2014

THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

CANADIAN PLANT DISEASE SURVEY

DISEASE HIGHLIGHTS

SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE

INVENTAIRE DES MALADIES DES PLANTES AU CANADA

APERÇU DES MALADIES

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

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

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Contents: **DISEASE HIGHLIGHTS** - 2013 GROWING SEASON
(+ earlier years for historical significance)

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

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

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

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

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INDEX – TITLES AND AUTHORS / TITRES ET AUTEURS

DIAGNOSTIC LABORATORIES/ LABORATOIRES DIAGNOSTIQUES

CEREALS / CÉRÉALES

VEGETABLES/LÉGUMES

Diagnostic Laboratories / Laboratoires Diagnostiques

CROP: Commercial Crops – Plant Health Laboratory Report
LOCATION: British Columbia

NAMES AND AGENCY:
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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE PLANT HEALTH LABORATORY IN 2013.

ABSTRACT: The Plant Health Laboratory provides diagnoses and disease management information for diseases and insects on crops from British Columbia. In 2013, we received 920 samples of Christmas trees, field crops, greenhouse vegetable and floriculture crops, herbaceous and woody ornamentals, fruit and speciality crops. New detections for B.C. included downy mildew (*Plasmopara obducens*) in *Impatiens walleriana*, leaf blotch (*Gnomonia comari* Karsten) in strawberry, club root (*Plasmodiophora brassicae*) in wasabi, downy mildew (*Pseudoperonospora humili*) in hops and powdery mildew (*Erysiphe cruciferatum*) in wasabi. These detections were confirmed by molecular tests. Downy mildew (*Peronospora sparsa*) was detected in rose samples from one nursery. High numbers of *Tobacco/Tomato mosaic virus* infections were detected in one organic vegetable greenhouse.

METHODS: The B.C. Ministry of Agriculture Plant Health Laboratory provides diagnoses and disease managements information for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes, and insect pests of agricultural crops grown in British Columbia. The following data reflect samples submitted to the laboratory by ministry staff, growers, agri-businesses, municipalities and master gardeners. Diagnoses were accomplished by microscopic examiniation, culturing onto artificial media, biochemical indentification of bacteria using BIOLOG®, serological testing of viruses, fungi and bacteria with micro-well and memberane based enzyme-linked immunosorbent assay (ELISA). Molecular techniques Polymerase Chain reaction (PCR) – conventional and/or real time) were used for some species diagnoses. Some specimens were referred to other laboratories for identification or confirmation of a diagnosis.

RESULTS AND COMMENTS: The year 2013 had a wet spring with heavy rains until mid June. After this the weather remained dry with clear sunny days into early fall. Weather conditions were conducive to the development of fungal and bacterial diseases. The lab received 920 samples between January 1 and November 30, 2013. Summaries of diseases and their causal agents diagnosed on crop samples submitted to the laboratory are presented in Tables 1 to 13 listed under 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, genetic abnormalities, environmental and chemical stresses including herbicide damage, fruit abortion due to lack of pollination, poor samples, insect-related injury and damage where no conclusive causal factor was indentified. The data are based on observation in the sample and new host/pathogen detections were not confirmed by Koch's postulates. Where possible, such detections were confirmed by more than one test.

Table 1.0 Summary of diseases diagnosed on b**erry crop** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Blackberry	Downy mildew	*Peronospora sparsa*	1
Blueberry	Anthracnose	*Colletotrichum acutatum*	1
	Armillaria root rot	*Armillaria nabsnona*	1
		Armillaria sp.	4
		Armillaria ostoyae	1
	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Blueberry Scorch Virus	*Blueberry scorch virus*	4
	Blueberry Shock Virus	*Blueberry shock virus*	12
	Crown and stem canker	*Phomopsis* sp.	5
	Crown gall	*Agrobacterium tumefaciens*	1
	Foliar blight	*Botrytis cinerea*	2
	Fruit rot	*Botrytis cinerea*	1
		Colletotrichum acutatum and *Botrytis cinerea*	1
	Godronia canker	*Godronia cassandrae*	1
	Leaf spot	*Botrytis cinerea*	2
		Gloeosporium sp.	1
		Phomopsis sp.	1
		Phyllosticta sp.	1
	Mummy berry	*Monilinia vaccinii-corymbosi*	1
	Nematode contribution	*Paratrichodorus* sp. and *Pratylenchus* sp.	1
		Pratylenchus sp.	1
	Nematode damage	*Paratrichodorus* sp.	1
	Phomopsis canker	*Phomopsis* sp.	8
	Root rot	*Phytophthora cinnamomi*	3
		Phytophthora sp.	13
	Stem canker	*Coniothyrium* sp.	4
Cranberry	Bitter rot	*Colletotrichum gloeosporioides*	1
	Early rot	*Phyllosticta* sp.	1
	Leaf spot	*Allantophomopsis* sp. and *Colletotrichum* sp.	1
	Leaf spot	*Allantophomopsis* sp.	1
	Stem canker and dieback	*Cytospora* sp.	1
	Upright dieback	*Phomopsis* sp.	3
Raspberry	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Nematode contribution	*Pratylenchus* sp. and *Xiphinema* sp.	2
		Xiphinema sp.	1
	Nematode damage	*Paratylenchus* sp.	1
		Pratylenchus sp.	2
	Root rot	*Phytophthora* sp.	4
	Verticillium wilt	*Verticillium dahliae*	1
Strawberry	Black root rot	*Cylindrocarpon* sp. and *Fusarium* sp.	2
	Crown / root rot	*Rhizoctonia* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Strawberry	Leaf blotch	*Gnomonia comari* *	2
	Leaf spot	*Gnomonia comari* * and *Robillarda* sp.	1
	Nematode damage	*Pratylenchus* sp.	4
		Pratylenchus sp. and *Xiphinema* sp.	1
	Root rot	*Phytophthora* sp.	3
		Oomycete	1
		Pratylenchus sp.	1
		Rhizoctonia sp. and *Pythium* sp.	1
		Rhizoctonia fragariae	1
	Verticillium wilt	*Verticillium dahliae*	1
		Verticillium sp.	2

*****First detection in B.C.

SAMPLES WITH DISEASE	110
SAMPLES WITH ABIOTIC DISORDERS	315
TOTAL SUBMISSIONS	425

Table 2.0 Summary of diseases diagnosed on **Christmas tree** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Abies fraseri	Root rot	*Phytophthora* sp.	1
Abies grandis	Interior needle blight	*Mycosphaerella* sp.	1
	Needle blight	*Hormonema meriodes*	1
Pseudotsuga menziesii	Needle blight	*Hormonema* sp.	1
	Needle blight	*Hormonema* sp. and *Phyllosticta* sp.	1
	Phomopsis canker	*Phomopsis* sp.	2

SAMPLES WITH DISEASE	6
SAMPLES WITH ABIOTIC DISORDERS	3
TOTAL SUBMISSIONS	9

Table 3.0 Summary of diseases diagnosed on **field crop** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Fescue	Basal anthracnose	*Colletotrichum graminicola*	1
	Leaf blight	*Fusarium* sp.	1
Orchard grass	Basal anthracnose	*Colletotrichum graminicola*	1
	Leaf blight	*Fusarium* sp.	1
Rye grass	Foliar blight	*Fusarium* sp.	1

SAMPLES WITH DISEASE	3
SAMPLES WITH ABIOTIC DISORDERS	2
TOTAL SUBMISSIONS	5

Table 4.0 Summary of diseases diagnosed on **field vegetable** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Artichoke (Jerusalem)	White mold	*Sclerotinia sclerotiorum*	1
Asparagus	Botrytis blight	*Botrytis cinerea*	1
Beet	Leaf spot	*Ramularia* sp.	1
	Botrytis root rot	*Botrytis cinerea*	1
	Phoma root rot	*Phoma betae*	3
Broccoli	Downy mildew	*Hyaloperonospora parasitica*	1
Cabbage	Leaf spot	*Alternaria* sp.	1
Carrot	Nematode damage	*Meloidogyne* sp.	1
Cauliflower	Club root	*Plasmodiophora brassicae*	1
Chive	Root rot	*Rhizoctonia solani*	1
Cucumber	Damping off	*Pythium* sp.	1
Eggplant	Verticillium wilt	*Verticillium dahliae*	1
	Root rot	Oomycete	1
Gailan	Downy mildew	*Hyaloperonospora parasitica*	1
Garlic	Blue mold	*Penicillium* sp.	1
	Botrytis bulb rot	*Botrytis porri*	1
	Garlic rust	*Puccinia porri*	1
	Purple blotch	*Alternaria porri*	1
	Scale blotch	*Embellisia allii*	1
	White rot	*Sclerotium cepivorum*	1
Leek	Nematode damage	*Pratylenchus* sp.	1
	Root rot	*Pythium* sp.	1
	Rust	*Puccinia allii*	1
Parsnip	Cercosporoid leaf blight	*Cercospora pastinacae*	1
Pepper	Stem rot	*Fusarium solani*	1
Potato	Black scurf	*Rhizoctonia solani*	5
	Common scab	*Streptomyces scabies*	1
	Early blight	*Alternaria solani*	1
	Leaf spot	*Botrytis cinerea*	1
	Silver scurf	*Helminthosporium solani*	2
	Soft rot	*Pectobacterium carotovorum* ss. *carotovorum*	1
Rhubarb	Nematode damage	*Pratylenchus* sp.	2
Sui choy	Black rot	*Xanthomonas campestris* pv. *campestris*	1
Tomato	Bacterial canker	*Clavibacter michiganensis* pv. *michiganensis*	2
	Fruit spot	*Alternaria alternata*	1
	Powdery mildew	*Oidiopsis* sp.	1
Watermelon	Fusarium wilt	*Fusarium oxysporum*	1
Zucchini	Anthracnose	*Colletotrichum orbiculare*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Zucchini	Leaf blight	*Alternaria* sp.	1
	Powdery mildew	*Sphaerotheca fuligenea*	1
	Scab	*Cladosporium cucumerinum*	2
	Soft rot	*Pectobacterium carotovorum* ssp. *carotovorum*	1

SAMPLES WITH DISEASE 52
SAMPLES WITH ABIOTIC DISORDERS 20
TOTAL SUBMISSIONS 72

Table 5.0 Summary of diseases diagnosed on f**orest nursery** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Pseudotsuga menziesii	Root rot	*Cylindrocarpon* sp.	1
	Root rot	*Fusarium* sp.	2

SAMPLES WITH DISEASE 2
SAMPLES WITH ABIOTIC DISORDERS 9
TOTAL SUBMISSIONS 11

Table 6.0 Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Alstromeria	Impatiens necrotic spot virus	*Impatiens necrotic spot virus*	3
Begonia	Stem rot	*Rhizoctonia solani*	1
Brassica oleracea	Downy mildew	*Hyaloperonospora parasitica*	1
Chrysanthemum	Tomato spotted wilt virus	*Tomato spotted wilt virus*	3
Cordyline	Leaf spot	*Alternaria* sp. and *Phyllosticta* sp.	1
	Root rot	Oomycete	1
Cosmos	Foliar blight	*Itersonilia perplexans*	1
	White smut	*Entyloma calendulae*	1
Impatiens	Downy mildew	*Plasmopara obducens**	4
	Rhizoctonia blight	*Rhizoctonia solani*	1
Impatiens walleriana	Downy mildew	*Plasmopara obducens**	1
Iris germanica	Ink spot	*Bipolaris iridis*	1
Pelargonium peltatum	Leaf spot	*Botrytis cinerea*	1
Physalis alkekengi	Bacterial blight	*Pseudomonas syringae*	1
Salvia	Leaf spot	*Pseudomonas* sp.	1
Sedum	Root rot	Oomycete	1
Trachycarpus	Leaf spot	*Pestalotiopsis* sp.	1

***** First detection in B.C.

SAMPLES WITH DISEASE 24
SAMPLES WITH ABIOTIC DISORDERS 20
TOTAL SUBMISSIONS 44

Table 7.0 Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Cucumber	Black root rot	*Phomopsis sclerotioides*	1
	Downy mildew	*Pseudoperonospora cubensis*	1
	Root rot	*Pythium* sp.	1
Eggplant	Damping off	*Pythium myriotylum*	1
Pepper	Bacterial spot	*Xanthomonas campestris*	1
	Crown and stem infection	*Fusarium oxysporum*	1
	Damping off	*Pythium myriotylum*	1
	Damping off	*Pythium* sp.	1
Pepper (seedling)	Fusarium stem rot	*Fusarium solani*	1
	Necrotic leaf spot	*Tomato spotted wilt virus*	1
Tomato	Fusarium wilt	*Fusarium oxysporum* f.sp. *lycopersici*	1
	Leaf mosaic/mottle	*Tobacco/Tomato mosaic virus*	25
	Leaf mold	*Cladosporium fulvum*	1
	Leaf mottle	Potyvirus	5
	Root rot	*Pythium* sp.	1
	Stem canker	*Botrytis cinerea*	2
	Stem rot	*Pectobacterium carotovorum* ssp. *carotovorum*	1
	Leaf spot	*Pseudomonas syringae* pv. *syringae*	1

