuracy of blight forecasts by using a method based on relative humidity in areas where growth is luxuriant and dew deposits and high relative humidity occur frequently toward the end of the season. This situation is typical of potato fields on muck soil and possibly too in the Eastern Townships (Lennoxville). In those regions, Hyre's method could be used for its great convenience and simplicity, but supplemented at a few strategic stations by Wallin's method.

Acknowledgements

I wish to express my thanks to the head and personnel of the following organizations for their kind collaboration: the Substation for organic soil at Ste-Clotilde, the Experimental Farms at Lennoxville and L'Assomption, the Quebec Plant Protection Stations at Ste-Clotilde and L'Assomption, Hardee Farms Ltd., Farnham Farms Ltd. and Terres Noires Ltée.

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EXPERIMENTAL TIMING OF FUNGICIDE APPLICATIONS ACCORDING TO TWO METHODS OF FORECASTING LATE BLIGHT OF POTATO

Thomas Simard and Jacques Simard[1]

Abstract

The results obtained show that late blight was as effectively controlled by 3 sprays applied according to Wallin's method as by 6 sprays applied according to the usual practice. In plots sprayed twice according to Hyre's criteria, the yield of marketable sound potatoes did not differ from that of the unsprayed plots. These results suggest that Wallin's method would be more accurate for a proper timing of fungicide applications on potatoes grown on muck soil.

Introduction

In 1961, an experiment was undertaken in order to study the possibility of using two different methods of forecasting late blight of potato for a proper timing of fungicide applications and, possibly, a more economical control of the disease. The first year's results showed the usefulness of forecasting methods in spray timing (4) and the advantage of continuing the study.

Methods and Procedures

The experiment was carried out on muck soil at the Canada Agriculture Substation at Ste-Clotilde, south of Montreal. It included 16 plots of the late susceptible variety Green Mountain, randomized in a Latin Square. The plots, consisting of 8 rows, 18 inches apart, were 50 feet long and were bordered by 2 unsprayed rows.

The two methods of late blight forecasting used in this experiment were those developed by Hyre and Wallin (2). The recording of the data for the two methods started on potato emergence. However, possible "favourable periods" occurring before the last week of June were to be ignored for the forecasting of the first appearance of blight. Previous results suggested that such early favourable periods were more valid for forecasting blight on summer than on late varieties (4, 2). The treatments were as follows:

A- Spraying according to Hyre's method of forecasting.
B- Spraying according to Wallin's method of forecasting.
C- Spraying according to normal farm practice.
D- Unsprayed.

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The fungicide used was maneb 50-W, at the rate of 2 lb per acre. The sprays were applied with a high power potato sprayer, except for the treatment on August 8 which, due to soil conditions, had to be made with a hand spray gun. The tops were rotobeaten and then chemically killed on September 19. The tubers were harvested on October 4, graded, and the rotten tubers sorted on October 10. Yield records and other data were taken in the 4 center rows of each plot.

A summary of blight forecasts and development and fungicide applications is given in Figure 1.

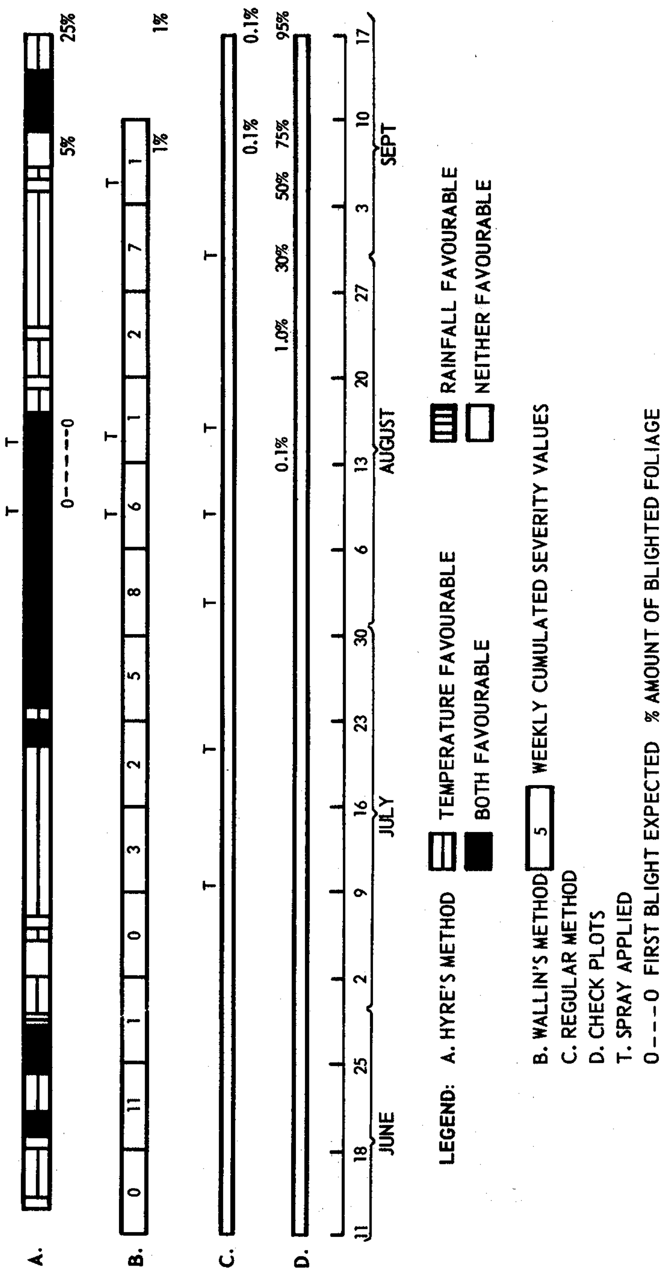

FIGURE 1. SPRAYING POTATOES IN ACCORDANCE TO TWO METHODS OF FORECASTING LATE BLIGHT.

Results

Figure 1 shows that 2 treatments were applied according to Hyre's method, 3 according to that of Wallin and 6 according to normal farm practice. It also shows that the sprays applied before August 8 were of no use and that the two forecasting methods were in close agreement in predicting the time of the blight outbreak and the timing of the first two sprays. However, a further infection period was detected only by Wallin's method, and a third spray was accordingly made on September 4 in plot B. On September 17, there was about 25% of foliage blight in plot A, only a trace in plots B and C, and 95% in check plots.

These results show that Wallin's method was more accurate than Hyre's method for the correct timing of fungicide applications. In the muck soil district, low rainfall and high relative humidity frequently prevail late in the season. Under those conditions in 1962, Figure 1 shows that Wallin's method detected an infection period at the end of August which was overlooked by Hyre's method. This is in agreement with the results obtained this year in the comparative study of the two forecasting methods at several stations (3).

The total and marketable yields as well as the amount of blighted tubers are shown in Table I.

Table 1. Total and marketable yields in pounds and amount of blighted tubers at harvest

Treatments	Yield in pounds Mean of 4 plots		Blighted tubers	
	Total	Marketable	Mean of 4 plots	Percentage
A- Hyre's method (2 sprays)	448.1	389.6	58.5	13.0
B- Wallin's method (3 sprays)	446.3	424.2	22.1	4.9
C- Farm practice (6 sprays)	447.9	426.9	21.0	4.7
D- Check	397.9	371.5	26.4	6.6
L.S.D. (5%)	35.7	29.7		

As shown in Table 1, there was no significant difference in total yield between plots which received respectively 2, 3 and 6 sprays. However, if we consider the yield of sound, marketable potatoes, there was no difference between plots which were sprayed 3 and 6 times, but the yield of plots which received only 2 sprays did not differ from that of the unsprayed plots.

These results suggest that the decrease in yield of marketable potatoes in plot A was due to the high number of tubers which became infected late in the season. The apparently lower percentage of tuber rot in the unsprayed plots was probably due to the fact that the tubers infected earlier in the season completely decayed in the soil and were not harvested.

The high percentage of tuber rot observed this year probably resulted from the high level of soil moisture which prevailed from the middle of July until harvest. Rainfall was 7.65 inches from July 16 to August 15, and 1.71 inches in the first half of September. The well known association of tuber rot with high soil moisture was recently confirmed by Zan (5).

Figure 2 shows that the progress curve of foliage blight in 1962 was drawn over a rather long period. As reported by Cox and Large (1), tuber rot is more threatening with this type of curve than with a steeper one such as occurred in 1961. The blight progress curve in 1962 also shows that the 75% stage of foliage blight occurred late, that is, about 12 days before the tops were killed. This also indicates that tuber rot rather than premature defoliation was responsible for the decreased yield (about 2 tons per acre) in the check plots.

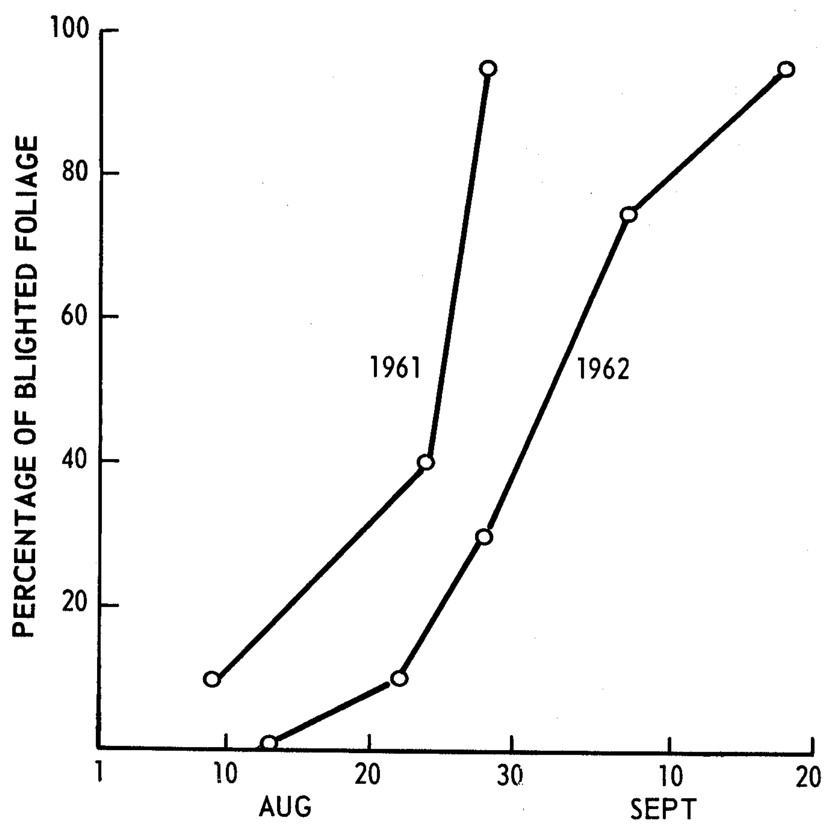

FIGURE 2. PROGRESS CURVE OF POTATO BLIGHT IN 1961 AND 1962

Acknowledgements

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GUMMING, DISTORTION, AND PITTING IN CHERRY AND APRICOT

T.B. Lott,[1] F.W.L. Keane,[2] and J. May[2]

Introduction

Severe gumming of trunks and branches, distortion of shoots, leaves, and fruits, and severe necrotic streaking and pitting of trunks have been observed in experimental plots at Summerland, B.C. These symptoms are often associated with each other, and have been observed in sweet and sour cherry and apricot. They have occurred in uninoculated as well as in inoculated trees. They are not known to indicate any recognized disease, though they have appeared most frequently in experiments with twisted leaf of cherry. Some but not all of them have been transmitted.

