Canadian Plant Disease Survey

Inventaire des maladies des plantes au Canada

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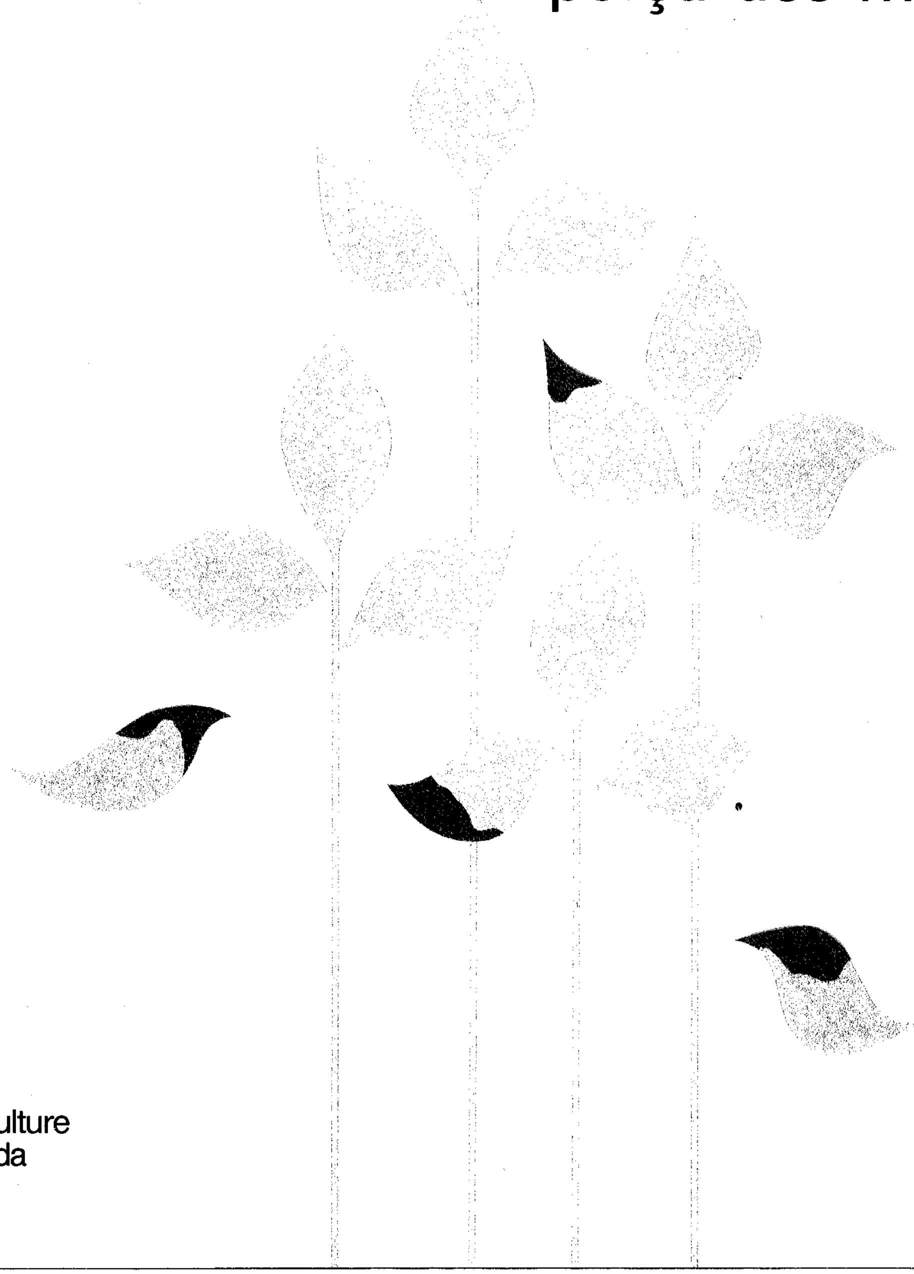

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The *Canadian Plant Disease Survey* is a periodical of information and record on the occurrence and severity of plant diseases in Canada and on the assessment of losses from disease. Other original information such as the development of methods of investigation and control, including the evaluation of new materials, will also be accepted. Review papers and compilations of practical value to plant pathologists will be included from time to time.

L'inventaire des maladies des plantes au Canada est un périodique d'information sur la fréquence des maladies des plantes au Canada, leur gravité, et les pertes qu'elles occasionnent. La rédaction accepte d'autres communications originales notamment sur la mise au point de nouvelles méthodes d'enquête et de lutte ainsi que sur l'évaluation des nouveaux produits. De temps à autre, il inclut des revues et des synthèses de rapports d'intérêt immédiat pour les phytopathologistes.

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FOREWORD

Included in this issue of the Canadian Plant Disease Survey is a compilation of the results of plant disease surveys for the 1989 crop year. This represents the third year of a project undertaken by the Canadian Phytopathological Society and the Research Program Service, Research Branch, Agriculture Canada. The Society recognizes the need for publication of plant disease surveys which are of value both to federal and provincial agencies in planning appropriate research for the control of plant diseases. These surveys are of intrinsic value to the literature of plant pathology of Canada. This year, L.W. Stobbs was asked to succeed J.A. Matteoni as coordinator of the project. Dr. Matteoni has accepted a position with industry in British Columbia.

The publication of these reports is dependent upon the voluntary contributions of Canadian plant pathologists, and their collation by experts familiar with the diseases of the major crop categories. The list of collators is appended. Publication of the survey is planned on an annual basis for the Spring Issue of Canadian Plant Disease Survey, with reports due to the collators by 1 December. Instructions for submissions, and forms are available from the collators.

We wish to thank all of the contributors and collators who have devoted a great amount of their time to the production of this third annual publication of disease survey results, and look forward to your future contributions.

L.W. Stobbs
J.A. Matteoni
Coordinators

H. Krehm
R. McNeil and P. Beauchamp
Compilers

AVANT-PROPOS

Ce numéro de l'Inventaire des maladies des plantes au Canada contient les résultats compilés d'études effectuées sur les maladies des plantes pour la campagne agricole de 1989. C'est la troisième année d'un projet entrepris par la Société canadienne de phytopathologie et le Service aux programmes de recherche de la Direction générale de la recherche d'Agriculture Canada. La Société reconnaît la nécessité de publier ces résultats sur lesquels s'appuient les organismes fédéraux et provinciaux pour planifier les travaux de recherche qui s'imposent pour lutter contre les maladies des plantes. De plus, ces études viennent enrichir incontestablement la documentation sur la pathologie des plantes au Canada. Cette année, à la demande de la Société, L.W. Stobbs a succédé à J.A. Matteoni comme coordonnateur du projet. Le Dr Matteoni a accepté un poste dans le secteur privé en Colombie-Britannique.

La publication de ces rapports est réalisable grâce à la contribution bénévole de phytopathologistes canadiens et au collationnement de leurs résultats par des spécialistes des maladies des grandes cultures. On trouvera en annexe la liste des analystes faisant le collationnement. Comme la publication des résultats se fait chaque année dans le numéro du printemps de l'Inventaire des maladies des plantes au Canada, les rapports doivent être remis aux analystes avant le 1er décembre. On peut s'adresser à eux pour obtenir les formulaires et la marche à suivre pour présenter ces rapports.

Nous tenons à remercier tous les contributeurs et analystes, qui ont consacré une grande partie de leur temps à la production de cette troisième publication annuelle des résultats des études sur les maladies des plantes et espérons vous compter de nouveau parmi nos collaborateurs.

L.W. Stobbs
J.A. Matteoni
Coordonnateurs

H. Krehm
R. McNeil et P. Beauchamp
Compilateurs

Possibilités de lutte biologique contre les maladies du feuillage et des tiges de la luzerne.

Y. Douville[1], C. Richard[2] et S. Pouleur[2]

Les auteurs discutent de la possibilité de pratiquer la lutte biologique contre les maladies du feuillage et des tiges de la luzerne. Le pathosystème visé est composé de cinq maladies : la tige noire, la plus importance; la tache lepto, la tache commune et la tache stemphylienne, d'importance secondaire; et l'anthracnose, sporadique. Le complexe d'agents pathogènes varie tout au cours de la saison de végétation, mais les pertes de rendement qu'il entraîne peuvent justifier un traitement à chaque coupe. On propose de sélectionner des antagonistes, un pour chaque maladie, et de les appliquer en mélange selon le pathosystème spécifique à chaque époque de la saison de récolte. Le mélange pourra être appliqué sur les débris végétaux comme traitement d'éradication ou encore sur les feuilles comme traitement préventif. Dans ce dernier cas, la stratégie de lutte devra être adaptée aux processus d'infection des champignons pathogènes. Les essais de lutte biologique contre les maladies du feuillage sont à leurs premiers pas. La lutte biologique combinée avec des méthodes traditionnelles de lutte et un modèle de prédiction de la gravité des maladies est la stratégie de répression proposée par les auteurs.

Can. Plant Dis. Surv. 70:1, 5-9, 1990.

In this paper, we discuss the use of biological control of foliar diseases of alfalfa. The pathosystem under consideration involves five diseases of which spring black stem is the most destructive; lepto leaf spot, common leaf spot and stemphylium leaf spot are of secondary importance; and anthracnose is a minor problem. The pathogen complex varies for the entire season, but since the total amount of loss can remain above the economic threshold, a treatment for each harvest is justifiable. We suggest the selection of an antagonist for each disease as an eradicant onto the vegetal debris, or as a preventive directly onto the plants. In the latter case, the control strategy should be adapted to the infection process of the pathogen. Applications can be made as a mixture of antagonists specific for the pathosystem significant at the time of application. Biocontrol of foliar diseases of alfalfa are in their infancy. A biological control program integrated with traditional control methods and a model to predict the severity of disease is probably the most promising strategy.

Introduction

Les maladies des parties aériennes de la luzerne causent des dommages importants à cette culture. Au Québec, le pourcentage de perte de rendement est estimé à 8 % (18) alors qu'on l'évalue à 15 % dans le nord-est américain (5). Au Canada comme aux États-Unis, les principales maladies des parties aériennes sont la tige noire (*Phoma medicaginis* Malbr. & Roum. in Roum., la tache commune (*Pseudopeziza medicaginis* (Lib.) Sacc.) la tache lepto (*Leptosphaerulina trifolii* (Rostr.) Petr.) la tache stemphylienne (*Stemphylium botryosum* Wallr.) et l'anthracnose (*Colleotrichum* spp.). Les principaux moyens de lutte se résument présentement à l'utilisation de cultivars résistants et aux pratiques culturales telles que la coupe hâtive et les rotations. Ces méthodes ne s'appliquent toutefois pas à l'ensemble des maladies. Nous pensons que des alternatives, telles que la lutte biologique, doivent être examinées sérieusement. Dans cet article, nous tenterons d'évaluer le potentiel de cette méthode pour la répression des maladies du feuillage de la luzerne. Nous discuterons d'abord de la rentabilité de la répression des maladies. Nous traiterons ensuite du pathosystème impliqué et aborderons quelques concepts de base pour un système de lutte biologique. Enfin, nous dresserons un bilan des expériences effectuées en lutte biologique contre les maladies du feuillage et traiterons de l'intégration de cette méthode de lutte avec d'autres moyens de répression.

Rentabilité économique de la lutte

Il a été montré à plusieurs reprises que les fongicides protègent la luzerne contre les maladies du feuillage et augmentent le rendement en fourrage (27, 28, 29). Cependant, l'opinion générale des producteurs et des conseillers agricoles est qu'il n'est pas économiquement avantageux de protéger la luzerne contre les agents pathogènes des parties aériennes à l'aide de pesticides. Toutefois, Broscious et Kirby (5) ont évalué plusieurs traitements fongicides dans l'état de l'Illinois et sont arrivés à la conclusion inverse. Ils ont démontré que le traitement le plus rentable était une application de mancozèbe 10 à 14 jours après chaque coupe. Ce traitement a permis d'obtenir un retour de 2,15 $ pour chaque dollar investi compte tenu d'un prix à la tonne de 72,75 $ et d'un coût pour chaque application de 17,90 $/ha. Ce traitement s'est avéré efficace lors de plusieurs coupes différentes et a permis de réduire à 5 % les pertes de rendement attribuables aux maladies estimées à 15 % dans cette étude. Dans ces circonstances, le pourcentage minimum de pertes de rendement pour que l'application de mancozèbe soit rentable est estimé à 8 %. Ce seuil est conservateur puisqu'il ne tient pas compte de l'amélioration probable de la qualité du fourrage.

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Malgré l'avantage économique d'un traitement fongicide, il demeure que les pesticides chimiques ne représentent probablement pas la meilleure façon de réprimer ces maladies. La protection de l'environnement, des animaux et des humains exige un traitement spécifique à l'organisme nuisible visé et laissant peu de résidus.

La lutte biologique pourrait être une alternative à la lutte chimique. En plus d'être respectueuse de l'environnement, cette méthode a permis de réduire les pertes dues à plusieurs maladies foliaires. Blakeman et Fokkema (3) et Sharma et Sankaron (21) ont effectué une excellente revue de la lutte biologique contre les maladies du feuillage. Plusieurs essais se sont avérés fructueux au champ. Cependant, ce moyen de lutte doit reposer sur des bases biologiques solides afin d'augmenter les chances de réussite.

Pathosystème et concept de lutte biologique

Une connaissance adéquate du pathosystème visé est essentielle pour un développement efficace d'un moyen de lutte. Cette connaissance repose sur l'ampleur des dommages causés par chacune des maladies au cours de la saison de végétation. Une vaste compréhension de l'épidémiologie et des processus d'infection des agents pathogènes est également primordiale.

Thal et Campell (26) soulignent que le pathosystème des maladies foliaires de la luzerne est complexe puisqu'il est constitué de plusieurs agents pathogènes présents en même temps à différents moments de la saison. Nous avons évalué l'importance relative de chaque maladie à différentes périodes de l'année en consultant six rapports d'inventaire (5, 17, 19, 23, 25, 28) réalisés dans le nord-est de l'Amérique du nord (fig. 1). Les variations climatiques et les particularités régionales peuvent modifier ces résultats, mais nous croyons que ce graphique est un portrait assez fidèle de ce pathosystème pour le territoire visé.

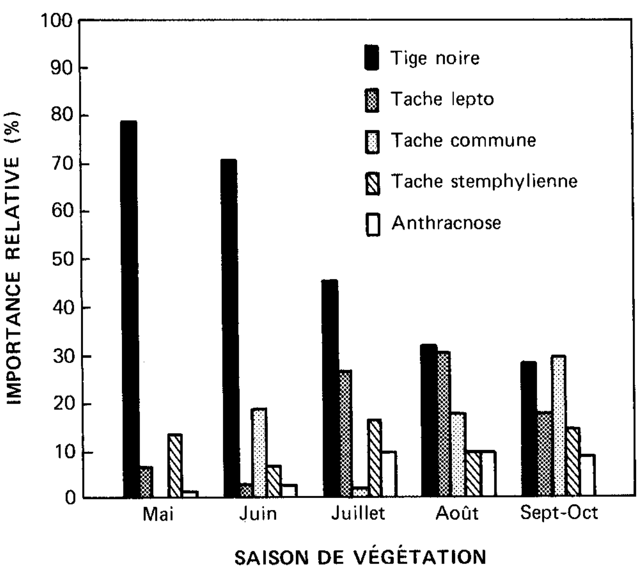

Figure 1. Importance relative des maladies du feuillage de la luzerne à différentes périodes de la saison de végétation.

Le pathosystème varie grandement au cours de la saison végétative. S'il est constitué principalement de la tige noire en mai et en juin, il se diversifie par la suite à mesure que la saison avance. À partir d'août, la diversification atteint son apogée. Quelques tendances se dessinent également quant à l'importance des pertes dues à chaque maladie selon le moment de la saison. La tige noire est de loin la maladie la plus importante. Quelle que soit la période, c'est une des maladies qui provoque le plus de pertes. Pour sa part, la tache lepto occasionne des dégâts peu importants au printemps, moyens à l'automne, mais assez importants en été. La tache commune est pratiquement absente en mai et en juillet, alors qu'elle est la plus importante à l'automne. La tache stemphylienne entraîne des pertes relativement constantes au cours de l'année, mais ne dépassant pas 20 % des pertes attribuables aux maladies. Enfin, l'anthracnose provoque des dégâts mineurs mais constants à partir de juillet.

De l'ensemble de ces observations, on peut tirer plusieurs conclusions. Premièrement, il est rentable de réprimer les maladies des feuilles de la luzerne à la condition de contrer plusieurs maladies à la fois et non une seule, exception peut-être de la première coupe où la tige noire domine nettement. Deuxièmement, puisque la luzerne est coupée de deux à quatre fois par année, plusieurs combinaisons de maladies seront rencontrées. Il semble donc nécessaire de mettre au point un traitement biologique multiple extrêmement flexible ayant comme base un mélange de plusieurs antagonistes, chaque antagoniste réprimant une maladie et le mélange variant selon le pathosystème rencontré. Finalement, étant donné son importance, nous croyons que la tige noire devrait faire l'objet des premiers essais de développment d'agents antagonistes, suivie de la tache lepto.

S'il demeure plausible que l'ensemble, ou sinon plusieurs maladies, doivent être réprimées, il faut d'abord savoir comment traiter chaque maladie individuellement. La réponse à cette question passe par la connaissance approfondie des agents pathogènes et de l'épidémiologie de ces maladies (tableau 1). Deux stratégies générales de lutte peuvent être envisagées contre ce pathosystème. Tout d'abord, on peut diriger la lutte contre les sources d'inoculum primaire et secondaire. Dans le premier cas, l'inoculum primaire de tous ces agents pathogènes provient de mycélium ou de sporocarpes présents sur les débris végétaux au printemps. De plus, pour la plupart d'entre eux, la source d'inoculum secondaire est constituée de feuilles tombées au sol après la défoliation ainsi que de tiges mortes. Des agents antagonistes, isolés des structures de propagation ou aptes à coloniser les tissus morts ou moribonds, peuvent donc représenter une voie possible de répression de ces maladies. D'autre part, on peut développer une stratégie de lutte empêchant directement l'infection de la feuille par le champignon pathogène. Dans ce cas, les antagonistes doivent être présents sur les feuilles saines avant l'arrivée des spores infectieuses. Les processus d'infection des champignons pathogènes seront un paramètre important à considérer dans la sélection des antagonistes. Ces processus comprennent la pénétration de la feuille par un tube germinatif via un stomate ou directement à travers la cuticule par un tube germinatif sans appressorium distinct. L'appressorium peut cependant être bien développé, situé sous ou latéralement à la spore et relié à celle-ci par un tube germinatif d'une longueur variable. La plupart des agents

Tableau 1. Caractéristiques des maladies des feuilles de la luzerne.

Maladies	Inoculum primaire		Inoculum secondaire		Mode de pénétration*						Temps requis†	Références
					Principal			Secondaire				
	Débris végétaux	Graine	Sur la plante	Au sol	A	TG	S	A	TG	S		
Tige noire	Mycélium Pynicdes	Mycélium	N	N	x	55			x	x	21	2, 9, 12, 15
Tache lepto	Périthèces			x	x	30		x			12	9, 14, 24
Tache commune	Apothèces		x	x	x	10		absent			24	9, 10, 13
Tache stemphylienne	Périthèces Mycélium	Mycélium?	?	?		70	x		x		24	4, 9, 22
Anthracnose	Acervules		x	x	x	<5		x	x		24	9, 16

* A = appressorium distinct (pénétration directe)
TG = longueur approximative du tube germinatif en µm
S = pénétration par les stomates (indirecte)

† Temps requis en heures pour que la majeure partie de la pénétration ait eu lieu

N = Négligeable

? = Donnée non disponible

pathogènes infectent la plante selon plusieurs de ces processus. Dans la discussion qui suivra, nous ne considérerons que le mode d'infection principal, c'est-à-dire celui le plus souvent rencontré.

Tout d'abord, la pénétration de l'hôte est largement accomplie en moins de 24 h pour tous les agents pathogènes. L'action de l'agent antagoniste, qu'elle soit par l'émission de métabolites ou par la privation de substances nutritives, devra donc se faire sentir avant cette période d'infection. L'action des antagonistes sera aussi conditionnée par la longueur et par l'emplacement du tube germinatif. Par exemple, les agents pathogènes de la tache commune, de la tache lepto et de l'anthracnose infectent la plante par un court tube germinatif souvent situé sous la spore. Une action directe contre le tube germinatif semble donc être difficile. L'antagoniste devra alors rendre inopérants les appressoriums en altérant leur morphologie ou leur physiologie. L'antagoniste pourra également réduire la germination des spores de l'organisme visé et conséquemment la formation d'appressoriums.

Une stratégie différente peut être adoptée pour la tige noire et la tache stemphylienne. Pour ces deux maladies, le tube germinatif représente une cible de choix car il est relativement long avant l'infection. La réduction de la croissance de celui-ci ou son altération devrait entraîner une réduction de la maladie. Cette stratégie n'exclut pas le recours à un antagoniste qui réduirait en plus le pourcentage de germination des spores.

À l'inverse, il est possible d'imaginer une stratégie de lutte diamétralement opposée qui consisterait à stimuler la croissance mycélienne du champignon pathogène sur la feuille. Dès 1929, Sampson (20) a noté que l'inoculation du *C. trifolii* en suspension dans une solution nutritive favorisait la croissance en surface des feuilles et empêchait la pénétration du champignon. De plus, Jones (10) a observé que les tubes germinatifs du *Pseudopeziza medicaginis* ne pouvait infecter la plante lorsqu'ils étaient longs. On peut donc penser à une intervention qui viserait à stimuler l'élongation des tubes germinatifs en vue de les rendre inoffensifs. La stimulation de la croissance mycélienne semble donc utilisable contre certaines maladies. Cet outil peut toutefois constituer une lame à deux tranchants puisqu'il peut entraîner une augmentation de l'infection, comme dans le cas de la tige noire (12).

Lutte biologique : quelques essais

Très peu de travaux ont été publiés sur la répression biologique des maladies du feuillage de la luzerne. Jones et Lukezic (11) rapportent les résultats d'essais de bactéries contre l'agent de la tige noire. Plusieurs isolats bactériens furent capables d'abaisser à moins de 25 % la germination des conidies du *P. medicaginis* in vitro. Cependant, seulement deux de ces isolats furent efficaces lors d'essais en serres; en champ, seule une espèce de *Flavobacterium*, isolée de feuilles de luzerne, a réduit faiblement la maladie. C'est un exemple d'expérience dont les résultats prometteurs au laboratoire n'ont pas été suivi du même succès en champ.

La tache lepto a fait également l'objet d'essais (7). Différents microorganismes reconnus pour leurs propriétés antagonistes ont été confrontés avec le *L. briosiana* en boîtes de Petri. Le *Pseudomonas putida* (Trevisan) Migula, le *Bacillus subtilis* (Ehrenber) Cohn et le *Trichoderma viride* Pers.: Fr. ont réduit la croissance du *L. briosiana*. L'antagoniste le plus actif, le *T. viride*, a inhibé la germination des spores de *L. briosiana* ainsi que le nombre et la longueur des tubes germinatifs dans une suspension de spores. Aucun des antagonistes n'a réduit significativement la tache lepto lors d'essais en chambre de culture.

Allen et Caddel (1) ont rapporté la présence de champignons saprophytiques sur les tiges tuées par l'anthracnose en Oklahoma. Ces champignons ont rapidement recouvert les tissus morts empêchant ainsi la sporulation de l'agent pathogène. C'est un exemple de répression naturelle de maladies en plein champ. Le *Bacillus subtilis* a réduit la croissance mycélienne et la longueur des tubes germinatifs du *C. trifolii* lors de tests in vitro (8). Il déforme également l'extrémité des tubes germinatifs en provoquant la formation de cellules sphériques. Son potentiel antagoniste est présentement à l'étude.

En somme, la lutte biologique contre les maladies des feuilles et de la tige de la luzerne possède un potentiel qui mérite d'être examiné. Une meilleure compréhension des mécanismes impliqués devrait permettre d'améliorer la performance des antagonistes.

La lutte biologique intégrée : une perspective

Comme l'a démontré l'étude de Broscious et Kirby (5), le traitement au mancozèbe, quoique efficace et économique, a fait diminuer de 68 % les pertes dues aux maladies foliaires, ce qui laisse place à d'autres méthodes de lutte. La lutte biologique combinée à des moyens traditionnels comme la résistance génétique, la rotation des cultures, l'utilisation de semences certifiées, etc., sera probablement encore plus rentable pour le producteur. De plus, des méthodes indirectes de lutte, telles qu'une fertilisation optimale, peuvent être ajoutées sans grandes difficultés à ce système de lutte.

Une composante toute aussi importante d'un système de lutte intégrée est l'inclusion d'un modèle de prédiction des pertes dues aux maladies foliaires. Nous croyons qu'un modèle doit faire partie intégrante d'un système de lutte efficace et rentable afin d'éviter tout traitement inutile. Déjà, Sundheim et Wilcoxson (24) rapportent que la gravité de la tache lepto est reliée aux précipitations atmosphériques à certaines périodes de la saison, mais non à la température. De même, Mead (12) précise dans sa synthèse sur la tige noire que cette maladie est favorisée par des températures froides et des conditions humides. Finalement, Morgan et Parbery (13) ont démontré que la tache commune a besoin de plus de 3 jours d'humidité relative élevée afin que les spores puissent être relâchées dans le milieu, germer et pénétrer la plante. Un modèle de prédiction simple, tenant compte par exemple de la température et des précipitations atmosphériques, rendrait plus facile l'utilisation d'un système de lutte intégrée par les producteurs.

Conclusion

Un pathosystème complexe et la nécessité de contrer simultanément plusieurs maladies au cours de différentes périodes de la saison compliquent la mise au point d'un système de lutte biologique. La mise en place d'un tel système demeure possible et devra reposer sur la répression de plusieurs maladies à la fois. Ce système devra probablement être secondé par des méthodes de lutte traditionnelle et être jumelé à un modèle de prédiction des maladies pour atteindre une efficacité optimale.

Remerciements

Nous remercions sincèrement M. Jean-Guy Martin pour l'aide apportée lors des essais sur la tache lepto. Nos remerciements s'adressent également à Mary Bom pour les réflexions apportées à ce travail et à la traduction anglaise du résumé.

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Populations of propagules of *Penicillium* spp. during immersion dumping of apples

P.L. Sholberg and G.R. Owen[1]

Population levels of propagules of *Penicillium* spp. in apple dump-tank water were related to apple cultivar and number of bins emptied into the water. When McIntosh apples were immersed in the dump-tank, the water contained 15,555 propagules/ml compared to water used to handle Spartan with 5,000 and Golden Delicious with 2,200 after 650 bins of each cultivar had been emptied. Propagule populations increased quickly during processing of the first 200 bins of fruit but stabilized and remained relatively constant thereafter. Filtration of immersion water reduced propagule concentrations in water used for McIntosh, Spartan and Golden Delicious when compared to nonfiltered water. Red Delicious dump-tank water averaged 22.8 propagules/ml of *Penicillium* spp. when treated with 50-100 μg/ml of available chlorine and 7.0 propagules/ml when the water was filtered in addition to chlorination.

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Les niveaux de population de propagules de *Penicillium* spp. dans l'eau des réservoirs d'immersion des pommes dépendaient du cultivar de ce fruit et du nombre de contenants vidés dans l'eau. Après vidage de 650 contenants de chaque cultivar, l'eau contenait 15 555 propagules/ml dans le cas des pommes McIntosh comparativement à 5 000 pour les Spartan et 2 200 pour les Golden Delicious. Le nombre de propagules a augmenté rapidement durant le traitement des 200 premiers contenants, mais s'est stabilisé et est demeuré relativement constant par la suite. La filtration de l'eau d'immersion a réduit la concentration de propagules dans le cas des McIntosh, des Spartan et des Golden Delicious. L'eau des réservoirs de Red Delicious comptait en moyenne 22,8 propagules/ml lorsqu'elle était traitée avec 50-100 μg/ml de chlore disponible et 7,0 propagules/ml quand elle était filtrée en plus d'être purifiée au chlore.

Introduction

Blue mold rot caused by *Penicillium expansum* is the most common and usually the most destructive of all the rots found on apple, pear, and quince in transit, in storage, and on the market (3). In a study on disorders of apples shipped to the New York market from 1972-1984 blue mold rot was the most damaging parasitic disease (2). Blanpied and Purnasiri (1) found that in water tanks used to handle apples in packing houses levels of 1,000 to 7,000 germinated *Penicillium expansum* propagules per ml of water were common. Spotts and Cervantes (5) showed that propagules of *Penicillium* spp. in dump-tank water increased from 189 propagules/ml in October to 4,167 in March, 1983 suggesting that decaying fruit stored in bins and processed later increased propagule levels. Presently at least one packinghouse in British Columbia uses chlorine to lower dump-tank water spore loads. In a study done in packinghouses in Oregon the average *Penicillium* spp. populations were 543 and 1,423 per ml in 1981-82 and 162 and 1,729 per ml in 1982-83 for dump-tank water containing chlorine, and no chemical, respectively (5).

It was the object of this study to count the number of propagules of *Penicillium* spp. in the immersion water of a packinghouse in British Columbia to determine if chlorination was necessary. We also decided to evaluate the effectiveness of both filtration and chlorination for removing propagules of *Penicillium* in the dump-tank water.

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Materials and methods

Sampling.

Dump-tank water at a commercial packinghouse was sampled daily during emptying of bins (360 kg/bin) of apples from controlled atmosphere (CA) storage. The apples from CA had been placed directly in storage from the field except for the Red Delicious variety which had been drenched with diphenylamine to prevent scald. Dump-tank water containing Golden Delicious was sampled in 1987 on January 19 to 26; Spartans, February 2 to 9; and McIntosh, February 11 to 18. The water was sampled by immersing a 250 ml sample bottle into a flume approximately 3 meters from the dump-tank where apples were immersed to remove them from the bins.

Populations of propagules of *Penicillium* spp. were monitored in the dump-tank water by taking 0.1 ml of the sampled water and spreading it over a petri plate 50 mm in diameter containing 10 ml of potato dextrose agar (Difco, Detroit, MI) acidified with 1.5 ml of 85% lactic acid per liter (APDA) and incubating at 25°C for 3-7 days (5). If the dump-tank water contained chlorine the APDA plates were immediately inoculated at the packinghouse because the effect of chlorine increased with time of exposure. At least 9 plates were inoculated for each sample of dump-tank water taken. After incubation, at 25°C, *Penicillium* spp. colonies were counted and again checked 6 days later for typical blue-green sporulation. Dump-tank water was diluted, up to 10^5 times when it was found that individual *Penicillium* colonies could not be counted because of high numbers.

Filtration.

The dump-tank used for the filtration experiments held 20,000 L of water which was filtered by using a circulating pump (Model No. RPF 700, Pac. Fab. Inc., Sanford, NC) delivering 250 L/min at 69 kPa through two Jacuzzi sand filter units (Model 24 FM-6, Jacuzzi Canada Ltd., Rexdale, Ont.) containing #16 silica sand connected in parallel for a surface area of 0.5574 m^2. A pressure switch automatically turned on a red signal light and shut off the circulating pump when the pressure between the intake and outlet varied by more than 69 kPa. The sand filter was backwashed manually with an external source of pressurized domestic water. Small amounts of water (20-50 L) were occasionally added to the dump-tank to keep the level adequate for moving fruit. The dump-tank water was usually changed and the tank cleaned every two weeks after approximately 1,000 bins of fruit had been emptied.

Dump-tank water was filtered and sampled for the following varieties on the following dates: McIntosh, January 5 to 12, 1987; Spartans, April 13 to 24; Golden Delicious, April 2 to 9 and May 19 to 27, 1987; Red Delicious, February 23 to March 3, March 23 to 30, and May 5 to 15, 1987.

Chlorination.
Dump-tank water was chlorinated by adding 12% commercial grade sodium hypochlorite to the dump-tank to maintain a concentration of 50-100 μg/ml of available chlorine in the water. This was accomplished by injecting the sodium hypochlorite in the dump-tank with an injector pump (Chem-Feed Model No. C 6125P, Blue-White Industries, Westminster, CA) which was operated when the dump-tank circulating pump was running. The pH of the dump-water was monitored daily with indicator paper at the packinghouse for a rough estimate of pH and again at the laboratory with a pH meter (Fisher Accumet pH Meter, Fisher Scientific Co., USA) to determine if buffer needed to be added to the dump-tank. An increase in pH substantially decreases the biocidal activity of chlorine, and a decrease in pH increases this activity. Available chlorine of the dump-tank water was measured several times each day with a colorometric test kit (Pennwalt Corp., Monrovia, CA 91016).

Dump-tank water was chlorinated for the following varieties on the following dates: Golden Delicious, May 19 to 27; and Red Delicious, March 23 to 30, April 27 to May 4, and May 5 to 15, 1987.

Results

Population levels of *Penicillium* spp. in apple dump-tank water.
Populations of *Penicillium* spp. in the immersion water varied with the apple cultivar. For example, McIntosh dump-tank water contained 15,555 propagules/ml compared to Spartan with 5,000 propagules/ml and Golden Delicious with 2,200 propagules/ml after approximately 650 bins of each variety had been emptied (Fig. 1). Populations of *Penicillium* spp. generally increased with the number of bins dumped. Initially the propagule population rose quickly with the immersion of the first 150-200 bins which also coincided with the first sampling and then rose much more slowly remaining relatively constant for the emptying of the remaining bins.

Effect of filtration on *Penicillium* spp. propagule populations.
Filtered dump-tank water from McIntosh apples contained fewer propagules/ml than nonfiltered water (Table 1). Propagule levels averaged 13,536 ± 2,654 in nonfiltered water compared to 5,535 ± 2,853 in filtered water.

The filter lowered the population of propagules in water used for dumping Spartan apples from controlled atmosphere storage. When the Spartans were dumped with the filter

Table 1. Effect of water treatment on the average number of propagules of *Penicillium* spp./ml in the dump-tank water.

	Variety			
Treatment*	McIntosh	Spartan	Golden Delicious	Red Delicious
Filtered	5,535 ± 3,853**	967 ± 868	360 ± 716	10,538 ± 5,566
Chlorinated	-	-		22.8 ± 4.0
Chlorinated and Filtered	-	-	0.6 ± 0.7	7.0 ± 3.0
None	13,536 ± 2,654	4,400 ± 841	3,106 ± 835	-

* The dump-tank was emptied and cleaned between treatments.

** The average number of propagules of *Penicillium* spp./ml was determined by counting propagules each day in the immersion water over a period of several days and averaging these values for the whole period.