SAMPLES WITH DISEASE	47
SAMPLES WITH ABIOTIC DISORDERS	23
TOTAL SUBMISSIONS	70

Table 8.0 Summary of diseases diagnosed on **herbaceous perennial** samples submitted to the B.C. ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Buxus	Boxwood blight	*Cylindrocladium pseudonaviculatum*	4
	Foliar blight	*Volutella* sp. and *Clonostachys* sp.	3
	Leaf and stem blight	*Volutella* sp., *Clonostachys* sp., and *Macrophoma* sp.	1
	Leaf blight	*Clonostachys* sp.	2
	Leaf spot	*Phyllosticta* sp.	3
	Volutella blight	*Volutella buxi*	6
Carex oshimensis	Anthracnose	*Colletotrichum graminicola*	1
Carex tenuiculmis	Root rot	Oomycete	1
Chrysanthemum	Cottony stem rot	*Sclerotinia sclerotiorum*	1
Clematis	Leaf spot	*Botrytis cinerea*	1
	Leaf spot	*Cladosporium* sp.	1
Dianthus	Stem and crown rot	*Fusarium proliferatum*	1
Gaultheria	Leaf spot	*Pseudomonas* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Lamium	Root rot	Oomycete	1
Parthenocissus tricuspidata	Downy mildew	*Plasmopara* sp.	1
Phlox	Downy mildew	*Peronospora phlogina*	1
	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Rosa	Black spot	*Marssonina rosae*	2
	Botrytis blight	*Botrytis cinerea*	1
	Brand canker	*Coniothyrium wernsdorffiae*	1
	Downy mildew	*Peronospora sparsa*	9
	Powdery mildew	*Podosphaera pannosa*	3
Sedum	Powdery mildew	*Erysiphe polygonii*	1

SAMPLES WITH DISEASE 43
SAMPLES WITH ABIOTIC DISORDERS 2
TOTAL SUBMISSIONS 45

Table 9.0 Summary of diseases diagnosed on **nut crop** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Hazelnut	Eastern Filbert Blight	*Anisogramma anomala*	1

SAMPLES WITH DISEASE 1
SAMPLES WITH ABIOTIC DISORDERS 2
TOTAL SUBMISSIONS 3

Table 10.0 Summary of diseases diagnosed on **specialty crop** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Hops	Alternaria cone disorder	*Alternaria alternata*	2
	Leaf spot	*Pseudomonas syringae*	1
	Downy mildew	*Pseudoperonospora humuli**	1
Wasabi	Club root	*Plasmodiophora brassicae**	6
	Crown and root rot	*Phytophthora* sp. and *Pythium irregulare*	1
		Rhizoctonia solani	1
	Powdery mildew	*Erysiphe cruciferarum**	1
	Root rot	Oomycete	2
	Soft rot	*Pectobacterium carotovorum* ss *carotovorum*	2

*****First detection in B.C.

SAMPLES WITH DISEASE 12
SAMPLES WITH ABIOTIC DISORDERS 2
TOTAL SUBMISSIONS 14

Table 11.0 Summary of diseases diagnosed on **sports field, golf course greens and lawn** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

SAMPLE SITE	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Green	Fairy ring	Basidiomycete	2
	Leaf blight	*Leptosphaerulina* sp.	1
	Nematode damage	*Helicotylenchus* sp., *Meloidogyne* sp. and *Mesocriconema* sp.	3
	Nematode damage	*Helicotylenchus* sp. and *Meloidogyne* sp.	3
	Nematode damage	*Paratylenchus* sp.	1
	Root rot	*Pythium* sp.	3
	Root damage	*Pythium* sp. and *Helicotylenchus* sp.	1
Lawn	Fairy ring	Basidiomycete	1
	Foliar anthracnose	*Colletotrichum graminicola*	1
	Leaf spot	*Leptosphaerulina* sp.	1
	Nematode contribution	*Helicotylenchus* sp. and *Mesocriconema* sp.	1
	Red thread	*Laetisaria fuciformis*	1
Sports field	Foliar blight	*Leptosphaerulina* sp.	1
	Root rot	*Pythium* sp.	1

SAMPLES WITH DISEASE	21
SAMPLES WITH ABIOTIC DISORDERS	7
TOTAL SUBMISSIONS	28

Table 12.0 Summary of diseases diagnosed on **tree fruit and grape** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Apple	Twig canker	*Botryosphaeria* sp.	1
	Anthracnose	*Cryptosporiopsis curvispora*	1
Cherry	Crown gall	*Agrobacterium tumefaciens*	1
	Cytospora canker	*Cytospora* sp.	1
	Nematode damage	*Pratylenchus* sp. and *Xiphinema* sp.	1
Cherry (sour)	Anthracnose	*Colletotrichum acutatum*	1
Grape	Cane dieback	*Botryodiplodia* sp.	1
	Nematode contribution	*Meloidogyne* sp. and *Xiphinema* sp.	1
	Stem canker	*Diaporthe* sp.	2
Nectarine	Coryneum blight	*Wilsonomyces carpophilus*	1
Peach	Coryneum blight	*Wilsonomyces carpophilus*	1
	Leaf curl	*Taphrina deformans*	1
Pear	Leaf spot	*Hendersonia* sp.	1
	Fire blight	*Erwinia amylovora*	1

SAMPLES WITH DISEASE	15
SAMPLES WITH ABIOTIC DISORDERS	15
TOTAL SUBMISSIONS	30

Table 13.0 Summary of diseases diagnosed on **woody ornamental** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2013.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	NO.
Abies	Foliar blight	*Hormonema* sp.	1
	Swiss needle cast	*Phaeocrytopus nudus*	1
Acer	Anthracnose	*Colletotrichum* sp. and *Diplodina* sp.	1
	Anthracnose	*Kabatiella apocrypta*	1
	Leaf spot	*Cylindrosporium* sp.	1
	Leaf spot	*Hendersonia* sp.	1
	Powdery mildew	*Sawadaea* sp.	1
	Stem /twig dieback	*Phomopsis* sp.	1
	Stem canker	*Cytospora* sp.	1
	Tar spot	*Rhytisma punctatum*	1
	Twig die back	*Diplodina* sp.	1
Acer japonica	Anthracnose	*Kabatiella* sp. and *Colletotrichum* sp.	1
	Canker	*Botryodiplodia* sp.	1
	Phytophthora crown rot	*Phytophthora* sp.	1
Acer platanoides	Anthracnose	*Apiognomonia* sp.	1
	Powdery mildew	*Sawadaea tulasnei*	2
Arbutus menziesii	Cytospora canker	*Cytospora* sp.	1
	Stem canker	*Dothiorella* sp.	1
	Tar spot	*Rhytisma* sp.	1
Buxus	Boxwood blight	*Cylindrocladium pseudonaviculatum*	1
	Volutella blight	*Volutella* sp. and *Clonostachys* sp.	1
Catalpa	Bacterial blight	*Pseudomonas syringae*	1
	Verticillium wilt	*Verticillium dahliae*	1
Cedrus	Tip blight	*Sirococcus* sp.	1
Cedrus atlantica	Shoot blight	*Sirococcus* sp.	1
Cedrus deodora	Needle blight	*Ceuthospora* sp.	1
Chamaecyparis nootkatensis	Foliar blight	*Seiridium unicornis* and *Pestalotiopsis* sp.	1
Cornus	Anthracnose	*Discula destructiva*	3
Cotoneaster	Fire blight	*Erwinia amylovora*	1
Crataegus	Leaf spot	*Entomosporium mespili*	1
Cupressocyparis leylandii	Leaf and twig blight	*Pestalotiopsis funerea*	1
Juniperus	Seiridium canker	*Seiridium* sp.	1
Magnolia	Anthracnose	*Colletotrichum gloeosporioides*	1
	Anthracnose	*Sphaceloma* sp.	1
	Bacterial blight	*Pseudomonas syringae*	2
	Stem canker	*Phomopsis* sp.	1
Malus	Bacterial canker	*Pseudomonas syringae*	1
	Stem canker	*Phoma* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	NO.
Paeonia	Leaf blotch	*Cladosporium paeoniae*	1
Philadelphus	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
Picea	Coniothyrium canker	*Coniothyrium* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	2
	Stem canker	*Gelatinosporium* sp.	1
Pinus	Needle blight	*Sclerophoma* sp.	2
	Needle cast	*Lophodermella concolor*, *Hendersonia* sp. and *Sclerophoma* sp.	1
Populus	Cytospora canker	*Cytospora* sp.	1
	Leaf spot	*Alternaria alternata* and *Discula* sp.	1
Prunus	Phomopsis canker	*Phomopsis* sp.	1
Prunus padus	Nectria canker	*Nectria cinnabarina*	1
Pseudotsuga menziesii	Damping off	*Fusarium* sp. and *Cylindrocarpon* sp.	1
	Damping off	*Fusarium* sp.	1
	Needle cast	*Rhabdocline pseudotsugae*	1
Quercus	Anthracnose	*Discula* sp.	1
Quercus macrocarpa	Anthracnose	*Discula quercina*	1
Quercus robur	Anthracnose	*Apiognomonia* sp.	1
Ribes sanguineum	Anthracnose	*Drepanopeziza ribis*	1
Rhododendron	Armillaria root rot	*Armillaria* sp.	1
	Leaf spot	*Seimatosporium* sp.	1
Rosa	Alternaria leaf spot	*Alternaria* sp.	5
	Black spot	*Diplocarpon rosae*	10
	Downy mildew	*Peronospora sparsa*	22
	Powdery mildew	*Podosphaera* sp.	10
	Rust	*Phragmidium* sp.	1
Salix	Root rot	Oomycete	1
Salix babylonica	Black canker	*Glomerella miyabeana*	1
	Leaf spot	*Gloeosporium* sp.	1
	Twig dieback	*Phomopsis* sp.	1
Syringa	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Leaf spot	*Colletotrichum gloeosporioides*	1
	Leaf spot	*Phyllosticta* sp.	1
	Root rot	Oomycete	1
Taxus	Root rot	*Phytophthora* sp.	2
Taxus baccata	Root rot	*Phytophthora* sp.	1
Thuja	Coryneum blight	*Seiridium cardinale*	2
	Foliar blight	*Pestalotiopsis* sp.	2
	Keithia blight	*Didymascella thujina*	1
	Mold (on cuttings)	*Penicillium* sp. and *Botrytis cinerea*	1
	Root rot	*Phytophthora* sp.	1
	Seiridium blight	*Seiridium cardinale*	3
	Shoot blight	*Sirococcus* sp. and *Sclerophoma* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	NO.
Thuja	Stem and leaf blight	*Pestalotiopsis* sp.	1
Thuja occidentalis	Foliar blight	*Seimatosporium* sp.	1
	Foliar blight	*Pestalotiopsis* sp.	3
Thuja plicata	Coryneum blight	*Seiridium cardinale*	2
	Keithia blight	*Didymascella thujina*	1
	Twig blight	*Pestalotiopsis* sp.	1
Vaccinium	Anthracnose	*Colletotrichum acutatum*	1

SAMPLES WITH DISEASE	145
SAMPLES WITH ABIOTIC DISORDERS	05
TOTAL SUBMISSIONS	150

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

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL ORNAMENTAL NURSERY CROPS IN BRITISH COLUMBIA IN 2013.

ABSTRACT: Diseases of commercial nursery ornamental crops and causal agents identified by Elmhirst Diagnostics & Research and Karlsson Crop Consulting in coastal British Columbia in 2013 are listed. No new pathogens were recorded in 2013. Corrections to the report on 2012 are submitted for the causal agents of anthracnose of *Gaultheria procumbens* and downy mildew of *Parthenocissu*s.

METHODS: Elmhirst Diagnostics & Research (EDR) provides diagnosis of diseases of commercial horticultural crops in British Columbia caused by fungi, bacteria, viruses, plant parasitic nematodes, arthropod and mite pests and abiotic factors. Diagnosis is primarily by association of symptoms with presence of a pathogen known to cause these symptoms, determined by microscopic examination. If the diagnosis is uncertain or if confirmation is needed, fungal and bacterial pathogens are isolated in pure culture for identification by morphological characteristics, or plant tissue or cultured specimens are sent to other certified laboratories for identification by ELISA, PCR or DNA sequencing.

RESULTS AND COMMENTS: A summary of diseases and causal agents diagnosed on ornamental crops is presented in Table 1. Problems caused by abiotic factors, *i.e.,* nutrient or pH imbalance, water stress, physiological response to growing conditions, genetic abnormalities and environmental and chemical stresses including herbicide damage, are not included.

Two corrections to the report on 2012 (Elmhirst, 2013) should be noted: anthracnose of *Gaultheria procumbens* is caused by *Colletotrichum gloeosporioides*, not *C. acutatum* and downy mildew of *Parthenocissus* is caused by a *Plasmopara* species, not a *Peronspora* sp. These diseases and pathogens were listed correctly in the report on 2011 (Elmhirst, 2012) and below.