Observations

Gumming of trunks and branches

For many years, very severe gumming of trunks and branches (Figures 1, 2, and 5) has been observed in some sweet cherry trees naturally infected with twisted-leaf virus. Other naturally infected trees have produced no gum. Severe gum has been produced in sweet cherry and apricot trees inoculated with some selections of twisted-leaf virus, but not in trees inoculated with other selections of this virus. Gum pockets are formed in or under the bark and gum is exuded. In time pockets of gum and dead tissue become embedded in the wood.

Distortion of shoots, leaves, and fruits

For several years, distortion of shoots, leaves, and fruits (Figures 1-4), not due to the twisted-leaf virus, has caused difficulty in experiments with twisted leaf. In sweet cherry the leaf symptoms resemble closely those produced by twisted-leaf virus (1, 3), and the fruit symptoms resemble those sometimes but not always found with twisted-leaf. Some terminal buds die. Some terminal and adjacent shoots grow only a few inches and may be curved through almost a full turn. Many of these show necrosis on the inner side of the curve and killing from the tip backwards. Shoots below the terminal bud are sometimes more numerous than normal. They may be all stunted, or one or two may grow several feet while the rest are stunted. Longer shoots sometimes weave, changing direction slightly but several times in the growth of a single year. These symptoms have been observed in several varieties of sweet cherry, and are particularly severe in Sam which is unaffected or only slightly affected by twisted leaf. Similar distortion of shoots and leaves has been observed to a smaller extent and in milder form in Montmorency sour cherry. Similar distortion and stunting of shoots, sometimes in severe form, has occurred without recognized leaf symptoms in Wenatchee apricot.

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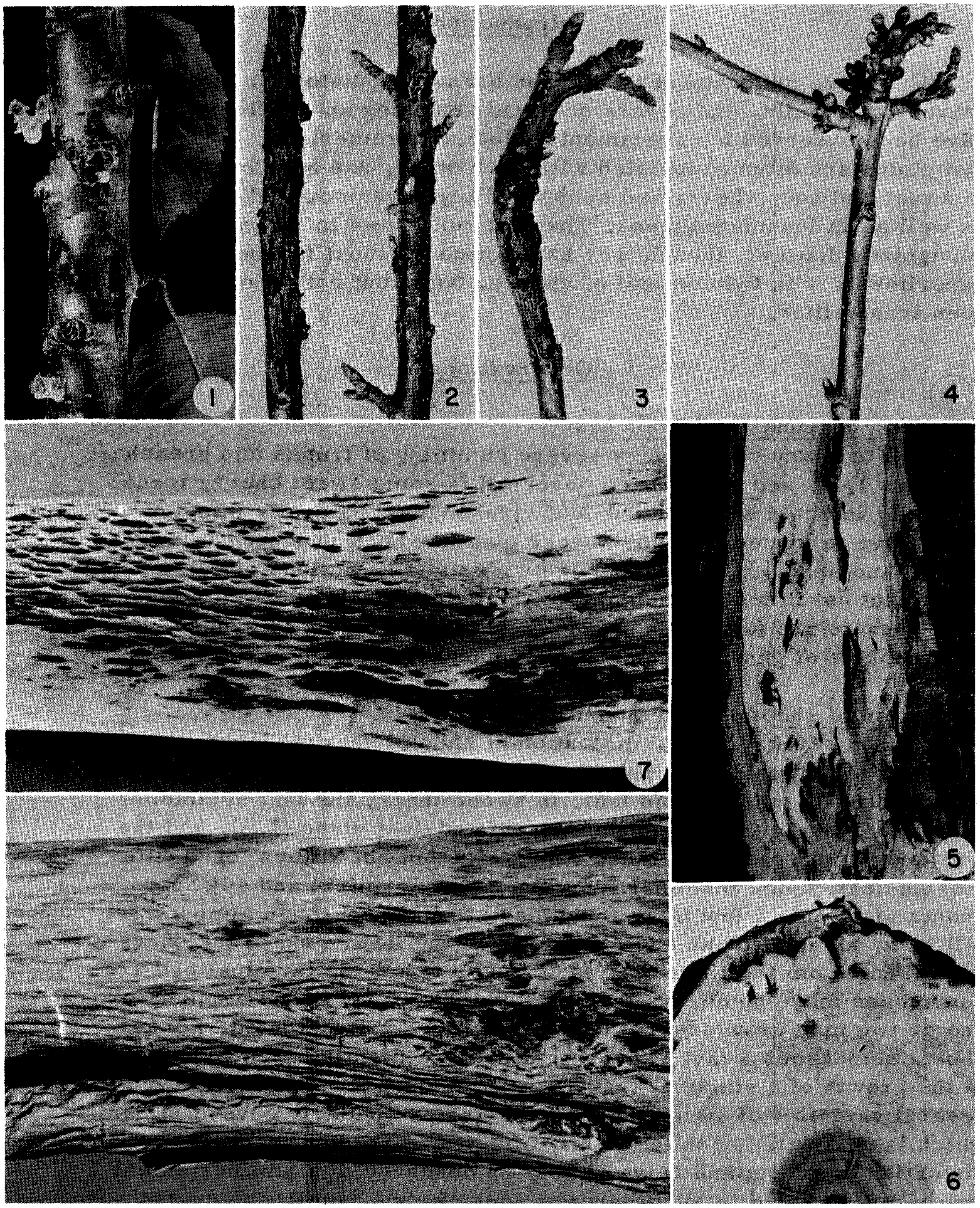

Figures 1-8. Symptoms in sweet cherry. Figure 1. Distortion of leaves and fresh gum on branch. Figure 2. Old gum blisters and cankers. Figure 3. Distortion and canker on shoot. Figure 4. Stunting and distortion of terminal and two side shoots. Figure 5. Gum in bark, embedded dead tissue and pitting in wood. Figure 6. Dead streaks in cambium and resulting damage to wood. Figures 7 and 8. Pitting in the wood.

Necrotic streaking and pitting of trunks

Recently, extensive striated areas (Figures 5-8) have been observed in the trunks of sweet cherry trees, particularly those showing gumming or distortion. These areas extend from the main roots upwards for a foot or more, and are sometimes continuous around the trunk. Outwardly the bark shows poorly defined sunken areas. The outer wood shows grooves and ridges. The grooves are discontinuous and from a fraction of an inch to several inches in length. Examination in depth shows that there have been vertical streaks of dead cambium with growth of wood on both sides, and increasing numbers of such dead streaks in successive years. The ridges are continuous vertically with numerous joins and branchings, and result from normal wood growth. In some less severely affected areas growth is almost stopped but without necrosis, resulting in a continuous ring of wood of varied thickness. In some sweet cherry trees on mazzard roots there was a marked difference in the severity of pitting in stock and scion portions of the tree. In Montmorency sour cherry trees on mahaleb roots, the short piece of mahaleb trunk was without any pitting, while the Montmorency trunk was severely pitted. In one such tree, pitting was severe in the lower trunk, diameter 2 1/4 inches, and the severity decreased progressively so that pitting was only just discernible in a branch 3 feet higher up and 1/2 inch in diameter. Pitting symptoms in Wenatchee apricot are similar to those in sweet cherry .

Discussion

Investigations are being continued to determine the cause or causes of the above syndrome in sweet and sour cherry and apricot, and to determine, more fully, the relationships of the several symptoms. Varietal susceptibilities are being studied. The possibility of soil transmission is being examined. Attempts are being made to evaluate the apparent absence of correlation between this syndrome and ring pox of apricot, in contrast with the strong correlation of twisted leaf of cherry and ring pox of apricot (2). In British Columbia, twisted leaf of cherry (1, 3) has only rarely been found with the fruit symptom which has been more general further south. This fruit symptom has been pronounced when it has been present, but its transmission has not been regular. Further consideration is being given to some indications that this fruit symptom may be correlated with the above syndrome rather than with twisted leaf of cherry as it is usually encountered in British Columbia. The above syndrome has been observed and studied mainly in experimental plots, but has also occurred to a small extent in commercial sweet cherry trees. It has sometimes been confused with twisted leaf, but this confusion is not considered to have affected the main part of the work with twisted-leaf virus. This paper is intended to indicate the problem. It is realized that much further work is required.

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SOME RECORDS OF PLANT-PARASITIC NEMATODES ENCOUNTERED IN CANADA IN 1962

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Root-knot Nematodes

The northern root-knot nematode, *Meloidogyne hapla* Chitwood, 1949, was found on intercepted plant material from several areas in the United States: on rose from Texas and Ohio, on *Hydrangea arborescens* and *Deutzia lemaini* from New York, on *Caladium* sp. from Florida, on *Weigela* sp. from Ohio and Tennessee, on *Spiraea* sp., *Syringa* sp., and *Philadelphus* sp. from Tennessee, on *Forsythia* sp. and *Philadelphus* sp. from Alabama, on *Artemisia* sp. from Indiana, on strawberry from Maryland, and on tomato from Virginia. It was intercepted on rose from England, Holland, Denmark, France, and on *Berberis thunbergii* var. *atropurpurea* from Holland. It was also found on *Philadelphus aurea* from a nursery at Strathroy, Ontario.

