Small fruits

CROP: Blueberries

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LOCATION: British Columbia

TITLE: SURVEY FOR BLUEBERRY SCORCH VIRUS *AND* TOMATO RINGSPOT VIRUS IN HIGHBUSH BLUEBERRY IN B.C., WASHINGTON AND OREGON

METHODS: A survey for blueberry scorch virus (BBScV)(Martin and Bristow, in press) and tomato ringspot virus (TomRSV) in highbush blueberry (*Vaccinium corymbosum*) was carried out in the Fraser Valley of B.C., Washington and Oregon during the summer of 1987.

Five thousand samples were tested for *each* virus by ELISA. Of several grinding buffers tested to keep the pH of the homogenized leaf tissue near neutrality 0.1M borate (pH 8.2) with 0.5% nicotine, 2% PVP, 0.1% non-fat dried milk and 0.5ml/l Tween-20 gave the best results with blueberry tissue and this buffer was used for the survey. Standard ELISA protocol (Clark and Adams, 1977) was used except for the different grinding buffer.

A sample was made up of three leaves taken from different branches on a single bush as BBScV does not appear to be equally distributed throughout a plant. Normally samples were tested the day after collection but could also be kept for several weeks at 4 C with no apparent loss in efficiency of detection.

RESULTS AND COMMENTS: TomRSV was found in only one 40 year old field in Whatcom County, Washington and the grower has since removed the infected bushes. BBScV was found in hundreds of plants but all were located in the Puyallup Valley, Washington. Field infections with BBScV were detected in 13 cultivars of highbush blueberry with varying response to infection. The cultivars 'Atlantic', `Berkeley', 'Collins', 'Dixie', 'Herbert', `Pemberton', and `Weymouth' showed blossom blight and marginal chlorosis of leaves produced on older wood; 'Olympia' and `Eberhardt' showed marginal chlorosis of older leaves; 'Jersey', 'Stanley', `Bluecrop', and `N15G' did not show symptoms.

A disease with symptoms similar to bushes infected with BBScV has been found in the Fraser Valley of B.C. and in Whatcom and Clark Counties of Washington and western Oregon. These bushes did not react with BBScv antiserum. Electron microscopy of ultrathin sections cut from fixed leaf tissue revealed long, flexous rod-shaped virus-like particles and numerous vesicles associated with these particles. This cytopathology is quite distinct from the large bundles of virus particles and lack of vesiculation observed in thin sections from bushes infected with BBScV and is similar to some features of Sheep Pen Hill disease in New Jersey.

Reference: Clark, M.E. and Adams, A.N. 1977. Characteristics of the micro-plate methcd of enzyme-linked immunosorbent assay or the detection of plant viruses. J. *Gen.* Virol. 34:475-483.

Martin, R.R. and Bristow, P.R. 1988. A carlavirus associated with blueberry scorch disease. Phytopathology (in press)

CROP: Blueberry

LOCATION: Manitoba

TITLE: Incidence of Plant Diseases in Blueberries in Manitoba i.n 1987

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METHODS: Results are based on samples of blueberries submitted to the Plant Pathology Laboratory and field examinations.

RESULTS: Commercial production of a lowbush, highbush blueberry cross is being undertaken by a few growers in Manitoba. The main disease problems encountered were cankers caused by Fusicoccum sp and Pestalotia sp.

CROP: Raspberries

LOCATION: British Columbia

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TITLE: SURVEY OF VIRUSES IN RASPBERRRIES IN B. C. AND WASHINGTON

METHODS: A survey of virus diseases of raspberries in British Columbia and Washington was carried out during the summer of 1986. Three methods of analysis; mhanical transmissions to Chenopodium quinoa, double-stranded RNA analysis, and a serological test (ELISA, specific for raspberry bushy dwarf (RBDV) and tomato ringspot (TomRSV) viruses) were used to test each of 450 samples collected. Samples of 15-20 g were collected and brought to the laboratory for analysis. Three leaflets, 1/2 tp 3/4 expanded, from each sample were used for mhanical transmissions to C. Quinoa. Another three young leaflets were used for the ELISA and 10 g from each sample were used for the dsRNA analysis (Kurppa and Martin, 1986).