Table 1: Diseases diagnosed in 2013 on commercial ornamental nursery crops in British Columbia by Elmhirst Diagnostics & Research and Karlsson Crop Consulting.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Abies procera	Root rot	*Phytophthora* sp.	1
Acer circinatum	Bacterial leaf spot/ blight	*Pseudomonas syringae*	1
Acer circinatum	Botrytis blight	*Botrytis cinerea*	1
Acer circinatum	Powdery mildew	*Sawadaea* sp.	3
Acer ginnala	Powdery mildew	*Sawadaea* sp.	1
Acer glabrum	Bacterial leaf spot/ blight	*Pseudomonas syringae*	1
Acer macrophyllum	Powdery mildew	*Sawadaea bicornis*	4
Acer palmatum 'Crippsii'	Botrytis blight	*Botrytis cinerea*	1
Acer rubrum 'Red Rocket'	Bacterial leaf spot/ blight	*Pseudomonas syringae*	1
Acer sp. seedlings	Bacterial leaf spot/ blight	*Pseudomonas syringae*	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Acer tataricum 'Hotwings'	Bacterial leaf spot/ blight	*Pseudomonas syringae*	2
Acer tataricum 'Hotwings'	Botrytis blight	*Botrytis cinerea*	1
Agave 'Baja'	Crown rot	Soft rot bacteria	1
Ajuga tenorii 'Chocolate Chip'	Botrytis blight	*Botrytis cinerea*	1
Alnus rubra	Rust	*Melampsoridium* sp.	2
Amelanchier alnifolia	Powdery mildew	*Podosphaera clandestine*	1
Amelanchier x grandiflora 'Autumn Brilliance'	Rust	*Gymnosporangium* sp.	1
Anaphalioides hookeri	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Andromeda polifolia 'Blue Ice'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Andropogon scoparius	Crown and stem canker	*Curvularia andropoginis*	1
Aquilegia Formosa	Powdery mildew	*Erysiphe* sp.	1
Arbus unedo	Root rot/wilt and leaf spot	*Phytophthora cinnamomi*	2
Arbutus menziesii	Root rot/wilt	*Phytophthora cinnamomi*	3
Arctostaphylos uva-ursi	Leaf spot	*Phoma* sp.	1
Arctostaphylos uva-ursi	Anthracnose	*Colletotrichum gloeosporioides*	2
Arctostaphylos uva-ursi	Bacterial leaf spot	*Pseudomonas* sp.	1
Arctostaphylos uva-ursi	Black root rot	*Thielaviopsis basicola*	1
Arctostaphylos uva-ursi 'Vancouver Jade'	Bacterial blight/stem canker	*Pseudomonas* sp.	1
Arctostaphylos uva-ursi 'Vancouver Jade'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Arrhenatherum elatius var. bulbosum 'Variegatum'	Rust	*Puccinia* sp.	2
Aruncus Sylvester	Bacterial leaf spot /shothole	*Pseudomonas syringae*	1
Betula glandulosa	Rust	*Melampsoridium botulinum*	1
Betula nigra 'Summer Cascade'	Rust	*Melampsoridium botulinum*	1
Betula occidentalis	Rust	*Melampsoridium botulinum*	1
Betula papyrifera	Rust	*Melampsoridium botulinum*	1
Betula platyphylla 'Dakota Pinnacle'	Bacterial leaf spot	*Pseudomonas* sp.	1
Betula platyphylla 'Dakota Pinnacle'	Rust	*Melampsoridium botulinum*	1
Buddleia davidii 'Santana'	Bacterial leaf blight	*Pseudomonas syringae*	1
Buxus sinica x sempervirens 'Green Velvet'	Box blight	*Cylindrocladium buxicola*	2

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Buxus sinica x sempervirens 'Green Velvet'	Volutella blight	*Volutella buxi*	3
Buxus x 'Calgary'	Volutella blight	*Volutella buxi*	1
Calamagrostis x acutiflora 'Eldorado', 'Karl Foerster', 'Overdam'	Rust	*Puccinia* sp.	4
Calluna vulgaris	Tip blight	*Pestalotia* sp.	1
Calluna vulgaris 'Alicia', 'Battle of Arnhem', 'C.D. Eason', 'Devon', 'Kinlochruel', 'Susanne'	Root rot	*Phytophthora* sp.	6
Calluna vulgaris 'Darkness', 'Sir John Charrington'	Rhizoctonia blight	*Rhizoctonia* sp.	1
Campanula x 'Kent Belle'	Root rot/dead plants	*Phytophthora* sp.	1
Campanula x 'Kent Belle'	Yellow streaked, white-edged leaves	Unidentified	1
Carex testacea	Rust	*Puccinia* sp.	1
Carthamus sp.	Root lesion nematode	*Pratylenchus penetrans*	1
Celastrus scandens 'Autumn Revolution'	Bacterial leaf spot/shothole	*Pseudomonas* sp.	1
Clematis 'Josephine Evijohill' and assorted	Clematis wilt	*Phoma clematidina*	4
Clematis 'Parisienne'	Distorted leaves, vein-clearing	Unidentified	1
Clematis sp.	Clematis wilt	*Phoma clematidina*	2
Clematis sp. (assorted varieties)	Botrytis blight	*Botrytis cinerea*	7
Clematis x 'Abilene'	Bacterial leaf spot	*Pseudomonas syringae*	1
Clematis x 'Abilene'	Botrytis blight	*Botrytis cinerea*	1
Clematis x 'Abilene'	Clematis wilt	*Phoma clematidina*	1
Clematis x 'Chevalier'	Botrytis blight	*Botrytis cinerea*	1
Coreopsis rosea 'Sweet Dreams'	Botrytis blight	*Botrytis cinerea*	1
Coreopsis x 'Jethro Tull'	Botrytis blight	*Botrytis cinerea*	1
Coreopsis x 'Jethro Tull'	Light-coloured leaf spots with dark rings	Unidentified	1
Cornus alba 'Hessei', 'Gouchaultii', 'Ivory Halo'	Bacterial leaf spot	*Pseudomonas syringae*	2
Cornus alba 'Ivory Halo', 'Kelseyi', 'Sibirica', 'Summer Gold'	Septoria leaf spot	*Septoria cornicola*	4
Cornus canadensis	Black root rot	*Thielaviopsis basicola*	3
Cornus kousa 'Midwinter Fire'	Septoria leaf spot	*Septoria cornicola*	1
Cornus nuttallii	Bacterial leaf spot	*Pseudomonas syringae*	1
Cornus nuttallii	Powdery mildew	*Erysiphales*	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Cornus nuttallii	Septoria leaf spot	*Septoria cornicola*	1
Cornus stolonifera	Septoria leaf spot	*Septoria cornicola*	1
Cotoneaster dammeri	Fire blight	*Erwinia amylovora*	1
Cupressus sp.	Leaf blight	*Phomopsis occulta* (weak pathogen or saprophye on dead inner leaves)	1
Cupressus sp.	Phomopsis blight/shoot dieback	*Phomopsis* sp.	1
Cupressus sp.	Root and crown rot	*Phytophthora* sp.	2
Cupressus sp.	Tip blight	*Pestalotia* sp.	1
Echinacea purpurea 'Double Decker', 'Firebird'	Distorted leaves, stunted plants	Unidentified	1
Eleagnus commutate	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Erica carnea 'Kramer's Red', 'Robert Jan'	Rhizoctonia blight/shoot dieback	*Rhizoctonia solani*	2
Erica carnea 'Kramer's Red', 'Robert Jan', 'Springwood Pink', Springwood White', 'Wintersonne'	Root rot/dieback	*Pythium* sp. / *Phytophthora* sp.	1
Escallonia x 'Newport Dwarf'	Root rot/stem canker	*Phytophthora* sp.	1
Euonymus fortunei 'Butterscotch'	Bacterial blight	*Pseudomonas syringae*	1
Euonymus japonicus 'Microphyllus Albovariegatus', 'Rokujo Variegata'	Bacterial blight	*Pseudomonas syringae*	2
Euphorbia x martinii 'Ascot Rainbow'	Powdery mildew	*Podosphaera euphorbiae*	1
Euphorbia x martinii 'Ascot Rainbow''	Botrytis blight	*Botrytis cinerea*	1
Ficus carica 'Chicago Hardy'	Irregular, yellow leaf blotches	Fig mosaic virus? (not tested)	1
Forsythia x intermedia 'Fiesta'	Bacterial blight	*Pseudomonas syringae*	1
Fragaria chiloensis	Powdery mildew	*Podosphaera aphanis*	1
Gaillardia aristata 'Arizona Sun'	White smut	*Entyloma polysporum*	1
Gardenia jasminoides 'Kleim's Hardy', 'Summer Snow'	Bacterial blight	*Pseudomonas* sp.	2
Gaultheria procumbens	Anthracnose	*Colletotrichum gloeosporioides*	2
Gaultheria shallon	Anthracnose	*Colletotrichum acutatum*	1
Gaultheria shallon	Bacterial leaf spot	*Pseudomonas* sp.	1
Gaultheria shallon	Phoma leaf spot	*Phoma exigua*	3