The southern root-knot nematode, *Meloidogyne incognita incognita* (Kofoid & White, 1919) Chitwood, 1949, was found on interceptions of *Lonicera* sp. from Texas, U.S.A., *Caladium* sp. from Illinois and New York, U.S.A., and tomato from Georgia, U.S.A. It was also found on begonia from St. Catharines, Ontario, and on *Cactus* sp. from a nursery at Dundas, Ontario.

The cotton root-knot nematode, *Meloidogyne incognita acrita* Chitwood & Oteifa, 1952, was found on *Hoya* sp. from Montreal, Quebec.

The Javanese root-knot nematode, *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949, was found on a shipment of tomato plants from Georgia, U.S.A.

The peanut root-knot nematode, *Meloidogyne arenaria* (Neal, 1889) Chitwood, 1949, was intercepted on rose from Texas, U.S.A.

The Thames root-knot nematode, *Meloidogyne arenaria thamesi* Chitwood, in Chitwood, Specht and Havis, 1952, was found on tomato from Georgia, U.S.A., and on *Hoya* sp. from Montreal, Quebec.

Cyst-forming Nematodes

The oat cyst nematode, *Heterodera avenae* Wollenweber, 1924, was found in soil in shipments of conifers from Belgium, *Syringa* sp. from Denmark, *Thuja* sp. from Holland, soil from automobiles from Germany, and in potato soil from Toronto, Ontario.

The cactus cyst nematode, *Heterodera cacti* Filipjev & Schuurmans Stekhoven, 1941, was found on *Cactus* sp. from a nursery at Dundas, Ontario.

The cabbage cyst nematode, *Heterodera cruciferae* Franklin, 1945, was found in shamrock soil from Ireland.

The pea cyst nematode, *Heterodera goettingiana* Liebscher, 1892, was found on *Clematis* sp. from Belgium and ornamentals from the United Kingdom.

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The hop cyst nematode, Heterodera humuli Filipjev, 1934, was found on hop from Sardis and Chilliwack, British Columbia.

The grass cyst nematode, Heterodera punctata, was found in shipments of Clematis sp., Taxus sp., Pinus sp. from Holland, cacti from Germany, in soil from East Germany, and in soil supporting potatoes from Toronto, Ontario.

The most important plant-parasitic nematode discovered in Canada in 1962 was the golden nematode (also called the potato root eelworm), Heterodera rostochiensis Wollenweber, 1923, on potato roots and in soil from an area in Newfoundland. This first record of the golden nematode in Canadian soil was made by Dr. O.A. Olsen, Experimental Farm, St. John's West, Newfoundland.

The clover cyst nematode, Heterodera trifolii Goffart, 1932, was intercepted on shipments with soil of junipers, Thuja sp., and Euonymus sp. from Holland, conifers and Cystisus sp. from Belgium. It was also found in potato soil from an area in Ontario, Quebec, and New Brunswick, and in nursery soil from Prince Edward Island.

Root-lesion Nematodes

Pratylenchus penetrans (Cobb, 1919) Filipjev & Schuurmans Stekhoven, 1941, was found in soil around roots of Rhododendron sp., lilac, Laburnum sp., malling root stock, Thuja sp., Thuja globosa, Pinus sp., Clematis sp., juniper, Taxus sp., and rose from Holland, hydrangea and Pinus mugo from Belgium, Clematis sp. and Ginkgo sp. from Germany, chrysanthemum, Coleus sp., currant, gooseberry from France, and mint from Portugal. It was also found in soil from Sheffield Mills, Nova Scotia, and in a sour cherry orchard at Fonthill, Ontario.

Pratylenchus pratensis (de Man, 1880) Filipjev, 1936, was found in soil around roots of Rhododendron sp., lilac, and Laburnum sp. from Holland, hydrangea from Belgium and rose from Denmark.

Pratylenchus convallariae Seinhorst, 1959 was found in soil supporting begonia, Coleus sp., and chrysanthemum from France, and mint from Portugal. A species closely resembling P. convallariae was found around begonia roots from a nursery at Dundas, Ontario.

Pratylenchus crenatus Loof, 1960 was found in soil around roots of Picea alba from Belgium, Taxus sp. from Holland, Laurentian Swede turnip from New Brunswick, in soil from Sheffield Mills, Nova Scotia, and in a sour cherry orchard at Fonthill, Ontario.

Pratylenchus neglectus (Rensch, 1924) Filipjev & Schuurmans Stekhoven, 1941 was intercepted in shamrock soil from Ireland, soil supporting Koster blue spruce from Holland, and strawberry roots from Ontario.

Pratylenchus vulnus Allen & Jensen, 1951 was found in soil around roots of Thuja sp. from Holland.

Pratylenchus sp. was found associated with the roots of rose from Denmark and Holland, Pinus sp. from Holland and Belgium, Picea sp., Taxus sp., Juniperus sp., and Clematis sp. from Holland, mint from Italy, and cacti from Austria.

Stunt Nematodes

Tylenchorhynchus brevicaudatus Hopper, 1959 was found around roots of raspberry from Abbotsford, British Columbia.

Tylenchorhynchus crassicaudatus Williams, 1960 was found in association with roots of *Citrus* sp. from Hong Kong.

Tylenchorhynchus brevidens, Allen, 1955 was found on soil blocks from Blackpool, England, and on cacti and crown-of-thorns from Germany.

Tylenchorhynchus bursifer Loof, 1959 was found in shipments with soil of *Thuja* sp., *Thuja globosa*, *Picea* sp., and *Taxus* sp. from Holland.

Tylenchorhynchus claytoni Steiner, 1937 was intercepted in soil around roots of *Rhododendron* sp., lilac, *Laburnum* sp., *Ribes* sp., *Lonicera* sp., *Spiraea* sp., and in soil from Holland, and on rose from California.

Tylenchorhynchus dubius (Buetschli, 1873) Filipjev, 1936 was found in soil in a shipment of *Picea alba* and *Amaryllis* sp. from Holland, and around roots of begonia from a nursery at Windsor, Ontario.

Tylenchorhynchus maximus Allen, 1955 was found in blueberry soil from Fredericton, New Brunswick.

Tylenchorhynchus parvus Allen, 1955 was intercepted in soil in shipments of herbaceous plants from Europe and rose from Denmark. *Tylenchorhynchus* sp. was noted around roots of *Rhododendron* sp. from Holland, and hydrangea from Belgium.

Spiral Nematodes

Rotylenchus robustus (de Man, 1876) Filipjev, 1936 was found in soil around roots of *Rhododendron* sp. and *Thuja* sp. from Holland and in shamrock soil from Ireland.

Rotylenchus uniformis (Thorne, 1949) Loof & Oostenbrink, 1958 was recorded in soil in shipments of hydrangea from Belgium, *Ginkgo* sp. from Germany, *Thuja* sp. from Holland, and mint from Portugal.

Rotylenchus goodeyi Loof & Oostenbrink, 1958 was found in soil supporting rose from Richmond Hill, Ontario. *Rotylenchus* sp. was also noted in soil supporting rose from Denmark.

Helicotylenchus erythrinae (Zimmermann, 1904) Golden, 1956 was found in soil around roots of *Pinus nigra* var. *austriaca* and *Thuja* sp. from Holland, heather from England, and *Philodendron hastatum* from Florida. *Helicotylenchus* sp. was noted in soil from Ireland and England, in juniper soil from Hong Kong, in soil supporting *Clematis* sp. from Holland, chrysanthemum, *Coleus* sp. and begonia from France, *Rhododendron* sp. from Germany, and in corn loam from the Central Experimental Farm, Ottawa, Ontario.

Scutellonema brachyurum (Steiner, 1938) Andrassy, 1958 was intercepted in soil around the roots of *Calla aethiopica* from Italy, *Primula* sp. from Sweden, and rose from the Central Experimental Farm, Ottawa, Ontario. *Scutellonema* sp. was also detected on interceptions of potato and dahlia tubers from Scotland.

Ring Nematodes

Criconema celetum Wu, 1960 was found in soil supporting rose from the Central Experimental Farm, Ottawa, Ontario.

Criconemoides curvatum Raski, 1952 was found around strawberry roots and in soil from Manotick, Ontario, and in a sour cherry orchard at Fonthill, Ontario.

Criconemoides lobatum, Raski, 1952 was found in soil blocks from Blackpool, England, and in soil from Sheffield Mills, Nova Scotia.

Pin Nematodes

Paratylenchus microdorus Andrássy, 1959 was intercepted in soil around roots of hydrangea from Belgium.

Paratylenchus macrophallus (de Man, 1880) Goodey, 1934 was found in soil supporting rose from Denmark.

Paratylenchus hamatus Thorne & Allen, 1950 was found around roots of rose at the Central Experimental Farm, Ottawa, Canada.

Paratylenchus nanus Cobb, 1923 was found in soil around roots of Ginkgo sp. from Germany, Primula sp. from Sweden, in soil from Italy, and from Sheffield Mills, Nova Scotia, on strawberry roots and soil from Manotick, Ontario, in sour cherry orchard at Fonthill, Ontario, and in soil around roots of Peperomia sp. from a greenhouse in Quebec City, Quebec. Paratylenchus sp. was also noted in soil blocks from England, shamrock soil from Ireland, soil supporting Thuja globosa, Taxus sp., and Clematis sp. from Holland, and cacti and Gypsophila sp. from Austria.

Other Tylenchids

Ditylenchus destructor Thorne, 1945, the potato-rot nematode, was found on potato tubers from Prince Edward Island, and species of Ditylenchus were collected from shipments with soil of palm plants from California, U.S.A., Rhododendron sp., and oleander from Germany, Philodendron hastatum from Florida, U.S.A. It was also found in soil supporting Taxus sp. from a nursery in Ontario, around strawberry roots and in soil from Manotick, Ontario, and in soil around roots of oats from Smithville, Ontario.

Species of the genera Tylenchus Bastian, 1865, Aglenchus (Andrássy, 1954) Meyl, 1961, Filenchus (Andrassy, 1954) Meyl, 1961, Psilenchus de Man, 1921, and Tetylenchus Filipjev, 1936 were also found in association with soil and plants imported from abroad and from some areas in Canada.

