2011

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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Contents: **DISEASE HIGHLIGHTS** - 2010 GROWING SEASON
(+ earlier years for historical significance)

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 or Phytoprotection

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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CEREALS / CERÉALES

OILSEEDS & SPECIAL CROPS / OLÉAGINEUX ET CULTURES SPÉCIALES

Diagnostic Laboratories / Laboratoires Diagnostiques

CROPS: Commercial Crops - Diagnostic Laboratory Report
LOCATION: British Columbia

NAMES AND AGENCY:
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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE PLANT DIAGNOSTIC LABORATORY IN 2010.

METHODS: The British Columbia Ministry of Agriculture Plant Diagnostic Laboratory provides diagnoses and disease management information for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes, insect pests and abiotic disorders of commercial agricultural crops grown in British Columbia. The following data reflect samples submitted to the laboratory by ministry staff, growers, agri-businesses, 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, fungi and bacteria with micro-well and membrane based enzyme linked immuno sorbent assay (ELISA). Molecular techniques (PCR – conventional and/or real time) were used for identification of some species specific diagnoses. Some specimens were referred to other laboratories for identification or confirmation of the diagnosis.

RESULTS AND COMMENTS: The year 2010 was a wet year with heavy rains until mid June. Following a brief summer, heavy rains returned and impacted field crop harvest. A few operations experienced major losses due to poor weather conditions during harvest. Most of the diseases diagnosed were common with a few organisms emerging as significant in terms of sites infected. Summaries of diseases and their causal agents diagnosed on commercial crop samples submitted to the laboratory are presented in Tables 1-11 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 stresses including herbicide damage, fruit abortion due to lack of pollination, poor samples, insect-related injury and damage where no conclusive causal factor was identified.

Table 1.0 Summary of diseases diagnosed on **field crop** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Alfalfa	Bacterial wilt	*Clavibacter michiganensis* subsp. *Insidiosus*	1
Grass	Powdery mildew	*Erysiphe* sp.	1
	Rust	*Puccinia* sp.	1
Wheat	Nematode damage	*Pratylenchus* sp. and *Paratrichodorus* sp.	1

DISEASED SAMPLES	4
ABIOTIC AND OTHER DISORDERS	0
TOTAL SUBMISSIONS	4

Table 2.0 Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Camassia quamash	Seed rot	*Penicillium* sp. and *Aspergillus* sp.	1
Dianthus	Alternaria blight	*Alternaria* sp.	1
Euphorbia pulcherrima	Root rot	Oomycete	1
Gaillardia	Leaf spot	*Cercospora* sp. *Ramularia* sp. *Alternaria* sp.	1
	White smut	*Entyloma polysporum*	1
Kalanchoe	Leaf spot	*Impatiens necrotic spot virus*	1
Lavandula	Root rot	*Thielaviopsis basicola*	6
	Foliar blight	*Botrytis cinerea*	1
	Stem canker	*Botrytis cinerea*	1
Phlox	Downy mildew	*Peronospora phlogina*	2
	Leaf spot	*Alternaria* sp. and *Colletotrichum* sp.	1
	Leaf spot	*Botrytis cinerea* and *Cladosporium* sp.	2
Salvia	Downy mildew	*Peronospora lamii*	1
	Powdery mildew	*Erysiphe* sp.	1

DISEASED SAMPLES 21
ABIOTIC AND OTHER DISORDERS 19
TOTAL SUBMISSIONS 40

Table 3.0 Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Cucumber	Black root rot	*Phomopsis sclerotioides*	1
	Leaf mosaic	Potyvirus	2
	Root rot	*Pythium* sp.	4
	Stem rot	*Fusarium solani*	1
Tomato	Root rot	Oomycete	1

DISEASED SAMPLES 09
ABIOTIC AND OTHER DISORDERS 11
TOTAL SUBMISSIONS 20

Table 4.0 Summary of diseases diagnosed on **mushroom** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Mushroom	Green mold	*Trichoderma aggresivum*	1

DISEASED SAMPLES 1
ABIOTIC AND OTHER DISORDERS 0
TOTAL SUBMISSIONS 1

Table 5.0 Summary of diseases diagnosed on **nut crop** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Hazelnut	Eastern filbert blight*	*Anisogramma anomala*	5

*Eastern filbert blight is now considered an established disease on hazelnut in the Fraser Valley of B.C. It is a regulated/quarantine disease and CFIA is in the process of de-regulating it.

DISEASED SAMPLES	5
ABIOTIC AND OTHER DISORDERS	0
TOTAL SUBMISSIONS	5

Table 6.0 Summary of diseases diagnosed on **herbaceous ornamental** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Ajuga	Crown and root rot	*Phoma* sp.	1
Clematis	Stem canker/wilt	*Ascochyta clematidina*	1
Dracaena sanderiana	Anthracnose	*Colletotrichum* sp.	1
Echinacea	Botrytis blight	*Botrytis cinerea*	1
Fargesia	Leaf spot	*Alternaria* sp. and *Cladosporium* sp.	1
		Alternaria sp., *Cladosporium* sp., & *Drechslera* sp.	1
	Root rot	Oomycete	2
Festuca	Root rot	Oomycete	1
Gaultheria	Foliar blight	*Botrytis cinerea*	1
Helleborus	Bacterial blight	*Pseudomonas syringae*	1
Heuchera	Black root rot	*Thielaviopsis basicola*	1
Hosta	Leaf spot	*Phyllosticta* sp.	1
		Phyllosticta sp. and *Botrytis cinerea*	1
Lavandula	Black root rot	*Thielaviopsis basicola*	3
	Foliar blight	*Botrytis cinerea*	1
Miscanthus sinesis	Root rot	Oomycete	1
Myosotis	Leaf spot	*Cercospora* sp.	1
Ophiopogon nigra	Root rot	Oomycete	1
Paeonia	Botrytis blight	*Botrytis cinerea*	1
	Root rot	*Thielaviopsis basicola*	1
Phalaris	Leaf spot	*Ramularia* sp.	1
Sambucus	Leaf spot	*Ascochyta* sp.	1

DISEASED SAMPLES	25
ABIOTIC AND OTHER DISORDERS	10
TOTAL SUBMISSIONS	35

Table 7.0 Summary of diseases diagnosed on **small fruit (berry crop)** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Blackberry	Cane blight	*Leptosphaeria* sp.	1
	Fruit rot	*Botrytis cinerea* and *Cladosporium* sp.	1
	Stem canker	*Botryodiplodia* sp.	1
	Stem canker	*Phomopsis* sp.	1
Blueberry	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	6
	Basal/crown canker*	*Phomopsis* sp.	3
	Blighted tips	*Phomopsis* sp., *Colletotrichum acutatum* and *Botrytis cinerea*	2
	Blueberry mosaic	Blueberry mosaic virus	1
	Blueberry scorch	Blueberry scorch virus	11
	Blueberry shock	Blueberry shock virus	2
	Botrytis blight	*Botrytis cinerea*	2
	Bud and twig blight	*Phomopsis* sp.	1
	Bud blight	*Gloeosporium* sp.	1
		Godronia cassandrae	2
	Crown gall	*Agrobacterium tumefaciens*	1
	Flower bud blight	*Colletotrichum acutatum*	1
	Fruit rot	*Botrytis cinerea*	1
		Botrytis sp., *Alternaria* sp. and yeast	1
	Godronia canker*	*Godronia cassandrae*	16
	Leaf blight	*Botrytis cinerea*	1
	Leaf spot	*Alternaria* sp.	1
	Mummy berry	*Monilinia vaccinii-corymbosi*	3
	Nematode contribution	*Paratrichodorus* sp.	3
		Paratrichodorus sp. / *Pratylenchus* sp.	3
	Nematode damage	*Pratylenchus* sp.	1
	Phomopsis stem canker*	*Phomopsis* sp.	20
	Poor bud set	Blueberry shock virus	4
	Poor growth	Blueberry scorch virus	2
	Root rot	Oomycete	14
		Phytophthora sp.	1
	Root die back	Oomycete	1
	Root rot	*Armillaria* sp.	1
	Stem canker*	*Coniothyrium* sp.	9
	Tip die back	*Botrytis cinerea*	1
		Phomopsis sp.	1
	Twig blight	*Botrytis cinerea*	1
		Colletotrichum acutatum	1
Cranberry	Anthracnose	*Glomerella cingulata*	2
	Black rot	*Allantophomopsis cytisporea*	4
	Blossom blight	*Godronia* sp.	2
	Foliar blight	*Colletotrichum* sp.	1
		Godronia sp. and *Phomopsis* sp.	1
	Fruit rot	*Botryosphaeria* sp.	1
		Godronia sp. and *Pestalotia* sp.	1
	Leaf blight	*Pestalotia* sp. and *Botrytis cinerea*	1
	Leaf spot	*Allantophomopsis* sp., *Botryosphaeria* sp., and *Pestalotia* sp.	2
		Allantophomopsis sp. and *Botrytis cinerea*	1

CROP	DISEASE/SYMPTOM	CAUSAL ASSOCIATED ORGANISM	No.
Cranberry	Leaf spot	*Allantophomopsis* sp. and *Discosia* sp	1
		Botryosphaeria sp.	1
		Botryosphaeria sp. and *Discosia* sp.	1
		Botryosphaeria sp., *Allantophomopsis* sp.	5
		Botryosphaeria sp., *Allantophomopsis* sp., and *Botrytis cinerea*	1
		Botryosphaeria sp., *Allantophomopsis* sp. and *Discosia* sp.	1
		Discosia sp.	1
	Root rot	Oomycete	1
	Stem die back	*Colletotrichum gloeosporioides*	1
		Phomopsis vaccinii	1
	Twig blight	*Colletotrichum* sp.	1
	Upright dieback	*Phomopsis* sp.	2
Raspberry	Late leaf rust	*Pucciniastrum americanum*	1
	Nematode contribution	*Pratylenchus* sp.	12
	Nematode damage	*Pratylenchus* sp. and *Xiphinema* sp.	3
	Root rot	Oomycete	13
		Phytophthora rubi	1
	Yellow rust	*Phragmidium rubi-idaei*	1
Strawberry	Leaf spot	*Mycosphaerella fragariae*	1
	Nematode damage	*Pratylenchus* sp.	5
		Ditylenchus sp.	1
		Meloidogyne sp.	1
	Red stele root rot	*Phytophthora fragariae*	2
	Root rot	*Idriella* sp.	2
		Oomycete	2
		Pythium sp.	1
	Root rot complex	*Cylindrocarpon* sp. and *Fusarium* sp.	1
	Vascular wilt	*Verticillium* sp.	1

Note*: Blueberry stem and crown canker and dieback - A number of young bushes, particularly var. Liberty, are showing dieback and reduced plant vigor due to stem and crown cankers at or near the soil level. This seems to be caused by a few fungal pathogens. A research project is underway(B.C. Ministry of Agriculture and B.C. Blueberry Council) to investigate the cause and find solutions to the problem.

DISEASED SAMPLES	204
ABIOTIC AND OTHER DISORDERS	206
TOTAL SUBMISSIONS	410

Table 8.0 Summary of diseases diagnosed on **tree fruit and grape** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Apple	Nematode damage	*Pratylenchus* sp. and *Xiphinema* sp.	1
Apricot	Shot hole	*Wilsonomyces carpophilus*	1
Cherry	Leaf curl*	*Taphrina cerasi**	1
	Root rot	Oomycete	1
Grape	Bunch rot	*Botrytis cinerea*	2
	Cane blight	*Phomopsis* sp.	1
	Powdery mildew	*Uncinula necator*	1
	Root rot / Abiotic stress	*Pythium* sp./ poor drainage	1
Peach	Bacterial canker	*Pseudomonas syringae*	2

Note*: Cherry leaf curl was detected in the Okanagan, B.C. for the first time in 2010, in a commercial cherry orchard.

DISEASED SAMPLES	21
ABIOTIC AND OTHER DISORDERS	02
TOTAL SUBMISSIONS	23

Table 9.0 Summary of diseases diagnosed on **golf course, lawn and sod** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Green	Foliar blight	*Ascochyta* sp.	1
	Fusarium patch	*Microdochium nivale*	1
	Localized dry spot	Basidiomycete	1
	Nematode contribution	*Paratrichodorus* sp.	1
	Nematode damage	*Helicotylenchus* sp., and *Meloidogyne* sp.	4
	Root rot	*Pythium* sp.	1
	Yellow patch	*Rhizoctonia cerealis*	2
Lawn	Foliar blight	*Ascochyta* sp.	1
	Leaf blight	*Leptosphaerulina* sp.	1
	Nematode damage	*Pratylenchus* sp. and *Meloidogyne* sp.	1
	Root damage	*Meloidogyne* sp., *Pratylenchus* sp. and *Paratylenchus* sp.	1
Sod	Anthracnose	*Colletotrichum graminicola*	4
	Brown patch	*Rhizoctonia solani*	1
	Crown and leaf infection	*Fusarium* sp.	1
	Leaf blight	*Leptosphaerulina* sp.	1
	Nematode contribution	*Pratylenchus* sp.	1

DISEASED SAMPLES	23
ABIOTIC AND OTHER DISORDERS	05
TOTAL SUBMISSIONS	28

Table 10.0 Summary of diseases diagnosed on **field vegetable** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Beet	Root rot	*Phoma betae*	2
Cabbage	Club root	*Plasmodiophora brassicae*	1
Corn	Seedling/ root rot	*Fusarium* sp.	1
Cucumber	Leaf spot	*Alternaria* sp.	1
	Root rot and wilt	*Fusarium* sp.	1
	Scab	*Cladosporium* sp.	1
Garlic	Bulb rot	*Botrytis allii*	1
		Penicillium sp.	1
	Embellisia skin blotch	*Embellisia allii*	1
	Fusarium basal rot	*Fusarium* sp.	1
	Nematode contribution	*Pratylenchus* sp., *Aphelenchoides* sp. and *Ditylenchus* sp.	1
	Rust	*Puccinia allii*	1
Leek	Basal rot	*Fusarium* sp.	1
Pepper	Root rot	*Pythium* sp.	1
Potato	Bacterial soft rot	*Erwinia* sp.	1
	Black dot*	*Colletotrichum coccodes**	5
	Black leg	*Pectobacterium carotovorum* ssp. *Carotovorum*	1
	Black scurf	*Rhizoctonia solani*	2
	Common scab	*Streptomyces scabies*	3
	Dry rot	*Fusarium* sp.	3
	Late blight	*Phytophthora infestans*	1
	Silver scurf	*Helminthosporium solani*	1
	Stem canker	*Rhizoctonia solani*	2
	Verticillium wilt	*Verticillium dahlia*	4
Rhubarb	Nematode damage	*Pratylenchus* sp.	1
	Root rot	Oomycete and multiple nematode genera	1
Rutabaga	Sclerotinia rot	*Sclerotinia sclerotiorum*	1
Squash	Black rot	*Didymella bryoniae*	4

Note* Black dot (*Colletotrichum coccodes*): this is the first report of the occurrence of black dot on potato in the Lower Mainland of B.C.

DISEASED SAMPLES	45
ABIOTIC AND OTHER DISORDERS	10
TOTAL SUBMISSIONS	55

Table 11.0 Summary of diseases diagnosed on **woody ornamental** samples submitted to the BCMA Plant Diagnostic Laboratory in 2010.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Abies	Foliar blight	*Hormonema* sp.	1
Acer	Stem canker	*Nectria* sp.	2
Acer ginnala	Verticillium wilt	*Verticillium* sp.	1
Acer palmatum	Anthracnose	*Discula* sp.	2
		Kabatiella sp.	1
	Root rot	Oomycete	1
	Twig canker	*Diplodina* sp.	1
Acer rubrum	Stem canker	*Phomopsis* sp.	1
Arbutus	Leaf spot	*Hendersonula* sp.	1
	Stem canker	*Cytospora* sp.	1
Asimina triloba	Leaf spot	*Entomosporium* sp.	1
	Root rot	Oomycete	1
Azalea	Leaf spot	*Colletotrichum* sp.	1
	Powdery mildew	*Erysiphe azaleae*	1
Buxus	Anthracnose	*Gloeosporium* sp.	1
	Root rot	Oomycete	1
	Twig canker	*Phomopsis* sp.	1
	Volutella blight	*Volutella* sp.	1
Calluna	Foliar blight	*Pestalotiopsis* sp.	1
	Root rot	Oomycete	1
	Web blight	*Rhizoctonia* sp.	1
Cedrus atlantica	Tip blight	*Sirococcus* sp. and *Sclerophoma* sp.	1
Chamaecyparis	Foliar blight	*Kabatina* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Clematis	Botrytis blight	*Botrytis cinerea*	1
	Leaf spot	*Cladosporium* sp. and *Alternaria* sp.	1
		Phyllosticta sp.	1
Cornus	Powdery mildew	*Microsphaera* sp.	1
	Root rot	*Thielaviopsis basicola*	1
		Oomycete	1
Cotoneaster	Bacterial blight	*Pseudomonas syringae*	1
Crataegus	Anthracnose	*Gloeosporium* sp.	1
	Fabrea blight	*Entomosporium* sp.	1
	Fire blight	*Erwinia amylovora*	9
Cupressus	Foliar blight	*Pestalotiopsis* sp.	1
		Phomopsis sp.	2
Cyperus	Foliar blight	*Botrytis cinerea*	1
Elaeagnus	Bacterial canker	*Pseudomonas syringae*	1
Elaeagnus angustifolia	Plant decline	*Phytophthora* sp. and *Fusarium* sp.	1
Euonymus	Leaf spot	*Phyllosticta* sp.	1
Euonymus alata	Stem canker	*Fusarium* sp. (*Nectria atrofusca*)	1
Fargesia	Root rot	Oomycete	1
Forsythia	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Root rot	Oomycete	2
Gleditsia	Stem canker	*Tubercularia* sp.	1
Hydrangea	Leaf and flower spot	*Pseudomonas syringae*	1
	Leaf spot	*Phyllosticta* sp.	1
Hydrangea macrophylla	Leaf spot	*Phyllosticta hydrangeae*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Ilex	Dieback	*Botryodiplodia* sp.	1
Juniperus	Twig blight	*Lophodermium* sp.	1
Laurus nobilis	Root rot	*Armillaria* sp.	1
Lonicera	Bacterial blight	*Pseudomonas syringae*	1
	Stem canker	*Phoma* sp.	1
Magnolia	Bacterial blight	*Pseudomonas syringae*	1
Malus	Bacterial blight	*Pseudomonas syringae*	1
	Cytospora canker	*Cytospora* sp.	1
	Fire blight	*Erwinia amylovora*	6
	Leaf spot	*Pseudomonas syringae*	1
	Stem canker	*Phomopsis* sp.	3
Pernettya	Anthracnose	*Sphaceloma* sp.	1
	Stem canker	*Phoma* sp.	1
Picea	Foliar blight	*Lirula macrospora*	1
	Tip blight	*Sirococcus* sp. and *Sclerophoma* sp.	1
Picea abies	Needle blight	*Rhizosphaera* sp.	1
Picea pungens	Foliar blight	*Botrytis cinerea* and *Cladosporium* sp.	1
	Sydowia blight	*Sclerophoma* sp.	1
Pieris	Phomopsis canker	*Phomopsis* sp.	1
Pieris japonica	Leaf spot	*Phyllosticta* sp.	1
Pinus	Needle cast	*Elytroderma deformans*	1
Platanus	Anthracnose	*Apiognomonia* sp.	1
Platanus acerfolia	Stem canker	*Cytospora* sp.	1
	Anthracnose	*Apiognomonia* sp.	3
Populus	Anthracnose	*Colletotrichum* sp.	1
	Cytospora canker	*Cytospora* sp.	2
	Foliar blight	*Ramularia* sp.	1
		Venturia populina	1
	Leaf spot	*Alternaria* sp.	1
		Alternaria sp., *Cladosporium* sp.	1
	Root rot	Oomycete	1
	Septoria leaf spot	*Septoria* sp.	1
Prunus	Anthracnose	*Gloeosporium* sp.	1
	Bacterial blight	*Pseudomonas syringae*	2
	Constriction canker	*Phomopsis* sp.	1
	Leaf blight	*Botrytis cinerea*	1
	Leaf spot	*Cladosporium* sp.	1
		Phyllosticta sp.	1
	Root rot	Oomycete	2
	Stem canker	*Cytospora* sp.	2
Prunus tenella	Anthracnose	*Colletotrichum* sp.	1
	Leaf spot	*Cladosporium* sp.	1
		Phyllosticta sp.	1
Pseudotsuga menziesii	Foliar blight	*Botrytis cinerea*	1
	Stem canker	*Phoma* sp.	1
Pyrus	Fire blight	*Erwinia amylovora*	2
	Stem canker	*Phomopsis* sp.	1
Quercus	Anthracnose	*Apiognomonia* sp.	1
Quercus rubra	Twig dieback	*Botryosphaeria* sp.	1
Rhododendron	Anthracnose	*Colletotrichum* sp.	1
	Dieback	*Phomopsis* sp.	1
	Foliar blight	*Pestalotia* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Rhododendron	Leaf spot	*Phyllosticta* sp., *Pestalotia* sp. and *Diplodina* sp.	2
		Phyllosticta sp. and *Diplodina* sp.	1
		Phyllosticta sp.	2
	Root rot	Oomycete	2
		Phytophthora sp.	3
	Twig canker	*Coniothyrium* sp.	1
Rhododendron quinquefolium	Root rot	*Phytophthora* sp.	1
Skimmia	Black root rot	*Thielaviopsis basicola*	1
Syringa	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	4
	Leaf blotch	*Cladosporium* sp. and *Alternaria* sp.	1
	Root rot	Oomycete	1
Thuja	Charcoal rot	*Macrophomina* sp.	1
	Foliar blight	*Botrytis cinerea*	1
		Lophodermium sp., *Pestalotia* sp. and *Botrytis* sp.	1
		Pestalotia sp.	1
		Seiridium cardinale	1
	Root rot	*Armillaria* sp.	1
		Oomycete	3
	Stem canker	*Cytospora* sp. (Valsa)	1
Tsuga heterophylla	Root rot	Oomycete	1
Ulmus	Root rot	Oomycete	2
Viburnum	Bacterial blight	*Pseudomonas syringae*	1

DISEASED SAMPLES	159
ABIOTIC AND OTHER DISORDERS	113
TOTAL SUBMISSIONS	267

CROPS: Commercial crops – Diagnostic Laboratory Report
LOCATION: Saskatchewan

NAMES AND AGENCIES:

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TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN MINISTRY OF AGRICULTURE CROP PROTECTION LABORATORY IN 2010

METHODS: The Crop Protection Laboratory of the Saskatchewan Ministry of Agriculture provides diagnostic services to the agricultural industry and recommendations for crop health problems. Services include disease, insect and weed identification, as well as testing of weed seeds for herbicide resistance. The Crop Protection Laboratory also provides a Dutch elm disease (DED) service to the general public, under which American elm (*Ulmus americana*) and Siberian elm (*U. pumila*) samples are tested for DED. Samples are submitted to the Crop Protection Laboratory by personnel from the Saskatchewan Ministry of Agriculture, the Saskatchewan Ministry of Environment, individual growers, crop insurance adjustors, agribusiness representatives and market/home gardeners. Disease diagnoses are accomplished by naked eye and microscopic visual examination and culturing on artificial media. Virus and bacterial diagnoses are based on visible symptoms. ELISA testing was used to identify wheat streak mosaic virus (WSMV) and bacterial mosaic.

RESULTS: From April 1 to November 30, 2010, the Crop Protection Laboratory received a total of 506 disease/disorder samples, 51% (260 samples) of which were elm samples submitted for DED testing. Categories and percentage of samples received (excluding DED samples) were: special crops (35%), cereals (16%), oilseeds (23%), shade trees (other than elm) (9%), vegetables (8%) fruit (3%), forages (4%) and ornamentals (2%). Samples which were submitted for disease identification, but were diagnosed with insect damage are not included in this report. Summaries of diseases and causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2010 are presented in Tables 1-8 by crop category.

Table 1: Diseases of **fruit crops** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Raspberry	Grey mold & blight	*Botrytis cinerea*	1
	Powdery mildew	*Sphaerotheca maculans*	1
Saskatoon berry	Cytospora canker/ dieback	*Cytospora* spp.	1
	Environmental stress/ injury		1
Strawberry	Common Leaf Spot	*Mycosphaerella fragariae*	1

Table 2: Diseases of **cereal crops** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Barley	Spot blotch	*Cochliobolus sativus*	1
	Spot form of net blotch	*Pyrenophora teres*	1
Durum wheat	Chemical Injury		1
	Foot rot/ spot blotch	*Bipolaris sorokiniana*	1
	Foot rot	*Fusarium* spp.	1
Oat	Bacterial blight/ stripe	*Pseudomonas syringae*	1
	Covered smut	*Ustilago hordei*	1
Wheat	Bacterial blight	*Xanthomonas campestris*	1
	Bacterial Mosaic	*Clavibacter michiganensis* subsp. *tessalarius*	1
	Cephalosporium stripe	*Cephalosporium gramineum*	1
	Chemical injury		5
	Environmental stress/ injury		5
	Fusarium head blight	*Fusarium avenaceum*	2
	Fusarium head blight	*Fusarium graminearum*	1
	Fusarium root and crown rot	*Fusarium culmorum*	1
	Pink snow mold	*Microdochium nivale*	1
	Typhula blight/ speckled snow mold	*Typhula* spp.	1
	Rhizoctonia root rot/ sharp eyespot	*Rhizoctonia* spp.	1
	Fusarium root rot	*Fusarium poae*	
	Root rot	*Rhizoctonia & Fusarium*	1
	Stagonospora leaf blotch	*Stagonospora nodorum*	1
	Spot blotch	*Cochliobolus sativus*	1
	Tan spot	*Pyrenophora tritici-repentis*	1
	Wheat streak mosaic	*WSMV*	6

Table 3: Diseases of **vegetable crops** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Potato	Black scurf	*Rhizoctonia solani*	1
	Chemical injury		1
	Soft rot	*Erwinia carotovora*	1
	Late blight	*Phytophthora infestans*	3
	Pythium leak	*Pythium ultimum*	2
Tomato			
	Environmental stress/ injury		1
	Late blight	*Phytophthora infestans*	2
	Sun scald		1
	White mold	*Sclerotinia sclerotiorum*	1

Table 4: Diseases of **special crops** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canaryseed	Chemical injury		1
	Black point/ head molds	*Cladosporium* spp.	6
Caraway	Ascochyta blight	*Ascochyta* spp.	1
	Leaf & flower blight	*Botrytis cinerea*	1
	Fusarium blight	*Fusarium sporotrichioides*	1
Chickpea	Ascochyta blight	*Ascochyta rabiei*	1
	Chemical injury		1
	No Diagnosis		1
Lentil	Anthracnose	*Colletotrichum truncatum*	3
	Ascochyta blight	*Ascochyta lentis*	4
	Chemical injury		15
	Environmental stress/ injury		25
	Fusarium decay of pods	*Fusarium equiseti*	1
	Grey mold	*Botrytis cinerea*	3
	Insufficient nodulation		1
	No Diagnosis		1
	Root rot	*Fusarium solani*	1
	Root rot	*Fusarium* spp.	3
	Root rot	Unidentified	1
	Seedling blight/ damping off		1
	Septoria leaf spot	*Septoria* spp.	1
	Stemphylium leaf blight	*Stemphylium botryosum*	9
	White mold	*Sclerotinia sclerotiorum*	4
Field pea	Ascochyta leaf & pod spot	*Ascochyta pisi*	1
	Chemical injury		4
	Environmental stress/ injury		6
	Foot rot	*Ascochyta* spp.	1
	Fusarium root rot	*Fusarium avenaceum*	2
	Fusarium root rot	*Fusarium poae*	1
	Fusarium root rot	*Fusarium solani*	4
	Root rot	*Fusarium* spp.	1
	Stem rot	*Rhizoctonia solani*	1
	Mycosphaerella blight	*Mycosphaerella pinodes*	13
	Ascochyta foot rot	*Phoma medicaginis*	2

Table 5: Diseases of **forage legume and grass crops** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Anthracnose	*Colletotrichum trifolii*	3
	Brown root rot	*Phoma sclerotioides*	1
	Common leaf spot	*Pseudopeziza trifolii*	4
	Crown rot		1
	Spring black stem & Leaf spot	*Phoma medicaginis*	1

Table 6: Diseases of **oilseed crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Camelina	Environmental stress/ injury		1
	White rust/ staghead and downy mildew	*Albugo candida/ Hyaloperonospora parasitica*	1
Canola	Black spot/ grey leaf spot	*Alternaria brassicae*	6
	Blackleg	*Phoma lingam*	4
	Root rot	*Fusarium* sp.	1
	Chemical injury		20
	Damping off		2
	Environmental stress/ injury		8
	Nutrient deficiency		1
	Root rot		1
Flax	Chemical injury		6
	Environmental stress/ injury		2
	No Diagnosis		1
	Pasmo	*Septoria linicola*	2
	Root rot	*Fusarium sp.*	1
Mustard	Fasciation		1

Table 7: Diseases of **ornamental plants** submitted to the Crop Protection Laboratory in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Caragana	Septoria leaf spot	*Septoria caraganae*	1
Turfgrass	Chemical injury		1
	Fusarium root rot	*Fusarium avenaceum*	1
	Leaf blight	*Pythium* sp.	1
Bluegrass	Bipolaris leaf spot	*Bipolaris* sp.	1
	Melting out	*Drechslera* sp.	1
Honeysuckle	Leaf blight	*Botrytis cinerea*	1

Table 8: Diseases of **shade trees** submitted to the Crop Protection Laboratory in 2010

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Elm*	Black spot	*Gnomonia ulmea*	1
	Dutch elm disease	*Ophiostoma novae-ulmi*	137
	Dothiorella wilt	*Dothiorella ulmi*	26
Fir	Needle cast	*Rhizosphaera kalkoffii*	1
Flowering crabapple	Apple scab	*Venturia inaequalis*	1
Green ash	Spot anthracnose	*Discula fraxinea / Sphaceloma sp.*	1
Maple	Environmental stress		1
	Chemical injury		1
Pine	Cytospora canker	*Cytospora kunzei*	1
Poplar	Chemical injury		1
	Poplar leaf rust	*Melampsora medusae*	1

*the remainder of 260 elm submissions were negative for known pathogens of elm

CROP: Diagnostic Laboratory Report
LOCATION: Manitoba

NAME AND AGENCY:
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[2]Manitoba Agriculture, Food and Rural Initiatives, Crops Knowledge Centre, Crops Branch, Box 1149, Carman, MB R0G 0J0

TITLE: 2010 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

METHODS: The Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by MAFRI extension staff, farmers, agri-business and the general public. Diagnosis is based on microscopy and visual examination for symptoms, culturing onto artificial media, and ELISA testing for some pathogens.

RESULTS: For the 2010 crop year one noteworthy occurrence was early detection (June 9) of late blight in tomato transplants being sold to home gardeners through major retailers. Late blight was subsequently diagnosed on potato and tomato samples throughout the season. Also, eyespot of corn (*Kabatiella zeae*) was detected this year and had not previously been documented by our laboratory. Summaries of diagnoses by crop category from January 1 to November 30 are presented in Tables 1-11.

Table 1. Summary of diseases diagnosed on **forage legume crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Common leaf spot	*Pseudopeziza medicaginis*	3
	Flower blight	*Botrytis cinerea*	1
	Leaf spot	*Leptosphaerulina briosiana*	1
	Root rot	*Cylindrocarpon* sp.	1
	Spring black stem and leaf spot	*Phoma medicaginis*	2
	Stem rot	*Sclerotinia trifoliorum*	1
	Stemphylium leaf spot	*Stemphylium* sp.	2
	Herbicide injury		1
	Nutrient deficiency		1
Birdsfoot trefoil	Anthracnose	*Colletotrichum* sp.	1

Table 2. Summary of diseases diagnosed on **greenhouse crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Pepper, green bell	Environmental injury		1
Tomato	Grey mould	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	2
	Chemical injury		1

Table 3. Summary of diseases diagnosed on **cereal crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Bacterial blight	*Pseudomonas syringae*	1
	Barley yellow dwarf	Barley Yellow Dwarf Virus (BYDV)	2
	Black point	*Fusarium* spp.*, Alternaria* sp.	1
	Common root rot	*Cochliobolus sativus*	4
	Fusarium head blight	*Fusarium* spp.	9
	Downy mildew	*Sclerophthora macrospora*	1
	Leaf rust	*Puccinia triticina*	6
	Loose smut	*Ustilago tritici*	1
	Root rot	*Fusarium* spp., *Pythium* sp., *Rhizoctonia solani*	5
	Septoria leaf spot	*Septoria* spp.	19
	Spot blotch	*Bipolaris sorokiniana*	3
	Stripe rust	*Puccinia striiformis*	2
	Tan spot	*Pyrenophora tritici-repentis*	28
	Wheat streak mosaic	Wheat Streak Mosaic Virus (WSMV)	25
	Physiological disorders	Undetermined	6
	Physiological leaf spot	Chloride deficiency	4
	Environmental injury		8
	Herbicide injury		16
	Nutrient deficiency		3
Barley	Fusarium head blight	*Fusarium* spp.	3
	Net blotch	*Drechslera teres*	3
	Root rot	*Fusarium* spp., *Rhizoctonia solani*	1
	Speckled leaf blotch	*Septoria passerinii*	2
	Environmental injury		2
	Nutrient deficiency		2
Oat	Bacterial blight	*Pseudomonas syringae*	1
	Crown rust	*Puccinia coronata* f. sp. *avenae*	1
	Leaf spot	*Stagonospora avenae*	4
	Root rot	*Fusarium* spp., *Bipolaris sorokiniana*	2
	Environmental injury		3
	Herbicide injury		3
Rye	Root rot	*Fusarium* spp.	2
	Leaf rust	*Puccinia* sp.	1
	Leaf spot	*Bipolaris sorokiniana*	1
	Environmental injury		1
	Nutrient deficiency		1

Table 4. Summary of diseases diagnosed on **grasses** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Turf grasses	Fusarium blight	*Fusarium* spp.	2
	Powdery mildew	*Blumeria graminis*	1
	Red thread	*Laetisaria fuciformis*	1

Table 5. Summary of diseases diagnosed on **vegetable crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Asparagus	Crown rot	*Fusarium* spp.	1
Bean, snap	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	2
Beet, red	Leaf spot	*Phoma betae*	1
	Root rot	*Fusarium* sp., *Pythium* sp.	1
	Storage rot	*Botrytis cinerea*	1
	Storage rot	*Phoma betae*	1
	Virus	undetermined	1
Cabbage	Blackleg	*Phoma lingam*	2
	Head rot	*Sclerotinia sclerotiorum*	1
	Leaf spot	*Alternaria brassicicola*	2
	Leaf spot	*Alternaria* sp.	3
	Root rot	*Rhizoctonia solani, Fusarium* sp.	1
Carrot	Alternaria leaf blight	*Alternaria dauci*	1
	Aster Yellows	Aster yellows phytoplasma	1
	Common scab	*Streptomyces scabies*	1
	Cavity spot	*Pythium* sp.	2
	Root rot	*Fusarium* spp., *Rhizoctonia solani*	3
	White mould rot	*Sclerotinia sclerotiorum*	2
Cauliflower	Leaf spot	*Alternaria brassicae*	1
	Leaf spot	*Phoma lingam*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Cucumber	Fruit rot	*Pythium* sp., *Fusarium* spp.	1
Onion	Downy mildew	*Peronospora destructor*	2
	Fusarium basal plate rot	*Fusarium oxysporum*	3
	Neck rot	*Botrytis allii*	2
	Purple blotch	*Alternaria porri*	1
	Stemphylium leaf blight	*Stemphylium vesicarium*	3
Parsnip	White mould	*Sclerotinia sclerotiorum*	3
Pepper, green bell	Root rot	*Fusarium* sp.	1
	Herbicide injury		1
Rutabaga	Black rot	*Xanthomonas campestris*	6
	Leaf spot	*Alternaria brassicae*	2
	Root rot	*Phoma lingam*	2
	Storage rot	*Phoma lingam*	1
Squash, butternut	Fruit rot	*Fusarium graminearum*	1
	Fruit rot	*Pythium* sp.	1

Table 5 cont.

Squash	Fruit rot	*Botrytis cinerea*	1
	Fruit rot	*Sclerotinia sclerotiorum*	1
Tomato	Late blight	*Phytophthora infestans*	10
	Septoria leaf spot	*Septoria lycopersici*	2
	Herbicide injury		1
	Nutrient deficiency		1

Table 6. Summary of diseases diagnosed on **potato crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	3
Blackleg	*Pectobacterium carotovorum* subsp. *atrosepticum*	4
Black dot, on stems	*Colletotrichum coccodes*	4
Black dot, on tubers	*Colletotrichum coccodes*	1
Black scurf	*Rhizoctonia solani*	5
Brown spot	*Alternaria alternata*	5
Calico	Alfalfa mosaic virus	1
Early blight, foliar	*Alternaria solani*	4
Fusarium dry rot	*Fusarium sambucinum*	3
Fusarium wilt	*Fusarium avenaceum*	1
Late blight, foliar	*Phytophthora infestans*	25
Late blight, tuber	*Phytophthora infestans*	3
Leak	*Pythium* sp.	3
Pink eye	Unknown	5
Pink rot	*Phytophthora erythroseptica*	3
Rubbery rot	*Geotrichum candidum*	2
Scab, common	*Streptomyces* spp.	3
Scab, powdery	*Spongospora subterranea*	1
Silver scurf	*Helminthosporium solani*	5
Verticillium wilt	*Verticillium dahliae*	9
Physiological disorders		4
Herbicide injury		3
Environmental injury		16

Table 7. Summary of diseases diagnosed on **oilseed crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Blackleg	*Leptosphaeria maculans*	17
	Black spot	*Alternaria brassicae*	2
	Downy mildew	*Peronospora parasitica*	3
	Fusarium wilt	*Fusarium oxysporum*	1
	Oedema	Physiological disorder	1
	Root rot	*Fusarium* spp., *Rhizoctonia solani*	6
	Seedling blight	*Rhizoctonia solani*	2
	Stem rot	*Sclerotinia sclerotiorum*	2
	Environmental injury		2
	Herbicide injury		20
	Nutrient deficiency	Sulphur deficiency	1
Camelina	Downy mildew	*Peronospora parasitica*	2
	White rust	*Albugo candida*	2
Flax	Brown stem blight	*Alternaria linicola*	2
	Leaf spot	*Phoma* sp.	1
	Pasmo	*Septoria linicola*	3
	Root rot	*Fusarium oxysporum*	1
	Environmental injury		1
	Herbicide injury		6
Sunflower	Leaf spot	*Alternaria* spp.	4
	Root rot	*Fusarium* sp.	1
	Rust	*Puccinia helianthi*	2
	Environmental injury		1
	Herbicide injury		4

Table 8. Summary of diseases diagnosed on **herbaceous ornamentals** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Dahlia	Leaf spot	*Colletotrichum* sp., *Leptosphaerulina* sp.	1
Helenium	Root rot	*Fusarium solani*	1
Iris (*Iris* × *germanica*)	Rhizome rot	*Botrytis convoluta*	1
Veronica	Stem rot	*Sclerotinia sclerotiorum*	1

Table 9. Summary of diseases diagnosed on **shelterbelt trees** and **woody ornamentals** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash	Anthracnose	*Gloeosporium aridum*	5
(*Fraxinus* sp.)	Canker	*Cytospora* sp.	2
	Canker	*Microsphaeropsis* sp.	1
	Canker	Unidentified	2
	Environmental injury		2
	Herbicide injury		6
Basswood	Herbicide injury		2
Caragana	Leaf spot	*Phyllosticta* sp.	1
	Environmental injury		1
	Herbicide injury		2
Cedar	Canker	*Seiridium cardinale*	1
(*Thuja* sp.)	Canker	*Pestalotiopsis* sp.	1
	Needle blight	*Phyllosticta* sp.	1
	Environmental injury		1
Crabapple	Fireblight	*Erwinia amylovora*	1
	Scab	*Venturia inaequalis*	4
Elm, American	Black leaf spot	*Stegophora ulmea*	2
(*Ulmus americana*)	Canker	*Botryodiplodia* sp.	5
	Canker	*Botryosphaeria* sp.	4
	Canker	*Sphaeropsis* sp.	1
	Canker	unidentified	7
	Dutch elm disease	*Ophiostoma ulmi*	44
	Verticillium wilt	*Verticillium* spp.	11
Juniper	Needle blight	*Lophodermium juniperinum*	1
	Twig blight	*Phomopsis* sp.	1
Lilac	Canker	Unidentified	1
	Herbicide injury		1
Maple, amur	Anthracnose	*Discula* sp.	2
(*Acer ginnala*)	Leaf spot	*Diplodina* sp.	1
	Iron chlorosis	Nutrient deficiency	2
Maple, Manitoba	Anthracnose	*Discula* sp.	2
(*Acer negundo*)	Environmental injury		1
	Herbicide injury		2
Mountain ash (*Sorbus* sp.)	Leaf spot	*Phyllosticta* sp.	1
Oak	Anthracnose	*Discula* sp.	7
(*Quercus macrocarpa)*	Leaf blister	*Taphrina caerulescens*	1
	Leaf spot	*Monochaetia* sp.	1
	Leaf spot	*Phyllosticta* sp.	1
	Herbicide injury		1

Table 9 cont.