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Genista Lydia	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Hedera helix 'Thorndale'	Bacterial leaf spot	*Pseudomonas syringae*	1
Helictotrichon sempervirens 'Saphirsprudel'	Rust	*Puccinia* sp.	1
Heuchera micrantha 'Caramel', 'Stormy Seas'	Bacterial leaf spot/ blight	*Pseudomonas* sp.	2
Heuchera micrantha 'Caramel', 'Cascade Dawn', 'Firefly', 'Frosted Violet', 'Hercules', 'Jade Gloss', 'Palace Purple','Plum Pudding', 'Rave on Coral Bells', 'Silver Scrolls', 'Stormy Seas'	Rust	*Puccinia heucherae*	14
Heuchera micrantha 'Caramel', 'Cascade Dawn', 'Firefly', 'Frosted Violet', 'Jade Gloss', 'Palace Purple','Plum Pudding', 'Rave on Coral Bells', 'Silver Scrolls'	Botrytis blight	*Botrytis cinerea*	13
Heuchera sanguinea 'Firefly'	Leaf spot/blight	*Botrytis cinerea*	1
Hibiscus x hybrida	Bacterial leaf spot	*Pseudomonas syringae*	2
Hosta sieboldiana 'Blue Mouse Ears'	Distorted leaves, yellow mosaic	Hosta virus X? (not tested)	1
Hosta sieboldiana 'American Halo', 'Antioch', 'Blue Hawaii', 'Dream Weaver', 'Earth Angel', 'Elegans', 'Fire and Ice', 'Francee', 'June', 'June's Fever', 'Liberty', 'Ocean Isle', 'Paradigm', 'Patriot', 'Queen of the Seas', 'Rainforest', 'Sunrise', 'Wide Brim'	Transparent leaf edges/ bacterial soft rot/leaf spot/botrytis	*Botrytis cinerea* and soft rot bacteria	18
Hosta sieboldiana 'American Halo', 'First Frost'	Bacterial leaf spot	*Pseudomonas* sp.	2
Hosta sieboldiana 'Blue Angel', 'Ocean Isle'	Botrytis leaf spot (hypersensitive reaction)	*Botrytis cinerea*	2
Hydrangea arborescens 'Annabelle'	Bacterial leaf spot	*Pseudomonas syringae*	2
Hydrangea arborescens 'Annabelle'	Leaf spot	*Ascochyta hydrangeae*	1
Hydrangea macrophylla 'Pink Beauty'	Distorted leaves, mosaic	Unidentified	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Hydrangea macrophylla 'Pink Beauty'	Leaf spot	*Ascochyta hydrangeae*	1
Hydrangea quercifolia x 'Pee Wee'	Bacterial leaf spot	*Pseudomonas syringae*	2
Hydrangea serrata 'Bluebird'	Leaf spot / blight	*Botrytis cinerea*	1
Hydrangea serrata 'Bluebird'	Cercospora leaf spot	*Cercospora hydrangeae*	1
Hydrangea sp.	Anthracnose	*Colletotrichum gloeosporioides*	2
Hydrangea sp.	Leaf spot	*Ascochyta hydrangeae*	1
Hylotelephium (Sedum) cauticola	Powdery mildew	*Erysiphe polygoni*	1
Hylotelephium (Sedum) telephium 'Autumn Joy', 'Matrona'	Bacterial soft rot	*Erwinia carotovora*	2
Hylotelephium (Sedum) telephium 'Autumn Joy', 'Purple Emperor'	Botrytis blight	*Botrytis cinerea*	2
Hylotelephium (Sedum) telephium 'Matrona'	Powdery mildew	*Erysiphe polygoni*	1
Hylotelephium (Sedum) telephium 'Purple Emperor'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Ilex verticillata 'Southern Gentleman'	Red ringspot	Unidentified	2
Impatiens walleriana	Downy mildew	*Plasmopara obduscens*	2
Juniperus horizontalis 'Blue Chip', 'Hughes', 'Gold Strike', 'Mother Lode', 'Prince of Wales', 'Yukon Belle', 'Wiltonii'	Root rot	*Phytophthora* sp.	6
Juniperus horizontalis 'Gold Strike'	Kabatina tip blight	*Kabatina juniperi*	1
Juniperus sabina 'Blue Danube', 'Moor-Dense', 'Tamariscifolia New Blue'	Root rot	*Phytophthora* sp.	3
Juniperus scopulorum	Root rot	*Phytophthora* sp.	1
Juniperus scopulorum 'Medora'	Kabatina tip blight	*Kabatina juniperi*	1
Juniperus scopulorum 'Medora'	Root rot	*Phytophthora* sp.	1
Juniperus scopulorum 'Medora'	Tip blight	*Sclerophoma pithyophila*	1
Juniperus sp.	Root rot	*Phytophthora* sp.	1
Juniperus squamata 'Blue Star'	Root rot	*Phytophthora* sp.	1
Kalmia latifolia 'Ostbo Red'	Leaf spot	*Phoma/Ascochyta* sp.	1
Lathyrus maritimus	Bacterial leaf spot	*Pseudomonas* sp.	1
Lavandula angustifolia	Bacterial blight	*Pseudomonas syringae*	1
Lavandula angustifolia	Root and crown rot	*Phytophthora* sp.	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lavandula stoechas	Bacterial leaf spot	*Pseudomonas syringae*	2
Lavandula stoechas	Black root rot	*Thielaviopsis basicola*	1
Ledum glandulosum	Rust	*Chrysomyxa* sp.	1
Libertia ixioides 'Taupo Blaze'	Crown rot	Unidentified	1
Lilium asiatica 'Tiny Icon', 'Tiny Nanny', 'Tiny Puppet', 'Tiny Toes'	Botrytis leaf spot	*Botrytis* sp.	4
Linnaea borealis	Black root rot	*Thielaviopsis basicola*	2
Lonicera caerulea	Powdery mildew	Erysiphales	1
Lonicera ciliosa	Powdery mildew	Erysiphales	1
Lonicera sp.	Powdery mildew	Erysiphales	1
Lupinus polyphyllus	Downy mildew	*Peronospora trifoliorum*	2
Lupinus polyphyllus	Powdery mildew	Erysiphales	1
Magnolia grandiflora 'Little Gem'	Bacterial leaf spot	*Pseudomonas syringae*	1
Magnolia kobus	Bacterial leaf spot	*Pseudomonas syringae*	1
Magnolia sieboldii	Yellow leaf mosaic	Unidentified	1
Magnolia stellata 'Royal Star'	Bacterial leaf spot	*Pseudomonas syringae*	1
Magnolia x brooklynensis 'Yellow Bird'	Bacterial leaf spot	*Pseudomonas syringae*	1
Magnolia x brooklynensis 'Yellow Bird'	Botrytis leaf spot	*Botrytis cinerea*	1
Magnolia x soulangeana 'Susan'	Bacterial leaf spot	*Pseudomonas syringae*	2
Mahonia aquifolium	Bacterial leaf spot	*Pseudomonas* sp.	1
Mahonia aquifolium	Botrytis leaf spot	*Botrytis cinerea*	1
Mahonia aquifolium	Leaf spot	*Phoma/Ascochyta* sp.	1
Mahonia aquifolium	Rust	*Cumminsiella mirabilissima*	2
Mahonia nervosa	Root rot	*Pythium* sp. / *Phytophthora* sp.	2
Malus fusca (Malus diversifolia)	Bacterial leaf spot	Unidentified	1
Malus fusca (Malus diversifolia)	Leaf spot	*Phoma/Ascochyta* sp.	1
Malus fusca (Malus diversifolia)	Powdery mildew	Erysiphales	2
Malus x 'Spring Snow'	Apple scab	*Venturia inaequalis*	1
Myrica californica	Bacterial leaf blight	*Pseudomonas* sp.	1
Nandina domestica 'Atomic Fireball', 'Gulf Stream', 'Moon Bay'	Botrytis blight	*Botrytis cinerea*	3
Oxalis oregana	Rhizoctonia blight	*Rhizoctonia solani*	1
Pachysandra terminalis	Volutella blight	*Volutella pachysandrae*	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Pachysandra terminalis 'Green Sheen'	Volutella blight	*Volutella pachysandrae*	1
Pachystima canbyi	Root rot/dieback	*Pythium* sp. / *Phytophthora* sp.	1
Pachystima myrsinites	Black root rot	*Thielaviopsis basicola*	1
Pachystima myrsinites	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Paeonia lactiflora 'Edulis Superba', 'Karl Rosenfield', 'Sarah Bernhardt', 'Shirley Temple'	Cladosporium leaf spot/blotch	*Cladosporium paeoniae (*plus secondary *Botrytis cinerea)*	4
Panicum virgatum 'Heavy Metal'	Rust	*Puccinia* sp.	1
Parthenocissus quinquefolia	Downy mildew	*Plasmopara* sp.	1
Parthenocissus tricuspidata 'Veitchii'	Downy mildew	*Plasmopara* sp.	1
Philadelphus coronarius 'Aureus'	Bacterial leaf spot	*Pseudomonas syringae*	1
Phlox paniculata 'David'	Septoria leaf spot	*Septoria phlogis*	2
Phlox subulata 'Candy Stripe', 'Cushion Blue', 'Drummond's Pink', 'Emerald Cushion', 'Red Wings', 'Snowflake'	Downy mildew	*Peronospora phlogina*	6
Phlox subulata 'Candy Stripe', 'Drummond's Pink', Snowflake'	Botrytis blight	*Botrytis cinerea*	3
Photinia x fraseri	Entomosporium leaf spot	*Entomosporium mespili*	2
Phyllostachys aureosulcata 'Alata'	Black sooty mold	Unidentified fungi	1
Physocarpus capitatus	Bacterial leaf spot	*Pseudomonas* sp.	1
Physocarpus opulifolius 'Center Glow', 'Diablo'	Powdery mildew	*Podosphaera aphanis var. physocarpi*	2
Pieris japonica 'Mountain Fire'	Botrytis blight	*Botryis cinerea*	1
Pieris japonica 'Mountain Fire'	Root rot	*Phytophthora* sp.	2
Polystichum munitum	Root rot	*Pythium* sp.	1
Populus balsamifera 'Paskapoo'	Rust	*Melampsora* sp.	1
Populus balsamifera 'Paskapoo'	Venturia blight	*Venturia populicola*	1
Populus tremuloides	Venturia blight	*Venturia populicola*	1
Populus tremuloides 'Erecta'	Bacterial leaf blight	*Pseudomonas* sp.	1
Populus trichocarpa	Anthracnose	*Marsonnina* sp.	1
Populus trichocarpa	Leaf spot	*Phomopsis* sp.	1
Populus trichocarpa	Septoria leaf spot	*Septoria* sp.	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Potentilla fruticosa 'Abbotswood'	Powdery mildew	Erysiphales	1
Prunus cerasus 'Evans'	Bacterial leaf spot/shothole	*Pseudomonas syringae*	1
Prunus cistena	Bacterial blight/stem canker	*Pseudomonas syringae*	1
Prunus incisa 'Little Twist'	Bacterial leaf blight	*Pseudomonas syringae*	1
Prunus triloba 'Multiplex'	Bacterial leaf blight	*Pseudomonas syringae*	1
Prunus x kerrasis 'Juliet', 'Romeo', 'Valentine'	Bacterial leaf spot/shothole	*Pseudomonas syringae*	1
Prunus x virginiana 'Schubert'	Bacterial leaf spot/shothole	*Pseudomonas syringae*	1
Pseudotsuga menziesii	Needle blight	*Phomopsis occulta (*weak pathogen or saprophye on dead inner leaves*)*	1
Pseudotsuga menziesii	Sooty mould/botrytis	*Hormonema* sp. plus secondary *Botrytis*	1
Rhododendron (Azalea) 'Elite', 'Golden Lights'	Botrytis blight	*Botrytis cinerea*	2
Rhododendron (Azalea) 'Elite', 'Golden Lights', 'Mandarin Lights', 'Northern Hi-Lights'	Root rot	*Phytophthora* sp.	4
Rhododendron (Azalea) 'Golden Lights'	Leaf blight/botrytis	*Botrytis cinerea*	1
Rhododendron (Azalea) 'Golden Lights', 'Lilac Lights', 'Mandarin Lights', 'Northern Hi-Lights', 'White Lights'	Powdery mildew	*Erysiphe azaleae*	5
Rhododendron impeditum	Powdery mildew	*Erysiphe azaleae*	1
Rhododendron x 'Olga Mezitt'	Botrytis blight	*Botrytis cinerea*	1
Rhododendron x 'Olga Mezitt'	Root rot	*Phytophthora* sp.	1
Rhododendron x 'PJM'	Root and crown rot	*Phytophthora* sp.	1
Rhododendron x 'PJM'	Root rot	*Phytophthora* sp.	1
Rhododendron x 'Ramapo'	Root rot	*Phytophthora* sp.	1
Ribes bracteosum	Powdery mildew	*Podosphaera mors-uvae*	1
Ribes bracteosum	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Ribes divaricatum	Bacterial leaf spot	*Pseudomonas syringae*	1
Ribes lacustre	Powdery mildew	*Podosphaera mors-uvae*	1
Rosa acicularis	Black spot	*Diplocarpon rosae*	1
Rosa nutkana	Black spot	*Diplocarpon rosae*	1
Rosa nutkana	Botrytis flower bud blight	*Botrytis cinerea*	1
Rosa nutkana	Downy mildew	*Peronospora sparsa*	1

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Rosa nutkana	Powdery mildew	*Podosphaera pannosa*	1
Rosa parviflora	Powdery mildew	*Podosphaera pannosa*	1
Rosa pisocarpa	Black spot	*Diplocarpon rosae*	1
Rosa pisocarpa	Downy mildew	*Peronospora sparsa*	1
Rosa rugosa	Botrytis flower bud blight	*Botrytis cinerea*	1
Rosa woodsii	Black spot	*Diplocarpon rosae*	2
Rosa woodsii	Powdery mildew	*Podosphaera pannosa*	1
Rosa woodsii	Downy mildew	*Peronospora sparsa*	1
Rosa x 'Adelaide Hoodless', 'Morden Snowbeauty', 'Scarlet Meidiland'	Bacterial leaf spot	*Pseudomonas syringae*	3
Rosa x 'Adelaide Hoodless', 'Morden Sunrise', 'Scarlet Meidiland', 'White Meidiland', 'Winnipeg Parks'	Powdery mildew	*Podosphaera pannosa*	5
Rosa x 'Morden Fireglow', 'Morden Sunrise', 'Scarlet Meidiland', 'Winnipeg Parks'	Downy mildew	*Peronospora sparsa*	3
Rosa x 'Morden Sunrise', 'Winnipeg Parks'	Black spot	*Diplocarpon rosae*	1
Rosmarinus officinalis	Bacterial stem canker	*Pseudomonas syringae*	1
Rosmarinus officinalis 'Speedy'	Bacterial leaf spot	*Pseudomonas syringae*	1
Rubus fruticosus 'Mure' (blackberry)	Downy mildew	*Peronospora sparsa*	1
Rubus idaeus 'Heritage'	Yellow rust	*Phragmidium rubi-idaea*	1
Rubus parviflorus (seedlings)	Black root rot	*Thielaviopsis basicola*	1
Rubus spectabilis	Bacterial leaf spot	*Pseudomonas* sp.	1
Rubus spectabilis	Downy mildew	*Peronospora sparsa*	1
Rudbeckia fulgida 'Goldsturm'	Purple leaf spots and yellow distorted leaves	Unidentified	1
Rudbeckia hirta	Botrytis blight	*Botrytis cinerea*	1
Rudbeckia hirta 'Autumn Colors'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Rudbeckia hirta 'Irish Eyes'	Distorted leaves, mosaic	Unidentified	1
Rudbeckia hirta 'Irish Eyes'	Root rot	*Phytophthora* sp.	1
Rudbeckia sp.	Ascochyta leaf spot	*Ascochyta* sp.	1
Sambucus racemosa	Bacterial leaf spot	*Pseudomonas* sp.	1
Sambucus racemosa 'Golden Glow', 'Sutherland Gold'	Foliar nematodes	*Aphelenchoides* sp.	2

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Sambucus racemosa 'Madonna'	Bacterial leaf spot	*Pseudomonas* sp.	1
Sempervivum x 'Jade Rose', 'Red Robin', 'Royal Ruby'	Botrytis blight	*Botrytis cinerea*	3
Solidago canadensis	Leaf rust	*Coleosporium asterum*	1
Spiraea japonica	Bacterial leaf spot	*Pseudomonas syringae*	1
Spiraea japonica 'Dart's Red', 'Firelight', 'Goldflame', 'Goldmound', 'Magic Carpet', 'Neon Flash', 'Shirobana'	Powdery mildew	*Podosphaera* sp.	9
Spiraea japonica 'Firelight', 'Goldflame'	Bacterial leaf spot	*Pseudomonas syringae*	2
Styrax japonica 'Fragant Fountain'	Bacterial leaf spot	*Pseudomonas* sp.	1
Symphoricarpos albus 'White', 'Green'	Powdery mildew	*Erysiphe symphoricarpi*	3
Symphoricarpos orbiculatus 'Red'	Powdery mildew	*Erysiphe symphoricarpi*	1
Syringa meyeri 'Palibin'	Leaf spot and stem canker	*Phytophthora* sp. **	1
Syringa meyeri 'Palibin'	Ascochyta leaf spot	*Ascochyta syringae*	1
Syringa patula 'Miss Kim'	Shoot tip dieback/botrytis	*Botrytis cinerea*	1
Syringa reticulata 'Ivory Silk'	Ascochyta leaf spot	*Ascochyta syringae*	1
Syringa reticulata 'Ivory Silk'	Bacterial leaf spot	*Pseudomonas syringae*	1
Syringa vulgaris	Ascochyta leaf spot	*Ascochyta syringae*	1
Syringa vulgaris	Bacterial leaf spot/blight	*Pseudomonas syringae*	2
Syringa vulgaris	Shoot tip dieback/botrytis	*Botrytis cinerea*	1
Syringa vulgaris 'Beauty of Moscow'	Shoot tip dieback/botrytis	*Botrytis cinerea*	1
Syringa vulgaris 'Beauty of Moscow', 'Father John'	Bacterial leaf spot	*Pseudomonas syringae*	2
Syringa vulgaris 'Father John'	Ascochyta leaf spot	*Ascochyta syringae*	1
Syringa vulgaris 'Prairie Petite', 'President Grevy'	Bacterial leaf spot/blight	*Pseudomonas syringae*	2
Syringa x 'Tinkerbelle'	Ascochyta leaf spot	*Ascochyta syringae*	1
Taxus baccata 'Melford'	Root rot	*Phytophthora* sp.	1
Tellima grandiflora	Powdery mildew	Erysiphales	2
Thuja occidentalis 'Brandon', 'Emerald Green', 'Golden Tuffet', 'Holmstrup', 'Rheingold', 'Skybound', 'Smaragd'	Twig blight	*Phomopsis spp.* and *Kabatina thujae*	8
Thuja occidentalis 'Brandon', 'Emerald Green', 'Smaragd'	Tip blight	*Pestalotiopsis* sp.	3

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Thuja occidentalis 'Golden Tuffet', 'Smaragd'	Root rot	*Phytophthora* sp.	2
Tiarella trifoliata	Powdery mildew	Erysiphales	1
Vaccinium corymbosum 'Bluecrop', 'Bluegold', 'Duke', 'Northland', 'Patriot'	Red leaf spots	Unidentified	5
Vaccinium membranaceum	Bacterial leaf spot	*Pseudomonas syringae*	1
Vaccinium ovatum	Root rot	*Phytophthora* sp.	1
Vaccinium ovatum 'Thunderbird'	Root and crown rot	*Phytophthora* sp.	1
Vaccinium parvifolium	Root rot	*Phytophthora* sp.	1
Vaccinium sp.	Botrytis blight	*Botrytis cinerea*	1
Vaccinium sp.	Red leaf spots	Unidentified	1
Vaccinium vitis-idaea	Crown rot	*Phytophthora* sp.	1
Vaccinium x 'Chippewa' 'North Blue'*, 'Northsky'*, 'Pink Lemonade', 'Top Hat'	Red leaf spots	Unidentified *	5
Vaccinium x 'Northland'	Bacterial leaf spot	*Pseudomonas syringae*	1
Vaccinium x 'Top Hat'	Bacterial leaf spot	*Pseudomonas syringae*	1
Veronica peduncularis 'Georgia Blue'	Botrytis blight	*Botrytis cinerea*	1
Veronica spicata 'Royal Blue', 'Royal Candles'	Downy mildew	*Peronospora* sp.	2
Veronica x hybrida 'Christy'	Botrytis blight	*Botrytis cinerea*	1
Viburnum carlcephalum	Bacterial leaf spot	*Pseudomonas syringae*	2
Viburnum edule	Bacterial leaf spot	*Pseudomonas syringae*	1
Viburnum opulus 'Nanum', 'Sterile'	Bacterial leaf spot	*Pseudomonas syringae*	1
Viburnum trilobum 'Alfredo', 'Bailey Compact'	Bacterial leaf spot	*Pseudomonas syringae*	1
Viola adunca	Black root rot	*Thielaviopsis basicola*	1
Viola adunca	Cercospora leaf spot	*Cercospora violae*	1
Vitis vinifera 'Prairie Star'	Botrytis blight	*Botrytis cinerea*	2
Vitis vinifera 'Prairie Star'	Powdery mildew	*Uncinula necator*	1
Woodwardia fimbriata	Root rot/dieback	*Pythium* sp.	1
Yucca filamentosa 'Bright Edge'	Crown rot/dieback	*Fusarium* sp. and soft rot bacteria	1
Yucca filamentosa 'Bright Edge'	Leaf spot	*Cylindrosporium angustifolium*	1
Yucca glauca	Basal rot /leaf dieback	*Pythium* sp. and soft rot bacteria	1
Total			486

Footnotes to Table 1

*Negative for blueberry scorch, blueberry shock and tomato/tobacco ringspot viruses in tests performed by the BC Ministry of Agriculture Plant Diagnostic Laboratory on samples submitted.