RESULTS: In the early summer (May and June) there was an excellent correlation between RBDV and TomRSV detection in all three tests, Two RBDV and one TomRSV positive sample by mhanical transmission and dsRNA were negative by ELISA, whcih may be due to uneven distribution of these viruses in some raspberry plants. Later in, the season the mhanical transmission tests were very unreliable,

To test for uneven distribution of RBDV within raspberry plants six leaves on each of 20 primocanes from one known infected plant of the varieties Trent and Creston were assayed for RBDV by ELISA. In 'Creston' each of the 6 leaves on all 20 canes indexed positive while in 'Trent', 4 canes indexed negative for RBDV and 16 indexed positive. All 6 leaves on canes indexing negative were negative and all leaves on infected canes were positive. The uneven distribution was between canes rather than within *canes.*

Of the 450 samples surveyed tobacco streak virus (TSV), RBDV, TomRSV and an ilar-like virus (ILV)were detected in 7, 8, 22, and 65 samples respectively. The ILV was detected only by dsRNA analysis and thought to be raspberry leaf spot virus based on symptoms in Rubus occidentalis and 'Norfolk giant'. However, RLSV infected leaves obtained from A. T. Jones (Scottish Crops Research Institute) did not give dsRNA bands and therefore these dsRNA bands are referred to as ILV since the number and position of the bands is similar to what we see with TSV another ilarvirus. The ILV is aphid transmitted and not transmitted mechanically whereas TSV is transmitted mechanically and not aphid transmitted.

The TSV, RBDV and TomRSV were distributed evenly throughout the sampling area, whereas the ILV was found primarly along Puget **Sound** and in the Fraser Valley (Fig.). Aphid populations were also noted while collecting samples. During the summer of 1986 populations of the raspberry aphid Amphorophora agathonica were in excess of 100/cane on susceptible varieties from the southern end of Puget Sound north into the Fraser Valley but were very rare

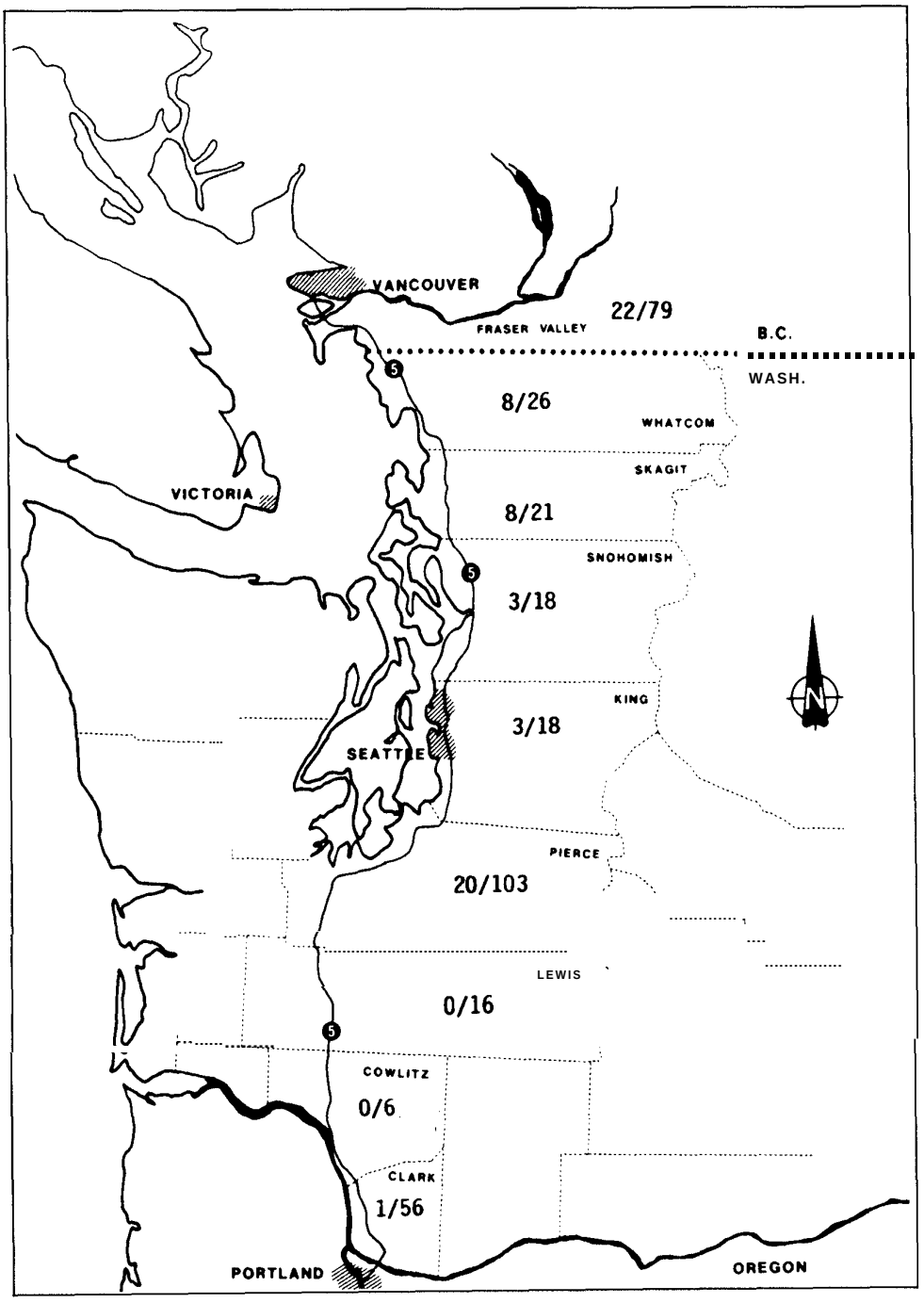
south of Puget Sound. This was thought to be due to the unseasonably cold winter of 1985-86 with the moderation of temperatures near the Sound responsible for higher aphid populations. The winter of 1986-87 was very mild followed by a warm spring and summer. High aphid populations were expected in the summer of 1987 but instead the raspberry aphid was difficult to find until autumn. It is now thought that the populations of raspberry aphids observed in raspberry fields is a function of the overwintering and early buildup of predators rather than how well the aphids survive the winter.

