



**2004**

**THE CANADIAN PHYTOPATHOLOGICAL SOCIETY  
CANADIAN PLANT DISEASE SURVEY**

**DISEASE HIGHLIGHTS**

**SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE**

**INVENTAIRE DES MALADIES DES PLANTES AU  
CANADA**

**APERÇU DES MALADIES**

The Society recognizes the continuing need to publish plant disease surveys to document plant pathology in Canada and to benefit federal, provincial and other agencies in planning research and development on disease control.

La Société estime qu'il est nécessaire de publier régulièrement les résultats d'études sur l'état des maladies au Canada afin qu'ils soient disponibles aux phytopathologistes et qu'ils aident les organismes fédéraux, provinciaux et privés à planifier la recherche et le développement en lutte contre les maladies.

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## Canadian Plant Disease Survey

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## Inventaire des maladies des plantes au Canada

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<b>Contents:</b>	<b>DISEASE HIGHLIGHTS-</b> 2003 GROWING SEASON (+ earlier years for historical significance)
	2 Contents/Sections
	3 2004 section editors/ directeurs de section- 2004
	4 Index- Titles and authors/Titres et auteurs
<b>Sections:</b>	7 Diagnostic laboratories / Laboratoires diagnostiques
	7 - British Columbia
	14 - Saskatchewan
	18 - Manitoba
	28 - Québec
	43 Cereals / Céréales
	86 Forages/ Plantes fourragères
	88 Oilseeds and Special Crops / Oléagineux et cultures spéciales
	113 Vegetables / Légumes
	--- Fruit, Nuts and Berries, Ornamentals and Turfgrass / Fruits, fruits à écale et baies, plantes ornementales et gazon
	118 Forest Trees/Arbres forestiers
	135 2004 Author index (alphabetical)/Index d'auteurs (alphabétique)-2004
	136 List of figures/Liste de figures

The *Canadian Plant Disease Survey* is a periodical of information and record on the occurrence and severity of plant diseases in Canada and the estimated losses from diseases.

Authors who wish to publish articles and notes on other aspects of plant pathology are encouraged to submit this material to the scientific journal of their choice, such as the *Canadian Journal of Plant Pathology and Phytoprotection*

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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.

Les auteurs qui veulent publier des articles et des notes sur d'autres aspects de la phytopathologie sont invités à soumettre leurs textes à la revue scientifique de leur choix, par exemple à la *Revue canadienne de phytopathologie* ou à *Phytoprotection*.

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**CANADIAN PLANT DISEASE SURVEY INDEX - AUTHORS AND TITLES****DIAGNOSTIC LABORATORIES / LABORATOIRES DIAGNOSTIQUES**

V. Joshi. Diseases Diagnosed on Commercial Crops Submitted to the BCMAFF Plant Diagnostic Laboratory in 2003	7
G. Holzgang and P.G. Pearse. Diseases Diagnosed on Crop Sample Submitted to the Saskatchewan Agriculture, Food and Rural Revitalization Crop Protection Laboratory in 2003	14
M.L. Desjardins, D.A. Kaminski, P.R. Northover and N. Selvanathan. 2003 Manitoba Crop Diagnostic Centre Laboratory Submissions	18
G. Gilbert, D. Hamel and M. Lacroix. Diseases Diagnosed on Commercial Crops Submitted to the MAPAQ Diagnostic Laboratory in 2003	28

**CEREALS / CÉRÉALES**

P.G. Pearse, G. Holzgang, C.L. Harris and M.R. Fernandez. Fusarium Head Blight in Barley in Saskatchewan in 2003	43
A. Tekauz, J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini and D. Schultz. 2003 Survey for Fusarium Head Blight of Barley in Manitoba	45
A. Tekauz, J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini and D. Schultz. Survey for Leaf Spot Diseases of Barley in Manitoba in 2003	47
A.G. Xue, K.M. Ho, Y. Chen and F. Sabo. Diseases of Barley in Central and Eastern Ontario in 2003	48
D.D. Orr and T.K. Turkington. 2003 Disease Survey in Central Alberta	50
T. Fetch and K. Dunsmore. Stem Rusts of Cereals in Western Canada in 2003	52
F. Fauteux, J.G. Menzies, F. Matheson, and C. Saramaga. Cereal Smut Surveys, 2003	53
S. Haber and R. Kurtz. Cereal Virus Disease Situation in Manitoba in 2003	54
S. Rioux, D. Dion et A. Comeau. Les Maladies des Céréales à Paille Présentes au Québec en 2003	55
D. A. Presello, X. Zhu, L.M. Reid, T. Woldemariam and D.E. Mather. Occurrence of Corn Virus Diseases in Ontario and Quebec from 1999 to 2001	57
X. Zhu, L. M. Reid, T. Woldemariam, A. Tenuta and P. Lachance. Survey of Corn Diseases and Pests in Ontario and Québec in 2003	61
J. Chong. Crown Rust of Oat in Western Canada in 2003	65
A. Tekauz, J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini and D. Schultz. Fusarium Head Blight of Oat in Manitoba in 2003	66
A. Tekauz, J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini and D. Schultz. Leaf Spot Diseases of Oat in Manitoba in 2003	67
T.K. Turkington, D.D. Orr, A. Kuzyk, R. Dunn, K. Kumar, K. Xi, B. Chapman, J. Calpas and S. Ali. Fusarium Head Blight Survey of Wheat, Alberta 2003	68
P.G. Pearse, G. Holzgang, C.L. Harris and M.R. Fernandez. Fusarium Head Blight in Common and Durum Wheat in Saskatchewan in 2003	70

M.R. Fernandez and P. G. Pearse. Leaf Diseases of Common and Durum Wheat in Saskatchewan in 2003	72
J. Gilbert, A. Tekauz, R. Kaethler, U. Kromer, K. Morgan, K. Slusarenko, E. Mueller and T. Unrau. 2003 Survey of Fusarium Head Blight of Spring Wheat in Manitoba	74
J. Gilbert, A. Tekauz, R. Kaethler, U. Kromer, K. Morgan, E. Mueller, K. Slusarenko and T. Unrau. Leaf Spot Diseases of Spring Wheat in Manitoba in 2003	75
B. McCallum, J. Hoepfner and B. Mulock. Leaf Rust and Stripe Rust of Wheat in Manitoba and Eastern Saskatchewan in 2003	77
A.G. Xue, H.D. Voldeng, F. Sabo and Y. Chen. Fusarium Head Blight of Spring Wheat in Eastern Ontario in 2003	78
A.G. Xue, H. D. Voldeng, Y. Chen and F. Sabo. Diseases of Spring Wheat in Eastern Ontario in 2003	80
A. Tekauz, E. Mueller, M. Beyene, M. Stulzer and D. Schultz. 2003 Survey of Fusarium Head Blight of Winter Wheat in Manitoba	82
A. Tekauz, E. Mueller, M. Beyene, M. Stulzer and D. Schultz. Leaf Spot Diseases of Winter Wheat in Manitoba in 2003	83
A.G. Xue, A. Tenuta, Y. Chen and F. Sabo. Diseases of Winter Wheat in Ontario in 2003	84
 <b>FORAGES / PLANTES FOURRAGÈRES</b>	
B.D. Gossen, J.J. Soroka, and K. Bassendowski. Foliar Disease Severity and Blossom Blight of Alfalfa in Saskatchewan	86
 <b>OILSEEDS AND SPECIAL CROPS / OLÉAGINEUX ET CULTURES SPÉCIALES</b>	
H. C. Huang, R. S. Erickson and T. F. Hsieh. Bacterial Wilt and Pink Seed of Dry Bean in Western Canada in 2002	88
L. Yager, R.L. Conner, D.L. McLaren and M. Groom. Diseases of Field Bean in Manitoba in 2003	90
R.M. Lange and C. Franke. Fusarium Wilt of Canola in Alberta and Saskatchewan in 2003	92
P.G. Pearse, R.A.A. Morrall, H.R. Kutcher, J.M. Yasinowski, R.K. Gugel, K.A. Bassendowski and L.E. Cowell. Survey of Canola Diseases in Saskatchewan, 2003	96
D.L. McLaren, R.G. Plattford, J.L. Lamb and D.A. Kaminski. Canola Diseases in Manitoba: Distribution, Prevalence and Incidence in 2003	98
K. Y. Rashid, M. L. Desjardins, S. Duguid and D. A. Kaminski. Diseases of Flax in Manitoba and Saskatchewan in 2003	100
S. Banniza, J.A. Parmelee, R.A.A. Morrall, A. Tullu and C.J. Beauchamp. First Record of Powdery Mildew on Lentil in Canada.	102
K.F. Chang, R. Bowness, S.F. Hwang, G.D. Turnbull, R.J. Howard and S.F. Blade. The Occurrence of Field Pea Diseases in Central and Southern Alberta in 2003	104
D.L. McLaren, R.L. Conner, L Yager and M. Groom. Diseases of Field Pea in Manitoba in 2003	107
R.A.A. Morrall, B. Carriere, C. Pearse, D.Schmeling and L. Thomson. Seed-Borne Pathogens of Chickpea, Lentil and Pea in Saskatchewan in 2003	109

K. Y. Rashid, M.L. Desjardins, and D. A. Kaminski. Diseases of Sunflower in Manitoba in 2003 111

### **VEGETABLES / LÉGUMES**

P.S. Bains, R.J. Howard, M. Mirza, N.A. Savidov, J.A. Hughes, S.L.I. Lisowski and P.A. Cote. Survey for Root and Stem Diseases in Greenhouse Cucumber in Alberta in 2003 113

H.W. Platt and A. MacPhail. Cross-Canada Late Blight Surveys in 2001 and 2002 115

### **FOREST TREES / ARBRES FORESTIERS**

M.S. Melzer and G.J. Boland. Survey of American Chestnut and Chestnut Blight in Ontario 118

J.A. Muir, L. Bedford, M. Grismer and L. Stordeur. Incidence of Comandra Blister Rust and Mortality of Lodgepole Pine in a Site Preparation Trial at Bednesti Lake, Central British Columbia, from 1988 to 2002 120

V. Vujanovic. Increased Incidence of Cryptocline Needle Disease on Pacific Yew 123

K.J. Harrison, G.A. Smith, J.E. Hurley and A.W. MacKay. *Ophiostoma tetropii* as a Detection Tool for the Brown Spruce Longhorn Beetle, *Tetrophium fuscum* (Fabr.) In Halifax, Nova Scotia 125

J.A. Muir. Incidental Surveys of Hemlock Dwarf Mistletoe in Coastal British Columbia 127

J. P. Doyon, E. Allen, J.G. Champagne, B. Callan and J.A. Bérubé. Exotic Fungal Pests Isolated from Foreign Wood Dunnage and Wood Packaging 133

## Diagnostic Laboratories / Laboratoires diagnostiques

**CROP:** Commercial crops - Diagnostic Laboratory Report  
**LOCATION:** British Columbia

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**TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BCMAFF PLANT DIAGNOSTIC LABORATORY IN 2003.**

**METHODS:** The BCMAFF Plant Diagnostic Laboratory provides diagnoses and control recommendations on diseases and disorders of commercial agricultural crops grown in British Columbia. The following data reflect samples submitted to the laboratory by the ministry staff, growers, agribusinesses, parks boards, and Master Gardeners. Diagnoses were accomplished by microscopic examination, culturing onto artificial media, biochemical identification of bacteria using BIOLOG®, serological testing of viruses and bacteria with micro-well and membrane based enzyme linked immunosorbent assay (ELISA), electron microscope identification of virus particles and the virus inclusion body technique. Molecular techniques were used for identification of some strain specific diagnoses. Some specimens were referred to other laboratories for identification or confirmation of the diagnosis.

**RESULTS AND COMMENTS:** In 2003 there were fewer than normal disease problems mainly due to unusual weather conditions. The weather was very dry during the peak-cropping season and many fungal and bacterial organisms did not establish and cause crop damage. However many drought related problems were observed. No quarantine problems were identified. Two new greenhouse vegetable diseases (powdery mildew on pepper and pepino mosaic virus in tomato) were observed. Summaries of the diseases and their causal agents diagnosed on commercial crops are presented in Tables 1-10 by crop category. The total number of submissions for each crop category is listed at the bottom of each table. Problems not listed include: abiotic problems such as nutritional stress, pH imbalance, water stress, drought stress, physiological response to growing conditions and genetic abnormalities; environmental and chemical damage; poor samples; insect-related injury and damage where no conclusive causal factor was identified.

**Table 1.** Summary of diseases diagnosed on **field crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Alfalfa	Crown rot	<i>Rhizoctonia solani</i>	1
<i>Dactylis glomerata</i>	Leaf spot	<i>Fusarium</i> sp.	1
Grass	Rust	<i>Puccinia</i> sp.	1
DISEASE SAMPLES			3
ABIOTIC AND OTHER DISORDERS			1
TOTAL SUBMISSIONS			<u>4</u>

**Table 2.** Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
<i>Antirrhinum</i>	Crown rot	<i>Fusarium</i> sp.	1
	Stem canker	<i>Botrytis cinerea</i>	1
<i>Bracteantha bracteata</i>	Leaf blight/spot	<i>Botrytis cinerea</i>	1
<i>Campanula</i>	Basal rot	<i>Rhizoctonia solani</i>	1
<i>Celosia</i>	Surface mould	<i>Alternaria</i> and <i>Cladosporium</i> spp.	1
<i>Celosia cristata</i>	Fusarium wilt	<i>Fusarium</i> sp.	1
<i>Chrysanthemum</i> sp	Stem canker	<i>Ascochyta chrysanthemi</i>	1
<i>Cyclamen</i>	Necrotic spot	Impatiens necrotic spot virus (INSV)	1
<i>Delphinium</i>	Grey mould	<i>Botrytis cinerea</i>	2
<i>Dianthus</i>	Root rot	<i>Pythium/Phytophthora</i> spp.	1
<i>Dianthus caryophyllus</i>	Leaf spot	<i>Alternaria</i> sp.	1
<i>Elymus</i>	Rust	<i>Puccinia</i> sp.	1
<i>Euphorbia pulcherrima</i>	Black root rot	<i>Thielaviopsis basicola</i>	1
	Root rot	<i>Pythium/Phytophthora</i> spp.	1
	Soft rot	<i>Erwinia carotovora</i> subsp. <i>carotovora</i>	1
<i>Gerbera</i>	Crown rot	<i>Botrytis cinerea</i>	1
<i>Helianthus annuus</i>	White smut	<i>Entyloma polysporum</i>	1
<i>Hemorocallis</i>	Leaf spot	<i>Alternaria</i> and <i>Phyllosticta</i> spp.	1
	Sheath blight	<i>Colletotrichum</i> sp.	1
<i>Lupinus</i>	Downy mildew	<i>Peronospora trifoliorum</i>	1
<i>Nephrolepis biserrata</i>	Anthracnose	<i>Colletotrichum</i> sp.	1
	Downy mildew	<i>Peronospora</i> sp.	1
<i>Osteospermum</i>	Stem rot	<i>Erwinia carotovora</i>	1
<i>Petunia</i>	Root rot	Oomycete	1
<i>Phalaenopsis</i>	Anthracnose	<i>Gloeosporium</i> sp.	1
	Crown rot	<i>Fusarium oxysporum</i>	1
	Leaf spot	Suspected cymbidium mosaic virus	1
	Root rot	<i>Rhizoctonia solani</i>	4
<i>Rosa</i>	Black spot	<i>Diplocarpon rosae</i>	1
	Crown canker	<i>Cylindrocladium</i> sp.	1
<i>Tulipa</i>	Root rot	<i>Pythium/Phytophthora</i> spp.	1
<i>Viola</i>	Leaf spot	<i>Cylindrocarpon</i> sp.	1
<i>Zantedeschia</i>	Rhizome rot	<i>Rhizoctonia solani</i>	1
DISEASE SAMPLES			37
ABIOTIC AND OTHER DISORDERS			37
TOTAL SUBMISSIONS			<u>74</u>

**Table 3.** Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Pepper	Fruit rot	<i>Fusarium subglutinans</i>	1
	Fusarium stem rot	<i>Fusarium</i> sp.	1
	Root rot	<i>Pythium/Phytophthora</i> spp.	1
Tomato	Bacterial canker	<i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i>	1
	Pepino Mosaic Virus	Pepino mosaic virus	3
DISEASE SAMPLES			7
ABIOTIC AND OTHER DISORDERS			19
TOTAL SUBMISSIONS			<u>26</u>

**Table 4.** Summary of diseases diagnosed on **herbaceous perennial** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
<i>Carex secta</i>	Leaf spot	<i>Septoria</i> sp.	1
<i>Carex</i> sp.	Rust	<i>Puccinia</i> sp.	1
<i>Cyperus alternifolius</i>	Root rot	<i>Pythium/Phytophthora</i> spp.	1
<i>Dianthus</i>	Basal anthracnose	<i>Colletotrichum</i> sp.	1
<i>Gaillardia</i>	Downy mildew	<i>Peronospora/Plasmopara</i> spp.	1
<i>Hosta</i>	Botrytis blight	<i>Botrytis cinerea</i>	1
	Crown rot	<i>Fusarium oxysporum</i>	1
<i>Narcissus</i>	White mold	<i>Ramularia</i> sp.	2
<i>Polemonium</i>	Powdery mildew	<i>Erysiphe cichoracearum</i>	1
<i>Rosamarinus</i>	Stem and leaf blight	<i>Botrytis cinerea</i>	1
<i>Tulipa</i>	Basal rot	<i>Fusarium</i> sp.	2
	Black rot	<i>Sclerotinia bulborum</i>	1
	Blue mold	<i>Penicillium</i> sp.	2
	Nematode damage	<i>Ditylenchus</i> sp.	1
DISEASE SAMPLES			17
ABIOTIC AND OTHER DISORDERS			5
TOTAL SUBMISSIONS			<u>22</u>

**Table 5.** Summary of diseases diagnosed on **small fruit** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Blueberry	Anthraxnose	<i>Colletotrichum</i> sp.	1
	Bacterial blight	<i>Pseudomonas syringae</i>	9
	Blossom blight	<i>Botrytis cinerea</i>	1
	Leaf mottling	Blueberry mosaic virus	1
	Blueberry Scorch Virus	Blueberry scorch virus*	5
	Botrytis blight	<i>Botrytis cinerea</i>	3
	Crown gall	<i>Agrobacterium tumefaciens</i>	1
	Foliar blight	<i>Botrytis cinerea</i>	1
	Foliar blight	<i>Godronia cassandrae</i>	1
	Fruit rot	<i>Botrytis cinerea</i>	1
	Godronia canker	<i>Godronia cassandrae</i>	2
	Root rot	<i>Phytophthora</i> sp.	1
	Root rot	Oomycete	1
	Tip dieback	<i>Botrytis cinerea</i>	2
	Tip die-back	<i>P. syringae</i>	1
	Twig blight	<i>Botrytis cinerea</i>	1
	Cranberry	Bitter rot	<i>Colletotrichum</i> sp.
Black rot		<i>Allantophomopsis</i> sp.	1
End rot		<i>Godronia cassandrae</i>	1
Root rot		<i>Phytophthora</i> sp./waterlogged soil	1
Twig blight		<i>Colletotrichum</i> sp.	1
Upright dieback		<i>Phomopsis</i> sp.	3
Raspberry	Fire blight	<i>Erwinia amylovora</i>	1
	Raspberry Bushy Dwarf	<i>Raspberry Bushy Dwarf Virus</i>	1
	Root lesions	<i>Pratylenchus</i> sp.	1
	Root rot	<i>Phytophthora fragariae</i>	2
	Root rot	<i>Phytophthora</i> sp.	1
Saskatoon	Fruit rot	<i>Monilinia, Cladosporium and Penicillium</i> spp.	1
Strawberry	Rhizoctonia canker	<i>Rhizoctonia</i> sp.	1

\* The total number of samples with blueberry scorch virus in BC was significantly higher than the numbers presented in this report. The numbers presented here indicate the positive samples from lab submissions only.

DISEASE SAMPLES	40
ABIOTIC AND OTHER DISORDERS	64
TOTAL SUBMISSIONS	<u>104</u>

**Table 6.** Summary of diseases diagnosed on **special crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

<b>CROP</b>	<b>DISEASE</b>	<b>CAUSAL/ASSOCIATED ORGANISM</b>	<b>NO.</b>
Basil	Vascular wilt	<i>Fusarium oxysporum</i>	1
Garlic	Neck rot	<i>Botrytis allii</i>	1
Ginseng	Root rot	<i>Cylindrocarpon destructans</i>	1
	Root rot	<i>Rhizoctonia solani</i>	2
	Root rot	<i>Rhizoctonia</i> sp.	1
	Rusty root	<i>Cylindrocarpon destructans</i>	1
Rosemary	Web blight	<i>Rhizoctonia solani</i>	1
Wasabi	Stem rot	<i>Phoma wasabiae</i>	1
DISEASE SAMPLES			9
ABIOTIC AND OTHER DISORDERS			0
TOTAL SUBMISSIONS			<u>9</u>

**Table 7.** Summary of diseases diagnosed on **tree fruit, grape and nut crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

<b>CROP</b>	<b>DISEASE</b>	<b>CAUSAL/ASSOCIATED ORGANISM</b>	<b>NO.</b>
Apple	European canker	<i>Nectria galligena</i>	2
Cherry	Bacterial canker	<i>Pseudomonas syringae</i> pv. <i>syringae</i>	3
	Shot hole	<i>Wilsonomyces carpophilus</i>	1
Grape	Grape decline	<i>Pythium/Phytophthora</i> spp.	1
	Powdery mildew	<i>Uncinula necator</i>	1
	Fire blight	<i>Erwinia amylovora</i>	3
Pear	Fire blight	<i>Erwinia amylovora</i>	2
Prunus sp.	Bacterial canker	<i>Pseudomonas syringae</i> pv. <i>syringae</i>	2
DISEASE SAMPLES			15
ABIOTIC AND OTHER DISORDERS			19
TOTAL SUBMISSIONS			<u>34</u>

**Table 8.** Summary of diseases diagnosed on **turfgrass** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP SITE	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Golf fairway	Rust	<i>Puccinia</i> sp.	1
Golf green	Anthracnose	<i>Colletotrichum graminicola</i>	4
	Basal anthracnose	<i>Colletotrichum graminicola</i>	2
	Basal anthracnose	<i>Colletotrichum</i> sp.	1
	Brown patch	<i>Rhizoctonia solani</i>	1
	Dollar spot	<i>Sclerotinia homoeocarpa</i>	1
	Downy mildew	<i>Sclerophthora</i> sp.	5
	Fairy ring	Basidiomycete	1
	Foliar blight	<i>Leptosphaerulina</i> sp.	1
	Fusarium patch	<i>Microdochium nivale</i>	9
	Leaf and sheath blight	<i>Rhizoctonia zeae</i>	3
	Pink patch	<i>Limonomyces roseipellis</i>	1
	Root rot	<i>Pythium</i> sp.	2
	Yellow patch	<i>Rhizoctonia cerealis</i>	1
Lawn	Anthracnose	<i>Colletotrichum graminicola</i>	1
	Ascochyta foliar blight	<i>Ascochyta</i> sp.	1
	Brown patch	<i>Rhizoctonia</i> sp.	1
	Foliar blight	<i>Curvularia</i> sp.	1
	Take-all patch	<i>Gaeumannomyces graminis</i>	1
Sod	Anthracnose	<i>Colletotrichum graminicola</i>	1
	Ascochyta leaf blight	<i>Ascochyta</i> sp.	2
	Basal anthracnose	<i>Colletotrichum</i> sp.	1
	Leaf and sheath blight	<i>Rhizoctonia zeae</i>	1
	Leaf blight	<i>Leptosphaerulina</i> sp.	1
	Rust	<i>Puccinia</i> sp.	1
Sports field	Fusarium patch	<i>Microdochium nivale</i>	1
DISEASE SAMPLES			46
ABIOTIC AND OTHER DISORDERS			24
TOTAL SUBMISSIONS			<u>70</u>

**Table 9.** Summary of diseases diagnosed on **field vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Asparagus	Crown rot	<i>Fusarium oxysporum</i>	1
Lettuce	Grey mold	<i>Botrytis cinerea</i>	1
	Lettuce drop	<i>Sclerotinia</i> sp.	1
Pea	Root rot	<i>Aphanomyces</i> sp.	1
Pepper	Vascular wilt	<i>Fusarium oxysporum</i>	2
	Vascular wilt	<i>Verticillium dahliae</i>	1
Potato	Black scurf	<i>Rhizoctonia solani</i>	1
	Dry rot	<i>Fusarium solani</i>	2
	Pythium leak	<i>Pythium</i> sp.	1
	Soft rot	<i>Erwinia carotovora</i> subsp. <i>atroseptica</i>	1
Rhubarb	Crop decline	<i>Rhizoctonia</i> sp.	1
	Root rot	<i>Pythium/Phytophthora</i> spp.	1
Squash	Black rot	<i>Didymella bryoniae</i>	1
Zucchini	Vascular wilt	<i>Fusarium</i> sp.	
DISEASE SAMPLES			16
ABIOTIC AND OTHER DISORDERS			20
TOTAL SUBMISSIONS			<u>36</u>

**Table 10.** Summary of diseases diagnosed on **woody ornamental** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2003.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
<i>Abies grandis</i>	Canker	<i>Grovesiella abieticola</i>	1
<i>Acer</i> sp.	Stem canker	<i>Diplodina</i> sp.	1
	Tar spot	<i>Rhytisma</i> sp.	1
	Verticillium wilt	<i>Verticillium</i> sp.	1
<i>Acer palmatum</i>	Twig canker	<i>Phomopsis</i> sp.	1
<i>Acer rubrum</i>	Crown and root rot	<i>Phytophthora</i> sp.	1
<i>Chamaecyparis</i> sp.	Root rot	<i>Phytophthora</i> sp.	1
<i>Chamaecyparis lawsoniana</i>	Black root rot	<i>Thielaviopsis basicola</i>	2
<i>Cornus kousa</i>	Crown canker	<i>Phytophthora</i> sp.	1
<i>Fraxinus</i> sp.	Canker	<i>Diaporthe</i> sp.	1
<i>Galium</i> sp.	Downy mildew	<i>Peronospora</i> sp.	1
<i>Gaultheria</i> sp.	Anthraxnose	<i>Colletotrichum</i> sp.	1
<i>Juglans</i> sp.	White leaf spot	<i>Microstroma juglandis</i>	1
<i>Kalmia</i> sp.	Foliar blight	<i>Phytophthora</i> sp.	1
<i>Malus</i> sp.	Anthraxnose	<i>Cryptosporiopsis curvispora</i>	1
	Fire blight	<i>Erwinia amylovora</i>	4
<i>Picea</i> sp.	Needle cast	<i>Rhizosphaera</i> sp.	1
<i>Picea glauca</i>	Twig dieback	<i>Ceuthospora</i> sp.	1
<i>Pieris</i> sp.	Root rot	<i>Phytophthora/Pythium</i> spp.	2
<i>Populus</i> sp.	Bacterial canker	<i>P. syringae</i> pv. <i>syringae</i>	1
	Leaf spot	<i>Colletotrichum gloeosporioides</i>	1
<i>Pyrus</i> sp.	Fire blight	<i>Erwinia amylovora</i>	1
<i>Rhododendron</i> sp.	Bud damage	<i>Botrytis cinerea</i>	1
	Leaf spot	<i>Alternaria</i> sp.	1
	Leaf spot	<i>Colletotrichum</i> & <i>Phyllosticta</i> spp.	1
	Leaf spot	<i>Phyllosticta</i> sp.	1
	Powdery mildew	<i>Microsphaera</i> or <i>Erysiphe</i> spp.	2
<i>Ribes sanguineum</i>	Crown rot	<i>Phytophthora</i> sp.	1
<i>Rosa</i> sp.	Canker	<i>Coniothyrium</i> sp.	1
<i>Salix</i> sp.	Anthraxnose	<i>Gloeosporium</i> sp.	1
	Bacterial blight	<i>Pseudomonas syringae</i>	1
	Twig canker	<i>Cytospora</i> sp.	1
	Foliar blight	<i>Marssonina salicicola</i>	1
<i>Styrax japonicus</i>	Black root rot	<i>Thielaviopsis basicola</i>	1
<i>Syringa vulgaris</i>	Botrytis blight	<i>Botrytis cinerea</i>	1
<i>Thuja pyramidalis</i>	Root rot	<i>Armillaria</i> sp.	1
	Root rot	<i>Phytophthora</i> sp.	1
<i>Thuja</i> sp.	Foliar blight	<i>Kabatina thujae</i>	1
<i>Tsuga canadensis</i>	Botrytis blight	<i>Botrytis cinerea</i>	1
	Foliar blight	<i>Sphaeceloma</i> sp.	1
DISEASE SAMPLES			46
ABIOTIC AND OTHER DISORDERS			67
TOTAL SUBMISSIONS			<u>113</u>

**CROP:** Commercial crops – Diagnostic Laboratory Report  
**LOCATION:** Saskatchewan

**NAME AND AGENCY:**

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**TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN AGRICULTURE, FOOD AND RURAL REVITALIZATION CROP PROTECTION LABORATORY IN 2003**

**METHODS:** Saskatchewan Agriculture, Food and Rural Revitalization's (SAFRR) Crop Protection Laboratory provides diagnostic services and recommendations for crop health problems to the agricultural industry. Services include disease, insect, and weed identification and testing of weeds for herbicide resistance. In addition, the SAFRR Crop Protection Laboratory provides a Dutch elm disease (DED) program to the general public, under which American elms are screened for DED. Samples are submitted to the Crop Protection Laboratory by SAFRR extension agrologists, growers, agribusiness, and home gardeners. Disease diagnosis is accomplished by microscopic examination, culturing on artificial media, ELISA testing and BIOLOG .

**RESULTS:** Between April 1 and November 1, 2003 the Crop Protection Laboratory received a total of 944 samples of which 71% were for disease diagnosis; 59% of these were American elm submitted for DED testing. Categories of highest to lowest volume (excluding the DED samples) were: oilseeds (28%), cereals (26%), special crops (20%), and forages (12%). Fruit, vegetables, woody ornamentals, herbaceous ornamentals, turf, and greenhouse crops comprised the remaining 14% of the samples. Summaries of diseases/causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2003 are presented in Tables 1-7 by crop category. There were 392 samples of American elm, submitted under the DED program (Table 8).

**Table 1.** Summary of plant diseases diagnosed on **oilseed crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Canola	Root rot/seedling blight	<i>Fusarium</i> spp./ <i>Rhizoctonia solani</i>	15
	Damping off/neck rot	<i>Pythium</i> spp.	4
	Fusarium wilt	<i>Fusarium avenaceum</i>	3
	Blackleg	<i>Leptosphaeria maculans</i>	2
	Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>	1
	Downy mildew	<i>Peronospora parasitica</i>	1
	Chemical injury		30
	Environmental injury		13
	Nutrient deficiency		1
	Flax/linola	Root rot/seedling blight	<i>Fusarium</i> spp./ <i>Rhizoctonia solani</i>
Chemical injury			6
Environmental injury			3

**Table 2:** Summary of plant diseases diagnosed on **cereal crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Barley	Common root rot/ seedling blight/ prematurity blight	<i>Cochliobolus sativus</i> / <i>Fusarium</i> spp.	7
	Net blotch	<i>Pyrenophora teres</i>	3
	Septoria leaf blotch	<i>Septoria passerinii</i>	1
	Spot blotch	<i>Cochliobolus sativus</i>	1
	Physiological leaf spot		1
	Environmental injury		15
	Chemical injury		9
	Nutrient deficiency		3
	Oat	Leaf blotch	<i>Pyrenophora avenae</i>
Environmental injury			2
Rye	Environmental injury		1
Wheat	Tan spot	<i>Pyrenophora tritici-repentis</i>	5
	Glume blotch/leaf blotch	<i>Septoria nodorum</i>	3
	Common root rot/ seedling blight/ prematurity blight	<i>Cochliobolus sativus</i> / <i>Fusarium</i> spp.	2
	Sooty mold	<i>Alternaria</i> / <i>Cladosporium</i> / <i>Cochliobolus</i>	2
	Black chaff	<i>Xanthomonas translucens</i>	1
	Wheat streak mosaic	Wheat streak mosaic virus	1
	Environmental injury		11
	Chemical injury		6
	Nutrient deficiency		2

**Table 3.** Summary of plant diseases diagnosed on **forage crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Alfalfa	Spring black stem/leaf spot	<i>Phoma medicaginis</i> var. <i>medicaginis</i>	22
	Leptosphaerulina leaf spot	<i>Leptosphaerulina briosiana</i>	8
	Stemphylium leaf spot	<i>Stemphylium botryosum</i>	9
	Root/crown rot	<i>Rhizoctonia solani</i> / <i>Fusarium</i> spp.	5
	Anthracnose	<i>Colletotrichum trifolii</i>	4
	Sclerotinia rot	<i>Sclerotinia sclerotiorum</i>	1
	Chemical injury		1
	Environmental injury		1
	Timothy	Root rot	<i>Fusarium</i> sp.

**Table 4.** Summary of plant diseases diagnosed on **special crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

<b>CROP</b>	<b>DISEASE</b>	<b>CAUSAL AGENT</b>	<b>NO. OF SAMPLES</b>
Bean	<i>Halo blight</i>	<i>Pseudomonas syringae</i> pv. <i>phaseolicola</i>	3
	Root rot	<i>Fusarium</i> sp.	1
Canaryseed	Chemical injury		1
	Chemical injury		1
Caraway	Environmental injury		1
	Root rot/ crown rot	<i>Fusarium</i> sp./ <i>Rhizoctonia</i> sp.	2
Chickpea	Chemical injury		1
	Ascochyta blight	<i>Ascochyta rabiei</i>	1
Lentil	Seedling blight/root rot	<i>Fusarium</i> sp./ <i>Rhizoctonia solani</i>	2
	Root rot/seedling blight	<i>Fusarium</i> spp./ <i>Rhizoctonia solani</i>	11
	Ascochyta blight	<i>Ascochyta lentis</i>	4
	Stem rot	<i>Botrytis cinerea</i>	2
	Stemphylium leaf spot	<i>Stemphylium botryosum</i>	1
	Anthraxnose	<i>Colletotrichum truncatum</i>	1
Millet	Secondary stem rot	<i>Fusarium</i> sp.	1
	Environmental injury		7
	Chemical injury		3
Mustard	Chemical injury		1
	Seedling blight/root rot	<i>Fusarium</i> sp./ <i>Rhizoctonia solani</i>	1
Pea	Root rot/seedling blight	<i>Fusarium</i> sp./ <i>Rhizoctonia solani</i>	12
	Mycosphaerella blight	<i>Mycosphaerella pinodes</i>	2
	Bacterial blight	<i>Pseudomonas syringae</i> pv. <i>pisi</i>	1
	Chemical injury		4
	Physiological stress		2

**Table 5.** Summary of plant diseases diagnosed on **fruit crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

<b>CROP</b>	<b>DISEASE</b>	<b>CAUSAL AGENT</b>	<b>NO. OF SAMPLES</b>
Apple	Fireblight	<i>Erwinia amylovora</i>	1
	Secondary root rot	<i>Fusarium</i> spp.	1
Cherry	Environmental injury		1
Saskatoon	Environmental injury		1
	Chemical injury		1

**Table 6.** Summary of plant diseases diagnosed on **vegetable crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Cucumber	Chemical injury		1
Onion	Soft rot	<i>Erwinia carotovora</i>	1
Potato	Powdery scab	<i>Spongospora subterranea</i>	1
	Dry rot	<i>Fusarium</i> sp.	1
Tomato	Bacterial speck	<i>Pseudomonas syringae</i> pv. <i>tomato</i>	2
	Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>	1
	Chemical injury		1

**Table 7.** Summary of plant diseases diagnosed on **woody ornamental crops** submitted to the SAFRR Crop Protection Laboratory in 2003.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Cedar	Environmental injury		1
	Salinity		1
Chokecherry	Leaf blister/curl	<i>Taphrina deformans</i>	1
	Cytospora canker	<i>Cytospora</i> sp.	1
Crabapple	Fireblight	<i>Erwinia amylovora</i>	1
Elm	Chemical injury		1
Maple	Chemical injury		2
	Environmental injury		1
Mountain ash	Environmental injury		1
Pine	Root rot	<i>Fusarium</i> sp./ <i>Pythium</i> sp./ <i>Cylindrocarpon</i> sp	1

**Table 8.** Summary of plant diseases diagnosed on **American elm** by the SAFRR Crop Protection Laboratory in 2003. Submissions are submitted under the provincial Dutch elm disease program.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
American elm	Dutch elm disease	<i>Ophiostoma nova-ulmi</i>	91
	Dothiorella wilt	<i>Dothiorella ulmi</i>	58
	Verticillium wilt	<i>Verticillium</i> sp.	2

\* The remaining DED submissions were negative for wilt disease organisms.