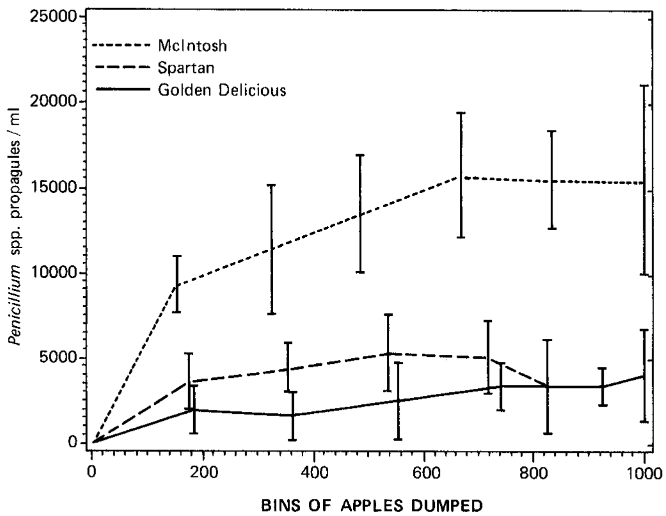

Figure 1. Contamination of dump-tank water by bins of Golden Delicious, McIntosh and Spartan apples after removal from controlled atmosphere storage in 1987 on January 19-26, February 11-18 and February 2-9, respectively. The dump-tank water was sampled each day after the bins had been emptied for that day. Each point represents the mean of nine replications and each bar represents the standard error of the mean.

running, it was done over a 14 day period and the filter operated for long periods without fruit being added to the dump water. Under these conditions, the spore population averaged 967 ± 868 compared to 4,400 ± 841 propagules/ml for the nonfiltered water.

Similarly, the filter lowered the number of propagules in the water used for dumping Golden Delicious apples to an average of 1,360 ± 716 compared to 3,106 ± 835 propagules/ml for the nonfiltered water.

Effect of chlorination on propagule populations.
Addition of 12% sodium hypochlorite to maintain 50-100 μg/ml free chlorine in the dump-tank reduced *Penicillium* spp. propagule numbers to extremely low levels. Red Delicious apples dumped into chlorinated nonfiltered water contained 22.8 ± 4.0 propagules/ml on average. Filtered water that was chlorinated into which Red Delicious apples were dumped contained only 7.0 ± 3.0 propagules/ml. Chlorine was also effective for keeping average propagule populations at 0.6 ± 0.7 for Golden Delicious apples dumped between May 19-27, 1987 when using the same filtered water from Red Delicious that had been treated with chlorine.

Filtered dump-tank water used less chlorine than nonfiltered water in this trial. For example, when filtered versus nonfiltered dump-tank water were compared for the amount of 12% sodium hypochlorite needed to maintain 50-100 μg/ml available chlorine for 1,000 bins of Red Delicious apples dumped, 109 liters was required for filtered and 131 L for nonfiltered water for fruit dumped between April 27 and May 15, 1987.

The average pH of the water for all runs which used chlorine was between 5.8 and 6.2 and did not require the addition of buffer for effective action.

Discussion

The McIntosh immersion water contained four times more propagules/ml than the Golden Delicious and three times more than the Spartan dump-tank water (Table 1). This indicated that the bins of McIntosh contained more apples with sporulating *Penicillium* spp. on them and were a greater storage risk. For all varieties, propagule concentrations were sufficiently high (greater than 1,500 per ml) in the immersion water after emptying approximately 200 bins that they posed a significant risk of infecting fruit if injury to the fruit should occur. Spotts (4) has shown for decay of pears that infection increases most rapidly with inoculum concentrations under 1,000 conidia/ml and that as concentrations go to 1,500 conidia/ml there is no further increase in infection.

Filtration was partially effective in removing propagules of *Penicillium* spp. from the dump-tank water. For example, with Spartan apples, the filtered water contained 967 propagules/ml compared to 4,400 propagules/ml for nonfiltered water (Table 1). Furthermore, the filtered water was from Spartan apples that were dumped in April compared to nonfiltered water which was from apples that were dumped in early February. Normally, fruit stored for a longer time would be expected to produce more propagules/ml in the dump-tank water (4).

Unfortunately, the filter system did not always work efficiently. A major problem with its operation was the need for frequent backwashing. This was not always practical under commercial operating conditions leading to water only being partially filtered. The filter system was effective at times but too erratic in its present form to provide reliable water sanitation. It was not able to lower propagule concentrations to levels low enough to remove the risk of infection to injured apples. Its main value lies in its ability to prolong the use of the dump-tank water by removing debris and enabling longer packing runs before the tank must be cleaned. Use of the filter also reduces the amount of dump-tank chemicals released into the environment. Filtration must be used in association with a method of disinfection such as chlorination to destroy pathogens in the dump-tank water.

Chlorine was very effective in destroying propagules of *Penicillium* spp. in filtered Red Delicious dump-tank water reducing the average number from 10,538 to 7. Chlorine was not quite as effective in nonfiltered water but nevertheless maintained a concentration of 22.8 propagules/ml.

It is clear from these results that 50-100 μg/ml of free chlorine is very beneficial in reducing the likelihood of infection by *Penicillium* spp. Fruit immersed into nonchlorinated water quickly becomes contaminated with high numbers of *Penicillium* spp. propagules. This fruit is more susceptible to infection because there is a much higher chance that the pathogen will be present at the site of an injury and, for this reason, the fruit is at a higher risk to decay as it moves into the marketing channels.

Acknowledgments

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The occurrence of powdery mildew on rutabagas in southern Ontario

V.I. Shattuck[1] *and R. Parry*[2]

Commercial rutabaga fields in southern Ontario were surveyed for the incidence and severity of powdery mildew during 1988 and 1989. The mean disease incidence in 1988 and 1989 was 79 and 56%, respectively, and the mean disease severity in 1989 was 14%. In both years, high amounts of powdery mildew were found in fields within Huron and Middlesex counties.

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En 1988 et en 1989, des champs de culture commerciale du rutabaga dans le sud de l'Ontario ont fait l'objet d'une étude visant à verifier la fréquence et la gravité du blanc. La fréquence moyenne de la maladie en 1988 et en 1989 a été de 79 et de 56 % respectivement et la gravité moyenne en 1989, de 14 %. Les deux années, le blanc était présent en abondance dans les champs des comtés de Huron et de Middlesex.

Introduction

Powdery mildew of crucifers, incited by the obligate fungus *Erysiphe cruciferarum*, is widespread and has been reported on many commercial crops including brussels sprouts, cabbage, cauliflower, Chinese cabbage, collards, kale, kohlrabi, mustard, radish, rape, rutabaga and turnips (Sherf and MacNab, 1986). The first symptom of this disease is the appearance of small white spots consisting of the interwoven threads of mycelia on older leaves and stems. Under favourable conditions for the disease, the mycelia gradually expand over the surface of tissues, produce conidia, and give the appearance of a greyish powdery coating.

Although powdery mildew has been present in Ontario for many years, this disease has not warranted special attention. An earlier survey on crucifer diseases in Ontario reported this pathogen only on turnips (rutabaga) (*Brassica napus* ssp. *rapifera*) and the incidence in fields small (Reyes, 1969). However, in recent years, growers of rutabaga in southern Ontario have expressed concerns about this disease in commercial fields. 'Laurentian', the most widely grown cultivar, is very susceptible to powdery mildew. Plants infected with this disease typically exhibit premature senescence of foliage. In addition, this disease predisposes rutabagas to other foliage and insect infections. In severe cases the plant canopy is reduced which makes the mechanical harvesting of roots when using a revolving belt-type pulling system difficult. It should be noted that over 85% of the rutabaga growers in southern Ontario currently depend on the revolving belt system for harvesting roots. Although the economic loss attributed to powdery mildew has not been determined, because of the disease, unharvestable roots are left in the field. At present, no fungicides are registered in Ontario for controlling this disease on rutabaga.

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As a first step in researching this disease, surveys were conducted in 1988 and 1989 in southern Ontario to estimate the infection percentage and the severity of this disease in commercial rutabaga fields.

Methods

In 1988, 16 late-season rutabaga fields were selected at random and examined to determine the percentage of plants possessing visual signs of powdery mildew infection. Groups of 10 plants in different areas within each field were randomly chosen and the older leaf stems and blades closely examined for the presence or absence of this disease. The number of infected plants was divided by the total number of plants surveyed in each field to calculate infection percentage. No attempts were made to classify the severity of this disease on infected plants. In 1989, the survey included all major rutabaga growing areas of the province and included a total of 18 fields selected at random. As in 1988, the percentage of infected plants was recorded, and also disease severity percentage was evaluated by assessing the leaf area covered with powdery mildew as described by James (1971). The evaluation was made on mid and older aged leaves of each plant and visually rated on a scale of 1, 5, 25 and 50%. In both years, infection data were gathered once for each field, and in 1989, the survey was conducted during the two weeks prior to harvest.

Results and discussion

Both years of the survey were atypically dry with temperatures above normal, and conditions generally conducive to disease development. The results of the survey are shown in Table 1, and indicate that the disease infection percentage varied among the counties examined. The infection and severity percentages of powdery mildew in both Huron and Middlesex counties were higher than the other counties and greatly exceeded the infection percentage previously reported (Reyes, 1969). It is not surprising that our findings are not in agreement with Reyes (1969) who noted only 1 to 10% infected plants within the fields he surveyed. As revealed in our survey, the occurrence of powdery mildew will depend on the area surveyed. Furthermore, we have noted that rutabagas at certain growth

Table 1. Incidence and severity of powdery mildew in the late-season rutabaga crops in southern Ontario during 1988 and 1989.

Year	County	Date of survey	Number of fields	Plants infected*	Severity of disease on plants infected*
	Huron	8/18 to 9/1	12	90	-
1988	Middlesex	8/24	1	70	-
	Oxford	8/22	3	37	-
	Huron	10/8	6	100	30
	Middlesex	10/17	2	100	25
1989	Oxford	9/26	7	30	1
	Simcoe	9/27	1	0	0
	Wellington	10/6	2	1	5

* Average value of the fields surveyed in each county.

stages are more susceptible to disease development. For example, we have observed that rutabaga leaf tissue becomes more prone to powdery mildew infection as it approaches maturity. Thus, during early vegetative growth stages susceptible plants exhibit much less susceptibility to this disease and a lower field infection percentage than at a mature stage of development. Since the location and plant age of the fields Reyes (1969) surveyed were not reported, no direct comparison can be made between his study and the survey reported here.

It should be noted that during the 1940's and 1950's rutabaga production was more evenly distributed throughout southern Ontario and involved over 600 growers. Currently, the number of growers has declined to less than 25. Much of the rutabaga acreage is concentrated in large operations in Huron and Middlesex counties and involves early, mid and late-season crops which are often planted close to one another. Although our survey investigated only the late rutabaga crop, we also observed pronounced powdery mildew infection on the early and mid-season crops. It is not unreasonable to assume that these crops might serve in this confined production setting as an inoculum source for the late crop. Interestingly, in recent years canola production within Huron and Middlesex counties has rapidly increased. Recent work on canola from Alberta reported that powdery mildew infection was surprisingly widespread in this crop (Slopek and Peters, 1988). Similarily, powdery mildew has also been observed in Ontario-grown canola, although the incidence and significance of this disease in unknown. In view of the fact that canola can serve as an overwinter host for diseases as Turnip Mosaic Virus (Stobbs and Shattuck, 1988), research should be designed to examine if canola could also serve as a "green-bridge" between seasons for powdery mildew.

It is noteworthy that the rutabaga fields in Wellington and Simcoe counties exhibited little and no mildew infection percentages, respectively. These isolated late-season fields were the only commercial plantings in their respective counties for 1989.

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First report of *Sclerotinia sclerotiorum* on *Lathyrus sativus*

R.C. Zimmer and Clayton Campbell[1]

Lathyrus sativus, commonly known as grass pea, has been added to the host range of the important fungal pathogen, *Sclerotinia sclerotiorum*. *L. sativus*, a drought tolerant pulse crop, is being developed for the brown soil zones of southern Manitoba, Saskatchewan and Alberta.

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Lathyrus sativus, appelé communément gesse cultivée, a été ajouté à la liste d'hôtes du redoutable champignon pathogène *Sclerotinia sclerotiorum*. *L. sativus*, une légumineuse à grains résistante à la sécheresse, a été sélectionnée pour les zones de sol brun du sud du Manitoba, de la Saskatchewan et de l'Alberta.

Introduction

Sclerotinia sclerotiorum (Lib.) de Bary is found worldwide on a wide range of host plants. Purdy (1979) reports it being recorded on 64 plant families, 225 genera and 361 species. It occurs in rather high incidence in the families: Leguminosae, Compositae, Polygonaceae, Solanaceae, Cruciferae, Umbelliferae and Vicieae.

Special field crops such as buckwheat, canola/rapeseed, mustard, fababeans, field beans, field peas, lentils, safflower and sunflower, found in the above-mentioned plant families, are susceptible to *S. sclerotiorum* and often comprise part of the rotation scheme of many farmers in Manitoba, Saskatchewan and Alberta.

Lathyrus sativus (L.), commonly known as grass pea because its leaflets are long and grass shaped, belongs to the family Vicieae. Due to its drought tolerance, Lathyrus has excellent potential for production in the low rainfall areas of the Canadian prairies where no annual pulse crop can presently be grown as an alternate crop. Many of the production practices used in field pea are transferable to grass pea.

A breeding program was initiated recently at the Agriculture Canada Research Station, Morden, Manitoba, to produce cultivars which are adaptable to the drier regions of the Prairie Provinces and which have little or no BOAA (beta-oxalylamino-L-alanine). BOAA is a neurotoxin which causes an irreversible crippling and paralysis when Lathyrus is consumed as a major part of the diet for an extended period of time. This program has been successful (Campbell and Briggs, 1987) and feeding studies are presently being conducted before the release of cultivars.

This note is to add *L. sativus* to the host range of *S. sclerotiorum*. In Figs. 1 and 2 symptoms of *S. sclerotiorum* infection are illustrated on the stems and pods. The infected stems (Fig. 1) take on a bleached appearance, which is characteristic of infection of other plant species by this pathogen. A white cottony growth of the fungal pathogen, which gives rise to the name 'white mold', was not apparent on the foliage. Perhaps this was because moist, humid conditions did not persist long enough. On the pods 'white mold' and sclerotial formation had occurred (Fig. 2). The source of infection was not determined, but it appeared to have originated from the soil.

The diseases caused by this pathogen occur generally in the cool, moist areas of the world. However, *S. sclerotiorum* may occur in localities considered to be hot and dry. *L. sativus* is being developed for the brown soil zone extending from south central Manitoba, through southern Saskatchewan to the foothills in southern Alberta. *S. sclerotiorum* would seem to be a production problem in that region only in times of persistent moisture. It also could be a production problem if Lathyrus was grown in areas with generally higher moisture levels and cooler temperatures.

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Fig. 1. In the center of the picture note bleached nature of *Lathyrus sativus* stems infected by *Sclerotinia sclerotiorum.*

Fig. 2. Pods of *Lathyrus sativus* showing characteristic 'white mold' and sclerotia.

A disease assessment key for Alternaria blackspot in rapeseed and mustard

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Alternaria blackspot is an important disease of rapeseed and mustard around the world. Whereas disease assessment keys have been prepared for many diseases, none are available for this disease. Keys for assessment of disease on both leaves and siliques have been prepared. This should allow for consistent assessment of Alternaria blackspot.

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La tache noire due à *Alternaria* est une maladie redoutable du colza et de la moutarde partout dans le monde. Bien que des clés d'évaluation aient été préparées pour de nombreuses maladies, il n'en existe aucune pour celle-ci. Des clés d'évaluation des dégâts causés aux feuilles et aux siliques ont été préparées. Cela devrait permettre une évaluation uniforme de la tache noire.

Introduction

Alternaria brassicae, causal agent of the blackspot of rapeseed, is an economically important pathogen in western Canada and around the world (7,8,9). In several countries of Europe and southeast Asia this disease imposes a major constraint on optimum yields of this oilseed crop. During certain years it is the most economically important disease of rapeseed (canola) in western Canada. Estimated yield losses in western Canada in 1987 were up to 30% in heavily infected fields, with significantly more than normal dockage (9). The losses and dockage levels were higher in 1989 (2).

Alternaria brassicae causes lesions on leaves which have necrotic centers surrounded by chlorotic areas (Fig. 1). This leads to reduction in photosynthetic area, defoliation and accelerated senescence. The pathogen synthesizes abscisic acid (3) which would aid in the accelerated senescence. Disease levels on leaves, through inoculum production, affect the disease severity on siliques. Lesions on siliques consist of necrotic spots with limited chlorotic areas in the early stages of lesion development (Fig. 2). Photosynthates from siliques are known to contribute significantly to the development of seeds in rapeseed (1). Also, the blackspot lesions on siliques cause increased fruit shattering and often a direct infection of seeds through siliques walls (Fig. 3).

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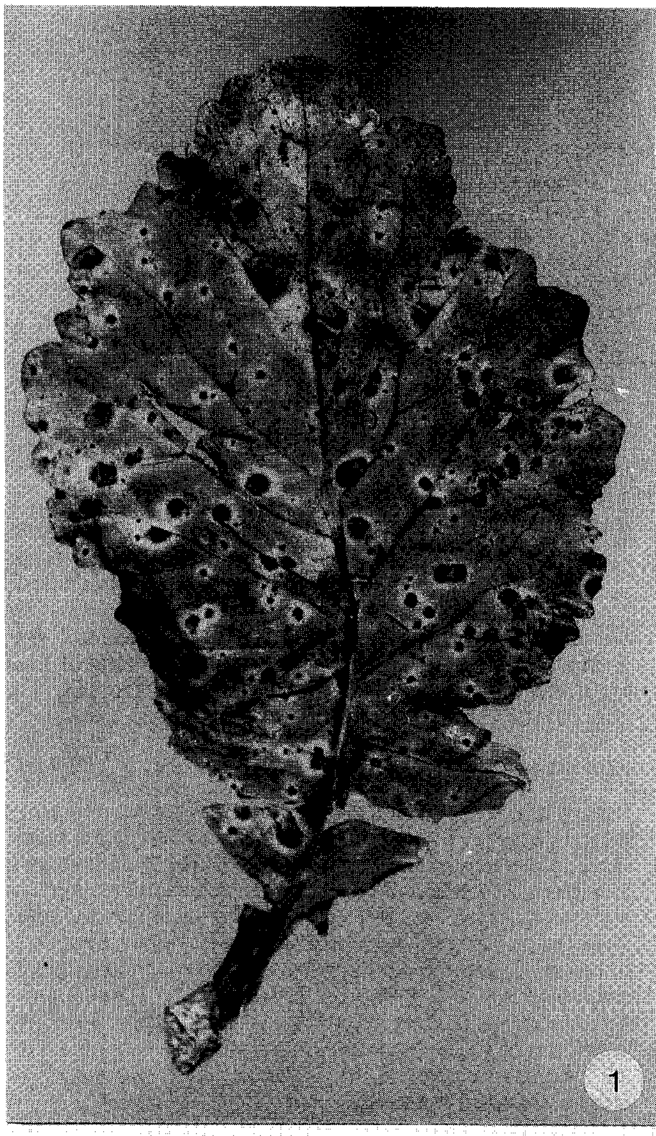
Disease assessment keys, based on the host area affected, have been prepared for many diseases (5,6). However, so far as the authors are aware, none is available for assessing blackspot of rapeseed and mustard. Charts for rating the different growth stages of rapeseed are available (4). Based on the aforesaid considerations, disease assessment keys were developed for both leaves and siliques of rapeseed and are presented in this paper.

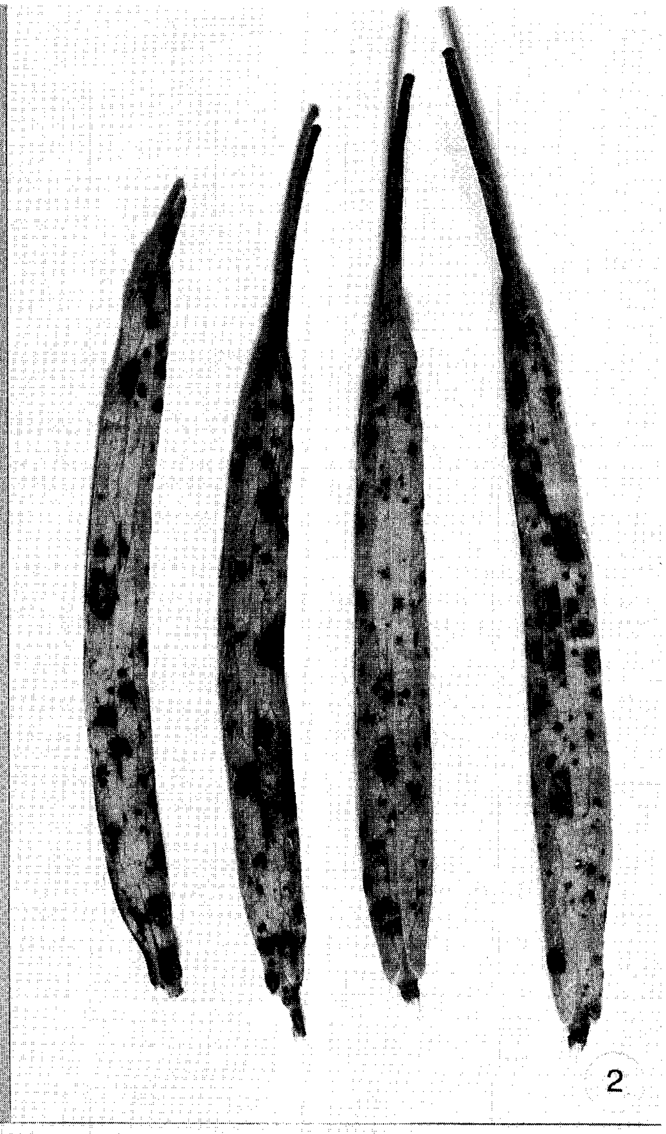
Materials and methods

Leaves and siliques of rapeseed with Alternaria blackspot were collected from the field and the symptoms studied. Drawings of leaves and siliques with lesions were prepared. The necrotic centers of lesions were colored black and the surrounding chlorotic areas were indicated by dotted lines. Both necrotic and chlorotic areas were included in calculation of the diseased area. Percent area covered with lesions was calculated using a CalComp 9000 digitizer. The digitizer calculated the area of a simple closed polygon when the boundary of the polygon was digitized by tracing it with a cursor. Drawings of 1, 5, 10, 20, 30 and 50% areas covered by lesions were prepared.

Results and discussion

Disease assessment keys for rapeseed leaves and siliques are given in Figures 4 and 5, respectively. In some cases, siliques collected from the field have lesions mainly on the upper side. Proper adjustment should be made if such is the case. The overall shape of leaves and siliques are similar in rapeseed and mustard, therefore these keys should permit blackspot assessment in both these crops. Also, these keys should be usable for assessing some other diseases of rapeseed and mustard as well, such as white rust caused by *Albugo candida* and white leaf spot caused by *Pseudocercosporella capsellae.*





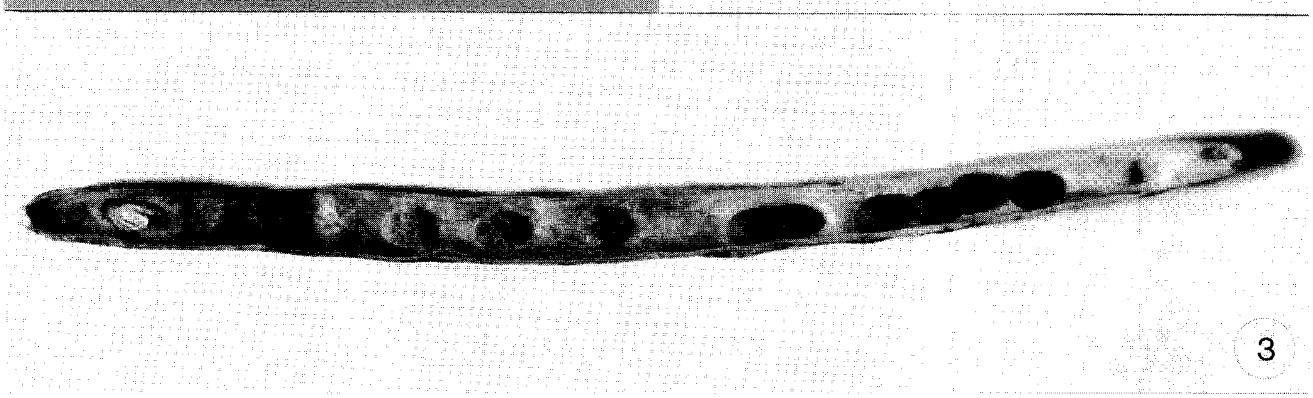
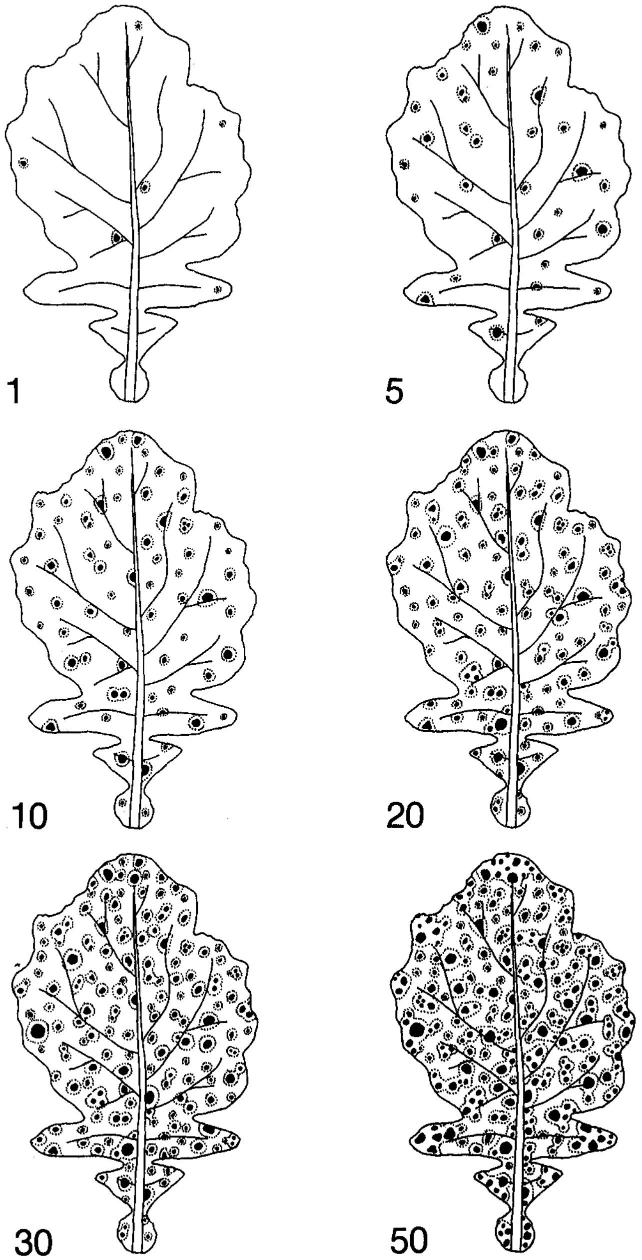


Figure 1. Leaf of *B. campestris* with Alternaria blackspot. The lesions consist of necrotic areas surrounded by chlorotic areas.

Figure 2. Siliques of *B. campestris* with Alternaria blackspot. The lesions consist of necrotic spots generally with limited chlorotic areas in the early stages of lesion development.

Figure 3. A silique of *B. campestris* with seeds colonized by *A. brassicae*.



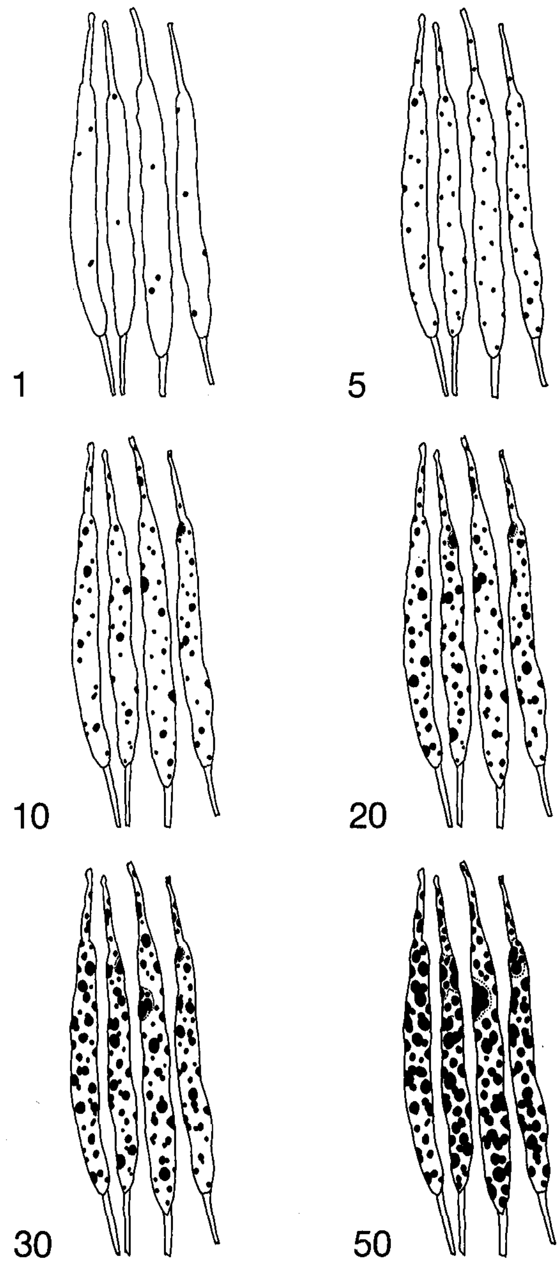


Figure 4. Drawings of leaves showing 1, 5, 10, 20, 30 and 50% of the surface areas covered with blackspot lesions. The dotted lines represent chlorotic areas surrounding the necrotic areas and are included as part of the diseased areas.

Figure 5. Drawings of siliques showing 1, 5, 10, 20, 30 and 50% of the surface areas covered with blackspot lesions. The dotted lines represent chlorotic areas surrounding the necrotic areas and are included as part of the diseased areas. The lesions on siliques generally did not have chlorotic areas in the early stages of lesion development.

Acknowledgement

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Distribution of virus vector nematodes associated with peach and other fruit crops in Essex County, Ontario

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The prevalence of virus-transmitting nematodes near Leamington in Essex County, Ontario, Canada was determined in a survey conducted during 1983 to 1985. At least one species of virus vector was found in 76% of all samples taken and 81% of all peach orchards sampled. *Xiphinema rivesi, X. americanum, Longidorus breviannulatus, L. diadecturus* and *L. elongatus* were found in 54%, 38%, 16%, 7% and 2%, respectively, of all sites tested, and in 65%, 44%, 28%, 7% and 2%, respectively, of peach orchards sampled.

Can. Plant Dis. Surv. 70:1, 23-26, 1990.

La prévalence de nématodes vecteurs de virus près de Leamington dans le comté d'Essex (Ontario, Canada) a été déterminée au cours d'une étude réalisée de 1983 à 1985. Au moins une espèce vecteur de virus a été trouvée dans 76 % des échantillons prélevés et dans 81 % de tous les vergers de pêchers échantillonés. *Xiphinema rivesi, X. americanum, Longidorus breviannulatus, L. diadecturus* et *L. elongatus* ont été trouvés dans 54 %, 38 %, 16 %, 7 % et 2 % respectivement, de tous les lieux analysés et dans 65 %, 44 %, 28 %, 7 % et 2 % respectivement des vergers de pêchers échantillonnés.

Introduction

An estimated 4,945,000 lbs. of peaches (a value of $1,300,500 representing 7% of the Ontario farm value (OMAF Publication No. 274A)) were marketed from Essex County, Ontario in 1987. The peaches grown in Essex County are prone to injury by insects, fungi, and virus-transmitting nematodes. *Xiphinema americanum* Cobb and *Xiphinema rivesi* Dalmasso, both known to transmit Tomato Ringspot Virus (TmRSV) (Teliz *et al*, 1966; Forer and Stouffer, 1982) and *Longidorus diadecturus* Eveleigh & Allen, known to transmit Peach Rosette Mosaic Virus (PRMV) (Allen, 1982) were found in soil samples taken from a sandy ridge near Leamington, Ontario where much of the peach production in Essex County is located. These two virus diseases are associated with yield and quality losses in peach (Forer and Stouffer, 1982; Klos, 1976; Allen, 1986), however, there is no information concerning the extent of nematode virus-vector species in this region. A study was conducted to determine the incidence of *X. americanum, X. rivesi* and *L. diadecturus* on the sandy ridge. The results of the survey are presented here.

Materials and methods

Peach orchards on and around a 3 km wide, 7 km long sandy ridge found at the juncture of Mersea, Gosfield South, and Gosfield North Townships in Essex County, Ontario were sampled during Sept. 1983, July 1984, and Aug. 1985. The area south of the sandy ridge, delineated by the 205-m contour line (Fig. 1), has undergone extensive urban development and therefore was not sampled. Five randomly selected 3-kg soil samples were taken from different sites, to a depth of 30 cm using a shovel, to form a single bulked soil sample from the interior of each orchard. Soil samples from other potential hosts were similarly taken from areas where peaches were not grown, in order to obtain a complete survey of the sandy ridge. The soil samples were stored in plastic bags at 4°C until they could be processed. Five-kg subsamples of randomly selected soil from each of the 92 samples obtained were processed using the Fenwick Can

Figure 1. Distribution of virus vector nematodes found on the sandy ridge near Leamington, Ontario (1983-1985).

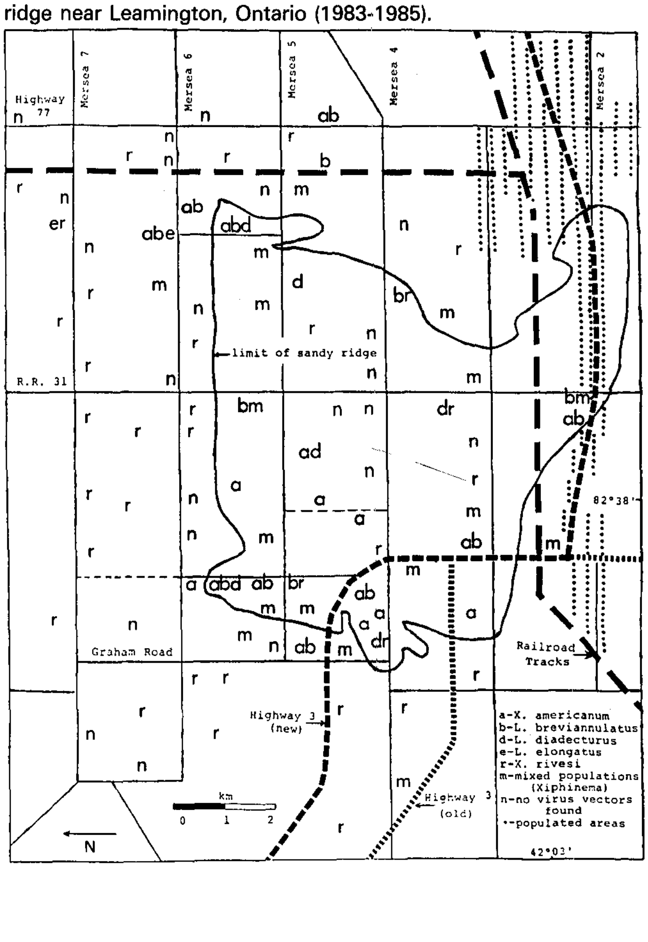

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Table 1. Summary of survey results for *Xiphinema americanum* and its hosts during 1983-1985.