The most common virus in this survey was the ILV which *is* aphid-borne. Use of aphid-resistant varieties gives excellent control of this virus in the field. None of over 100 samples of aphid resistant varieties tested indexed positive for this virus. Several of the newer varieties released from the small fruit breeding program at Agriculture Canada in Vancouver are resistant to aphids (Daubney 1980, 1987) and should help limit the spread of this virus.

References: Daubeny, H.A. 1987. Chilliwack and Comox red raspberries. HortScience 22: (In Press).

Daubeny, H.A. 1980. Red raspberry cultivar development in British Cloumbia with special reference to pest response and germplasm exploitation. Acta Hort. 112: 59-67.

Kurppa, A. and Martin, R.R. 1986. Use of double-stranded RNA for detection and identification of virus diseases of Rubus species. Acta Hort. 186: 51-62.



Distribution of Aphid-Borne **Rubus** Virus

CROP: Raspberry

LOCATION: British Columbia

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TITLE: TOMATO RINGSPOT VIRUS DISEASE SURVEY OF RED RASPBERRY

METHODS: Tomato ringspot virus (TomRSV) has been isolated in previous years from a few commercial red raspberry plantings in the Fraser Valley. In 1987, a more detailed survey was undertaken, involving 20 commercial raspberry plantings located in the Fraser Valley and southern 'Vancouver Island. Approximately, 50 samples of each cultivar at each location were indexed by the ELISA technique. In order to optimize detection, the many variables of the double antibody sandwich technique were investigated. Most indexing was done during the period May to July using leaves from primocanes as the virus source. Some known infected plants were indexed at intervals from February through to October to determine seasonal variability of test results.

RESULTS:

(a) Occurrence and distribution: TomRSV was not detected in any of the 7 plantings on Vancouver Island nor in 11 of the 13 plantings on the mainland. The two exceptions were a 4-hectare planting of cv. Willamette near Chilliwack and a 3-hectare planting of Willamette and Chilcotin near Sumas. Both of these plantings were extensively infected although infection was in localized patches, with some areas of the planting being completely virus-free and other areas being totally infected. The average infection was 20 percent in the Sumas planting and 35 percent in the Chilliwack planting. Many plants showed varying degrees of interveinal chlorosis of the leaves of fruiting canes but few of the plants showed distinctive symptoms in current year canes.

