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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 for publication of plant disease surveys which benefit both federal and provincial agencies in planning appropriate research for the control of plant diseases. The reports you contribute are important to document plant pathology in Canada.

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Contents: **DISEASE HIGHLIGHTS**- 2002 GROWING SEASON
(+ earlier years for historical significance)

Sections:

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

Authors who have traditionally published scientific notes in the *Canadian Plant Disease Survey* are encouraged to submit this material to the scientific journal of their choice, such as the *Canadian Journal of Plant Pathology* and *Phytoprotection.*

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L'Inventaire des maladies des plantes au Canada est un périodique d'information sur la fréquence des maladies des plantes au Canada, leur gravité, et les pertes qu'elles occasionnent.

On encourage les auteurs, qui traditionnellement publiaient des articles scientifiques dans l'Inventaire des maladies des plantes au Canada, à soumettre dorénavant leurs textes au journal scientifique de leur choix comme la *Revue canadienne de phytopathologie* et *Phytoprotection.*

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Diagnostic Laboratories / Laboratoires diagnostiques

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

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BCMAFF PLANT DIAGNOSTIC LABORATORY IN 2002.

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

RESULTS AND COMMENTS: The year 2002 was a record year for few problems, mainly due to unusual weather conditions. The weather was very dry during the peak cropping season and many fungal and bacterial pathogens did not become established and cause crop damage. However many drought-related problems were observed. No quarantine problems were identified. Summaries of the diseases and their causal agents diagnosed on commercial crops are presented in Tables 1-10 by crop category. The total number of submissions for each crop category is listed at the bottom of each table. Problems not listed include: abiotic disorders such as nutritional stress, pH imbalance, water stress, drought stress, physiological response to growing conditions and genetic abnormalities; environmental and chemical damage; poor samples, insect-related injury; and damage where no conclusive causal factor was identified.

Table 1. Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Pepper	Root rot	*Fusarium* sp.	1
	Stem canker	*Botrytis cinerea*	1
Tomato	Vascular wilt	*Verticillium* sp.	1
DISEASED SAMPLES			3
ABIOTIC AND OTHER DISORDERS			12
TOTAL SUBMISSIONS			15

Table 2. Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Azalea sp.	Root rot	Oomycete	1
Begonia sp.	Powdery mildew	*Erysiphe* sp.	1
Blechnum spicant	Pythium root rot	*Pythium* sp.	1
Cyclamen sp.	Root rot	Oomycete	1
Dahlia sp.	Tomato spotted wilt	Tomato Spotted Wilt Virus	1
Euphorbia pulcherrima	Powdery mildew	*Erysiphe* sp.	1
	Root rot	*Thielaviopsis basicola*	2
	Stem canker	*Botrytis cinerea*	2
Eustoma sp.	Root rot	*Pythium* sp.	1
Fuchsia sp.	Black root rot	*Thielaviopsis basicola*	1
Gerbera sp.	Crown and root rot	*Phytophthora* sp.	1
	Crown rot	*Fusarium solani*	1
Howeia forsteriana	Root rot	Oomycete	1
Impatiens sp.	Impatiens necrotic spot	Impatiens Necrotic Spot Virus	2
Iris germanica	Botrytis rot	*Botrytis* sp.	2
Iris sp.	Botrytis rot	*Botrytis convoluta*	1
Lisianthus sp.	Root rot	Oomycete	1
Osteospermum sp.	Damping off	*Rhizoctonia solani*	1
	Stem canker	*Ascochyta* sp.	1
Pelargonium sp.	Bacterial blight	*Xanthomonas campestris* pv. *pelargonii*	2
	Damping-off	*Fusarium solani*	1
Petunia sp.	Flower blight	*Botrytis cinerea*	1
Rosa rugosa	Leaf spot	*Sphaceloma* sp.	1
Rosa sp.	Damping-off	*Rhizoctonia solani*	1
	Downy mildew	*Peronospora sparsa*	1
	Petal spot	*Botrytis cinerea*	1
Veronica sp.	Leaf spot	*Ramularia* sp.	1
Viola sp.	Black root rot	*Thielaviopsis basicola*	1
DISEASED SAMPLES			33
ABIOTIC AND OTHER DISORDERS			25
TOTAL SUBMISSIONS			58

Table 3. Summary of diseases diagnosed on **nut crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Corylus sp.	Eastern filbert blight	*Anisogramma anomala*	1
Juglans sp.	Anthracnose	*Marssoniella juglandis*	1
DISEASED SAMPLES			2
TOTAL SUBMISSIONS			2

Table 4. Summary of diseases diagnosed on **herbaceous perennial** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Aquilegia sp.	Leaf spot	*Ascochyta* sp.	1
Brassica oleracea	Downy mildew	*Peronospora parasitica*	1
Clematis sp.	Leaf spot & stem rot	*Ascochyta clematidina*	1
Galium sp.	Downy mildew	*Peronospora calotheca*	1
Leucanthemum sp.	Leaf spot	*Septoria leucanthemi*	1
Lupinus arcticus	Downy mildew	*Peronospora trifoliorum*	1
Phormium sp.	Anthracnose	*Colletotrichum* sp.	1
	Root rot	Oomycete	1
Sagina subulata	Rust	*Puccinia arenariae*	1
Vinca sp.	Phomopsis canker	*Phomopsis* sp.	1
	Stem dieback	*Phoma* sp.	1
	Stem rot	*Rhizoctonia solani*	1
DISEASED SAMPLES			12
ABIOTIC AND OTHER DISORDERS			11
TOTAL SUBMISSIONS			23

Table 5. Summary of diseases diagnosed on **small fruit and grape** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Blueberry	Bacterial blight	*Pseudomonas syringae*	15
	Blueberry scorch	Blueberry Scorch Virus	5
	Godronia canker	*Godronia cassandrae*	4
	Mummy berry	*Monilinia vaccinii-corymbosi*	1
	Root rot	Oomycete.	3
	Tip dieback	*Botrytis cinerea*	1
	Twig canker	*Phomopsis* sp.	1
Cranberry	Black rot	*Allantophomopsis* sp.	1
	Leaf spot (bitter rot)	*Colletotrichum* sp.	1
	Upright dieback	*Phomopsis* sp.	3
Raspberry	Root rot	*Phytophthora fragariae*	1
	Root rot	*Phytophthora* sp.	2
	Spur blight	*Didymella applanata*	2
Red Currant	Crown and root rot	*Phytophthora* sp.	1
Strawberry	Root lesion nematode	*Pratylenchus* sp.	1
	Red stele	*Phytophthora fragariae*	1
DISEASED SAMPLES			43
ABIOTIC AND OTHER DISORDERS			45
TOTAL SUBMISSIONS			88

Table 6. Summary of diseases diagnosed on **special crop s**amples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Basil	Bacterial blight	*Pseudomonas syringae*	1
Echinacea	Stem and crown rot	*Sclerotinia sclerotiorum*	1
Ginseng	Root rot	*Phytophthora* sp./*Cylindrocarpon* sp.	1
	Root rot	*Phytophthora* sp./*Rhizoctonia* sp.	1
	Root rot	*Rhizoctonia solani*	1
	Rusty root	*Cylindrocarpon destructans*	3
DISEASED SAMPLES			8
TOTAL SUBMISSIONS			8

Table 7. Summary of diseases diagnosed on **turfgrass samples** submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP/SITE	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Fairway	Anthracnose	*Colletotrichum graminicola*	1
	Downy mildew	*Sclerophthora* sp.	1
	Brown patch	*Rhizoctonia solani*	1
Green	Ascochyta leaf blight	*Ascochyta* sp.	1
	Downy mildew	*Sclerophthora* sp.	2
	Fusarium patch	*Microdochium nivale*	1
	Leaf spot	*Septoria* sp.	1
	Rhizoctonia patch	*Rhizoctonia zeae*	1
	Root rot	*Pythium* sp.	2
Lawn	Anthracnose	*Colletotrichum graminicola*	1
	Downy mildew	*Sclerophthora* sp.	1
	Root rot	*Pythium* sp.	1
	Snow mould	*Typhula* sp.	1
Sod Farm	Ascochyta leaf blight	*Ascochyta* sp.	1
	Basal rot	*Colletotrichum graminicola*	1
	Fairy ring	*Basidiomycete*	1
	Fusarium patch	*Microdochium nivale*	1
Sports Field	Anthracnose	*Colletotrichum graminicola*	1
	Foliar blight	*Ascochyta* sp.	1
	Fusarium patch	*Microdochium nivale*	1
	Brown patch	*Rhizoctonia solani*	1
DISEASED SAMPLES			23
ABIOTIC AND OTHER DISORDERS			25
TOTAL SUBMISSIONS			48

Table 8. Summary of diseases diagnosed on **tree fruit** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Apple	European canker	*Nectria galligena*	1
	Fire blight	*Erwinia amylovora*	2
Cherry	Bacterial canker	*Pseudomonas syringae*	1
Prunus sp.	Bacterial blight	*Pseudomonas* sp.	1
	Bacterial canker	*Pseudomonas syringae*	1
	Brown rot	*Monilinia* sp.	1
	Stem canker	*Cytospora* sp.	1
Pear	European canker	*Cytospora* sp.	1
DISEASED SAMPLES			9
ABIOTIC AND OTHER DISORDERS			7
TOTAL SUBMISSIONS			16

Table 9. Summary of diseases diagnosed on **field vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Arugula	Downy mildew	*Peronospora parasitica*	2
Asparagus	Fusarium crown/root rot	*Fusarium oxysporum* f.sp. *asparagi*	1
Cabbage	Head rot	*Pseudomonas fluorescens*	1
Carrot	Cavity spot	*Pythium* sp.	1
Cucumber	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	1
	Fusarium wilt	*Fusarium oxysporum*	1
Garlic	Basal rot	*Fusarium* sp.	1
	White rot	*Sclerotium cepivorum*	4
Onion	Bulb rot	*Botrytis* sp.	1
Parsnip	Leaf spot	*Cercospora* sp.	1
Pea	Black root rot	*Thielaviopsis basicola*	1
Pepper	Verticillium wilt	*Verticillium dahliae*	1
Potato	Common scab	*Streptomyces* sp.	1
	Dry rot	*Fusarium* sp.	2
	Pink rot	*Phytophthora erythroseptica*	1
	Pythium leak	*Pythium ultimum*	1
	Stem canker	*Rhizoctonia solani*	1
Rhubarb	Grey mould	*Botrytis cinerea*	1
Squash	Verticillium wilt	*Verticillium dahliae*	1
Tomato	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	1
	Crown and root rot	*Fusarium oxysporum*	1
DISEASED SAMPLES			26
ABIOTIC AND OTHER DISORDERS			16
TOTAL SUBMISSIONS			42

Table 10. Summary of diseases diagnosed on **woody ornamental** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2002.

CROP	DISEASE	CAUSAL/ASSOCIATED ORGANISM	NO.
Abies procera	Needle blight	*Rhizosphaera* sp.	1
	Root rot	Oomycete	1
Acer rubrum	Nectria canker	*Tubercularia* sp.	1
Arbutus sp.	Leaf spot	*Septoria* sp.	1
Azalea sp.	Root rot	*Phytophthora* sp.	1
Buxus sp.	Volutella blight	*Volutella* sp.	1
Carex sp.	Crown rot	Oomycete	1
Carpinus sp.	Twig canker	*Phomopsis* sp.	1
Caryopteris sp.	Bacterial blight	*Pseudomonas syringae*	1
Clematis sp.	Leaf spot	*Ascochyta* sp.	1
Cornus sp.	Anthracnose	*Discula destructiva*	1
Cotoneaster sp.	Fire blight	*Erwinia amylovora*	1
Daphne sp.	White rot	*Sclerotinia* sp.	1
Elaeagnus sp.	Black root rot	*Thielaviopsis basicola*	1
Gaultheria sp.	Anthracnose	*Colletotrichum* sp.	2
Juniperus sp.	Root rot	Oomycete	1
Larix sp.	Stem canker	*Phomopsis* sp.	1
Magnolia sp.	Leaf blotch	*Guignardia* sp.	1
Picea pungens	Needle blight	*Rhizosphaera* sp.	1
Pinus jeffreyi	Needle cast	*Dothistroma* sp.	1
Pinus sylvestris	Needle cast	*Lophodermium* sp.	1
Prunus sp.	Leaf spot	*Coccomyces* sp.	1
Quercus rubra	Stem canker	*Dothiorella* sp.	1
Rhododendron sp.	Anthracnose	*Colletotrichum* sp.	1
	Foliar blight	*Phytophthora citricola*	1
	Stem dieback	*Phomopsis* sp.	1
Rosa sp.	Root rot	Oomycete	1
Stewartia sp.	Root rot	*Phytophthora* sp.	1
Thuja sp.	Charcoal rot	*Macrophomina phaseolina*	1
Vaccinium sp.	Foliar blight	*Phytophthora cinnamomi*	1
Vaccinium ovatum	Needle rust	*Pucciniastrum goeppertianum*	1
DISEASED SAMPLES			32
ABIOTIC AND OTHER DISORDERS			91
TOTAL SUBMISSIONS			123

CROP: Commercial Crops - Diagnostic Laboratory Report
LOCATION: Saskatchewan

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TITLE: **DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN AGRICULTURE, FOOD AND RURAL REVITALIZATION CROP PROTECTION LABORATORY IN 2002.**

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

RESULTS: Between April 1 and November 7, 2002 the Crop Protection Laboratory received 972 samples of which 78% were for disease diagnosis (48% of these were American elms submitted for Dutch elm disease testing). Categories of highest to lowest volume (excluding the Dutch elm disease samples) are: special crops (29.5%), cereals (28.5%), oilseeds (20.5%), fruit (5%), forages (3%) and vegetables (2%). Woody ornamentals, herbaceous ornamentals, turf, and greenhouse crops comprised the remaining 11% of the samples. Summaries of diseases/causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2002 are presented in Tables 1-7 by crop category. Samples submitted under the Dutch elm disease program totalled 361. Results of the Dutch elm disease program are presented in Table 8.

Table 1. Summary of plant diseases diagnosed on **cereal crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Barley	Fusarium head blight	*Fusarium* spp.	1
	Common root rot/ seedling blight/ prematurity blight	*Cochliobolus sativus*/ *Fusarium* spp.	13
	Net blotch	*Pyrenophora teres*	7
	Spot blotch	*Cochliobolus sativus*	2
	Black point	*Cochliobolus sativus*	1
	Fusarium stem rot	*Fusarium avenaceum*	1
	Sooty molds	*Alternaria* spp./ *Cladosporium* sp.	1
	Chemical injury		14
	Environmental injury		5
Oats	Common root rot	*Fusarium* spp.	1
	Crown rust	Puccinia coronata	1
	Leaf blotch	*Pyrenophora avenae*	1
	Environmental injury		4
	Chemical injury		2
Rye	Common root rot/ seedling blight/ prematurity blight	*Cochliobolus sativus*/ *Fusarium* spp.	1
	Environmental injury		2
Triticale	Nutrient deficiency		1
Wheat	Common root rot/ seedling blight/ prematurity blight	*Cochliobolus sativus*/ *Fusarium* spp.	24
	Tan spot	*Pyrenophora tritici-repentis*	6
	Head blight	*Fusarium* spp.	3
	Glume blotch/ leaf blotch	*Septoria nodorum*	3
	Leaf rust	*Puccinia recondita*	2
	Loose smut	*Ustilago tritici*	2
	Seed rot	*Penicillium* sp.	1
	Wheat Streak Mosaic	Wheat Streak Mosaic Virus	1
	Environmental injury		22
	Herbicide injury		6
	Nutrient deficiency		2

Table 2. Summary of plant diseases diagnosed on **forage crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Alfalfa	Spring black stem/ leaf spot	*Phoma medicaginis* var. *medicaginis*	7
	Stemphylium leaf spot	*Stemphylium botryosum*	2
	Environmental injury		2
	Chemical injury		1

Table 3. Summary of plant diseases diagnosed on **fruit crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Saskatoon	Fireblight	*Erwinia amylovora*	2
	Entomosporium leaf spot	*Entomosporium mespli*	1
	Salinity injury		1
	Chemical injury		1
Seabuckthorn	Split gill fungus	*Schizophyllum commune*	1
Strawberry	Root rot	*Cylindrocarpon* sp./ *Fusarium* spp./ *Rhizoctonia solani*	1
	Strawberry crimp	*Aphelenchoides fragariae*	3
	Nutrient deficiency		1

Table 4. Summary of plant diseases diagnosed on **oilseed crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Canola	Root rot	*Fusarium* spp./ *Rhizoctonia solani*	9
	Fusarium wilt	*Fusarium avenaceum/ F. oxysporum*	8
	Blackleg	*Leptosphaeria maculans*	5
	Black spot	*Alternaria spp.*	5
	Sclerotinia stem rot	*Sclerotinia sclerotiorum*	1
	Grey stem	*Pseudocercosporella capsellae*	1
	Chemical injury		27
	Environmental injury		14
	Physiological stress		8
	Nutrient deficiency		1
Flax	Root rot/ seedling blight	*Fusarium* spp.	1
	Chemical injury		9
	Environmental injury		4
Sunflower	Environmental injury		1

Table 5. Summary of plant diseases diagnosed on **special crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Bean	Bacterial brown spot	*Pseudomonas syringae*	2
	Alternaria leaf/ pod rot	*Alternaria* sp.	1
	Environmental injury		1
Canaryseed	Leaf mottle	*Septoria triseti*	4
	Common root rot	*Fusarium* sp./ *Cochliobolus sativus*	1
	Fusarium head blight	*Fusarium graminearum/ F. sporotrichioides*	1
	Chemical injury		4
	Environmental injury		2
Caraway	Root rot/ crown rot	*Fusarium* sp./ *Pythium* sp.	1
Chickpea	Ascochyta blight	*Ascochyta rabiei*	6
	Seedling blight/ root rot	*Fusarium* sp./ *Rhizoctonia solani*	5
	Chemical injury		2
	Environmental injury		2
Coriander	Agronomic practices		1
Lentil	Anthracnose	*Colletotrichum truncatum*	18
	Ascochyta blight	*Ascochyta lentis*	9
	Root rot/ seedling blight	*Fusarium* spp./ *Rhizoctonia solani*	3
	Secondary molds	*Alternaria* spp./ *Cladosporium* sp.	3
	Cercospora leaf spot	*Cercospora* sp.	1
	Chemical injury		24
	Environmental injury		6
	Physiological stress		2
	Nutrient stress		1
Mustard	Chemical injury		2
	Environmental injury		1
Pea	Root rot/ seedling blight	*Fusarium* spp./ *Rhizoctonia solani*	6
	Mycosphaerella blight	*Mycosphaerella pinodes*	3
	Septoria blotch	*Septoria pisi*	1
	Sooty molds	*Alternaria* spp./ *Cladosporium* spp./ *Stemphylium* spp.	1
	Chemical injury		11
	Environmental injury		2
	Nutrient deficiency		1

Table 6. Summary of plant diseases diagnosed on **vegetable crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Cantaloupe	Environmental injury		1
Cucumber	Damping off/ seedling blight	*Fusarium* sp./ *Pythium* sp.	1
	Environmental injury		2
Potato	Early blight	*Alternaria solani*	2
	Leak	*Pythium* sp.	1
	Soft rot	*Erwinia carotovora*	1
	Chemical injury		1
Tomato	Black speck	*Pseudomonas* sp.	1

Table 7. Summary of plant diseases diagnosed on **woody ornamental crops** submitted to the SAFRR Crop Protection Laboratory in 2002.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
American elm	Chemical injury		2
Ash	Ochre spreading tooth	*Steccherinum ochraceum*	1
	Chemical injury		2
	Environmental injury		1
Caragana	Chemical injury		1
Cotoneaster	Chemical injury		1
Crabapple	Fireblight	*Erwinia amylovora*	1
Juniper	Environmental injury		1
Lilac	Environmental injury		1
Maple	Environmental injury		1
Pine	Salinity		2
Poplar/Aspen	Cytospora canker	*Cytospora* sp.	3
	Environmental injury		2
	Chemical injury		1
	Nutrient deficiency		1
	Salinity		1
Spruce	Environmental injury		4
	Chemical injury		3
Willow	Environmental injury		1

Table 8. Summary of plant diseases diagnosed on **American elm** by the SAFRR Crop Protection Laboratory in 2002. Submissions were submitted under the provincial Dutch elm disease program.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
American elm	Dutch elm disease	Ophiostoma nova-ulmi	146
	Dothiorella wilt	*Dothiorella ulmi*	30
	Verticillium wilt	*Verticillium* spp.	3

CROP: Commercial Crops - Diagnostic Laboratory Report
LOCATION: Manitoba

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TITLE: 2002 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

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

RESULTS: Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1-10.

Table 1. Summary of diseases diagnosed on **cereal crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Anthracnose	*Colletotrichum graminicola*	3
	Bacterial blight	*Pseudomonas syringae*	3
	Black head mould	*Alternaria* sp., *Cladosporium* sp.	8
	Browning root rot	*Pythium* sp.	3
	Common root rot	*Fusarium* spp., *Cochliobolus sativus*	7
	Downy mildew	*Sclerophthora macrospora*	5
	Ergot	*Claviceps purpurea*	2
	Glume blotch	*Leptosphaeria nodorum*	10
	Head blight	*Fusarium* spp.	6
	Leaf rust	*Puccinia recondita*	10
	Loose smut	*Ustilago tritici*	1
	Powdery mildew	*Erysiphe graminis* f. sp. *tritici*	2
	Root rot	*Rhizoctonia* sp.	1
	Septoria leaf spot	*Septoria* spp.	19
	Spot blotch	*Cochliobolus sativus*	6
	Tan spot	*Pyrenophora tritici-repentis*	6
	Wheat streak mosaic	Wheat streak mosaic virus	4
	Environmental injury		36
	Herbicide injury		20
Barley	Barley yellow dwarf	Barley yellow dwarf virus	3
	Black point	*Bipolaris sorokiniana, Alternaria* sp.	2
	Common root rot	*Fusarium* spp., *Cochliobolus sativus*	9
	Fusarium head blight	*Fusarium avenaceum, F. graminearum*	7
	Spot blotch	*Bipolaris sorokiniana*	11
	Net blotch	*Pyrenophora teres*	6
	Browning root rot	*Pythium* sp.	1
	Leaf rust	*Puccinia hordei*	2
	Septoria leaf spot	*Septoria* spp.	1
	Environmental injury		15
	Herbicide injury		9
	Nutrient deficiency		2
Oats	Bacterial blight	*Pseudomonas syringae*	5
	Barley yellow dwarf	Barley yellow dwarf virus	1
	Drechslera leaf spot	*Drechslera avenae*	4
	Browning root rot	*Pythium* sp.	1
	Common root rot	*Fusarium* sp.	1
	Fusarium head blight	*Fusarium* sp.	1
	Root rot	*Rhizoctonia* sp.	1
	Leaf rust	*Puccinia coronata*	1
	Stem rust	*Puccinia graminis* f. sp. *avenae*	1
	Environmental injury		13
	Nutrient deficiency		4
	Herbicide injury		8

Table 2. Summary of diseases diagnosed on **forage legume crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Anthracnose	*Colletotrichum* sp.	1
	Spring black stem and leaf spot	*Phoma medicaginis*	6
	Root rot	*Rhizoctonia* sp.	1
	Root rot	*Fusarium* spp.	2
	Rust	*Uromyces striatus*	3
	Stemphylium leaf spot	*Stemphylium botryosum*	2
	Environmental injury		4
	Nutrient deficiency		5
Red clover	Leaf spot	*Stemphylium* sp.	1
Trefoil	Herbicide injury		1

Table 3. Summary of diseases diagnosed on **grasses** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lawn grasses	Anthracnose	*Colletotrichum graminicola*	4
	Root rot	*Fusarium graminearum, Fusarium avenaceum, Fusarium* spp.	7
	Leptosphaerulina leaf blight	*Leptosphaerulina* sp.	2
	Brown patch	*Rhizoctonia* sp.	3
Brome	Herbicide injury		1
Orchard grass	Root rot	unidentified	1
	Environmental injury		1
Prairie sandreed	Leaf spot	*Drechslera* sp.	1
	Leaf spot	*Bipolaris sorokiniana*	1
	Environmental injury		2
Timothy	Purple eye spot	*Heterosporium phlei*	2
	Environmental injury		1
Virginia wild rye	Leaf spot	*Drechslera* sp., *Bipolaris* sp.	1

Table 4. Summary of diseases diagnosed on **greenhouse crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lettuce	Leaf and head rot	*Sclerotinia sclerotiorum*	1
	Root rot	*Pythium* sp.	1
	Aster yellows	Aster yellows phytoplasma	1
Peony	Root rot	*Fusarium* sp.	1

Table 5. Summary of diseases diagnosed on **vegetable crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Cabbage	Black rot	*Xanthomonas campestris*	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium* sp., *Rhizoctonia* sp.	1
Cabbage, Napa (*Brassica napa var. pekinensis*	Phoma leaf spot	*Phoma* sp.	2
Carrot	Root rot	*Fusarium solani*	1
	Root rot	*Rhizoctonia* sp.	1
Cauliflower	Black rot	*Xanthomonas campestris*	1
	Verticillium wilt	*Verticillium dahliae*	1
Corn	Stalk rot	*Fusarium graminearum*	1
Garlic	Fusarium basal plate rot	*Fusarium oxysporum* f. sp. *cepae*	1
	Penicillium decay	*Penicillium hirsutum*	3
	Clove rot	*Fusarium* sp.	1
Muskmelon	Damping off	*Fusarium* sp.	1
Onion	Botrytis neck rot	*Botrytis allii*	2
	Purple blotch	*Alternaria porri*	1
	Fusarium basal plate rot	*Fusarium oxysporum*	2
	Leaf spot	*Stemphylium* sp.	3
	Smudge	*Colletotrichum* sp.	1
Pepper	Herbicide injury		1
Rhubarb	Leaf spot	*Cercospora* sp.	1
Tomato	Early blight	*Alternaria solani*	2
	Fruit rot	*Alternaria* sp., *Penicillium* sp.	1
	Anthracnose	*Colletotrichum* sp.	1
	Stem rot	*Sclerotinia sclerotiorum*	1
	Physiological disorder		1
	Environmental injury		3

Table 6. Summary of diseases diagnosed on **oilseed crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Flax & Linola	Pasmo	*Septoria linicola*	1
	Root rot	*Rhizoctonia solani*, *Fusarium* sp.	1
	Seed decay	*Alternaria* sp., *Aspergillus* sp., *Colletotrichum* sp., *Fusarium sp.*	3
	Environmental injury		2
	Herbicide injury		11
Sunflower	Head rot	*Sclerotinia sclerotiorum*	4
	Root rot	*Fusarium* sp.	1
	Rust	*Puccinia helianthi*	2
	Phoma canker	*Phoma* sp.	2
	Phomopsis canker	*Phomopsis helianthi*	1
	Verticillium wilt	*Verticillium dahliae*	4
	Environmental injury		1
	Herbicide injury		6
Canola	Aster yellows	Aster yellows phytoplasma	3
	Blackleg	*Leptosphaeria maculans*	10
	Black spot	*Alternaria* spp.	1
	Downy mildew	*Peronospora parasitica*	12
	Fusarium root rot	*Fusarium* spp.	4
	Fusarium wilt	*Fusarium oxysporum*, *F. avenaceum*	21
	Root rot	*Rhizoctonia solani*, *Fusarium* spp., *Pythium* spp.	10
	Stem rot	*Sclerotinia sclerotiorum*	4
	Environmental injury		32
	Herbicide injury		224*
	Nutrient deficiency		4

* The Clearfield (CF) cultivar 45A77 with herbicide group 2 (acetolactate synthase inhibitor) injury accounted for 120 of these; group 2 injury was also diagnosed on 61 additional canola samples, 20 Liberty Link (LL), 14 Roundup Ready (RR), and 11 conventional canola samples, as well as on 17 of unspecified cultivar. Group 4 (auxin mimic) injury was diagnosed on 12 CF, 7 LL, 6 RR and 2 conventional samples, as well as on 14 of unspecified cultivar (41 in all). Glyphosate injury was diagnosed on 2 samples.

Table 7. Summary of diseases diagnosed on **shelterbelt trees and woody ornamentals** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash (*Fraxinus* sp.)	Anthracnose	*Gloeosporium aridum*	2
	Leaf spot	*Cylindrosporium* sp.	1
	Leaf spot	undetermined	1
	Canker	*Cytospora* sp.	1
	Canker	*Nectria* sp.	1
	Herbicide injury		16
Basswood	Canker	*Nectria* sp.	1
Caragana	Leaf spot	*Septoria caraganae*	1
Cotoneaster	Canker	unidentified	1
Elm	Black spot	*Gloeosporium ulmeum*	2

	Canker	*Botryosphaeria dothidea*	1
	Canker	*Cytospora* sp.	1
	Canker	unidentified	3
	Dutch elm disease	*Ophiostoma ulmi*	37
	Dothiorella wilt	*Dothiorella ulmi*	2
	Herbicide injury		2
	Environmental injury		2
Hackberry	Verticillium wilt	*Verticillium* sp.	1
Highbush cranberry	Leaf spot	*Alternaria* sp.	1
Juniper	Needle blight	*Cercospora* sp.	2
	Needle spot	*Lophodermium* sp.	1
Maple	Canker	undetermined	1
	Herbicide injury		8
Mountain ash	Canker	*Cytospora* sp.	2
	Canker	undetermined	1
	Fireblight	*Erwinia amylovora*	1
	Hawthorn rust	*Gymnosporangium globosum*	2
Nannyberry	Powdery mildew	*Microsphaera penicillata*	1
Ninebark	Powdery mildew	*Sphaerotheca* sp.	1
Oak	Anthracnose	*Apiognomonia quercina*	1
Poplar	Canker	*Cytospora* sp.	1
	Canker	undetermined	1
	Leaf spot	*Septoria populicola*	1
Rose	Downy mildew	*Peronospora sparsa*	1
	Grey mould	*Botrytis cinerea*	1
	Powdery mildew	*Sphaerotheca pannosa*	1
Spruce	Cytospora canker	*Leucostoma kunzei*	5
	Canker	*Phomopsis* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	21
	Needle blight	*Lirula* sp.	2
	Needle rust	*Chrysomyxa* sp.	2
	Root rot	*Fusarium* sp., *Pythium* sp.	1
	Herbicide injury		2
	Environmental injury		26

Table 8. Summary of diseases diagnosed on **potato crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*	2
Bacterial ring rot	*Clavibacter michiganensis* subsp. *sepedonicus*	1
Blackleg	*Erwinia carotovora* subsp. *atroseptica*	3
Black scurf	*Rhizoctonia solani*	1
Black dot	*Colletotrichum coccodes*	8
Early blight	*Alternaria solani*	9
Fusarium dry rot	*Fusarium sambucinum*	8
Fusarium wilt	*Fusarium avenaceum*	2
Late blight	*Phytophthora infestans*	12
Silver scurf	*Helminthosporium solani*	1
Verticillium wilt	*Verticillium dahliae*	18
Blue mould tuber rot	*Penicillium* sp.	2
Tuber rot	*Phytophthora* sp.	1
Pink rot	*Phytophthora erythroseptica*	6
Physiological disorders		2
Environmental injury		5
Herbicide injury		7

Table 9. Summary of diseases diagnosed on **special field crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canaryseed	Root rot	*Fusarium* sp., *Bipolaris sorokiniana*	1
	Septoria leaf spot	*Septoria triseti*	1
	Fusarium head blight	*Fusarium* spp.	2
	Environmental injury		2
	Herbicide injury		1
Corn	Common smut	*Ustilago maydis*	3
	Ear moulds	*Rhizopus* sp., *Aspergillus* sp., *Penicillium* sp., *Mucor* sp. and *Cladosporium* spp.	1
	Root rot	*Fusarium* sp.	1
	Stalk rot	*Fusarium graminearum*	1
	Environmental injury		3
	Herbicide injury		2
	Nutrient deficiency		2
Faba bean	Root rot	*Fusarium* sp.	2
	Dodder	*Cuscuta* sp.	1
Field bean	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	12
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	6
	Bacterial blight	*Pseudomonas syringae*	4
	Brown spot	*Pseudomonas syringae* pv. *syringae*	3
	Anthracnose	*Colletotrichum lindemuthianum*	7
	Alternaria leaf spot	*Alternaria* spp.	1
	Root rot	*Fusarium solani, Fusarium* spp.	10
	Rust	*Uromyces appendiculatus*	1
	Virus	undetermined	1
	Fusarium yellows	*Fusarium oxysporum* f. sp. *phaseoli*	1
	Environmental injury		11
	Herbicide injury		1
	Mechanical injury		2
Field pea	Aphanomyces root rot	*Aphanomyces euteiches* f. sp. *pisi*	1
	Root rot	*Fusarium solani, Fusarium* spp.	9
	Bacterial blight	*Pseudomonas syringae* pv. *pisi*	1
	Environmental injury		3
	Herbicide injury		9
	Nutrient deficiency		2
Hemp	Aster yellows	Aster yellows phytoplasma	1
Millet	Nutrient deficiency		1
Sorghum	Bacterial leaf spot	*Pseudomonas syringae*	1
Soybean	Bacterial blight	*Pseudomonas syringae* pv. *glycinea*	5
	Bacterial pustule	*Xanthomonas axonopodis* pv. *glycines*	1
	Root rot	*Fusarium* spp.	3
	Septoria leaf spot (brown spot)	*Septoria glycines*	1
	Downy mildew	*Peronospora manshurica*	2
	Environmental injury		3
	Herbicide injury		3
	Iron chlorosis	iron deficiency	4

Table 10. Summary of diseases diagnosed on **fruit crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2002.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Apple scab	*Venturia inaequalis*	1
	Canker	unidentified	2
	Canker	*Cytospora* sp.	1
	Fire blight	*Erwinia amylovora*	2
	Frogeye leaf spot	*Botryosphaeria obtusa*	2
	Nectria twig blight	*Nectria cinnabarina*	1
	Silver leaf	*Chondrostereum purpureum*	2
	Environmental injury		5
	Herbicide injury		2
	Iron chlorosis	iron deficiency	3
Cherry	Eutypa dieback	*Libertella blepharis*	1
Chokecherry	Black knot	*Apiosporina morbosa*	1
	Canker	*Leucocytospora* sp.	1
	Shot hole	*Wilsonomyces carpophilus*	2
Grape	Anthracnose	*Elsinoë ampelina*	1
	Downy mildew	*Plasmopara viticola*	1
Plum	Canker	undetermined	2
Raspberry	Cane blight	*Leptosphaeria coniothyrium*	4
	Fire blight	*Erwinia amylovora*	3
	Spur blight	*Didymella applanata*	3
Saskatoon	Powdery mildew	*Podosphaera clandestina*	1
	Entomosporium leaf and berry spot	*Entomosporium mespili*	1
	Canker	*Cytospora* sp.	1
	Canker	*Diplodia* sp.	1
	Root rot	*Fusarium* sp., *Cylindrocarpon* sp.	1
	Rust	*Gymnosporangium* sp.	4
	Environmental injury		1
	Iron chlorosis	iron deficiency	2
Sea buckthorn (*Hippophae rhamnoides*)	Root necrosis	*Fusarium* sp.	1
	Verticillium wilt	*Verticillium* sp.	1
Strawberry	Angular leaf spot	*Xanthomonas fragariae*	1
	Black root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia* sp.	1
	Common leaf spot	*Mycosphaerella fragariae*	1
	Crown rot	*Rhizoctonia* sp.	1
	Root rot	*Fusarium* spp.	4
	Anthracnose fruit rot	*Colletotrichum* sp.	2
	Herbicide injury		1

CROP: Commercial Crops - Diagnostic Laboratory Report
LOCATION: Québec

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE MAPAQ DIAGNOSTIC LABORATORY IN 2002

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

RESULTS AND COMMENTS: The crop distribution of samples was: field vegetable crops 27.4%, greenhouse vegetables 8.8%, stored vegetables 1.4%, small fruits 28.9%, fruit trees 2.4%, annual and perennial ornamentals 4.5%, woody ornamentals 3.3%, greenhouse ornamentals 10.4%, cereal crops 8.0% and other crops (forage and commercial crops) 4.9%. Problems not listed include insect related injury, pathogen detection in substrates and asymptomatic plants, damage where no conclusive disease-causing organism was identified and seed problems.