Aphelenchids

Aphelenchus avenae Bastian, 1865 was found in soil supporting hydrangea from Belgium, potato and dahlia tubers from Scotland, rose, dahlia, and gladiolus from Denmark, Calla aethiopica from Italy, Citrus sp. from Hong Kong, Taxus sp., Clematis sp., Amaryllis sp., Thuja pyramidalis, and Koster blue spruce from Holland, chrysanthemum, Coleus sp., and begonia from France, mint from Portugal, and was also found in iris soil from Oregon, U.S.A.

Aphelenchoides parietinus (Bastian, 1865) Steiner, 1932 was found in association with roots of Pinus nigra var. austriaca from Holland, and cacti from Germany.

Aphelenchoides subtenuis (Cobb, 1926) Steiner & Buhrer, 1932 was found in soil around roots of junipers from Holland, and rose from a nursery at Toronto, Ontario.

Aphelenchoides sp. resembling A. limberi Steiner, 1936 was found associated with Philodendron sp. from Italy.

Aphelenchoides ritzemabosi (Schwartz, 1911) Steiner & Buhrer, 1932 was found on Verbena hybrida from Saanichton, British Columbia.

Seinura sp. was recorded from samples of soil supporting rose from a nursery at Toronto, Ontario, Clematis sp., and Taxus sp. from Holland, and cacti from Germany.

Dorylaimids

Xiphinema americanum Cobb, 1913 was found in shipments with soil, of rose from Holland, in soil near pine roots from Gatineau Park, Quebec, and in a sour cherry orchard at Fonthill, Ontario.

Xiphinema diversicaudatum (Micoletzky, 1927) Thorne, 1939 was found in soil blocks from Blackpool, England, and on rose from a commercial firm in Ontario.

Trichodorus pachydermis Seinhorst, 1954 was found around the root system of various shrubs and Rhododendron sp. from Holland.

Trichodorus christiei Allen, 1957 was found in soil around roots of Philodendron hastatum from Florida, U.S.A. Trichodorus sp. was also noted on Picea alba from Holland.

Tylencholaimellus striatus Thorne, 1939 was found in soil around roots of hydrangea from Belgium.

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A SURVEY OF FOLIAR DISEASES OF CULTIVATED STRAWBERRIES IN NOVA SCOTIA[1]

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Abstract

A survey of the foliar diseases on commercial strawberry varieties in Nova Scotia was carried out during 1962. Leaf spot caused by *Mycosphaerella fragariae* was the most prevalent foliage pathogen. Blotch, *Gnomonia fructicola*; blight, *Dendrophoma obscurans*; and scorch, *Diplocarpon earliana*, although present in most fields are not considered to be economically important pathogens of strawberry foliage in Nova Scotia. Infection suspected to be caused by a species of *Gloeosporium* was found on strawberry foliage for the first time in this area. The symptom expression of blotch and blight and the sporulating characteristics of *D. obscurans* do not agree with those already reported.

Introduction

Dominion Bureau of Statistics figures show a trend of increasing strawberry acreage and yield in Nova Scotia (Appendix 1). This increase has been particularly significant in recent years. Expanding marketing outlets for processed and frozen strawberries is expected to further enhance the economic importance of this crop to the agricultural economy of Nova Scotia.

To ascertain the incidence of foliar diseases of strawberries in Nova Scotia a survey was carried out during the summer of 1962. No comparable survey of strawberry diseases had been carried out prior to this time.

Previous Reports of Strawberry Leaf Spot Diseases in Nova Scotia

Leaf spot, caused by *Mycosphaerella fragariae* (Tul.) Lindau (*Ramularia tulansii* Sacc.), was first reported in 1925 by J.F. Hockey (6) on both cultivated and wild species throughout the province. Since then it has been reported almost every year with leaf infections up to 100 per cent and estimated reduction in yields from nil to 50 per cent.

Leaf blotch, caused by *Gnomonia fructicola* (Arnaud) Fall (*Zythia fragariae* Laibach), was first reported on strawberries in Nova Scotia in 1952 (2). Except in 1953, blotch has been reported each year with infections ranging from trace to 10 per cent on strawberry foliage. Damage to leaves was reported as nil except for 1952 when it was reported as moderate.

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Leaf blight, caused by Dendrophoma obscurans (Ell. & Ev.) H.W. And., was first reported in Nova Scotia in 1953, by C.O. Gourley (4), on most varieties grown. Since that time it has been reported every year and except for 1953 and 1954 when it was heavy and moderate, respectively, only trace infections were present. No reduction in crop yields has been recorded as a result of blight infections on the foliage.

Leaf scorch, caused by Diplocarpon earliana (Ell. & Ev.) Wolf., was reported in Nova Scotia in 1951 by D.W. Creelman (1). From 1954 through 1959 it was reported by C.O. Gourley. Infections varied from trace to 75 per cent.

Materials and Methods

A preliminary study of the organisms on overwintering strawberry leaves was carried out during May 1962 in the Kings Co. area of Nova Scotia. Leaves from all plantings in Kings Co. included in the main survey and leaves from two additional plantings were collected, washed in tap water for about 5 minutes, and placed on a moist paper towel in an 8" x 10" x 4" plastic container with a tight fitting cover. After 6 to 7 days at room temperature the leaves were examined for fungi and rated for the presence of overwintering disease organisms (See footnote, Table 1).

The main survey included 110 fields of 12 different varieties from the four main producing areas in Nova Scotia, namely Kings, Digby, Colchester and the Chester Basin area of Lunenburg Co. This included 43 newly-set fields, 56 first-year fruiting beds, 10 second-year and 1 third-year fruiting bed. A severity rating from absent to severe for each symptom was noted for each field of each variety. Samples were collected from those leaves showing symptoms whose causal agent was not known. These leaves were surface sterilized and portions of the infected areas were planted on PDA and PDA containing a decoction from boiled strawberry leaves. Streptomycin, 50 μg/ml, was added to each medium. In addition sterilized leaves were incubated in sterile moist chambers. The last of these methods was particularly important for the identification of D. earliana which was difficult to culture on the two agar media.

Results and Discussion

Throughout the survey the organisms most consistently isolated from strawberry foliage were M. fragariae, G. fructicola, Dendrophoma obscurans and Diplocarpon earliana, the causal organisms of leaf spot, leaf blotch, leaf blight, and leaf scorch, respectively. In addition, a species of Gloeosporium was consistently isolated. Other organisms isolated, which are probably not causal agents of leaf spots, in order of decreasing prevalence, were Botrytis cinerea Pers. ex Fr., Alternaria sp., Septoria sp., Chaetomium sp., Harknessia sp., Penicillium sp., Hormodendrum sp., Fusarium sp., Sordaria sp., Colletotrichum sp., Verticillium sp., and Gliocladium roseum Bainier, Peziza ostracoderma Korf, Absidia sp., and Rhizopus sp.

The average severity rating of major strawberry leaf pathogens for all varieties on overwintered leaves was 7 for M. fragariae, 5 for G. fructicola and 3 for Dendrophoma obscurans. Diplocarpon earliana was not found on overwintered leaves from commercial plantations but was found on overwintered leaves from seedling plots at the Research Station. Perithecia of M. fragariae were produced in abundance on infected leaves. No perithecia of G. fructicola were found on overwintered leaves. Numerous pycnidia containing spores of Z. fragariae, the imperfect stage of G. fructicola, were present on the overwintered leaves of all varieties except Surecrop. The spores were exuded in a cream to yellowish-brown mass that became darker with age. This is considered the primary source of blotch inoculum. D. obscurans was observed in small amounts on overwintered leaves and was detected by the presence of a cream to brown pycnidial exudate darkening with age. The spores of D. obscurans were never exuded from the pycnidium in a horn as noted by Fall (3).

The field survey (Table 1) showed that M. fragariae was the most prevalent and destructive foliage pathogen of strawberries in Nova Scotia. Prior to July the incidence of leaf spot caused by this fungus was greater on fruiting beds than on new plantings, probably because of the abundance of overwintering inoculum in the older plantings. The first infections of M. fragariae on new foliage were noted early in June as small red spots on Cavalier and Redcoat. Some difficulty was experienced in isolating the organism from these immature spots. Later in the season new infections often began as small, tan spots. The difference in early symptom expression is suspected to be a reaction to different races of M. fragariae rather than a varietal reaction since both incipient red and tan spots were noted on almost all varieties in the survey. The red spots enlarged to about 3 to 4 mm in diameter with the center of the infected area becoming light in color. The small tan spots enlarged up to approximately 5 mm in diameter and were surrounded by a red peripherial zone which gradually faded into the surrounding green tissue. Thus, the final mature spots of both types were variable in size, being from 3 to 8 mm in diameter, red in color, with a variable white to tan dead center area.

M. fragariae was quite prevalent in all areas surveyed. The varieties in order of decreasing susceptibility are shown in Table 1. It is important to note that for some varieties only a few fields were available for inclusion in the survey.

Table I. Incidence of infection in relation to varieties

Varieties	Total No. of fields sampled	Total No. of observations	Average rating of all sampling dates, areas, and age plantings: Mycosphaerella fragariae	Gnomonia fructicola	Dendrophoma obscurans	Diplocarpon earliana	Gloeosporium sp.
Cavalier	23	82	8.0[a]	2.4	.3	.1	.2
Seedling #K53-1-77	2	7	7.4	2.4	0	0	1.7
Sparkle	27	96	6.5	2.9	3.6	.3	.6
Catskill	7	21	6.4	2.0	0	.4	trace
Robinson Beauty	7	19	6.4	2.5	0	1.4	.1
Redcoat	22	87	5.4	3.3	.2	.1	.1
Early Dawn	3	10	5.3	1.3	.2	0	0
Senator Dunlap	4	14	5.1	3.3	.1	0	0
Premier	6	22	4.4	1.5	0	0	.7
Surecrop	6	22	4.3	2.0	.1	0	.4
Guardsman	2	9	4.1	2.3	0	0	0
Grenadier	1	5	2.4	3.6	0	0	0

(a) The actual ratings were absent, trace, light, moderate, heavy and severe. For tabular use these were changed to the numerals 0,2,4,6,8, and 10, respectively.

The visual severity rating in July was less than in June (Table 2) because of the increase in the amount of new foliage. An increase in M. fragariae spots occurred toward the end of July and throughout August. Because infection takes place from 7 to 12 days prior to visual symptom expression (3), the first extensive infections began in July.