Poplar (*Populus* spp.)	Anthracnose	*Colletotrichum* sp.	1
	Bronze leaf disease	*Apioplagiostoma populi*	1
	Canker	*Cytospora* sp.	1
	Canker	Unidentified	2
	Leaf spot	*Marssonina* sp.	3
	Leaf spot	*Phyllosticta* sp.	3
	Leaf spot	*Septoria* sp.	2
	Melanconium dieback	*Melanconium* sp.	2
	Iron chlorosis	Nutrient deficiency	1
	Herbicide injury		2
Russian olive	Canker	*Tubercularia* sp.	1
Spruce (*Picea* spp.)	Canker	*Sphaeropsis* sp.	1
	Canker	*Pestalotiopsis* sp.	1
	Cytospora canker	*Leucostoma kunzei*	2
	Canker	Unidentified	1
	Needle blight	*Lirula* sp.	5
	Rhizosphaera needlecast	*Rhizosphaera kalkhoffi*	3
	Rust, needle	*Chrysomyxa* sp.	3
	Stigmina needle blight	*Stigmina lautii*	13
	Twig blight	*Phomopsis* sp.	1
	Twig canker	*Pestalotiopsis* sp.	1
	Environmental injury		6
	Herbicide injury		2
Willow	Black canker	*Glomerella miyabeana*	1
	Canker	*Cytospora sp.*	1
	Herbicide injury		3

Table 10. Summary of diseases diagnosed on **fruit crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Canker	*Botryosphaeria* sp.	1
	Canker	*Cytospora* sp.	1
	Canker	*Diplodia* sp.	1
	Canker	*Phomopsis* sp.	1
	Iron chlorosis	Nutrient deficiency	3
	Leaf spot	*Phyllosticta* sp.	1
	Leaf spot	*Phoma* sp.	2
	Scab	*Venturia inaequalis*	1
	Herbicide injury		1
Cherry, dwarf sour (*Prunus cerasus*)	Anthracnose	*Colletotrichum* sp.	2
	Canker	*Cerrena unicolor*	1
	Cherry leaf spot	*Phloeosporella padi*	1
	Herbicide injury		1
Cherry, pin (*Prunus pensylvanica*)	Canker	*Botryosphaeria* sp.	1
Chokecherry (*Prunus virginiana*)	Cherry leaf spot	*Phloeosporella padi*	1
Pear	Canker	*Phomopsis* sp.	1
	Leaf spot	*Phyllosticta* sp.	1
	Herbicide injury		1
Plum	Anthracnose	*Colletotrichum* sp.	1
Raspberry	Anthracnose	*Elsinoë veneta*	1
	Cane blight	*Coniothyrium fuckelii*	2
	Crown gall	*Agrobacterium tumefacians*	1
	Fruit rot	*Botrytis cinerea*	1
	Spur blight	*Phoma* sp.	2
	Herbicide injury		1
Saskatoon	Dieback	*Cytospora* sp.	1
	Entomosporium leaf and berry spot	*Entomosporium mespili*	2
	Fruit rot	*Botrytis cinerea*	1
	Leaf spot	*Phyllosticta* sp.	1
	Powdery mildew	*Podosphaera clandestina*	1
	Root rot	*Fusarium solani*	1
Strawberry	Black root rot	*Fusarium* spp., *Cylindrocarpon* sp.	2
	Root rot	*Rhizoctonia solani*	1
	Nutrient deficiency		1

Table 11. Summary of diseases diagnosed on **special field crops** submitted to the MAFRI Crop Diagnostic Centre in 2010.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Corn	Crazy top	*Sclerophthora macrospora*	1
	Eyespot	*Kabatiella zeae*	1
	Goss's wilt	*Corynebacterium michiganensis* subsp. *nebraskensis*	1
	Root rot	*Fusarium* sp.	1
	Rust	*Puccinia sorghi*	1
	Storage moulds	*Cladosporium* sp., *Fusarium* spp., *Penicillium* spp., *Aspergillus* spp.	1
	Environmental injury		1
	Herbicide injury		1
Faba bean	Ascochyta blight	*Ascochyta fabae*	1
	Chocolate spot	*Botrytis fabae*	1
	Root rot	*Fusarium solani*	1
Field bean	Brown spot	*Pseudomonas syringae* pv. *syringae*	2
	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	3
	Root rot	*Fusarium* sp.	1
	Rust	*Uromyces appendiculatus*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Field pea	Anthracnose	*Colletotrichum pisi*	4
	Ascochyta leaf spot	*Ascochyta* sp.	8
	Root rot	*Aphanomyces euteiches*	1
	Root rot	*Fusarium* spp.	6
	Root rot	*Pythium* sp.	1
	Root rot	*Rhizoctonia solani*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
	Herbicide injury		1
Hemp	Herbicide injury		1
Lentil	Anthracnose	*Colletotrichum truncatum*	1
	Ascochyta blight	*Ascochyta lentis*	1
	Leaf spot	*Stemphylium botryosum*	1
	Root rot	*Fusarium* spp.	2
Soybean	Anthracnose	*Colletotrichum* sp.	2
	Bacterial blight	Undetermined	3
	Brown spot	*Septoria glycines*	4
	Downy mildew	*Peronospora manshurica*	2
	Leaf spot	*Phyllosticta* sp.	1
	Pod rot, seed rot	*Sclerotinia sclerotiorum*	1
	Root rot	*Fusarium* spp. *Pythium* spp., *Rhizoctonia solani*	17
	Root rot	*Phytophthora* sp.	11
	Stem rot	*Phomopsis* sp.	3
	Environmental injury		2
	Herbicide injury		7

CROP: Vegetable Crops – Diagnostic Laboratory Report
LOCATION: Bradford/Holland Marsh, Ontario

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TITLE: DISEASES DIAGNOSED ON VEGETABLE CROPS SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2010

METHODS: As part of the integrated pest management (IPM) program, the plant disease diagnostic laboratory of the Muck Crops Research Station (MCRS), University of Guelph, provides diagnosis and control recommendations for diseases of vegetable crops to growers in the Bradford/Holland Marsh, and surrounding area of Ontario. The program objectives are to scout growers' fields, provide growers with disease and insect forecasting information and to identify and diagnose diseases, insect pests and weeds. Samples are submitted to the MCRS diagnostic laboratory by IPM scouts, growers, agribusiness representatives and crop insurance agents. Disease diagnoses are based on a combination of visual examination of symptoms, microscopic observations and culturing onto artificial media.

RESULTS AND COMMENTS: Weather conditions in the 2010 growing season were conducive for most pathogens including downy mildew fungi, bacteria, *Pythium* spp., *Sclerotinia* spp*. and Rhizoctonia* spp*.* Excessive soil moisture created ideal conditions for soil-borne pathogens, particularly *Pythium* spp*.* on carrot, resulting in a high incidence of root dieback, cavity spot and forking. Severe heat injury was observed on onions, particularly in crops that were seeded early in the season due to an extreme heat wave and shortage of rain from mid- to late May. From January 7 to November 30, 2010, the MCRS diagnostic laboratory received 378 samples. Of these, 87% were for disease diagnosis (329 in total). Categories of samples received were: Onion (50.8%), carrot (25.8%), lettuce (5.8%), celery (5.8%) and other crops (12.1%). In the 2010 growing season, 34 insect or insect damage and 15 weed identifications were also completed. A summary of diseases diagnosed by the MCRS diagnostic laboratory in 2010 and their causal agents is presented in Table 1.

Table 1: Summary of plant diseases diagnosed on crops submitted to the MCRS Diagnostic Laboratory in 2010.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Asparagus	Environmental injury	Frost damage	1
Beet	Cercospora leaf spot	*Cercospora beticola*	2
	Rhizoctonia root rot	*Rhizoctonia* spp.	1
	Environmental injury	Fluctuating soil moisture level	1
	Nutrient deficiency		1
Begonia	Nutrient deficiency		1
Carrot	Pythium root dieback	*Pythium* spp.	13
	Cavity spot	*Pythium* spp.	4
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	29
	Crown gall	*Agrobacterium tumefaciens*	3
	Aster yellows	Phytoplasma	5
	Sclerotinia rot	*Sclerotinia sclerotiorum*	3
	Crown rot	*Rhizoctonia solani*	3
	Crater rot	*Rhizoctonia carotae*	1
	Violet root rot	*Rhizoctonia crocorum*	1
	Fusarium dry rot	*Fusarium* spp.	4
	Root knot nematode	*Meloidogyne hapla*	3
	Grey mould	*Botrytis cinerea*	1
	Growth crack (split)	Fluctuating soil moisture level	6
	Chemical injury		2
	Heat canker	High temperature	7
Cabbage	Downy mildew	*Peronospora parasitica*	1
	Black leaf spot	*Alternaria brassicae*	2
	Black rot	*Xanthomonas campestris* pv. *campestris*	2
	Edema	Environmental effect	1
	Black speck	Environmental effect	1
	Nutrient deficiency		1
Celery	Early blight	*Cercospora apii*	1
	Aster yellows	*Phytoplasma*	2
	Bacterial leaf spot	*Pseudomonas syringae*	6
	Soft rot	*Erwinia carotovora*	2
	Chemical injury		2
	Nutrient deficiency		5
Chinese radish	Splitting	Fluctuating soil moisture level	1
Chrysanthemum	Environmental injury	Heat stress	1
Garlic	Basal rot	*Fusarium oxysporum* f. sp. *cepae*	3
	Stem and bulb nematode	*Ditylenchus dipsaci*	1
Lettuce	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	7
	Grey mould	*Botrytis cinerea*	3
	Downy mildew	*Bremia lactucae*	2
	Bacterial leaf spot	*Xanthomonas campestris* pv. *vitians*	2
	Powdery mildew	*Erysiphe cichoracearum*	1
	Environmental injury	Heat stress	1
	Chemical injury	Spray drift injury	2
	Tip burn	Calcium deficiency	1
Onion	Downy mildew	*Peronospora destructor*	9
	Purple blotch	*Alternaria porri*	38
	Botrytis leaf blight	*Botrytis squamosa*	31
	Stemphylium leaf blight	*Stemphylium vesicarium*	28
	White rot	*Sclerotium cepivorum*	4

Table 1. (contd.)

Onion (contd.)	Smut	*Urocystis cepulae*	4
	Soft rot	*Erwinia carotovora*	3
	Sour skin	*Pseudomonas cepacia*	2
	Enterobacter bulb decay	*Enterobacter cloacae*	1
	Basal rot	*Fusarium oxysporum*	2
	Pink root	*Phoma terrestris*	3
	Black mould	*Aspergillus* sp.	1
	Blue mould	*Penicillium* sp.	1
	Environmental injury	Pelting rain injury	4
	Environmental injury	Heat canker	30
	Environmental injury	Ozone injury	1
	Chemical injury	Herbicide damage	5
Parsley	Nutrient deficiency		1
	Chemical injury	Herbicide damage	2
Parsnip	Surface browning	Enzyme oxidation	1
Pepper	Nutrient deficiency		1
Poinsettia	Chemical injury		1
Potato	Common scab	*Streptomyces* sp.	1
Quince	Quince rust	*Gymnosporangium clavipes*	1
Radish	Black root	*Aphanomyces raphani*	1
Spinach	Alternaria leaf spot	*Alternaria* spp.	1
	Fusarium wilt	*Fusarium oxysporum* f. sp. *spinaciae*	1
	Nutrient deficiency		1
Shanghai bok choy	Nutrient deficiency		1
Sweet basil	Downy mildew	*Peronospora belbahrii*	1
Swiss chard	Cercospora leaf spot	*Cercospora beticola*	1
	Nutrient deficiency		1
	Environmental injury	High salt concentration	1
Tomato	Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*	1
Yay choy	Nutrient deficiency		1

DISEASED SAMPLES	243
ABIOTIC AND OTHER DISORDERS	86
TOTAL SUBMISSIONS	329

CULTURES : Cultures commerciales reçues au Laboratoire de diagnostic en phytoprotection
RÉGION : Québec

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TITRE : MALADIES DIAGNOSTIQUÉES SUR DES ÉCHANTILLONS DE CULTURES COMMERCIALES SOUMIS AU LABORATOIRE DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ EN 2010

MÉTHODES : Le Laboratoire de diagnostic en phytoprotection du MAPAQ fournit un service d'identification des maladies parasitaires et non parasitaires pour les cultures commerciales au Québec. Les données rapportées présentent les maladies identifiées sur les échantillons de plantes soumis par les conseillers agricoles du MAPAQ, de la Financière agricole du Québec (FADQ), de l'Institut québécois du développement de l'horticulture ornementale (IQDHO) et par ceux de l'industrie. Tous les échantillons font l'objet d'un examen visuel préalable suivi d'un examen à la loupe binoculaire. Selon les symptômes, un ou plusieurs tests diagnostiques sont réalisés dans le but de détecter ou d'identifier l'agent pathogène. Tous les tests de diagnostic utilisés au laboratoire sont issus de protocoles largement reconnus. Voici les principaux : les nématodes sont extraits par l'entonnoir de Baermann et identifiés par microscopie; les champignons sont isolés sur les milieux de culture artificiels, identifiés par microscopie et le pouvoir pathogène de certains genres est vérifié; les bactéries sont aussi isolées sur des milieux de culture artificiels (généraux et différentiels) puis identifiées par les tests biochimiques classiques (API-20E, Biolog^{R}, ELISA ou PCR); les phytoplasmes sont détectés par PCR et les virus par le test sérologique ELISA. Les références consultées pour les noms des maladies et des micro-organismes sont *Noms des maladies des plantes au Canada*, 4^{e} éd. 2003 et *Maladies des grandes cultures au Canada,* 1re éd. 2004.

RÉSULTATS ET DISCUSSION : Les tableaux 1 à 12 présentent le sommaire des maladies identifiées sur les cultures commerciales. Au tableau 1, les maladies des plantes maraîchères de plein champ regroupent aussi les transplants provenant des serres et des pépinières. Toutes les plantes ornementales, peu importe leur provenance, ont été regroupées dans le tableau 11. Sauf exception, ce sont des espèces herbacées. Du 1er janvier au 15 décembre 2010, 1571 maladies ont été diagnostiquées. Parmi ces maladies, 1249 (79 %) sont d'origine parasitaire (65% en 2009) ce qui représente une hausse appréciable. De ce nombre, 975 sont attribuables aux champignons, 153 aux bactéries, 76 aux virus, 26 aux phytoplasmes et 19 aux nématodes. L'INSV est le virus retrouvé le plus souvent parmi les 18 types de virus détectés et ce sont les plantes ornementales qui en étaient les plus affectées. Les plantes maraîchères provenant des champs, des serres et des entrepôts constituaient ensemble 47 % des échantillons. Une diminution du nombre d'échantillons a été notée en provenance de la serriculture maraîchère et des petits fruits tandis que les légumes d'entreposage et les plantes ornementales montraient une augmentation. Davantage de tests de détection des phytoplasmes ont été réalisés sur les échantillons ce qui permit de rapporter plus souvent ce microorganisme cette année.

Les totaux de maladies ne correspondent pas au nombre d'échantillons réellement traités parce que plusieurs maladies peuvent être identifiées sur un même échantillon. De plus, ces totaux ne tiennent pas compte des causes indéterminées, des diagnostics incertains et des échantillons soumis pour une détection spécifique de certains microorganismes ou autres problèmes. Lorsque non précisés, les agents non infectieux regroupent les déséquilibres minéraux, les pH inadéquats, les sols asphyxiants ou salins, les insolations, le gel hivernal, le froid et l'excès de chaleur, les polluants atmosphériques, l'intumescence (œdème), les phytotoxicités causées par le mauvais usage des pesticides, l'excès ou le manque d'eau et les désordres génétiques.

REMERCIEMENTS : Nous remercions Marion Berrouard, Marilyn Boutin, Carolle Fortin, Audrée Gilbert, Anne-Lise Larouche, Chantal Malenfant, Sophie Richard et Mario Tésolin pour leur assistance technique.

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Ail	*Aspergillus* sp.	Pourriture du bulbe	1
	Botrytis sp.	Pourriture du col	9
	Ditylenchus sp.	Enflure	2
	Burkholderia gladioli	Pourriture brune	1
	Fusarium spp.	Fusariose du plateau	4
	ArMV	Anomalie de coloration du bulbe	1
	INSV		
	Potyvirus	Anomalie de coloration du bulbe	1
	PVX	Anomalie de coloration foliaire	2
		Anomalie de coloration du bulbe	1
Asperge	*Fusarium oxysporum*	Pourriture fusarienne	2
	Stemphylium sp.	Tache stemphylienne	1
Aubergine	*Alternaria alternata*	Alternariose	2
	Sclerotinia sclerotiorum	Sclérotiniose	4
	Stress climatiques		2
	Stress culturaux		3
Betterave/poirée	*Aphanomyces* sp.	Malformation des racines	1
	Fusarium oxysporum	Pourriture fusarienne des racines	2
	Pseudomonas syringae	Tache foliaire	1
	Rhizoctonia solani	Rhizoctone	1
Brocoli	*Alternaria brassicicola*	Tache noire	2
	Peronospora sp.	Mildiou	1
	Phytotoxicité herbicides		1
	Stress climatiques		5
Carotte/panais	*Cercospora* sp.	Cercosporose	2
	Erysiphe sp.	Blanc	1
	Phoma sp.	Pourriture racinaire	1
	Pratylenchus sp.	Lésions des racines	1
	Pythium spp.	Pourridié pythien	2
	Rhizoctonia sp.	Rhizoctone	1
	Stress climatiques		3
	Stress culturaux		1
Céleri	*Acremonium* sp.	Tache sur pétiole	1
	Cercospora sp.	Cercosporose	1
	Pseudomonas syringae	Tache bactérienne	1
	Pythium ultimum	Pourridié pythien	1
	Carence de Ca		3
	Cœur noir		2
	Phytotoxicité herbicides		1
	Stress climatiques		1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Chou/Chou de Bruxelles/Radis	*Alternaria brassicae*	Tache grise	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Peronospora sp.	Mildiou	1
	Phytoplasme	Malformation de la plante	2
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia solani	Jambe noire	1
	Xanthomonas campestris pv. *campestris*	Nervation noire	3
	Stress climatiques		1
	Stress culturaux		3
Chou chinois	*Colletotrichum* sp.	Anthracnose	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phytophthora sp.	Pourriture du collet	1
	Xanthomonas campestris pv. *armoraciae*	Tache bactérienne	2
Chou-fleur	*Alternaria brassicicola*	Tache noire	2
	Fusarium oxysporum	Fusariose vasculaire	1
	Rhizoctonia solani	Tige noire	2
	Pseudomonas syringae	Moucheture bactérienne	1
	Xanthomonas campestris pv. *armoraciae*	Nervation noire	2
	Phytotoxicité herbicides		2
	Stress culturaux		3
Citrouille	*Alternaria* sp./ *Aspergillus* sp./ *Cladosporium* sp./ Mucor sp.	Pourriture des fruits	3
	Cladosporium cucumerinum	Gale	1
	Colletotrichum sp.	Anthracnose	2
	Erwinia tracheiphila	Flétrissement bactérien	4
	Fusarium graminearum/ F. *oxysporum*	Pourriture des racines et collets	16
	Fusarium spp.	Pourriture des fruits	8
	Phoma sp.	Pourriture noire	1
	Phytophthora capsici	Pourridié phytophthoréen	10
	Potyvirus	Feuilles difformes	1
	ZyMV	Mosaïques	3
	Pseudomonas syringae	Tache angulaire	3
	Pythium sp.	Pourridié pythien	4
	Sclerotinia sclerotiorum	Sclérotiniose	3
	Septoria sp.	Tache septorienne	2
	Sphaerotheca sp. (*Oïdium*)	Blanc	3
	Xanthomonas campestris	Tache bactérienne	1
	Phytotoxicité herbicides		1
	Stress culturaux		2
Concombre	*Erwinia tracheiphila*	Flétrissement bactérien	2
	Fusarium solani	Pourriture des racines et du collet	1
	Pythium irregulare	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Concombre	*Ulocladium consortiale*	Tache foliaire	1
	Potyvirus	Anomalie de coloration foliaire	1
	Pseudomonas syringae	Tache angulaire	2
	Carence P		1
Courge	*Cladosporium* spp.	Gale/tache foliaire	5
	Alternaria alternata	Tache alternarienne	3
	CMV	Mosaïque	1
	Erwinia tracheiphila	Flétrissement bactérien	9
	Fusarium spp.	Pourriture des fruits/des racines	11
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phoma cucurbitacearum	Pourriture noire	4
	Phytophthora capsici	Pourriture des fruits	5
	Pseudomonas syringae	Tache angulaire	1
	Pythium ultimum	Pourriture du fruit, des racines et du collet	6
	Septoria sp.	Tache septorienne	1
	Stress climatiques		5
	Stress culturaux		4
Épinard	*Aphanomyces* sp.	Racine noire	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium oxysporum	Fusariose	3
	Pythium ultimum	Pourridié pythien	2
	Stress climatiques		2
	Stress culturaux		5
Haricot/Pois/ Gourgane	*Alternaria alternata*	Tache sur gousses	1
	Fusarium oxysporum/ F*. solani*	Pourriture fusarienne	11
	Pseudomonas syringae	Graisse bactérienne	4
	Pythium ultimum	Pourriture pythienne des racines	5
	Rhizoctonia solani	Rhizoctone	2
	Insolation		1
	Phytotoxicité herbicides		1
Laitue	*Bremiae lactucae*	Mildiou	1
	Fusarium sp.	Pourriture des racines	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pseudomonas cichorii	Tache luisante	4
	Pseudomonas fluorescens	Brûlure de la marge	1
	Pythium spp.	Pourriture des racines et du collet/nanisme	3
	Rhizoctonia solani	Rhizoctone	4
	Septoria lactucae	Septoriose	1
	Stemphylium sp.	Tache foliaire	1
	Xanthomonas campestris	Tache bactérienne	3
	Phytotoxicité herbicides		1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Laitue	Stress climatiques		3
	Stress culturaux		2
Maïs sucré	*Colletotrichum graminicola*	Anthracnose	1
	Dérèglement génétique		1
	Phytotoxicité herbicides		3
Melon/ Pastèque	*Phoma* sp.	Tache foliaire	1
	Phytophthora capsici	Pourriture du fruit	1
	Pseudomonas syringae	Tache angulaire	4
	Stress culturaux		2
Oignon/ Échalotte/ Poireau	*Alternaria porri*	Tache pourpre	2
	Colletotrichum circinans	Anthracnose	3
	Burkholderia cepaciae	Pourriture bactérienne	2
	Burkholderia gladioli	Pourriture brunâtre	1
	Fusarium moniliforme/ F. proliferatum/ F.culmorum	Pourriture du bulbe et des racines	2
	Fusarium oxysporum	Fusariose du plateau	7
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Penicillium sp./ levures	Pourriture des bulbes	3
	Potyvirus	Mosaïques	1
	Pythium irregulare	Pourriture pythienne	2
	Rhizoctonia solani	Rhizoctone	1
	Stemphylium sp.	Moisissure noire des feuilles	6
	Déséquilibre du pH		4
	Salinité inadéquate du sol		5
	Stress climatiques		4
	Phytotoxicité herbicides		2
	Entyloma sp.	Charbon	1
	Pseudomonas syringae	Moucheture bactérienne	1
Piment/Poivron	*Botrytis cinerea*	Moisissure grise	1
	Fusarium oxysporum	Fusariose des racines et du collet	10
	Myxomycètes	Tache foliaire	1
	Phytophthora capsici	Pourriture de fruits et de racines	6
	Pseudomonas syringae	Moucheture bactérienne	3
	Rhizoctonia solani	Tige noire	3
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Verticillium sp.	Verticilliose	1
	Stress climatiques		1
Pomme de terre	*Alternaria solani*	Alternariose	5
	AMV	Mosaïque foliaire	1
	Colletotrichum coccodes	Dartrose	11
	Fusarium oxysporum	Pourriture fusarienne	5
	Helminthosporium solani	Tache argentée	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Phytophthora erythroseptica	Pourriture rose	5

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Pomme de terre	*Phytophthora infestans*	Mildiou	1
	Phytoplasmes	Malformation des tiges et des feuilles	2
	PLRV	Malformation et anomalie de coloration foliaire	1
	Potyvirus	Mosaïque foliaire	2
	PVY	Mosaïque foliaire	3
	Rhizoctonia solani	Rhizoctonie	8
	Streptomyces sp.	Gale commune	1
	Verticillium dahliae	Verticilliose	9
	Cœur brun		1
	Nécrose vasculaire au défanage		1
	Peau d'éléphant		2
	Phytotoxicité herbicides		7
	Salinité élevée du sol		3
	Autres stress climatiques		8
	Autres stress culturaux		1
Rhubarbe	*Ascochyta* sp.	Tache ascochytique	3
	Colletotrichum sp.	Anthracnose	1
	Cylindrocarpon sp./ *Fusarium* sp.	Pourriture des racines et du collet	2
	Rhizoctonia solani	Rhizoctone	1
	Pratylenchus sp.	Lésions des racines	1
	ToRSV	Tache foliaire	1
Tomate	*Alternaria alternata*	Alternariose	1
	AMV	Mosaïque	1
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	5
	Colletotrichum coccodes	Anthracnose sur fruits	4
	Fusarium spp.	Pourriture de fruits ou de racines	2
	Geotrichum candidum	Pourriture laiteuse	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phytophthora infestans	Mildiou	4
	Septoria sp.	Tache septorienne	1
	Xanthomonas campestris	Tache bactérienne	1
	Carences minérales		5
	pH du sol élevé		1
	Stress climatiques		3
Zucchini	*Erwinia tracheiphila*	Flétrissement bactérien	2
	Pseudomonas syringae	Tache angulaire	5
	Phytophthora capsici	Pourriture des fruits	1
Total			**533**

Tableau 2. Sommaire des maladies diagnostiquées parmi les **légumes d'entrepôt** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Ail	*Fusarium moniliforme*	Pourriture des bulbes	1
	Penicillium sp.	Pourriture des bulbes	1
Betterave	*Aphanomyces* sp.	Chancre sur racines	1
	Fusarium oxysporum	Pourriture des racines	1
Carotte	*Phytophthora* sp.	Pourriture caoutchouc	1
Oignon	*Fusarium* sp.	Pourriture des bulbes	3
	Penicillium sp.	Pourriture des bulbes	4
Pomme de terre	*Colletotrichum coccodes*	Dartrose	14
	Fusarium avenaceum/ F. graminearum/ F. oxysporum	Pourriture fusarienne	7
	Geotrichum sp.	Pourriture sûre	1
	Gliomastix sp.	Noircissement des tubercules	1
	Helminthosporium solani	Tache argentée	13
	Phytophthora erythroseptica	Pourriture rose	1
	Phytophthora infestans	Mildiou	1
	PMTV	Anomalie de coloration dans le tubercule	1
	Potyvirus	Anomalie de coloration dans le tubercule	1
	Pythium sp.	Pourridié pythien	1
	PVX	Tache foliaire	1
	Rhizoctonia solani	Rhizoctonie	9
	Spongospora sp.	Gale poudreuse	4
	Verticillium dahliae	Flétrissement verticillien	2
	Cœur brun		2
	Cœur creux		1
	Cœur noir		1
	Froid		1
	Tache de rouille		1
	Tache plombée		1
	Autres agents non infectieux		2
Rutabaga	*Sclerotinia sclerotiorum*	Sclérotiniose	1
Total			**79**

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Concombre	*Erwinia tracheiphila*	Flétrissement bactérien	1
	Fusarium oxysporum	Fusariose vasculaire	1
	Pseudomonas syringae	Tache angulaire	2
	Pseudoperonospora sp.	Mildiou	1
	Pythium spp.	Pourriture des tiges et du collet	2
	Stress climatiques		1
	Stress culturaux		2
Laitue	*Rhizoctonia solani*	Rhizoctone	3
	Salinité élevée du sol		1
	Stress climatiques		1
Poivron	*Alternaria* sp.	Pourriture des fruits	1
	Phytophthora sp.	Pourriture de racines et du collet	2
	Pseudomonas syringae	Moucheture bactérienne	2
Tomate	*Botrytis cinerea*	Moisissure grise	4
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	31
	Erysiphe orontii	Blanc	2
	Fulvia fulva	Moisissure olive	3
	Fusarium oxysporum	Pourriture des racines et du collet	15
	Fusarium solani	Chancre de collet et de tige	15
	INSV	Anomalie de coloration foliaire	1
	PePMV	Anomalie de coloration foliaire	11
	Phytophthora infestans	Mildiou	1
	Phytophthora nicotianae	Pourriture et chancre à la tige	7
	Pseudomonas corrugata	Moelle noire	2
	Pythium irregulare	Pourriture pythienne	5
	Rhizoctonia solani	Rhizoctone commun	3
	Blessure par dégouttement		4
	Désordre physiologique/ argenture/ boulishness*		4
	Excès de chaleur		2
	Intumescence		1
	pH élevé du sol		2
	Polluants gazeux		2
	Salinité du sol élevée		2
	Transpiration excessive du feuillage		2
	Autres agents non infectieux		2
Total			**141**

*Boulishness : dérèglement physiologique chez le plant de tomate caractérisé par un développement monstrueux; le diamètre de la tige augmente, les feuilles deviennent très longues et très vertes, raides et ondulées, portant souvent des rosettes foliacées sur les nervures principales; les fruits restent verts, petits et durs très longtemps.

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Amélanchier	*Entomosporium mespili*	Entomosporiose	2
Argousier	Excès d'eau		2
Bleuetier en corymbe/nain	*Alternaria alternata*	Pourriture des fruits	1
	Aureobasidium sp.	Brûlure des rameaux	3
	Botrytis cinerea	Moisissure grise	4
	Colletotrichum sp.	Anthracnose	1
	Fusicoccum sp.	Chancre	7
	Gibbera vaccinicola (Protoventuria)	Gale de tige	2
	Monilinia sp.	Pourriture sclérotique	1
	Oidium sp.	Blanc	1
	Pezicula sp.	Malformation de tige	1
	Phytoplasme	Malformation/nanisme	8
	Protoventuria myrtilli	Tache foliaire	1
	Ramularia sp.	Tache ramularienne	2
	Rhizobium radiobacter	Tumeur du collet	3
	ToRSV	Malformation foliaire/dépérissement	1
	Carences minérales		6
	Gel hivernal		3
	Phytotoxicité herbicides		5
	pH inadéquat		6
	Stress climatiques		1
	Autres stress culturaux		2
Camerise	*Microsphaera (Oïdium)*	Tache foliaire	2
Canneberge	*Protoventuria myrtilli*	Tache foliaire	1
	Blessure mécanique		1
Cassissier/Gadellier/Groseillier	*Cronartium ribicola*	Rouille vésiculeuse du pin	2
	Puccinia sp.	Rouille	1
	Septoria sp.	Tache septorienne	1
Fraisier	*Aphelenchoides* sp.	Dépérissement de feuilles	3
	Botrytis cinerea	Moisissure grise	3
	Diplocarpon earlianum	Tache pourpre	1
	Hainesia sp.	Dépérissement de feuilles	1
	Longidorus sp.		1
	Meloidogyne sp.	Nodosité des racines	1
	Phytophthora cactorum	Pourriture du fruit et du collet	2
	Phytophthora spp.	Pourriture des racines/dépérissement	7
	Phytoplasmes	Malformation	1
	Pratylenchus sp.	Lésions des racines	3
	Pythium sp./ *Rhizoctonia* sp./ *Cylindrocarpon* sp./ *Fusarium* sp.	Pourriture noire des racines	40

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Fraisier	*Ramularia* sp.	Tache commune	1
	Sphaerotheca macularis (Oïdium)	Blanc	2
	Verticillium dahliae	Verticilliose	6
	Zythia fragariae		1
	Gel hivernal	Brûlure foliaire	4
	Jaunisse de juin		2
	Phytotoxicité herbicides		13
	Autres stress climatiques		4
	Autres stress culturaux		5
Framboisier rouge/noir	*Arthuriomyces* sp.	Rouille	1
	Botrytis cinerea	Moisissure grise	5
	Cladosporium sp./ *levures/ Hainesia* sp.	Pourriture des fruits	6
	Coniothyrium sp.	Brûlure des tiges	2
	Erwinia amylovora	Brûlure bactérienne	1
	Gnomonia sp.	Chancre sur tige	1
	Phytophthora spp.	Pourridié phytophthoréen	7
	Pratylenchus sp.	Lésions des racines	2
	Pseudomonas syringae	Brûlure bactérienne	2
	Pythium sp./ *Rhizoctonia* sp./ *Cylindrocarpon* sp./ *Fusarium* sp.	Pourriture noire des racines	13
	Rhizobium radiobacter	Tumeur du collet	4
	Septoria rubi	Tache septorienne	1
	ToRSV	Anomalie de coloration foliaire	1
	Gel hivernal		3
	Phytotoxicité herbicides		2
	Autres stress climatiques		8
	Autres stress culturaux		4
Kiwi	*Rhizobium radiobacter*	Tumeur du collet	1
Vigne	*Alternaria* sp.	Pourriture des baies	1
	Botrytis cinerea	Moisissure grise	3
	Colletotrichum acutatum	Anthracnose	2
	Elsinoe (Sphaceloma) ampelina	Anthracnose	1
	Oïdium sp.	Blanc	2
	Phomopsis sp.	Brûlure phomopsienne	3
	Phyllosticta ampelicida	Pourriture noire	5
	Phytoplasme	Malformation/anomalie de coloration	4
	Pseudopezicula sp.	Rougeot parasitaire	1
	Phytotoxicité herbicides		7
	Autres stress climatiques		4
	Stress culturaux		3
Total			**272**

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Avoine	*Pratylenchus* sp.	Lésions des racines	1
	Carence de Mn	Tache grise	1
Orge	*Drechslera teres*	Rayure réticulée	2
	Fusarium spp.	Fusariose	4
	Gaeumannomyces graminis	Piétin-échaudage	2
	Puccinia sp.	Rouille	1
	Pythium sp.	Piétin brun	2
	Septoria sp.	Tache septorienne	1
	Phytotoxicité herbicides		2
Blé	*Alternaria* sp./ *Cladosporium* sp./ *Ulocladium* sp.	Moisissure noire	5
	Drechslera sp.	Tache bronzée	1
	Fusarium graminearum	Fusariose	1
	BYDV-PAV	Jaunisse nanisante	1
	Stress culturaux		2
Seigle	*Fusarium avenaceum*	Pourridié fusarien	1
	Pythium ultimum	Piétin brun	1
Triticale	*Bipolaris* sp.	Tache helminthosporienne	6
	pH élevé du sol		3
Total			**37**

Tableau 6. Sommaire des maladies diagnostiquées parmi les **cultures industrielles** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Canola	*Fusarium* spp.	Pourriture fusarienne	1
	Plasmodiophora brassicae	Hernie	2
Houblon	*Pseudoperonospora* sp.	Mildiou	1
Maïs	*Alternaria* sp./*Cladosporium* sp./ *Stemphylium* sp.	Moisissure noire	2
	Bipolaris sp.	Tache foliaire	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium spp.	Fusariose	3
	Pythium spp.	Piétin brun	1
	Phytotoxicité herbicides		5
	Stress climatiques		1
	Stress culturaux		3

Tableau 6. Sommaire des maladies diagnostiquées parmi les **cultures industrielles** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Soya	*Alternaria alternata*	Alternariose	2
	Colletotrichum sp.	Anthracnose	5
	Fusarium spp.	Pourriture fusarienne	6
	Peronospora manshurica	Mildiou	1
	Phomopsis sp.	Brûlure phomopsienne	4
	Pratylenchus sp.	Lésion des racines	2
	Pythium spp.	Pourriture pythienne	2
	Rhizoctonia solani	Rhizoctone commun	1
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Ozone		4
	Phytotoxicité herbicides		5
	Stress culturaux		3
Total			**58**

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Luzerne	*Leptosphaerulina* sp.	Tache de poivre	1
	Ozone		1
Millet perlé	Phytotoxicité paraquat		1
Total			**3**

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Cerisier	*Alternaria alternata*	Tache foliaire	2
	Apiosporina sp.	Nodule noir	1
	Aureobasidium sp.	Tache foliaire	2
	Cladosporium sp.	Tache foliaire	2
	Monilia sp.	Pourriture brune	3
	Podosphaera sp.	Blanc	1
	Septoria sp.	Tache septorienne	2
	Phytoplasme	Brûlure foliaire/dépérissement	5
	Xiphinema sp.	Taches sur racines	1
	Stress culturaux		1

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Poirier	*Erwinia amylovora*	Feu bactérienne	2
	Phoma sp.	Taches foliaire	1
	Phomopsis sp.	Chancre phomopsien	1
Pommier	*Alternaria* sp./ *Aspergillus* sp./ *Aureobasidium* sp. /*Botrytis cinerea*/ *Cladosporium* sp./ *Fusarium* spp./ *Geotrichum* sp./ levures/ *Microsphaeropsis* sp./ *Penicillium* sp./ *Stemphylium* sp.	Moisissure du coeur	106
	Cytospora leucosperma	Chancre cytosporéen	1
	Erwinia amylovora	Feu bactérienne	6
	Fusarium sp. / Pythium sp./ Rhizoctonia sp.	Pourriture noire des racines	5
	Phlyctema sp.	Chancre phomopsien	2
	Phomopsis mali	Anthracnose	1
	Pseudomonas syringae	Chancre bactérien	2
	Sphaeropsis malorum	Chancre sur rameau	1
	Spilocea pomi	Tavelure	3
	Gel hivernal		1
	Grêle		1
	Phytotoxicité pesticides		1
	Autres agents non infectieux		2
Total			**156**

Tableau 9. Sommaire des maladies diagnostiquées parmi les **graminées à gazon** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Vert de golf (Agrostide/pâturin annuel)	Basidiomycètes	Dépérissement	1
	Colletotrichum graminicola	Anthracnose	3
	Curvularia sp.	Tache foliaire	5
	Fusarium equiseti	Tache fusarienne	3
	Leptosphaerulina sp.	Tache foliaire	2
	Pratylenchus sp.	Lésions des racines	2
	Puccinia sp.	Rouille	1
	Pythium torulosum	Piétin brun	2
	Rhizoctonia sp.	Rhizoctone brun	2
Total			**21**

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Abies balsamea	Salinité élevée du sol	Jaunissement du feuillage	1
Acer sp.	*Pseudomonas syringae*	Brûlure marginale des feuilles	1
Juglans cinerea	*Fusarium* sp.	Chancre sur tige	1
	Irpex lacteus	Dépérissement	1
	Melanconium oblongum	Dépérissement	3
Myrica gale	Phytotoxicité herbicides		1
Pinus strobus	*Cylindrocarpon* sp.	Pourriture des racines	1
	Fusarium spp.	Pourriture des racines	1
Populus sp.	*Cytospora* sp.	Chancre cytosporéen	1
	Asphyxie racinaire	Dépérissement	1
Quercus sp.	Phytotoxicité herbicides	Malformation/anomalies de coloration	3
Rosa rugosa	Phytotoxicité herbicides		1
Salix silicola	*Glomerella* sp.	Pourriture de tiges	1
Sambucus sp.	*Ascochyta* sp.	Tache ascochytique	1
	Xanthomonas campestris	Brûlure foliaire	1
Syringa sp.	*Pseudomonas syringae*	Brûlure bactérienne	2
	Phytotoxicité herbicides		3
Thuja occidentalis	*Didymascella thujina*	Brûlure des aiguilles	1
	Kabatina sp.	Brûlure des aiguilles	1
	Pestalotiopsis funerea	Brûlure des aiguilles	1
	Phoma sp.	Anomalie de coloration foliaire	1
	Stress culturaux		1
Weigela sp.	Phytoplasme	Malformations des tiges	1
Total			**30**

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Actaea	*Pythium* sp.	Pourriture des racines	1
	ph élevé du sol		1
Adiantum	*Aphelenchoides* sp.	Brûlure foliaire	2
	Phoma sp.	Dépérissement	2
	ph élevé du sol		3
Aeschynanthus	Déséquilibre minéral		1
	INSV	Anomalie de coloration foliaire	1
Amsonia	ph élevé du sol		1
Aquilegia	*Botrytis cinerea*	Moisissure grise	1
Arisperma	*Pythium* sp.	Pourridié pythien	1
	ph élevé du sol		1
Astragalus	*Pythium irregulare*	Pourridié pythien	1
Athyrium	ph élevé du sol		3
	Phoma sp.	Dépérissement	1
Belamcanda	TSWV	Anomalie de coloration foliaire	1
Begonia	ArMV	Anomalie de coloration foliaire	1
	INSV	Anomalie de coloration foliaire	2
	Phytophthora sp.	Pourridié phytophthoréen	1
	Stress culturaux		1
Bellis	Stress culturaux		2
Bergenia	*Pythium* sp.	Pourridié pythien	1
	pH élevé du sol		1
Bryophytes	pH élevé du sol		1
Budleia	*Pythium*	Pourridié pythien	1
Calibrachoa	*Botrytis cinerea*	Moisissure grise	4
	Fusarium spp.	Pourriture des racines	6
	INSV	Mosaïque et malformation	1
	Phytophthora drechsleri/ P. *nicotiana*	Pourriture des racines et du	6
	Pythium spp.	collet	7
	Thielaviopsis basicola	Pourridié pythien	6
	Salinité élevée du sol	Pourriture noire des racines	5
	Autres stress culturaux		2

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Canna	*Fusarium oxysporum*	Pourridié fusarien	2
	Potyvirus	Mosaïque	1
	Stress culturaux		2
Chrysanthemum	*Rhizobium radiobacter*	Tumeur du collet	1
	Stress climatiques		1
	Stress culturaux		4
Clerodendron	INSV	Tache foliaire	1
Coleus	INSV	Brûlure foliaire	1
Coreopsis	*Plasmopara* sp.	Mildiou	1
Crocosmia	Potyvirus	Jaunissement entre les nervures	1
Cyclamen	*Fusarium oxysporum*	Pourridié fusarien	1
Dahlia	*Pythium* sp.	Pourridié pythien	2
Dicentra	*Phytophthora* sp.	Pourridié phytophthoréen	2
	Pythium sp.	Pourridié pythien	2
Dracaena/ Cordyline	*Colletotrichum* sp.	Anthracnose	1
	Fusarium oxysporum	Pourridié fusarien	1
Echinacea	*Fusarium oxysporum*	Pourridié fusarien	2
	Phytoplasme	Malformation foliaire	1
	Pythium sp.	Pourridié pythien	1
	Septoria sp.	Tache septorienne	1
	Salinité élevée du sol		3
	Autres stress culturaux		3
Euphorbia pulcherrima	*Fusarium* sp.	Pourridié fusarien	2
	Pythium sp.	Pourridié pythien	1
	Stress culturaux		2
Gaillardia	*Rhizobium radiobacter*	Tumeur du collet	1
Gazania	*Pythium* sp.	Pourridié pythien	1
	Salinité élevée du sol		1
Harrisia	Agents non infectieux		2
Hedera	Salinité élevée du sol		1
Helichrysum	*Fusarium oxysporum*	Pourridié fusarien	2

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Helichrysum	*Pythium irregulare*	Pourridié pythien	1
Hemerocallis	*Kabatiella* sp.	Tache foliaire	2
Hosta	*Alternaria alternata*	Tache foliaire	1
	Botrytis sp.	Moisissure grise	1
Hosta	*Fusarium heterosporum*/ *F. oxysporum*	Pourriture du collet et des racines	2
	HVX	Mosaïque	3
	Stress culturaux		3
Hydrangea	*Ascochyta sp.*	Tache et pourriture foliaire	2
	Pseudomonas fluorescens/ P. marginalis	Pourriture de feuilles	2
Hydrastis	*Botrytis cinerea*	Moisissure grise	1
Impatiens	*Alternaria* sp.	Tache alternarienne	1
	Fusarium oxysporum	Pourridié fusarien	2
	Myrothecium sp.	Tache foliaire	1
	Pythium sp.	Pourridié pythien	3
	Rhizoctonia solani	Rhizoctone	5
	Verticillium dahliae	Flétrissement verticillien	1
Kalanchoe	Salinité élevée du sol		1
Lathyrus	*Phoma* sp.	Tache foliaire	1
Lavandula	*Botrytis cinerea*	Moisissure grise	2
	Phoma sp.	Pourriture du collet	2
	Thielaviopsis basicola	Pourriture noire des racines	1
	Salinité élevée du sol		1
Ligustrum	*Colletotrichum* sp.	Anthracnose	1
Lobelia	INSV	Brûlure marginale des feuilles	5
	Pythium irregulare	Pourridié pythien	3
	Rhizoctonia solani	Rhizoctone	1
	Salinité élevée du sol		1
Mandevilla	*Cylindrocarpon* sp.	Pourriture des racines	1
	Fusarium oxysporum	Pourridié fusarien	2
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
	Oedème		1
Matteuccia	*Phoma* sp.	Anomalie de coloration de la tige	1
	Pseudomonas syringae	Tache foliaire	1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Matteuccia	*Pythium irregulare*	Pourridié pythien	1
Miltonia	*Fusarium moniliforme/* F.*oxysporum*	Pourridié fusarien	2
	INSV	Jaunissement aléatoire des feuilles	2
	Rhizoctonia solani	Rhizoctone	1
Miscanthus	Basidiomycète	Pourriture des racines	1
	Fusarium sp.	Pourridié fusarien	1
	Pythium sp.	Pourridié pythien	1
	Potyvirus	Tache foliaire	2
Monarda	INSV	Tache foliaire	1
Musa	ArMV	Anomalie de coloration foliaire	2
	TRSV	Anomalie de coloration foliaire	1
Paeonia	Phytoplasme	Malformation foliaire	1
Palmiers	*Colletotrichum* sp.	Anthracnose	1
	Fusarium sp.	Pourridié fusarien	3
	Penicillium sp.	Pourriture du collet	1
Pelargonium	PFBV	Tache jaune	2
	Xanthomonas hortorum pv. *pelargonii*	Pourriture bactérienne	2
	Agents non infectieux		1
Pennisetum	AMV	Anomalie de coloration foliaire	1
	CMV	Tache foliaire	1
Petunia	ArMV	Anomalie de coloration foliaire	1
	Fusarium oxysporum	Pourridié fusarien	1
	Phytotoxicité herbicides		1
Phlox	*Fusarium* sp.	Pourridié fusarien	2
	Phytophthora nicotiana	Pourridié phytophthoréen	2
	Pythium sp.	Pourridié pythien	2
	Rhizoctonia solani	Rhizoctone brun	4
	pH élevé du sol		1
Physostegia	INSV	Jaunissement foliaire	1
Polemonium	CMV	Jaunissement entre les nervures	1
Polytrichum	pH élevé		1
Rudbeckia	*Plasmopara*	Mildiou	1
	Septoria sp.	Tache septorienne	2

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Rudbeckia	Phytotoxicité herbicides		1
Saintpaulia	*Fusarium solani*	Pourridié fusarien	1
Salvia	*Alternaria* sp.	Tache foliaire	1
	Xanthomonas campestris	Tache bactérienne	1
	Carence de P	Anomalie de coloration foliaire	1
Scaveola	Phytotoxicité pesticides		1
Surfinia	*Botrytis cinerea*	Moisissure grise	1
Tradescantia	Potyvirus	Tache foliaire	1
	TBRV	Tache foliaire	1
Tricyrtis	Potyvirus	Tache foliaire	1
Trollius	*Ascochyta* sp.	Tache ascochytique	2
Valeriana	*Pseudomonas marginalis*	Malformation foliaire	2
Veronica	*Ditylenchus* sp.	Tache foliaire	1
	Phytoplasme	Malformation des feuilles	1
	Puccinia sp.	Rouille	1
	Carence minérale		1
Vinca	*Phoma* sp.	Dépérissement	1
Viola	Carence N, P, K		3
Zinnia	*Sclerotinia* sp.	Sclérotiniose	1
Total			**246**

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et les fines herbes** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Basilic	*Alternaria alternata*	Tache foliaire	1
	Fusarium oxysporum	Fusariose	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia sp.	Rhizoctone	1
	Froid		1
	pH élevé du sol		1

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et les fines herbes** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2010.