ACKNOWLEDGEMENT: The authors gratefully thank Carolle Fortin, Chantal Malenfant, Mario Tésolin and Lise Vézina for technical assistance.

Table 1. Summary of **field vegetable** crop diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Asparagus	*Puccinia asparagi*	5
Bean	*Fusarium* sp.	1
	Pythium root rot	1
	Rhizoctonia root rot	2
	2,4-D injury	1
	Glyphosate injury	1
	Heat stress	1
Broccoli	*Alternaria brassicicola*	2
	Phoma crown rot	1
	Plasmodiophora brassicae	1
	Pseudomonas fluorescens	1
	Xanthomonas campestris pv. *armoraciae*	2

	Boron deficiency	1
	Cold injury	1
	Heat stress	1
Cabbage	*Alternaria brassicicola*	1
	Fusarium oxysporum	4
	Pythium root rot	3
	Rhizoctonia root rot	2
	Pseudomonas fluorescens	1
	Xanthomonas campestris pv. *armoraciae*	1
	Black speck	1
	Cold injury	1
	Heat stress	1
Cantaloup	*Pseudomonas syringae*	2
Carrot	*Cercospora carotae*	2
	Rhizoctonia solani	3
	Xanthomonas campestris pv. *carotae*	3
	Heat stress	1
Cauliflower	*Alternaria brassicicola*	1
	Phytophthora sp.	1
	Pythium root rot	3
	Rhizoctonia solani	3
	Malathion injury	5
	Magnesium deficiency	1
	Sunburn injury	1
Celery	*Cercospora apii*	2
	Pythium root rot	3
	Septoria leaf spot	1
	Pseudomonas syringae	6
	Pseudomonas viridiflava	2
	High light stress	1
Chinese cabbage	Rhizoctonia root rot	1
	Pseudomonas syringae	3
	Xanthomonas campestris	1
	Boron deficiency	1
	Heat stress	1
Corn	*Fusarium avenaceum*	1
	Longidorus sp.	1
	Acid soil	1
	Allelopathic crop debris	1
	Poor pollination	1
	Water stress	1
Cucumber	Pythium crown rot	2

	Rhizoctonia fruit rot	1
	Verticillium wilt	1
	Pseudomonas syringae	2
	Erwinia tracheiphila	3
Garlic	Botrytis sp.	2
	Ditylenchus sp.	1
	Potyvirus	5
	Ozone injury	1
Lettuce	*Botrytis cinerea*	3
	Microdochium sp.	1
	Oïdium sp.	1
	Pythium root rot	3
	Rhizoctonia basal rot	2
	Sclerotinia sp.	6
	Xanthomonas campestris	4
	Boron toxicity	2
	Calcium deficiency	3
	Heat stress	9
Onion	*Botrytis* sp.	2
	Fusarium basal rot	3
	Phytophthora sp.	1
	Pythium root rot	3
	Stemphylium botryosum	1
	Pseudomonas syringae	1
	Ozone injury	1
	Water injury	2
	Ascochyta sp.	1
	Fusarium oxysporum	1
	Pythium root rot	1
Pepper	*Fusarium oxysporum*	2
	Pythium root rot	8
	Rhizoctonia root rot	1
	Sclerotinia sclerotiorum	1
	Clavibacter michiganensis subsp. *michiganensis*	3
	Pseudomonas syringae	12
	Xanthomonas campestris	1
	Calcium deficiency	1
	Sun burn	1
Potato	*Alternaria solani*	1
	Colletotrichum coccodes	7
	Fusarium tuber rot	9
	Helminthosporium solani	7
	Phytophthora erythroseptica	3
	Phytophthora infestans	2
	Pythium tuber rot	5

	Rhizoctonia solani	16
	Verticillium wilt	15
	Clavibacter michiganensis subsp. *sepedonicus*	6
	Erwinia carotovora subsp. *atroseptica*	1
	Erwinia carotovora subsp. *carotovora*	5
	Streptomyces spp.	1
	Pratylenchus sp.	8
	Early frost damage	2
	Black heart	1
	Bruise	3
	Heat stress	12
	Heat necrosis	1
	Water stress	1
Pumpkin	*Cladosporium cucumerinum*	1
	Fusarium fruit spot	1
	Oïdium sp.	1
	Pythium root rot	1
	Sclerotinia sclerotiorum	1
	Agrobacterium tumefaciens	1
	Pseudomonas syringae	1
	Xanthomonas campestris	1
	Potyvirus	1
	Physiological spot	1
	Water stress	1
Rutabaga	*Pseudomonas syringae*	1
Spinach	Fusarium root rot	1
	Phytophthora root rot	1
Squash	*Erwinia tracheiphila*	2
	Heat stress	1
	Ozone injury	1
Tomato	*Alternaria solani*	2
	Botrytis cinerea	1
	Fulvia fulva	
	Pythium root rot	2
	Septoria leaf spot	1
	Sclerotinia sclerotiorum	1
	Clavibacter michiganensis subsp. *michiganensis*	9
	Pseudomonas syringae pv. *tomato*	7
	Xanthomonas campestris	2
	Cold injury	1
	Glyphosate injury	1
Watermelon	Verticillium sp.	1
	Glyphosate injury	1
Total submissions		344

Table 2. Summary of **greenhouse vegetable** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Allium spp.	*Fusarium oxysporum*	1
(onion, leek)	Pythium root rot	2
	Heat stress	1
	pH imbalance	1
	Water stress	1
Cole crops	*Alternaria brassicicola*	3
	Xanthomonas campestris pv. *armoraciae*	6
	Heat stress	1
	Salt damage	1
Cucumber	Alternaria leaf spot	1
	Ascochyta leaf spot	3
	Cladosporium sp.	1
	Didymella sp.	1
	Fusarium spp.	2
	Phoma leaf spot	1
	Phomopsis canker	1
	Pythium root rot	7
	Sclerotinia sclerotiorum	1
	Verticillium wilt	1
	Erwinia tracheiphila	2
	Pseudomonas syringae	3
	Xiphinema sp.	1
Lettuce	*Botrytis cinerea*	2
	Oïdium sp.	1
	Pythium root rot	2
	Boron toxicity	1
	Cold injury	1
	Heat injury	1
	Salt damage	3
Tomato	*Botrytis cinerea*	5
	Fusarium oxysporum f. sp. *radicis-lycopersici*	5
	Phytophthora cinnamomi (root rot)	1
	Pyrenochaeta lycopersici	6
	Pythium root rot	12
	Verticillium spp.	2
	Erwinia carotovora subsp. *carotovora*	7
	Clavibacter michiganensis subsp. *michiganensis*	8
	Impatiens Necrotic Spot Virus (INSV)	2
	Cold injury	1
	Manganese toxicity	3
	Paraquat injury	1

	pH imbalance	1
	Phosphorus deficiency	1
	Salt damage	2
Total submissions		110

Table 3. Summary of **stored vegetable** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Cole crops	*Pseudomonas marginalis*	1
	Rhizoctonia carotae	1
	Necrotic spot	1
	Mechanical injury	2
Potato	*Botrytis cinerea*	1
	Fusarium dry rot	2
	Helminthosporium solani	1
	Phytophthora nicotiana	1
	Pythium tuber rot	1
	Erwinia carotovora subsp. *carotovora*	2
	Black heart	1
	Frost injury	1
	Heat necrosis	1
	Hollow heart	1
	Stem end browning	1
Total submissions		18

Table 4. Summary of **small fruit** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Blueberry	*Botrytis cinerea*	3
	Colletotrichum fruit rot	12
	Godronia cassandrae	1
	Microsphaera sp.	1
	Monilinia fruit rot	1
	Phomopsis canker	1
	Pucciniastrum goeppertianum	4
	Ramularia canker	2
	Septoria sp.	4
	Tomato ring spot virus (ToRSV)	10
	Tobacco ring spot virus (TRSV)	1
	Xiphinema sp.	1
	Salt injury	2
	Sun burn	3
	Winter damage	2

Cranberry	*Godronia cassandrae*	1
	Phyllosticta leaf spot	3
	Protoventuria leaf spot	2
	Water deficit	1
Currant, gooseberry	Cercospora leaf spot	1
	Colletotrichum fruit rot	2
	Sphaerotheca sp.	1
	Heat stress	1
Grape	*Plasmopara viticola*	1
	Rhizoctonia sp.	1
	Sphaceloma ampelinum	1
	Agrobacterium sp.	1
	Alkaline soil	1
	Winter damage	3
Raspberry	*Armillaria mellea*	1
	Botrytis cinerea	1
	Coniothyrium fuckelii	2
	Cylindrocarpon root rot	1
	Didymella applanata	5
	Idriella root rot	1
	Phytophthora root rot	20
	Pythium root rot	8
	Rhizoctonia root rot	5
	Sphaceloma necator	1
	Sphaerotheca sp.	1
	Yeast fruit rot	1
	Agrobacterium tumefaciens	11
	Erwinia amylovora	4
	ToRSV	3
	Pratylenchus sp.	4
	Dichlobenil injury	1
	Glyphosate injury	3
	Mineral deficiencies	2
	pH imbalance	3
	Sun burn	4
	Spring frost	2
	Winter damage	5
Strawberry	*Botrytis cinerea*	1
	Colletotrichum sp.	2
	Cylindrocarpon root rot	4
	Diplocarpon earliana	2
	Phytophthora cactorum	2
	Phytophthora fragariae	2
	Phytophthora spp.	28
	Pyrenochaeta sp.	8
	Pythium root rot	32
	Ramularia brunnea	7

	Rhizoctonia root rot	29
	Sphaerotheca macularis	9
	Verticillium dahliae	13
	Xanthomonas fragariae	10
	ToRSV	1
	Longidorus sp.	1
	Pratylenchus sp.	19
	Xiphinema sp.	1
	Phytoplasma	3
	Black root rot	2
	Glyphosate injury	2
	Heat spot	1
	pH imbalance	7
	Salt injury	3
	Spring frost	5
	Terbacil injury	2
	Wind injury	2
	Winter injury	4
Total submissions		362

Table 5. Summary of **fruit tree** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	**CAUSAL AGENT/DISEASE**	**NO. OF SAMPLES**
Apple	Cytospora canker	1
	Phomopsis canker	2
	Rhizoctonia root rot	1
	Tubercularia sp.	1
	Erwinia amylovora	18
	Bitter pit	1
	Scald	1
Cherry	*Pseudomonas syringae*	1
Pear	Phomopsis canker	1
Plum	*Monilinia fructicola*	1
	Poor pollination	1
	Water deficit	1
Total submissions		30

Table 6. Summary of **herbaceous plant** (annual and perennial) diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Echinacea sp.	Phytoplasma	1
	Boron deficiency	1
Helianthus annuus	*Sclerotinia sclerotiorum*	1
Helichrysum sp.	Verticillium wilt	1
Hemerocallis sp.	Aureobasidium leaf spot	1
	Colletotrichum sp.	2
	Acid soil	1
Lilium sp.	*Rhizoctonia solani*	2
Phalaenopsis sp.	Cymbidium mosaic virus (CyMV)	1
	Odontoglossum ring spot virus (ORSV)	1
Potentilla sp.	Salt damage	1
Scrophularia sp.	INSV	1
Turfgrass	*Colletotrichum* sp.	1
	Curvularia sp.	3
	Fusarium avenaceum	2
	Fusarium equiseti	3
	Fusarium spp.	5
	Gaeumannomyces sp.	9
	Leptosphaerulina sp.	1
	Pythium root rot	11
	Rhizoctonia root rot	8
Total submissions		57

Table 7. Summary of **woody ornamental** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Abies balsamea	Fusarium root rot	2
	Rhizoctonia root rot	1
Acer spp.	Discula leaf spot	1
	Phomopsis canker	1
	Pythium root rot	1
	Calcium deficiency	1
Betula sp.	Spring frost injury	1

Chamaecyparis sp.	Cylindrocarpon root rot	1
	Fusarium root rot	1
	Pestalotiopsis leaf blight	1
Cornus sp.	Salt damage	2
	Pseudomonas syringae	1
Crataegus sp.	*Pseudomonas syringae*	1
	Erwinia amylovora	1
Fagus sp.	Cytospora canker	1
Hydrangea sp.	*Pseudomonas syringae*	1
	Xanthomonas campestris	1
	Salt damage	1
Juniperus sp.	Phomopsis leaf blight	1
Myrica sp.	Salt damage	1
Pinus sp.	*Sphaeropsis sapinea*	1
	Winter injury	1
Rhododendron sp.	Salt damage	1
Rosa sp.	Diplocarpon leaf spot	1
	Peronospora sp.	2
Salix sp.	Salt damage	1
Sorbus sp.	Cytospora canker	1
Spiraea sp.	Phloeospora leaf spot	1
Syringa vulgaris	*Ascochyta* sp.	1
	Phytophthora root rot	1
	Pseudomonas syringae	1
Thuja sp.	Armillaria root rot	1
	Cylindrocarpon root rot	1
	Fusarium root rot	1
	Pestalotiopsis leaf blight	1
	Light stress	1
	Sun burn	1
	Temperature stress	1
Total submissions		41

Table 8. Summary of diseases on **greenhouse ornamental plants** diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Aquilegia sp.	Ascochyta leaf spot	1
	Oïdium sp.	1
Artemisia sp.	pH imbalance	1
Begonia sp.	Verticillium wilt	1
	INSV	1
Brugmansia sp.	Potyvirus	2
Calceolaria sp.	Boron deficiency	1
	Heat stress	1
Calibrachoa sp.	Pythium root rot	1
	Tobacco mosaic virus (TMV)	4
	Tomato mosaic virus (ToMV)	5
	Iron deficiency	1
	Phosphorus deficiency	1
Campanula sp.	INSV	1
Canna sp.	Potyvirus	2
Chrysanthemum sp.	Acremonium wilt	1
	Alternaria chrysanthemi	1
	Pythium root rot	1
	pH imbalance	1
	Salt damage	1
Clematis sp.	*Meloidogyne* sp.	1
Coreopsis sp.	*Verticillium albo-atrum*	1
	Genetic abnormality	1
	pH imbalance	1
Cuphea sp.	Alternaria leaf spot	1
Cyclamen sp.	Pythium root rot	1
Dahlia sp.	Pythium root rot	1
	Cucumber mosaic virus (CMV)	1
	INSV	1
	TMV	1
	Tomato spotted wilt virus (TSWV)	1
Euphorbia pulcherrima	Phytophthora root rot	2
	Heat stress	1

	pH imbalance	1
	Salt damage	2
Gaillardia sp.	Entyloma leaf spot	1
Gerbera jamesonii	Pythium root rot	1
Hedera helix	*Xanthomonas campestris*	1
Hemerocallis sp.	Aureobasidium leaf spot	1
Hydrangea sp.	2,4-D injury	1
Hygrophila sp.	Rhizoctonia root rot	2
Impatiens sp.	Pythium root rot	2
	INSV	11
	Salt damage	3
Lamium sp.	*Peronospora* sp.	1
Lilium sp.	Potyvirus	1
Lobelia sp.	INSV	2
Lonicera sp.	Phytophthora root rot	1
Lupinus sp.	*Colletotrichum* sp.	1
Osteospermum sp.	Salt injury	1
Pelargonium sp.	*Botrytis cinerea*	2
	Pythium black leg	3
	Puccinia sp.	1
	Xanthomonas campestris pv. *pelargonii*	4
	Pelargonium flower break virus (PFBV)	2
	Acid soil	3
	Salt injury	2
Pentas sp.	Phytoplasma	1
Petunia sp.	*Botrytis cinerea*	1
	Verticillium wilt	1
	Mg deficiency	1
	Water spot	1
Philodendron sp.	INSV	1
Phlox sp.	*Peronospora* sp.	1
	CMV	1
	INSV	1

	Salt damage	1
Pistia sp.	Pythium root rot	2
Rosa sp.	*Peronospora sparsa*	1
	Pratylenchus sp.	1
Salvia sp.	Rhizoctonia root rot	1
	Pythium root rot	1
	Pseudomonas syringae	1
	INSV	1
	Ethylene injury	1
Surfinia sp.	Verticillium wilt	3
	TMV	3
	ToMV	3
	Boron deficiency	1
	Ethylene injury	1
	Genetic disorder	2
	Iron deficiency	1
Torenia sp.	INSV	2
Verbena sp.	*Botrytis cinerea*	1
	Malathion injury	1
Wisteria sp.	Spring frost injury	1
Total submissions		131

Table 9. Summary of **cereal crop** diseases diagnosed by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Barley	*Bipolaris sorokiniana*	24
	Drechslera teres	2
	Fusarium head blight	9
	Gaeumannomyces graminis	2
	Pythium root rot	5
	Rhynchosporium sp.	1
	Septoria sp.	1
	Ustilago sp.	1
	Acid soil	1
	Heat stress	1
	Water deficit	2
Corn	Fusarium head blight	4
	Pythium root rot	3
	Dicamba injury	1
	Dimethenamide injury	1
	Diphenyl ether injury	1

	Glufosinate injury	6
	Nicosulfuron injury	1
Oats	*Bipolaris sorokiniana*	2
	Colletotrichum leaf spots	2
	Fusarium head blight	2
	Gaeumannomyces graminis	2
	Pythium root rot	3
	Barley yellow dwarf virus (BYDV)	1
	Manganese deficiency	1
	Water deficit	3
Wheat	*Bipolaris sorokiniana*	3
	Cladosporium seed spot	1
	Fusarium head blight	5
	Gaeumannomyces graminis	2
	Septoria tritici	1
	Pratylenchus sp.	1
	Acid soil	1
	Allelopathic crop debris	1
	MCPA injury	1
Total submissions		100

Table 10. Summary of diseases diagnosed on **other crops** by the MAPAQ diagnostic laboratory in 2002.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Soybean	Fusarium head blight	7
	Phomopsis sp.	4
	Phytophthora root and crown rot	1
	Pythium root rot	2
	Rhizoctonia solani	2
	Septoria glycines	1
	Pseudomonas marginalis	1
	Meloidogyne sp.	1
	Calcium deficiency	1
	Magnesium deficiency	1
	Ozone injury	1
	Soil compaction	1
	Water excess	1
	Water stress	1
Tobacco	Fusarium root rot	2
	Pythium root rot	14
	Thielaviopsisopsis root rot	8
	Pratylenchus sp.	3
	Allelopathic crop debris	1
	Cold injury	2
	Light stress	2

Salt damage	2
Wind injuiry	2
Total submissions	61
GRAND TOTAL	1254

Cereals / Céréales

CROPS / CULTURES: Barley and Wheat
LOCATION / RÉGION: Central Alberta

NAME AND AGENCY / NOM ET ORGANISME:
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TITLE / TITRE: 2002 CEREAL DISEASE SURVEY IN CENTRAL ALBERTA

INTRODUCTION AND METHODS: A survey of diseases of barley and hard red spring wheat was conducted on July 30 and August 1, 2002 in fields randomly selected in Census District 8 (north-central Alberta). This area encompasses Sylvan Lake on the west, Bashaw on the east and is bordered north and south by Ponoka and Innisfail, respectively. Fields were traversed in an inverted V, with visual analysis of 5 plants taking place at 3 locations. Severity of leaf diseases was scored on a 0-9 scale, with a 4 rating equal to 1 percent of leaf area diseased (PLAD) on the upper leaf canopy, 5-10 PLAD on the middle canopy and 10-25 PLAD on the lower canopy. Common root rot (CRR) was assessed on subcrown internodes using a 0-4 scale where 1=trace and 4=severe. Other diseases were rated as a percent of the plants affected. After the survey was completed, a representative subsample of the diseased material collected was cultured in the laboratory for pathogen identification.

RESULTS AND COMMENTS: The results are presented in Table 1. Central Alberta experienced a severe drought during the growing season, resulting in very unthrifty plants and very low disease levels. Seventeen barley fields were examined, 14 of which were 2-row and three 6-row barley. Scald (*Rhynchosporium secalis*) was the most commonly observed leaf disease, followed by net blotch (*Pyrenophora teres*) and spot blotch (*Cochliobolus sativus*). These leaf diseases were mainly confined to the lower plant canopy. Common root rot (*C. sativus* and *Fusarium* spp.) was generally at low levels, with only one field of 12 affected that rated a 3. Loose smut (*Ustilago nuda*) and powdery mildew (*Erysiphe graminis*) were noted in three and one fields, respectively.

On wheat septoria/stagonospora leaf blotch (*Septoria tritici, Stagonospora nodorum*) was present in nine of the 10 fields at relatively low levels, while glume blotch (*S. nodorum*) was found in only one field with a rating of 1. Comon root rot occurred only at low levels in four fields and take-all (*Gaeumannomyces graminis*) was at trace levels in two fields. Powdery mildew (*Erysiphe graminis*) was noted in only 1 field in trace amounts. Tan spot (*P. tritici-repentis*) and ergot (*Claviceps purpurea*) and were not observed.

Table 1. Disease incidence and severity in 17 barley and 10 wheat fields in central Alberta 2002.

		Disease severity rating (0-9) or incidence (%)	
Barley Disease	No. fields affected	Mean	Range
Scald (0-9)	14	2.0	1-4
Net blotch (0-9)	11	1.7	1-4
Spot blotch (0-9)	10	1.8	1-4
Common root rot (0-4)	12	1.0	0-3
Loose smut (%)	3	0.2	0.01-0.5
Powdery mildew (%)	1	1.0	1.0

Wheat Disease	No. fields affected	Mean	Range
Septoria leaf complex (0-9)	9	2.1	1-4
Common root rot (0-4)	4	1.0	0-2
Take-all (%)	2	trace	trace
Powdery mildew (%)	1	1	1
Septoria glume blotch (%)	1	1	1

CROP / CULTURE: Oat, Barley and Wheat
LOCATION / RÉGION: Québec

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TITLE / TITRE: DISEASES IN CEREALS IN QUÉBEC IN 2002

INTRODUCTION AND METHODS: The Québec registration and recommendation trials for spring cereals were visited once or twice from mid-July to early August in 2002 to document the presence and severity of diseases. Plants were at the medium milk to soft dough growth stages. Foliar diseases were assessed visually according to a 0-9 scale (0 = no symptoms; 9 = flag leaf with symptoms on more than 50 % of its surface). Ratings of 1-3 were considered 'low intensity', 4-6, moderate, and 7-9, high. Commercial cereal fields, located in various regions of Québec, were also visited in order to detect root disease problems.

RESULTS AND COMMENTS: In 2002, cool conditions in May and June delayed heading and flowering by one to two weeks in all regions. The first few days of July were very warm and humid, followed by more seasonal temperatures for the remainder of the month. August was characterized by very hot and dry conditions in most regions.

In oat, as is usual, speckled leaf blotch (*Stagonospora avenae*) was the most prevalent disease, at moderate symptom intensity. Infection by crown rust (*Puccinica coronata*) was moderate in Sainte-Anne-de-Bellevue and low in La Pocatière, similar to 2001. Barley yellow dwarf/red leaf (barley yellow dwarf virus) was almost absent in 2002 and only the trials at Sainte-Anne-de-Bellevue could be assessed.

Wheat leaf blotches caused by *Drechslera tritici-repentis* and *Stagonospora nodorum* were found throughout the the province. Symptom development in all cases was low to moderate. Powdery mildew (*Blumeria graminis*, syn. *Erysiphe graminis*), found only in Princeville in the last few years, was also observed in Saint-Hyacinthe and Saint-Augustin in 2002. Its intensity was moderate in Princeville and low at the two other trial sites. Leaf rust (*Puccinia triticina*) was present at low intensity in most regions. Infestations by barley yellow dwarf virus were practically absent in 2002 and no trials could be assessed.

As is normal on barley, a moderate incidence of net blotch (*Drechslera teres*) was observed everywhere in Québec. Scald (*Rhynchosporium secalis*) was also present, especially in the Lac-Saint-Jean region where the symptom intensity varied from low to moderate, depending on cultivars. Leaf rust (*Puccinia hordei*) returned in 2002 in the south and central regions, but only at low infection levels. Powdery mildew, usually noted only in La Pocatière, was also found in Saint-Simon and Princeville in 2002. This may be explained by the cool conditions that extended until the end of June. Barley yellow dwarf was not observed at any trial location.

A serious problem related to *Pythium* spp. and the waterlogging complex was observed in cereal fields in several regions of the province. It likely occurred because of root damage due to wet soils in the spring, followed by subsequent drought conditions. *Pythium* curtails normal root development, and a drought following a wet spring can therefore lead to poor stands and unthrifty plants. Barley crops were more sensitive to *Pythium* damage than other cereals. Losses of grain yield exceeding 50% were observed in parts of some wheat fields, while losses of more than 70% occurred in some barley crops. Oat appeared to be the cereal least damaged.

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: **2002 SURVEY FOR FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA**

INTRODUCTION AND METHODS: A total of 42 barley fields (16 two-row, 26 six-row) in southern Manitoba were surveyed for the presence of fusarium head blight (FHB) between July 29 and August 8, 2002. The fields were selected randomly along the survey routes. Incidence of FHB (the percentage of heads with typical symptoms) in each field was assessed by sampling 80-100 spikes at 3 locations for disease. FHB severity (the average affected proportion of symptomatic heads) was estimated visually in the field. Several affected heads were collected at each field site and stored in paper envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from five heads per location. The kernels were surface sterilized in 0.3% NaOCl (Javex brand) and plated onto potato dextrose agar to quantify and identify *Fusarium* spp. on kernels.

RESULTS AND COMMENTS: Conditions initially (May and June) were cool and moist in southern Manitoba in 2002, then became warm and drier in July and into late August. Subsequently, frequent showers hindered harvesting operations and crops remained in the field under moist conditions longer than desirable. As such, conditions for *Fusarium* inoculum production on overwintered crop stubble in the spring, and for initial infection of cereal spikes were moderately favourable, and this subsequently led to widespread and occasionally severe development of FHB. The late rains likely contributed to additional, non-destructive *Fusarium* infection, which, however, may have further reduced quality.

Fusarium head blight was found in all 42 fields surveyed. Average incidence of FHB in two-row crops was 23% (range 4 - 57%), while severity averaged 13% (range 3 - 36%); in six-row crops incidence was 21% (range 4 - 73%) and severity 11% (range 2 - 25%). The resulting average FHB index (incidence X mean severity) / 100) for 2-row barley was 4.1%, and that for 6-row barley 3.0%; for all barley this was 3.4% (range of 0.1 to 21%). This would have resulted in an estimated yield loss from FHB of about 1%. The overall severity of FHB was about half that in 2001, and for the second year in a row, 2-row crops had a higher FHB index than 6-row crops; this is unexpected as 2-row barleys generally have a higher level of resistance to FHB than 6-row types.

The *Fusarium* species isolated from kernels are shown in Table 1. As for the past several years, *F. graminearum* was the predominant pathogenic species on kernels, but was found at lower levels than normal (Tekauz et al. 2001, 2001). For a second year, *F. poae* was detected in a high proportion of fields and isolated at a higher frequency on kernels. In 2002, *F. sporotrichioides* was much more common on kernels than found previously, likely the result of wet conditions at maturity which delayed harvesting.

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

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. graminearum	69.1	44.5
F. poae	76.2	20.8
F. sporotrichioides	52.4	26.4
F. avenaceum	19.1	3.5
F. equiseti	16.7	3.7
F. culmorum	4.8	1.1

CROP / CULTURE: Barley
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2002

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 33 2-row and six 6-row barley fields in Saskatchewan in 2002. Fields were surveyed between July 25 and September 30, with the majority being surveyed in August. The range in survey dates was a result of variable moisture conditions and crop maturity across the province. Regions in the north and west of the province suffered from drought and were not surveyed. Hence the total number of fields sampled was lower in 2002 than in previous years (Fernandez et al. 2002, 2001, 2000).

Saskatchewan Agriculture, Food and Rural Revitalization extension agrologists collected 50 heads at random from each field at the milk to dough stages. The heads were analyzed at the Crop Protection Laboratory in Regina by visually inspecting for FHB symptoms. The number of infected heads per field and the number of infected kernels within those heads were recorded. A FHB disease severity rating, also know as the FHB index, was determined for each field (% FHB severity = % heads affected x mean % severity of infection / 100). A mean FHB severity was also calculated for each soil zone (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey) and for the whole province. Glumes and/or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for one min. and cultured on potato dextrose agar and carnation leaf agar for identification of *Fusarium* species.

RESULTS AND DISCUSSION: In 2002, FHB occurred in 70% of 2-row barley fields and 100% of 6-row barley fields (Table 1). These values were somewhat higher than in previous surveys (Fernandez et al. 2002, 2001, 2000). In 2002, FHB incidence was greatest in Zone 3 for both 2-row and 6-row barley, similar to previous surveys. The soil characteristics, precipitation and evapotranspiration patterns in eastern and northern cereal production regions are more favourable for FHB development.

In general, FHB disease severity was very low in 2002 due to dry conditions. The overall mean FHB severity for the province was 0.6% for both 2-row and 6-row barley. These values are low compared to previous years; for example, in 2001, overall mean FHB severity was 2.5% for 6-row barley and 1.0% for 2-row barley (Fernandez et al. 2002).

In 2002 the most commonly isolated *Fusarium* species was *F. poae* accounting for 27% of total *Fusarium* isolations, followed by *F. avenaceum* (22%) and *F. sporotrichioides* (18%) (Table 2). *Fusarium graminearum* accounted for 7% of total *Fusarium* isolations. It was found in three of the 39 barley fields surveyed, all located in Zone 3, one field in the extreme south-east and two in the east-central region.

These survey results may not provide an accurate representation of grain quality at the end of the 2002 growing season as cool wet weather starting in August delayed harvest in most regions of Saskatchewan. The Crop Protection Laboratory reported isolating other fungi at higher levels than in previous years from most of the barley samples submitted for the survey. Furthermore, seed testing labs have reported high levels of various *Fusarium* species and other saprophytes on wheat samples (R.A.A. Morrall, pers. com.), confirming that weather conditions further deteriorated kernel quality after this survey was conducted.

REFERENCES:

Fernandez, M.R., P.G. Pearse, G. Holzgang, and G.R. Hughes, 2002. Fusarium head blight in barley in Saskatchewan in 2001. Can. Plant Dis. Surv. 82: 32-33. (http://www.cps-scp.ca/cpds.htm)

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Table 1. Barley (2-row and 6-row) fields infected with fusarium head blight (FHB) and mean FHB disease severity according to soil zones in Saskatchewan, 2002.

Soil Zone	No. affected fields / total fields (% affected)		Mean Disease Severity [1]	
	2-row	6-row	2-row	6-row
Zone 1 Brown	3 / 6 (50%)	0	0.4%	-
Zone 2 Dark Brown	10 / 15 (67%)	2 / 2 (100%)	0.6%	0.4%
Zone 3 Black/Grey	10 / 12 (83%)	4 / 4 (100%)	0.8%	0.7%
Overall Mean	22 / 33 (70%)	6 / 6 (100%)	0.6%	0.6%

[1] % FHB severity = % heads affected x mean % severity of infection / 100

Table 2. Prevalence of *Fusarium* species in barley in Saskatchewan in 2002.

Soil Zones	Number of barley fields from which Fusarium species were isolated (% of total *Fusarium* isolations)					
	F. avenaceum	*F. equiseti*	*F. graminearum*	*F. poae*	*F. sporotrichioides*	*F. spp.*
Zone 1 Brown	2 (29%)	2 (29%)	0	0	1 (14%)	2 (29%)
Zone 2 Dark Brown	4 (25%)	1 (6%)	0	6 (38%)	5 (31%)	0
Zone 3 Black/Grey	4 (18%)	1 (5%)	3 (14%)	6 (27%)	2 (9%)	6 (27%)
Overall Mean	10 (22%)	4 (9%)	3 (7%)	12 (27%)	8 (18%)	8 (18%)

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA IN 2002

INTRODUCTION AND METHODS: The occurrence of fusarium head blight (FHB) in oat in southern Manitoba was assessed in 34 commercial fields surveyed from July 31 to August 8 when most crops were at the late milk to soft dough stage of growth (ZGS 77-83). Fields were sampled at regular intervals along the survey routes, depending on availability. Fusarium head blight in each field was assessed by non-destructive sampling of a minimum of 80-100 plants at each of 3 locations for percentage of infected panicles (disease incidence), and for the average percentage of the panicle affected (severity). Disease levels were calculated as the 'FHB index' (% incidence x mean % severity / 100). Several affected panicles closest to each of the 3 plant clumps sampled were collected from each location, placed in plastic bags and frozen. Subsequently, up to 50 putatively infected seeds per field were surface-sterilized for 3 min. in 0.3% NaOCl, air-dried, and plated onto potato dextrose agar to quantify the *Fusarium* spp. present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2002 were relatively cool and moist early in the growing season (to mid-June) and then became warmer with variable moisture until near harvest. Frequent showers in late August and September hampered combining operations in many regions. Conditions appeared suitable for moderate development of FHB in cereal crops.

All 34 fields surveyed had visible symptoms of FHB. However, because of the open type of inflorescence in oat, and the generally lower level of disease, FHB was more difficult to recognize in this crop than in wheat or barley. Overall, incidence of FHB was 7.9% (range <0.1 - 37.3%), severity 7.3% (range 3.3 - 16.7%) and the FHB index 0.8% (range <0.1 - 6.2%). As such, FHB was estimated to have caused minimal, if any, yield loss in the commercial oat crop. This is the first comprehensive survey for FHB of oat conducted in Manitoba, and while the disease was less prevalent in oat than in barley or wheat in 2002 (Gilbert et al. 2003, Tekauz et al. 2003) , it was widespread, and affected a few fields at moderate levels.

Fusarium spp. isolated and their occurrence in fields and kernels are listed in Table 1. *Fusarium poae* was slightly more common in oat than *F. graminearum*, the species most often isolated from wheat and barley.

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Gilbert, J., A. Tekauz, R. Kaethler, U. Kromer, K. Morgan, E. Mueller, K. Slusarenko and T. Unrau. 2003. Fusarium head blight survey of spring wheat in Manitoba in 2002. Can. Plant Dis. Surv. 83: (this issue).

Tekauz, A., J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini, R. Kaethler and F. Reverchon. 2003. 2002 Survey for Fusarium head blight of barley in Manitoba. Can. Plant Dis. Surv. 83: (this issue).