**CROP:** Diagnostic Laboratory Report  
**LOCATION:** Manitoba

**NAME AND AGENCY:**

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**TITLE: 2003 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS**

**METHODS:** The Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba Agriculture, Food and Rural Initiatives extension staff, farmers, agribusiness, and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

**RESULTS:** Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1-11.

**Table 1.** Summary of diseases diagnosed on **cereal crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Bacterial leaf blight	<i>Pseudomonas syringae</i>	2
	Black head mould	<i>Alternaria</i> sp., <i>Cladosporium</i> sp.	1
	Common root rot	<i>Fusarium</i> spp., <i>Cochliobolus sativus</i>	6
	Head blight	<i>Fusarium</i> spp.	2
	Leaf rust	<i>Puccinia triticina</i>	1
	Septoria leaf spot	<i>Septoria</i> spp.	2
	Seedling blight	<i>Bipolaris sorokiniana</i> , <i>Fusarium</i> spp.	4
	Tan spot	<i>Pyrenophora tritici-repentis</i>	9
	Wheat streak mosaic	Wheat streak mosaic virus	4
	Environmental injury		31
	Herbicide injury		14
	Barley	Browning root rot	<i>Pythium</i> sp.
Common root rot		<i>Fusarium</i> spp., <i>Cochliobolus sativus</i>	9
Net blotch		<i>Pyrenophora teres</i>	3
Spot blotch		<i>Bipolaris sorokiniana</i>	1
Environmental injury			17
Herbicide injury			14
Nutrient deficiency			1
Oat	Bacterial blight	<i>Pseudomonas syringae</i>	17
	Drechslera leaf spot	<i>Drechslera avenae</i>	5
	Seedling blight	<i>Fusarium</i> sp., <i>Pythium</i> sp.	2
	Septoria leaf spot	<i>Septoria avenae</i>	1
	Wheat streak mosaic	Wheat streak mosaic virus	1
	Environmental injury		10
	Herbicide injury		11
	Nutrient deficiency		2
Rye	Common root rot	<i>Cochliobolus sativus</i> , <i>Fusarium</i> spp.	1

**Table 2.** Summary of diseases diagnosed on **forage legume crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Brown root rot	<i>Phoma sclerotoides</i>	3
	Cercospora leaf spot	<i>Cercospora medicaginis</i>	1
	Root rot	<i>Fusarium</i> spp.	3
	Rust	<i>Uromyces striatus</i>	3
	Spring black stem and leaf spot	<i>Phoma medicaginis</i>	4
	Stemphylium leaf spot	<i>Stemphylium botryosum</i>	2
	Yellow leaf blotch	<i>Leptotrochila medicaginis</i>	3
	Nutrient deficiency		1
Sweet clover	Herbicide injury		1
Vetch	Root rot	<i>Fusarium</i> sp.	1

**Table 3.** Summary of diseases diagnosed on **grasses** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lawn grasses	Melting out	<i>Drechslera</i> sp.	1
Meadow brome	Environmental injury		1
Meadow fescue	Net blotch	<i>Drechslera dictyoides</i>	1
Perennial rye	Leaf spot	undetermined	1
Timothy	Bacterial blight	<i>Pseudomonas</i> sp.	1

**Table 4.** Summary of diseases diagnosed on **greenhouse crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Impatiens	Environmental injury		1
Petunia	Stem rot	<i>Fusarium</i> sp.	1
Spruce	Seedling blight	<i>Pythium</i> sp.	1
Tomato	Seedling blight	<i>Pythium</i> sp.	1
	Herbicide injury		1
Watermelon	Seedling blight	<i>Pythium</i> sp.	1

**Table 5.** Summary of diseases diagnosed on **vegetable crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Beet	Leaf spot	<i>Alternaria</i> sp.	1
Cabbage	Root rot	<i>Fusarium</i> sp., <i>Pythium</i> sp.	1
Carrot	Powdery mildew	<i>Erysiphe heraclei</i>	1
Cauliflower	Root rot	<i>Fusarium solani</i>	1
Corn	Stalk rot	<i>Fusarium graminearum</i>	2
Cucumber	Angular leaf spot	<i>Pseudomonas syringae</i> pv. <i>lachrymans</i>	1
Lettuce	Environmental injury		1
Muskmelon	Fusarium wilt	<i>Fusarium oxysporum</i>	1
	Postharvest rot	<i>Alternaria alternata</i>	1
	Powdery mildew	undetermined	1
Onion	Black mould	<i>Aspergillus niger</i>	1
	Blue mould	<i>Penicillium</i> sp.	2
	Botrytis neck rot	<i>Botrytis allii</i>	5
	Fusarium basal plate rot	<i>Fusarium oxysporum</i>	10
	Leaf spot	<i>Stemphylium vesicarium</i>	2
	Purple blotch	<i>Alternaria porri</i>	1
	Root rot	<i>Fusarium</i> spp., <i>Pythium</i> sp.	2
	Smut	<i>Urocystis</i> sp.	1
Pepper	Fruit rot	<i>Sclerotinia sclerotiorum</i>	1
	Leaf spot	<i>Alternaria</i> sp.	1
	Stem rot	<i>Sclerotinia sclerotiorum</i>	1
	Environmental injury		1
Tomato	Septoria leaf spot	<i>Septoria lycopersici</i>	1
	Environmental injury		1
	Herbicide injury		1
Watermelon	Fruit rot (in field)	<i>Fusarium equiseti</i>	1
	Fruit rot (in field)	<i>Sclerotinia sclerotiorum</i>	1
	Postharvest fruit rot	<i>Alternaria alternata</i>	1
	Postharvest fruit rot	<i>Fusarium equiseti</i> , <i>Fusarium graminearum</i> , <i>Geotrichum candidum</i>	1
	Verticillium wilt	<i>Verticillium dahliae</i>	1

**Table 6.** Summary of diseases diagnosed on **oilseed crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Flax	Fusarium wilt	<i>Fusarium oxysporum</i> f. sp. <i>lini</i>	2
	Pasmo	<i>Septoria linicola</i>	1
	Root rot	<i>Fusarium</i> sp.	1
	Environmental injury		4
	Herbicide injury		10
	Nutrient deficiency		1
Sunflower	Root rot	<i>Fusarium</i> sp., <i>Pythium</i> sp.	1
	Herbicide injury		9
Canola	Blackleg	<i>Leptosphaeria maculans</i>	10
	Damping off	<i>Fusarium</i> spp., <i>Rhizoctonia solani</i> , <i>Pythium</i> spp.	9
	Downy mildew	<i>Peronospora parasitica</i>	2
	Fusarium root rot	<i>Fusarium</i> spp.	2
	Fusarium wilt	<i>Fusarium oxysporum</i> , <i>F. avenaceum</i>	3
	Root rot	<i>Rhizoctonia solani</i> , <i>Fusarium</i> spp., <i>Pythium</i> spp.	4
	Stem rot	<i>Sclerotinia sclerotiorum</i>	4
	Environmental injury		10
	Herbicide injury		71

**Table 7.** Summary of diseases diagnosed on **shelterbelt trees and woody ornamentals** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash ( <i>Fraxinus</i> sp.)	Anthracnose	<i>Gloeosporium aridum</i>	6
	Rust	<i>Puccinia sparganioides</i>	2
	Herbicide injury		22
Basswood	Herbicide injury		5
Birch	Canker	unidentified	1
	Canker	<i>Gelatinosporium</i> sp.	1
	Dieback	<i>Melanconium betulinum</i>	1
	Environmental injury		2
Caragana	Leaf spot	<i>Septoria caraganae</i>	4
	Environmental injury		1
	Herbicide injury		3
Cotoneaster	Fireblight	<i>Erwinia amylovora</i>	1

Chokecherry (Schubert)	Black knot	<i>Apiosporina morbosa</i>	1
	Herbicide injury		1
Dogwood ( <i>Cornus alba</i> )	Leaf spot	<i>Septoria</i> sp.	1
	Environmental Injury		3
Elm	Anthrachnose	<i>Gloeosporium</i> sp.	1
	Canker	<i>Botryodiplodia</i> sp.	2
	Dutch elm disease	<i>Ophiostoma ulmi</i>	12
	Environmental injury		4
	Herbicide injury		1
Juniper	Canker	<i>Botryosphaeria</i> sp.	1
	Canker	<i>Phomopsis</i> sp.	2
	Canker	<i>Seiridium</i> sp.	1
	Canker	<i>Sphaeropsis</i> sp.	2
	Needle blight	<i>Lophodermium juniperi</i>	1
	Rust	<i>Gymnosporangium</i> sp.	1
	Environmental injury		2
Lilac	Bacterial blight	<i>Pseudomonas syringae</i>	1
	Environmental injury		1
	Herbicide injury		3
Manitoba maple ( <i>Acer negundo</i> )	Canker	undetermined	5
	Wilt	<i>Fusarium oxysporum</i>	1
	Environmental injury		2
	Herbicide injury		4
	Nutrient deficiency		2
Mountain ash	Fireblight	<i>Erwinia amylovora</i>	1
Oak	Herbicide injury		2
Pine	Western gall rust	<i>Endocronartium harknessii</i>	1
	Environmental injury		1
Poplar	Bronze leaf disease	<i>Apioplagiostoma populi</i>	2
	Environmental injury		3
	Herbicide injury		2
	Nutrient deficiency		2
Rose	Black spot	<i>Marssonina rosae</i>	1
	Environmental injury		1
	Herbicide injury		1
Spruce	Cytospora canker	<i>Leucostoma kunzei</i>	4
	Canker	unidentified	1
	Needle cast	<i>Rhizosphaera kalkhoffii</i>	22
	Environmental injury		15
	Herbicide injury		2

Thuja sp.	Canker	<i>Phomopsis</i> sp.	1
	Canker	<i>Sphaeropsis</i> sp.	1
Walnut	Canker	<i>Melanconium</i> sp.	1
Willow	Canker	unidentified	1
	Herbicide injury		9

**Table 8.** Summary of diseases diagnosed on **potato crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	<i>Erwinia carotovora</i> subsp. <i>carotovora</i>	4
Blackleg	<i>Erwinia carotovora</i> subsp. <i>atroseptica</i>	3
Black dot	<i>Colletotrichum coccodes</i>	5
Early blight	<i>Alternaria solani</i>	5
Fusarium dry rot	<i>Fusarium sambucinum</i>	9
Fusarium wilt	<i>Fusarium avenaceum</i>	3
Fusarium wilt	<i>Fusarium solani</i>	1
Grey mould	<i>Botrytis cinerea</i>	3
Late blight	<i>Phytophthora infestans</i>	8
Leak	<i>Pythium ultimum</i>	3
Pink rot	<i>Phytophthora erythroseptica</i>	3
Rhizoctonia canker	<i>Rhizoctonia solani</i>	3
Scab, common	<i>Streptomyces</i> sp.	1
Scab, powdery	<i>Spongospora subterranea</i>	2
Tuber rot	<i>Geotrichum candidum</i>	1
Tuber rot	<i>Phytophthora infestans</i> , <i>Phytophthora erythroseptica</i>	4
Verticillium wilt	<i>Verticillium dahliae</i>	11
Physiological disorders		11
Environmental injury		20
Herbicide injury		2

**Table 9.** Summary of diseases diagnosed on **special field crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canaryseed	Septoria leaf spot	<i>Septoria triseti</i>	1
	Environmental injury		2
	Herbicide injury		2
Corn	Common smut	<i>Ustilago maydis</i>	1
	Root rot	<i>Fusarium</i> sp.	1
	Stalk rot	<i>Fusarium graminearum</i>	4
	Environmental injury		1
	Herbicide injury		4
	Nutrient deficiency		2
	Faba bean	Root rot	<i>Fusarium</i> sp.
Nutrient deficiency			1
Field bean	Common blight	<i>Xanthomonas axonopodis</i> pv. <i>phaseoli</i>	22
	Halo blight	<i>Pseudomonas syringae</i> pv. <i>phaseolicola</i>	3
	Anthracnose	<i>Colletotrichum lindemuthianum</i>	25
	Alternaria leaf spot	<i>Alternaria</i> sp.	1
	Root rot	<i>Fusarium</i> spp., <i>Rhizoctonia solani</i> , <i>Pythium</i> spp.	11
	Rust	<i>Uromyces appendiculatus</i>	1
	White mold	<i>Sclerotinia sclerotiorum</i>	1
	Environmental injury		8
	Herbicide injury		2
	Field pea	Downy mildew	<i>Peronospora viciae</i>
Mycosphaerella blight		<i>Mycosphaerella pinodes</i>	1
Root rot		<i>Fusarium</i> sp.	3
Lentil	Root rot	<i>Fusarium</i> sp.	1
Millet	Root rot	<i>Fusarium</i> sp.	1
	Stem rot	<i>Fusarium graminearum</i>	2
	Herbicide injury		1
Soybean	Bacterial blight	<i>Pseudomonas syringae</i> pv. <i>glycinea</i>	6
	Downy mildew	<i>Peronospora manshurica</i>	2
	Fusarium wilt	<i>Fusarium oxysporum</i>	1
	Root rot	<i>Fusarium</i> spp., <i>Pythium</i> spp.	7
	Seedling blight	<i>Fusarium avenaceum</i> , <i>Fusarium</i> sp.	2
	Environmental injury		7
	Herbicide injury		3
	Iron chlorosis	iron deficiency	4

**Table 10.** Summary of diseases diagnosed on **fruit crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

<b>CROP</b>	<b>SYMPTOM/ DISEASE</b>	<b>CAUSAL AGENT</b>	<b>NUMBER OF SAMPLES</b>
Apple	Canker	unidentified	2
	Canker	<i>Cytospora</i> sp.	1
	Fire blight	<i>Erwinia amylovora</i>	1
	Frogeye leaf spot	<i>Botryosphaeria obtusa</i>	3
	Environmental injury		1
	Herbicide injury		3
	Iron chlorosis	iron deficiency	1
Chokecherry	Black knot	<i>Apiosporina morbosa</i>	1
Plum	Shot hole	<i>Wilsonomyces carpophilus</i>	1
Raspberry	Cane blight	<i>Leptosphaeria coniothyrium</i>	2
	Fruit rot	<i>Botrytis cinerea</i> , <i>Rhizopus</i> sp.	3
	Spur blight	<i>Didymella applanata</i>	1
	Environmental injury		1
	Herbicide injury		1
	Iron chlorosis	iron deficiency	1
Saskatoon	Canker	<i>Cytospora</i> sp.	1
	Entomosporium leaf and berry spot	<i>Entomosporium mespili</i>	1
	Root rot	<i>Fusarium</i> sp., <i>Fusarium oxysporum</i> , <i>Cylindrocarpon</i> sp.	3
	Rust	<i>Gymnosporangium clavipes</i>	1
	Environmental injury		1
	Herbicide injury		1
Sea Buckthorn ( <i>Hippophae rhamnoides</i> )	Stem canker	<i>Phoma</i> sp.	1
Strawberry	Fruit rot	<i>Botrytis cinerea</i> , <i>Fusarium</i> spp.	2
	Root rot	<i>Fusarium</i> spp.	4
	Environmental injury		1
	Herbicide injury		2

**Table 11.** Summary of diseases diagnosed on **herbaceous ornamentals and interiorscape plants** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2003.

<b>CROP</b>	<b>SYMPTOM/ DISEASE</b>	<b>CAUSAL AGENT</b>	<b>NUMBER OF SAMPLES</b>
Begonia	Root rot	<i>Pythium</i> sp.	1
<i>Ficus benjamina</i>	Canker	<i>Phomopsis cinerescens</i>	1
Geranium	Stem rot	<i>Sclerotinia sclerotiorum</i>	1
	Environmental injury		1
Lavatera	Anthracoise	<i>Colletotrichum malvarum</i>	1
Marigold	Stem rot and flower rot	<i>Sclerotinia sclerotiorum</i>	1

**CROP:** Diagnostic Laboratory Report - Commercial Crops  
**LOCATION:** Québec

**NAME AND AGENCY:**

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**TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE MAPAQ DIAGNOSTIC LABORATORY IN 2003**

**METHODS:** The objective of the MAPAQ diagnostic laboratory is to provide diagnosis and control recommendations for disease problems of commercial crops. The following data reflect diagnoses of samples submitted to the laboratory by extension staff of MAPAQ, the "Financière agricole du Québec", the "Institut québécois du développement de l'horticulture ornementale" and by the agricultural industry. Diagnosis was based on visual examination of symptoms and on the use of various laboratory tests to detect and to identify pathogens. The following tests are used in the laboratory; for nematodes, isolation with the Baermann funnel and microscope examination; for fungi, isolation on artificial media, microscope examination and pathogenicity testing; for bacteria, isolation on artificial media, classical biochemical tests including API-20E and BIOLOG<sup>®</sup>, ELISA and PCR tests; for phytoplasmas, PCR tests and for viruses, ELISA tests.

**RESULTS AND COMMENTS:** The distribution of samples by crop was: field vegetables 31.0%, greenhouse vegetables 13.0%, storage vegetables 2.0%, small fruits 16.4%, fruit trees 3.0%, annual and perennial ornamentals 4.2%, woody ornamentals 2.2%, greenhouse ornamentals 15.2%, cereals 8.0% and other crops (forage, herbs and commercial crops) 5.0%. Problems not listed include insect related injury, pathogen detection in substrates and asymptomatic plants, damage where no conclusive disease-causing organism was identified and seed problems. Diseases diagnosed on samples in the various crop categories are presented in Tables 1 to 10.

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**Table 1.** Summary of vegetable field crop diseases diagnosed by the MAPAQ diagnostic laboratory in 2003

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Asparagus	Fusarium root rot	2
	<i>Puccinia asparagi</i>	3
	Stemphylium leaf spot	1
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	1
Bean	Phytophthora root rot	1
	Pythium root rot	2
	Sclerotinia white mold	1
	Potyvirus	1
	Fomesafen injury	1
	Water excess	1
Broccoli	<i>Alternaria brassicae</i>	1
	<i>Botrytis cinerea</i>	1
	<i>Plasmodiophora brassicae</i>	2
	<i>Pseudomonas cichorii</i>	1
	Pythium root rot	2
	<i>Erwinia carotovora</i>	3
	<i>Xanthomonas campestris</i> pv. <i>armoraciae</i>	2
	<i>Xanthomonas campestris</i> pv. <i>campestris</i>	3
	Brown bud	2
	Magnesium deficiency	1
	pH imbalance	2
Cabbage	<i>Alternaria brassicicola</i>	2
	<i>Fusarium oxysporum</i>	2
	Pythium root rot	1
	Rhizoctonia root rot	1
	<i>Sclerotinia sclerotiorum</i>	1
	<i>Pectobacterium carotovora</i> ( <i>Erwinia</i> )	3
	<i>Pseudomonas viridiflava</i>	1
	<i>Xanthomonas campestris</i> pv. <i>campestris</i>	3
	Acid soil	1
	Ammonium injury	1
	Black speck	1
	Calcium deficiency	3
	Cold injury	1
	Linuron injury	2
	Molybdenum deficiency	1
Cantaloup	<i>Alternaria</i> leaf spot	2
	<i>Ascochyta</i> leaf spot	1
	<i>Fusarium oxysporum</i>	2
	Pythium root rot	1
	<i>Pseudomonas syringae</i>	2
	Ozone injury	1
Carrot	<i>Alternaria</i> leaf spot	1
	<i>Cercospora</i> leaf spot	2
	Pythium root rot	3
	Rhizoctonia crown rot	3
	<i>Pectobacterium carotovora</i> ( <i>Erwinia</i> )	1
	<i>Pseudomonas viridiflava</i>	1
	<i>Meloidogyne</i> sp.	1
	Compact soil	1
	Heat stress	1
	Water stress	1

Cauliflower	<i>Alternaria brassicicola</i>	2
	<i>Rhizoctonia solani</i>	1
	<i>Pectobacterium carotovorum</i> (Erwinia)	3
	<i>Xanthomonas campestris</i> pv. <i>armoraciae</i>	1
	<i>Xanthomonas campestris</i> pv. <i>campestris</i>	2
Celery	<i>Fusarium oxysporum</i>	1
	<i>Pectobacterium carotovorum</i> (Erwinia)	3
	<i>Pseudomonas cichorii</i>	1
	<i>Pseudomonas viridiflava</i>	1
Chinese cabbage	Alternaria leaf spot	1
	Cercospora leaf spot	1
	Pythium root rot	2
	Verticillium wilt	3
	<i>Pectobacterium carotovorum</i> (Erwinia)	6
	<i>Pseudomonas viridiflava</i>	1
	Heat stress	1
Corn (sweet)	<i>Fusarium oxysporum</i>	1
	<i>Longidorus</i> sp.	1
	Acid soil	1
	Compact soil	2
	Dicamba injury	1
	Glyphosate injury	2
Cucumber	Alternaria leaf spot	1
	Phoma fruit rot	1
	Rhizoctonia fruit rot	5
	Ulocladium leaf spot	2
	<i>Pectobacterium carotovorum</i> (Erwinia)	1
	<i>Pseudomonas syringae</i>	1
	<i>Erwinia tracheiphila</i>	1
	Potyvirus	1
	Heat stress	1
	Wind injury	1
Leek	<i>Fusarium oxysporum</i>	1
	Pythium root rot	5
	Rhizoctonia root rot	5
Lettuce	Marssonina sp.	2
	<i>Microdochium</i> sp.	3
	Pythium root rot	4
	Rhizoctonia basal rot	5
	<i>Sclerotinia</i> sp.	1
	<i>Pectobacterium carotovorum</i> (Erwinia)	1
	<i>Pseudomonas cichorii</i>	3
	<i>Pseudomonas syringae</i>	2
	<i>Pseudomonas viridiflava</i>	1
	<i>Xanthomonas campestris</i>	8
	Boron deficiency	1
	Calcium deficiency	2
	Early frost damage	1
	Glyphosate injury	1
	Phosphorus deficiency	1
	Salt damage	2
Onion	<i>Alternaria porri</i>	1
	<i>Botrytis</i> sp.	3
	<i>Colletotrichum circinans</i>	1
	<i>Fusarium</i> basal rot	4
	<i>Peronospora destructor</i>	5
<i>Pyrenochaeta terrestris</i>	2	

Onion (contd.)	Pythium root rot	2
	<i>Stemphylium botryosum</i>	10
	Urocystis sp.	2
	Rain injury	1
Pea	<i>Aphanomyces</i> sp.	1
	Fusarium root rot	4
Pepper	<i>Botrytis cinerea</i>	1
	Pythium root rot	3
	<i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i>	8
	<i>Pseudomonas syringae</i>	8
	Cucumber mosaic virus (CMV)	6
	Heat stress	3
	Mechanical injury	2
	Paraquat injury	2
Wind injury	1	
Potato	<i>Alternaria solani</i>	2
	<i>Botrytis cinerea</i>	1
	<i>Colletotrichum coccodes</i>	4
	Fusarium tuber rot	4
	<i>Helminthosporium solani</i>	6
	<i>Phytophthora erythroseptica</i>	1
	<i>Phytophthora infestans</i>	6
	Pythium tuber rot	5
	<i>Rhizoctonia solani</i>	1
	Sclerotinia stem rot	1
	Verticillium wilt	22
	<i>Clavibacter michiganensis</i> subsp. <i>sepedonicus</i>	5
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	15
	<i>Pseudomonas fluorescens</i>	2
	<i>Streptomyces</i> spp.	10
	<i>Pratylenchus</i> spp.	1
	Black heart	1
	Calcium deficiency	1
	Cold stress	1
	Dicamba injury	1
	Heat stress	2
	Hollow heart	1
	Genetic disorder	1
	Glyphosate injury	1
	Late frost damage	1
	Maleic hydrazide injury	10
	Manganese toxicity	1
Ozone injury	1	
pH imbalance	2	
Phenoxy herbicide injury	1	
Pumpkin	<i>Alternaria</i> leaf spot	2
	<i>Cladosporium</i> leaf spot	1
	Phoma fruit rot	1
	<i>Phytophthora capsici</i>	1
	Septoria leaf spot	1
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	1
	<i>Pseudomonas syringae</i>	2
	Potyvirus	2
	Heat stress	1
	Pendimetalin injury	1
	Poor pollination	1
Raddichio	<i>Colletotrichum</i> sp.	1
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	1
	<i>Pseudomonas cichorii</i>	1

Raddichio (contd.)	<i>Pseudomonas fluorescens</i>	1
	<i>Pseudomonas syringae</i>	1
	Phenoxy herbicide injury	1
Rutabaga	Peronospora sp.	1
	Pythium root rot	1
	Rhizoctonia root rot	1
	<i>Xanthomonas campestris</i>	1
	Handling injury	3
Spinach	Pythium root rot	2
	Tomato black ring virus	1
Squash	<i>Colletotrichum</i> sp.	1
	Oidium sp.	1
	Phoma fruit rot	2
	<i>Erwinia tracheiphila</i>	1
	<i>Pseudomonas syringae</i>	2
	<i>Xanthomonas campestris</i>	2
	Potyvirus	2
	Edema	1
	Wind injury	1
Tomato	<i>Fusarium equiseti</i>	1
	Phytophthora root rot	1
	<i>Pyrenochaeta lycopersici</i>	1
	<i>Sclerotinia sclerotiorum</i>	2
	Septoria leaf spot	2
	<i>Clavibacter michiganensis</i> sub sp. <i>michiganensis</i>	7
	<i>Pseudomonas syringae</i>	7
	Acid soil	1
	Blotchy ripening	1
	Heat stress	1
	Terbacil injury	1
Total submissions		433

**Table 2:** Summary of greenhouse vegetable diseases (field transplants included) diagnosed by the MAPAQ diagnostic laboratory in 2003.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
<i>Allium</i> spp. (onion, leek)	Fusarium root rot	2
	Pythium root rot	4
	Rhizoctonia root rot	3
	pH imbalance	1
	Salt damage	1
Cole crops	Fusarium root rot	1
	Pythium root rot	3
	Rhizoctonia root rot	2
	<i>Pseudomonas viridiflava</i>	1
	<i>Xanthomonas campestris</i> pv. <i>armoraciae</i>	8
	<i>Xanthomonas campestris</i> pv. <i>campestris</i>	1
pH imbalance	2	
Cucumber	Ascochyta leaf spot and crown canker	4
	Pyrenochaeta root rot	1
	Pythium root rot	7
	Ulocladium leaf spot	1
	<i>Erwinia tracheiphila</i>	1

Cucumber (contd.)	<i>Pseudomonas</i> sp.	1
	Potyvirus	1
	Cold stress	1
	Heat stress	1
Lettuce	<i>Botrytis cinerea</i>	1
	Sclerotinia leaf rot	1
	<i>Pseudomonas</i> leaf spot	1
	Salt damage	1
Pepper	<i>Pseudomonas syringae</i>	3
	CMV	8
Tomato	<i>Botrytis cinerea</i>	22
	<i>Erysiphe orontii</i>	4
	<i>Fusarium oxysporum</i> f. sp. <i>radicis-lycopersici</i>	5
	<i>Phytophthora cinnamomi</i>	1
	Penicillium fruit rot	2
	<i>Pyrenochaeta lycopersici</i>	8
	Pythium root rot	11
	Rhizoctonia root rot	2
	Rhizopus fruit rot	1
	Verticillium wilt	3
	<i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i>	37
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	2
	<i>Meloidogyne</i> sp.	4
	Boron deficiency	1
	Calcium deficiency	1
	Edema	1
	Genetic disorder	1
	Glyphosate injury	1
	Heat stress	1
	Manganese deficiency	1
	Manganese toxicity	3
	Mechanical injury	1
	pH imbalance	2
	Salt damage	1
	SO <sub>2</sub> injury	1
	Zinc toxicity	1
	<b>Total submissions</b>	

**Table 3:** Summary of storage vegetable diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Carrot	<i>Fusarium solani</i>	1
Cole crops	<i>Sclerotium rolfsii</i>	1
	Calcium deficiency	1
Onion	Botrytis neck rot	1
Potato	<i>Alternaria solani</i>	1
	<i>Fusarium</i> dry rot	4
	Phoma dry rot	1
	<i>Phytophthora erythroseptica</i>	2
	<i>Phytophthora infestans</i>	1
	<i>Clavibacter michiganensis</i> subsp. <i>sepedonicus</i>	1
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	2
	<i>Pseudomonas marginalis</i>	1

Potato (contd.)	MopTop virus	1
	Bruise	2
	Frost damage	2
	Heat and drought necrosis	2
	Maleic hydrazide injury	2
	Stem end browning	1
<b>Total submissions</b>		<b>27</b>

**Table 4:** Summary of small fruit diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

<b>CROP</b>	<b>CAUSAL AGENT/DISEASE</b>	<b>NO. OF SAMPLES</b>
Blueberry	Aureobasidium canker	2
	Colletotrichum fruit rot	2
	<i>Godronia cassandrae</i> ( <i>Fusicoccum</i> )	2
	<i>Microsphaera</i> sp.	2
	Monilinia fruit rot	3
	Phomopsis canker	5
	Ramularia canker	1
	<i>Seimatosporium</i> sp.	1
	<i>Septoria</i> sp.	1
	Tomato ring spot virus (ToRSV)	1
	Xiphinema sp.	1
	Acid soil	3
	Genetic disorder	1
	Gramoxone injury	1
	Low light	1
	Low temperature	1
Sunburn	1	
Winter damage	1	
Cranberry	Colletotrichum fruit rot	1
	<i>Godronia cassandrae</i> ( <i>Fusicoccum</i> )	2
	Phomopsis canker	1
	Phyllosticta leaf spot	2
	Physalospora leaf spot	1
	Protoventuria leaf spot	1
	Pythium root rot	1
	Rhizoctonia root rot	1
Currant, gooseberry	<i>Botrytis cinerea</i>	1
	<i>Puccinia</i> sp.	1
	Septoria leaf spot	1
Grape	<i>Plasmopara viticola</i>	1
	<i>Rhizoctonia</i> sp.	1
	<i>Uncinula</i> sp.	1
	Heat stress	1
	Magnesium deficiency	1
	Potassium deficiency	1
Raspberry	Phytophthora root rot	8
	Rhizoctonia root rot	1
	<i>Sphaceloma necator</i> ( <i>Elsinoe veneta</i> )	1
	<i>Agrobacterium tumefaciens</i>	1
	<i>Erwinia amylovora</i>	1
	ToRSV	3
	<i>Pratylenchus</i> sp.	3
	<i>Xiphinema</i> sp.	3

Raspberry (contd.)	pH imbalance	4
	Rain injury	1
	Salt stress	1
	Soil stress	1
	Spring frost	1
	Winter damage	4
Serviceberry	<i>Fusarium moniliforme</i>	1
	<i>Gymnosporangium</i> sp.	1
	<i>Podosphaera</i> sp.	1
	<i>Rhizoctonia</i> sp.	1
	Boron deficiency	1
	Growth crack	1
Strawberry	<i>Botrytis cinerea</i>	11
	<i>Colletotrichum</i> sp.	1
	Cylindrocarpon root rot	5
	<i>Diplocarpon earliana</i>	6
	<i>Hainesia lythri</i>	2
	Idriella root rot	3
	<i>Phytophthora cactorum</i>	3
	<i>Phytophthora fragariae</i>	1
	<i>Phytophthora</i> spp.	4
	<i>Pyrenochaeta</i> sp.	7
	Pythium root rot	12
	<i>Ramularia brunnea</i>	2
	<i>Rhizoctonia</i> root rot	18
	Slime mold	1
	<i>Sphaerotheca macularis</i>	8
	<i>Verticillium dahliae</i>	14
	<i>Xanthomonas fragariae</i>	3
	<i>Longidorus</i> sp.	2
	<i>Pratylenchus</i> sp.	5
	Phytoplasma	1
	Atrazine injury	1
	Calcium deficiency	1
	Glyphosate injury	3
Heat stress	3	
pH imbalance	5	
Salt injury	6	
Spring frost	2	
Winter injury	10	

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 Total submissions

228

**Table 5.** Summary of fruit tree diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

<b>CROP</b>	<b>CAUSAL AGENT/DISEASE</b>	<b>NO. OF SAMPLES</b>
Apple	Colletotrichum leaf spot	1
	Nectria canker	2
	Phytophthora root rot	1
	<i>Sphaeropsis malorum</i>	2
	Verticillium wilt	1
	<i>Erwinia amylovora</i>	16
	Burr knot	1
	Genetic disorder	1
	Hail damage	1
	Scald	1
	Winter injury	3
Pear	Sphaeropsis leaf spot	1
	<i>Venturia piri</i>	1
	<i>Erwinia amylovora</i>	4
	Winter injury	2
Plum	<i>Monilinia fructicola</i>	1
	<i>Pseudomonas syringae</i>	1
<b>Total submissions</b>		<b>40</b>

**Table 6:** Summary of herbaceous ornamental plant (annual and perennial) diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

<b>CROP</b>	<b>CAUSAL AGENT/DISEASE</b>	<b>NO. OF SAMPLES</b>
<i>Astilbe</i> sp.	Rhizoctonia root rot	1
<i>Callistephus chinensis</i>	Coleosporium sp.	1
	Fusarium root rot	1
<i>Canna</i> sp.	Fusarium root rot	1
	Pythium root rot	1
	Potyvirus	1
<i>Chrysanthemum</i> sp.	<i>Pseudomonas cichorii</i>	1
<i>Dactinus</i> sp.	Phytophthora root rot	1
	Pythium root rot	1
	Rhizoctonia root rot	1
<i>Digitalis</i> sp.	Colletotrichum leaf spot	1
<i>Echinacea purpurea</i>	Alternaria leaf spot	1
<i>Helichrysum</i> sp.	Verticillium wilt	1
<i>Hibiscus syriacus</i>	Phytophthora root rot	1
<i>Hydrangea</i> sp.	Salt damage	1

<i>Lilium</i> sp.	Colletotrichum leaf spot	1
<i>Millepertuis</i> sp.	Colletotrichum leaf spot	1
<i>Primula</i> sp.	<i>Pseudomonas cichorii</i>	1
<i>Statice</i> sp.	<i>Botrytis cinerea</i>	1
Tithonia	<i>Botrytis cinerea</i>	1
	Pythium root rot	1
	<i>Sclerotinia sclerotiorum</i>	1
Turfgrass	<i>Colletotrichum</i> sp.	3
	<i>Curvularia</i> sp.	3
	<i>Fusarium acuminatum</i>	1
	<i>Fusarium avenaceum</i>	1
	<i>Fusarium equiseti</i>	1
	<i>Fusarium</i> spp.	2
	<i>Gaeumannomyces</i> sp.	6
	<i>Leptosphaerulina</i> sp.	1
	Pythium root rot	15
	Rhizoctonia root rot	2
	<i>Sclerotinia homeocarpa</i>	1
	<i>Septoria</i> sp.	1
	Glyphosate injury	1
<hr/>		
Total submissions		60