	% (Ratio) of host samples containing *X. americanum*: total samples taken	% (Ratio) of host samples containing *X. americanum*: samples taken per host	% (Ratio) of host samples containing *X. americanum*: total number of samples containing *X. americanum*
Peach	30.4 (28/92)	65.1 (28/43)	80 (28/35)
Apple	4.4 (4/92)	28.6 (4/14)	11.4 (4/35)
Grape	1.1 (1/92)	16.7 (1/6)	2.9 (1/35)
Raspberry	1.1 (1/92)	33.3 (1/3)	2.9 (1/35)
Spruce	1.1 (1/92)	100 (1/1)	2.9 (1/35)

Table 2. Summary of survey results for *Xiphinema rivesi* and its hosts during 1983-1985.

	% (Ratio) of host samples containing *X. rivesi*: total samples taken	% (Ratio) of host samples containing *X. rivesi*: samples taken per host	% (Ratio) of host samples containing *X. rivesi*: total number of samples containing *X. rivesi*
Peach	20.7 (19/92)	44.2 (19/43)	36 (18/50)
Apple	10.9 (10/92)	71.4 (10/14)	20 (10/50)
Cedar	6.5 (6/92)	66.7 (6/9)	12 (6/50)
Grape	5.4 (5/92)	83.3 (5/6)	10 (5/50)
Oak	2.2 (2/92)	100 (2/2)	4 (2/50)
Cherry	2.2 (2/92)	100 (2/2)	4 (2/50)
Strawberry	1.1 (1/92)	50 (1/2)	2 (1/50)
Spruce	1.1 (1/92)	100 (1/1)	2 (1/50)
Sour Cherry	1.1 (1/92)	100 (1/1)	2 (1/50)
Pear	1.1 (1/92)	100 (1/1)	2 (1/50)
Plum	1.1 (1/92)	100 (1/1)	2 (1/50)
Chestnut	1.1 (1/92)	100 (1/1)	2 (1/50)
Bush Lot	1.1 (1/92)	100 (1/1)	2 (1/50)

Extraction Procedure (Fenwick, 1940). The runoff from the Fenwick Can was poured through a 250 μm mesh screen. The nematodes were washed from the screen into 100 ml test tubes and stored at 1°C until they could be examined. The virus vector nematodes found were fixed in 4% formalin and stored in dehydrated glycerin and sent to the Biosystematics Research Centre in Ottawa for identification.

Results and discussion

One species of plant parasitic nematode was recovered from 88% (81/92) of the samples tested while at least one species of virus-vector nematode was recovered from 76% (70/92) of the samples tested. Of the peach orchards sampled, 81% (35/43) had a virus vector present while 7% (3/43) were completely free of plant parasitic nematodes. Virus vectors found include *Xiphinema rivesi*, *X. americanum*, *Longidorus diadecturus*, *L. breviannulatus* Norton and Hoffman and *L. elongatus* (deMan) Thorne and Swanger. Bonsi (1984) reported that populations of *X. americanum* and *X. rivesi* (100/100 cm^3 soil) will significantly reduce apple and peach seedling growth, even if virus particles are not present.

Of the *Xiphinema* species, *X. americanum* was found in 35 samples (Table 1). Most of the samples containing *X. americanum* were from the ridge itself or from the area south of the ridge. Although the specific soil composition was not recorded, the soil south of the ridge tended to be sandier than that north of the ridge (Richards *et al*, 1949). The prevalence of *X. americanum* in sandier soils supports Allen *et al* (1988) who in their reexamination of *X. americanum* in the Canadian National Collection report "In all cases, *X. americanum* (were) recovered from well-drained soils with a high sand content". On the other hand, *Xiphimema rivesi* was found throughout the area sampled on a variety of hosts (Table 2). The prevalence of *X. rivesi* in this survey agrees with Forer and Stouffer (1982) who reported *X. rivesi* to be more widely distributed geographically than *X. americanum* and Allen *et al* (1988) who reported *X. rivesi* to occur in a variety of soil types.

Of the three *Longidorus* species in this survey, *L. breviannulatus* was the most prevalent, being found in 15 samples (Table 3 (i)). Allen (1986) reported that *L. breviannulatus* will ingest PRMV particles but does not readily transmit the virus although Huff *et al* (1987) reported that in greenhouse studies *L. breviannulatus* will acquire Brome Mosaic Virus (BMV) from mechanically inoculated barley and transmit BMV to healthy barley. As far as BMV transmission is concerned, *L. breviannulatus* is of limited importance in the area surveyed because little barley is grown on the sandy ridge. However, the host range of *L. breviannulatus* has not been examined thoroughly, and eventually may be of concern because of its potential to produce disease. *L. breviannulatus* has been implicated as one of the causes of stunting corn in Iowa (Malek *et al*, 1980) as well as being associated with the decline in bentgrass in Pennsylvania (Forer, 1977). These reports suggest that this species may parasitize grasses predominantly and therefore, in peach orchards, may be probing at peach roots as a last resort (Norton, 1984).

L. diadecturus is considered to be epidemiologically important because of its efficient transmission of PRMV (Allen *et al*, 1986). *L. diadecturus* was found in only 6 samples (Table 3 (ii)) and is therefore of lesser importance than the *Xiphinema* spp. reported. *L. diadecturus* is known only from its original source location on the sandy ridge in Essex County.

Table 3. Summary of survey results for *Longidorus* spp. and their hosts during 1983-1985.

	% (Ratio) of host samples containing *Longidorus* spp.: total samples taken	% (Ratio) of host samples containing *Longidorus* spp.: samples taken per host	% (Ratio) of host samples containing *Longidorus* spp.: total number of samples containing *Longidorus* spp.
		(i) *Longidorus breviannulatus*	
Peach	27.9 (19/92)	27.9 (12/43)	80 (12/15)
Apple	1.1 (1/92)	7.1 (1/14)	6.7 (1/15)
Raspberry	1.1 (1/92)	33.3 (1/3)	6.7 (1/15)
Cherry	1.1 (1/92)	100 (1/1)	6.7 (1/15)
		(ii) *Longidorus breviannulatus*	
Peach	3.3 (3/92)	7 (3/43)	50 (3/6)
Raspberry	2.2 (2/92)	66.7 (2/3)	33.3 (2/6)
Cherry	1.1 (1/92)	50 (1/2)	16.7 (1/6)

L. elongatus was found in 2 samples in this survey on non-preferred hosts (peach and cedar), and although this nematode will transmit virus, the species seems to have limited significance in this area.

Other plant parasitic nematodes found include *Tylenchorhynchus nudus* (first Ontario record), *Tylenchorhynchus maximus, Helicotylenchus digonicus, Helicotylenchus platyurus, Helicotylenchus pseudorobustus, Hemicycliophora uniformis, Criconemella xenoplax* (known to reduce root and shoot growth in peach (Nyczepir *et al*, 1986)), *Pratylenchus* spp. and *Heterodera* spp.

Conclusions

Canadian *Xiphinema* spp. are more important pests than *Longidorus* spp. because of their prevalence and ability to survive on a wide variety of hosts (Tables 1, 2). The proven ability of *Xiphinema* spp. to transmit both TmRSV and PRMV increases their significance in Canadian soils. *L. diadecturus*, the more efficient longidorid vector in this study, was less numerous than *L. breviannulatus*, although the vector-significance of the latter is dubious. The two *Xiphinema* spp. found in this survey tend to inhabit different soil types, therefore it is recommended that soil samples from fields to which susceptible crops will be planted be checked for the presence of these nematode species. Also, because peaches are hosts for many virus-vector nematode species (Tables 1, 2, 3), soil samples from old orchards should be tested before planting any susceptible crops.

Acknowledgements

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Diagonistic laboratories / Laboratoires diagnostiques

Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: Manitoba

Title / Titre: Diseases of Fruits Diagnosed on Samples Submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1989.

Name and Agency / Nom et Organisation: Platford, R.G.
Manitoba Agriculture
Agricultural Services Complex,
201-545 University Cres.,
WINNIPEG, Manitoba
R3T 5S6

METHODS: Fruit samples, submitted to the Manitoba Agriculture Plant Pathology Laboratory were examined for the presence of disease.

RESULTS:

Apple: Of 187 samples of apple trees, 29 showed cytospora canker (*Cytospora* spp.), 21 fire blight (*Erwinia amylovora*), 8 frogeye leaf spot (*Physalospora obtusa*), 8 silver leaf (*Chondrostereum purpureum*), 3 unspecified virus diseases, and 5 scab (*Venturia inaequalis*). In 42 samples, nutrient deficiencies, primarily of iron, were diagnosed. The majority of the fire blight infected samples were from Winnipeg and also showed symptoms of environmental stress and drought stress over the past 2 years.

Plum: Of 8 samples of plum, 2 showed plum pockets (*Taphrina communis*), 2 shot hole (*Coccomyces* spp.), and 4 were affected by environmental stress.

Pear: Of 24 samples of pear, 8 were affected by fire blight (*Erwinia amylovora*), 3 by cytospora canker (*Cytospora* spp.), and 13 by environmental stress.

Raspberries: In 61 samples of raspberries examined for disease, 13 showed spur blight (*Didymella applanata*), 9 cane blight (*Leptosphaeria coniothyrium*), 5 root rot (*Fusarium* spp.), 5 fruit rot (*Botrytis cinerea*), 3 fire blight (*Erwinia amylovora*), 2 anthracnose (*Elsinoe veneta*), 2 powdery mildew (*Sphaerotheca macularis*), 1 virus (unspecified virus), 1 crown gall (*Agrobacterium* spp.), and 14 showed symptoms of environmental stress. In 6 samples, insect injury rather than disease, was the problem diagnosed.

Saskatoon: Of 11 samples of saskatoons, 3 were affected by rust (*Gymnosporangium* spp.), 2 powdery mildew (*Podosphaera clandestina*), 1 crown gall (*Agrobacterium radiobacter* var. *tumefasciens*), 1 cytospora canker (*Cytospora* spp.), 1 cylindrocarpon root rot (*Cylindrocarpon* spp.) and 5 environmental stress.

Strawberries: In 56 samples of strawberries, 16 showed root rot (*Fusarium* spp.), 7 fruit rot (*Botrytis cinerea*, *Discohainesis oenotherae*), 13 showed environmental stress (including drought, high temperature, and nutrient stress), 4 showed slime mold, 3 showed root rot (*Pythium* spp.), and 4 showed root rot (*Cylindrocarpon* spp.). In 16 samples, insect injury rather than disease was the problem.

Crop/Culture: Diagnostic Laboratory Report

Location/Emplacement: Prince Edward Island

Title/Titre: Diseases Diagnosed on Potatoes Submitted to the Prince Edward Island Pathology Laboratory, From 1984 to 1989

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METHODS: The P.E.I. Plant Pathology Diagnostic Service provides identification and recommendations on disease problems related to potatoes and other crops. This is a provincial disease service and the following results are based only on the potato samples submitted to the Plant Pathologist. Hence, this data does not necessarily reflect the most prevalent disease problems in the province. The majority of samples were from potato producers, shippers, dealers, Agriculture Canada inspectors, and chemical company representatives.

Isolation procedures varied depending on symptom expression. The three most common media used on a regular basis included potato dextrose agar (PDA), potato dextrose agar with antibiotics (PDA+), and water agar (WA). The data was collected on an annual basis from November 1 to October 31 of the following year.

RESULTS and COMMENTS: Diseases diagnosed on potato samples between 1984 and 1989, are presented in table 1. Frequencies are expressed as a percent of the total potato samples received in a given year. Disease frequencies vary between years due to variations in rainfall, temperature, and other environmental conditions. Physiological disorders were most frequently diagnosed in 1986, 1987, and 1989, with frequencies of 32%, 14%, and 22% of total samples, in each year, respectively. During 1984, 1986, and 1989, late blight (*Phytophthora infestans*), was the most common infectious disease diagnosed on potato samples, with annual frequencies of 23%, 33%, and 21%, respectively. In 1988, verticillium wilt (*Verticillium* spp.) was diagnosed on 25% of total potato samples received. Early blight (*Alternaria solani*) was the disease diagnosed most frequently in 1985 (11%) and 1989 (10%).

Positive laboratory identification of a disease will assist a producer in deciding the most effective control measures required to alleviate or control disease problems.

Table 1 FREQUENCY OF POTATO DISEASES DIAGNOSED EXPRESSED AS PERCENT TOTAL ANNUAL POTATO SAMPLES SUBMITTED*

	1984	1985	1986	1987	1988	1989
Late blight (*Phytophthora infestans*)	23	10	33	3	8	21
Common scab (*Streptomyces scabies*)	14	6	-	8	1	2
Fusarium dry rot (*Fusarium* spp.)	12	1	5	3	7	3
Bacterial soft rot (*Erwinia* spp.)	8	6	2	6	2	2
Blackleg (*Erwinia* spp.)	4	6	2	3	2	3
Pocket rot (*Phoma* sp.)	8	1	-	-	1	2
Early blight (*Alternaria solani*)	4	11	4	13	6	10
Verticillium wilt (*Verticillium* spp.)	4	8	6	10	25	7
Rhizoctonia (*Rhizoctonia solani*)	4	10	5	11	10	9
Gray mold (*Botrytis cinerea*)	2	17	5	10	8	2
Pink eye (*Pseudomonas florescens*)	2	1	-	3	4	2
Seed piece decay	-	-	-	5	-	2
Black dot (*Colletotrichum coccodes*)	-	4	-	-	-	1
Mosaic viruses	-	-	-	2	-	1
Leak (*Pythium* spp.)	-	-	-	2	1	3
Silver scurf (*Helminthosporium* spp.)	-	-	-	2	1	-
Physiological disorders	10	15	32	14	15	22
No diseases	5	5	6	6	7	9
Total Number Annual Potato Samples	106	105	91	56	84	106

*The year indicated is the year in which 10/12 months of each sampling period, fell.

Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: Manitoba

Title / Titre: Diseases Diagnosed on Samples of Pulse Crops and Alfalfa Submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1989.

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METHODS: Ten samples of field beans, 21 of field peas and 15 of lentils submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1989, were examined for disease. Twenty-one samples of alfalfa submitted by agricultural representatives and grassland specialists, were also examined.

RESULTS:

Field Beans: In 10 samples of field beans, 5 showed bacterial blight (*Xanthomonas campestris* pv. *phaseoli*), 3 showed environmental stress, and 2 herbicide injury.

Field Peas: In 21 samples of field peas, 10 showed root rot (*Fusarium* spp.), 1 showed Mycosphaerella blight (*Mycosphaerella pinodes*), 1 showed anthracnose (*Colletotrichum* spp.) and 1 showed environmental stress. In addition to disease, 8 samples showed symptoms of herbicide injury.

Lentils: In 15 samples of lentils, 8 showed anthracnose (*Colletotrichum truncatum*), 2 ascochyta blight (*Ascochyta fabae* f. sp. *lentis*), and 5 samples were found to be affected by environmental stress (high temperatures, low soil moisture).

Alfalfa: In 21 samples of alfalfa examined for disease, 5 showed blackstem (*Phoma medicaginis*), 1 brown rot (*Plenodomus meliloti*), 1 crown rot (*Fusarium* spp.), 1 yellow blotch (*Leptotrochila medicaginis*), 6 environmental stress, and 3 no detectable disease. Alfalfa fields in southern Manitoba were under severe moisture stress in 1989.

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Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: British Columbia

Title / Titre: 1989 VEGETABLE, TURF AND ORNAMENTAL DISEASES IN BRITISH COLUMBIA

DIAGNOSTIC LAB

Over 640 submissions from commercial operations came into the diagnostic lab from January to November, 1989. Many types of crops were represented because of the wide diversity of British Columbia agriculture. The only home garden samples were those brought in by garden centres and landscape maintenance companies. A sudden cold snap in early February was responsible for damage to perennials and the very wet growing season promoted foliar blights.

VEGETABLES

There were 78 vegetable submissions with noteworthy ones reported here (Table 1). Carrot black root rot (*Thielaviopsis basicola*) was severe this year. Bacterial blight of celery (*Pseudomonas syringae* pv. *apii*) was introduced for the first time on infected imported transplants. Bacterial blight of pepper (*Xanthomonas campestris* pv. *vesicatoria*) was likely introduced on infected seed and transplants. Tomato spotted wilt virus (TSWV) infected lettuce transplants while in a greenhouse next to infected tomato.

Table 1. Vegetable diseases of note in British Columbia in 1989.

Crop	Disease	No. of Samples
Asparagus	Purple Spot (*Stemphylium sp.*)	3
	Rust (*Puccinia aspargi*)	1
Brussels Sprouts	Sclerotinia stalk rot (*Sclerotinia sclerotiorum*)	1
Cabbage	Black rot (*Xanthomonas campestris*)	1
Carrot	Black root rot (*Thielaviopsis basicola*)	2
	Cavity spot (*Pythium sp.*)	2
Cauliflower	Black rot (*Xanthomonas campestris*)	1
Celery	Bacterial blight (*Pseudomonas syringae* pv. *apii*)	5
Lettuce	Lettuce Drop (*Sclerotinia minor*)	1
	Tomato spotted wilt virus (TSWV)	1
Melon	Verticillium wilt (*Verticillium dahliae*)	1
	Angular leaf spot (*Pseudomonas lacrymans*)	1
Pepper	Bacterial blight (*Xanthomonas campestris* pv. *vesicatoria*)	2
	Verticillium wilt (*Verticillium dahliae*)	1
Potato	Silver scurf (*Helminthosporium solani*)	1
	Rhizoctonia (*Rhizoctonia solani*)	3
	Bacterial ring rot (*Corynebacterium sepidonicum*)	1
	Blackleg (*Erwinia carotovora*)	2
	Early blight (*Alternaria solani*)	2
	Pink rot (*Pythium sp.*)	2
	Late blight (*Phytophthora infestans*)	1
	Sclerotinia stem rot (*Sclerotinia sclerotiorum*)	1
Tomato	Tobacco mosaic virus (TMV)	3
	Bacterial canker (*Corynebacterium michiganense*)	1

TURF

There were 43 turf samples submitted to the lab in 1989 (Table 2.) Most grass species were *Poa*, *Festuca*, or *Agrostis*. Red thread (*Laetisaria sp*.)was severe on many lawns in Salmon Arm and Sicamous in September due to the wet conditions. Problems due to poor turf management were common. Necrotic ring spot (*Leptosphaeria korrae*) was diagnosed on six lawns and appears to be restricted to the Okanagan.

Table 2. Turf problems in B.C. in 1989.

Disease	No. of Samples
Take-All patch (*Gaeumannomyces graminis*)	1
Blister smut (*Entyloma dactylidis*)	2
Anthracnose (*Colletotrichum graminicola*)	3
Nectrotic ring spot (*Leptosphaeria korrae*)	3
Melting out (*Curvularia lunata*, *Drechslera*)	3
Rust (*Puccinia sp*.)	1
Rhizoctonia blight (*Rhizoctonia solani*)	4
Pythium blight (*Pythium sp*.)	4
Red thread (*Laetisaria sp*.)	6
Poor cultural conditions	16
Miscellaneous	1

NURSERY CROPS

There were 125 submissions of nursery crops. Cold damage from a sudden cold snap in early February 1989 caused damage to many nursery crops. Maple anthracnose, causal agent as yet undetermined, was severe, possibly because of the wet growing season. Fireblight (*Erwinia amylovora*) occurred on cotoneaster in coastal B.C. Phytopthora root rot (*Phytophthora sp*.) was common on juniper.

Cereals / Céréales

Crop / Culture: Barley

Location / Emplacement: Alberta

Title / Titre: INCIDENCE OF EYESPOT IN BARLEY IN ALBERTA, 1989

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METHODS Barley fields were surveyed for eyespot (*Pseudocercosporella herpotrichoides*). A total of fifty stems were collected from each field. Samples were collected just prior to swathing or shortly thereafter. The lowest two internodes of each stem were examined for the presence of eyespot lesions. The number of stems with one or more lesions present was noted. The survey area extended from Barrhead to Picture Butte, with the majority of surveyed fields located near Edmonton and Red Deer. Regression analyses were conducted to determine whether eyespot incidence was related to seeding date, target yield and location.

RESULTS: Eyespot was found in ninety percent of the barley fields surveyed. The average incidence of eyespot per field was 24.6%. Crop rotation appeared to have some effect on disese incidence (Table 1). Barley crops following canola had less eyespot (13.0%) than those following barley (26.8%) or wheat (32.2%). Twelve barley cultivars were surveyed. The most common cultivars were Leduc (15 fields surveyed), Harrington (11) and Heartland (5). The average incidence of eyespot per field was 36.4% for Harrington, 28.4% for Heartland and 22.8% for Leduc. There was no correlation between eyespot incidence and seeding date (r^2 = 0.002), target yield (r^2 = 0.015) or location (r^2 = 0.010). Anthracnose (*Colletotrichum graminicola*) was present in some of the survey fields. There was a high incidence of symptoms (9.6%) which resembled eyespot but were sufficiently different that these were not considered eyespot lesions. It is suspected that these are sharp eyespot lesions (*Rhizoctonia solani*, *R. cerealis*). Isolations are presently being conducted.

Table 1. Effect of crop rotation on incidence of eyespot in barley fields in Alberta.

1988 CROP	NO. OF FIELDS SURVEYED	NO. OF FIELDS WITH EYESPOT	EYESPOT INCIDENCE[1]			
			MIN.	MAX.	AVE.	S.E.
BARLEY	29	24	0	82	26.8	24.4
CANOLA	11	11	0	38	13.0	13.0
WHEAT	7	7	4	62	32.2	22.2
OATS	2	2	2	84	43.0	-
SUGAR BEETS	2	2	0	4	2.0	-
FALLOW	2	2	10	74	42.0	-
GRASS	1	1	6	6	6.0	-
TOTAL	54	49	0	82	24.6	24.4

1 - Percentage of stems infected in surveyed fields.

Crop / Culture: Barley

Location / Emplacement: Saskatchewan and bordering areas

Name and Agency / Nom et Organisation:

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University of Saskatchewan

Title / Titre: Saskatchewan Barley Leaf Disease Survey, 1989

METHODS: 1989 was the third year of the Saskatchewan Barley Leaf Disease Survey. Methods used were as described by Weller and Rossnagel (1988). Samples were obtained from 30 sites; 21 in Saskatchewan, 3 in Alberta, 3 in Manitoba, 2 in North Dakota and 1 in Montana.

RESULTS: Little disease occurred except at sites in the northern portion of the region where adequate moisture was received in 1988 and 1989 - Beaverlodge and Edmonton, Alberta; and Meadow Lake, Medstead, Shellbrook and Nipawin, Saskatchewan. The other areas were affected by the drought in 1988 and/or the dry period of July and August, 1989. A positive relationship was noted between disease severity and the susceptibility of the cultivar providing the barley stubble at the sites.

Spot-form net blotch (*Pyrenophora teres* f. *maculata*) was again the most common foliar disease. It occurred in moderate to heavy amounts at 5 sites. Light infections occurred at 8 sites. Trace infections were difficult to distinguish when spot blotch (*Cochliobolus sativus*) and net-form net blotch (*Pyrenophora teres* f. *teres*) were also present. Scald (*Rhynchosporium secalis*) occurred at one site in heavy amounts, one in moderate amounts, four in light amounts and at ten in trace amounts. Spot blotch occurred at one site in moderate amounts, four in light amounts and twenty-three in trace amounts. Net-form net blotch occurred in light amounts at three sites and as a trace at eighteen sites. Septoria (*Septoria spp.*) occurred in light amounts at two sites and as a trace at twelve sites. Other diseases noted in non-threatening amounts included stem rust (*Puccinia graminis* f.sp. *tritici*), leaf rust (*Puccinia hordei*), powdery mildew (*Erysiphe graminis*), halo spot (*Selenophoma donacis*), smuts (*Ustilago hordei* and *U. nuda*), ergot (*Claviceps purpurea*) and bacterial infections (species unknown). Signs of viral infection were not common and Russian wheat aphids were not found.

At non-Saskatchewan sites, spot-form net blotch, the most common barley foliar disease in Saskatchewan in our 3-year survey, was not a problem in 1989 except at Edmonton. Alberta sites tended to show more scald. United States and Manitoba sites were dry and tended to demonstrate spot blotch infections.

Reference: Weller, J.A. and Rossnagel, B.G. 1989. Can. Plant Dis. Surv. 69: 29.

Crop/Culture: Barley

Location/Emplacement: Manitoba and Saskatchewan

Title/Titre: BARLEY SMUT SURVEY, 1989

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Nom et Organisation:
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METHODS: In July, 1989, 178 barley fields were surveyed for Ustilago hordei, U. nigra and U. nuda in Manitoba and Saskatchewan. The northern area was covered by a route from Winnipeg-Saskatoon-Prince Albert-Swan River-Winnipeg and the southern area in a one-day trip north of Winnipeg and a route (thanks to J. Nielsen) from Winnipeg-Leader-Elstow-Winnipeg. Fields of barley were selected at random at approximately 15 km intervals, depending on the frequency of the crop in the area. An estimate of the percentage of infected plants (i.e. plants with sori) was made while walking an ovoid path of approximately 100 m in each field. Levels of smut greater than trace were estimated by counting plants in a 1 m^2 area at at least two sites on the path. U. nuda and U. nigra were differentiated by observing germinating teliospores with a microscope.

RESULTS: See Table 1. Smut was found in 70% of the fields examined. The average level was 0.8%. The highest incidence of smut observed in any one field was 10% U. nuda in six-row barley near St. Eustache, Manitoba.

COMMENTS: The over-all level of infection (0.8%) was similar to that for the survey of 1988. This probably reflects the continued warm, dry conditions in 1988, during the time when the seed for 1989 was infested/infected, and therefore may mean that low levels of smut will be observed again in barley in 1990.

TABLE 1. Incidence of smut on barley, 1989

Province	Crop	% fields affected			Mean % infected plants
		U. hordei	U. nigra	U. nuda	
Manitoba	2-row	6	19	63	0.2
	6-row	17	17	73	1.0
Saskatchewan	2-row	11	5	41	0.1
	6-row	33	7	70	1.3

Crop/Culture: Barley

Location/Emplacement: Southeastern Manitoba

Title/Titre: BARLEY LEAF DISEASES IN MANITOBA IN 1989

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METHODS: Twenty-five barley fields were surveyed in southeastern Manitoba on July 20 and July 26 to assess leaf disease incidence and severity. Fields were chosen at random along the survey routes. Severity was rated visually in both the upper and lower crop canopies by examining plants along an inverted V transect about 50 m long and using a four-point scale: trace (<5% leaf area damaged); slight (5-15%); moderate (16-40%); and severe (41-100%). Representative leaf samples were collected for subsequent pathogen identification. This was done by surface sterilizing infected leaf tissue pieces and placing these in moist chambers to promote sporulation.

RESULTS AND COMMENTS: Of the fields surveyed, 21 were six-rowed and 4 two-rowed. Growth stage at time of sampling was 73-85 (Zadoks scale). No difference in disease severity was apparent between the two barley types. Severity in the upper canopy (top two leaves) was rated as trace in 28% of fields, slight in 60%, moderate in 12% and severe in none. In the lower canopy disease levels were somewhat higher: trace - 20%; slight - 36%; moderate - 36%; and severe - 8%. The 44% of fields with moderate to severe leaf disease on lower leaves likely reflected the frequent and heavy rainfall earlier in the growing season (June), while the relatively low levels on upper leaves resulted from the subsequent very dry conditions during the month of July. The low levels of disease on upper leaves suggest that minimal yield loss resulted from leaf diseases in southeastern Manitoba in 1989. Two pathogens were isolated from leaf lesions - *Pyrenophora teres* (net blotch) and *Cochliobolus sativus* (spot blotch); both were widespread and found in 72% and 84% of fields respectively. The enhanced incidence of spot blotch may have been a reflection of the high temperatures prevailing during late June and the month of July.

Crop/Culture: Barley and Spring Wheat

Location/Emplacement: Manitoba

Title/Titre: DISEASES DETECTED IN SAMPLES SUBMITTED TO THE MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY IN 1989

Name and Agency/ Nom et Organisation:
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METHODS: One hundred and thirty-eight samples of spring wheat and 114 samples of barley submitted by agricultural representatives and growers in Manitoba were analyzed for presence of disease.

RESULTS AND COMMENTS:

Wheat: In the 138 samples of wheat examined, 13 were diagnosed with common root rot (*Cochliobolus sativus*, *Fusarium* spp.), 8 with barley yellow dwarf (barley yellow dwarf virus), 3 with septoria leaf blotch and glume blotch (*Septoria* spp.), 2 with flame chlorosis (virus-like organisms), 1 with Fusarium head blight (*Fusarium* spp.), 1 with take all root rot (*Gaeumannomyces graminis*), 1 with wheat streak mosaic virus disease, 63 with environmental stress. The large number of wheat samples showing symptoms of stress from low soil moisture and high temperatures were mainly from the southwest region, south and west of Brandon and the Central region from Plumas, Gladstone, Carman and areas south of Carman. There was also a large number of samples (46) which displayed symptoms of herbicide injury.

Barley: In the 114 barley samples, damage related to environmental conditions was detected in 20 samples. Cool spring soil conditions and a prolonged period of hot, dry weather in July and August were the main environmental problems. Flame chlorosis (virus-like organism) became more prominent in 1989 and was found in 17 samples. In most cases damage was less than 10% but the problem is spreading and becoming more severe. The majority of infected fields were in Western Manitoba but a few fields were detected in Eastern Manitoba near Niverville and Glenlea. Barley yellow dwarf virus disease was found in 7 samples. Leaf diseases included net blotch (*Drechslera teres*), spot blotch (*Cochliobolus sativus*) and scald (*Rhynchosporium secalis*) and were found in 24 samples. Infection levels were highest in the eastern region, where yield losses as high as 30% were estimated. Common root rot (*Cochliobolus sativus*, *Fusarium* spp.) was detected in 13 samples but the loss in most cases was less than 5%. Herbicide injury was detected in 16 samples and in one field resulted in a total crop loss. Smut was found in 4 samples. Rust (*Puccinia graminis*) was detected in 2 samples. In 14 samples, no disease and no typical stress symptoms could be detected.

Crop / Culture: Barley, Winter Wheat

Location / Emplacement: Prince Edward Island

Title / Titre: SURVEY OF ROOT AND CROWN ROT ORGANISMS IN CEREALS AS AFFECTED BY CROP SEQUENCES

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MATERIALS AND METHODS: The purpose of this study was to monitor the incidence of crown and root rot pathogens of cereals in crop sequences. Thirty barley and winter wheat plants were sampled early, mid, and late during the 1988 growing season from 4 commercial fields each of the following crop sequences: clover-potato-barley, ryegrass-potato-barley, potato-pea-barley, and potato-pea-winter wheat. Each plant was rated for crown and root rot (0 = healthy; 5 = crowns and roots completely rotted causing plant death). Disease severity was calculated for each plot using the following formula:

$$\text{Disease Severity} = \frac{\sum \left(\text{No. plants in disease category} \times \text{No. value of category}\right)}{\text{Total no. of plants} \times 5} \times 100$$

Fungal pathogens were isolated from crown and root tissue. Nematode and fungi were also isolated from soil collected early and late in the growing season.

RESULTS AND COMMENTS: Moderate crown and root rot severity was observed in the cereal fields investigated during 1988. *Rhizoctonia solani* was prevalent in cereal crowns but not in roots, and soil populations averaged 5.7 colony forming units (cfu)/50 g dry soil and tended to be highest in fields following potato-pea sequences (Table 1). *Bipolaris sorokiniana* and *Fusarium graminearum* were isolated infrequently from crown and roots of both barley and winter wheat. *Fusarium sambucinum* and *F. avenaceum* isolated from 8.5% and 12.8% of crowns respectively and tended to be highest in winter wheat. Stunt nematode (*Tylenchorhynchus* sp.) were isolated from soil of both winter wheat and barley, and population levels were highest in soil of barley following ryegrass-potato and potato-pea sequences. Severity of crown and root rot of barley was positively and significantly correlated (P=0.05) with incidence of *R. solani* in crown and roots, *B. sorokiniana* in crowns, and population levels of stunt nematodes in soil. Stunt nematodes have been isolated from soil around roots of cereals grown on P.E.I., however their role in the crown and root rot complex has not been established.

Table 1. Mean incidence and soil population levels of crown and root pathogen isolates from cereals in 1989 following different crop sequences.

	Rhizoctonia solani			*Bipolaris sorokiniana*		*Fusarium sambucinum*			*Fusarium avenaceum*			*Fusarium graminearum*			Stunt	Disease
Sequence[1]	Crown %	Root %	Soil[2]	Crown %	Root %	Crown %	Root %	Soil[3]	Crown %	Root %	Soil[3]	Crown %	Root %	Soil[3]	Nematode no./kg	Severity (0-100)
Rg-Pot-B	38.3	1.1	3.3	2.5	0.0	4.2	0.3	207	12.5	0.3	145	2.5	0.0	47	2468	34.5
Cl-Pot-B	27.5	1.4	3.0	1.7	0.0	7.5	0.3	593	10.8	0.3	46	0.0	0.0	30	931	35.3
Pot-P-B	45.6	3.0	8.9	4.4	6.7	5.6	1.8	1349	8.9	0.4	72	0.0	0.0	19	3421	36.7
Pot-P-WW	35.8	1.7	7.6	0.8	0.6	16.7	1.1	1254	19.2	2.2	138	1.7	0.0	0	995	34.3
Mean	36.9	1.8	5.7	2.4	1.8	8.5	0.9	851	12.8	0.8	100	1.0	0.0	24	1941	33.7

[1]Rg = Ryegrass, Pot = Potato, B = Barley, Cl = Clover, P = Pea, WW = Winter Wheat.
[2]Colony forming units/50 g dry soil.
[3]Colony forming units/g dry soil.

Crop / Culture: Barley, Oats, Triticale, and Wheat

Location / Emplacement: Maritime Provinces

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Title / Titre: CEREAL DISEASE PROFILE IN THE MARITIME PROVINCES - 1989

METHODS: Surveys of the cereal producing areas of New Brunswick, Nova Scotia, and Prince Edward Island were conducted during the summer of 1989. Isolations of pathogens were made to confirm disease identities as required. Some 50 commercial fields in total were examined in all three Provinces with the majority of winter wheat fields being located in the Annapolis Valley of Nova Scotia. No commercial fields of triticale were located and all observations of this crop were from research plots. Milling wheat analysis were conducted by the Kentville Research Station.

WEATHER CONDITIONS: Cereal production was generally better than average in the Maritime Provinces in 1989 with high yields reported. In Prince Edward Island this was due to early seeding dates and suitable weather patterns. Temperatures in August were higher than normal and this, coupled with rainfall patterns during infection periods, resulted in harvest commencing about 10 days earlier than normal with completion in mid-September during good weather conditions. In Nova Scotia and New Brunswick, weather patterns were close to long term averages and with similar planting and harvest dates compared to previous years. Survival of fall seeded cereals was good in Nova Scotia and New Brunswick but poor in Prince Edward Island because of ice sheeting.

BARLEY: The foliar diseases, net blotch and scald incited by *Pyrenophora teres* and *Rhyncosporium secalis*, respectively, were the diseases of concern on spring barley. On Prince Edward Island, net blotch appeared to be the more significant as scald lesioning did not progress, probably due to the relatively dry warm weather which was present in 1989. Barley crops in New Brunswick illustrated more scald than net blotch symptoms. Scald appears to becoming a more significant disease in this area and is noted to be of greater significance now than in past years. In Nova Scotia, barley diseases were less severe than normal. Neither scald nor net blotch appeared to be yield appeared to be yield limiting as leaf spotting became severe only late in the season. Severe scald symptoms were limited to individual farms in eastern Nova Scotia and this was related to dates of planting and local weather patterns. Fusarium head blight was not reported as a problem in barley. Symptoms could be found more frequently on 6-row than 2-row cultivars, albeit all at low levels. Common root rot was observed in all areas but not observed as a problem of greater significance than is normally associated with barley.