(b) Effect of virus on growth and yield: Growth and yield records were taken on a 10-plant block of 'Willamette' raspberries infected with TomRSV, and an adjacent 10-plant block from a healthy portion of the same field. The diseased plants, which had probably been infected for at least four years, were stunted and had fewer fruiting canes, and bud break was 2-3 weeks later than on healthy plants. Fruit weight and the num'ber of berries was recorded twice a week for the five-week picking season. The virus-free plants yielded an average of 2011 g of fruit per plant; infected plants yielded an average of 655 g per plant. The average number of berries on healthy plants was 879; on infected plants it was 473. Thus, two factors contributed to the yield reduction on the infected plants: the number of berries per plant and the berry size. Despite the 2-3 week delay in bud break on infected plants in the spring, peak berry production was delayed only four days.

(c) Seasonal variation in ELISA detection: Testing for tomato ringspot virus was done at intervals from February through to October on field grown raspberry plants to determine seasonal variability of test results. Polyclonal antibodies were used to coat the microtiter plates and monoclonal antibodies were used for conjugate in ELISA tests. Sap was extracted from the raspberry tissue by means of the Pollahne leaf press. These ELISA tests demonstrated that infected plants could be reliably detected in the spring of the year, but the reliability of the test decreased as the season progressed. Bark tissue and dormant buds constituted good test material during the winter and early spring. Leaf tissue was material test tissue from bud break through to leaf drop. High background readings occasionally encountered in mid-summer were avoided by using tissue:buffer ratios in the order of 1:100.

(d) Optimizing ELISA detection: To optimize detection of tomato ringspot virus in red raspberry, the many variables in the double antibody sandwich ELISA technique were investigated. G-globulin from a high quality polyclonal antiserum was used at a dilution of 1:2000, followed by a conjugate prepared from monoclonal g-globulin at 1:2000 dilution. Microtiter wells were coated overnight or longer, followed by incubation of test antigen for 16 hours, conjugate for 6 hours and subtrate for 24 hours, all steps at 20°C. Under the above conditions, infected leaf tissue gave an absorbance reading of 2.0 to 3.0 at sap dilutions ranging from 1:125 to 1:1000, whereas healthy controls gave readings of less than 0.1. Leaf tissue was the standard source of virus inoculum that was used to test variables, but virtually any tissue from an infected plant (bark, roots, fruit, petals, etc.) proved to be a suitable inoculum source.

COMMENT:

TomRSV does not appear to be extensively distributed in raspberry plantings in the Fraser Valley and southern Vancouver Island. It is probably confined to those soils in which there is a moderately high population to those nematodes belonging to the genus Xiphinema that are capable of vectoring the virus. It was originally thought that the only vector was X. americanum but several closely related species may be involved (Stace-Smith, 1984). The fact that the virus does not appear to be present in the native vegetation adjacent to the raspberry plantings suggest that it was introduced in the infected sucker plants that were used to establish the planting. This circumstantial evidence points to the value of using planting stock obtained from certified virus-free sources.

Reference: Stace-Smith, R. 1984. Red raspberry virus diseases in North America. Plant Dis. 68: 274-279.

CROP: Raspberry

LOCATION: Manitoba

TITLE: Incidence of Plant Diseases in Raspberries in Manitoba in 1987

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METHODS: Results are based on 53 samples of raspberries submitted to the Plant Pathology Laboratory and field examinations.

RESULTS: Fifty percent showed cane blight and/or spur blight. Several samples were affected by anthracnose. Nutrient deficiencies mainly iron chlorosis was the problem diagnosed in 9% of samples. Other diseases identified were Botrytis fruit rot and mosaic virus.

CROP: Red Raspberries

LOCATION: Nova Scotia

TITLE: SURVEY OF SPUR BLIGHT AND CANE BOTRYTIS IN COMMERCIAL RED RASPBERRY PLANTINGS IN NOVA SCOTIA

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METHODS: Fifteen commercial red raspberry plantings in seven counties were surveyed in 1987 for spur blight, caused by Didymella applanata (Niessl) Sacc., and cane botrytis, caused by Botrytis cinerea Pers. ex Fr. A random sample of 50 second-year canes was collected from each cultivar in each planting in April, May or June and brought back to the laboratory for examination. Spur blight and cane botrytis were identified by visual inspection of lesions on the canes. Disease incidence was expressed as the percentage of canes showing symptoms in each 50-cane sample. Distribution of disease on individual canes was assessed by marking each cane off into consecutive 15-cm sections and recording the presence of lesions in each section.