Table 2 Incidence of infection in relation to date of sampling

Organism	Average of all areas, varieties and years of planting				
	Sampling period				
	up to 24-6-62	25-6-62 to 9-7-62	10-7-62 to 24-7-62	25-7-62 to 8-8-62	9-8-62 to 25-8-62
Mycosphaerella	6.4	5.0	5.7	6.7	7.1
Gnomonia	0	0.3	2.6	3.6	4.9
Dendrophoma	0	0	0.2	0.4	0.2
Diplocarpon	0	0	0.1	0.1	0.6
Gloeosporium	0	0.1	0.5	0.3	0.5

Blotch caused by G. fructicola, was generally the second most prevalent foliar disease in the areas surveyed in Nova Scotia. In late June and early July blotch infections began to appear and by July 15 were quite prevalent on most fruiting beds in all areas. It was not found on new plantings until mid-July on Senator Dunlap. The disease ratings in Table 2 show the gradual increase during the latter part of July and throughout August. Commonly grown varieties which appear to be most highly susceptible, in order of decreasing susceptibility, are Senator Dunlap, Redcoat, Sparkle, Robinson Beauty, and Cavalier. Grenadier was more heavily infected than any other variety but only one field was examined. Even though spores of Z. fragariae, the conidial stage of G. fructicola, are present as early in the spring as the conidia of Ramularia tulasnii, the imperfect stage of M. fragariae, infection apparently occurs later in the season or a longer incubation period is required. Age of the leaf may also be a factor.

Blotch was usually confined to mature leaves and symptoms first appeared as a red to purple area which often involved up to one-half the leaf. At this stage a blotch infection could easily be mistaken for a mineral deficiency. As the infections enlarge, the centers of the reddish-purple areas dry out to an orange-brown color. The Redcoat and Sparkle varieties in particular exhibit this sequence in symptom expression. G. fructicola has also been isolated from small red spots that could be mistaken for early symptoms initiated by many strawberry leaf pathogens. In the late summer G. fructicola was often isolated along with M. fragariae from tan spots described as caused by the latter fungus. In these cases G. fructicola was suspected to be a secondary organism in the spot since M. fragariae was always present. The presence of different symptom expressions, caused by the blotch fungus, may be influenced by different races of G. fructicola as well as by different varieties of strawberries.

No definite blight symptoms caused by Dendrophoma obscurans were noted in the field. Severity ratings were made from plating and moist chamber material. Many times, on leaves incubated in the moist chamber, D. obscurans was present with G. fructicola on the spots characteristic of blotch infections. G. fructicola was isolated from almost all of the blotch spots on fresh leaves but only occasionally was D. obscurans present. When D. obscurans appeared on moist chamber leaves without G. fructicola, it was generally on a necrotic area around the margin of the leaf. D. obscurans was more prevalent on dead petioles, damaged runners, and dead runner plants than on leaves of living plants. Insufficient observations of this type made it impossible to postulate whether D. obscurans was actually parasitic on the leaf areas from which it was isolated. The presence of D. obscurans with G. fructicola on a blotch spot and on damaged runners and runner plants suggests that D. obscurans is less parasitic than G. fructicola. It would appear that G. fructicola is the primary pathogen causing the blotch spot with D. obscurans occasionally entering the spot as a secondary organism. This does not agree with the findings and views of Fall (3) who described symptoms for D. obscurans infections which resemble those symptoms noted in this survey for blotch caused by G. fructicola. She considered G. fructicola the less parasitic of the two and described no symptoms for G. fructicola infections. Fall (3) noted that a Gnomonia sp. was isolated from lesions thought to be caused by D. obscurans and questioned whether Gnomonia was causing the lesion or was secondary to some other fungus such as D. obscurans.

D. obscurans was isolated only after the middle of July. The data in Table 2 show that the highest severity rating for blight occurred around the 1st of August. Even at this time the proportion of infected leaves was low. D. obscurans was most prevalent on Sparkle (Table 1).

From this survey, Diplocarpon earliana, the scorch organism, does not generally appear to be of great importance as a strawberry leaf pathogen in Nova Scotia. When first noted in the field survey the scorch infections were blotchy and resembled a small G. fructicola blotch area without a dead center. This blotchy area was later determined to be the result of a number of infections of D. earliana in a small area. Because the organism was difficult to isolate it is suspected that it was not identified as early as the primary symptoms were actually present. Plants infected with D. earliana were inspected periodically to follow the symptom sequence. Symptoms began as small red spots which could be mistaken for early infections caused by other organisms. The red color of the spots disappeared with age and finally changed to a dark purple-black. Where spots coalesced the leaf tissue between the points of infection dried out and turned brown. Occasionally entire leaves were killed. Black acervuli formed in the center of the dark purple-black spots and these fruiting structures could barely be distinguished with the naked eye. Fall (3) noted the presence of both a blotch and a spot type symptom. The blotch type which began as a red spot was the only type noted in this survey. The results in Table 1 show that D. earliana infection was found mainly on the leaves of Robinson Beauty, Catskill and Sparkle. A trace was found on Cavalier and Redcoat.

D. earliana was isolated from leaves collected from fruiting beds in Digby and Colchester Counties. In agar plates a Septoria sp. often appeared along with D. earliana. The fungus Septoria aciculosa Ell. & Ev. was reported from Nova Scotia as the cause of a leaf spot on strawberry by C.O. Gourley (5). The species of Septoria encountered in this survey was not determined and may have been a secondary organism. In Kings Co. scorch symptoms appeared on both Grenadier and Guardsman varieties but no isolations were made to verify this diagnosis. These fields were plowed before further samples could be taken. Early in September scorch was found in fields of first year Sparkle nursery stock in Kings Co., not in the general survey, and leaves were collected and placed in moist chambers. Within a few days abundant acervuli were present on the purple-black spots and D. earliana spores could easily be identified. Thus, Lunenburg Co. was the only area in the survey where D. earliana was not found, possibly because later observations were not made.

An organism formerly unreported on strawberry leaves in Nova Scotia and suspected to be a species of Gloeosporium (henceforth referred to as Gloeosporium) was frequently isolated from lesions on strawberry foliage. Generally it was relatively unimportant as a pathogen compared to M. fragariae and G. fructicola. The spots from which Gloeosporium was isolated were reddish to purple in color with no definite margins and varying in size from 2 to 5 mm in diameter. Occasionally leaves showing areas of reddening along the main veins and in the adjacent tissues yielded cultures of Gloeosporium. On Premier the center of the spots became a much darker purple than with other varieties. These spots never became necrotic suggesting a higher type of parasitism than with M. fragariae and G. fructicola. Except for Colchester Co. this organism was found in each area surveyed. It was most prevalent in the Chester Basin area of Lunenburg Co.

Gloeosporium was isolated, at least in trace amounts, from all varieties except Senator Dunlap, Early Dawn, Grenadier and Guardsman. The data in Table 1 indicate that it was most prevalent on Seedling #K53-1-77, Premier and Sparkle. The number of Gloeosporium infections increased as the season advanced. These results were based only on comparative visual symptoms since the fungus was not actually isolated in culture until early August. In Lunenburg Co., Gloeosporium appeared to be almost universally present on all varieties, especially on fruiting beds and was more prevalent on older plantings.

Gloeosporium was present in association with other organisms causing leaf spots. In the Chester Basin area it was isolated from tan colored spots associated with *M. fragariae* from a typical scorch spot from which *D. earliana* was also isolated and from a typical blotch spot of *G. fructicola*. This indicates that this species of *Gloeosporium* besides being the cause of primary infections on strawberry foliage may also act in a secondary capacity.

The results of the survey show that *Mycosphaerella fragariae* leaf spot is at present the only economically important disease on strawberry foliage in this province. Infections caused by *Gnomonia fructicola*, *Dendrophoma obscurans*, *Diplocarpon earliana* and *Gloeosporium* species, although present in most fields surveyed, are not considered to be important foliage pathogens in Nova Scotia.

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Appendix 1

Strawberry Production in Nova Scotia[1]

Year	Production (Quarts)	Price per quart	Value
1939	943,000	$ .10	$ 94,000
1955))average 1959)	1,061,400	.25	267,800
1960	2,295,000	.20	459,000
1961	2,300,000	.245	563,500
1962[2]	1,800,000	.28	404,000

[1] Crop and Seasonal Price Summaries, Canada Department of Agriculture Vol. 14, Part 1, 1960-61, with amendment.

[2] Figures obtained from Nova Scotia Department of Agriculture and Marketing.

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PATHOGENICITY OF CERTAIN VERTICILLIUM ISOLATES FROM FRUIT AND VEGETABLE HOSTS TO SOME ORNAMENTALS[1]

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Abstract

The pathogenicity of eleven isolates of Verticillium albo-atrum R. & B. cultured from naturally infected fruit and vegetable hosts was determined on twelve genera of ornamental plants. Plants of each genus were infected by one or more isolates and the symptoms ranged from flaccidity and yellowing of lower leaves to complete wilting. The incubation periods, however, varied to a great extent depending upon the host. The isolates differed in their pathogenic ability but host specificity was not evident.

Introduction

The importance of the disease caused by the fungus Verticillium albo-atrum R. & B. and related species can not be overemphasized since the fungus is one of the most ploephagous pathogens known. The recorded hosts of pathogenic Verticillia are numerous (3, 5, 15, 17). Over 70 families of dicotyledonous plants have been found to be susceptible to this fungus (7). Despite such a wide host range, a high degree of specialized parasitism has also been noted in isolates obtained from peppermint (6, 11), Brussels sprouts (9) and pepper (10). Apart from the reports of such host-specificity, marked differences in pathogenic ability are known to exist among various isolates of the pathogen in different areas (1, 2, 4).

The main purpose of the present investigation was to determine the pathogenic ability of a number of isolates of Verticillium albo-atrum R. & B. obtained from certain fruit and vegetable crops toward a group of ornamental hosts belonging to twelve genera on which the disease symptoms had not been adequately described and definite proof of pathogenicity was lacking.

Materials and Methods

The isolates of the pathogen were secured by direct isolation of naturally-diseased peach, apricot, cherry, shiro plum, strawberry, raspberry, honeysuckle, eggplant, tomato and potato plants and from lettuce seeds. A brief description of each isolate is presented in the Table 1.

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Table 1. Host, sources and the type of resting body of the isolates of Verticillium albo-atrum employed.