** Not *P. ramorum* by previous PCR tests in 2011 and 2012.

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CROPS: Commercial crops – Diagnostic Laboratory Report
LOCATION: Saskatchewan

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TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED IN 2013 TO THE SASKATCHEWAN MINISTRY OF AGRICULTURE CROP PROTECTION LABORATORY

ABSTRACT: Saskatchewan's Crop Protection Laboratory received 704 disease/disorder samples in 2013. The causes were fungi, bacteria, viruses, phytoplasmas, herbicide injury and the environment. Forty-eight percent of the samples were Dutch elm disease or dothiorella wilt of elm. Root rot was common in pulses and cereals, herbicide injury on oilseeds, and aster yellows on field and fruit crops.

METHODS: The Saskatchewan Ministry of Agriculture's Crop Protection Laboratory (CPL) provides diagnostic services to the agricultural industry on all crop health problems. Services include disease, insect and weed identification, as well as testing of weed seeds for herbicide resistance. The CPL also provides a Dutch elm disease (DED) service to the general public, under which American elm (*Ulmus americana*) and Siberian elm (*U. pumila*) samples are tested for DED. Samples are submitted to the CPL by personnel from the Saskatchewan Ministry of Agriculture, the Saskatchewan Ministry of Environment, individual growers, crop insurance adjustors, agribusiness representatives and market/home gardeners. Samples have also been received from clients located in Alberta and Manitoba. Diagnosis of fungal plant diseases is performed primarily through assessment of plant symptoms, visual microscopic examination, and isolation of fungal organisms on artificial media. When additional confirmation is needed, diseased samples are sent to research laboratories for identification of associated pathogens by other means, such as polymerase chain reaction (PCR). Viral and bacterial diagnoses are based on visible symptoms. ELISA testing was used to identify wheat streak mosaic virus (WSMV) in 2013.

RESULTS: A total of 704 disease/disorder samples were submitted to the CPL from April 17 to November 20, 2013. Out of this, 48% (338 samples) were elm samples submitted for DED testing. Categories and percentages of samples received (excluding DED samples) were: special crops (39%), cereals (30%), oilseeds (16%), ornamental shade trees (other than elm) (6%), forages (5%), vegetables (2%) and fruit (2%). Samples that were submitted for disease identification but were diagnosed with insect damage are not included in this report. Summaries of diseases and causal agents diagnosed on crop samples submitted to the CPL in 2013 are presented in Tables 1-7 by crop category.

Table 1: Summary of diseases diagnosed on **fruit crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Dwarf sour cherry	Cherry leaf spot	*Blumeriella jaapii*	3
Raspberry	Chemical damage		1
Strawberry	Phyllody (aster yellows)	*Candidatus* Phytoplasma asteris	1

Table 2: Summary of diseases diagnosed on **special crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lentil	Root rot	*Fusarium* spp./ *Rhizoctonia* sp./ *Pythium* sp.	41
	Anthracnose	*Colletotrichum truncatum*	2
	Herbicide injury	Group 2 and 4 herbicides	4
	Environmental injury	Excess moisture/poor root development	8
	Stemphylium blight	*Stemphylium botryosum*	7
	Ascochyta blight	*Ascochyta lentis*	2
Pea	Herbicide injury		7
	Mycosphaerella blight	*Mycosphaerella pinodes*	3
	Root rot	*Fusarium* spp./ *Rhizoctonia* sp./ *Pythium* sp.	41
	Foot rot	*Phoma medicaginis*	4
Chickpea	Root rot	*Fusarium* spp.	1
	Chemical injury		4
	Ascochyta blight	*Ascochyta rabiei*	1
Mustard	Chemical injury	Group 4 herbicide	2
	Environmental injury	Stress	1

Table 3: Summary of diseases diagnosed on **vegetable crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Potato	Common scab	Environmental	1
Corn	Root rot	*Fusarium* spp.	1
Cucumber	Downy mildew	*Pseudoperonospora cubensis*	1
Tomato	Septoria leaf spot	*Septoria lycopersici*	1
Garlic	Bulb decay	*Penicillium* sp.	1
	Root rot	*Fusarium* spp.	3

Table 4: Summary of diseases diagnosed on **cereal crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Barley	Head blight	*Fusarium* spp.	1
	Root rot	*Cochliobolus sativus*	6
	Herbicide injury		1
	Aster yellows	*Candidatus* phytoplasma asteris	1
	Environmental injury	Excess moisture	1
	Environmental injury	Cold and wind damage	1
Durum wheat	Root rot	*Fusarium* spp. *Cochliobolus sativus*	10
	Tan spot	*Pyrenophora tritici-repentis*	2
	Leaf spot	*Septoria tritici*	2
	Environmental injury		2
	Chemical injury		1
	Aster yellows	*Candidatus* Phytoplasma asteris	1
Kamut	Environmental injury		1
Oats	Crown rust (leaf)	*Puccinia coronata*	2
	Septoria leaf spot complex	*Septoria* spp.	1
	Environmental injury	Heat stress, wind damage	2
	Halo blight	*Pseudomonas syringae* pv. *coronafaciens*	2
Wheat	Fusarium head blight	*Fusarium* spp.	10
	Tan spot	*Pyrenophora tritici-repentis*	2
	Leaf rust	*Puccinia triticina*	2
	Septoria leaf blotch	*Septoria* sp.	3
	Spot blotch	*Cochliobolus sativus*	1
	Common root rot	*Cochliobolus sativus/ Fusarium* spp.	2
	Prematurity blight	Heat	1
	Bacterial leaf blight	*Pseudomonas* sp.	2
	Environmental injury	Excess moisture/ wind	13
	Herbicide injury	Groups 1,4 and drift	10
	Nutrient deficiency	Nitrogen deficiency	2
	Physiological leaf spot		1
	Wheat streak mosaic	Wheat streak mosaic virus	2
	Aster yellows	*Candidatus* phytoplasma asteris	4

Table 5: Summary of diseases diagnosed on **oilseed crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Black spot	*Alternaria brassicae*	6
	Blackleg	*Leptosphaeria* spp.	4
	Root rot	*Rhizoctonia* or *Fusarium* spp.	7
	Grey stem /white spot	*Pseudocercosporella capsellae*	1
	Aster yellows	*Candidatus* Phytoplasma asteris	2
	Herbicide injury	Groups 2, 4, and late glyphosate application	21
	Nutrient deficiency	Nitrogen and Phosphorus	3
	Environmental injury	Excess moisture	2
	Hail damage		1
Flax	Herbicide injury	Group 4	3
	Environmental injury	Excess moisture	1
	Root rot	*Pythium* sp. and *Fusarium* spp.	2
	Aster yellows	*Candidatus* Phytoplasma asteris	1

Table 6: Summary of diseases diagnosed on **forage legume and grass crops** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Common leaf spot	*Pseudopeziza medicaginis* *Typhula* sp.	1
	Winter crown rot / snow mold	*Microdochium nivale*	1
	Downy mildew	*Peronospora trifoliorum*	6
	Anthracnose	*Colletotrichum trifolii*	1
	Chemical damage		1
Red clover	Spring black stem	*Cercospora zebrina*	1
	Powdery mildew	*Erysiphe polygoni*	1
	Leaf spot	*Pseudopeziza* sp.	1
Crested wheat grass	Stem smut	*Ustilago hypodytes*	1

Table 7: Summary of diseases diagnosed on **woody ornamental trees** submitted to the Saskatchewan Crop Protection Laboratory in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Poplar (*Populus* sp.)	Leaf blight	*Venturia populina*	2
	Leaf spot	*Marssonina* sp.	1
	Environmental injury		1
Elm (*Ulmus* spp.)	Dutch Elm Disease	*Ophiostoma novae-ulmi*	140*
	Dothiorella Wilt	*Dothiorella ulmi*	16*
	Anthracnose/ black spot	*Stegophora ulmea*	2
	Leaf blight	*Phomopsis* sp.	1
Maple (*Acer* sp.)	Environmental injury		1
	Twig canker	*Cytospora* sp.	1
Ash (*Fraxinus* sp.)	Anthracnose	*Gnomoniella fraxini*	1
Spruce (*Picea* sp.)	Needle cast	Environmental	11
Fir (*Abies)*	Needle Loss	Not known	1

*the remaining 170 American elm submissions were negative for known pathogens of elm

CROP: Diagnostic Laboratory Report
LOCATION: Manitoba

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TITLE: 2013 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

ABSTRACT: Diseases and disorders of plants analyzed by the Manitoba Crop Diagnostic Centre were recorded for the year 2013. Samples received by the laboratory covered most crops grown in Manitoba and included ornamentals. Clubroot was found for the first time in canola in two fields.

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

RESULTS: Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1-11 and cover the time period from January 1 to November 30, 2013. For the 2013 year, diseases of note were the first occurrence of clubroot in canola (2 positive fields), a field of potato with violet root rot (field was carrots the previous season), and centre rot of stored onion bulbs (stored from 2012 crop year) caused by *Pantoea agglomerans*.

Table 1. Summary of diseases diagnosed on **herbaceous ornamentals** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Gerber daisy (*Gerbera hybrida*)	Crown rot	*Rhizoctonia solani,* *Pythium* sp., *Fusarium* sp.	1
Gladiolus	Corm rot	*Fusarium oxysporum*	1
Hollyhock	Rust	*Puccinia malvacearum*	1

Table 2. Summary of diseases diagnosed on **greenhouse crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Cucumber	Physiological disorder		1
Lettuce (hydroponic)	Root rot	*Pythium* sp.	1
Orchid (*Phalaenopsis* sp.)	Stem rot	*Botrytis cinerea*	1
Tomato	Wilt	*Fusarium oxysporum*	1
	Nutrient deficiency		1

Table 3. Summary of diseases diagnosed on **cereal crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Black head moulds	*Epicoccum* sp., *Alternaria* sp.	1
	Common root rot	*Cochliobolus sativus*	1
	Fusarium head blight	*Fusarium* sp.	2
	Powdery mildew	*Blumeria graminis*	4
	Root rot	*Fusarium* sp.	5
	Root rot	*Fusarium* sp., *Rhizoctonia solani*	5
	Root rot	*Pythium* sp.	2
	Spot blotch	*Bipolaris sorokiniana*	1
	Tan spot	*Pyrenophora tritici-repentis*	13
	Wheat streak mosaic	Wheat Streak Mosaic Virus (WSMV)	5
	Physiological disorders	undetermined	8
	Environmental injury		38
	Herbicide injury		15
	Nutrient deficiency		12
Barley	Common root rot	*Cochliobolus sativus*	1
	Net blotch	*Drechslera teres* f. *maculata*	1
	Root rot	*Pythium* sp.	1
	Herbicide injury		6
	Environmental injury		5
	Nutrient deficiency		6
Oat	Bacterial blight	*Pseudomonas syringae*	1
	Fusarium head blight	*Fusarium* sp.	2
	Pyrenophora leaf blotch	*Pyrenophora avenae*	1
	Root rot	*Fusarium* sp.	1
	Stem rust	*Puccinia graminis* f. sp. *avenae*	1
	Physiological disorder	undetermined	1
	Blast	environmental injury	3
	Environmental injury		2
	Herbicide injury		1
Rye	Ergot	*Claviceps purpurea*	1
	Environmental injury		1
	Herbicide injury		1

Table 4. Summary of diseases diagnosed on **forage grasses and lawn grasses** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Orchard grass	Root rot	*Fusarium* sp*., Pythium* sp.	1
Timothy	Brown leaf stripe	*Cercosporidium graminis*	1
Turf Grass	Root rot	*Fusarium* sp.	1
	Leaf spot and melting out	*Bipolaris* sp.	1
	Red thread	*Laetisaria fuciformis*	1