CULTURE	AGENT PATHOGÈNE/CAUSE	MALADIE/SYMPTÔME	NOMBRE
Coriandre	*Xanthomonas campestris*	Tache bactérienne	1
Fenouil	*Fusarium oxysporum*	Pourriture fusarienne	2
	Pythium ultimum	Pourriture pythienne	1
	Rhizoctonia solani	Rhizoctone	2
Persil	*Fusarium* spp.	Fusariose	2
	Phytoplasme	Malformation des feuilles	1
Total			**15**
GRAND TOTAL			**1529**

CROP: Diagnostic Laboratory Report - All Crops
LOCATION: Prince Edward Island

NAMES AND AGENCIES:
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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS IN PRINCE EDWARD ISLAND, 2010

METHODS: The Prince Edward Island (PE) Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis and control recommendations primarily for disease problems of commercial crops produced on PE. The PDDS also provides a Dutch elm disease (DED) diagnostic service for the provincial Department of Environment, Energy and Forestry and local cities. Samples are submitted to the laboratory by agriculture extension staff, producers, growers, agri-business representatives, crop insurance agents and the general public. Diagnoses are based on a combination of a visual examination of symptoms, microscopic observation and culturing onto artificial media.

RESULTS AND COMMENTS: A total of 470 samples were processed for the 2010 growing season. Categories of samples received were: potato (58.0%), cereals (8.7%), other crops (17.6%) and Dutch elm disease service samples (15.7%). The percentage of samples from provincial crop insurance agents was 40.2 %. A total of 660 disease and 19 insect identifications was completed during the period January 1st , 2010 to December 17th 2010. The diagnoses reported may not necessarily reflect the major diseases encountered during the season, but rather those most prevalent among samples submitted. The planting season started early due to higher than normal temperatures for the month of April, (e.g. 2.7-16.0°C for April 3rd) coupled with minimal precipitation. However, excessive moisture during the early part of August and high temperatures in September contributed to an increase in the level of bacterial diseases.

Table 1: Summary of diseases diagnosed on commercial crop samples submitted to the Plant Disease Diagnostic laboratory, Prince Edward Island Department of Agriculture in 2010

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO.OF TIMES AGENTS WERE IDENTIFIED
VEGETABLES:			
Bean	Anthracnose	*Colletotrichum* sp.	2
Cabbage	Head rot	*Sclerotinia sclerotiorum*	1
Cauliflower	Clubroot	*Plasmodiophora brassicae*	1
	Wirestem	*Rhizoctonia* sp.	1
Corn	Ear rot	*Fusarium* sp.	2
	Northern leaf spot	*Cochliobolus* sp.	1
	Bacterial soft rot	*Clostridium* sp.	27
		Erwinia sp. (*Pectobacterium* sp.)	13
		Pseudomonas sp.	16

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO.OF TIMES AGENTS WERE IDENTIFIED
Potato	Black dot	*Colletotrichum coccodes*	9
	Black scurf	*Rhizoctonia solani*	15
	Blackleg	*Pectobacterium* sp.	21
	Botrytis grey mould	*Botrytis cinerea*	1
	Brown spot	*Alternaria alternata*	6
	Common scab	*Streptomyces scabies*	16
	Early blight	*Alternaria solani*	6
	Early dying syndrome	*Colletotrichum coccodes*	4
		Fusarium avenaceum	2
		Fusarium sp.	2
		Verticillium *dahliae*	1
		Verticillium albo-atrum	1
		Rhizoctonia solani	2
	Fusarium dry rot	*Fusarium avenaceum*	15
		Fusarium coeruleum	9
		Fusarium oxysporum	*2*
		Fusarium sambucinum	14
		Fusarium solani	3
		Fusarium spp.	8
	Fusarium wilt	*Fusarium avenaceum*	1
		Fusarium oxysporum	3
		Fusarium sp.	3
	Insect	Cutworm	2
		Mite	1
	Nematode	Unidentified species	1
		Slug	3
		Wireworm	7
		Click beetle	1
		Stink bug	1
		Leaf miner	1
	Late blight	*Phytophthora infestans*	60
	Leak	*Pythium* sp.	5
	Physiological disorders	Bruising	1
		Chemical damage	4
		Chilling	12
		Elephant hide	1
		Fertilizer burn	1
		Frost damage	20
		Greening	8
		Hollow heart	4
		Jelly end rot	3
		Little tuber	1
		Mechanical injury	7
		Off-type	1
	Pink rot	*Phytophthora erythroseptica*	34
	Pinkeye	*Pseudomonas* sp.	27
	Powdery mildew	*Erysiphe* sp.	3
	Stem canker	*Rhizoctonia solani*	13
	Silver scurf	*Helminthosporium solani*	8

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO.OF TIMES AGENTS WERE IDENTIFIED
Potato (contd.)	Verticillium wilt	*Verticillium dahliae*	3
		Verticillium sp.	1
	Virus	Mosaic virus	2
Rutabaga	Blackleg	*Phoma lingam*	2
	Fusarium wilt	*Fusarium oxysporum*	1
	Wirestem	*Rhizoctonia solani*	2
Tomato	Grey mould	*Botrytis cinerea*	2
	Septoria leaf spot	*Septoria* sp. (*Stagonospora sp.)*	1
CEREAL CROPS:			
Barley	Black point	*Bipolaris* sp.	1
	Fusarium head blight	*Fusarium* sp.	1
	Glume blotch	*Septoria* sp.	1
	Net blotch	*Pyrenophora* sp.	2
	Physiological disorder	Nutritional imbalance	2
	Powdery mildew	*Blumeria graminis*	4
	Root rot	*Cochliobolus* sp.	1
	Spot blotch	*Bipolaris* sp.	2
	Scald	*Rhynchosporium* sp.	2
	Seedling blight	*Bipolaris* sp.	2
	Smut	*Ustilago* sp.	2
	Sooty mould	*Alternaria* sp.	1
		Bipolaris sp.	3
		Fusarium sp.	1
	Spot blotch	*Bipolaris* sp.	2
		Cochliobolus sp.	1
Oat	Fusarium head blight	*Fusarium graminearum*	1
		Fusarium sp.	1
	Physiological disorder	Blast	1
	Septoria leaf spot	*Septoria* sp. (*Stagonospora* sp.)	1
	Spot blotch	*Cochliobolus* sp.	1
Wheat	Black head moulds	Alternaria sp.	2
		Cladosporium sp.	4
	Fusarium head blight	*Fusarium graminearum*	15
		Fusarium sp.	2
	Glume blotch	*Septoria* sp. (*Stagonospora sp.*)	11
	Sooty mould	*Alternaria sp.*	1
OILSEED CROPS:			
Crambe	Blackleg	*Leptosphaeria* sp.	2
	Fusarium wilt	*Fusarium* sp.	2

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO.OF TIMES AGENTS WERE IDENTIFIED
Crambe (contd.)	Insect	Diamondback moth	2
		Maggot	2
Soybean	Anthracnose	*Colletotrichum* sp.	2
	Brown spot	*Septoria* sp.	3
	Rhizoctonia root rot	*Rhizoctonia* sp.	4
	Root and stem rot	*Colletotrichum* sp.	1
		Fusarium sp.	6
		Nematode	2
		Phytophthora sp.	2
		Rhizoctonia sp.	8
		Sclerotinia sclerotiorum	1
	Rust	*Phakopsora* sp.	1
	Target spot	*Corynespora* sp.	1
	White mould	*Sclerotinia sclerotiorum*	8
SMALL FRUIT:			
Blueberry (Lowbush)	Botrytis leaf spot	*Botrytis cinerea*	1
	Godronia canker	*Fusicoccum* sp.	1
	Leaf spot	*Septoria* sp.	7
	Phomopsis canker	*Gloeocercospora* sp.	1
		Phomopsis sp.	1
	Physiological disorder	Chemical damage	1
	Red leaf	*Exobasidium* sp.	2
Cranberry	Fairy ring	*Helicobasdium* sp.	1
	Phytophthora root rot	*Phytophthora* sp.	1
	Upright dieback	*Colletotrichum* sp.	1
		Phomopsis sp.	2
	Viscid rot	*Phomopsis* sp.	1
Strawberry	Black root rot	*Fusarium oxysporum*	1
		Rhizoctoni solani	1
	Crown rot	*Phytophthora* sp.	1
	Fusarium wilt	*Fusarium avenaceum*	1
		Fusarium oxysporum	1
	Leaf spot	*Phomopsis* sp.	1
	Root rot	*Pythium* sp.	1
		Rhizoctonia sp.	1
OTHER CROPS:			
Elm	Dutch elm disease	*Ophiostoma nova-ulmi*	20
	Negative for DED		45
Hay	Insect	Cutworm	1

TOTAL: 660

Cereals / Céréales

CROP / CULTURE : Barley
LOCATION / RÉGION: Central Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT :
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TITLE / TITRE: 2010 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

INTRODUCTION AND METHODS: A survey to document diseases of barley was conducted in 20 fields in Central Alberta from August 4 to 9, 2010. Growers were contacted for permission to access their land, with the evaluation being done at the late milk to soft dough stage of crop development. The fields were traversed in a diamond pattern starting at least 25 m from the field edge, with visual assessments made of 5 penultimate leaves at each of 5 locations that were at least 25 m apart. Leaf diseases were rated for percent leaf area diseased (PLAD) with symptoms of scald, netted net blotch or other leaf spots. Common root rot (CRR) was assessed on sub-crown internodes using a 0-4 scale where 0=none, 1=trace and 4=severe. Other diseases, if present, were rated as a percent of the plants affected. Following the survey, a representative tissue sub-sample of diseased plant parts collected at each location was cultured in the laboratory for pathogen isolation and identification.

RESULTS AND COMMENTS: Survey results are presented in Table 1. Growing conditions in central Alberta were wet and cool during May, June and July. August was somewhat dryer, but nonetheless crop maturity in 2010 was delayed. Disease development was relatively high throughout the region.

Scald (*Rhynchosporium secalis*) levels ranged from 0.1 to 6 % PLAD in 12 fields; in two fields the plants had a PLAD range of 40% to 60%, in another two fields 60 to 80%, and in the remainder there was no scald. As with scald, more netted net blotch (*Pyrenophora teres* f. *teres*) was observed throughout the survey region in 2010 than in 2009 (Rauhala and Turkington 2010): the PLAD was 0.1% to 10% in 10 fields, crops in three fields had a PLAD of 36%, 68%, and 84% respectively, with the remaining crops showin no evidence of netted net blotch. Other leaf spots, primarily diagnosed as spotted net blotch (*P. teres* f. *maculata*), were found in 95% of the fields surveyed. Their severity ranged from 0.1% to 21%. *Alternaria* spp. were also isolated from sub-samples of leaf tissue exhibiting 'spotted net blotch' symptoms.

Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all fields, at similar levels to those in 2009 (Rauhala and Turkington 2010).

There was no stripe rust (*Puccinia striiformis)* observed in any of the commercial barley fields surveyed.

REFERENCE:
Rauhala, N.E., and Turkington, T.K. 2010. 2009 barley disease survey in central Alberta. Can. Plant Dis. Surv. 89: 53. (cps-scp.ca/cpds.shtml)

Table 1. Disease incidence and severity in 20 commercial barley fields in central Alberta, 2010.

Disease (severity rating scale)	% of crops affected	Overall average severity (%)	Range in average severity per field (%)
Scald (PLAD*)	80	13	0 – 71
Netted net blotch (PLAD)	65	11	0 – 84
Other leaf spots (PLAD)	95	6	0.1 – 21
Common root rot (0-4)	100	1.7	0 – 4

*Percent leaf area diseased

CROP / CULTURE : Barley
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2010

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 43 barley crops (34 two-row; 9 six-row). Fields and results were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey), and fields under irrigation were considered separately and referred to as the Irrigation Zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with Saskatchewan Ministry of Agriculture randomly collected 50 spikes from barley crops at late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each barley crop surveyed: FHB severity (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes 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 to confirm the presence of *Fusarium* species in infected kernels.

RESULTS AND COMMENTS: Approximately 850,000 ha (2.1 million acres) of barley were seeded in Saskatchewan in 2010 (Statistics Canada, 2010). Excess precipitation combined with lack of both heat and sunshine created many challenges for farmers. Crops were stressed from excess moisture and disease pressure. Most of the province received 115 to 150 percent of average precipitation with potentially up to 3.2 million ha (8 million acres) left unseeded and 1.6 million ha (4 million acres) damaged by flooding (Saskatchewan Ministry of Agriculture, 2010).

In 2010, FHB occurred in 94% and 100% of the surveyed two-row and six-row barley crops, respectively (Table 1). The provincial mean FHB severities in 2010 for two-row barley (3.0%) and six-row barley (4.5%) were substantially higher than in 2009 (two-row barley - 1.4% and six row barley - 1.1%) (Dokken-Bouchard et al. 2010). Severity of FHB for two- and six-row barley were highest in soil zone 2. All crops surveyed except two in soil zone 1 had visible FHB symptoms. Five of the two-row barley and three of the six-row barley crops showed severities higher than 5%.

Similar to 2008 and 2009, the most frequently isolated causal pathogen identified on samples with visible FHB symptoms was *F. poae* (40% of total *Fusarium* isolates), followed by *F. avenaceum* (36%), *F. sporotrichioides* (9%), *F. equiseti* (4%), and *F. graminearum* (3%). *Fusarium acuminatum* and *F. culmorum* were each identified from 2% of the barley isolates.

Fusarium graminearum was found in 12% of the barley survey samples collected. This accounted for 4% of isolates from two-row barley but none of the isolates from six-row barley, whereas in 2009 *F. graminearum* was identified in 15% of the isolations (Dokken-Bouchard et al. 2010). None of the barley samples from the brown soil zone were infected with *F. graminearum*; whereas 1% and 4% of the isolations from the dark brown and black/grey soil zones, respectively, were identified as *F. graminearum*.

Other barley pathogens found infrequently included *Cochliobolus* and *Septoria* spp. Secondary moulds were isolated from 99% of barley samples in 2010.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of cereal samples for this survey.

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Dokken-Bouchard, F.L., Northover, P.R., Weitzel, C.N., Shiplack, J.J., and M.R. Fernandez, M.R. 2010. Fusarium head blight in barley in Saskatchewan in 2009. Can. Plant Dis. Surv. 90: 66–67. (cps-scp.ca/cpds.shtml)

Saskatchewan Ministry of Agriculture. 2010. Final crop report. (www.agriculture.gov.sk.ca)

Statistics Canada. 2010. Field Crop Reporting Series – November estimate of production of principal field crops. Catalogue no. 22-002-X.

Table 1. Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil zone in Saskatchewan, 2010.

Soil Zones	Two-Row Barley		Six-Row Barley	
	No. crops affected / total crops surveyed (% of crops infected)	**Mean FHB Severity[1] (range)**	**No. crops affected / total crops surveyed (% of crops infected)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	4/6 (67%)	1.4% (0 – 3.8%)	---	---
Zone 2 Dark Brown	10/10 (100%)	3.6% (0.3 - 16.2%)	3/3 (100%)	6.5% (2.0 – 12.3%)
Zone 3 Black/Grey	17/17 (100%)	3.3% (0.3 - 13.1%)	5/5 (100%)	3.8% (0.3 - 11.0%)
Irrigation Zone	1/1 (100%)	0.2%	1/1 (100%)	2.3%
Overall Total/Mean	32/34 (94%)	3.0%	9/9 (100%)	4.5%

[1] Percent FHB severity = [% of spikes affected x mean proportion (%) of kernels infected] / 100

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: MONITORING FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA IN 2010

INTRODUCTION AND METHODS: In 2010, a total of 32 barley crops (26 two-rowed, 6 six-rowed) in southern Manitoba were monitored for the visible presence of fusarium head blight (FHB) from July 21-30, when crops were at the early- to soft-dough (ZGS 80-85) stages of growth. The fields were selected at random along the survey routes, depending on crop frequency. The area sampled was bounded by Highway #s 17, 16 and 45 to the north, Hwy #3 to the south, Hwy #12 to the east and Hwy #83 to the west. The incidence of FHB (the percentage of spikes with typical symptoms) was assessed in each crop by sampling 80-120 spikes at three locations and averaging the results. The average spike proportion infected (SPI) was estimated for each crop. Several affected spikes were collected at each survey site and stored in paper envelopes. Subsequently, a total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from five spikes per location. The kernels were surface sterilized in 0.3% NaOCl and plated onto potato dextrose agar in Petri plates (10 kernels per plate). This was to quantify *Fusarium* spp. on kernels and identify them based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Conditions during the 2010 growing season in agricultural regions of Manitoba were wetter than normal (up to 200% of normal total rainfall), but with near normal growing degree day accumulations. Seeding of some spring crops was delayed or abandoned due to wet fields, and crop development slowed by early-season cool weather. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost. Barley was grown on some 168,000 ha (415,000 acres), with three two-rowed cultivars making up about half of the area: 'Conlon' (28%), 'Newdale' (11%) and 'AC Metcalfe' (11%) ('Yield Manitoba 2011', Manitoba Crop Development Council, supplement to the Manitoba Co-operator, Feb. 24, 2011).

Putative symptoms of FHB were recorded in 31 of the 32 crops surveyed. Average incidence of FHB in two-rowed crops was 12.5% (range 1.0 - 63%), while the spike proportion infected (SPI) averaged 10.0% (range 5.0 - 55%); in six-rowed crops incidence was 6.9% (range 2.9 - 9%) and the SPI 6.3% (range 3.0 - 10%). The resulting average FHB Index (%incidence X %SPI / 100) for 2-row barley was 1.4% (range 0.1 - 13%), and that for 6-row barley 0.4% (range 0.2 – 0.8%). The mean FHB Index for all barley was 1.3%. This level would have resulted in a minimal yield loss to FHB in barley in 2010. The mean FHB Index in 2010 was similar to that reported for 2009 (Tekauz et al. 2010). The lower FHB severity in six-rowed vs. two-rowed barley found in 2010 also occurred in 2009, and is difficult to explain, given that the six-rowed crop is regarded as being more susceptible to FHB.

Fusarium colonies developed in samples from 30 of the 32 surveyed crops, and from 18% of the total kernels plated on potato dextrose agar medium. The latter was a considerably lower level than found in 2009 (Tekauz et al. 2010). The *Fusarium* species isolated from kernels are listed in Table 1. In 2010, *F. graminearum* and *F. poae* both were dominant - each was found in about 2/3rd of crops and made up 45% of the total *Fusarium* flora. This is in contrast to 2009 when *F. graminearum* predominated (Tekauz et al. 2010). *Fusarium sporotrichioides* was detected in 22% of fields and comprised 8% of the total *Fusarium*.

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Tekauz, A., Gilbert, J., Stulzer, M., Beyene, M., and Slusarenko, K. 2010. Monitoring fusarium head blight of barley in Manitoba in 2009. Can. Plant Dis. Surv. 90: 60-61. (cps-scp.ca/cpds.shtml)

Table 1. *Fusarium* spp. isolated from fusarium head blight-affected kernels of barley in Manitoba in 2010.

***Fusarium* spp.**	**Percent of crops**	**Percent of kernels**
F. avenaceum	6	0.7
F. equiseti	3	0.3
F. graminearum	69	45.2
F. poae	66	45.2
F. sporotrichioides	22	8.3

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: LEAF SPOT DISEASES DETECTED IN MANITOBA BARLEY CROPS IN 2010

INTRODUCTION AND METHODS: In 2010, leaf spot diseases of barley in Manitoba were assessed by surveying 32 farm fields (26 two-rowed, 6 six-rowed) from July 21-30, when most crops were at the early- to soft-dough stages of growth (ZGS 80-85). Crops were sampled at regular intervals along the survey routes, depending on availability. The area sampled was bounded by Highway #s 17, 16 and 45 to the north, Hwy #3 to the south, Hwy #12 to the east and Hwy #83 to the west. Disease incidence and severity were recorded by averaging their ratings on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Disease 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%). Infected leaves with typical symptoms were collected at each site, dried, and stored in paper envelopes. Subsequently, surface-sterilized pieces of infected leaf tissue were placed on filter paper in moist chambers for 3-5 days to promote sporulation to identify the causal agent(s), and thereby determine the disease(s) present.

RESULTS AND COMMENTS: Conditions during the 2010 growing season in agricultural regions of Manitoba were wetter than normal (up to 200% average rainfall), but with near normal growing degree day accumulation. Seeding of some spring crops was delayed or abandoned due to wet fields (the latter mainly in parts of the Interlake and South-west) and crop development was slowed by early-season cool weather. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost. Barley was grown on some 168,000 ha (415,000 acres) in 2010, with three two-rowed cultivars making up half the total area, i.e. 'Conlon' (28%), 'Newdale' (11%) and 'AC Metcalfe' (11%) ('Yield Manitoba 2011', Manitoba Crop Development Council, supplement to the Manitoba Co-operator, Feb. 24, 2011).

Leaf spots were observed in the upper and/or lower leaf canopies of all the barley crops surveyed. Disease levels in the upper canopy were trace, very slight or slight in 81% of crops, moderate in 13%, and severe in 3%. Respective severity categories in the lower canopy were estimated as 38%, 28%, and 13%, with 22% being senescent. These levels are lower than those reported for 2009 (Tekauz et al. 2010), but similar to those for the two previous years (Tekauz et al. 2009, 2008). The overall low level of leaf spot severity was somewhat surprising, as the wet conditions in 2010 should have favoured leaf spot development. Possibly, an increased usage of foliar fungicides in barley - applied to control leaf spots or fusarium head blight (FHB) – may have suppressed infection. New product registrations to suppress FHB in barley recently became available. On average, yield losses attributable to leaf spots were likely only 1-2%.

Pyrenophora teres (causal agent of net blotch) and *Cochliobolus sativus* (spot blotch) were the principal pathogens, and caused most of the leaf spot damage observed (Table 1). The first species was isolated from 31 of the 32 crops, indicating the widespread occurrence of net blotch in the province. *Septoria passerinii* (speckled leaf blotch) was found in more crops than usual in 2010 and also caused more of the total damage than recorded in the previous few years (Tekauz et al. 2010, 2009, 2008).

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Tekauz, A., J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, and T. Unrau. 2009. Leaf spot diseases in Manitoba barley crops in 2008. Can. Plant Dis. Surv. 88:56-57. (cps-scp.ca/cpds.shtml)

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Table 1. Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2010

Pathogen	Incidence (% of crops)	Frequency (% of isolations)*
Pyrenophora teres	97	54.0
Cochliobolus sativus	69	38.0
Septoria passerinii	34	8.0

*indicative of the relative foliar damage caused

CROP / CULTURE: Barley
LOCATION / RÉGION: Ontario

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TITLE / TITRE: DISEASES OF BARLEY IN EASTERN ONTARIO IN 2010

INTRODUCTION AND METHODS: A survey of barley diseases was conducted in eastern Ontario in the last week of July when plants were at the soft dough stage of development. Twenty fields were chosen at random in regions 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). Disease diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for covered smut, ergot, leaf stripe, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of three random sites in each field. A FHB index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection, respectively. Determination of the causal species of FHB was based on 50 infected spikes collected from each field. The spikes were air-dried at room temperature and subsequently threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 seconds and plated in 9-cm diameter Petri plates on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. The plates were incubated for 10-14 days at 22-25ºC and a 14-hour photoperiod using fluorescent and long wavelength UV tubes. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: The surveyed fields consisted of 5 two-rowed and 15 six-rowed barley crops. A total of 14 diseases or disease complexes were observed (Table 1). Spot blotch (*Cochliobolus sativus*) and net blotch (Pyrenophora teres) were the most common foliar diseases, and were seen in 20 and 19 fields, at severities of 4.8 and 3.3, respectively. Severe infection levels attributed to spot blotch or net blotch were found in 8 and 4 fields, respectively. Yield reductions due to the two diseases were estimated to have averaged >10% in the affected fields. Leaf rust (*Puccinia hordei*) and the Septoria/Stagonospora blotch complex [including speckled leaf blotch (S*eptoria tritici*) and leaf blotch (*Stagonospora nodorum*)], were observed in 14 and 19 fields at mean severities of 2.1 and 1.7, respectively. No severe levels of these diseases were found. Other foliar diseases observed included barley yellow dwarf (BYD), powdery mildew *(Erysiphe graminis*), scald (*Rhynchosporium secalis*) and stem rust (*Puccinia graminis* f. sp. *tritici* or f. sp. *secalis*). Their average severities were 1.3, 2.2, 1.4, and 2.3 and were observed in 7, 6, 7, and 8 fields, respectively. The affected plants all had only trace to slight levels of infection and none of these diseases would have resulted in significant damage to the crop.

Covered smut (*Ustilago hordei*), ergot (*Claviceps purpurea*), and leaf stripe (*Pyrenophora graminea*) were observed in 3, 14, and 4 fields at incidence levels of 1.0, 0.7, and 1.4%, respectively. These three diseases likely resulted in minimum crop damage. Loose smut (*U. nuda*) and take-all (*Gaeumannomyces graminis*) were found in 8 and 18 fields at mean incidences of 3.0 and 3.8%, respectively; these were higher severities than found in 2009 (Xue and Chen 2010). Fusarium head blight was observed in all fields (Table 1). The FHB index ranged from 1.0 to 40.0% with a mean of 9.1%. Severe or very severe levels of infection attributable to FHB were recorded in three and two fields, respectively. The disease likely resulted in significant losses of grain yield and quality in barley in 2010. Nine *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium graminearum* predominated and occurred in 90.5% of surveyed fields and on 27.0% of infected kernels. *Fusarium poae* was found in 95.2% of surveyed fields and 9.5% of affected kernels; the frequency of this species on kernels was higher than in 2009 (Xue and Chen 2010). *Fusarium avenaceum, F. equiseti,* and *F. sporotrichioides*

were common, occurring in 33.3-61.9% of surveyed fields, but kernel infection only ranged from 1.9-2.8%. Other species identified included *F. acuminatum, F. oxysporum, F. solani and F. verticillioides,* but only in a relatively few fields and on less than 1.0% of kernels.

Overall, the relative prevalence and severity of foliar diseases in barley in 2010 were similar to those reported in 2009 (Xue and Chen 2010). Spot blotch and net blotch continued to be the most prevalent diseases and were estimated to have caused significant yield reduction in 2010. Loose smut, take-all and FHB were more common and severe in 2010 than in 2009 (Xue and Chen 2010). High temperatures and frequent periods of rain in June and early July in 2010 were likely responsible for the increased severity of these diseases. The year 2010 can be described as an FHB-epidemic year for barley in Ontario.

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A.G. Xue and Y. Chen. 2010. Disease of barley in eastern Ontario in 2009. Can. Plant Dis. Surv. 90:68-69. (cps-scp.ca/cpds.shtml)

Table1: Prevalence and severity of barley diseases in eastern Ontario in 2010.

DISEASE	NO. CROPS AFFECTED (n=20)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
BYD	7	1.3	1.0-2.0
Leaf rust	14	2.1	1.0-4.0
Net blotch	19	3.3	1.0-7.0
Powdery mildew	6	2.2	2.0-3.0
Scald	7	1.4	1.0-2.0
Septoria/Stagonospora blotch	19	1.7	1.0-3.0
Spot blotch	20	4.8	2.0-7.0
Stem rust	8	2.3	1.0-4.0
Covered smut (%)	3	1.0	0.1-2.0
Ergot (%)	14	0.7	0.1-2.0
Leaf stripe (%)	4	1.4	0.1-3.0
Loose smut (%)	8	3.0	0.5-7.0
Take-all (%)	18	3.8	0.5-10.0
Fusarium head blight**	20		
Incidence (%)		39.0	10.0-80.0
Severity (%)		20.0	10.0-50.0
Index (%)		9.1	1.0-40.0

*Foliar disease severity rated on a scale of 0 (no disease) to 9 (severely diseased); leaf stripe, covered smut, ergot, loose smut, and take-all severity based on % plants infected

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

Table 2: Frequency of *Fusarium* species isolated from Fusarium damaged barley kernels in eastern Ontario in 2010.

***Fusarium* spp.**	**% OF FIELDS**	**% OF KERNELS**
Fusarium spp.	100.0	45.3
F. acuminatum	14.3	0.7
F. avenaceum	33.3	1.9
F. equiseti	33.3	2.3
F. graminearum	90.5	27.0
F. oxysporum	14.3	0.9
F. poae	95.2	9.5
F. solani	4.8	0.1
F. sporotrichioides	61.9	2.8
F. verticillioides	14.3	0.3

CROP / CULTURE: Spring and Winter Cereals
LOCATION / RÉGION: Southern Alberta

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TITLE / TITRE: 2010 SOUTHERN ALBERTA STRIPE RUST SURVEY

INTRODUCTION AND METHODS: Commercial crops of wheat, barley and triticale were surveyed for stripe rust (*Puccinia striiformis*) in southern Alberta from June 8 to September 30, 2010. Fields were traversed in a "V" pattern until 10 sites separated by 25 m had been evaluated for incidence and severity. Incidence was estimated visually as percent infected plants per 4 m. of row. Ten infected leaves from each observation point were evaluated for severity using the modified Cobb Scale (1). Means for severity and incidence of the observation sites were calculated for each location. Crops classed as clean had no stripe rust. Incidence levels of 1-2% with severity levels of 1-3% were classed as trace whereas incidence and severity from trace levels to 5% were defined as light. Moderate infections ranged in incidence from 6-15% and severity from 6-20%. Infections in excess of moderate levels were classed as severe (Table 1). Rainstorms in mid-June resulted in flooded fields in the Medicine Hat, Seven Persons, Taber and Lethbridge areas. Many producers reseeded flooded fields, further retarding crops and this resulted in late-season infections, the creation of a 'green bridge', and subsequent infection of fall-sown cereals. Fall-sown cereals were evaluated at the 3 leaf stage on September 30, 2010.

RESULTS AND COMMENTS: Surveys on winter cereals seeded in 2009 and spring cereals seeded in 2010 began on June 8 and June 17, respectively. Evaluation of crops continued throughout the growing season and completed with a final survey of fall-sown winter cereals on September 30. Trace levels of stripe rust were first observed in winter wheat at Lethbridge on June 27. As no stripe rust was observed prior to this date, it is unlikely stripe rust overwintered in southern Alberta in 2009-2010. By July 8th, stripe rust incidence and severity in flag leaves of the susceptible winter wheat cultivar AC Bellatrix were 50% and 80%, respectively, in the Cypress Hills region. By late July, severity in many crops of winter wheat cv. AC Radiant approached 30% suggesting the *Yr10* gene that confers stripe rust resistance in this cultivar was no longer effective.

The occurrence of stripe rust in hard red spring wheat was low as the dominant cultivar Lillian(2) that carries the gene *Yr18* remained resistant. Infections in the other common cultivars, such as Harvest and CDC Go, resulted in levels of severity and incidence ranging from 5 to 10%. Susceptible cultivars, such as Abound and Superb commonly had incidence and severity levels approaching 30%. The cool, wet conditions favoured secondary infections and severity on susceptible cultivars increased to 70-80% by mid-August in the area east of Fort McLeod. Half of the 10 crops of durum wheat surveyed were observed to have trace to light levels of infection. Of the six crops of triticale surveyed, all were free of stripe rust. Eleven fields of barley were surveyed during the season and only one late-sown crop near Lethbridge had trace levels of stripe rust by mid-September. High incidence and severity of stripe rust in juvenile winter wheat were observed in late September in the Cardston, Magrath and Lethbridge areas.

REFERENCES:
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2. Canadian Wheat Board 2010 Variety Survey (http://www.cwb.ca/en/farmers/surveys/variety/archive/popups/districts/district.jsp)

Table 1. Distribution of cereal crops surveyed in southern Alberta in 2010 in disease classes for stripe rust.

Disease Class	**Clean**	**Trace**	**Light**	**Moderate**	**Severe**
Percent Incidence	**0**	**1-2%**	**3-5%**	**6-15%**	**16-100%**
Percent Severity	**0**	**1-3%**	**4-5%**	**6-20%**	**21-100%**
Juvenile winter wheat (June 2010)	11	0	0	0	0
Adult winter wheat (July-Aug. 2010)	0	0	3	9	2
Spring wheat (Aug. 2010)	17	5	10	8	7
Durum wheat (Aug. 2010)	5	3	2	0	0
Triticale (Aug. 2010)	6	0	0	0	0
Barley	10	1	0	0	0
Juvenile winter wheat (Sept. 2010)	0	0	0	2	7

CROPS / CULTURES: Wheat, barley, oat
LOCATION / RÉGION: Saskatchewan

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TITLE /TITRE: SEED-BORNE FUSARIUM ON CEREALS IN SASKATCHEWAN IN 2010

INTRODUCTION AND METHODS: The results of agar plate tests on cereal seed samples from Saskatchewan provided by three companies are summarized. The tests were conducted between early September and late December, 2010 and it was assumed that the majority of samples came from the 2010 crop. The tests were conducted either to determine the frequencies of each species of *Fusarium* present or simply to detect *F. graminearum.* Data were tabulated for each Saskatchewan crop district [CD] (5) for *F. graminearum* and for all species combined (total *Fusarium*). The mean percent seed infection levels with *F. graminearum* and with total *Fusarium* were calculated. In addition, the percentage of *F. graminearum*–free samples was calculated. As almost none of the samples tested were free of all *Fusarium* spp., data on % *Fusarium*-free samples were not tabulated by CD.

The tests were performed on random seed samples, with no attempt to select fusarium-damaged kernels. Plating techniques varied slightly among companies. All tests were done by plating seed on potato dextrose agar and the petri dishes were incubated for 5 to 7 days. Illumination was with either fluorescent or a mixture of fluorescent and near UV (black) light and the dishes were arranged either singly or in stacked pairs under the light source. The number of seeds tested per sample was usually 200, but occasionally 400 or 1000. Thus, the probability of obtaining false negative results varied among tests. However, this was of negligible concern in 2010 because levels of seed-borne *Fusarium* spp. were very high.

RESULTS AND COMMENTS: In Saskatchewan the 2010 growing season was characterized by below-average temperatures, except in October, and six successive months (April – September) of well above average precipitation (5). These weather conditions caused delayed seeding, inability to plant crops, flooding damage, retarded plant development, failure to ripen, and slow, delayed harvesting (mostly in October). The only area of Saskatchewan with relatively good harvest conditions at the normal time was the extreme south (CDs 1A, 2AS, 3AS, 3BS, and 4A). However, even there substantial areas were not seeded or were damaged by flooding in the spring. Crop yields were generally above average, but quality was poor with the exception of the extreme south (5).

Fusarium head blight was more conspicuous in late summer on wheat and barley in eastern and south-eastern regions than in 2009 (1, 2). No data are available on the proportion of cereal crops that were sprayed with fungicides to control head blight. However, the cool moist weather in late summer in most areas was highly conducive to saprophytic spread of *Fusarium* spp. in ripening spikes and panicles. This undoubtedly also led to infection of cereal grains.

The data compiled are based on 470 samples (61% common wheat [all classes of spring and winter combined], 29% durum, 8% barley, 2% oat). As in previous years, *F. acuminatum*, *F. avenaceum*, *F. culmorum*, *F. equiseti*, *F. graminearum*, *F. poae* or *F. sporotrichioides* accounted for most of the *Fusarium spp.* isolated. Levels of seed-borne *Fusarium* were unprecedented. The provincial mean for total *Fusarium* (19%) was not only higher than any of the previous five years but almost four times the unweighted mean of those years (3, 4). Similarly, the provincial mean for *F. graminearum* of 4.2% was over four times as high as the previous recorded high of 1.0 in 2005 and seven times higher than the unweighted 5-year average. *Fusarium graminearum* was recorded in all but two of 20 districts and the two

districts were represented by very few samples. The species was present in 64% of all samples tested, higher by a factor of 1.5 than any of the previous 5 years (3, 4).

Mean levels of *F. graminearum* and of total *Fusarium* varied widely among CDs (Table 1). *Fusarium graminearum* was most abundant in CDs 1, 2, 5 and 8A, all adjacent to or near the Manitoba border, as has been reported in previous years. One sample from CD 5B had 76% infection with *F. graminearum* and 99% with total *Fusarium*. However, perhaps the most striking feature of the data collected was the very high levels of total *Fusarium* in areas normally considered to be prime areas for growing high-quality common and durum wheat. For example, samples with 20 - 40% total *Fusarium* were common in CDs 2A, 3BN, 6 and 7.

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5. Saskatchewan Ministry of Agriculture. 2010. Final Crop Report December, 2010. Regina, SK. 17 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

Table 1. Number of cereal seed samples tested from September to December 2010 and levels of infection with *Fusarium graminearum* or total *Fusarium* spp. in relation to Saskatchewan Crop Districts

		Fusarium graminearum		**Total *Fusarium****
Crop District	**No. of samples tested**	**Mean % infection**	**Samples with no infection detected**	**Mean % infection**
1A	18	3.1	0%	14.8
1B	6	4.4	0%	8.8
2A	33	3.8	18%	20.7
2B	51	2.2	35%	7.7
3AN	10	0.5	50%	3.3
3AS	22	0.3	73%	7.8
3BN	16	0.3	69%	20.9
3BS	3	0	100%	16.8
4A	8	0.1	75%	1.7
4B	9	0.1	78%	10.1
5A	15	5.5	0%	12.2
5B	36	28.1	8%	54.1
6A	40	2.5	10%	22.0
6B	63	2.1	46%	15.6
7A	41	0.5	66%	27.3
7B	11	<0.1	91%	18.4
8A	58	4.5	14%	15.3
8B	17	0.6	53%	21.9
9A	10	0.6	50%	10.0
9B	3	0	100%	1.3
TOTAL	470*	4.2	36%	19.0

*Number of samples tested for total *Fusarium* from all crop districts was 441.

CROP/ CULTURE: Barley, Oat and Wheat
LOCATION / RÉGION: Manitoba and eastern Saskatchewan

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TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2010

INTRODUCTION AND METHODS: Surveys of producer fields and trap nurseries of barley, oat and wheat for incidence and severity of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. and *P. graminis* Pers. f. sp. *avenae* Eriks. & E. Henn.) were conducted in July, August, and September 2010. Infected stem tissue samples were collected from the sites surveyed. Urediniospores were obtained from collections and evaluated for virulence specialization on sets of host differential lines (Fetch, 2009).

RESULTS AND COMMENTS: Cool conditions in May resulted in delayed planting of cereal crops, particularly in western Saskatchewan and Alberta. Mean temperature was average for the 2010 growing season across the Prairie region. Precipitation was well above average across the prairies, with 150-200% of the normal found in the rust area and >200% in central Saskatchewan. Environmental conditions for rust infection were good across the prairies. Nevertheless, incidence and severity on susceptible lines in trap nurseries and in commercial oat and barley fields was at trace levels across western Canada. Most commercial grain crops in Manitoba were sprayed with foliar fungicides, thus limiting the number of untreated crops for rust to infect. Low levels of stem rust inoculum migrating from the USA also help explain the light infection found in the trap nurseries.

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, cultivated barley, and on wild barley (*Hordeum jubatum*) in 2010. All isolates of *P. graminis* f. sp. *tritici* race in 2010 were QFCSC, which has been dominant since 2004.

Stem rust in cultivated and wild oat was at trace levels in western Canada in 2010. All oat cultivars except 'Stainless' are susceptible to stem rust races TJG, TJJ, and TJS (Fetch and Jin, 2007). Race TGN was dominant in 2010 (26% of total samples), followed by TGB (18%), TGD (14%), TJN (13%) and TJS (11%). Race TJJ (NA67), which has been dominant in the population for over 10 years, fell to 6% of the population in 2010.

A new and unique race of oat stem rust (TGP) was detected in 2010. This was found in one sample collected near Briercrest, Saskatchewan and is virulent on gene *Pg16*. This is the first report of virulence to *Pg16* from an isolate originating in the Prairie region. Race TGP is similar to race TGN and may have arisen as a single stem mutation in virulence to *Pg16*. Race TGP is not likely to threaten oat production at this time because it is avirulent to genes *Pg9*, *Pg13*, and the *Pg-a* complex. Genes *Pg2* and *Pg13* are likely present in resistant commercial oat cultivars (Mitchell Fetch and Fetch, 2011), and *Pg-a* is present in the cultivars Stainless and Souris.

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CROPS / CULTURES: Barley, Oat, Wheat
LOCATION / RÉGION: Manitoba and Saskatchewan

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TITLE / TITRE: **CEREAL SMUT SURVEYS, 2010**

INTRODUCTION AND METHODS: In July 2010, 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 sampled was covered by routes from Winnipeg - Weyburn - Moose Jaw - Watrous - Saskatoon - Melfort - Wadena - Canora – Yorkton - Roblin - Dauphin - Winnipeg, as well as one-day surveys around Winnipeg, MB in the Red River valley, near Brandon, MB, and in Manitoba's Interlake region. Fields were selected at random at about 10 - 15 km intervals, depending on 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 (<0.01%) were estimated by counting plants in a one m^2 area at a minimum of two sites along the path.

An isolate of smut was collected from each crop with smut and compared with a carboxin-sensitive isolate, '72-66' from Canada, and a carboxin-resistant isolate, 'Viva' (Newcombe and Thomas, 1991) from France. The teliospore germination assay of Leroux (1986) and Leroux and Berthier (1988) was used to determine if resistance to the fungicide carboxin was present. Teliospores of each isolate were streaked on half-strength potato dextrose agar amended with 0 or 1.0 µg ml^{-1} of carboxin. Cultures were incubated at 20°C in a controlled environment chamber and examined for teliospore germination after 24 h.