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

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. poae	61.8	37.3
F. graminearum	52.9	32.3
F. sporotrichioides	64.7	23.4
F. avenaceum	26.5	5.5
F. equiseti	8.8	1.5

CROP / CULTURE: Wheat
LOCATION / RÉGION: Alberta

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TITLE / TITRE: **1999, 2000, 2001, and 2002 FUSARIUM HEAD BLIGHT SURVEYS IN ALBERTA**

INTRODUCTION AND METHODS: During July and August in1999, 2000, 2001, and 2002, cooperative surveys for the presence of fusarium head blight (FHB) in wheat fields in the province were conducted by Agriculture and Agri-Food Canada (AAFC) and Alberta Agriculture, Food and Rural Development staff. Collaborators were provided with sampling instructions and images of typical FHB symptoms to aid in the assessments. The surveys typically covered an area from Barrhead, east to Provost, and south to Lethbridge. Fields also were surveyed in the Peace River region of Alberta. Counts of 300 heads were taken in each of 109 fields in 1999, 93 in 2000, 163 in 2001, and 60 in 2002 and the incidence of FHB determined. Assessments were typically made at the late milk to dough stage of development by walking along a diamond-shaped path starting at least 25 m in from the edge of the field. At each of three sites along the path 100 heads were evaluated at random. All heads exhibiting suspicious symptoms were then sent to AAFC Lacombe for confirmation of symptomatology and assessment of the causal agent(s). Portions of the affected heads were surfaced sterilized in 5% commercial bleach for approximately 1 min. followed by plating on potato dextrose agar. Plates were then incubated for at least 7 days under a combination of fluorescent and black light, prior to identification of *Fusarium* spp. present.

RESULTS AND COMMENTS: The results are presented in Table 1. From 1999 to 2002, 86% of the wheat fields surveyed did not have any plants with visible symptoms of FHB. In the fields with plants exhibiting symptoms the yearly average incidence of FHB ranged from 0.8 to 2.5%. The maximum observed incidences per field were 1.0, 9.0, 10.7, and 6.3% for 1999, 2000, 2001, and 2002, respectively. Most wheat plants exhibiting symptoms of FHB from 1999 to 2001 were in fields located in central Alberta (over 70%), but in 2002 six of the eight fields with suspect plants occurred in southern Alberta. From 1999 to 2001, the maximum incidence levels tended to occur in fields northwest of Edmonton, in the Barrhead, Westlock, and Morinville areas.

In 1999 none of the symptoms of FHB were due to *F. graminearum*, but to *F. culmorum*, *F. avenaceum* and on one head, to *F. pseudograminearum* (confirmed by Dr. K. Seifert, Eastern Cereal and Oilseed Research Centre, Ottawa ON). In 2000 almost all of the symptoms were due to *F. avenaceum*, except for one head from southern Alberta, which was infected with *F. graminearum*. In 2001 most of the symptoms again were due to *F. avenaceum* and some *F. culmorum*, while *F. graminearum* was isolated from one head from a field in southern Alberta. In 2002, *F. graminearum* was found associated with symptoms in three fields from southern Alberta, while in the remaining five positive fields, the symptoms were caused by *F. culmorum* and *F. avenaceum*.

We gratefully acknowledge the technical assistance of Alberta Agriculture, Food and Rural Development staff, the financial support of the Alberta Agricultural Research Institute, and the assistance of Dr. K. Seifert.

Table 1. Incidence of fusarium head blight in Alberta wheat fields, 1999-2002.

Year	Total no. of fields *	No. fields without symptoms	No. fields affected	% of fields affected	Mean incidence in affected fields	Maximum observed incidence per field
1999	109	104	5	4.6	0.8	1
2000	93	83	10	10.8	2.5	9
2001	163	128	35	21.5	1.4	10.7
2002	60	52	8	13.3	2	6.3
Overall	425	367	58	15.8	1.7	

*300 heads were assessed in each of the fields sampled.

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: **FUSARIUM HEAD BLIGHT SURVEY OF SPRING WHEAT IN MANITOBA IN 2002**

INTRODUCTION AND METHODS: Fifty-six southern Manitoba spring wheat fields were surveyed to assess incidence and severity of fusarium head blight (FHB) between July 29 and August 8, 2002.

The incidence (percentage of infected spikes) and severity (average percentage of the spike affected) of FHB in each field were assessed by sampling 50 to 100 wheat spikes at three locations (Zadoks growth stage 80-85), and additional spikes were collected for subsequent pathogen identification. Up to 30 kernels per field collection were surface-sterilized and incubated on potato dextrose agar under continuous cool white light for 4-5 days to identify the *Fusarium* species present . When more than one *Fusarium* species was present, single spores were grown on carnation leaf agar or synthetic nutrient agar to facilitate identification. The FHB index (FHB-I) was calculated as follows: Average % incidence X Average % severity/100.

RESULTS AND COMMENTS: The disease was present in every field, but at lower severity than in any year since 1993, except in the Red River Valley where FHB-I averaged 10.3 %. In other areas of the province FHB-I ranged from 0.03% in the southwest to 5.5% in southeast. Hot dry weather at wheat flowering in these areas is the most likely reason for the low levels. In the Red River Valley both temperatures and rainfall were higher than normal. *Fusarium graminearum* was the predominant species (96%) isolated from kernels from infected heads. Two other species were found at low levels, *F. sporotrichioides* (2.7%) and *F. equiseti* (1.4%) (Table 1). Based on these results, FHB was moderately severe only in the Red River Valley, and here significant damage would have been encountered.

Table 1. Percent *Fusarium* species isolated from kernels of spring wheat in southern Manitoba in 2002.

***Fusarium* spp**.	
F. graminearum	95.9
F. equiseti	1.4
F. sporotrichioides	2.7

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

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN EASTERN ONTARIO IN 2002

INTRODUCTION AND METHODS: A survey for the presence of fusarium head blight (FHB) in spring wheat was conducted in the third week of July when plants were at the soft dough stage of development. The 31 wheat fields surveyed were chosen at random in regions of eastern Ontario, where most of the spring wheat in the province is grown. Fusarium head blight was estimated as both incidence (percent infected spikes) and severity (0-9), on a plant population of approximately 200 spikes at each of three random sites per field. The 0-9 scale for severity was modified from that of Xue et al. (2002), and consisted of 0 = no visible symptoms; 1 = majority of infected spikes have 1 diseased spikelet; 2 = majority have 2 diseased spikelets; 3 = majority have 3 diseased spikelets; 4 = majority have more than 3 diseased spikelets, but <1/4 spike area with symptoms (SAS); 5 = majority have <1/3 SAS; 6 = majority have <1/2 SAS; 7 = majority have <2/3 SAS, slight peduncle discoloration; 8 = majority have <3/4 SAS, restricted peduncle discoloration; and 9 = >3/4 SAS, extended peduncle discoloration, spike dead. Overall disease levels were calculated on a percentage scale as the "FHB intensity" using the formula FHB intensity = %incidence x (severity/9). Intensity values of $\leq$1, $\leq$10, $\leq$20, and >20 were considered slight, moderate, severe, and highly severe infection, respectively.

The relative prevalence of *Fusarium* species was determined from 10 infected heads collected randomly from each field, which were threshed after air-drying at room temperature. Ten discolored kernels from each field sample were selected, surface sterilized in 1% NaOCl for 30 sec. and plated onto modified potato dextrose agar (10 g dextrose per litre, which is 50% of the normal rate), amended with 100 ppm streptomycin sulfate, in 9-cm petri dishes. Plates were incubated at 22-25/C, with 14-hours of illumination by fluorescent and long wave ultraviolet tubes for 14 days. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Fusarium head blight was observed in all 31 fields surveyed (Table 1). Incidence ranged from 0.1-91.7%, with a mean of 24.1%. Severity ranged from 1 to 5.7, with a mean of 2.7, on the 0-9 scale. FHB intensity ranged from 0.1-58.1%, with a mean of 9.7%. Slight, moderate, severe, and highly severe FHB infections were observed for 6, 17, 4, and 4 fields, respectively. The four fields with highly severe infections were located at Finch, Napanee, Odessa, and Tweed.

Four *Fusarium* species were isolated from infected kernels (Table 2). *Fusarium graminearum* was the predominant species, occurring in 87.1% of the fields and on 57.7% of the infected kernels. The other three species, *F. culmorum, F. oxysporum,* and *F. poae* were found infrequently, each from less than 10% of fields and 1% of the infected kernels.

Although FHB symptoms were observed in all surveyed fields, the overall severity in 2002 was lower than in 2001 (Xue et al. 2002). *Fusarium graminearum* remained the predominant causal agent, as observed in 2001. However, the proportion of other *Fusarium* species was lower in 2002 than in 2001. *Fusarium crookwellense* and *F. sporotrichiodes*, each recovered from more than 15% of fields in 2001, were not isolated in 2002. The total precipitation and mean temperatures in eastern Ontario in June and July of 2002 were similar to those in 2001, but were slightly drier and warmer than the long-term average. This has been the second consecutive year that FHB was not a major threat to spring wheat in eastern Ontario.

REFERENCES:

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

Table 1. Occurrence of fusarium head blight in 31 fields of spring wheat in eastern Ontario in 2002.

FIELD LOCATION	INCIDENCE (%)	SEVERITY (0-9)	INTENSITY (0-100)*
Ashton	43.3	3.7	17.8
Athens	30	3	10.0
Avonmore	40	4.3	19.1
Carleton Place	33.3	2.7	10
Casselman	3.7	1.7	0.7
Chesterville	3	2	0.7
Crookston	25	3	8.3
Dalkeith	11.7	2.7	3.5
Dunvegan	15	2.7	4.5
Dwyer Hill	11.3	1	1.3
Finch	61.7	5.7	39.1
Iroquois	0.1	1	0.1
Johnstown	0.1	1	0.1
Kemptville	10	1	1.1
Limoges	30	3.3	11
Napanee	51.7	5.0	28.7
Odessa	60	4.0	26.7
Osgoode	18.3	2.3	4.7
Ottawa	0.1	1	0.1
Perth	21.7	2.0	4.8
Riceville	16.7	1.0	1.9
Richmond	33.3	2.0	7.4
Rockland	6.7	3.3	2.5
Shannonville	30	2.7	9.0
South Mountain	0.1	1.0	0.1
Stittsville	33.3	2.7	10.0
Thomasburg	30	1.7	5.7
Tweed	91.7	5.7	58.1
Vernon	20	5.0	11.1
Westbrook	10	2	2.2
Winchester	4	3.3	1.5
Mean	24.1	2.7	9.7

* FHB intensity = incidence x (mean severity/9).

Table 2. Frequency of *Fusarium* species isolated from spring wheat in eastern Ontario in 2002.

***FUSARIUM* SPP.**	**% FIELDS**	**% KERNELS**
F. culmorum	3.2	0.6
F. graminearum	87.1	57.7
F. oxysporum	3.2	0.3
F. poae	6.5	0.6

CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: **FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2002**

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 104 common wheat (Canada Western Red Spring and Canada Prairie Spring) and 48 durum wheat (Canada Western Amber Durum) fields in Saskatchewan in 2002. Fields were surveyed between July 25 and September 30, with the majority being surveyed in August. The range in survey dates was a result of variable moisture conditions and crop maturity across the province. Regions in the north and west of the province suffered from severe drought conditions and were not surveyed; therefore the total number of fields sampled was lower in 2002 than in previous years (Fernandez et al. 2002, 2001, 2000).

Saskatchewan Agriculture, Food and Rural Revitalization's extension agrologists collected 50 heads at random from each field at the milk to dough stages. The heads were analyzed by the Crop Protection Laboratory in Regina by visually inspecting for FHB symptoms. The number of infected heads per field and the number of infected glumes/kernels within those heads were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each field (% FHB severity = % heads affected x mean % severity of infection / 100). Mean FHB severity was also calculated for each soil zone (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey soils) and for the province. Glumes and/or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for one min. and cultured on potato dextrose agar and carnation leaf agar for identification of *Fusarium* species.

RESULTS AND DISCUSSION: In 2002, FHB occurred in 47% of the common wheat and 58% of the durum wheat fields surveyed (Table 1). These values were similar to values reported in past years (Fernandez et al. 2002, 2001, 2000). For both durum and common wheat, the lowest incidence was found in Zone 1 and highest in Zone 3, similar to previous years. The soil characteristics, precipitation and evapotranspiration patterns in eastern and northern cereal production regions are more favourable for FHB development.

In general, FHB disease severity was very low in 2002 due to the dry conditions. The overall mean FHB severity for the province was higher for common wheat at 0.8% than for durum wheat at 0.2% (Table 1). In 2002, the overall mean FHB severity in common wheat was lower than in 2001 (2.9%), 2000 (1.7%), 1999 (1.1%) and 1998 (3.0%). The overall mean FHB severity in durum wheat also was lower in 2002 than in 2001 (4.5%), 2000 (1.2%), 1999 (0.5%) and 1998 (2.3%). In 2002, the mean disease severity for common wheat was highest in Zone 3 at 1.3%. This observation is consistent with that of previous years since *Fusarium graminearum* is well established in eastern regions of the province where the moist and warm conditions favourable for FHB development frequently occur. The common wheat field with the highest FHB severity (15.4%) was located near Redvers in the extreme southeast of the province. The durum field with the highest FHB severity (1.1%) was near Outlook and was under irrigation.

In 2002 the most commonly isolated *Fusarium* species from wheat fields was *F. sporotrichioides*, accounting for 30% of total *Fusarium* species, followed closely by *F. poae* (24%) and *F. avenaceum* (23%) (Table 2). *Fusarium graminearum* accounted for 10% of total *Fusarium* species, which was lower than in 2001 (40%) (Fernandez et al. 2002). In 2002 *F. graminearum* was isolated from only 13 of the 152 wheat fields surveyed. Eleven of these fields were located in the southeast region and two in the east-central region. All species were less prevalent in Zone 1 than in the other two zones.

These survey results may not provide an accurate representation of grain quality at the end of the 2002 growing season since cool wet weather in August delayed harvest in most regions of Saskatchewan. The Crop Protection Laboratory reported isolating other fungi at levels much higher than in previous years from most of the wheat samples submitted for the survey. Furthermore, seed testing laboratories reported high levels of various *Fusarium* species and other saprophytes on wheat samples (R.A.A. Morrall, pers. com.), confirming that weather conditions further deteriorated kernel quality after this survey had been conducted.

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Table 1. Common and durum wheat fields infected with fusarium head blight (FHB) and mean FHB disease severity according to soil zones in Saskatchewan, 2002.

Soil Zones	Common Wheat		Durum Wheat	
	No. fields affected / total fields (and %)	Mean Disease Severity[1]	No. fields affected / total fields (and %)	Mean Disease Severity[1]
Zone 1 Brown	3 / 14 (21%)	0.1%	6 / 14 (43%)	0.1%
Zone 2 Dark Brown	18 / 46 (39%)	0.2%	19 / 30 (63%)	0.2%
Zone 3 Black/Grey	28 / 44 (64%)	1.3%	3 / 4 (75%)	0.1%
Overall Mean	49 / 104 (47%)	0.8%	28 / 48 (58%)	0.2%

[1] FHB severity = % heads affected x mean % severity of infection / 100

Table 2. Prevalence of *Fusarium* species in wheat in Saskatchewan in 2002.

Soil Zones	Number of wheat fields from which *Fusarium* species were isolated (% of total *Fusarium* isolations)					
	F. avenaceum	*F. culmorum*	*F. graminearum*	*F. poae*	*F. sporotrichioides*	*F. spp.*
Zone 1 Brown	4 (31%)	0	0	0	8 (61%)	1 (8%)
Zone 2 Dark Brown	13 (21%)	3 (5%)	4 (7%)	16 (26%)	17 (28%)	8 (13%)
Zone 3 Black/Grey	11 (22%)	1 (2%)	9 (18%)	14 (27%)	12 (23%)	4 (8%)
Overall Mean	28 (23%)	4 (3%)	13 (10%)	30 (24%)	37 (30%)	13 (10%)

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: SURVEY FOR FOLIAR DISEASES OF BARLEY IN MANITOBA IN 2002

INTRODUCTION AND METHODS: Foliar barley diseases in Manitoba were surveyed in 42 fields (16 two-row, 26 six-row) from July 29 to August 8 when most crops were at the soft dough stage (ZGS 85). Fields were sampled at regular intervals along the survey routes, depending on availability. Disease severity was recorded by averaging values on about 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Severity was rated on both the upper (flag and penultimate leaves) and lower canopies, using a scale of: 0 (no 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, and dried and stored in paper envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2002 were relatively cool and moist early in the growing season (to mid-June) but then became warmer and with variable moisture until near harvest. Frequent showers in late August and September hampered combining in many regions. Leaf spot development was somewhat delayed, but developed to moderate levels in many crops. As appears to be general for barley, the field history, i.e., presence or absence of barley stubble from the previous year, appeared to have the overriding influence on the level of leaf spotting observed.

Leaf spots were observed in the upper and/or lower leaf canopies of all fields surveyed. Disease levels in the upper canopy were 0, trace or very slight in 21% of fields, slight in 22%, moderate in 26%, severe in 24% and leaves senescent in 7%. Respective levels in the lower canopy were 0%, 26%, 5%, 24% and 45%. On the basis of 50% of fields having moderate or severe leaf spotting in the upper canopy, these diseases caused moderate damage in 2002; average grain yield losses were likely in the range of 5-10%.

Cochliobolus sativus (spot blotch) was the most common pathogen isolated from leaf tissue (Table 1), and was found in all fields surveyed. It was responsible for most of the leaf spotting recorded. *Pyrenophora teres* accounted for about 1/4 of the damage while the three *Septoria* pathogens (speckled leaf blotch) had a minimal impact. The predominance of *C. sativus* on barley in Manitoba in 2002 is similar to that first observed in 2001 (Tekauz et al. 2002).

REFERENCES:

Tekauz, A.,J. Gilbert, E. Mueller, M. Stulzer, E. Nehodin, R. Kaethler and D.A. Kaminski. 2002.Survey for leaf spot diseases of barley in Manitoba in 2001. Can. Plant Dis. Surv. 82:55-56.
(http://www.cps-scp.ca/cpds.htm)

Table 1. Prevalence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2002

Pathogen	Prevalence (% of fields)	Frequency (% of isolations)*
Cochliobolus sativus	100.0	73.0
Pyrenophora teres	56.1	23.3
Septoria passerinii	12.2	2.0
Septoria avenae f.sp. triticea	7.3	1.5
Stagonospora nodorum	2.4	0.2

* indicative of the relative foliar damage observed

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN 2002 IN MANITOBA

INTRODUCTION AND METHODS: The presence of fusarium head blight (FHB) in winter wheat in southern Manitoba was assessed by surveying 36 farm fields between July 9 and 25, 2002 when most crops were at the mid- to soft-dough stage of growth (ZGS 83-85). Because winter wheat is not widely grown in Manitoba (in 2002 it was planted on about 5% of the total wheat acreage - Canadian Wheat Board) the fields were not surveyed at random; rather, information on their location was obtained by contacting Manitoba Agriculture extension personnel and producers who normally grow the crop. The fields surveyed were located in southern Manitoba, in the area bounded by Hwy #16 and the US border, Souris to the west and Steinbach to the east. 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 percentage of the head affected (severity). Disease levels were calculated as the 'FHB index' (% incidence x mean % severity / 100). Several affected heads were collected at each field site and stored in paper envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from five heads per location. These were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar to quantify and identify the *Fusarium* spp. present.

RESULTS AND COMMENTS: Conditions in spring 2002 were initially cool and relatively moist, and moderately suitable for *Fusarium* inoculum development on overwintered plant straw and debris. Winter wheat normally flowers about 2 weeks earlier than spring-seeded crops. The lower probability of adequate moisture for spike infection at this time apparently allows the crop to escape the disease in some years. In spite of this, and the general use of foliar fungicides to protect the crop from various diseases, FHB was common in winter wheat in 2002.

All the 36 fields surveyed had visible symptoms of FHB, although in several of these the incidence of infected spikes was a trace (less than one in a thousand). Overall, incidence of FHB was 10.1% (range <0.1 - 82.3%), severity 37.5% (range 7.0 - 100%) and the FHB Index (%incidence x %severity / 100) 4.1% (range <0.1 - 41.2%). As such, FHB was estimated to have caused average yield losses in commercial winter wheat of about 3.0%. This level of loss is higher than found in 2001 and 2000 (Tekauz et al. 2001, 2002).

The *Fusarium* spp. isolated and their occurrence in fields and on kernels are listed in Table 1. As found annually for all wheat types grown in Manitoba, *F. graminearum* was the predominant pathogen species.

REFERENCES:

Tekauz, A., E. Mueller, M. Stulzer and E. Nedohin. 2002. Fusarium head blight in winter wheat in Manitoba in 2001. Can. Plant Dis. Surv. 82:59-60. (http://www.cps-scp.ca/cpds.htm)

Tekauz, A., J. Gold, M. Idris, M. Beyene, M. Stulzer, E. Nedohin and B. Geoffroy. 2001. Fusarium head blight of winter wheat in Manitoba in 2000. Can. Plant Dis. Surv. 81:96-97.
(http://www.cps-scp.ca/cpds.htm)

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

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. graminearum	97.2	97.9
F. poae	8.3	0.4
F. culmorum	5.6	1.0
F. sporotrichioides	5.6	0.4
F. avenaceum	2.8	0.2
F. equiseti	2.8	0.1

CROP / CULTURE: Barley
LOCATION / RÉGION: Eastern Ontario

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TITLE / TITRE: FOLIAR DISEASES OF BARLEY IN EASTERN ONTARIO IN 2002

INTRODUCTION AND METHODS: A survey of foliar diseases in barley was conducted in the third week of July when plants were at the soft dough stage of development. The 33 barley fields surveyed were chosen at random in regions of eastern Ontario, where most of the spring barley in the province is grown. Disease severity was determined by rating 10 flag and penultimate leaves, sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and >6 were considered trace, slight, moderate, and severe infection, respectively. In addition, the incidence of barley stripe, ergot, loose smut, and take-all was estimated as the percentage of plants infected, when these diseases were present.

RESULTS AND COMMENTS: Ten diseases or disease complexes were observed in the 33 fields surveyed (Table 1). Of these, net blotch (*Pyrenophora teres*), observed in 26 fields, was the most prevalent with a mean severity of 3.7. Severe net blotch infection was observed in six fields (disease scores >6.0). These severely infected fields were located at or near Innisville, Plainfield, Marsville, Vernon, and Dunvegan. Yield reductions due to net blotch were estimated to average at least 15% for the surveyed fields. Net blotch was considered the major factor limiting barley yield in eastern Ontario in 2002.

Spot blotch (*Cochliobolus sativus*) was observed in 15 fields and was the second most common disease. However, the mean severity was only 1.2. Fourteen fields had trace to slight levels of infection, with only one having a moderate level. The disease did not appear to have caused significant damage.

Scald (*Rhynchosporium secalis)* was observed in seven fields with a mean severity of 2.1. All affected fields were located east of the Ottawa valley. Two fields were rated as having moderate infection; however, as the yield was almost set at the time the crop was surveyed, no significantly damage likely occurred. No severe scald infections were observed.

Powdery mildew (*Erysiphe graminis* f. sp. *hordei*) was observed in three fields at a mean severity of 2.4. A moderate level of infection was observed in only one field. The disease appeared to have caused little damage to affected crops.

The septoria complex, including speckled leaf blotch (*Septoria avenae* f. sp. *triticea),* leaf blotch (*S. passerinii*), and glume blotch (*S. nodorum*), was observed in three fields, at a mean severity of 1.3. Only trace or slight levels of infection were found.

Leaf rust (*Puccinia hordei*) was observed in five fields, at a low mean severity of 0.8. No moderate or severe infection occurred and the disease appeared to be of minor importance in 2002.

Barley stripe (*Pyrenophora graminea*) was observed in three fields, at an average incidence of 11.2%. Two fields had fewer than 1% infected plants, but in one located near Almonte, more than 30% of the plants were infected; a considerable reduction in yield could be expected.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*) and take-all (*Gaeumannomyces graminis*) were observed in 5, 10, and 3 fields, at incidence levels ranging from 0.1-3.0%, 0.1-2.0%, and 0.5-1.0%, respectively. These diseases likely resulted in minimal yield reductions.

Total precipitation and mean temperatures in eastern Ontario in June and July, 2002 were similar to those in 2001, but were slightly drier and warmer than the long-term average. In general, the disease survey results in 2002 were similar to those in 2001 (Xue 2002). Net blotch remained the major barley disease, and caused significant yield reductions for the second consecutive year. Spot blotch was common but only at low severity. However, this disease has the potential to cause significant damage to barley production in Ontario. Powdery mildew, scald, and the septoria complex were observed only in isolated fields in the past two years. These diseases also may pose a threat when environmental conditions for their development are favourable. All other diseases were of minor importance.

REFERENCES:

Xue, A.G. 2002. Foliar diseases of barley in Ontario in 2001. Can. Plant Dis. Surv. 82:64-65. (http://www.cps-scp.ca.cpds.htm)

Table 1. Prevalence and severity or incidence of diseases in 33 fields of barley in eastern Ontario in 2002.

DISEASE	NO. FIELDS AFFECTED	SEVERITY OR INCIDENCE IN AFFECTED FIELDS*	
		Mean	Range
Leaf rust	5	0.8	0.4-1.5
Net blotch	26	3.7	0.6-7.1
Powdery mildew	3	2.4	1.3-4.1
Scald	7	2.1	0.3-5.1
Septoria complex	3	1.3	0.4-1.9
Spot blotch	15	1.2	0.4-5.5
Barley stripe (%)	3	11.2	0.5-31.7
Ergot (%)	5	1	0.1-3.0
Loose smut (%)	10	0.8	0.1-2.0
Take-all (%)	4	0.8	0.5-1.0

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

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FOLIAR DISEASES OF OAT IN MANITOBA IN 2002

INTRODUCTION AND METHODS: Foliar diseases of oat in Manitoba were assessed by surveying 34 commercial fields from July 31 to August 8 when most crops were at the late milk to soft dough stage of growth (ZGS 77-83). Fields were sampled at regular intervals along the survey routes, depending on availability. Disease severity was recorded by averaging ratings on about 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 6-category scale: 0 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Leaves with typical symptoms were collected at each site and dried and stored in paper envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2002 were relatively cool and moist early in the growing season (to mid-June) and then became warmer, with variable moisture until near harvest. Frequent showers in late August and September hampered combining operations in many regions. Leaf spot infection in oat likely was delayed somewhat, but there is little information available on the influence of environmental factors on leaf spot development in this crop. Average severity in farm fields reached only a 'light' level . However, in two adaptation trials near Winnipeg, an unprecedented, severe, level of leaf spotting was noted in several cultivars under test.

Leaf spots were observed in the upper and/or lower leaf canopies in all oat fields surveyed. Disease levels in the upper canopy were 0, trace or very slight in 47% of fields, slight in 29%, moderate in 21%, severe in 0% and leaves senescent in 3%. Respective levels in the lower canopy were 9%, 20%, 12%, 18% and 41%. On the basis of most fields having trace or slight levels of disease in the upper canopy, foliar diseases in oat caused little damage in 2002; on average, grain yield losses were likely in the range of 1-2%, similar to that found in 2001(Tekauz et al. 2002).

Pyrenophora avenae (pyrenophora leaf blotch) and *Phaeosphaeria avenaria* f.sp.*avenaria* ('Septoria' leaf blight) were the pathogens isolated most frequently from infected leaf tissue and caused about 3/4 of the damage observed. *Cochliobulus sativus* (spot blotch) accounted for much of the remaining damage. Anthracnose (*Colletotrichum graminicola*) was found, but only at a very low frequency (Table 1). Compared to 2001, the year the first contemporary survey for leaf spots of oat was conducted in Manitoba, in 2002 the importance of *P. avenea* increased substantially, while that of *C. sativus* diminished somewhat.

REFERENCES:

Tekauz, A., E. Mueller, M. Stulzer, E. Nedohin and D.A. Kaminski. 2002. Oat leaf spot diseases in Manitoba in 2001. Can. Plant Dis. Surv. 82:61. (http://www.cps-scp.ca/cpds.html)

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

Pathogen	Prevalence (% of fields)	Frequency (% of isolations)*
Pyrenophora avenae	87.9	38.3
Phaeosphaeria avenaria f.sp. *avenaria*	87.9	36.1
Cochliobolus sativus	81.8	24.0
Colletotrichum graminicola	6.1	1.6

* indicative of the relative foliar damage observed

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2002

INTRODUCTION AND METHODS: Fifty-six southern Manitoba spring wheat fields were surveyed to assess prevalence and severity of foliar diseases between July 29 and August 8, 2002. Leaves were collected between heading and the soft dough stage of development. Severity of disease on flag and flag $^{-1}$ leaves is reported as percent leaf affected. Samples of diseased leaf tissue were surface-sterilized and placed in moisture chambers for 5-7 days to promote pathogen sporulation for disease identification.

RESULTS AND COMMENTS: Average percent necrosis on the flag leaves was 34.4%, and on the flag $^{-1}$ 43%. Spot blotch, caused by *Cochliobolus sativus,* was the predominant leaf spot disease in southern Manitoba in 2002; it was favoured by higher than average temperatures and rainfall in June and July (Gilbert et al. 1998). *Cochliobolus sativus* accounted for 47% of the 672 fungal isolations from leaf tissue. *Pyrenophora tritici-repentis*, cause of tan spot, *Septoria tritici* cause of septoria tritici blotch, and *Stagonospora nodorum* cause of stagonospora nodorum blotch accounted for 18%, 17% and 18% of isolations, respectively. This marks a second year in which the prevalence of *Septoria tritici* was lower than observed between 1994 and 2000. At the same time *S. nodorum* was found at higher levels than *S. tritici* in two areas of southern Manitoba: the south central region and the Red River Valley. A change in predominance from *S.nodorum* to *S. tritici* was documented in 1994 (Gilbert et al. 1998). It will be of interest to see if this recent trend to increased *S. nodorum,* decreased *S. tritici* and predominance of *C. sativus* predominance*,* continues in the future.

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

Table 1. Prevalence and isolation frequency of leaf spot pathogens in 56 fields of hard red spring wheat in Manitoba in 2001.

	Disease			
Number of fields = 56	**S. nodorum blotch *(Stagonospora nodorum*)**	**S. tritici blotch *(Septoria tritici)***	**Spot blotch *(Cochliobolus sativus)***	**Tan spot *(Pyrenophora tritici-repentis*)**
Fields (%)	64	57	96	63
Isolations (%)	18	17	47	18

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

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TITLE / TITRE: FOLIAR DISEASES OF SPRING WHEAT IN ONTARIO IN 2002

INTRODUCTION AND METHODS: A survey for the presence of foliar diseases in spring wheat was conducted in the third week of July when plants were at the soft dough stage of development. The 31 spring wheat fields surveyed were chosen at random in regions in eastern Ontario, where most of the spring wheat in the province is grown. Disease severity was determined by rating 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and >6 were considered trace, slight, moderate, and severe infection, respectively. Incidence of loose smut and take-all, when these diseases were present, was estimated as the percentage of plants infected.

RESULTS AND COMMENTS: Nine diseases were detected in the 31 fields surveyed (Table 1). Of these, septoria leaf blotch (*Septoria* spp.) was the most prevalent and was observed in 24 fields. However, the mean disease severity was only 1.7 on the 0-9 scale. Severe infection caused by septoria leaf blotch was observed in only one field at Riceville. The disease did not result in significant damage.

Powdery mildew (*Erysiphe graminis* f. sp*. tritici*) and bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*) were the second and third most commonly found foliar diseases, occurring in 6 and 4 fields, at mean severities of 2.2 and 2.9, respectively. These appeared to have caused little damage as no severe infections were observed.

Other foliar diseases detected included leaf rust (*Puccinia triticina*), septoria glume blotch (*Stagonospora nodorum*), spot blotch (*Cochliobolus sativus*), and tan spot (*Pyrenophora tritici-repentis*). These diseases were each observed in a maximum of three fields, at severities of less than 1.5. They likely were of minor importance.

Loose smut (*Ustilago tritici*) and take-all (*Gaeumannomyces graminis* var. *tritici*) were observed in two and 13 fields, at incidence levels ranging from 0.5-1.0% and 0.2-8.3%, respectively. They did not appear to cause significant damage, except in the one field with 8.3% take-all located at Winchester.

Total precipitation and mean temperatures in eastern Ontario in June and July of 2002 were considered similar to those in 2001, but were slightly drier and warmer than the long-term average. All nine diseases identified on spring wheat in 2002 were also observed in 2001 (Xue 2002). Ergot, observed in four of the 26 fields in 2001, was not found in 2002. Leaf rust was of minor importance in 2002, whereas it was the most prevalent disease in 2001.

REFERENCE:

Xue, A.G. 2002. Foliar diseases of spring wheat in Ontario in 2001. Can. Plant Dis. Surv. 82:69-70. (http://www.cps-scp.ca/cpds.htm

Table 1. Prevalence and incidence or severity of foliar and other diseases in 31 fields of spring wheat in eastern Ontario in 2002.

DISEASE	NO. FIELDS AFFECTED	DISEASE SEVERITY OR INCIDENCE* IN AFFECTED FIELDS	
		Mean	Range
Bacterial leaf blight	4	2.9	1.1-5.0
Leaf rust	2	1.4	0.4-2.5
Powdery mildew	6	2.2	1.4-4.1
Septoria glume blotch	1	0.5	0.5
Septoria leaf blotch	24	1.7	0.1-6.9
Spot blotch	3	1	0.1-1.5
Tan spot	3	0.7	0.3-1.3
Loose smut (%)	2	0.8	0.5-1.0
Take-all (%)	13	1.7	0.2-8.3

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

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

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TITLE / TITRE: **LEAF DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2002**

INTRODUCTION AND METHODS: A survey for foliar diseases of common and durum wheat was conducted between the milk and dough growth stages in nine crop districts (CD) in Saskatchewan. Some of the most drought-affected areas in west-central and northern CDs were not surveyed. In each of 56 fields (42 common wheat, 14 durum wheat), 10 flag leaves were collected at random and air dried at room temperature. Percent leaf area affected by leaf spots (severity) was recorded for each leaf. An average percent leaf area with leaf spots was calculated for each field and CD. Surface disinfested leaf pieces were plated on water agar for identification and quantification of leaf spotting pathogens.

RESULTS AND COMMENTS: Leaf spots were observed in 84% of the common and durum wheat fields surveyed. Leaf spot severities in individual fields ranged from trace to 25%. The highest mean leaf spot severities were observed in CDs 3AS (south-west) and 1B (south-east) (Table 1).

As in previous years, the most prevalent leaf spotting pathogen was *Pyrenophora tritici-repentis* (tan spot), both in the number of fields where it was present and in the percent leaf area colonized (Table 1). *Septoria nodorum* was the second most common species. This is in contrast to 2001 and 2000 when *Cochliobolus sativus*, *S. tritici* or *S. avenae* f. sp. *triticea* were the second most commonly isolated pathogens, but similar to 1999 where *S. nodorum* was also the second most common species (Fernandez and Pearse 2002, Fernandez et al. 2002, 2001, 2000, Hughes et al. 2001, 2000).

Leaf rust at levels of up to 20% was found mostly in the eastern part of the province in 35% of the fields. No stripe rust was observed.

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

REFERENCES:

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

Fernandez, M.R., G.R. Hughes and P.G. Pearse, 2001. Leaf diseases of durum wheat in Saskatchewan in 2000. Can. Plant Dis. Surv. 81: 86-87. (http://www.cps-scp.ca.cpds.htm)

Fernandez, M.R., G.R. Hughes, and P.G. Pearse, 2000. Leaf diseases of durum wheat in Saskatchewan in 1999. Can. Plant Dis. Surv. 80:52-53. (http://www.cps-scp.ca.cpds.htm)

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

Hughes, G.R., M.R. Fernandez and P.G. Pearse, 2001. Leaf diseases of common wheat in Saskatchewan in 2000. Can. Plant Dis. Surv. 81: 91-94. (http://www.cps-scp.ca.cpds.htm)

Hughes, G.R., M.R. Fernandez, and P.G. Pearse, 2000. Leaf diseases of common wheat in Saskatchewan in 1999. Can. Plant Dis. Surv. 80:62-64. (http://www.cps-scp.ca.cpds.htm)

Table 1. Distribution and severity of leaf spotting diseases, and estimate of the percentage of flag leaf area colonized by leaf spotting fungi, in common and durum wheat fields in Saskatchewan in 2002.