Table 5. Summary of diseases diagnosed on **vegetable crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bean, snap	Stem rot	*Sclerotinia sclerotiorum*	1
	Common blight	*Xanthomonas phaseoli*	1
Beet, red	Root rot	*Fusarium solani*	1
Cabbage	Black rot	*Xanthomonas campestris*	1
Carrot	Alternaria leaf spot	*Alternaria dauci*	1
Cauliflower	Black rot	*Xanthomonas campestris*	1
Corn, sweet	Root rot	*Fusarium* sp.	1
Cucumber	Environmental injury		2
	Nutrient deficiency		1
Daikon radish	Root rot	*Pythium* sp.	1
Garlic	Fusarium basal plate rot	*Fusarium oxysporum*	2
Onion	Bacterial centre rot	*Pantoea agglomerans*	1
	Black mold	*Aspergillus niger*	1
	Fusarium bulb rot	*Fusarium* sp.	1
	Mushy rot	*Rhizopus* sp.	2
	Neck rot	*Botrytis allii*	2
Pepper	Sclerotinia fruit rot	*Sclerotinia sclerotiorum*	1
Rutabaga	Nutritional deficiency	undetermined	1
Squash	Powdery mildew	*Sphaerotheca* sp.	1
Tomato	Early blight	*Alternaria solani*	4
	Fusarium wilt	*Fusarium oxysporum*	1
	Fruit rot	*Alternaria alternata*	1
	Septoria leaf spot	*Septoria lycopersici*	1
	Virus disease	undetermined	3
	Environmental injury		1
Zucchini	Fruit rot	*Fusarium* sp.	1
	Fruit rot	*Sclerotinia sclerotiorum*	1
	Fruit abortion	incomplete pollination	1

Table 6. Summary of diseases diagnosed on **shelterbelt trees** and **woody ornamentals** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash (*Fraxinus* sp.)	Anthracnose	*Gloeosporium aridum*	2
	Verticillium wilt	*Verticillium dahliae*	2
	Herbicide injury		2
Basswood	Canker	*Nectria* sp.	1
(*Tilia americana*)	Twig blight	*Phyllosticta* sp.	1
Caragana	Herbicide injury		1
Cedar (*Thuja* sp.)	Canker	unidentified	7
Cotoneaster	Environmental injury		1
Crabapple	Herbicide injury		1
Dogwood	Anthracnose	*Colletotrichum* sp.	1
(*Cornus sericea*)	Powdery mildew	*Erysiphe* sp.	1
	Root rot	*Fusarium solani*	1
	Root rot	*Phytophthora* sp.	1
Elm, American	Canker	*Botryodiplodia* sp.	2
(*Ulmus americana*)	Dutch elm disease	*Ophiostoma ulmi*	53
	Verticillium wilt	*Verticillium* sp.	2
	Wetwood	*Erwinia* sp.	1
Elm, Siberian (*Ulmus pumila*)	Dutch elm disease	*Ophiostoma ulmi*	1
Fir, balsam (*Abies balsamea*)	Twig canker	*Phomopsis* sp.	2
Juniper	Canker	unidentified	1
Lilac	Powdery mildew	*Erysiphe syringae*	1
	Herbicide injury		1
Maple, Amur (*Acer ginnala*)	Iron chlorosis	nutrient deficiency	1
Maple, Manitoba	Environmental injury		1
(*Acer negundo*)	Herbicide injury		3
Maple, Silver (*Acer saccharinum*)	Iron chlorosis	nutrient deficiency	1
Mountain ash (*Sorbus* sp.)	Canker	*Cytospora* sp.	1
Oak	Anthracnose	*Discula* sp.	6
(*Quercus*	Leaf blister	*Taphrina caerulescens*	2
macrocarpa)	Environmental injury		3

Table 6 (contd.)

Pine, Scots (*Pinus sylvestris*)	Environmental injury		3
	Physiological disorder		1
Poplar (*Populus* spp.)	Canker	*Fusarium solani*	1
	Canker	*Cytospora* sp.	2
	Herbicide injury		1
	Environmental injury		1
Rose	Virus	unidentified	1
Spruce (*Picea* spp.)	Canker	unidentified	5
	Canker	*Cytospora* sp.	
	Needle blight	*Lirula* sp.	2
	Root rot (2nd year plants)	*Fusarium solani*	1
	Stigmina needle blight	*Stigmina lautii*	10
	Environmental injury		19
	Nutrient deficiency		2
Willow	Canker	*Cytospora* sp.	3
	Willow scab and black canker	*Venturia saliciperda* *Glomerella miyabeana*	1
	Iron chlorosis	Nutrient deficiency	2
	Environmental injury		2
	Herbicide injury		5

Table 7. Summary of diseases diagnosed on **oilseed crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Blackleg	*Leptosphaeria maculans*	23
	Black spot	*Alternaria brassicae*	3
	Clubroot	*Plasmodiophora brassicae*	2
	Downy mildew	*Peronospora parasitica*	9
	Root rot	*Fusarium* sp., *Pythium* sp.	3
	Root rot	*Rhizoctonia solani*	6
	Stem rot	*Sclerotinia sclerotiorum*	1
	Nutrient deficiency	Sulphur deficiency	8
	Nutrient deficiency	undetermined	4
	Environmental injury		16
	Herbicide injury		27
Flax	Fusarium wilt	*Fusarium oxysporum*	1
	Root rot	*Fusarium oxysporum, Rhizoctonia solani*	1
	Environmental injury		1
	Herbicide injury		4
Sunflower	Verticillium wilt	*Verticillium dahliae*	1
	Stem rot	*Sclerotinia sclerotiorum*	2
	Environmental injury		2
	Herbicide injury		4

Table 8. Summary of diseases diagnosed on **fruit crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Fireblight	*Erwinia amylovora*	2
	Silver leaf	*Chondrostereum purpureum*	1
	Fruit abortion	Physiological disorder	1
	Environmental stress		1
	Nutrient deficiency		1
Gooseberry	Leaf spot	*Gloeosporidiella variabilis*	1
Grape	Downy mildew	*Plasmopara viticola*	1
Plum	Plum pocket	*Taphrina pruni*	2
Raspberry	Anthracnose	*Elsinoë veneta*	1
	Botrytis grey mold	*Botrytis cinerea*	1
	Cane blight	*Coniothyrium fuckelii*	1
	Fireblight	*Erwinia amylovora*	2
	Spur blight	*Phoma* sp.	1
	Nutrient deficiency		1
Saskatoon berry	Environmental injury		1
Strawberry	Black root rot	*Rhizoctonia* sp.	1
	Leather rot	*Phytophthora cactorum*	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Fusarium* spp.	1

Table 9. Summary of diseases diagnosed on **forage legume crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Common leaf spot	*Pseudopeziza medicaginis*	1
	Leptosphaerulina leaf spot	*Leptosphaerulina briosiana*	2
	Spring black stem/ leaf spot	*Phoma medicaginis*	3
	Summer black stem and leaf spot	*Cercospora medicaginis*	1
	Root rot	*Rhizoctonia solani*	2
	Virus	unidentified	1
	Herbicide injury		2
	Nutrient deficiency		1
Birdsfoot trefoil	Anthracnose	*Colletotrichum* sp.	1
	Stemphylium leaf spot	*Stemphylium* sp.	1

Table 10. Summary of diseases diagnosed on **special field crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Corn	Common rust	*Puccinia sorghi*	1
	Goss's wilt	*Clavibacter michiganensis* subsp. *nebraskensis*	2
	Holcus spot	*Pseudomonas syringae*	1
	Northern corn leaf blight	*Helminthosporium turcicum*	1
	Root rot	*Fusarium graminearum,*	3
	Root rot	*Fusarium sp.*	2
	Yellow leaf blight	*Phyllosticta maydis*	1
	Floppy corn syndrome	environmental injury	4
	Herbicide injury		3
	Nutrient deficiency		4
Faba bean	Root rot	*Fusarium* spp., *Rhizoctonia solani*	2
Field bean	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	2
	Leaf spot	*Alternaria alternata*	1
	Pod spot	*Alternaria alternata*	1
	Root rot	*Fusarium oxysporum, F. solani*	5
	Root rot	*Rhizoctonia solani*	1
	Rust	*Uromyces appendiculatus*	1
	Stem breakage	physiological disorder	2
	Environmental injury		1
	Herbicide injury		1
	Nutrient deficiency		1
Field pea	Anthracnose	*Colletotrichum pisi*	1
	Root rot	*Fusarium solani*	3
	Root rot	*Rhizoctonia solani*	1
	Herbicide injury		1
Hemp	Flower blight	*Fusarium graminearum, F. sporotrichioides*	1
	Root rot/wilt	*Fusarium oxysporum*	1
	Herbicide injury		1
Millet	Bacterial leaf spot	*Pseudomonas syringae*	5
	Stem rot	*Fusarium graminearum*	2
Soybean	Alternaria leaf spot	*Alternaria alternata*	3
	Anthracnose	*Colletotrichum* sp.	1
	Bacterial blight	*Pseudomonas* sp.	16
	Brown spot	*Septoria glycines*	6
	Cercospora blight	*Cercospora kikuchii*	3
	Downy mildew	*Peronospora manshurica*	8
	Root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*	9
	Root rot	*Phytophthora sojae*	16
	Stem blight	*Phomopsis longicolla*	4
	Stem rot	*Sclerotinia sclerotiorum*	2
	Environmental injury		17
	Herbicide injury		11
	Iron chlorosis	nutrient deficiency	3
	Nutrient deficiency		11

Table 11. Summary of diseases diagnosed on **potato crops** submitted to the MAFRD Crop Diagnostic Centre in 2013.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	7
Blackleg	*Pectobacterium carotovorum* subsp. *atrosepticum*	1
Black dot, on leaves	*Colletotrichum coccodes*	2
Black dot, on stems	*Colletotrichum coccodes*	4
Black scurf (tuber)	*Rhizoctonia solani*	1
Brown spot	*Alternaria alternata*	1
Early blight, foliar	*Alternaria solani*	1
Early blight, tuber	*Alternaria solani*	2
Fusarium dry rot	*Fusarium sambucinum*	4
Late blight, foliar	*Phytophthora infestans*	1
Rhizoctonia stem and stolon canker	*Rhizoctonia solani*	1
Pink eye	unknown	2
Pink rot	*Phytophthora erythroseptica*	6
Root rot	*Pythium* spp.	3
Rubbery rot	*Geotrichum candidum*	1
Scab, common	*Streptomyces* spp.	1
Scab, powdery	*Spongospora subterranea*	5
Silver scurf	*Helminthosporium solani*	1
Verticillium wilt	*Verticillium dahliae*	4
Violet root rot	*Rhizoctonia crocorum*	1
Physiological disorders		4
Herbicide injury		3

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

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2013

ABSTRACT: The integrated pest management program of the Muck Crops Research Station provides diagnostics service to vegetable growers around the Holland/Bradford Marsh, Ontario. In 2013, 293 samples were submitted to the laboratory for identification and possible control recommendations. Samples included infectious diseases, physiological disorders, weeds, insects and insect damage.

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

RESULTS AND COMMENTS: Weather conditions in the 2013 growing season were conducive for the development of many pathogens including bacteria, *Pythium* spp., *Sclerotinia* spp*. and Rhizoctonia* spp*.* Excessive soil moisture, associated with above average rainfall recorded in May, June, July, August and September, created ideal conditions for soil borne pathogens, particularly *Pythium* spp*.* and *Rhizoctonia* spp. on carrot. From 8 January to 15 November, 2013, the diagnostic laboratory of the MCRS received 252 diseased plant samples for diagnosis as part of the IPM program. Of these, 78% were infectious diseases (196 in total) and 22% physiological disorders (56 in total). These samples were associated with the following crops: onion (41.5%), carrot (22.1%), celery (11.9%), brassicas (7.5%), lettuce (2.4%), and other crops (14.6%). A total of 24 samples of insects or insect damage were assessed and there were also 17 weed identifications. A summary of diseases diagnosed and causal agents on crop samples submitted to the MCRS diagnostic laboratory in 2013 is presented in Table 1.