WHEAT: Winter wheat crops were of above average yield and quality where winter survival was good. Good growing conditions resulted in low disease levels with the exception of powdery mildew (*Erysiphe graminis* f.sp. *tritici*) which was of increased incidence and severity. Damage by mildew was frequently reported as the cause of downgrading of milling wheat. Blackpoint or smudge was also the cause of downgrading of milling winter wheat but to a lesser extent than mildew. Fusarium head blight severity was much reduced in 1989 compared to 1988; nevertheless, tombstoning remained high and was the cause of some downgrading from milling to feed quality. Winter wheat following winter wheat were more heavily infected with take-all (*Gaeumannomyces graminis*). Leaf and glume blotch (*Septoria nodorum*) were also more severe in the absence of an adequate rotation. Stripe (*Cephalosporium gramineum*) was found at several locations in the Annapolis Valley at levels considered detrimental to yield. Leaf and glume blotch was found on all winter wheat cultivars but not to significant levels. Snowmolds were widespread but did not appear to be damaging to survival.

Spring wheat crops were not subjected to the normally severe fusarium head blight symptoms due to advantageous weather conditions, however the disease was observed at low levels in all areas of the Maritimes. Powdery mildew was less noticeable primarily due to a greater percentage of the crop being planted to the feed wheat cultivar Belvedere, which has greater resistance and is produced at lower nitrogen fertility levels than the milling cultivars Ketapwa and Max. These milling cultivars were severely affected by powdery mildew and all milling crops required fungicide applications for mildew control. Leaf and glume blotch was widespread on all spring wheat cultivars but did not become severe until very late in the summer. Loose smut was noticeable on susceptible cultivars, especially where seed treatments had not been applied.

OATS: Septoria speckled leaf blotch (*Septoria avenae*) was the only foliar disease of consequence on oats in the Atlantic Provinces and the oat crop generally was above normal in yield and quality. In a number of instances on Prince Edward Island fusarium head blight was observed to be quite prominent on hulless oats compared to normal hulled oat cultivars. In all three Provinces, BYDV was observed more frequently than in the last ten to fifteen years.

TRITICALE: Only limited numbers of observations were carried out but this crop was quite healthy with low levels of foliar diseases and less fusarium head blight than normally associated with this species.

Crop/Culture: Downy Brome (*Bromus tectorum* L.) and Japanese Brome (*Bromus japonicus* Thunb.)

Location/Emplacement: Southwestern Saskatchewan

Title/Titre: OCCURRENCE OF *Ustilago bullata* Berk. ON WEEDY ALIEN ANNUAL *Bromus* SPECIES IN CEREALS AND FORAGES

Name and Agency/ Nom et Organisation:
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METHODS: During July to September in 1988 and 1989, 195 fields were surveyed for the occurrence of *U. bullata* on downy brome and 8 fields of Japanese brome were surveyed. Generally these two weed species have a patchy distribution in fields. The survey was conducted by counting the number of plants showing obvious smut symptoms in a maximum of ten patches per field. Downy brome has rapidly invaded crop and forage land in southwestern Saskatchewan during the last 10 years and is a major weed across 31 rural municipalities, while Japanese brome is less widespread and tends to occur in cooler/ wetter areas of the region, particularly at higher elevations. These weeds occur in a range of crops and habitats across southwestern Saskatchewan including winter and spring wheat, fall rye, crested wheatgrass, smooth brome, alfalfa and native rangeland areas.

RESULTS AND COMMENTS: Downy brome infected with *U. bullata* was found in 45 of the 195 fields surveyed (23%) and infected Japanese brome was found in 4 of the 8 fields surveyed (50%). Within an individual patch or field, the infection level ranged from 5 to 100%. On an individual plant basis, all infected plants had 100% of the spikelets exhibiting smut symptoms and seed production in all infected plants was reduced to zero. Both these annual bromes reproduce exclusively by seed, and *U. bullata* appears to effectively regulate population density under field conditions. The density of the weed infestations ranged from 1 plant/sq. m to over 1500 plants/sq. m in the fields surveyed. These surveys represent the first recorded occurrence of *U. bullata* on downy brome and Japanese brome in Saskatchewan. In spite of the reported wide host range of *U. bullata*, the smut was not evident on any grass species occurring in conjunction with downy brome and Japanese brome in all fields surveyed.

REFERENCE: Fischer, G.W. 1940. Host specialization in the head smut of grasses, *Ustilago bullata*. Phytopathology 30: 991-1017.

Crop/Culture: Oat

Location/Emplacement: Manitoba

Title/Titre: OCCURRENCE AND VIRULENCE OF OAT CROWN RUST IN MANITOBA IN 1989

Name and Agency/ Nom et Organisation:
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METHODS: The occurrence of oat crown rust (causal agent *Puccinia coronata* f. sp. *avenae*) in Manitoba was determined by frequent examination of farm fields or stands of wild oat (*Avena fatua* L.), from early July to late August. Rust samples were collected mainly from wild oat and from rust nurseries located near Woodmore, Brandon, Morden, and Dauphin. The rust nurseries were comprised of susceptible lines with no known crown rust resistance genes, isogenic lines with resistance genes Pc38, Pc39, Pc55, Pc63, Pc64, and Pc68, and the cultivars Fidler and Dumont.

Collections of crown rust were established on Makuru oat in the greenhouse. After sporulation, a single-pustule isolate was isolated from each collection. The single pustule-derived isolates were then inoculated to a set of 19 isogenic lines containing the resistance genes Pc35, Pc38, Pc39, Pc40, Pc45, Pc46, Pc48, Pc50, Pc54, Pc55, Pc56, Pc58, Pc59, Pc60, Pc61, Pc62, Pc63, Pc64, and Pc67, for virulence combination identification. The isolates were also inoculated to the cultivar Dumont.

RESULTS AND COMMENTS: For the second consecutive year, the incidence of oat crown rust was one of the lightest reported in Manitoba in recent years. The prolonged hot and dry conditions during July and August restricted the development of the rust. Only trace levels of infection were found on wild oat and on oat in farm fields and rust nurseries in late August.

To date one hundred and fifty single-pustule isolates, comprising 50 virulence combinations, have been established. Isolates with virulences to gene Pc46 (11.4%) or to both genes Pc35 and Pc46 (16.8%) were the most common, but there was also an alarming abundance of different isolates with virulences to both genes Pc38 and Pc39. The latter isolates were first detected in low number (0.01%) in Manitoba in 1987 (Chong, 1988). In 1989 thirty-two isolates (21.3% of isolates) with virulences to plants with both genes Pc38 and Pc39 have been identified. These isolates were highly variable in virulence and were also virulent to other Pc genes (Table 1). Twenty-eight of these isolates were also virulent on Dumont, which carries Pc38, Pc39, plus a third unidentified gene for crown rust resistance.

The recent widespread use of oats with resistance genes Pc38 and Pc39 has exerted selective pressure on the Manitoba rust population causing a major shift in virulences to these genes. If the trend of increased virulence to this gene combination continues, significant crop losses are likely in the near future, because all the rust resistant cultivars currently grown in Manitoba rely on these genes for crown rust protection. Oats with complex resistance are being developed at the Winnipeg Research Station.

REFERENCE

Chong, J. 1988. Virulence and distribution of *Puccinia coronata* in Canada in 1987. Can. J. Plant Pathol. 10: 348-353.

Table 1. Isolates of Puccinia coronata with virulences to the gene combination of Pc38 and Pc39 and Dumont in Manitoba in 1989.

Virulence combination (susceptible Pc genes, Dumont)	No. of isolates	% of isolates
38,39,55,63	1	0.7
38,39,46,55,63	3	2.0
38,39,46,55,Dumont	2	1.3
38,39,55,63,Dumont	5	3.4
35,38,39,55,63,Dumont	2	1.3
38,39,40,55,63,Dumont	3	2.0
38,39,40,55,64,Dumont	3	2.0
38,39,55,56,63,Dumont	1	0.7
35,38,39,46,55,63,Dumont	2	1.3
35,38,39,50,55,63,Dumont	1	0.7
35,38,39,55,63,67,Dumont	1	0.7
38,39,40,54,55,63,Dumont	1	0.7
38,39,40,55,63,64,Dumont	1	0.7
35,38,39,40,46,55,63,Dumont	1	0.7
35,38,39,40,55,63,67,Dumont	1	0.7
35,38,39,46,55,59,63,Dumont	1	0.7
38,39,40,55,60,63,64,67,Dumont	2	1.3
35,38,39,40,55,59,60,63,67,Dumont	1	0.7
Total	32	

Crop / Culture: Spring Wheat and Spring Barley

Location / Emplacement: Central Saskatchewan

Title / Titre: DISEASE SURVEY OF IRRIGATED CEREALS IN SASKATCHEWAN IN 1989

Name and Agency / Nom et Organisation:

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(The support of the Saskatchewan Agriculture Development Fund is acknowledged.)

METHODS: The sites studied were located along the South Saskatchewan River and associated irrigation canals from Hague to Riverhurst. Twenty-one fields of spring wheat and 4 fields of spring barley were surveyed three times during the growing season by collecting 40 plants from 10 sites in each field. All of the fields were irrigated by a center pivot system. Sampling began 10 m inside the outside wheel track of the pivot and a diamond pattern was followed with each collection site being 10 m apart. Individual plants were rated for foliar diseases using a 0-9 scale (Couture, L. 1980. Can. Plant Dis. Surv. 60: 8-10). Common root rot was rated by scoring the percent discoloration present on subcrown internodes using the Horsfall-Barratt Grading System. At harvest time, the same fields were visited again to collect head samples. These were used to assess head and kernel discoloration. Representative samples of internodes, leaves, glumes and seeds were saved for examination and/or plating to determine causal agents. Plant samples were collected on the following dates with growth stages (Tottman, D.R. and Broad, H. 1987. Ann. Appl. Biol. 110: 441-454) given in brackets: June 19-21 (G.S. 14-24), July 24-26 (G.S. 61-77) and August 14-15 (G.S. 83-87).

RESULTS: The average foliar disease rating in spring wheat for each of these periods was 0.1, 2.7 and 4.6, respectively, while in spring barley it was 0.1, 2.8 and 5.1, respectively. A rating of 5.1 indicated the upper leaves to be free of disease symptoms while the middle leaves showed 10-15% symptoms and the bottom leaves showed at least 50% symptoms. The average rating for common root rot for spring wheat was 2.6, 9.2 and 21.4 percent, respectively, for the three collection times while for spring barley it was 1.9, 12.7 and 20.2 percent, respectively. Take-all was suspected in one barley field at a level of 8% and also in three wheat fields at levels of 8, 10 and 16%, respectively. Positive identification of the causal agent has not been done yet. The disease, however, was not severe enough to kill the affected plants. Head samples were collected August 22. The average head discoloration (glume blotch symptoms) for wheat was 0.8%; 3.0% of the kernels exhibited smudge/blackpoint symptoms. Although there were no pink kernels, 2% of the kernels in one field had tombstone appearance. The average head discoloration found in the barley fields was 0.01% and only 1% of the kernels had blackpoint/smudge symptoms. Loose smut occurred in several fields at levels less than 1% affected plants. Determination of the causal agents associated with diseased tissue found on internodes, leaf, glume and seed samples has yet to be done.

Crop / Culture: Wheat

Location / Emplacement: Manitoba

Title / Titre: FOLIAR PATHOGENS OF SPRING WHEAT IN MANITOBA IN 1989

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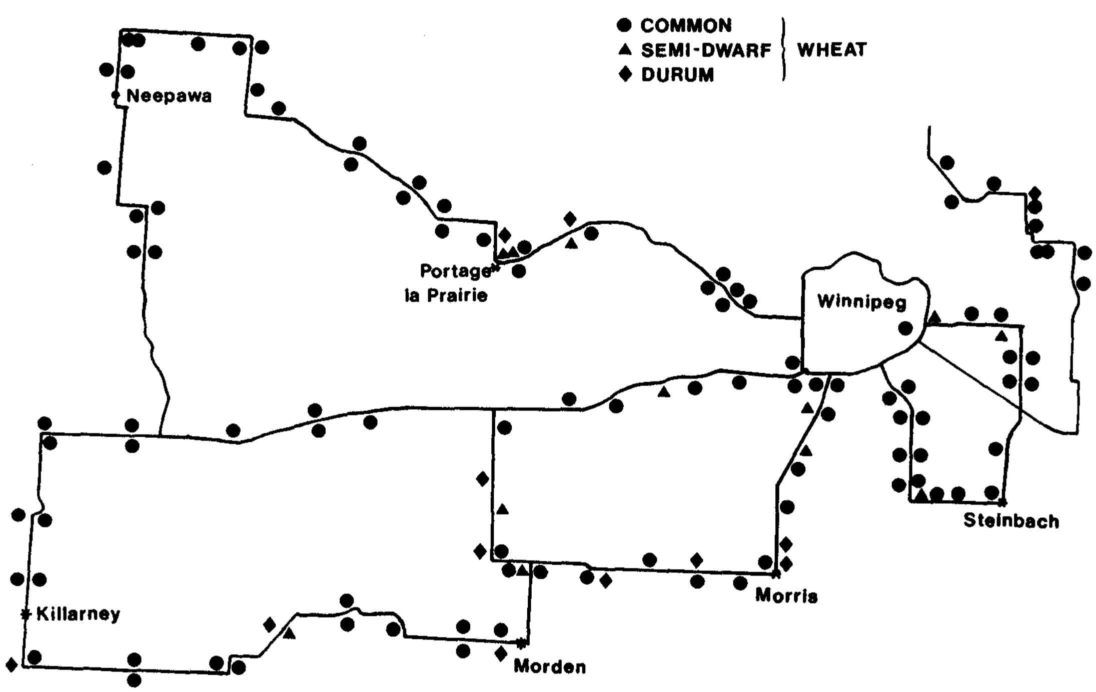
METHODS: One hundred and twenty-four fields of wheat (100 common, 12 durum, and 12 semi-dwarf) in southern Manitoba were surveyed from 20-26 July 1989 for foliar pathogens (Fig. 1). Fields were selected at random along the survey routes. Growth stage was recorded and the severity of foliar disease was categorized as 0, TR, 1, 2, 3, or 4, with 4 describing dead leaves, 3 severely affected, 2 moderately, and 1 lightly affected. Infected tissue was collected, and was subsequently surface sterilized and placed in moist chambers for 4-5 days to induce sporulation to facilitate pathogen identification.

RESULTS AND COMMENTS: Maturity of plants at sampling ranged from water ripe to early dough (GS 71-83). Most were in the medium to late milk stage (GS 75-77). Disease levels ranged from 0 to 1 on the flag leaves and from 1 to 2 on lower leaves.

Cochliobolus sativus (spot blotch) was isolated from 79.8% of the fields sampled, while the incidence of tanspot (Pyrenophora tritici-repentis) was 54.8%. Both spot blotch and tanspot were widespread throughout the survey area. Septoria leaf blotch (Septoria nodorum, Septoria avenae f. sp. triticea) was found in 35.4% of fields. It was also widespread but less frequent to the south and west of the survey area. Septoria nodorum blotch was more common than septoria avenae blotch, 31.5% and 9.7% respectively. Glume blotch (S. nodorum) was isolated from heads of wheat in 2 fields just west of Steinbach. Trace levels of leaf rust were observed in 24 (19.4%) fields, mostly south of Winnipeg.

Fig. 1 Wheat fields surveyed for foliar pathogens in 1989.



Crop/Culture: Spring Bread Wheat

Location/Emplacement: Province of Quebec

Title/Titre: SURVEY OF SPRING BREAD WHEAT DISEASES IN THE ST-HYACINTHE REGION IN 1989

Name and Agency/ Nom et Organisation:
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METHODS: Ten fields of two spring bread wheat cultivars were surveyed for leaf, root, and head diseases in the St-Hyacinthe region, southwestern Quebec in 1989. The intensity of foliar diseases was assessed on 10-20 plants at 10 sites chosen along a W transect across each field surveyed. A dozen plants at each site were pulled out during the dough development stages to check for symptoms of take-all. Leaf diseases were evaluated before heading as percentage leaf area affected on the whole plant and, after heading, on the top leaves only using the Horsfall and Barratt grading system[1]. Head blight was assessed as the percentage of visibly infected spikelets on 50 heads chosen at random at each site.

RESULTS AND COMMENTS: Table 1 presents the minimum - maximum percentage disease intensity recorded before and after heading. Before heading tan spot (*Pyrenophora tritici-repentis*) was observed only in three fields where stubbles from the previous year's wheat crop remained on the soil surface. After heading, *Septoria* leaf blotch (*Septoria nodorum*) was observed in trace quantities and was mixed with tan spot lesions. Powdery mildew (*Erysiphe graminis*) was observed both before and after heading in four of the five fields of cultivar Katepwa. Leaf rust (*Puccinia recondita*) was observed only late in the season in six fields. Take-all (*Gaeumannomyces graminis*) was not observed on the samples surveyed. *Fusarium* head blight (*Fusarium graminearum*) was observed in all the fields surveyed and was generally more severe on the cultivar Max.

Table 1. Prevalence and intensity of spring bread wheat diseases in the St-Hyacinthe region of Quebec in 1989.[1]

		% minimum - maximum disease intensity				
		Leaf	Powdery	Leaf	Head blight	
Cultivar	Growth Stages[2]	spots	mildew	rust	Heads	Spikelets
Max	40 - 49	0-3.7	0	0	-	-
	75 - 83	4-29.0	0	0-2.0	0.15-5.42	0.05-0.84
Katepwa	40 - 49	0-0.6	0-2.7	0	-	-
	75 - 83	2.2-5.8	0-5.5	0-0.2	0.33-2.07	0.18-0.33

[1]Horsfall & Barratt grading system. Phytopathology 35(8): 655 (Abstr.).
[2]Zadoks *et al*. growthg stages of cereals. Weed Res. 14(6): 415-421.

Crop / Culture: Wheat

Location / Emplacement: Saskatchewan

Name and Agency / Nom et Organisation:
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Title / Titre: SUMMARY OF WHEAT DISEASE DIAGNOSES FOR SAMPLES SUBMITTED TO THE SASKATCHEWAN AGRICULTURE CROP PROTECTION LABORATORY

The Crop Protection Laboratory of Saskatchewan Agriculture and Food examined 198 wheat samples submitted for disease diagnosis in 1989. A summary of diagnoses is provided in the table. Note that the percentages add to over 100 because more than one disease was often present on individual samples. Common root rot was the most common disease diagnosis, followed by Septoria leaf spot. Early season weather conditions were favorable for leaf spotting, but dry conditions over much of the province beginning mid July limited development of foliar diseases to below normal levels. Environmental damage, primarily due to heat and drought stress was common. Numerous samples with physiological disorders such as abnormal stem and head bending were also received. Wheat streak mosaic virus was confirmed on winter wheat or spring wheat adjacent to winter wheat from three separate locations in southern Saskatchewan.

Table. Diseases and disorders diagnosed by the Crop Protection Laboratory in 1989 wheat crops.*

Disease or disorder	Percentage of samples affected
Common root rot (*Cochliobolus sativus*, *Fusarium* spp.)	49
Septoria spp.	23
Physiological problems	13
Heat or drought stress	12
Herbicide damage	8
Tan spot (*Pyrenophora tritici-repentis*)	6
Sooty molds (*Alternaria* spp., *Cladosporium* spp.)	3
Ascochyta tritici leaf spot	3
Seedling blight (*Cochliobolus sativus*, *Fusarium* spp.)	3
Anthracnose (*Colletotrichum graminicola*)	2
Wheat streak mosaic	2
Loose smut (*Ustilago tritici*)	1
Take-all root rot (*Gaeumannomyces graminis* var. *tritici*)	1
Snow mold (*Fusarium nivale*)	1

* Based on 198 samples

Crop / Culture: Wheat/oat/barley

Location / Emplacement: Manitoba and eastern Saskatchewan

Name and Agency / Nom et Organisation:
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Title / Titre: OCCURRENCE OF CEREAL RUSTS IN WESTERN CANADA IN 1989

METHODS: Fields of cultivated oats and wheat were examined throughout the growing season in Manitoba and eastern Saskatchewan for wheat leaf rust, wheat stem rust, and oat stem rust. Barley stem rust observations were made in non-inoculated rust nurseries and some commercial fields.

RESULTS AND COMMENTS: Wheat leaf rust (*Puccinia recondita* f. sp. *tritici*) was first observed in southern Manitoba during the first week of July. Cool and dry conditions prevailed over the prairie region during spring and early summer, delaying the initial arrival and spread of wheat leaf rust in this region. Rust infections were heavy on susceptible cultivars in the Red River Valley, and were light on commercial fields throughout southern Manitoba and southeastern Saskatchewan. Leaf rust did not spread as far into central and northern Saskatchewan as in previous years due to the cool and dry conditions. Yield losses to leaf rust in 1989 in western Canada are expected to be minimal due to resistant cultivars and environmental conditions. Wheat stem rust (*Puccinia graminis* f. sp. *tritici*) was not observed on susceptible lines in trap nurseries in southern Manitoba until late July. Hot dry weather reduced infection intensities, and all resistant spring wheat cultivars remained unaffected. There were no reports of stem rust in winter wheat. However, some barley cultivars (e.g. Ellice) in rust nurseries became heavily infected, and damaging levels of infection were observed in some commercial fields of Argyle and Duke barley. All the barley cultivars indicated carry the T-gene for stem rust resistance, and there appeared to be interactions with the stressful environmental conditions of 1989 to produce the higher infections. There were no changes of virulence in the stem rust populations. Infections of oat stem rust (*P. graminis* f. sp. *avenae*) remained light in 1989 due to the hot dry weather and the widespread use of resistant cultivars.

Crop / Culture: Wheat and barley

Location / Emplacement: Manitoba

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Title / Titre: FLAME CHLOROSIS, A NEW VIRUS-LIKE DISEASE OF CEREALS IN MANITOBA: 1989 SURVEY

BACKGROUND: In 1985, a novel disease described as "flame chlorosis" (FC) was observed in spring barley near Newdale, Manitoba (1). Symptoms were striking and distinct from those of any other reported disease of cereals. In 1986 and 1987 scattered diseased plants were identified in a small number of barley fields, within 50 km of the original Newdale site. The disease has been shown to be soil-transmitted and associated with a novel cytopathology and a specific set of double-stranded (ds) RNA species (1). In 1988, FC of barley was identified at many more locations near Newdale and at several locations outside the Newdale region. In 1989, spring wheat with FC symptoms was observed and found to have dsRNA species and cytopathology similar to those associated with the disease in barley.

METHODS: Flame chlorosis is readily diagnosed in the first month of seedling growth by its striking and characteristic leaf symptoms (1). Surveys were conducted between June 7 and 23 in the barley-growing regions north and west of Brandon, and in the Red River Valley south and east of Winnipeg. FC plants and symptomless specimens from the field were transplanted into pots and subsequently maintained in growth cabinets (1). Plants whose later-emerging leaves also displayed typical FC symptoms were recorded as disease-positive. A representative sampling of FC-positive as well as symptomless control plants was further analyzed by electron microscopy and dsRNA analysis to confirm the diagnosis of flame chlorosis.

RESULTS AND COMMENTS: Locations where more than 0.1% of plants showed FC symptoms, and FC symptoms were subsequently confirmed in later-emerging leaves, are shown in Fig. 1. In 1989, virtually all of the approximately 70 fields of wheat or barley in the surveyed area north and west of Brandon that were examined thoroughly had at least trace levels of FC. It is significant that FC was recorded at a few sites in eastern Manitoba in both barley and wheat, because surveys done before 1988 had failed to find the disease in this region. Flame chlorosis is increasing in frequency in western Manitoba, and probably spreading to other areas of the province. While disease levels were below thresholds of economic damage in almost all fields where FC was identified in either wheat or barley, continuous cultivation with cereals may enable disease levels to increase to the point where they cause losses in direct proportion to the percentage of diseased plants in the field. This situation was observed in two fields near Newdale in 1985 and 1987. Flame chlorosis surveys will be conducted in future years to monitor progress of the disease.

REFERENCE

1. Haber, S., W. Kim., R. Gillespie and A. Tekauz. 1990. Flame Chlorosis: a new, soil-transmitted, virus-like disease of barley in Manitoba, Canada. J. Phytopathol. (in press).

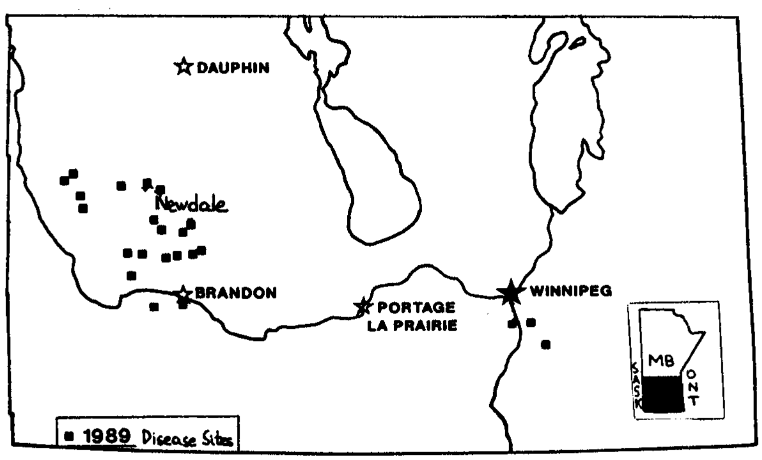

Figure 1. Sites in Manitoba where flame chlorosis affected more than 0.1% of barley or wheat plants in the field.

Crop/Culture: Wheat

Location/Emplacement: Manitoba

Title/Titre: OCCURRENCE OF FUSARIUM HEAD BLIGHT IN MANITOBA IN 1989

Name and Agency/ Nom et Organisation:
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METHODS: One hundred and three wheat fields were examined for Fusarium head blight between July 26 and August 10, 1989. Twelve heads were sampled for the presence and identification of *Fusarium* species from an area of about 50 x 30 m at the edge of each field. Crop developmental stages at the time of sampling ranged from early milk to hard dough.

RESULTS AND COMMENTS: Fusarium head blight was found in 63% of fields examined. It occurred in 55% (42 of 76) of common, 91% (10 of 11) of durum and 75% (12 of 16) of semi-dwarf wheat fields (Fig. 1). Severity levels ranged from trace to 10% (average 1%) with higher levels occurring in durum wheat fields. The generally low severity of Fusarium head blight in 1989 was probably the result of low levels of precipitation in July. *F. graminearum*, *F. poae* and *F. sporotrichioides* were the species isolated most frequently (Table 1).

Table 1. Distribution of *Fusarium* species in common, durum and semi-dwarf wheat fields in Manitoba in 1989.

	No. wheat fields			
Fusarium spp.	Common	Durum	Semi-dwarf	Total
F. graminearum	14	6	2	22
F. poae	13	3	4	20
F. sporotrichioides	17	7	6	30
F. culmorum	0	1	5	6
F. equiseti	2	0	3	5
F. acuminatum	4	0	0	4
F. avenaceum	1	0	0	1

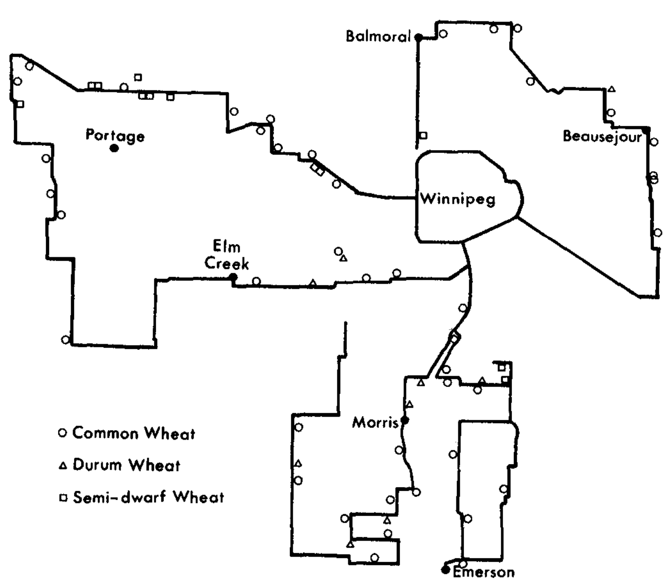

Fig. 1. Location of wheat fields testing positive for Fusarium head blight in 1989.

Crop / Culture: Wheat

Location / Emplacement: Province of Quebec

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Title / Titre: OCCURRENCE OF WHEAT DISEASES IN QUEBEC IN 1989

The incidence of wheat diseases was examined at six different regions of Quebec in late July and early August in 1989. _Fusarium_ head blight was low to moderate in most regions. Powdery mildew (_Erysiphe graminis_) was moderate to severe on susceptible cultivars only in southwestern Quebec. Leaf spots caused by _Pyrenophora tritici-repentis_ mixed in the later part of the season with _Septoria norodum_ were widespread as usual in all regions. However, their intensities were only moderately severe at the late dough stages. Glume blotch (_Septoria nodorum_) occurred only in trace quantities at Lennoxville and at Quebec City area. Leaf rust (_Puccinia recondita_) was light to severe at the late dough stages in southwestern Quebec and at the lake St-John area. Ergot (_Claviceps purpurea_) was moderately severe on six cultivars at Ste-Rosalie in southwestern Quebec and also on triticale cultivars at St-Eugene in the lake St-John area. Take-all (_Gaeumannomyces graminis_) and loose smut (_Ustilago nuda_) were observed in trace amounts in all the regions. A physiological leaf spot occurred suddently from moderate to severe quantities, after heading on the cultivar Max, when a period of hot sunny weather was followed by much cooler temperatures in the St-Hyacinthe region. Most fields of winter wheat were severely affected by winterkill probably due to the large amount of rainfall in the fall of 1988.

Crop / Culture: Wheat

Location / Emplacement: Prince Edward Island

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Title / Titre: INCIDENCE OF ROOT ROT ORGANISMS, ROOT ROT SEVERITY, AND TAKE-ALL IN WINTER WHEAT FOLLOWING CEREAL AND LEGUME ROTATION CROPS

MATERIALS AND METHODS: The purpose of this study was to determine the incidence of root and crown rot organisms affecting winter wheat, cv. Borden following different previous crops. Thirty winter wheat plants were sampled three times during 1989 from 4m x 6m plots previously planted with red clover, lupins, peas, barley, and oats in 1988. Plants were washed under tap water, assessed for take-all symptoms, and rated for crown and root rot (0 = healthy and 5 = crowns and roots completely rotted causing death). Disease severity was calculated using the following formula:

$$\text{Disease Severity} = \frac{\sum \left(\text{No. plants in disease category} \times \text{No. value of category} \right)}{\text{Total no. of plants} \times 5} \times 100$$

Soilborne pathogens were isolated from crowns and roots from all sample dates.

RESULTS AND COMMENTS: Crown and root rot (Table 1) was moderate in winter wheat regardless of the crop grown previously. Take-all symptoms were observed in all plots, particularly in winter wheat following barley. Incidence of white heads was also highest in winter wheat following barley. White heads were significantly correlated (P=0.05) with the frequency of take-all observed on crown and root tissue. *Rhizoctonia solani*, *Fusarium avenaceum*, and *F. sambucinum* were isolated most frequently from crowns and the incidence tended to be slightly higher in winter wheat following oats in this study (Table 2). *Rhizoctonia cerealis* and *F. graminearum* were isolated at low levels from all plots. Root and crown root severity was positively correlated with the incidence of take-all, and levels of *F. avenaceum* and *F. sambucinum* isolated from roots. Preliminary results from this study indicate previous crop can influence the incidence of soilborne cereal pathogens in succeeding winter wheat crops grown on P.E.I..

Table 1. Crown and root rot disease severity, and incidence of take-all and white heads in winter wheat in 1989 following clover, lupins, peas, oats, and barley.

Previous Crop (1988)	Disease Severity (1-100)	Take-all %	White Heads %
Clover	48.8	8.7	7.3
Lupins	50.7	2.1	6.8
Peas	48.8	2.1	6.2
Barley	53.2	20.4	18.6
Oats	48.6	6.2	9.5

Table 2. Incidence of crown and root rot pathogens in winter wheat in 1989 following oats, barley, lupins, peas, and clover.

Previous Crop (1988)	*Rhizoctonia solani*		*Rhizoctonia cerealis*		*Fusarium sambucinum*		*Fusarium avenaceum*		*Fusarium graminearum*	
	Crown %	Root %	Crown %	Root %	Crown %	Root %	Crown %	Root %	Crown %	Root %
Clover	26.7	0.3	2.5	1.7	23.3	0.8	23.3	0.8	1.7	0.0
Lupins	22.5	0.8	2.5	0.8	30.0	0.3	30.0	1.1	0.8	0.0
Peas	21.7	0.8	1.7	0.0	30.0	0.6	30.0	1.1	0.0	0.0
Barley	26.7	0.3	4.2	0.0	25.0	0.8	24.2	0.8	0.0	0.0
Oats	35.8	1.1	2.5	0.3	39.2	0.3	33.3	1.1	0.0	0.0

Crop / Culture: Winter Wheat

Location / Emplacement: Province of Quebec

Title / Titre: SURVEY OF WINTER WHEAT DISEASES IN THE ST-HYACINTHE REGION OF SOUTHWESTERN QUEBEC IN 1989

Name and Agency / Nom et Organisation:

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METHODS: Seven fields of winter wheat: one of Yorkstar, three of Monopol, and three of Karat, were surveyed for leaf, root, and head diseases in the St-Hyacinthe region of southwestern Quebec in 1989. Foliar disease intensity was assessed on 10-20 plants at 15 sites along a W transect across the field examined. Samples of 10 plants were pulled out at each site to assess for root and basal stem diseases in the laboratory. Leaf diseases were evaluated before and after heading at the growth stages shown in Table 1. Root, stem, and head diseases were evaluated when emergence of inflorescence was completed. Disease intensity of leaves were recorded as percentage leaf area affected on the whole plant before heading, but on top leaves only after heading using the Horsfall and Barratt grading system[1]. Root and basal stem diseases were assessed by recording the number of plants showing symptoms of necrosis. Head blight was assessed as the percentage head and spikelets infected on 50 heads chosen at random at each site.

RESULTS AND COMMENTS: Table 1 presents the minimum - maximum percentage disease intensity recorded for the diseases observed before and after heading. Before heading, tan spot (*Pyrenophora tritici-repentis*) was present in six of the seven fields and was more severe in those where wheat stubbles from last year's crop were present on the soil surface. Powdery mildew (*Erysiphe graminis*) was presently mostly at the booting stages and was most severe in two fields protected from the wind. Leaf rust occurred in one field of Karat and in one of Yorkstar at the late soft dough stages. Head blight (*Fusarium graminearum*) was most severe in one field of Karat and was not recorded in the Yorkstar cultivar. Take-all (*Gaeumannomyces graminis*) was observed in trace amounts in the seven fields. Stem necrosis due to *Bipolaris sorokiniana* and *Fusarium* sp. was present on less than 10% of the plants in four of the seven fields surveyed. Snow mold damage was not observed in the field surveyed but water and ice-encasement damage varied from 20% to 90% of the fields in southwestern Quebec.