**Table 7:** Summary of woody ornamental diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

<b>CROP</b>	<b>CAUSAL AGENT/DISEASE</b>	<b>NO. OF SAMPLES</b>
<i>Abies balsamea</i>	Armillaria root rot	2
	Winter injury	1
<i>Acer</i> spp.	Aureobasidium leaf spot	2
	Nectria canker	1
	Phomopsis canker	1
	Salt damage	1
	Winter injury	1
<i>Alnus</i> sp.	Taphrina leaf curl	1
<i>Betula</i> sp.	Phenoxy herbicide injury	1
<i>Carya</i> sp.	Phomopsis canker	1
<i>Chamaedorea</i> sp.	<i>Gliocladium</i> sp.	1
<i>Fagus</i> sp.	Winter injury	1
<i>Forsythia</i> sp.	<i>Fusarium</i> root rot	1
<i>Juniperus</i> sp.	Kabatina leaf blight	2
	Winter injury	1
<i>Larix</i> sp.	Cylindrocarpon root rot	1
	Cytospora canker	1

<i>Picea</i> sp.	Phytophthora root rot	1
	Pythium root rot	2
	Winter injury	1
<i>Populus</i> sp.	<i>Agrobacterium tumefaciens</i>	1
	<i>Fusarium solani</i>	1
<i>Prunus</i> sp.	<i>Agrobacterium tumefaciens</i>	1
<i>Quercus rubra</i>	SO <sub>2</sub> injury	1
<i>Rhus typhina</i>	Pythium root rot	1
	Salt damage	1
<i>Thuja occidentalis</i>	Phenoxy injury	1
<i>Tilia</i> sp.	Discula leaf spot	1
	Heat stress	1
<b>Total submissions</b>		<b>33</b>

**Table 8:** Summary of diseases of greenhouse ornamental plants diagnosed by the MAPAQ diagnostic laboratory in 2003.

<b>CROP</b>	<b>CAUSAL AGENT/DISEASE</b>	<b>NO. OF SAMPLES</b>
<i>Aconitum</i> sp.	Boron deficiency	1
<i>Ajuga reptans</i>	<i>Phoma</i> sp.	1
	Rhizoctonia root rot	1
	Alfalfa mosaic virus (AMV)	4
	CMV	1
	Tobacco ring spot virus (TRSV)	1
<i>Alternanthera</i> sp.	Rhizoctonia leaf rot	1
<i>Aquilegia</i> sp.	Acid soil	1
<i>Artemisia</i> sp.	Impatiens necrotic spot virus (INSV)	1
<i>Astilbe</i> sp.	<i>Colletotrichum</i> sp.	1
	<i>Pseudomonas cichorii</i>	1
	Salt damage	1
<i>Bacopa</i> sp.	<i>Botrytis cinerea</i>	1
<i>Begonia</i> sp.	Rhizoctonia root rot	1
	<i>Botrytis cinerea</i>	1
	Phytoplasma	1
	<i>Aphelenchoides</i> sp.	2
	Heat stress	1
<i>Brugmansia</i> sp.	Potyvirus	1
<i>Calibrachoa</i> sp.	pH imbalance	1
<i>Calla</i> sp.	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	1
<i>Campanula</i> sp.	Phosphorus deficiency	1
	INSV	1

<i>Canna</i> sp.	Potyvirus	1
<i>Chrysanthemum</i> sp.	Pythium root rot	1
	Salt damage	1
<i>Clematis</i> sp.	Phoma crown canker.	1
<i>Coleus</i> sp.	INSV	5
<i>Coreopsis</i> sp.	Genetic disorder	1
<i>Crossandra</i> sp.	INSV	1
<i>Cuphea</i> sp.	Salt damage	1
<i>Cyperus</i> sp.	Pythium root rot	1
<i>Delphinium</i> sp.	<i>Botrytis cinerea</i>	1
	Genetic disorder	1
<i>Dicksonia</i> sp.	pH imbalance	1
<i>Digitalis</i> sp.	<i>Botrytis cinerea</i>	1
<i>Dracaena</i> sp.	<i>Colletotrichum</i> sp.	1
	Rhizoctonia root rot	1
<i>Echinacea purpurea</i>	Phytoplasma	1
<i>Euphorbia pulcherrima</i>	Pythium root rot	4
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	1
	Phytoplasma	1
	Salt damage	3
<i>Exacum</i> sp.	INSV	1
<i>Fuschia</i> sp.	Phytophthora root rot	1
	Pythium root rot	1
<i>Gaillardia</i> sp.	INSV	1
<i>Gazania</i> sp.	pH imbalance	1
<i>Gerbera jamesonii</i>	Boron deficiency	1
	Salt damage	1
<i>Impatiens</i> sp.	<i>Botrytis cinerea</i>	2
	Rhizoctonia root rot	1
<i>Lamium</i> sp.	<i>Peronospora</i> sp.	1
	pH imbalance	1
<i>Lilium</i> sp.	Potyvirus	1
<i>Lychnis</i> sp.	INSV	2
<i>Millepertuis</i> sp.	<i>Erysiphe</i> sp.	2
<i>Monarda fistulosa</i>	<i>Botrytis cinerea</i>	1
<i>Ophiopogon</i> sp.	<i>Fusarium</i> sp.	2
	Salt damage	1
Orchids	Cymbidium mosaic virus	1
	Odontoglossum ring spot virus	1

<i>Osteospermum</i> sp.	<i>Botrytis cinerea</i>	5
<i>Pelargonium</i> sp.	<i>Botrytis cinerea</i>	6
	Pythium black leg	21
	<i>Pectobacterium carotovorum</i> ( <i>Erwinia</i> )	25
	<i>Ralstonia solanacearum</i>	7
	<i>Xanthomonas campestris</i> pv. <i>pelargonii</i>	14
	Edema	4
	Genetic disorder	1
	Iron deficiency	1
	pH imbalance	5
	Salt damage	2
Yellow net vein	1	
<i>Penstemon</i> sp.	INSV	1
<i>Petunia</i> sp.	<i>Thielaviopsis basicola</i>	1
	Salt damage	1
<i>Phlox</i> sp.	Potyvirus	1
	ToRSV	1
	Acid soil	1
<i>Primula</i> sp.	Pythium root rot	1
<i>Rhododendron</i> sp.	Pythium root rot	1
<i>Rosa</i> sp.	<i>Botrytis cinerea</i>	4
	Phytophthora root rot	4
	Copper hydroxide toxicity	1
<i>Rudbeckia</i> sp.	Calcium deficiency	2
<i>Saintpaulia ionantha</i>	Corynespora leaf spot	1
	Rhizoctonia root rot	2
<i>Santolina</i> sp.	<i>Phoma</i> sp.	2
<i>Sedum</i> sp.	<i>Phytophthora</i> sp.	1
<i>Streptocarpus</i> sp.	Salt damage	2
<i>Surfinia</i> sp.	Tomato mosaic virus	1
	Boron deficiency	1
	Ethylene injury	1
	Genetic disorder	2
	Iron deficiency	1
<i>Tetrastigma</i> sp.	Edema	1
<i>Verbena</i> sp.	INSV	1
<i>Zebrina</i> sp.	Fusarium root rot	1
	Pythium root rot	1
<i>Zinnia</i> sp.	<i>Botrytis cinerea</i>	1
	Pythium root rot	1
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Total submissions		210

**Table 9:** Summary of cereal crop diseases diagnosed by the MAPAQ diagnostic laboratory in 2003.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Barley	<i>Bipolaris sorokiniana</i>	10
	<i>Drechslera teres</i>	5
	Fusarium head blight	1
	Fusarium root rot	4
	<i>Gaeumannomyces graminis</i>	1
	Melanosis	2
	Pythium root rot	2
	Rhizoctonia root rot	1
	<i>Septoria</i> sp.	2
	Alkaline soil	1
	Glyphosate injury	1
	Hail injury	1
	<i>Rhynchosporium</i> sp.	1
	Heat stress	8
Poor pollination	1	
Corn	Fusarium head blight	2
	Rhizoctonia root rot	1
	<i>Longidorus</i> sp.	1
	Bromoxynil injury	1
	Dicamba injury	2
	Glyphosate injury	3
	Nicosulfuron injury	1
	ph imbalance	2
	Phenoxy herbicide injury	2
	Phosphorus deficiency	1
Trifluralin injury	2	
Oat	Colletotrichum leaf spot	3
	<i>Drechslera teres</i>	2
	Fusarium head blight	3
	<i>Gaeumannomyces graminis</i>	2
	Pythium root rot	1
	Stagonospora leaf spot	8
	<i>Ustilago avenae</i>	1
	Barley yellow dwarf virus	1
	Alkaline soil	1
	Heat stress	2
Manganese deficiency	1	
Wheat	Black mold ( <i>Alternaria</i> sp.)	2
	<i>Bipolaris sorokiniana</i>	1
	Cladosporium seed spot	2
	<i>Drechslera teres</i>	1
	Fusarium head blight	6
	<i>Gaeumannomyces graminis</i>	2
	Pythium root rot	1
	Rhizoctonia root rot	1
	Stagonospora leaf spot	5
	BYDV	1
Wheat	Heat stress	1
	pH imbalance	2
	Sunburn	1
Total submissions		110

**Table 10:** Summary of diseases of oilseed, special and legume crops diagnosed by the MAPAQ diagnostic laboratory in 2003.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Alfalfa	Leptosphaerulina leaf spot	1
	<i>Phytophthora megasperma</i>	1
	Rhizoctonia root rot	1
	Verticillium albo-atrum	1
Basil	<i>Botrytis cinerea</i>	3
	<i>Fusarium oxysporum</i>	1
	Pythium root rot	3
Canola	<i>Alternaria alternata</i>	1
	<i>Alternaria brassicicola</i>	1
	Sclerotinia stem rot	1
Coriander	<i>Pseudomonas syringae</i>	1
Rosemary	Xanthomonas leaf spot	1
Sage	Xanthomonas leaf spot	1
Soybean	Cercospora leaf spot	1
	Colletotrichum stem canker	2
	Fusarium root rot	8
	<i>Microsphaera</i> sp.	1
	<i>Phomopsis</i> sp.	9
	Phytophthora root and crown rot	6
	Pythium root rot	2
	Rhizoctonia root rot	1
	<i>Septoria glycines</i>	1
	<i>Pseudomonas marginalis</i>	1
	Potyvirus	1
	Atrazine injury	1
	Bentazon injury	1
	Dicamba injury	2
	Heat stress	1
	Imazethapyr injury	1
	Iron deficiency	1
	Magnesium deficiency	1
	pH imbalance	1
	Potassium deficiency	2
Salt damage	1	
Sun scald	1	
Water stress	3	
Sunflower	<i>Plasmopora</i> sp.	1
Tobacco	Thielaviopsis root rot	1
	Glyphosate injury	
Total submissions		69
<b>TOTAL SUBMISSIONS</b>		<b>1390</b>

## Cereals / Céréales

**CROP / CULTURE:** Barley  
**LOCATION / RÉGION:** Saskatchewan

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2003**

**INTRODUCTION AND METHODS:** *Fusarium* head blight (FHB) incidence and severity were assessed in 42 2-row and 20 6-row barley crops in Saskatchewan between July 7 and August 22, 2003. Fields were grouped according to soil zones (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey), and fields under irrigation were grouped separately and were referred to as in the irrigation zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

Saskatchewan Agriculture, Food and Rural Revitalization extension agrologists collected 50 heads at random from each crop at the milk to dough stages. The heads were analyzed by the Crop Protection Laboratory in Regina for visual FHB symptoms. The number of infected heads per crop and the number of infected glumes and/or kernels within those heads were recorded. An FHB disease severity rating, also known as the FHB index, was determined for each crop (FHB index = % heads affected x mean % severity of infection / 100). Mean FHB severities were calculated for each soil/irrigation zone and for the whole province. Glumes and/or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min. and cultured on potato dextrose agar and carnation leaf agar for subsequent identification of *Fusarium* species.

**RESULTS AND DISCUSSION:** In 2003, FHB occurred in 38% of the 2-row and 50% of the 6-row barley crops surveyed (Table 1). These prevalence values are the lowest reported since the survey began in 1999 (Pearse et al., 2003).

Severities of FHB in 2003 likewise were the lowest ever reported (Pearse et al., 2003). Dry, hot conditions that began in late June and continued until harvest were not conducive for FHB development. Mean disease severities were <1% in all zones, and the overall mean severity for the province was 0.1% for both 2-row and 6-row barley (Table 1). Overall mean severities have been relatively low since the onset of the survey, ranging from 0.6–1.3% for 2-row and 0.2–2.5% for 6-row barley (from 1999-2002). In 2003, the highest severity was 1.1%, found in a crop of 6-row barley in the irrigation zone.

In 2003, the most commonly isolated *Fusarium* species was *F. poae*, accounting for 60% of total *Fusarium* isolations, followed by *F. acuminatum* (16%), *F. avenaceum* (8%), *F. sporotrichioides* (8%), *F. equiseti* (5%) and *F. culmorum* (3%). No *F. graminearum* was isolated from crops surveyed in 2003.

**REFERENCE:**

P.G. Pearse, G. Holzgang, C.L. Harris, and M.R. Fernandez. 2003. *Fusarium* head blight in barley in Saskatchewan in 2002. Can. Plant Dis. Surv. 83: 48-49. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Prevalence and severity of fusarium head blight (FHB) in crops grouped by soil and irrigation zones in Saskatchewan, 2003.

Soil Zone	No. affected crops / total crops (% of crops infected)		Mean FHB Index <sup>1</sup>	
	2-row	6-row	2-row	6-row
Zone 1 Brown	2 / 10 (20%)	0	T <sup>2</sup>	–
Zone 2 Dark Brown	3 / 9 (33%)	1 / 1 (100%)	0.2%	0.2%
Zone 3 Black/Grey	11 / 23 (48%)	7 / 16 (44%)	0.2%	T
Irrigation Zone	0	2 / 3 (67%)	0.1%	0.5%
Overall Mean	16 / 42 (38%)	10 / 20 (50%)	0.1%	0.1%

<sup>1</sup> FHB index = % heads affected x mean % severity of infection / 100

<sup>2</sup> T = trace values of FHB, <0.1%

**CROP / CULTURE:** Barley  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: 2003 SURVEY FOR FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA**

**INTRODUCTION AND METHODS:** A total of 30 barley fields (15 two-row crops, 15 six-row crops) in southern Manitoba were surveyed for the presence of fusarium head blight (FHB) between July 14 and July 31, 2003. The fields were selected randomly along survey routes. FHB incidence (the percentage of spikes with typical symptoms) in each field was assessed by sampling 80-100 spikes at 3 locations for disease. FHB severity (the average affected proportion of symptomatic spikes) was estimated visually in the field. Several affected spikes were collected at each field site and stored in paper envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from at least 5 spikes per location, surface sterilized in 0.3% NaOCl (Javex brand) and plated onto potato dextrose agar to quantify and identify *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Moisture levels in spring 2003 over most of southern Manitoba were ideal for crop development, but from the end of June to mid-August little or no rain fell in the region, and this period was accompanied by warm to hot winds. As such, conditions were not conducive for the infection of cereal crops by *Fusarium* following heading and early grain-filling.

Fusarium head blight was observed in 28 of the 30 fields surveyed. Average incidence of FHB in two-row crops was 4.9% (range 0 - 36%), while severity averaged 7.1% (range 0 - 25%); in six-row crops average incidence was 5.4% (range 0 - 22%) and average severity 4.4% (range 0 - 25%). The resulting average FHB Index (%incidence X %severity) / 100 for 2-row barley was 0.9%, and that for 6-row barley 0.5%; for all barley this was 0.7% (range 0 - 7.2%). This is one of the lowest severities of FHB recorded since surveys of barley crops for FHB were initiated in 1994. This level of disease would have resulted in negligible losses from FHB in 2003. For the third year in a row, 2-row crops had a higher FHB Index than 6-row crops (Tekauz et al. 2003); in years prior to this, the opposite was true (Tekauz et al. 2001).

The *Fusarium* species isolated from kernels are shown in Table 1. As has been the case for the past several years, *F. graminearum* was the predominant pathogenic species. For a third consecutive year, *F. poae* was isolated at a high frequency from kernels. Compared to 2002, *F. sporotrichioides* was much less common in 2003 (Tekauz et al. 2003).

**REFERENCES:**

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M., Ghazvini, H., Kaethler, R., and Reverchon, F. 2003. 2002 Survey for fusarium head blight of barley in Manitoba. Can. Plant Dis. Surv. 82: 46-47. (<http://www.cps-scp.ca/cpds.htm>)

Tekauz, A., Gilbert, J., Gold, J., Mueller, E., Idris, M., Stulzer, M., Beyene, M. and Nedohin, E. 2001. Fusarium head blight of barley in Manitoba and eastern Saskatchewan in 2000. Can. Plant Dis. Surv. 81: 65. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** *Fusarium* spp. isolated from barley kernels in Manitoba in 2003.

<b><i>Fusarium</i> spp.</b>	<b>Percent of fields</b>	<b>Percent of kernels</b>
<i>F. avenaceum</i>	30.0	8.9
<i>F. equiseti</i>	3.3	1.2
<i>F. graminearum</i>	70.0	58.3
<i>F. poae</i>	56.7	26.6
<i>F. sporotrichioides</i>	26.7	3.8

**CROP / CULTURE:** Barley  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: SURVEY FOR LEAF SPOT DISEASES OF BARLEY IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** Leaf spot diseases of barley in Manitoba were assessed by surveying 30 farm fields (15 two-row crops, 15 six-row crops) from July 14 to July 31 when most crops were at the soft dough stage of growth (ZGS 85). Fields were sampled at regular intervals along the survey routes, depending on availability. Incidence and severity of diseases were recorded by averaging their occurrence and level on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field margin. Ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe or senescent (41-100%). Infected leaves with typical symptoms were collected at each site and dried and stored in envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present, as well as their relative impact.

**RESULTS AND COMMENTS:** Conditions during the spring of 2003 in southern Manitoba were ideal for crop development; soil moisture levels were optimal at the start of the growing season, and periodic showers throughout May and June maintained moisture reserves. However, throughout July and to mid-August, little or no rain was recorded in the region and soils became quite dry, exacerbated by frequent warm to hot winds. The conditions were ideal for early-season leaf spot development, but were not conducive to subsequent infection of the flag leaf, before or after crop heading.

Leaf spots were observed in the upper and/or lower leaf canopies of all barley fields surveyed. Disease severity levels in the upper canopy were nil to slight in 90% of fields, moderate in 10%, and severe or senescent in none. Respective severity categories in the lower canopy were 53%, 7%, and 10%; 30% were senescent. On the basis of most crops having nil to slight leaf spot development in the upper canopy, foliar diseases in barley caused little or no damage in 2003; on average, grain yield losses likely were <1%.

*Cochliobolus sativus* (spot blotch) and *Pyrenophora teres* (net blotch) were most often isolated from infected leaf tissue, and were found in most crops surveyed (Table 1). These two species were responsible for most of the leaf spotting recorded. The *Septoria* pathogens (speckled leaf blotch) had little impact. In contrast to 2002 and 2001, *C. sativus* did not predominate in 2003 (Tekauz et al. 2003).

**Table 1.** Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2003.

Pathogen	Incidence (% of crops)	Frequency (% of isolations)*
<i>Cochliobolus sativus</i>	83.3	46.8
<i>Pyrenophora teres</i>	80.0	44.7
<i>Septoria avenae</i> f.sp. <i>triticea</i>	23.3	6.6
<i>Septoria passerinii</i>	10.0	1.8

\* indicative of the relative amount of foliar damage due to the species

**REFERENCE:**

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M., Ghazvini, H., Morgan, K., and Reverchon, F. 2003. Survey for foliar diseases of barley in Manitoba in 2002. Can. Plant Dis. Surv. 83: 60-61. (<http://www.cps-scp.ca/cpds.htm>)

**CROP / CULTURE:** Barley  
**LOCATION / RÉGION:** Ontario

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**TITLE / TITRE: DISEASES OF BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2003**

**INTRODUCTION AND METHODS:** A survey of barley crops for the presence of diseases other than fusarium head blight was conducted in the third week of July when plants were at the soft dough stage of development. Twenty-five fields were chosen at random in central and eastern regions of Ontario where most of the spring barley is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and  $\geq 6$  were considered trace, slight, moderate, and severe infection, respectively. Severity of barley stripe, ergot, loose smut, and take-all was evaluated by estimating the percentage of plants infected.

**RESULTS AND COMMENTS:** A total of 11 diseases or disease complexes were observed in the crops surveyed (Table 1). Net blotch (*Pyrenophora teres*) was the most prevalent disease, observed in 24 crops, and with a mean disease severity of 2.6. Eight crops had moderate infections, the highest level observed. The crops were located at or near Antrim, Clarence, Curren, Dwyer Hill, Kinburn, North Gower, Guelph, and Myrtle. Yield reductions due to net blotch were estimated to be at least 10% on average in the surveyed crops. Net blotch has been the most prevalent foliar disease of barley in central and eastern Ontario for the past three years and was considered the major yield limiting factor in 2003.

Spot blotch (*Cochliobolus sativus*) was observed in 20 crops at a mean severity level of 1.2, and was the second most common barley disease. Nineteen crops had only trace to slight levels of infection, while one at Almonte had a moderate infection. Leaf rust (*Puccinia hordei*) and stem rust (*Puccinia graminis* f. sp. *tritici*) were observed in 16 and 4 crops, at mean severities of 1.0 and 1.5, respectively. No moderate or severe infections were found. Scald (*Rhynchosporium secalis*) was observed in 9 crops at a mean severity of 0.4. All affected crops had only trace infections. The septoria complex, including speckled leaf blotch (*Septoria avenae* f. sp. *triticea*), leaf blotch (*S. passerinii*), and glume blotch (*Stagonospora nodorum*), was observed in 8 crops at a mean severity of 0.4. Only trace and slight infections were found. Powdery mildew (*Erysiphe graminis* f. sp. *hordei*) was observed in 4 crops, at a mean severity of 1.6. A moderate infection was observed in one field. Stem rust was observed in 4 crops at a mean severity of 1.5. None of these diseases likely caused significant damage to barley in 2003.

Barley stripe (*Pyrenophora graminea*), ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*), and take-all (*Gaeumannomyces graminis*) were observed in 2, 2, 3, and 8 crops, at mean infection levels of 0.5, 0.4, 0.3 and 1.1%, respectively. These diseases likewise appeared to result in minimal damage to barley.

Total precipitation and mean temperatures in central and eastern Ontario in June and July were slightly wetter and cooler than in 2001 and 2002. The pattern of foliar diseases in 2003 was similar to that in 2002 (Xue et al. 2003), except that leaf rust was more common in 2003. Net blotch has been the major disease for three consecutive years. Spot blotch and leaf rust were commonly observed at lower severities and, like net blotch, may have the potential to cause significant damage to barley production in Ontario. Powdery mildew, scald, and the septoria complex were observed in isolated fields and may pose a threat when environmental conditions are favourable. Other diseases were of minor importance.

**REFERENCE:**

A.G. Xue, Y. Chen, F. Sabo, and K.M. Ho. 2003. Foliar diseases of barley in eastern Ontario in 2002. Can. Plant Dis. Surv. 83:64-65. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Prevalence and severity of diseases of barley in central and eastern Ontario in 2003.

DISEASE	NO. CROPS AFFECTED (n=25)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
Leaf rust	16	1.0	0.2-2.5
Net blotch	24	2.6	1.4-5.8
Powdery mildew	4	1.6	0.3-3.0
Scald	9	0.4	0.2-0.9
Septoria complex	8	0.4	0.1-1.2
Spot blotch	20	1.2	0.2-5.3
Stem rust	4	1.5	0.4-2.6
Barley stripe	2	0.5	0.3-0.7
Ergot	2	0.4	0.2-0.7
Loose smut	3	0.3	0.2-0.5
Take-all	8	1.1	0.5-2.0

\*Foliar disease severity was rated on a scale of 0 (no disease) to 9 (severely diseased); for barley stripe, ergot, loose smut and take-all, severity was rated as percent plants infected.

**CROP / CULTURE:** Cereals (Barley and Wheat)  
**LOCATION / RÉGION:** Central Alberta

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**TITLE / TITRE: 2003 CEREAL DISEASE SURVEY IN CENTRAL ALBERTA**

**INTRODUCTION AND METHODS:** A survey of diseases of barley and wheat was conducted on July 29 and 31, 2003 in fields randomly selected in Census District 8 (north-central Alberta). This area encompasses Sylvan Lake on the west, Bashaw on the east and is bordered north and south by Ponoka and Innisfail, respectively. Fields were traversed in an inverted V, with visual analysis of 5 plants taking place at 3 locations. Leaf diseases were scored on a 0-9 scale, with a 4 rating equal to 1% of leaf area diseased (PLAD) on the upper leaf canopy, 5-10 PLAD on the middle canopy and 10-25 PLAD on the lower-canopy. Common root rot (CRR) was assessed on sub-crown internodes using a 0-4 scale where 1=trace and 4=severe. Other diseases were rated as a percent of the plants affected. After the survey was completed, a representative sub-sample of the diseased material collected was cultured in the laboratory for pathogen identification.

**RESULTS AND COMMENTS:** Results are presented in Table 1. Central Alberta experienced a hot and dry summer which followed the drought of 2002. Disease levels tended to be low and yields below average. Grasshopper damage was a factor in the majority of the fields surveyed. Thirty-three barley fields were examined, 22 of which were 2-row and 11, 6-row. Scald (*Rhynchosporium secalis*) was the most commonly observed leaf disease, followed by the net-form of net blotch (*Pyrenophora teres* f. *teres*) and the spot-form of net blotch (*P. teres* f. *maculata*). Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) was more severe than in 2002, with 6 of 14 fields rating 3 or 4. Loose smut (*Ustilago nuda*) was noted at trace amounts in 7 fields, covered smut (*Ustilago hordei*) at trace amounts in 2, 2-row fields, and bacterial blight (*Xanthomonas translucens*) at trace levels in 2, 6-row fields. Low levels of septoria blotches (*Septoria* spp.) were noted in 5 fields in the northern portion of the surveyed area; an unusual occurrence for central Alberta. Prematurity blight (*C. sativus* and *Fusarium* spp.) was noted in 2, 2-row fields.

Septoria/Stagonospora leaf blotch (*Septoria tritici*, *Stagonospora nodorum*) was present in 9 of the 11 hard red spring wheat fields, mainly at low levels. Common root rot (*C. sativus* and *Fusarium* spp.) was more severe than in 2002, take-all (*Gaeumannomyces graminis*) was detected at trace levels in 2 fields and powdery mildew (*Blumeria graminis*) was noted in 2 fields, one rating 5. Tan spot (*Pyrenophora tritici-repentis*) and ergot (*Claviceps purpurea*) were not found. Stripe rust (*Puccinia striiformis*) was observed in 3 fields and is becoming a more commonly encountered disease in central Alberta.

**Table 1.** Prevalence and incidence or severity of diseases in 33 barley and 11 wheat fields in central Alberta 2003.

Barley Disease	% Fields Affected	Disease rating <sup>*</sup>	
		Mean	Range
Scald (0-9)	55	3.3	2-7
Net blotch (0-9)	52	3.4	2-5
Spot form of net blotch (0-9)	36	3.1	1-4
Common root rot (0-4)	42	1.8	0-4
Loose smut (%)	21	trace	trace
Septoria (%)	15	trace	trace-1

Wheat Disease	% Fields Affected	Mean	Range
Septoria leaf complex (0-9)	82	2.8	2-6
Common root rot (0-4)	55	1.7	0-3
Take-all (%)	18	trace	trace
Powdery mildew (%)	18	4	3-5
Stripe rust (%)	27	trace	trace

<sup>\*</sup>Ratings on 0-9 and 0-4 scales indicate severity, on % scale indicate incidence

**CROP / CULTURE:** Cereals (Barley, Oat and Wheat)  
**LOCATION / RÉGION:** Manitoba and eastern Saskatchewan

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**TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2003**

**INTRODUCTION AND METHODS:** Surveys of fields and trap nurseries of barley, oat and wheat for incidence and severity of stem rust (*Puccinia graminis* f. sp. *tritici* and *P. graminis* f. sp. *avenae*) were conducted in July, August, and September 2003. Infected stem tissue samples were collected from fields and trap nurseries. Urediniospores were obtained from collections and evaluated for virulence specialization on appropriate sets of host differential lines.

**RESULTS AND COMMENTS:** Historically average temperatures in April and May occurred in 2003, and seeding across much of the Prairie region began in late April. Environmental conditions were highly unfavorable for stem rust infection in most of Alberta and along the Manitoba-Saskatchewan border in 2003 due to extremely dry conditions. Stem rust infection on susceptible lines in trap nurseries was at trace levels across Western Canada. Some late-planted oat fields in the Red River Valley had low (trace to 15% severity) stem rust infection. Late arrival and low pressure of inoculum from the USA is the likely reason for the low stem rust levels in cultivated and wild oat in eastern Manitoba in 2003, as excellent levels of stem rust infection developed in inoculated nurseries near Winnipeg without irrigation.

All spring wheat cultivars recommended for production in Manitoba and Saskatchewan have excellent resistance to stem rust, and no stem rust infection was observed in any commercial wheat fields. Stem rust was detected at trace levels on susceptible wheat lines in trap nurseries and on wild barley (*Hordeum jubatum*) in 2003; the predominant races were QFCSR and QFCSH. Barley cultivars recommended for production in Manitoba and Saskatchewan are susceptible to stem rust races QCCJ and RCCJ. These races were dominant on cultivated barley samples in 2003. In contrast to 2002 when stem rust severity was slightly higher (trace to 7%) compared to recent years, only trace levels of stem rust were seen in commercial barley fields in 2003.

All oat cultivars recommended for production in Manitoba and Saskatchewan are susceptible to stem rust races NA67 and NA76. However, due to very light inoculum pressure from June to August, oat stem rust severity was very light in 2003. Heaviest infection was found in the Red River Valley and Interlake (severity of 60% at Arborg) area of Manitoba, but was generally at trace to 5% levels in 2003. Losses from rust infection were minimal (<1%) in 2003. Nevertheless, the need for new effective resistance to NA67 is vital. The frequency of NA67 in the oat stem rust population was 63% for the samples from wild oat and 85% for the samples from cultivated oat. Oat stem rust in Texas, where the rust overwinters, was severe in nursery plots and was found earlier than normal. The potential for substantial economic damage to commercial oat crops remains high in the rust areas of Western Canada, due to the predominance of NA67 and the establishment of this race in the overwintering areas of Texas in the USA. Lines with effective resistance to NA67 (*Pg16*, *Pg-a*) are in early agronomic trial testing in breeding programs at the Agriculture and Agri-Food Canada Cereal Research Centre (AAFC-CRC). Additionally, oat accessions with putative novel stem rust resistance have been identified in the stem rust pathology program at AAFC-CRC and the transfer of this resistance into adapted oat germplasm is underway.

**CROP / CULTURE:** Cereals (Barley, Oat and Wheat)  
**LOCATION / RÉGION:** Manitoba and Saskatchewan

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**TITLE / TITRE: CEREAL SMUT SURVEYS, 2003**

**INTRODUCTION AND METHODS:**

In July 2003, cereal crops in Manitoba and Saskatchewan were surveyed for the presence of smut diseases caused by *Ustilago hordei*, *U. nigra*, *U. nuda*, *U. tritici*, *U. avenae* and *U. kolleri*. The area was covered by routes from Winnipeg - Estevan - Moose Jaw - Saskatoon - Prince Albert - Melfort - Yorkton - Roblin - Swan River - Dauphin - Neepawa - Winnipeg, as well as one day trips around Winnipeg, MB in the Red River valley and Manitoba's Interlake region. Fields were selected at random at approximately 10 - 15 km intervals, depending on the frequency of the crops 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 (<0.1%) were estimated by counting plants in a 1m<sup>2</sup> area at a minimum of two sites on the path.

**RESULTS AND COMMENTS:**

Loose smut (*Ustilago tritici*) was found in 23 (23%) of the 99 fields of bread wheats surveyed. In 19 of these, there was a trace level of infection; three fields had 0.1% smutted plants and one field had 0.2% smutted plants. In durum wheat, loose smut was found at trace levels in 44% of the 25 fields surveyed. In awned wheats (likely the CPS wheat class), loose smut was detected in 41% of the 44 fields surveyed. Most fields had a trace level of infection, but three fields had 0.1 % smutted plants and one field had 5.0% smutted plants.

Two (6%) of 35 oat fields had smutted plants at trace levels of infection. Smutted oat plants were infected with *Ustilago avenae* (loose smut).

A high incidence of loose smut (*U. nuda*) was found in 6-row barley with 38 (70%) of the 54 fields surveyed containing infected plants. Most fields had trace levels of infection, but nine fields had levels of smutted plants ranging from 0.1 to 2%. In 2-row barley, 6 (17%) of 33 fields were affected with levels of smutted plants ranging from trace to 0.1%. As in 2000, 2001, and 2002 (Menzies et al., 2001, 2002, 2003), false loose smut (*Ustilago nigra*) was not found. For the first time in four years, covered smut (*U. hordei*) was found at trace levels in one (2%) field of 6-row barley.

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Menzies, J.G., F. Matheson, C. Saramaga, and D. Beimcik. 2003. Cereal Smut Surveys, 2002. Can. Plant Dis. Surv. 83: 75 (<http://www.cps-scp.ca/cpds.htm>)

**CROP / CULTURE:** Cereals (Barley, Oat and Wheat)  
**LOCATION / RÉGION:** Manitoba and Saskatchewan

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**TITLE / TITRE: CEREAL VIRUS DISEASE SITUATION IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** Cereal virus diseases monitored in 2003 were barley yellow dwarf (BYD), wheat streak mosaic (WSM) and the soil-transmitted flame chlorosis (FC). Collaborators collected samples from late May to late August in Manitoba and parts of eastern Saskatchewan. The proportion of plants with suspected virus symptoms in surveyed crops was estimated and specimens with and without symptoms collected for testing. Infection with BYDV and WSMV was confirmed by transmission to indicator hosts, and for BYDV characterized to serotype, by enzyme-linked immunosorbent assay (ELISA). In addition, transmission to indicator hosts was used to assess virulence against historical benchmarks. For WSMV, transmission was by mechanical inoculation to a range of susceptible spring bread and durum wheat hosts; for BYDV, transmission was by cereal aphids to sets of seedlings of a susceptible oat host.

**RESULTS AND COMMENTS:**

**Barley Yellow Dwarf:** Losses due to BYD in 2003 were among the lowest in 20 years, and even lower than in 2000 and 2001 (1,2). Cereal aphid populations with BYDV were not detected in Manitoba until late June, and numbers were low, resulting in only very scattered incidence of the disease. Most of the relatively small number of earliest-arriving cereal aphids were oat bird-cherry (*Rhopalosiphum padi*), the most efficient vector of the predominant BYDV strain, PAV. All virus isolates from small grains were the PAV strain (non-specifically transmitted by *R. padi*). Even late-seeded fields of oat and barley had very low levels of disease and only trace losses occurred. By contrast, research plots artificially inoculated in mid-June with viruliferous aphids showed high to extreme levels of disease due to the synergistic effects of high temperature and long periods of bright sunlight at the critical stage of stem elongation.

**Wheat Streak Mosaic:** Outbreaks of WSM in spring wheat crops in Manitoba were notable in 2003, both for their local severity and for appearing at sites where the disease had not previously been recorded. In recent years, winter wheat cultivation has expanded in regions such as south-central Manitoba, where it has not traditionally been practised. In 2003, severe local outbreaks of WSM were confirmed at a few sites in the Interlake region; winter wheat had recently been introduced there as part of programs to benefit migratory waterfowl. With the increasing use of winter wheat in hitherto 'spring-wheat-only' areas, the overall incidence and severity of WSM in spring wheat continue to increase. As in recent years in Manitoba and eastern Saskatchewan, crop-destroying losses were more likely to occur in spring wheat crops adjacent to winter wheat inoculum sources than in winter wheat crops themselves.

**Flame Chlorosis:** FC was not seen in 2003. After expansion in the late 1980s and early 1990s (3), FC has declined to the point that it has been seen at only a few sites or, as in 1999, 2002 and 2003, not at all.