RESULTS AND COMMENTS: Loose smut (*Ustilago tritici*) was found in 16 (21%) of 76 fields of awnless common wheat surveyed. Two crops had incidences of 0.3%, and incidences of 0.2% and 0.1% were found in one crop each. The incidence of smut in the remainder of the infested crops was at trace levels. In awned common wheat, loose smut was found in 14 (17%) of 84 fields. One crop had an incidence of 1%, one had 0.5%, two had 0.2%, two had 0.1%, and the other infested crops had only trace levels. In durum wheat, loose smut was found in 11 (50%) of the 22 fields surveyed. Three had 2% infected plants, 2 had 0.5%, 1 had 1.5%, 1 had 0.1%, and the remaining infested fields had only trace levels.

None of the 39 fields of oat surveyed was observed to have smutted plants.

Loose smut (*U. nuda*) was found in 8 (57%) of 14 fields of six-row barley surveyed. Two crops had 3.0% incidence, one crop each had incidences of 2%, 0.3%, 0.2% and 0.1% and the smut incidence in the remainder of infested fields was at trace levels. Three (7%) of the 44 fields of two-rowed barley surveyed were found to have smutted plants. One crop had an incidence of 0.3%, and all other crops had trace levels. False loose smut (*Ustilago nigra*) was found in one six-row crop at a trace level. Covered smut (*U. hordei*) was not found in any fields of barley surveyed in 2010.

One isolate of *U. nuda* collected from a two-row barley crop was able to germinate and grow on agar amended with carboxin. This suggests that the isolate may be resistant to the fungicide carboxin, but further studies must be done to confirm this preliminary finding.

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CULTURES / CROPS: Avoine, *Avena sativa*; Orge, *Hordeum vulgare*; Blé, *Triticum aestivum*
RÉGION / LOCATION: Québec

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TITRE / TITLE : **MALADIES OBSERVÉES CHEZ LES CÉRÉALES AU QUÉBEC EN 2010**

INTRODUCTION et MÉTHODES : Les essais d'enregistrement et de recommandation de blé de printemps, d'orge et d'avoine, répartis dans différentes régions du Québec (CÉROM 2010), ont été visités une fois durant l'été 2010 pour y dépister les maladies du feuillage. L'intensité des symptômes a été notée entre le stade de développement laiteux moyen à pâteux moyen de la céréale et selon l'échelle de notation 0 à 9 (0 = aucun symptôme; 9 = symptômes sur plus de 50 % de la surface de la feuille étendard). Les valeurs de 0 à 4 réfèrent à une faible intensité, les valeurs de 4 à 6 à une intensité moyenne et les valeurs de 6 à 9 à une intensité élevée. L'information relative au déclassement de lots de blé dû à la présence de grains fusariés ou de désoxynivalénol provient du Service de mise en vente en commun du blé destiné à la consommation humaine de la Fédération des producteurs de cultures commerciales du Québec (FPCCQ). La Financière agricole du Québec (FADQ) a fourni, quant à elle, le nombre d'avis de dommages aux cultures d'orge qui avaient comme cause principale la fusariose. Les dommages causés par la cécidomyie orangée du blé (*Sitodiplosis mosellana*), un insecte associé à la fusariose de l'épi (*Fusarium graminearum*) par le transport de l'inoculum de *Fusarium* jusqu'aux épis, ont été notés visuellement sur 45 lots de blé récoltés dans différentes régions du Québec.

RÉSULTATS et COMMENTAIRES : Le printemps 2010 a été très hâtif de sorte que la plupart des essais ont été semés tôt et dans de bonnes conditions. Dans les régions centrales et du sud-ouest de la province, les précipitations ont été bien réparties tout au long de l'été alors que dans les régions du Saguenay-Lac-Saint-Jean, du Bas-Saint-Laurent et de la Gaspésie, les cultures semées plus tardivement ont souffert de sécheresse. Pour ce qui est des températures, il y a eu canicule pendant la première semaine de juillet dans presque toutes les régions visitées.

Comme à chaque année la tache ovoïde (*Stagonospora avenae*) de l'avoine a été observée dans toutes les régions en 2010. L'intensité des symptômes était moyenne pour la plupart des lignées/cultivars évalués. La rouille couronnée (*Puccinica coronata*) a été beaucoup moins répandue qu'à l'habitude alors qu'elle a été notée seulement à La Pocatière (Bas-Saint-Laurent). Par contre l'intensité des symptômes de rouille de cet essai a été très discriminante envers les lignées/cultivars, variant de faible à élevée. La jaunisse nanisante de l'orge (VJNO) a été, tout comme en 2009, quasi absente des essais visités (Rioux et al. 2010).

Chez le blé en 2010, les taches foliaires (*Pyrenophora tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*) d'intensité moyenne-élevée étaient présentes dans toutes les régions. La rouille des feuilles (*Puccinia triticina*) était moins répandue et de plus faible intensité que par les années passées, alors que l'oïdium (*Blumeria graminis* f. sp*. tritici*, syn. *Erysiphe graminis*) présent aux deux stations habituelles, soit Princeville (Centre-du-Québec) et Saint-Augustin-de-Desmaures, et aussi à la nouvelle station de Saint-Lambert (Chaudière-Appalaches), a été plus intense en 2010. La fusariose de l'épi s'est manifestée fortement dans le sud-ouest de la province, en Montérégie-Est et en Montérégie-Ouest, où elle a été la principale cause du déclassement de 95 % des lots de blé produits dans ces deux régions. Les autres régions ont été épargnées par la maladie. La plus grande superficie en maïs des

deux régions touchées, et par conséquent la plus grande quantité de résidus de maïs se trouvant à la surface du sol, jumelée à des précipitations qui ont permis la production et la dissémination de l'inoculum pendant l'épiaison et la floraison du blé peuvent expliquer la plus grande incidence de fusariose de ces deux régions par rapport aux autres. Le degré d'infestation de cécidomyie orangée du blé des lots de grains évalués a été plus élevé en 2010 qu'en 2009 avec en moyenne 2,6 larves par épi comparativement à 1,8 en 2009 (Rioux et al. 2010). En moyenne, 1,2 % (0 à 4,9 %) des grains présentaient des dommages dus à l'insecte. Près de 16 % (7/45) des échantillons dépassaient les 2 % de grains cécidomyiés qui est la norme pour le blé CWRS (Canada Western Red Spring) grade nº1.

Ce qui a retenu l'attention chez l'orge en 2010 est la présence plus marquée de l'oïdium (*Blumeria graminis* f.sp*. hordei*). Cette maladie s'est, en effet, manifestée dans quatre régions (Montérégie-Est, Centre-du-Québec, Capitale-Nationale et Bas-Saint-Laurent) et l'intensité des symptômes a varié de faible à moyenne, alors qu'habituellement elle est moins répandue et d'intensité plutôt faible. Les taches foliaires (*Pyrenophora teres*, *Rhynchosporium secalis* et *Cochliobolus sativus*), quant à elles, ont été comme à l'habitude omniprésentes et d'intensité moyenne à élevée. La rouille des feuilles (*Puccinia hordei*) n'a pas été observée chez l'orge en 2010. Selon les informations obtenues de la FADQ (Bertrand Leclerc, communication personnelle), la fusariose de l'épi chez l'orge n'a pas été un grave problème en 2010 pour l'ensemble du Québec alors que 5,7 % des producteurs assurés (56 sur 989) ont signalé des dommages à leur culture attribuables à cette maladie. Rappelons que cette proportion était de 30,5 % en 2009 et 14,3 % en 2008 (Rioux et al. 2010).

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

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TITLE / TITRE: SURVEY OF CORN DISEASES AND PESTS IN ONTARIO AND QUÉBEC IN 2010

INTRODUCTION AND METHODS: From September 3 to September 16, 2010, a corn pest (diseases and insect pests) survey was conducted in Ontario and Québec. As in previous years (1, 2, 3), the emphasis of this year's survey was to determine the distribution and severity of corn diseases and insect pests including eyespot (*Aureobasidium zeae*), common rust (*Puccinia sorghi*), northern corn leaf blight (*Exserohilum turcicum*), anthracnose leaf blight (*Colletotrichum graminicol*a), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi* = *Sphacelotheca reiliana*), ear rot (*Fusarium spp*.), stalk rot (*Fusarium spp*. and *C. graminicol*a), Stewart's wilt (*Pantoea stewartii* = *Erwinia stewartii*), European corn borer (*Ostrinia nubilalis*), corn rootworm (*Diabrotica longicornis* and *D. virgifera*), and corn flea beetle (*Chaetocnema pulicaria*). In addition, scouting for newer pests to Canada, especially grey leaf spot (*Cercospora zeae-maydis*) was continued.

At each of 152 fields in Ontario and 54 fields in Québec surveyed, the incidence of each pest and the severity of the predominant pests were recorded. Nine Stewart's wilt-like leaf samples were collected in the survey from southern Ontario. ELISA tests for the pathogen *P. stewartii* (Stewart's wilt) were done using reagent sets, protocols, and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

RESULTS AND COMMENTS:
Fungal leaf diseases: Eyespot was detected in 101 fields in Ontario and 51 fields in Québec (Table 1). Twenty-eight crops were rated as having intermediate to high levels of eyespot severity, and included nine with very high severities in Oxford, Wellington, Dufferin, Northumberland, Renfrew, Leeds & Grenville, Ottawa-Carleton, and Stormont, Dundas & Glengarry counties, ON, and seven with intermediate to high levels in Vaudreuil-Soulanges, Maskoutains, and D'Autray counties, QC. Some hybrids entered in the Ontario Corn Committee (OCC) trials at Alma and Elora in Wellington County, at Pakenham in Ottawa-Carleton County, and at Lancaster in Stormont, Dundas & Glengarry County, ON were moderately to highly susceptible to eyespot. Unusually, eyespot and common rust appeared together in five Ontario crops at combined intermediate to high severities. Common rust was found in 129 crops in Ontario and 37 in Québec (Table 1). Three sweet corn crops had intermediate to high disease severity levels. In 2010, common rust was more prevalent in southern Ontario than in eastern Ontario and Québec; however, two crops in eastern Ontario, and three in Québec had intermediate disease severity levels. Thirteen crops were found to have intermediate to high levels of common rust, including five with very high levels in Wellington, Northumberland, Ottawa-Carleton, and Stormont, Dundas & Glengary counties, ON. Some hybrids entered in the OCC trials at Alma, Elora and Pakenham appeared to be moderately to highly susceptible to common rust. Southern rust (*Puccinia polysora* Underw.) was not found in 2010. Typical symptoms of grey leaf spot (GLS) were found in 90 crops in 18 counties of Ontario and two crops in two counties in Québec (Table 1). GLS was found at intermediate severities in two Middlesex, one Oxford, and one Wellington County crops. One hybrid in the Alma OCC trial was highly susceptible to GLS. Grey leaf spot was first observed in Québec in 2010. The incidence of GLS appears to be increasing annually and has the potential to become a significant problem in Canada, as it is in the United States. Anthracnose leaf blight (ALB) was found in 96 crops in Ontario and 43 in Québec (Table 1). Overall, ALB is one of the most common leaf diseases in Canada but in 2010 its incidence was sporadic. Northern corn leaf blight (NCLB) was found in 149 crops in Ontario and 53 in Québec. NCLB was the most prevalent leaf disease in Ontario and Quebec in 2010. Only four of the corn crops surveyed did not show symptoms of the disease (Table 1). In Ontario, 24 crops had intermediate and high disease severity levels, including three seed corn crops; very high severity levels

were recorded in nine grain corn crops in Chatham-Kent, Lambton, Huron, Perth, Wellington, Hastings, Lanark, Renfrew, Ottawa-Carleton, and Stormont, Dundas & Glengarry counties, ON. Four grain corn crops in Québec had intermediate or high disease severities, including two with very high levels of NCLB in Vaudreuil-Soulanges and Drummond counties, QC. At the Ridgetown, Thorndale, Woodstock, Waterloo, and Lancaster OCC trials, some hybrids showed intermediate susceptibility to NCLB, while at the Blyth, Wingham, Alma, and Ottawa OCC trials, many hybrids were intermediate to highly susceptible to NCLB. Both resistant and susceptible NCLB lesion types were observed in 29 crops in Ontario and 19 in Québec, some even on the same leaf. Resistant and susceptible lesions on the same hybrid, especially on the same leaf, indicate that different pathogenic races may exist in both Ontario and Québec. Five crops had very high NCLB disease levels even though plants had both resistant and susceptible lesions. A new disease in the survey area, Northern corn leaf spot (NCLS), was observed, with long narrow stripe-like lesions along the leaf veins, somewhat similar to those of grey leaf spot. The pathogen involved, *Cochliobolus carbonum,* has similar spores to *E. turcicum*, but the spores are both shorter and darker in colour. NCLS were found in seven crops in Ontario (Table 1), including two of the OCC trial locations, and three crops in Québec.

Fungal Ear and Stalk diseases: Gibberella/Fusarium ear rots were observed in 61 crops in Ontario and 25 in Québec (Table 1). Two seed corn crops were also affected; one had >10% incidence and another 100% ear rot incidence, which appeared to be associated with split kernels in the ear. Penicillum ear rot was found at the Tilbury OCC trial field. Common smut was distributed across 90 crops in Ontario and 24 in Québec in 2010 (Table 1). Ten crops had >5% incidence of common smut in Ontario, including four seed corn crops with 20-24% incidence in the southern part of the province. In Québec, there were only two crops with significant common smut incidence levels of 5-10%. Head smut was found in four eastern Ontario crops, one of these at 17% incidence in Ottawa-Carleton County, and in 16 crops in Québec, where five had incidences of 3-25% and 11 had incidences <1%. As in previous years, many ears had black mould /spores on the kernels as a result of damage by birds or insects.

Stalk rot, including Anthracnose stalk rot/top-die back, *Fusarium* stalk rot, and *Pythium* stalk rot were found in 111 crops in Ontario and 47 in Québec (Table 1). Only eight crops in Ontario and two in Québec had severe top-die back with incidence levels of 80-100%. *Pythium* stalk rot, often referred to as early death, was most often detected in irrigated seed corn fields or wet grain corn fields.

Bacterial diseases: In 2010, no typical Stewart's wilt symptoms were observed. All nine equivocal samples collected were negative for *P. stewartii*, based on the ELISA test. It was noted that populations of the Corn flea beetle (CFB) were very low in southern Ontario in 2010.

No Goss's bacterial wilt (*Clavibacter michiganensis* subsp. *nebraskensis* = *Corynebacterium michiganense* pv. *nebraskense*) and no Holcus leaf spot (*Pseudomonas syringae*) were found in 2010.

Virus diseases: No virus diseases were observed during the 2010 survey.

Insects: European corn borer (ECB) damage was observed in 94 crops in Ontario and 33 in Québec (Table 1). Some hybrids at the West Loren, Winchester and Lancaster OCC trials had up to 10-20% incidence of this insect pest. Corn rootworm (CRW) damage was observed in 111 crops in Ontario and 53 in Québec (Table 1). As in previous years (1, 2, 3), the main damage from CRW in most fields was leaf feeding and silk pruning.

Populations of grasshopper, most likely red-legged grasshopper [*Melanoplus femur-rubrum* (De Geer)], were low in 2010 in both Ontario and Québec. However, more aphid damage was observed in Ontario in 2010, including damage to plants at six OCC trial fields. Corn blotch leaf miner (*Agramyza parvicornis* Loew), was not as prevalent as in previous years. As reported before, brown stink bug (*Euschistus servus*) and picnic Beetle (*Glischrochilus quadrisignatus*) were found in a few fields in both Ontario and Québec, but their populations were very low.

Mites: Two-spotted spider mite (*Tetranychus urticae* Koch = *T. bimaculatus* Harvey) populations were low in 2010 in both Ontario and Québec.

Summary: Moderate to high temperatures and adequate precipitation levels in most regions surveyed resulted in 2010 being a very favourable growing season for corn. However, more than 20 days of rain, including six long-lasting rainfalls between August 1 and September 15, created excellent conditions for foliar disease development, especially for northern corn leaf blight, common rust, eyespot, and grey leaf spot. Northern corn leaf blight was the most prevalent disease in 2010. Eyespot and common rust were severe in some counties in both Ontario and Québec. The highest severities of grey leaf spot found to date were observed in three Ontario counties. Stewart's wilt was not found in 2010. Higher levels of common smut were found in seed corn fields in southern Ontario, and more head smut was found in eastern Ontario and Québec than in other regions. Ear rot was severe in two seed corn crops. Anthracnose leaf blight, and stalk rot were less important diseases in 2010. European corn borer, corn rootworm, grasshoppers, and mites were less problematic in 2010 than previously, in both Ontario and Québec.

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Table 1: Distribution of pests in corn fields in Ontario and Québec in 2010

County	# of Fields	Eyespot	Rust	GLS	ALB	NCLB	NCLS	Smut	Head smut	Ear rot	Stalk rot	ECB	CRW	Grasshopper	Mites
Ontario															
Bruce	1		1	1	1	1		1			1	1	1	1	
Chatham-Kent	27	4	26	23	24	27		23		17	15	23	9	15	12
Dufferin	4	4	4	2	2	4		2		1	3	3	4	3	1
Durham	1	1				1					1	1		1	
Elgin	6	6	6	6	6	6		4		2	5	6	5	4	2
Essex	5		5	4	4	5		3		2	5		3	2	2
Hastings	3	1	2		2	3				1	2	2	2	3	1
Huron	10	4	9	10	4	10		7		1	7	4	10		5
Lambton	9	3	7	9	7	9		3		3	9	2	4	8	6
Lanark	8	8	7	1	3	8		4		5	8	7	8	4	4
Leeds & Grenville	7	7	6	1	5	7	2	6		7	7	5	6	4	1
Lennox & Addington	1	1		1	1	1					1		1	1	
Middlesex	7	3	7	7	3	7	1	7		2	5	3	5	5	3
Northumberland	5	5	4	2	3	5		1		1	3	4	3	4	2
Ottawa-Carleton	9	9	6	2	5	9	2	4	3	6	8	5	6	6	5
Oxford	6	6	6	5	1	6	1	4		2	4	4	5	6	1
Perth	7	6	6	6	2	7		6		1	3	6	6	7	2
Prescott & Russell	4	2	3		2	4		1			4	2	4	1	1
Renfrew	14	14	11		5	11		2	1	7	10	3	13	10	6
Stormont, Dundas & Glengarry	9	9	7	2	9	9	1	6		2	4	8	8	7	2
Waterloo	5	4	2	4	5	5		3			3	1	5	4	3
Wellington	4	4	4	4	2	4		3		1	3	4	3	3	1
Total	**152**	**101**	**129**	**90**	**96**	**149**	**7**	**90**	**4**	**61**	**111**	**94**	**111**	**99**	**60**
Québec															
Argenteuil	1	1	1			1				1	1		1	1	
Bas-Richelieu	3	3	2		3	3		2		1	3	1	3	3	1
Brome-Missisquoi	3	3	1		3	3		2		1	3	1	3	3	
D'Autray	2	2	2		1	2		1	2	1	2	1	2	2	
Drummond	3	3	2		3	3	1	1			3	3	3	3	1
Haut-Richelieu	3	3	3		2	3		2			3	1	2	3	2
Joliette	2	2	2		1	2		1		2	2	2	2	2	1
Maskinonge	5	3	4		3	5		1	3	4	4	4	5	4	3
Maskoutains	7	6	4	1	6	6	2	3	3	3	6	4	7	4	5
Mirabel	3	3	2		1	3			2	1	3	2	3	1	
Montcalm	3	3	1		3	3		1	3	1	3	2	3	3	2
Moulins	2	2	1		2	2			1	1	1	2	2	1	
Nicolet-Yamaska	3	3	2		3	3		2	2	2	3	2	3	3	1
Rouville	5	5	4		5	5		4		2	5	3	5	3	1
Trois-Rivières	2	2	2	1	2	2				2	2	2	2	2	
Vaudreuil-Soulanges	7	7	4		5	7		4		3	3	3	7	7	
Total	**54**	**51**	**37**	**2**	**43**	**53**	**3**	**24**	**16**	**25**	**47**	**33**	**53**	**45**	**16**

Rust = common rust. GLS = Grey leaf spot. ALB = Anthracnose leaf blight, NCLB = northern corn leaf blight, NCLS = northern corn leaf spot, Smut = Common smut. Ear rot: including Gibberella ear rot and Fusarium ear rot. Stalk rot: including Fusarium stalk rot, Pythium stalk rot, Anthracnose stalk rot, and top-die back. ECB = European corn borer. CRW = Corn rootworm, including both western and northern corn rootworm.

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: 2009 AND 2010 SURVEYS FOR FHB-CAUSING FUSARIUM SPECIES IN SASKATCHEWAN OAT CROPS

INTRODUCTION AND METHODS: The prevalence and severity of FHB in oat crops in Saskatchewan and the identification and quantification of *Fusarium* species responsible were determined from a survey of 259 commercial fields between August 6 and September 17, 2009 and 72 fields between August 5 and September 14, 2010. There were fewer available oat crops in 2010, possibly due to excessive rainfall throughout spring and summer and its effect on the number of fields that were seeded. Delayed seeding may also have led to crops not being at the appropriate developmental stage, and hence not being sampled at the time of the survey.

Oat crops were selected at random and ideally panicles were collected at the late milk to early dough stage of development. Samples were not collected from adjacent fields or from atypical areas in fields (i.e., low-lying areas, edges, or knolls). Twenty panicles were harvested from each crop, placed in paper bags, and air-dried at room temperature. Samples were hand threshed and 50 oat grains were surface-sterilized in 3% (v/v) NaOCl for 2 minutes. Surface-sterilized grains were rinsed in water to remove residual NaOCl and plated on potato dextrose agar. Fungal colonies were isolated and *Fusarium* species identified based on morphological characteristics (Gerlach and Nirenberg 1982).

The remaining grain was ground to a fine powder and DNA was extracted using a commercially-available extraction kit. Primers and TaqMan probes (6-FAM/TAMRA) specific for five *Fusarium* species (*F. graminearum*, *F. poae*, *F. sporotrichioides*, *F. culmorum*, and *F. avenaceum*) were designed based on available DNA sequence information (Halstensen et al., 2006; Yli-Mattila et al., 2008; Nicolaisen et al., 2009) and real-time PCR was performed with the StepOnePlus Real-Time PCR system or the 7900HT Fast Real-Time PCR System (Applied Biosystems) to detect and quantify each *Fusarium* species.

RESULTS AND COMMENTS: The results from the agar plate method and real-time PCR to detect the presence of *Fusarium* species are provided in Table 1. A comparison of the two methods indicates real-time PCR was more sensitive than the agar plate method in detecting the various species.

In 2009, *F. poae* was the most prevalent species with 244 of 259 crops testing positive for its presence. The next most common species detected were *F. avenaceum* (61 crops) and *F. graminearum* (13 crops). *F. culmorum* and *F. sporotrichioides* were detected in only 7 and 6 crops, respectively, while *F. equiseti* was detected in only one crop based on the plate method. No crop tested positive for all *Fusarium* species and only 13 were free of detectable levels of any of the species (based on real-time PCR). All crops negative for *F. poae* were also negative for other species in the real-time PCR analysis, except for two crops in which *F. graminearum* or *F. sporotrichioides* was detected.

In 2010, *F. poae* was again the most prevalent species (detected in all 72 crops tested) with *F. graminearum* (45 crops) and *F. avenaceum* (13 crops) being the next most common. *Fusarium culmorum* and *F. sporotrichioides* were detected in only 2 crops each. Similar to 2009, no crop tested positive for all *Fusarium* species, although one had detectable levels of all species except *F. sporotrichioides.*

The quantity of *Fusarium* DNA detected by real-time PCR ranged from 0.002 to 3.509 pg/ng extracted DNA in 2009 and 0.010 to 4.793 pg/ng extracted DNA in 2010. In general, the level of *Fusarium* infestation as determined by the quantity of DNA of each species per sample was similar in 2009 and

2010. The range of *Fusarium* DNA abundance in crops that tested positive for each species is provided in Figure 1.

ACKNOWLEDGEMENTS:
We thank Bruce Roskens (Quaker Oats), the Saskatchewan Ministry of Agriculture, and the Saskatchewan Crop Insurance Corporation for assistance with oat sample collection. We gratefully acknowledge the Western Grains Research Foundation for their financial support.

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Yli-Mattila, T., Paavanen-Huhtala, S., Jestoi, M., Parikka, P., Hietaniemi, V., Gagkaeva, T., Sarlin, T., Haikara, A., Laaksonen, S., and Rizzo, A. 2008. Real-time PCR detection and quantification *of Fusarium poae*, *F. graminearum*, *F. sporotrichioides*, and *F. langsethiae* in cereal grains in Finland and Russia. Arch. Phytopathol. Plant Protect. 41:243-260.

Table 1. *Fusarium* spp. detected in oat crops in Saskatchewan in 2009 and 2010.

	2009		2010	
***Fusarium* spp.**	**% of crops (agar plate)**	**% of crops (real-time PCR)**	**% of crops (agar plate)**	**% of crops (real-time PCR)**
F. graminearum	0.4	5.0	1.4	62.5
F. poae	29.7	94.2	33.3	100
F. sporotrichioides	1.2	2.3	0.0	2.8
F. culmorum	0.4	2.7	1.4	2.8
F. avenaceum	3.9	23.6	4.2	18.1
F. equiseti	0.4	n/a*	0.0	n/a*

*real-time PCR not performed to detect the presence of *F. equiseti*

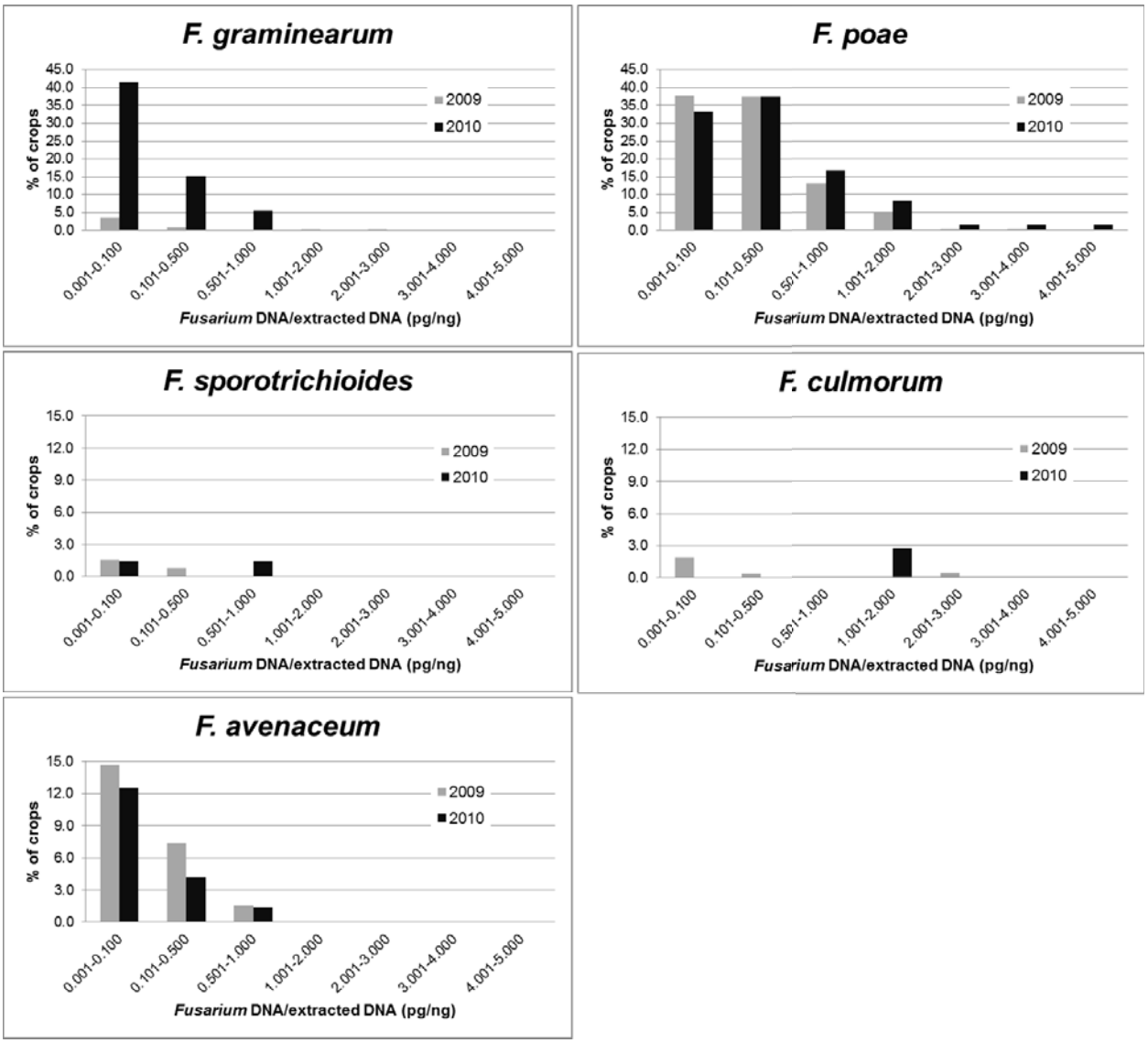

Figure 1. *Fusarium* DNA abundance in Saskatchewan oat crops in 2009 and 2010. Note differences in y-axis scale between *F. graminearum* and *F. poae* and the other species.

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: MONITORING FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA IN 2010

INTRODUCTION AND METHODS: The occurrence of Fusarium head blight (FHB) in oat in southern Manitoba in 2010 was assessed by monitoring 40 commercial fields from July 21-30, when crops were at the late milk to soft dough (ZGS 78-85) stages of growth. The fields were selected at random along the survey routes, depending on crop frequency. The area of southern Manitoba sampled was bounded by Highway #s 17, 16 and 45 to the north, Hwy #3 in the south, Hwy #12 to the east, and Hwy #83 to the west. Fusarium head blight in each crop was assessed by collecting a minimum of 80-100 plants gathered as a clump at each of 3 locations and assessing them for the presence of infected spikelets on panicles (disease incidence), and for the average proportion of putatively infected panicles (SPI). Fusarium head blight severity was calculated as the 'FHB Index' (% incidence x % SPI) / 100. Several affected panicles, or 'normal' panicles, as necessary, closest to each of the clumps sampled were collected from each location, placed in plastic bags and frozen. Subsequently, 50 putatively infected kernels per field were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar in Petri plates (10 kernels per plate). This was to identify and quantify the *Fusarium* spp. present based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Conditions during the 2010 growing season in southern Manitoba were wetter than normal (up to 200% normal total rainfall), but with near normal growing degree day accumulation. Seeding of some spring crops was delayed or abandoned due to wet fields, and crop development slowed by early-season cool weather. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost.

Oat was grown on some 192,000 ha (475,000 acres) in Manitoba in 2010, with five cultivars each occupying >10% of the acreage: 'Furlong' (22%), 'Leggett' (20%), 'Souris' (16%), 'Pinnacle' (11%) and 'Ronald' (11%) ('Yield Manitoba 2011', Manitoba Agricultural Services Corporation, supplement to The Manitoba Co-operator, Feb 24, 2011).

Eleven of the 40 oat crops monitored, appeared to be 'free' of FHB, based on the lack of definitive symptoms such as orange-pink or otherwise discoloured spikelets on a panicle. Overall, the average incidence of FHB was estimated to be 1.2% (range 0 - 11%), SPI as 6.1% (range 0 - 65%) and the FHB Index 0.1% (range 0 – 1.3%). As such, FHB was estimated to have caused no yield loss in Manitoba oat crops in 2010. This low level of mid-season FHB severity is typical for oat, and since 2003 the FHB Index has typically been <0.1%, and always much lower than that in wheat or barley.

Fusarium colonies developed from 7.4% of the oat kernels plated on potato dextrose agar medium, less than half the percentage in 2009, which, however, was an unusual situation (Tekauz et al. 2010). *Fusarium graminearum* predominated in 2010, was found in 2/3rd of crops and made up 2/3rd of the total *Fusarium* flora (Table 1). Three other *Fusarium* spp. were detected in from 18-23% of fields, and comprised 8-14% of the total *Fusarium*.

REFERENCE:
Tekauz, A., Stulzer, M., and Beyene. 2010. Fusarium head blight of oat in Manitoba in 2009. Can. Plant Dis. Surv. 90: 53-54. (cps-scp.ca/cpds.shtml)

Table 1. *Fusarium* spp. isolated from fusarium head blight affected oat kernels from Manitoba in 2010.

Fusarium spp.	Percent of crops	Percent of kernels
F. avenaceum	18	7.5
F. equiseti	5	1.4
F. graminearum	65	67.3
F. poae	25	13.6
F. sporotrichioides	23	10.2

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba and East-Central Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES IN MANITOBA AND SASKATCHEWAN OAT IN 2010

INTRODUCTION AND METHODS: In 2010, leaf spot diseases in 40 commercial oat crops in Manitoba and 10 in east-central Saskatchewan were assessed during surveys done from July 21-30 (MB) and August 24-27 (SK) at which time plants were at the late-milk to soft-dough (ZGS 78-85) stages of growth. Fields were sampled at regular intervals along the survey routes, depending on availability. The area sampled in Manitoba was bounded by Highways # 67, 16 and 46 to the north, the Manitoba/North Dakota border to the south, Hwys #12 and 9 to the east, and Hwys #83 and 41 to the west. Disease incidence and severity were recorded by averaging their occurrence on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Disease ratings were taken on 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%). Infected leaves with putative leaf spot symptoms were collected at each site and dried and stored in paper envelopes. In Saskatchewan, the crops surveyed were in the east-central region and only the upper canopy was sampled for leaf spot severity. Foliar tissue with typical lesions was collected at each site, placed in paper envelopes and allowed to dry. For all collections, surface-sterilized pieces of infected leaf tissue were subsequently placed in moist chambers for 3-5 days to promote pathogen sporulation to identify the causal agent(s), and to determine the disease(s) present and their relative importance.

RESULTS AND COMMENTS: In southern Manitoba, conditions during the 2010 growing season were wetter than normal (up to 200% total rainfall), but with near normal growing degree day accumulation. Seeding of some spring crops was delayed or abandoned due to wet fields (the latter largely in the Interlake and South-west regions), and crop development was slowed by early-season cool weather. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost. In Saskatchewan, excess precipitation combined with lack of both heat and sunshine created many challenges for farmers in 2010. Crops were stressed from excess moisture with most of the province receiving 115 to 150 per cent of normal precipitation. Early-season conditions resulted in many crops not being seeded, or if seeded, subsequently being damaged by flooding.

Oat was grown on some 475,000 acres in Manitoba in 2010, with five cultivars each occupying >10% of the acreage: 'Furlong' (22%), 'Leggett' (20%), 'Souris' (16%), 'Pinnacle' (11%) and 'Ronald' (11%) – ('Yield Manitoba 2011', Manitoba Agricultural Services Corporation, supplement to The Manitoba Co-operator, Feb 24, 2011). In Saskatchewan, some 376,000 ha (930,000 acres) of oat were seeded but only 273,000 ha harvested (Statistics Canada, Field Crop Reporting Series, 2010).

Leaf spots were observed in the upper and/or lower leaf canopies of 31 (78%) of the Manitoba oat crops monitored, a somewhat lower proportion than usual; in Saskatchewan all 10 crops sampled showed evidence of leaf spotting (Tekauz et al., 2010, 2009, 2008). In Manitoba, all crops with visible leaf spotting had disease levels in the upper canopy rated as trace to slight. In the lower canopy trace to slight levels were observed in 75% of the affected crops, while moderate and severe/senesced levels were noted in 20% and 5%, respectively. On average, yield losses from leaf spots in oat in Manitoba would have been minimal, perhaps 1-2%. In Saskatchewan, 6 crops were rated as having trace or slight levels of leaf spotting in the upper canopy, 3 with a moderate level and one with a severe level. This suggests that leaf spots caused somewhat more damage to oat in east-central Saskatchewan than in Manitoba, but likely still only a yield loss of < 5%.

In Manitoba, *Pyrenophora avenae*, causal agent of pyrenophora leaf blotch, was the most prevalent pathogen and caused most of the damage observed (Table 1). This is in contrast to 2009, when *Stagonospora avenae* f.sp. *avenae* (stagonospora leaf blotch) predominated (Tekauz et al. 2010), but similar to the situation occurring in previous years (Tekauz et al. 2009, 2008). *Cochliobolus sativus* (spot blotch) was more prevalent than in the previous three years, and was estimated to have caused 20% of the damage observed. *Stagonospora avenae* f.sp. *avenae* levels were much lower than normal, and this pathogen and the disease it causes appeared to be only minor components of the leaf spot complex on oat in 2010.

In east-central Saskatchewan, *P. avenae* predominated, as has been the case in the previous three years (Tekauz et al. 2010, 2009, 2008), but even more so in 2010. The pathogen was detected in all fields and caused nearly all of the leaf spot damage observed (Table 1). *Stagonospora avenae* f.sp. *avenae* and *Cochliobolus sativus* were less prevalent and caused minor damage to the crop.

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Tekauz, A., Kutcher, H.R., Mueller, E., Stulzer, M, and Beyene, M. 2008. Foliar diseases in Manitoba and Saskatchewan oat fields in 2007. Can. Plant Dis. Surv. 88:75-76. (cps-scp.ca/cpds.shtml)

Table 1. Incidence and isolation frequency of leaf spot pathogens from oat crops sampled in southern Manitoba and east-central Saskatchewan in 2010.

Pathogen	Incidence (% of crops)		Frequency (% of isolations)*	
	MB	SK	MB	SK
Pyrenophora avenae	65	100	74.0	85.0
Cochliobolus sativus	33	30	20.0	8.0
Stagonospora avenae f. sp. *avenae*	10	20	6.0	8.0

*indicative of the relative amount of foliar damage observed

CROP / CULTURE: Oat
LOCATION / RÉGION: Eastern Ontario

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TITLE / TITRE: DISEASES OF OAT IN EASTERN ONTARIO IN 2010

INTRODUCTION AND METHODS: A survey of oat diseases was conducted in eastern Ontario in the last week of July when plants were at the soft dough stage of development. Fifteen fields were chosen at random in eastern Ontario regions where most of the oat 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). Disease diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for ergot, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (percent infected panicles) and severity (percent infected spikelets in the affected panicles) based on approximately 200 panicles at each of three random sites in each field. A FHB index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 50 infected heads (panicles) collected from each field. The panicles were air-dried at room temperature and subsequently threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 seconds and plated in 9-cm diameter Petri plates on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. The plates were incubated for 10-14 days at 22-25ºC and with a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: A total of 10 diseases were observed in the oat crops surveyed (Table 1). Crown rust (*Puccinia coronata* f.sp*. avenae*) was the most prevalent disease and was observed in all fields at a mean severity of 4.5. Severe levels of infection were noted in six fields. Yield reductions attributable to crown rust were estimated to average >10% in the surveyed fields. Spot blotch (*Cochliobolus sativus*) and stagonospora leaf blotch (*Stagonospora avenae* f.sp. *avenaria)* also were common foliar diseases and were recorded in 14 and 13 fields, at mean disease severities of 3.4 and 3.1, respectively. Severe levels of infection from each disease were found in two fields and were estimated to have resulted in yield reductions of >5%. Barley yellow dwarf (BYDV), halo blight (*Pseudomonas syringae* pv. *coronafaciens*) and pyrenophora leaf blotch (*Pyrenophora avenae*) were observed in 4, 8 and 14 fields at mean severities of 1.0, 1.8 and 2.6, respectively; these all likely resulted in minimum damage.

Take-all root disease (*Gaeumannomyces graminis* var. *avenae*) was found in 13 crops at a mean incidence of 3.5% (Table 1); this incidence level was higher than found in 2009 (Xue and Chen 2010). Ergot (*Claviceps purpurea*) and loose smut (*Ustilago nuda*) were recorded in 4 and 3 fields at mean incidences of 0.3% and 0.7%, respectively; they likely had a minor impact on crop yield. Fusarium head blight was observed in all fields surveyed with an FHB Index ranging from 0.3 to 4.0% and a mean of 1.3%. Severe or very severe levels of infection by FHB were not observed. Eight *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium poae* predominated, occurring in all fields, and on 14.3% of discolored kernels. *Fusarium graminearum* and *F. sporotrichioides* also were commonly isolated and were recorded in 73.3 and 60.0% of the surveyed crops, and 5.4 and 2.5% of discoloured kernels, respectively. Other *Fusarium* species included *F. acuminatum, F. avenaceum, F. equiseti*, *F. oxysporum,* and *F. solani*, but these were isolated from only 0.3 to 1.4% of discolored kernels suggesting they were minor contributors to FHB in oat in Ontario.

Overall, the relative prevalence and severity of foliar diseases in oat in 2010 were similar to levels found in 2009 (Xue and Chen 2010). Crown rust, spot blotch, and stagonospora leaf blotch continued to be the most prevalent diseases and were estimated to have caused significant yield reductions in 2010. The incidence of take-all was greater in 2010 than 2009 (Xue and Chen 2010). Fusarium head blight was recorded in all fields but at only low visible severities. Symptoms of FHB have not been particularly evident in eastern Ontario oat crops in any survey since 2006. The higher than normal temperatures and frequent periods of rain in June and early July were likely responsible for the widespread occurrence and increased severity of take-all and FHB in oat in 2010.

REFERENCE:

Xue, A.G., and Chen. Y. 2010. Diseases of oat in eastern Ontario in 2009. Can. Plant Dis. Surv. 90:86-87. (cps-scp.ca/cpds.shtml)

Table1: Prevalence and severity of oat diseases in eastern Ontario in 2010.

	NO. CROPS	DISEASE SEVERITY IN AFFECTED CROPS*	
DISEASE	**AFFECTED (n=15)**	**MEAN**	**RANGE**
BYD	4	1.0	1.0-1.0
Crown rust	15	4.5	1.0-8.0
Halo blight	8	1.8	0.0-3.0
Pyrenophora leaf blotch	14	2.6	1.0-4.0
Spot blotch	14	3.4	1.0-7.0
Stagonospora leaf blotch	13	3.1	1.0-7.0
Ergot (%)	4	0.3	0.1-0.5
Loose smut (%)	3	0.7	0.1-2.0
Take-all (%)	13	3.5	0.5-10.0
Fusarium head blight**	15		
Incidence (%)		11.3	5.0-20.0
Severity (%)		10.3	5.0-20.0
Index (%)		1.3	0.3-4.0

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

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

Table 2. Frequency of *Fusarium* species isolated from discoloured kernels of oat in eastern Ontario in 2010.

***Fusarium* spp.**	**% OF CROPS**	**% OF KERNELS**
Fusarium spp.	100.0	25.0
F. acuminatum	13.3	0.4
F. avenaceum	26.7	0.8
F. equiseti	26.7	1.4
F. graminearum	73.3	5.4
F. oxysporum	13.3	0.2
F. poae	100.0	14.3
F. solani	6.7	1.0
F. sporotrichioides	60.0	2.5

CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2010

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 165 wheat crops in Saskatchewan in 2010: 128 common wheat (Canada Western Red Spring, Canada Prairie Spring, and Soft White Spring classes) and 37 durum wheat (Canada Western Amber Durum class). Crops were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey), and fields under irrigation were considered separately and referred to as the Irrigation Zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with Saskatchewan Ministry of Agriculture randomly collected 50 spikes from each wheat crop at the late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each wheat crop surveyed: FHB severity (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes 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 to confirm presence of *Fusarium* spp. in infected kernels.

RESULTS AND COMMENTS: Approximately 3 million ha (7.4 million acres) of spring wheat and 1.1 million ha (2.8 million acres) of durum wheat were seeded in Saskatchewan in 2010 (Statistics Canada, 2010). Excess precipitation combined with lack of both heat and sunshine created many challenges for farmers in 2010. Crops were stressed from excess moisture and disease pressure. Most of the province received 115 to 150 per cent of average precipitation with potentially up to 3.2 million ha (8 million acres) left unseeded and 1.6 million ha (4 million acres) damaged by flooding (Saskatchewan Ministry of Agriculture, 2010).