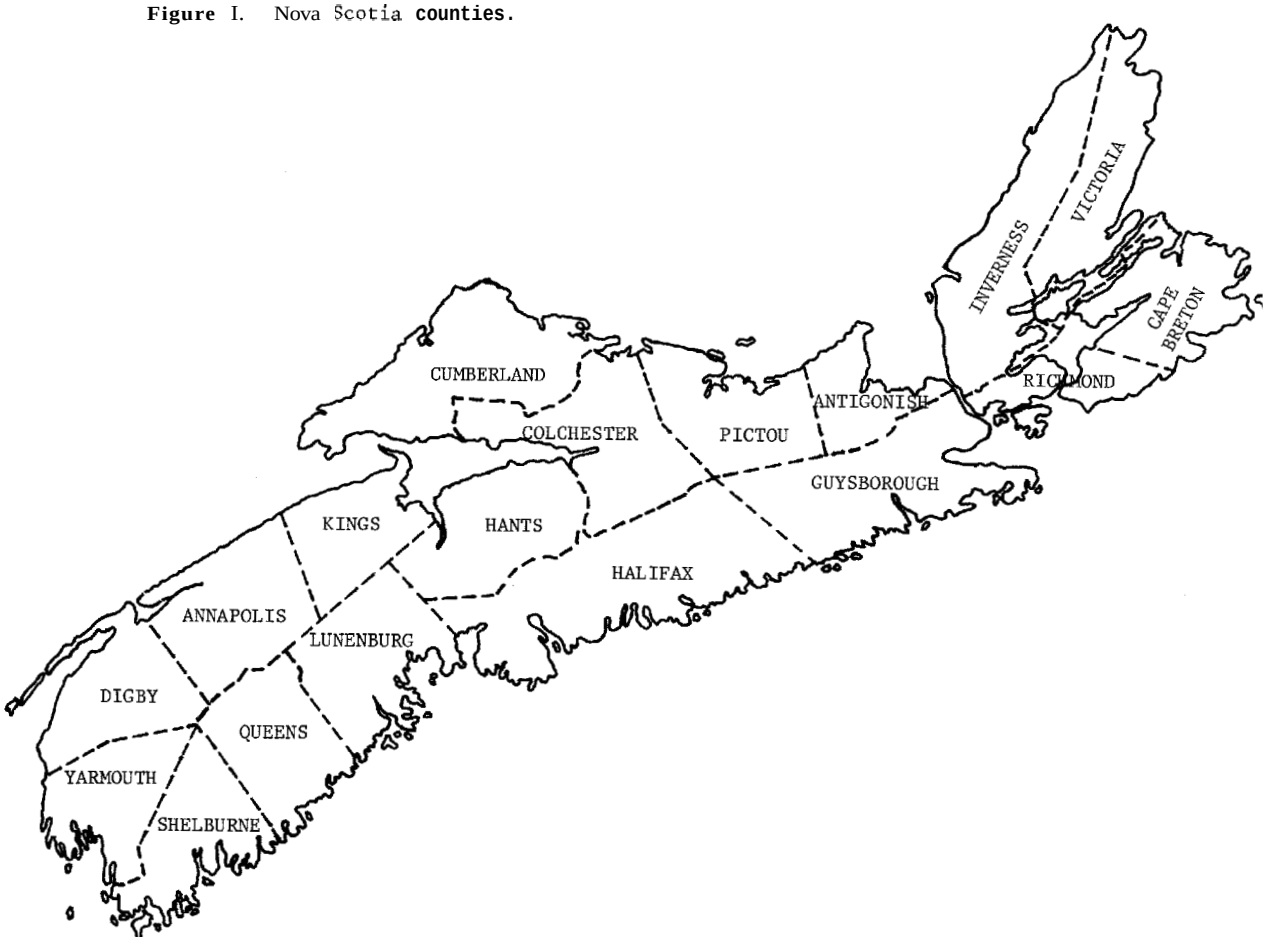
RESULTS AND COMMENTS: See Table 1 and Fig. 1. The higher levels of spur blight were usually found in plantings where recommended spray schedules had not been followed and/or where cane density was unusually high, resulting in poor air circulation. The incidence of cane botrytis was highest near commercial strawberry fields, which probably served as sources of inoculum. The number of samples of cultivars other than Festival was too small for a meaningful comparison of cultivar disease ratings, but in mixed plantings there was some evidence that Carnival and Comet were more resistant to both diseases than Festival. In all cultivars the incidence of both diseases was highest on the lower one-third to one-half of the canes.