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**CULTURE/ CROP:** Céréales (Avoine [*Avena sativa*], Orge [*Hordeum vulgare*], Blé [*Triticum aestivum* ] )  
**RÉGION/ LOCATION:** Québec

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**TITRE / TITLE: LES MALADIES DES CÉRÉALES À PAILLE PRÉSENTES AU QUÉBEC EN 2003**

**MÉTHODES:** Nous avons visité à une ou deux reprises les essais d'avoine, de blé et d'orge de printemps du réseau d'enregistrement et recommandation du Québec lorsque les plantes étaient au stade de développement laiteux moyen à pâteux moyen. L'incidence des maladies foliaires a été notée selon une échelle de 0 à 9 (0 = plante saine; 9 = feuille étandard présentant des symptômes sur plus de 50 % de sa surface), de même que les maladies de l'épi du blé (0 = absence de symptôme; 9 = 90 % des épillets atteints par la maladie). L'intensité des symptômes foliaires est considérée faible pour des cotes variant de 0 à 4; moyenne pour des cotes de 4 à 6; et élevée pour des cotes de 6 à 9. Des données supplémentaires du contenu des grains en mycotoxines ont été recueillies auprès d'acheteurs de grains du Québec. Des cultures de blé et d'orge situées dans différentes localités au Québec ont aussi été visitées afin d'y détecter des problèmes causés par les pourritures des racines.

**RÉSULTATS et COMMENTAIRES:** Les stress biotiques et abiotiques se sont combinés pour nuire aux racines de manière significative en 2003. De façon générale en 2003, les conditions climatiques ont été très pluvieuses pour la période des semis et pour les semaines subséquentes, soit en avril, mai et au début de juin. Les semis ont ainsi été retardés, rendant les cultures plus sensibles aux maladies et occasionnant le développement de talles secondaires tardives. Ces conditions ont nui à l'établissement des racines et favorisé les pourritures pythiennes (*Pythium* spp.) dans plusieurs champs, l'orge étant plus affectée que le blé. Par la suite, de la mi-juin à la mi-juillet, on a connu des conditions relativement chaudes et sèches dans la grande région de Montréal, entrecoupées toutefois de faibles averses localisées et relativement régulières. Les racines ont alors subi quelques dommages par les autres pourritures (*Cochliobolus* et *Fusarium* spp.), et ce surtout dans les sols chauds. Cette période a été suivie de précipitations abondantes et fréquentes jusqu'à la mi-août. Ailleurs au Québec, les conditions étaient moins chaudes, davantage pluvieuses et caractérisées par des averses régulières.

Le fait marquant de 2003 a été, sans aucun doute, la forte incidence de la fusariose des inflorescences chez toutes les espèces de céréales, et ce, dans toutes les régions du Québec. Selon les données recueillies de différents acheteurs de grains, il s'agirait de la pire épiphytie de fusariose que le Québec ait connu jusqu'à ce jour. La dernière épiphytie, qui remonte à 1996, n'avait touché que le blé, mais celle de 2003 a touché toutes les céréales à paille. Le blé et l'orge auraient été les plus infectés alors que plus de 75 % des échantillons de blé analysés (~ 800 échantillons de grains) et aux environs de 70 % des échantillons d'orge (>2000 échantillons) contenaient plus de 1 ppm de déoxynivalénol (DON). Plus de la moitié de ces échantillons analysés contenaient au moins 2 ppm de DON; le contenu en DON le plus élevé a été de 18 ppm chez le blé et de 31 ppm chez l'orge. L'avoine, qui est habituellement beaucoup moins affectée par la fusariose que le blé et l'orge, a été cette fois-ci passablement atteinte. En effet, près de 60 % des quelques 400 échantillons de grains analysés contenaient plus de 1 ppm de DON; 40 % en contenaient plus de 2 ppm; et le contenu maximal obtenu a été de 12 ppm.

La maladie foliaire de l'avoine la plus fréquente au Québec est demeurée en 2003 la maladie des taches ovoïdes (*Stagonospora avenae*). L'intensité des symptômes était plutôt moyenne dans le sud et le centre de la province, alors qu'elle était plus élevée au Lac-Saint-Jean et dans le Bas-Saint-Laurent. La rouille couronnée (*Puccinica coronata*) a été observée à Sainte-Anne-de-Bellevue et Saint-Simon dans la plaine

de Montréal, à Pintendre dans la zone du centre et à LaPocatière dans la zone périphérique. L'intensité des symptômes variait passablement d'une lignée à l'autre, allant de faible à élevée. La jaunisse nanisante de l'orge (VJNO), quant à elle, n'a pas été observée chez l'avoine en 2003.

Chez le blé, les taches foliaires causées par les *Drechslera tritici-repentis* et *Stagonospora nodorum*, étaient encore en 2003, les maladies foliaires les plus répandues avec une incidence faible à moyenne. La rouille des feuilles (*Puccinia triticina*) et l'oïdium (*Blumeria graminis* f. sp. *tritici*, syn. *Erysiphe graminis*) se sont peu manifestés en 2003. C'est à Princeville que ces maladies ont eu le plus d'incidence et cette incidence était plutôt faible. La jaunisse nanisante de l'orge a été rare en 2003 chez le blé. Pour la fusariose de l'épi, étant donné que les symptômes sont apparus tard en juillet, la notation des symptômes n'a été possible qu'à un seul site d'essai du réseau d'enregistrement et recommandation du Québec, soit celui d'Hébertville au Lac-Saint-Jean. Le pourcentage d'épillets fusariés variait de 8 à 40 % selon les lignées.

Chez l'orge, la rayure réticulée (*Drechslera teres*) a été la plus répandue. Comme à l'habitude on l'a observée dans toutes les régions du Québec et l'intensité des symptômes variait de moyenne, dans la plaine de Montréal, à élevée dans les autres régions. La rhynchosporiose (*Rhynchosporium secalis*), la rouille des feuilles (*Puccinia hordei*), l'oïdium (*Blumeria graminis* f.sp. *hordei*, syn. *Erysiphe graminis*) et la jaunisse nanisante de l'orge ont été très peu ou pas du tout observés en 2003.

**CROP / CULTURE:** Corn  
**LOCATION / RÉGION:** Ontario and Quebec

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: OCCURRENCE OF CORN VIRUS DISEASES IN ONTARIO AND QUEBEC FROM 1999 TO 2001**

**INTRODUCTION AND METHODS:** Abnormal plants exhibiting virus-like symptoms are frequently observed in corn crops and breeding nurseries in eastern Canada but the importance of virus diseases in eastern Canadian corn fields is not clear. Virus-like symptoms may be caused by factors other than viruses, such as herbicide toxicity, insect attack or mineral deficiency. Viruses that might have the potential to cause outbreaks in Canada include: barley yellow dwarf luteovirus (BYDV), maize dwarf mosaic potyvirus [MDMV, (=MDMV-A)], sugarcane mosaic potyvirus [SCMV, (= MDMV-B)], johnsongrass mosaic potyvirus (JgMV) [= MDMV-0], maize chlorotic mottle machlomovirus (MCMV), maize chlorotic dwarf waikavirus (MCDV), wheat streak mosaic potyvirus (WSMV) and maize white line mosaic virus, ungrouped (MWLMV). All of these viruses are found in corn crops close to the Canada-U.S. border. Some also are found in small-grain cereal crops.

To assess the occurrence of viruses that might have the potential to cause disease outbreaks in corn crops, virus diseases were surveyed from 1999 to 2001 in the largest corn growing regions of Canada: southern Ontario, eastern Ontario, and western Quebec (Table 1). Sixty-nine crops were surveyed in 1999, 114 in 2000, and 117 in 2001. To include as much genetic variability as possible, the survey was conducted mostly in grain hybrid trials and seed-industry demonstration trials. In addition, 3, 9 and 11 sweet corn crops were surveyed in 1999, 2000, and 2001, respectively. In each year, the fields were surveyed during the grain-filling period. The symptoms observed were recorded, and leaf samples were taken from all plants exhibiting symptoms typical of any of the eight targeted diseases. Leaf samples also were taken from plants exhibiting an abnormal appearance such as dwarfing, other deformities, and discoloration. Leaf samples were stored for 1-10 days in plastic bags at 4°C and tested for known viruses using ELISA assays and reagent sets and protocols provided by AGDIA Inc. (Elkhart, Indiana, U.S.). Each sample was assayed for BYDV-MAV, BYDV-RPV, WSMV, MWLMV, MCMV, MCDV, SCMV, JgMV and MDMV.

**RESULTS AND COMMENTS:** BYDV was identified at only two locations in 1999. No BYDV was found in 2000 and 2001. In 1999, ELISA tests were positive for BYDV-MAV in 3 of 18 plants tested from a late flowering exotic cultivar in Ottawa, ON (Table 2), and in 1 of 3 plants tested from a sweet corn field in Maynard, ON. Both crops had flowered late in relation to other corn crops in the region and had severe aphid infestations. The plants sampled from these crops exhibited shortening in the uppermost internodes but did not exhibit typical BYDV symptoms, such as leaf yellowing and red pigmentation (Brown et al., 1984). All positive samples reacted with the MAV reagent set but not with the RPV reagent set, suggesting that the strain(s) infecting the plants belong to the MAV group (BYDV-MAV, BYDV-PAV and BYDV-SGV).

WSMV was identified only in 2000 and only at a very low incidence in one sweet corn crop (Table 2). Considering the low frequencies of corn crops infected with BYDV and WSMV, and the low incidence of these viruses in affected fields, it seems unlikely that either of these diseases are important in corn crops in Ontario or Quebec.

MDMV was identified in 2000 and 2001, mostly in sweet corn fields. Its incidence was low in May-planted crops but relatively high in crops that had been planted later in the season (Table 2). These included sweet corn crops planted in June or July and a grain corn crop planted in August for demonstration purposes at Ridgeway, ON. Maize dwarf mosaic can be caused by MDMV, SCMV or JgMV. Only MDMV and SCMV were identified from these fields, which is consistent with the fact that MDMV and SCMV are more prevalent than JgMV in the northern USA (Gordon et al., 1979). MDMV and SCMV are vectored in a non-persistent manner by several aphids. Studies done in Ohio indicated that the number of viruliferous aphids can increase 20-fold between May and August (Knoke et al., 1974). In the late-planted corn fields surveyed here, it is likely that large populations of viruliferous aphids were present at juvenile crop stages when corn is particularly susceptible to these diseases. This resulted in a relatively high level of maize dwarf mosaic.

Most of the plants that had exhibited an abnormal appearance, but not that normally associated with any of the 8 targeted viruses, were found to be virus-free when assayed.

In conclusion, the incidence of viruses seems to be very low in corn crops planted during May, the month in which corn is usually planted in Ontario and Quebec. Thus, virus diseases appear to be of little economic importance in these regions. However, MDMV and SCMV may occur at higher incidences in crops planted in June and beyond. This includes sweet corn crops planted later in the season to allow producers to satisfy the demands for fresh-market produce over a long period.

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**Table 1.** Regions, counties and number of fields surveyed for corn virus diseases in Ontario and Quebec, 1999 to 2001.

Region	County	Number of Surveyed Fields		
		1999	2000	2001
Southern Ontario	Dufferin	–	1	2
	Durham	3	2	4
	Elgin	3	2	5
	Essex	–	2	1
	Huron	3	5	2
	Kent	4	11	14
	Lambton	–	1	1
	Middlesex	2	15	12
	Oxford	2	3	4
	Peel	1	1	3
	Perth	–	2	3
	Wellington	2	2	5
Eastern Ontario	Frontenac	3	4	2
	Hastings	-	1	-
	Lanark	2	2	2
	Leeds and Greenville	9	11	6
	Ottawa-Carleton	7	6	5
	Prescott and Russell	1	6	4
	Renfrew	3	6	4
	Stormont, Dundas and Glengarry	7	7	8
	Waterloo	1	2	2
	York	1	1	2
Western Quebec	Acton	3	-	-
	Argenteuil	1	1	2
	Brome-Missisquoi	2	1	2
	D'Autray	1	-	1
	Joliette	-	-	1
	La Rivière-Du-Nord	-	1	-
	La Vallée-Du-Richelieu	-	1	1
	Lajem merais	-	1	2
	Le Bas-Richelieu	1	-	1
	Le Haut-Richelieu	1	-	1
	La Haute-Yamaska	-	1	1
	Les Maskoutains	3	9	9
	Mirabel	-	-	1
	Montcalm	2	1	2
	Vaudreuil-Soulanges	1	5	2

**Table 2.** Occurrence of ELISA-positive plants for barley yellow dwarf luteovirus (BYDV), sugarcane mosaic potyvirus (SCMV), maize dwarf mosaic potyvirus (MDMV) and wheat streak mosaic potyvirus (WSMV) among symptomatic plants collected in a survey for corn virus diseases conducted in Ontario and Quebec from 1999 to 2001.

Year	Location †	County	Type of corn	Month crop planted	% of symptomatic plants ‡	Plants tested by ELISA	Number of ELISA-positive plants			
							BYDV	SCMV	MDMV	WSMV
1999	Ottawa	Ottawa-Carleton	Exotic	May	-	18	3	-	-	-
	Maynard	Leeds and Grenville	Sweet	May	-	3	1	-	-	-
2000	Ottawa	Ottawa-Carleton	Sweet	May	-	9	-	1	-	-
	Bothwell	Kent	Sweet	May	-	3	-	2	1	-
	North Crest	Middlesex	Sweet	June	0.5	10	-	7	3	-
	Ballymote	Middlesex	Sweet	June	12.0	30	-	14	10	2
	Ballymote	Middlesex	Sweet	June	6.0	8	-	-	7	-
	London	Middlesex	Sweet	June	4.0	6	-	4	1	-
	London	Middlesex	Sweet	June	4.0	7	-	6	2	-
	Ridgetown	Kent	Yellow dent	Aug.	75.0	15	-	11	6	-
2001	Glanworth	Middlesex	Sweet	July	4.0	6	-	-	6	-
	London	Middlesex	Sweet	June	-	2	-	2	-	-
	St. Thomas	Elgin	Sweet	June	-	2	-	2	-	-
	Ste-Madeleine	Les Maskoutains	Sweet	June	-	4	-	4	-	-

† All locations with the exception of Ste-Madeleine, QC, are in Ontario. ‡ At some locations, the disease incidence was very low and not recorded.

**CROP / CULTURE:** Corn  
**LOCATION / RÉGION:** Ontario and Québec

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: SURVEY OF CORN DISEASES AND PESTS IN ONTARIO AND QUÉBEC IN 2003**

**INTRODUCTION AND METHODS:** From August 20 to September 17, 2003, a survey of corn diseases and pests was conducted in Ontario and Québec. As in previous years, the emphasis of the survey was to determine the distribution and severity of the bacterial disease, Stewart's wilt (*Pantoea stewartii* = *Erwinia stewartii*). The distribution and severity of other diseases and insects, including eyespot (*Aureobasidium zeae*), common rust (*Puccinia sorghi*), northern leaf blight (*Exserohilum turcicum*), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghii* = *Sphacelotheca reiliana*), ear rot (*Fusarium* spp.), stalk rot (*Fusarium* spp., and *Colletotrichum graminicola*), European corn borer (*Ostrinia nubilalis*), corn rootworm (*Diabrotica longicornis* and/or *D. virgifera*), and corn flea beetle (*Chaetocnema pulicaria*) also were recorded. In addition, scouting for any recent new pests in Canada was conducted, in particular for grey leaf spot (*Cercospora zeae-maydis*).

At each of the 169 field locations surveyed, the incidence of each pest and the severity (described as: 'slight', 'moderate', 'severe', etc.; or, as % of plants affected) of the predominant disease and pest species were recorded. Alternatively, for diseases, the resistance phenotype of the host was noted. Additionally, nine field collections of Stewart's wilt leaf samples and 22 of seedling plant samples were collected in June by personnel from the Ontario Ministry of Agriculture and Food at Ridgetown College, and from the University of Guelph, Kemptville College, as well as four corn flea beetle samples obtained from insect traps in Lambton county, ON. All samples were tested for the pathogen *P. stewartii* by ELISA, using reagent sets, protocols, and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

**RESULTS AND COMMENTS:**

**Fungal leaf diseases:** **Eyespot** was found in 64 fields (Table 1). At the Ontario Corn Committee (OCC) trials in Ottawa and Lancaster, only a few of the hybrids tested were found to be moderately susceptible, while others had little or no disease. **Common rust** was found in most fields; in some seed corn fields in Essex County, ON, this occurred at a moderate level of severity. **Southern rust** (*Puccinia polysora*) was not found this year. Typical symptoms of **grey leaf spot** were detected in 22 fields in 5 counties of Ontario. As in 2002, grey leaf spot was more severe than other leaf diseases such as eyespot and rust, in some fields in Chatham-Kent county, ON. **Anthraxnose leaf blight**, caused by *C. graminicola*, the same pathogen that also causes anthracnose stalk rot and top-die back, was found in 52 fields in 23 counties. While not severe, this is the first time this foliar disease has been so widely distributed. **Northern leaf blight** was found in 7 fields, with one of these, a seed corn field at Erie Beach, Chatham-Kent county, ON, having plants showing moderate susceptibility; this did not, however, result in significant yield loss. No northern leaf blight was found at the two farms at St-Philippe, Argenteuil County, QC, and in Forfar, Leeds and Grenville County, ON, where severe blight damage was reported in 1998 (1) and 2000 (2).

**Fungal Ear and Stalk diseases:** **Gibberella/Fusarium ear rots** were observed in 57 fields surveyed in September with most having a disease incidence of 1-20%. In eastern Ontario, some hybrids had 40-50% ear rot levels, higher than recorded in the past four years; these likely were due to the high rainfall in September and October, 2003. *Gibberella zeae* (= *Fusarium graminearum*), *F. subglutinans*, and *F. poae* were the three main pathogenic species. One field in Le Bas-Richelieu County, QC, had an ear rot incidence of 85%, with 3-25% of kernels in diseased ears affected. Here, the primary pathogen was identified as *F. poae*. This field had had 10 years of continuous cropping of corn and wheat, and this likely was responsible for the high severity of ear rot found. **Common smut** was widely distributed and found in 104 fields in 2003. Some seed corn fields in Essex and Chatham-Kent Counties, ON, showed moderate levels of ear and/or stalk rot, at incidence levels of 5-20%. In an AAFC experimental field in Renfrew County, ON, 20-100% of the plants, depending on the corn genotype, exhibited common smut; however, most smut galls emerged from the tassel node and only caused the tassel to bend. A similar situation was found in a field in Les Maskoutains County, QC, but here only 7% of the plants were affected. **Head smut** was found only at the AAFC Greenbelt Farm, Ottawa-Carleton County, ON, which has been monitored

since 1998 (1, 2, 3, 4). In 2003, the incidence of head smut in the centre field was only 2%, and was less than 1% in the other fields sampled. This was the lowest level recorded since 1998.

Stalk rot, including [Anthracnose stalk rot/Top-die back](#), [fusarium stalk rot](#), and [pythium stalk rot](#) were found at 57 field locations in southern Ontario, eastern Ontario, and Québec. At the time of the survey, damage from these diseases appeared to be minimal. However, significant lodging of crops occurred in eastern and southwestern Ontario in October and November as a result of heavy rains accompanied by strong winds. Here, anthracnose and fusarium stalk rot incidences were as high as 50-70% in some hybrids, and these became the two main diseases present.

**Bacterial diseases:** [Stewart's wilt](#) was found infrequently in 2003. Typical symptoms were observed in August in only 9 fields in Ontario; these were located in the counties of Chatham-Kent and Frontenac (Table 1). No Stewart's wilt was found in Québec. Stewart's wilt also was rare in grain corn evaluated in the OCC trials. Of the 9 leaf wilt samples collected, 7 were positively identified as Stewart's wilt by the ELISA test. Significantly, of the 22 wilt seedling samples collected, all from Essex and Chatham-Kent Counties, ON, 17 tested positive with ELISA. Moreover, in one of these field collections, 10% of the 60 seedlings sampled tested positive, confirming that Stewart's wilt can be seed-borne. Seedling death resulting from Stewart's wilt infection was due mainly to coleoptile decay at the 3-5 leaf stage. The 4 corn flea beetle samples, each involving 10-20 adult beetles, all tested positive for *P. stewartii*; however, no typical Stewart's wilt symptoms were observed at either the seedling or mature plant stages. Six crops that tested positive for *P. stewartii* at the seedling stage were sampled again in August. Only a slight amount of typical Stewart's wilt symptoms were found in 4 crops and 2 showed none, including that with 10% positive seedling plants. It was noted that populations of [corn flea beetle](#), a vector of Stewart's wilt, were very low in southern Ontario in 2003. Our observations and results suggest that the relationships among wilt at the seedling stage, that at the mature plant stage, and the population of corn flea beetle is quite complicated. While Stewart's wilt can be seed-borne, it appears that a certain population of the corn flea beetle is necessary to spread the disease to other developing corn plants. Further research is needed to investigate the relationship between corn flea beetle populations and Stewart's wilt epidemics.

[Holcus leaf spot](#) (*Pseudomonas syringae*) was found in a field in Prescott and Russell County, ON, on plants in the first 5-10 rows bordering a dirt road; this had resulted in considerable dust accumulation on the leaves, suggestive that microscopic damage to the leaf epidermis had occurred, providing an entry point for bacterial inoculum. No [Goss' bacterial wilt](#) (*Clavibacter michiganensis* subsp. *nebraskensis* = *Corynebacterium nebraskense*) was observed in 2003.

**Viral diseases:** Only one field in Essex, and two fields in Chatham-Kent counties, ON, had plants with apparent maize dwarf mosaic (MDM) symptoms, however, no confirmatory ELISA tests were done. It was noted that populations of the MDMV aphid vector were very low in corn fields until mid-August in 2003; as such, the period of corn susceptibility to MDM would have passed.

**Insects:** [European corn borer](#) (ECB) damage was observed in 120 fields. Damage caused by ECB was more severe in eastern Ontario and Québec than in southern Ontario. In Renfrew, Ottawa-Carleton, Prescott and Russell Counties, ON, and Argenteuil County, QC, damage in some fields was extended to 25-90% of the plants. Damage by the ECB did not appear to be correlated with previous levels of infestation and damage, as most fields with greater damage from ECB in 2002, displayed only slight damage in 2003.

[Corn rootworm](#) (CRW) damage was widespread and observed in 113 fields. As found in previous years, damage in most fields involved leaf feeding and silk pruning by the insect. In eastern Ontario in 2003, adult beetles were observed as early as mid-June, almost one month earlier than normal. Hot weather in early and mid-June in eastern Ontario could explain this observation.

As already indicated, [aphid](#) populations were lower in 2003 early in the season, but these became high after mid-August in eastern Ontario and Québec. [Corn blotch leaf miner](#) (*Agramyza parvicornis*) was found in all fields surveyed in both Ontario and Québec, but did very little damage. [Red-legged grasshopper](#) (*Melanoplus femur-rubrum*), were numerous in most fields. Grasshopper numbers were highest in field areas along roads, ditches, and streams, where as many as 10 adults per m<sup>2</sup> were counted during the survey period. Relatively dry conditions over the previous few summers have been

favourable for insect development and as a result, grasshoppers have become more numerous and problematic in both Ontario and Québec.

**Mites:** Unfavourable environmental conditions due to frequent rains led to low levels of the two-spotted spider mite (*Tetranychus urticae* = *T. bimaculatus*) in corn fields surveyed in 2003.

**Other:** **Pythium seedling damp-off** was observed two weeks after a long period of rain in late May in Québec. A single field with **crazy top** downy mildew (*Sclerophthora macrospora*) symptoms was detected in Ottawa-Carleton County, ON. **Brown stink bug** (*Euschistus servus*) damage was reported in Vaudreuil-Soulanges County, QC, in late June. Brown stink bugs are difficult to scout for as the insect blends well with the soil and also hides quickly. The population of brown stink bug may not be high, but the insect can cause significant damage to plants. Both nymphs and adults suck on inside tissues when leaves are still in the whorl, resulting in a long transparent to whitish strip of tissue that becomes visible on affected leaves when these elongate. This symptom is somewhat like Stewart's wilt, but differs in having a feeding scar at one end. **Corn earworm** (*Helicoverpa zea*) was not severe in 2003.

**Summary:** As a result of a very wet growing season in 2003, anthracnose leaf blight and northern leaf blight incidences were higher than normal; overall, however, the severity of leaf diseases was low. Ear rot and stalk rot diseases were prevalent in the fall. Stewart's wilt incidence was much lower than found previously, probably as a result of the low corn flea beetle populations in 2003. European corn borer was a problem in eastern Ontario and Québec and grasshoppers were a problem in both Ontario and Québec.

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**Table 1:** Distribution of diseases and pests of corn in Ontario and Québec in 2003.

County	# of fields	Eye-spot	Rust	GLS	ALB	NLB	Wilt	Smut	Ear rot	Stalk rot	ECB	CRW	CFB
<b>Ontario</b>													
Chatham-Kent	18	3	18	11	4	4	3	13			17	6	5
Dufferin	1		1									1	
Durham	5		4					4			4	4	4
Elgin	6		6	3				2			2	4	
Essex	10	4	10	4	4	1		10			5	4	3
Frontenac	4	1	3				1	1	1	1	4	1	
Haldimand-Norfolk	4	2	4					3			1	3	1
Huron	6	1	6	3	1						3	6	4
Lambton	5	1	5					4			2	2	2
Lanark	3		3					3	2	1	2		
Leeds and Grenville	13	5	10		3			9	5	6	13	10	
Middlesex	4	1	4	1				3			4	3	3
Ottawa-Carleton	9	7	7		3	1		5	6	4	9	9	
Oxford	4		4		2			2			1	4	1
Peel	1		1								1	1	
Perth	6	1	6		1			2			2	5	1
Prescott & Russell	8	5	7		6			6	6	7	6	4	
Renfrew	9		8		1			3	4	7	9	5	
Stormont Dundas	4	4	4		4	1		2	4	1	4	4	
Glengarry													
Victoria	2		2					2			1	2	
Waterloo	3		3		1			1			2	2	
Wellington	6	1	6		1						1	5	2
York	2		2		1			1			1	1	
<b>Québec</b>													
Acton	2	2	2					2	1	1	2	2	
Argenteuil	2	2	1		1			1	2	1	1	1	
Brome-Missisquoi	1	1	1		1			1	1	1		1	
D'Au-tray	3	2	1		1			3	1	3	2	2	
La Rivière-Du-Nord	1	1			1			1	1	1	1		
Lajemmerais	1	1						1		1	1	1	
Le Bas-Richelieu	4	2	2		3			2	2	3	3	3	
Le Haut-Richelieu	1	1			1				1			1	
La Haute-Yamaska	3	3			2			2	3	2	1	1	
Les Maskoutains	7	4	1		3			5	7	7	7	6	
Montcalm	3	3	3					3	3	3	3	3	
Rouville	3	1	3		2			3	3	2	1	2	
Vaudreuil-Soulanges	5	5	4		5			4	4	5	4	4	
<b>Total</b>	<b>169</b>	<b>64</b>	<b>142</b>	<b>22</b>	<b>52</b>	<b>7</b>	<b>4</b>	<b>104</b>	<b>57</b>	<b>57</b>	<b>120</b>	<b>113</b>	<b>26</b>

Rust = Common rust; GLS = Grey leaf spot; ALB = Anthracnose leaf blight; NLB = Northern leaf blight; Wilt = Stewart's wilt; Smut = Common smut; Ear rot - includes gibberella ear rot and fusarium ear rot; Stalk rot - includes fusarium stalk rot, anthracnose stalk rot, and top-die back; ECB = European corn borer; CRW = Corn rootworm, including both western and northern corn rootworm; CFB = Corn flea beetle.

**CROP / CULTURE:** Oat  
**LOCATION / RÉGION:** Manitoba and eastern Saskatchewan

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**TITLE / TITRE: CROWN RUST OF OAT IN WESTERN CANADA IN 2003**

**INTRODUCTION AND METHODS:** Surveys for oat crown rust (*Puccinia coronata* f. sp. *avenae*) incidence and severity were conducted in southern Manitoba from July 9<sup>th</sup> to August 19<sup>th</sup>, and in Saskatchewan on August 12<sup>th</sup> and 13<sup>th</sup>. Crown rust collections were obtained from wild oat (*Avena fatua*) and commercially grown oat in farm fields, and from susceptible and resistant oat lines and cultivars grown in uniform rust nurseries. The nurseries were located at Brandon, Emerson, and Morden, MB, and at Indian Head, SK. Virulence phenotypes of single-pustule isolates established from the rust collections were identified, using 16 single-gene backcross lines carrying crown rust resistance genes *Pc38*, *Pc39*, *Pc40*, *Pc45*, *Pc46*, *Pc48*, *Pc50*, *Pc51*, *Pc52*, *Pc54*, *Pc56*, *Pc58*, *Pc59*, *Pc62*, *Pc64*, and *Pc68* as the primary differential hosts (Chong et al. 2000). Single-gene lines with *Pc91*, *Pc94* and *Pc96* were used as supplemental differentials. Genes *Pc91*, *Pc94* and/or *Pc96* are being used in oat breeding programs at the Cereal Research Centre, Winnipeg, Eastern Cereal and Oilseed Research Centre, Ottawa, Lacombe Research Centre, Lacombe, and Crop Development Centre, Saskatoon.

**RESULTS AND COMMENTS:** The outbreak of crown rust on oat in Manitoba and eastern Saskatchewan was one of the lightest in many years. Trace amounts were first observed on wild oat in areas near Carman, MB, on July 9<sup>th</sup>, but remained mostly at trace levels in commercial oat crops across southern Manitoba and eastern Saskatchewan in mid-August. For the second year in a row, hot dry conditions in late July and early August severely limited rust development in both regions. However, at one location near Carman, MB, where a crop of 'AC Assiniboia' was grown in proximity to buckthorn, the alternate host, % leaf area coverage reached 80S by July 30<sup>th</sup>. This was the highest crown rust severity ever seen on a cultivar with crown rust resistance gene *Pc68*. Crops of 'AC Assiniboia' planted further away from the alternate host had only trace to 2S % leaf area coverage. The proximity effect of buckthorn infections demonstrates the importance of removal of this alternate host in the vicinity of oat fields to reduce crown rust severity by eliminating early infection. Had conditions been more conducive for development of the rust in 2003, there would be more widespread damage by the rust in oat crops around the Carman area.

To date, 164 single-pustule isolates of *P. coronata* f. sp. *avenae* obtained in Manitoba and Saskatchewan in 2003 have been evaluated for virulence phenotype. One hundred and twenty-two isolates originated from wild oat. Virulence frequencies of these isolates to *Pc38* and *Pc39* were 83% and 82%, respectively, indicating cultivars such as 'Dumont', 'Robert', 'Riel', 'AC Belmont', 'AC Marie', 'AC Preakness', and 'AC Rebel' would be completely susceptible. 'Triple Crown' carries crown rust resistance gene *Pc48*, and 'AC Assiniboia', 'AC Medallion', 'AC Pinnacle', 'Ronald', 'Gwen' and 'Kaufmann', carry *Pc68* in addition to *Pc38* and/or *Pc39*. Virulence frequencies among the 122 isolates from wild oat to *Pc48* and *Pc68* were 27% and 12%, respectively. Virulence to *Pc48* and *Pc68* thus accounted for 39% of the isolates in the rust population. Of the 42 isolates from collections in oat crops in Manitoba and eastern Saskatchewan, 81% and 91% were virulent to *Pc38* and *Pc39*, respectively. Thirty-six percent and 33% of the isolates were virulent to *Pc48* and *P68*, respectively. One isolates from wild oat was virulent to *Pc91*. Seven isolates were virulent to *Pc96*. A new oat cultivar with a new crown rust resistance gene combination, *Pc68* and *Pc94* (developed by the Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg), was recently approved for commercial production in Manitoba and eastern Saskatchewan, the rust-prone areas in western Canada. Virulence to *Pc94* has been extremely rare in Canada since a line with this gene was first tested in 1993. In 2003, none of the isolates from western Canada had virulence for this gene.

**REFERENCE:**

Chong, J., K.J. Leonard, and J.J. Salmeron. 2000. A North American system of nomenclature for *Puccinia coronata* f. sp. *avenae*. Plant Dis. 84:580-585.

**CROP / CULTURE:** Oat  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** The occurrence of *Fusarium* head blight (FHB) in oat in southern Manitoba was assessed by surveying 23 commercial fields from July 16 to July 31 when most crops were at the late milk to soft dough stage of growth (ZGS 77-83). Fields were sampled at regular intervals along the survey routes, depending on availability. *Fusarium* head blight in each field was assessed by sampling of a minimum of 80-100 plants at each of 3 locations for percentage of infected panicles (disease incidence), and for the average proportion of the panicle affected (severity). Disease levels were calculated as the 'FHB Index' (% incidence x % severity / 100). Several affected panicles closest to each of the 3 plant clumps sampled were collected from each location, placed in plastic bags and frozen. Subsequently, up to 50 putatively infected seeds per field were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar to identify and quantify the *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Moisture levels in spring 2003 over most of southern Manitoba were ideal for crop development, but from the end of June to mid-August little or no rain fell in the region; this period was accompanied by frequent warm to hot winds. As such, conditions were not conducive for the infection of cereal crops by *Fusarium* at heading and during subsequent grain filling.

Sixteen of the 23 fields surveyed had visible symptoms of FHB. However, because of the open inflorescence (panicle) in oat, and the generally low levels of disease, FHB was difficult to assess in this crop. Overall, incidence of FHB was 0.3% (range <0 - 1.8%), severity 2.0% (range 0 - 6.0%) and the FHB Index 0.01% (range 0 - 0.05%). As such, FHB was estimated to have caused no damage to the commercial oat crop. This level of disease was much lower than that in 2002 (Tekauz et al. 2003), which is consistent with what was found in 2003 in barley, spring- and winter wheat.

The *Fusarium* spp. isolated and their occurrence in crops and on kernels are listed in Table 1. In contrast to 2002 (Tekauz et al. 2003), *F. graminearum* was the predominant species present. *Fusarium graminearum* was isolated at higher levels, and all other species at lower levels than found in 2002. *Fusarium culmorum*, found in 2003, was not isolated from infected oat kernels in 2002.

**Table 1.** *Fusarium* spp. isolated from Manitoba oat kernels in 2002.

<i>Fusarium</i> spp.	Percent of crops	Percent of kernels
<i>F. avenaceum</i>	4.4	2.3
<i>F. culmorum</i>	4.4	4.6
<i>F. graminearum</i>	30.4	65.9
<i>F. poae</i>	21.7	20.5
<i>F. sporotrichioides</i>	8.7	6.8

**REFERENCE:**

Tekauz, A., Mueller, E., Stulzer, M., Beyene, M., Ghazvini, H., Schultz, D., and Reverchon, F. 2003. *Fusarium* head blight of oat in Manitoba in 2002. Can. Plant Dis. Surv. 83: 50-51. (<http://www.cps-scp.ca/cpds.htm>)

**CROP / CULTURE:** Oat  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** Leaf spot diseases of oat in Manitoba were assessed in 23 fields during surveys done from July 16 to July 31 when most crops were at the late milk to soft dough stages (ZGS 77-83). Fields were sampled at regular intervals along survey routes, depending on availability. Disease incidence and severity were recorded by averaging their occurrence and level on about 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Leaves with typical symptoms were collected at each site and dried and stored in envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify causal agent(s), determine the disease(s) present, and assess their relative importance.

**RESULTS AND COMMENTS:** Conditions during the spring in southern Manitoba were ideal for crop development; soil moisture levels were optimal at the start of the growing season, and periodic showers in May and June maintained moisture reserves. However, from July to mid-August, little or no rain fell and frequent warm to hot winds resulted in soils becoming quite dry. Conditions were ideal for early leaf spot development, but not conducive to later infection of the flag leaf, before and after crop heading.