In 2010, FHB occurred in 87% and 89% of the surveyed common and durum wheat crops, respectively (Table 1). Prevalence and severity of FHB in common wheat were lowest in soil zone 1 and highest in soil zone 2. The sample with the highest FHB severity (17.2 %) was from a durum wheat crop in soil zone 2. This severity level was much higher than the highest found in 2009 (5.4 %) from a soft white spring wheat crop in soil zone 2. Overall, the provincial mean FHB severity for common wheat (1.1 %) and durum wheat (2.0%) were higher than in 2009 (common wheat - 0.5% and durum wheat – 0.3%). This year is the first year since 2001 that provincial annual mean FHB severities have exceeded 1% (Dokken-Bouchard et al. 2010).

The most frequently isolated causal pathogen identified on wheat samples with visible FHB symptoms was *F. avenaceum*, accounting for 50% (common wheat) and 44% (durum wheat) of all *Fusarium* isolates. *Fusarium poae* was identified in 21% of common wheat isolations and 11% of durum wheat isolations. Other *Fusarium* species isolated from common and durum wheat samples included *F. graminearum* (8% of isolates) *F. culmorum* (6%), *F. sporotrichioides* (6%), *F. equiseti* (5%), and *F. acuminatum* (3%). These results are similar to those obtained in 2008-09 (Dokken et al. 2010), except

that *F. avenaceum* has replaced *F. poae* as the dominant species for the province. *Fusarium avenaceum* was the dominant species on durum in the brown and dark brown soil zones and on common wheat in the dark brown soil zones and black/grey soil zones. However, *F. poae* was still the dominant species on common wheat in the brown soil zone.

Fusarium graminearum was found in 19% of the wheat survey samples collected. This accounted for 10% of the *Fusarium* isolations from durum and 8% of the *Fusarium* isolations from common wheat. *Fusarium graminearum* represented 3% of isolates from durum but none of the common wheat isolates in the brown soil zone. In the dark brown soil zone, 19% of the isolates from durum and 9% of the isolates from common wheat were *F. graminearum*. In the black/grey soil zones, 8% of the isolates from common wheat were *F. graminearum*.

Other fungal pathogens observed on wheat spikes collected in 2010 included *Septoria* and *Cochliobolus* spp. Secondary moulds were isolated from 99% of the wheat samples.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of samples for this survey.

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Dokken-Bouchard, F.L., Northover, P.R., Weitzel, C.N., Shiplack, J.J., and M.R. Fernandez, M.R. 2010. Fusarium head blight in common and durum wheat in Saskatchewan in 2009. Can. Plant Dis. Surv. 90: 98–99. (cps-scp.ca/cpds.shtml)

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Table 1. Prevalence and severity of fusarium head blight (FHB) in common and durum wheat crops grouped by soil zone in Saskatchewan, 2010.

Soil Zones	Common Wheat		Durum Wheat	
	No. crops affected / total crops surveyed (% of crops infected)	**Mean FHB Severity[1] (range)**	**No. crops affected / total crops surveyed (% of crops infected)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	15/19 (79%)	0.4% (0 – 3.3%)	21/25 (84%)	1.2% (0 – 7.3%)
Zone 2 Dark Brown	32/36 (89%)	1.7% (0 – 11.2%)	11/11 (100%)	4.0% (0.1 – 17.2%)
Zone 3 Black/Grey	58/66 (88%)	1.0% (0 – 9.1%)	---	---
Irrigation Zones	6/7 (86%)	0.2% (0 – 0.4%)	1/1 (100%)	1.5%
Overall Total/Mean	111/128 (87%)	1.1%	33/37 (89%)	2.0%

[1] Percent FHB severity = [% of spikes affected x mean proportion (%) of kernels infected] / 100.

CROP / CULTURE: Common and durum wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: **LEAF SPOTTING AND RUST DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2010**

INTRODUCTION AND METHODS: A survey for leaf spotting diseases of common and durum wheat was conducted in Saskatchewan in 2010 when crops were between the milk and dough stages of growth. A total of 85 common wheat and 37 durum wheat crops were sampled in 18 crop districts (CDs) (Saskatchewan Ministry of Agriculture 2010). In each field, 50 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, and mean severities were calculated for each crop and each CD. For crops with leaf spot severities ≥10% (64 in total), 1 cm^2 surface-disinfested leaf pieces were plated on water agar to identify and quantify the leaf spotting pathogens.

In most cases information was obtained on the previous crop and the tillage method used . Comparison of disease and fungal pathogen levels among tillage systems (conventional, minimum, and zero) was done for dryland crops grouped by soil zone (SZ) (SZ1: Brown, SZ2: Dark Brown, and SZ3: Black/Grey). The previous crop was characterized as a non-cereal (canola, chickpea, flax, lentil or pea) in 66 fields and a cereal in 3 fields; 18 of the surveyed fields had been summerfallowed the previous year.

RESULTS AND COMMENTS: Leaf spotting was observed in all crops surveyed (Table 1). For individual crops, the flag leaf area affected ranged from 1% to 38%. The overall mean leaf spot severity (11.3%) in 2010 was greater than in the previous three years (Fernandez et al. 2008, 2009, 2010). This can likely be attributed to the abundant moisture throughout the growing season in 2010. As in previous years, *Pyrenophora tritici-repentis* (tan spot) was the most prevalent leaf spot pathogen, followed by *Stagonospora nodorum* (septoria leaf spot complex) and *Cochliobolus sativus* (spot blotch). *Septoria tritici* (septoria leaf spot complex) was isolated less frequently and from the lowest number of crops.

When all crops were combined, mean leaf spotting severity was similar among soil zones (Table 1). Severity differences among CDs were likewise minor; CDs with high mean severities were scattered across the province, e.g. CDs 2B (south-central), 4B (south-west), 5A/5B (east), 7A (west-central), and 9A (north-west). The highest frequency of *C. sativus* isolations were in central and south-western CDs (2B, 3AN/3AS, 3BN/3BS, 6A, 6B), the lowest in SZ3. *Pyrenophora. tritici-repentis* was most commonly isolated in SZ1, followed by SZ2 and with the least frequent in SZ3. The highest frequencies of *P. tritici-repentis* isolations were from southern and west-central CDs (3AN/3AS, 3BN/3BS, 4B, 7A), as well as CD 9B (north-west), and CD 2A (south-east). Conversely, the highest frequencies of *S. tritici* and *S. nodorum* were in SZ3, followed by SZ2. *Stagonospora. nodorum* was isolated most frequently from eastern CDs (1A, 2A, 5A/5B) and CD 9A (north), while *S. tritici* most frequently *from* eastern and central CDs (1A, 5A/5B, 6B, 8A/8B). In common wheat *P. tritici-repentis* was isolated at a higher frequency in SZ2 (60%) than in SZ3 (47%). However, *S. nodorum*, particularly, and *S. tritici* to a lesser extent were more prevalent in SZ3 than SZ2. Their combined frequencies were 30% in SZ3 and 21% in SZ2.

A comparison of common and durum wheat indicated that durum had the greater mean leaf spot severity (Table 1). *Pyrenophora tritici-repentis* was more prevalent in durum than common wheat, while the opposite was true for *S. nodorum* and *S. tritici*. This can be attributed to the greater susceptibility of

durum to *P. tritici-repentis*, and to the greater presence of this pathogen, relative to *S. nodorum* and *S. tritici*, in SZ1 than in SZ2 and 3 , where fewer durum crops were sampled. The proportions of durum in all wheat sampled were: 63% for SZ1, 28% for SZ2, and 0% for SZ3.

A *Pseudoseptoria* species was detected in four crops sampled in CDs 3BN, 4B, and 7A at low frequencies (mean of 3%).

Classification of fields according to tillage systems revealed that overall, there were relatively small differences among systems in mean leaf spot severity (range of 11-12%), or in isolation of *P. tritici-repentis* (59-71%), or *S. nodorum* (22% for minimum-till, and 13-15% for the other two systems). The higher 24% frequency of *S. tritici* under minimum-till compared to the other tillage systems (7-8%) agrees with observations for SZ2 from 2009 (Fernandez et al. 2010). In the 2010 survey, within each tillage system there were few and no consistent differences in disease severity or fungal isolation among soil zones (data not shown).

Classification of fields according to previous crop and by SZ also showed few and no consistent differences for leaf spotting severity (data not shown). Overall, there was a somewhat lower leaf spot severity in wheat grown after an oilseed (9%) than after a pulse crop or summerfallow (14-15%). In 2009, highest mean leaf spotting in SZ3 was observed when the previous crop was a pulse (Fernandez et al. 2010). In 2010, there were few differences among previous crop categories in isolation of the various fungal pathogens, except for *S. tritici* which was isolated at its lowest frequency following a pulse (6%), and its highest frequency after fallow (27%). In 2008, for all three SZs combined, the lowest isolations of *S. nodorum* and *S. tritici* were also observed in wheat grown after a pulse crop (Fernandez et al. 2009).

Compared to previous years, the negligible influence of tillage system or previous crop in 2010 to the mean severity of leaf spotting or percentage of fungal isolations may be attributed to environmental conditions conducive to more disease development than in the previous few years. These conditions likely overrode any impact of agronomic practices on disease severity or fungal isolations.

Leaf rust was detected in 59% of the wheat crops surveyed, at a mean severity of 0.9% (range trace to 5%). As in previous years, leaf rust was most prevalent in eastern CDs (1A, 5A/5B). Stripe rust was detected across most CDs at trace levels in 13% of the wheat crops surveyed.

ACKNOWLEDGEMENT:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for collecting leaf samples for this survey.

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Saskatchewan Ministry of Agriculture. 2010. Final Crop Report December, 2010. Regina, SK. 17 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

Table 1. Incidence and severity of leaf spotting diseases and percentage fungal isolation of the most common leaf spotting pathogens in common and durum wheat crops, surveyed in Saskatchewan in 2010.

Soil Zone/ Crop District/ Wheat Species	No. crops[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Stagonospora nodorum*	*Septoria tritici*	*Cochliobolus sativus*
		%				
Soil Zone						
1 (Brown)	35	10.6	84/18	7/12	1/3	14/13
2 (Dark Brown)	53	12.4	67/31	15/25	13/12	19/25
3 (Black/Gray)	35	10.4	47/15	30/15	18/12	8/10
Crop District						
1A	7	9.4	48/3	42/3	17/1	5/3
2A	8	10.9	80/3	47/1	5/1	3/3
2B	10	11.7	62/7	2/6	9/1	35/7
3AN/3AS	7	11.1	79/4	14/2	-	19/3
3BN/3BS	12	7.8	75/4	4/3	1/2	29/3
4B	9	17.9	90/8	7/5	<1/1	7/5
5A/5B	5	13.0	31/3	27/3	25/3	12/3
6A	15	9.3	57/7	20/6	9/2	26/5
6B	8	9.5	63/4	16/3	17/3	16/3
7A	16	13.7	78/10	13/9	13/4	5/7
8A/8B	9	10.2	51/2	2/2	43/2	4/2
9A	7	14.6	49/7	37/7	10/5	10/3
9B	10	9.2	88/2	9/2	5/1	<1/1
Mean/total:	**123**	**11.3**	**67/64**	**18/52**	**14/27**	**15/48**
Wheat Species						
durum	37	15.6	82/26	4/18	1/4	18/21
common	85	9.5	57/38	25/34	16/23	13/27

[1] Number of crops sampled. All crops had leaf spotting lesions on the flag leaf.
[2] Mean percent flag leaf affected by leaf spots.
[3] Mean percent fungal isolation/number of crops in which the fungus occurred. For each CD, the number of crops in which *P. tritici-repentis* was detected is the total number of crops for which leaf tissue pieces were plated for fungal identification and quantification.

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: 2010 SURVEY OF FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA

INTRODUCTION AND METHODS: Fifty-two spring wheat fields were surveyed between July 21 and July 27, 2010 in southern Manitoba to monitor the incidence and severity of fusarium head blight (FHB). Disease symptoms in each field were assessed at growth stage ZGS 65 – 87 by sampling about 100 spikes at three locations for incidence and severity; spikes were collected from each field for subsequent pathogen identification. From each field collection, at least 10 spikes were threshed and 10 kernels selected for subsequent analysis. Kernels 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 species was unknown, single spores were grown on SNA agar to facilitate identification. The FHB index (overall severity) was calculated as follows: (average % incidence X average % severity) / 100.

RESULTS AND COMMENTS: Average disease levels were generally low within the regions surveyed, but individual crops in two regions, the Southwest and Eastern/Interlake, had higher disease severities (Table 1). The range in FHB indices varied widely from a minimum of 0 to a maximum of 10.4%, with an average for the province of 1.7%.

Fusarium species were isolated from 84% (457/545) of kernels examined in 2010, compared to 63% in 2009 (Gilbert at al. 2010). As in other years, *Fusarium graminearum* was the predominant species, accounting for 94.5% of isolations. Other species isolated at low levels included *F. sporotrichioides* (3.7%), *F. equiseti* (0.8%), *F. poae* (0.4%) and *F. avenaceum* and *F. culmorum* (both 0.2 %); the latter four each represented only 1-4 isolations from the total kernels examined.

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Gilbert, J., Tekauz, A., Kaethler, R., Slusarenko, K., Leclerc, C., Mueller, E., Stulzer, M. and Beyene, M. 2010. Survey of fusarium head blight of spring wheat in Manitoba in 2009. Can. Plant Dis. Surv. 90:105. (cps-scp.ca/cpds.shtml)

Table 1. Fusarium head blight (FHB) index in wheat crops surveyed from crop reporting districts in Manitoba, 2010.

Region	Number of fields	Crop district	Average FHB index (%)	Range (%)
Southwest	13	1, 2, 3	1.7	0.0 - 9.98
Central	23	7, 8	0.6	0.3 - 2.82
Northwest	1	4, 6	<0.1	0.01
Eastern / Interlake	15	9, 10, 11, 12	4.6	.04 - 10.4

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: MONITORING FUSARIUM HEAD BLIGHT IN WINTER WHEAT, MANITOBA 2010

INTRODUCTION AND METHODS: The prevalence of fusarium head blight (FHB) in winter wheat in Manitoba in 2010 was assessed by monitoring 46 farm fields from June 30-July15 when most crops were at the late milk to soft dough stage of growth (ZGS 75-85). Because winter wheat is not grown extensively in Manitoba (in 2010 it was grown on about 8% of the total wheat acreage of 1.1M ha (2.7M acres) in the province – ('Yield Manitoba 2011', Manitoba Agricultural Services Corporation, supplement to The Manitoba Co-operator, Feb 24, 2011) the fields were not surveyed at random. Instead, information on their location was obtained by contacting Manitoba Agriculture, Food and Rural Initiatives extension personnel or producers who normally grow the crop. The fields surveyed were located in southern Manitoba, in an area bounded by Highway #s 44, 67 and 16 to the north, the Manitoba/North Dakota border to the south, Hwy #12 to the east, and Hwy #s 21 and 83 to the west. Fusarium head blight in each field was assessed by non-destructive sampling of a minimum of 80-100 plants at each of 3 locations to determine the percentage of infected spikes (disease incidence), and the average spike proportion infected (SPI). The overall severity was expressed as the FHB Index ' (% incidence x % SPI / 100). Several affected spikes (or, "normal" spikes when symptoms were not evident) were collected from each monitored site and stored in paper envelopes. A total of 50 discoloured, putatively infected kernels, when available, or a combination of discoloured and (or) normal kernels, were subsequently removed from five spikes per location. The kernels were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar in Petri plates (10 kernels/plate) to quantify and identify the *Fusarium* spp. present, based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Conditions during the 2010 growing season in southern Manitoba were wetter than normal (up to 200% total normal rainfall), but with near normal growing degree day accumulation. Seeding of some spring crops was delayed or abandoned due to wet fields, and crop development was slowed by early-season cool conditions. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost

CDC Falcon was again the predominant winter wheat cultivar planted in Manitoba, occupying 78% of the winter wheat area. It was grown in 37 of the 46 fields for which cultivar information was available. The cultivars CDC Buteo and McClintock were grown in 6 and 2 fields, respectively. Foliar fungicides are applied routinely to most winter wheat crops in Manitoba, and for the 24 crops for which information was forwarded, most had been sprayed with a propiconazole- or tebuconazole-containing product alone, or a combination of the two, one preceding the other.

Symptoms of FHB (bleaching of spikes) were observed in all winter wheat fields sampled. Overall, incidence of FHB was 16.1 (range 0.6 - 48%), SPI was 61.4% (range 14 - 100%) and the resulting FHB Index 11.8% (range 0.1 - 45%). As such, FHB was estimated to have caused yield losses of about 5% in commercial winter wheat in 2010. The severity of FHB in 2010 was the second highest recorded since systematic monitoring for FHB in winter wheat began in 1998. Contamination of grain by deoxynivalenol (DON) could be expected. The frequent showers throughout the growing season provided continual favourable conditions for *Fusarium* infection. Winter wheat, which often 'escapes' infection due to its earlier flowering when moisture levels may be lower, was, therefore, not spared in 2010. In the absence of foliar fungicide use, FHB severity levels likely would have been considerably higher.
Fusarium colonies developed from 64.9% of the selected kernels plated on potato dextrose agar medium. As occurs annually (Tekauz et al. 2010), *Fusarium graminearum* was essentially the sole *Fusarium*

species isolated. It was found in all fields having visible FHB symptoms, and was isolated from 99.9% of *Fusarium*-positive kernels. *Fusarium poae* was the only other *Fusarium* species found (Table 1)

REFERENCE:

Tekauz, A., Stulzer, M, and Beyene M. 2010. Fusarium head blight of winter wheat in Manitoba in 2009. Can. Plant Dis. Surv. 90: 106-107. (cps-scp.ca/ www.cpds.shtml)

Table 1. *Fusarium* spp. isolated from winter wheat crops in Manitoba in 2010.

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. graminearum	100	99.9
F. poae	2	0.1

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 2010

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 2010.

RESULTS AND COMMENTS: Wheat leaf rust, caused by *Puccinia triticina*, was first observed on spring wheat in 2010 at Winkler, MB on June 9. This is a relatively early appearance for leaf rust and one which has commonly led to more severe epidemics in past years. However, in commercial spring wheat crops little to no leaf or stripe rust was found. All the fields surveyed appeared to have been sprayed with foliar fungicides which controlled these rusts completely. In contrast, nonsprayed trap plots and nurseries had relatively high levels of leaf rust, and stripe rust was also detected at low levels. Leaf rust severity on the susceptible cultivar AC Barrie in nonsprayed plots ranged from 5% to 60% of the flag leaf covered with leaf rust pustules. This would suggest a fairly severe epidemic year, however, as indicated above, the high frequency of foliar fungicide application controlled leaf rust in commercial fields (Table 1). This and genetic resistance in many cultivars prevented any significant losses to leaf rust in crops of spring wheat in 2010. Only isolated pustules of stripe rust (*P. striiformis*) were found throughout southern Manitoba and Saskatchewan.

Table 1. Average percentage (%) of the flag leaf infected with leaf rust in surveys from 2001 to 2010 in Manitoba and Saskatchewan

Year	Manitoba	Saskatchewan
2001	10.0	3.0
2002	18.0	5.0
2003	2.5	2.0
2004	7.0	2.0
2005	20.0	22.0
2006	10.2	5.3
2007	15.7	4.9
2008	1.1	0.1
2009	trace	trace
2010*	25.0	3.0

*Determined from AC Barrie in nonsprayed nurseries and trap plots.
Results for other years were determined from commercial fields.

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: 2010 SURVEY FOR LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA

INTRODUCTION AND METHODS: A survey of 52 southern Manitoba spring wheat fields was conducted between July 21 and July 27, 2010 to assess for the prevalence and severity of foliar diseases. Leaves were collected between the heading and soft dough stages of development. Severity of diseases on upper and lower leaf canopies was categorized based on the amount of necrotic tissue as 0, trace, 1, 2, 3 or 4, with 4 describing dead leaves and 1 lightly affected. A total of 414 samples of diseased leaf tissue was surface-sterilized and placed in moisture chambers for 5 – 7 days to promote pathogen sporulation for disease identification.

RESULTS AND COMMENTS: The average level of necrosis caused by leaf spots on the flag leaves was 1.84 and on the lower leaves 2.90 (excluding leaves that were senesced at the time of survey). Crops in the Northwest (1 field only) and Eastern / Interlake regions (Crop Districts 4, 6, and 9-12) had the highest severity levels.

Pyrenophora tritici-repentis was the dominant pathogen in all regions, accounting for 61% of isolations, somewhat fewer than 80.4% in 2009 (Gilbert et al. 2010). The pathogen was isolated in 50 of 52 fields sampled. Although not as commonly isolated as *P. tritici-repentis*, levels of *Stagonospora nodorum, Cochliobolus sativus* and *Septoria tritici* were double those in 2009; they were isolated at similar levels from all regions surveyed.

REFERENCE:
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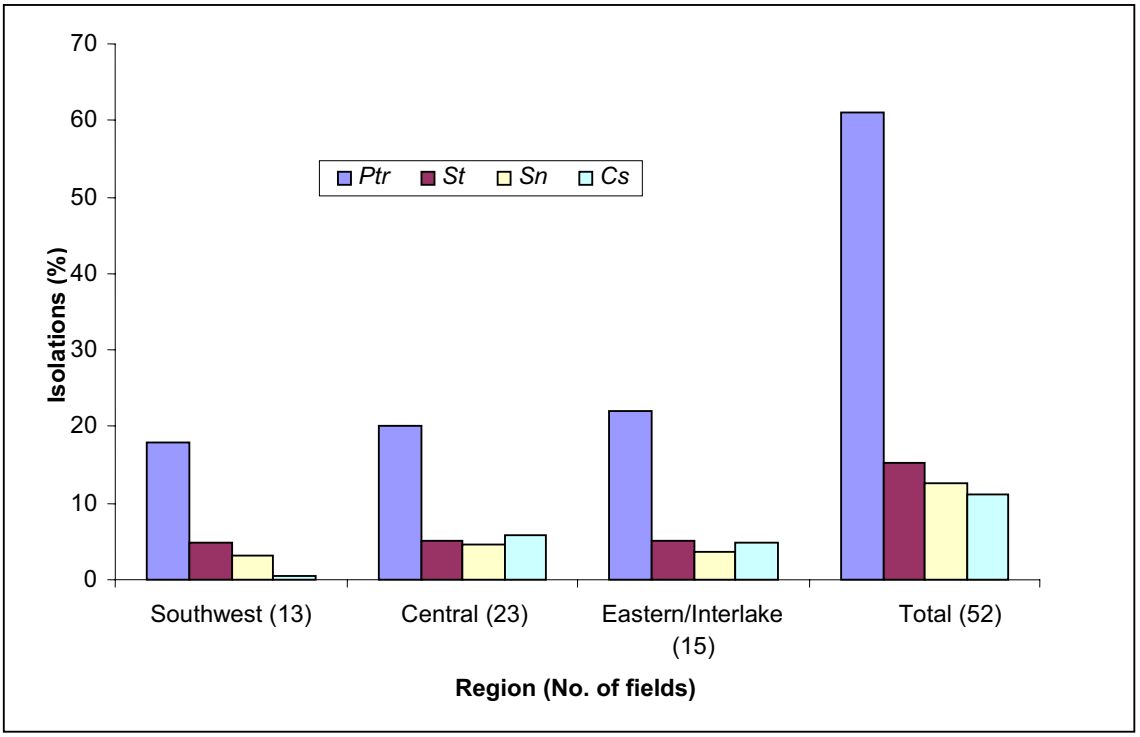
Table 1. Prevalence and isolation frequency of leaf spot pathogens in hard red spring wheat fields in Manitoba in 2009.

	Disease			
	Septoria nodorum blotch (*Stagonospora nodorum*)	**Septoria tritici blotch (*Septoria tritici*)**	**Tan spot (*Pyrenophora tritici-repentis*)**	**Spot blotch (*Cochliobolus sativus*)**
Wheat crops affected (Total = 52)	29	36	50	21
Isolations (%) (Total = 414)	12.4	15.4	61.1	11.1

Fig. 1 Isolations of foliar pathogens by region in southern Manitoba in 2010



Ptr = Pyrenophora tritici-repentis, St = Septoria tritici, Sn = Stagonospora nodorum, Cs = Cochliobolus sativus.
Northwest Region (1 field) not shown but included in the total.

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: WINTER WHEAT LEAF SPOT DISEASES IN MANITOBA IN 2010

INTRODUCTION AND METHODS: The occurrence and severity of spotting diseases of winter wheat in Manitoba in 2010 were assessed by surveying 46 farm fields from June 30 – July 15 when most crops were at the mid-milk to soft-dough stage of growth (ZGS 75-85). Because winter wheat is not grown extensively in Manitoba (in 2010 it was grown on about 8% of the total wheat acreage of 1.1 M ha (2.7M acres) in the province ('Yield Manitoba 2011', Manitoba Agricultural Services Corporation, supplement to The Manitoba Co-operator, Feb 24, 2011) the fields were not surveyed at random. Instead, information on their location was obtained from Manitoba Agriculture, Food and Rural Initiatives (MAFRI). The crops surveyed were located in southern Manitoba, within an area bounded by Highway #s 44, 67 and 16 to the north, the Manitoba/North Dakota border to the south, Hwy #12 to the east, and Hwy #s 21 and 83 to the west. Leaf spots were rated on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Severity of symptoms was recorded for both the upper (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 leaf spot symptoms were collected at each site, placed in paper envelopes and allowed to dry. Subsequently, surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to promote sporulation, allow for identification of the causal pathogen(s), and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions during the 2010 growing season in southern Manitoba were wetter than normal (up to 200% normal rainfall), but with near normal growing degree day accumulation. Seeding of some spring crops was delayed or abandoned due to wet fields (primarily in parts of the Interlake and the South-west) and crop development slowed by early-season cool weather. Despite difficult conditions, reasonable crops were harvested in many districts, due in large part to an unusually long period without a killing frost. The frequent rain showers throughout the growing season were expected to favour the development of foliar diseases.

CDC Falcon was the predominant winter wheat cultivar planted in Manitoba, as has been the case for several years, and occupied 78% of the winter wheat acreage. It was grown in 37 of the 46 fields for which cultivar information was available. CDC Buteo and McClintock were grown in 6 and 2 fields, each. Foliar fungicides are applied routinely to most winter wheat crops in Manitoba, and for the 24 crops for which this information was obtainable, most had been sprayed with a propiconazole- or tebuconazole-containing product alone, or a combination of the two, one preceding the other.

Leaf spotting was evident in the upper or lower plant canopies in all fields surveyed. Disease levels in the upper canopy were trace to slight in 53% of crops, moderate in 40% and severe in 6%. In the lower plant canopy, trace to slight leaf spot levels were present in 26% of the crops, moderate in 17%, and 57% had senesced. The upper canopy severity levels suggest that leaf spots caused some damage to winter wheat in 2010, likely an average estimated yield loss of 2-3%. The widespread use of foliar fungicides as part of winter wheat management in Manitoba likely reduced the level of leaf spot damage.

Pyrenophora tritici-repentis, causal agent of tan spot, was the dominant leaf spot pathogen in 2010 (Table 1). This h as has been the case in most years in both spring wheat and winter wheat in Manitoba in most years (Gilbert et al. 2010, 2009; Tekauz et al. 2010, 2009). The pathogen was recovered from 70% of crops and was estimated to have caused virtually all the foliar damage observed. *Cochliobolus sativus* (causal agent of spot blotch) was also isolated, but from only a few crops. Uncharacteristically, no

Stagonospora or *Septoria* species were recovered in 2010. The trace levels of leaf spot in several crops resulted in failure to isolate a recognized pathogen from the leaf samples collected from these crops.

ACKNOWLEDGEMENT:
We thank Patti Cuthbert and other MAFRI personnel for supplying information on the geographical location of the Manitoba winter wheat crops sampled for this survey.

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Gilbert, J., Tekauz, A., Kaethler, R., Kromer, U., Leclerc, C., Unrau, T., Mueller, E., Stulzer, M., and Beyene, M. 2009. Survey for leaf spot diseases of spring wheat in Manitoba in 2008. Can. Plant Dis. Surv. 89: 98-99. (cps-scp.ca/cpds.shtml)

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Table 1. Incidence and isolation frequency of leaf spot pathogens from Manitoba winter wheat in 2010.

Pathogen	Incidence (% of crops)	Frequency (% of isolations)*
Pyrenophora tritici-repentis	70	98.0
Cochliobolus sativus	4	2.0

*indicative of the relative foliar damage caused

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: 2010 SURVEY FOR FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN ONTARIO

INTRODUCTION AND METHODS: In 2010, twenty commercial winter wheat fields from Ontario were sampled at harvest to assess the presence of fusarium head blight (FHB). FHB presence and severity were based on the level of mycotoxin(s) detected. Grain samples were obtained from fields in nine counties (Perth, Haldimand, Huron, Elgin, -Kent, Brant, Hamilton-Wentworth, Middlesex and Wellington) and included eight winter wheat cultivars ('Harvard', 'Princeton', '25R39', 'Emmit', '25R47', '25R56', '25R51' and 'Beecher'). Deoxynivalenol (DON), nivalenol, T2, and HT2 contents were assessed on a 20 g sub-sample of the harvested seed using Gas Chromatography-Mass Spectrometry (GS-MS) analysis.

RESULTS AND COMMENTS: DON was detected in all but one sample (cv. 'Princeton' grown in Wellington County). The highest level of DON (1.1 ppm) was found in the cv. 'Harvard' grown in Perth County (Table 1). The average DON level was 0.42 ppm. Individual and average DON levels were lower than those measured in 2008 (Tamburic-Ilincic, 2009) or 2009 (Tamburic-Ilincic and Schaafsma, 2010) in Ontario. Nivalenol, T2, and HT2 toxins were not detected in any sample. By contrast, traces of T2 toxin (0.07 ppm) and HT2 toxin (0.06 ppm) were detected at the Woodslee site in Essex county in 2009 (Tamburic-Ilincic and Schaafsma, 2010).

REFERENCES:
Tamburic-Ilincic, L. 2009. 2008 survey for fusarium head blight of winter wheat in Ontario. Can. Plant Dis. Surv. 89:102-103. (cps-scp.ca/cpds.shtml)

Tamburic-Ilincic, L., and Schaafsma, A.W. 2010. 2009 survey for fusarium head blight of winter wheat in Ontario. Can. Plant Dis. Surv. 90:113. (cps-scp.ca/cpds.shtml)

Table 1. Levels of deoxynivalenol (DON) in parts per million (ppm) in 20 commercial crops of winter wheat in Ontario in 2010.

County	**Cultivar**	**DON (ppm)**
Brant	Emmit	0.37
Brant	Emmit	0.36
Chatham-Kent	25R47	0.46
Chatham-Kent	25R47	0.45
Chatham-Kent	25R47	0.42
Chatham-Kent	25R51	0.22
Chatham-Kent	25R51	0.20
Elgin	Emmit	0.75
Haldimand	Princeton	0.91
Haldimand	Princeton	0.17
Haldimand	Beecher	0.15
Hamilton-Wentworth	25R47	0.27
Huron	25R39	0.82
Huron	25R56	0.43
Middlesex	Princeton	0.16
Perth	Harvard	1.10
Perth	Princeton	0.92
Perth	Emmit	0.15
Perth	25R51	0.12
Wellington	Princeton	Non-detectable
Average DON (n=20)		**0.42**

CROP / CULTURE: Spring wheat
LOCATION / RÉGION: Eastern and central Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: DISEASES OF SPRING WHEAT IN EASTERN ONTARIO IN 2010

INTRODUCTION AND METHODS: A survey of spring wheat diseases was conducted in eastern Ontario in the last week of July when plants were at the soft dough stage of development. Twenty-eight fields were chosen at random in regions of eastern and central Ontario where most of the spring wheat 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). Disease diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for ergot, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (percent infected spikes) and severity (percent infected spikelets in the affected spikes) based on approximately 200 spikes at each of three random sites per field. An FHB index [(% incidence x % severity)/100] was determined for each crop. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 30 infected spikes collected from each field. The spikes were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCI for 60 seconds and plated in 9-cm diameter Petri plates on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. The plates were incubated for 10-14 days at 22-25ºC and with a 14-hour photoperiod using florescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: A total of 12 diseases were observed in the crops surveyed (Table 1). Spot blotch (*Cochliobolus sativus*) and the septoria/stagonospora leaf blotch complex (normally associated with infection by *Septoria tritici* and *Stagonospora* spp.), were the most common foliar diseases, and were observed in all crops at mean disease severities of 3.8 and 3.3, respectively. Severe infection levels attributed to spot blotch and septoria/stagonospora leaf blotch were found in 7 and 4 fields, respectively. Yield reductions due to the two diseases were estimated at >10% in the surveyed crops. Stagonospora glume blotch (*Stagonospora nodorum*) was also observed in all surveyed fields at a mean severity of 2.1. Although no crops were severely impacted by stagonospora glume blotch, it is likely that seed quality was compromised. Leaf rust (*Puccinia triticina)* and tan spot (*Pyrenophora tritici-repentis*) were observed in 26 and 19 fields at mean severities of 2.4 and 1.7, respectively. Severe levels of leaf rust were detected in two fields, but no crop was severely affected by tan spot. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), powdery mildew (*Erysiphe graminis* f. sp. *tritici)*, and stem rust (*Puccinia graminis*); their average severities were 2.0, 1.9, and 2.7 based on observations in 3, 8 and 6 fields, respectively. The affected plants all had only trace to slight levels of infection; as such, none of these diseases would have resulted in significant damage to crops.

Ergot (*Claviceps purpurea*) and loose smut (*Ustiago tritici*) were observed in 24 and 3 fields at incidence levels of 1.4 and 1.2 %, respectively. They likely resulted in minimum damage. Take-all root disease (*Gaeumannomyces graminis* var. *tritici*) was found in 27 fields at a mean incidence 3.9%, a higher severity than observed in 2009 (Xue and Chen 2010). Fusarium head blight was observed in all fields at a mean FHB index of 11.8%, and a range of 0.3 to 36.0% (Table 1). Severe or very severe levels of FHB were recorded in 6 and 5 fields, respectively. This disease likely resulted in a significant loss of grain yield and quality in spring wheat across Ontario in 2010. Seven *Fusarium* species were isolated from the

infected kernels (Table 2). *Fusarium graminearum* predominated and occurred in all fields and on 53.3% of putatively infected kernels. *Fusarium sporotrichioides* and *F. poae* were found in 27.6 and 41.4% of the surveyed fields and on 2.3 and 4.2% of the kernels, respectively; the frequency of these species on kernels was higher than in 2009 (Xue and Chen 2010). *Fusarium equiseti* and *F. avenaceum* were quite common, occurring in 13.8-24.1% of surveyed crops, but were isolated from only 0.9-2.7% of kernels. Other species found included *F. culmorum* and *F.* oxysporum, which were isolated from less than 1.0% of kernels.

Overall, the relative prevalence and severity of spring wheat foliar diseases in 2010 were similar to levels reported for 2009 (Xue and Chen 2010). Spot blotch and septoria/stagonospora leaf blotch continued to be the most prevalent diseases and were estimated to have caused significant yield reductions in 2010. Take-all root disease and FHB were more common and severe in 2010 than in 2009 (Xue and Chen 2010). The high temperatures and frequent periods of rain in June and early July in 2010 were likely responsible for the increased occurrence and severity of these diseases. The 2010 year can be considered as an FHB epidemic year for spring wheat in Ontario.

REFERENCE:

Xue, A.G., and Chen, Y. 2010. Diseases of spring wheat in eastern Ontario in 2009. Can. Plant Dis. Surv.. 90:114-115. (cps-scp.ca/cpds.shtml)

Table 1. Prevalence and severity of spring wheat diseases in eastern and central Ontario in 2010.

	NO. CROPS	DISEASE SEVERITY IN AFFECTED CROPS*	
DISEASE	**AFFECTED (n=28)**	**MEAN**	**RANGE**
Bacterial blight	3	2.0	2.0-2.0
Leaf rust	26	2.4	0.5-7.0
Powdery mildew	8	1.9	1.0-4.0
Stagonospora glume blotch	28	2.1	1.0-4.0
Septoria/Stagonospora leaf blotch	28	3.3	1.0-7.0
Spot blotch	28	3.8	1.0-7.0
Stem rust	6	2.7	2.0-5.0
Tan spot	19	1.7	1.0-4.0
Ergot (%)	24	1.4	0.0-5.0
Loose smut (%)	3	1.2	0.5-2.0
Take-all (%)	27	3.9	0.1-10.0
Fusarium head blight**	28		
Incidence (%)		37.7	5.0-90.0
Severity (%)		28.2	5.0-60.0
Index (%)		11.8	0.3-36.0

*Foliar disease severity rated on a scale of 0 (no disease) to 9 (severely diseased); ergot, loose smut, and take-all severity based on % plants infected.
** FHB Index = (% incidence x % severity)/100.

Table 2. Frequency of *Fusarium* species isolated from FHB-affected wheat kernels in Ontario in 2010.

***Fusarium* spp.**	**% OF FIELDS**	**% OF KERNELS**
Fusarium spp.	100.0	64.0
F. avenaceum	24.1	2.7
F. culmorum	10.3	0.5
F. equiseti	13.8	0.9
F. graminearum	100.0	53.3
F. oxysporum	3.4	0.2
F. poae	41.4	4.2
F. sporotrichioides	27.6	2.3

Oilseeds & Special Crops / Oléagineux et Cultures Spéciales

CROP: Dry bean
LOCATION: Manitoba

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TITLE: DISEASES OF DRY BEAN IN MANITOBA IN 2010

METHODS: Crops of dry bean were surveyed for root diseases at 40 different locations and for foliar diseases at 42 locations in Manitoba. During the root disease survey, the severity of halo blight (*Pseudomonas syringae* pv. *phaseolicola*) also was assessed as a percentage of leaf tissue with symptoms. The survey for root diseases and halo blight was conducted in the first week of July when plants were at the seedling to early bloom stage. For foliar diseases, the survey was carried out in early September when the plants were starting to mature. The crops surveyed were selected at random from regions in southern Manitoba, where most dry bean crops are grown. For the root diseases, at least ten plants were sampled at each of three random sites in each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant). Fifteen to eighteen roots with disease symptoms per crop were collected for isolation of the causal organism in the laboratory in order to confirm the visual assessment. Foliar diseases were identified by symptoms. Levels of common bacterial blight (CBB) (*Xanthomonas axonopodis* pv. *phaseoli*) were estimated based on the percent incidence of leaf infection and severity was measured on a scale of 0 (no disease) to 5 (50-100% of the leaf area covered by lesions). Severity of anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces appendiculatus*) and white mould (*Sclerotinia sclerotiorum*) severity were assessed as a per-centage of infected plant tissue. In each crop with anthracnose symptoms, pods were collected to isolate the causal organism to confirm that the symptoms were caused by *C. lindemuthianum*.

RESULTS AND COMMENTS: Frequent showers occurred throughout the summer and daily temperatures were close to normal. Two root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all 40 crops surveyed for root diseases, making it the most prevalent root disease of dry bean. Crops from which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 0.4 to 7.0 with an average of 3.7. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 27of the 40 crops surveyed with severity ratings of 0.9 to 7.0 and an average severity of 3.7. Sixteen crops had average root rot ratings above a severity of 4 (i.e., symptoms were present on 50% of the root system). Halo blight with a severity of 15% was observed in one of the 40 crops. Pythium root rot was not detected in any of the crops surveyed.

Four diseases were observed during the foliar disease survey (Table 2). Common bacterial blight was the most prevalent foliar disease and symptoms were observed in 40 crops. However, the leaves had completely senesced in two of the 42 crops, so the incidence and severity of CBB or rust could not be assessed there. The incidence of CBB on the leaves ranged from 10 to 40% with an average of 24%, while severity was consistently rated as 3. Incidences of 20% or above were observed in 33 crops. Anthracnose was detected in five dry bean crops with disease severity ranging from 0 to 10% and averaging 3%. Bean rust was only observed in two dry bean crops with an average severity of 2%. White mould symptoms were detected in 35 crops with an incidence of plant tissue infection that ranged from 0 to 60% with an average of 15%. Incidences of white mould of 10% or higher were observed in 15 dry bean crops and would have adversely affected crop yield.

Table 1. Prevalence and severity of root diseases and halo blight in 40 crops of dry bean in Manitoba in 2010.

Disease	No. crops affected	Disease Severity	
		Mean[1]	Range
Fusarium root rot[2]	40	3.7	0.4-7.0
Rhizoctonia root rot[2]	27	3.7	0.9-7.0
Pythium root rot	0	0.0	0.0
Halo blight[3] (%)	1	15	0-15

[1]Means are based on an average of the crops in which the diseases were observed.
[2]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant).
[3]Halo blight severity was assessed as a percentage of leaf tissue displaying symptoms.

Table 2. Prevalence and severity of foliar diseases in 42 crops of dry bean in Manitoba in 2010.

Disease	No. crops affected	Disease Severity[1]		Incidence of Leaf Infection	
		Mean[2]	Range	Mean[2]	Range
Common bacterial blight[3]	40	3	3	24%	10-40%
Anthracnose (%)	5	3	0-10		
Rust[3] (%)	2	2	0-2		
White mould (%)	35	15	0-60		

[1]Anthracnose, rust and white mould severity were rated as the percentage of infected plant tissue; common bacterial blight severity was rated on a scale of 0 (no disease) to 5 (whole plant severely diseased).
[2]Means are based on an average of the crops in which the diseases were observed.
[3]Mean of 40 dry bean crops, since all the leaves in two crops had senesced.

CROP: Canola
LOCATION: Alberta

NAMES AND AGENCIES:
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TITLE: THE OCCURRENCE OF CLUBROOT ON CANOLA IN ALBERTA IN 2010

METHODS: A total of 341 commercial canola (*Brassica napus* L.) crops in 16 counties in central Alberta were surveyed for the incidence of clubroot (Table 1), caused by the obligate parasite *Plasmodiophora brassicae* Woronin. Of these crops, 29 were confirmed to be clubroot-resistant canola hybrids. With one exception, the crops surveyed were all in fields where clubroot had not been previously identified. The survey was conducted in September and October, 2010, with the crops visited after swathing. The roots of all plants within a 1 m^2 area at each of 10 locations along the arms of a 'W' sampling pattern were dug from the soil and examined for the presence of galls, which were taken as an indication of *P. brassicae* infection. The severity of root infection on each sampled plant was assessed on a 0 to 3 scale, adapted from Kuginuki et al. (1), where 0 = no galling, 1 = a few small galls, 2 = moderate galling and 3 = severe galling. The individual ratings were then used to calculate an index of disease (ID) for each field, according to the method of Horiuchi and Hori (2) as modified by Strelkov et al. (3). Visits to fields were coordinated with the Agricultural Fieldman in each municipality.

RESULTS AND COMMENTS:
Sixty seven of the 341 canola crops surveyed were found to be clubroot-infested, of which 66 represented new cases of the disease (including two in the County of Lamont, representing the first confirmed cases of clubroot in that municipality) (Table 1). A very low level of disease was also found in one field that was first identified as clubroot-infested in 2005, but which was cropped to a resistant canola hybrid in 2010. Clubroot was detected in 15 of 29 fields cropped to a resistant canola hybrid, and in 52 of 312 fields cropped to susceptible hybrids or hybrids of unknown resistance. Clubroot severity within the infested resistant crops was low (ID <10%) in 12 fields, and moderate (ID = 10-30%) in 3 fields. In the infested susceptible crops, disease severity was low in 31 fields and moderate in 21. No heavily infested crops were identified in the 341 fields visited, perhaps because fields with severe clubroot infestations would have been sown to a resistant cultivar. In addition to the infested canola crops found in this survey, another 27 new cases of clubroot were identified in a survey conducted by the County of Leduc (A. Van Beers, personal communication), and another 16 in a survey conducted by Parkland County (T. Warren, personal communication). Therefore, a total of 110 new cases of clubroot on canola were confirmed in Alberta in 2010. A new case of clubroot was also identified on cabbage and broccoli in a field in northeast Edmonton (4). A total of 566 fields in Alberta are now confirmed to be infested with clubroot. These fields are distributed over 18 counties throughout the province as well as a rural area of the City of Edmonton. However, the outbreak remains most severe in central Alberta (Fig. 1).