Table 1. Prevalence and intensity of winter wheat diseases in the St-Hyacinthe region of southwestern Quebec in 1989.[1]

	% minimum - maximum disease intensity					
	Leaf	Powdery	Leaf	Head blight		Stem
Growth Stages[2]	spots	mildew	rust	Heads	Spikelets	necrosis
Before heading*						
31	0-2.6	0-1.3	0	-	-	-
45	0-4.1	0-17.5	0	-	-	-
After heading**						
59	1.9-9.6	0-7.0	0	-	-	0-8.0
85	2.3-10.2	0-10.3	0-6.2	0-2.3	0-15.0	-

*Disease assessment on all the leaves.
**Disease assessment on top leaves only.

[1]Horsfall & Barratt grading system. Phytopathology 35(8): 655 (Abstr.).
[2]Zadoks *et al.* growth stages of cereals. Weed Res. 14(6): 415-421.

Crop/Culture: Cereals

Location/Emplacement: Central Alberta

Title/Titre: CEREAL DISEASE SURVEY IN CENTRAL ALBERTA - 1989

Name and Agency/ Nom et Organisation:
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METHODS: In early August 34 fields of barley, 13 fields of oats and 17 fields of spring wheat were surveyed in C.D. 8 in central Alberta. Fields were selected at random and were traversed in an inverted V. Plants were examined every 10 paces for visual disease symptoms. Four categories were used based on percent area diseased: trace ≤ 1%; slight < 5%; moderate 5-25%; and severe > 25%. In dealing with whole plant diseases (eg. take-all) the same categories would apply to the percent of plants infected in square metre samples.

RESULTS AND COMMENTS:

Weather: The 1989 growing season was characterized by frequent light rains and warmer than average temperatures, which resulted in high levels of leaf disease. Hail was widespread and devastating in the Lacombe-Clive area. Generally, yields were higher than average but quality was very low. The low quality was attributed to high disease levels and three weeks of rain between late August and mid-September. This resulted in only 5% of the barley crop grading malting quality and only 11% of the wheat grading No. 1, both down by two-thirds.

Two-Row Barley: Ten fields of two-row barley were surveyed. In this crop district the majority of these would be seeded to the cultivar Harrington. Ninety per cent of the fields were infected with net blotch (Pyrenophora teres) and scald (Rhynchosporium secalis). Scald was more severe than net blotch, with 56% of fields having flag leaves infected with ≥ 20% scald as compared to 22% for the same level of net blotch. Common root rot (Cochliobolus sativus and Fusarium spp.) occurred in 90% of the fields examined in mainly the trace category. Only one field was noted with a moderate level of root rot, in an area that appeared to be suffering from drought. Covered and loose smut (Ustilago hordei and U. nuda) were observed in only one field each, in trace amounts.

Six-Row Barley: Twenty-four fields of six-row barley were surveyed. Foliar disease incidence was about the same as in the 2-row barleys (83% of the fields), but the level was lower and there were fewer fields rating ≥ 20% disease on the flag leaf. There were only 20% in this category for scald and none for net blotch. One field near Rimbey had 100% scald infection on the penultimate leaves and 50% on the flag, resulting in a significant yield loss. Loose smut was noted in 30% of the fields, all in trace amounts. Covered smut was present in 38% of the fields, two of these rating levels of 1% infection. One field west of Blackfalds had up to 75% of the upper leaves affected by a physiological leaf blackening, a condition that would result in yield loss. Two fields were noted with 1% scald infection on the heads, these had low infections (1-5%) of scald on the flag leaves. Common root rot was found in all of the fields that could be rated but only one of these was in the slightly diseased category.

Oats: Oats continues to be the most disease free cereal in Central Alberta, but this year suffered from higher levels of blast than usually seen. All fields surveyed showed blast symptoms and the majority rated 5% or higher of the florets aborted. Septoria leaf blotch (Septoria avenae) occurred in all fields examined. More than 10% of the flag leaves were infected in one quarter of these fields. There was an increased incidence of barley yellow dwarf along the eastern border of C.D. 8, one field of which had a 10% level of infection.

Spring Wheat: Septoria leaf spot (Septoria complex) was present in every wheat field surveyed, with 65% of them rating ≥ 10% of the upper leaves infected. Glume blotch (Septoria nodorum) was present in 24% of the fields, but only one rated as high as 10% of the heads infected. Common root rot was recorded in 71% of the fields, mainly in the trace category. One field rated slightly diseased. Powdery mildew (Erysiphe graminis) was present in about half of the wheat fields, divided equally into the trace and slight categories. Both stem melanosis (Pseudomonas cichorii) and leaf rust (Puccinia recondita) were rarely found this summer. Each disease occurred in one field at trace levels. Take-all (Gaeumannomyces graminis), however, occurred frequently, and at high levels. Fifty-three percent of all wheat fields surveyed had take-all, with two of these rating 5% infection. Both of these fields were within an area 25 km east of Innisfail.

Crop/Culture: Cereals

Location/Emplacement: Saskatchewan

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Title/Titre: CEREAL DISEASES IN NE SASKATCHEWAN IN 1989

METHODS: Disease surveys were conducted in crop districts 5b, 8a, 8b, and 9a during the period of August 9-21, 1989. Fields were surveyed at random in each crop district, and samples were obtained by walking diagonally into each field surveyed and selecting one plant every 10-15 paces until a total of ten plants had been pulled. Samples were then evaluated for diseases according to the visual symptoms expressed on the plant. Root rot readings were based on a scale where 0 = healthy, 2 = trace, 5 = moderate, and 10 = severe damage according to lesions found on the subcrown internode. All other diseases were recorded as an estimate of the percentage of leaf or stem area affected. Results for each disease were totaled and averaged over the number of samples and fields surveyed to give the disease index. Number of fields affected over the total number of fields surveyed gave the percentage of fields affected.

RESULTS AND COMMENTS:

Wheat: Fifty-eight wheat fields were surveyed within the four crop districts mentioned previously. Root rot (*Cochliobolus sativus* and *Fusarium* spp.) was the most widespread disease occurring in 100 percent of the fields surveyed with a disease index of 2.74. The disease incidence of root rot in crop District 8a was over 30 percent higher than in the other 3 crop districts. Foliar diseases occurred at very low levels, tan spot (*Drechslera tritici-repentis*) was found in 79 percent of the fields, but had a disease index of less than 2. Septoria leaf spot (*Septoria* spp.) and leaf rust (*Puccinia recondita*) were also found at levels of less than 2, but in 56 and 34% of the fields respectively. Powdery mildew (*Erysiphe graminis*) was found in levels of less than 1 and in only 10% of fields surveyed.

Table 1. Severity and prevalence of wheat diseases

Crop District	No. fields	Disease index/% fields affected			
		Root rot	Septoria	Leaf rust	Powdery mildew
5b	15	1.6/67	1.2/67	3.8/60	<0.1/7
8a	9	3.8/100	<0.9/67	<0.7/44	<0.1/22
8b	17	2.6/76	1.2/53	<0.2/41	<0.2/24
9a	17	3.9/82	<0.8/47	<0.1/6	0/0
Total or average	58	1.1/79	1.0/57	1.2/35	<0.1/12

Barley: Fifty-one barley fields were surveyed to establish severity and prevalence of diseases. Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) was present in every field surveyed at trace levels. Net blotch (*Pyrenophora teres*) was the most commonly encountered leaf disease with 98% of the fields affected and a disease index of less than 5. Other diseases such as scald (*Rhynchosporium secalis*), speckled leaf blotch (*Septoria passerinii*), powdery mildew (*Erysiphe graminis*) had disease indices of less than 1 and occurred in a very low percentage of the fields. Loose smut (*Ustilago nuda*) was not found among the sampled plants but was noted in 3 fields in crop district 8b, 5 fields in crop district 9a, and 1 field in crop district 5b.

Table 2. Severity and prevalence of barley diseases

Crop district	No. fields	Disease index/% fields affected						
		Root rot	Net blotch	Scald	Septoria	Powdery mildew	Leaf rust	Stem rust
5b	13	3.6/100	4.7/92	<0.1/39	<0.1/15	<0.1/8	1.6/15	<0.1/31
8a	12	3.7/100	3.5/100	<0.6/17	<0.1/16	0/0	0/0	<0.1/33
8b	13	3.6/100	3.8/100	<0.1/15	0/0	0/0	0/0	<0.1/46
9a	13	3.4/100	6.0/100	<0.7/54	<0.1/31	<0.1/8	0/0	<0.1/15
Total or average	51	3.6/100	4.5/98	<0.4/32	<0.1/16	<0.4/4	<0.4/4	<0.1/24

Oats: A total of 13 oat fields were surveyed with root rot (*Fusarium* spp.) and Septoria blotch (*Septoria avenae*) being found in every field. Disease indices for both diseases were less than 3. Blast was the only other abnormality noted on the oats and it was found in 76% of the fields with a disease index of 1.9.

Forage legumes / Légumineuses fourragères

Crop / Culture: Alfalfa

Location / Emplacement: Northeastern Alberta

Title / Titre: SURVEY OF CROWN AND ROOT ROT OF ALFALFA IN NORTHEASTERN ALBERTA

Name and Agency / Nom et Organisation:

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METHODS: Twenty-five alfalfa fields in northeastern Alberta were surveyed in 1989 for incidence and severity of crown and root rot diseases. Five plants were dug up at each of ten sites equally spaced along the arms of a W pattern. All plants were shaken free of soil, placed in a paper bag, and stored in a cooler until they could be processed. Plants were rinsed with tap water and split longitudinally to visually assess the severity of crown and root rot. Severity scores were assigned based on a scale of 0 to 3 where 0 = clean, 1 = 1-20%, 2 = 21-50%, and 3 = 51-100% of the crown and root discolored.

RESULTS: Crown and root rot was found in all of the alfalfa fields surveyed. Average disease incidence and severity of crown and root rot were 61% and 1.01, respectively (Table 1).

Table 1. Incidence and severity of crown and root rot of alfalfa in northeastern Alberta in 1989.

Location	No. of fields surveyed	Incidence %		Severity	
		Mean	Range	Mean	Range
Bonnyville	5	45	14-74	0.65	0.14-1.30
Lac La Biche	4	65	38-94	1.23	0.42-2.16
Lamont	1	88	---	1.28	---
Lloydminster	4	63	26-96	1.25	0.31-2.26
Provost	3	73	52-96	1.31	0.86-2.20
St. Paul	4	37	4-66	0.71	0.04-1.34
Two Hills	9	62	34-96	0.87	0.34-1.77
Vegreville	1	58	---	0.62	---
Wainwright	4	61	15-95	1.21	0.30-2.16
Total/Average	35	61	---	1.01	---

Crop/Culture: Alfalfa

Location/Emplacement: Saskatchewan

Title/Titre: FOLIAR DISEASES OF ALFALFA IN N.E. SASKATCHEWAN, 1989.

Name and Agency / Nom et Organisation:
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METHODS: Seventeen dryland alfalfa fields in Crop Districts 5b, 8a and 9a in the northeastern grainbelt of Saskatchewan were surveyed for foliar diseases from 11 August to 21 August 1989. Each field was surveyed by walking diagonally through it and collecting 10 stems, one per 10-pace interval. Each shoot was rated for percentage leaf area affected and a mean calculated for each disease identified. Pathogens were identified on the basis of symptoms on the fresh material.

RESULTS AND COMMENTS: Foliar disease levels were very low this year (Table 1), considerably lower than in 1987 and 1988. Yellow leaf blotch (Leptotrochila medicaginis) and common leaf spot (Pseudopeziza medicaginis) were found in every field examined. Black stem (Phoma medicaginis) was found in half of the fields. Pepper spot (Leptosphaerulina briosiana) occurred at trace levels in five fields, and stagonospora leaf spot (Leptosphaeria pratensis) in only one field. All the fields surveyed were suffering from moisture and heat stress.

Table 1. Prevalence and severity of alfalfa leaf spot diseases in northeastern Saskatchewan in 1989.

Disease	% of fields with symptoms	% leaf area affected
Yellow leaf blotch	100	2.7
Common leaf spot	100	1.9
Black stem	53	1.9
Stagonospora leaf spot	29	<0.1
Pepper spot	6	<0.1

Crop/Culture: Alfalfa

Location/Emplacement: Ontario and Québec

Title/Titre: Importance des maladies foliares de la luzerne dans quelques régions du Québec et de l'Ontario en 1989.

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CANADA

MÉTHODE: On a évalué la surface foliaire affectée par les maladies dans sept champs du Québec et de l'Ontario. Des champs à Guelph (sud de l'Ontario), à Deseronto (centre de l'Ontario) et dans le comté de Portneuf (centre du Québec) furent visités à la fin mai et à la mi-juillet. On a examiné au moins 10 plants à chaque visite.

RÉSULTATS: La tige noire printanière (*Phoma medicaginis* var. *medicaginis*) fut la maladie la plus importante en mai dans chaque région (Tableau 1). À cette date, la tache commune (*Pseudopeziza medicaginis*) fut présente seulement à Guelph, la localité la plus au sud de l'échantillonage. À la mi-juillet, la tache commune était la maladie la plus importante du pathosystème en Ontario et d'une importance moyenne dans Portneuf. La tige noire printanière a été plus grave en juillet au nord-est, Portneuf, qu'au sud-ouest, Guelph. D'autres agents pathogènes, tels que le *Leptosphaerulina briosianna* et le *Stemphylium botryosum*, furent des composantes mineures du pathosystème à chaque visite dans toutes les régions. Ces résultats confirment que la composition du pathosystème des maladies foliares de la luzerne change au cours de la saison végétative et que les méthodes de lutte doivent s'adapter à cette évolution.

Tableau 1. Importance relative des maladies foliaires de la luzerne.

Localité	Date d'échantillonage			
	Fin mai		Mi-juillet	
	TN	TC	TN	TC
Guelph (Ont)	3	1	0	3
Deseronto (Ont)	3	0	1	3
Portneuf (Que)	3	0	2	2

TN = Tige noire printanière (*Phoma medicaginis* var. *medicaginis*)
TC = Tache commune (*Pseudopeziza medicaginis*)

0 = maladie absente due pathosystème
1 = composante mineure du pathosystème
2 = composante intermédiaire du pathosystème
3 = composante majeure du pathosystème

Crop / Culture: Forage Legumes

Location / Emplacement: Saskatchewan

Title / Titre SURVEY OF FORAGE LEGUMES TO ASSESS WINTER INJURY IN 1989.

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METHODS: Twenty-three alfalfa fields in central and northeastern Saskatchewan and three fields in the southeastern grainbelt were examined in the spring of 1989 for snow mold and low-temperature damage. Five fields of red clover and one of sweet clover were examined in northeastern Saskatchewan. Identification of the cause of injury was based on symptoms.

RESULTS AND COMMENTS: There was no snow mold injury on any of the forage legumes examined in this survey. Spring growth of alfalfa was very good in central regions, but was slow in the northeast. Severe early-season drought occurred in the northeast, making it very difficult to determine how much of the slow initial growth was due to low-temperature injury and how much was due to drought stress. However, red clover and sweet clover fields in this region were almost completely killed (95-99% damage) as a result of low-temperature injury, and most of the fields which were examined were subsequently plowed down.

Only three alfalfa fields in southern Saskatchewan were examined as part of this survey. However, early season growth in this area was generally slow due to low-temperature injury and drought. Snow fences trapped a deep snow cover early in the winter on an alfalfa yield loss assessment trial at Swift Current in southeastern Saskatchewan. In this trial, cottony snow mold was severe in plots inoculated with *Coprinus psychromorbidus* but there was no snow mold or winter injury in non-inoculated plots. Adjacent trials which lacked snow fencing were almost completely killed as a result of low-temperature damage.

Oilseeds and special crops / Oléagineux et cultures spéciales

Crop / Culture: Canola

Location / Emplacement: British Columbia

Title / Titre: 1988 and 1989 CANOLA DISEASE SURVEY IN BRITISH COLUMBIA

Name and Agency / Nom et Organisation:
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METHODS: Canola surveys were conducted in 1988 and 1989 to determine if virulent blackleg (Leptosphaeria maculans) had been introduced into the Peace River region of British Columbia (B.C.). Since virulent blackleg is carried on infected seed B.C. growers have been advised to use seed from the Peace River region where the disease is not known to occur. Although Brassica campestris cv. Tobin is the major canola cultivar grown in the region, approximately 10-15% of the acreage is B. napus cv. Westar. Westar seed is imported so these fields were given priority during the surveys.

In mid-September, 1988, a disease survey was carried out on canola fields after swathing in the Peace River region of B.C. Surveying was done by walking into each field along an inverted V transect and stopping five times at 30 m intervals to examine ten plants. A total of 50 stems per field were examined for blackleg lesions and roots were rated for root rot caused by Rhizoctonia solani. Two hundred fields totalling 16,000 ha were surveyed out of 48,000 ha of canola grown that year. The number of fields surveyed represents one field per 240 ha of canola grown in the region.

In 1989, the survey was carried out in mid-July during blossoming to the early ripening stage. Fields were surveyed by examining plants along short transects in the field and along the field margins. Just over one hundred fields totalling 8,000 ha were surveyed out of 40,000 ha grown in 1989. The number of fields surveyed represents one field per 400 ha of canola. In addition, two fields totalling 40 ha of B. napus cv. Global were surveyed in the Chilliwack area of south coastal British Columbia.

Canola stems with lesions resembling blackleg were collected during both surveys and diagnosed at the provincial plant diagnostic clinic in Cloverdale. A total of 126 canola stem samples were collected for diagnosis in 1988 and 42 samples in 1989. Samples were incubated and examined under the microscope and tissue isolated onto selective media according to McGee and Petrie (1). Virulence determinations of L. maculans isolates were made by Dr. G.A. Petrie in 1988 and by researchers at the Agriculture Canada Research Station, Vancouver in 1989.

RESULTS AND COMMENTS: Eight L. maculans isolates from the 1988 survey were identified as G.S. Pound's weekly virulent Puget Sound strain by Dr. G.A. Petrie. No strongly virulent blackleg was found in 1988. Only two suspect isolates from the 1989 survey require further testing.

Root rot (Rhizoctonia solani) occurred in all of the fields surveyed in 1988. Average disease ratings ranged from a trace to severe.

An important disease noted during the 1989 survey was sclerotinia stem rot (Sclerotinia sclerotiorum) which occurred in 33% of the fields surveyed. Low levels of white rust (staghead), (Albugo candida), black spot (Alternaria spp.) and downy mildew (Peronospora parasitica) were also recorded. Slight hail injury and stem cracking from moisture fluctuations were also reported.

1. McGee, D.C. and G.A. Petrie. 1978. Variability of Leptosphaeria maculans in relation to blackleg of oilseed rape. Phytopathology 68: 625-630.

Crop / Culture:

Canola

Location / Emplacement:

Alberta

Title / Titre:

BLACKLEG OF CANOLA SURVEY IN ALBERTA - 1989

Name and Agency / Nom et Organisation:

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INTRODUCTION:

A province-wide survey for virulent blackleg (*Leptosphaeria maculans*) of canola was carried out in July and August with the co-operation of provincial/municipal fieldmen and Agriculture Canada seed inspectors and assistance from plant pathologists at Brooks, Fairview, and Vegreville in confirming the virulent nature of the pathogen.

METHODS:

The survey was based on inspecting a minimum of one commercial field for every 2,000 ha of canola in Alberta. Field sites were randomly preselected from a computor-based list. If canola was not being grown on the selected site then the nearest canola field to that site was surveyed. The number of fields surveyed in each municipality was determined by the acreage of canola. Each field was sampled by walking along the path of an inverted W, starting 100 paces from the edge of the field and examining plants at 5 stops about 100 paces apart. At each stop, ten plants were examined visually and those suspected to be infected with blackleg were counted and collected for laboratory testing. The presence of the virulent form of blackleg was confirmed by cultural methods(2).

RESULTS:

The results are summarized in the Table. Infested fields were found primarily in east-central Alberta, census divisions 7 and 10(1) in the survey of commercial fields. There were an additional 12 municipalities (198 fields) in and around this region in which no blackleg was found. Blackleg was absent from all 505 fields surveyed in the remaining census divisions. In addition to the survey of commercial fields, all 626 pedigree seed fields and 14 Grow With Canola research plots were checked during routine inspections and blackleg was found in only one pedigree seed field in census division 10. Province-wide the average field infestation level, for the 1.12 million ha of canola, is close to 2.5%.

COMMENTS:

The environment was conducive to blackleg development throughout the summer. Disease incidence, however, was much lower in 1989 than 1988, although the disease was found at several new locations in 1989, including the Counties of Beaver and Smoky Lake, and the Municipal District (M.D.) of Bonnyville. The lower disease incidence was probably due to fewer farmers growing canola on canola stubble and a 15% decline in acreage. Furthermore, since the survey was conducted from mid-July to early August, as opposed to after swathing in 1988, full expression of the disease symptoms may not have occurred in certain fields. Apart from the fields sampled randomly, as described above, another 43 canola fields were confirmed as positive for virulent blackleg in 1989 primarily in census divisions 7 and 10 but isolated instances of infestations occurred in census division 4, 8 and 12.

TABLE BLACKLEG OF CANOLA SURVEY IN ALBERTA - 1989

Municipalities with Confirmed Virulent Blackleg of Canola

MUNICIPALITY	NUMBER OF FIELDS SURVEYED	NUMBER OF FIELDS WITH VIRULENT BLACKLEG
EAST CENTRAL ALBERTA		
Co. of Paintearth #18	18	2
Co. of Flagstaff #29	30	2
Co. of Beaver #9	42	2
Co. of Smoky Lake #13	5	1
Co. of Vermilion River #24	22	6
Co. of Minburn #27	14	1
M.D. of Provost #52	19	4
M.D. of Wainwright #61	17	3
M.D. of Bonnyville #87	6	1
TOTAL	173	22

REFERENCES:

1. Kharbanda, P.D., I.R. Evans, L. Harrison, S. Slopek, H.C Huang, D. Kaminksi, and J.P. Tewari, 1989. Blackleg of Canola Survey in Alberta - 1988. Can. Plant Dis. Surv. 69(1):55-57.

2. McGee, D.C. and G.A. Petrie. 1978. Variability of *Leptosphaeria maculans* in relation to blackleg of oilseed rape. Phytopathology 68:625-630.

Crop / Culture: Rapeseed/Canola

Location / Emplacement: Alberta

Name and Agency / Nom et Organisation:
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Title / Titre: CANOLA DISEASE SURVEY IN THE PEACE RIVER REGION IN 1989

METHODS: A survey of 48 rapeseed/canola fields was conducted in July and August, 1989 in the Peace River region of Alberta. The total area of canola production in 1989 was approximately 365,000 hectares. The diseases reported in this survey were the same as in 1988 and include root rot, foot rot, sclerotinia stem rot, black spot and blackleg.

Fields were sampled by walking into each one in a W pattern and collecting the first plants at a site 100 paces from the edge of the field. Ten plants were selected at random at each of five sites along the W pattern for a total of 50 plants per field. Disease incidence was recorded on every plant. Root rot ratings were recorded using a 0-4 scale, where 0 = no lesions on taproot, 1 = light brown lesions on taproot but no girdling, 2 = coalesced brown lesions on taproot but no girdling, 3 = dark brown lesions girdling taproot above main laterals (wirestem appearance), 4 = severe necrotic lesions on taproot, roots rotted off and plant dead.

RESULTS AND COMMENTS: The results are given in Table 1.

The root rot complex was, as in previous years, the most prevalent disease affecting 100% of the fields surveyed with 47.6% of the plants infected (Table 1). Disease incidence was lower than in 1988 when 99.1% of plants were infected. Disease severity was also lower in 1989 with a mean root rot rating of 1.1 compared to 2.4 in 1988. Prevalence of sclerotinia stem rot increased over 1988 with 48% of fields infested compared to 35% in 1988. The mean number of plants infected was 20.5% compared to 5% in 1988. Prevalence of black spot and foot rot was lower with 85% and 52% respectively.

Table 1. Prevalence and incidence of root rot, foot rot, sclerotinia stem rot, blackleg and black spot of canola in the Peace River region in 1989.

Disease	Prevalence (% fields infested)	Incidence (% plants infected)
Root Rot (Rhizoctonia, Pythium, Fusarium)	100	47.6
Black Spot (Alternaria spp.)	85	24.9
Foot Rot (Rhizoctonia, Fusarium)	52	4.6
Sclerotinia (Sclerotinia sclerotiorum)	48	20.5
Avirulent Blackleg (Leptosphaeria maculans)	17	1.6

Crop / Culture: Canola

Location / Emplacement: Central Alberta

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Title / Titre: SURVEY OF ALTERNARIA BLACKSPOT AND SCLEROTINIA STEM ROT IN CENTRAL ALBERTA IN 1989

METHODS: Fifty-seven randomly selected fields were surveyed in central Alberta during the middle of August, 1989. Two locations within each field, away from the edge or corners, were assessed visually for disease severity and the average recorded. For assessment of alternaria blackspot, percent areas of siliqua covered with lesions were determined. For assessment of sclerotinia stem rot, the percentage of stems with symptoms was determined. Fields with less than 1% sclerotinia stem rot were categorized as having trace levels.

RESULTS AND COMMENTS: Every field surveyed had alternaria blackspot. Percent areas of siliqua covered with lesions ranged from 1 to 50% (Fig. 1). The average for the 9 fields of *Brassica napus* in the survey was 5% and for the 48 fields of *B. campestris* it was 22%. This supports the findings that *B. napus* is less susceptible to *Alternaria brassicae* than *B. campestris* (Skoropad and Tewari, 1977; Conn and Tewari, 1989). The level of blackspot depended partly on how early the crop was planted. Fields that were more mature at the time of survey had less disease. Every field surveyed had sclerotinia stem rot. The percentage of stems infected ranged from trace to 95% (Fig. 2). If the trace levels are set to 0%, then the average for the 9 fields of *B. napus* was 3.4% and for the 48 fields of *B. campestris* it was 13.6%. Thus, the average levels of both diseases in fields of *B. campestris* were about 4 times those in the fields of *B. napus*.

Yield data were obtained from 3 fields in the Innisfail area that had been rated for the 2 diseases (Table 1). Yield data were obtained from 5 fields in the Barrhead area in which disease had not been rated (Table 1). Yields in the Barrhead fields were only about 52% of the farmers' expectations with an average of 19% dockage (Table 1). Yields in the 3 Innisfail fields were only about 60% of the farmers' expectations with 11% dockage (Table 1). In 1988 these same Innisfail farmers obtained 1970-2250 kg/ha, with 4% dockage. The crops in 1989 looked better than those in 1988 but yielded less. The levels of alternaria blackspot and sclerotinia stem rot in the Innisfail area were lower in 1988. This indicates that these diseases were likely the principal cause of yield loss in 1989. The relationship between level of disease and yield loss in the Innisfail fields shown in Table 1, indicates that a greater portion of yield loss may have been due to blackspot rather than to sclerotinia stem rot, since an increase of sclerotinia stem rot from 10 to 30% did not appreciably affect yield. However, the timing of infection with *Sclerotinia* in the different fields is not known and may have affected yield. The field near Edmonton that had 95% sclerotinia stem rot (Fig. 2) had practically 100% yield loss and must have been infected early. There were also reports of some farmers in the Sylvan Lake and Rimbey areas suffering practically 100% yield losses when they had expected good yields. The levels of the 2 diseases in these specific fields are, however, not known. The severity of blackspot was also evidenced by the fact that seeds of some siliqua were colonized by *A. brassicae*. The wet weather in August may have allowed *A. brassicae* to grow inside siliqua and led to higher dockage since many seeds were shrivelled. The diseases caused yield losses indirectly as well. Some of the fields surveyed had hail damage. Damage due to hail was greater in fields with higher levels of disease because diseased plants were more mature and siliqua shattered easily. Also, since diseased siliqua shattered more easily, there would have been greater seed losses during swathing and combining. Thus, alternaria blackspot caused significant yield losses and was the most economically important disease of canola in central Alberta this year. Sclerotinia stem rot did not appear to have caused significant yield losses in most of the fields in this survey. If weather conditions are favorable for these diseases next year, yield losses may be much more severe because of the large amounts of inocula present.

During this survey the presence or absence of some other diseases was also noted. Gray stem was the next most common disease with about 30% of the fields infected. Staghead and aster yellows were observed in only 2 fields. In the previous year these 2 diseases had been relatively more common. No symptoms of blackleg were observed in this survey.

ACKNOWLEDGEMENT: This survey was financed by a grant from the Natural Sciences and Engineering Research Council of Canada. We thank Mr. J. Soldan, District Agriculturist, Alberta Agriculture, Barrhead, Alberta, for providing yield data from his area.

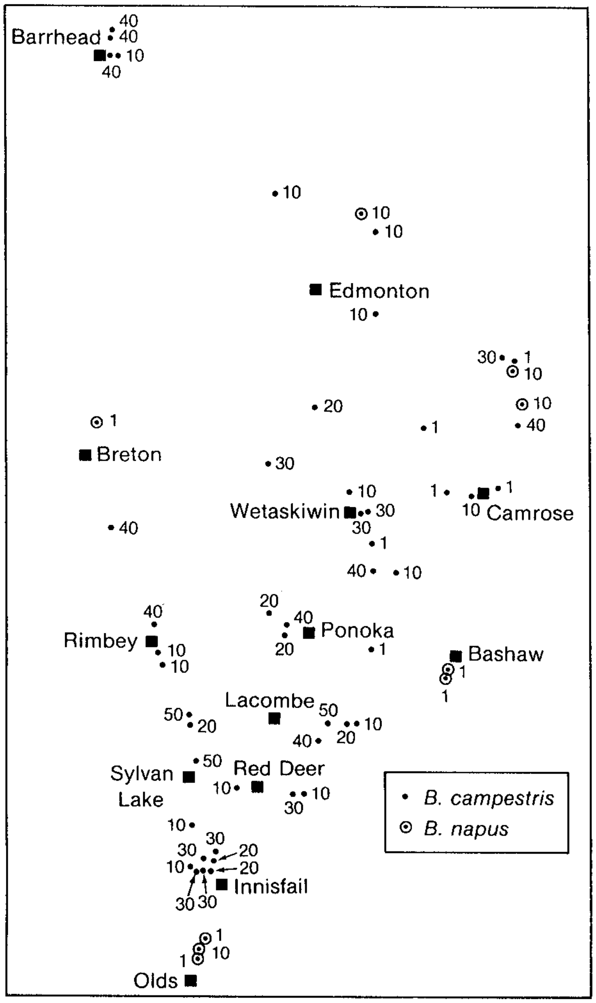

Figure 1. Locations of fields surveyed for alternaria blackspot in 1989. The numbers represent percent areas of siliqua covered with lesions.

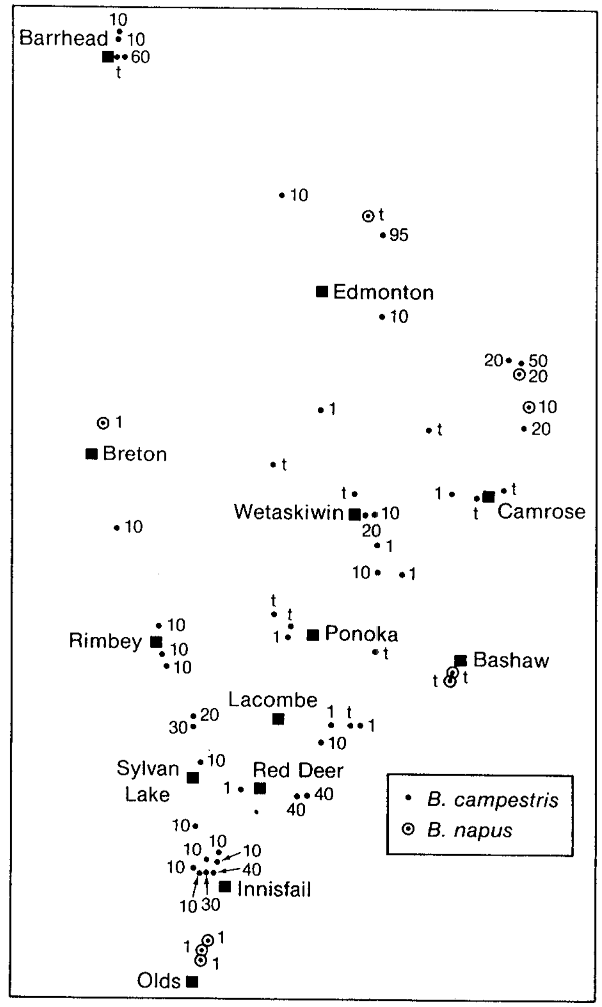

Figure 2. Locations of fields surveyed for sclerotinia stem rot in 1989. The numbers represent percent of stems with symptoms. Fields with less than 1% were categorized as having trace (t) levels.

Table 1. Levels of diseases and yields in canola (B. campestris) fields in central Alberta in 1989.

area	Alternaria blackspot(%)	Sclerotinia stem rot(%)	expected yield (kg/ha)	actual yield (kg/ha)	dockage (%)
Innisfail	30	30	2250	1240	11
Innisfail	30	10	2250	1400	11
Innisfail	30	10	2250	1400	11
Barrhead	*	*	1400	960	24
Barrhead	*	*	1690	1070	20
Barrhead	*	*	2250	1070	18
Barrhead	*	*	2250	960	24
Barrhead	*	*	1970	900	30

* Levels of diseases were not determined in these fields.

REFERENCES: Conn, K.L. and J.P. Tewari 1989. Interactions of Alternaria brassicae conidia with leaf epicuticular wax of canola. Mycol. Res. **93**:240-242.

Skoropad, W.P. and J.P. Tewari 1977. Field evaluation of the role of epicuticular wax in rapeseed and mustard in resistance to alternaria blackspot. Can. J. Plant Sci. **57**:1001-1003.

Crop / Culture: Canola

Location / Emplacement: Saskatchewan

Title / Titre: CANOLA DISEASES IN N.E. SASKATCHEWAN, 1989

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METHODS: Fifty canola fields were surveyed between August 8 and 18, 1989 in crop districts 5b, 8a, 8b and 9a. Fields surveyed were selected at random in each crop district, and samples were collected by walking diagonally into the field and selecting one plant every 10 paces until a total of 10 plants had been sampled. Diseases were assessed according to the visual symptoms on each plant. Root rot readings were based on a scale where 0 = healthy, 2 = trace, 5 = moderate and 10 = severe, according to lesions found on the roots. All other diseases were recorded as the estimated percentage of leaf or stem area affected. Results for each disease were averaged over the number of samples and fields surveyed to give the disease index. Numbers of fields affected over the total number of fields surveyed by 100 gave the percentage of fields affected.

RESULTS AND COMMENTS: The severity and prevalence of diseases of canola in the areas surveyed are shown in Table 1. Disease severity was lower in 1989 than in 1988 and 1987 when surveys were also carried out in the same crop districts. However, except for blackleg, diseases occurred in a greater percentage of the fields in 1989. Blackleg occurred in only 44% of the fields in 1989 compared to 70% and 100% in 1987 and 1988, respectively. Adequate moisture in the spring of 1989 allowed good germination, but hot, dry and windy weather beginning in mid-July probably suppressed disease development, resulting in low disease levels. The fact that a majority of the diseases were more widespread than in previous surveys may mean more severe disease problems in the future if conditions are favorable.