Leaf spots were observed in the upper and/or lower leaf canopies in 21 of the 23 fields surveyed. Severity levels in the upper canopy were nil, trace or very slight in 61% of crops, slight in 30%, moderate in 9%, and severe and senescent in none. Respective severities in the lower canopy were 17%, 13%, 17%, and 4%; 49% were senescent. Since most crops had low levels of disease in the upper canopy, leaf spots caused negligible damage in oat in 2003; on average, yield losses were likely <1%; less than found in 2002 or 2001 (Tekauz et al. 2003).

*Pyrenophora avenae* (pyrenophora leaf blotch) and *Phaeosphaeria avenaria* f.sp. *avenaria* ('septoria' leaf blight) were isolated most frequently from leaf tissue and caused most of the damage observed (Table 1). *Cochliobolus sativus* (spot blotch), was much less prevalent in crops than in 2002 (Tekauz et al. 2003). Anthracnose, caused by *Colletotrichum graminicola* was detected, but as in 2002, only at a very low frequency.

**REFERENCES:**

Tekauz A., Mueller E., Stulzer M., Beyene M., Ghazvini H., Schultz D., and Reverchon F. 2003. Foliar diseases of oat in Manitoba in 2002. Can. Plant Dis. Surv. 83: 66-67. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Incidence and isolation frequency of leaf spot pathogens of oat in Manitoba in 2002

Pathogen	Incidence (% of fields)	Frequency (% of isolations)*
<i>Pyrenophora avenae</i>	77.3	50.6
<i>Phaeosphaeria avenaria</i> f.sp. <i>avenaria</i>	81.8	44.6
<i>Cochliobolus sativus</i>	13.6	1.8
<i>Colletotrichum graminicola</i>	4.5	1.2
<i>Phoma</i> spp.	4.5	1.8

\* indicative of the relative amount of foliar damage observed

**CROP / CULTURE:** Wheat

**LOCATION / RÉGION:** Alberta

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT SURVEY OF WHEAT, ALBERTA 2003**

**INTRODUCTION AND METHODS:** During July and August 2003, cooperative surveys for the presence of fusarium head blight (FHB) in wheat fields in the province were conducted by Agriculture and Agri-Food Canada (AAFC) and Alberta Agriculture, Food and Rural Development staff. Collaborators were provided with sampling instructions and images of typical FHB symptoms to aid in assessments. The surveys covered an area from Barrhead, east to Camrose, and south to the Lethbridge area. Fields also were surveyed in the Peace River region of Alberta. Counts of 300 wheat heads were taken in each of 105 fields and the incidence of FHB determined. Assessments typically were made by following a diamond-shaped path starting at least 25 m in from the edge of the field, when crops were at the late milk to dough stage of development. At each of three sites along the path, 100 randomly sampled heads were evaluated. All heads exhibiting possible FHB symptoms were then sent to the AAFC Lacombe Research Centre for confirmation of symptoms and assessment of the causal agent(s). Portions of the affected heads were surfaced sterilized in 5% commercial bleach for approximately 1 min. followed by plating on potato dextrose agar amended with 0.033 g L<sup>-1</sup> Rose Bengal. Plates were incubated for at least 7 days under a combination of fluorescent and black light, before identification of *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Results are presented in Table 1. In 2003, 50.5% of the wheat fields surveyed had no plants with visible symptoms of FHB; the remainder had symptoms similar to those typical of FHB. Most crops surveyed in the Peace River region (11 of 17) and areas south of Edmonton towards Lacombe (17 of 20) had no symptoms of FHB. The mean incidence of FHB in affected crops in the Peace region and crops south of Edmonton towards Lacombe was <0.5%, with the incidence for individual affected crops ranging from 0.3 to 0.7%. In the area immediately around Edmonton FHB symptoms occurred in 22 of 25 crops with an overall average incidence of 3.4% in affected crops; the incidence for individual affected crops ranged from 0.3 to 9.3%. In southern Alberta, 21 of the 43 crops surveyed had FHB symptoms with an overall average incidence of 2.5% and incidences for individual affected fields ranging from 0.3 to 9.3%. Of the 43 crops surveyed in southern Alberta, 35 were under irrigation, while 8 were dryland crops. Only one of the 8 dryland crops had symptoms of FHB with an incidence of 0.7%. In comparison, 20 irrigated crops had symptoms of FHB at an average incidence of 2.6%, and incidences for individual affected fields from 0.3 to 9.3%

All visible symptoms of FHB in central Alberta and the Peace River region were due largely to *F. culmorum*, *F. poae*, and *F. avenaceum*, with the number of heads per field (out of 300) affected by these pathogens ranging from 1 to 14 heads. *Fusarium graminearum* was not recovered from these samples. In southern Alberta, the head symptoms in 10 of the 21 affected fields were due solely to *F. graminearum*, with 1 to 24 heads involved. All these fields were under irrigation. Symptoms in other FHB-positive fields were ascribed to *F. culmorum* and *F. avenaceum*, with the number of heads per field affected by these pathogens ranging from 1 to 17.

We gratefully acknowledge the technical assistance of Agriculture and Agri-Food Canada and Alberta Agriculture, Food and Rural Development staff and the financial support of the Alberta Agricultural Research Institute.

**Table 1.** Incidence of fusarium head blight in Alberta wheat crops, 2003.

Region	Total no. of crops surveyed	No. crops without symptoms	No. crops affected	% of crops affected	Mean incidence in affected crops (%)	Maximum observed incidence per crop
Peace River region	17	11	6	35.3	0.4	0.7
Edmonton area	25	3	22	88	3.4	9.3
South of Edmonton	20	17	3	15	0.3	0.3
Southern Alberta	43	22	21	48.8	2.5	9.3
Overall	105	53	52	49.5	2.5	

<sup>a</sup>300 heads assessed in each of the crops sampled.

**CROP / CULTURE:** Wheat  
**LOCATION / RÉGION:** Saskatchewan

**NAME AND AGENCIES / NOM ET ORGANISME:**

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2003**

**INTRODUCTION AND METHODS:** *Fusarium* head blight (FHB) incidence and severity were assessed in 148 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 52 durum wheat (Canada Western Amber Durum class) crops in Saskatchewan in 2003. Crops were surveyed between July 7 and August 22. Fields were grouped according to soil zones (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey soils), and fields under irrigation were grouped separately as in the irrigation zone (fields along the South Saskatchewan River in central and west-central Saskatchewan).

Saskatchewan Agriculture, Food and Rural Revitalization's extension agrologists collected 50 heads at random from each crop at the milk to dough stages. The heads were analyzed by Crop Protection Laboratory staff in Regina for visual FHB symptoms. The numbers of infected heads per crop and of infected glumes and/or kernels within those heads were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each crop (FHB index = % heads affected x mean % severity of infection / 100). Mean FHB severity was calculated for each soil zone and for the province. Glumes and/or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min. and cultured on potato dextrose agar and carnation leaf agar for identification of *Fusarium* species.

**RESULTS AND DISCUSSION:** Although overall FHB prevalences and severities have been relatively low since the provincial survey began in 1998, the 2003 levels were the lowest ever reported (Pearse et al. 2003). In 2003, FHB occurred in 28% of the common wheat and 25% of the durum wheat fields surveyed (Table 1). In previous years (1998-2002), these prevalence values ranged from 43 to 62% for common wheat and 50 to 58% for durum wheat in the crops surveyed.

FHB disease severities in 2003 also were the lowest found to date (Table 1), as a result of the prolonged dry conditions experienced over most regions of the province. For common wheat, mean FHB severities were at trace (<0.1%) levels for all zones. In durum wheat, mean FHB severities were all <1%, with the highest severities found in the black/grey soil zone (0.4%) and the irrigation zone (0.6%). The overall provincial mean FHB severity for durum was 0.2%. Three crops located in either the extreme southeast of the province or in the irrigation zone had severities ranging from 2 to 3%; the higher FHB severities found in these regions are similar to those observed in previous years.

In 2003 the most commonly isolated *Fusarium* species was *F. poae*, accounting for 41% of total *Fusarium* species, followed by *F. avenaceum* (24%) and other species (Table 2). *Fusarium graminearum* was isolated from only three crops and accounted for only 4% of total *Fusarium* species, which was lower than in 2002 (10%) and 2001 (40%) (Pearse et al. 2003). All species were less prevalent in the brown soil zone than the other two soil zones.

**REFERENCE:**

Pearse, P.G., G. Holzgang, C.L. Harris, and M.R. Fernandez. 2003. *Fusarium* head blight in common and durum wheat in Saskatchewan in 2002. *Can. Plant Dis. Surv.* 83: 57-58. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Incidence and severity of fusarium head blight in common and durum wheat crops grouped by soil or irrigation zones in Saskatchewan, 2003.

Soil Zone	Common Wheat		Durum Wheat	
	No. crops affected / total crops (and %)	Mean FHB Index <sup>1</sup>	No. crops affected / total crops (and %)	Mean FHB Index <sup>1</sup>
Zone 1 Brown	3 / 24 (13%)	T <sup>2</sup>	5 / 26 (19%)	0.2%
Zone 2 Dark Brown	12 / 46 (26%)	T	5 / 20 (25%)	T
Zone 3 Black/Grey	25 / 68 (37%)	T	1 / 2 (50%)	0.4%
Irrigation Zone	2 / 10 (20%)	T	2 / 4 (50%)	0.6%
Overall Mean	42 / 148 (28%)	T	13 / 52 (25%)	0.2%

<sup>1</sup> FHB index = % heads affected x mean % severity of infection / 100

<sup>2</sup> T = trace values of FHB, <0.1%

**Table 2.** Prevalence of *Fusarium* species isolated from common and durum wheat crops in Saskatchewan in 2003.

Soil Zone	Number of crops with <i>Fusarium</i> spp. isolates (% of total <i>Fusarium</i> isolations per zone)					
	<i>F.</i> <i>avenaceum</i>	<i>F.</i> <i>culmorum</i>	<i>F.</i> <i>graminearum</i>	<i>F.</i> <i>poae</i>	<i>F.</i> <i>sporotrichioides</i>	Other <i>F.</i> spp.
Zone 1 Brown	0	1 (11%)	0	7 (78%)	1 (11%)	0
Zone 2 Dark Brown	6 (22%)	1 (4%)	1 (4%)	8 (29%)	1 (4%)	10 (37%)
Zone 3 Black/Grey	11 (31%)	0	0	16 (46%)	6 (17%)	2 (6%)
Irrigated Zone	2 (29%)	0	2 (29%)	1 (14%)	1 (14%)	1 (14%)
Overall Mean	19 (24%)	2 (3%)	3 (4%)	32 (41%)	9 (11%)	13 (17%)

**CROP / CULTURE:** Common and durum wheat

**LOCATION / RÉGION:** Saskatchewan

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**TITLE / TITRE: LEAF DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2003**

**INTRODUCTION AND METHODS:** A survey for foliar (leaf spots and leaf rust) diseases of common and durum wheat was conducted between the milk and dough growth stages in 16 crop districts (CD) in Saskatchewan in 2003. In each of 130 fields, 10 flag leaves were collected at random and air dried at room temperature. Percent leaf area affected by leaf spots (severity) was recorded for each leaf. An average percent flag leaf area with leaf spots was calculated for each field and CD. Surface-disinfested leaf pieces were plated on water agar for identification and quantification of leaf spot pathogens.

**RESULTS AND COMMENTS:** Leaf spots were observed in 58% of the common and durum wheat fields surveyed, at a mean percent flag leaf area infected of about 2%. This overall leaf spot incidence and severity was lower than in past years, and can be attributed to dry conditions prevailing during adult plant development. The highest mean leaf spot severities were observed in the east (CD 5B), central (CDs 6A and 6B), and north-west (CDs 9A and 9B) regions (Table 1).

As in previous years (Fernandez and Pearse 2002, 2003, Fernandez et al. 2002), the most prevalent leaf spot pathogen was *Pyrenophora tritici-repentis* (tan spot), both in the number of fields where it was present, and in the percent leaf area colonized (Table 1). Similar to 2002, *Stagonospora nodorum* was the second most common species; this was followed by *Septoria tritici*. *Cochliobolus sativus* and *Septoria avenae* f. sp. *triticea* were the least common species, and were isolated from infected leaves in about a third of all fields surveyed.

Leaf rust, at levels of up to 20%, was found in about 72% of the fields, mostly in the eastern part of the province.

**ACKNOWLEDGEMENT:**

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in this survey.

**REFERENCES:**

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Fernandez, M.R., G. Hughes, and P.G. Pearse, 2002. Leaf spot diseases of durum wheat in Saskatchewan in 2001. Can. Plant Dis. Surv. 82: 34-35. (<http://www.cps-scp.ca/cpds.htm>)

Fernandez, M.R., and P.G. Pearse, 2002. Leaf spot diseases of common wheat in Saskatchewan in 2001. Can. Plant Dis. Surv. 82: 39-40. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Distribution and severity of leaf spot diseases, and estimate of the percentage of flag leaf area colonized by leaf spot fungi in common and durum wheat fields in Saskatchewan in 2003.

Crop District	No. Crops affected <sup>1</sup> / surveyed	Mean severity <sup>2</sup>	<u>Leaf spot pathogens</u>				
			<i>P. tritici-repentis</i>	<i>Stag. nodorum</i>	<i>S. tritici</i>	<i>S. avenae f.sp.triticea</i>	<i>C. sativus</i>
1A	4/5	2	59/3 <sup>3</sup>	13/3	18/2	6/1	14/3
2B	8/20	1	80/2	8/2	8/2	5/1	4/1
3A-N	2/3	2	82/1	17/1	–	1/1	–
3A-S	1/5	<1	78/1	–	10/1	–	12/1
3B-N	1/10	<1	–	–	–	–	–
3B-S	1/9	<1	100/1	–	–	–	–
4A	4/10	<1	–	–	–	–	–
5A	7/8	2	32/3	41/4	17/2	27/3	12/2
5B	12/12	6	63/12	21/12	4/3	6/8	17/8
6A	9/12	3	55/5	32/5	16/3	5/1	4/3
6B	6/6	5	31/6	34/6	13/5	16/4	13/6
7B	3/8	1	96/2	–	–	–	4/2
8A	4/5	2	23/3	67/3	16/1	10/1	2/1
8B	7/10	2	77/3	17/3	1/2	7/3	5/2
9A	4/4	4	77/3	19/2	6/1	4/2	5/3
9B	3/3	3	25/2	41/2	20/2	12/2	3/2
<b>Mean/total:</b>	<b>76/130</b>	<b>2</b>	<b>57/47</b>	<b>28/43</b>	<b>12/24</b>	<b>9/27</b>	<b>10/34</b>

<sup>1</sup>number of crops with leaf spot lesions on the flag leaf.

<sup>2</sup>mean percent flag leaf area infected.

<sup>3</sup>mean percent leaf area colonized by the fungus / number of crops where the fungus occurred.

**CROP / CULTURE:** Spring Wheat  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: 2003 SURVEY OF FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA**

**INTRODUCTION AND METHODS:** Forty-four spring wheat fields were surveyed between July 16 and 31, 2003 in southern Manitoba to assess incidence and severity of fusarium head blight (FHB). The incidence and severity of FHB in each field were assessed by sampling 50 to 100 spikes at three locations (Zadoks growth stage 80-85), and additional spikes were collected for subsequent pathogen identification. Up to 30 kernels per field collection were surface-sterilized and incubated on potato dextrose agar under continuous cool white light for 4-5 days to isolate and identify the *Fusarium* species present. When the *Fusarium* species was unknown, single spores were grown on carnation leaf agar or synthetic nutrient agar to facilitate identification. The FHB index was calculated as follows: Mean % incidence X Mean % severity/100.

**RESULTS AND COMMENTS:** The disease was present in 41 of 44 fields, but at lower severity than in any year since 1993, except for one field in the Red River Valley (FHB Index = 30.6). Elsewhere the FHB Index ranged from 0 to 7.2%, and overall averaged 1.6%. It is probable that dry weather during the spring limited development of natural *F. graminearum* inoculum, as disease developed to severe levels in artificially inoculated experimental plots. *Fusarium graminearum* was the predominant species (94%) isolated from kernels sampled from infected heads. Three other species were found at low levels, *F. sporotrichioides* (4.0%), *F. equiseti* (1.5%) and *F. culmorum* (0.3%) (Table 1). Based on these results, FHB did not cause significant damage to spring wheat in Manitoba in 2003.

**CROP / CULTURE:** Spring Wheat

**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** Forty-three southern Manitoba spring wheat cropsfields were surveyed between 16-31 July, 2003 to assess prevalence and severity of foliar diseases. Leaves were collected between heading and soft dough stages of development. Severity of disease on the flag and flag<sup>-1</sup> leaves is reported as percent leaf area affected. Samples of diseased leaf tissue were surface-sterilized and placed in moisture chambers for 5-7 days to promote pathogen sporulation for disease identification.

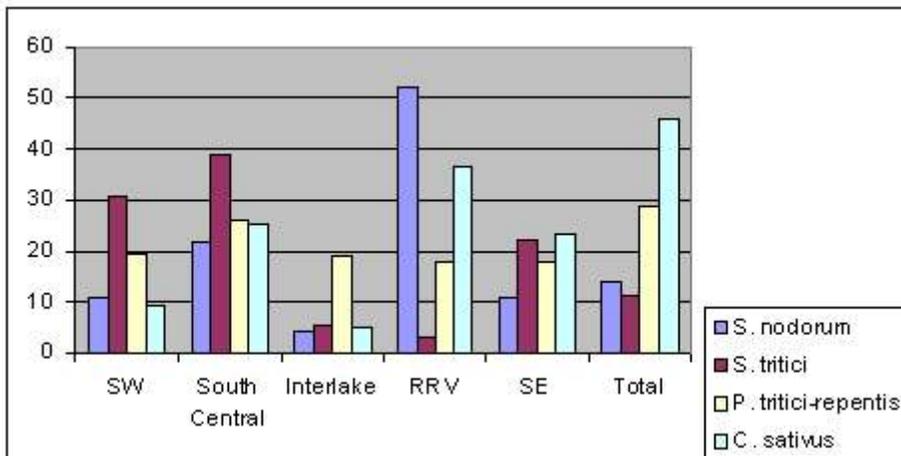
**RESULTS AND COMMENTS:** Average percent necrosis caused by leaf spots on the flag leaves was 19%, and on the flag<sup>-1</sup> 55%. Weather conditions were generally unfavourable for leaf spot development and the number of isolations made to identify foliar pathogens was approximately half those of 2002. During the survey it was observed that many crops had been sprayed with a foliar fungicide, which likely contributed to the lower leaf spot levels in this season. As for 2002, spot blotch, caused by *Cochliobolus sativus*, was the predominant leaf spot disease in southern Manitoba. *Cochliobolus sativus* accounted for 46% of the 398 fungal isolations from leaf tissue (Table 1). *Pyrenophora tritici-repentis*, the cause of tan spot, was the second most prevalent pathogen accounting for 29% of the isolations, higher than in 2002. *Septoria tritici*, the cause of septoria tritici blotch, and *Stagonospora nodorum*, the cause of stagonospora nodorum blotch accounted for 11% and 14% of isolations, respectively. This continues a trend in which the recent prevalence of *Septoria tritici* has been lower than observed between 1994 and 2000. A change in predominance from *S. nodorum* to *S. tritici* was documented in 1994 (Gilbert et al. 1998). In 2003, *S. nodorum* was found at higher levels than *S. tritici* in the Red River Valley (Fig. 1). The patterns of higher levels of *S. nodorum* and lower levels of *S. tritici*, and predominance of *C. sativus* in 2003 is similar to that observed in 2002.

**REFERENCE:**

Gilbert, J., S.M. Woods, and A. Tekauz. 1998. Relationship between environmental variables and the prevalence and isolation frequency of leaf-spotting pathogens in spring wheat. *Can. J. Plant Pathol.* 20:158-164.

**Table 1.** Prevalence and isolation frequency of leaf spot pathogens in 43 crops of hard red spring wheat in Manitoba in 2003.

	Disease			
	S. nodorum blotch ( <i>Stagonospora nodorum</i> )	S. tritici blotch ( <i>Septoria tritici</i> )	Spot blotch ( <i>Cochliobolus sativus</i> )	Tan spot ( <i>Pyrenophora tritici-repentis</i> )
Crops infected	44	30	76	79
(%)				
Isolations (%)	14	11	46	29



**Figure 1.** Isolations of foliar pathogens by region in southern Manitoba in 2003 (RRV= Red River Valley).

**CROP / CULTURE:** Wheat  
**LOCATION / RÉGION:** Manitoba and eastern Saskatchewan

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**TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2003**

**INTRODUCTION AND METHODS:** Trap nurseries and commercial fields of wheat in Manitoba and eastern Saskatchewan were surveyed for the incidence and severity of leaf rust (*Puccinia triticina* Eriks.) and stripe rust (*Puccinia striiformis* Westend. f.sp. *tritici*) during July and August 2003.

**RESULTS AND COMMENTS:** In 2003 wheat leaf rust was first observed during the first week of July in Manitoba, which is much later than usual. The disease developed slowly through July and August. Wheat was generally seeded fairly early in Manitoba and as a result the crop in many fields matured before the leaf rust epidemic developed; additionally, most wheat fields in south central Manitoba were sprayed with fungicides which effectively controlled leaf rust. In fields throughout Manitoba that apparently were not treated with a fungicide, leaf rust severity ranged from trace to 20% of the flag leaf area affected with an average of 2.5%, which is much lower than average. Leaf rust was either not detected, or found at only trace levels in fields surveyed in eastern Saskatchewan during late July. Dry conditions throughout this region in 2003 were not conducive to disease development.

Wheat stripe rust was observed sporadically throughout southern Manitoba during 2003. It was more common in western Manitoba where it was found in many fields at trace levels. Stripe rust was found in most fields throughout eastern Saskatchewan at severity levels of trace to 5%. Stripe rust was very rare in the eastern prairies of Canada prior to 2000 but it was reported in this region in both 2000 and 2001 (Fetch and McCallum, 2001, 2002) but not in 2002 (McCallum et al. 2003). While the damage caused by stripe rust in the eastern prairies of Canada has been minimal to date, it appears that the disease is now well established in the central great plains of the U.S.A. and Canada. Stripe rust was also reported throughout southern Ontario during 2003 with severity in farm fields ranging from trace to 10%.

**REFERENCES:**

Fetch, T. and McCallum, B. 2002. Stripe rust of wheat in Manitoba in 2001. Can. Plant Dis. Surv. 82:42. (<http://www.cps-scp.ca/cpds.htm>)

Fetch, T. and McCallum, B. 2001. Stripe rust of wheat in Manitoba and Saskatchewan in 2000. Can. Plant Dis. Surv. 81:88. (<http://www.cps-scp.ca/cpds.htm>)

McCallum B., Fetch T., Seto Goh P., Mulock B., Hiebert C. and Hoepfner J. 2003. Leaf and stripe rust of wheat in Manitoba and Saskatchewan, 2002. Can. Plant Dis. Surv. 83:80. (<http://www.cps-scp.ca/cpds.htm>)

**CROP / CULTURE:** Spring Wheat  
**LOCATION / RÉGION:** Eastern Ontario

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN EASTERN ONTARIO IN 2003**

**INTRODUCTION AND METHODS:** A disease survey for the presence of fusarium head blight (FHB) in spring wheat was conducted in the third week of July when plants were at the soft dough stage of development. The 28 spring wheat fields surveyed were chosen at random in eastern Ontario, the region where most of the spring wheat is grown. Both incidence (percent infected spikes) and severity (percent infected spikelets in diseased heads) of FHB were assessed, based on approximately 200 spikes sampled at each of three random sites per field. A FHB index (%incidence x %severity)/100 was determined for each crop. Index values of <1, <10, <20, and  $\geq 20\%$  were considered slight, moderate, severe, and very severe infection, respectively.

Determination of the causal *Fusarium* species was based on 10 affected heads collected per field; these were air-dried at room temperature and subsequently threshed. Ten random discolored kernels per sample were surface sterilized in 1% NaOCl for 30 seconds, and plated in 9-cm diameter petri dishes onto modified potato dextrose agar (10 g dextrose per liter, or 50% the label rate) amended with 100 ppm streptomycin sulfate. Plates were incubated for 10-14 days at 22-25°C and with a 14-hour photoperiod using fluorescent and long-wave-ultraviolet tubes. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

**RESULTS AND COMMENTS:** Fusarium head blight was observed in 26 of the 28 fields surveyed (Table 1). Incidence ranged from 1.0 to 43.3%, with a mean of 14.3%, while severity ranged from 6.0 to 43.3%, with a mean of 21.6%. The FHB index ranged from 0.0 to 18.8%, with a mean of 3.7%. Severe (10 to <20%) levels were observed in two crops at Curran and Stittsville. Seventeen crops had moderate levels of infection and in the remainder it was slight.

Four *Fusarium* species were isolated from infected kernels (Table 2). *Fusarium graminearum* was the predominant species - it occurred in 96.4% of fields and was isolated from 77.5% of infected kernels. The other species, *F. avenaceum*, *F. poae*, and *F. sporotrichioides* were found infrequently, each in a maximum of about 10% of fields and 1% of infected kernels.

Although FHB symptoms were observed in most surveyed fields, overall severity in 2003 remained similar to that found in 2002 and 2001 (Xue et al. 2003, 2002). *Fusarium graminearum* remained the predominant causal agent, as in the two previous years. *Fusarium poae* was isolated annually at low frequencies. Occurrence of other *Fusarium* species varied over the years: *F. crookwellense* was recovered only in 2001; *F. avenaceum* in 2003 only; and *F. sporotrichioides* in 2001 and 2003, but not in 2002. Total precipitation and mean temperatures in eastern Ontario in June and July were near the long-term averages, but it was slightly wetter and cooler than in 2001 and 2002. This has been the third consecutive year that FHB was not a major threat to spring wheat in eastern Ontario.

**REFERENCES:**

- Xue, A.G., H.D. Voldeng, F. Sabo, Y. Chen, P. Matthew, and R. Stanley. 2002. Fusarium head blight of spring wheat in eastern Ontario in 2001. Can. Plant Dis. Surv. 82:66-68. (<http://www.cps-scp.ca/cpds.htm>)
- Xue, A.G., H.D. Voldeng, F. Sabo, Y. Chen, P. Matthew, and R. Stanley. 2003. Fusarium head blight of spring wheat in eastern Ontario in 2002. Can. Plant Dis. Surv. 83:55-56. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Location of 28 spring wheat fields in eastern Ontario and levels of fusarium head blight in 2003.

<b>FIELD LOCATION</b>	<b>INCIDENCE (%)</b>	<b>SEVERITY (%)</b>	<b>FHB INDEX*</b>
Alexandria	3.0	10.0	0.3
Alfred	15.0	38.3	5.8
Almonte	5.0	8.3	0.4
Antrim	1.0	6.7	0.1
Blakeney	16.7	16.7	2.8
Burritt's Rapids	5.0	23.3	1.2
Carleton Place	5.0	11.7	0.6
Carp	20.0	20.0	4.0
Chesterville	30.0	30.0	9.0
Cumberland	10.0	30.0	3.0
Curran	26.7	40.0	10.7
Dunvegan	20.0	30.0	6.0
Nepean	8.3	13.3	1.1
Kars	16.7	28.3	4.7
Kemptville	6.7	8.3	0.6
Manotick	5.0	10.0	0.5
North Gower	15.0	6.0	0.9
Ottawa	10.0	13.3	1.3
Pakenham	0.0	0.0	0.0
Sarsfield	11.7	36.7	4.3
St.Isidore	20.0	30.0	6.0
St.Pascal	15.0	20.0	3.0
Stittsville	43.3	43.3	18.8
Vankleek Hill	5.0	43.3	2.2
Vernon	21.7	13.3	2.9
Williamsburg	18.3	20.0	3.7
Winchester	16.7	11.7	1.9
Woodlawn	0.0	0.0	0.0
Range of disease level	1.0-43.3	6.0-43.3	0.1-18.8
Mean disease level	14.3	21.6	3.7

\* FHB index = (%incidence x %severity)/100.

**Table 2.** Frequency of *Fusarium* species isolated from spring wheat in eastern Ontario in 2003.

<b>FUSARIUM SPP.</b>	<b>% FIELDS</b>	<b>% KERNELS</b>
<i>F. avenaceum</i>	3.6	0.4
<i>F. graminearum</i>	96.4	77.5
<i>F. poae</i>	10.7	1.1
<i>F. sporotrichioides</i>	3.6	0.4

**CROP / CULTURE:** Spring Wheat  
**LOCATION / RÉGION:** Eastern Ontario

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**TITLE / TITRE: DISEASES OF SPRING WHEAT IN EASTERN ONTARIO IN 2003**

**INTRODUCTION AND METHODS:** A survey for diseases in spring wheat other than fusarium head blight was conducted in the third week of July when plants were at the soft dough stage of development. The 28 fields surveyed were chosen at random in eastern Ontario, the region where most of the spring wheat is grown. Severity of foliar diseases was determined by rating 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and  $\geq 6$  were considered trace, slight, moderate, and severe infection, respectively. Severity of ergot, loose smut, and take-all was evaluated by estimating the percentage of plants infected.

**RESULTS AND COMMENTS:** Ten diseases were observed in the fields surveyed (Table 1). Septoria leaf blotch (*Septoria* spp.) was the most prevalent disease, observed in 23 crops with a mean severity of 2.3. Seven crops had moderate infections, the highest level seen. They were located at or near Kars, Chesterville, Vankleek Hill, Stittsville, Williamsburg, Woodlawn, and Burritt's Rapids. Yield reductions due to septoria leaf blotch were estimated to average about 5%.

Tan spot (*Pyrenophora tritici-repentis*) was the second most prevalent disease, observed in 22 crops at a mean severity of 2.1. Eight crops had moderate infection levels; in others levels were trace to slight. Tan spot was found in only 3 of 31 crops surveyed in 2002 (Xue et al. 2003); its widespread occurrence in 2003 may be attributed to the slightly wetter and cooler conditions in 2003 in June and July. Leaf rust (*Puccinia triticina*) and septoria glume blotch (*Septoria nodorum*) were each observed in 10 crops at mean severities of 1.3 and 1.5, respectively. Moderate disease levels for each were recorded in only one crop. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), powdery mildew (*Erysiphe graminis* f. sp. *tritici*), and spot blotch (*Cochliobolus sativus*). These diseases were found in 5, 8, and 11 crops at mean severities of 0.9, 1.4, and 0.9, respectively and all affected crops had either trace or slight infection levels. None of these diseases caused significant damage.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*), and take-all (*Gaeumannomyces graminis* var. *tritici*) were observed in 3, 5, and 12 crops, at mean infection levels of 0.2, 0.3 and 2.7%, respectively. These diseases did not appear to cause much damage, except for three crops with more than 5% take-all located at Dunvegan, North Gower and Carleton Place.

Total precipitation and mean temperatures in central and eastern Ontario in June and July were near the long-term average, but were somewhat wetter and cooler than in 2002 and 2001. The pattern of foliar diseases in spring wheat in 2003 was generally similar to that found in 2002 (Xue et al. 2003), except that tan spot and septoria glume blotch were more common in 2003. Septoria leaf blotch has been the major disease of spring wheat, causing measurable yield reductions for three consecutive years. This disease has the potential to cause significant damage to spring wheat production in Ontario. The other diseases have been of relatively minor importance.

**REFERENCE:**

Xue, A.G., H.D. Voldeng, Y. Chen, F. Sabo, P. Matthew, and R. Stanley. 2003. Foliar diseases of spring wheat in Ontario in 2002. Can. Plant Dis. Surv. 83:69-70. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Prevalence and severity of diseases of spring wheat in eastern Ontario in 2003.

DISEASE	NO. CROPS AFFECTED (n=28)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
Bacterial leaf blight	5	0.9	0.1-2.4
Leaf rust	10	1.3	0.1-3.8
Powdery mildew	8	1.4	1.0-2.4
Septoria glume blotch	10	1.5	0.3-0.4
Septoria leaf blotch	23	2.3	0.9-5.5
Spot blotch	11	0.9	0.2-1.7
Tan spot	22	2.1	0.1-4.2
Ergot	3	0.2	0.1-0.2
Loose smut	5	0.3	0.2-0.5
Take-all	12	2.7	0.5-6.7

\*Foliar disease severity was rated on a scale of 0 (no disease) to 9 (severely diseased); for ergot, loose smut, and take-all, severity was rated as percent plants infected.

**CROP / CULTURE:** Winter Wheat  
**LOCATION / RÉGION:** Manitoba

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: 2003 SURVEY OF FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA**

**INTRODUCTION AND METHODS:** The occurrence of fusarium head blight (FHB) of winter wheat in southern Manitoba was assessed by surveying 54 farm fields between July 9 and 16, 2003 when most crops were at the mid- to soft-dough stage of growth (ZGS 83-85). Because winter wheat is not widely grown in Manitoba (in 2003 it was planted on about 8% of the total wheat acreage - Manitoba Crop Insurance) the fields were not surveyed at random; rather, information on their location was obtained by contacting extension personnel, and producers who normally grow the crop. The crops surveyed were located in south-central Manitoba, in the area bounded by Highways #18 in the west, #59 east, #s 67 and 1 north, and the US border south. In each field FHB was assessed by sampling of a minimum of 80-100 plants at each of 3 locations for percentage of infected spikes (disease incidence), and the average proportion of the spike affected (severity). Disease levels were calculated as the 'FHB Index' (% incidence x % severity / 100). Affected spikes were collected at each field site and stored in envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from 5 or more spikes per location, surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar to quantify and identify the *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Moisture levels in spring 2003 over most of southern Manitoba were ideal for crop development, but from the end of June to mid-August little or no rain fell in the region, and this period was accompanied by warm to hot winds. As such, conditions were not conducive for the infection of wheat by *Fusarium* at flowering (from early to late July depending on wheat type).

Visible symptoms of FHB were observed in all 54 crops of winter wheat surveyed, although in many of these the incidence of infected spikes was a trace (less than one in a thousand). Overall, average incidence of FHB was 2.7% (range <0.1 - 10.2%), average severity of affected spikes 58.0% (range 7.0 - 90.0%) and the average FHB Index 0.6% (range <0.1 - 0.9%). This is the lowest level of disease found in winter wheat since surveys for FHB in the crop were initiated in 1998 (Tekauz et al. 1999). As such, losses from FHB in winter wheat in 2003 can be described as negligible.

The *Fusarium* spp. isolated and their occurrence in fields and on kernels are listed in Table 1. As in previous years, *F. graminearum* was the predominant species found.

**Table 1.** *Fusarium* spp. isolated from Manitoba winter wheat kernels in 2003.

<i>Fusarium</i> spp.	Percent of crops	Percent of kernels
<i>F. avenaceum</i>	16.7	0.7
<i>F. culmorum</i>	3.7	0.6
<i>F. equiseti</i>	1.9	0.1
<i>F. graminearum</i>	98.2	98.3
<i>F. poae</i>	1.9	0.1
<i>F. sporotrichioides</i>	11.1	0.4

**REFERENCE:**

Tekauz, A., Gilbert, J., Idris, M., Kromer, U., Stulzer, M., Heath, J., and Parmentier, M. 1999. Fusarium head blight in winter wheat in Manitoba in 1998. Can. Plant Dis. Surv. 79: 94. (<http://www.cps-scp.ca/cpds.htm>)

**CROP / CULTURE:** Winter wheat  
**LOCATION / RÉGION:** Manitoba

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**TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2003**

**INTRODUCTION AND METHODS:** Leaf spot diseases in the Manitoba winter wheat crop were assessed by surveying 54 farm fields between July 9 and July 13, when most plants were at the early to soft dough stage of growth (ZGS 83-85). Because winter wheat is not widely grown in Manitoba (in 2003 it was planted on about 8% of the total wheat acreage - Manitoba Crop Insurance) crops were not surveyed at random; rather, information on their location was obtained by contacting extension personnel, and producers who normally grow the crop. The crops surveyed were located in south-central Manitoba, in the area bounded by Highways #18 in the west, #59 east, #s 67 and 1 north, and the US border south. Disease incidence and severity were recorded by averaging their occurrence and level on about 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Ratings were taken on both the upper (mainly the flag leaf) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Leaves with typical symptoms were collected at each site, dried and stored in envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal pathogen(s), determine the disease(s) present, and assess their relative importance.