This year (2010) marked the first time that clubroot-resistant canola hybrids were readily available to Alberta farmers. The deployment of genetically resistant cultivars represents one of the most effective and economical methods to manage clubroot. It is interesting to note, however, that at least some clubroot symptoms could be found in more than half of the resistant crops surveyed. This could reflect several possibilities, including the presence of susceptible volunteers and off-types, as well as the fact that while most resistant hybrids exhibit highly reduced symptoms of infection, they are not generally immune. It is also likely that most resistant crops were planted in fields with established clubroot infestations, and thus were exposed to high disease pressure. Nevertheless, the occurrence of clubroot in resistant hybrids has epidemiological implications and highlights the need for appropriate clubroot resistance management strategies.

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Table 1. Distribution of clubroot-infested canola fields identified in Alberta in 2010.

County	Number of fields surveyed	Number of new cases of clubroot-infested fields
Barrhead	18	5
Camrose	21	3
Flagstaff	19	0
Lacombe	21	0
Lac Ste. Anne	21	0
Lamont	23	2
Leduc	34	16[a]
Parkland	20	11[b]
Ponoka	22	3
Red Deer	18	0
Strathcona	26	10
Sturgeon	18	5[c]
Thorhild	19	0
Westlock	26	7
Wetaskiwin	16	4
Yellowhead	19	0
TOTAL	341	66

[a]An additional 27 clubroot-infested fields were identified in a survey conducted by the County of Leduc, bringing the total number of new cases in that municipality to 43
[b]An additional 16 clubroot-infested fields were identified in a survey conducted by Parkland County, bringing the total number of new cases in that municipality to 27
[c]A small amount of disease was also found in a sixth field in Sturgeon County, which was cropped to a resistant cultivar, but was excluded from the totals since it had originally been identified in 2005

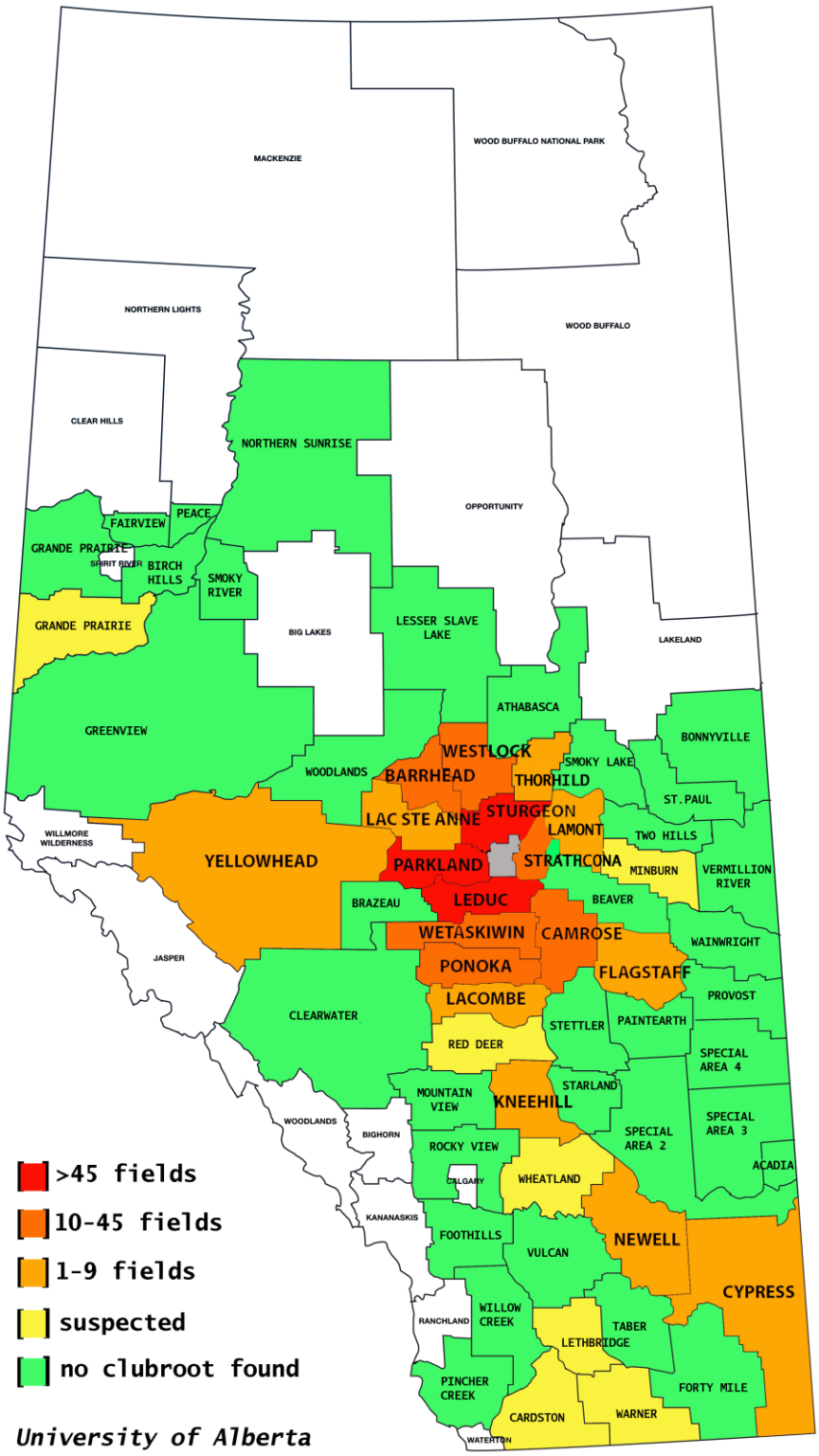

Figure 1. Occurrence of clubroot on canola in Alberta as of October 2010. The disease has been confirmed in a total of 566 fields representing 18 counties and a rural area of the City of Edmonton. In addition, suspected cases of clubroot have been reported from at least seven other municipalities.

CROP: Canola.
LOCATION: Alberta

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TITLE: SURVEY OF BLACKLEG AND OTHER CANOLA DISEASES IN ALBERTA, 2010

METHODS: A total of 148 canola crops were surveyed between August 11 and September 24 in the major canola production regions of Alberta. To ensure that the distribution of survey locations reflected the distribution of canola across Alberta, the number of fields surveyed in each Consolidated Census Subdivision (CCS) was adjusted to represent 0.6% of the total canola seeded area within each CCS, as determined by the 2006 Statistics Canada Census of Agriculture (Statistics Canada 2006). In Alberta, CCS boundaries are equivalent to municipal boundaries and are subdivisions of Census Agricultural Regions (CAR). CARs are sub-provincial geographic areas created by Statistics Canada for disseminating agriculture statistics. The data were summarized by CAR to allow future comparisons with Statistics Canada data and maintain producer anonymity. The total number of fields surveyed within each CAR was as follows: CAR 1 (5 fields), 2 (24), 3, (10), 4A (21), 4B (29), 5 (29), 6 (5), and 7 (27).

Where possible, crops were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). Disease assessments were made in each field by collecting 20 plants from each of five sites at least 20 m from the edge of the field and separated from each other by at least 20 m. Presence or absence of symptoms on each plant was determined to give percent disease incidence for sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg(*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.),alternaria pod spot(*Alternaria brassicae*, *A. raphani*) and fusarium wilt (*F. oxysporum* f. sp. *conglutinans*). For sclerotinia stem rot, each plant was rated for severity according to a scale of 0 to 5 (Kutcher and Wolf 2006).The severity of basal stem blackleg was scored by the percentage of cross-sectional basal stem area discoloured by the disease, according to a standard procedure (Western Canada Canola/ Rapeseed Recommending Committee 2009). For alternaria black spot (*Alternaria brassicae, A.raphani*), percent severity of lesions on the pods of each plant was assessed (Conn et al. 1990). When diseases were observed in a crop, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1% incidence. Mean disease incidence or severity values were calculated for each CCS and CAR.

RESULTS AND COMMENTS: While blackleg basal cankers were observed in 53% of the Alberta canola crops surveyed (Table 2), the prevalence of blackleg varied widely across the province. It was lowest in CAR 2 (Figure 1), particularly in the municipalities of Lethbridge, Newell, Vulcan, and Warner, where no basal cankers were found. Prevalence of basal blackleg cankers varied greatly within the Peace River region (CAR 7). Prevalence in the municipalities of Grande Prairie, Northern Sunrise, and Smoky River was 40%, 50%, and 43% of fields, respectively, but no basal cankers were found in the remaining six municipalities. Overall, rainfall in the Peace River region was substantially below long term average (Alberta Environment 2010), and the crop in the Peace region with a high incidence of basal blackleg (66%) was located in a small area with higher than normal rainfall. This suggests that dry conditions may

partially explain the low prevalence of basal blackleg canker in the Peace River region. Prevalence of basal blackleg symptoms was greatest in CARs 4A, 4B, and 6 in east-central Alberta (67%, 89%, and 80%, respectively). The mean incidence of basal blackleg cankers averaged across all crops was 9%, while the incidence in infected crops (i.e. excluding crops where no blackleg was found) was 16%. The highest incidence of basal cankers was found in CAR 4A (19%); incidence was lowest in regions 2 (0.4%) and 7 (0.5%).

Severity of basal stem lesions was low. Province-wide, 71% of crops had an average basal stem severity rating of 2 or less. The mean severity of blackleg basal cankers in the province was 0.7 on the 0 – 5 scale (Table 2). Severity in infested crops was 1.4. The severity of basal blackleg was greatest in regions where incidence and prevalence were also highest (Figure 1). Mean severity was highest in CAR 4A (1.8) and lowest in region 1 (1.0). Overall, basal stem blackleg was widespread in Alberta, but severity of symptoms remained low, with the highest levels in the regions where blackleg has been established the longest.

Blackleg stem lesions were present in 50% of canola crops in Alberta with a mean incidence of 8%. The highest mean incidence was in CAR 1 (20%) and lowest in region 6 (0.4%). The incidence of stem lesions was consistently associated with hail damage. In one canola crop in CAR 1 100% of the plants sampled had stem lesions caused by hail and all of the lesions were infected by blackleg. In 2010, 66% of canola crops in Alberta were affected by either basal or upper stem blackleg, or both. The mean incidence of basal or stem symptoms was 14% and the highest incidence was in CAR 4A (29%) The incidence of combined blackleg symptoms in the other regions ranged from 27% in CAR 4B to 1% in CAR 2.

Sclerotinia stem rot was observed in 64% of crops surveyed. The mean incidence and severity in the province were 15% and 2.1, respectively (Table 2). Incidence was highest in CAR 6 (30%), and lowest in region 7 (4%). The mean severity of stem rot in canola crops in Alberta was 2. Severity of stem rot was highest in CAR 6 (4.2) and lowest in region 7 (0.4).

Aster yellows was observed in 3% of canola crops in Alberta with a mean incidence of 0.1% (Table 3). The highest prevalence of aster yellows was in CAR 5 (10%) with a mean incidence of 0.2%. Aster yellows was not found in CAR 1,3,4A,4B, 6, and 7.

Fusarium wilt was found in 3% of canola crops in the province with a mean incidence of 0.3% and a mean severity of 0.1%. Fusarium wilt prevalence was 10% in CAR 5 and 4% in region 4B but at levels of severity less than 1%. Fusarium wilt was not detected in any other region.

Foot rot was recorded in 13% of canola crops in the province with a mean incidence of 0.7%. It was recorded only in CAR 3 (46% of crops), 4A (14%), 4B (26%) and 5 (14%). Mean incidence of fusarium wilt in these regions was 3%, 0.2%, 2%, and 1%, respectively.

Alternaria pod spot was found in only 23% of the 100-plant survey samples, but symptoms were observed in a total of 41% of canola crops overall. The greatest incidence of pod spot was in CAR 4B (26%) and the lowest in CAR 1 (0.4%), where the disease was only found in Special Area 4. Pod spot was not found in the remaining three municipalities in this region.

Brown girdling root rot (BGRR) was found in 20% of canola crops in Alberta with a mean incidence of 3%. The regions with the highest prevalence of BGRR were CAR 6 (60%) and CAR 7 (24%). The lowest BGRR prevalence was in CAR 3 (9%). The highest incidences of BGRR were in CAR 5 (6%) and 4B (7%). The incidence in the other regions ranged from 0.2% in CAR 3 to 1.8% in CAR 1.

Plants with club root symptoms were found in only three fields, all in CAR 5; however, results of a more extensive survey are reported elsewhere in this issue of Canadian Plant Disease Survey (Strelkov et al. 2011). Two of the crops in region 5 with club root were in Leduc County; the remaining field was in Sturgeon County. The mean incidence in the affected crops was 25%, while incidence across all fields in CAR 5 was 3%.

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Table 1. Assessment scale used to score severity of blackleg symptoms.

Severity Score	Description
0	No diseased tissue visible in the cross section
1	diseased tissue occupies 25% or less of cross section
2	diseased tissue occupies 26-50% of cross section
3	diseased tissue occupies 51-75% of cross section
4	diseased tissue occupies >75% of cross section with little or no constriction of affected tissues
5	diseased tissue occupies 100% of cross section with significant constriction of affected tissues; tissue dry and brittle, plant dead

Table 2. Prevalence, incidence, and severity of blackleg and sclerotinia stem rot in Alberta in 2010

	Blackleg Basal Canker	Blackleg Stem Lesions	Combined Blackleg	Sclerotinia stem rot
Prevalence (% crops with symptomatic plants)	53.4	50.7	66.2	38.5
Mean incidence across all crops	8.7	8.1	13.9	15.1
Mean incidence in infected crops	16.3	16.0	21.1	23.2
Mean severity across all surveyed fields	0.7	PR[a]	PR	2.1
Mean severity in infected crops	1.4	PR	PR	3.2

[a] PR= Present; disease severity was not evaluated, but symptoms were observed.

Table 3. Prevalence, incidence and severity of minor diseases of canola in Alberta in 2010

	Aster Yellows	Fusarium wilt	Foot rot	Pod spot	Alternaria crop rating	Club-root	Brown Girdling Root Rot
Prevalence (% crops with symptomatic plants)	2.7	3.4	12.8	23.0	41.2	2.0	20.3
Mean incidence across all crops	0.1	0.3	0.7	10.4	NA[b]	0.5	2.9
Mean incidence in infected crops	3.3	9.0	5.5	45.3	NA	24.7	15.3
Mean severity across all surveyed fields	PR[a]	0.1	PR	0.4	1.3	0.0	PR
Mean severity in infected crops	PR	4.4	PR	34.0	3.1	1.9	PR

[a] PR= Present; disease severity was not evaluated, but symptoms were observed.
[b] NA= Data not collected

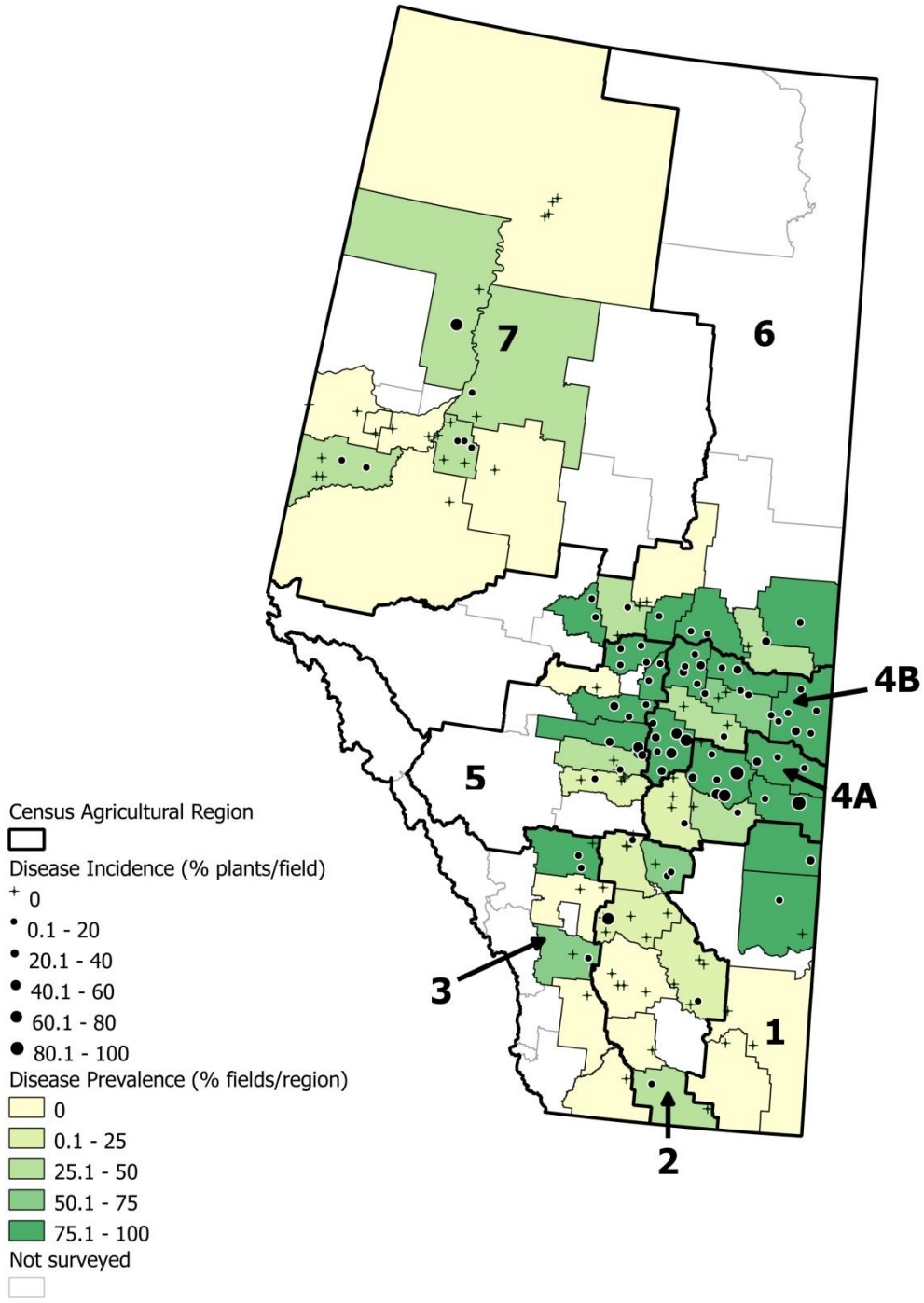

Figure 1. Prevalence and incidence of basal blackleg canker in Alberta in 2010.

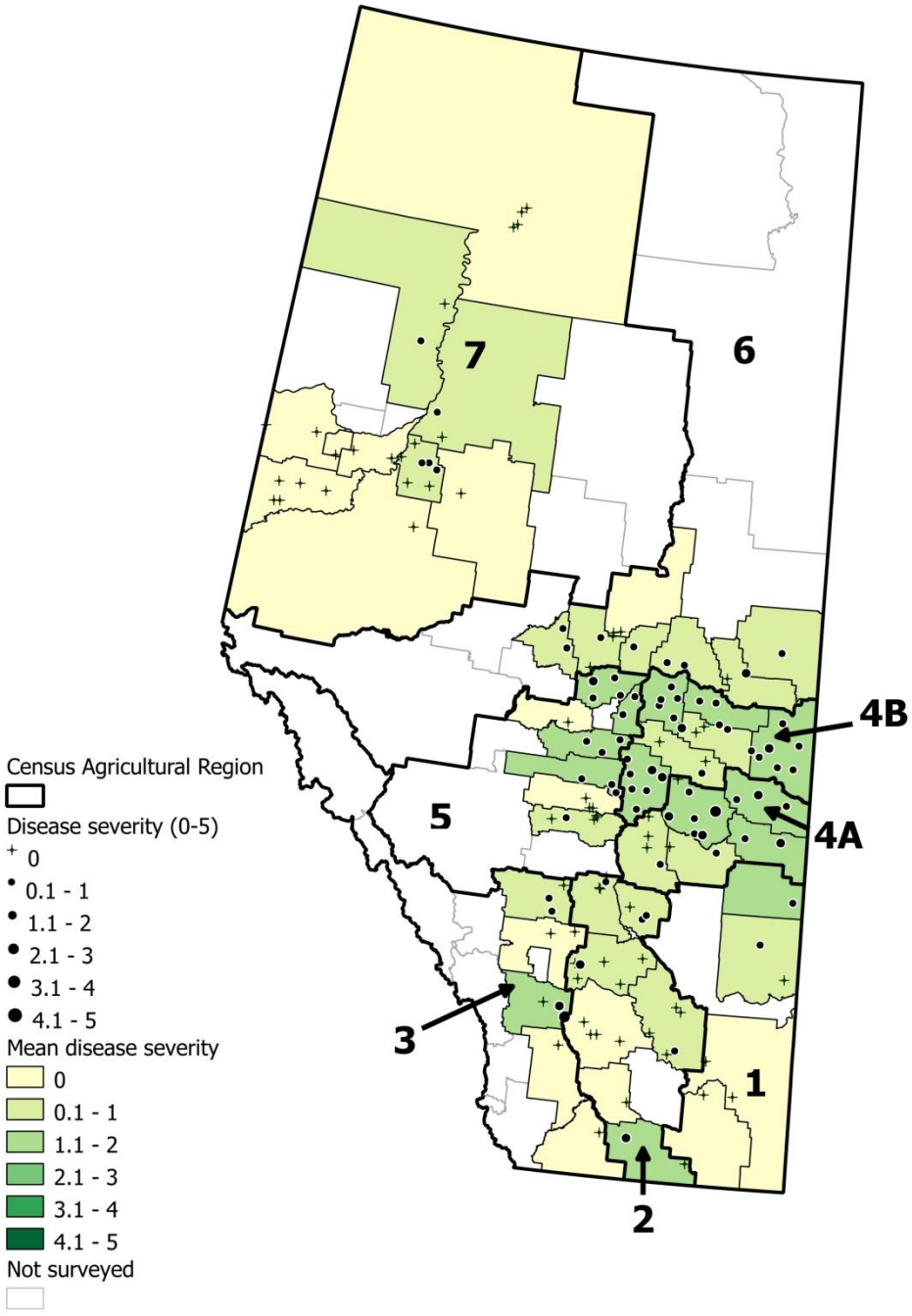

Figure 2. Severity of basal blackleg symptoms in Alberta in 2010.

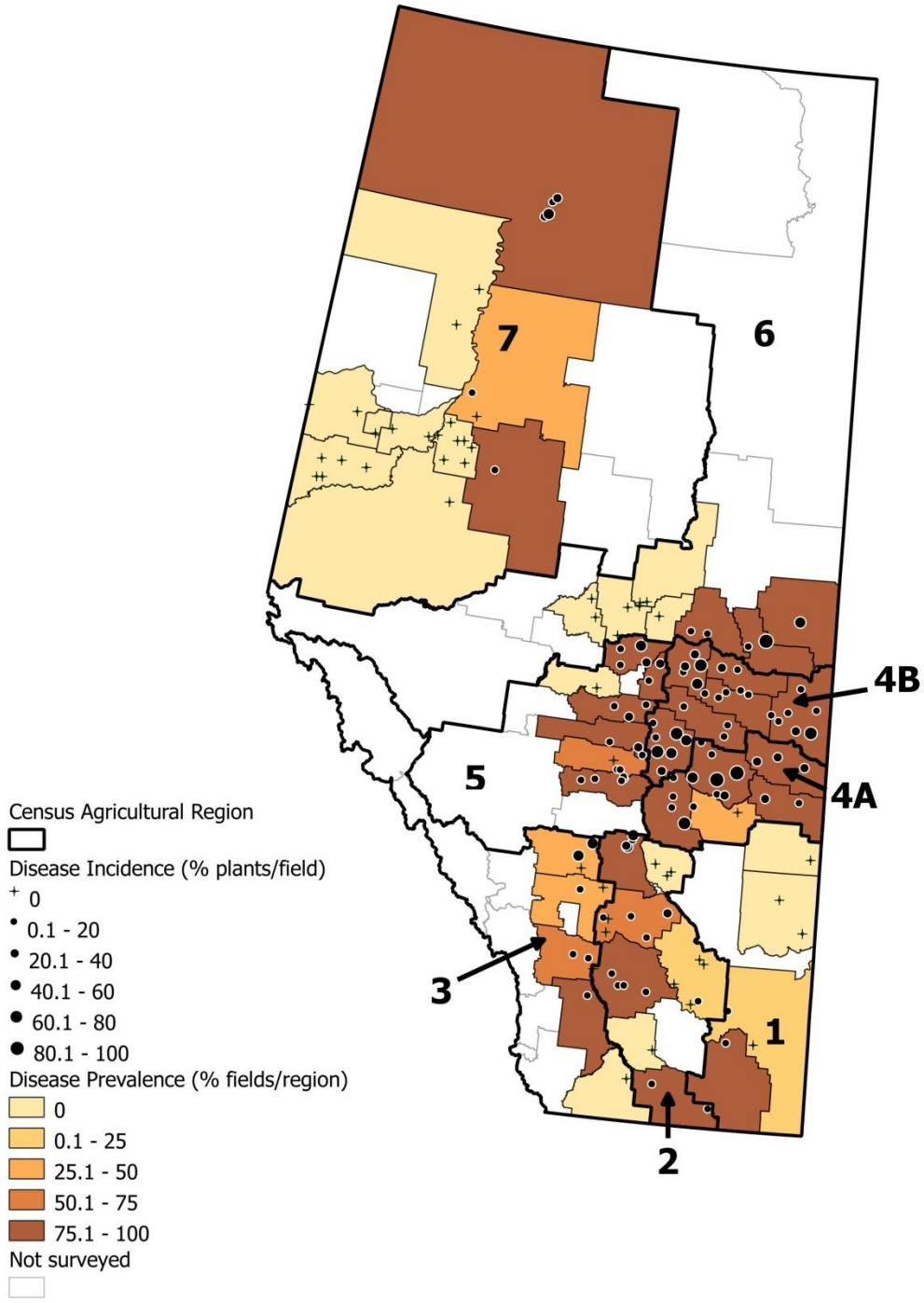

Figure 3. Prevalence and incidence of sclerotinia stem rot in Alberta in 2010.

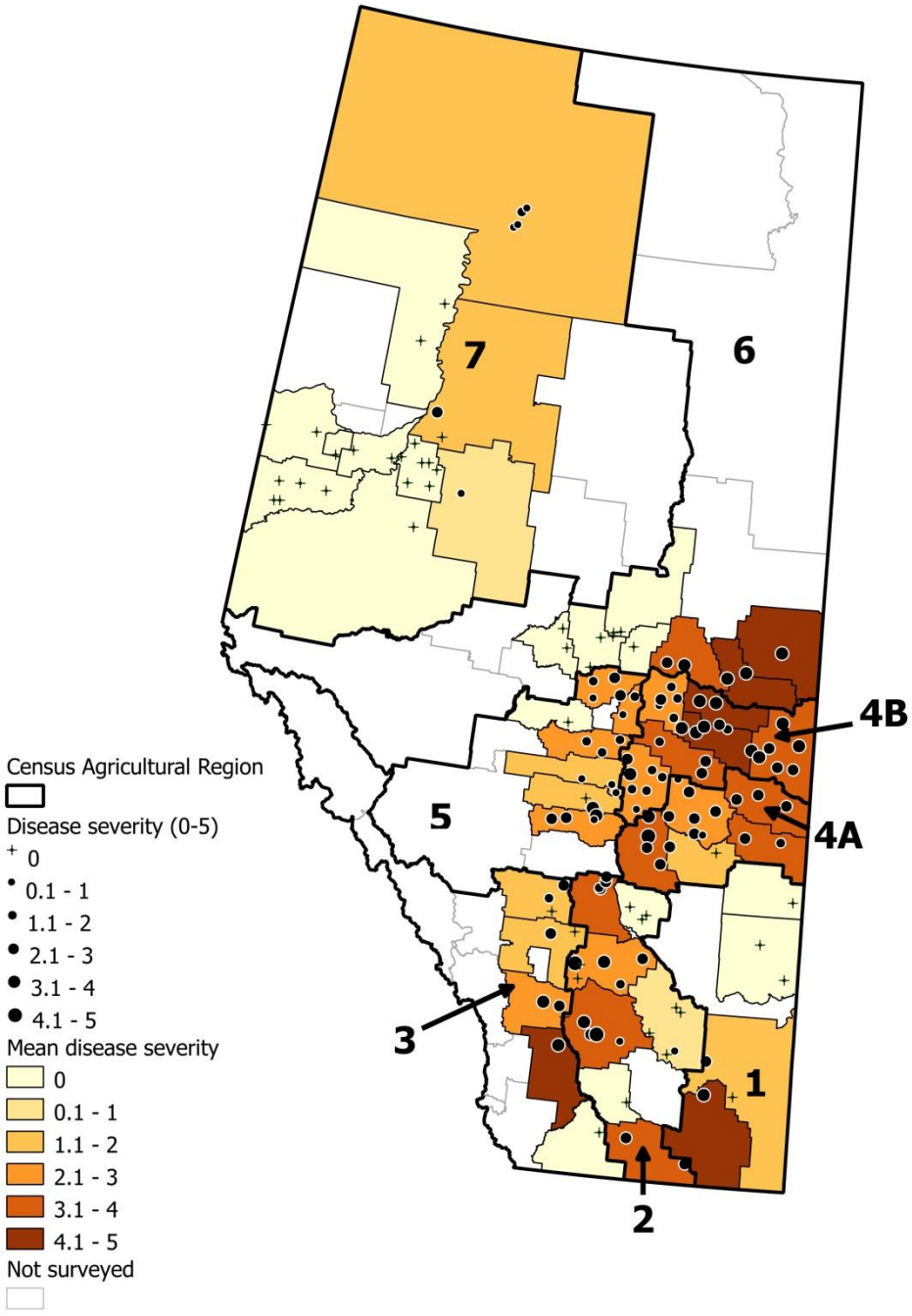

Figure 4. Severity of sclerotinia stem rot in Alberta in 2010.

CROP: Canola
LOCATION: Saskatchewan

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TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2010

METHODS: A total of 265 canola (*Brassica napus*) fields were surveyed between July 29 and September 15 in the major canola production regions of Saskatchewan. The number of canola fields surveyed per region was targeted to be approximately proportionate to the amount of canola grown in each of the regions, which included northwest (38 fields in Saskatchewan crop districts (CD) 9AW and 9B), northeast (52 fields in CD 8 and 9AE), west-central (35 fields in CD 6B and 7), east-central (104 fields in CD 5 and 6B), southwest (10 fields in CD 3ASW, 3BN and 4B), and southeast (26 fields in CD 1 and 2B) Saskatchewan. Eleven crops in the west-central region and 4 in the southwest region were under irrigation. Most of the crops were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). Disease assessments were made in each crop by collecting 20 plants from each of five sites at least 20 m from the edge of the field and separated from each other by at least 20 m. Presence or absence of symptoms on each plant was determined to give percent disease incidence for sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.), and fusarium wilt (*F. oxysporum* f.sp. *conglutinans*). For sclerotinia stem rot, each plant was also rated for disease severity, using the 0-5 scale in Table 1 (Kutcher and Wolf 2005). For blackleg, plants were scored for either severe basal stem cankers or any other type of blackleg stem lesion. Plants with severe basal stem cankers were also rated for disease severity using the 0-5 scale in Table 2 (Western Canada Canola/Rapeseed Recommending Committee 2009). For alternaria black spot (*Alternaria brassicae, A. raphani*), percent severity of lesions on the pods of each plant was assessed (Conn et al. 1990). When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1%. Mean disease incidence or severity values were calculated for each region. Mean incidence or severity values equal to or less than 0.1% were reported as “trace”. Soil samples (~1L) from 60 of the fields surveyed in 2009 (Dokken-Bouchard et al. 2010) and 76 of the fields surveyed in 2010 were analysed using the PCR based diagnostic test of Cao et al. (2007) for the presence of *P. brassicae* Woronin.

RESULTS AND COMMENTS: Similar to 2009, approximately 3.1 million ha (7.7 million acres) of canola were seeded in Saskatchewan in 2010 (Statistics Canada, 2010). Excess precipitation combined with lack of both heat and sunshine created many challenges for farmers in 2010. Crops were stressed from excess moisture and disease pressure. Most of the province received 115 to 150% of normal average precipitation and flooding damage in crops was common (Saskatchewan Ministry of Agriculture, 2010).

Sclerotinia stem rot was observed in 91% of the crops surveyed. Incidence ranged from 0 to 93% and mean severity ranged from 0 to 5. Severity was highest in the north-west region (average rating of 3), whereas prevalence (94%) and mean incidence (23%) were highest in the west-central region. This contrasts with 2009, when stem rot incidence was lowest in the west-central region (0.7% main stem and 1% upper branch/pod lesions). Weather likely contributed to this difference in disease; in 2009 west-central Saskatchewan experienced drought-like conditions while 2010 was excessively wet. Mean total incidence of sclerotinia for the 15 irrigated crops (32%) was higher than the mean total incidence without irrigation (20%). Mean incidence for the province in 2010 was the highest observed in the previous 11 years of the canola survey, which included three others generally considered to have greater than normal precipitation (1999, 2000, 2004: 13 to 17%) (Dokken-Bouchard et al. 2010).

Blackleg (stem lesions and/or basal cankers) was observed in 55% of the crops surveyed, with incidence ranging from 0 to 100% for basal stem cankers and mean severity ranging from 0 to 4.5 for these symptoms. Stem lesion incidence also ranged from 0 to 100% and was often associated with hail injury. Mean incidence for the province (3% basal and 2% upper stem) was higher than in 2009 (1.7% total), lower than 1999 (11%), and similar to the range for 2000 to 2008 (2.9 to 5% total blackleg), excluding 2002 (trace).

Aster yellows was observed in 13% of the crops surveyed, with incidence ranging from 0 to 17%. Mean incidence for the province was 0.3%, which was slightly higher than in 2009 and 2008 (trace and 0.2%, respectively). The highest incidence of aster yellows (2%) occurred in 2007 (Pearse et al. 2008). Prevalence (12%) and mean incidence (0.5%) of foot rot was lower than in 2009 (36% prevalence and 2% mean incidence), which was higher than in previous years. Alternaria black spot was reported in 19% of the crops surveyed. While the prevalence was lower than 2009 (53%) and 2008 (64%), the mean severity of alternaria black spot (0.3%) fell between the values reported for 2008 (trace) and 2009 (0.5%) (Dokken-Bouchard et al. 2010). Fusarium wilt symptoms were reported at an average of 4% severity in 4% of the crops surveyed in 2010, similar to 2009 (Dokken-Bouchard et al. 2010); however no plant samples were taken to confirm these observations. Clubroot symptoms were not observed in any of the surveyed crops and the pathogen was not detected in any soil samples from 2009 or 2010.

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Table 1. Sclerotinia rating scale (Kutcher and Wolf 2005).

Disease Rating	Lesion Location	Symptoms
0	None	No symptoms
1	Pod	Infection of pods only
2	Upper plant parts	Lesion situated on main stem or branch(es) with potential to affect up to ¼ of seed formation and filling on plant
3		Lesion situated on main stem or on a number of branches with potential to affect up to ½ of seed formation and filling on plant
4		Lesion situated on main stem or on a number of branches with potential to affect up to ¾ of seed formation and filling on plant
5	Lower plant part	Main stem lesion with potential effects on seed formation and filling of entire plant

Table 2. Blackleg rating scale (WCC/RRC 2009)

Rating	Description
0	No disease visible in the cross section
1	Diseased tissue occupies up to 25% of cross-section
2	Diseased tissue occupies 26 to 50% of cross-section
3	Diseased tissue occupies 51 to 75% of cross-section
4	Diseased tissue occupies more than 75% of cross-section with little or no constriction of affected tissues
5	Diseased tissue occupies 100% of cross-section with significant constriction of affected tissues; tissue dry and brittle; plant dead

Table 3. Mean incidence and severity of sclerotinia and blackleg of canola in Saskatchewan in 2010.

REGION[1] (NO. OF FIELDS)	Sclerotinia		Blackleg		
	Incidence	Severity[2]	Upper Stem Lesions	Basal Cankers	Basal Canker Severity[3]
Northwest (39)	20	3.0	4.7	5.4	0.7
Northeast (48)	20	2.5	2.4	2.8	0.7
West-central (46)	22	2.4	1.5	1.1	0.5
East-central (97)	22	2.4	1.5	2.0	0.6
Southwest (10)	15	2.0	9.0	3.5	0.5
Southeast (25)	12	2.0	1.1	6.0	0.5
Overall mean (265)	20	2.5	2.4	3.0	0.6

[1] Fields were surveyed in major canola production regions in the following rural municipalities of Saskatchewan: Northwest = 406, 435, 437, 440, 464, 466, 467, 471, 472, 493, 494, 496 to 499, 501, 502, 561, 588; Northeast = 308, 369 to 373, 394, 397, 399 to 401, 426 to 429, 456, 457, 459 to 461, 486, 487, 490, 520; West-central = 253, 254, 259, 283 to 285, 290, 315, 319, 344, 345, 347, 349 to 352, 377, 379 to 382, 409; East-central = 152, 181, 183 to 185, 187, 190, 211, 213 to 216, 218 to 223, 241, 243, 244, 246, 247, 250, 252, 271, 273 to 277, 279, 280, 282, 285, 301, 303, 308 to 301, 312, 333 to 338, 340 to 344, 347, 350, 351, 366, 368, 380; Southwest = 71, 167, 225, 228, 229, 231, 255; Southeast = 32, 33, 61, 92, 95, 122 to 125, 127 to 129, 151, 153 to 156, 158, 160, 161, 191, 192.
[2] Sclerotinia rating as per Table 1
[3] Blackleg rating as per Table 2

Table 4. Mean incidence of alternaria pod spot, aster yellows, brown girdling root rot, foot rot, and fusarium wilt of canola in Saskatchewan in 2010.

REGION[1] (NO. OF FIELDS)	Alternaria Pod Spot	Aster Yellows	Brown Girdling Root Rot	Foot Rot	Fusarium Wilt
Northwest (39)	8	1.0	0	1.0	Trace
Northeast (48)	13	Trace	0	0.8	0
West-central (46)	2.5	Trace	Trace	0.4	Trace
East-central (97)	19	0.3	0	0.2	Trace
Southwest (10)	10	0.2	0	0	0.5
Southeast (25)	0.2	0.2	0	0.4	0.4
Overall mean (265)	11	0.3	Trace	0.5	Trace

CROP: Canola
LOCATION: Manitoba

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TITLE: SURVEY OF CANOLA DISEASES IN MANITOBA IN 2010

METHODS: From July 30 to mid-September of 2010, 163 canola crops were surveyed in the southwest (66), northwest (26), eastern/interlake (32) and central (39) regions. All crops were *Brassica napus* and were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). They 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*), fusarium wilt (*F. oxysporum* f.sp. *conglutinans*) and clubroot (*Plasmodiophora brassicae*). For sclerotinia stem rot, each plant was scored based on the possible impact of infection on yield using a disease severity scale of 0 (no symptoms) to 5 (main stem lesion with potential effects on seed formation and filling of entire plant) (Kutcher and Wolf, 2006). Blackleg lesions that occurred on the upper portions of the stem were assessed separately from basal stem cankers. Basal stem cankers were scored using a disease severity scale based on area of diseased tissue in the cross-section of the stem where 0 = no diseased tissue visible in the cross section and 5 = diseased tissue occupied 100% of cross section with plant dead (WCC/RRC, 2009). The prevalence and percent severity (Conn et al. 1990) of alternaria pod spot (*Alternaria* spp.) were also determined. When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1%. In addition to the visual assessment of canola diseases, 80 soil samples were collected throughout Manitoba for DNA analysis to detect the clubroot pathogen.

In each canola crop, 100 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. For soil collection, samples were obtained from each of the five points of the “W”, or if the field entrance was visible, they were collected at 5 points near this entrance.

RESULTS: A number of diseases were present in each of the four regions of Manitoba, but clubroot symptoms were not observed in any of the crops surveyed in 2010. In addition, no clubroot spores were detected in the soil samples from 60 and 79 Manitoba canola fields targeted for DNA analysis in 2009 and 2010, respectively. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1) in 2010. The prevalence of sclerotinia-infested crops ranged from a high of 92% in the northwest region to 78% in the eastern/interlake region, with a provincial mean of 88%. This was similar to the prevalence of 91% in 2009 (McLaren et al. 2010). Mean disease incidence ranged from 42% in the eastern/interlake to 24% in the southwest region with a provincial mean of 31%. The mean disease incidence in 2009 was 18%. Disease severity was assessed for the first time in 2010 with values of 2.6,

1.8, 2.7 and 2.2 in the central, eastern/interlake, southwest and northwest regions, respectively, with a provincial mean of 2.4.

Blackleg basal cankers occurred in 58% of the crops surveyed in 2010 with disease incidence ranging from 17% in the eastern/interlake region to 10% in both the northwest and central regions, with a provincial mean of 13%. In 2009, blackleg basal cankers were found in 56% of surveyed crops with a mean disease incidence of 4% (McLaren et al. 2009) for the province. The severity of blackleg basal cankers was assessed for the first time in 2010 and was 2.5, 1.6, 1.8, and 1.7 in the central, eastern/interlake, southwest and northwest regions, respectively, with a provincial mean of 2.0. A disease severity rating of 2 is equivalent to diseased tissue occupying 26-50% of the basal stem cross section.

The mean prevalence of blackleg stem lesions was 66% in 2010 with 65%, 54% and 56% of crops infested with stem lesions in 2007, 2008, and 2009, respectively (McLaren et al. 2008; 2009; 2010). The mean incidence in 2010 was 11% which was higher than that observed in 2009 (4%). A high incidence of stem lesions was frequently associated with hail damage to canola stems.

The mean prevalence of alternaria pod spot in 2010 was 91%, 87%, 53% and 23% for crops surveyed in the eastern/interlake, central, southwest and northwest regions, respectively (Table 1). The severity of alternaria pod spot was low (Table 2) with means <3%. Higher than normal precipitation in the interlake region likely favoured the higher incidence and severity of pod spot in this region.

The mean prevalence of aster yellows in the crops surveyed in 2010 was 14% and was similar to the mean prevalence of 15% observed in 2009. Aster yellows was observed in all regions in 2010, with a mean disease incidence of 2% in crops with this disease.

Of the 163 canola crops examined in Manitoba, fusarium wilt was observed in 3%, with a mean incidence of 2%. No fusarium wilt was observed in the eastern/interlake region (Table 1). This disease was found in 21%, 18%, 15%, 9% and 4% of fields in 2005, 2006, 2007, 2008 and 2009, respectively, illustrating a reduction in disease prevalence from 2005 to the present. This is likely due to the use of wilt-resistant canola cultivars.

Foot rot occurred in 10% of canola crops surveyed. This disease was recorded in 38% of crops in the northwest region where excess moisture was reported to have occurred in 50% of fields surveyed. Mean disease incidence ranged from 18% in the central region to 3% in both the southwest and eastern/interlake regions, with a provincial mean of 10%.

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Table 1. Number of canola crops surveyed and disease prevalence in Manitoba in 2010.