Crop District	No. fields affected/ surveyed[1]	Mean severity[2]	Leaf spot pathogens[3]				
			P. tritici-repentis	***S. nodorum***	***S. tritici***	***S. avenae f.sp. triticea***	***C. sativus***
1A	5/7	1	49/3	52/2	17/1	-	16/2
1B	5/5	11	53/5	55/2	19/5	4/1	8/3
2A	5/6	4	78/5	20/3	-	2/1	12/4
3A-N	6/6	3	83/5	19/3	5/3	-	7/2
3A-S	5/5	15	80/5	14/5	1/2	-	8/4
3B-N	5/8	1	57/3	59/2	4/3	-	-
4A	4/7	1	50/1	50/1	-	-	-
5A	5/5	7	64/5	18/2	31/4	-	7/3
6A	7/7	7	83/6	9/6	11/3	-	4/3
Mean/ total:	**47/56**	**5**	**70/38**	**25/26**	**14/21**	**3/2**	**9/21**

[1] number of fields with leaf spotting lesions on the flag leaf.
[2] mean percent flag leaf area infected.
[3] average percent of affected leaf area colonized by fungus / number of fields where it occurred.

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2002

INTRODUCTION AND METHODS: Foliar diseases of the Manitoba winter wheat crop were assessed by surveying 36 fields from July 9 to 25 when most had plants that were at the early to soft dough stage (ZGS 83-85). Because winter wheat occupies a small acreage in Manitoba (about 5% of the total 2002 wheat acreage - Canadian Wheat Board) the fields were not surveyed at random; rather, their location was identified by Manitoba Agriculture extension personnel and producers who grow the crop. The fields surveyed were in southern Manitoba, in the area bounded by Hwy #16 and the US border, Souris to the west and Steinbach to the east. Disease incidence and severity were recorded by averaging their occurrence on about 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Diseases were rated on both the upper (mainly flag leaf) and lower leaf canopies, using a six-category scale: 0 (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 and dried and stored in paper envelopes. Surface-sterilized pieces of infected tissue were placed in moist chambers for 3-5 days to identify the causal pathogen(s) and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2002 were generally cool and moist in the early growing season (to mid-June) and then became warmer with variable moisture. Conditions for infection and development were thus suitable for one or more of the normally-occurring wheat leaf spot diseases.

Leaf spots were observed in the upper or lower canopies of all fields surveyed. Disease levels in the upper canopy were 0, trace or very slight in 3% of fields, slight in 61%, moderate in 14%, severe in 5% and leaves senescent in 17%. In the lower canopy they were 0%, 3%, 5%, 0% and 92%, respectively. Based on development in the upper canopy (>60% of fields with trace to slight leaf spotting), foliar diseases in winter wheat in 2002 caused little damage, likely less than a 2% yield loss. Tan spot (*Pyrenophora tritici-repentis*) and spot blotch (*Cochliobolus sativus)* were the most prevalent diseases (Table 1). The contribution of tan spot to the leaf spot complex was lower than in 2001, but higher than in 2002 in spring wheat (Gilbert et al. 2003, Tekauz et al. 2002). By contrast, spot blotch was more prevalent in winter wheat in 2002 than it was in 2001. Septoria tritici blotch (=speckled leaf blotch) and septoria avenae blotch were not detected in 2002.

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

Pathogen	Incidence (% of fields)	Frequency (% of isolations)*
Pyrenophora tritici-repentis	80.0	49.0
Cochliobolus sativus	66.7	39.8
Stagonospora nodorum	23.3	11.2

* indicative of the relative foliar damage observed

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

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TITLE / TITRE: CEREAL SMUT SURVEYS, 2002

INTRODUCTION AND METHODS: In July 2002, cereal crops were surveyed for *Ustilago hordei*, *U. nigra*, *U. nuda*, *U. tritici*, *U. avenae* and *U. kolleri* in Manitoba and Saskatchewan. The area was covered by a route of Winnipeg - Estevan - Moose Jaw - Saskatoon - Prince Albert - Melfort - Yorkton - Russell - Brandon - Winnipeg, as well as one day trips around Winnipeg, MB. Fields were selected at random at approximately 10 - 15 km intervals, depending on the frequency of the crops in the area. An estimate of the percentage of infected plants (i.e., plants with sori) was made while walking an oval path of approximately 100 m in each field. Levels of smut greater than trace (<0.1%) were estimated by counting plants in a one m^2 area at a minimum two sites on the path.

RESULTS AND COMMENTS: Loose smut (*Ustilago tritici*) was found in 10 (10%) of the 98 fields of bread wheats surveyed. In eight of these, there was a trace level of infection; two fields had 0.1% smutted plants. In durum wheat, loose smut was found in 50% of the 22 fields surveyed and levels of infection ranged from trace to 1.0%. In awned wheats (likely of the CPS wheat class), loose smut was detected in 40% of the 25 fields surveyed, mostly at trace levels. One of these fields had 5.0% smutted plants.

Three of 46 oat fields of oat had smutted plants at trace levels of infection. Smutted oat fields were infected with *Ustilago avenae*.

A high incidence of loose smut was found in barley with 42% of the 66 fields surveyed containing infected plants. Prevalence was particularly high in 6-row barley (67% of 33 fields) with infection levels of trace to 1.0% smutted plants. In 2-row barley, 18% of 33 fields were affected with levels of trace and 0.1%. As in 2000 and 2001 (Menzies et al., 2001, 2002), false loose smut (*Ustilago nigra*) and covered smut (*Ustilago hordei*) were not found.

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

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TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2002

INTRODUCTION AND METHODS: Surveys of fields and trap nurseries of barley, oat and wheat for incidence and severity of stem rust *(Puccinia graminis* f. sp. *tritici* and *P. graminis* f. sp. *avenae*) were conducted in July, August, and September 2002. Infected stem tissue samples obtained from fields and trap nurseries were evaluated for virulence specialization on appropriate sets of host differential lines. Disease and host growth stage data were used to estimate yield losses in oat resulting from moderate to heavy stem rust infection in 2002.

RESULTS AND COMMENTS: Colder than normal conditions in April and May, along with dry soil conditions in Alberta and Saskatchewan, delayed seeding across much of the Prairie region until late May or early June and favored stem rust infection. Environmental conditions were highly unfavorable for stem rust infection in Alberta and northern Saskatchewan in 2002 due to extremely dry conditions. Stem rust infection on susceptible lines in trap nurseries was low (trace to 5% severity) in eastern Saskatchewan, and was variable (trace to 60% severity) in central and eastern Manitoba depending on planting date. Moderate to severe levels of stem rust infection developed during late summer-early fall on wild barley *(Hordeum jubatum*) and wild oat *(Avena fatua*).

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. Barley cultivars recommended for production in Manitoba and Saskatchewan are susceptible to stem rust races QCCJN and RCCJN. These races appear to be predominant (preliminary survey data) in the wheat stem rust population in the Prairies in 2002, and stem rust severity was slightly higher (trace to 7%) compared to recent years in commercial barley fields.

All oat cultivars recommended for production in Manitoba and Saskatchewan are susceptible to stem rust races NA67 and NA76. The oat cultivar 'Triple Crown' is susceptible to all races currently found in the oat stem rust population and was widely grown (23% of the acreage) in Manitoba in 2002. Stem rust infection in Manitoba and eastern Saskatchewan was the highest seen since the epidemic of 1977. Stem rust infection was most severe (>50% severity in some fields) in late-planted fields in the Red River Valley region of Manitoba. However, light to moderate (5-25% severity) infection was common in oat fields near Winnipeg. Late-planted commercial fields sustained yield losses estimated at exceeding 50%, but losses attributable to stem rust were confounded by leaf spot infection (*Septoria avenae*). Losses from crown rust infection were minimal with disease severity at the lowest levels observed for many years. Preliminary estimates of average losses incurred by oat producers in Manitoba and eastern Saskatchewan as a result of stem rust infection is 5-10% yield loss. This represents a $10-20 million dollar loss based on 2002 oat production and current commodity prices of $220/MT.

No new races of *P. graminis* f. sp. *tritici* were found that threaten Canadian wheat or barley production. The predominance of races QCCJN and RCCJN in the 2002 stem rust population is a warning of possible future stem rust losses in barley. Barley fields should be carefully monitored in the 2003 cropping season for stem rust infection and protected as necessary. The continued increase in frequency of races NA67 and NA76 of *P. graminis* f. sp. *avenae* and concurrent severe losses in some late-planted fields is of major concern. These races are virulent on the effective stem rust resistance genes *(Pg2, Pg9,* and *Pg13)* deployed in Canadian oat cultivars. Race NA67 continues to predominate in the oat stem rust population while the prevalence of race NA76 continues to increase. Since all currently grown oat cultivars are susceptible, it is imperative to develop cultivars with resistance to these races as quickly as possible. Lines with effective resistance are being developed in breeding programs at the Agriculture and Agri-Food Canada, Cereal Research Centre, Winnipeg. In addition, oat accessions with putative novel stem rust

resistance have been identified in the stem rust pathology program there and are being investigated for inheritance of resistance and the transfer of this resistance into adapted oat germplasm.

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

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TITLE / TITRE: **CEREAL VIRUS DISEASE SITUATION IN MANITOBA IN 2002**

INTRODUCTION AND METHODS: Virus diseases on cereals in Manitoba monitored in 2002 were barley yellow dwarf (BYD), wheat streak mosaic (WSM) and flame chlorosis (FC).

Collaborators identified and collected samples from early June to late August in cereal crops in Manitoba and parts of eastern Saskatchewan. The proportion of plants with suspected virus symptoms in surveyed fields was estimated and specimens with and without symptoms collected for testing. Infection with BYDV and WSMV was confirmed by transmission to indicator hosts, and for BYDV, also characterized as to serotype, by enzyme-linked immunosorbent assay (ELISA). In addition to confirming identity of causal agents, transmission to indicator host plants was used to assess virulence against historical benchmarks. For WSMV, transmission was by mechanical inoculation to a range of susceptible spring bread and durum wheat hosts; for BYDV, transmission was by cereal aphids to sets of seedlings of a susceptible oat host.

RESULTS AND COMMENTS:

Barley Yellow Dwarf - Losses due to BYD in 2002 were generally mild, as in 2000 and 2001 (1,2), Cereal aphid populations carrying BYDV first arrived in Manitoba in mid-June, about 7-10 days earlier than in 2001, but numbers were low and incidence sporadic. In 2002 there were fewer than average days with strong southerly winds, so natural aphid arrivals were lower. Most of the relatively small number of early-arriving cereal aphids were oat bird-cherry (*Rhopalosiphum padi*), the most efficient vector of the predominant BYDV strain, PAV. Although losses were generally mild, sites in southern Manitoba that were seeded extremely late, showed localized losses in barley and, less frequently, oat. Losses due to BYD in wheat were very small. All virus isolates obtained from small grains were of the PAV strain (non-specifically transmitted by the oat bird-cherry aphid).

Wheat Streak Mosaic - Continuing the trend of recent years (1,2),the increase in winter wheat production in south-central Manitoba appears to be associated with local, sometimes severe outbreaks of WSM in both spring and winter wheat crops. However, crop-destroying losses are more likely to occur in spring wheat crops adjacent to winter wheat inoculum sources than in winter wheat crops themselves. In 2002, WSM was at high levels in winter and spring wheat fields near Nokomis in south-central Saskatchewan, a region not previously noted for the disease. Infection with WSMV was again common in winter wheat fields in southwestern and south-central Manitoba, but losses were sporadic and localized within fields, as inoculum sources appeared to be winter wheat plants that were volunteers from crops of one or two years before. Losses in nearby spring wheat fields were usually worse, due to both higher disease incidences and the fact that spring wheat plants were infected at an earlier, more vulnerable growth stage.

Flame Chlorosis - FC was not observed in Manitoba in 2002. After expanding in the late 1980s and early 1990s (3), the incidence of this soil-transmitted disease has declined to the point that in recent years it is observed at only a handful of sites or, as in 1999, not at all.

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

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TITLE / TITRE: **LEAF AND STRIPE RUST OF WHEAT IN MANITOBA AND SASKATCHEWAN, 2002**

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*) and stripe rust (*Puccinia striiformis* f.sp. *tritici*) during July and August 2002. Leaves infected with leaf rust were collected for virulence phenotype identification by inoculating urediniospores from these leaves onto a set of 16 single-gene differential wheat lines.

RESULTS AND COMMENTS: Wheat leaf rust was first seen in the 2002 crop season on winter wheat in Manitoba on June 20, later than average. Surveys revealed that it was widespread throughout southern Manitoba and S.E. Saskatchewan in late July and early August. Average severity in southern Manitoba was 18.0% of the flag leaf area covered with leaf rust pustules. South-central Manitoba (Morden, Carman, Winkler area) had the highest levels of infection but many fields there were treated with fungicides to control leaf rust. In S.E. Saskatchewan there was an average of 5.0% flag leaf infection. Drier conditions resulted in less disease than in Manitoba. Overall the level of leaf rust in Manitoba and S.E. Saskatchewan in 2002 was higher than in 2001 and 2000, but not as high as in 1999 (McCallum et al. 2000, 2001, 2002). Resistant cultivars such as AC Cora and McKenzie continue to provide good protection against infection. The predominant virulence phenotypes of *P. triticina* from Manitoba and Saskatchewan were MBDS (32.8%), TGBJ (28.0%), and TBBJ (9.9%). The first three letters of the virulence phenotypes are as defined by Long and Kolmer (1989) and the fourth letter indicates the reaction, using the same coding system, of four additional single-resistance-gene Thatcher lines, each with either *LrB*, *Lr10*, *Lr14a*, or *Lr18*.

No wheat stripe rust was observed in commercial fields or nursery plots in southern Manitoba and S.E. Saskatchewan in 2002. This is in contrast to the sporadic appearance of stripe rust in this region in both 2000 and 2001 (Fetch and McCallum 2001, 2002). Although stripe rust did appear in the southern Great Plains states of the U.S.A., an epidemic did not develop in the northern Great Plains states in 2002.

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

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TITLE / TITRE: SURVEY OF CORN DISEASES AND PESTS IN ONTARIO AND QUÉBEC IN 2002

INTRODUCTION AND METHODS: From August 27 to September 26, 2002 a corn disease and pest survey was conducted in Ontario and Québec. The emphasis of the survey was to determine the distribution and severity of the bacterial disease Stewart's wilt (*Pantoea stewartii* = *Erwinia stewartii*). The distribution and severity of other diseases and insects, including eyespot (*Aureobasidium zeae*), northern leaf blight (*Exserohilum turcicum*), common rust (*Puccinia sorghi*), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi* = *Sphacelotheca reiliana*), stalk rot (*Fusarium* spp., and *Colletotrichum graminicola*), ear rot (*Fusarium* spp.), European corn borer (*Ostrinia nubilalis*) and corn rootworm (*Diabrotica longicornis* and/or *D. virgifera*) were also recorded. In addition, scouting for any new diseases or pests in Canada was conducted, especially for grey leaf spot (*Cercospora zeae-maydis*).

At each of 135 locations surveyed, the incidence of each disease and pest and the severity of the predominant kinds was recorded. Sixty-four Stewart's wilt leaf samples and 15 Stewart's wilt ear samples were collected during the survey. In addition in October 10, corn flea beetle samples were collected from Harrow, Ridgetown, Tilbury, Wheatley, (all collected with insect traps) and Wyoming (two collected with insect traps, one from weeds, and another from corn leaves), Ontario. ELISA tests for the pathogen *P. stewartii* were conducted using reagent sets, protocols, and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

RESULTS AND COMMENTS:

Fungal leaf diseases: Eyespot was found at 78 locations (Table 1); only a few hybrids were found to be moderately susceptible in an Ontario Corn Committee (OCC) trial in Ottawa. Like eyespot, common rust was found at most locations (Table 1), but no serious outbreaks were found and only a few hybrids exhibited moderate susceptibility in the OCC Lancaster trial. Southern rust (*Puccinia polysora*) was found this year from southern to eastern Ontario, although severity levels were low with symptoms only found on the bottom leaves. Southern rust has three main characteristics that distinguish it from common rust: the pustules are smaller, uredinia are more yellowish than those of common rust, and pustules of southern rust are densely scattered on the upper leaf surface, not on both surfaces as is the case with common rust. Northern leaf blight was found at only one location and without any significant yield losses. No blight was found at the two farms in St-Philippe, Argenteuil County, QC, and in Forfar, Leeds and Grenville County, ON where we reported severe blight damage in 1998 (1) and 2000 (2), respectively. Typical symptoms of grey leaf spot were found in 26 fields in nine counties of Ontario (Table 1). In Chatham-Kent County, grey leaf spot was more severe in some fields than other leaf diseases, such as eyespot and rust; this indicates that the pathogen has the potential to become a major problem in Canada. The incidence of grey leaf spot was substantially greater in 2002 than when we first reported the disease in 2001.

Fungal Ear and Stalk diseases: Gibberella/fusarium ear rots were observed at 44 locations at relatively low severities. Similar to 2001, higher disease incidences were found in Quebec and eastern Ontario (3). Common smut was widely distributed in 2002, being found at 110 locations. Some seed corn fields had intermediate to high severities, with one field in Haldimand-Norfolk County, ON, having up to 95% of the ears smutted. As in 2001, drought-stressed fields had more common smut, especially on late germinated plants and on tillers. Head smut was found only at the Agriculture and Agri-Food Canada (AAFC) Greenbelt Farm, Ottawa-Carleton County, ON. We have been monitoring this field since 1998 (1, 2, 3);

this year, head smut incidence was 12%, which is lower than in 1998, 1999, and 2001, but higher than in 2000. However, in nine other fields we investigated on this farm, six had an incidence of 3-11%, two had less than 1%, and only one was free of head smut.

Stalk rot, including anthracnose stalk rot/top-die back, fusarium stalk rot, and pythium stalk rot were found at 33 locations in southern Ontario, eastern Ontario, and Québec. None of these occurrences appeared to be causing serious crop damage at the time of the survey.

Bacterial diseases: Typical Stewart's wilt symptoms were found at 42 locations in Ontario, in the ten counties of Chatham-Kent, Elgin, Essex, Frontenac, Haldimand-Norfolk, Huron, Lambton, Middlesex, Oxford, and Waterloo (Table 1). No Stewart's wilt was found in Québec. Little Stewart's wilt was found on grain corn, including in some of the OCC trials. However, in some seed corn fields more than 25% of leaf area was affected by this disease, with some levels as high as 75%. Of 64 leaf wilt samples taken, 57 were positively identified as Stewart's wilt by an ELISA test. All 5 samples with sunburn symptoms (1) were positive. Of 15 ear samples taken, only three tested positive and these were all from the same field with stunted plants and wilt symptoms from the bottom to the top leaves. So far, all positive seed also had kernel red streak symptoms.

No holcus leaf spot (*Pseudomonas syringae*) and no Goss' bacterial wilt (*Clavibacter michiganensis* subsp. *nebraskensis* = *Corynebacterium nebraskense*) were observed in 2002.

Viral diseases: Only one field in Renfrew, ON, had plants with mosaic symptoms, but no ELISA test was done to confirm this. No other locations, including five sweet corn fields (two were late-planted) had plants with viral symptoms. It is interesting to note that aphid populations in 2002 in both Ontario and Quebec were exceptionally low.

Insects: Corn flea beetle (*Chaetocnema pulicaria*) populations were very high in Essex and Chatham-Kent Counties, ON in 2002. In some fields, including both grain and seed corn, hundreds of corn flea beetle (CFB) adults were found on each plant, resulting in up to 25-50% of the leaf area damaged. However, CFB populations decreased from southern to eastern Ontario and Quebec where adults were rarely observed. Corn flea beetle is the main vector of Stewart's wilt; however, the severity of Stewart's wilt symptoms we observed was not positively correlated with CFB populations. This was especially apparent in the seed corn fields. Thus, we know that the ratio of CFB adults with and without *P. stewartii* bacteria plays a very important role in the epidemiology of Stewart's wilt. Of the 10 CFB adult samples collected, six from Essex and Chatham-Kent Counties (Harrow, Tilbury, Ridgetown, Wheatley) tested positive for *P. stewartii* by the ELISA test, but only one of the four samples from Lambton County (Wyoming) tested positive. This result agrees with our observation of much more Stewart's wilt in Essex and Chatham-Kent Counties than in Lambton County. We conducted further tests from four trap samples from Tilbury, ON; four replicates of 5-, 10-, 20-, 50-, and 100-adult groups each were tested for *P. stewartii*. All 5- and 50-adult groups tested positive, and two replicates of the 10- and 20- adult groups and three of the 100-adult group were positive. This result showed that a minimum five adults can be used to test the population in each trap. A new model could be established for predicting the severity of Stewart's wilt in the coming season at a certain location (field) by monitoring the percentage of bacteria-carrying adults, the late fall CFB population, and winter temperatures.

Corn earworm (*Helicoverpa zeae*) caused severe damage on several farms in September in Antoine-Labelle County, QC. In one field investigated, up to 68% of the ears had earworm damage and about one third of these still had larvae whose colour varied from dark brown to green to bright yellow. Insect tunnels were mostly in the top one-third of the ears; about 50% of infested ears also had black mold (*Trichoderma* spp.) and fusarium ear rot, which may lead to more serious losses than caused by the earworm itself. Many earworm were also observed in late maturing exotic corn in AAFC Ottawa's breeding nursery. European corn borer (ECB) damage was observed at 114 locations. In Chatham-Kent, Essex, and Middlesex Counties, ECB was much less prevalent than in 2001; however, one field in Lambton County and another in Renfrew County, ON, had more than 25% of the plants damaged by ECB. In one seed corn field in Essex County, ON, more than 10% of the plants had ECB damage.

As in other years, corn rootworm (CRW) damage was observed at 97 locations, with leaf feeding and silk pruning the predominant symptom. A field in Renfrew County, ON, had up to 40% root lodging, and most ear silks were pruned and many cobs barren; however, in the same field, corn planted two weeks earlier in

another section, did not show much damage. This indicates that planting date can be used to avoid CRW damage. If corn pollen is shed earlier than mid-July, severe CRW damage can probably be avoided in Ontario and Québec.

As mentioned above, aphid populations were low in both Ontario and Québec. Corn blotch leaf miner (*Agramyza parvicornis*) was found at most locations in both Ontario and Québec. This insect was only found on the lower surface of leaves with low incidence of infestation and almost no economic loss.

Mites: Two-spotted spider mites (*Tetranychus urticae = T. bimaculatus*) were numerous in southern Ontario, but losses were minimal compared to 2001.

Others: Many fields had stand problems in 2002, especially in Québec and eastern Ontario. This was often caused by seedling damping-off at the 6- to 8-leaf stage in June, during two weeks following a long period of rain.

SUMMARY: As a result of a very dry season in 2002, leaf diseases such as northern leaf blight, eyespot, and common rust were less prevalent than in previous years. However, the incidence of grey leaf spot was higher than in 2001. Lower levels of ear diseases were found, except for an increase in common smut incidence. Stewart's wilt was the most prevalent disease of corn in southern Ontario, partly because of the very high CFB population in 2002. Corn earworm was a relatively important pest in September in Québec and eastern Ontario. Stalk rot, viral diseases and other insects were also not prevalent in 2002.

ACKNOWLEDGEMENTS: We greatly appreciate the help and scouting by E. Shaham, and A. Parker. This survey was supported in part by the Ontario Corn Producers Association, the Ontario Seed Growers' Association and the Canada-Ontario Research & Development Fund.

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Table 1. Distribution of diseases and pests of corn in Ontario and Québec in 2002.

County	# of fields	Eyespot	Rust	GLS	Wilt	Smut	Ear rot	Stalk rot	ECB	CRW	CFB
ONTARIO											
Chatham-Kent	25	10	25	11	23	25	6	4	25	25	25
Dufferin	2	1	2				1		2	2	
Elgin	4	2	4	3	2	3			4	2	4
Essex	8	3	8	1	7	8	2		8	8	8
Frontenac	4	2	3		1	3	2	2	2		
Haldimand-Norfolk	8	2	7	4	1	7	1		6	1	1
Huron	4	4	3	2	3	4			1	3	3
Lambton	1		1	1	1	1		1	1		1
Lanark	2	1	1			2	1		2	2	
Leeds and Grenville	8	7	7			5	6	6	6	4	
Middlesex	4	2	3	2	1	3	1	1	3	2	1
Ottawa-Carleton	10	7	6			7	4	5	10	5	
Oxford	3		3		2	3	2		3	2	2
Perth	2	2	2	1		2	1		1	1	
Prescott and Russell	5	5	2			2			4	4	
Renfrew	8	1	6			8	3	5	7	8	
Stormont, Dundas and Glengarry	4	4	4	1		3	1		4	4	
Waterloo	1		1		1	1	1	1	1	1	1
Wellington	2	2	2			2	1	1	2	2	
QUEBEC											
Acton	1	1	1							1	
Antoine-Labelle	1	1	1			1	1		1		
Argenteuil	2	1	2			2	1	1	1	2	
Brome-Missisquoi	2	2	2			1			2	2	
D'Autray	2	2	2			1		1	2	2	
La Rivière-Du-Nord	1	1	1			1			1	1	
La Valle-du-Richelieu	1	1				1				1	
Lajemmerais	2	1	2			1			1	1	
Le Bas-Richelieu	1		1			1	1	1	1		
Le Haute-Yamaska	2	2	1			2		1	2		
Les Maskoutains	8	5	8			3	5	1	5	6	
Montcalm	3	2	3			3	1	1	3	3	
Vaudreuil-Soulanges	4	4	4			4	2	1	3	2	
Total	135	78	118	26	42	110	44	33	114	97	46

Rust: Mostly common rust, but southern rust was also found in Ontario. GLS = Gray leaf spot. Wilt = Stewart's wilt. Smut = Common smut. Ear rot: including Gibberella ear rot and Fusarium ear rot. Stalk rot: including Fusarium stalk rot, Anthracnose stalk rot, and top-die back. ECB = European corn borer. CRW = Corn rootworm, including both western and northern corn rootworm. CFB = Corn flea beetle.

Forages/ plantes fourragères

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

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TITLE: FOLIAR DISEASES AND BLOSSOM BLIGHT OF ALFALFA IN SASKATCHEWAN, 2002

METHODS: Foliar disease severity was assessed in 18 alfalfa hay and seed fields throughout Saskatchewan from late June to mid-July. Stems were collected at several sites along a teardrop-shaped circuit into the field and were brought back to the lab for assessment. Disease identification was based on visual symptoms. In addition, the incidence of flower infestation with *Botrytis cinerea* and *Sclerotinia sclerotiorum* (causal agents of blossom blight) was assessed in three commercial alfalfa seed fields in July. At mid flower and again 7-10 days later, at least 40 blossoms were collected and plated onto a semi-selective agar without surface sterilization. After 5-10 days of incubation, colonies were counted and the percentage infestation with each pathogen was calculated.

RESULTS AND COMMENTS: In 2002, weather conditions early in the growing season were cool and very dry. In most parts of the province, the dry conditions persisted through most of the growing season, and disease levels were very low. However, as in 2001, precipitation was at or above seasonal norms in the southeastern portions of the province, and foliar disease severity was moderate to high in many fields. Downy mildew (*Peronospora trifoliorum*) occurred at moderate to severe levels at many sites in the eastcentral and southeast regions. Common leaf spot [*Pseudopeziza medicaginis*], which is favoured by warm conditions, occurred at low levels at sites across the survey area, and spring black stem (*Phoma medicaginis*) occurred at low levels at several sites (Table 1). The incidence of blossom blight pathogens in blossoms was low at all three sites (Table 2).

ACKNOWLEDGEMENT: Thanks to the farmers who assisted in the blossom blight study.

Table 1. Mean percent foliar disease severity (range in brackets) and diseases present in commercial alfalfa fields in central and southeast Saskatchewan, 2002.

Region & dominant disease†	# Fields	% Leaf area affected	Other diseases
Southeast			
- downy mildew	4	16% (5 - 30)	SBS, CLS
- common leaf spot	3	1% (trace - 2)	SBS
- spring black stem	1	2%	---
Southcentral			
- common leaf spot	2	1% (trace - 2)	ST
Southwest			
- spring black stem	1	2%	---
Eastcentral			
- downy mildew	4	65% (30 - 85)	SBS, CLS, ST
Northeast			
- common leaf spot	3	0% (trace - 1)	ST, SBS
Overall	18	19%	

† Common leaf spot (*Pseudopeziza medicaginis*) = CLS; downy mildew (*Peronospora trifoliorum*); spring black stem (*Phoma medicaginis*) = SBS; Stemphylium leaf spot (*Stemphylium* spp.) = ST.

Table 2. Mean flower infestation (range in brackets) with *Botrytis cinerea* or *Sclerotinia sclerotiorum* at mid and late bloom in commercial alfalfa seed fields in Saskatchewan, 2002.

Region	No. fields assessed	Mid bloom		Late bloom	
		B. cinerea	*S. sclerotiorum*	*B. cinerea*	*S. sclerotiorum*
Northeast	2	3% (0-5)	3% (0-5)	0%	9% (1-16)
Southeast	1	3%	5%	0%	29%

CROP: Alfalfa (*Medicago sativa* L.)
LOCATION: Alberta

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TITLE: DISEASE SURVEY OF FORAGE ALFALFA IN ALBERTA IN 2002

METHODS: Fifty alfalfa fields, ranging in age from first- to fifth-year stands, were surveyed in July, 2002. The survey covered 24 fields in the eastcentral region of Alberta and 26 fields in the Peace region (Fig. 1). One or more stems from each of four plants were sampled at each of five random sites at each location, and foliar disease incidence was recorded on each plant. Disease severity was not recorded because levels were generally low in all fields. Soil samples (0 – 20 cm deep) were also collected at each site. Crown and root disease severity was estimated using a scale of 0 to 4 (0 = no disease, 1 = small lesions on the root, 2 = large lesions covering at least ¼ of the root circumference, 3 = large lesions covering at least ½ of the root cross-section, and 4 = large lesions covering at least ½ of the root cross-section and completely girdling the root). Plant samples were collected and diseased portions were cultured in the laboratory on water agar and acidified potato dextrose agar to recover fungal pathogens.

RESULTS AND COMMENTS: Spring black stem and leaf spot (*Phoma medicaginis*) and yellow leaf blotch (*Leptotrochila medicaginis*) were the most common foliar diseases observed, with an incidence in infested fields of 15.8% and 15.2%, respectively (Table 1). Common leaf spot (*Pseudopeziza medicaginis*) was frequently identified in the Peace region, but was a minor disease in the eastcentral region. Leptosphaerulina leaf spot (*Leptosphaerulina briosiana*) and anthracnose (*Colletotrichum* spp.) were also identified as minor foliar diseases. Foliar disease development was generally slower and less severe than in previous years (Wang et al. 2002, 2000, 1999), partly due to the severe drought during the growing season.

Alfalfa mosaic (AMV) was an important disease in the Peace region. Ten of 26 surveyed crops were infected by the virus, with an average incidence of 18.1% (range, 5-25%) (Table 1). Only two crops were infected in the eastcentral region. The infection rates were low, and no visible AMV hot spots were observed, unlike the Peace region in 1999 (Wang et al. 2000)

Crown and root rot diseases were found in all regions surveyed. Disease incidence ranged from trace levels to 100%, except in four noninfected crops. Disease severity was generally low. Overall, crown and root rot disease incidence in the eastcentral region was slightly higher than in the Peace region, while severity levels in both regions were similar (Table 2). *Fusarium, Rhizoctonia* and *Phoma* spp. were frequently isolated from infected crowns and roots.

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Table 1. Foliar disease incidence in alfalfa fields in Alberta in 2002

Disease	Pathogen	No. fields infested		Incidence (%) in infested fields
		Eastcentral	Peace	
Yellow leaf blotch	*Leptotrochila medicaginis*	13	13	15.2 (5 – 30)[z]
Spring black stem	*Phoma medicaginis*	7	14	15.8 (5 – 55)
Alfalfa mosaic	Alfalfa mosaic virus	3	10	18.1 (5 - 25)
Common leaf spot	*Pseudopeziza medicaginis*	2	10	10.0 (5 - 25)
Leptosphaerulina leaf spot	*Leptosphaerulina briosiana*	4	4	12.5 (5 - 25)
Anthracnose	*Colletotrichum* spp.	2	3	10.0 (5 - 25)

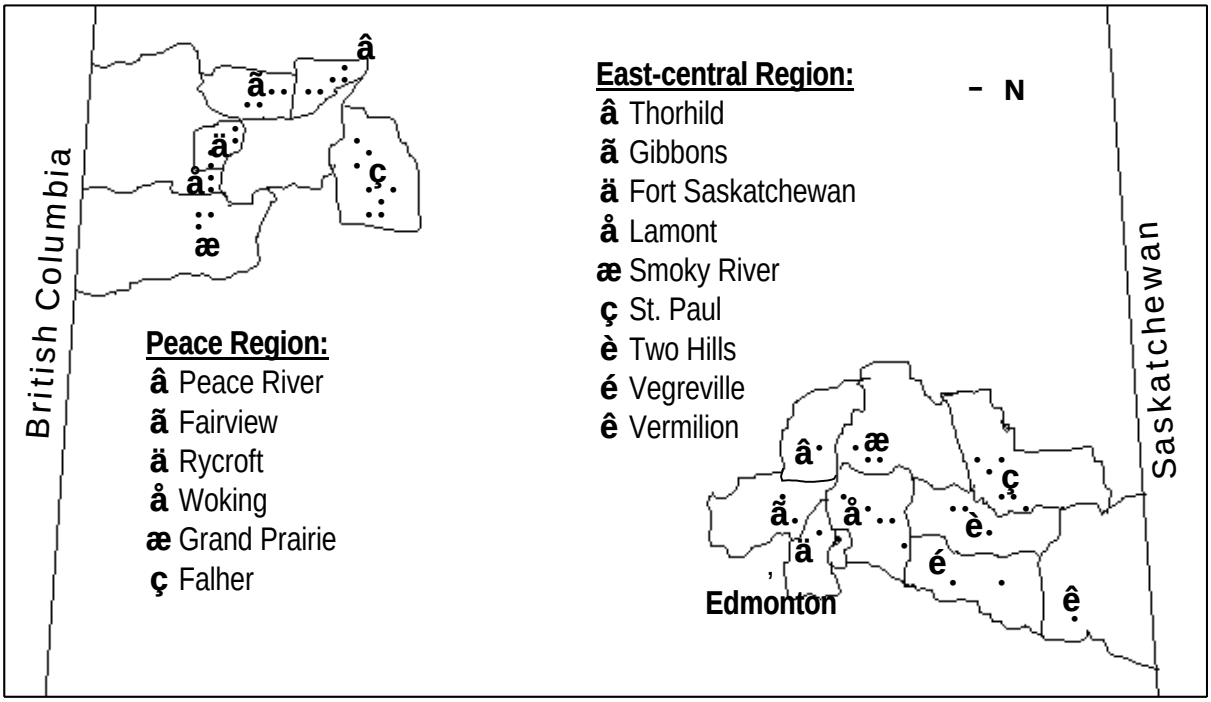
[z] Values in parentheses are the range of disease incidence in the infested fields.

Table 2. Summary of crown and root rot in alfalfa fields in Alberta in 2002

Region	No. of fields	Severity (0 - 4)		Incidence (%)	
	surveyed/infested	Mean (range)	SD	Mean (range)	SD[z]
Eastcentral	24/22	0.8 (0.1 - 1.5)	0.5	55.4 (10 - 85)	28.5
Peace	26/24	0.7 (0.1 - 2.6)	0.6	40.4 (10 - 100)	26.9

[z]SD = Standard deviation.