Table 1. Severity and prevalence of canola diseases in 1989.

Crop district	No. fields	Disease index/% fields affected				
		Blackleg	Blackspot	Stem rot	White rust	Root rot
5b	12	1.3/75	0.7/92	0.1/17	0/0	0.2/17
8a	9	0/0	1.7/100	0.1/11	0.1/11	0.1/11
8b	17	0/0	0.5/82	0.1/6	0.2/30	<0.1/12
9a	12	0.9/100	2.1/92	1.0/58	<0.1/42	<0.1/8
Total or average	50	0.6/44	1.3/92	0.3/23	<0.1/21	<0.1/12

Blackleg (*Leptosphaeria maculans*), Blackspot (*Alternaria* spp.), Stem rot (*Sclerotinia sclerotiorum*), White rust (*Albugo candida*), Root rot (*Rhizoctonia solani* & *Fusarium* spp.).

Crop / Culture: Canola

Location / Emplacement: Saskatchewan

Name and Agency / Nom et Organisation:
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Title / Titre: SURVEY OF BLACKLEG AND SCLEROTINIA IN SASKATCHEWAN CANOLA CROPS, 1989

METHODS: Two hundred and fifty-five canola fields were surveyed after swathing during the period August to October, 1989. The majority were sampled by extension agrologists or regional soils and crops specialists according to instructions provided to them. Twenty-five stem bases per field were collected by pulling up 5 plants every 25 paces while walking a diagonal from the edge of the field. All samples were mailed to a central location for disease assessment. Isolations were made for the determination of blackleg virulence according to the method of McGee & Petrie (1978) for samples originating from areas without a history of virulent blackleg. A severity index was established for each field by averaging severity ratings which were made on a scale of 0 to 3, where 0 = no disease, 1 = small lesion covering 1/4 stem circumference or less, 2 = lesion covering greater than 1/4 stem circumference but not completely girdling stem, and 3 = lesion completely girdling stem.

RESULTS AND COMMENTS: Results broken down by crop district are shown in the table. The majority of extension agrologists in the canola growing region of Saskatchewan participated in the survey. Some samples were also received from traditionally non-canola growing areas in south east and south west Saskatchewan. While some crop districts were more heavily sampled than others, the numbers generally reflect the amount of canola grown in an area.

Blackleg (*Leptosphaeria maculans*) was found in 92% of fields surveyed. The mean percentage of infected plants per field was 52% for all fields or 56% for fields where blackleg was detected. Blackleg was most damaging in crop district 5b followed closely by 8b, 6a and 9a. Incidence of blackleg was found to be higher than reported in the past. A previous Saskatchewan Agriculture survey (Jesperson, 1989) conducted in 1986 found virulent blackleg in 65% of fields at a mean percentage of 29% infected plants per field for all fields or 45.5% for fields where blackleg was detected. Results indicate that blackleg has continued to spread across Saskatchewan.

Sclerotinia stem rot (*Sclerotinia sclerotiorum*) was found in 13% of fields surveyed at a mean incidence of 2% of plants per field. In infested fields only, mean incidence was 14%. Incidence was highest in crop district 9b, followed by 1a and 8a. Damage due to sclerotinia appeared to be limited by dry weather over much of the province.

REFERENCES:

1. McGee, D.C. and Petrie, G.A. 1978. Variability of *Leptosphaeria maculans* in relation to blackleg of oilseed rape. Phytopathology 68:625-630.

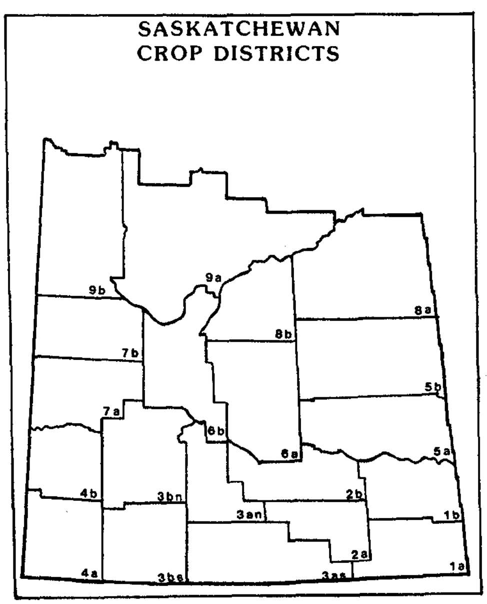
2. Jesperson, G.D. 1989. Survey of blackleg, sclerotinia and footrot in Saskatchewan canola crops, 1986. Canadian Plant Disease Survey 69(1):60-61.

Table. Incidence of blackleg and sclerotinia of canola in Saskatchewan, 1989

Crop District	Number of Fields Surveyed	BLACKLEG % Fields Affected	BLACKLEG Mean % Incidence	BLACKLEG Mean Severity Index*	SCLEROTINIA % Fields Affected	SCLEROTINIA Mean % Incidence
1a	8	25	2	0.1	38	5
1b	10	40	21	0.4	0	0
2b	4	75	20	0.3	0	0
3 + 4	6	100	23	0.3	17	1
5a	24	100	42	0.9	0	0
5b	29	100	79	1.9	0	0
6a	30	100	65	1.4	0	0
6b	17	82	40	0.9	18	1
7	13	85	38	0.9	15	1
8a	30	87	39	0.8	33	3
8b	25	100	67	1.7	4	0.2
9a	34	91	60	1.4	24	2
9b	25	100	52	1.0	36	10
Total or Average	255	92	52	1.1	13	2

* Severity index scale = 0 to 3

Figure 1. Saskatchewan crop districts and subdistricts



Crop / Culture: Canola

Location / Emplacement: Manitoba

Title / Titre: DISTRIBUTION, PREVALENCE AND INCIDENCE OF CANOLA DISEASES IN 1989

Name and Agency / Nom et Organisation:
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METHODS: Two surveys were conducted in southern Manitoba during the third week in August. During the first survey, 62 fields of *Brassica napus* and 9 fields of *B. rapa* (synonym: *B. campestris*) were surveyed. The presence of various diseases was noted in each field. For each field disease incidence was determined on a sample of 60 plants. Plants with disease symptoms were taken from 42 fields. Pieces of the stem, stem base and tap root were plated on V8-juice agar containing rose bengal and streptomycin (McGee and Petrie 1978). Developing fungal colonies were identified.

A second survey was conducted in the Dauphin area in which 32 fields of *B. napus* were inspected. The presence of various diseases was noted in each field. Disease incidence was determined on a sample of 40 plants in each field. In addition, results are included from samples that were received by the plant pathology lab of Manitoba Agriculture from four fields near Winnipeg.

Results: Blackleg, caused by *Leptosphaeria maculans*, was found in 66 of the 107 fields (Fig. 1). Fields with blackleg infection were distributed over the entire growing area. Blackleg was more prevalent in crop districts 3, 4, and 6 than in other districts. Symptoms were variable and ranged from the typical stem canker to a foot rot without pycnidia. In addition, stems with large grey lesions, caused by *L. maculans*, were observed in 23 fields.

Pieces of the stem, stem base and root were incubated on V8-juice agar. Colonies of *L. maculans*, *Rhizoctonia solani* and *Fusarium* spp. were obtained. Pieces of the stem base and tap root from the same plant often yielded colonies of more than one pathogen. Pieces with grey stem lesions yielded only colonies of *L. maculans*. Based on pycnidia and pigment production on agar, strains of *L. maculans* can be differentiated into aggressive and non-aggressive (McGee and Petrie 1978). Cultural characteristics of the colonies obtained indicated that aggressive strains were present in all infested fields and that several fields were infested by a combination of aggressive and non-aggressive strains.

Foot rot and root rot, caused by *Fusarium* spp. and *R. solani*, were observed in 42 fields (Fig. 1). Fields were distributed over the entire province. Prevalence was higher in crops districts 3, 4 and 8 than in other districts. As plants were often colonized by more than one pathogen, it was impossible to determine the incidence of blackleg and foot rot/root rot separately. When the incidence for blackleg and foot rot/root rot are combined, up to 30% of the plants were infected in crop districts 2, 5, 7, 8 and 12, and up to 80% of the plants in districts 3, 4, and 6.

Sclerotinia stem rot, caused by *Sclerotinia sclerotiorum*, was observed in 21 fields (Fig. 2). Most affected fields were located in crop districts 5 and 6. Incidence ranged from 2 to 33% in both districts.

Blackspot, caused by *Alternaria* spp., was observed in 14 fields (Fig. 2). Affected fields were mainly located in crop districts 5 and 6. In the affected fields most plants were diseased but severity was low. Blackening of the swath, caused by *Alternaria* spp., was observed in several fields in crop districts 5 and 6. A trace of aster yellows was observed in 4 fields (Fig. 2). These fields were mainly located in crop district 5.

Heat and moisture stress were a serious problem in 1989 as they were in 1988. The most severely affected area was crop district 1, where significant yield reductions due to environmental stress were observed.

REFERENCE: McGee, D.D., and G.A. Petrie. 1978. Variability of *L. maculans* in relation to blackleg of oilseed rape. Phytopathology 68: 625-630.

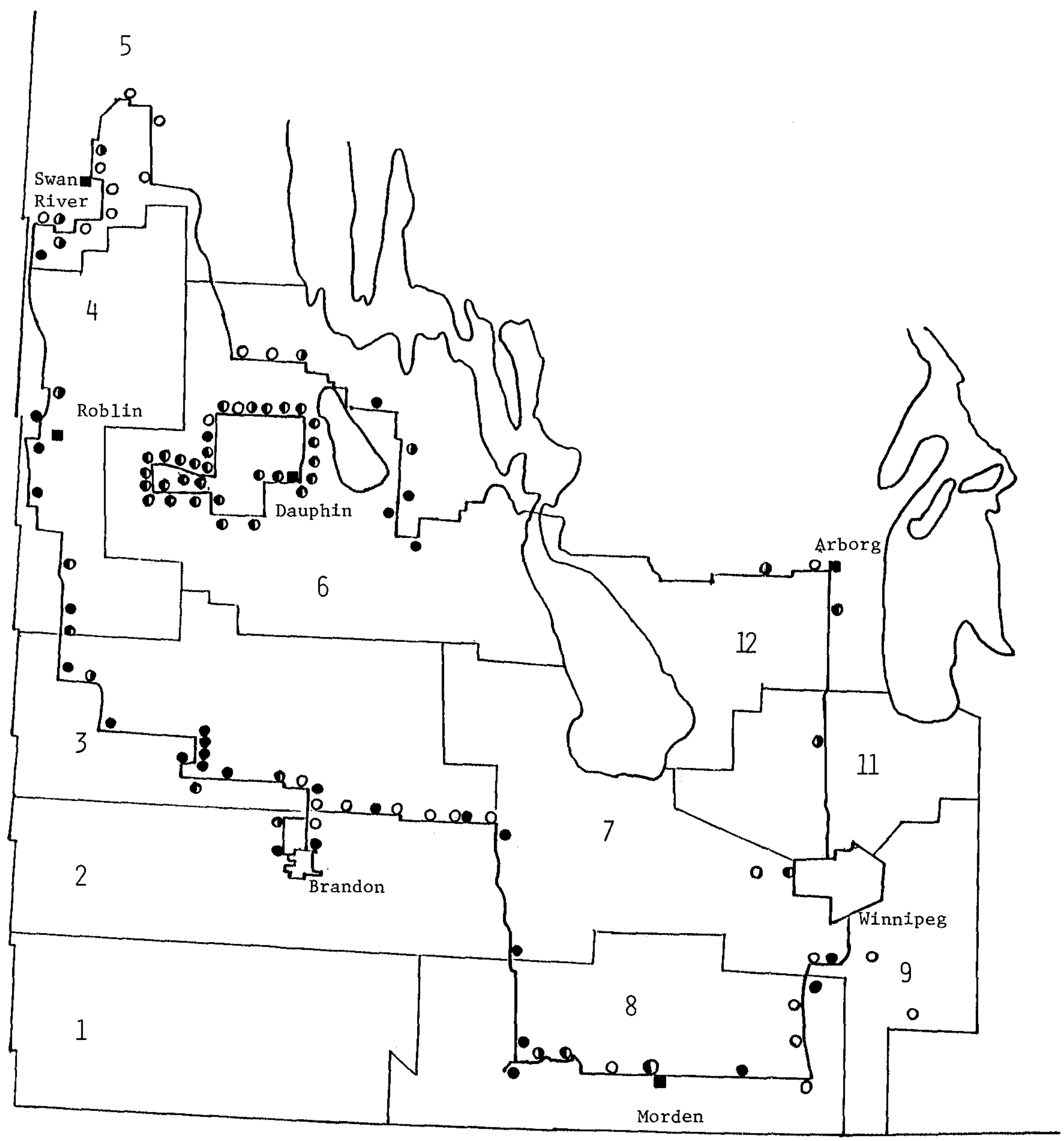

Fig. 1. Distribution of the fields for the canola survey in Manitoba in 1989. Symbols indicate the presence of diseases: ◐ :blackleg; ◑ :footrot/root rot; ● :both blackleg and foot rot/root rot. Numbers indicate Manitoba Crop Districts.

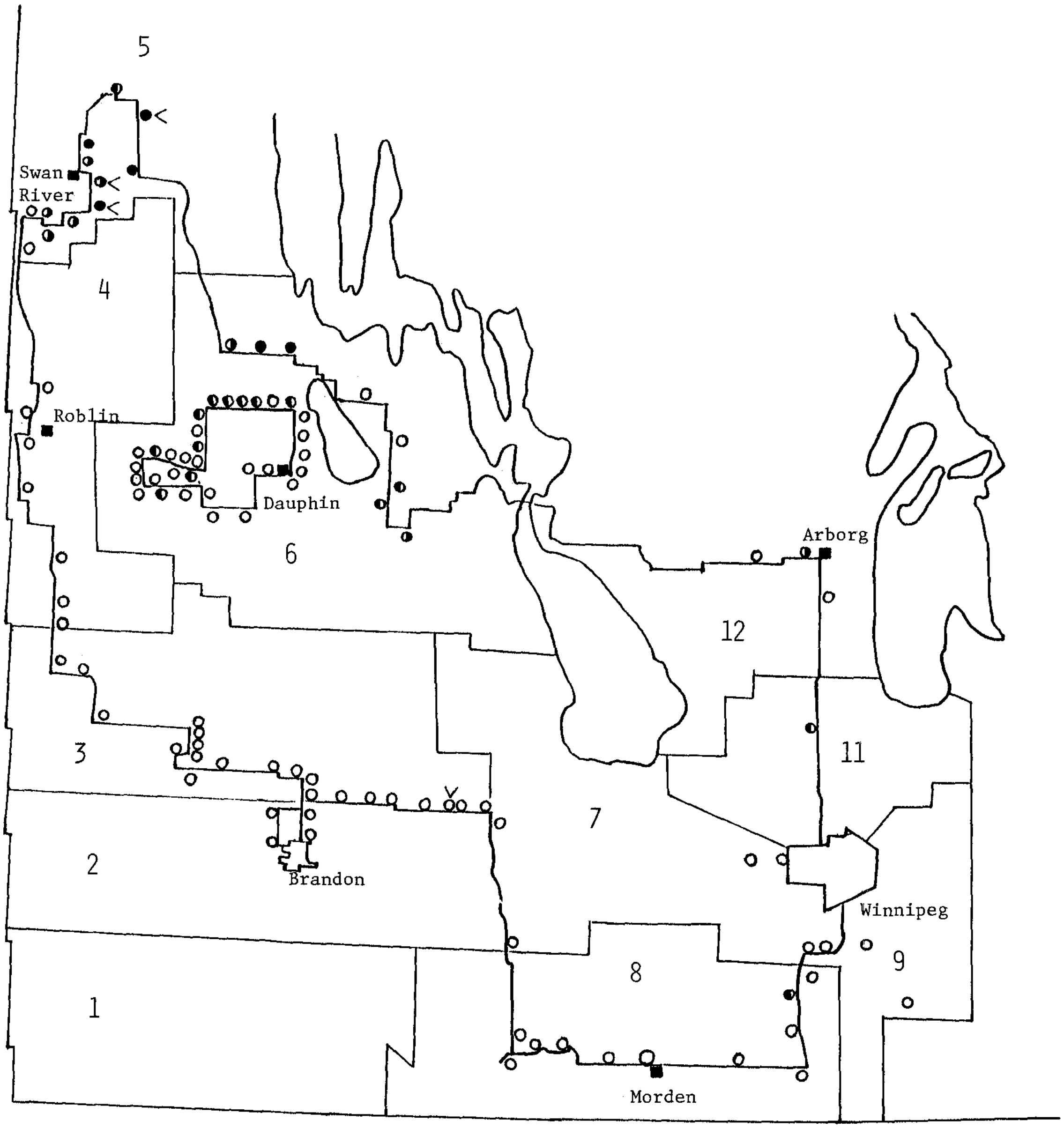

Fig. 2. Distribution of the fields for the canola survey in Manitoba in 1989. Symbols indicate the presence of diseases: ◐ :Sclerotinia stem rot; ◑ :blackspot; ● :both Sclerotinia stem rot and blackspot; > :aster yellows. Numbers indicate Manitoba Crop Districts.

Crop / Culture: Rapeseed/Canola

Location / Emplacement: Southwestern Ontario

Name and Agency / Nom et Organisation:
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Title / Titre: SURVEY FOR SCLEROTINIA STEM ROT OF WINTER AND SPRING RAPESEED/CANOLA IN SOUTHWESTERN ONTARIO IN 1988 AND 1989.

METHODS: A disease survey was conducted in 1988 and 1989 to determine the prevalence of sclerotinia stem rot (*Sclerotinia sclerotiorum*) of rapeseed/canola (*Brassica campestris*, *B. napus*) in southwestern Ontario. Individual fields were sampled by assessing 100 plants for disease symptoms at each of eight locations along a diamond-shaped sampling pattern within each field. Each side of the sampling pattern was 100 m long and samples were taken every 50 m. All fields were assessed within two weeks of harvest.

RESULTS AND COMMENTS: Results of the disease surveys are summarized in Table 1. Sclerotinia stem rot was not observed in any of the winter or spring rapeseed/canola fields observed in southwestern Ontario in 1988. In 1989, sclerotinia stem rot was present in all of the winter rapeseed/canola fields (100%) examined and in 16 of 25 spring rapeseed/canola fields (64%). Disease incidence within the winter and spring crops averaged 22.6 and 1.7%, respectively. Environmental conditions during 1988 were relatively hot and dry during much of the growing season and few apothecia were observed in the survey fields during crop flowering. In 1989, environmental conditions were cool and wet during much of the flowering period of the winter crops but were warmer and dryer during the flowering period of the spring crops. Apothecia were commonly observed during the flowering period of many of the winter crops but were less commonly observed during the flowering period of the spring crops.

Table 1. Prevalence and incidence of sclerotinia stem rot of winter and spring rapeseed/canola in southwestern Ontario in 1988 and 1989.

YEAR	CROP	NUMBER OF FIELDS		PERCENTAGE OF DISEASED PLANTS	
		Evaluated	Diseased	Mean	Range
1988	Winter	35	0	---	---
	Spring	35	0	---	---
1989	Winter	25	25	22.6	0.6 - 76.6
	Spring	25	16	1.7	0 - 8.0

Crop/Culture: Flax

Location/Emplacement: Saskatchewan

Title/Titre: FLAX DISEASES IN N.E. SASKATCHEWAN, 1989

Name and Agency/ Nom et Organisation:

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METHODS: Thirty-nine flax fields were surveyed between August 9 and 21, 1989 in crop districts 5b, 8a, 8b, and 9a. Fields surveyed were selected at random in each crop district and sampled by collecting one plant every ten paces until a total of 10 plants had been collected in each field. Diseases were identified by visual symptoms and the severity of each disease recorded as the estimated leaf, stem or root area affected. Results for each disease were averaged over the total number of samples and fields surveyed to give the disease index. Number of fields affected over total number of fields surveyed by 100 gave the percentage of fields affected.

RESULTS AND COMMENTS: Extremely low levels of disease were found in 1989 (Table 1). Pasmo (*Septoria linicola*) had an average disease index of less than 0.3 and occurred in 77% of the fields surveyed. Root rot (several fungi) had an even lower disease index than pasmo, and was found in only 48% of the surveyed fields. No other leaf, stem or root diseases were encountered during this survey.

Table 1. Severity and incidence of flax diseases, 1989

Crop district	No. fields	Disease index/% fields affected	
		Root rot	Pasmo
5b	8	0.1/50	0.1/75
8a	9	0.2/56	0.3/89
8b	13	0.4/62	0.3/69
9a	9	0.1/22	0.3/78
Total or average	39	0.2/48	0.3/77

Crop / Culture: Flax

Location / Emplacement: Manitoba

Title / Titre: SURVEY OF FLAX DISEASES IN MANITOBA IN 1989

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Methods: A total of 57 flax fields were surveyed south of Highway No. 1 in southern Manitoba in 1989. Twenty-seven fields were surveyed on July 24, 22 fields on August 2 and 8 fields on August 22. Fields were selected at random and each field was sampled by two persons walking 100 m in opposite directions inside the field following an inverted V pattern. Diseases were identified by symptoms and the prevalence and incidence of each disease were recorded. In addition 19 samples of flax submitted to the Manitoba Agriculture Plant Pathology Laboratory by agricultural representatives and growers were analysed.

Results: The flax crop in southern Manitoba had a good but slow start in 1989 with good emergence. The stand was very good in most of the fields surveyed and few fields were fair to poor. The incidence of heat canker was very low in comparison with high levels in 1988. The crop vigour ranged from good to poor depending on the moisture level, which was generally below normal in southern Manitoba. Fusarium wilt (*Fusarium oxysporum f.* sp. *lini*) was observed only in one field and at less than 1%. Aster yellows (Mycoplasma like organism) was also observed at less than 1% in one field. Pasmo (*Septoria linicola*) was observed in 4 fields at levels of trace to 1% towards the end of the season. Rust (*Melampsora lini*) was not encountered in any of the 57 fields surveyed nor on the 30 rust differential lines planted at Morden and Portage la Prairie. However, it is important to note that moderate to high levels of aphid infestation were observed in 56% of the fields surveyed and must have contributed to a reduction in flax yield. Of the 19 samples submitted to the Manitoba Agriculture Plant Pathology Laboratory, 2 showed seedling blight (*Rhizoctonia solani*, *Fusarium* spp.), 2 pasmo (*Septoria linicola*), 1 Fusarium wilt (*Fusarium oxysporum f.* sp. *lini*) and 10 environmental stress from low soil moisture and high temperatures. In addition, 4 samples showed herbicide drift injury.

Crop / Culture: American Ginseng
Panax quinquefolium

Location / Emplacement: British Columbia

Title / Titre: GINSENG DISEASES IN BRITISH COLUMBIA FROM 1987 - 1989

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The first B.C. ginseng planting was established in 1981 at Lytton. Since then, small plantings ranging in size from 0.2 - 1 ha have been established throughout the Okanagan - Kootenay and Thompson - Cariboo regions of B.C. (Figure 1). The total ginseng acreage in B.C. is now estimated at 120 ha worth over $38 million. Ginseng growers have been concerned about diseases that could decrease crop yield and quality. A common disease first diagnosed in commercial ginseng plantings in 1987 was damping off (*Rhizoctonia*, *Fusarium*). This was followed by an isolated incidence of alternaria leaf and stem blight (*Alternaria panax*) in the Kootenays and phytophthora root rot (*Phytophthora cactorum*) in the Okanagan. Another problem was interveinal chlorosis due to zinc deficiency in the Okanagan and Lytton ginseng plantings.

Since 1987, the number of ginseng samples submitted to the provincial plant diagnostic clinic at Cloverdale has steadily increased (Table 1.) Alternaria leaf and stem blight, phytophthora root rot and damping off due to *Rhizoctonia* and *Fusarium* are the three most common ginseng diseases. Sclerotinia white mold was also identified in a Kamloops ginseng planting.

Non-pathogenic disorders of ginseng include phytotoxicity, winter injury, rusty root, sun scorch, paper leaf and nutrient deficiencies. The most widespread disorder in 1989 was severe phytotoxicity from mancozeb sprays. Damage resulted when ginseng seedlings were sprayed during hot weather with mancozeb at the full label rate. Ginseng seedlings became stunted and distorted with distinct red ring spots and necrotic blotches on the leaves. We expect that the plants will recover from the spray injury. Winter injury occurred in plantings in Kamloops and Winfield. Heavy rains followed by freezing temperatures led to brown, decayed ginseng roots in Winfield. The problem in Winfield was compounded by poor soil drainage. Rusty root characterized by dark, red-brown root lesions may have been due to an insect maggot feeding on roots at a Lillooet site. Sun scorch showed up as distinct white spots and blotches on ginseng leaves left exposed to direct sunlight when side panels for shading were omitted. Drought stress differs from sun scorch by the papery, light brown lesions (paper leaf) that form at leaf margins and tips. In certain areas ginseng plants developed interveinal chlorosis of the leaves due to zinc or magnesium deficiency.

TABLE 1: Ginseng Diseases in B.C. from 1987 - 1989

	Number of Ginseng Samples Diagnosed				
	Alternaria	Fusarium	Phytophthora	Rhizoctonia	Sclerotinia
OKANAGAN - KOOTENAY REGION					
Armstrong	1				
Galloway	1				
Glade	1				
Kelowna	2		1		
Nelson			2		
Peachland	1				
Vernon	1		3	2	
Winfield	2		1		
THOMPSON - CARIBOO REGION					
Clearwater	1	1			
Kamloops	1				2
Lillooet/Lytton	2	2	1	1	

Figure 1. B.C. - Agriculture and Fisheries regions.

Crop / Culture: Lentil

Location / Emplacement: Manitoba

Title / Titre: ANTHRACNOSE OF LENTIL IN MANITOBA IN 1989

Name and Agency / Nom et Organisation:

R.A.A. MORRALL[1], R.J. GIBSON[2] and C.C. BERNIER[2]
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METHOD: A new anthracnose disease of lentil caused by Colletotrichum truncatum was discovered in southern Manitoba in 1987. A survey during the 1988 season which was marked by drought and extreme heat, showed that the disease was present in all major areas of lentil production but mostly at low levels. Precipitation and temperature were more favourable for disease development in 1989 and a limited survey was conducted in two major areas of lentil production, namely the Rosenort/St. Jean area south of Winnipeg, and the Portage La Prairie area west of Winnipeg. During visits a semi-quantitative assessment of anthracnose was made by walking at least 100 m through the crop and rating disease severity as none, slight, moderate or severe.

RESULTS AND COMMENTS: In the Rosenort/St. Jean area the disease was detected in 12 out of 16 fields visited. The disease was slight in most crops, moderate in a few, and severe in one. The frequency of infested crops and the disease severity appeared to decline towards the southern Manitoba border near Emerson. In the Portage region 9 out of 10 crops surveyed were moderately to severely infested with anthracnose. In severely diseased crops, numerous lesions were present on stems, leaves and pods, and large areas with diseased plants were visible from a distance. The climatic conditions in the Portage area appeared to have favoured movement of the disease into the upper part of the canopy leading to the large areas of plant dieback. In the St. Jean area, lesions were restricted to the lower part of the canopy due to either late infection or to less favourable conditions. The high incidence and severity observed in 1989 in contrast to 1988 indicate clearly that anthracnose can build up rapidly even in fields where the crop was not sown on lentil stubble.

The effect of anthracnose on yield of lentil was determined in plot trials sown on lentil stubble at Portage. Disease was moderate in plots sprayed with the fungicide chlorothalonil and severe in non-sprayed plots. Seed yields of plots not sprayed with the fungicide were on the average 44% lower than the yields in plots sprayed several times. Based on plot results, yield reductions due to anthracnose in farm fields in the Portage area were estimated to range from 40 to 60%.

ACKNOWLEDGEMENTS: This work was supported by the Western Grains Research Foundation.

Crop/Culture: Field pea

Location/Emplacement: Northwestern Alberta

Title/Titre: ROOT ROT DISEASE COMPLEX SURVEY IN NORTHWESTERN ALBERTA IN 1989

Name and Agency / Nom et Organisation:

S.F. Hwang and D. Aiello, Alberta Environmental Centre, TOB 4LO; A. Macaulay and K. Lopetinsky, Alberta Agriculture, Barrhead, Alberta, TOG OEO; J. Hladky, Alberta Agriculture, Morinville, Alberta, TOG 1PO; P. Hawkings, Alberta Agriculture, Stony Plain, Alberta, TOE 2GO; C. Loessin, Alberta Agriculture, Thorhild, Alberta, TOA 3JO; and R. Carlyon, Alberta Agriculture, Westlock, Alberta, TOG 2LO.

METHODS: Twenty-eight pea fields in northwestern Alberta were surveyed in June of 1989 for root rot (Fig. 1). The plants in one-meter length rows were dug up at each of ten sites spaced equally along the arms of a W pattern in each field. All plants were stored in a cooler at 5°C. Roots were washed and the incidence and severity of root rot assessed. Severity ratings were assigned based on a scale of 0 to 4 where 0 = healthy, 1 = 1 - 10%, 2 = 11 - 25%, 3 = 26 - 50%, and 4 = 51 - 100% root discolored.

RESULTS AND COMMENTS: Peas with root rot were found in all fields surveyed. Mean disease incidence and severity of root rot were 26% and 0.37 (on a scale of 0 - 4), respectively (Table 1).

Table 1. Incidence and severity of root rot of pea in northwestern Alberta in 1989.

Location	No. of Fields	Incidence (%) Mean	Range	Severity Mean	Range
Barrhead	6	26	6-47	0.41	0.06-1.06
Morinville	9	28	11-52	0.37	0.12-0.66
Stony Plain	2	20	10-30	0.25	0.10-0.40
Thorhild	5	25	16-32	0.40	0.21-0.59
Westlock	6	31	15-42	0.42	0.16-0.55
Total/Average	28	26	-	0.37	-

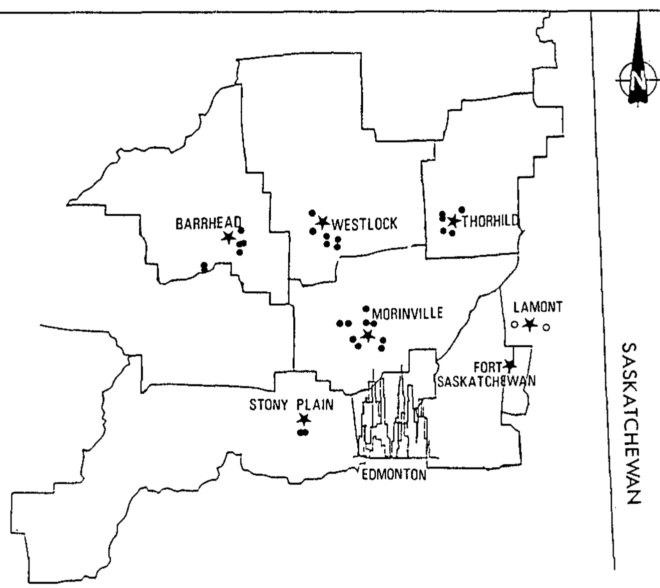

Fig. 1

Crop/Culture: Pea

Location/Emplacement: Saskatchewan

Title/Titre: PEA DISEASES IN N.E. SASKATCHEWAN, 1989

Name and Agency/ Nom et Organisation:

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METHODS: Eleven fields of pea were surveyed from August 11 to 18, 1989 in N.E. Saskatchewan. Fields surveyed were selected at random throughout the survey route and sampled by collecting one plant each ten paces, ten times in each field. Diseases were identified by the visual symptoms on the plant and the severity of each disease recorded as the estimated percentage of leaf or stem area affected. Root rot and foot rot severity were assessed on a scale where 0 = healthy, 2 = trace, 5 = moderate and 10 = severe. Results for each disease were averaged over total number of samples and fields surveyed to give the disease index. Number of fields affected over total number of fields surveyed by 100 gave the percentage of fields affected.

RESULTS AND COMMENTS: The reduction in the number of pea fields surveyed in 1989 compared with previous years was due to the lack of seeded acres. According to Statistics Canada seeded pea acreage in 1989 was about half of that seeded in both 1987 and 1988. Powdery mildew (*Erysiphe polygoni*) was the most serious disease this year (Table 1). Mycosphaerella blight (*Mycosphaerella pinodes*) was less severe but had a similar prevalence to the previous two years. Foot rot (*Ascochyta* sp.) was more severe and more widely distributed than in the two previous years. Levels of root rot (*Fusarium* sp.), ascochyta leaf spot (*Ascochyta pisi*) and downy mildew (*Peronospora viciae*) were comparable to those found in 1987 and 1988.

Table 1. Severity and prevalence of peas diseases in 1989

Disease	Severity*	Prevalence**
Powdery mildew	20.3	82
Mycosphaerella blight	6.3	91
Foot rot	2.9	91
Root rot	1.8	55
Ascochyta leaf spot	0.2	45
Downy mildew	<0.1	9

*Disease index
**% fields affected

Crop / Culture: Safflower

Location / Emplacement: Southern Alberta

Name and Agency / Nom et Organisation:
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Title / Titre: SURVEY FOR SEEDLING BLIGHT OF SAFFLOWER

METHODS: From May 26 to June 20, 1989, 11 safflower fields in southern Alberta (Fig. 1) were surveyed for disease when crops were at the seedling stage or slightly older. The survey procedure consisted of walking through each field in a teardrop pattern and stopping at 200-pace intervals a total of 10 times. At each stop, plants within a 1 m^2 area were counted, carefully dug to preserve the roots intact, and bagged. Plants were washed, examined for disease symptoms, and rated for disease severity. Samples of diseased tissue were assayed for fungal pathogens by surface sterilizing in 1% sodium hypochlorite, rinsing in sterile water, and plating onto selective media. Plates were incubated at 20°C for 5-7 days before observation. Prevalent fungal species were subcultured for pathogenicity tests, which are pending.

RESULTS AND COMMENTS: Plants with root rot and/or stem canker symptoms were found in all fields. These were collectively termed seedling blight, and disease incidence and severity ratings were made accordingly (Table 1). No leaf diseases were observed. Plant density ranged from 15.5 to 49.7/m^2. A stand of 40-70 plants/m^2 is considered optimum under Alberta conditions. Seedling blight incidence varied from 18.9 to 82.4%, and the disease severity index ranged from 9.4 to 28.6. In general, seedling blight incidence and severity were higher in 1989 compared to 1988. Cool, wet weather conditions prevailed during late May'89 and this appeared to favor seedling blight. The predominant fungi isolated and average % tissue pieces colonized by each were: *Alternaria* spp. - 24.6, *Fusarium* spp. - 8.7, *Penicillium* spp. - 5.7, and *Pythium* spp. 2.3. A considerable amount of wireworm damage (5.8 to 38.6% incidence, $\overline{X}$ = 17.4%)) was also seen.