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Crop Region	No. of Crops	Sclerotinia stem rot		Blackleg basal cankers		Blackleg stem lesions		Alternaria pod spot		Aster yellows		Fusarium wilt	
		P[1]	DI[2]	P	DI	P	DI	P	Sev.[3]	P	DI	P	DI
Central	39	90	30	72	10	77	11	87	<1	8	1	3	2
East./Inter.	32	78	42	47	17	75	13	91	3	6	1	0	0
Northwest	26	92	37	54	10	38	9	23	1	38	2	12	1
Southwest	66	91	24	56	15	67	10	53	1	12	2	2	3
All regions	163	88	31	58	13	66	11	64	2	14	2	3	2

[1] Mean percent prevalence.
[2] Mean percent disease incidence.
[3] Mean percent severity.

Table 2. Distribution of incidence (sclerotinia, blackleg, aster yellows, and fusarium wilt) and severity (alternaria pod spot) classes in 163 crops of *Brassica napus* in Manitoba in 2010.

Percentage of crops with						
Incidence range	Sclerotinia stem rot	Blackleg basal cankers	Blackleg stem lesions	Aster Yellows	Fusarium wilt	Alternaria pod spot
0%	12	42	34	86	97	36
1-5%	9	28	33	13	3	60
6-10%	14	8	14	1	0	1
11-20%	19	12	7	0	0	2
21-50%	26	6	10	0	0	1
>50%	20	4	2	0	0	0

CROP: Chickpea (*Cicer arietinum*)
LOCATION: Saskatchewan

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TITLE: **ASCOCHYTA BLIGHT ON CHICKPEA IN SASKATCHEWAN, 2009 AND 2010**

METHODS: A survey was conducted in 10 chickpea fields on Aug. 5, 11, 2009 and in 8 chickpea fields on Sept. 02, 2010 (pod stage to maturity) to assess incidence and severity of ascochyta blight (*Ascochyta rabiei*). The survey covered parts of south-west and south-central Saskatchewan. Ten plants were assessed at each of 10 sites along a teardrop-shaped circuit in each field. Blight incidence was counted and severity was assessed using the 0–11 Horsfall-Barratt scale (1).

RESULTS AND COMMENTS: In 2009, weather conditions in the survey region during the growing season were cool, with below-normal rainfall (2). Wet weather is conducive to development of ascochyta blight, so severity was generally lower than normal. However, the incidence of blight within fields was high (up to 93%). Most crops had been sprayed repeatedly with fungicides (up to four times). Severity varied substantially from field to field and within individual fields, from flecking and a few lesions to minor stem lesions and leaf lesions, to severe stem breakage (Table 1).

In 2010, weather conditions during the growing season were cool but extremely wet, with record rainfall (2), so the incidence and severity of ascochyta blight were higher than in 2009. Incidence was high (range 75–95%) in every crop but severity varied substantially (range 2–53%). Large lesions on pods caused the seed to shrivel or abort. In one field with high levels of blight, empty pods littered the soil surface, and girdling stem lesions occurred frequently in crops where severity was high. Each crop had received several fungicide applications. Despite frequent fungicide applications, only one crop had low incidence (8%) and severity (2%). Other diseases included root rot and white mold (*Sclerotinia sclerotiorum*) within the canopy in thicker crops.

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Table 1. Mean incidence and severity (%) of ascochyta blight (range in brackets) in commercial chickpea crops in Saskatchewan, 2009 and 2010, reported by crop district (CD).

Year	Region (Crop District)	No. of fields	Incidence (%)	Severity (%)
2009	South-west (CD 3A)	2	69 (40–95)	6 (0–12)
	South-west (CD 3B)	6	66 (40–95)	6 (0–25)
	West-central (CD 7A)	2	55 (40–70)	2 (0–3)
2010	South-west (CD 3A)	2	78 (75–80)	7 (3–12)
	South-west (CD 3B)	4	93 (85–95)	24 (6–94)
	West-central (CD 7A, 6B)	2	52 (8–95)	8 (2–13)

CROP: Flax
LOCATION: Manitoba

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TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2010

METHODS: A total of 39 flax crops were surveyed in 2010, 20 in southern Manitoba, and 19 in southern and eastern Saskatchewan. Nine crops were surveyed in mid-August, 28 crops in the last week of August, and 2 crops in the first week of September. Eighty-one percent of the crops were the brown seed-colour linseed flax, and 19 % were yellow seed-colour flax. Crops surveyed were selected at random along pre-planned routes in the major areas of flax production. Each crop was sampled by two persons walking ~100 m in opposite directions to each other in the field following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of fusarium wilt (*Fusarium oxysporum lini*), pasmo (*Septoria linicola*), powdery mildew (*Oidium lini*), rust (*Melampsora lini*), alternaria blight (*Alternaria* spp.), and aster yellows were recorded. Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, 14 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-two percent of the flax crops surveyed in 2010 were rated excellent for stand and the remainder were good to fair. Eight percent of the crops surveyed in Manitoba and 35% in Saskatchewan were maturing early with excellent to good vigour, while the other crops had poor vigour and were expected to mature late. The 2010 growing season started normally with abundant moisture and good growing conditions. However excess moisture late in the season, especially in Saskatchewan, created unfavourable conditions for maturity and was expected to reduce the yield and quality of harvested seed. The 2010 survey showed only minor differences between Manitoba and Saskatchewan in the incidence and severity of major diseases, but there was more lodging and lower vigour in most crops in Saskatchewan than in Manitoba.

Pasmo, the most prevalent disease in 2010, was observed in 98% of crops surveyed (Table 1). The prevalence and severity on stems were higher than in previous years (1, 2, 3, 4), due perhaps to frequent rains favouring disease development in August. Pasmo severity ranged from trace to 20% of the stem area affected in most infested crops and was >30% in 15% of the crops (Table 1).

Some root infections and fusarium wilt were observed in 39% of flax crops in 2010. Incidence was very low (trace to 5%) in most crops (Table 1). Prevalence of these diseases in 2010 was lower than in previous years probably due to below-normal temperatures early in the season which do not favour root infection (1, 2, 3).

Powdery mildew was at record low levels. It was observed in 15% of flax crops in Manitoba and 11% in Saskatchewan (Table 1); severity ranged from trace to 10% leaf area affected in most crops. Powdery mildew infections started late in 2010 and developed slowly resulting in lower incidence and severity than in previous years (1, 2, 3).

Rust was not observed in any of the crops surveyed in 2010, nor in flax rust trap nurseries planted at Morden and Portage la Prairie, Manitoba, and Indian Head, Saskatchewan.

Aster yellows (phytoplasma) was observed in 13% of flax crops with incidence ranging from trace to 1% affected plants. Alternaria blight was observed in 54% of the crops with a severity range from trace to 10% leaf area affected. No sclerotinia stem infections were evident in any of the crops surveyed in 2010.

Of the14 flax samples submitted to the Crop Diagnostic Centre, two were identified with alternaria blight, three with pasmo, one with leaf spot caused by *Phoma* spp., one with fusarium wilt, one with environmental injury, and six with chemical injury.

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 39 crops of flax in Manitoba and Saskatchewan in 2010.

Fusarium Wilt				**Pasmo**				**Powdery Mildew**			
Disease Class		**Crops**		**Disease Class**		**Crops**		**Disease Class**		**Crops**	
Incid.[1]	**Sever.[2]**	**No**	**%**	**Incid.[1]**	**Sever.[2]**	**No**	**%**	**Incid.[1]**	**Sever.[2]**	**No**	**%**
0%	0%	24	61	0%	0%	1	2	0%	0%	34	87
1-5%	1-5%	15	39	1-10%	1-5%	15	39	1-10%	1-5%	4	10
5-20%	5-10%	0	0	10-30%	5-10%	7	18	10-30%	5-10%	1	2
2-40%	10-20%	0	0	30-60%	10-20%	10	26	30-60%	10-20%	0	0
>40%	10-40%	0	0	>60%	20-50%	6	15	>60%	20-50%	0	0

[1] Disease incidence = Percentage of infected plants in each crop.
[2] Disease severity = Percentage of roots affected by fusarium wilt, of stems affected by pasmo, and of leaves affected by powdery mildew.

CROP: Lentil
LOCATION: Saskatchewan

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TITLE: SEED-BORNE PATHOGENS OF LENTIL AND CHICKPEA IN SASKATCHEWAN IN 2010

METHODS: Results were summarized of agar plate tests on seed samples from Saskatchewan conducted by three companies between September and late December 2010. The seed samples were assumed to be predominantly from the 2010 crop. On lentil the tests were conducted to detect pathogens causing ascochyta blight (*Didymella* [*Ascochyta*] *lentis*), anthracnose (*Colletotrichum truncatum*), botrytis stem and pod rot (grey mould) and seedling blight (*Botrytis* spp.), and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). All samples were tested for *Ascochyta* and slightly fewer for *Colletotrichum*, *Botrytis* and *Sclerotinia*. For *Ascochyta* and *Botrytis* mean % seed infection and % samples free of infection were calculated for each crop district [CD] in Saskatchewan (8). For *Colletotrichum* only the % infected samples for the whole province were calculated and for *Sclerotinia* the % infected samples for CDs and for the province were calculated. Anthracnose and sclerotinia stem and pod rot are not highly seed-borne on lentil and are generally at low levels even in seed from severely infested crops (1).

On chickpea the tests were conducted to detect *D. rabiei* (ascochyta blight), *B. cinerea (*botrytis blight) and *S. sclerotiorum (*sclerotinia stem and pod rot). Due to the small number of chickpea samples tested, Kabuli and Desi chickpea data were combined and only mean figures for the province were calculated.

The seed samples could not all be classified according to cultivar or whether the crops had been treated with seed treatments or foliar fungicides. However, lentil growers in Saskatchewan commonly use ascochyta-resistant cultivars and spray with foliar fungicides to control ascochyta blight and anthracnose. Similarly, chickpea growers are accustomed to making multiple fungicide applications during the growing season in order to prevent crop failure, especially with Kabuli cultivars.

RESULTS AND COMMENTS: In Saskatchewan the 2010 growing season was characterized by below-average temperatures, except in October, and six successive months (April – September) of well above average precipitation (8). These weather conditions caused delayed seeding, inability to plant crops, flooding damage, retarded plant development, failure to ripen, and slow, delayed harvesting (mostly in October). The only area of Saskatchewan with relatively good harvest conditions at the normal time was the extreme south (CDs 1A, 2AS, 3AS, 3BS, and 4A). However, even there substantial areas were not seeded or were damaged by flooding in the spring. Crop yields were generally above average, but quality was poor except in the extreme south (8).

Poor crop quality in lentil was characterized by discoloured and weather-damaged seed (3). These symptoms were due to rank crop growth which failed to ripen in late summer, often coupled with severe infestations of botrytis and sclerotinia stem and pod rots (R.A.A. Morrall, personal observations). Many seed samples were heavily infested with *Botrytis* spp. as well as with *Fusarium avenaceum*, a cause of seedling blight and root rot in lentil (1). This pathogen is not normally tested for by seed labs but been noted in previous surveys of lentil seed in wet years (7). In 2010 lentil seed samples with high *Botrytis* infection, 5-15% infestation by *F. avenaceum* and low levels of *Sclerotinia* were common. Pink seed infestation (1, 2) was also noted more often than usual. In contrast, chickpea crop quality was generally fair to good, reflecting the fact that the majority of this crop was grown in southern Saskatchewan.

During the 4-month period covered by this report 1202 samples were processed. This is double the number reported for a slightly shorter period in 2009 (6) but similar to numbers reported in wet years like 2002 (7) and 2004 (5). Mean levels of seed-borne *Ascochyta* varied from 0 to 2.7% among CDs (Table 1) with a provincial mean of 0.4%, similar to the four previous years (6). The percentage of ascochyta-free samples varied from 45 to 100% with a provincial mean of 84%. These data present a good picture of ascochyta seed health in 2010 despite weather highly favourable for spread of ascochyta blight. A frequency distribution showed only 2.3% of all seed samples had more than 5% ascochyta seed infection. It is probable that most of the heavily infected seed samples resulted from poor management practices, such as the use of outdated ascochyta-susceptible cultivars or planting lentil crops on lentil stubble.

Low levels (mostly < 2%) of *Colletotrichum* were found in about 17% of the total lentil samples, about double those in recent years (6). However, 17% is similar to the number in wet years like 2002 (7) and 2004 (5), when harvest was delayed and there was more time for anthracnose to spread to lentil pods.

Low levels (mostly <3%) of *Sclerotinia* were found in 54% of total lentil samples. The percentage within individual CDs varied from 0% in CDs 3BS and 4A to 100% in CDs 5B and 8. However, these four CDs were represented by very few samples. In CDs represented by more than 20 samples (Table 1) the variation was from 22% in CD 3AS to 96% in CD 7B. This indicates that inoculum of *Sclerotinia* is now present in a high percentage of fields in all major lentil growing areas of the province.

Mean *Botrytis* levels in seed varied from 0.6% in CD 3AS to 11.7% in CD 5A with a provincial mean of 5.3% (Table 1). Similarly, the percentage of *Botrytis* -free samples varied from 0% in six CDs to 50% in CD 3BS, with a provincial mean of only 18%. The mean infection of 5.3% is more than twice as high as values in the wet years of 2002 (7) and 2004 (5) and five times the mean of the previous nine years, 2001-2009 (4, 5, 6, 7). Undoubtedly *Botrytis* was the main cause of poor seed quality in lentil in 2010 and was responsible for downgrading, low germination, a risk of botrytis seedling blight in 2011 and an incentive to treat seed with a fungicide in 2011.

Only 62 chickpea seed samples were tested by the three labs in the September-December time period. Most of these came from CDs 2B, 3 and 7. The mean infection levels of the samples for the province were: Ascochyta = 2.5%, Botrytis = 3.2%, Sclerotinia = 0.3%. The percentages of disease-free samples were Ascochyta = 15%, Botrytis = 23%, Sclerotinia = 71%.

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Table 1. Numbers of lentil samples tested from September to December, 2010 by three commercial companies, and levels of infection with *Ascochyta* and *Botrytis* in relation to Saskatchewan Crop Districts.

Crop District	*Ascochyta lentis*			*Botrytis* spp.		
	Number of samples tested	Mean % infection	% samples with 0% infection	Number of samples tested	Mean % infection	% samples with 0% infection
1A	13	0	100	13	1.4	15
1B	0	-	-	0	-	-
2A	62	0.3	85	62	1.1	40
2B	180	0.2	76	179	1.8	31
3AN	36	<0.1	97	35	3.8	14
3AS	89	0.3	83	76	0.6	46
3BN	145	0.5	86	143	7.1	10
3BS	22	1.1	68	16	2.5	50
4A	8	2.7	63	8	0.7	25
4B	12	0.7	72	12	5.7	0
5A	11	0.6	45	11	11.7	0
5B	3	0.1	67	3	8.6	0
6A	64	0.1	92	64	7.1	2
6B	230	<0.1	95	188	7.0	14
7A	289	0.7	84	287	7.5	11
7B	26	0	100	25	5.1	4
8A	1	0	100	1	6.0	0
8B	2	0	100	2	10.2	0
9A	4	0	100	4	6.1	25
9B	5	0	100	5	3.6	0
TOTAL	1202	0.4	86	1134	5.3	18

CROP: Field Pea
LOCATION: Saskatchewan

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TITLE: SURVEY OF FIELD PEA DISEASES IN SASKATCHEWAN, 2010

METHODS: A total of 112 Saskatchewan field pea crops were randomly chosen for survey between June 8 and August 25. Regions surveyed included north-west (16 locations), north-east (11), west-central (20), east-central (11), south-west (48), and south-east (6) Saskatchewan. Most of the crops were surveyed shortly before harvest while pea plants were between BBCH growth stages 69 and 89 (Lancashire et al. 1991). Some of the crops were assessed earlier between BBCH growth stages 34 and 67, in order to monitor root rot and early signs of foliar disease. Disease assessments were made qualitatively in each crop by observing several representative plants to ascertain general health and presence or absence of symptoms. Prevalence of the following diseases was recorded: root rot (*Aphanomyces euteiches* f. sp. *pisi* / *Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani*), ascochyta leaf and pod spot (*Ascochyta pisi*), powdery mildew (*Erysiphe pisi*), sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*), septoria leaf blotch (*Septoria pisi*), and downy mildew (*Peronospora viciae*). Percentages of the crops surveyed showing symptoms of each of these diseases were calculated for each region (Table 1). Prevalence and estimated severity of mycosphaerella blight / ascochyta foot rot (*Mycosphaerella pinodes* / *Phoma medicaginis* var. *pinodella*) was also determined. Percentages of crops surveyed showing zero, trace, light, moderate, or severe levels of this disease complex were calculated for each region (Table 2).

RESULTS AND COMMENTS: Slightly less than 1 million ha (2.4 million acres) of field pea were seeded in Saskatchewan in 2010 (Statistics Canada, 2010). Excess precipitation combined with lack of both heat and sunshine created many challenges for farmers in 2010. Crops were stressed from excess moisture, flooding and disease pressure. Most of the province received 115 to 150 per cent of normal average precipitation.

Root rot was reported in 29% of the pea crops surveyed. This number would appear to underestimate a concern that has been raised by some farmers in Saskatchewan in recent years. Similar to the report of the 2009 pea disease survey (Dokken-Bouchard et al. 2010), some crops in which root rot was not identified may have sustained earlier root rot infections that were no longer visible by the time the survey was conducted late in the season. Furthermore, root rot may have been masked by environmental stress in pea crops that were flooded.

Mycosphaerella blight was the most prevalent disease observed, which is consistent with previous disease surveys in Saskatchewan and Manitoba (Dokken-Bouchard et al. 2010, McLaren et al. 2010). Symptoms were found in the upper canopy of 88% of the crops surveyed and in the lower canopy of 98% of crops surveyed, with severity ranging from trace to severe.

Ascochyta leaf and pod spot was most prevalent in the south-west with symptoms observed in 52% of crops surveyed in that region and was prevalent in the west-central (20%) and south-east (17%) regions. It was not observed in any crops in the north-east or east-central regions and was observed in only one crop in the north-west region. These regional differences coincide with previous disease surveys in Saskatchewan (Dokken-Bouchard et al. 2010) as well as pea seed testing data (Morrall et al. 2010). It is uncertain why ascochyta leaf and pod spot are more prevalent in the southern and west-central regions; possible reasons include environmental conditions or pea cultivars chosen. Although the pea cultivar was known in 28 of the crops surveyed, there were insufficient data to relate prevalence of ascochyta leaf and pod spot to cultivars grown in different regions.

Septoria blotch was reported in the northern and southern regions of the province, in 33% and 79% of pea crops surveyed in the south-east and south-west, respectively and in 55% and 6% of pea crops surveyed in the north-east and north-west, respectively. The disease was not observed in any of the east- or west-central pea crops surveyed.

Powdery mildew was reported on 10% of the crops surveyed in the province, but was not found in the west-central or south-east regions. In 2009 powdery mildew was not observed on pea crops surveyed in the north-west and east-central regions; however this year prevalence was highest (25%) in the north-west. The overall low prevalence is likely due to the use of resistant cultivars by growers, and is consistent with previous pea surveys in Saskatchewan and Manitoba (Dokken-Bouchard et al. 2010, McLaren et al. 2010). Downy mildew was observed in the upper canopy of 4% and the lower canopy of 7% of crops surveyed. In crops with downy mildew, disease severity was always low on the lower and upper foliage. None of the surveyors reported finding systemically-infected plants. There were more reports of downy mildew in 2009; with infection in the lower canopy of 30% of crops surveyed and systemic infections in five diseased crops (Dokken-Bouchard et al. 2010). While this disease is considered to be becoming endemic in Alberta (Chang et al. 2009), it remains sporadic in Saskatchewan.

Sclerotinia stem rot was reported in 34% of the pea crops surveyed in the province, but was not found anywhere in the south-east region. Prevalence was highest in the east-central region at 82%.

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Table 1. Prevalence of field pea diseases in crops surveyed in Saskatchewan in 2010.

Region (No. of Crops)	Percentage (%) of Pea Crops with Disease Symptoms					
	Root Rot	Ascochyta Leaf and Pod Spot	Septoria Blotch	Powdery Mildew	White Mould	Downy Mildew
North-west (16)	19	6	6	25	38	0
North-east (11)	36	0	55	9	64	0
West-central (20)	60	20	0	0	60	0
East-central (11)	45	0	0	9	82	27
South-west (48)	13	52	79	10	8	8
South-east (6)	33	17	33	0	0	17
Overall mean (112)	29	28	42	10	34	7

Table 2. Severity of mycosphaerella blight/ascochyta foot rot in pea crops surveyed in Saskatchewan in 2010.

Region (No. of Crops)	Overall Prevalence	Portion of Canopy	Percentage (%) of Pea Crops with Zero, Trace, Light, Moderate, or Severe Disease Rating				
			0	T	L	M	S
North-west (16)	100	Upper	0	25	63	13	0
		Lower	0	0	25	38	38
North-east (11)	100	Upper	9	27	36	18	9
		Lower	0	0	18	55	27
West-central (20)	100	Upper	0	10	10	55	25
		Lower	0	0	5	20	75
East-central (11)	100	Upper	9	27	27	18	18
		Lower	0	9	18	27	45
South-west (48)	96	Upper	21	31	25	21	2
		Lower	4	15	40	31	10
South-east (6)	100	Upper	17	33	33	17	0
		Lower	0	17	17	50	17
Overall mean (112)	98	Upper	12	26	29	25	8
		Lower	2	8	26	33	31

CROP: Pea
LOCATION: Saskatchewan

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TITLE: SEED-BORNE PATHOGENS OF PEA IN SASKATCHEWAN IN 2010

METHODS: Results were summarized of agar plate tests on seed samples from Saskatchewan conducted by three companies between September and late December 2010. The samples usually consisted of 200 seeds and were assumed to be predominantly from the 2010 crop. The tests were conducted to detect the pathogens causing ascochyta blights (*Mycosphaerella* [*Ascochyta*] *pinodes*, *Didymella* [*Ascochyta*] *pisi* and *Phoma medicaginis* var. *pinodella* = *A. pinodella*), botrytis blight (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for the ascochyta blight pathogens. It is unknown which of the seed samples came from pea crops that had been treated with registered seed treatments or foliar fungicides. In recent years spraying strobilurin fungicides has become a common practice on pea crops in Saskatchewan.

RESULTS AND COMMENTS: In Saskatchewan the 2010 growing season was characterized by below-average temperatures, except in October, and six successive months (April – September) of well above average precipitation (7). These weather conditions caused delayed seeding, inability to plant crops, flooding damage, retarded plant development, failure to ripen, and slow, delayed harvesting (mostly in October). The only area of Saskatchewan with relatively good harvest conditions at the normal time was the extreme south (CDs 1A, 2AS, 3AS, 3BS, and 4A). However, even there substantial areas were not seeded or were damaged by flooding in the spring. Crop yields were generally above average, but for many crops quality was poor except in the extreme south (7).

Crop quality in pea was less affected by the adverse conditions than most other crops. Germination percentages was similar to those in normal years. Also, a field survey of pea crops in 2010 (1) revealed no major differences in levels of *Ascochyta*-incited diseases compared with 2009. However, ripening was delayed and many pea crops were harvested in October instead of late August.

The number of seed samples tested by the three companies was 308, 25% more than the number reported in 2009 (5) but similar to numbers in some previous years. Increases and decreases of this type may reflect visible seed quality, commodity prices, or planting intentions for the subsequent year. For *Ascochyta* spp. mean % seed infection and % samples free of infection were calculated for each Saskatchewan crop district [CD] (7) (Table 1). However, this was not done for *Botrytis* and *Sclerotinia* because the low mean infection levels in all CDs would make comparisons meaningless. The majority of samples from all crop districts had 1% or less infection with either *Botrytis* or *Sclerotinia*.

Mean levels of seed-borne *Ascochyta* in individual crop districts varied from 0.5 to 17.0% (Table 1). However, if CDs represented by fewer than 10 samples were excluded, the range was from 4.2 to 13%, values within the range of those reported in the previous nine years (2, 3, 4, 5, 6). The mean provincial level of infection (7.1%) was the second highest in the last 10 years; in 2004, it was 7.4 (4). The percentage of samples in which no *Ascochyta* was detected was only 4%, the lowest in the last 10 years. Over these 10 years (2, 3, 4, 5, 6) there appears to have been a clear downward trend in *Ascochyta*-free samples, perhaps related to increases in pea acreages and a trend towards growing the crop in all areas of the province.

A separate set of samples of pea seed was used to compare the frequency of two *Ascochyta* spp. in CDs in Saskatchewan. For the tenth consecutive year (2, 3, 4, 5, 6) *A. pinodes* was the dominant species in central and northern CDs, while *A. pisi* was more commonly isolated from southern areas (Table 2). However, in contrast with 2009 (5) *A. pisi* was isolated more frequently than *A. pinodes* only in CDs 2, 3AS and 3BS, not on a province-wide basis. Also, the geographic separation of species was less clear than observed in previous years.

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Table 1. Number of pea seed samples tested from September to December, 2010 by three commercial companies and levels of infection with *Ascochyta* in relation to Saskatchewan Crop Districts

Crop District	No. of samples tested	Mean % infection	% samples with 0% infection
1A	4	9.8	0
1B	2	1.3	0
2A	0	-	-
2B	27	4.3	7
3AN	10	7.2	0
3AS	32	4.2	3
3BN	15	7.7	7
3BS	2	17.0	0
4A	1	0.5	0
4B	1	0.5	0
5A	12	6.3	0
5B	9	4.3	0
6A	46	4.9	0
6B	46	10.3	4
7A	18	11.5	0
7B	20	7.2	15
8A	20	7.7	5
8B	7	13.0	0
9A	20	7.6	5
9B	16	7.3	6
TOTAL	308	7.1	4

Table 2. Mean levels of *Ascochyta pinodes* and of *Ascochyta pisi* in pea seed samples tested from September 2010 to April 2011 by one commercial company in relation to Saskatchewan Crop Districts

Crop district	Mean % infection with *Ascochyta pinodes*	Mean % infection with *Ascochyta pisi*
1A	-	-
1B	7.1*	0.7*
2A	0.5*	11.5*
2B	1.1	2.9
3AN	5.6*	3.4*
3AS	0.4	2.1
3BN	5.3	2.7
3BS	1.4*	5.6*
4A	0.2*	0*
4B	5.4*	5.3*
5A	7.0	0.6
5B	9.7	1.8
6A	8.6	0.7
6B	9.3	2.9
7A	8.5	2.8
7B	7.8	1.0
8A	7.8	0.5
8B	8.7	1.4
9A	5.1	0.8
9B	5.1	0.4
OVERALL	7.0	1.7

* Based on fewer than 10 samples

CROP: Field pea
LOCATION: Manitoba

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TITLE: FIELD PEA DISEASES IN MANITOBA IN 2010

METHODS: Field pea crops were surveyed for root and foliar diseases at 41 and 40 different locations, respectively, in Manitoba. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where field pea is commonly grown. The survey for root diseases was conducted during late June to mid July when most plants were at the late vegetative (pre-flowering) stage. The severity of root diseases was rated on a scale of 0 (no disease) to 9 (death of plant). To confirm the visual disease identification, five to ten symptomatic roots were collected per field for isolation of fungi in the laboratory. *Fusarium* species were identified based on the methods of Nelson et al. (1983). Foliar diseases were assessed during late July and early August when most plants were at the round pod stage. A minimum of 30 plants (10 plants at 3 sites) was assessed in each field. Foliar diseases were identified by symptoms. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 9 (whole roots/plants severely diseased). Powdery mildew and downy mildew severity were rated as the percentage of leaf area infected.

RESULTS AND COMMENTS: Three diseases were observed during the survey for root diseases (Table 1). Fusarium root rot *(Fusarium solani* f. sp. *pisi and F. avenaceum*) was the most prevalent and was observed in all fields surveyed, as in previous years (McLaren et al. 2009, 2010).

Frequent showers occurred throughout the field season and severity means for all root diseases were higher in 2010 than in the previous year. *Fusarium avenaceum* was more frequently isolated from symptomatic roots than *F. solani* f. sp. *pisi* in 2008, 2009 and 2010. Rhizoctonia root rot (*Rhizoctonia solani*) were detected in 10 fields in 2010. Four pea crops had average root rot severity ratings above a value of 4 (i.e.,symptoms were present on 50% of the root system). Fusarium wilt (*F. oxysporum*) was also detected in 36 fields during the survey for root diseases.

Four foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2009, 2010), and was present in all fields surveyed. Sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*) was detected in 35 fields. The prevalence of sclerotinia-infested crops was 88% in 2010 compared with 7.5% reported in 2009 (McLaren et al. 2010). Downy mildew (*Peronospora viciae*) was detected in 28% of the fields surveyed with a mean disease severity of 0.1. Powdery mildew (*Erysiphe pisi*) was not observed in any of the surveyed fields. Because all newly registered pea cultivars are required to have resistance to powdery mildew, the absence of this disease can be attributed, in part, to the use of new cultivars by growers. However, mildew was observed very late in the growing season on a few susceptible lines at AAFC-Morden, which suggests that there may have been crops with powdery mildew later which was not present at the time of the survey. Other foliar diseases, such as septoria blotch (*Septoria pisi*), bacterial blight (*Pseudomonas syringae* pv. *pisi*) and anthracnose (*Colletotrichum pisi*) were not observed in the surveyed fields.

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Table 1. Prevalence and severity of root diseases in 41 crops of field pea in Manitoba in 2010.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Fusarium root rot	41	2.8	1.2-6.2
Rhizoctonia root rot	10	2.6	1.2-5.0

[1]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 40 crops of field pea in Manitoba in 2010.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Mycosphaerella blight	40	5.0	0.6-8.4
Sclerotinia stem rot	35	0.6	0.1-1.8
Powdery mildew	0	0	0
Downy mildew	11	0.1	0-0.2
Anthracnose	0	0	0

[1]Powdery and downy mildew severity were 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). Mean values are based only on fields where the disease was present.

CROP: Sunflower
LOCATION: Manitoba

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TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2010

METHODS: A total of 33 sunflower crops were surveyed in 2010 in Manitoba. Ninety percent were confectionery hybrids and 10 were oilseed hybrids, a drop in the oilseed acreage in 2010 in comparison with previous years (1, 2, 3). Eight crops were surveyed in July, 18 in August, and seven in September. The crops were surveyed along pre-planned routes in the major areas of sunflower production. Each crop was sampled by two persons walking ~100 m in opposite directions to each other in the field following an "M" pattern. Diseases were identified by symptoms and the percent incidences 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 diseases (*Phoma* spp. & *Phomopsis* spp.) were estimated as percent leaf or stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1). Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, 12 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: Ninety-two percent of the sunflower crops surveyed in 2010 had excellent to good stands while the rest had fair to poor stands. Fifty-five percent of the crops were maturing early, and only 8% maturing very late. Fifty-five percent of the crops had good to excellent vigour, and only 12% had poor vigour (Table 1). The 2010 growing season started normally with abundant rainfall and good growing conditions but soil moisture levels and temperatures were not favourable for high downy mildew infections. Above normal temperatures in July and August, above normal moisture in late August and September, and frost-free conditions in September helped the crops to develop and mature normally. However, below-normal temperatures in September were not favourable for the development of sclerotinia head rot in most sunflower crops. Traces of infestation with the sunflower beetle (*Zygogramma exclamationis*) were observed in a few crops and traces to 10% infestations by grasshoppers observed in 6% of the crops. Infestations at trace to 5% levels with seed weevil (*Smicronyx fulvus*) were observed in 40% of the crops, and with sunflower midge (*Contarinia schulzi*) in 10% of the crops.

Sclerotinia wilt was present in 55% of the crops surveyed in 2010 with incidence ranging from trace to 30% infected plants (Table 1). Sclerotinia head rot and mid-stem infection, both caused by ascospore infections, were present in 21% of crops. These were all crops surveyed in September; incidence ranged from trace to 20%. The prevalence and incidence of head rot in 2010 were much lower than in 2009 but similar to previous years (1, 2, 3, 4).

Rust was present in 40% of the crops surveyed, with severity ranging from trace to 40% leaf area affected (Table 1). Preliminary analysis of rust isolates collected indicates the prevalence of race-group 700 including 726, 736, and 776, which are virulent on most commercial sunflower hybrids. Rust infections started relatively late in 2010 and did not develop rapidly in most crops surveyed. Rust incidence and

severity in 2010 were lower than in 2009 and 2008, but similar to 2007 (1, 2, 3), probably due to late onset of infection and the above-normal temperature and low relative humidity in July and August. Verticillium wilt was present in 30% of the crops surveyed, with incidence ranging from trace to 5% (Table 1). Incidence was lower in 2010 than in 2009 and previous years (1, 2, 3, 4).

Downy mildew was observed in 58% of crops with incidence ranging from trace to 20% (Table 1). Preliminary analysis of the isolates collected indicates the predominance of races 730, 720, 730, and 320. The prevalence and incidence of downy mildew in 2010 were similar to 2009/2008 but lower than in 2007 (1) due perhaps to normal soil moisture levels at the seedling stage.

Traces to 5% leaf area infected by *Septoria helianthi* and *Alternaria* spp. were observed in 42% of the crops surveyed (Table 1). These are similar severity and prevalence values to previous years (1, 2, 3, 4). Traces to 20% of stem lesions caused by *Phoma* were present in 30% of crops and traces to 5% stem lesions caused by *Phomopsis* were present in a few crops. Traces to 5% leaf area affected by powdery mildew were also observed in a few crops.

Of the 12 samples submitted to the Crop Diagnostic Centre, two were identified as infected with rust, four with *Alternaria* spp., one with *Fusarium* spp., one with environmental injury, and four as chemical injury.

ACKNOWLEDGMENTS: The technical assistance of Tricia Cabernel, Maurice Penner, and Jamie Carlson is gratefully acknowledged.

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Table 1. Prevalence and index of diseases in 33 crops of sunflower in Manitoba in 2010.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt	18	55%	1.3	T – 3
Sclerotinia head rot/stem rot	7	21%	1.3	T – 3
Verticillium wilt	10	30%	1.0	T – 1
Downy mildew	19	58%	1.2	T – 3
Rust	13	40%	1.5	1 – 4
Leaf spots (Septoria & Alternaria)	14	42%	1.1	T – 2
Lateness[2]	2	8%	2.5	1 – 4
Stand	2	8%	1.4	1 – 4
Vigour	4	12%	2.4	1 – 4

[1] Disease index on a scale of T to 5: T (Trace) = < 1%, 1= 1-5%, 2= 5-20%, 3= 20-40%, 4= 40-60%, and 5= > 60% disease levels. Index is for disease incidence with downy mildew, verticillium wilt, sclerotinia; and for disease severity measured as % leaf and stem area affected with rust and leaf spots.

[2] Indexes for lateness, stand, and vigour are based on a 1-5 scale (1= early/very good and 5= very late/very poor).

Vegetables / Légumes

CROP: Cruciferous vegetables
LOCATION: Alberta

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TITLE: INCIDENCE OF CLUBROOT ON CRUCIFEROUS VEGETABLES IN ALBERTA IN 2010

METHODS: Seven commercial vegetable farms or market gardens in central and southern Alberta were surveyed for symptoms of clubroot caused by *Plasmodiophora brassicae* Woronin in 2010. Six of the seven farms/gardens were near Edmonton (two at the same location), and one farm near Lethbridge (Fig. 1). The locations were selected because they included many of the largest vegetable farms in Alberta and were surveyed in previous years. They contained a total of 116 different vegetable plots at 10 different field sites. In the Edmonton area (Sites 1-6), sampling was on September 28-29th. Sampling at Site 7, near Lethbridge, was on October 5. At each location, five random sampling sites were selected along a diagonal transect across each plot. Five plants were dug up and examined at each site giving a total of 25 roots examined in each of the 116 vegetable plots. Ten types of cruciferous vegetables were encountered: bok choy [*Brassica rapa* L. subsp. *chinensis* (Lour.) Hanelt]; broccoli [*Brassica oleracea* L. var. *italica* Plenck]; Brussels sprouts [*Brassica oleracea* L. var. *gemmifera* DC.]; cabbage, i.e. white, red and savoy [*Brassica oleracea* L. var. *capitata* L.]; cauliflower [*Brassica oleracea* L. var. *botrytis* L.]; kale [*Brassica oleracea* L. var. *acephala* DC.], kohlrabi [*Brassica oleracea* L. var. *gongylodes L.*], rutabaga [*Brassica napobrassica* Mill], su choy [*Brassica rapa* L. subsp. *pekinensis* (Lour.) Hanelt], and turnip [*Brassica rapa* L. var. *rapa* L.]. Vegetable plots surveyed at each location are given in Table 1. Conspicuous galls or tumors visible on root tissues were considered a positive diagnosis for clubroot.

RESULTS AND COMMENTS: The vegetable crops surveyed ranged in development from mature to nearing maturity, with some already harvested. All crops were sufficiently developed to display clubroot symptoms with suitable disease pressure and environmental conditions. The most commonly encountered vegetable was cabbage, which was sampled at all seven farms/gardens (Table 1). Environmental conditions in 2010 were favorable for clubroot development as there was abundant soil moisture throughout the growing season due to above average precipitation. Clubroot symptoms were observed on cabbage and broccoli in a single field at location 2, near Edmonton (Figures 1-2). The infested field had been previously used to grow canola. However, previous survey records indicated that clubroot was not detected there when a canola crop was grown there in 2006 (unpublished data).

In Alberta, over the past five years clubroot has been observed in canola (*Brassica napus* L.) and cruciferous vegetables. In canola, annual surveys since 2005 have indicated an increase in the distribution and incidence of this disease (6, 7, 8, 9, 10, 11, 12). The clubroot survey results for canola in Alberta for 2010 are presented in a separate report (13). In mixed cruciferous vegetables, clubroot was reported in the Edmonton area in 2004, 2005, 2006, and 2007 (1, 2, 4, 5) and in southern Alberta in 2008 (3). No vegetable surveys were conducted in 2009. Unlike the situation in canola, where the disease has been reported in over 560 fields since 2003 (13), clubroot has been observed only sporadically in vegetable fields at relatively few locations. Additionally, at all of the previously infested locations in Alberta, no symptoms were observed in 2010.This indicates successful containment and management of the infestation by vegetable growers via liming of soils, rotation, sanitation, cultivar selection and cultural

practices. This survey demonstrates the importance of growers' understanding the history of rented land in order to avoid planting susceptible cruciferous vegetable crops into previously infested canola fields.

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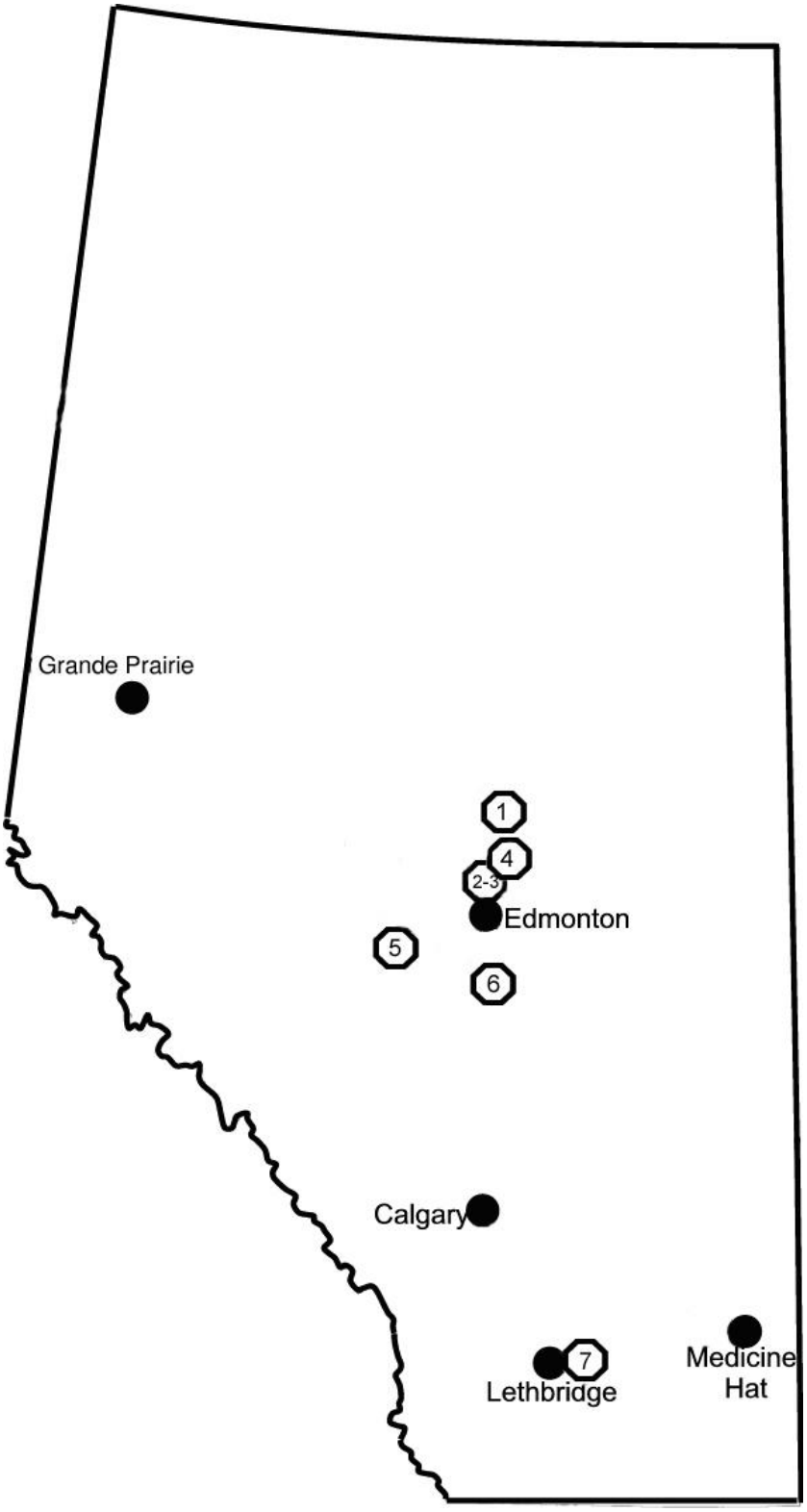

Figure 1. Alberta map showing vegetable farm locations sampled for clubroot.

Table 1. Vegetable plots sampled at each of six locations in Alberta. Sampling dates are shown in parentheses below the location number.

Crop	Loc. 1 (09-28-10)	Loc. 2 (09-28-10)	Loc. 3 (09-28-10)	Loc. 4 (09-28-10)	Loc. 5 (09-29-10)	Loc. 6 (09-29-10)	Loc. 7 (10-05-10)	Total
Bok Choy						3	1	4
Broccoli	4	1		4	2			11
Brussels sprouts	1	1		2	1			5
Cabbage (White)	9	4	3	8	5	2	5	36
Cabbage (Red)	2	1		4	2		1	10
Cabbage (Savoy)	1	1		3	1			6
Cauliflower	4	1	1	10	3		1	20
Kale				4				4
Kohlrabi	3	1		3			1	8
Rutabaga	1				1			2
Su Choy						3	1	4
Turnip					3			3
Total	25	10	4	38	18	8	10	113

Figure 2. Above-ground symptoms (stunting, yellowing and wilting) in cabbage due to clubroot at Location 2 (upper panel). Cabbage root samples with root galls collected from Location 2 (lower panel)

CROP: Carrot
LOCATION: Bradford/Holland Marsh, Ontario

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TITLE: DISEASES AND PHYSIOLOGICAL DISORDERS OF CARROT IN THE HOLLAND/ BRADFORD MARSH, ONTARIO, IN 2010

INTRODUCTION AND METHODS: A survey of carrot crops for the presence of diseases and physiological damage was conducted in late September 2010 when the carrot harvest season started in the Bradford/Holland Marsh, Ontario. The survey was part of the Muck Crops Research Station (MCRS), University of Guelph, Integrated Pest Management program to identify and quantify root damage in carrot caused by pathogens, environmental conditions and insect pests. One hundred carrots were randomly collected from five sites (20 per site) at each of the 24 commercial carrot farms surveyed. Tops were removed and the roots were immediately placed in a cold storage facility (0^{o}C; 95% relative humidity) for seven weeks before evaluation. Carrot roots were washed and assessed for diseases in mid-November 2010. Diseases and physiological damage were identified by visual symptoms.