Host	Source	Resting body
Apricots	Vineland, Ontario	Microsclerotia
Cherry	" "	"
Peach	" "	"
Strawberry	" "	"
Raspberry	" "	"
Lonicera	" "	"
Shiro plum	" "	"
Tomato	" "	"
Eggplant	" "	"
Potato	Charlottetown, P.E.I.	Dark mycelium
Lettuce seed	Ottawa, Ontario.	Microsclerotia

The dark mycelium type of isolate was unquestionably Verticillium albo-atrum R. & B. as interpreted by most authors (2, 4, 8, 14, 15, 17). Opinions differ regarding the nomenclature of the microsclerotia-producing cultures. Some authors regard them as V. dahliae Kleb. (2, 8, 14, 17), a distinct species. The present writer shares the view of Rudolph (15) and others (4, 11, 18) who consider the latter group as belonging to the species Verticillium albo-atrum R. & B.

The following ornamental plants were selected from Rudolph's index (15) for infection experiments: Antirrhinum majus L. (snapdragon), Callistephus chinensis (L) Nees (China aster), Dianthus caryophyllus L. (carnation), Geranium sanguineum L. (blood-red geranium), Helichrysum bracteatum Ndr. (strawflower), Impatiens sultani Hook. f. (garden balsam), Lathyras odoratus L. (sweet pea), Lupinus polyphyllus Lyndl. (lupine), Mentha piperita L. (peppermint), Monarda odoratissima Benth. (horsemint), Petunia hybrida Vilm. (garden petunia) and Senecio cruentus (Mass.) D.C. (cineraria). All test plants were raised from commercially available seeds and clones, and a drastic selection was made for morphological uniformity of the seedlings prior to inoculation.

At least twenty seedlings (4-6 weeks old) of each host were inoculated by soaking the washed roots in a homogenized suspension of each isolate for 16-18 hours. The inoculum was prepared from 14-21 day old cultures and consisted of microsclerotia, mycelium and conidia (approx 4×10^4/ml). The inoculated seedlings were potted in steam-sterilized soil and placed on greenhouse benches. Hosts which did not show distinct symptoms in the greenhouse were tested under field condition during the summer to ascertain whether the natural environment would enhance the disease development. Before planting, the test plot was fumigated with chloropicrin as recommended by Wilhelm and Koch (19).

Both in the greenhouse and in the field the inoculated plants were observed carefully for over four months for external symptoms and finally reisolations were made from each plant to determine the infectivity of the fungus. The most dependable method of reisolation was to plate small pieces of petioles of lower leaves. The pieces were surface sterilized by rinsing them in a 1% solution of sodium hypochlorite for 10-15 minutes and plated directly on water-agar medium. Within 3-4 days the fungus appeared as white tufts of mycelium from the cut ends of the petioles (Fig. 1).

Results

Observations on symptomatology, incubation period and the severity of the disease on various hosts with the eleven isolates of the fungus were as follows:

The most rapid and severe development of the disease was noticed on lupine, strawflower and cineraria. The incubation period was 15-20 days with each of these hosts. On lupine the initial symptoms were flaccidity and drooping of the leaflets; occasionally, with some degree of twisting and curling. This condition was soon followed by collapse and drying of the petioles (Fig. 3). On the strawflower, at first, the lower leaves wilted and turned brown, but as the disease progressed the central leaves tended to twist and curl giving the plant a somewhat loose and ragged appearance (Fig. 2). Vandermeer (17) and Tompkins and Ark (18) have also noticed similar symptoms on lupine and strawflower respectively. The initial symptom on cineraria was flaccidity of the lower leaves. This condition was followed by greyish-green discoloration and necrosis of the lamina or portion of it delimited by the larger veins. Finally the whole leaf drooped (Fig. 5). In all of the above mentioned hosts the vascular discoloration caused by the fungus was rapid and the browning of vessels was conspicuous. All isolates employed were severely pathogenic to these hosts, and the disease symptoms were quite distinct while, on the other hand, none of the isolates incited the disease on carnation and peppermint plants.

The rest of the hosts studied (china aster, garden balsam, sweet pea, petunia, geranium, snapdragon and horsemint) were infected by one or more isolates and the symptoms mainly consisted of yellowing and drying of lower leaves, although these external symptoms could easily be confused with the normal senescense of older leaves. Typical wilting of a petunia plant is shown in Fig. 4. By isolating the pathogen from lower leaves it was observed that all of the isolates were pathogenic to china aster, geranium, sweet pea and petunia. It was also interesting to note that the snapdragon was attacked by three ('eggplant', 'peach' and 'raspberry'), garden balsam by two ("Shiro plum" and *Lonicera*)

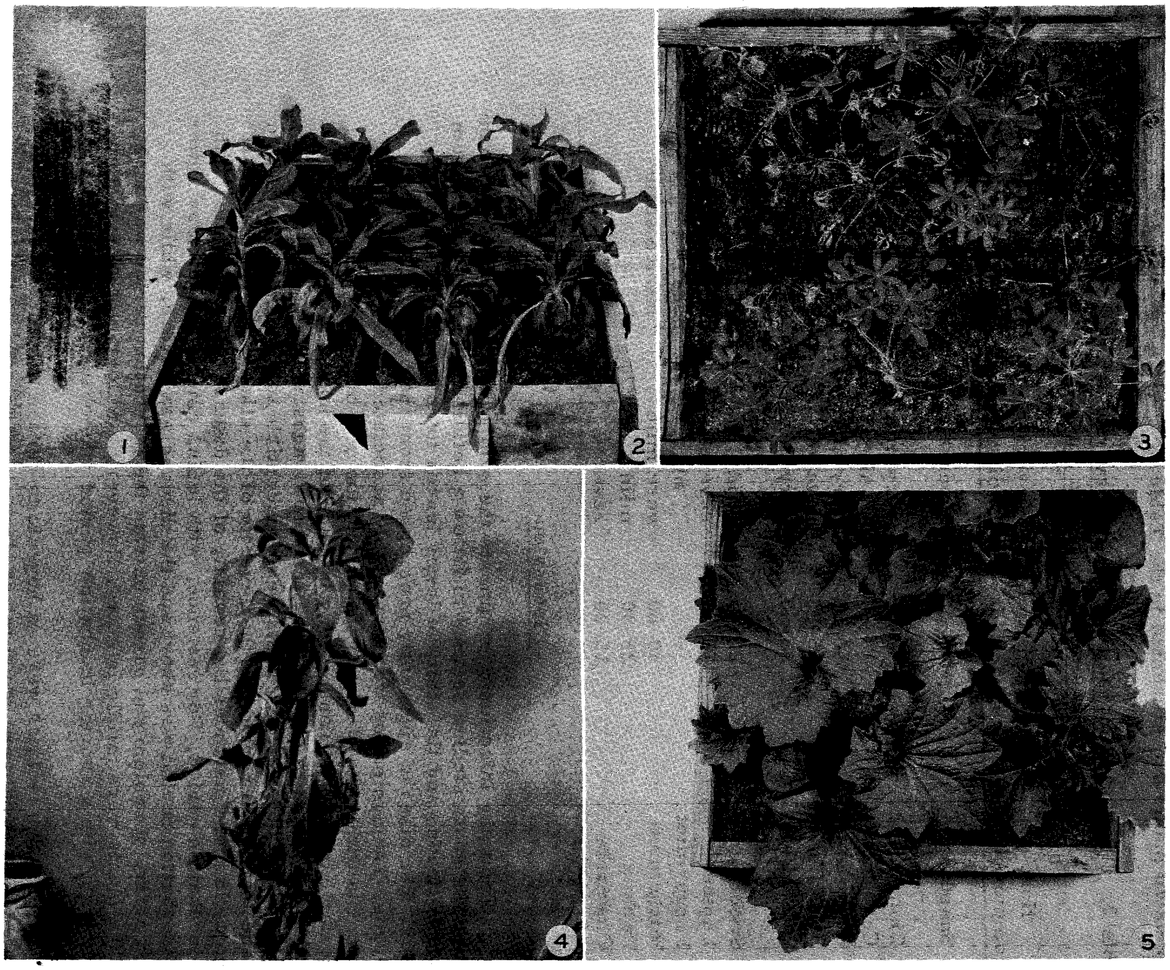

Fig. 1. Tuft of mycelium of *Verticillium* at the cut ends of a petiole of *Hetichrysum bracteatum* Ndr.
Fig. 2-5. External symptom of *Verticillium* wilt on *Helichrysum bracleatum* Ndr., *Lupinus polyphyllus* Lyndl., *Petunia hybrida* Vilm., and *Senecio cruentus* (Mass) D.C.

and horsemint by one ('lettuce seed') of the isolates. The period of incubation, the severity of disease and the pathogen reisolated from the inoculated plants are presented in the Table 2.

Table 2. Period of incubation, disease severity and pathogenic isolates of the various ornamental hosts studied.

Host (common names)	Incubation period (days)	Severity of disease	Pathogenic isolates
1. Snapdragon	25-30	moderate	'eggplant' 'peach' 'raspberry'
2. China aster	40-45	very mild	all
3. Carnation	--	nil	none
4. Geranium	50-60	very mild	all
5. Strawflower	15-20	severe	all
6. Garden balsam	45-50	very mild	'Shiro plum' and *Lonicera*'
7. Sweet pea	25-30	mild	all
8. Lupine	15-20	severe	all
9. Peppermint	---	nil	none
10. Horsemint	50-60	very mild	'lettuce seed'
11. Petunia	25-30	mild	all
12. Cineraria	15-20	severe	all

Discussion

From the infection experiments the symptomatology of Verticillium wilt on the hosts studied seemed to follow a definite pattern, ranging from slight yellowing and flaccidity of lower leaves to complete wilting of all leaves. The disease apparently progressed from the base of the plant upwards. The symptoms were invariably associated with the presence of the fungus within the plant and the production of a brown substance in the vascular bundles was conspicuous in some of the hosts. However, no attempt was made to characterize this brown substance.

Seven of the twelve hosts were susceptible to all isolates employed but the incubation period and the severity of the disease varied from host to host. In most instances the severity of the disease was correlated with the incubation period. For instance, with lupin, cineraria and strawflower the incubation period was short and the disease was severe, while with china aster, geranium and garden balsam the incubation period was long and the plants were mildly infected. However, a milder type of symptom expression with a shorter incubation period was observed in petunia and sweet pea.