Table 1. Incidence of spur blight and cane botrytis in 15 commercial red raspberry plantings in Nova Scotia

Planting	County	Cultivar	Disease Incidence (%)* Spur Blight	Cane Botrytis
1	Annapolis	Festival	96	2
2	Colchester	Festival	30	44
3	Colchester	Comet	0	0
3	Colchester	Festival	2	10
4	Hants	Festival	94	0
5	Kings	Festival	2	52
6	Kings	Festival	8	26
7	Kings	Festival	22	12
8	Kings	Festival	28	2
9	Kings	Festival	94	0
10	Kings	Festival	100	0
11	Kings	Boyne	92	0
11	Kings	Carnival	68	0
11	Kings	Festival	98	2
12	Lunenburg	Carnival	72	4
13	Pictou	Comet	16	2
13	Pictou	Festival	48	12
13	Pictou	Nova	32	0
14	Pictou	Festival	60	16
15	Yarmouth	Carnival	54	2
15	Yarmouth	Nova	84	2
		Mean	52.5	9.0

*50 canes of each cultivar in each planting were rated for disease.

Figure I. Nova Scotia **counties.**



CROP: Strawberry

LOCATION: British Columbia

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TITLE: SURVEY FOR COLLETOTRICHUM ACUTATUM IN STRAWBERRY FIELDS IN THE LOWER FRASER VALLEY

METHODS: Twenty seven commercial strawberry fields were surveyed in early September for disease caused by Colletotrichum acutatumin the lower Fraser Valley from Westham Island in the west to Rosedale in the east. Plants were examined along a transect in the form of a modified inverted W pattern in each field. Petioles or runners showing typical lesions were collected, taken back to the laboratory an cultured for the presence of the fungus.The number of plants sampled per field depended on the number of diseased plants found.

RESULTS AND COMMENTS: C. acutatum causes a serious disease of strawberry under the hot, humid conditions of the irrigated strawberry culture systems used in California where many of our certified planting stock comes from. The disease had not been recorded in B.C. on strawberries and is unlikely ever to be important with our cooler, drier conditions. However, this, organism has a wide host range, including seedlings of many of our important tree species, particularly hemlock and Douglas fir. The organism was isolated from hemlock seedlings growing in a seedling nursery in the Aldergrove area of the central Fraser valley in 1985. As the nursery is next to a strawberry field planted with certified plants from California it was assumed that the disease came in with the plants. However, the nursery also contained seedling trees brought in from New Zealand where the disease is also prevalent. The purpose of the survey was to determine if C. acutatum was being brought into B.C. with the certified strawberry plants from California.

Typical symptoms were found in most of the fields surveyed but only one isolate of C. acutatum was obtained from the Langley area. Both Botrytis cinerea, Rhizoctonia solani and Gloeosporium spp. cause similar symptoms and were isolated a number of times; B. cinerea was isolated from 18 fields, R. solani from 6 and Gloeosporium spp. from 8. Isolations were random throughout the sampling area with no significant clustering of any one organism. Although C. acutatum was found, the extremely low incidence coupled with the lack of evidence as to the source of the original infestation would indicate that importation of California planting stock is unlikely to pose any threat to the forest tree nursery industry.

CROP: Strawberry

LOCATION: Manitoba

TITLE: Incidence of Plant Diseases in Strawberries in Manitoba in 1987

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METHODS: Results are based on 61 samples of strawberries submitted to the Plant Pathology Laboratory and field examination.

RESULTS: Crown rot was a major problem in older stands. Wilt symptoms were particularly evident following hot dry weather in mid June. The fungi isolated from dead roots and crowns were usually Fusarium sp. and Cylindrocarpon destructans. Occasionally plants were received that were infected with Rhizoctonia solani. In one field near Teulon in the Interlake region plants showing wilt were found to be affected by Pythium sp. Hot, dry weather in May and June prevented the widespread development of fruit rot on June bearing varieties. Moist weather in late July and August was very favorable for a heavy development of leaf spot caused mainly by Mycosphaerella fragariae. In some cases leaf spot was due to Diplocarpon sp. In a field near Beausejour the variety Kent was heavily infected with Mycosphaerella leaf spot while an adjacent planting of the variety Gorella showed only a trace amount of leaf spot.