**RESULTS AND COMMENTS:** Spring conditions in southern Manitoba were ideal for crop development; soil moisture levels were optimal to start the growing season, and periodic showers in May and June maintained moisture reserves. However, from July to mid-August, little or no rain fell; this and frequent warm to hot winds resulted in soils becoming quite dry. Conditions were ideal for early-season leaf spot development, but not conducive to subsequent infection of the flag leaf, before and after crop heading.

Leaf spots were observed in the upper or lower leaf canopies in 53 of the 54 crops surveyed. Disease levels in the upper canopy were nil, trace or very slight in 15% of fields, slight in 33%, moderate in 44%, severe in 2%, and leaves senescent in 17%. Respective severities in the lower canopy were 4%, 4%, 13%, 6% and 74%. Based on slight to moderate disease levels in the upper canopy in 78% of fields, leaf spot diseases in winter wheat likely caused yield losses of 2-5%. Tan spot (*Pyrenophora tritici-repentis*) was the most prevalent disease (Table 1), followed by spot blotch (*Cochliobolus sativus*), which was less important than in 2002 (Tekauz et al. 2003). *Septoria tritici*, *S. avenae* f.sp. *triticea* and *Ascochyta tritici*, not detected in 2002, were all found in 2003, albeit at low levels. The occurrence of *A. tritici* was unusual.

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Tekauz, A., Mueller, E., Beyene, M., Stulzer, M., Schultz, D., and Reverchon, F. 2003. Leaf spot diseases of winter wheat in Manitoba in 2002. Can. Plant Dis. Surv. 83: 73-74. (<http://www.cps-scp.ca/cpds.htm>)

**Table 1.** Incidence and isolation frequency of leaf spot pathogens of winter wheat in Manitoba in 2002

Pathogen	Incidence (% of crops)	Frequency (% of isolations)*
<i>Pyrenophora tritici-repentis</i>	87.0	57.0
<i>Cochliobolus sativus</i>	63.0	26.3
<i>Stagonospora nodorum</i>	46.3	9.5
<i>Septoria tritici</i>	16.7	5.2
<i>Septoria avenae</i> f.sp. <i>triticea</i>	9.3	1.5
<i>Ascochyta tritici</i>	3.7	0.5

\*indicative of the relative amount of foliar damage observed

**CROP / CULTURE:** Winter Wheat  
**LOCATION / RÉGION:** Ontario

**NAME AND AGENCY / NOM ET ORGANISME:**

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**TITLE / TITRE: DISEASES OF WINTER WHEAT IN ONTARIO IN 2003**

**INTRODUCTION AND METHODS:** A survey for diseases in winter wheat other than fusarium head blight was conducted in the first week of July when plants were at the soft dough stage of development. The 18 winter wheat fields surveyed were chosen at random in central Ontario, the region where most winter wheat is grown. Disease severity was determined by rating 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and  $\geq 6$  were considered trace, slight, moderate, and severe infection, respectively. Severity of dwarf bunt, loose smut, and take-all was estimated as the percentage of plants infected.

**RESULTS AND COMMENTS:** A total of 10 diseases were observed in the 18 fields surveyed (Table 1). Of these, septoria leaf blotch (*Septoria* spp.) was the most prevalent and was found in every crop, at a mean disease severity of 2.3. Six crops had moderate infections, the highest level detected. The fields were located at or near Palmerston, Fordwich, Bornholm, Luca, Medina, and Marden. Yield reductions due to septoria leaf blotch were estimated to be about 5%.

Leaf rust (*Puccinia triticina*) was the second most prevalent disease, observed in 17 crops with mean disease severity of 1.4. Two crops had moderate infection; in the remainder it was trace to slight. Powdery mildew (*Erysiphe graminis* f. sp. *tritici*), spot blotch (*Cochliobolus sativus*), and tan spot (*Pyrenophora tritici-repentis*) were observed in 15, 15, and 17 crops at mean severities of 0.5, 0.6, and 0.7, respectively. Other foliar diseases observed included septoria glume blotch (*Septoria nodorum*) in 10 crops, and stripe rust (*Puccinia striiformis* f.sp. *tritici*) in 5, at mean severities of 0.9 and 0.2, respectively. Although some were quite common, these diseases likely caused minimal damage to winter wheat crops in 2003.

Dwarf bunt (*Tilletia controversa*), take-all (*Gaeumannomyces graminis*), and loose smut (*Ustilago tritici*) were each observed in single crops at 20.0, 5.7, and 0.5% levels, respectively. Both dwarf bunt and take-all caused significant damage to the infected crops. The crop infected with take-all was near Harriston. The crops infected with dwarf bunt was located near Bornholm and a strong 'fishy' odour was associated with the disease at the time of the survey. Dwarf bunt is also known as 'stinking smut', and is an internationally quarantined disease of wheat. A low incidence of this disease has been observed in isolated fields in central Ontario in the past few years (Peter Johnson, OMAFRA, personal communication). If dwarf bunt were to become more widespread it could result in severe economic losses to the Ontario wheat industry. Some countries, such as China, have a zero tolerance for dwarf bunt spores in imported grain. Contamination with dwarf bunt could therefore jeopardize export markets. Clearly, there is a need to control or eliminate this disease in Ontario.

**Table 1.** Prevalence and severity of diseases of winter wheat in central Ontario in 2003.

DISEASE	NO. CROPS AFFECTED (n=18)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
Leaf rust	17	1.4	0.1-3.8
Powdery mildew	15	0.5	0.1-2.2
Septoria glume blotch	10	0.9	0.2-2.1
Septoria leaf blotch	18	2.3	0.3-3.9
Spot blotch	15	0.6	0.1-1.3
Stripe rust	5	0.2	0.1-0.4
Tan spot	17	0.7	0.1-2.4
Dwarf bunt	1	20.0	20.0
Loose smut	1	0.5	0.5
Take-all	1	5.7	5.7

\*Foliar disease severity was rated on a scale of 0 (no disease) to 9 (severely diseased); for dwarf bunt, loose smut, and take-all, severity was rated as percent plants infected.

## Forages / Plantes Fourragères

**CROP:** Alfalfa (*Medicago sativa*)  
**LOCATION:** Saskatchewan

**NAME AND AGENCY:**

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**TITLE: FOLIAR DISEASE SEVERITY AND BLOSSOM BLIGHT OF ALFALFA IN SASKATCHEWAN, 2003.**

**METHODS:** Foliar disease severity (% leaf area affected) was assessed in 18 alfalfa (*Medicago sativa*) hay fields throughout Saskatchewan from late June to mid-July. Stems were collected at several sites along a teardrop-shaped circuit into each field and brought back to the lab for assessment. Disease identification was based on visual symptoms, with occasional isolation (where required) to confirm the identity of the pathogen.

In addition, the incidence of flower infestation with *Sclerotinia sclerotiorum* and *Botrytis cinerea* (causal agents of blossom blight) was assessed in three commercial alfalfa seed fields in northcentral and northeastern Saskatchewan. At least 80 blossoms were collected and plated onto a semi-selective agar medium without surface sterilization, at mid flower (mid July), late flower (late July), and early pod set (early August). After 5-10 days of incubation, colonies were counted and the percentage infestation with each pathogen was calculated. The severity of foliar diseases in these fields was rated in early August.

**RESULTS AND COMMENTS:** In 2003, weather conditions during the growing season in most regions of Saskatchewan were extremely dry, so disease levels were generally low (Table 1). Yellow leaf blotch [*Leptotrochila medicaginis*] was the dominant disease at several sites in the southeast, and spring black stem [*Phoma medicaginis*] was dominant in northern areas. Common leaf spot [*Pseudopeziza medicaginis*] occurred at several sites, and downy mildew [*Peronospora trifoliorum*] was observed at one site. The incidence of blossom blight pathogens was similar in all three fields (Table 2); levels of *S. sclerotiorum* were moderately low, but still higher than expected given the weather conditions. Levels of *B. cinerea* were extremely low throughout the sampling period.

**Table 1.** Mean foliar severity (range in brackets) of dominant diseases in commercial alfalfa fields in Saskatchewan, 2003.

Region & Dominant disease	No. of fields	Leaf area affected (%)	Other diseases
Eastcentral			
yellow leaf blotch (YLB)	7	2% (trace - 5%)	---
common leaf spot (CLS)	2	1% (trace - 2%)	---
spring black stem	2	trace	CLS, YLB
downy mildew	1	1%	---
Southeast			
spring black stem	3	1% (trace - 1%)	---
yellow leaf blotch	1	trace	CLS
Southcentral			
common leaf spot	2	trace	YLB
Seed fields (northcentral/northeast)			
spring black stem	3	19% (8 - 38%)	CLS
Total	21		

**Table 2.** Mean flower infestation (range in brackets) with *Botrytis cinerea* and *Sclerotinia sclerotiorum* in three alfalfa seed fields in northcentral and northeastern Saskatchewan, 2003.

Date	Growth stage	No. of fields	<i>B. cinerea</i>	<i>S. sclerotiorum</i>
July 15-18	mid flower	3	0%	23% (20-27%)
July 24-28	late flower	3	0% (0-1%)	27% (23-34%)
Aug 01-07	early podding	3	0%	21% (19-24%)

## Oilseeds and Special Crops / Oléagineux et Cultures Spéciales

**CROP:** Dry Bean  
**LOCATION:** Alberta, Saskatchewan and Manitoba

**NAMES AND AGENCY:**

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**TITLE: BACTERIAL WILT AND PINK SEED OF DRY BEAN IN WESTERN CANADA IN 2002**

**METHODS:** Seed samples from 254 dry bean crops grown in Alberta (53 crops in the Bow Island and Taber Regions), Saskatchewan (5 crops in the Outlook and Riverhurst regions) and Manitoba (196 crops) in 2002 were obtained from seed cleaning plants and examined for the bacterial wilt pathogen *Curtobacterium flaccumfaciens* pv. *flaccumfaciens*. Each seed sample was sorted into categories of discolored and healthy seeds. All of the discolored seeds and 20 healthy seeds from each sample were streaked onto potato dextrose agar (PDA) in petri dishes, and incubated at room temperature (20±2°C). The plates were examined for the presence of pathogens after 3 and 7 days. Microorganisms derived from discolored seeds were isolated and identified by comparing colony characteristics on PDA to standard reference cultures, which were collected from bulk samples of 2001 crops grown in Alberta (Huang *et al.*, 2002; Hsieh *et al.*, 2002) and deposited in the Lethbridge Research Centre culture collection.

**RESULTS:** *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* (Hall, 1994), was found in 59%, 80%, and 28% of samples tested from Alberta, Saskatchewan, and Manitoba, respectively (Table 1). The frequency of seeds with the pathogen ranged from 0 to 12% in the samples. Both yellow and orange variants occurred in all three Prairie Provinces. The frequency of western Canadian crops with the yellow variant alone was 27% (69 crops), whereas the frequency of crops with the orange variant alone was 4% (10 crops), and the frequency of crops with both variants was 4% (10 crops). The bacterial wilt pathogen was not isolated from healthy seeds.

Pink seed of bean caused by *Erwinia rhapontici* was found in 4 crops in Alberta and 2 crops in Manitoba, but was not found in Saskatchewan (Table 1). The frequency of pink seeds ranged from 0 to 1%. *Erwinia rhapontici* was not isolated from healthy seeds.

**DISCUSSION:** Bacterial wilt of bean was first reported in Alberta from the 2001 bean crop (Hsieh *et al.*, 2002). A survey of bean seed samples from 2001 crops showed that 74% of crops surveyed in Alberta and Saskatchewan were infected with bacterial wilt, and that both yellow and orange variants of the pathogen were present in both provinces, sometimes in the same crop (Huang *et al.*, 2003b). The current survey confirms the findings of 2001 in Alberta and Saskatchewan and further indicates the occurrence of the yellow and orange strains of bacterial wilt in Manitoba. To our knowledge, this is the first record of bacterial wilt of bean in Manitoba.

Pink seed of bean caused by *E. rhapontici* was found only in four crops in southern Alberta and two crops in Manitoba. This is the first known occurrence of pink seed of bean in Manitoba. The disease has been previously reported on dry pea in Alberta (Huang *et al.*, 1990), and Saskatchewan (Huang, unpublished), Canada, and in Montana, USA (Schroeder *et al.*, 2002), as well as on lentil and chickpea in Saskatchewan (Huang *et al.*, 2003b). These findings suggest that further research on these two new bacterial diseases of dry bean is warranted.

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Schroeder, B.K., Lupien, S.L. and Dugan, F.M. 2002. First report of pink seed of pea caused by *Erwinia rhapontici* in the United States. *Plant Dis.* 86: 188.

**CROP:** Field bean  
**LOCATION:** Manitoba

**NAMES AND AGENCIES:**

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**TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2003**

**METHODS:** Crops of field bean were surveyed for root diseases at 70 different locations and for foliar diseases at 100 locations in Manitoba. The survey for root diseases was conducted in the first week of July when plants were at the second to third trifoliolate stages and for foliar diseases in the third week of August when the plants were at the pod-fill to early maturity stages. The crops surveyed were chosen at random from regions in southeast and south-central Manitoba, where most field bean is grown. Ten plants were sampled at each of three random sites for each crop surveyed. Diseases were identified by symptoms. Root diseases were rated on a 0 (no disease) to 9 (death of plant, seedlings did not emerge or died back soon after emergence) scale. Five to ten symptomatic roots were collected per crop for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 5 (whole roots/plants were severely diseased).

**RESULTS AND COMMENTS:** *Fusarium* root rot (*Fusarium solani*) was observed in 66 of the 70 crops surveyed for root diseases (Table 1), which made it the most widespread root disease of dry bean. *Rhizoctonia* root rot (*Rhizoctonia solani*) was detected in 21 of the crops surveyed, but generally was more severe than *Fusarium* root rot.

Symptoms of common bacterial blight (*Xanthomonas axonopodis* pv. *phaseoli*) were observed in all of the commercial dry bean crops that were surveyed for foliar diseases (Table 2). However, there was a wide range in severity among the crops. Bean anthracnose (*Colletotrichum lindemuthianum*) was detected in 62 of the 100 crops. Anthracnose severity ratings of 2 (i.e., more than 10% of the crop canopy diseased) or more were observed in 30 crops and this would have resulted in reductions in yield. Eighteen of these 30 crops had anthracnose ratings above 4 (i.e., over 25% of the canopy was diseased), which would have had a severe adverse impact on yield and quality. Yellow symptoms (cause unknown) were found in 28 crops at moderate levels. Severe rust (*Uromyces appendiculatus*) symptoms appeared to have developed early enough to reduce yield in a number of crops. A period of extremely hot weather in August probably was responsible for the low incidence and severity of white mould (*Sclerotinia sclerotiorum*).

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**Table 1.** Prevalence and severity of root diseases in 70 crops of field bean in Manitoba in 2003.

<b>Disease</b>	<b>No. crops affected</b>	<b>Disease Severity</b>	
		<b>Mean</b>	<b>Range</b>
Fusarium root rot	66	1.8	0.3-5.0
Rhizoctonia root rot	21	2.9	0.2-3.2

**Table 2.** Prevalence and severity of foliar diseases in 100 crops of field bean in Manitoba in 2003.

<b>Disease</b>	<b>No. crops affected</b>	<b>Disease Severity</b>	
		<b>Mean</b>	<b>Range</b>
Bacterial blight	100	2.2	1-4
Yellows	28	2.5	1-5
Anthracnose	62	2.2	1-4
Rust	18	3.3	1-4
White mould	13	1.7	1-3

**CROP:** Canola  
**LOCATION:** Alberta and Saskatchewan

**NAMES AND AGENCY:**

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**TITLE: FUSARIUM WILT OF CANOLA IN ALBERTA AND SASKATCHEWAN IN 2003**

**METHODS:** A total of 53 *Brassica napus* fields were surveyed in the southern and central canola production areas of Alberta. The fields were surveyed before swathing, when the canola plants were at crop growth stages 79 to 83 (2). Assessments were made by randomly selecting 100 plants along the length of a diamond or "W"-shaped pattern. The presence or absence of symptoms on each plant was used to calculate disease incidence for fusarium wilt (*Fusarium oxysporum*). Severity of symptoms was determined using a scale (Table 1) to rate each plant. Mean disease severity was then calculated for each field. Infection of symptomatic plants by *F. oxysporum* was confirmed in selected fields by identification on potato dextrose agar and carnation leaf agar (1, 4). For most fields, cultivars were identified by contacting the growers. In a few cases, cultivars were identified by signage present in the field.

The incidence of fusarium wilt in 18 additional fields of *B. napus* cv. 45A55 in the County of Vermilion River was estimated at growth stages 79 to 83 by visual assessment of entire crops.

The relative susceptibility of some *B. napus* cultivars was tested at two Saskatchewan locations in fields where fusarium wilt occurred in 2002. Plots of three rows of each cultivar were seeded in a four-replicate, randomized complete block design. Fifty plants were evaluated in each plot at growth stages 79 to 83 using the scale in Table 1.

**RESULTS AND COMMENTS:** The incidence and severity of fusarium wilt in Alberta was greatest in the east-central region (Counties or Municipal Districts of Camrose, Flagstaff, Lamont, Minburn, Smoky Lake, Two Hills, and Vermilion River) (Table 2, Fig. 1). Wilt occurred at low levels in some other locales, and was infrequently observed in Saskatchewan (5). The mean incidence in the 18 fields of *B. napus* cv. 45A55 in the County of Vermilion River was 22%; disease incidence in these fields ranged from 2.5% to 80% (Fig. 1). Southern Alberta and the Peace River region were not surveyed.

The incidence of fusarium wilt in Alberta was slightly less overall than in 2002, but greater at some locations. For example, in the east-central region, incidence decreased in relation to 2002 levels (3) in Camrose County, but increased in Lamont, Minburn, Two Hills and Vermilion River. In 2002, reports of severe fusarium wilt in the Strathmore area near Calgary were received (T. Ferguson, pers comm.), but similar reports from Strathmore or nearby areas were not received in 2003.

The highest disease severities were confined to a few cultivars in the fields surveyed (Table 3), as well as in field trials at two locations in Saskatchewan (Table 4). This suggests that the importance of fusarium wilt may decrease in the near future if susceptible cultivars are withdrawn from the market.

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**Table 1.** Evaluation scale used to determine severity of fusarium wilt of canola in Alberta and Saskatchewan in 2003.

Value	Chlorosis*	Necrosis	Extent of wilted pods
0	None	None	None
1	Interveinal chlorosis* of some leaves, most lower leaves chlorotic*	None	None
3	Significant chlorosis of entire branches, or bilateral chlorosis of main stem	Some leaves or stems necrotic	None
5	Significant chlorosis of pods, some chlorotic tissue remains in leaves and stems	Some minor branches necrotic	<25% of pods on entire plant wilted
7	Little or none	Main stem or large branches bilaterally necrotic	Large racemes wilted, or pods of main raceme bilaterally wilted
9	Little or none	Most tissue necrotic or plant dead	All pods wilted

\*Bright yellow chlorosis characteristic of fusarium wilt, not pale yellow chlorosis characteristic of senescence or other diseases.

**Table 2.** Severity of fusarium wilt of canola in 14 Alberta municipalities or counties in 2003.

Municipality/County	Number of fields	Disease severity (1-9)	
		Mean	Maximum
<b>East central region</b>			
Beaver	1	1	1
Bonnyville	6	1	1
Flagstaff	8	2	6
Lamont	4	2	5
Minburn	4	5	8
Smoky Lake	6	3	6
St. Paul	3	2	4
Two Hills	6	3	7
Vermilion River	4	2	4
<b>Central region</b>			
Camrose	3	1	1
Mountain View	4	1	1
<b>South central region</b>			
Kneehill	1	4	4
Rocky View	2	1	1
Wheatland	1	1	1
Mean		2	4

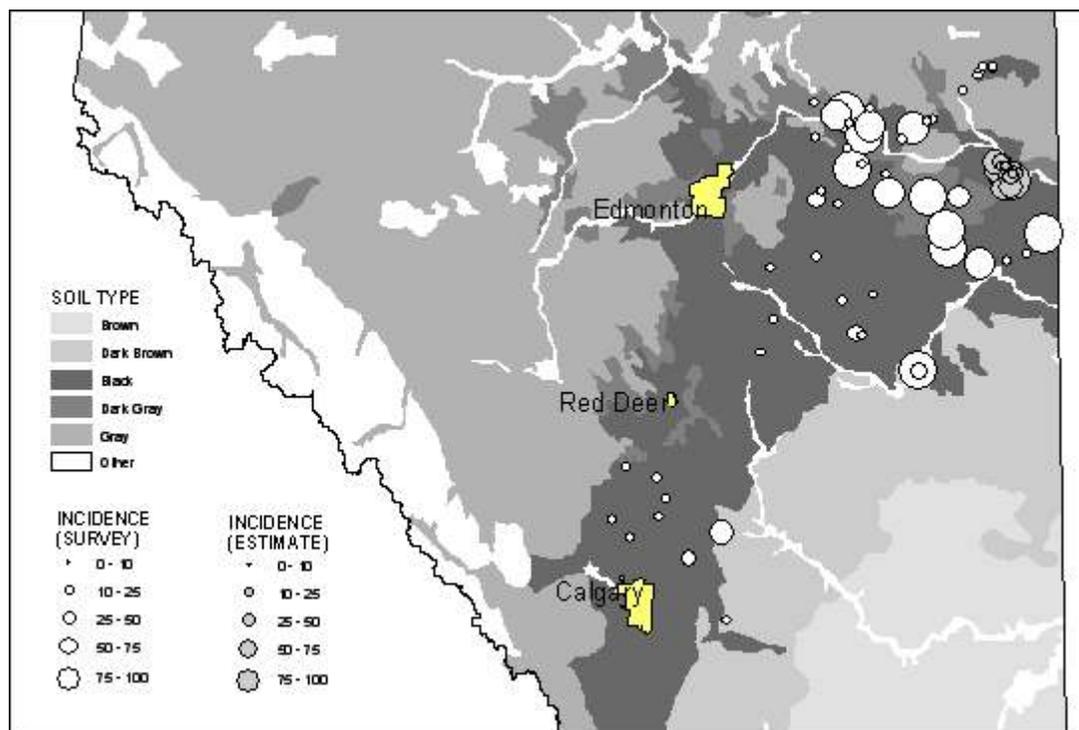
**Table 3.** Severity and incidence of fusarium wilt of canola in relation to cultivar in survey of commercial fields in Alberta in 2003.

Cultivar	Number of fields	Severity (1-9)		Incidence (%)	
		Mean	Maximum	Mean	Maximum
45A55	9	4	8	59	100
46A76	1	1	1	0	0
Canterra 1604	1	4	4	58	58
Champion	1	1	1	11	11
DKL 3235	3	1	1	2	6
DKL 3455	4	1	1	0	0
DS Roughrider	2	2	2	15	23
IMC 208	2	1	1	0	0
IMC 304	1	1	1	0	0
Invigor 2573	1	1	1	2	2
Millenium	1	1	1	0	0
Pioneer Hi-Bred Glyphosate resistant	1	1	1	0	0
SW Rider	1	1	1	11	11
Unknown	25	2	6	21	100
Mean		2	8	22	22

**Table 4.** Severity and incidence of fusarium wilt of *Brassica napus* cultivars in replicated plots at two locations in Saskatchewan in 2003.

Cultivar	Severity (1-9)		Incidence (%)	
	Star City	Yorkton	Star City	Yorkton
45A55	5a*	0.25	63a	79a
DS Roughrider	5a	5b	61a	73a
46A76	2b	1c	25b	22b
DKL 33-45	2b	2c	31b	26b
DKL 3235	2b	1c	24b	20b
Hyola 454	1b	2c	15b	28b
Q2	1b	1c	18b	17b

\*Means in a column with the same letter are not significantly different at  $p = 0.05$  according to Duncan's multiple range test.



**Figure 1.** Incidence of fusarium wilt in 53 *Brassica napus* fields in Alberta in 2003. Each circle represents one field, and the size of the circle is proportional to the percentage of infected plants at that location. Disease incidence was determined either by counting the number of symptomatic plants in 100 randomly selected plants per field (white circles), or by visually estimating the percentage of infected plants in entire crops (grey circles).

**CROP:** Canola  
**LOCATION:** Saskatchewan

**NAMES AND AGENCIES:**

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**TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2003**

**METHODS:** A total of 85 fields of *Brassica napus* were surveyed between August 10 and 18 in the major canola production regions of Saskatchewan including the north-west (21 fields), north-central (14), north-east (20), east-central (13) and south-east (17). Canola fields were surveyed before swathing and when the crop was between growth stages 5.2 and 5.3 (Canola Council of Canada). Disease assessments were made in each field by collecting 20 plants from 5 sites which were separated by at least 20 m and were 20 m from the edge of the field. The presence or absence of lesions on each plant was determined to give percent disease incidence for the following diseases: sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.) and fusarium wilt (*F. oxysporum*). For sclerotinia stem rot, each plant was scored for both main stem and upper branch/pod lesions. For blackleg, plants were scored for either severe basal stem cankers or any other type of blackleg stem lesion. For alternaria pod spot (*Alternaria brassicae*, *A. raphani*), the percent severity of lesions on the pods of each plant was assessed. If alternaria pod spot was present in a field, but at a level estimated to be below 1%, the disease was recorded as a "trace". Similarly, when the other diseases were observed in a field, but not in the sample of 100 plants, the disease was recorded as a "trace". When calculating means, all trace values were counted as 0.1%. Field results were combined for each region and mean disease incidence or severity values were determined.

**RESULTS AND COMMENTS:** Sclerotinia stem rot was observed in only 15 of the 85 fields surveyed. Overall mean incidence values for the province were 0.1% main stem lesions and 0.3% upper pod lesions. Mean incidences were at trace values in all regions except for the north-central region, which had 1% incidence as a result of one crop developing nearly 20% upper stem/pod lesions. The 2003 overall incidence values were slightly lower than in 2001 and much lower than in 2000 (14%) and 1999 (22%) (Pearse et al. 2003). The dry conditions have not favoured sclerotinia infection, and as a result, no significant yield loss has occurred as a result of this disease in recent years.

Blackleg was observed in 47 of the 85 fields surveyed, with incidence values ranging from 0 to 10% for basal stem cankers and from 0 to 65% for lesions occurring elsewhere on the stem. The highest incidences were observed in fields that had received hail damage. Blackleg incidence values were 3-4% in the east-central and south-east regions and 2% in the north-central and north-east regions. The overall mean incidence values for the province were "trace" for basal stem lesions and 3% for lesions elsewhere on the stem. Overall mean incidence values for lesions elsewhere on stems were similar to 2001 and 2000 (3%) and lower compared to 1999 (8%) (Pearse et al. 2003).

Aster yellows was observed in 32 of the 85 fields surveyed and was present in all regions, but the overall disease incidence for the province was less than 0.1%. This is similar to 2001 (0.3%) and lower than 2000 (1.6%) and 1999 (1%) (Pearse et al. 2003). Foot rot was observed in 19 of the 85 fields and was present in all regions; overall incidence for the province was 0.4%. Fusarium wilt was observed in six of the 85 fields surveyed, with five of these fields located in the north-west and one in the north-central region. The overall fusarium wilt incidence for the province was less than 0.1%. Awareness of fusarium wilt has increased in recent years in Saskatchewan and Alberta (Benard et al., 2003; Pearse et al. 2003). Alternaria pod spot was observed in all regions but at only trace levels. Hot dry conditions in late summer and early harvest were not conducive to alternaria pod spot development.

In most regions, early moisture was sufficient to develop good crop stands, but the hot dry weather late in the season reduced yields. Insects were the most significant canola pests in 2003. Reports of feeding damage and/or presence of several insect pests including flea beetles, grasshoppers, aphids, diamondback moths, thrips and beet webworms were obtained from many fields surveyed.

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**CROP:** Canola  
**LOCATION:** Manitoba

**NAME AND AGENCY:**

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**TITLE: CANOLA DISEASES IN MANITOBA: DISTRIBUTION, PREVALENCE AND INCIDENCE IN 2003**

**METHODS:** In August 2003, 259 canola crops were surveyed in the eastern/interlake (37), southwest (83), northwest (61) and central (78) regions. All crops were *Brassica napus*. All crops were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (phytoplasma), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*) and fusarium wilt (*Fusarium* spp.). Blackleg lesions that occurred on any part of the canola stem were assessed separately from basal stem cankers. The prevalence and percent severity of alternaria pod spot (*Alternaria* spp.) was determined.

In each canola crop, one hundred plants were selected in a regular pattern starting at a corner of the field or at a convenient access point. The edges of the fields were avoided. Twenty plants were removed from each of five points of a "W" pattern in the field. Points of the "W" were at least 20 paces apart. All plants were pulled up, removed from the field and examined for the presence of diseases.

**RESULTS:** Several diseases were present in each of the four regions of Manitoba. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1). The prevalence of sclerotinia-infested crops ranged from a high of 86% in the eastern/interlake region to 25% in the southwest region with a provincial mean of 55%. This increased from a mean of 40% in 2002 (McLaren *et al.*, 2003). Mean disease incidence ranged from 16% in the northwest region to 5% in the southwest region. The provincial mean of 12% was greater than in 2002 and would result in about a 6% yield loss.

Blackleg basal cankers occurred in 38% of the crops surveyed in 2003 with disease incidence ranging from 8% in the southwest to 2% in the central and eastern/interlake regions, and with a provincial mean of 5%. Mean disease incidence was similar in 2002, with the highest value of 8% occurring in the northwest region (McLaren *et al.*, 2003). Severe blackleg cankers were evident in many blackleg-infested crops in 2003 and caused a yield loss estimated at about 3% on a province-wide basis.

The mean prevalence of blackleg stem lesions was 41%. Prior to 2003, 66%, 54%, 20% and 20% of crops were infested with stem lesions in 1999 (McLaren and Platford, 2000), 2000 (McLaren and Platford, 2001), 2001 (McLaren *et al.*, 2002) and 2002, respectively. The mean incidence in 2003 was 5% which was the same as observed in 2002.

The severity of alternaria pod spot was low (Table 2), with means of <6% in all regions (Table 1). In the northwest, only 2 fields were seen with pod spot. In the central, eastern/interlake, and southwest regions, pod spot was observed in 37, 13 and 25% of the crops surveyed, respectively. This compared with 4% in the eastern/interlake region, 3% in the central region and 5% in the southwest regions in 2002. Although pod spot was most prevalent in the western part of the province during 1999-2000, it was observed more frequently in the central and eastern/interlake regions of Manitoba in 2001. Pod spot was least prevalent in the northwest region in 2001-02 and this was evident in 2003 as well.

The prevalence of aster yellows in the 2003 crops ranged from 5% in the eastern/interlake region to 1% in both the central and the southwest regions with a provincial mean of 2%. This decreased from a prevalence of 5% in 2002 and 16% in 2001 (McLaren *et al.*, 2002; 2003). Mean disease incidence was 1% in all regions. Foot rot was not observed in any of the canola crops surveyed in 2003.

Of the 297 canola fields examined, fusarium wilt was observed in 2% with a mean disease incidence of 7%. All confirmed cases of fusarium wilt occurred in the western and central regions of the province with no suspect plants observed in surveyed fields in the Eastern/Interlake area. The plants suspected of having fusarium wilt were assessed in the lab to confirm presence of the disease. Both *Fusarium avenaceum* and *F. oxysporum* were isolated from canola stem samples.

**ACKNOWLEDGEMENTS:** We thank the Manitoba Canola Growers Association for financial support and the Manitoba Crop Insurance Corporation for providing a database of canola fields. The technical support of T. Henderson, J. He and M. L. Desjardins is also gratefully acknowledged.

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**Table 1.** Number of canola crops surveyed and disease prevalence in Manitoba in 2003.

Crop Region	No. of crops surveyed	Sclerotinia stem rot		Blackleg basal cankers		Blackleg stem lesions		Alternaria pod spot	Aster yellows		Fusarium wilt <sup>1</sup>		
		P <sup>2</sup>	DI <sup>3</sup>	P	DI	P	DI	P	Mean % severity	P	DI	P	DI
Central	78	71	10	40	2	50	3	37	1.9	1	1	3	2
E/I	37	86	15	49	2	41	2	13	1.8	5	1	0	0
NW	61	57	16	11	4	44	9	3	0.1	2	1	2	5
SW	83	25	5	51	8	30	6	25	2.5	1	1	4	12

<sup>1</sup> Based on survey of 259 fields.

<sup>2</sup> Mean percent prevalence.

<sup>3</sup> Mean percent disease incidence.

**Table 2.** Distribution of incidence (sclerotinia, blackleg, aster yellows, and fusarium wilt) and severity (alternaria pod spot) classes in 259 crops of *Brassica napus* in Manitoba in 2003.

	Percentage of crops with					
	Sclerotinia stem rot	Blackleg basal	Blackleg stem	Alternaria pod spot	Aster yellows	Fusarium wilt
0	116	161	163	202	254	253
1-5%	66	76	84	55	5	3
6-10%	25	11	13	2	0	2
11-20%	23	5	2	0	0	1
21-50%	25	6	6	0	0	0
>50%	4	0	1	0	0	0

**CROP:** Flax  
**LOCATION:** Manitoba

**NAME AND AGENCY:**

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**TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2003**

**METHODS:** A total of 90 flax crops were surveyed in 2003, 54 in Manitoba and 36 in Saskatchewan. Fifteen crops were surveyed during the first week in August, 15 crops during the second week, 48 crops during the third week, and 12 crops during the last week of August. Solin flax with low linolenic acid and other yellow seed-colour flax constituted 12% of the crops surveyed, and brown seed-colour linseed constituted 88%. Crops surveyed were selected at random along preplanned routes in the major areas of flax production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of each disease were recorded. Stand and vigour were rated on a scale of 1 to 5 (1 = very good, and 5 = very poor).

In addition, 19 samples of flax plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives by agricultural representatives and growers.

**RESULTS AND COMMENTS:** Ninety-four percent of the flax crops surveyed in 2003 were rated very good for stand establishment, and 84% had very good vigour. Twenty-four percent of the crops surveyed were seeded late and were expected to be late for maturity and harvesting. Growing conditions were generally good for most of the growing season except for abnormally dry weather towards the end of the season, which resulted in premature ripening and lower yields in some areas of western Manitoba and in Saskatchewan.

Pasmo (*Septoria linicola*) was the most prevalent disease, observed in 64% of the crops surveyed (Table 1) but in 100% of crops surveyed in late August. The prevalence and severity of pasmo in 2003 were lower than in 2002 but similar to 2001 (1, 2, 3), due perhaps to the dry conditions at the end of the season. In the infested crops, pasmo incidence ranged from 1% to 100% infected plants, and severity ranged from 1% to >6% stem and leaf area affected. Nine and 14% of the severely affected crops had, respectively, 20% and 50% of stem area affected by pasmo (Table 1).

Root infections and fusarium wilt (*Fusarium oxysporum f.sp. lini*) were observed in 30% of flax crops in 2003 with incidence ranging from trace to 10% (Table 1). The prevalence and incidence of fusarium wilt in 2003 was the lowest recorded in the last 5 years (1, 2, 3). Powdery mildew (*Oidium lini*) was observed in 22% of crops surveyed in 2003 with a severity range from trace to 20% leaf area affected. The incidence and severity of this disease were low in 2003, similar to levels observed in the last three years (1, 2, 3, 4). Traces of aster yellows (phytoplasma) were observed in several crops in 2003. The incidence and severity of aster yellows in 2003 were lower than the levels observed in the last three years (1, 2, 3).