Only two isolates were pathogenic to garden balsam and three to snapdragon and only one could infect *Monarda* while none of the isolates were able to cause disease in mint and carnation. The garden balsam has very few fungal diseases (13). These results strongly suggest that there are qualitative differences among the isolates, but at this stage no generalization can be made regarding the nature of the differences except for the fact that strict host-specificity was not evident in any of the isolates.

There seems to be a potential value of hosts like lupin, cineraria and strawflower in the study of Verticillium wilt problems because of their high susceptibility to the various isolates of the fungus and the short incubation period of the disease. There is also a strong possibility that any of the above mentioned hosts may be successfully used as indicator plants (18) when assessing the inoculum potential of *Verticillium* in soil. With respect to other ornamental hosts studied, the disease can best be diagnosed by isolating the pathogen from petioles of the lower leaves of a suspected plant.

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THE DISCOVERY OF GOLDEN NEMATODE IN NEWFOUNDLAND

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The presence of golden nematode in Newfoundland was first suspected on October 9, 1962, when Arran Victory potatoes growing in a field at Manuels, Nfld., were examined. The plants were stunted and had produced a very small crop. Nematode cysts in the orange and brown color stages could be seen on the potato roots. A sample was collected and sent to the Nematology Section, Entomology Research Institute, Ottawa. The nematode cysts were positively identified as Heterodera rostochiensis Woll. on October 19.

Following the identification, a preliminary survey of the St. John's and Conception Bay areas was made by the senior author and staff members of the Plant Protection Division, St. John's. Golden nematode cysts were found at Chamberlains, Manuels, Foxtrap, Cupids, and Bay Roberts, communities on the south and west shores of Conception Bay.

Since these results indicated the possibility of general occurrence of the golden nematode in Newfoundland, an extensive survey of the province was initiated with the cooperation of the Plant Protection Division and the Agricultural Division of the Provincial Department of Mines, Agriculture and Resources. Soil samples were collected from all cultivated areas of the island and further results are awaiting examination of the soil samples.

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STORAGE ROTS OF TOMATOES IN NOVA SCOTIA IN 1962

C.L. Lockhart[1]

A survey was made of the organisms causing rots of tomatoes, varieties Harrow and Stokesdale, in common storage at Kentville, Nova Scotia. For this purpose, counts were made of the rots as the tomatoes were removed from storage from September to November. A total of 5000 tomatoes were examined. The results are given in the following table.

Rots of stored green-mature tomatoes expressed as percent

Organism	Harrow %	Stokesdale %
Colletotrichum coccodes	8.4	8.1
Alternaria tenuis	5.2	8.2
Phytophthora infestans	0.06	5.8
Botrytis cinerea	0.1	3.9
Sclerotinia sclerotorium	0.1	0.5
Phoma destructiva	0.02	0.15
Penicillium spp.	0.0	0.05
Spotted wilt	0.06	0.17
Bacteria	1.4	1.1
Total rots	15.3	28.0

The variety Stokesdale showed a higher incidence of *Botrytis cinerea* and late blight than the variety Harrow.

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SURVEY FOR VIRUS DISEASES OF CEREALS IN MANITOBA AND SASKATCHEWAN

J.T. Slykhuis[1]

In July 1962, a survey for virus diseases on spring cereals was made in Manitoba and Saskatchewan in co-operation with personnel of the Canada Department of Agriculture Research Stations at Winnipeg and Saskatoon.

Barley yellow dwarf was found in trace amounts only in about one-third of the grain fields examined in Manitoba in the vicinity of Winnipeg and south-west to the Saskatchewan border. Diseased plants were more readily found in oats than in wheat or barley. Most of the symptoms observed appeared to be in early stages of development, but some of the affected plants were slightly stunted. Although several species of aphids known to be vectors, including Rhopalosiphum padi (L.), R. maidis (F.), Macrosiphum avenae (F.) and M. dirhodum (Walker), were found in most areas surveyed, so few were present that it did not appear likely that barley yellow dwarf virus could spread rapidly enough to cause an appreciable effect on yield of any of the grains this year, unless larger numbers of aphids appeared on the late-sown crops in the Winnipeg area, where many fields were sown very late.

In Saskatchewan, barley yellow dwarf symptoms and a few aphids were found on several plants in one-third to one-half of the fields of oats, barley and spring wheat examined in the south-east from Carnduff to Melville, but both virus symptoms and aphids were extremely rare along a route through Regina, Moose Jaw and Swift Current, then north through Outlook to Saskatoon, and in the area north-east to Melfort.

In both Manitoba and Saskatchewan a search was also made for wheat striate mosaic virus and its vector Endria inimica (Say). The later leafhopper is often abundant during July in grasses along roadsides and in pastures, but this year populations were sparse. There was no evidence of wheat striate mosais in any of the areas of south-eastern Saskatchewan and southern Manitoba where it occurred in trace amounts in nearly all wheat fields examined in 1961. Although several plants with leaf symtoms similar to wheat striate mosaic were found in a field of durum wheat in Manitoba and one in western Saskatchewan, tests did not indicate the presence of wheat striate mosaic virus.

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DISEASES OF SUNFLOWERS IN MANITOBA IN 1962

J.A. Hoes and E.D. Putt[1]

During the 1962 season 36 fields of sunflowers including 25 fields of Mennonite and 11 of Admiral or Advent were examined for disease in the Red River Valley of Manitoba. The precipitation during the growing season was above average and the temperature below average. In May, 8.40 inches of rain were recorded at Morden compared with the 44-year average of 2.28 inches. In the three months, June to August, total precipitation was 9.29 inches as compared with the 44-year average of 8.27 inches. As a result, seeding of many fields was delayed and some failed to mature before frost occurred.

It is a principle in plant pathology that reduction in yield may vary markedly with the disease and environmental factors concerned. With an early systemic infection of downy mildew a diseased sunflower plant is a complete loss and environment of little importance once the plant is infected. The same is true of Sclerotinia attacking before the plant is in bloom. In the case of rust especially, and to a lesser degree in the case of leaf mottle, reduction in yield due to disease is largely dependent on intensity of initial attack and subsequent speed and severity of disease development. Here environment is of relatively greater importance in determining the reduction in yield. The above should be fully realized in assessing the effect of different diseases on sunflower yield in 1962 as outlined below.

Rust (Puccinia helianthi) occurred on 100% of the plants in all 25 fields of Mennonite. In 11 fields, pustule density was low (5-20%); in seven fields, medium (20-60%); and in seven fields high (50-100%). Except in three fields, there was no appreciable damage due to rust. In the 11 fields containing Admiral or Advent, rust occurred in traces only. Though rust was widespread, the damage in general was only slight because initial infection was very weak.

Leaf mottle (Verticillium albo-atrum) was widespread. Disease severity was slight, (trace-10% of infected plants) in 23 fields; moderate, (15-40%) in three fields; and severe, (50-100%) in ten fields. Among the ten fields with severe infection it is estimated that nearly complete loss occurred in two fields, 50% loss in five fields and 10-15% loss in three fields.

Downy mildew (Plasmopora halstedii) was in general more prevalent than usual. In two fields 20-25% of the plants were infected; in two fields 5-10% were diseased, and a trace-2% occurred in eight fields. In 24 fields the disease was absent or scarce.

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Sclerotinia wilt (*Sclerotinia sclerotiorum*) affected 40% of the plants in one field; 20-25% in two fields; 10% in two fields, and 5% in five fields. In 26 fields the disease was absent or occurred in traces only.

Septoria leaf spot (*Septoria helianthi*) was conspicuous. Of 26 fields where symptoms could be recognized, four fields showed slight, (trace-10%) infection; two fields showed moderate, (30-40%) infection; and in four fields infection was severe (80-100%). Damage was slight in general. Field observations on 107 lines suggest that lines differ in degree of susceptibility. Lines representative of the range observed are being examined under controlled conditions. Sackston (1) reports that the disease was very prevalent in 1947. Since then Sackston found it only once in 1955 and again, but in trace amounts only, in 1959 (1). The prevalence of the disease in 1962 is no doubt due to the very wet growing season. Considering the large amounts of inoculum presently available, it is felt that a prolonged period of wet weather early in the growing season of 1963 could result in serious losses from this disease.

In spite of the severity and extent of disease occurrence in 1962, the average yield per acre was about 800 lbs. This is well above the 17-year average yield of 580 lbs. per acre. The above-normal precipitation may have compensated for disease losses by promoting more vigorous plant growth than is usual.

Mr. Peter Bergen of Co-op. Vegetable Oils Ltd., Altona, participated in part of the survey. Mr. Bergen also estimated the average yield for 1962.

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BACTERIAL BLIGHT OF FIELD BEANS IN 1962

M.D. Sutton and V.R. Wallen

Five-hundred and ninety-nine acres of registered field beans, including 363 acres of Sanilac, 191 acres of Michelite and 45 acres of Seaway were inspected for the incidence of bacterial blight in south-western Ontario in 1962. The initial inspection of 222 acres was made during the first week of July and comprised 122, 75 and 25 acres of the varieties Sanilac, Michelite and Seaway, respectively. The second inspection of 377 acres was made during the fourth week of August and comprised 241 acres of Sanilac, 116 acres of Michelite and 20 acres of Seaway.

The purpose of the first survey was to find out if seed-borne bacterial blight had been transmitted to the 1962 crop from the seed of beans inspected in 1961. Thirteen fields, representing originally 9 seed lots of which only one was reported healthy in 1961, were inspected. The seed of eight fields was treated while the remaining five fields represented untreated seed.

Both fields grown from the seed lot reported healthy in 1961 were reported healthy in 1962 whether the seed was treated or untreated. The progeny of 3 of 4 fields of untreated seed exhibited definite symptoms of seed-borne bacterial blight. These fields were grown from seed lots that contained from a trace to 100 per cent leaf infection and from a trace to 25 per cent pod infection. Of the 7 remaining fields, all but one produced from treated seed and the progeny of 1961 infected fields, only one showed a trace of infection when ititially inspected. The untreated field exhibited moderate infection.

The results of these inspections indicated initially that fungicidal seed treatments had controlled seed-borne infection. However, further examinations of the fields during the second survey showed that the seed treatments had only delayed the initial expression of bacterial blight symptoms for a period of one to two weeks. It would appear therefore that the treatments had a slight bacteriostatic effect on the organisms within the seed.