Table 1: Summary of diseases diagnosed on plants submitted to the MCRS Diagnostic Laboratory in 2013.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Amaranth	Phoma leaf spot	*Phoma betae*	1
Bean	Anthracnose	*Colletotrichum lindemuthianum*	1
Beet	Alternaria leaf spot	*Alternaria brassicae*	3
	Cercospora leaf spot	*Cercospora beticola*	4
	Nutrient deficiency	N deficiency	1
	Nutrient deficiency	Ca deficiency	1
	Chemical injury	Herbicide damage	1
Broccoli	Chemical injury	Herbicide damage	1
Carrot	Aster yellows	*Candidatus* Phytoplasma asteris	2
	Crown rot	*Rhizoctonia solani*	2
	Cavity spot	*Pythium* spp.	3
	Sclerotinia rot	*Sclerotinia sclerotiorum*	3
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	12
	Pythium root dieback	*Pythium* spp.	7
	Crater rot	*Rhizcotonia carotae*	2
	Crown gall	*Agrobacterium tumefaciens*	5
	Damping off	*Pythium spp.* and/or *Rhizoctonia spp.*	6
	Fusarium rot	*Fusarium* spp.	1
	Chemical injury	Herbicide damage	7
	Growth crack (Split)	Fluctuating moisture level	3
	Forking	Growth point damage	2
	Bruising	Physiological disorder	1
Cauliflower	Alternaria leaf spot	*Alternaria* spp.	1
Celeriac	Soft rot	*Erwinia carotovora*	1
	Bacterial leaf spot	*Pseudomonas syringae*	1
	Early blight	*Cercospora apii*	3
	Late blight	*Septoria apiicola*	3
	Chemical injury	Herbicide damage	1
Celery	Bacterial leaf blight	*Pseudomonas cichorii*	2
	Bacterial leaf spot	*Pseudomonas syringae* pv.*apii*	3
	Soft rot	*Erwinia carotovora*	3
	Celery leaf curling	*Colletotrichum* spp.	2
	Early blight	*Cercospora apii*	4
	Late blight	*Septoria apiicola*	3
	Pink rot	*Sclerotinia sclerotiorum*	2
	Nutrient deficiency	B deficiency	3
	Physiological disorder	Transplant shock	1
	Physiological disorder	Tip burn	1
	Wilting	Excessive moisture	1
	Chemical injury	Herbicide damage	4
Chinese broccoli	Bacterial leaf spot	*Pseudomonas syringae*	2
	Alternaria leaf spot	*Alternaria brassicae*	2
	Nutrient deficiency	Mg deficiency	1
Flowering cabbage	Alternaria leaf spot	*Alternaria brassicae*	2
	Tip burn	Heat stress/Ca deficiency	1
Gladiolus	Botrytis leaf spot and blight	*Botrytis* spp.	1
	Fusarium rot	*Fusarium oxysporum* f.sp. *gladioli*	1
Leek	Stemphylium leaf blight	*Stemphylium vesicarium*	1
Lettuce	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	2
	Gray mould	*Botrytis cinerea*	1

Table 1, contd.			
Lettuce	Downy mildew	*Bremia lactucae*	2
	Powdery mildew	*Erysiphe cichoracearum*	1
Napa cabbage	Alternaria leaf spot	*Alternaria brassicae*	1
Marigold	Physiological disorder	Heat stress	1
Mustard green	Damping off	*Pythium* spp.	1
Onion	Stemphylium leaf blight	*Stemphylium vesicarium*	22
	Purple blotch	*Alternaria porri*	20
	Pink root	*Phoma terrestris*	2
	Botrytis leaf blight	*Botrytis squamosa*	5
	Damping off	*Pythium* spp./*Rhizoctonia* spp.	2
	Smut	*Urocystis cepulae*	7
	Anthracnose	*Colletotrichum* sp.	1
	White rot	*Sclerotium cepivorum*	4
	Downy mildew	*Peronospora destructor*	8
	Slippery skin	*Burkholderia gladioli* pv. *alliicola*	1
	Bacterial rot/Soft rot	*Erwinia carotovora*	8
	Environmental injury	Frost damage	1
	Tip burn	Heat stress	7
	Chemical injury	Herbicide damage	6
	Environmental injury	Pelting rain injury	4
	Wilting	Excessive moisture	6
Pak Choy	Alternaria black spot	*Alternaria brassicae*	4
	Bacterial leaf spot	*Pseudomonas syringae*	1
	Fusarium yellows	*Fusarium oxysporum*	1
Parsley	Septoria blight	*Septoria petroselini*	1
	Nutrient deficiency	Mg deficiency	1
Pepper	Bacterial leaf spot	*Xanthomonas campestris* pv. *vesicatoria*	2
Potato	Black scurf	*Rhizoctonia solani*	1
Pumpkin	Alternaria leaf spot	*Alternaria cucumerina*	1
Radish	Alternaria leaf spot	*Alternaria brassicae*	1
Spinach	Downy mildew	*Peronospora farinosa* f. sp. *spinaciae*	1
Swiss chard	Alternaria leaf spot	*Alternaria brassicae*	1
Tomato	Bacterial leaf spot	*Xanthomonas campestris* pv. *vesicatoria*	1
	Early blight	*Alternaria solani*	3
	Late blight	*Phytophthora infestans*	1
DISEASED SAMPLES			**196**
ABIOTIC AND OTHER DISORDERS			**56**
TOTAL SUBMISSIONS			**252**

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CROPS: Commercial Crops **-** Diagnostic Laboratory Report
LOCATION: Ontario

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PEST DIAGNOSTIC CLINIC, UNIVERSITY OF GUELPH IN 2009

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Pest Diagnostic Clinic, University of Guelph in 2009 are summarized in this report. Samples included greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruits, turfgrass and trees.

METHODS: The Pest Diagnostic Clinic of the University of Guelph provides plant pest diagnostic services to growers, agri-businesses, provincial and federal governments and homeowners across Canada. Services include disease diagnosis, plant parasitic nematode identification and enumeration, pathogen detection from soil and water, and insect and plant identification. The following data are for samples received by the laboratory for disease diagnosis in 2009. Diagnoses were accomplished using microscopic examination, culturing on artificial media, biochemical identification of bacteria using BIOLOG®, enzyme linked immunosorbent assay (ELISA), polymerase chain reaction (PCR)-based techniques including DNA multiscan, PCR and RT-PCR, and DNA sequencing.

RESULTS AND COMMENTS: In 2009, from January 1 to December 31, the Pest Diagnostic Clinic received samples representing plants in over 75 genera, for disease diagnosis. Results are presented in Tables 1 -6 below. For various reasons, the frequency of samples submitted to the laboratory does not reflect the prevalence of diseases of various crops. Problems caused by plant parasitic nematodes, insects, and abiotic factors are not listed. Most diseases identified in 2009 are commonly diagnosed.

Table 1. Summary of plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Brassica sprout blend (*Brassica* spp.)	Bacterial decay	*Pseudomonas fluorescens*	1
	Rot	*Pythium dissotocum*	1
Carrot (*Daucus carota*)	White mold	*Sclerotinia sclerotiorum*	2
Cucumber (*Cucumis sativus*)	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	1
	Crown rot	*Fusarium oxysporum*	2
	Cucumber Green Mottle Mosaic Virus	Cucumber Green Mottle Mosaic Virus (CGMMV)	6
	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
	Fruit rot	*Pythium ultimum*	1

Table 1 (contd.)			
Cucumber (*Cucumis sativus*)	Leaf spot	*Alternaria* sp.	2
	Melon Necrotic Spot Virus	Melon Necrotic Spot Virus (MNSV)	9
	Powdery mildew	*Sphaerotheca fuliginea*	1
	Root rot	*Phytophthora drechsleri*	2
	Root rot	*Pythium ultimum*	1
Eggplant (*Solanum melongena*)	Bacterial leaf spot	*Pseudomonas syringae*	1
Green bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum* sp.	1
Lettuce (*Lactuca sativa*)	Crown and root rot	*Phytophthora drechsleri*	2
	Crown and root rot	*Pythium dissotocum*	6
	Root rot	*Phytophthora drechsleri*	4
	Root rot	*Pythium dissotocum*	7
	Soft rot	*Pectobacterium carotovora*	1
Luffa sp.	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	1
Onion (*Allium cepa*)	Iris Yellow Spot Virus	Iris Yellow Spot Virus (IYSV)	1
	Leaf blight	*Stemphylium* sp.	1
	Soft rot	*Pseudomonas marginalis*	1
	White rot	*Sclerotium cepivorum*	1
Pepper (*Capsicum annuum*)	Crown and root rot	*Phytophthora capsici*	2
	Crown and root rot	*Pythium aphanidermatum*	1
	Crown rot	*Fusarium oxysporum*	1
	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
	Fruit rot	*Colletotrichum acutatum*	1
	Fruit rot	*Rhizopus* sp.	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Pepper Mild Mottle Virus	Pepper Mild Mottle Virus (PMMoV)	2
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
	Stem and crown rot	*Phytophthora cactorum*	1
	Stem and crown rot	*Phytophthora capsici*	2
	Stem rot	*Botrytis cinerea*	1
	Stem rot	*Colletotrichum* sp.	1
	Stem rot	*Phytophthora capsici*	1
	Stem rot	*Phytophthora citricola*	1
	Stem rot	*Sclerotinia* sp.	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Potato (*Solanum tuberosum*)	Crown and stem rot	*Rhizoctonia solani*	1
	Early blight	*Alternaria solani*	1

Table 1 (contd.)			
Potato (*Solanum tuberosum)*	Late blight	*Phytophthora infestans*	3
	Pink rot	*Phytophthora erythroseptica*	1
	Stem and tuber rot	*Phytophthora cryptogea*	1
	Tuber rot	*Pythium aphanidermatum*	1
Rutabaga (*Brassica napus*)	Verticillium wilt	*Verticillium albo-atrum*	1
Sugarbeet (*Beta vulgaris*)	Crown rot	*Rhizoctonia solani*	1
Tomato (*Lycopersicon esculentum*)	Anthracnose	*Colletotrichum* sp.	1
	Anthracnose	*Colletotrichum coccodes*	2
	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	40
	Bacterial speck	*Pseudomonas syringae*	2
	Bacterial spot	*Xanthomonas campestris*	21
	Bacterial wilt	*Ralstonia solanacearum*	1
	Corky root	*Pyrenochaeta lycopersici*	8
	Crown and root rot	*Fusarium oxysporum*	5
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium irregulare*	1
	Crown and root rot	*Pythium ultimum*	3
	Crown rot	*Fusarium oxysporum*	3
	Crown rot	*Phytophthora capsici*	1
	Crown rot	*Phytophthora cryptogea*	1
	Crown rot	*Phytophthora drechsleri*	1
	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
	Early blight	*Alternaria solani*	1
	Fruit rot	*Penicillium* sp.	1
	Fruit spot	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	5
	Grey mold	*Botrytis cinerea*	1
	Pepino Mosaic Virus	Pepino Mosaic Virus (PepMV)	10
	Pith necrosis	*Pseudomonas corrugata*	1
	Potyvirus	Potyvirus group	2
	Root rot	*Fusarium oxysporum*	5
	Root rot	*Pythium dissotocum*	4
	Root rot	*Pythium ultimum*	3
	Stem rot	*Fusraium oxysporum*	1
	Stem rot	*Pythium ultimum*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
	Tomato Mosaic Virus	Tomato Mosaic Virus (ToMV)	3
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	2
	Verticillium wilt	*Verticillium dahliae*	2
Tomato seed (*Lycopersicon esculentum*)	Bacterial spot	*Xanthomonas campestris* pv. *vesicatoria*	1

Table 2. Summary of plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Apple (*Malus* sp.)	Crown and root rot	*Phytophthora cryptogea*	1
	Fire blight	*Erwinia amylovora*	4
	Leaf spot	*Pseudomonas syringae*	1
Black raspberry (*Rubus occidentalis*)	Powdery mildew	*Oidium* sp.	1
Blueberry (*Vaccinium corymbosum*)	Blueberry Shock Virus	Blueberry Shock Virus (BlShV)	2
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	1
	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	2
Cantaloupe (*Cucumis melo*)	Bacterial blight	*Pseudomonas syringae*	1
	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
Pear (*Pyrus* sp.)	Fire blight	*Erwinia amylovora*	1
Raspberry (*Rubus idaeus*)	Potyvirus	Potyvirus group	1
	Raspberry Bushy Dwarf Virus	Raspberry Bushy Dwarf Virus (RBDV)	5
	Stem blight	*Botrytis cinerea*	1
	Root rot	*Pythium ultimum*	3
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Rhizoctonia solani*	1
	Crown rot	*Colletotrichum acutatum*	1
	Crown rot	*Fusarium* sp.	1
	Crown rot	*Phytophthora fragariae*	1
	Crown rot	*Rhizoctonia solani*	1
	Root rot	*Cylindrocarpon destructans*	1
	Root rot	*Fusarium* sp.	2
	Root rot	*Phytophthora cinnamomi*	1
	Root rot	*Phytophthora fragariae*	1
	Verticillium wilt	*Verticillium dahliae*	1
Watermelon (*Citrullus lanatus*)	Anthracnose	*Colletotrichum* sp.	1
	Gummy stem blight	*Didymella bryoniae*	2
	Root rot	*Fusarium oxysporum*	1

Table 3. Summary of plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
African violet (*Saintpaulia* sp.)	Root rot	*Phytophthora* sp.	1
Alstroemeria (*Alstroemeria* sp.)	Crown and root rot	*Fusarium oxysporum*	2
	Root rot	*Pythium ultimum*	1
	Root rot	*Pythium sylvaticum*	1
Aster (*Aster* sp.)	Flower blight	*Botrytis cinerea*	1
Azalea (*Rhododendron* sp.)	Crown and root rot	*Phytophthora cryptogea*	1
	Grey mold	*Botrytis cinerea*	1
	Root rot	*Fusarium oxysporum*	1
Begonia (*Begonia* sp.)	Bacterial leaf spot	*Xanthomonas campestris* pv. *begoniae*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	4
Bleeding-heart (*Dicentra* sp.)	Tobacco Rattle Virus	Tobacco Rattle Virus (TRV)	2
	White mold	*Sclerotinia sclerotiorum*	2
Calla lily (*Zantedeschia* sp.)	Root rot	*Erwinia carotovora*	1
Chrysanthemum (*Chrysanthemum* sp.)	Root rot	*Fusarium oxysporum*	2
Clematis (*Clematis* sp.)	Clematis wilt	*Phoma clematidina*	1
	Powdery mildew	*Oidium* sp.	1
Coreopsis auriculata	Root rot	*Fusarium* sp.	1
	Root rot	*Phytophthora nicotianae*	1
Creeping bentgrass (*Agrostis* sp.)	Red thread	*Laetisaria fuciformis*	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium ultimum*	2
Cyclamen (*Cyclamen* sp.)	Root rot	*Fusarium oxysporum*	1
Dahlia (*Dahlia* sp.)	Leaf spot	*Cercospora* sp.	1
English ivy (*Hedera helix*)	Bacterial leaf spot	*Xanthomonas campestris*	1
Frosty fern (*Selaginella kraussiana*)	Leaf blight	*Botrytis cinerea*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium dissotocum*	1
Geranium (*Geranium* sp.)	Bacterial leaf spot	*Xanthomonas campestris*	1
Gerbera (*Gerbera* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Phytophthora drechsleri*	1
	Crown and root rot	*Pythium dissotocum*	2
	Crown rot	*Fusarium oxysporum*	1
	Powdery mildew	*Oidium* sp.	1
Hardy geranium (*Geranium* sp.)	Root rot	*Pythium dissotocum*	2
Hellebore (*Helleborus* sp.)	White mold	*Sclerotinia sclerotiorum*	1
Heuchera (*Heuchera* sp.)	Rust	*Puccinia heucherae*	1
Hosta (*Hosta* sp.)	Hosta Virus X	Hosta Virus X (HSVX)	10
Iris (*Iris* sp.)	Potyvirus	Potyvirus group	1
Ivy geranium (*Pelargonium* x *hortorum*)	Crown rot	*Fusarium oxysporum*	1
	Root rot	*Thielaviopsis basicola*	1