RESULTS AND COMMENTS: Weather conditions in the 2010 growing season were conducive for most pathogens including *Pythium*, *Sclerotinia and Rhizoctonia* spp. Total monthly rainfall for June, July, August and September was above the previous 10-year average and likely resulted in excessive soil moisture. In turn this created ideal conditions for soil borne pathogens, particularly *Pythium*, resulting in a high incidence of cavity spot and pythium root dieback. Of the crops surveyed, 75 and 100% showed pythium root dieback and cavity spot, respectively.

Crater rot (*Rhizoctonia carotae* Rader) was found in 11 (46%) of the 24 carrot crops surveyed. The results of a carrot disease survey in 2009 from the Bradford/Holland Marsh were not reported; however, in 2009 there was only one carrot sample with crater rot submitted to the diagnostics laboratory of the MCRS (Tesfaendrias and McDonald, 2010).

Ten (42%) of the crops sampled had crown gall (*Agrobacterium tumefaciens*) with disease incidence ranging from 1 to 19%. Fusarium rot (*Fusarium* spp.) was found on carrots from two fields with an incidence of 2% in each. Sclerotinia rot (*Sclerotinia sclerotiorum*) was found in three (13%) of the fields surveyed. Sclerotinia rot infection starts in the field and continues in storage and is the most destructive storage pathogen of carrot (Howard et al., 1994).

Carrot roots from 63% of the fields surveyed showed splitting (growth cracks) which most likely resulted from fluctuating moisture levels during the growing season. Forking of carrots was observed in 88% of the fields surveyed. Marketable yield, particularly the fresh market type of carrot, was probably reduced due to this splitting and forking.

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Table 1. Disease incidence on carrot samples collected from commercial fields in the Bradford/Holland Marsh, Ontario in 2010.

Disease	Mean incidence (%) (n = 24)	% Crops affected* (n = 24)
Cavity spot	11.1	100
Pythium root dieback	2.9	75
Crater rot	0.8	46
Crown gall	2.0	42
Sclerotinia rot	0.2	13
Fusarium rot	0.2	8
Forking	3.7	88
Splitting (Growth cracks)	3.1	63

*Prevalence

CROP: Onion
LOCATION: Bradford/Holland Marsh, Ontario

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TITLE: INCIDENCE OF STEMPHYLIUM LEAF BLIGHT ON ONION IN THE BRADFORD/HOLLAND MARSH, ONTARIO, IN 2010

INTRODUCTION AND METHODS: A severe foliar disease of onion (*Allium cepa* L.) was first observed in 2008 during regular scouting of onion crops in the Holland/Bradford Marsh as part of an integrated pest management (IPM) program offered by the Muck Crops Research Station. In 2010, the disease was found in more fields. Initial symptoms on leaves consisted of tip necrosis followed by small, light yellow to brown disolourations with water-soaked lesions. These small lesions grew into elongated spots that frequently coalesced, resulting in blighted leaves. A fungus was isolated from infected tissue and identified as *Stemphylium vesicarium* (Wallr.), based on morphological characteristics (Ellis, 1971). Stemphylium leaf blight has some symptoms that are similar to purple blotch caused by *Alternaria porri* (Ell.), but stemphylium leaf blight kills onion leaves more rapidly. Both diseases are managed in the same manner. In 2010, 25 commercial onion crops around the Bradford/Holland Marsh were surveyed for the presence of stemphylium leaf blight through the IPM program.

RESULTS AND COMMENTS: In 2008, stemphylium leaf blight symptoms were localized within fields and reported from only four fields. In 2009, 18 samples submitted to the MCRS diagnostic laboratory were confirmed to be infected with *S. vesicarium*. During the 2010 growing season, stemphylium leaf blight was confirmed in all of the 25 commercial onion crops surveyed.

To our knowledge, these are the first reports of stemphylium leaf blight caused by *S. vesicarium* on onion in the Bradford/Holland Marsh, Ontario. Previous reports of stemphylium leaf blight caused by *S. vesicarium* in various onion-producing regions include from India (Gupta et al., 1994), Egypt (Hassan et al., 2007), New York in onion grown on organic soil (Shishkoff and Lorbeer, 1989) and Brazil (Boiteux et al., 1994) and Spain (Basallote-Ureba and Prados-Ligero, 1999) in garlic.

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Fruits, Nuts and Berries, Ornamentals and Turfgrass / Fruits, Fruits à Écale et Baies, Plantes Ornementales et Gazon

CROP/CULTURE: Grape (*Vitis vinifera*)
LOCATION/RÉGION: British Columbia

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TITLE/TITRE: TRUNK DISEASES OF WINE GRAPES IN THE OKANAGAN VALLEY.

INTRODUCTION: In 2010, vineyards in the Okanagan Valley and Vancouver Island were surveyed for the presence of grapevine trunk diseases considered to be major problems for vineyard managers worldwide. The majority of these trunk diseases have only recently been identified in BC vineyards (O'Gorman et al., 2009 & 2010). Also, individual trunk diseases are caused by a number of different fungal pathogens so the survey was conducted to: 1) identify the diseases present; 2) determine which pathogen species are associated with each disease; and 3) confirm the pathogenicity of new species identified.

METHODS: Symptomatic vines complete with roots were collected and brought back to the laboratory for analysis. In order to expose necrotic tissue, cross sections of the vines were taken from root material and from the trunk, both above and below the graft union. Small pieces of plant tissue (5-10 mm) were shaved from the margins of necrotic areas and then surface sterilized in a 0.53% NaOCl solution, rinsed in sterile distilled water and plated on acidified potato dextrose agar. Emerging fungal isolates were transferred onto new plates for visual identification using colony morphology and microscopic characteristics. To assess the pathogenicity of isolates, small plugs of fungal cultures were used to inoculate surface sterilized green grapevines shoots.

To confirm the fungal identifications, DNA was extracted from pure cultures and the internal transcribed spacer (ITS) regions of ribosomal RNA genes were amplified and sequenced. DNA sequence data were imported into SeqMan Pro analysis software (Lasergene 7.1: DNASTAR Inc., Madison, WI) for manual editing and BLAST searches of the GenBank database (National Center for Biotechnology Information: http://www.ncbi.nlm.nih.gov/).

RESULTS AND COMMENTS: In this year's survey, 15 sites were visited and five different trunk and root diseases were identified from symptomatic vines. Out of the seven diseases identified (Table 1) only grapevine dieback caused by *Truncatella angustata* was new. However, several new fungal species were identified as being associated with some of the trunk diseases reported in previous surveys. The identity of the pathogens was based on fungal morphology, species specific PCR assays and BLAST search results of ITS sequence data. The Canadian Plant Disease Survey Index (http://www.cps-scp.ca/CPDS-Software.shtml) and USDA Agriculture Research Service fungal database (http://nt.ars-grin.gov/fungaldatabases/) were used to conduct preliminary searches for reported occurrences of pathogen species identified in this survey.

Information on new diseases or grapevine pathogens new to BC identified in this year's survey follows:

Dieback: *Truncatella angustata*, has a worldwide distribution in many hosts including grapevine. It has been reported on willow and hemlock in Canada (Kope and Shamoun 2000, Vujanovic & Labrecque 2002) but not on grape. Pathogenicity of a *Truncatella* sp. on grapes has been reported, but showing only low virulence, and it was suggested to act as a weak or opportunistic pathogen (Úrbez-Torres, et al., 2009). However, in our lab pathogenicity tests the BC isolates rapid development of lesions from which the pathogen was easily re-isolated.

Botryosphaeria canker: Bot-canker was commonly identified in this year's survey and several different *Botryosphaeria* spp. were isolated from cankers. However, we isolated *B. obtusa* from vine cankers and, to our knowledge, this is the first report of this pathogen on grape in Canada. *Botryosphaeria obtusa* is a common pathogen of many hosts in Canada including, but not limited to apple, spirea, magnolia, mountain ash and white spruce.

Black foot: A new *Cylindrocarpon* species identified in the survey was *C. pauciseptatum* which was isolated from vines with black foot symptoms (Table 1). *Cylindrocarpon pauciseptatum* has been recently reported elsewhere as being able to produce necrotic root lesions on grapevine rootstock 110R (Alaniz et al., 2009).

Eutypa dieback: Two new species, *Cryptovalsa ampelina* and *Diatrypella favacea* were isolated from grapevine cankers with eutypa dieback symptoms (Table 1). *Cryptovalsa ampelina* and *Diatrypella* species are known to be associated with eutypa dieback on grapevines in other areas of the world, but this is the first report of these pathogens on grape in Canada. *Diatrypella favacea* has been reported on birch in Canada (Ginns, 1986; and Abbott & Currah, 1989), but we found no records of the occurrence of *C. ampelina* in Canada. To date pathogenicity tests have been conducted only on the *D. favacea* isolate, which was able to produce lesions on green vines, but it was difficult to re-isolate from the necrotic tissue.

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Table 1. Disease and pathogen identification from grapevine trunk disease samples.

Variety	*Rootstock*	*Planted*	*Disease*	*Pathogen ID*
Ortega	self rooted	unknown	black foot	*Cylindrocarpon* sp.
Gewürztraminer	S04	2005	black foot	*Cylindrocarpon* sp.
Riesling	SO4	2006	black foot	*Cylindrocarpon pauciseptatum**
Chardonnay	self rooted	2000	black foot	*Cylindrocarpon liriodendri*
Sauv Blanc	3309	2005	black foot	*Cylindrocarpon macrodidymum*
Sauv Blanc	3309	2005	esca	*Phaeomoniella chlamydospora*
Merlot	unknown	2005	esca	*Phaeomoniella chlamydospora*
Chardonnay	self rooted	1992	esca	*Phaeoacremonium angustius*
Sauv Blanc	3309	2005	Eutypa dieback	*Eutypa* sp.
Pinot Noir	S04/102	1997	Eutypa dieback	*Eutypa* sp.
Optima	self rooted	1998	Eutypa dieback	*Diatrypella favacea**
Pinot Blanc	3309	1999	Eutypa dieback	*Cryptovalsa ampelina**
Pinot Blanc	3309	1999	bot-canker	*Botryosphaeria* sp.
Chardonnay	self rooted	1992	bot-canker	*Botryosphaeria stevensii*
Chardonnay	self rooted	1992	bot-canker	*Botryosphaeria dothidea*
Gewürztraminer	3309	2006	bot-canker	*Botryosphaeria obtusa**
Ortega	self rooted	unknown	bot-canker	*Botryosphaeria* sp.
Siegerrebe	unknown	1998	dieback	*Truncatella angustata**
Optima	self rooted	1998	dieback	*Truncatella angustata **
Gewürztraminer	3309	2006	dieback	*Truncatella angustata **
Riesling	SO4	2006	Phomopsis**	*Phomopsis viticola*
Riesling	SO4	1987	Roeslaria root rot	*Roeslaria* sp.

*New species identified in this year's survey.
**Phomopsis cane and leaf spot.

Forest Trees / Arbres Forestiers

CROP / CULTURE: Poplar (*Populus* spp)
LOCATION / RÉGION: British Columbia

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TITLE / TITRE: PRELIMINARY DISTRIBUTION SURVEYS FOR *SEPTORIA MUSIVA* ON POPLAR IN THE UPPER FRASER VALLEY

INTRODUCTION: *Septoria musiva* Peck (teleomorph *Mycosphaerella populorum* G. E. Thomps.) causes leaf blight and, more importantly, stem cankers that often lead to breakage of *Populus* spp. in the midwest and eastern portions of North America. All native North American *Populus* species are somewhat susceptible, and hybrid poplars and Eurasian species sustain the most damage (stem cankers), usually resulting in broken stems of young trees (Feau *et al*. 2010). *Septoria musiva* is not native to the Pacific Northwest (Newcombe 1995). In 2007 *S. musiva*, was reported for the first time in British Columbia (BC) on hybrid *Populus* clones (Callan *et al.* 2007). These hybrids are grown in BC for rapid production of fibre, and many are especially susceptible to the disease (Ostry & McNabb 1985). The presence of this disease will have an impact on hybrid poplar plantation forestry in BC. Also, the native poplar species, black cottonwood (*P. trichocarpa* Torr. & A. Gray), trembling aspen (*P. tremuloides* Michx.), and balsam poplar (*P. balsamifera* L.) are important riparian species, and the impact of this disease on them is currently unknown. Should the disease become established in BC, international export of *Populus* and some of its products could be affected. From experience in other parts of North America, it is quite clear that S**. musiva** can cause extensive damage and hence economic losses (Royle & Ostry 1995; Spielman *et al.* 1986).

METHODS: Field sampling consisted of two seasons of roadside collections of poplar foliage. In 2008, foliage was collected in September and October from 446 trees, while a year later 407 additional samples were collected at two sampling intervals, in July and then again in October. The sample area was bounded by Dewdney, BC in the west, Yale, BC in the north and Manning Provincial Park to the east. The inability to differentiate visually the foliar symptoms of *S. musiva* from those of the native and relatively benign *S. populicola* Peck makes the use of genetic tools to confirm identity mandatory. Similarly, the presence of cankers on stems and branches is often difficult to attribute solely to *S. musiva* since other fungi and some insects cause similar damage. Molecular techniques like those outlined in Feau *et al*. (2005) were used to positively identify the presence of *S. musiva* from material collected from leaf spots.

RESULTS AND COMMENTS: The results of the genetic testing of leaf spots collected from sampled poplars are presented in Table 1. The difference between the number of leaves with spots that were sampled versus the number of spots sequenced (853 vs 561) was because not all leaf spot nucleic acid could be amplified. *Septoria musiva* was confirmed in 1.6% of the samples (Table 1). The distribution of these positive results was widely spread across the sample area (Fig.1) indicating either recently detected multiple introductions, rapid spread from a single introduction, or undetected slow spread over a long period. The four positive samples collected in 2008 were confirmed as being from *P. trichocarpa* trees. Improvements to the genomic testing portion of the project should allow us to revisit the collected samples and determine if there are missed positives in the collection. Additional positives will fill out the distribution of the fungus and help guide us in what possible options we might have for management of *S. musiva*.

Table 4. Results obtained from DNA sequencing for samples collected in 2008 and 2009.

	2008	**2009**	**Total**
Number of trees sampled	446	407	853
Number of leaf spots sequenced	288	273	561
Septoria populicola	282 (97.9%)	243 (89%)	525 (93.6%)
Septoria musiva	4 (1.4%)	5 (1.8%)	9 (1.6%)
Other	2 (0.7%)	25 (9.2%)	27 (4.8%)

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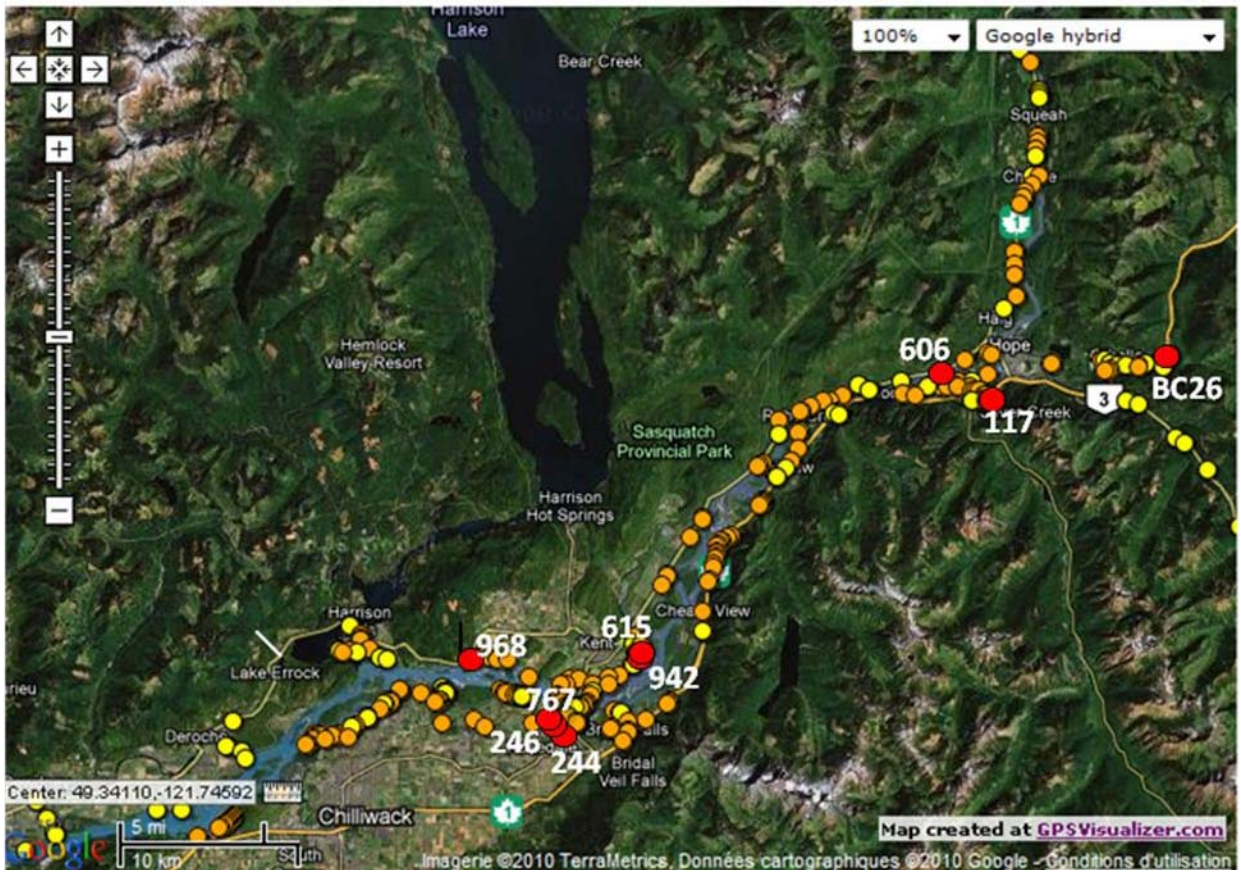

Figure 5. The distribution of poplar trees sampled in the upper Fraser Valley in July (yellow or white) and October (orange or lightly shaded) 2009 with the location of all the *Septoria musiva* positive samples identified in red or as large darkly shaded circles.

CROP/CULTURE: White pine (*Pinus monticola* D. Don)
LOCATION/RÉGION: British Columbia

NAMES AND AGENCIES/ NOMS ET ÉTABLISSEMENTS:
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TITLE/TITRE: DOTHISTROMA NEEDLE BLIGHT ON WESTERN WHITE PINE IN BRITISH COLUMBIA

INTRODUCTION: Dothistroma needle blight (*Dothistroma septosporum* (Dorog.) Morelet), also known as red band needle blight, can be a devastating disease of pines (Barnes et al. 2005; Woods et al. 2005). Needles of all ages are affected, usually in the lower portion of the crown, but in more severe cases the disease can cause total defoliation and mortality. This is the case with the current *D. septosporum* outbreak in northwestern British Columbia (BC) where it is causing unprecedented mortality in plantations and mature stands of lodgepole pine (*P. contorta* var. *latifolia* Dougl. *ex*. Loud.) (Woods et al. 2005). Severe defoliation caused by *D. septosporum* has been reported in western white pine (*P. monticola* D. Don) in Idaho (Shaw and Leaphart 1960). However, in BC the disease was not reported to cause severe defoliation on *P. monticola* until 1982 when it caused up to 80% discoloration and defoliation in 15-30 year-old stands of nearly pure white pine in southeastern BC [Forest Insect and Disease Conditions (FIDS) 1982-1990]. In 1982, at the most severely affected location near Nakusp, a permanent sample plot was established by FIDS and examined for 8 years. Although severity varied annually (between 56 and 82% of needles infected), the disease was nonetheless present each year and caused substantial reduction in height and diameter (Unger and Vallentgoed 1990). Mortality resulting from repeated severe infections was reported for only one tree during the 8-year assessment (FIDS 1982-1990).

Western white pine is highly susceptible to the introduced blister rust *Cronartium ribicola* J.C. Fisch. *in* Rabh., which causes branch and stem cankers. There are several tree improvement programs to screen for rust resistance in western North America (Eramian 1999; Hunt 1999; Kitzmiller and Samman 1999; Sniezko 1999). In BC, provenance trials support broad seed transfer rules for maintaining adaptability and productivity of western white pine, such that coastal trees originating north of the Columbia River in Washington State plus interior trees can be planted on the coast. However, coastal trees are not cold hardy enough to be recommended for plantations in the BC Interior (Thomas and Lester 1992; Meagher and Hunt 1999). Thus, there are two western white pine-seed zones for BC: coastal and interior. Although a single dominant gene or major gene resistance (MGR) against blister rust is known from southern Oregon (Kinloch et al.1999), much of the resistance seems to be ontogenetic (Sniezko et al. 2000; Hunt 2005). Mature plant resistance appears to be a common phenomenon in several host-pathogen interactions (Punithalingam and Gibson 1973; Liu and Harder 1996; Ficke et al. 2003), including against *C. ribicola* in both *P. strobus* L. (Patton 1961) and *P. monticola* (Hunt 2005). Selecting pines for increased ontogenetic resistance to *C. ribicola* may require evaluation in longer term field trials rather than inoculating and screening the more susceptible young seedlings. In BC such long term trials have recently been established (Carlson et al. 2010; King et al. 2010). A few older trials already existed and have been examined for rust incidence several times. Dothistroma needle blight has been noted in two of these trials and in other white pine plantations throughout the southern BC Interior.

Dothistroma septosporum sporulates early in the season during cool, moist weather and produces spores for a longer time than *C. ribicola* produces basidiospores. It is important to survey for *D. septosporum* because it may be: 1) able to out-compete *C. ribicola* for suitable needle infection sites, thus interfering with results of field evaluations for longer-term resistance to *C. ribicola*; 2) be so severe on trees of particular provenances that seed transfer rules will need to be modified; and 3) be severe on certain blister rust-selected trees to the point that they should be culled from orchards. The objective of the present study was to observe the symptoms and general impact of *D. septosporum* on *P. monticola* in BC and specifically on stocks selected for blister rust resistance.

METHODS: All trials examined were originally established to test field resistance to blister rust, or to demonstrate resistance, or to be used operationally to establish western white pine plantations. They were established by the Canadian Forestry Service or different agencies within the BC Forest Service. Since they were evaluated for *D. septosporum* incidence and damage by different agencies different evaluation methods were used.

Two older trials where *D. septosporum* was noted were at Pye Lake on Vancouver Island and on Texada Island, both coastal locations (Fig. 1). The Pye Lake site, planted in 1984, had two types of planting blocks: sub-block and mixed block. The sub-block type had 40 Idaho trees (rust resistant seed from the R.T. Bingham Arboretum) and 60 nonselected local trees (Sayward provenance) as adjacent sub-blocks. The mixed block type had *P. monticola* trees alternated with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco. Nearly every other *P. monticola* originated from Idaho or was from the Sayward provenance (for more details see Hunt 1994 and 2002). *Dothistroma septosporum* was first observed in 1995. A survey for white pine blister rust and *D. septosporum* was conducted the following year. The most severely blighted trees (trees exhibiting discolouration of needles, defoliation and stem or branch lesions) were growing near a swamp and were confined to one of the sub-blocks and one of the mixed blocks. Trees with greater than 50% defoliation were recorded as severely blighted and these same blocks were re-evaluated for similar defoliation and mortality in 2001 and 2007. The two white pine sources were compared by a Chi-square test (testhttp://www.graphpad.com/quickcalcs/chisquared1.cfm).

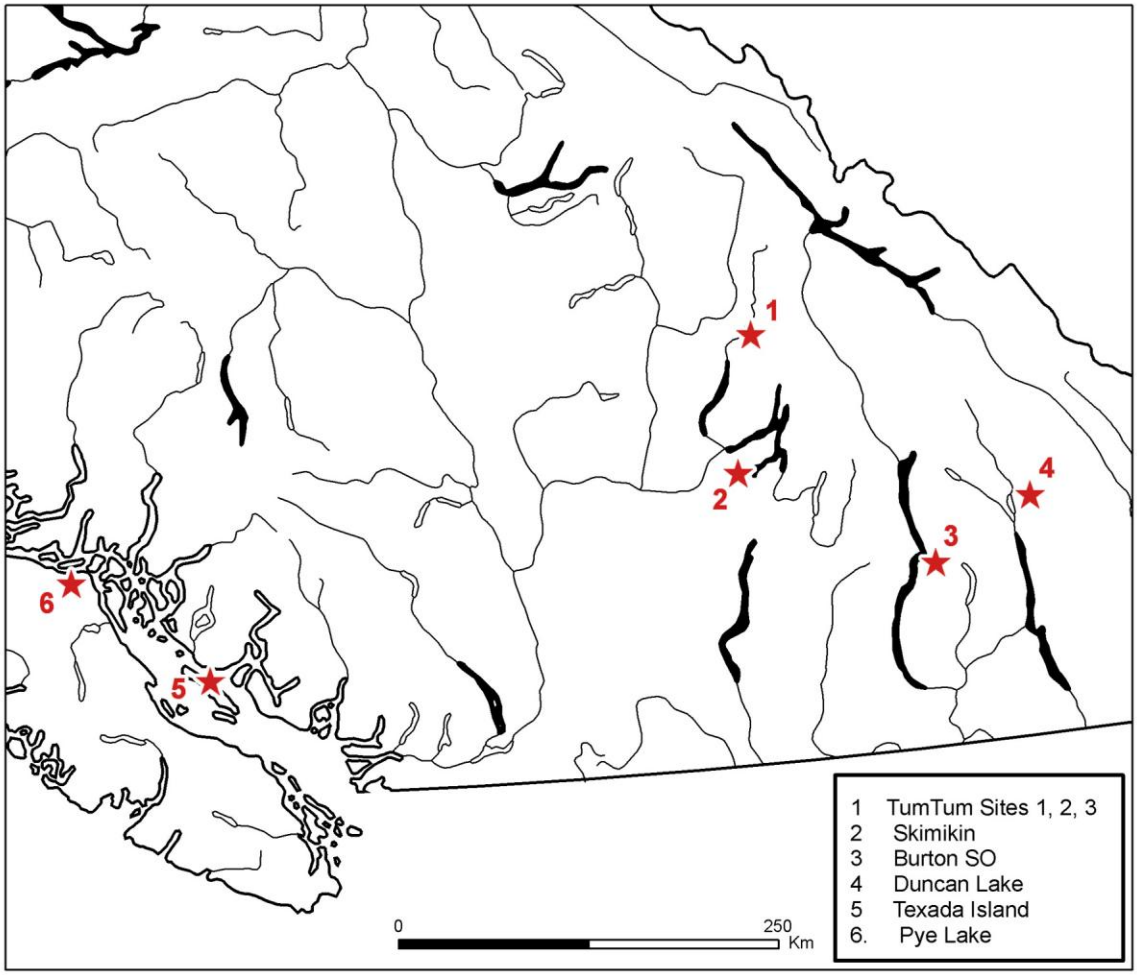

Figure 1. Map of southern British Columbia showing the location of the study sites.

The Texada Island site was planted in 1994 and consisted of four-tree-row plots replicated seven times for several coastal families, an interior family, an Idaho family, a blister rust-resistant MGR family (Washington State X Southern Oregon), and a Macedonian pine (*Pinus peuce* Grisebach) provenance from Bulgaria. Trees were evaluated for *D. septosporum* infection in 2003 by measuring the height of live crown defoliation with a tape measure and estimating the percentage of foliage discolouration as compared to noninfected foliage to create a disease index. Only samples sizes of 12 or greater were compared using the Student-Newman-Keuls multiple range test (Statistica 6.1, StatSoft Inc., 2325 E. 13th St., Tulsa, OK, 74104, USA).

Dothistroma septosporum was noted in a blister rust demonstration trial at Duncan Lake in south-eastern BC (Fig. 1). The Duncan Lake trial was established in 1998 and consists of one interior provenance in four replicate blocks (500 individuals) and six Idaho seedlots (100 to 700 individuals each) planted in one to six blocks for a total of 17 blocks of Idaho stock. The trees were evaluated in 2007 for presence or absence of stem and branch die-back and again in 2008 for defoliation by scoring each tree on the following scale: 0 = no defoliation, 1 = small amount of defoliation (<50%), and 3 = >50% defoliation. Scores were added and then averaged by block, which were in turn averaged to yield weighed scores by white pine source for the entire plantation.

Plantings using the blister rust-resistant source from Idaho (R.T. Bingham Arboretum) were established as follows: 1) Three interior plantations (Tum Tum 1, 2, and 3) in 1999 at North Adams Lake, 2) an abandoned interior seed orchard in Burton in 1988, and 3) the Skimikin seed orchard in 1980. All five sites were examined in 2007 and *D. septosporum* was identified by the characteristic black and erumpent stromata on moribund or necrotic needles bearing distinct dark brown or red banding. If found, spores were collected.

RESULTS AND COMMENTS: Where spores found (Table 1), measurements of their width matched those for *D. septosporum* (Barnes et al. 2005). Symptoms on stems and branches included fingernail-sized sunken lesions and resinosis in the bark at the base of infected needles (Fig. 2), similar to those attributed to a resistant reaction to *C. ribicola* (Bingham 1983). Frequently, the host formed a necrophylactic periderm (Mullick 1977) in the bark around the base of diseased needles that appeared as a small circular raised area on the branch or stem (Fig. 3). At some sites these small circular lesions amalgamated into a stem canker (Fig. 4) causing die-back above the canker. No fruiting was observed on any circular depressions or larger cankers and although attempts were made, no pathogens were isolated. Table 1 shows signs and symptom development on *P. monticola* caused by *D. septosporum* across several geographically distant locations in southern BC.

Table 1. Presence/absence of signs and symptoms of *Dothistroma septosporum* on *Pinus monticola* at several locations in British Columbia.

			D. septosporum symptoms and signs					
Site	BEC[1] zone	Stand age (yrs)	Stroma	Spores	Red Bands	CD[2]	Cankers	Mortality[3]
Pye Lake	CWHxm2	24	yes	2.5[4]	yes	yes	yes	yes
Texada Island	CWHxm1	24	yes	2-2.5	yes	yes	no	no
Skimikin	IDFmw2	27	yes	2-2.5	yes	yes	no	no
Tum Tum 1	ICHdw3	9	yes	no	yes	yes	yes	no
Tum Tum 2	ICHdw3	9	yes	no	yes	yes	yes	no
Tum Tum 3	ICHdw3	9	yes	no	yes	yes	yes	no
Duncan Lake	ICHmw2	10	yes	2-2.5	yes	yes	yes	yes
Burton SO	ICHmw2	20	yes	no	yes	yes	no	no

[1]Ecological zone. See Meidinger and Pojar (1991); Braumandl and Curran (1992).
[2]Circular depressions. [3]Mortality was caused by cankering and severe defoliation.
[4] Spore width in µm.

Figure 2. Circular stem lesion at the base of a needle cluster. Needles bear stromata of *Dothistroma septosporum*

Figure 3. (left) Small, older stem lesion caused by *Dothistroma septosporum* showing sloughing of rhytidome tissue following formation of a necrophylactic periderm.

Figure 4. (right) Small lesions of *Dothistroma septosporum* amalgamating to form a larger stem canker.

Initially, at Pye Lake (in 1996) it appeared that both *P. monticola* sources (Sayward and Idaho) were similarly infected because in the mixed planting 68% and 70% of trees exhibited severe defoliation (>50% foliage loss) among a total of 34 local (Sayward) and 29 Idaho trees, respectively. However, in the sub-block type only 32% of the local provenance showed infection compared to 71% infection in the Idaho trees. Between 1996 and 2007 trees died from both blister rust and *D. septosporum*. When the blister rust-killed trees were excluded from the samples there was considerably more *D. septosporum* mortality in the Idaho source (40% mixed block and 82% sub-block) than in the local provenance (10% mixed block and 46% sub-block) (Table 2). By 2007, in the mixed block, there was significantly more mortality and defoliation among 21 Idaho trees than in 30 Sayward trees ($\chi 2 = 4.94$; $p = 0.026$). More Sayward trees recovered from blighting than Idaho trees (Table 2).

At Texada Island there was considerable variation in height of live crown defoliation even in adjacent trees from the same family. The interior and Idaho sources were significantly more damaged than only one or two coastal families (Fig. 5); however, the MGR family (Oregon X Washington) was significantly more damaged than all coastal BC families ($p = 0.05$) (Fig. 5). Interestingly, *P. peuce* was not attacked.

At Duncan Lake in 2007, the six Idaho seedlots ranged from having 15 to 19% of the trees with branch or stem die-back compared to the BC interior population which averaged 16% of the trees with branch or stem die-back. In 2008 the defoliation score for the Idaho seedlots ranged from 1.52 to 1.99 with an average of 1.84 compared to a range of 1.36 to 1.91 and a mean of 1.67 for the BC population.

At the three Tum Tum sites near North Adams Lake, the severity of defoliation and cankering on 8-year-old Idaho-sourced P. monticola was the worst we observed (Table 1). Here, and at both Burton and

Skimikin, no formal surveys were done because all trees were from Idaho sources and could not be directly compared to local stock. Only defoliation and circular lesions were observed at the latter two sites (Table 1).

Table 2. The percent *Dothistroma septosporum* infection of *Pinus monticola* trees growing at Pye Lake, British Columbia in 1996 and of these the percent infection, mortality and trees recovered in 2007 as recorded from two plantation blocks (Mixed and Sub blocked) for two sources (Idaho and Sayward)

Mixed Block

	1996	2007		
Source	% Infection	% Infection[1]	% Mortality	% Trees recovered[2]
Idaho	70	7	40	53
Sayward	68	14	10	76

Sub Blocked

	1996	2007		
Source	% Infection	% Infection[1]	% Mortality	% Trees recovered[2]
Idaho	71	12	82	6
Sayward	32	38	46	15

[1]None of the trees that lacked initial severe infection in the mixed block suffered future *D. septosporum* mortality whereas, in the sub block, three additional Idaho trees and one additional Sayward tree died *from D. septosporum.*
[2]This is the % of trees that had no blighting in 2007, but were blighted in 1996.

Of the two known species of *Dothistroma* affecting pines*,* only *D. septosporum* is known from BC. In this study the spore widths (Table 1) confirm the designation for the pathogen of dothistroma needle blight of western white pine as *D. septosporum* (Barnes et al*.* 2005). For more than 10 years circular lesions, cankering and die-back associated with *D. septosporum* were noted on western white pine in BC. Significant mortality was observed at the plantation with the longest infestation (Pye Lake). However, at the three younger Tum-Tum plantations cankering was much more severe, such that considerable mortality is anticipated. Mortality caused by *D. septosporum* will reduce the stocking and increase risk that these stands will not achieve 'free-growing' status. This status is a licensee obligation for ensuring effective reforestation under the *Forest and Range Practices Act* administered by the BC Ministry of Forests and Range. The damage is in sharp contrast to earlier observations in a permanent plot established in the B.C. Interior (FIDS, 1982–1990) and in Idaho (Shaw and Leaphart 1960), where only defoliation was reported. No pathogens have been observed to fruit on the lesions or cankers, nor have they been isolated from the lesions or cankers. Small circular lesions on branches have formed around a single needle cluster, and sometimes these needles bear *D. septosporum* stromata. The first criterion of Koch's postulates is to have consistent association of the pathogen with the symptoms. Because this close association has been observed many times over several years, we believe the lesions and their amalgamation into cankers are caused by *D. septosporum*. Moreover, the authors are unaware of any example of an air-borne pathogen that meets this first criterion and where subsequent fulfilment of Koch's postulates has revealed a different causal agent. Consequently, we believe the probability that the lesions are caused by an overlooked or undescribed pathogen is remote; however, stem cankering has not been previously been attributed to *D. septosporum.*

Defoliation of BC Interior and Idaho stocks of western white pine at the Texada plantation ranked high, but this was significant for only a few coastal families. Obvious variation from tree to tree in the four- row plots suggests that trees displaying significantly less defoliation could be selected. It was surprising that at Pye Lake the Idaho source did not recover from severe infection as well as the local Sayward provenance, and to date, mortality has been greater among the Idaho source (Table 1). This result suggests that Idaho stocks should be used with caution on the coast, and in particular they should not be

transferred into environments conducive to *D. septosporum* infection, as even local stocks may prove unsatisfactory for restocking. The importance of local environmental conditions to mortality was apparent at Pye Lake as only two of six blocks, those near the swamp, had copious needle blighting and barks lesions. Cankering was a result of an amalgamation of adjacent bark lesions, which could occur only under intense infection. Severe infection may be reduced in high hazard environments (McCulloch and Woods 2009) by minimizing the planting of susceptible hosts. Unfortunately, the blister rust-resistant MGR trees at Texada were significantly more infected than all other provenances. The tree-to-tree variation within families in the Texada plantation suggests there is an opportunity to select for resistance to dothistroma needle blight.

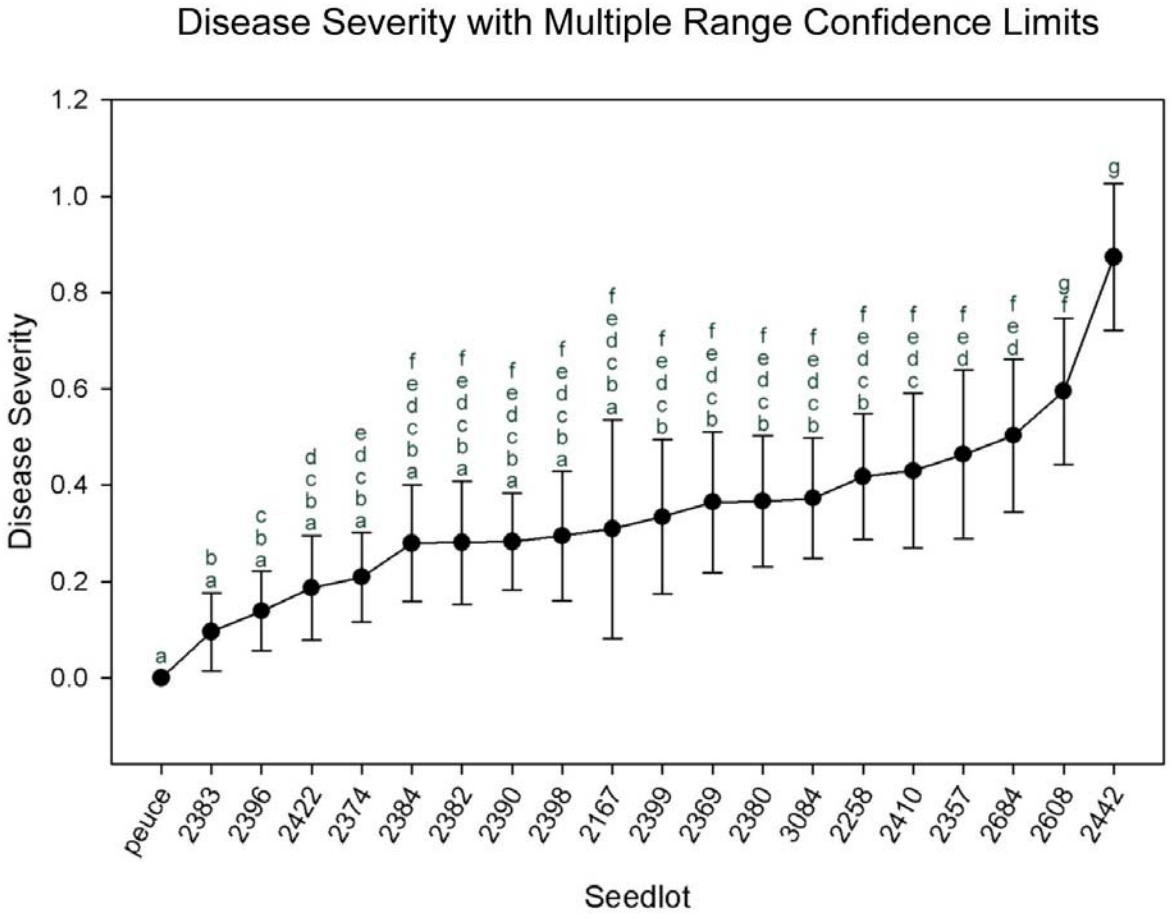

Figure 5. Dothistroma disease severity index with SNK multiple range test of provenances. All provenances are from coastal British Columbia except 2684 (Idaho), 2608 (British Columbia interior) and 2442 (Oregon X Washington).

Historically, dothistroma needle blight has been considered to have a relatively minor impact on endemic hosts. More recently however, an outbreak of this disease in northwestern British Columbia has decimated entire plantations of lodgepole pine and in some cases has killed even mature trees. Local increases in summer precipitation, an indirect effect of climate change, appear to be the driver behind the current outbreak (Woods et al. 2005). If precipitation increases in future, as climate models suggest for certain biogeoclimatic zones (Meidinger and Pojar 1991) across southern BC, the climate may then become more conducive for spread and severity of foliar diseases like dothistroma blight. This will have serious implications for the health of lodgepole and western white pine in BC. There is an apparent lack of infection on *P. peuce* in contrast to the severe infections observed on pines from western North

America: limber (*P. flexis* James), white bark (*P. albicaulis* Engelm.) (Taylor and Walla 1999), lodgepole (Woods et al. 2005), Monterey (*P. radiata* D. Don) (Punithalingam and Gibson 1973), ponderosa (*P. ponderosa* Laws.) (Peterson 1967) and western white. Thus, one could argue that the pathogen has been introduced from Europe. However, *P. nigrum* Arnold., native to Europe, is also highly susceptible (Peterson 1967; Bassett 1969) and even *P. peuce* has been listed as a host in Austria (Barnes et al. 2008). Genetically, *D. septosporum* appears to exhibit plasticity in pathogenesis because, on occasion, it has attacked conifers other than pines (Bassett 1969; Allen et al. 1996, Punithalingam and Gibson 1973), so a recent change to being a canker pathogen is a possibility. On the other hand, it is also possible that cankers have been overlooked, but were observed in our study because copious inoculum that developed on highly susceptible pines produced an abundance of symptoms. In BC, western white pine primarily exists as a minor component in mixed conifer stands (Hunt 2009). Most of the other conifers are non-hosts for *D. septosporum.* Mixtures with non-hosts are well-known to reduce disease damage dramatically (Wolfe 1985). However, because western white pine is fast growing, a high-value timber species (Muir and Hunt 2000), and has known resistance to *Phellinus sulphurascens* Pilát (formerly *P. weirii* (Murr.) Gilb) (Theis and Sturrock 1995), it is sometimes a favoured planting choice (Sorensen 2009). This will increase its relative abundance in a stand mixture, which could potentially augment dothistroma needle blight. Additionally, compared to many other conifers, western white pine appears to be adaptable to a wide range of biogeoclimatic zones/subzones. In the face of global warming this may favour a wider use of the species for reforestation (Hunt et al. 2009). It would also increase the relative abundance of white pine in the landscape. Our observations were that cankering caused by *D. septosporum* occurred only on imported western white, or local sources growing amongst these imported sources. The local sources were less damaged than the imported sources. Consequently, we encourage British Columbia tree breeding programs that use imported gene sources for blister rust resistance to test selections for resistance to *D. septosporum* too.

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