Table 1. Safflower survey data, 1989.[1]

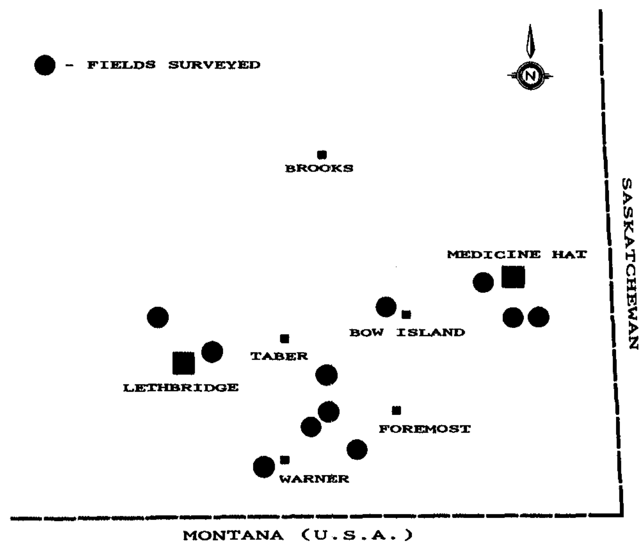
Field	Density	Seedling blight	
no.	(plants/m^2)	Incidence (%)	Severity[2]
1	44.2	18.9	9.7
2	23.0	69.3	21.6
3	41.0	55.5	18.6
4	31.0	53.6	18.9
5	30.9	56.3	22.0
6	49.7	38.0	14.4
7	15.5	73.4	25.7
8	20.5	82.4	28.6
9	26.7	42.9	15.2
10	21.8	47.4	15.6
11	38.3	28.5	9.4
Avg.	31.1	51.5	18.2

[1] Figures in this table are averages of 10 sampling sites/field.

[2] Severity Index = $\left[\frac{(S_1 \times 1)+(S_2 \times 2)+(S_3 \times 3)}{T \times 3}\right] \times 100$

Where S_1 = No. of plants with 1-25% of stem/root blighted.
S_2 = No. of plants with 26-75% of stem/root blighted.
S_3 = No. of plants with 76-100% of stem/root blighted.
T = Total no. plants examined, including healthy ones.

Figure 1. Safflower fields surveyed in 1989.



REFERENCE: Howard, R.J., E.R. Moskaluk, and F.T. Allen. 1988. Survey for seedling blight of safflower. Can. Plant Dis. Surv. 69(1):69.

Crop / Culture: Soybean

Location / Emplacement: Prince Edward Island

Title / Titre: INCIDENCE AND POPULATIONS OF SOILBORNE ORGANISMS IN SOYBEANS GROWN ON PRINCE EDWARD ISLAND

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MATERIALS AND METHODS: The purpose of this study was to determine the incidence and population levels of soilborne organisms in soybeans grown on P.E.I.. Observations on foliar diseases were also taken. A total of 12 commercial soybean fields were sampled from 1986-1989. Thirty soybean plants were sampled during each of June, July, and September. Each plant was rated for root rot (0 = healthy; 5 = death), before hypocotyl, epicotyl, and root tissue was excised and plated on selective growth media. Root rot severity was calculated using the formula:

$$\text{Disease Severity} = \frac{\sum \left(\begin{array}{c}\text{No. plants in} \\ \text{disease category}\end{array} \times \begin{array}{c}\text{No. value} \\ \text{of category}\end{array} \right)}{\text{Total no. of plants} \times 5} \times 100$$

Nematodes and fungi were isolated from the plant tissues and soil sampled from soybean fields.

RESULTS AND COMMENTS: White mold (*Sclerotinia sclerotiorum*), anthracnose (*Colletotrichum lindemuthianum*), and brown spot (*Septoria glycines*) were observed more often on soybean stems and leaves in fields during 1986 than in 1987 or 1988. During the course of this study, severity of root rot differed greatly from year to year (Table 1). Root rot was particularly severe in 1986.

Fungi were isolated most often from hypocotyl tissue (Table 2). *Fusarium oxysporum* was recovered most frequently from all tissue. *Rhizocotnia solani*, *F. sambucinum*, and *F. avenaceum* were recovered at similar levels from hypocotyl tissue. The impact of *F. sambucinum* and *F. avenaceum* affecting soybeans is unknown. Notably, these two species were isolated from all soybean tissues (Table 2). *Fusarium solani* was isolated primarily from hypocotyl tissue although at relatively low levels. A root lesion nematode (*Pratylenchus penetrans*) was extracted frequently from roots. All organisms were isolated from soil in soybean fields, however *F. oxysporum* and a root lesion nematode appeared to be most prevalent.

Table 1. Soybean root rot severity (1-100) from 1986-1988.

Year	Sample date		
	June	July	September
1986	16.7a*	72.5a	91.7a
1987	11.1a	36.7b	68.9b
1988	28.8a	33.3b	49.7c

*Figures in columns followed by the same letter are not significantly different (P=0.05) using Least Significant Differences.

Table 2. Mean incidence and population levels of soilborne organisms in soybeans.

Tissue	Rhizoctonia solani %	Fusarium oxysporum %	Fusarium solani %	Fusarium sambucinum %	Fusarium avenaceum %	Root lesion nematode no./g dry roots
Hypocotyl	12.8a*	44.0a	6.4a	16.2a	16.4a	-
Epicotyl	5.9b	32.9b	4.6ab	13.1ab	8.7b	-
Roots	3.0b	13.3c	2.1b	9.1b	6.4b	8342
Soil populations**	cfu/50g 5.4	cfu/g 2800	cfu/g 348	cfu/g 424	cfu/g 189	no./kg 4459

*Figures in columns followed by the same letter are not significantly different (P=0.05) using Least Significant Differences.
**Colony forming units (cfu) per dry soil weight basis.

Crop / Culture: Sunflower

Location / Emplacement: Southern Alberta

Name and Agency / Nom et Organisation:
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Title / Titre: SURVEY FOR SCLEROTINIA WILT AND HEAD ROT OF SUNFLOWER IN SOUTHERN ALBERTA IN 1989

METHODS: Nine fields of sunflower (Helianthus annuus L.) in the County of Forty Mile and the Municipal District of Taber were surveyed on August 31, 1989. In each field, six rows of 25 plants per row were rated for incidence of sclerotinia wilt and head rot.

RESULTS AND COMMENTS: Sclerotinia wilt was found in all 3 fields surveyed in the County of Forty Mile near Bow Island, and in 5 of the 6 fields surveyed in the Municipal District of Taber (Table 1). The disease incidence varied with fields, ranging from light or less than 5% wilt to severe or greater than 50% wilt.

Sclerotinia head rot was found in only 2 of the 9 fields surveyed. The disease incidence was very light (less than 1%) in both fields.

Table 1. Survey for sclerotinia wilt and head rot of sunflower in southern Alberta, 1989.

County or Municipality	Field No.	Sclerotinia disease (%) Wilt	Head Rot
County of Forty Mile	1	54	0
	2	1.3	0
	3	16.7	0
Municipal District of Taber	4	0.7	0
	5	4.0	0
	6	0	0
	7	2.7	0.7
	8	31.3	0.7
	9	5.3	0

Crop / Culture: Sunflower

Location / Emplacement: Manitoba

Title / Titre: SURVEY OF SUNFLOWER DISEASES IN MANITOBA IN 1989

Name and Agency / Nom et Organisation:

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Methods: A total of 34 oilseed and 9 non-oilseed (confectionery) sunflower fields were surveyed mostly south of Highway No. 1 in southern Manitoba in 1989. Three fields were surveyed on July 24, 12 fields on August 2, 7 fields on August 9, 14 fields on August 24 and 7 fields on September 6. Fields were selected at random and each field was sampled by two persons walking 100 m in opposite directions across the field following an inverted V pattern. Diseases were identified by symptoms and the prevalence and incidence of each disease was recorded. The rust disease severity was measured as percent leaf area infected. A disease index was calculated for each field based on disease incidence (DI) or disease severity (DS), (Table 1). In addition 14 samples submitted to the Manitoba Agriculture Plant Pathology Laboratory by agricultural representatives and growers were analysed.

Results: Sclerotinia wilt (*Sclerotinia sclerotiorum*) and rust (*Puccinia helianthi*) were the most common and widespread diseases on sunflower in 1989. Sclerotinia wilt was observed during and after flowering in 88% of the fields surveyed and ranged from trace to 40% DI in most fields with up to 100% DI in one field north of Morden. Rust was found in 86% of the fields surveyed with severity ranging from 10% to 100%. The highest rust severity scores were obtained from western Manitoba where race 3 is prevalent and resistance is absent in commercial hybrids. The lack of rust in 7 fields surveyed in central Manitoba on and before the first week in August may be due to the earliness of the survey and the prevalence of race 1, to which most commercial hybrids are resistant. However, moderate levels of rust (up to 40% DS) were recorded from fields in the central area towards the end of the season.

Verticillium wilt (*Verticillium dahliae*) was found in 49% of the fields surveyed with a range from trace to 20% DI. Traces of downy mildew (*Plasmopara halstedii*) were observed in three fields and up to 20% DI was observed in 23% of the fields, especially those surveyed towards the end of the season. Traces of septoria leaf spots (*Septoria helianthi*) and stem lesions (*Phoma* spp. and *Phomopsis* spp.) were observed in various sunflower fields towards the end of the season. No signs of sclerotinia head rot (*S. sclerotiorum*) or botrytis head rot (*Botrytis* spp.) were encountered during the 1989 field survey.

The incidence and severity of sclerotinia wilt, rust and rhizopus head rot were relatively the same in the oilseed and non-oilseed sunflower fields. However, the incidence of verticillium wilt and downy mildew were higher (2 to 3 fold) in the non-oilseed than in oilseed sunflower fields probably due to the lack of resistance in non-oilseed sunflower hybrids.

In the 14 samples of sunflower submitted to the Manitoba Agriculture Plant Pathology Laboratory, 3 showed sclerotinia wilt (*Sclerotinia sclerotiorum*) 3 head rot (*Rhizopus* spp.), 2 phoma black stem (*Phoma* spp.) and 1 root rot (*Fusarium* spp.). In addition to disease, 4 samples showed herbicide drift injury and 1 insect damage.

TABLE 1: Sunflower fields affected and disease severity in southern Manitoba in 1989.

Disease	% of fields infested	Mean of disease index*	Range of disease index
Sclerotinia wilt	88%	1.6	1-5
Verticillium wilt	49%	1.1	1-2
Rust**	86%	1.7	1-5
Downy mildew	9%	1.3	1-2
Rhizopus head rot	23%	1.0	0-1
Stand	-	1.3	1-2
Vigour	-	2.0	1-3

* Disease index is based on a scale 1-5 (1= trace to 5% disease, 2= 5% to 20% disease, 3= 20% to 40% disease, 4= 40% to 60% disease and 5= greater than 60% disease levels). Index is based on disease incidence for all except rust, which is based on disease severity measured as leaf area infected. Indexes for stand and vigour are based on a 1-5 scale (1= very good and 5= very poor vigour.

** The most severely rust infested fields were in western Manitoba where races 3 and 4 were predominant in the rust population.

Vegetables / Légumes

Crop/Culture: Potatoes

Location/Emplacement: Manitoba

Title/Titre: DISEASE SURVEY OF POTATO FIELDS IN SOUTHERN MANITOBA AND DISEASES DETECTED IN SAMPLES SUBMITTED TO MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY IN 1989.

Name and Agency/ Nom et Organisation:
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GEISEL, B.
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Methods: Eighty fields of potatoes (Russet Burbank variety), were randomly selected within the Manitoba potato growing area. Thirty-two in the Carberry are, 20 in Winkler area and 20 in Portage la Prairie, McGregor and 8 in other areas outside the main potato producing regions. Stem samples were taken in late August and early September and examined at the Manitoba Agriculture Plant Pathology Laboratory for evidence of Verticillium wilt (*Verticillium* spp.), Black dot (*Colletotrichum coccodes*, *Fusarium* spp. and *Rhizoctonia solani*). Isolations(where required)to verify presence of disease organisms were done using Potato dextrose agar and Sorbose agar.

Results: Of the 80 fields surveyed 23 (28.7%) showed symptoms of early senescence. Verticillium wilt (*Verticillium dahliae*) was found in 17 fields (21.2%) black dot (*Colletotrichum coccodes* in 16 fields (20%) Fusarium (*Fusarium* spp.) in 5 fields (6.2%) and black scurf (*Rhizoctonia solani*) in 3 fields (3.7%). In 11 fields (13.7%) Verticillium occurred in association with other diseases, with black dot in all of the 11 fields (13.7%) with Fusarium in 2 fields (2.5%) and with Rhizoctonia in 2 fields (2.5%). In 6 fields (7.5%) only Verticillium wilt was detected.

The incidence of Verticillium wilt (*Verticillium dahliae*) in the survey area was 50% in the Winkler fields, 35% in Portage/MacGregor, and 0% in both Carberry and the other fields outside the 3 main potato growing areas.

In 80 samples of potatoes, 8 showed a root rot-wilt (*Fusarium* spp., *Verticillium* spp.) 5 black scurf (*Rhizoctonia solani*), 5 scab (*Streptomyces scabies*) 4 dry rot (*Fusarium* spp.) 6 early blight (*Alternaria solani*), 1 leak (*Pythium ultimum*), 10 environmental stress. Drought conditions in south central Manitoba reduce potato yields as much as 50%. Damage was particularly severe in the Winkler area.

Crop / Culture: Vegetables

Location / Emplacement: Manitoba

Title / Titre: DISEASES DIAGNOSED IN SAMPLES OF BROCCOLI, CARROTS, CAULIFLOWER, CUCUMBER, ONIONS, SNAP BEANS AND TOMATOES SUBMITTED TO THE MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY IN 1989.

Name and Agency / Nom et Organisation:

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Methods: Samples of broccoli, carrots, cauliflower, cucumber, corn, onions, snap beans and tomatoes submitted by the vegetable specialist and vegetable growers were examined for presence of disease.

Results:

Broccoli: In 8 samples of broccoli 4 were affected by black rot (Xanthomonas campestris) and 4 were affected by brown bud (environmental stress of high temperatures at blossom bud initiation stage).

Cabbage: In 4 samples of cabbage 1 showed black rot (Xanthomonas campestris), 1 root rot (Rhizoctonia solani and Fusarium spp.) and 2 showed environmental stress.

Celery: In 2 samples of celery, 1 showed aster yellows (aster yellows mycoplasma like organism) and 1 late blight (Septoria apii).

Carrots: In 3 commercial carrot fields aster yellows, (aster yellows mycoplasma like organism) was found to be between 1 and 3%. Leaf blight (Alternaria daucii) was present at low levels in the 3 fields.

Corn: In 6 samples of corn 1 showed common smut (Ustilago maydis), 1 head smut (Sphacelotheca reiliana), 1 crazy top (Sclerophthora macrospora), 1 kernel discolouration (Alternaria spp. and Cladosporium spp.) and 2 showed symptoms of environmental stress.

Cucumber: In 23 samples of cucumber, 10 showed scab (Cladosporium cucumerinum), 1 angular leaf spot (Pseudomonas syringae pv. lachrymans), 1 Alternaria leaf spot (Alternaria spp.), 1 root rot (Fusarium spp.), 1 cucumber wilt (Erwinia tracheiphila), 1 powdery mildew (Erysiphe cichoracearum) and 8 environmental stress.

SNAP BEANS: In 9 samples of snap beans 3 showed root rot (Fusarium spp.) 2 white mold (Sclerotinia sclerotiorum) and 4 environmental stress.

ONIONS: In 31 samples of onions, 8 were affected by basal rot (Fusarium spp.), 4 Penicillium bulb rot (Penicillium spp.), 3 neck rot (Botrytis allii), 2 blast (Botrytis cinerea) 2 sour rot (Pseudomonas spp.) 2 purple blotch (Alternaria porii), 1 smut (Urocystis magica), downy mildew (Peronospora destructor) and 9 environmental stress.

Tomatoes: In 74 samples of tomatoes, primarily of home garden origin, 13 were affected by root rot and wilt (Fusarium spp.), 10 by early blight (Alternaria solani) 2 by Septoria leaf spot (Septoria lycopersici), 3 by botrytis (Botrytis cinerea), 26 by blossom end rot (environmental stress and calcium deficiency and 6 were affected by insects.

Lettuce: In one greenhouse producing lettuce hydroponically, basal rot (Botrytis cinerea) caused a crop loss of 20% during January.

Tree fruits and nuts / Arbres fruitiers et noix

Crop/Culture: Hazelnut

Location/Emplacement: South coastal British Columbia

Name and Agency/ Nom et Organisation: A. J. Buonassisi
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Title/Titre: 1989 Eastern Filbert Blight Survey in South Coastal British Columbia

METHODS: Hazelnut growers are concerned that Eastern filbert blight, caused by the fungus *Anisograma anomala*, could be introduced into British Columbia on hazelnut (*Corylus*) planting stock from Washington and Oregon. We surveyed hazelnut orchards in the upper Fraser Valley near Agassiz to determine if the disease had been introduced into British Columbia. Approximately 70 acres of hazelnuts were surveyed plus two nurseries producing hazelnut planting stock. The predominant hazelnut variety is Barcelona with Daviana as the pollenizer but there is some Royal, Duchilly, Ennis and Butler production. The hazelnut orchards were surveyed by walking along rows of trees and closely checking for branch dieback or flagging. Closer inspection of flagged branches was made for evidence of Eastern filbert blight perennial cankers and the distinctive large (3 x 6 mm), black, oval-shaped perithecia that protrude in rows along the canker surface.

RESULTS AND COMMENTS: No evidence of Eastern filbert blight was observed during both the 1988 and 1989 surveys. A ban against imported *Corylus* planting stock from the western United States was imposed in early 1989. The industry retains access to new hazelnut varieties through a two year post-entry quarantine program.

Bacterial blight, thought to be incited by *Pseudomonas syringae*, is another disease that occurred in two out of the eight hazelnut orchards surveyed in 1989. The most damage was from severe freezing temperatures in early February which caused almost complete crop loss.

Crop / Culture: Apple

Location / Emplacement: Ontario

Title / Titre: DISEASE SURVEY OF COMMERCIAL APPLE ORCHARDS IN SOUTHERN ONTARIO

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METHODS: Fruit harvest assessments were carried out in southern Ontario in 87 different commercial orchards. Fruit from four trees per orchard were sampled at or just prior to harvest maturity. From standard sized trees, 33 fruit from the top, skirt inside and skirt outside were checked. One extra apple was checked from each tree to bring the sample total to 100 apples per tree.

From dwarf sized trees, 33 fruit from each of the top, middle and bottom portions of the tree were checked. One extra apple was picked from each tree to bring the sample size to 100 apples per tree.

Exceptions to this sampling procedure included the St. Lawrence Valley, where 300 fruit per orchard were checked (25 fruit from the top, middle and bottom of 4 trees); in Norfolk county, where 200 apples were examined in 2 of the orchards; and in Middlesex, where 200 fruit were examined at one site.

At most sites, McIntosh and Delicious were checked, but occasionally Empire, Idared, and Spartan were assessed.

Observations from one abondoned orchard in Durham county, and from one certified organic (Organic Crop Improvement Association, Ontario chapter) orchard in Middlesex are included for comparison.

Fruit was checked for apple scab (Venturia inaequalis (Cke.) Wint.), fly speck (Leptothyrium pomi (Mont. and Fr.) Sacc.), sooty blotch (Gloeodes pomigena (Schw.) Colby), quince rust (Gymnosporangium clavipes Cke., and Pk.), cedar-apple rust (G. juniperi-virginianae Schw.), and insect injury. These were reported by area as to the presence or absence of disease or insect injury.

RESULTS AND COMMENTS: The incidence of sooty blotch, quince rust, and cedar-apple rust was low in 1989. Scab, however, was prevalent in orchards throughout Ontario, averaging 1.2% of infected fruit at harvest. In 1988, the average was 0.46%.

Fruit injury from insect pests was, in general, considerably higher than damage from diseases, with the exception of 6 commercial orchards; 1 from Norfolk-Brant, 2 from Halton-Peel, 1 from Durham, and 2 from Prince Edward Counties.

ACKNOWLEDGEMENTS: We thank the Horticultural Crop Advisors, Pest Management Advisors and others in the Plant Industry Branch who collected the data for the apple harvest assessments.

Comparison of Disease Incidence And Insect Damage in Commercial, Organic, and Abandoned Orchards, 1989

Area	Number of fruit	Percent fruit affected					
		Scab	Fly speck	Sooty blotch	Quince rust	Cedar-apple rust	Insect damage
Ontario (Commercial)	33,900	1.2	0.3	0.01	0.01	0	5.9
Abandoned (Durham)	50	68	28	20	0	0	87
Organic (Middlesex)	200	61	0	0	0	0	100

Apple Harvest Assessment, Southern Ontario, 1989

Area	Number of orchards	Number of apples	Number of fruit affected (range): Scab	Fly speck	Sooty blotch	Quince rust	Cedar-apple rust	Percent damage: Insect	Disease
Essex-Kent	7	2,800	5 (1-4)	6 (1-5)	0	0	0	4.2	0.4
Elgin	5	2,000	3 (3)	18 (1-14)	0	0	0	6.0	1.0
Middlesex	3	1,000	1 (1)	2 (1-8)	0	0	0	2.3	0.3
Norfolk-Brant	33	12,800	69 (1-26)	78 (1-41)	2 (1-2)	0	0	12.8	1.2
Halton-Peel	4	1,600	154 (45-109)	0	0	0	0	6.6	9.6
Niagara	6	2,400	24 (2-8)	0	0	0	0	3.4	1.0
Georgian Bay	7	2,800	15 (1-7)	0	0	0	0	9.4	0.5
Durham	8	3,200	34 (1-30)	14 (1-8)	0	0	0	5.2	1.5
Northumberland, Prince Edward, Hastings	11	4,400	81 (1-49)	0	0	3 (3)	0	4.9	1.9
St. Lawrence Valley	3	900	15 (4-6)	0	0	0	0	4.3	1.7

Apple Harvest Assessment, Southern Ontario, 1989

Area	Number of orchards	Number of apples	Number of orchards affected: Scab	Fly speck	Sooty blotch	Quince rust	Cedar-apple rust
Essex-Kent	7	2,800	2	2	0	0	0
Elgin	5	2,000	1	4	0	0	0
Middlesex	3	1,000	1	2	0	0	0
Norfolk-Brant	38	12,800	12	12	1	0	0
Halton-Peel	4	1,600	2	0	0	0	0
Niagara	6	2,400	5	0	0	0	0
Georgian Bay	7	2,800	6	0	0	0	0
Durham	8	3,200	4	4	0	0	0
Northumberland, Prince Edward, Hastings	11	4,400	8	0	0	1	0
St. Lawrence Valley	3	900	3	0	0	0	0

Crop / Culture: Pears and Junipers

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Location / Emplacement: Lower Mainland and Vancouver Island, British Columbia

Title / Titre: PEAR TRELLIS RUST SURVEY IN SOUTH COASTAL BRITISH COLUMBIA

METHODS: In order to ship junipers or pear trees to the Okanagan or Eastern Canada, nurseries in the B.C. Coastal area must be certified free of pear trellis rust (*Gymnosporangium fuscum*). Beginning in 1989, this requirement also applied to junipers and pears destined for the prairie provinces.

To facilitate this, a survey of pear trees within 1 km or more of each juniper producing nursery is carried out annually. If infections are found on pear, the junipers in the vicinity are checked for infections the following spring and, if found to be diseased, they are destroyed. In 1989, two students carried out the work on the Lower Mainland and two worked on Vancouver Island, particularly the Saanich Peninsula, where the disease is well established.

RESULTS AND COMMENTS: See table below. As a result of the 1989 work, approximately 55 nurseries out of 75 that applied, were certified to ship junipers and/or pears.

Area	Number of Junipers Examined	Number of Junipers Removed	Pear Trees Examined	Pear Infections/Tree 5-50	Pear Infections/Tree >50
LOWER MAINLAND					
Abbotsford	721	0	125	20	10
Aldergrove	0	0	33	0	0
Bradner	237	0	65	2	2
Chilliwack	204	0	55	1	0
Delta	0	0	20	0	0
Hatzic	72	0	0	-	-
Langley	2513	0	467	66	6
Maple Ridge	0	0	26	0	0
Matsqui	0	0	13	0	0
Mission	369	0	76	13	6
Pitt Meadows	0	0	76	1	1
Richmond	1133	0	252	98	79
Surrey	816	59	494	163	82
Vancouver	2	2	2	0	2
VANCOUVER ISLAND					
Saanich Peninsula	2255	361	1628	653	660
Central Vancouver Is.	46	46	174	9	7
TOTAL FOR 1989	8368	468	2506	1026	255
TOTAL FOR 1988	5274	456	50476*	1719	490

* Includes nursery trees.

Crop/Culture: Sweet Cherry

Location/Emplacement: British Columia

Name and Agency/
Nom et Organisation: S.C. Li and A.J. Hansen
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Research Station
Summerland, B.C.
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Title/Titre: STATUS OF LITTLE CHERRY ERADICATION EFFORTS

METHODS: As part of an on-going survey for the little cherry disease, 2596 sweet and sour cherry trees in the town of Creston, B.C. were checked for fruit symptoms. A pre-survey by a recently trained fieldman was followed by a more detailed inspection of those trees that had been identified as suspicious. The final survey was carried out by experienced personnel from the Summerland Research Station. Commercial orchards, semi-abondoned plantings and gardens were checked during the second and third week of July 1989. Infected trees were identified on the basis of fruit symptoms. Sweet cherry cultivars react to infection with reduced fruit size, lack of colour development during the last ten days before harvest, triangular shape and wrinkled fruit skin on two of three sides of the fruit. Symptoms are especially severe in the first year after infection. Among the major cultivars in the area, Lambert and Bing are especially severely affected while Van shows milder symptoms.

During each of the previous surveys, trees were encountered which could not be definitely classified as either healthy or little cherry diseased. Testing of these suspicious trees for little cherry was carried out routinely by budding a triplet of one- or two-year-old 'Sam', 'Decon' and 'Canindex 1' cherry trees with buds from the suspected field trees. In some cases, fruiting, 'Lambert' trees were also included. Unfavourable environmental conditions, such as lack of irrigation, zinc deficiency induced by high pH and general neglect can also cause small fruit size but do not induce the other specific symptoms. Symptoms induced by other cherry viruses, such as necrotic ringspot, prune dwarf, twisted leaf and mottle leaf do not generally interfere with the symptom reading.

RESULTS AND COMMENTS: Of the 2596 trees inspected, 84 were found to be definitely infected with the little cherry agent while 237 were considered to be suspicious or highly suspicious. Budwood from these latter trees were taken for testing at Summerland.

Seven trees which had been identified in 1988 as being suspicious or highly suspicious had given positive little cherry indexing results on the indicators in 1989. Most of the original field trees had been removed in 1988 and all remaining trees showed highly suspicious or definite little cherry symptoms in 1989.

The present work was carried out as part of a long-term study of little cherry epidemiology and of the effect of eradication measures. After seven years of surveys and increasingly complete eradication of infected backlog trees, the incidence of newly infected trees has been reduced from approximately 45 per year to around 2 per year. Increased awareness by growers, improved control methods for the vector, increasingly better eradication of the infected trees and an expansion of the surveyed area have contributed to the success of the program. If the present efforts continue at the same level, the disease can be essentially eliminated from the Creston district by 1992.

A separate testing program has been carried out for seedlings of sweet cherry and of Prunus emarginata, which is indigenous in the area. These two species do not display identifiable symptoms of little cherry in the field. Bulked samples from 10 to 25 seedling trees were indexed on a pair of indicators. The indexing results indicate that little cherry has become established only in one patch of seedling cherries and in one patch of Prunus emarginata. Both are located directly adjacent to severely infected commercial orchards. Twenty-six tests conducted with similar bulked samples from groups of cherry seedlings and Prunus emarginata which were more than 50 meters away from orchards did not yield any little cherry. The possible escape of little cherry into the native vegetation was of major concern since Prunus emarginata could provide a permanent reservoir from which the disease could re-invade newly planted orchards. Small patches of seedling cherries and Prunus emarginata near the orchard area have now been included in the surveying, indexing and eradication program.

Crop / Culture: SWEET CHERRY

Location / Emplacement: OKANAGAN VALLEY BRITISH COLUMBIA

Title / Titre: LITTLE CHERRY DISEASE SURVEY IN THE OKANAGAN VALLEY, BRITISH COLUMBIA

Name and Agency / Nom et Organisation:

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METHODS: The annual survey of sweet cherry trees in the Okanagan Valley of British Columbia was conducted during harvest in July 1989 for symptoms of little cherry disease. Two employees of the B.C. Ministry of Agriculture and Fisheries examined orchards in districts with a history of disease. Over a three week period most orchards in Penticton and Naramata were visited plus parts of Summerland, Westbank, Kelowna and Oyama. Approximatly 250 properties were visited Fruit on diseased trees is small and maturity delayed. Some varieties have pointed and angular fruit. Following field identification, tree owners are issued removal notices. Trees with questionable symptoms are indexed at the Summerland Research Station. Buds from the suspect tree are placed in indicator trees which are usually of the Sam variety. Sam leaves turn red in late summer of the following year if the disease is present. The infectious agent is assumed to be a virus-like organism.

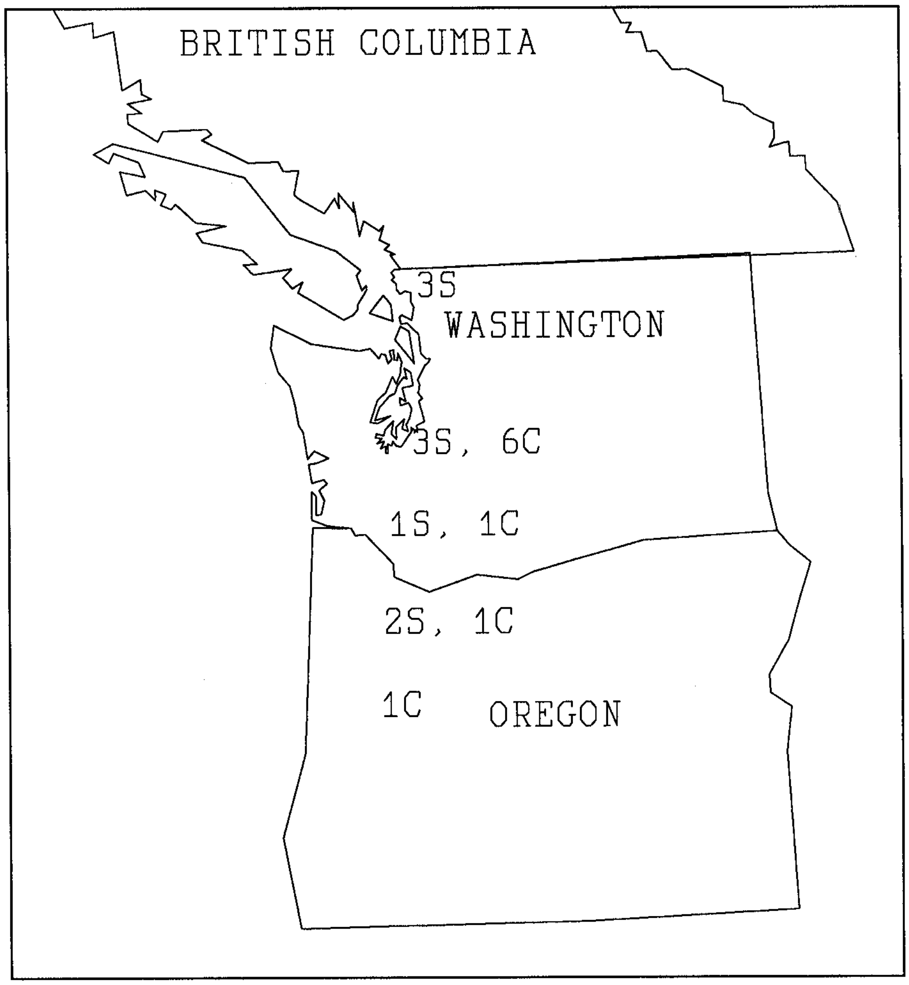
RESULTS AND COMMENTS: Forty-three diseased trees were found in 1989. The table below gives a comparison of numbers found in the various districts in recent years:

SUMMARY OF NUMBER OF TREES WITH LITTLE CHERRY DISEASE

	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976
Oliver	0	0	0	0	0	0	0	0	0	5	0	0	2	1
Keremeos	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Penticton	32	49	57	21	19	26	39	104	53	49	46	64	184	303
Naramata	0	3	0	2	1	6	17	39	20	18	28	84	121	0
Summerland	2	2	3	1	4	2	5	4	5	8	4	0	7	0
Kelowna	6	8	3	0	0	10	1	0	6	25	22	41	0	0
Westbank	1	25	27	0	0	0	0	0	0	0	0	0	0	0
Winfield	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Oyama	2	14	7	3	7	3	2	5	2	11	7	0	0	0
Total	43	101	97	27	31	47	64	152	86	116	109	193	314	304

The number of diseased trees identified in 1989 was down substantially from the previous two years indicating a return to the relatively slow spread pattern observed in the mid-1980's. The drop in numbers in Westbank is due to the complete removal of a badly infected orchard.

The combination of the tree removal program and the natural predation of apple mealy bug, the insect vector of the disease, plus spray programs targeted to control the vector may explain the gradual decline in disease incidence since its peak in 1977. The complete removal of several orchards with a high disease incidence has also checked the spread. Compared to the Kootenay region of B.C. in the 1940's when the disease spread like wild fire, little cherry is being contained in the Okanagan.



Distribution of blueberry scorch viruses found in the Pacific Northwest in the summer of 1989. S = the newly identified spherical virus, C = the carlavirus, numbers indicate the number of farms in an area that had fields testing positive for each virus.

Small fruits / Petits fruits

Crop / Culture: Blueberries

Location / Emplacement: Vancouver, B.C.

Title / Titre: SURVEY OF HIGHBUSH BLUEBERRIES FOR SCORCH VIRUSES

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METHODS: In 1989 highbush blueberry (*Vaccinium corymbosum*) plantings in British Columbia, Washington and Oregon were surveyed for blueberry scorch carlavirus (Martin and Bristow, 1988) and a newly identified spherical virus from highbush blueberry. Each sample consisted of 3 or 4 fully mature leaves collected from different branches on a bush. Samples were tested by ELISA using polyclonal antisera to each of the two viruses. Samples were ground in 0.05 M borate, pH 8.0, containing 0.05% Tween-20, 0.1% non-fat dried milk and 0.5% nicotine alkaloid (MacDonald et al., 1989). Samples were considered positive if the A_{405} values were greater than twice the mean of negative controls (mean of 6 healthy samples). Any questionable results were retested.

RESULTS AND COMMENTS: The carlavirus was found in Pierce and Clark counties in Washington and in Clackamas and Benton counties in Oregon. The newly identified spherical virus was found in Whatcom, Pierce and Clark counties in Washington and in Clackamas and Yamhill counties in Oregon. Neither of the viruses has been found in British Columbia despite extensive testing.

The spherical virus has been found in three fields in Whatcom county Washington, which is just across the border from the Fraser Valley in British Columbia. Both the carlavirus and spherical viruses move rapidly in blueberry fields and represent potential disease problems to the blueberry industry in British Columbia. Significant losses can be incurred with infection by either of the viruses in some cultivars of highbush blueberry.