Most of the 377 acres inspected during the second survey was concentrated in the Blenheim area adjacent to Lake Erie and the immediate area around Chatham. In this area bean crops were sown quite late and the seed-borne nature of bacterial blight in many fields was still very evident. Distinct, well defined loci of infection were scattered throughout the fields. This condition was particularly true in fields of Sanilac beans. Individual fields of this variety exhibited up to 80 per cent leaf infection and 50 per cent pod infection. Fields of Michelite and Seaway grown in the same area were free of blight or showed only traces of leaf and pod infection. Bacteriological examination of infected plant material indicated that *Xanthomonas phaseoli* (common blight) and *Pseudomonas phaseoliocola* were present in the area inspected.

During the survey other diseases of beans were observed. Anthracnose (Colletotrichum lindemuthianum) was repeatedly found, primarily in trace amounts in the variety Michelite. Sclerotinia wilt (Sclerotinia sclerotiorum) was found in almost all fields; infection ranged from a trace to slight in isolated areas in most fields, however, severe infestations of the fungus occurred where growth was extremely succulent on low-lying land. Fusarium root rot (Fusarium solani) was found in trace amounts in a few fields. Common and yellow bean mosaics were prevalent in many of the fields inspected. One field of Michelite showed a heavy infection of bean rust (Uromyces appendiculatus) in certain areas of the field.

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DISEASES OF FIELD BEANS IN WESTERN ONTARIO IN 1962

G.H. Clark[1]

The outstanding feature of the field bean growing season was the extremely dry soil conditions that prevailed in the bean growing area of Western Ontario during June and early July. This condition resulted in the prevalence of fields that showed multiple nutritional disorders. Nearly all of these fields recovered following heavy rains that occurred during the second week of July, and made extremely good growth during the remainder of the growing season. In fact, such favorable growing conditions prevailed during late July and August that many bean fields had excessive vine growth. This was probably partly due to the fact that more nitrogen fertilizer is now being applied to the bean crop than was the case a few years ago. This excessive vine growth resulted in severe damage from white mold (Sclerotinia sclerotiorum) in numerous fields in Kent County.

The bacterial blights, (Xanthomonas phaseoli and Pseudomonas phaseolicola) were observed on all varieties of beans in Ontario but were more widespread and severe on the bush bean varieties, Sanilac and Seaway.

Root rot (Fusarium solani f. phaseoli) was present in almost all the bean fields examined but was severe in only a few instances. In one field in which the crop was almost totally destroyed by root rot the field had been successively cropped to white beans for several years. Some reduction in stand was also found in fields where drainage was inadequate.

Sunscald (nonparasitic) was present in most bean fields in 1962. Early maturing fields of beans, especially those planted to the varieties Sanilac and Seaway, were somewhat more affected than later maturing crops of beans.

Anthracnose (Colletotrichum lindemuthianum) was not encountered in the 1962 bean surveys. The infrequency of this disease may be attributed to the greater use of disease-free seed and the predominance of the anthracnose-resistant variety, Sanilac.

Common mosaic (virus) was rarely observed and was seen mainly on the Michelite variety. Yellow mosaic was prevalent in many fields. Rust (Uromyces phaseoli) was observed in only a few fields and infections were not severe.

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PEA DISEASE SURVEY OF THE OTTAWA VALLEY

V.R. Wallen[1]

A total of 110 acres of field peas were inspected for the incidence of disease in the Ottawa Valley in 1962. The principal variety grown this year was B.C. Blues although smaller acreages of Creamette and Chancellor were included in the inspection.

For the second successive year leaf and pod spot (Ascochyta pisi) was not observed in any field. However, foot rot caused by Ascochyta pinodella was present in every field examined. This disease caused a trace to 30 per cent loss of plants in the various fields. The variety B.C. Blues appears to be particularly susceptible to this organism. A trace amount of infection was noted in the variety Creamette. The blight organism (Mycosphaerella pinodes) which causes symptoms indistinguishable from Ascochyta pinodella caused a slight amount of damage in one field of Chancellor peas.

It would appear that the situation with regard to Ascochyta diseases in this area is changing rapidly because of the use of varieties with high A. pisi resistance. B.C. Blues is highly resistant to all four races of A. pisi but from this year's field inspection it would appear that it is susceptible to A. pinodella. Creamette, the other predominent variety grown in this area, shows high resistance to A. pisi and has so far not shown any degree of susceptibility to A. pinodes or A. pinodella. Previous acreages in this area were grown almost exclusively to the varieties Chancellor and Arthur which are highly susceptible to A. pisi.

Rust (Uromyces fabae) was found in two fields causing trace and slight amounts of damage. Virus diseases were noted only in the one variety Chancellor. Mosaic and stunt occurred in trace amounts while streak occurred on approximately 15 per cent of the plants and was responsible for loss of seed set on the plants attacked.

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THE INCIDENCE OF APPLE SCAB IN THE FARNHAM DISTRICT OF QUEBEC IN 1962.

Roger Desmarteau[1]

In 1962, conditions were very favorable for apple scab development in the Farnham district. From April 29, at greentip stage, to October 1st, 18.85 inches of rain distributed on 57 days were recorded. The monthly precipitation appears in Table 1.

Table 1 - The monthly precipitation at Farnham

April	4.85	August	3.075
May	3.585	Sept.	2.815
June	3.484	Oct.	5.38
July	4.82	Total	28.004

Growth was rapid at the beginning of the season: only four days elapsed from greentip to early pre-pink. Then cool temperature prevailed and the vegetative development of the trees slowed down. It took 12 days from early pre-pink to pink stage and the blossoming period stretched on 10 days from pink to calyx. The vegetative stages for the variety McIntosh appear in Table 2.

Table 2 - Vegetative stages recorded for McIntosh

Greentip	May 1	Advanced Pink	May 18
Delayed dormant	May 3	50% bloom	May 19
Early pre-pink	May 5	Full bloom	May 20
Pre-pink	May 14	Calyx	May 28
Pink	May 17	1st cover	June 4

The first effective ascospore ejection was recorded on May 1st, after exposing spore traps during the precipitation of April 29-30. The first scab infection occurred when green tissues were just showing, at a time when no spray had been applied in most orchards. Moreover, two severe infections occurred during bloom while many growers were prevented from applying a fungicide because of the wind. In all, ten primary infections plus a number of secondary ones occurred in the district.

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The dates on which primary infections occurred are shown in Table 3. The infection periods were determined according to the Mills Chart with the help of a Casella Recording Rain Gauge and a one-day thermograph.

Table 3 - Primary infection periods - Farnham 1962

Infection Date	Vegetative Stage	Temperature Wetness (1)	Infection Date	Vegetative Stage	Temperature Wetness (1)
April 29-30 May 1	greentip	49° 42 hrs	May 31	Calyx	68.6 12 hrs.
May 3-4	Delayed dormant	48.1° 48 hrs	June 10-11	--	68.5° 17 hrs
May 6	Early pre-pink	50.5° 19 hrs	June 19	--	59.2° 23 hrs.
May 15 (doubtful)	Pre-pink	57° 11 hrs	June 22-23	--	65° 18 hrs
May 20-21	Full bloom	61.5° 15 hrs	June 24	--	61.5° 11 hrs.
May 24	Bloom	65.9° 18 hrs.			

(1) Mean temperature and length of the wetting periods.

Seasonal Scab Development

First scab was observed on May 24 in both the experimental orchard and commercial orchards of the district, presumably resulting from infections on April 29-30 and May 3-4. The spots were localized on both sides and at the apex of the cluster bud leaves.

On June 7, more scabby leaves were noted in the experimental orchard but it was not until mid-June that the least successful program permitted spread of the disease. As an example, on June 14, a count revealed an average of 453 scabby leaves per tree in one treatment. At the same time, scab was reported by several growers and a survey revealed a severe scab development in a few orchards.

On August 22, foliage scab had been checked in some plots while secondary scab was observed on fruits and leaves with the least successful spray programs. At harvest, calyx scab only was found in plots where foliage scab had been checked whereas summer and fall fruit scab were also present in some treatments.

In addition, in August, a survey was made in the Farnham district and vincinity and in Two-Mountains county. Scab was found ranging from trace to nearly 90 per cent. However, it may be said that, in general, the majority of orchards were commercially clean.

Table 4 summarizes observations on scab development and losses encountered in some of the orchards visited. The scab percentages were obtained by actual counts made at random in a number of McIntosh trees selected for their particular location in a given orchard. Yields mentioned in the table are estimates.

Table 4 - Apple Scab Survey - 1962

Location	Total tree population	% Scab	Remarks
Dunham	500	5%	calyx scab only -
"	2,000	72%	defoliation: actual vs possible yield: 7000 vs 10-15000 bushels -
Frelighsburg	1,500	22%	15,000 bushels -
"	450	8%	low site -
"	3,000	75%	defoliation: actual vs possible yield: 20000 vs 40000 bushels -
St-Armand	1,000	17%	high site -
		88%	low part of orchard - defoliation -
Bedford	1,000	82%	defoliation -
West Shefford	1,500	45%	low site -
		4%	high site -
Granby	1,000	74%	defoliation -
Oka	900	8%	10-12000 bushels -
St-Placide	600	12%	There was less scab damage found in Two-Mountain -

REACTION OF SWEET CLOVER VARIETIES TO BLACKSTEM

B. Berkenkamp and H. Baenziger[1]

Sweet Clover trials, including eight different varieties were seeded at Lacombe in the spring of 1962 without a companion crop. Excellent stands were established and, by the end of the growing season, dwarf types ranged from 12 to 18 inches in height, while standard varieties ranged from 24 to 30 inches. In late August some plots were severely infected with *Ascochyta* sp. A test replicated six times was subsequently scored for disease severity using a scale from 1 to 5, where 1 = disease free, 2 = trace, 3 = moderate, 4 = prevalent, 5 = severe). Average ratings for varieties and significance ranges (1% level) were as follows:

Alpha	Denta	Arctic	Madrid (Sask.)	Madrid (USA)	Cumino & Erector	Brandon Dwarf
4.83	2.50	2.33	2.16	2.00	1.38	1.50

Standard error of means = .18

The variety Alpha was very susceptible and extremely sensitive to the disease. Lesions occurred on large portions of the stems and the disease caused severe defoliation. Denta exhibited moderate infection but this variety appeared to possess marked tolerance to blacksten. Plants were vigorous and the foliage showed healthy color. Brandon Dwarf showed greatest resistance to blackstem.

[1]Plant Pathologist and Plant Breeder, Experimental Farm, Lacombe, Alberta.

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