Rust (*Melampsora lini*) was not observed in any of the 96 crops surveyed, nor in the rust-differential flax nurseries planted at Morden, Portage la Prairie, Saskatoon, and Indian Head. No severe lodging was recorded in flax crops in 2003, and no signs of stem infection by *Sclerotinia sclerotiorum* were encountered in this survey. However, various levels of infection by *Alternaria* spp. were observed on the foliage of maturing flax.

Of the 19 flax samples submitted to the Manitoba Crop Diagnostic Centre, three were affected by root rot (*Fusarium oxysporium f.sp.lini*), one by *Septoria linicola*, four by environmental injury, 10 by herbicide damage, and one by nutrient deficiency.

**ACKNOWLEDGEMENTS:** The assistance of Lawrence Wiebe, Maurice Penner, and Tricia Walske in conducting this survey is gratefully acknowledged.

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**Table 1.** Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 90 crops of flax in Manitoba and Saskatchewan in 2003.

Fusarium Wilt				Pasma				Powdery Mildew			
Crops		Disease		Crops		Disease		Crops		Disease	
No.	%	Incid. <sup>1</sup>	Sever. <sup>2</sup>	No.	%	Incid. <sup>1</sup>	Sever. <sup>2</sup>	No.	%	Incid. <sup>1</sup>	Sever. <sup>2</sup>
63	70%	0%	0%	32	36%	0%	0%	70	78%	0%	0%
22	24%	1-5%	1-5%	20	22%	1-10%	1-5%	10	11%	1-10%	1-5%
5	6%	5-20%	5-10%	17	19%	10-30%	5-10%	2	2%	10-30%	5-10%
-	0%	2-40%	10-20%	8	9%	30-60%	10-20%	6	7%	30-60%	10-20%
-	0%	>40%	10-40%	13	14%	>60%	20-50%	2	2%	>60%	20-50%

<sup>1</sup>Disease Incidence = Percentage of infected plants in each crop.

<sup>2</sup>Disease severity = Percentage of roots affected by fusarium wilt, stems affected by pasmo, and leaves affected by powdery mildew.

**CROP:** Lentil  
**LOCATION:** Saskatchewan

**NAMES AND AGENCIES:**

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**TITLE: FIRST RECORD OF POWDERY MILDEW ON LENTIL IN CANADA**

**INTRODUCTION AND METHODS:** Powdery mildew was detected on lentil (*Lens culinaris* Medik.) accession FLIP 2000-6L (Food Legume Improvement Program, ICARDA, Syria) in early September 2002 in a field experiment at the University of Saskatchewan. Many other FLIP lines and Canadian cultivars nearby had no symptoms, suggesting that they either escaped infection or were resistant to mildew. Mildew symptoms were also detected on some faba bean (*Vicia faba* L.) plants surrounding the plots. Further symptoms were found on a few lentil plants of breeding lines in nearby breeder plots and in plots of non-cultivated lentil species. On susceptible plants, the leaves, stems, and pods were covered with a characteristic white powdery growth, profuse adaxially and sparse abaxially, consisting of mycelium, conidiophores and conidia. Cleistothecia developed, which were globose, scattered and mainly adaxial. Several developmental stages of the cleistothecia were observed.

**RESULTS AND COMMENTS:** Based on dichotomous appendages on the cleistothecia, the fungi on both lentil and faba bean in the plots were identified as *Microsphaera* spp. As only a few ascocarps were mature, the species could not be identified beyond doubt. Appendages on the ascocarps from lentil had dichotomously forked tips with divergent ends that did not curve, suggesting that it may have been *M. diffusa* Cke. & Pk. (2). This putative species had been identified in 1985 on *L. orientalis* (Boiss.) Schmalh. grown in Saskatchewan but had not been reported in the literature. Appendages on cleistothecia from faba bean had more or less curved tips, suggesting that the species may have been *M. ludens* (Salmon) Blumer (2). According to the recently revised classification of the powdery mildews based on molecular data and the anamorphs, *Microsphaera* is reduced to synonymy with *Erysiphe* s.str. (3, 9).

The weather in Saskatoon in August 2002 was characterized by above average rainfall compared to the previous 5-year average (78 mm compared to 36 mm), below average daily maximum temperature (22°C compared to 26°C) and above average maximum relative humidity (98% compared to 82 %). As a consequence, lentil plants continued to grow instead of ripening. The availability of green lentil tissue late in the season may have allowed powdery mildew infection to occur. No infection was observed in 2003, when lentil plants matured in mid-August. Earlier senescence of leaf tissue in other years may have allowed lentil plants to escape infection.

In the literature, *Erysiphe polygoni* DC and *Leveillula taurica* (Lév.) Arnaud are listed as causal agents of powdery mildew on lentil (1). Both are considered as pathogens of lesser economic importance in the Near East, Europe, the Indian subcontinent and South America (1). *Erysiphe pisi* DC (*E. polygoni* sensu lato) is considered to be widespread on faba bean, while *E. cichoracearum* DC and *L. taurica* (Lév.) Arnaud have been reported from the Middle East (4). *Microsphaera penicillata* (Wallr. Ex Fr.) Lév. var. *ludens* (Salm.) W. B. Cooke was found on faba bean in Saskatchewan in 1973 (7). *Microsphaera ludens* is considered to be an innocuous pathogen on faba bean (5, 6, 7, 8), and observations that only some genotypes were affected in 2002 suggest that *M. diffusa* infects lentil only sporadically. However, further investigation of the host range of *Microsphaera* species from *Lens* and *Vicia* in Canada is needed to determine whether species are host-specific and whether there is potential for powdery mildew to become a major pathogen of lentil. It is obvious that recent revisions in the systematics of powdery mildews may question a differentiation between *M. ludens* and *M. diffusa*, and demand clarification of the relationship between both of these species, as well as with *E. polygoni*, *E. pisi* and *L. taurica* on several pulse crops.

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**CROP:** Field Pea (*Pisum sativum* L.)  
**LOCATION:** Central and southern Alberta

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**TITLE: THE OCCURRENCE OF FIELD PEA DISEASES IN CENTRAL AND SOUTHERN ALBERTA IN 2003**

**METHODS:** Forty-four commercial crops of field pea in central and southern Alberta (Table 1) were surveyed in late July and mid-August for root rot (*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*), mycosphaerella blight (*Mycosphaerella pinodes*) sclerotinia stem rot (*Sclerotinia sclerotiorum*) and powdery mildew (*Erysiphe pisi*). Twenty plants were sampled at each of five equally spaced sites along the arms of a "W" pattern in each field. Roots were washed and root rot severity was estimated visually on the samples by using a 0-9 scale (3). Root pieces from severely infected plants were selected from each field and were surface sterilized in 1% NaOCl solution for 2 min., rinsed three times in sterile distilled water and plated onto acidified potato dextrose agar to determine the types of microorganisms present (Table 2). The leaves were assessed for mycosphaerella blight and powdery mildew severity based on a 0-9 scale developed by Xue and Burnett (5).

**RESULTS AND COMMENTS:** Mycosphaerella blight infection levels were very low in southern Alberta. High temperatures and dry weather hindered disease development, although the lower leaves were infected in some areas. In central Alberta (Vegreville + Willingdon), disease severity was lower than in previous years (1, 2, 4). Dry weather during late July and early August restricted disease development.

High levels of powdery mildew occurred at several locations in southern and central Alberta. The disease began to develop as early as mid-July, and many growers sprayed crops with Kumulus (a.i. sulphur) or Headline (a.i. pyraclostrobin) fungicides. The disease was so severe in the Ranier area that thick white mycelia covered the entire surface of plants in affected fields. Pods on heavily infected plants became blackish as cleistothecia coated the surface, and many pods aborted or developed only one or two shriveled seeds. This damaged seed quality and caused significant yield reduction in affected fields. Marrowfat pea and cv. Eiffel were among the most susceptible cultivars. Early-maturing pea cultivars or plants with late infection showed limited damage. Overall, disease incidence and severity were higher than in previous years (1, 2). Cool, wet weather in early May, along with snowfall in many areas, resulted in a delay of up to two weeks in the seeding of many pea crops. This may have contributed to the greater incidence of powdery mildew, since later seeded crops are especially prone to this disease. Moreover, hot days followed by cool nights in July and August resulted in heavy overnight dew formation and very high relative humidity during the early morning hours. This also promoted the development of powdery mildew.

To a much lesser extent, sclerotinia stem rot appeared scattered in small areas of several fields near Vegreville. This disease usually appears when the canopy becomes dense enough to retain high humidity.

Root rot was found in all fields surveyed (Table 1), usually at scattered locations throughout the fields. Occasionally, infected plants did not show typical leaf-yellowing symptoms, but all affected plants were stunted. Disease severity ranged from 0.8 to 4.2 and averaged 1.9. The major microorganisms isolated from diseased roots were *Fusarium* spp. followed by bacteria, *Rhizopus* spp., *Pythium* spp., and *Rhizoctonia solani* (Table 2). *Alternaria* spp. and *Aspergillus* spp were also found in minor quantities. Yellow patches were found in a pea field near Beiseker early in the spring, when plants were in the 3-5 node growth stage. However, this yellowing phenomenon disappeared one month later, indicating that the yellowing may have been caused by herbicide damage.

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**Table 1.** Severity of root rot, mycosphaerella blight and powdery mildew on pea crops from 44 fields in central Alberta in 2003.

Location	No. Fields Surveyed	Root rot (0-9)	MB (0-9) <sup>a</sup>	PM (0-9) <sup>b</sup>
Bashaw	2	1.2	0.3	- <sup>c</sup>
Daysland	3	1.2	0.8	-
Kelsey	3	1	0	-
Lacombe	5	2	0	5.3
Leduc	2	1.5	0.8	-
Ranier	3	-	0	9
Lomond	2	3.3	0	2
Millet	4	1	0.3	-
Penhold	7	2.9	0	5.8
Red Deer	1	4.2	0	0
Vegreville	9	3.2	5.1	4.4
Wetaskiwin	2	0.8	0.4	-
Willingdon	1	2.9	0	7.8

<sup>a</sup> Mycosphaerella blight

<sup>b</sup> Powdery mildew

<sup>c</sup> Data not collected

**Table 2.** Microorganisms isolated from root samples collected from 42 pea fields in central Alberta in 2003

Field Location	No. roots sampled	Percentage of root samples containing:							
		<i>Fusarium</i> spp.	<i>Rhizopus</i> spp.	<i>Alternaria</i> spp.	Bacteria	<i>Penicillium</i> spp.	<i>Pythium</i> spp.	<i>Rhizoctonia solani</i>	<i>Aspergillus</i> spp.
Bashaw	47	100	42	0	36	0	0	3	0
Daysland	58	88	4	0	52	0	8	0	0
Kelsey	53	87	3	0	70	0	2	0	0
Lacombe	62	82	1	1	35	1	5	0	0
Leduc	36	96	18	0	76	4	6	0	0
Millet	102	80	11	5	80	1	15	0	0
Lomond	14	100	36	0	0	0	0	0	0
Penhold	88	79	3	1	29	1	1	0	0
Red Deer	10	50	0	0	50	0	10	0	0
Vegreville	84	86	1	0	35	0	1	3	1
Wetaskiwin	61	94	14	0	57	0	16	11	0
Willingdon	21	95	24	0	19	5	0	0	0

**CROP:** Field pea  
**LOCATION:** Manitoba

**NAMES AND AGENCIES:**

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**TITLE: DISEASES OF FIELD PEA IN MANITOBA IN 2003**

**METHODS:** Crops of field pea were surveyed for root diseases at 32 different locations and for foliar diseases at 20 locations in Manitoba. The survey for root diseases was conducted in the second week of July when the plants were at the thirteen nodes to late flowering stages, and for foliar diseases in the first week of August when the plants were at the pod-fill to mature stages. The crops surveyed were chosen at random from regions in southwest and south-central Manitoba, where most field pea is grown. Twenty plants were observed/sampled for each crop surveyed. Diseases were identified by symptoms. Root diseases were rated on a 0 (no disease) to 9 (death of plant, the seedling could not emerge or died back quickly after emergence) scale. Five to ten symptomatic roots were collected per field for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 9 (whole roots/plants severely diseased). Powdery mildew was rated as the percentage of leaf area infected.

**RESULTS AND COMMENTS:** Three diseases were observed in the root disease survey (Table 1). *Fusarium* root rot (*Fusarium solanif. sp. pisi*) was the most prevalent disease and was observed in all 32 fields. *Fusarium* wilt (*Fusarium oxysporum*) and rhizoctonia root rot (*Rhizoctonia solani*) were observed in 5 and 4 of the fields surveyed, respectively.

Four foliar diseases were observed (Table 2). *Mycosphaerella* blight (*Mycosphaerella pinodes*) and powdery mildew (*Erysiphe pisi*) were the most prevalent diseases and were observed in 20 and 10 of the 20 crops surveyed, respectively. No *Fusarium* wilt was observed possibly due to the fact that the survey was conducted later in the growing season than usual. The plants were at the mature stage at the time of rating, making it difficult to view the symptoms of *Fusarium* wilt. Other foliar diseases, such as septoria blotch (*Septoria pisi*), and downy mildew (*Peronospora viciae*) were each observed at low levels in two and only one field, respectively. No bacterial blight (*Pseudomonas syringae* pv. *pisi*) was observed.

**Table 1.** Prevalence and severity of root diseases in 32 crops of field pea in Manitoba in 2003.

Disease	No. crops affected	Disease severity (0-9)*	
		Mean	Range
Fusarium root rot	32	2.8	0.8-4.2
Fusarium wilt	5	2.7	0.8-3.7
Rhizoctonia root rot	4	2.7	1.6-3.8

\*All diseases were rated on a scale of 0 (no disease) to 9 (whole roots severely diseased).

**Table 2.** Prevalence and severity of foliar diseases in 20 crops of field pea in Manitoba in 2003.

<b>Disease</b>	<b>No. crops affected</b>	<b>Disease severity*</b>	
		<b>Mean</b>	<b>Range</b>
Mycosphaerella blight	20	6.3	2-9
Fusarium wilt	0	0	0
Powdery mildew	10	70.3	3-100
Septoria blotch	2	4	3-5
Downy mildew	1	2.5	2.5
Bacterial blight	0	0	0
Unidentified	4	2.3	2-3

\*Powdery mildew was rated as the percentage of leaf area infected; other diseases were rated on a scale of 0 (no disease) to 9 (whole plant severely diseased).

**CROP:** Pulses (chickpea, lentil, pea)  
**LOCATION:** Saskatchewan

**NAMES AND AGENCIES:**

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**TITLE: SEED-BORNE PATHOGENS OF CHICKPEA, LENTIL AND PEA IN SASKATCHEWAN IN 2003**

**METHODS:** The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2003 crop were summarized. The tests were conducted to detect the pathogens causing the following diseases: ascochyta blight (*Ascochyta rabiei*), botrytis blight [grey mould] (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*) of chickpea; ascochyta blight (*Didymella* [A.] *lentis*), anthracnose (*Colletotrichum truncatum*), botrytis stem and pod rot (grey mould) and seedling blight (*B. cinerea*) and sclerotinia stem and pod rot (*S. sclerotiorum*) of lentil; and ascochyta blights (*Mycosphaerella* [A.] *pinodes* and *A. pisi*), botrytis blight (*B. cinerea*) and sclerotinia stem and pod rot (*S. sclerotiorum*) of pea. All samples were tested for *Ascochyta* and slightly fewer for *Colletotrichum*, *Botrytis* or *Sclerotinia*.

It is unknown which of the seed samples came from crops that had been grown from seed treated with registered fungicides, such as captan, thiram, Crown (a.i. thiabendazole + carbathiin), Vitaflo 280 (a.i. carbathiin + thiram) and Apron (a.i. metalaxyl), or sprayed with registered foliar fungicides, such as Bravo (a.i. chlorothalonil), Dithane (a.i. mancozeb), Headline (a.i. pyraclostrobin) and Quadris (a.i. azoxystrobin). Many of the lentil samples came from crops of ascochyta-resistant lentil cultivars. These were first widely grown in 2000 (2) and have now largely replaced older susceptible cultivars in all market classes.

**RESULTS AND COMMENTS:** The growing season in Saskatchewan was marked by good soil moisture conditions for planting and early growth, and rainfall to early July ranging from below normal in central areas to near normal in most southern and northern areas. However, pockets of very dry conditions occurred everywhere and major grasshopper infestations were general. July and August were hot and dry throughout the province, resulting in a record early harvest and high quality seed. Mean yields of lentil and pea crops for the province increased over those in 2002, but were still less than the 10-year average for 1994-2003, and chickpea yields were slightly lower than in 2002 (7).

Based on crop inspections in a few areas of the province by the senior author, plus anecdotal reports from pathologists and agronomists, diseases caused by species of *Ascochyta*, *Botrytis*, *Colletotrichum* or *Sclerotinia* in lentil and pea were at low levels in Saskatchewan in 2003. Even ascochyta blight of chickpea was much less severe than in 2002 and earlier years (3). The low levels of these diseases were undoubtedly due to hot dry weather, and, in the case of chickpea, probably also to a 74% decline in the acreage planted compared with 2002 (7).

By mid-December only 455 samples of lentil, 393 of pea and 71 of chickpea (desi and kabuli combined) had been tested by the four companies. These represent declines over the corresponding figures for 2002 of 57%, 48% and 64%, respectively (3,4,5). The declines were no doubt due to growers' obvious awareness of the high quality of seed harvested in 2003. In contrast with previous years (1,2,3,4,5,6), figures for seed infection with *Ascochyta* and *Botrytis* were not classified according to crop districts of Saskatchewan because levels were too low to make meaningful comparisons. Levels of seed-borne *Colletotrichum* and *Sclerotinia* were also not compared because they are always very low.

Mean levels of infection with *Ascochyta* spp. for the whole province were about 0.1% for lentil, 0.3% for pea, and 0.4% for chickpea (desi and kabuli combined). These contrast with corresponding figures of 1.5%, 1.5% and 4.9% for 2002 (3,4,5) and are the lowest values recorded in any of the last five years (1,2,3,4,5,6). Mean levels of *Botrytis* infection were <0.1% for both lentil and pea, and 0% for chickpea.

Perhaps the clearest indication of the disease-free quality of seed harvested in 2003 compared with previous years is given by the differences in percentages of samples which tested 0% infection with *Ascochyta* or with *Botrytis* (Table 1). As in previous years (1,2,3,4,5,6) very few samples of the three crops were infected with *Sclerotinia*, and very few lentil samples with *Colletotrichum*. In marked contrast to 2002 (3,4), *Fusarium avenaceum* was isolated very infrequently from lentil and chickpea samples.

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**Table 1.** Percentages of pulse crop seed samples testing 0% infection with *Ascochyta* and *Botrytis* in samples tested by commercial companies from September to mid-December, 1999-2003\*

Year	<i>Ascochyta spp.</i> **			<i>Botrytis cinerea</i>		
	Lentil	Pea	Chickpea	Lentil	Pea	Chickpea
2003	91	78	55	96	98	100
2002	54	48	25	41	98	60
2001	69	61	39	63	93	11
2000	34	24	29	20	72	47
1999	17	17	54	69	65	50

\* See references 1,2,3,4,5,6

\*\* *Ascochyta spp.* = *A. lentis* for lentil, *A. pinodes* and *A. pisi* for pea, and *A. rabiei* for chickpea.

**CROP:** Sunflower  
**LOCATION:** Manitoba

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**TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2003**

**METHODS:** A total of 70 sunflower crops in Manitoba were surveyed in 2003. Sixty-six percent of the crops were confectionery hybrids and 34% were oilseed hybrids. Twenty-nine crops were surveyed in the second week of August, 10 crops in the third week of August, 21 crops in the last week of August, and 10 crops in the second week of September. Crops were surveyed along preplanned routes in the major areas of sunflower production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the percent incidence of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem infections (*Phoma* spp. & *Phomopsis* spp.) were estimated as percent leaf and stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1).

In addition, 10 samples of sunflower plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives, by agricultural representatives and growers.

**RESULTS AND COMMENTS:** Eighty percent of the sunflower crops surveyed in 2003 had good to excellent stands and vigour. Forty percent of the crops surveyed were seeded late. Growing conditions were generally good during the first half of the growing season, but drier than normal conditions during the second half of the growing season, resulting in premature ripening and lower yields, especially in western Manitoba. Traces to 5% infestation of sunflower midge (*Contarinia schulzi*) were observed in 20% of the crops in the Red River Valley; however, the severity of infestation was extremely low in comparison to previous years. (1, 2, 3). Traces to 5% damage from sunflower beetle (*Zygogramma exclamationis*) were observed in 30% of the crops, and 1-20% damage from grasshoppers were observed in 38% of the crops in Manitoba.

Rust was the most prevalent sunflower disease in 2003, present in 65% of the crops surveyed, with severity ranging from trace to >60% leaf area affected, especially in the south central region of Manitoba (Table 1). Most rust epidemics occurred in early-seeded crops, where favourable conditions of moisture and temperature for early rust infections and development prevailed during the first half of the growing season. The incidence and severity of rust have been on the rise for the last two years (1, 2, 3).

Sclerotinia wilt/basal stem infection was present in 56% of the crops surveyed, with incidence ranging from trace to 20% infected plants. Sclerotinia head rot and mid-stem breakage caused by ascospore infections were present in 70% of crops surveyed during the last week of August and in September (37% in August and 80% in September). The incidence of head rot ranged from trace to 5% in crops surveyed in August, and from 5% to 10% in crops surveyed in September (Table 1). Although sclerotinia head rot was present in most crops, the incidence was lower in 2003 than in 2002 (1).

Verticillium wilt was present in 22% of the crops surveyed, with incidence ranging from trace to 10% infected plants (Table 1). The severity of verticillium wilt in 2003 was lower than in previous years due perhaps to the drier than normal conditions prevailing in Manitoba in 2003 (1, 2, 3, 4).

Downy mildew was observed in 30% of the crops with low incidence of trace to 20% infected plants in affected crops (Table 1). The prevalence and incidence of downy mildew were higher in 2003 than in the past 5 consecutive years (1, 2, 3) due perhaps to wet soil conditions and normal soil temperatures at the seedling stage.

Traces to 10% leaf area covered by spots caused by *Septoria helianthi* and *Alternaria* spp. were observed in 22% of crops surveyed in 2002. *Phoma* and *Phomopsis* stem lesions were present in 5% of the crops at trace to 5% stem area affected. Traces to 5% leaf area affected by powdery mildew were observed in several crops in south central Manitoba (Table 1).

Of the 10 samples submitted to the Manitoba Crop Diagnostic Centre, one sample of root rot caused by *Fusarium* sp. and *Pythium* sp. was identified, and nine samples with herbicide damage were identified.

**ACKNOWLEDGMENTS:** The assistance of Lawrence Wiebe, Maurice Penner, and Tricia Walske in conducting this survey is gratefully acknowledged.

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**Table 1.** Prevalence and intensity of diseases in 70 crops of sunflower in Manitoba in 2003.

Disease	Crops Affected		Disease Index <sup>1</sup>	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt	39	56%	0.7	T - 3
Sclerotinia head rot/stem rot	50	70%	0.6	T - 2
Verticillium wilt	15	22%	0.5	T - 2
Downy mildew	21	30%	1	T - 3
Rust	46	66%	2.4	T - 5
Septoria leaf spot	15	22%	1.1	T - 2
Powdery mildew	4	5%	0.5	T - 1
Phoma stem lesions	4	5%	0.6	T - 1
Lateness <sup>2</sup>	28	40%	2.1	1 - 4
Poor stand	12	17%	1.5	1 - 4
Poor vigour	14	20%	1.8	1 - 4

<sup>1</sup> Disease index is based on a scale of 1 to 5: Trace (T) = < 1%, 1= 1% 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 downy mildew, verticillium wilt, and sclerotinia infections; and on disease severity measured as percent leaf and stem area affected for rust, septoria leaf spot, powdery mildew, and phoma stem lesions.

<sup>2</sup> Indexes for lateness, stand, and vigour are based on 1-5 scale (1= early/very good and 5= late/very poor). Twenty-eight crops were late, 12 crops had poor stand, and 14 crops had poor vigour.

## Vegetables / Légumes

**CROP:** Greenhouse cucumber  
**LOCATION:** Alberta

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### TITLE: SURVEY FOR ROOT AND STEM DISEASES IN GREENHOUSE CUCUMBER IN ALBERTA IN 2003.

**METHODS:** Thirteen commercial cucumber greenhouses in southern and central Alberta were surveyed for root and stem diseases in June, 2003, and ten were surveyed again in November. Depending upon the size of the greenhouse, 5-10% of the plant population was evaluated for the presence of root and stem rot (*Pythium* spp.), fusarium wilt (*Fusarium oxysporum*), and gummy stem blight (*Didymella bryoniae*) diseases. Plants showing wilt symptoms in conjunction with brown, mushy and disintegrating roots were considered positive for pythium root and stem rot. Plants exhibiting foliar wilt symptoms along with longitudinal brown streaks on the stem and discoloration of the stem vascular tissues were counted as having fusarium wilt. Typical symptoms of gummy stem blight included tan to dark brown lesions on stems, amber-red gummy deposits and large numbers of black fruiting bodies. Disease incidence (% infected plants) was calculated for each row surveyed and the data were expressed as a range. The occurrence of other minor diseases was noted, but was not quantified.

**RESULTS AND COMMENTS:** The results from the surveys done in June and November are presented in Table 1. In June, the most prevalent disease was fusarium wilt; it was present in 12 of the 13 greenhouses. Pythium root and stem rot and gummy stem blight were observed in 3 and 9 greenhouses, respectively. The severity of fusarium wilt was also higher than the other two diseases.

In November, gummy stem blight was observed in the highest number of greenhouses, followed by fusarium wilt. Pythium root and stem rot was observed in only 2 of the 10 greenhouses surveyed. High disease incidence of  $\geq 10\%$  was observed in 3 of the 6 greenhouses with gummy stem blight, in both greenhouses where pythium root and stem rot were found, and in 1 of the 4 greenhouses with fusarium wilt. In a greenhouse with a 91-100% incidence of gummy stem blight, the grower had applied large amounts of water to the crop and the relative humidity was consistently high. At the time of the November survey, several of the crops were scheduled for imminent removal.

Generally, operations with high levels of disease lacked an effective sanitation program, and infested crop residues and weeds were often prevalent throughout the greenhouses. In the November survey, all of the cucumber crops had powdery mildew, ranging from mild to severe in intensity.

**Table 1.** Incidence of root and stem diseases in commercial cucumber greenhouses in Alberta in 2003.

June			
Greenhouse number	Disease incidence (%)*		
	Fusarium wilt	Pythium root/stem rot	Gummy stem blight
1	2 - 4	0	8 - 14
2	0 - 1	0	0 - 1
3	5 - 58	0	0 - 4
4	0 - 5	0	0 - 9
5	0	0 - 3	0
6	5 - 9	0	3 - 19
7	0 - 3	0 - 5	0
8	14 - 30	3 - 11	0
9	5 - 24	0	0
10	0 - 6	0	0 - 6
11	0 - 3	0	7 - 36
12	0 - 1	0	0 - 1
13	5 - 58	0	0 - 4
November			
1	0 - 3	8 - 42	0 - 3
2	0 - 7	6 - 12	0
3	0	0	91 - 100
4	0	0	16 - 56
5	0	0	0 - 9
6	5 - 20	0	0 - 6
7	0	0	0
8	1 - 6	0	0
9	0	0	3 - 10
10	0	0	0

\* Range of disease incidence values in rows surveyed in the respective greenhouse.

**CROP:** Potato  
**LOCATION:** Canada

**NAME AND AGENCY:**

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**TITLE: CROSS-CANADA LATE BLIGHT SURVEYS IN 2001 AND 2002**

**METHODS:** In 2001, 5 samples of tomato and in 2002, 22 samples of potato and tomato suspected of having late blight were received from one and four provinces, respectively. Isolates of *Phytophthora infestans* (de Bary) were prepared in pure culture and characterized for mating type and metalaxyl sensitivity, according to Peters (4) and Peters et al. (5). Metalaxyl sensitivity was based on 100 µg/ml metalaxyl in the medium, according to Peters (4). Glucose phosphate isomerase (*Gpi*) allozyme patterns were characterized according to Goodwin et al. (3).

**RESULTS:** The number of samples received in 2001 and 2002 was considerably less than the 213, 93 and 340 samples received in 2000 (6), 1999 (2) and 1998 (1), respectively. These sample numbers tended to reflect disease incidences in Canada during these years. The pathogen was successfully recovered from some but not all of the potato and tomato samples received. The recovery of active *P. infestans* from the samples was 64% in 2002 and this was lower than in 2001 (80%), 2000 (89%), 1999 (75%), and 1998 (81%) but similar to that in 1997 (60%). Many of the samples received were also infected by other fungi such as *Verticillium*, *Alternaria*, *Botrytis*, *Fusarium*, or *Rhizoctonia* species. In 2001, no potato samples infected by late blight were received and the isolates from the infected tomato samples were either the A1 or A2 mating type (Table 1). In 2002, the A2 mating type was found in three of the four Canadian provinces from which infected samples were received and represented 53% of the isolates obtained versus 35% for the A1 mating type (Table 1). Of the A2 mating types, 82% were from potato and 18% were from tomato. The A1 mating type was from potato from one province. For the potato samples, one province had the A1 mating type while three had the A2 mating type. For the only tomato sample, the pathogen isolate was an A2 mating type. However, in 2002 none of the samples from any province had more than one mating type.

For samples from which the pathogen was obtained, no isolates with sensitivity to the fungicide metalaxyl were identified in 2001 and only one isolate from potato was sensitive to metalaxyl (MS) in 2002 (Table 1). In 2001, all of the isolates had metalaxyl-moderately resistant (MMR) responses while in 2002, 94% of the isolates had MMR responses. In 2002, all isolates from potato samples and the single isolate from tomato were MMR. Metalaxyl-moderately resistant isolates from potato were obtained from 4 different provinces. Unlike previous years, metalaxyl-highly resistant (MHR) isolates were not obtained from potato or tomato in 2001 and 2002.

Of the most frequently occurring GPI-genotypes in Canada recently, US8 and US11, only US8 was found in 2001 and 2002 (Table 2). In 2001, 33% the isolates obtained from the tomato samples were US8. In 2002, 14 of the potato isolates and the only isolates from tomato were characterized as US8 (88%) while one isolate from potato and one from tomato were characterized with unknown GPI-genotype banding patterns. Another recognized GPI genotype was found in 2001; one of the four isolates obtained from tomato was US6. In addition, 50% of the isolates in 2001 and 12% in 2002 demonstrated various unusual banding patterns or unknown GPI genotypes (UN) that are unlike the currently recognized GPI genotypes. Meanwhile, unlike previous years (1,2), no US11 or US14 were found in 2001 and 2002. Although no potato samples were received in 2001, in 2002 US8 was found in potato samples from 4 provinces and UN genotypes in 1 province. For tomato isolates, US6, US8, and UN genotypes were all obtained from a single province in 2001, and US8 and UN genotypes from a single province in 2002.

Populations of *P. infestans* continue to demonstrate variability in Canada, especially in terms of new pathogen genotypes. Further study is required to determine the cause of the changing pathogen populations and their impact on disease and its control. Disease risk remains a concern due to the occurrence of both mating types. This means that sexual reproduction, as well as migration from other countries, could lead to new, more aggressive pathogen genotypes and that oospores could overwinter and initiate epidemics. Testing of tomato samples continues to demonstrate that pathogen population changes are not restricted to potato. Tomato can be a potential source of inoculum for potato and vice versa. The occurrence of tomato late blight in crops and home gardens across Canada needs to be studied. Furthermore, while infected potato seed tubers, volunteer plants and cull piles act as major sources of

air-borne inoculum, incidences of late blight on 'nightshade' weeds along field borders have also been reported and require more investigation.

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**Table 1.** Characterization of Canadian late blight pathogen isolates from potato and tomato by mating type and metalaxyl sensitivity in 2001 and 2002.

	<u>POTATO</u>				<u>TOMATO</u>				<u>TOTAL</u>			
	<u># Isolates</u>		<u># Provinces</u>		<u># Isolates</u>		<u># Provinces</u>		<u># Isolates</u>		<u># Provinces</u>	
<b>Mating Type</b>												
	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>
A1	0	6	0	1	1	0	1	0	1	6	1	1
A2	0	9	0	3	5	2	1	1	5	11	1	3
<b>Metalaxyl Sensitivity</b>												
	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>
MS	0	1	0	1	0	0	0	0	0	1	0	1
MMR	0	15	0	4	6	1	1	1	6	16	1	4
MHR	0	0	0	0	0	0	0	0	0	0	0	0

**Table 2.** Characterization of Canadian late blight pathogen isolates from potato and tomato by glucose phosphate isomerase (GPI) banding pattern in 2001 and 2002.

	<u>POTATO</u>				<u>TOMATO</u>				<u>TOTAL</u>			
	<u># Isolates</u>		<u># Provinces</u>		<u># Isolates</u>		<u># Provinces</u>		<u># Isolates</u>		<u># Provinces</u>	
<b>GPI Genotype</b>												
	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>	<u>2001</u>	<u>2002</u>
US6	0	0	0	0	1	0	1	0	1	0	1	0
US8	0	14	0	4	2	1	1	1	2	15	1	4
UN*	0	1	0	1	3	1	1	1	3	2	1	1

\*UN = GPI banding patterns not recognized under previously established GPI-genotype characterizations.

## Forest Trees / Arbres Forestiers

**CROP:** American Chestnut  
**LOCATION:** Ontario

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**TITLE: SURVEY OF AMERICAN CHESTNUT AND CHESTNUT BLIGHT IN ONTARIO**

**INTRODUCTION AND METHODS:** In Canada, American chestnut (*Castanea dentata* (Marsh.) Borkh.), naturally occurs below the 43rd parallel in the Carolinian zone of southern Ontario (Fox 1949). American chestnut was one of the dominant, hardwood, forest tree species in the northeastern forests of North America until the population was devastated by the introduction of *Cryphonectria parasitica* (Murrill.) Barr, the fungus causing chestnut blight (Kuhlman 1978). Blight entered North America from Asia at New York City around 1904 (Gravatt and Gill 1930) and reached southern Ontario in the 1920's (McKeen 1995). It is estimated that there were 1.5-2.0 million chestnut trees in southern Ontario before the introduction of blight (McKeen 1995). Today, American chestnut still survives as remnant populations and individuals throughout its native range, mainly by resprouting from root collars. However, sprouts often succumb to blight before reproductive maturity. American chestnut was designated as a threatened species in 1987 by the Committee on the Status of Endangered Wildlife in Canada. A survey of American chestnut populations in Ontario in the early to mid 1980s reported 62 sites with at least one tree > 10 cm diameter breast height (DBH) (Ambrose and Aboud 1986). This survey was conducted in the early to mid 1990s to update the status of American chestnut in Ontario.

Sites where American chestnut were known to occur were visited between 1992 and 1996. Presence of blight, DBH, and reproductive potential were recorded.

**RESULTS:** During the four years of this survey, 302 American chestnut seedlings, sprouts or trees (e.g. individuals) were located in southern Ontario and 124 (41%) of these individuals had visible symptoms of chestnut blight (Table 1). Over 70% of the American chestnut individuals examined occurred in Elgin, Haldimand-Norfolk, and Middlesex Counties. Over half (52%) of the individuals were  $\leq 10$  cm DBH, and 42 (14%) were >30 cm DBH. Flowers or burrs were found in association with 62 (21%) trees, indicating that these individuals had reached reproductive maturity (Table1).