Wild *Vaccinium* species and weeds in and around infected fields all tested negative for both scorch viruses. Since these viruses appeared in different areas at about the same time it is possible that these viruses moved into the area on infected planting stock. The carlavirus is very similar to a virus from Sheep Pen Hill diseased blueberries in New Jersey. The spherical virus is distinct from any other virus reported from blueberry. A virus certification program for blueberry planting stock using ELISA to test for these viruses along with more work on the epidemiology of these viruses will help prevent the movement of these viruses into the Fraser Valley. Early detection along with removal of infected bushes should be an effective means of controlling these diseases.

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Crop / Culture: Blueberry

Location / Emplacement: South Coastal British Columbia

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Title / Titre: INCIDENCE OF HIGH BUSH BLUEBERRY DISEASES IN 1989 IN BRITISH COLUMBIA

METHODS: Results are based on 51 blueberry samples from south coastal B.C. which were submitted to the provincial plant diagnostic clinic at Cloverdale.

RESULTS AND COMMENTS: The five major diseases of highbush blueberry in 1989 were mummyberry (*Monilinia vaccinii-corymbosi*), grey mold (*Botrytis cineria*), Godronia canker (*Godronia cassandrae*), bacterial blight (*Pseudomonas syringae*) and crown gall (*Agrobacterium tumefaciens*) (Table 1). Bacterial blight, grey mold and winter injury commonly occurred on the same sample. Phytophthora root rot (*Phytophthora sp.*) is increasing while there was only an isolated incidence of Armillaria root rot (*Armillaria mellea*).

Non-pathogenic disorders of blueberries in 1989 included winter injury caused by low temperatures (-15°C) in early February, excessive pruning, fertilizer burn, deep planting and flooding.

Table 1. Incidence of highbush blueberry diseases in British Columbia's south coastal region in 1989.

Blueberry Diseases	Number of Samples	Per Cent of Samples[1]
Mummyberry (*Monilinia vaccinii-corymbosi*)	8	16%
Grey Mold (*Botrytis cineria*)	8	16%
Godronia canker (*Godronia cassandrae*)	6	12%
Bacterial Blight (*Pseudomonas syringae*)	6	12%
Crown Gall (*Agrobacterium tumefaciens*)	6	12%
Phytophthora root rot (*Phytophthora sp.*)	3	6%
Armillaria root rot (*Armillaria mellea*)	1	2%
Non-pathogenic Disorders		
Winter injury; frost	5	10%
Other	21	42%

[1] Based on 51 samples submitted to the B.C. provincial plant diagnostic clinic. Certain samples had more than one disease or disorder.

Crop/Culture: Cranberry

Location/Emplacement: Southwestern British Columbia

Title/Titre: SURVEY OF PRE- AND POSTHARVEST FUNGAL DISEASES OF CRANBERRY FRUIT

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METHODS: Five hundred ml samples were taken from each of three tote boxes of harvested cranberries per bog, varieties Stevens, Bergman and MacFarlane, from 18 wet-picked bogs and 1 dry-picked bog as they arrived at the central receiving station in Richmond, B.C. The farms sampled were chosen to represent all the main cranberry-growing areas in B.C. Four of the bogs were in the Pitt Meadows area, 2 near Fort Langley, 2 in the Iron River area on Vancouver Island, 1 in Delta and the rest from Richmond. The three samples from each farm or bog were bulked for examination. The bulked samples were weighed, total berries counted, rots separated from healthy, weighed and counted and separated into disease categories. The remaining healthy berries were stored in paper bags at 3°C for 30 days. The rots were again separated from healthy berries, weighed and counted and separated into disease categories. Percent rot was calculated using total numbers of berries versus number of diseased berries.

RESULTS AND COMMENTS: Preharvest fruit rots were in all samples, ranging from 1.46% to 15.51% and averaging 6.33%. The dry-picked bog had 6.12% rot. Rots found were similar in both wet and dry-picked bogs. The most prevalent rot was end rot (*Godronia cassandrae* f. *vaccinii* Groves), closely followed by early rot (*Phyllosticta vaccinii* Earle). Both these rots occurred in all fields. Viscid rot (*Diaporthe vaccinii* Shear), black rot (*Apostrasseria lunata* (Shear) Nag Raj), yellow rot (*Botrytis* sp.) and Gibbera berry speckle (*Gibbera myrtilli* (Cooke) Petr.) occurred in trace amounts in a few fields. There was no correlation between causal agent, location of field or variety.

Postharvest rots followed a similar pattern with the same rots in the same order of occurrence. In addition, wet-picked fruit suffered considerable physiological breakdown with up to 50% of the fruit undergoing softening and juice loss. No organisms were isolated from this type of fruit. In contrast, dry-picked fruit did not break down but remained firm and in good condition.

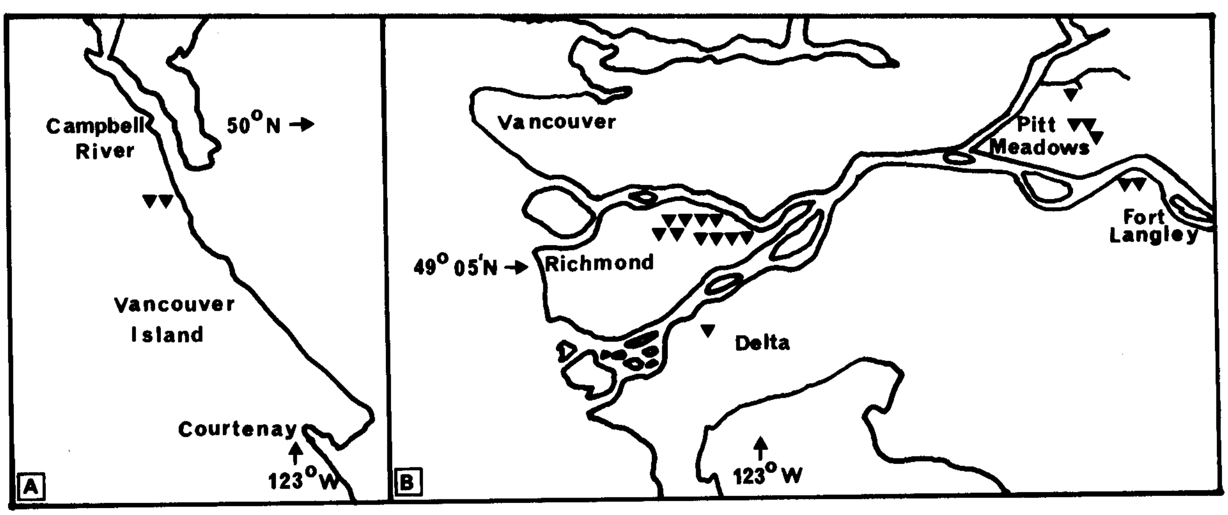

Fig. 1. Maps of locations of cranberry bogs sampled. A, Vancouver Island. B, Lower Fraser Valley.

Crop / Culture: Saskatoon, Amelanchier alnifolia

Location / Emplacement: Alberta

Title / Titre: SURVEY FOR DIEBACK AND CANKER DISEASE OF SASKATOON CAUSED BY CYTOSPORA SP.

Name and Agency / Nom et Organisation:

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METHODS: Saskatoon orchards in the south central, north central and Peace River regions of Alberta were surveyed in the summers of 1988 and 1989. Twelve orchards were examined in 1988 and eleven orchards were surveyed in 1989. A systematic sampling technique was used in which every tenth bush was examined and rated as having the disease based on symptoms of dieback, exfoliation, canker, shrivelled bark, flagging and/or the presence of pycnidia. Disease severity was rated numerically according to the number of main branches affected: 0= no disease; 1 = 1% to 25%; 2 = 26% to 50%; 3 = 51% to 75%; 4 = 76% to 100%. Random samples from each site were collected and returned to the laboratory for isolation and identification of the pathogen.

RESULTS AND COMMENTS: Dieback and canker disease caused by Cytospora leucostoma was observed in all orchards surveyed. Data collected over two years indicated that the incidence was highest in south central Alberta (Table 1). However, statistical analysis showed that there were no significant differences among areas while the variation among orchards within an area was highly significant. The frequently observed symptoms were branch tip dieback and diffuse cankers with pycnidia.

General observations suggest that the incidence of the disease may be associated with drought stress, mechanical injury from harvesting equipment and pruning wounds and low temperature injury.

Table 1. Incidence and severity of dieback and canker disease in Alberta 1988 and 1989.

Area Surveyed	Incidence (%)	Severity (% bushes per category)				
		0	1	2	3	4
S. Central	31	64	23	7	2	3
N. Central	18	82	11	3	1	3
Peace River	16	86	11	1	0	1

Crop/Culture: Grapes

Location/Emplacement: Nova Scotia

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Title/Titre: Crown gall disease survey in Nova Scotia vineyards.

Method: In January 1989 a questionnaire was circulated to the 51 grape growers registered in the Nova Scotia Grape Acreage Survey, 1988 (NS Department of Agriculture and Marketing, Truro). The mailing included a description of crown gall disease (caused by *Agrobacterium tumefaciens*) taken from The Compendium of Grape Diseases published by the American Phytopathological Society, 1988. The one page questionnaire asked the growers to enter the varieties of grapes planted in their vineyards, to assess if crown gall was present and if present to estimate the extent of the damage.

Results and Discussion: 37 growers (37%) returned the questionnaire in the stamped/addressed envelope provided. Four respondents had discontinued growing grapes and were not included in subsequent analyses. Fourteen growers (42.5%) of the remaining 33 respondents reported that crown gall was not present in their vineyards. Five growers (15%) declared that they were not sure and 14 (42.5%) said they definitely had crown gall.

The extent of the disease in this latter group and the varieties infected are tabulated below:

Grower	Percentage of specific vines infected	Percentage of vine death attributable to crown gall
1	Seyval (5%), Reisling (90%) Bacchus (100%)	90%
2	Baco Noir (4%), Castel (6%)	80%
3	Foch (1%)	1%
4	Seyval (<1%), Foch (<1%), Baco Noir (3%)	1%
5	Foch (5%), Baco Noir (13%)	3%
6	Seyval (<1%), Foch (1%), Michurinetz (1%), Chardonnay (60%)	100%
7	Baco Noir (20%)	100%
8	N.Y. Muscat (10%), Baco Noir (50%), Van Buren (80%)	0%
9	Seyval (10%), Cabernet (100%)	100%
10	Foch (20%)	80%
11	Michurinetz (<1%)	0%
12	Foch (60%)	-
13	Castel (77%), N.Y. Muscat (100%), Bacchus (100%), Pinot Noir (100%), Chardonnay (100%)	50%
14	Foch (2%), Seyval (2%), L'Acadie Blanc (5%), Reisling (60%), Chardonnay (100%)	100%

The susceptibilities of the varieties planted in Nova Scotia appear to be following patterns observed in other wine growing regions. *Vitis vinifera* cultivars and the French hybrids are the most heavily infected. In 7 of the vineyards crown gall disease is rated as the major cause of vine death.

When the analysis was extended to include the 14 crown gall free vineyards some features emerged which may be unique to the Nova Scotian situation. The table below outlines these features.

Continued:

Three groups emerge with different susceptibilities to crown gall. The first group comprising varieties from Bacchus to Foch carry infection in >35% of all vineyards. The second group of L'Acadie Blanc, N.Y. Muscat and Seyval are only infected in 20-30% of the vineyards. These cultivars are known to be susceptible and their low infection rate is probably more a reflection of recent plantings. The final group from Dechaunac to Michurinetz may be enjoying some measure of resistance to crown gall as only a maxinum of 9% of the vineyards reported infection in these varieties. Certainly the data for the Russian hybrid Michurinetz is significant because it is the most popular grape variety grown in the province; an estimated 49.1 acres in a total vine acreage of 176.5. Presumably the resistance is afforded by having *V. amurensis* in the parents. The preponderance of this cultivar may help to contain the spread of crown gall in the province's vineyards.

Variety	No. of vineyards with crown gall absent in the variety	No. of vineyards with crown gall present in in the variety	Ratio present/ total
Bacchus	0	2	2/2
Cabernet	0	1	1/1
Van Buren	0	1	1/1
Chardonnay	4	3	3/7
Baco Noir	7	5	5/12
Castel	3	2	2/5
Reisling	2	2	2/4
Foch	12	7	7/19
L'Acadie Blanc	4	1	1/5
N.Y. Muscat	8	2	2/10
Seyval	14	5	5/19
Dechaunac	4	0	0/4
Pollux	2	0	0/2
Vidal	1	0	0/1
Severnyji	1	0	0/1
Michurinetz	20	2	2/22

The author gratefully acknowledges the support of the Canada/NS Agri-Food Development Agreement and the staff at the Kentville Agriculture Centre.

Ornamentals / Plantes ornementales

Crop / Culture: Ornamentals

Location / Emplacement: Ontario

Title / Titre: Update on the Incidence of Tomato Spotted Wilt Virus in Greenhouses

Name and Agency / Nom et Organisation: B. Tehrani, W.R. Allen, J.A. Matteoni
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Research Station
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METHODS: Diseased ornamentals were submitted to the Research Station by extension personnel, growers and sales representatives. Additional samples were collected during a greenhouse survey conducted this year throughout southern Ontario, including growers who have had a previous record of tomato spotted wilt virus (TSWV), (2). Diagnostic procedures for positive identification included ELISA and bioassay (1).

RESULTS AND COMMENTS: Tomato spotted wilt virus is present in many greenhouse operations throughout the Niagara peninsula and southern Ontario. It has caused considerable losses, repeatedly in some crops (Table 1). The greatest losses were sustained during years 1985-1987. Intensive preventive measures taken to reduce populations of the vector, the western flower thrips *Frankliniella occidentalis* (Pergande), decreased crop losses in recent years. Eradication of the thrips has not been possible through chemical applications, but has been achieved through a break in the cropping cycle and thorough sanitation. A serotype of TSWV, originally detected in New Guinea impatients, was also detected in gloxinia, begonia, and exacum.

REFERENCES: 1. Allen W.R., and J.A. Matteoni. 1988. Cyclamen Ringspot: Epidemics in Ontario greenhouses caused by the tomato spotted wilt virus. Can. J. Plant Pathol. 10:41-46. 2. Matteoni, W.R. Allen, and A.B. Broadbent. 1988. Tomato spotted wilt virus in greenhouse crops in Ontario. Plant Dis. 72:801

TABLE 1. Incidence of tomato spotted wilt virus in greenhouse ornamentals.[1]

Genus	Common name	Incidence in years 1983-88	1989
Ageratum houstonianum Mill.	Ageratum	1	-
Anemone coronaria L.	Anemone	1	-
Antirrhinum majus L.	Snapdragon	1	1
Alstroemeria	Alstroemeria	1	-
Begonia X *hiemalis* Fotsch.	Begonia	1	3
Brassaia actinophylla Endl.	Umbrella tree	1	-
Browallia L.sp.	Bush Violet	-	1
Calceolaria crenatiflora Cav.	Calceolaria	2	-
Calendula officinalis L.	Calendula	1	-
Callistephus chinensis (L.) Nees	China aster	1	-
Capsicum L.sp.	Ornamental pepper	1	2
Catharanthus roseus (L.) G.Don	Periwinkle	1	-
Chrysanthemum X *morifolium* Ramat.	Florist's chrysanthemum	7	3
C. frutescens L.	Marguerite	1	-
C. X *superbum* Bergman ex J. Ingram	Shasta daisy	1	-
Cyclamem persicum Mill.	Cyclamen	8	2
Cymbidium Swrtz spp.	Cymbidium orchid	1	-
Dahlia Cac.sp. (=*D.* X *pinnata* X *D. coccinea*.)	Dahlia	2	-
Dracaena fragrans massangeana L. Ker. - Gawl.	Corn plant	-	1
D. marginata L.	Spiker	-	1
Exacum affine Balf F.	Persian violet	2	1
Fushsia L.spp.	Fuchsia	2	-
Gaillardia X *grandiflora* Van Houtte	Blanket flower	-	1
Gardenia jasminoides L.sp. Ellis	Gardenia	-	1
Gerbera jamesonii H.Bolus ex Hook.f.	Gerbera	1	1
Gypsophia elegans Bieb.	Baby's breath	-	1

Crop / Culture: Ornamentals

Location / Emplacement: Ontario

Title / Titre: Update on the Incidence of Tomato Spotted Wilt Virus in Greenhouses

Name and Agency / Nom et Organisation:
B. Tehrani, W.R. Allen
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Hydrangea L.sp. (=*Hortensia* Comm. ex Juss).	Hydrangea	-	1
Impatiens walleriana Hook.f.	New Guinea impatiens	19	8
	Sultana, bedding	1	-
I. balsamina L.	Balsam	-	1
Kalanchoe sp. Adans.	Kalanchoe	-	1
Lilium longiflorum Thumb.	Easter Lily	-	1
Nolana L.f. Dumort.	Nolana	-	1
Pelargonium X *hortorum* L.H. Bailey	Geranium	-	1
Petunia x *hybrida* Hort. Vilm.-Andr.	Petunia	1	-
Primula vulgaris Huds. (=*P. acaulis*)	Primula	1	-
Saintpaulia ionantha H. Wendl.	African Violet	3	-
Salvia splendens F. Sellow ex Roem. & Schlt.	Scarlet Sage	1	-
Schefflera arboricola H. Ayata	Dwarf schefflera	-	1
Schlumbergea bridgesii (Lem.) Lofgr. (= *Zygocactus truncata* (Haw.) K. Schum.)	Christmas cactus	-	1
Senecio X *hybridus* (Willd.) Regel.	Cineraria	5	1
Sinningia speciosa (Lodd.) Harn.	Gloxinia	10	4
Stephanotis floribunda Brongn.	Stephanotis	1	4
Tagetes patula L.	Marigold	1	-
Yucca baccata L. (= *Hesperoyucca* (Engelm.)Bak.)	Yucca	-	2
Zinnia elegans Jacq.	Zinnia	-	1
Total		80	47

[1] Tomato spotted wilt virus infection determined on the bases of ELISA and bioassay

Turf / Gazon

Crop/Culture: Turf Grasses

Location/Emplacement: Saskatchewan

Title/Titre: SURVEY OF GOLF COURSES FOR WINTER INJURY IN 1989.

Name and Agency/ Nom et Organisation:
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METHODS: Twenty-five golf courses throughout Saskatchewan were examined in early spring (02 April - 16 May) for damage due to snow molds and low-temperature/ desiccation injury. At least three greens and two fairways were examined at each location. Disease severity was rated on a five point scale; None, Trace < 1% of plants killed, Slight = 1-10%, Moderate = 11-25%, Severe > 25%. Identification of the cause of injury was based on symptoms.

RESULTS AND COMMENTS: Snow mold damage was minimal on golf courses in Saskatchewan in 1989. Slight to moderate desiccation and low-temperature injury was observed on greens at almost all locations. In the northeastern grainbelt, an unusually late snow cover left greens open to drying winds and low-temperature until mid-winter. In general, injury was most severe on Poa annua turf. One course in the northwest suffered severe freezing injury to several greens when a severe cold snap occurred shortly after the greens were irrigated in early spring.

On greens and tees, Coprinus psychromorbidus and Microdochium nivale were found at trace to slight levels at many locations. Green surrounds were more severely affected, with cottony snow mold (C. psychromorbidus) predominant. Damage was moderate to severe in areas where snow accumulated and generally slight in more open areas. Snow mold damage on fairways and other Poa pratensis turf (e.g. domestic lawns) was negligible. No damage caused by Myriosclerotinia borealis or Typhula spp. was noted at any location. Snow cover in the winter of 1988-89 was generally shallow and of short duration throughout the survey region, and this presumably was the factor which limited the extent of snow mold development.

Severe damage caused by Microdochium nivale occurred in plots of Agrostis stolonifera turf on an experimental sand green at Saskatoon. In the fall of 1988, this green had been inoculated with M. nivale, was heavily fertilized with nitrogen and was not treated with fungicide. Several patches of the disease were noted in September 1988, before a permanent snow cover developed. Closely spaced snow fencing resulted in a deep, persistent snow cover and snow mold damage was severe (mean 77%), but spring recovery was rapid.

Crop / Culture: Turf and Lawn Grasses

Location / Emplacement: Manitoba

Title / Titre: TURF AND LAWN GRASS DISEASES DIAGNOSED AT THE MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY IN 1989.

Name and Agency / Nom et Organisation:

PLATFORD, R. G.
Manitoba Agriculture
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R3T 5S6

Methods: Results are based on 165 samples of turf and lawn grass submitted to the Manitoba Agriculture Plant Pathology Laboratory.

Results: In 165 samples of turf and lawn grass samples examined, melting out (*Drechslera poae*) was found in 38, Fairy ring (*Marasmius oreades*) in 25, snow mold (*Coprinus* spp., *Typhula* spp., and *Sclerotinia borealis*) in 9, Fusarium patch (*Fusarium* spp.) in 9, powdery mildew (*Erysiphe graminis*) in 7, anthracnose (*Colletotrichum graminicola*) in 5, red thread (*Laetisaria fuciformis*) in 2 creeping red fescue lawns, and pythium blight (*Pythium* spp.) in 2 samples. Environmental stress from drought was the cause of damage in 18 samples. In 50 samples the main cause of injury was insects rather than disease.

Forest trees / Arbres forestiers

Crop / Culture: Elm

Location / Emplacement: Manitoba

Title / Titre: Incidence of Dutch Elm Disease in Manitoba in 1989

Name and Agency / Nom et Organisation:
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METHODS: Results are based on 1,987 samples of American elm, *Ulmus americana* and 93 Siberian elm *Ulmus pumila* submitted to the Plant Pathology Laboratory from a survey conducted by the Manitoba Department of Natural Resources. Trees were selected for sampling and submission to the laboratory on the basis of presence of wilted brown leaves and internal brown staining of the cambium. All samples submitted were cultured on potato dextrose agar medium and incubated for 7 days at 20°C. Fungal identifications were done after 7 days.

Results: There were 2,080 elm trees showing symptoms of leaf wilt and vascular staining sampled in Manitoba in the 1989 survey, 1,987 American elm (*Ulmus americana*) and 93 Siberian elm (*Ulmus pumila*). Branch samples were submitted to the Manitoba Agriculture Plant Pathology Laboratory for culturing. The results indicated that (1,828) 92% of American elms sampled were infected with Dutch Elm Disease (DED) caused by *Ophiostoma ulmi* (*Ceratocystis ulmi*) and 2% of Siberian elm. The results of the survey are presented in Table 1. Tree removals are also included as this indicates the real impact of DED in the areas sampled. In many areas where DED is prevalent,only a few samples are taken to confirm presence of DED,and surrounding elms with similar symptoms or trees with more than 50% of the crown dead are marked for removal. The sampling results do not give a full indication of the impact of DED in rural Manitoba as sampling and tree removals are concentrated in cities, towns and municipal parks in areas which have a cost sharing agreement with the Manitoba Department of Natural Resources.

There was a dramatic increase of DED in the Winnipeg area with 1,156 trees confirmed versus 811 in 1988,but more importantly,there were 10,860 trees marked for removal compared to 5,129 in 1988 for an increase of 112%. The areas that showed that greatest increase in numbers of diseased trees were in St. Boniface/ St. Vital with a 169% increase and Assiniboine Park/Fort Garry with a 146% increase. In both of these areas the majority of DED infected trees were along the Red River,and in Assiniboine/Fort Garry along the west side of the Red River and Assiniboine River. Once DED becomes established in native stands of elms along rivers it is very difficult to control. In contrast,the trees in Winnipeg Centre/Fort Rouge are primarily boulevard and private residential owner trees. In this area there has,over the past 10 years, been very little increase in the incidence of DED.

The disease control program has been very successful in planted urban areas as opposed to native stands of trees along streams and rivers. As in 1988 there were large numbers of elms removed in the buffer zones surrounding Winnipeg. In 1989, 3,830 trees were marked for removal in Ritchot municipality south of Winnipeg along the Red River, compared to 2,809 in 1988. However in 1987 there were 4,367 trees removed in Ritchot municipality,so there has not been a significant increase in tree removals,but the disease has remained at very high levels for the last five years. Other areas with high numbers of diseased and hazard trees are the RM of St. Francois Xavier:1,191 (420 in 1988),and RM of Cartier:809 (928 in 1988) both on the Assiniboine River just west of Winnipeg,and the RM's of West and East St. Paul along the Red River north of Winnipeg with a total of 1,063 trees marked for removal (1,340 in 1988). As is apparent from the tree removal numbers in the buffer zones,the incidence of DED remains very high in these river bank elm stands.

There was an increase of 42% in the tree removals in the Brandon area. There was no major expansion of the disease westward towards Saskatchewan. Dutch Elm Disease continues to be a problem in Portage, Carman and Morden in the Central area, Selkirk in the Interlake, St. Anne in the Eastern area and Souris and Brandon in Western Manitoba. Dutch Elm Disease was detected for the first time in Dauphin.

TABLE 1. INCIDENCE OF DUTCH ELM DISEASE IN MANITOBA IN 1989

AREA	TREES SAMPLED		TREES DISEASEDa		PERCENT INFECTED		TREES REMOVED		PERCENT CHANGE
	88	89	88	89	88	89	88	89	
Wpg. Centre/ Fort Rouge	72	95	60	80	83	84	213	266	25
Wpg. St. James/ Assiniboia	60	112	51	106	85	94	379	546	44
Wpg. Lord Selk./ West Kildonan	105	115	87	102	82	89	565	1164	106
Wpg. East Kildonan/ Transcona	231	87	211	71	91	82	692	517	-25
Wpg. St. Boniface/ St. Vital	206	370	186	351	90	95	1231	3313	169
Wpg. Assiniboine Pk/ Fort Garry	234	482	226	446	92	93	2048	5054	146
Winnipeg	908	1261	811	1156	89	92	5129	10860	112
Brandon	45	151	38	126	84	80	1817	2579	42
Interlake (1)	260	128	219	103	84	80	2149	863	60
Central (2)	475	418	428	346	89	83	6160	8932	45
Eastern (3)	58	32	53	20	91	63	432	429	-1
Western (4)	71	128	60	82	85	64	1961	1464	34

(a) Based on confirmation of presence of _Ophiostoma ulmi_ (_Ceratocystis ulmi_) in laboratory cultures

(1) Interlake region includes the City of Selkirk and allareas north of Winnipeg between Lake Manitoba and Lake Winnipeg

(2) Central region includes the town of Portage la Prairie and the area south to the United States border and east to the Red River

(3) Eastern region includes all area east of the Red River to the Ontario border.

(4) Western region includes area west of Portage la Prairie to the Saskatchewan border excluding the City of Brandon.

Crop / Culture: Lodgepole pine

Location / Emplacement: Cariboo Forest Region
British Columbia

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Williams Lake, B.C. V2G 1R8

Title / Titre: Incidence of Gall Rust and Blister Rust on Young Lodgepole Pine.

Methods: In 1989, 31 sites of lodgepole pine (*Pinus contorta* var. *latifolia*) were surveyed for incidence of western gall rust (*Endocronartium harknessii*) and blister rust (stalactiform blister rust, *Cronartium coleosporiodes*, and comandra blister rust, *C. comandrae*). The sites included plantations of 10 to 20 years age, spaced stands, and natural stands scheduled to be spaced.

Within each stand parallel transects at 100m spacing were run, and circular plots (radius 3.99m) were established at 50m intervals. All pine trees within the plots were counted and examined.

Where trees were infected with western gall rust, the location on the tree and type of infection were noted. Stem galls were aged by counting the whorls from the top of the tree down to the gall. For trees infected with blister rust, the location and the size of the infected area were recorded.

Because of the similarity of stalactiform and comandra blister rust cankers, occurrences were recorded only as "blister rust".

Incidence (per cent trees infected) was compared for rust, for stand treatment, stand density, and biogeoclimatic zone. The age of stem galls in planted stands was compared to the overall age of the stand to estimate the incidence of gall rust on nursery stock.

The survey was undertaken as a Biology Co-operative program between Simon Fraser University and the Ministry of Forests.

Results: Incidence of western gall rust was highest on trees in planted stands at 14 per cent (%), followed by spaced stands (5.5%), and natural stands (4.5%). Branch galls occurred on 71% of trees in the spaced stands, 54% in planted stands, and 52% in natural stands.

Tree mortality associated with stem galls was 8.5% in 11 of the 31 stands surveyed. For all stands, mortality caused by western gall rust was 3.75%. Mortality was greatest in natural stands (1.2%), followed by planted stands (0.75%). Incidence of gall rust appeared higher in moister, cooler biogeoclimatic zones than in the very dry to dry regions.

The overall incidence of blister rust was 0.51%. Incidence was highest in spaced stands (0.95%), followed by natural stands (0.47%), and planted stands (0.37%). In contrast to western gall rust, the majority of infections were on the bole. The average length of bole lesions was 0.24m.

Blister rust incidence appeared slightly higher in the dry to moist regions, but did not differ noticeably with differences in stand density.

Comments: The higher incidence (14%) of western gall rust stem infection in planted stands could be attributed to a variety of factors such as faster growth and more susceptible shoot tissue, or to planting of trees that are genetically more susceptible.

In the spaced, natural stands, gall rust incidence was similar to that in unspaced natural stands, but the fewer stem infections in the spaced stands indicated that the spacing had removed stem infected trees.

Although stem infection and tree mortality were noticeably greater in natural stands, the effects should be minimal because these stands have more stems per hectare, and losses probably will have little effect on stand yield at harvest time.

The low incidence of blister rust (0.51%) could be attributed to a low occurrence of the alternate hosts, Indian paintbrush (*Castilleja* spp.) and comandra (*Comandra* spp.).

Although the levels of blister rust were too low to discern any definite trends, the incidence was higher in spaced stands as reported previously by Navratil and Bella (USDA Forest Service, Gen. Tech. Rep. INT-243, 1988) and by van der Kamp and Spence (Forestry Chron. 63:334-339, 1987).

Crop / Culture: Spruce and Pine

Location / Emplacement: Manitoba

Title / Titre: DISEASES OF SPRUCE AND PINE DETECTED IN SAMPLES SUBMITTED TO THE MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY IN 1989.

Name and Agency / Nom et Organisation:

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Methods: One hundred and eighteen samples of spruce trees, and 20 samples of pine were examined for presence of disease.

Results:

Spruce: Cytospora canker (*Cytospora* sp.) was found in 14 samples, needle cast (*Rhizosphaera kalkhoffii*) in 8. In 48 samples, environmental stress including drought and winter injury was the cause of damage as evident by browning of needles. In 8 samples nutrient deficiencies, iron and nitrogen, were the problem. In addition to damage caused by disease, insect injury was the problem diagnosed in 40 samples.

Pine: In 20 samples of pine, needle cast (*Cyclaneusma* spp.) was detected in 5 samples, and seedling damping off (*Fusarium* spp.) was detected in 1 sample. Apart from diseases, insect injury was the problem diagnosed in 3 samples. Environmental stress was the problem detected in 11 samples.

Crop / Culture: Shade Trees

Location / Emplacement: Manitoba

Title / Titre: DISEASE OF SHADE TREES AND SHELTER BELT TREES DIAGNOSED IN SAMPLES SUBMITTED TO THE MANITOBA AGRICULTURE PLANT PATHOLOGY LABORATORY

Name and Agency / Nom et Organisation:

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Methods: Twenty-two samples of ash, 15 basswood, 50 birch, 42 maple, 22 oak, 44 poplar, 4 russian olive submitted to the Plant Pathology Laboratory were examined for disease.

Results:

Ash: Of the 22 samples of ash, 2 were found to be affected by anthracnose (Gloeosporium aridum), 1 with cytospora canker (Cytospora chrysoperma) and 19 with environmental stress.

Basswood: In the 15 samples of basswood, 8 showed cytospora canker (Cytospora spp.), 1 root rot (Fusarium sp.) and 6 environmental stress.

Birch: In 50 samples of birch, 44 were diagnosed as being affected by birch dieback, a complex of drought, nutrient stress and bronze birch borer insect damage; 5 showed nutrient deficiency symptoms and 1 herbicide damage.

Maple: In 42 samples of maple, 9 showed cytospora canker (Cytospora spp.) and 33 environmental stress.

Oak: In 22 samples of Bur oak 9 showed oak decline caused by a complex of environmental stress and Armillaria root rot (Armillaria mellea), 3 showed anthracnose (Gnomonia quercina). In addition to disease, 5 samples showed herbicide drift injury and 5 insect damage.

Poplar: Of 44 samples of poplar 23 showed cytospora canker (Cytospora chrysosperma), 9 pollacia shoot blight (Venturia spp.), 4 septoria leaf spot (Septoria spp.), 1 leaf rust (Melampsora spp.), 1 hypoxylon canker (Hypoxylon mammatum), 1 slime flux (mechanical injury and bacterial fermentation), 1 powdery mildew (Uncinula adunca) and 4 were affected by herbicide drift.

Russian Olive: In 4 samples of Russian olive, 2 showed Phomopsis canker (Phomopsis arnoldiae), 1 verticillium wilt (Verticillium spp.) and 1 sample showed symptoms of environmental stress.

Instructions to authors

Articles and brief notes are published in English or French. Manuscripts (original and one copy) and all correspondence should be addressed to Dr. H.S. Krehm, Research Program Service, Research Branch, Agriculture Canada, Ottawa, Ontario K1A 0C6.

Manuscripts should be concise and consistent in style, spelling, and use of abbreviations. They should be typed, double spaced throughout, on line-numbered paper. All pages should be numbered, including those containing abstract, tables, and legends. For general format and style, refer to recent issues of the *Survey* and to *CBE Style Manual* 3rd ed. 1972. American Institute of Biological Sciences, Washington, D.C. Whenever possible, numerical data should be in metric units (SI) or metric equivalents should be included. Square brackets may be used to enclose the scientific name of a pathogen, following the common name of a disease, to denote cause.

Titles should be concise and informative providing, with the Abstract, the key words most useful for indexing and information retrieval.

Abstracts of no more than 200 words, in both English and French, if possible, should accompany each article.

Figures should be planned to fit, after reduction, one column (maximum 84 × 241 mm) or two columns (maximum 175 × 241 mm), and should be trimmed or marked with crop marks to show only essential features. Figures grouped in a plate should be butt-mounted with no space between them. A duplicate set of unmounted photographs and line drawings is required. Figures should be identified by number, author's name, and abbreviated legend.

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Les articles et les communiqués sont publiés en anglais ou en français. Les manuscrits (l'original et une copie) et toute la correspondance qui s'y rapporte doivent être envoyés à D^r H.S. Krehm, Service des programmes de recherche, Direction de la recherche, ministère de l'Agriculture du Canada, Ottawa, (Ontario) K1A 0C6.

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Les figures doivent pouvoir, après réduction, remplir une colonne (maximum 84 × 241 mm) ou deux colonnes (maximum 175 × 241 mm) et devraient être taillées ou montrer les parties essentielles à garder. Les figures groupées sur une même planche doivent être montées côte à côte, sans intervalle. L'article doit être accompagné d'un double des photographies non montées et des graphiques. Les figures doivent être numérotées, porter le nom de l'auteur et une légende abrégée.

Les tableaux doivent être numérotés en chiffres arabes et avoir un titre concis. Ils ne devraient pas avoir de lignes verticales. Les renvois doivent être identifiés par un signe typographique particulier (* † § # ¶ ** ††) surtout lorsqu'il s'agit de nombres.

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