Figure 1. Distribution of alfalfa fields surveyed in Alberta in 2002.
* Each dot on the map represents one surveyed field.



Oilseeds and special crops/oléagineux et cultures spéciales

CROP: Dry Bean
LOCATION: Alberta and Saskatchewan

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TITLE: DISTRIBUTION OF NEW SEED-BORNE DISEASES OF DRY BEAN IN ALBERTA AND SASKATCHEWAN IN 2001

METHODS: Seed samples from 50 irrigated dry bean crops grown in Alberta (46 crops) and Saskatchewan (4 crops) in 2001 were obtained from seed cleaning plants and examined for the presence of seedborne pathogens. The samples from Alberta were collected from crops in the Bow Island region (Bow Island, Burdett, Grassy Lake, Seven Persons) or the Taber region (Barnwell, Coaldale, Cranford, Enchant, Hays, Rolling Hills, Taber, Vauxhall) and the samples from Saskatchewan were collected from crops near Riverhurst. Each seed sample was sorted into categories of healthy seeds and discolored seeds, and the number and weight of seeds in each category were determined. All of the discolored seeds from each sample were streaked onto potato dextrose agar (PDA) in petri dishes, and incubated at room temperature (20±2°C). The plates were examined for the presence of pathogens after 3 and 7 days. Microorganisms derived from discolored seeds were isolated and identified by comparing colony characteristics on PDA to standard reference cultures, which were collected from bulk samples of 2001 crops grown in Alberta (Hsieh *et al*., 2002; Huang *et al*., 2002) and deposited in the Lethbridge Research Centre culture collection.

RESULTS: Bacterial wilt of bean caused by *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* (Hall, 1994), is a new disease of common bean in western Canada (Hsieh *et al.*, 2002), and was found in 37 crops (34 crops in Alberta and 3 in Saskatchewan), representing 74% of the crops surveyed (Table 1). The disease was found in all areas surveyed except Cranford, Alberta. The frequency of seeds with bacterial wilt varied from 0 to 8%. Isolations showed that, among the 37 crops with bacterial wilt, 31 crops had the yellow variant and 29 had the orange variant of the pathogen. Both yellow and orange variants were found in Alberta and Saskatchewan.

Pink seed, a new disease of common bean caused by *Erwinia rhapontici* (Huang *et al*., 2002), was found in 2 crops, representing 4% of the crops surveyed (Table 1). The samples with pink seed were collected from bean crops near Taber, Alberta. The frequency of pink seeds ranged from 0 to 3%.

Other pathogens found in the seed samples of dry bean crops produced in Alberta and Saskatchewan in 2001 included *Alternaria* spp. (18 crops), *Sclerotinia sclerotiorum* (5 crops) and *Rhizoctonia solani* (1 crop).

DISCUSSION: This survey of seed samples of dry bean crops produced in 2001 reveals that bacterial wilt of bean is widespread in the bean production regions of southern Alberta, and also occurs in Saskatchewan. Both yellow and orange variants of *C. flaccumfaciens* pv. *flaccumfaciens* are present in the bean production areas of Alberta and Saskatchewan.

Although pink seed of bean caused by *E. rhapontici* was found for the first time and only in two crops in southern Alberta, the disease has been reported on dry pea in Alberta (Huang *et al*., 1990) and Saskatchewan (Huang, unpublished), Canada, and in Montana, USA (Schroeder *et al*., 2002). These discoveries highlight the need for research on the epidemiology and control of these two new bacterial diseases of dry bean.

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Table 1. Distribution of new seedborne pathogens of dry bean in Alberta and Saskatchewan in 2001.

		No. crops with			
		bacterial wilt			pink seed
Location	No. crops surveyed	yellow variant only	orange variant only	both variants	
Bow Island Region					
Bow Island	5	2	1	2	0
Burdett	4	1	1	1	0
Grassy Lake	3	0	0	3	0
Seven Persons	4	0	0	3	0
Taber Region					
Barnwell	3	0	0	1	0
Coaldale	4	0	1	0	0
Cranford	1	0	0	0	0
Enchant	4	1	0	1	0
Hays	3	0	0	3	0
Rolling Hills	3	1	0	1	0
Taber	7	2	1	3	2
Vauxhall	5	1	1	3	0
Saskatchewan					
Riverhurst	4	0	1	2	0
TOTAL	**50**	**8**	**6**	**23**	**2**

CROP: Field bean
LOCATION: Manitoba

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TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2002

METHODS: Crops of field bean were surveyed for root diseases at 44 different locations and for foliar diseases at 76 locations in Manitoba. The survey for root diseases was conducted in the last week of June when plants were at the first to second trifoliolate stages and for foliar diseases in the first week of September when the plants were at the pod-fill to early maturity stages. The crops surveyed were chosen at random from regions in southeast and south-central Manitoba, where most field beans are grown. Ten plants were sampled at each of three random sites for each crop. Diseases were identified by symptoms. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedlings did not emerge or died back soon after emergence). Five to 10 symptomatic roots were collected per field for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 5 (whole roots/plants were severely diseased). Anthracnose and white mould were rated as a percentage of plants infected.

RESULTS AND COMMENTS: Two major root diseases were observed (Table 1). Fusarium root rot (*Fusarium solani*) and rhizoctonia root rot (*Rhizoctonia solani*) were the most prevalent diseases and observed in 40 and 16 of the 44 fields surveyed, respectively. Early in the growing season, anthracnose (*Colletotrichum lindemuthianum*) was also observed in one field.

Later in the growing season, five foliar diseases were observed (Table 2). Bacterial blights (*Xanthomonas campestris* pv. *phaseoli* and *Pseudomonas syringae* pv. *phaseolicola*) were the most prevalent of the foliar diseases and were observed in all of the 76 fields surveyed. Yellows-type symptoms were observed in 59 fields, but usually at a low severity. The identity of the pathogen(s) associated with these symptoms remain to be determined. Anthracnose was observed in 59 bean fields, but its incidence and severity were generally low. The prevalence and severity of white mould (*Sclerotinia sclerotiorum*) was quite high in comparison to previous years due to the fact that the survey was performed later in the growing season. Bean rust (*Uromyces appendiculatus*) was observed in 17 fields, but generally it appeared to have developed late in the growing season.

Table 1. Prevalence and severity of root diseases in 44 crops of field bean in Manitoba in 2002.

		Disease Severity	
Disease	**No. fields affected**	**Mean**	**Range**
Fusarium root rot	40	2.1	0.5-6.2
Rhizoctonia root rot	16	1.5	0.5-3.0

Table 2. Prevalence and severity of foliar diseases in 76 crops of field bean in Manitoba in 2002.

		Disease Severity*	
Disease	**No. fields affected**	**Mean**	**Range**
Bacterial blight	76	3	37259
Yellows	59	2.2	37258
Anthracnose	59	3.1	37285
Rust	17	3.3	37290
White mould	31	14.2	1-60

*Anthracnose and white mould were rated as percent plants infected; other diseases were rated on a scale of 0 (no disease) to 5 (whole plant severely diseased).

CROP: Canola
LOCATION: Alberta

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TITLE: SURVEY OF FUSARIUM WILT AND OTHER CANOLA DISEASES IN ALBERTA IN 2002

METHODS: A total of 52 *Brassica napus* fields were surveyed between August 19 and August 28 in the central and east central canola production areas of Alberta. The fields were surveyed before swathing, and in most cases, at least some of the crop was at crop growth stages 79 to 83 (Bleiholder *et al*., 1997). Due to drought, in most fields many plants were at much earlier growth stages. Generally plants were sampled by randomly selecting 100 plants along a diamond or "W"-shaped pattern. However, some fields were not surveyed in detail due to effects of drought, immaturity of the crop, or time constraints. The presence or absence of signs or symptoms on each plant was used to calculate disease incidence for the following diseases: fusarium wilt (*Fusarium avenaceum, F. oxysporum)*, sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), foot rot (*Fusarium spp., Rhizoctonia solani*), and aster yellows (AY phytoplasma). For sclerotinia stem rot, each plant was scored for either a main stem lesion or an upper stem or pod lesion. For alternaria pod spot, (*Alternaria brassicae, A. raphani*), the percent severity of lesions on the pods of each plant was assessed (Conn et al., 1990). When diseases were observed in a field, but not found in the sample of 100 plants, the disease was recorded as a "trace". When calculating means, all trace values were recorded as 0.1%. The results for each region were combined and mean disease incidence or severity values were determined.

RESULTS AND COMMENTS: The 2002 field season was extremely dry throughout most of Alberta, resulting in negligible disease levels, with the notable exception of fusarium wilt. Although the Peace region was not officially surveyed, reports from the area indicated that there was only one instance of fusarium wilt. No other disease problems of importance were reported from the Peace region. There were a few reports of fusarium wilt in southern Alberta, as well as one from the Barrhead region, northeast of Edmonton. No other significant diseases were reported in these areas. Of note, there were reports of extensive reddening of canola plants in the area between Edmonton and Lacombe, and these reports were confirmed by this survey.

In central and east-central Alberta, if canola crops reached maturity, they tended to mature very late and very unevenly and were often swathed for green feed. Therefore, many fields were surveyed while they were still very green. This undoubtedly resulted in an underestimation of the final incidence of fusarium wilt.

Fusarium wilt was observed in 24 of the 52 fields, and incidence values ranged from 0 to 52%. Mean incidence was highest in the east central area (Table 1). Plants with symptoms of both fusarium wilt and blackleg or sclerotinia were not included in the calculations of fusarium wilt incidence due to the difficulty of reliably distinguishing symptoms. Of the fields that were surveyed, the average incidence of fusarium wilt in the two regions was 10%. The results confirm the 2001 report that fusarium wilt is increasing in incidence in the east central region, and appears to be moving west (Benard et al., 2002).

Sclerotinia stem rot was observed in only two of the 52 fields, and only at trace incidence values. A trace amount of blackleg was found in only one field. Neither foot rot nor alternaria pod spot was observed in any of the fields surveyed. Aster yellows was observed in nine of the 52 fields, with incidence values ranging from 0 to 5%. None of these diseases was of any consequence.

Table 1. Fusarium wilt incidence by county in central and east central Alberta in 2002.

County	No. fields with fusarium wilt	Minimum wilt incidence	Maximum wilt incidence	Mean wilt incidence
EAST CENTRAL				
Camrose	37715	0	30	9
Lamont	37626	0	0	0
Beaver	37656	0	10	2.5
Minburn	37745	10	40	30
Two Hills	37684	0	52	25
Smoky Lake	37621	0	0	0
Vermilion River	37746	0	30	2
	17/33	*0*	*52*	*16*
CENTRAL				
Leduc	37626	0	0	0
Wetaskiwin	37751	0	10	3
Sturgeon	37621	0	0	0
Thorhild	37621	0	0	0
	37759	*0*	*10*	*1.5*
Overall	***24/52***	***0***	***52***	***10***

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CROP: Canola
LOCATION: Manitoba

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TITLE: CANOLA DISEASES IN MANITOBA: DISTRIBUTION, PREVALENCE AND INCIDENCE IN 2002

METHODS: In August 2002, 297 canola crops were surveyed in the eastern/interlake (49), southwest (81), northwest (70) and central (97) regions. All crops were *Brassica napus*. All crops were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (phytoplasma), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*) and fusarium wilt (*Fusarium* spp.). Blackleg basal stem cankers were assessed separately from other blackleg lesions that occurred on any part of the stem. The prevalence and percent severity of alternaria pod spot (*Alternaria* spp.) was determined.

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

RESULTS: A number of diseases were present in each of the four regions of Manitoba. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1). The prevalence of sclerotinia-infested crops ranged from a high of 52% in the central region to 30% in the northwest region with a provincial mean of 40%. This decreased from a prevalence of 76% in 2001 (McLaren *et al.*, 2002). Mean disease incidence ranged from 9% in the southwest region to 4% in the northwest region. The provincial mean of 6% was less than in 2001 and would result in about a 3% yield loss.

Blackleg basal cankers occurred in 16% of the crops surveyed in 2002 with disease incidence ranging from 8% in the northwest region to <1% in the central region and with a provincial mean of 4%. Mean disease incidence was slightly higher in 2001, with the highest value of 7% occurring in the both the northwest and eastern/interlake regions (McLaren *et. al.*, 2002). However, severe basal cankers were evident in many of the blackleg-infested crops in 2002 and caused an estimated yield loss of about 4% on a province-wide basis.

The mean prevalence of blackleg stem lesions was 20%, the same as in 2001. Prior to 2001, 72%, 66%, and 54% of crops were infested with stem lesions in 1998 (McLaren and Platford, 1999), 1999 (McLaren and Platford, 2000), and 2000 (McLaren and Platford, 2001), respectively. The mean incidence in 2002 was 5% which was greater than in 2001 but less than in the three previous seasons.

The severity of alternaria pod spot was low (Table 2), with means of <6% in the central and southwest regions (Table 1) and no pod spot evident in the northwest region. In the eastern/interlake region, only 2 fields were observed to have pod spot but no severity values were recorded. In the central, eastern/interlake, and southwest regions, pod spot was observed in 3, 4 and 5% of the crops surveyed, respectively. These decreased from prevalence values of 63% in the eastern/interlake region, 53% in the central region and 17% in the southwest region in 2001. Although pod spot was most prevalent in the western part of the province during 1999-2000, it was observed more frequently in the central and eastern/interlake regions of Manitoba in 2001. The disease was least prevalent in the northwest region in 2001 and this was evident in the 2002 season as well.

The prevalence of aster yellows in the crops surveyed in 2002 ranged from 8% in the eastern/interlake region to 1% in the northwest region with a provincial mean of 5%. This decreased from a prevalence of 16% in 2001 (McLaren *et al.*, 2002). The average disease incidence was 1% in all regions. Foot rot was also observed in 3% of canola crops surveyed, with a mean disease incidence below 3%.

Of the 297 canola crops examined in Manitoba, fusarium wilt was observed in <2%, with a mean disease incidence of 8%. Following reports that fusarium wilt was suspected of being more common in areas of western Manitoba, a targeted survey of 12 fields was conducted. The majority of these fields were in the northwest region. Fusarium wilt was observed in the plant samples collected from 5 of these fields with mean disease incidence of 47%. Although the disease was not seen in the 100-plant samples collected from three fields, it was present in other areas of these fields and samples were collected. *Fusarium avenaceum* was the predominant *Fusarium* species isolated from symptomatic stem samples.

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

Table 1. Number of canola crops surveyed and disease prevalence in Manitoba in 2002.

Crop Region	No. of crops surveyed	Sclerotinia stem rot		Blackleg basal cankers		Blackleg stem lesions		Alternaria pod spot		Aster yellows		Fusarium wilt[1]	
		P[2]	DI[3]	P	DI	P	DI	P	Mean % severity	P	DI	P	DI
E/I	49	31	6	6	1	24	2	4	4	8	1	0	0
Central	97	52	7	22	<1	20	1	3	4.7	5	1	0	0
SW	81	41	9	21	3	17	2	5	5.3	6	1	3	14
NW	70	30	4	11	8	20	14	0	0	1	1	3	2

[1] Based on survey of 297 fields; does not included targeted survey results.
[2] Mean percent prevalence.
[3] Mean percent disease incidence.
[4] Two fields were noted to have pod spot but no severity ratings were taken

Table 2. Distribution of incidence (sclerotinia, blackleg, aster yellows, and fusarium wilt) and severity (alternaria pod spot) classes in 297 crops of *Brassica napus* in Manitoba in 2002.

	Percentage of crops with					
		Blackleg				
	Sclerotinia stem rot	basal cankers	stem lesions	Alternaria pod spot	Aster yellows	Fusarium wilt
0	178	248	238	69	282	293
1-5%	79	40	50	14	15	2
6-10%	19	7	5	1	0	1
11-20%	13	1	3	1	0	0
21-50%	8	1	0	0	0	1
>50%	0	0	1	0	0	0

CROP: Canola
LOCATION: Saskatchewan

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TITLE: FUSARIUM WILT AND OTHER DISEASES OF CANOLA IN SASKATCHEWAN, 2002

INTRODUCTION AND METHODS:

Fusarium wilt of canola reduces the translocation of water and nutrients up the stem due to plugging of vascular tissues by the pathogens (Lange et al. 2000). It was first reported in eastern Alberta in 1999; since then it has increased in incidence in the east-central region and is believed to be moving west (Benard et al. 2002). Symptoms include discolouration of the stems, premature desiccation of the entire plant and little or no seed fill. The pathogens have been identified as *Fusarium oxysporum* and *F. avenaceum*, but more work is needed to determine the primary pathogen and the conditions favouring infection and disease development.

Due to drought over much of the canola-growing region in 2002, a formal canola disease survey was not conducted in Saskatchewan. However, producers from the east-central region reported symptoms suspected to be fusarium wilt and this prompted an informal tour with provinicial extension agrologists on August 28.

RESULTS AND COMMENTS:

Seven *Brassica napus* fields were observed on August 28 in east-central Saskatchewan near Langenburg, Wroxton, Sturgis and Norquay. Incidences were not recorded for each field but symptoms ranged from light (small patches of plants with some stem discolouration) to severe (widespread plants with reduced seed fill). The occurrence of fusarium wilt in the seven fields was suspected to be related to cultivar and moisture stress. Six of the fields were planted to cv. 45A55 and one to cv. DS-Roughrider. The crops had suffered from poor emergence, wind damage and drought stress in the spring. Although they appeared to recover somewhat during the season, they became affected by fusarium wilt during pod development. Comparatively, other fields in the region planted to other cultivars appeared to have compensated for earlier poor growing conditions and showed no wilt symptoms. There was no relation between wilt severity and management practices other than cultivar. The most severely affected crop was planted on summerfallow and suffered from wind and drought stress. In another case, part of a crop planted into cereal residue that had been burned in the fall had less fusarium wilt than part in an area that was not burned. On August 29, a cultivar trial including 45A55 near Semans and a field planted to cv. 45A55 near Foam Lake were scouted, but fusarium wilt was not found. However, these crops had not suffered from as much moisture stress as the crops mentioned previously.

In Saskatchewan in 2002 other canola diseases, such as sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma) and alternaria pod spot (*Alternaria brassicae, A. raphani*) were either absent or occurred in only trace amounts.

The *Fusarium* species responsible for fusarium wilt are believed to be endemic to Saskatchewan's agricultural soils but have not caused disease in most years. Fusarium wilt was suspected in 1996 in the Tisdale region but the causal pathogen was not confirmed (D.A. Kaminski, pers. com.). Fusarium wilt was first included as a disease to watch for in the 1999 canola disease survey, but was not found in that year (Pearse et al. 2000). In 2000, one fusarium wilt-infected plant was found in a field in the southeast region (Pearse et al. 2001). In 1999 and 2000, moisture was not limiting in most of the canola regions surveyed. In 2001, fusarium wilt was observed in five of 95 fields surveyed, one in the north-central region and four in the north-east region (Pearse et al. 2002). Overall mean incidence was low (0.3%) and the crop with

the highest incidence (19%) was located in the northeast region. The fields affected were planted to cv. 45A55 and were believed to have suffered from moisture stress.

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CROP: Caraway (*Carum carvi* L.)
LOCATION: Saskatchewan

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TITLE: BLIGHT OF CARAWAY IN SASKATCHEWAN FROM 2000 TO 2002

METHODS: Fields were surveyed each year when plants were in mid- to full-flower by walking in a 50-100 m circle. Disease incidence was based on the percentage of plants showing browning and death of growing tips, flowers, and umbels, to extensive dieback of shoots. The presence of aster yellows was also noted.

Samples of blighted tissue were collected to determine the cause of the disease. Small pieces of diseased tissue were surface disinfected in 0.6% NaOCl and plated on various media. Transfers were made onto potato dextrose agar to establish pure cultures. Koch's postulates were followed by inoculating pots of flowering plants from a growth chamber with aqueous suspensions from the cultures. Inoculated plants were enclosed in plastic bags for 4 to 6 days. If symptoms developed, the cause of the disease was confirmed by reisolating the organism. For organisms that were pathogenic, the procedures for inoculation, symptom production, and reisolation, were repeated at least three times. Several *Fusarium* sp. obtained from Robin Morrall were also tested for pathogenicity.

RESULTS AND COMMENTS: Koch's postulates and the frequency of isolation from infected plants collected in fields, or the presence of the pathogen in infected tissue, indicated an *Ascochyta* sp. was the major cause of blight in caraway. A species of *Aureobasidium*, which is the major cause of blossom blight in coriander (1), also caused blight on caraway, as did *Fusarium avenaceum, F. poae*, *F. culmorum*, *F. equiseti*, *F. sporotrichioides*, *F. graminearum*, *Botrytis cinerea* and an unknown non-sporulating fungus. *Fusarium avenaceum* and the unknown non-sporulating fungus were isolated from infected tissue. Pycnidia and conidia of *Ascochyta* were abundant in diseased flower parts but this fungus was extremely difficult to isolate from infected tissue.

In 2000, 20 fields at 11 locations were surveyed between June 22 and July 24. Blight, caused by *Ascochyta* sp., was not found or was at low levels at Moose Jaw, Lucky Lake, Imperial, Nokomis and Paddockwood. Disease incidence was between 1 and 10% at Prince Albert, Albertville, Domremy and Naicam. Several fields were observed at Birch Hills and some had no disease or traces of blight, but there were two fields where 80 to 95% of the plants were diseased. At Gerald, fields were 50 to 80% damaged. Severely affected fields tended to be older, that is, at least 3 years old and in the second year of seed production, but there were exceptions such as a 50%-damaged, 2-year-old field at Gerald. Some fields showed distinct patches of disease indicating foci of infection that may have originated from seed. High levels of disease were also associated with a prolonged moist period during flowering. Aster yellows was present in all fields at low levels, except for one field at Imperial which had about 20% infected plants.

In 2001, 22 fields at 12 locations were surveyed between June 22 and 29. Blight, caused by *Ascochyta* sp., was found only at a low level in one field at Gerald. Aster yellows was present in almost all fields at low levels, except for one 3-year-old field at Paddockwood that had about 50% infected plants. Drought stress was the major problem elsewhere, including fields in the Albertville, Meath Park, Prince Albert, Pathlow, Domremy, Birch Hills, Naicam, Elstow, Lanigan, and Nokomis areas.

In 2002, 11 fields at eight locations were surveyed between July 2 and 3. Ten fields had no blight but high levels of blight, caused by *Ascochyta* sp., with 80% infected plants occurred at Gerald in a 3-year-old crop. Traces of aster yellows occurred in four fields at Birch Hills, Pathlow, Nokomis, and Gerald. Drought stress was the major problem elsewhere, including fields in the Paddockwood, Meath Park, Naicam, and Lanigan areas.

ACKNOWLEDGEMENTS: Funding support was provided by the Agriculture Development Fund of the Saskatchewan Department of Agriculture, Food and Rural Revitalization.

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CROP: Chickpea (*Cicer arietinum* L.)
LOCATION: Alberta

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TITLE: OCCURRENCE OF ASCOCHYTA BLIGHT AND ROOT ROT DISEASES ON CHICKPEA IN ALBERTA IN 2001 AND 2002

METHODS: Fifty commercial fields (Table 1) were sampled during the third week of July, 2001. One hundred plants were dug at five equally spaced sites (20 plants/site) along the arms of a "W" sampling pattern in each field. Roots were washed and assessed for root rot severity using the following scale: 0 = no root rot, 1 = 1-10% root discoloration, 2 = 11-25% root discoloration, 3 = 26-50% root discoloration and 4 = > 50% root discoloration. Foliar diseases were estimated visually on the samples using the 0-9 scale developed by Xue et al. (4). In 2002, 53 commercial fields were visually assessed in August for ascochyta blight incidence and severity, and for root rot incidence using the same W-pattern (Table 2). All chickpea plants in a 5-acre experimental field at the Crop Diversification Centre South (CDCS), Brooks and a 2-acre experimental field at CDC North (CDCN), Edmonton were also surveyed. Plants showing symptoms of yellowing and wilting were dug and removed for identification of causal microorganisms. Pieces of root and stem bases from each field were surface-sterilized in a 1% NaOCl solution for 2 min, rinsed three times in sterile distilled water and plated onto acidified potato dextrose agar to determine the types of microorganisms present.

RESULTS AND COMMENTS: In 2001, 41 of the 50 fields showed very low levels of root rot (mean severity = 0.10) (Table 1). Ascochyta blight severity was also low (mean = 0.01), likely due to the hot, dry weather that prevailed in the summer. The same situation was reported in Saskatchewan (2).

No ascochyta blight was observed at CDCN in central Alberta during the summer of 2002, due to extremely dry conditions. In contrast, unusually cool, wet weather dominated southern Alberta at the same time, and caused a severe outbreak of ascochyta blight in most chickpea fields (Table 2). The disease first appeared on seedlings in mid-June at Carmangay and was widespread by August. However, the disease was not evenly distributed. Plants of kabuli cv. Sanford became heavily infected with ascochyta and pycnidia formed, while disease incidence and severity were low in the desi cvs. CDC Nika and Anna. Abundant rain and low temperatures in August and September resulted in vigorous, indeterminate growth and delayed harvesting of many chickpea fields until October. Consequently, ascochyta infections spread to the seed coat and drastically reduced seed quality.

Seed-borne ascochyta of chickpea has been well documented in Saskatchewan (3). In 2001, many Alberta growers saved their own seed for planting in 2002. This may have contributed to the high disease incidence in 2002. Some growers applied alternating Bravo and Quadris fungicide treatments up to four times over the summer, but were unable to control the disease completely.

Botrytis grey mold and sclerotinia white mold also severe on cv. Sanford plants in two trials at CDCS, Brooks but did not seriously affect most commercial fields. As in 1999 (1), root rot was caused mostly by *Fusarium* spp., with infected plants showing yellowing, browning or wilting symptoms. In some instances, dead patches developed in fields after plants reached the flowering stage. However, the overall severity of root rot was low (Table 2).

ACKNOWLEDGEMENTS: The authors wish to thank Doug Fraser (No-Bull Marketing Ltd.) for his assistance in locating chickpea growers.

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Table 1. Severity of root rot and ascochyta blight in 50 chickpea fields in southern Alberta in 2001.

Field location	No. fields surveyed	Type	Mean disease severity	
			Root rot (0-4)	Ascochyta (0-9)
Bow Island	1	Desi	0.09	0
	16	Kabuli	0.21	0.07
Carmangay	3	Desi	0.02	0
	12	Kabuli	0.04	0.01
Nobleford	1	Desi	0.01	0
	2	Kabuli	0.01	0
Taber	10	Kabuli	0.05	0.02
Wrentham	5	Kabuli	0.16	0

Table 2. Incidence and severity of root rot and ascochyta blight in chickpea fields at 55 locations in Alberta in 2002.

Field location	No. fields surveyed	Type	Ascochyta		Root rot	
			Incidence(%) Mean (Range)	Severity (0-9) Mean (Range)	incidence(%) Mean (Range)	
Carmangay	14	Desi	23.4 (0-83)	1.3 (0-5.6)	15.6	(0-57)
	24	Kabuli	Carmangay	1.8 (0.04-6.0)	<1.0	(0-1)
CDCS, Brooks	2	Desi	0	0	1.5	(1-2)
	1	Kabuli	40	1.9	3.0	(1-5)
CDCN, Edmonton	1	Desi	0	0	7.5	(5-10)
Lomond	2	Desi	22.5 (20-25)	2.5 (2.4-2.6)	46.0	(37-55)
	2	Kabuli	57.0 (13-100)	4.8 (0.6-9.0)	19.0	(1-37)
Tilley	1	Desi	0	0	<1.0	(0-1)
	2	Kabuli	63.0 (60-66)	5.5 (5.3-5.8)	2.2	(1.4-3.0)
Vauxhall	6	Kabuli	69.5 (51-100)	3.7 (2.4-5.6)	<1.0	(0-1)

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

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TITLE: WIDESPREAD OCCURRENCE OF ASCOCHYTA BLIGHT ON CHICKPEA IN SASKATCHEWAN IN 2000

METHODS: Twenty fields of chickpea in Saskatchewan were surveyed for diseases during the growing season of 2000. Ascochyta blight (*Ascochyta rabiei*) severity was assessed using the 0-11 Horsfall-Barratt scale (1) at five spots in each of 20 fields from June 12 until early August, and values were converted to percent leaf and stem area affected. In addition, 35 fields were assessed (starting in June) by trained staff of Saskatchewan Agriculture, Food and Rural Revitalization using the same rating scale. All of the results from the 55 fields were posted on a website (http://paridss.usask.ca/specialcrop/pulse_diseases) as an extension service. Overwintered stubble infested with *A. rabiei* was collected from several fields to assess the production of air-borne ascospores, as described previously (2).

RESULTS AND COMMENTS: As in 1999, the growing season in 2000 was cool and wet; this provided favourable conditions for development of ascochyta blight. Symptoms on chickpea seedlings were reported as early as June 12 in southern Saskatchewan, which was much earlier than in previous years. By the end of June, most fields in the central and southwest regions had blight severity levels of 1-5% (Table 1). In July, blight severity was still below 20% in most fields, but a few had severity levels of >50%. However, by the beginning of August, the number of fields with blight severity > 50% increased. Sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*) also occurred at low levels. Botrytis stem and pod rot (*Botrytis cinerea*) was observed on pods later in the season.

The widespread occurrence and early appearance of ascochyta blight symptoms was attributed to cool, wet weather conditions favourable for pathogen spread and infection, to high levels of inoculum in chickpea- production areas, and to planting of infected seed. Ascospores were not found on infested material collected from overwintered chickpea stubble in May 2000 (2). However, mature ascospores were present on samples from one field later in the spring, indicating that air-borne spores may have contributed to spread of the pathogen.

ACKNOWLEDGMENTS: Thanks to staff of Saskatchewan Agriculture, Food and Rural Revitalization for submitting reports to the Pulse Crop Diseases website, and to the Agri-Food Innovation Fund for financial support of the project.

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Table 1. Ascochyta blight severity in Saskatchewan chickpea fields assessed during the 2000 growing season.

Date	Cultivar	# Fields	Severity (%)	
			Mean	Range
June 12 - 28	**Kabuli**			
	Sanford	6	6	37274
	Dwelley	2	3	37291
	Amit	2	5	5
	cv. unknown	2	2	37257
	Desi			
	Myles	1	5	5
	cv. unknown	1	0	0
July 2 - 26	**Kabuli**			
	Sanford	6	14	2-63
	Dwelley	2	14	37517
	cv. unknown	12	5	37274
	Desi			
	Myles	7	20	0-82
	cv. unknown	4	2	2
August 4 - 8	**Kabuli**			
	Sanford	1	82	82
	Dwelley	1	19	19
	Desi			
	Myles	7	40	9-82
	cv. unknown	1	9	9
# kabuli fields		**34**		
# desi fields		**21**		
Total # of fields		**55**		

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

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TITLE: SURVEY OF ASCOCHYTA BLIGHT AND OTHER DISEASES OF CHICKPEA IN SASKATCHEWAN IN 2002.

METHODS: A survey was conducted in over 40 fields of chickpea on June 28 (seedling stage), July 31 (late-flower to podding), August 7-9 (late-flower to podding) and August 19 (podding) to assess incidence and/or severity of ascochyta blight (caused by *Ascochyta rabiei*) and other diseases. Ascochyta blight was scored at five spots in each field using the 0 -11 Horsfall-Barratt scale (5) on June 28, July 31 and August 19. The mean of the five ratings was converted to percent disease severity. At another observation date, ascochyta blight was visually estimated as percent severity. Two fields in central and seven in southern Saskatchewan were assessed three times to follow the progress of ascochyta blight. In addition, five chickpea crops (desi cv. Myles-2; kabuli cvs. CDC Xena-2 and Amit-1) in the Regina area were monitored about once every 6 days from June 11 to July 31. The objective was to detect disease symptoms at an early stage and make recommendations for fungicide application, but quantitative disease assessments were not made.

Other diseases such as sclerotinia stem and pod rot (caused by *Sclerotinia sclerotiorum*), botrytis stem and pod rot (*Botrytis cinerea*) and root rots were also noted when present. Fungal isolations on potato dextrose agar were made from samples collected in some fields.

The presence of ascospores of *A. rabiei* on overwintered stubble was also assessed on samples obtained on June 28 from approximately ten fields which were previously seeded to chickpea, either in 2000 or 2001. The presence of ascospores was determined using two methods, as previously described (1,2).

RESULTS AND COMMENTS: As in 2001, drought was widespread in Saskatchewan in 2002. However, southern Saskatchewan received more rain (above average) than the central and northern areas and this favoured ascochyta blight development in this region (6). Most fields that were surveyed on June 28 and July 31 were in southern Saskatchewan (Table 1, Fig. 1). Symptoms of ascochyta blight were widespread on seedlings by June 28 in southern Saskatchewan, probably as a result of widespread inoculum from crops in 2000 and 2001 (2,3). However, severity was generally low in many fields, ranging from 2 to 38% and up to 63% in two fields seeded to cultivar Sanford (Table 1, Fig. 1). By the second rating, the majority of fields had over 63% disease severity. Many fields seeded to cv. Sanford in southern Saskatchewan had up to 95% severity and in the central region 2 to 63% severity (Table 1). By August 19, severity on whole-leaf kabuli cultivars ranged from 19 to 81% in central and up to 99% (dead) in southern Saskatchewan (Table 1, Fig. 1).

Blight was more severe in fields seeded to whole-leaf than to fern-leaf cultivars (Table 1-2, Fig 1),consistent with previous observations (2,4). More fields were surveyed with kabuli cultivars than with desi types (Table 1). Crops of cv. Sanford assessed 3 times for blight in southern Saskatchewan, completely died, while severity on cv. Amit was only 9% by the third rating on August 19 (Fig. 1). In central Saskatchewan where severe drought occurred, blight severity at Elrose decreased from an initial high of 38% to a low on August 19 of 5%, and at Zealandia remained constant at 2% (Fig. 1). Warm dry conditions inhibited blight development as new plant growth developed. Overall, cv. Amit showed better resistance than other commercial cultivars, even in southern Saskatchewan. The advanced breeding line 95NN-29 also showed low disease levels in cultivar trials at Frontier (Table 1), Outlook and Saskatoon (data not shown).

In all five crops monitored in the Regina area, ascochyta blight symptoms were first observed at very low levels on June 23. Initial fungicide applications were made in all cases within five days. Subsequently, ascochyta blight developed rapidly in the CDC Xena crops and slowly in the other three. By the end of July, three applications had been made in the crops of cv. CDC Xena, two in the crops of cv. Amit and in one crop of cv. Myles, and one in the other crop of cv. Myles. Severe ascochyta infections had developed in cv. CDC Xena, but only slight infections in cvs. Amit and Myles.

Ascospores were observed on overwintered chickpea stubble collected from two of 10 fields on June 28, suggesting that the sexual state contributed to the spread of inoculum and blight initiation through dispersal of air-borne spores. In many fields, such as those at Gravelbourg, Frontier and Elrose, symptoms appeared evenly distributed throughout the field as opposed to in patches, which may implicate the spread of air-borne spores.

Growers in Saskatchewan frequently reported severe blighting even after claiming that they sprayed their crops with fungicides. Some growers sprayed 5 times by July 31 (G. Bell, personal communication), well before the season was over. In some areas, both kabuli and desi cultivars suffered premature ripening and browning; purpling of plant tissue on desi cultivars, and yellowish-brown discoloration of plant tissue in kabuli cultivars were observed as result of drought and heat stress.

Sclerotinia stem and pod rot and botrytis stem and pod rot were present at low levels in some fields. *Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Fusarium* and *Alternaria* spp. were isolated from chickpea tissue in some fields.

ACKNOWLEDGMENTS: Financial support from the Western Grains Research Foundation is gratefully acknowledged.