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**Table 1.** American chestnut survey locations and tree descriptions

County	Township	Total # Trees	#Trees with Blight	# Individuals in DBH Range <sup>1</sup> (cm)					# Reproductive Trees
				0-2.5	2.6-10	10.1-20	20.1-30	>30	
Brant	Burford	27 <sup>2</sup>	0	17 <sup>2</sup>	0	1	1	8	0
	South Dumfries	1	1	0	0	0	1	0	1
Elgin	Aldborough	1	0	0	0	0	0	1	0
	Bayham	22	12	15	0	2	0	2	3
	Malahide	26	2	11	7	3	1	1	3
	Yarmouth	2	0	0	0	0	1	1	2
Essex	Gosefield	1	1	0	0	0	0	0	1
	Mersea	4	0	0	0	0	0	0	0
	City of Windsor	7	6	4	0	1	1	1	1
Haldimand -Norfolk	Delhi	17	11	5	1	1	2	5	6
	Nanticoke City Mun.	23	0	3	1	8	7	3	16
	Norfolk	56	21	5	13	22	8	8	12
Hamilton -Wentworth	Ancaster	2	1	0	0	0	0	2	2
	Flamborough	1	1	0	0	0	0	1	1
Kent	Zone	5	5	2	1	0	1	0	0
Middlesex	Cardoc	6	1	3	0	0	1	2	2
	City of London	5	1	0	1	1	1	1	2
	Mosa	55	38	7	38	6	0	2	2
Niagara	City of Niagara Falls	4	2	0	2	1	0	1	0
	Pelham	26	18	3	13	0	2	0	2
	City of St. Catharines	1	1	0	0	0	0	1	0
Oxford	Tillsonburg	9	1	3	0	0	3	2	6
Waterloo	North Dumfries	1	1	0	1	0	0	0	0
<b>TOTAL</b>		<b>302</b>	<b>124</b>	<b>78</b>	<b>78</b>	<b>46</b>	<b>30</b>	<b>42</b>	<b>62</b>

<sup>1</sup> DBH = Diameter of tree at breast height (cm).<sup>2</sup> Total number of trees may differ from sum of # individuals because of missing data.

**CROP:** Lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.)  
**LOCATION:** British Columbia

**NAMES AND AGENCIES:**

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**TITLE: INCIDENCE OF COMANDRA BLISTER RUST AND MORTALITY OF LODGEPOLE PINE IN A SITE PREPARATION TRIAL AT BEDNESTI LAKE, CENTRAL BRITISH COLUMBIA, FROM 1988 TO 2002.**

**METHODS:** Lodgepole pine is a predominant tree species in western North America that is used extensively for reforestation because it grows in a wide range of environments, is hardy, and grows rapidly (5). However, many diseases of the tree species are known (2, 3, 4, 8) and stem rusts are regarded as major threats to intensive management (10). In British Columbia (BC), stem rusts are common and very damaging (7, 8, 9), necessitating measures or treatments to prevent or reduce damage in young reforested stands (6).

In 1987-1988, a 10.5-ha experimental trial was established (1) near Bednesti Lake, approximately 50 km west of Prince George in central BC. The site is 850 m above sea level in the sub-boreal-spruce ecological zone, Stuart dry-warm subzone, SBSdw3. Objectives of the trial were to determine effects of site preparation treatments on establishment and early growth of lodgepole pine. Several treatments stimulated early stem volume growth but also appeared to increase incidence of stem rusts, including comandra blister rust (*Cronartium comandrae* Peck) and western gall rust (*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka) (1). Of these, comandra blister rust (CBR) is considered the most lethal. Young trees are usually infected by CBR low on stems, which are rapidly girdled and killed by the rust. However, data on the rate of infection and mortality of trees due to CBR were lacking. Trees at Bednesti were inspected annually for stem rusts, and CBR was identified by microscopic examination of spores of each infection. The year of infection was determined by the age of the infected stem segment.

**RESULTS AND COMMENTS:** By September 2002, 14 years after planting, 385 (32%) of the 1200 planted trees in the five treatments were infected by one or more stem rusts, with 103 trees infected by CBR (Table 1). Most of the CBR occurred on stems, and only three trees had both stem and branch infection. Site preparation treatments appeared to increase incidence of CBR, but there did not appear to be a good correlation with tree height growth because the furrow treatment that suppressed tree height growth for several years had the highest incidence of CBR.

CBR infected young trees mostly in the early years of establishment, from 1988 to 1992 (Table 2). Most (31) of the stem-infected trees were infected in 1988, with decreasing numbers of trees infected thereafter until 1992. No trees were infected by CBR after 1992. Trees infected by CBR began dying in 1992, increasing to 5 to 8 dead trees per year from 1996 to 1999, and then decreasing to one dead per year in 2000 and 2001. By 2002 at a tree age of 14 years, only 31 of 65 CBR-infected trees were dead. This appeared to be a lower rate of mortality than commonly expected. However, the height of most of the surviving CBR-infected trees was obviously very reduced.

Apparently, incidence and effects of CBR infection can be assessed with confidence at a tree age of approximately 5 years in central BC in order to determine the stocking and health of young reforested stands. Although the incidence of CBR is low in the Bednesti Lake trial, incidence of stem rusts is quite variable in BC (7, 9), and infection might continue in older trees in other areas. Continued survival of half of the CBR-infected trees for up to 14 years after initial infection suggests that in some instances, depending on incidence of infection and rate of tree growth, young infected trees might need to be removed to ensure unimpeded growth of nearby uninfected trees. Although many CBR-infected trees lived longer than was expected, it still appears likely that most infected trees will either die or suffer severe growth repression, and will not be acceptable future crop trees.

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**Table 1.** Incidence of comandra blister rust on lodgepole pine at the Besnesti Lake site preparation and establishment trial, 1988 to 2002.

Site preparation treatment	Comandra blister rust	
	No. infected stem	No. infected trees branch
control	9	5
bedding plow	12	8
burned	14	8
Delta hinge	12	10
furrow	18	7
Totals (% total trees)	65 (5.4)	38 (3.2)

**Table 2.** Stem infection by comandra blister rust and mortality of lodgepole pine trees at Bednesti Lake establishment trial.

Year	No. stem trees infected	No. trees dying by year										Total dead by 2002
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
1988	31	1			1	5	2	4	3	1		17
1989	19					3	3	1	3			10
1990	9							1		1		2
1991	4											0
1992	2									1	1	2
Totals	65	1			1	8	5	6	6	3	1	31

**CROP / CULTURE:** Pacific Yew (*Taxus brevifolia*)  
**LOCATION / RÉGION:** Québec

**NAME AND AGENCY / NOM ET ORGANISATION :**

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**TITLE/TITRE: INCREASED INCIDENCE OF CRYPTOCLINE NEEDLE DISEASE ON PACIFIC YEW**

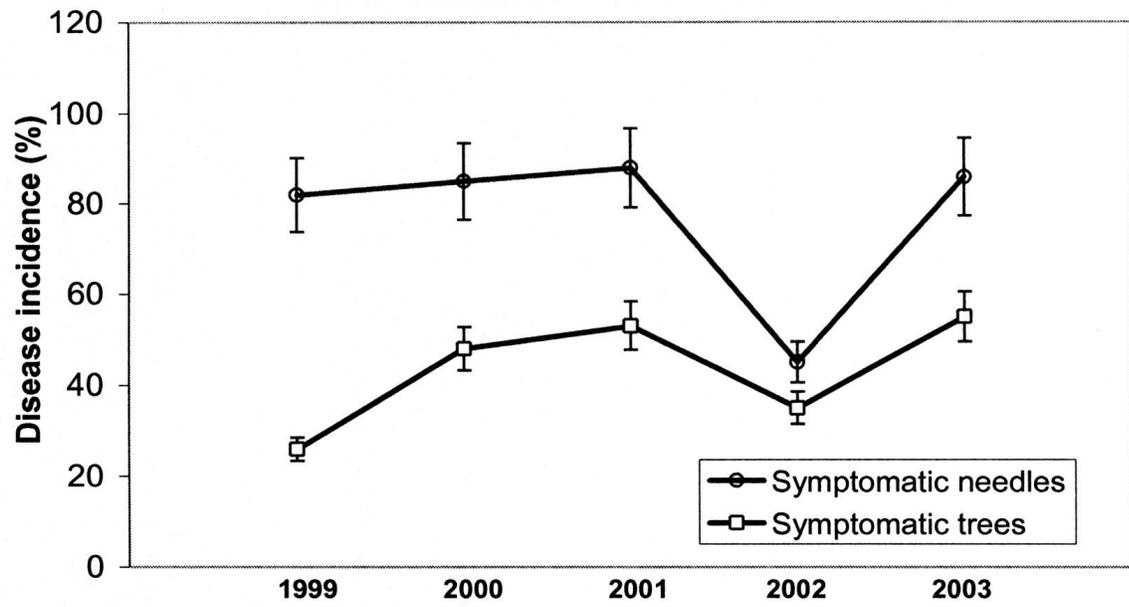
**INTRODUCTION AND METHODS:** *Cryptocline taxicola* (Allesch.) Petrak (Coelomycetes) seems to be the most important pathogen on needles of the Pacific yew (*Taxus brevifolia*) in Canada (1, 2). The fungus was also recently reported as an important pathogen of *T. baccata* var. *fastigiata* in Europe (3). Although this fungus can attack various yew species in Canada, the United States and Europe (1, 2, 3, 4), we know nothing about the origin of the fungus in Canada or its ecology in northeastern North America (Canada and Vermont). Annually from August 1999 to 2003, the frequency of fungal colonization of Pacific yew needles was determined in plantations at the Montreal Botanical Garden. Ten trees were surveyed from 1999 to 2001 and 20 trees from 2002 to 2003. On each tree 30 current-year and 30 second-year needles (10 non-symptomatic, 10 chlorotic, 10 necrotic), were collected. Characteristic symptoms on needles of Pacific yew were surveyed according to previous diagnostic data (2). This investigation was completed in the IRBV laboratories.

**RESULTS AND COMMENTS:** At each of the two sites (Alpine Garden and Chinese Garden), the average percentage of diseased trees increased from 30% in 1999 to 55% in 2003 when three trees (15%) died (Fig. 1). Besides *C. taxicola*, some other secondary fungal invaders, *Cytospora* sp., *Dothichiza* sp. and *Pestalotiopsis* sp., were occasionally isolated from the dead trees. Decreased disease occurrence was noted in 2002 with an average of 35% incidence. This was associated with sanitary measures applied in fall 2001, which consisted of cutting off symptomatic branches. However, favourable conditions during the 2003 growing seasons, e.g., high temperatures and excessive precipitation, could be responsible for the increased incidence on Pacific yew. A similar situation was found throughout the island of Montreal. Consequently, it is evident that cutting measures have not stopped fungal propagation and disease expression and are only temporary solutions. Therefore, further investigations are needed in order to propose an adequate control strategy against cryptocline needle disease in eastern Canada in the context of climatic changes.

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**Figure 1. Cryptocline disease incidence on Pacific yew in the Montreal Botanical garden tree plantations**



**CROP:** Spruces  
**LOCATION:** Nova Scotia

**NAMES AND AGENCY:**

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**TITLE: *OPHIOSTOMA TETROPII* AS A DETECTION TOOL FOR THE BROWN SPRUCE LONGHORN BEETLE, *TETROPIUM FUSCUM* (FABR.), IN HALIFAX, NOVA SCOTIA**

**INTRODUCTION:** The invasive brown spruce longhorn beetle, or “BSLB”, is a member of the Cerambycidae (longhorned beetles) and, although native to Europe, was discovered in Point Pleasant Park in the Halifax Regional Municipality of Nova Scotia in 1999. At this time, there is an on-going eradication effort in the municipality, led by the Canadian Food Inspection Agency. To date, this insect has not been found further than 25 km from Point Pleasant Park. This Heritage Park is believed to be the beetle’s point of entry to North America, as it is located immediately next to a container pier in the Port of Halifax (1). The beetle was discovered in the park attacking numerous native red spruce (*Picea rubens* Sarg.), as well as smaller numbers of white spruce [*Picea glauca* (Moench) Voss], black spruce [*Picea mariana* (Mill.) BSP], and introduced Norway spruce [*Picea abies* (L.)].

Bark and ambrosia beetles of the family Scolytidae, with their mycangial structures, have links to a variety of well known ophiostomatoid fungi (e.g., Dutch elm disease). Although little is known about the fungal associates of the longhorned beetles, one species of *Ophiostoma* has been evident from the time of the first discovery of BSLB in Nova Scotia. K. Jacobs *et al.* determined the identity of this *Ophiostoma* to be *O. tetropii* Mathiesen, a fungus described previously from Europe (2). *Ophiostoma tetropii* could be isolated from wood infested by BSLB, from the insect’s pupal chambers and directly from individual BSLB adults.

**RESULTS AND COMMENTS:** Over the past 3 years, evidence has accumulated that *O. tetropii* and BSLB are intimately associated. In the course of the eradication surveys around the Halifax Regional Municipality, we have found that the presence of *O. tetropii* is a good indicator that BSLB is, or was, present in trees from which this fungus was cultured. The signs and symptoms of the initial attack by BSLB can be concealed by the attack of native spruce beetle, *Dendroctonus rufipennis* (Kirby) or by the use of dead or dying trees by several native secondary species of bark beetles or longhorn beetles. In several cases, the first indication that BSLB was present in an outlying area was the isolation of *O. tetropii* from suspect trees in the area. Subsequent rearings of insects from trees at these locations produced adults confirmed as BSLB. When present, *O. tetropii* can be isolated on selective cycloheximide-streptomycin-malt-agar or “CSMA” medium (3) and identified in about 4 weeks versus a minimum of 12–14 weeks for the rearing of overwintered life stages to adult emergence of BSLB. For suspect samples collected in late summer, the insect rearing period must be extended to 24–28 weeks to allow for complete insect development and adult emergence.

Timely culture results for *O. tetropii* allow the regulatory agency to focus its detection survey and insect eradication efforts to best advantage.

*Ophiostoma tetropii* has been found at 24 widely scattered locations in the Halifax Regional Municipality, both within and outside the Regulated Area under the Ministerial Order for the Brown Spruce Longhorn Beetle Eradication Program (4). There were repeated isolations of this fungus from many BSLB infested trees in research areas such as Point Pleasant Park and McNabs Island in the Halifax Regional Municipality. Trees not infested with BSLB yielded cultures of the ubiquitous *Ophiostoma piceae* (Münch) Syd. & P. Syd. and a few other ophiostomatoid species. *Ophiostoma piceae* is commonly found in spruces and is often associated with the native spruce beetle and several secondary species of the Scolytidae.

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(<http://www.inspection.gc.ca/english/sci/surv/bslb/maps/mob.pdf>)

**CROP:** Western hemlock [*Tsuga heterophylla* (Raf.) Sarg.]  
**LOCATION:** British Columbia

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**TITLE: INCIDENTAL SURVEYS OF HEMLOCK DWARF MISTLETOE IN COASTAL BRITISH COLUMBIA.**

**INTRODUCTION AND METHODS:** Hemlock dwarf mistletoe (HDM, *Arceuthobium tsugense* (Rosendahl) G.N. Jones subsp. *tsugense*) is a common, widespread parasite of western hemlock in coastal forests of western North America including British Columbia (BC), and causes distinctive pathogenic effects (Hennon et al. 2001). However, the impact of HDM on forest productivity and sustainability of certain forest practices in infested stands, particularly retention harvesting and silviculture, remains controversial. Previous surveys indicated HDM is a frequent residual pathogen in variable retention harvested areas, e.g., in Clayoquot Sound (Edwards 2002). Its impacts could be exacerbated due to increased retention of live, infected trees (Beese et al. 2003), but no data are available to substantiate or estimate future impacts.

Morphologically distinct subspecies of HDM preferentially infect western hemlock, shore pine, mountain hemlock, and possibly amabilis fir (Wass and Mathiasen 2003, R. L. Mathiasen, pers. comm.), and rarely, other associated species such as western white pine, Sitka spruce and Douglas-fir. Angiosperm parasites, such as HDM and other dwarf mistletoes, survive only on live coniferous trees. HDM seeds are dispersed by hydrostatic (explosive) discharge of seeds, which travel up to 15 m, but usually only 10 m or less. Most infection occurs by seeds that are intercepted by tree foliage, lodge at the base of needles on bark, and in spring, germinate and penetrate into the bark to form a parasitic relationship with the host branch or stem. Infections become apparent after two years or longer, initially as small swellings of the bark and later, often as fan-shaped, flattened, proliferations of branches that are tapered and evidently swollen at the bases. These are called witches' brooms. These infections persist and grow as long as the tree branch or stem remains alive, and after several decades can develop into massive growths.

Dwarf mistletoe infection is often indicated by dense overlapping foliage on lower crowns of infected trees. Trees must be inspected closely for occurrences of witches' brooms and other characteristic symptoms to identify infected trees positively. Aerial shoots and berries of dwarf mistletoe are often difficult to detect as they are usually found only on well-exposed branches in the upper third of the tree crown (Smith 1969, Shaw and Weiss 2000) and are often absent (suppressed) on lower shaded branches. In dense stands of tall trees, it is usually almost impossible to determine if there is infection in the upper third of the crown of lightly infected trees unless they are felled. However, on most diseased trees, more infections tend to occur in the lower third of tree crowns.

From approximately 1998 to 2003, several locations in coastal BC were examined for HDM incidence to determine spread of the parasite into stands of young trees, and to select study areas to measure and model impacts of HDM on tree growth. Observations of HDM based on these casual inspections were tabulated to assist possible further studies.

**RESULTS AND COMMENTS:** Trees infected by HDM are common in coastal BC (Table 1), but areas of second growth or young trees with severe infection are less common. Most young hemlock stands develop from extensive disturbances such as windstorms or logging where many residual trees were destroyed or cut, thus effectively reducing HDM spread into young stands (Trummer et al. 1998). In some young stands, dwarf mistletoe infection is evident only on a few branches low on the stem, with little infection evident higher on the stem or on branches in the live crown. However, determining the full extent of infection in tall western hemlock trees from ground level inspection is often problematic, as described above.

Several examples of vigorous spread from residual trees into young trees were found, such as those at or near Courtenay, Cumberland, Jordan River, and Tofino. As well, at Vancouver, two very extensive examples of severely infected young stands developed, one after selective logging in Pacific Spirit Regional Park at the University of BC and the other as a result of frequent partial cutting to remove dangerous trees in Stanley Park. Severe infestation of a multi-layered, unevenaged stand on a steep slope was observed at Tow Hill Ecological Reserve, Naikoon Provincial Park, at the northeastern tip of Graham Island, Queen Charlotte Islands. These examples indicate that in 60 to 80 years during the expected rotation time to maturity of coastal hemlock forests, significant HDM infestations can develop. They also substantiate previous findings of significant infection and impacts in second-growth hemlock, including increased rates of tree mortality, and reduced stem growth (Bloomberg and Smith 1982, Stewart 1976, Thomson et al. 1985). These observations lend support to the concern that the variable-retention harvesting practices and silviculture regimes in infested coastal forests are creating conditions that exacerbate spread and impacts of hemlock dwarf mistletoe.

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**Table 1.** Notable infestations of western hemlock dwarf mistletoe (HDM) on Vancouver Island, the Queen Charlotte Islands (QCI) and Lower Mainland, British Columbia observed in the period 1998 to 2003. (All sites in coastal western hemlock [CWH] ecological zone, except as noted below).

Location	Approximate number of HDM- infected trees	Features, comments
<b>Vancouver Island</b>		
Campbell River: Montane alternative silvicultural systems (MASS) project,	1000+	Upper CWH transition to Mountain Hemlock zone, 740 - 850 m elevation. See project web page for background. <a href="http://www.pfc.cfs.nrcan.gc.ca/silviculture/mass/site_e.html">http://www.pfc.cfs.nrcan.gc.ca/silviculture/mass/site_e.html</a> In 1998, five years after logging, very few HDM shoots on few infections visible on lower stems or residual advanced regeneration. HDM shoots only found on upper half to one-third of crown of windthrown mature tree, approx 40 m height. No apparent infection of regenerating or planted hemlock (Hw), 1 m height. Site is at upper elevation limit of 800 m for HDM in BC. HDM survey by Nevill and Wood (1995).
Chemainus: Chemainus R., Cranko Rd. approx 2.6 km N of junction with Mt. Sicker Rd.,	10	Scattered 2 <sup>nd</sup> growth Hw with some HDM along riverbank.
Courtenay: Browns River	1000+	Clearcut opening at 300 m elevation, where many residuals were left, particularly near border. Extensive HDM on residual overstory trees, residual trees (advanced regeneration) scattered throughout opening, and regenerating young trees. Vigorous seed production and numerous infections with seeds. Many young infections have "yellow flag" of chlorotic foliage on shoot distal to infection. Close to riverbank. Extensive infection and spread in adjacent second-growth, dense Hw. Medium to good site.
Comox: Point Holmes (north of Comox)	1000+	Extensive infection of shore pine on sand dunes.
Cumberland: 4 km on road to Pigeon Lake regional disposal site.	1000+	Extensive HDM infection in patches in 45-60 year hemlock at 200 m elevation. Less hemlock and more Douglas-fir driving north. More severely infected trees have noticeably more foliage due to dense, flattened witches' brooms and possibly are older than less severely infected trees nearby.
Deep Bay: Waterloo Creek, 3 km S Bulkley Bay, Hwy 19.	100	Scattered 5 to 10 m residuals adjacent (W side) Hwy 19. In and near other Hw regeneration area established just before or after new highway construction. Min. of Transportation photos of right-of-way show infected trees. Vigorous seed production.
Deep Bay: McNaughton Creek, 3 km S Bulkley Bay (on Hwy 19A 100 m N of E&N railway crossing)	10	A few lightly infected trees. Very brushy high-quality site.

Duncan: Chemainus River regional park (approx 5 km on Hillcrest Rd., off Hwy 18, W of Duncan)	10	A few small patches of large second-growth Hw with HDM along/near creek on west side of road. Possibly some scattered HDM through park near river.
Jordan River: China Creek Campground, Juan de Fuca Provincial Park,	1000+	Infected 65-year-old second growth Hw at park entrance and old-growth on trail to beach, with light to severe HDM in several patches. Pronounced stem infections and lower infected branches with foliage in dense crown cover. Some second-growth trees have infection apparently only on lower branches. Patch of young year trees on lower bench on beach trail with HDM spread approx. 10-15 m from old infected trees. Frequent windthrown trees with HDM.
Lake Cowichan: Beaver Lake, approx 3 km E of Lake Cowichan	1000+	Scattered HDM in patchy Hw with numerous Douglas-fir. Coastal Douglas-fir zone. Excellent site for D-fir. Near Cowichan Lake Educational Center.
Lake Cowichan: Harris Creek road, 15 km southwest of Lake Cowichan	1000+	Approx. 2 ha second-growth Hw (60+ years) on good site. Former study site for mistletoe spread model (Bloomberg and Smith 1985).
Parksville: Horne Lake,	1000+	Canadian Forestry Service study area for biological control. Scattered separate infestations of shore pine and Hw subspecies of HDM throughout area. Shore pine HDM common from here north to Qualicum Bay (Cochrane Rd.).
Parksville: Little Qualicum Falls Prov. Park	10	A few Hw with HDM near road to campground, approx. 30 m from junction with main road to day-use area.
Parksville: Qualicum River, fish hatchery on Fisheries Road	10-100	HDM on very large, vigorous Hw in riparian area, 50-100 m west of main buildings.
Port McNeill: Beaver Lake Demonstration Forest, junction Hwy 19 and Port Alice Road	1000+	Patches of infected old-growth hemlock and adjacent young stand. Windfall gaps.
Port McNeill	1000+	Scattered old-growth residuals and small lightly infested patches of second-growth hemlock. Many young hemlock stands originated from extensive windstorm in 1910 that destroyed many thousands of hectares.
Qualicum: Englishman River Falls Prov. Park,	1000+	Extensive 50-100-m patch infected Hw on access road approx 100 m east of main entrance parking lot. Most Hw and HDM around a moist depression with skunk cabbage, at/near crest of riverbank. Trees toppling. Gap with Hw regenerating trees. Scattered, very large old-growth D-fir. Very good growing site.

Sooke: Muir Creek (Hwy 14, 2 km W of Muir Creek),	1-10	Three infected 5-6 m height residuals or regeneration at W side of road in young 10-ha (?) stand. HDM in lower crown. Potential seed collection area.
Tofino-Ucluelet	1000+	Scattered light to severely infected hemlock throughout area. Hemlock and HDM on knolls with western red cedar and shore pine predominating. See Edwards (2002) for survey of mistletoe-infected residuals in retention cutblocks.
Tofino airport	100-1000	Several patches of lightly, moderately and severely infected 60-year second growth on road to Grice Bay. Medium to good site.
<b>Lower Mainland</b>		
Abbotsford: Mission Tree Farm,	2	Infected trees along BC Hydro land W side of Stave Lake on good site
Maple Ridge: Malcolm Knapp Research Forest, (University of BC)	1000+	Extensive infestations in good sites near main entrance gate in 1991 shelterwood and nearby previously burned-over area.
North Vancouver: Mt. Seymour Park	1000+	Scattered small patches of old hemlock snags and adjacent younger "regeneration" along road to ski area up to 10 km post at 860 m elevation. (Re-examine trees in this area to determine if mountain hemlock and possibly mountain hemlock-DM subspecies occur here)
Vancouver: Stanley Park,	1000+	Extensive HDM infection in good to excellent quality sites. Extensive partial cutting to remove dangerous old-growth trees over last 5 decades. Frequent tree breakage associated with HDM stem swellings and large severely infected trees. Numerous fallen large branches with large HDM witches brooms. Two apparently resistant hemlock near Prospect Point lookout, despite extensive infection in general area.
Vancouver: Pacific Spirit Regional Park, University of BC.	1000+	Extensive HDM infection and infection centres with gaps/broken or dead trees in 90-year second-growth, 40-50 m height on excellent quality site. Infested area escaped burning after logging and infected residual hemlock survived. Severe HDM infection with numerous fallen, broomed branches. HDM-infected branches with green foliage survive low on stem well below most live foliate branches. Lower infected branches have no HDM shoots, but shoots common on branches fallen from upper crown.
West Vancouver: Lighthouse Regional Park, Point Atkinson,	1000+	Extensive, severe HDM in Douglas-fir/ hemlock, old-growth forest around and near entrance parking lot. Uneven-aged hemlock understory.

**Queen Charlotte Islands:**

Copper Bay, south of Sandspit, QCI	1000+	Retention harvested, severely infested site. Numerous HDM-infected residual trees left in and around cutover openings.
Queen Charlotte City, QCI	1000+	Scattered infested trees on upper slopes around settlement. Excellent sites. Patchy hemlock with alder and spruce predominating.
Rennell Sound, QCI	1000+	Scattered patches of lightly to severely infected trees. High quality sites.
Tow Hill, Naikoon Prov. Park, Queen Charlotte Islands	1000+	Extensive stand of severely infected, all-aged hemlock stand on steep slope, 10 to 100 m elevation. Possibly most severely infected area in coastal BC. Extensive tree collapse and infected hemlock, apparently windthrown in random directions; numerous fallen broomed branches.

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**SUBSTRATE:** Imported wood dunnage and wood packaging

**LOCATION:** British Columbia and Quebec

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## **TITLE: EXOTIC FUNGAL PESTS ISOLATED FROM FOREIGN WOOD DUNNAGE AND WOOD PACKAGING**

**INTRODUCTION AND METHODS:** Foreign wood dunnage and wood packaging are two of the main means of introduction of exotic forest pests to Canada. Many devastating diseases such as Dutch elm disease and oak wilt arrived in this manner in North America (Table 1). To intercept introduced exotic fungi and to study rates of introduction, the Canadian Food Inspection Agency (CFIA) and the Canadian Forest Service (CFS) are collaborating to search for and identify these exotic fungi. Our goals are to: 1. collect exotic fungi arriving in Canada on wood dunnage and wood packaging, and 2. identify exotic fungi arriving in Canada and predict their potential as pests. A total of 49 wood samples was taken from shipments arriving at Vancouver and Montreal harbours from May 2001 to August 2002. Isolations were performed on different growth media and fungal isolates were transferred and purified as required.

Identifications were carried out using molecular methods. The nuclear ribosomal ITS gene of each isolate was amplified by PCR using primers ITS1F and ITS 4 (2). It was then sequenced and compared with known sequences in GenBank using BLAST. Sequences were then aligned with the most similar fungal sequences using MegAlign and sequence similarities were analyzed with PAUP 4.0. (1)

**RESULTS AND DISCUSSION:** More than 300 isolations on different growth media were performed and 121 fungal isolates were obtained. Sixty-one isolates were successfully sequenced and identified as 32 different taxa using the species names provided by BLAST in GenBank (Table 2). Nineteen of these were common moulds or cosmopolitan saprophytes, 12 common forest fungi and one isolate is unknown to GenBank but belongs to a potentially damaging fungal genus. Introduced exotic fungi found in this study were usually common cosmopolitan moulds, saprophytes or fungal pests. However a few new potentially damaging fungal pathogens are still being introduced every year on wood dunnage and wood packaging. One example found in this survey was an unknown *Cylindrocarpon* sp., closely related to *Cylindrocarpon destructans* (Zinssmeister) Scholten. *Cylindrocarpon* is a genus with many forest pathogenic species. Further tests in containment facilities will be necessary to fully assess its potential as a pest.

The present techniques and sampling procedures are ineffective to detect exotic fungal pests with an endophytic life cycle such as *Sirococcus clavignenti-juglandacearum*, temporarily asymptomatic fungi like *Phytophthora ramorum*, or any pathogens not causing diseases in their native range. For this reason, this survey provides only a partial picture of the potential threats of exotic fungi to Canadian forests.

**ACKNOWLEDGEMENTS:** The author would like to thank CFIA inspectors for collecting samples and Julie Dubé for technical support.

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**Table 1.** Past exotic disease introductions to Canada and the USA ('+' indicates it was introduced on dunnage).

Disease	Causal agent	Year introduced
Chestnut blight	<i>Cryphonectria parasitica</i>	1900's
White pine blister rust	<i>Cronartium ribicola</i>	1917
Beech bark disease	<i>Nectria coccinea</i> var. <i>faginata</i>	1920 +
European larch canker	<i>Lachnellula willkommii</i>	1920's
Oak wilt	<i>Ceratocystis fagacearum</i>	1940's +
Dutch elm disease	<i>Ophiostoma novo-ulmi</i>	1941 +
Butternut canker	<i>Sirococcus clavignenti-juglandacearum</i>	1967
Scleroderris canker	<i>Gremmeniella abietina</i> var. <i>abietina</i> European race	1977
Sudden Oak Death	<i>Phytophthora ramorum</i>	1995

**Table 2.** Exotic fungi found during survey of wood dunnage and wood packaging in 2001-2002, identified using BLAST in Genbank.

Fungal species	No. times found		No. times found
		Forest fungi	
Common moulds			
<i>Ampelomyces humuli</i>	1	<i>Ascocoryne cylichnium</i>	1
<i>Aspergillus nidulans</i>	1	<i>Bjerkandera adjusta</i>	1
<i>Aspergillus oryzae</i>	2	<i>Cylindrocarpon</i> sp.	1
<i>Cladosporium</i> sp.	1	<i>Ophiostoma picea</i>	2
<i>Eurotium</i> sp.	1	<i>Ophiostoma querci</i>	1
<i>Fusarium sambucinum</i>	1	<i>Phellinus igniarius</i>	2
<i>Gliocladium roseum</i>	2	<i>Pycnoporus cinnabarinus</i>	1
<i>Mucor circinelloides</i>	1	<i>Schizophyllum commune</i>	1
<i>Mucor plumbeus</i>	1	<i>Scleromitrlula</i> sp.	1
<i>Mucor racemosus</i>	1	<i>Xylobolus annosum</i> <sup>1</sup>	2
<i>Nectria gliocladioides</i>	1	<i>Thanatephorus cucumeris</i>	2
<i>Nectria haematocca</i>	1	Unknown basidiomycete	1
<i>Penicillium</i> sp.	2	<i>Kretzschmaria deusta</i> <sup>2</sup>	2
<i>Trichoderma viride</i>	7		
<i>Trichoderma aureoviride</i>	4		
<i>Trichoderma atroviride</i>	9		
<i>Trichoderma citrinoviride</i>	2		
<i>Trichoderma harzianum</i>	1		
<i>Trichothecium roseum</i>	1		

<sup>1</sup>Named *Stereum annosum* in Genbank. <sup>2</sup>Named *Ustulina deusta* in Genbank.

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K. Bassendowski	86, 96	M. Lacroix	28
L. Bedford	120	J.L. Lamb	98
C.J. Beauchamp	102	R.M. Lange	92
J.A. Bérubé	133	S.L.I. Lisowski	113
M. Beyene	45, 47, 66, 67, 82, 83	A.W. MacKay	125
S.F. Blade	104	A. MacPhail	115
G.J. Boland	118	D.E. Mather	57
R. Bowness	104	F. Matheson	53
B. Callan	133	B. McCallum	77
J. Calpas	68	D.L. McLaren	90, 98, 107
B. Carriere	109	M.S. Melzer	118
J.G. Champagne	133	J.G. Menzies	53
K.F. Chang	104	M. Mirza	113
B. Chapman	68	K. Morgan	74, 75
Y. Chen	48,78, 80, 84	R.A.A. Morrall	96, 102, 109
J. Chong	65	E. Mueller	45, 47, 66, 67, 74, 76, 82, 83
A. Comeau	55	J. Muir	120, 127
R.L. Conner	90, 107	B. Mulock	77
P.A. Cote	113	P.R. Northover	18
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M.L.. Desjardins	18, 100, 111	J.A. Parmelee	102
D. Dion	55	C. Pearse	109
J.P. Doyon	133	P.G. Pearse	14, 43, 70, 72, 96
S. Duguid	100	R.G. Platford	98
R. Dunn	68	H.W. Platt	115
K. Dunsmore	52	D.A. Presello	57
R.S. Erickson	88	K.Y. Rashid	100, 111
F. Fauteux	53	L.M. Reid	57, 61
M.R. Fernandez	43, 70, 72	S. Rioux	55
T. Fetch	52	F. Sabo	48, 78, 80, 84
C. Franke	92	C. Saramaga	53
H. Ghazvini	45, 47, 66, 67	N.A. Savidov	113
G. Gilbert	28	D. Schmeling	109
J. Gilbert	45, 47, 66, 67, 74, 75	D. Schultz	45, 47, 66, 67, 82, 83
M. Grismer	120	N. Selvanathan	18
B.D. Gossen	86	K. Slusarenko	74, 75
M. Groom	90, 107	G.A. Smith	125
R.K. Gugel	96	J.J. Soroka	86
S. Haber	54	L. Stordeur	120
D. Hamel	28	M. Stulzer	45, 47, 66, 67, 82, 83
C.L. Harris	43, 70	A. Tekauz	45, 47, 66, 67, 74, 75, 82, 83
K.J. Harrison	125	A. Tenua	61, 84
K.M. Ho	48	L. Thomson	109
J. Hoepfner	77	T.K. Turkington	50, 68
G. Holzgang	14, 43, 70	A. Tullu	102
R.J. Howard	104, 113	G.D. Turnbull	104
T.F. Hsieh	88	T. Unrau	74, 75
H.C. Huang	88	H.D. Voldeng	78, 80
J.A. Hughes	113	V. Vujanovic	123
J.E. Hurley	125	T. Woldemariam	57, 61
S.F. Hwang	104	K. Xi	68
V. Joshi	7	A.G. Xue	48, 78, 80, 84
R. Kaethler	74, 75	L. Yager	90, 107
D.A. Kaminski	18, 98, 100, 111	J.M. Yasinowski	96
U. Kromer	74, 75	X. Zhu	57, 61
K. Kumar	68		

**LIST OF FIGURES**

Caption	Page No.
Isolations of foliar pathogens by region in southern Manitoba in 2003 (RRV= Red River Valley)	76
Incidence of fusarium wilt in 53 <i>Brassica napus</i> fields in Alberta in 2003. Each circle represents one field, and the size of the circle is proportional to the percentage of infected plants at that location. Disease incidence was determined either by counting the number of symptomatic plants in 100 randomly selected plants per field (white circles), or by visually estimating the percentage of infected plants in entire crops (grey circles).	95
Cryptocline disease incidence on Pacific yew in the Montreal Botanical garden tree plantations	124