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Table 1. Ascochyta blight severity in chickpea fields in central (C) and southern (S) Saskatchewan on June 28, July 31 and August 7-9 & 19, 2002.

			Ascochyta blight severity (%)			
Location	**Cultivar**	**Type**	June 28	July 31	August 7-9	August 19
Aneroid (S)	Sanford or CDC Xena	Whole leaf-kabuli	63			
"	Sanford or CDC Xena	"	9			
Woodrow (S)	CDC Chico	Fern - kabuli	5			
Meyronne (S)	Sanford or CDC Xena	"	19	38		
Lafleche (S)	Sanford or CDC Xena	"	9			
Limerick (S)	CDC Chico	Fern - kabuli	19			
"	CDC Chico	"	19			
Gravelbourg (S)	CDC Yuma	"	2			
"	Sanford	Whole leaf-kabuli	2			
Stewart Valley (S)	Sanford or CDC Xena	Whole leaf-kabuli	2			
Swift Current (S)	Sanford or CDC Xena	"	5			
Sanctuary (C)	Sanford	"		2		19
Kyle (C)	Sanford or CDC Xena	"		19		19
"	CDC Xena	"		63		63
"	Sanford or CDC Xena	"		38		38
Stewart Valley (S)	Sanford or CDC Xena	"		19		81
"	Sanford or CDC Xena	'		9		81
"	Sanford or CDC Xena	"		38		81
"	Sanford or CDC Xena	"		63		81
Simmie (S)	Sanford	"		95		
"	Myles	Fern - desi		9		
Frontier (S)	Sanford	Whole leaf-kabuli		98		
"	Sanford	"		81		
"	Sanford	"		63		
"	Sanford	"		38		
"	Sanford	"		95		
Cadillac (S)	Sanford	'		95		
Gravelbourg (S)	Sanford	"		95		
"	CDC Xena	Fern - kabuli		95		
Swift Current (S)	Myles	Fern desi			5	
Frontier (S)	95NN-29*	Fern kabuli			2	
Lisieux (S)	Amit	"			2	
Swift Current (S)	Amit	"			4	
Swift Current (S)	CDC Xena	Whole leaf kabuli			19	
Cadillac (S)	Sanford or Xena	"			63	
Claydon (S)	Sanford or Xena	"			63	
Elrose (C)	Sanford	"			19	
Kyle (C)	Sanford	"			19	
Total desi		**2**				
Total kabuli		**36**				

*Assessed in a cultivar trial.

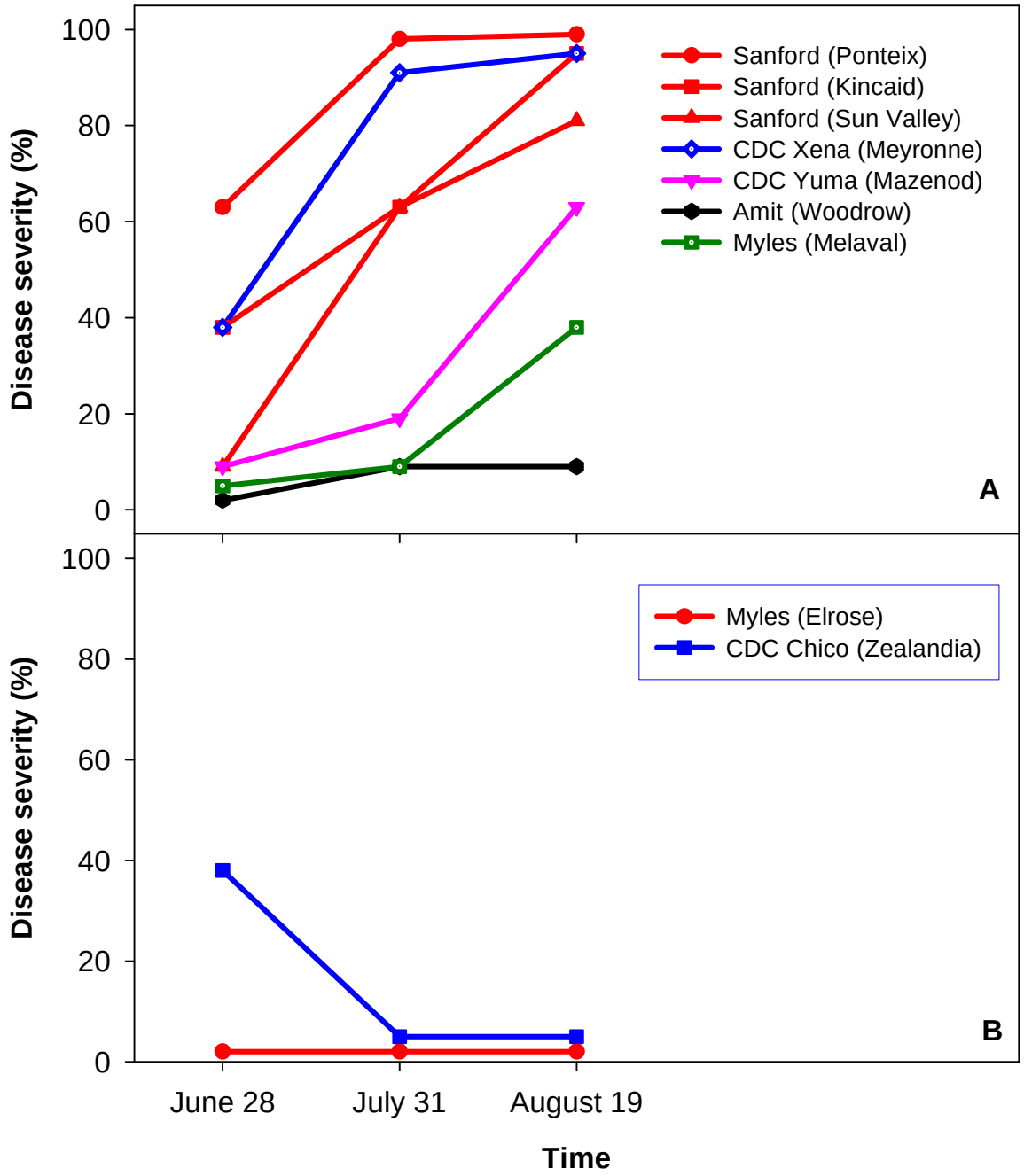

Fig. 1. Progress of ascochyta blight in 2002 in commercial fields of several cultivars located (**A**) in southern Saskatchewan with mostly above average rainfall and (**B**) in severely dry central Saskatchewan (locations in brackets).

CROP: Chickpea
LOCATION: Saskatchewan

NAMES AND AGENCIES:
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TITLE: SEED-BORNE PATHOGENS OF CHICKPEA IN SASKATCHEWAN IN 2002.

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2002 crop were summarized separately for kabuli and desi chickpea. The tests were conducted to detect the pathogens causing ascochyta blight (*Ascochyta rabiei*), botrytis blight [grey mould] (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for *Ascochyta*. Figures for *Ascochyta* and *Botrytis* were classified according to crop districts [CD] of Saskatchewan (3). However, this was not done for *S. sclerotiorum* because infection levels are generally so low that comparisons of means would be valueless.

It is unknown which of the samples came from crops that had been treated with registered fungicides. However, generally Apron (a.i. metalaxyl) is used as a seed treatment against *Pythium* on kabuli chickpea and Crown (a.i. thiabendazole + carbathiin) is used to control seed-borne *Ascochyta* on both classes of chickpea. In 2002, most crops of chickpea in Saskatchewan received several applications of Bravo (a.i. chlorothalonil) or Quadris (a.i. azoxystrobin) during the summer for control of ascochyta blight.

RESULTS AND COMMENTS: The growing season in Saskatchewan was marked first by very cool dry conditions in the spring. This was followed by well-above average rainfall in crop districts (3) in the south (the main chickpea-producing area) from June to September, but severe drought in June and July in central and northern districts. Some chickpea production occurs in west-central Saskatchewan. Cool wet conditions occurred throughout the province from August through October, causing delayed maturity and regrowth in many crops. Snow fell in October, further delaying harvest. The quantity and quality of seed harvested from most crops was far below average.

By mid-December only 111 kabuli and 88 desi seed samples had been tested by the four companies. These represent decreases of 90% and 64%, respectively, over corresponding figures for 2001 (1). The decreases are probably due to (a) a decline in the acreage of chickpea from 2001 to 2002, (b) an expected further decline in acreage in 2003, and (c) the extremely poor quality of the harvested seed.

Levels of seed-borne *Ascochyta* varied among crop districts (Table 1), but sample sizes were too small in many districts to interpret these differences. The provincial means for desi and kabuli cultivars were 6.2 and 4.9 times higher, respectively, than the corresponding means for 2001 (1). These increases reflect the severe infestations of ascochyta blight experienced by most growers, especially on unifoliolate kabuli cultivars, despite multiple foliar fungicide applications. The maximum recorded values of ascochyta seed infection were 44.0% in kabuli and 28.0% in desi chickpea. The overall percentages of samples in which no *Ascochyta* was detected were 19 for kabuli and 32 for desi, both lower than in 2001(1).

Botrytis was detected in 36% of the kabuli samples tested and 44% of the desi samples (Table 2), a considerable increase over 2001 (1). The mean provincial infection levels were 0.8% for kabuli cultivars and 1.9% for desi cultivars, values which are much higher than in 2001, but less than in 2000 (2). The highest levels of *Botrytis* recorded in 2002 were 15.1% and 26.5% for kabuli and desi cultivars, respectively. *Botrytis* was a significant problem on chickpea in Saskatchewan in 2002 because of the late-season rainfall and renewed growth in crops. However, it is possible that average seed infection levels were lower than in 2000 (2) because crop canopies had been thinned by severe infestations of ascochyta blight.

In addition to the seed-borne pathogens of chickpea which laboratories normally evaluate, many of the tests revealed unusually high levels of seed infection with *Fusarium avenaceum*, especially in desi samples. This and other *Fusarium* species cause seedling blights of pulses such as chickpea; infestation with *F. avenaceum* is a further indication of the low quality of chickpea seed harvested from the 2002 crop.

Since seed testing laboratories are not notified of the year in which samples submitted for testing were produced, it is likely that at least some samples tested in the winter of 2002-2003 were produced in 2001 or earlier. Thus, the difference in seed quality between 2002 and previous years is probably greater than suggested by the figures in this report.

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Table 1. Number of chickpea seed samples tested from September to mid-December, 2002 by four commercial companies and percent infection with *Ascochyta* in relation to Saskatchewan Crop Districts

Crop District	KABULI			DESI		
	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection	% samples with 0% infection
1A	-	-	-	2	0	100
1B	-	-	-	-	-	-
2A	17	2.2	29	14	1.4	50
2B	17	5.4	18	4	3.6	50
3AN	7	14.3	0	7	8.8	14
3AS	17	2.9	12	11	2.4	36
3BN	16	4.4	19	21	7.2	14
3BS	5	13.7	0	-	-	-
4A	2	14.5	50	-	-	-
4B	9	5.4	33	3	1.2	0
5A	-	-	-	4	1	50
5B	-	-	-	-	-	-
6A	4	5.1	25	3	3.6	0
6B	5	6.2	0	12	1	33
7A	11	7.5	18	5	6	40
7B	-	-	-	-	-	-
8A	-	-	-	1	10.3	0
8B	1	0	100	-	-	-
9A	-	-	-	1	0	100
9B	-	-	-	-	-	-
TOTAL	111	5.7	19	88	3.9	32

Table 2. Number of chickpea seed samples tested from September to mid-December, 2002 by four commercial companies and percent infection with *Botrytis* in relation to Saskatchewan Crop Districts

Crop District	KABULI			DESI		
	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection	% samples with 0% infection
1A	-	-	-	1	0	100
1B	-	-	-	-	-	-
2A	9	1.1	56	13	2.5	46
2B	12	1.8	42	3	4.8	67
3AN	4	1.1	25	4	0.3	75
3AS	9	0.1	78	6	4.6	50
3BN	12	1.7	75	15	2.8	33
3BS	4	4.2	50	-	-	-
4A	1	0	100	-	-	-
4B	6	0	100	3	0.1	67
5A	-	-	-	4	0.1	75
5B	-	-	-	-	-	-
6A	4	0.1	50	1	0	100
6B	2	0.1	50	10	0.1	90
7A	7	0	100	2	0.1	50
7B	-	-	-	-	-	-
8A	-	-	-	1	0.5	0
8B	-	-	-	-	-	-
9A	-	-	-	1	0.5	0
9B	-	-	-	-	-	-
TOTAL	70	0.8	64	64	1.9	56

CROP: Coriander (*Coriandrum sativum* L.), Anise (*Pimpinella anisum* L.), Cumin (*Cuminum cyminum* L.), Dill (*Anethum graveolens* L.)
LOCATION: Saskatchewan

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TITLE: BLIGHT OF CORIANDER IN SASKATCHEWAN FROM 2000 TO 2002 WITH NOTES ON ANISE, CUMIN AND DILL

METHODS: Fields were surveyed each year when plants were in mid- to full-flower by walking in a 50-100 m circle. Disease incidence was based on the percentage of plants showing browning and death of growing tips, flowers, and umbels, to extensive dieback of shoots. The presence of aster yellows was also noted.

Samples of blighted tissue were collected to determine the cause of the disease. Small pieces of diseased tissue were surface disinfected in 0.6% NaOCl and plated on various media. Transfers were made onto potato dextrose agar to establish pure cultures. Koch's postulates were followed by inoculating pots of flowering plants from a growth chamber with aqueous suspensions from the cultures. Inoculated plants were enclosed in plastic bags for 4 to 6 days. If symptoms developed, the cause of the disease was confirmed by reisolating the organism. For organisms that were pathogenic, the procedures for inoculation, symptom production, and reisolation, were repeated at least three times. Several *Fusarium* sp. obtained from Robin Morrall were also tested for pathogenicity.

RESULTS AND COMMENTS: Koch's postulates and the frequency of isolation from infected plants collected in fields, or the presence of the pathogen in infected tissue, indicated an *Aureobasidium* sp. was the major cause of blight in coriander. A species of *Ascochyta*, which is the major cause of blossom blight in caraway (1) also caused blight on coriander, as did *Fusarium avenaceum, F. poae*, *F. culmorum*, *F. equiseti*, *F. sporotrichioides*, *F. graminearum*, *Botrytis cinerea* and an unknown non-sporulating fungus. *Fusarium avenaceum* and the unknown non-sporulating fungus were isolated from infected tissue.

Aureobasidium sp. was difficult to isolate from diseased tissue. It was slow growing and easily overgrown by saprophytes that were present in blighted tissue. *Aureobasidium* sp. was isolated by plating disinfected small pieces of recently blighted tissue on water agar. The sparse growth on water agar allows the characteristic growth of *Aureobasidium* sp., that is, whorls of budding spores on hyphae, to be seen under a microscope. The fungus was then transferred onto potato dextrose agar where it produced a slimy bacteria-like growth.

In 2000, 22 fields at 10 locations were surveyed between July 24 and 26. None or up to 5% blight, caused by *Aureobasidium* sp., was found at Annaheim, Nokomis, Gerald, Prince Albert, Imperial, Lucky Lake, Eston and Loreburn. Forty to 60% disease incidence was found at Albertville and Meath Park. Blight showed up in many fields as distinct patches. At one location near Meath Park these likely originated from seed as the farmers had never grown the crop before, nor was, or had there been, any coriander grown nearby. One of their fields had about 50% disease but all the rest showed 1 to 5 m^2 patches which covered 1 to 5% of the field. Some fields in other locations showed the effect of spread from a previous nearby crop. Aster yellows was present in all fields at trace amounts.

In 2001, five fields at four locations (St. Denis, Nokomis, Imperial, Gerald) were surveyed between July 19 and 23. No blight was found in any fields. Aster yellows was present at trace levels in one field near Nokomis. Drought stress was the most important problem. Due to the drought, other areas of the province were not surveyed.

In 2002, 12 fields at seven locations were surveyed between July 18 and 24. A trace of blight occurred in the field at Gerald. This was caused by *Ascochyta* sp., likely because it was next to a severely blighted field of caraway, where the disease was caused by *Ascochyta* sp. Other fields in the survey were near Assiniboia, Moose Jaw, Loreburn, Lucky Lake and Stalwart. There was a trace of aster yellows in two fields, at Imperial and Gerald.

On anise no blight was observed in a field near Eston in 2000. This long-season crop is grown only on a limited acreage. Koch's postulates showed blight of anise could be caused by *Aureobasidium* sp., *Ascochyta* sp., *Fusarium avenaceum*, *F. culmorum, F. equiseti*, *F. graminearum,* and *F. sporotrichioides*.

On cumin no blight was observed in a plot at Saskatoon in 2002. Cumin is rarely grown because of poor seed production that is suspected to be due to blight. Koch's postulates showed blight of cumin could be caused by *Aureobasidium* sp., *Ascochyta* sp., *Fusarium avenaceum*, *F. culmorum*, *F. equiseti* , *F. graminearum, F. poae , F. sporotrichioides* and *Botrytis cinerea*.

On dill no blight was observed in fields at Prince Albert and Gerald in 2000, and in a field at Gerald in 2001. Koch's postulates showed blight of dill could be caused by *Fusarium avenaceum, F. culmorum* and *F. sporotrichioides*.

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CROP: Flax
LOCATION: Manitoba

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TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2002

METHODS: A total of 63 flax crops in Manitoba and 33 in Saskatchewan were surveyed in 2002. Fourteen crops were surveyed during the first week, 20 crops during the second week, 48 crops during the third week, and 14 crops during the last week of August. Solin flax with low linolenic acid and other yellow seed- colour flax constituted 15%, and brown seed-colour linseed constituted 85% of the crops surveyed. Crops surveyed were selected at random along preplanned routes in the major areas of flax production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of each disease were recorded. Stand and vigour were rated on a scale of 1 to 5 (l = very good, and 5 = very poor)

In addition, 15 samples of flax plants were submitted for analysis to the Manitoba Agriculture and Food Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: Eighty-three percent of the flax crops surveyed in 2002 were rated very good for stand establishment, and 75% had very good vigour. Thirty-seven percent of the crops surveyed were seeded late and were expected to be late for maturity and harvesting. Growing conditions were generally good except for the below-normal moisture conditions in Saskatchewan which resulted in low yield in drought-stricken areas.

Pasmo (*Septoria linicola*) was observed in 75% of the crops surveyed (Table 1) especially those surveyed in late August. The prevalence and severity of pasmo in 2002 were higher than in 2001 (1, 2), due perhaps to the above-normal wet conditions towards the end of the season. In the infested crops, pasmo incidence ranged from 1% to 100% infected plants, and severity ranged from 1% to >50% stem and leaf area affected. Twenty-one and 14% of the severely affected crops had, respectively, 20% and 50% of stem area affected by pasmo (Table 1).

No severe lodging was recorded in flax crops in 2002, and no signs of stem infections by *Sclerotinia sclerotiorum* was encountered in this survey. However, various levels of infections by *Alternaria* spp. were observed on the foliage of maturing flax.

Root infections and fusarium wilt (*Fusarium oxysporum f.sp. lini*) were observed in 44% of flax crops in 2002 in comparison with 75%, 54%, and 93% of crops, respectively, in 2001, 2000 and 1999 (1, 2, 3). Incidence of fusarium wilt ranged from traces to 20%.

Powdery mildew (*Oidium lini*) was observed in 23% of crops surveyed in 2002 with a severity range from traces to 10% leaf area affected. The incidence and severity of this disease were low in 2002, similar to the last two years (1, 2).

Traces to 5% affected plants were observed for aster yellows (phytoplasma) in a few flax crops in 2002. The incidence and severity of aster yellows in 2002 were similar to 2001 and 2000 but lower than in 1999 when the severity of this disease was higher than in any of the last 10 years (1, 2, 3).

Rust (*Melampsora lini*) was not observed in any of the 96 crops surveyed, nor in the rust-differential flax nurseries planted at Morden, Portage la Prairie, Saskatoon, and Indian Head.

Of the 15 flax samples submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre, two were affected by root rot, and one by saprophytic fungi. In addition to diseases, 13 samples were affected by herbicide injury, primarily by Group 2 herbicides and by glyphosate (Group 9).

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 96 crops of flax in Manitoba and Saskatchewan in 2002.

Fusarium Wilt				**Pasmo**				**Powdery Mildew**			
Crops		Disease		Crops		Disease		Crops		Disease	
No.	%	Incid.[1]	Sever.[2]	No.	%	Incid.[1]	Sever.[2]	No.	%	Incid.[1]	Sever.[2]
54	56%	0%	0%	24	25%	0%	0%	74	77%	0%	0%
8	8%	1-5%	1-5%	16	17%	1-10%	1-5%	20	21%	1-10%	1-5%
28	29%	5-20%	5-10%	22	23%	10-30%	5-10%	2	2%	10-30%	5-10%
3	3%	2-40%	10-20%	20	21%	30-60%	10-20%	0	0%	30-60%	10-20%
3	3%	>40%	10-40%	14	14%	>60%	20-50%	0	0%	>60%	20-50%

[1] Disease Incidence = Percentage of infected plants in each crop.

[2] Disease severity = Percentage of roots affected by fusarium wilt, stems affected by pasmo, and leaves affected by powdery mildew.

CROP: Lentil (*Lens culinaris*)
LOCATION: Saskatchewan

NAMES AND AGENCIES:
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TITLE: DISEASES OF LENTIL IN SASKATCHEWAN IN 2002

METHODS: Surveys were conducted for the two major diseases of lentil, ascochyta blight (caused by *Ascochyta lentis*), and anthracnose, (caused by *Colletotrichum truncatum*). Notes were also made on other diseases including sclerotinia stem and pod rot (caused by *Sclerotinia sclerotiorum*) and botrytis stem and pod rot (caused by *Botrytis cinerea*), as well as root rots. The first survey was done on June 28 in 15 fields, which were located in southern Saskatchewan and a second survey was done on July 31 in 17 fields of which half were located in central and the other half in southern Saskatchewan. Ascochyta blight and anthracnose severities were assessed using the 0 -11 Horsfall-Barratt scale (1) on plants at five random spots in each field. The mean of the five ratings was converted to percent infected plant area. Fungal isolations for root rot and foliar pathogens were made on potato dextrose agar from samples in each field.

In addition, 26 lentil crops in the Regina area and one in the Dafoe area (170 km ESE of Saskatoon) were monitored about once every 6 days from June 23 to July 24. The majority were ascochyta-resistant cultivars (CDC Milestone 11; CDC Sovereign 5; CDC Robin 4; CDC Glamis 2; CDC Grandora 1), but four were susceptible cultivars (Eston 2, Laird 1; Crimson 1). The objective was to detect symptoms early and make recommendations for fungicide application, but quantitative disease assessments were not made.

RESULTS AND COMMENTS: Many lentil crops in central Saskatchewan had stunted and chlorotic plants due to drought and heat stress. During the first survey conducted on June 28, ascochyta blight severity was 5% or less. Of the 15 fields surveyed, anthracnose was found in only one at 2% severity (Table 1). Seedling blights and root rots were present by the end of June. Isolations included the following pathogens; *A. lentis, C. truncatum, Fusarium* spp., *Rhizoctonia solani, Botrytis cinerea and Alternaria alternata.* By the end of July, ascochyta blight and anthracnose severities were low in central Saskatchewan where there was severe drought. However, even under more favorable conditions in southern Saskatchewan, ascochyta and anthracnose pressures were still low. In general, there appeared to be more symptoms of ascochyta blight than anthracnose. In one field at Stewart Valley there was a high level of anthracnose at the end of July. These observations do not indicate how diseases progressed beyond July 31, but levels probably increased more in southern Saskatchewan than in central regions; the crop did not mature for at least one month and rainfall frequency increased towards the end of the season.

In the 26 crops that were monitored regularly, ascochyta blight symptoms were first observed in late June in only five crops and at only trace levels. Subsequently, ascochyta blight did not increase on either the resistant or susceptible cultivars. Anthracnose symptoms on leaflets were first observed, mostly at low levels, in six crops on June 23, six on June 30, seven on July 1, one on July 5, two on July 6, one on July 7, one on July 12, one on July 13, one on July 18, and one on July 24. The symptoms were widely distributed in the field only in crops grown on 2- or 3-year rotations, and were scattered or confined to edges of the field in crops on longer rotations. Applications of chlorothalonil or mancozeb were made, usually soon after symptoms were first observed, as follows: 0 applications - 4 crops, 1 application to only one or more edges of the field - 7 crops; 1 application - 12 crops; 2 applications - 4 crops. At the end of July, levels of anthracnose were low in all crops, except one on a short rotation where the fungicide application was delayed substantially after symptoms first developed.

Other diseases observed in the crops that were monitored were botrytis seedling blight (*Botrytis* spp.) in five, stemphylium blight (*Stemphylium* sp.) in seven, root rot (*Fusarium* spp. and *Rhizoctonia solani*) in eight crops, and septoria leaf spot (*Septoria* sp.) in nine. All these were at trace or low levels, except for septoria leaf spot in two crops of CDC Robin, where moderate infection occurred. In one of these crops, there was a severe infestation with *Vicia americana* var. *minor* and lesions on leaves of this weed were infected by what appeared to be the same species of *Septoria.*

REFERENCES:
Campbell, C. L., and L. V. Madden. 1990. Introduction to Plant Disease Epidemiology. Wiley-Interscience, NY. 532 pp.

Table 1. Disease severities in 32 lentil fields and root rot pathogens isolated from sample plants from central and southern Saskatchewan in 2002.

	June 28			July 31		
	Disease severity (%)		Root rot	Disease severity (%)		Root rot
Location	Ascochyta	Anthracnose	pathogens[†]	Ascochyta	Anthracnose	pathogens
Swift Current	2	0	Bc			
Rhineland	2	0	Bc			
“	0	0				
Blumenhof	0	0				
“	2	0	Rs			
“	2	0	Rs			
Ponteix	5	0	F			
Aneroid	0	0				
“	5	0	Rs			
Kincaid	0	0				
Congress	0	0				
“	0	0				
Moose Jaw	2	2				
Tuxford	0	0				
“	2	0	F			
Outlook				0	0	
Bounty				0	0	Bc
Milden				0	0	
“				0	0	
Dinsmore				0	0	
“				0	0	
“				0	2	Bc
“				0	2	
Stewart Valley				0	0	
“				0	63	Rs, F
Swift Current				0	0	
“				0	0	
Simmie				0	0	Rs, Bc, A
“				2	0	
Frontier				0	0	F, A, Bc
Kenaston				0	0	F
“				0	2	F

[†]Bc = *Botrytis cinerea*, Rs = *Rhizoctonia solani*, *Alternaria alternata*, F= *Fusarium* spp.
B. cinerea was responsible for seedling blights.

CROP: Lentil
LOCATION: Saskatchewan

NAMES AND AGENCIES:
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TITLE: SEED-BORNE PATHOGENS OF LENTIL IN SASKATCHEWAN IN 2002.

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2002 crop were summarized. The tests were conducted to detect the pathogens causing ascochyta blight (*Didymella* [*Ascochyta*] *lentis*), anthracnose (*Colletotrichum truncatum*), botrytis stem and pod rot (grey mould) and seedling blight (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). All samples were tested for *Ascochyta* and slightly fewer for *Colletotrichum*, *Botrytis* and *Sclerotinia*. Figures for *Ascochyta* and *Botrytis* were classified according to crop districts [CD] of Saskatchewan (3). However, this was not done for *Colletotrichum* and *Sclerotinia* because infection levels are generally so low that comparisons of means would be valueless.

It is unknown which of the seed samples came from lentil crops that had been treated with registered fungicides. Bravo (a.i. chlorothalonil) and Dithane (a.i. mancozeb) are registered as foliar protectants against ascochyta blight and anthracnose. Crown (a.i. thiabendazole + carbathiin) is often used as a seed treatment against seed-borne *Ascochyta* and *Botrytis*; Vitaflo 280 (a.i. carbathiin + thiram) is registered to control seed rot and seedling blights caused by *Pythium*, *Rhizoctonia* and *Fusarium*. Many of the samples tested came from crops of ascochyta-resistant lentil cultivars. These were first widely grown in 2000 (3) and are now rapidly replacing older susceptible cultivars in all market classes.

RESULTS AND COMMENTS: The growing season in Saskatchewan was marked first by very cool dry conditions in the spring. This was followed by well-above average rainfall from June to September in crop districts (3) in the south, but severe drought in June and July in central and northern districts. Lentil production is concentrated in the south, central and west-central regions of the province. A significant frost occurred in a large part of western Saskatchewan on August 2. Cool wet conditions prevailed throughout the province from August through October, causing delayed maturity and regrowth in lentil crops previously affected by drought. Snow in October further delayed harvest. Only about 2/3 of the 0.6 million ha sown was harvested for seed, and the quality of harvested seed from most crops was very low. Mean yield for the province was slightly increased over that in 2001, but was less than 75% of the long term average (2).

By mid-December nearly 1050 lentil seed samples had been tested by the four companies, an increase of about 15% over the corresponding figure for 2001. Levels of seed-borne *Ascochyta* in individual samples ranged from 0% to 51.75% (in a sample from CD 3BN). Mean levels varied among crop districts (Table 1), but were not clearly related to rainfall totals for the growing season. The highest means based on relatively large numbers of samples were in CDs 3BN, 3BS and 5A. The low mean in CD 6B is probably attributable to drought until near the end of July.

On a provincial basis the mean level of *Ascochyta* seed infection was 1.5%, while 54% of samples tested 0%. The corresponding figures for 2001 were 0.6% and 69%. The increase in level of seed-borne *Ascochyta* from 2001 to 2002 occurred despite a larger percentage of crops consisting of ascochyta-resistant cultivars. It is undoubtedly related to wet weather, either throughout the summer or at the end of the growing season. Infection of seed samples of resistant cultivars with low levels of *Ascochyta* was probably because of saprophytic invasion of the pods in late summer (1).

Botrytis was detected in 59% of all samples tested, in contrast with only 37% in 2001, 80% in 2000, 69% in 1999 and 73% in 1998 (2). The mean infection level for the province was 1.9%, compared with 0.4% in 2001, 2.3% in 2000, 0.7% in 1999 and 0.3% in 1998. The highest level of *Botrytis* observed in an individual sample was 33.25% in a sample from CD 3BN. The means levels of *Botrytis* were substantially higher in CDs 3AN, 3AS, 3BN, 3BS and 6A than in other CDs. All five of these CDs had excessive rainfall in August and substantial parts of them had above-normal rain in July, too. The lower provincial mean level of *Botrytis* in seed in 2002 (1.9%) than in 2000 (2.3%) is probably related to a more general distribution of regions with conditions conducive to *Botrytis* in 2000 (3).

Colletotrichum truncatum, which is never a highly seed-borne pathogen, was, however, detected at low levels in 16.5% of the samples tested. This is more than double the percentage in 2001 and 2000 and considerably more than in several previous years (2,3). It is possible that this was related to late-season infection of plants in 2002, due to August rainfall and delayed maturity. Early-season infection with anthracnose often kills plants before seed-set. However, later infection after seed set may have resulted in spread of the pathogen to pods and seed, even in crops protected earlier by fungicide application.

As in most previous years (2,3), *S. sclerotiorum* was isolated from relatively few lentil seed samples in 2002, and usually at low levels.

In addition to the seed-borne pathogens of lentil which laboratories normally evaluate, many of the tests in 2002 revealed unusually high levels of seed infection with *Fusarium* species, especially *F. avenaceum.* Some samples were infected at levels of 20-30% and levels of 5-10% were common. *Fusarium avenaceum* is a well-known cause of seedling blight in lentil, but is usually found in lentil seed at only trace levels. The infection of seed with *F. avenaceum* is a further indication of the low quality of seed harvested from the 2002 crop. The impact that seed infection with *F. avenaceum* will have on emergence in 2003 is unknown.

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Table 1. Number of lentil seed samples tested from September to mid-December, 2002 by four commercial companies and percent infection with *Ascochyta* and *Botrytis* in relation to Saskatchewan Crop Districts

Crop District	*Ascochyta*			*Botrytis*		
	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection	% samples with 0% infection
1A	10	0	100	10	0.2	80
1B	2	1.5	0	2	0.5	50
2A	62	0.2	77	53	0.7	45
2B	293	0.9	56	277	1.1	44
3AN	43	0.9	58	36	5.6	14
3AS	68	0.5	53	61	2.5	38
3BN	217	3	37	196	3.2	24
3BS	40	3.6	25	33	4.7	18
4A	5	12	0	5	0.8	20
4B	12	3.1	25	10	0.6	30
5A	26	4	54	27	0.3	63
5B	4	0.2	50	4	1	50
6A	69	0.7	67	69	2.3	38
6B	104	0.3	71	98	0.9	57
7A	73	1.1	52	61	0.6	69
7B	2	0	100	2	0.1	50
8A	3	0	100	3	0.4	33
8B	1	0	100	1	0.7	0
9A	5	0.3	80	4	0	100
9B	1	1	100	1	1	0
TOTAL	1039	1.5	54	953	1.9	41

CROP: Field Pea (*Pisum sativum*)
LOCATION: Saskatchewan

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TITLE: DISEASE SURVEY IN FIELD PEA IN SASKATCHEWAN IN 2002

METHODS: Surveys were conducted in central and southwest Saskatchewan in 10 fields on June 28, 11 fields on July 31 and 3 fields between August 7 and 9 for the ascochyta complex, (caused by *Mycosphaerella pinodes*, *Ascochyta pisi* and *Phoma medicaginis* var. *pinodella*) and other diseases. The assessments for ascochyta severity and bacterial blight (*Pseudomonas syringae* pv. *pisi*) were conducted using the 0 -11 Horsfall-Barratt scale (1) by rating approximately 10 plants at five spots in each field sampled. Means of the five ratings were converted to percent disease severity. Samples were collected from each field for isolation of pathogenic foliar and root fungi on potato dextrose agar.

In addition, 11 pea crops in the Regina area, five in the Dafoe-Raymore area (170-190 km ESE of Saskatoon), and eight in the Foam Lake-Ituna area (230-300 km ESE of Saskatoon) were monitored about once every 6 days from June 23 to July 30. The distribution of crops among cultivars was as follows: Swing 7; Toledo 4; Delta 2; Alfetta 1; Courier (maple pea) 1; Eclipse 1; Espace 1; CDC Handel 1; CDC Mozart 1; Marrowfat 1; Nitouche 1, SW Parade 1; Scuba 1; 4010 (forage pea) 1. The cultivars Eclipse, CDC Handel, CDC Mozart and SW Parade are all resistant to powdery mildew (*Erysiphe pisi*). The objective of monitoring was to detect disease symptoms at an early stage and make recommendations for fungicide application, but quantitative disease assessments were not made.

RESULTS AND COMMENTS: Drought and heat stress especially in the central regions of the province resulted in premature ripening and chlorotic symptoms on plants. In the first survey conducted on June 28, only ascochyta blight symptoms were observed in most fields and severities ranged from 1 to 38% (Table 1). All the fields surveyed in June were located in southern Saskatchewan, where conditions were favorable for disease development as result of wetter weather than in central Saskatchewan. By the end of July, ascochyta blight severity was low (1-9%) in 4 fields and moderate (19-63%) in 7 fields (Table 1). Bacterial blight was unusually widespread (2), and symptoms were prominent at the second survey with severities as high as 95% in one field (Table 1). In certain fields symptoms of bacterial blight also occurred evenly throughout the fields. The widespread distribution of symptoms in 2002 throughout the province may have been caused by wind-driven rain and hail in some areas.

In three other fields seeded to cv. Alfetta at Elrose, Outlook and Swift Current, which were surveyed between August 7 and 9, ascochyta severity was 19% in each field. Powdery mildew was observed in one field near Saskatoon towards the end of the season in August. *Rhizoctonia solani*, *Fusarium* spp. and *Alternaria alternata* were isolated from root with symptoms.

In the crops that were monitored, symptoms of the ascochyta complex were first observed in late June or early July in most crops, but generally remained at trace levels until the end of July. However, in the crops of Marrowfat and 4010, slight and moderate severities, respectively, developed, but not early enough to warrant fungicide applications. In the Regina area, powdery mildew was not observed in any crops throughout the monitoring period. However, in the Dafoe-Raymore and Foam Lake-Ituna areas powdery mildew was first observed in some fields on July 5 and July 10, respectively. In these areas, mildew severity at the end of July on susceptible cultivars ranged from slight to severe. Three of the monitored crops were sprayed twice with sulphur for mildew control.

Other diseases observed in the crops that were monitored were seedling blight (pathogens unknown) in six crops, rust (*Uromyces viciae-fabae*) in four, downy mildew (*Peronospora viciae*) in seven, septoria leaf blotch (*Septoria pisi*) in one and bacterial blight in two. All these were at trace or low levels. The two crops with bacterial blight were both in the Regina area in places where hail damage occurred.

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Yager , L., and R.L. Conner. 2002. Diseases of field pea in Manitoba in 2001. Can. Plant Dis. Surv. 82: 116-117. (http://www.cps-scp.ca/cpds.htm)

Table 1. Severity of ascochyta blight and bacterial blight in field pea in central and southern Saskatchewan on June 28 and July 31, 2002 and pathogens isolated from plants with symptoms.

Field Location	Disease			
	Ascochyta blight (%)		Bacterial blight (%)	Others
	June 28	July 31	July 31	June 28
Swift Current	9			F[1]
Rhineland	2			
"	19			F
Cadillac	0			
"	0			
Kincaid	19			Rs, A
"	0			F, A
Limerick	5			Rs, A
Assiniboia	38			F, A
Tuxford	2			
Outlook		0	0	
Dinsmore		0	0	
"		0	0	
"		0	0	
"		63	81	
Swift Current		5	81	
Kenaston		0	0	
Simmie		19	9	
"		63	9	
"		38	19	
Ponteix		9	95	

Rs = *Rhizoctonia solani*, A= *Alternaria alternata*, F= *Fusarium* spp.

CROP: Pea
LOCATION: Saskatchewan

NAMES AND AGENCIES:
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TITLE: SEED-BORNE PATHOGENS OF PEA IN SASKATCHEWAN IN 2002.

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2002 crop were summarized. The tests were conducted to detect the pathogens causing ascochyta blights (*Mycosphaerella* [*Ascochyta*] *pinodes* and *A. pisi*), 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. Figures for *Ascochyta* spp.were classified according to crop districts [CD] of Saskatchewan (2). However, this was not done for *B. cinerea* and *S. sclerotiorum* because the infection levels were so low that comparisons of means would have been valueless.

RESULTS AND COMMENTS: The growing season in Saskatchewan was marked first by very cool dry conditions in the spring. This was followed by well-above average rainfall from June to September in crop districts in the south, but severe drought in June and July in central and northern districts, where pea growing is traditionally centred. A significant frost occurred in a large part of western Saskatchewan on August 2. Cool wet conditions prevailed throughout the province from August through October, causing delayed maturity and regrowth in crops previously affected by drought. Snow in October further delayed harvest. Only about 85% of the 0.95 million ha of pea sown was harvested for seed, and the quality of harvested seed from many crops was low. Mean pea yield for the province was 11% below that of 2001 and 39% below the 10-year mean.

By mid-December over 750 pea seed samples had been tested by the four companies, about 38% more than in 2001 (1), even though seeded acreage in Saskatchewan in 2002 was lower than in 2001. This may reflect a greater interest in growing the crop, because of high prices after two successive years of below average yields. However, it may also be due to concerns related to the poor quality of seed harvested in 2002.

Mean levels of seed-borne *Ascochyta* spp. varied among crop districts (Table 1). The lowest levels were in areas most severely affected by drought (CDs 7 and 9), but the highest values were not confined to areas where abundant rain fell in mid- and late summer. Since seed testing laboratories are not notified of the year in which samples submitted for testing were produced, it is possible that this apparent discrepancy is due to submission of samples of “carry-over” seed from areas where yield or quality were poor. The maximum *Ascochyta* value recorded was 30.0% in a sample from CD 6B. On a provincial basis mean seed infection was 1.5% and the percentage of samples in which no infection was detected was 48%. These values were 67% higher and 22% lower, respectively, than corresponding values for 2001 (1).

For the second successive year (3) most isolates of *Ascochyta* from pea seed in southern Saskatchewan CDs were *A. pisi*. However, *A. pinodes* was, as usual, by far the dominant species in traditional pea-growing areas further north. In 2002, as in 2001 (1) many seed samples from the south were infected exclusively with *A. pisi*. At one testing lab, the relative distribution of isolates of the two species (based on over 650 isolates) was 33% *A. pisi* to 67% *A. pinodes* for CDs 1-4, 2% *A. pisi* to 98% *A. pinodes* for CDs 5-9, and 44% *A. pisi* to 56% *A. pinodes* overall.

Botrytis was detected in less than 2% of pea samples tested compared with 7% in 2001 (1) and 28% in 2000(3). Also, the mean seed infection level was less than 0.1% and there was little variation among crop districts. *Botrytis* was again not a problem on pea crops in Saskatchewan in 2002. Similarly, *S. sclerotiorum* was isolated from a very small percentage of seed samples tested in 2002 and always at very low levels.

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Table 1. Number of pea seed samples tested from September to mid-December, 2002 by four commercial companies and percent infection with *Ascochyta* spp. in relation to Saskatchewan Crop Districts

Crop District	No. of samples tested	Mean % infection	% samples with 0% infection
1A	23	1.7	35
1B	9	2.5	22
2A	29	0.5	66
2B	75	1.1	57
3AN	8	4.8	25
3AS	85	2.3	29
3BN	72	2	38
3BS	34	1.4	21
4A	1	0	100
4B	9	0.4	78
5A	18	0.4	56
5B	60	1.9	40
6A	69	0.5	64
6B	61	1.3	59
7A	12	0.4	75
7B	26	0	100
8A	79	2.3	28
8B	38	1.2	37
9A	42	0.3	76
9B	10	0.2	70
TOTAL	760	1.5	48

CROP: Field pea
LOCATION: Manitoba

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TITLE: **DISEASES OF FIELD PEA IN MANITOBA IN 2002**

METHODS: Crops of field pea were surveyed for root diseases at 41 different locations and for foliar diseases at 58 locations in Manitoba. The survey for root diseases was conducted in the last week of June when the plants were at the 6-node to early flowering stages and for foliar diseases in the first week of August when the plants were at the pod-fill to maturity stages. The crops surveyed were chosen at random from regions in southwest and south-central Manitoba, where most field pea is grown. Ten plants were sampled for each crop surveyed. Diseases were identified by symptoms. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, the seedling could not emerge or died back quickly after emergence). Five to ten symptomatic roots were collected per field for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 9 (whole roots/plants were severely diseased). Powdery mildew was rated as a percentage of leaf area infected.

RESULTS AND COMMENTS: Three diseases were observed in the root disease survey (Table 1). Fusarium root rot (*Fusarium solani* f. sp. *pisi*) and fusarium wilt (*Fusarium oxysporum*) were the most prevalent diseases, observed in 38 and 18 of the 41 fields surveyed, respectively. Rhizoctonia root rot, caused by *Rhizoctonia solani*, was observed in 8 of the fields surveyed.

Six foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*), powdery mildew (*Erysiphe pisi*) and septoria blotch (*Septoria pisi*) were the most prevalent diseases and were observed in 57, 21 and 15 of the 58 fields surveyed, respectively. The incidence of fusarium wilt decreased from previous years possibly due to the fact that the survey was conducted later in the growing season than usual. The plants were mature at the time of rating, making it difficult to view the symptoms of fusarium wilt. Other foliar diseases, such as downy mildew (*Peronospora viciae*) and bacterial blight (*Pseudomonas syringae* pv. *pisi*) were each observed at low levels in only one field.

Table 1. Prevalence and severity of root diseases in 41 crops of field pea in Manitoba in 2002.

		Disease Severity (0-9)*	
Disease	**No. fields affected**	**Mean**	**Range**
Fusarium root rot	38	2.2	0.5-6.5
Fusarium wilt	18	2.4	0.5-5.8
Rhizoctonia root rot	8	1.9	0.6-3.1

*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 58 crops of field pea in Manitoba in 2002.

		Disease Severity*	
Disease	**No. fields affected**	**Mean**	**Range**
Mycosphaerella blight	57	4.8	37263
Fusarium wilt	1	8	8
Powdery mildew	21	19.3	5-60
Septoria blotch	15	1.7	37258
Downy mildew	1	2	2
Bacterial blight	1	3	3
Unidentified	5	1.8	37258

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

CULTURE/CROP: Soja *(Glycine max)*
REGION/LOCATION: Québec

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TITRE/TITLE: APERÇU DES MALADIES VIRALES DU SOJA AU QUÉBEC EN 2002

INTRODUCTION ET MÉTHODOLOGIE: En 2002, le Centre de recherche sur les grains inc. (CÉROM) et Agriculture et Agro-alimentaire Canada ont réalisé une enquête visant à déterminer la présence de virus dans des plantes de soja provenant de champs commerciaux du Québec et à en estimer leur fréquence. Les quatre virus suivants ont été évalués : le virus de la mosaïque du soja (SMV), le virus de la marbrure des gousses du haricot (BPMV), le virus de la nécrose annulaire du tabac (TRSV) et le virus de la mosaïque de la luzerne (AMV).

L'enquête a été menée dans le sud-ouest (Montérégie Ouest) du Québec, région où on avait rapporté (Jacques Brodeur, entomologiste, Université Laval, comm. pers.) les populations les plus élevées du puceron du soja parmi toutes les régions en observation au Québec. Cinq champs ont été visités (Fig. 1). Dans chacun de ces champs, les jeunes feuilles de trois plantes consécutives sur le rang ont été prélevées à dix emplacements différents distancés d'au moins 20 m entre-eux. Ces échantillons de jeunes feuilles ou de feuilles nouvellement formées ont été mis dans des sacs de plastique identifiés par le numéro d'emplacement et de champ et déposés dans une glacière contenant de la glace ou " ice-pak " précongelés pour le transport vers le laboratoire où ils ont été conservés à 4°C jusqu'à leur traitement.

Un test sérologique en DAS-ELISA a été utilisé pour détecter la présence des virus (Michelutti et al. 2002). Au total, 47 échantillons de jeunes feuilles (Fig. 1) prélevés dans cinq champs différents ont pu être testés.

RÉSULTATS ET COMMENTAIRES: Les tests sérologiques ont révélé la présence du TRSV dans huit échantillons provenant de quatre champs sur cinq. Les tests ont aussi mis en évidence la présence du AMV dans sept échantillons provenant de trois champs différents. À notre connaissance, il s'agit de la première mention de la présence du TRSV et du AMV chez le soja au Québec. D'autres tests sont cependant nécessaires pour corroborer cette observation. L'enquête devrait se poursuivre en 2003 et couvrir l'ensemble de la zone de production du soja du Québec.

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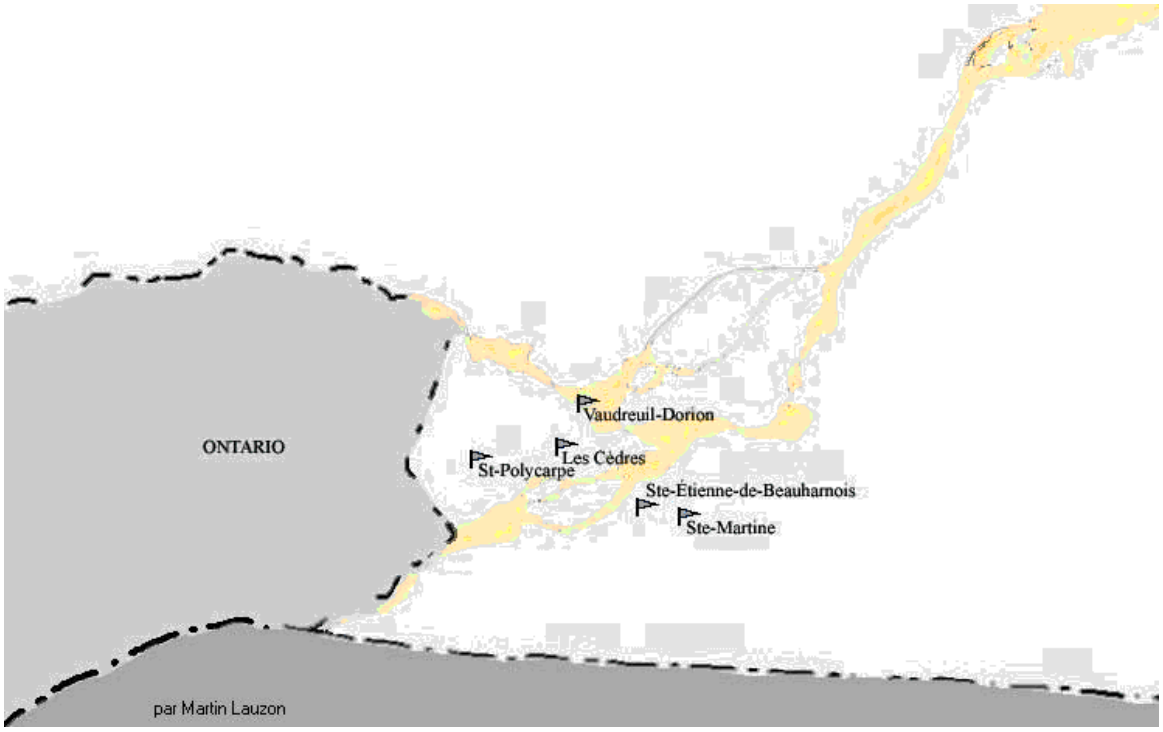

Fig. 1. Location spatiale des champs de soja où les échantillons ont été prélevé dans le sud-est du Québec.

CROP: Soybean
LOCATION: Ontario

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TITLE: SURVEY OF SOYBEAN FIELDS IN ONTARIO FOR VIRUSES IN 2002

INTRODUCTION AND METHODS: In 2001 Agriculture and Agri-Food Canada and the Ontario Ministry of Agriculture and Rural Affairs conducted a survey of commercial soybean fields in Ontario for the presence of the viruses soybean mosaic virus (SMV), bean pod mottle virus (BPMV), tobacco ringspot virus (TRSV) and, for some samples, tobacco streak virus (TSV) and found, for the first time in Ontario and Canada, the presence of BPMV (Michelutti et al., 2002). In 2002 a similar survey was conducted in commercial soybean fields in Ontario. A new virus, alfalfa mosaic virus (AMV), was incorporated in the survey, and TSV was not included because of its low incidence and economic significance.

AMV belongs to the Alfamovirus group (Brunt et al., 1996) and causes necrotic or chlorotic local lesions, and sometimes mosaic on leaves. Symptoms persist, or disappear soon after infection. It is transmitted by aphids in a non-persistent manner, by mechanical inoculation, by grafting, by seed and by pollen to the seed.

The survey was conducted in the soybean growing counties of Ontario, ranging from Windsor to Ottawa. Samples of newly formed leaves or young leaves with unusual symptoms from over 400 sites were processed and tested. A double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) was used to detect these viruses (Michelutti et al. 2002).

RESULTS AND COMMENTS: Samples from 16 different sites in commercial fields spread from Essex County to Ottawa tested positive for TRSV. Samples from 13 different sites in commercial fields spread from Essex County to Ottawa tested positive for SMV. Samples from 20 different sites in commercial fields located in Essex County, Grey County, and the Ottawa region, tested positive for BPMV. Samples from 15 different sites in commercial fields spread from Essex County to Ottawa tested positive for AMV. All four viruses were found in samples originating in soybean breeding nurseries. Three viruses, SMV, TRSV (Tu, 1988), and BPMV (Michelutti et al. 2002) have been found in Ontario previously, but, to the best of our knowledge, this is the first report of AMV in soybean in Ontario. Further tests are needed to corroborate these findings. Additional surveys will be conducted in 2003.

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CROP: Sunflower
LOCATION: Manitoba

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TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2002

METHODS: Eighty sunflower crops in Manitoba were surveyed in 2002. Seventy-seven percent of the crops were confectionery hybrids and 23% were oilseed hybrids. Seventeen crops were surveyed in the second week of August, 30 crops in the third week of August, 15 crops in the last week of August, four crops in the first week of September, and 14 crops in the last week of September. Crops were surveyed along preplanned routes in the major areas of sunflower production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the percent incidence of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem infections (*Phoma* spp. *& Phomopsis* spp.) were measured as percent leaf and stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1).

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

RESULTS AND COMMENTS: Ninety percent of the sunflower crops surveyed in 2002 had excellent to good stands and vigour. Twenty percent of the crops were seeded late and were expected to mature very late. Growing conditions were generally good except for above-normal temperatures and moisture during the maturity period which had increased the incidence and severity of sclerotinia head rot toward the end of the season. Traces to 5% infestation of sunflower midge (*Contarinia schulzi*) were observed in 35% of the crops in the Red River Valley; however, the severity of infestation was extremely low in comparison to previous years. (1, 2, 3). Traces to 5% damage from sunflower beetle (*Zygogramma exclamationis*) were observed in 33% of the crops, and 1-20% damage from grasshoppers were observed in 30% of the crops, especially in southwestern Manitoba (Table 1).

Sclerotinia wilt/basal stem infection was present in 68% of the crops surveyed, with incidence ranging from traces to 10% infected plants (Table 1). Sclerotinia head rot and mid-stem breakage caused by ascospore infections were present in 33% of crops surveyed during the last week of August and early September. However, the weather conditions in September increased the prevalence of the disease to 93%, and the incidence to 20-65% infected heads in 50% of the crops surveyed in the last week of September.

Verticillium wilt was present in 50% of the crops surveyed, with incidence ranging from traces to 20% infected plants (Table 1). The severity of verticillium wilt was also enhanced by the above-normal temperature and moisture conditions at the end of the season, and was higher than that recorded in Table 1 from this survey. This reflects the high level of susceptibility in the confectionery hybrids presently grown in Manitoba.

Downy mildew was observed in 10% of the crops with incidence of only traces to 1% infected plants in affected crops (Table 1). This is the 5th consecutive year where dry soil conditions and above-normal soil temperatures at the seedling stage may have contributed to low incidence of downy mildew.

Rust was present in 50% of the crops surveyed, with severity ranging from traces to 20% leaf area affected in most crops and >60% leaf area affected in a few crops in south-central Manitoba (Table 1). The incidence and severity of rust were higher in 2002 than in 2001 (1).

Traces to 10% leaf area covered by spots caused by *Septoria helianthi* and *Alternaria* spp. were observed in 40% of crops surveyed in 2002. *Phoma* stem lesions were present in 6% of the crops at traces to 5% stem area affected (Table 1). Traces of *Phomopsis* stem lesions were observed in a few crops before September but the incidence and severity of this disease increased sharply in September, due perhaps to the above-normal temperature and moisture conditions. Traces to 5% leaf area affected by powdery mildew were observed in 6% of the crops towards the end of the season.

Of the 10 samples submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre, two samples were identified with verticillium wilt, two with sclerotinia head rot, one with basal stalk rot, two with rust, one with fusarium root rot, and one each with *Phoma* and *Phomopsis* spp.

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Table 1. Prevalence and intensity of sunflower diseases in Manitoba in 2002.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt	54	68%	1.1	T - 2
Sclerotinia head rot/stem rot	26	33%	1.7	T - 4
Verticillium wilt	40	50%	1	T - 2
Downy mildew	8	10%	1	T - 1
Rust	40	50%	1.9	T - 5
Septoria leaf spot	32	40%	1.1	T - 2
Powdery mildew	5	6%	1	T - 1
Phoma stem lesions	5	6%	1	T - 1
Lateness[2]	16	20%	1.8	1 - 4
Poor stand	8	10%	1.5	1 - 4
Poor vigour	8	10%	1.5	1 - 3

[1] Disease index is based on a scale of 1 to 5: Trace (T) = < 1%, 1= 1% to 5% disease, 2= 5% to 20% disease, 3= 20% to 40% disease, 4= 40% to 60% disease, and 5= greater than 60% disease levels. Index is based on disease incidence for downy mildew, verticillium wilt, and sclerotinia infections; and on disease severity measured as percent leaf area affected for rust, septoria, powdery mildew and phoma infections.

[2] Indexes for lateness, stand, and vigour are based on 1-5 scale (1= early/very good and 5= late/very poor). Only 16 crops were late, 8 crops had poor stand, and 8 crops had poor vigor.

Fruit, Nuts and Berries, Ornamentals and Turfgrass,/ Fruits, fruits à écale, et baies, plantes ornementales et gazon

CROPS: Black currant (*Ribes nigrum* L.), Red currant (*R. rubrum* L.), Gooseberry (*R. grossularis* L.)
LOCATION: Southern and central Alberta

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TITLE: DISEASES OF CURRANT AND GOOSEBERRY IN CENTRAL AND SOUTHERN ALBERTA IN 2002

METHODS: Nineteen commercial and three research orchards of currant and gooseberry were surveyed between mid-July and the first week of September, 2002 (Table 1). The incidence of foliar diseases, such as powdery mildew (*Sphaerotheca mors-uvae* (Schwein.) Berk. & M.A. Curtis), leaf spot (*Alternaria* spp.) and rust (*Cronartium ribicola* J.C. Fisch.), were visually estimated on 20 plants at each of five locations in an orchard. Rust severity was estimated visually on the samples by using the following scale: 0 = no rust, 1 = 1-10% foliar infection, 2 = 11-25% foliar infection, 3 = 26-50% foliar infection and 4 = > 50% foliar infection. Wilted or dead plants were removed from each field, the roots were washed, and infected tissues (stem base, root and leaf pieces) were surface sterilized in a solution of 1% NaOCl for 2 minutes, rinsed three times in sterile distilled water, and plated onto potato dextrose agar (PDA). Microorganisms growing from infected tissues were identified according to spore morphology after microscopic examination. Root rot incidence for each orchard was determined by dividing the number of diseased plants by the total number of plants examined.

RESULTS AND COMMENTS: The most commonly grown cultivars of black currant in commercial orchards in southern Alberta in 2002 were Ben Alder and Ben Lomond, which are highly susceptible to rust. However, field observations in a research orchard at the Crop Diversification Centre South (CDCS) at Brooks, Alberta showed that both cultivars were resistant to powdery mildew. Rust was epidemic in all black currant orchards surveyed in southern Alberta (Tables 1 & 2) due to the cool, wet weather. Many growers experienced rust infection for the first time on their third-year crops. Infections began in early August and, by mid-September, the lower leaves of susceptible plants were entirely covered with pustules. This caused early defoliation. Black currants are an alternate host for white pine blister rust, which has caused severe losses for the forest industry in North America (1, 2).

Powdery mildew was severe on young shoots and leaves of some experimental black currant cultivars growing at CDCS. The black currant cultivar Titania and lines of gooseberry growing in the same orchard were immune to both powdery mildew and rust.

Stem canker, caused by *Nectria cinnabarina* (Tode:Fr.) Fr., was observed in one orchard in central Alberta. Alternaria leaf spot occurred at a low incidence in many orchards. Hinnonmaki-Red and Hinnonmaki-Yellow gooseberries were especially susceptible to *Alternaria* spp. in an orchard near Red Deer.

In central Alberta, no powdery mildew or rust occurred on black currants; however, root rot caused up to 30% mortality in several first-year orchards. Root rot also occurred in one black currant orchard grown under irrigation near Lethbridge. The major microorganisms isolated from the roots were *Fusarium* spp. (85%), *Alternaria* spp. (33%), *Pythium* spp. (28%) and unidentified bacteria (23%). Other minor microorganisms were *Rhizoctonia solani* Kühn, *Sclerotinia* sp., *Trichoderma* spp., and *Penicillium* spp. Root rot diseases posed a severe threat to seedling establishment in some orchards and their control should be studied further.

ACKNOWLEDGEMENTS: The authors wish to thank B. Welty for her assistance in providing lists and locations of currant growers in central Alberta.

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Table 1. Occurrence of currant diseases in 22 orchards surveyed in central and southern Alberta in 2002

Disease	Pathogen	No. orchards	Disease incidence (%)	
			Average	Range
Rust	*Cronartium ribicola*	8	60	0 - 100
Powdery mildew	*Sphaerotheca mors-uvae*	3	20	0 - 100
Leaf spot	*Alternaria* spp.	17	10	1 - 20
Stem canker	*Nectria cinnabarina*	1	3	0 - 10
Root rot	*Fusarium* spp. and others	8	12	5 - 30

Table 2. Susceptibility of *Ribes* spp. to rust in orchards of southern Alberta in 2002

Crops	Cultivars	No. orchards surveyed	Rust incidence (%)		Rust severity (0-4)[a]	
			Average	Range	Average	Range
Black currant	Ben Alder	8	95	90-100	3.5	1-4
	Ben Lomond	7	97	90-100	3.7	1-4
	Titania	6	0	0	0	0
Red currant	Rovalda	1	3	0	0.2	0-1
	Red Star	1	5	0	0.3	0-1
Gooseberry	17 cvs.	2	0	0	0	0

[a] Rust severity was estimated visually on the samples by using the following scale: 0 = no rust, 1 = 1-10% foliar infection, 2 = 11-25% foliar infection, 3 = 26-50% foliar infection and 4 = > 50% foliar infection.

CROP: Grape
LOCATION: British Columbia

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TITLE: DISEASES OF WINE GRAPES IN BRITISH COLUMBIA IN 2001

INTRODUCTION: Wine grapes have become an important crop in the southern interior of British Columbia (BC) where most of the important *Vitis vinifera* cultivars are grown. The majority of the vines were planted in the last ten years and disease problems are just starting to develop (British Columbia Ministry of Agriculture, Food and Fisheries, 2000). A limited survey for foliar diseases of wine grapes was conducted in the Okanagan and Similkameen Valleys of the BC interior from June to September, 2001. Nine vineyard blocks spread from the most southern location at Osoyoos near the US border to Kelowna at the northern end of the growing area were surveyed. All but the Summerland site were operated by commercial wineries and had been planted in the last five years. Seven of the sites were planted with the Chardonnay cultivar known to be extremely susceptible to powdery mildew (*Uncinula necator*). The two other sites were planted with Pinot Noir and Reisling and expected to be more susceptible to bunch rot (*Botrytis cinerea*).

METHODS: Since most vineyards are regularly sprayed with fungicides for disease control, at each vineyard, five panels (five vines to a panel) in three rows were left unsprayed. At each site a Watch Dog data logger (Model 450, Spectrum Technologies Inc., Plainfield, Illinois) was used to log leaf wetness, temperature and relative humidity. The data loggers were placed in the first panel near a roadway and downloaded every two weeks throughout the growing season. Disease assessments and samples were taken from the middle row, and the two outside rows acted as barriers to spray drift. Powdery mildew was determined by visually examining 50 leaves and 5 berry clusters for evidence of symptoms weekly from June to September. Infection by *B. cinerea* was determined by sampling 10 berry clusters beginning in late June and continuing every two weeks until September. The berry clusters were brought back to the laboratory at the research centre in Summerland, BC where they were incubated in humid chambers at 20^{o}C for five to seven days, after which *B. cinerea* infection was recorded.

RESULTS AND COMMENTS: Conditions were extremely conducive to powdery mildew infection at all the vineyards in June, July, August and September in 2001 as shown by the mean conidial index developed in California (Gubler et al. 1999) for wine grapes (Table 1). The conidial index depends solely on temperature in the grape canopy and has been used to forecast risk of powdery mildew. Fungicide spray applications are based on the disease risk, with applications every seven to 10 days when risk is high and every 14 to 21 days when the risk is low. Foliar powdery mildew first occurred at Okanagan Falls, BC in June and July at extremely low levels (Table 2). These infections were likely due to primary ascospore infection and did not appear to spread. At the Summerland site, powdery mildew is not regularly controlled with fungicides and a high residual population has become established in the vineyard. Levels of foliar powdery mildew there reached 100% of the leaves infected by September, and a high percentage of the berry clusters were damaged by powdery mildew. By the end of the growing season six of the nine vineyards had powdery mildew, although only Summerland had disease levels that resulted in crop loss.

Botrytis cinerea infection was evaluated at eight vineyards (Table 3). The pathogen was recorded at seven sites in June and July, and at all sites in August. The survey was ended in September at all but the Westbank site, where 90% infection was recorded on Reisling grapes. Bunch rot caused by *B. cinerea* was observed at Summerland on Pinot Noir, at Penticton on Chardonnay, and at Westbank on Reisling grapes. It appears that high levels of *B. cinerea* infection do not always develop into bunch rot.

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Table 1. Mean conidial index for nine vineyards surveyed in 2001

Location in BC	Cultivar	Mean conidial index[1]			
		June	July	August	September
Osoyoos1	Chardonnay	81.6	90.6	97.7	99.5
Osoyoos2	Chardonnay	76.3	90.6	97.1	98.4
Oliver	Chardonnay	79.7	87.4	75.8	94.4
Keremeos	Chardonnay	62.0	89.0	95.5	96.3
Okanagan Falls	Chardonnay	78.7	88.7	97.1	94.2
Summerland	Pinot Noir	79.0	97.1	97.4	97.3
Penticton	Chardonnay	69.0	94.5	95.2	68.0
Westbank	Reisling	88.2	92.9	96.5	90.0
Kelowna	Chardonnay	77.3	89.4	95.2	94.0

[1]Index values indicate the following: 0-30 = powdery mildew reproduces every 15 days or not at all; 40-50 = powdery mildew reproduces every 8 to 11 days; 50-100 = powdery mildew reproduces every 5 days.

Table 2. Percent incidence of foliar powdery mildew at nine vineyards surveyed in 2001

Location in BC	Cultivar	Percent leaves with grape powdery mildew			
		June	July	August	September
Osoyoos1	Chardonnay	0	0	0	0
Osoyoos2	Chardonnay	0	0	3	0
Oliver	Chardonnay	0	0	2	15
Keremeos	Chardonnay	0	0	15	26
Okanagan Falls	Chardonnay	1	4	4	8
Summerland	Pinot Noir	0	0	90	100
Penticton	Chardonnay	0	0	0	23
Westbank	Reisling	0	0	0	0
Kelowna	Chardonnay	0	0	3	2

Table 3. Percent incidence of grape clusters infected by *Botrytis cinerea* at eight vineyards surveyed in 2001

Location in BC	Cultivar	Percent clusters infected with *B. cinerea*			
		June	July	August	September
Osoyoos2	Chardonnay	13	0	53	---
Oliver	Chardonnay	10	15	10	---
Keremeos	Chardonnay	20	20	30	---
Okanagan Falls	Chardonnay	7	43	80	---
Summerland[1]	Pinot Noir	45	15	53	---
Penticton[1]	Chardonnay	---	10	50	---
Westbank[1]	Reisling	20	35	33	90
Kelowna	Chardonnay	5	10	57	---

[1]Severe bunch rot was observed in these vineyards at harvest.

CROP: Apple
LOCATION: British Columbia

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TITLE: POSTHARVEST DECAY OF STORED APPLES IN BRITISH COLUMBIA IN 2000

INTRODUCTION: Almost half of the apples harvested from British Columbia's primary apple growing areas of the Okanagan and Similkameen Valleys are placed in large cold storage rooms located at seven major packinghouses. Apples are removed from cold storage throughout the winter and spring and packed. Fruit destined to be kept the longest is put into controlled atmosphere (CA) storage where temperature, oxygen, and carbon dioxide concentration are rigorously controlled. The apple industry in British Columbia through the Okanagan Federated Shippers Association (OFSA) maintains a research program that has responsibility for determining optimum storage conditions for each apple cultivar. In the last storage year, information was required on storage atmospheres for 'Ambrosia,' 'McIntosh' , 'Fuji', and 'Gala' apples. In cooperation with OFSA, apples were surveyed from various growing areas for postharvest decay. Usually the decay is caused by either *Penicillium* spp. or *Botrytis cinerea* as we found in an earlier survey on rotten fruit from three packinghouses (Sholberg and Haag, 1996). There are several species of *Penicillium* on apples, with *P. expansum* the most common, comprising around 80% of the isolates. *P. solitum* is likely the second most important species, although it is considered a weak pathogen of apple compared to *P. expansum. Penicillium* spp. cause the postharvest disease known as blue mold, where conidia from decayed fruit infect wounds during harvest and handling (Sholberg, 2000). *Botrytis cinerea* causes the postharvest disease known as grey mold. Similarly, conidia of *B. cinerea* infect wounds or injuries on apples during harvest and handling of fruit going into storage (Sholberg, 2000). Therefore, all postharvest decays are much more common on injured fruit.

METHODS: Generally apples were picked at early to late maturity from each location and combined in average samples of 130 apples. First, McIntosh apples (130 per location) were harvested in mid September, 1999 in the North Okanagan Valley (Table 1). Next, Gala apples were harvested from three sites in the Central Okanagan Valley in late September (Table 2). Ambrosia apples (130 per location) were harvested in early October, 1999 from one site in the Similkameen Valley, three sites in the Central Okanagan Valley and one site in the Northern Okanagan Valley (Table 3). Finally, Fuji apples were harvested from three sites in the Kelowna area in late October (Table 4). The apples were picked by employees of OFSA and immediately brought to the Pacific Agri-food Research Centre (PARC), Summerland for storage. Half the apples were placed in air storage at 0°C (65 per location) and the other half (65 per location) were placed in rigorously controlled CA storage chambers. CA treatments were at 0°C, but with varying oxygen and carbon dioxide conditions. After 3 to 9 months of storage, the fruit were examined for quality, physiological disorders, and postharvest decay. Isolations were made from all apples that appeared to be infected. Isolations were made by removing the fruit skin from the margin of a lesion and aseptically placing bits of decayed tissue on petri plates containing potato dextrose agar. After incubation at 0°C for at least two weeks the isolates were identified based on colony morphology and spore characteristics.

RESULTS: Early McIntosh apple decay was relatively high at 15%, with the majority of the decay caused by *B. cinerea,* after only 3 months in air for apples from the North Okanagan Valley (Table 1). In contrast, there was no McIntosh decay in CA storage for the first three months at the Westbank site. Later during storage of McIntosh, *Penicillium* spp. were the most important storage pathogens with air and CA storage. Gala apples stored in air had less decay than McIntosh but more decay in CA after storage for 9 months (Table 2). *Penicillium* spp. were responsible for most of the decay in Gala. Ambrosia decay reached high levels in CA storage with apples from all sites and locations after 9 months in storage (Table 3). Apples stored in air generally had less decay although fruit from the Central Okanagan Valley reached 12% decay in air compared to 14% in CA storage. *Penicillium* spp. produced the highest levels of decay especially after 9 months in CA storage. Fuji apples stored in air were free of decay after 6 months storage in air but 15% of the fruit decayed in CA storage over the same period of time (Table 4). Most of the decay was caused by *B. cinerea* in Fuji compared to *Penicillium* spp. in Ambrosia, Gala, and McIntosh.

DISCUSSION: Postharvest decay was a significant problem in apples stored for more than 3 months in the 1999 (Sholberg et al. 2002) and the 2000 storage seasons. CA storage promoted decay especially in Ambrosia and Fuji. This is opposite to what is expected. Normally CA storage reduces decay because the low oxygen concentration reduces growth of pathogens such as *Botrytis* and *Penicillium* spp. Pathogens such as *B. cinerea,* grow at near optimum rates with 4% oxygen. A decrease in growth rate can be detected at 2%, and growth is reduced nearly 50% with 1% oxygen (El-Goorani and Sommer, 1981). In this survey, Ambrosia and Fuji were stored with 1.2% oxygen and decay would be expected to be lower than in air. There is no obvious reason why growth under CA conditions was higher than in air in

the 2000 storage season, but it does not appear to be restricted to this survey. Packinghouse managers reported unusual levels of decay in fruit stored under CA conditions. This could indicate that fungi that cause decay are becoming tolerant of low levels of oxygen. CA storage of apples has been a widespread practice in the Okanagan Valley since the early 1980's. Perhaps isolates tolerant of low oxygen concentration have been selected by placing contaminated apples in CA storages for two decades. If CA storages are not thoroughly cleaned each year, tolerant isolates could persist and infect the new crop, especially if the fruit were stored for over 3 months. Further research is needed to determine if isolates from CA storages are tolerant to lower levels of oxygen than normal field isolates.

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Table 1. Postharvest decay of McIntosh apples stored three to nine months in air and in controlled atmosphere (CA) storage

Location and number of sites[1]	Pathogen	Percent decayed apples					
		Air[2] 3 mths	CA[3] 3 mths	Air 6 mths	CA 6 mths	Air 9 mths	CA 9 mths
Westbank, B.C. Area (1 sites)	*Botrytis cinerea*	0	0	0	0	8.9	0
	Penicillium spp.	0	0	5.1	0	5.5	5.6
	Combined	0	0	5.1	0	14.4	5.6
Winfield & Oyama, B.C. Area (2 sites)	*B. cinerea*	9.2	1.7	6.2	1.3	10	0.6
	Penicillium spp.	5.8	0	7.8	7	25.5	2.8
	Combined	15	1.7	14	8.3	35.5	3.4

[1] Number of sites refers to the number of orchards where 130 apples were harvested per location and separated into lots of 65 for each storage regime.
[2] Air storage was at 0°C with 21.0% oxygen and 0.2% carbon dioxide.
[3] CA storage was at 1.7°C with 2.5% oxygen and 1.5-5.0% carbon dioxide.

Table 2. Postharvest decay of Gala apples stored for nine months in air and in controlled atmosphere (CA) storage

Location and number of sites[1]	Pathogen	Percent decayed apples	
		Air[2]	CA[3]
Okanagan area (3 sites)	*B. cinerea*	0	1.7
	Penicillium spp.	8.9	8.3
	Combined	8.9	10

[1] Number of sites refers to the number of orchards where apples were harvested and separated into lots of 65 apples for each storage regime.
[2] Air storage was at 0°C with 21.0% oxygen and 0.2% carbon dioxide.
[3] CA storage was at 0°C with 2.5% oxygen and 5.0% carbon dioxide.

Table 3. Postharvest decay of Ambrosia apples stored three to nine months in air and in controlled atmosphere (CA) storage

Location and number of sites[1]	Pathogen	Percent decayed apples					
		Air[2] 3 mths	CA[3] 3 mths	Air 6 mths	CA 6 mths	Air 9 mths	CA 9 mths
Cawston area (1 site)	*B. cinerea*	0	6.7	0	0	0.5	0
	Penicillium spp.	4	6	5.5	10.7	4.7	17.8
	Combined	4	12.7	5.5	10.7	5.2	17.8
Central Okanagan area (3 sites)	*B. cinerea*	0	0.7	0	1	1.3	3
	Penicillium spp.	2	0.7	2	4.5	10.7	10.9
	Combined	2	1.4	2	5.5	12	13.9
Kelowna area (1 site)	*B. cinerea*	0	0	0	0	0	6.6
	Penicillium spp.	0	0	0	2	2.9	9.6
	Combined	0	0	0	2	2.9	16.2

[1] Number of sites refers to the number of orchards where apples were harvested and separated into lots of 65 apples for each storage regime and duration.
[2] Air storage was at 0°C with 21.0% oxygen and 0.2% carbon dioxide.
[3] CA storage was at 0°C with 1.2% oxygen and 1.5% carbon dioxide.

Table 4. Postharvest decay of Fuji apples stored three to nine months in air and in controlled atmosphere (CA) storage

Location and number of sites[1]	Pathogen	Percent decayed apples					
		Air[2] 3 mths	CA[3] 3 mths	Air 6 mths	CA 6 mths	Air 9 mths	CA 9 mths
Kelowna area (3 sites)	*B. cinerea*	0	7.8	0	14.4	0	8.9
	Penicillium spp.	0	0	0	1.1	1.7	2.5
	Combined	0	7.8	0	15.5	1.7	11.4

[1] Number of sites refers to the number of orchards where apples were harvested and separated into lots of 65 apples for each storage regime and duration.
[2] Air storage was at 0°C with 21.0% oxygen and 0.2% carbon dioxide.
[3] CA storage was at 0°C with 1.2% oxygen and 1.0% carbon dioxide.

Forest trees/ Arbres forestiers

CULTURE: Eastern white pine (*Pinus strobus*)
LOCATION: Newfoundland

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TITLE: INCIDENCE OF WHITE PINE BLISTER RUST IN NEWFOUNDLAND

INTRODUCTION AND METHODS: White pine blister rust (WPBR), caused by *Cronartium ribicola* J.C. Fischer ex Rabh. results in the formation of perennial cankers that girdle the branches and stem, leading to tree mortality. This disease was accidentally introduced into North America in the early 1900s, presumably from Europe, and has since killed millions of eastern white pines (*Pinus strobus* L.) and severely restricted regeneration (Benedict 1967). Newfoundland is at the northeastern distribution limit of white pine in North America, where WPBR damage has been devastating. White pine populations have decreased from a dominant part of the forest canopy to a minor component with restricted stands (Lowe et al. 1994). However, the incidence of WPBR has never been quantified in Newfoundland. The purpose of this survey is to document the incidence of WPBR in naturally regenerating stands of white pine in Newfoundland.

Five stands of white pine were sampled in 1995 and 1996 (Table 1). At each site, transects were constructed to inspect at least 40 pine trees, depending on pine availability. Each tree was checked for the presence of cankers on the stem and branches. Cankers on branches were taken into account only in the final incidence analysis when there were no stem cankers. In addition, the height of the cankers and the age of the trees were determined. Dead trees with visible traces of WPBR stem cankers were also recorded.

RESULTS: White pine stands in the appropriate age class for a survey of blister rust symptoms are scarce in Newfoundland. We were able to find sites in all the main forest regions, i.e., western, north central and eastern Newfoundland. They varied in age (20- to 50-year-old white pines), drainage class and richness (Table 1).

The average WPBR incidence at Stephenville, Gander, Colliers and Triton Brook was 33%, 31%, 33% and 37%, respectively (Table 2). Taking into account the standard deviations observed, these stands do not exhibit statistically significant differences in incidence, despite considerable ecological differences such as richness, drainage class and competition. These factors are known to have an impact on blister rust incidence (Van Arsdel et al. 1956).

The New Bay site had a total mean WPBR incidence of 66% (Table 2), significantly higher than the other sites. No satisfactory explanations regarding age, drainage and site richness can be proposed to explain this local doubling of WPBR incidence.

Most of the lethal stem cankers observed in this study were located in the lower 60 cm of the stem, indicating that infections probably originated in the first 6 years of growth. Branch cankers were common in this survey and, at some sites, accounted for up to 45% of the cankers observed and were located at heights above 60 cm. These branch cankers can be removed by pruning, resulting in healthy trees and considerable reduction in blister rust incidence. It is recommended to act when the trees are young in order to remove branch cankers before they can reach the stem. Systematic pruning within the first 12 years is highly recommended (Laflamme et al. 1998).

Dead trees with some evidence of blister rust symptoms were quite common, accounting for up to 80% of the observed incidence in old stands like Colliers, but generally less than 25% of the incidence in younger stands (Table 2).

DISCUSSION: This survey is a snapshot of WPBR incidence and does not represent a measure of the total incidence that will affect a stand throughout the years. In young stands, dead seedling, saplings and trees infected by blister rust rapidly fall to the forest floor and degrade. Young dead trees therefore are not fully detected in a survey like ours, thus leading to an underestimation of WPBR incidence. Unpublished preliminary data of systematically surveyed white pine plantations in Newfoundland suggest that the final WPBR incidence in a stand throughout its life can be twice as high as the values observed in this study.

The high WPBR incidence in the five populations studied suggests that Newfoundland should be considered a hazard zone 3 for blister rust damage (Lavallée1986), as expected from the latitude and the climate of this island. It has been recommended not to plant white pine in a hazard zone 3. However, as mentioned by Lavallée (1986), considerable variation in blister rust incidence can be found within a zone. Site aspect, richness, preparation and drainage have significant impact on white pine blister rust incidence. For this reason, we have initiated a white pine planting program in collaboration with the Newfoundland Department of Natural Resources to test the effect of these factors. In 1994-95, eight white pine plantations were established and will be assessed annually for blister rust incidence until 2010.

There are silvicultural and biological control programs currently under development in Newfoundland. Control will facilitate the reintroduction of white pine to its previous range, the establishment of plantations and a renewed importance in forests. In Newfoundland, where white pine has virtually vanished from its former range, the reintroduction of this once prolific species could increase biodiversity and the reforestation of poor and marginal sites where white pine outcompetes other species.

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Table 1. White pine blister rust survey locations and site descriptions.

Name	Location	Age class	Drainage	CLI class[1]	Composition	Forest type[2]	History
Stephenville	48/29N35"N 58/14N20"W Western NF	12-21	moderate	5	Bsp, Bf,Wpi scattere d Wb, moderate competition	Gaultheria-Balsam fir	Cut 1970-71
Gander	48/51N05"N 55/03N10"W Northeastern NF	12-21	excessively drained	7	Bsp, Wpi, moderate competition	Kalmia-Black spruce	Cut 1970
Colliers	47/27N59"N 53/12N20"W Southeastern NF	40	moderately well drained	5	Bf 90%, Wpi 10% moderate competition	Cintonia-Balsam fir	Cut ca. 1951
New Bay	49/10N58"N 55/34N45"W North Central NF	18-22	very well drained	5	75% Bsp, 25% Bsf 5% Wpi high competition	Pleurozium-Bsf or Black spruce-Feathermoss	Cut ca. 1980
Triton Brook	48/37N30"N 54/34N10"W Northeastern NF	15-20	moderate	5	Bsp 90%, Bsf 9%, Wpi 1% moderate competition	Rubus-Bsf	Cut ca. 1980

[1] Canadian Land Inventory forest capability class (Beanlands and Damman 1972)
[2] Forest Site Classification manual (Meades and Moores 1989)

Table 2. Occurrence of white pine blister rust and mean % incidence in naturally regenerating Newfoundland white pine stands in 1994-95.

Transect	N	Stem cankers	Branch cankers	Dead trees	Total incidence
Stephenville					
1	100	15	9	2	26
2	100	22	12	2	36
3	100	29	5	1	35
4	100	19	10	5	34
Mean % incidence (standard deviation)					**33% (±5)a**
Gander					
1	100	18	1	3	22
2	100	18	4	6	28
3	100	30	4	0	34
4	100	21	10	7	38
Mean % incidence (standard deviation)					**31% (±7)a**
Colliers					
1	50	12	6	12	30
2	100	8	6	34	48
3	50	6	10	6	22
4	50	6	0	24	30
Mean % incidence (standard deviation)					**33% (±11)a**
New Bay					
1	95	42	24	4	71
2	100	34	14	16	64
3	83	54	8	2	64
Mean % incidence (standard deviation)					**66% (±4)b**
Triton Brook					
1	44	13	3	21	37
2	53	11	17	9	38
3	68	30	3	3	35
Mean % incidence (standard deviation)					**37% (±1)a**

CROP / CULTURE: Pine
LOCATION / REGION: Québec

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TITLE/TITRE: INCREASED INCIDENCE OF *SPHAEROPSIS SAPINEA* ON *PINUS* SPECIES IN QUÉBEC.

INTRODUCTION AND METHODS: *Sphaeropsis sapinea* (Fr.) Dyko & Sutton [= *Diplodia pinea* (Desm.) Kickx] is one of the most important pathogens of pine worldwide, causing a number of different symptoms including shoot blight, stem canker, root disease and blue stain (1). Recently, we found that pine cones and seeds vary in susceptibility to infection at an inter- and intraspecies level (2). Although this fungus can attack many other coniferous species and genera (*Abies, Cupressus, Cedrus, Juniperus, Larix, Picea* and *Pseudotsuga*), little is known of the host-fungus relationship, infection incidence and disease severity in the temperate climate in eastern Canada. The incidence of disease was assessed in four frequently attacked *Pinus* species growing in urban plantations of Montréal, Québec: *P. mugo* Turra, *P. nigra* Arnold, *P. resinosa* Aiton and *P. sylvestris* L. Each taxon was located in a separate group, and groups with at least one tree with disease symptoms were selected for disease assessment. Twenty-five trees (5 trees/species) were selected and sampled twice each year (spring and autumn) in 1998 and 2002. Three distal branches (10 cm long) were collected randomly from each tree (15 branches/species), and isolations were made from bark. The pathogen was isolated on potato dextrose agar and malt agar and an isolation frequency (IF) calculated.

RESULTS AND COMMENTS: *Sphaeropsis sapinea* was isolated from shoot blight infested material (Figs. 1a-1e). There was an increased incidence, up to 25% of branches infected, from 1998 to 2002 for all pine species (Fig. 2). The largest incidence of infection was observed in 2002 on *P. nigra* (IF = 28%), followed in decreasing order by *P. mugo* (IF = 19%), *P. resinosa* (IF = 16%) and *P. sylvestris* (IF = 14%). Three strains of *S. sapinea* were characterized by differences in morphology (Figure 1f). Further studies are needed to characterize the incidence of the strains, their morphotypes, physiology and virulence.

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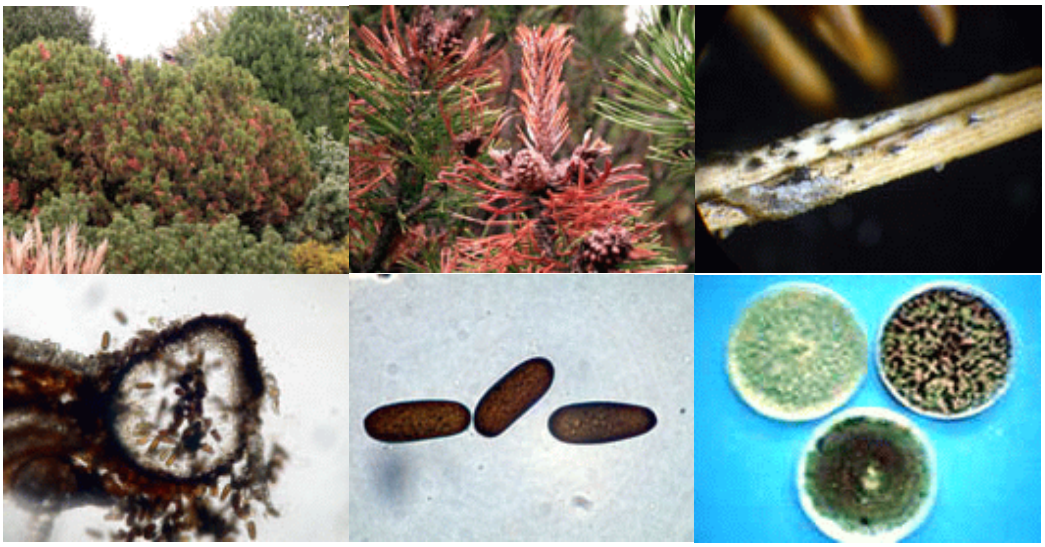
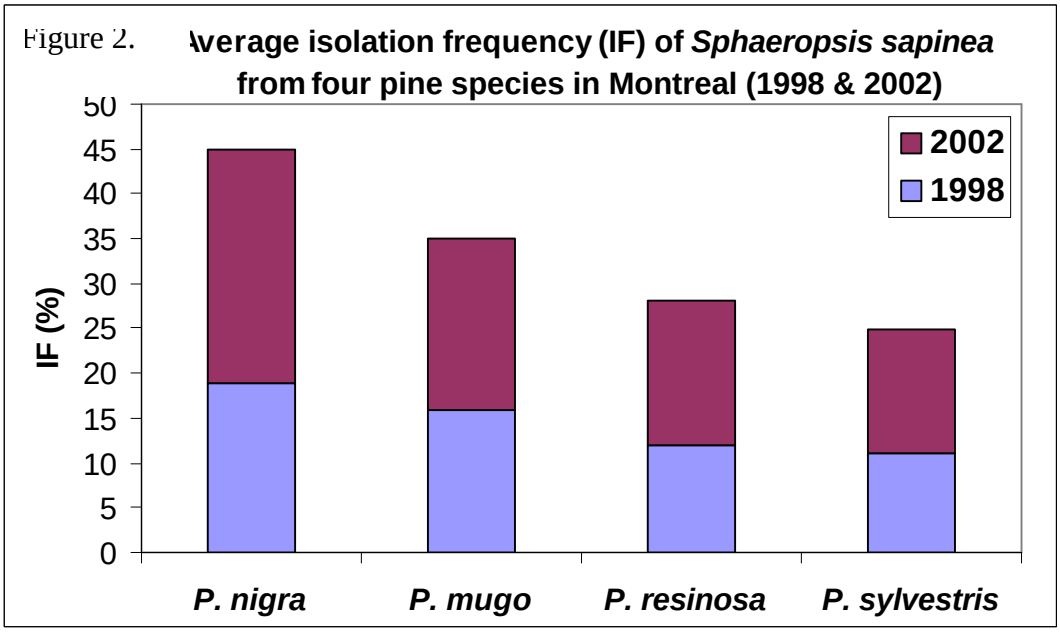


Figure 1. Symptoms of *Sphaeropsis sapinea* shoot blight on *Pinus mugo*: Top left) attacked tree, Top centre) dead shoot, Top right) fruiting bodies on dead needles, Bottom left) pycnidium, Bottom centre) conidia, and Bottom right) cultural morphology of three isolated strains : 'A', 'B' and 'C'.

Figure 2.



CROP / CULTURE: Sugar Maple
LOCATION / RÉGION: Québec

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TITLE/TITRE: PATHOGEN BIODIVERSITY ON SUGAR MAPLE IN NATURAL FORESTS AND URBAN PLANTINGS IN QUEBEC

INTRODUCTION AND METHODS: Sugar maple (*Acer saccharum* Marsh.) is economically one of the most important hardwood species in eastern Canada. In recent decades several anthropogenic and natural negative impacts have caused an important tree decline. Also, the 1998 ice storm caused considerable changes in the composition and dynamics of forests in Québec, including significant loss of biomass. Also, it could have induced changes in the composition of the fungal communities in the sugar maple canopy (2).

The purpose of this investigation was to assess the fungal assemblages in the leaves (L) and branches (B) of *A. saccharum* trees that were symptomatic and non-symptomatic to establish an efficient control strategy. Samples were collected from sugar maple trees from two natural forest ecosystems (*Acereto-Fagetum americanae*), 80 km southeast of Montreal, as well from solitary trees ca. 50 years old at the Montreal Botanical Garden. The two natural forests are Muir's Wood, a 12-ha protected old-growth forest ca. 300 years old, and Green-Bank Wood, a 5-ha managed and naturally regenerated forest ca. 80 years old. At each site, five plots were chosen: four at each corner of a square of 100 x 100 m, and one in the centre of the square. In the first week of October 1999 and 2000, 25 leaves and 5 branches were collected from each of five trees per plot. A pole pruner was used to collect branches in the lower 8 to 10 m of the canopy. Branches were brought to the laboratory within 6 h and used for fungal isolation within 24h of collection. Three small segments (1 cm x 0.5 cm) from each leaf or from branch bark were excised, surface sterilized and incubated on potato dextrose agar at 18ºC for approximately 4 weeks in the dark. Fungi were identified by microscopic examination and subculturing onto various artificial media.

RESULTS AND COMMENTS: The number of potentially pathogenic fungi isolated was higher for leaves (27) than bark (13) and varied according to collection sites (Table 1). Of 32 identified fungal taxa, 25 (78%) have not been reported previously on sugar maple in the Province of Québec (1). A large number of fungal species caused disease-like symptoms in leaves (L) and branches (B) including: *Alternaria alternata* (L), *Cristulariella depraedans* (L), *Diplodina acerina* (L, B), *Discula campestris* (L, B), *Fusicoccum* sp. (B), *Fusarium* sp. (B), *Massaria inquinans* (B), *Mycosphaerella punctiformis* (L) and *Phyllosticta minima* (L). Future investigations are needed to characterize the pathogenicity and impacts of these taxa to evaluate risks of potentially new sugar maple pathogens and to establish adequate control strategies in the context of climatic changes, and weather events like the 1988 ice storm.

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Table 1. Biodiversity of potentially pathogenic fungi found on leaves and branches of *Acer saccharum* Marsh. in southern Quebec in 1999 and 2000

Taxon	Tree Tissues	Muir's Wood	Green-Bank Wood	Montreal Botanical Garden	Isolation Frequency*	New report of fungus/host combination
Acremonium bacillisporum (Onions & Barron) W. Gams	L	x	-	-	+	Yes
Alternaria alternata (Fr. : Fr.) Keissler	L, B	x	x	x	+++	Yes
Arthrinium sp.	B	x	-	-	+	Yes
Aureobasidium apocryptum (Ellis & Everh.) Herman.-Nijhof	L, B	x	x	x	++	No
Chaetosphaerella fusispora Sivan	B	x	x	x	+	Yes
Cladosporium cladosporioides (Fresen.)G.A. De Vries	L	x	x	x	++	Yes
Coniothyrium fuckelii Sacc.	L, B	x	x	x	++	Yes
Cristulariella depraedans (Cooke) Höhn	L	x	x	-	+	No
Curvularia sp.	L, B	x	-	-	+	Yes
Diplodina acerina (Pass.) Sutton	L, B	x	-	-	+	Yes
Discula campestris (Pass.) Arx.	L	x	x	x	+++	No
Epicoccum purpurascens Ehrenb. ex Schlecht.	L, B	x	x	x	+++	Yes
Fusicoccum sp.	L, B	x	x	-	+	Yes
Fusarium sp.	L, B	x	x	-	+	Yes
Gliocladium sp.	L	x	-	-	+	Yes
Gliomastix sp.	L	x	-	-	+	Yes
Hainesia sp.	L	x	-	-	+	Yes
Massaria inquinans (Tode:Fr.) De Not.	B	x	-	-	+	No
Mycosphaerella punctiformis (Pers.:Fr.) Starb.	L	x	x	-	++	Yes
Paecilomyces farinosus (Holm ex S.F. Gray) Brown & Smith	L, B	x	-	-	+	Yes
Paecilomyces marquandii (Mas.) Hughes	L	x	-	-	+	Yes
Penicillium frequentans Westling	L. B	x	x	-	++	Yes
Penicillium sp.	L	x	-	-	+	Yes
Phoma cava Schulzer	L, B	-	-	x	+	Yes
Phyllosticta minima (Berk. & M.A. Curtis) Underw. & Earle	L	x	x	x	+++	No
Sordaria sp.	B	x	x	x	0	Yes
Sporothrix sp.	L	x	x	-	+	Yes
Trichoderma hamatum (Bon.) Bainier	L, B	x	x	-	+	Yes
Ulocladium sp.	L, B	x	x	-	+	Yes
Sterile mycelium	L, B	x	x	x	+++	-
Thiridaria rubronotatum (Berk. & Broome) Sacc.	B	x	-	-	+	Yes
Verticillium dahliae Kleb.	L, B	x	-	-	+	No

Note : x, present, -, absent; *Isolation frequency scale : +, occasionally present (1-10%), ++, frequent (10-25%) and +++, very frequent (>25%);

CROP: Coniferous and deciduous tree species
LOCATION: Invermere Timber Supply Area, Nelson Forest Region, Southeast Interior British Columbia

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TITLE: ARMILLARIA ROOT DISEASE IN TIMBER TYPES AND ECOSYSTEMS IN THE INVERMERE TIMBER SUPPLY AREA

INTRODUCTION: Armillaria root disease in British Columbia (BC) and in the Invermere Timber Supply Area (TSA) is caused by *Armillaria ostoyae* (Romagn.) Herink, one of ten species of *Armillaria* that occur in British Columbia (1). Losses of 43% in annual forest volume increments have been identified for lodgepole pine (*Pinus contorta* Dougl. var *latifolia* Engelm.) forests in Alberta (3). Similar losses due to mortality, reduced growth rates and lower site productivity have also been apparent in Douglis-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and lodgepole pine forests in BC (4, 5). Although incidence of armillaria root disease and other damage has been sampled over a wide range of young managed stands in BC (9), quantitative data on incidence and impacts are needed for particular forest management areas (8). These are needed to determine local effects on timber supplies and to develop effective strategies and treatments for timber harvesting and silviculture reforestation to prevent or mitigate root disease damage. Much of the recent timber harvesting in the Invermere TSA has been directed to control or salvage mortality from mountain pine beetle (*Dendroctonus ponderosae* Hopk.) and Douglas-fir bark beetle (*Dendroctonus pseudotsugae* Hopk.) infestations. The objective of this project was to develop an inventory for the Invermere TSA of known and confirmed locations of *A. ostoyae* by harvested block (number), affected timber species (type group) and biogeoclimatic zone.

METHODS: Over a 23-year period from 1979 to 2002, *A. ostoyae* was surveyed in 561 blocks either harvested or designated for harvest. Block locations were recorded by National Topographic System (NTS) map number and harvesting opening number used in the Integrated Silviculture Information System (ISIS). Discrepancies in block areas were encountered using ISIS and ministry harvesting and inventory files. Harvested block sizes varied over several years due to changes in definition, technology, harvesting and treatment amendments, and ISIS system upgrades. Initially, block area was determined using harvest area estimates and dot grids. Later, areas were traversed by compass or by GPS measurements. For 376 of the harvested blocks, pre-harvest forest cover, type group and biogeoclimatic ecosystem classification (2) were available from the ISIS files. Locations for 499 surveyed blocks were mapped using Micro station.dgn format and data recorded in Excel 97 spreadsheets, recently converted to Access 97.

In each block, a ground survey covering approximately 5% of the area was undertaken. Parallel transects from a minimum of 50 m to approximately 200 m apart were run in a cardinal direction across each block, generally perpendicular to contour lines, and at least 25 m from the perimeter of the block. Trees and stumps were examined on contiguous plots 3 m wide by 25 m long on each side of the transect line. Based on recent work that showed extensive occurrence of *A. ostoyae* in roots (7), we assumed that a plot was infested if a characteristic mycelial fan (1) of *A. ostoyae* was detected under the bark of a tree or stump. In 10% of the initial surveyed blocks, representative samples were sent to the Pacific Forestry Centre, Victoria, to verify identifications.

RESULTS AND COMMENTS: Out of 561 blocks (30,138 ha) examined, 427 (23,244 ha) had evidence of *A. ostoyae*. Harvested blocks with armillaria root disease were widely distributed throughout the Invermere TSA (Fig. 1). In Table 1, occurrence of armillaria root disease is shown by block, type group and biogeoclimatic ecosystem classification. Armillaria root disease was common in the interior Douglis-fir (IDF) and montane spruce (MS) ecosystems. Table 2 shows the occurrence of armillaria root disease on surveyed blocks by timber type, including the average area infected per block. The weighted average of above ground, armillaria infection level for all blocks affected was 8.1% with a range in infection levels of between 0.0% and 26.0%. Blocks of lodgepole pine and/or Douglis-fir had the most frequent occurrence of armillaria root disease and highest percentages of infected area per block. Blocks harvested had an average preharvest forest age of 101 to 120 years (age class 6) with a range of ages between 61 and 250 plus years (age class 4 to 9). The frequent occurrence and sampling of these stands reflected harvesting activity in response to mountain pine beetle and Douglis-fir bark beetle infestations and in several instances armillaria root disease was not detected until 3 to 7 years after harvesting. Harvesting, particularly partial cutting, may have exacerbated armillaria root disease impacts (6). In several blocks, armillaria root disease induced a change in tree species from initially established Douglis-fir to less susceptible species such as lodgepole pine. In a few blocks, reforestation efforts failed. These blocks are recorded as not satisfactorily restocked (NSR). Detailed compilations of these surveys will be posted on the ministry Forest Practices Branch web site: http://www.for.gov.bc.ca/HFP/forsite/Forest_Health.htm.

The results of these surveys substantiate previous opinions about the widespread occurrence and potentially major impacts of armillaria root disease on forest productivity in the Invermere TSA. Our detailed inventory of

armillaria root disease by block and tree species will facilitate application of forest practices and/or treatments to mitigate damage and provide a valuable base for further work to determine long term impacts of the root disease. Currently, many legislative changes in forest management responsibilities are being implemented, with an increasing responsibility of industry. Government and industry must consider the current occurrences of armillaria root disease and future impacts on forest productivity to ensure stewardship and sustainability of forest resources.

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Figure 1. *Armillaria ostoyae* locations in the Invermere Timber Supply Area 1979-2002.

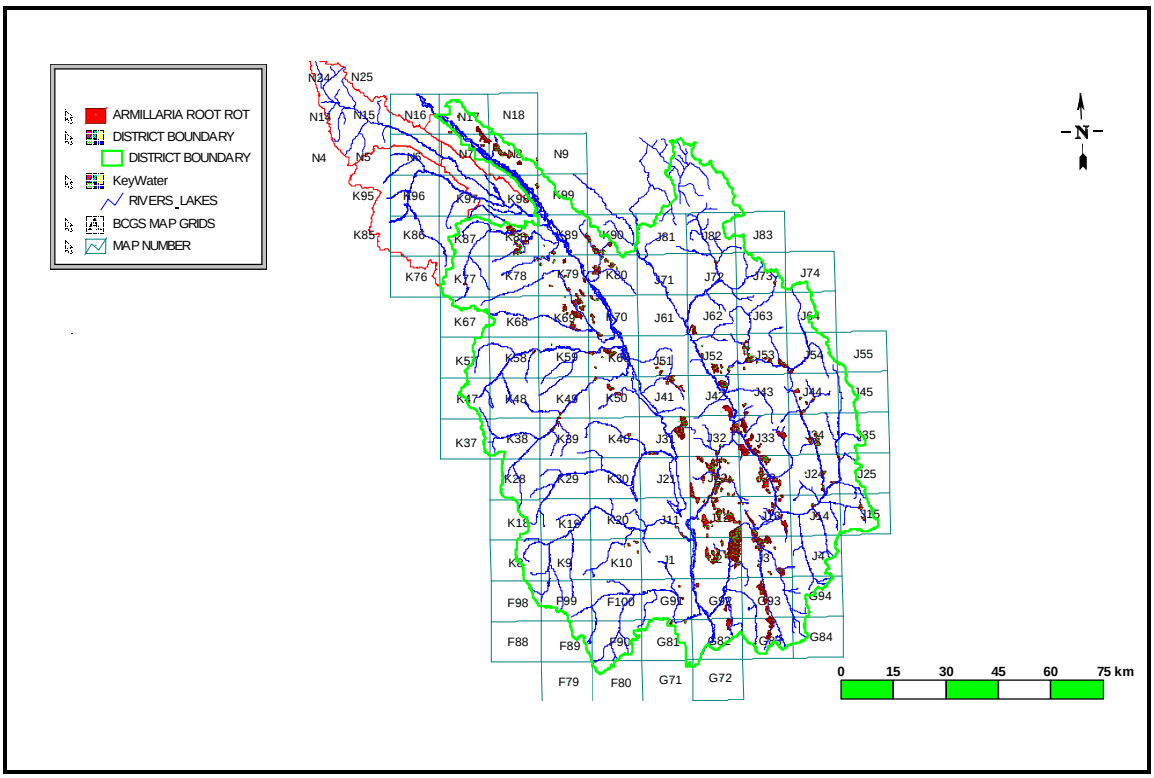

Table 1. Occurrence of armillaria root disease in the Invermere TSA, BC, by tree species[1] groups[2] and biogeoclimatic ecosystems[3].

Tree Species[(1)] (Type Group no.[2])	No. blocks examined	No. blocks with *A. ostoyae*	No. blocks without *A. ostoyae*	No. blocks with *A. ostoyae* by ecosystem[3]			
				ESSF	IDF	MS	ICH
None (None)	185	136	49	16	43	70	7
Fd(1)	35	31	4	4	23	4	0
FdCw(2)	3	3	0	1	0	2	0
FdH(3)	5	5	0	4	1	0	0
FdS(4)	11	10	1	1	1	7	1
FdPl(5)	63	47	16	1	14	32	0
FdPy(6)	1	1	0	0	1	0	0
FdL(7)	31	25	6	0	18	7	0
CwFd(10)	1	1	0	0	0	0	1
BS(20)	6	6	0	5	0	1	0
S(21)	3	2	1	1	0	1	0
SH(22)	9	7	2	1	0	4	2
SH(23)	1	0	1	0	0	0	0
SB(24)	12	6	6	6	0	0	0
SPl(25)	6	6	0	5	0	1	0
Pl(28)	61	43	18	4	2	37	0
PlFd(29)	84	64	20	0	12	48	4
PlS(30)	13	9	4	3	2	4	0
PlDecid(31)	1	1	0	0	0	1	0
Py(32)	2	2	0	0	2	0	0
LFd(33)	12	7	5	0	3	4	0
L(34)	12	11	1	0	0	6	5
AtConif(41)	2	2	0	2	0	0	0
AtDecid(42)	2	2	0	0	0	2	0
TOTAL	561	427	134	54	122	231	20

[1]Tree species: Fd Douglis-fir, Pl lodgepole pine, Cw western redcedar, H western hemlock, S spruce (*Picea* spp. hybrid), Py ponderosa pine, L western larch, B *Abies* sp., Decid deciduous species, At trembling aspen, Conif coniferous sp. For scientific names, see reference (1).

[2]Numerals indicate ministry inventory type groups.

[3]Ecosystem: ESSF Engelmann spruce subalpine fir, IDF interior Douglas-fir, MS montane spruce, and ICH interior cedar hemlock. For descriptions, see reference (2).

Table 2. Occurrence of *Armillaria ostoyae* by tree species, type group per block.

Tree species (Type group)[1]	Total blocks surveyed No.	Total blocks surveyed Ha	Blocks with *A. ostoyae* Ha	Per cent block area infested by *A. ostoyae*
None (none)	185	7465	4073	8.0%
Fd(1)	35	2570	2344	10.6%
FdCw(2)	3	60	60	10.7%
FdH(3)	5	219	219	2.6%
FdS(4)	11	748	626	11.4%
PdPl(5)	63	3870	3336	12.1%
FdPy(6)	1	86	86	9.5%
FdL(7)	31	2418	2114	14.2%
CwFd(10)	1	16	16	24.0%
BS(20)	6	176	176	8.4%
S(21)	3	180	80	7.2%
SFd(22)	9	517	454	4.9%
SH(23)	1	7	0	0.0%
SB(24)	12	291	219	2.5%
SPl(25)	6	329	329	5.5%
Pl(28)	61	4125	3247	5.6%
PlFd(29)	84	4036	3215	9.3%
PlS(30)	13	1227	962	2.0%
PiDecid(31)	1	59	59	26.0%
Py(32)	2	49	49	6.0%
LFd(33)	12	482	381	8.4%
L(34)	12	990	981	7.7%
AtConif(41)	2	204	204	14.0%
AtDecid(42)	2	14	14	3.0%
TOTAL	561	30138	23244	8.1%

[1]For Species abbreviation see Table 1.

[2]Under Tree Species, Type Group Column, None (None) indicates Blocks lacking pre-harvest forest information.

LIST OF 2002 CPDS AUTHORS IN ALPHABETICAL ORDER

LIST OF FIGURES