Table 3 (contd.)			
CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Kalanchoe (*Kalanchoe* sp.)	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium ultimum*	1
	Stem rot	*Fusarium oxysporum*	2
	Stem rot	*Rhizoctonia solani*	1
Leucanthemum (*Leucanthemum* sp.)	Root rot	*Phytophthora drechsleri*	1
	Root rot	*Pythium dissotocum*	1
Monkshood (*Aconitum carmichaelii*)	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
Narcissus (*Narcissus* sp.)	Crown and bulb rot	*Fusarium oxysporum*	1
	Potyvirus	Potyvirus group	1
Nertera granadensis	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium* sp.	1
New Guinea impatiens (*Impatiens hawkeri*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	6
	Root rot	*Pythium dissotocum*	1
Orchid (*Phalaenopsis* sp.)	Cymbidium Mosaic Virus	Cymbidium Mosaic Virus (CymMV)	1
	Odontoglossum Ringspot Virus	Odontoglossum Ringspot Virus (ORSV)	1
Osteospermum sp.	Anthracnose	*Colletotrichum* sp.	1
	Crown rot	*Phytophthora cinnamomi*	1
	Crown rot	*Pythium* spp.	1
Pansy (*Viola* sp.)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
Passion flower (*Passiflora* sp.)	Crown gall	*Agrobacterium tumefaciens*	1
Poinsettia (*Euphorbia pulcherrima*)	Root rot	*Fusarium oxysporum*	1
Purple coneflower (*Echinacea angustifolia*)	Anthracnose	*Colletotrichum* sp.	2
Purple fountain grass (*Pennisetum setaceum*)	Root rot	*Pythium graminicola*	1
	Root rot	*Pythium irregulare*	1
Rose (*Rosa* sp.)	Cane blight	*Botrytis cinerea*	1
	Downy mildew	*Peronospora sparsa*	2
	Grey mold	*Botrytis* sp.	1
Sedum (*Sedum* sp.)	Bacterial soft rot	*Erwinia chrysanthemi*	1
	Crown and root rot	*Rhizoctonia solani*	1
Snapdragon (*Antirrhinum* sp.)	Rust	*Puccinia antirrhini*	1
Spathiphyllum sp.	Crown rot	*Fusarium oxysporum*	1
	Crown rot	*Fusarium solani*	1

Table 3 (contd.)			
Turfgrass (Gramineae)	Microdochium patch	*Microdochium nivale*	1
	Red thread	*Laetisaria fuciformis*	2
	Root rot	*Fusarium* sp.	1

Table 4. Summary of plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Austrian pine (*Pinus nigra*)	Diplodia tip blight	*Sphaeropsis sapinea*	1
Colorado Blue Spruce (*Picea pungens*)	Rhizosphaera needle cast	*Rhizosphaera kalkhoffii*	3
Crabapple (*Malus* sp.)	Canker	*Phomopsis* sp.	2
Dogwood (*Cornus* sp.)	Leaf spot	*Septoria* sp.	1
Dwarf pussy willow (*Salix* sp.)	Root rot	*Phytophthora nicotianae*	1
Euonymus (*Euonymus* sp.)	Anthracnose	*Gloeosporium* sp.	1
Eastern white cedar (*Thuja occidentalis*)	Root rot	*Pythium sylvaticum*	1
	Tip blight	*Pestalotiopsis funerea*	2
Hackberry (*Celtis occidentalis*)	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Phytophthora* sp.	1
Ironwood (*Ostrya virginiana*)	Leaf spot	*Septoria* sp.	1
Japanese lilac (*Syringa reticulata*)	Verticillium wilt	*Verticillium albo-atrum*	1
Japanese maple (*Acer palmatum*)	Crown and root rot	*Fusarium oxysporum*	2
Juniper (*Juniperus* sp.)	Root rot	*Phytophthora cinnamomi*	1
	Tip blight	*Phomopsis* sp.	1
Kerria japonica	Leaf and stem spot	*Septoria* sp.	1
Maple (*Acer* sp.)	Verticillium wilt	*Verticillium wilt*	1
Nannyberry (*Viburnum lentago*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
Norway spruce (*Picea abies*)	Rhizosphaera needlecast	*Rhizosphaera kalkhoffii*	1
Red pine (*Pinus resinosa*)	Root rot	*Pythium ultimum*	1
Waxflower (*Chamelaucium* sp.)	Root rot	*Phytophthora drechsleri*	1
Spruce (*Picea* sp.)	Rhizosphaera needle cast	*Rhizosphaera kalkhoffii*	2
Weeping pussy willow (*Salix caprea*)	Root rot	*Phytophthora nicotianae*	1
White pine (*Pinus strobus*)	Root rot	*Pythium ultimum*	1
White spruce (*Picea glauca*)	Rhizosphaera needle cast	*Rhizosphaera kalkhoffii*	3

Table 5. Summary of plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Barley (*Hordeum vulgare*)	Cereal Yellow Dwarf Virus	Cereal Yellow Dwarf Virus (CYDV)	1
Bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum* sp.	3
	Anthracnose	*Colletotrichum lindemuthianum*	2
Black bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum* sp.	1
Corn (*Zea mays*)	Maize Dwarf Mosaic Virus	Maize Dwarf Mosaic Virus (MDMV)	1
Cranberry bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum* sp.	1
Durum wheat (*Triticum* sp.)	Leaf spot	*Septoria* sp.	1
Dutch brown bean (*Phaseolus vulgaris*)	Potyvirus	Potyvirus group	1
Oat (*Avena sativa*)	Crown rust	*Puccinia coronata*	1
	Take-all	*Gaeumannomyces graminis*	1
Otebo bean (*Phaseolus vulgaris*)	Potyvirus	Potyvirus group	3
Peanut (*Arachis hypogaea*)	Anthracnose	*Colletotrichum* sp.	1
	Stem rot	*Rhizoctonia solani*	1
Soybean (*Glycine max*)	Anthracnose	*Colletotricum* sp.	2
	Bacterial blight	*Pseudomonas syringae*	1
	Downy mildew	*Peronospora* sp.	2
	Root rot	*Fusarium oxysporum*	8
	Root rot	*Fusarium solani*	11
	Root rot	*Phytophthora* sp.	6
	Root rot	*Pythium ultimum*	2
	Root rot	*Rhizoctonia solani*	2
Spring wheat (*Triticum* sp.)	Root rot	*Fusarium culmorum*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium ultimum*	1
Wheat (*Triticum* sp.)	Crown rot	*Fusarium* sp.	1
	Ergot	*Claviceps purpurea*	1
Wheat	Glume blotch	*Septoria* sp.	4
	Head blight	*Fusarium* sp.	1
	Powdery mildew	*Erysiphe graminis*	1
White bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum* sp.	8
	Anthracnose	*Colletotrichum lindemuthianum*	7
Winter wheat (*Triticum* sp.)	Barley Yellow Dwarf Virus strain PAV	Barley Yellow Dwarf Virus strain PAV (BYDV-PAV)	1

Table 6. Summary of plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2009.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Amaranth (*Amaranthus* sp.)	White rust	*Albugo* sp.	1
Basil (*Ocimum basilicum*)	Crown and root rot	*Fusarium* sp.	2
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Calendula sp.	Bacterial leaf spot	*Pseudomonas cichorii*	1
Ginseng (*Panax* sp.)	Root rot	*Cylindrocarpon destructans*	1
	Root rot	*Rhizoctonia solani*	1

CROPS: Commercial Crops **-** Diagnostic Laboratory Report
LOCATION: Ontario

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PEST DIAGNOSTIC CLINIC, UNIVERSITY OF GUELPH IN 2010

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Pest Diagnostic Clinic, University of Guelph in 2010 are summarized in this report. Samples included greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruit, turfgrass and trees.

METHODS: The Pest Diagnostic Clinic of the University of Guelph provides plant pest diagnostic services to growers, agri-businesses, provincial and federal governments and homeowners across Canada. Services include disease diagnosis, plant parasitic nematode identification and enumeration, pathogen detection from soil and water, and insect and plant identification. The following data are for samples received by the laboratory for disease diagnosis in 2010. Diagnoses were accomplished using microscopic examination, culturing on artificial media, biochemical identification of bacteria using BIOLOG®, enzyme linked immunosorbent assay (ELISA), polymerase chain reaction (PCR)-based techniques including DNA multiscan, PCR and RT-PCR, and DNA sequencing.

RESULTS AND COMMENTS: In 2010, from January 1 to December 31, the Pest Diagnostic Clinic received samples representing plants in about 100 genera, for disease diagnosis. Results are presented in Tables 1-6 below. For various reasons, the frequency of samples submitted to the laboratory does not reflect prevalence of diseases of various crops. Problems caused by plant parasitic nematodes, insects, and abiotic factors are not listed. Most diseases identified in 2010 are commonly diagnosed.

Table 1. Summary of plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Bean (*Phaseolus vulgaris*)	Anthracnose	*Colletotrichum lindemuthianum*	5
Cabbage (*Brassica oleracea* var. *capitata*)	Black rot	*Xanthomonas campestris*	1
Carrot (*Daucus carota*)	Root dieback	*Pythium sylvaticum*	1
Cauliflower (*Brassica oleracea* var. *botrytis*)	Black rot	*Xanthomonas campestris*	2
Chinese cabbage (*Brassica rapa* subsp. *pekinensis*)	Leaf spot	*Alternaria brassicae*	1
Cilantro (*Coriandrum sativum*)	Root rot	*Fusarium* spp.	1
Cilantro (*Coriandrum sativum*)	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1

Table 1 (contd.)			
Cucumber (*Cucumis sativus*)	Crown rot	*Pythium aphanidermatum*	2
	Cucumber Green Mottle Mosaic Virus	Cucumber Green Mottle Mosaic Virus (CGMMV)	17
	Downy mildew	*Pseudoperonospora cubensis*	1
	Melon Necrotic Spot Virus	Melon Necrotic Spot Virus (MNSV)	1
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium dissotocum*	1
	Stem rot	*Pythium aphanidermatum*	1
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	3
Eggplant (*Solanum melongena*)	Verticillium wilt	*Verticillium dahliae*	1
Garlic (*Allium sativum*)	Bulb rot	*Fusarium proliferatum*	1
Leek (*Allium porrum*)	Bacterial soft rot	*Pseudomonas fluorescens*	1
Lettuce (*Lactuca sativa*)	Crown rot	*Fusarium solani*	2
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium dissotocum*	1
	Septoria leaf spot	*Septoria lactucae*	1
Onion (*Allium cepa*)	Bacterial leaf spot	*Pseudomonas syringae*	1
	Leaf spot	*Phyllosticta* sp.	1
	Leaf spot	*Stemphylium* sp.	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium* sp.	1
Pea (*Pisum sativum*)	Downy mildew	*Peronospora* sp.	1
Pepper (*Capsicum annum*)	Fruit rot	*Fusarium* spp.	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Pepper Mild Mottle Virus	Pepper Mild Mottle Virus (PMMoV)	1
	Tomato Mosaic Virus	Tomato Mosaic Virus (ToMV)	1
Potato (*Solanum tuberosum*)	Bacterial soft rot	*Pectobacterium carotovorum*	1
	Black dot	*Colletotrichum coccodes*	1
	Black scurf	*Rhizoctonia solani*	2
	Late blight	*Phytophthora infestans*	1
	Leak	*Pythium ultimum*	1
	Wilt	*Fusarium oxysporum*	1
Radish (*Raphanus sativus*)	Downy mildew	*Peronospora parasitica*	1
Spinach (*Spinacia oleracea*)	Stem rot	*Pythium aphanidermatum*	1
Sugarbeet (*Beta vulgaris*)	Cercospora leaf spot	*Cercospora beticola*	4
Sweet potato (*Ipomoea batatas*)	Root rot	*Fusarium solani*	1

Table 1 (contd.)			
Sweet potato	Scurf	*Monilochaetes infuscans*	2
Tomato (*Lycopersicon esculentum*)	Anthracnose	*Colletotrichum* sp.	2
	Anthracnose	*Colletotrichum coccodes*	1
	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	43
	Bacterial leaf spot	*Xanthomonas campestris*	6
	Bacterial stem rot	*Pectobacterium carotovorum*	2
	Crown rot	*Phytophthora nicotianae*	1
	Crown rot	*Pythium irregulare*	1
	Crown and root rot	*Fusarium oxysporum*	1
	Fruit spot	*Alternaria alternata*	1
	Grey mold	*Botrytis cinerea*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Leaf mold	*Fulvia fulva*	1
	Pepino Mosaic Virus	Pepino Mosaic Virus (PepMV)	4
	Pospiviroid	Pospiviroid	2
	Stem rot	*Erwinia carotovora*	1
	Stem rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium* sp.	2
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Fusarium solani*	3
	Root rot	*Pythium ultimum*	4
	Root rot	*Thielaviopsis basicola*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
	Tomato Mosaic virus	Tomato Mosaic Virus (ToMV)	2
	Verticillium wilt	*Verticillium dahliae*	4
Tomato seed (*Lycopersicon esculentum*)	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	3
Zucchini (*Cucurbita pepo*)	Powdery mildew	*Sphaerotheca fuliginea*	1

Table 2. Summary of plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Apple (*Malus* sp.)	Bitter rot	*Colletotrichum acutatum*	1
	Black rot	*Botryosphaeria obtusa*	5
	Blister spot	*Pseudomonas syringae*	1
	Canker	*Phomopsis* sp.	3
	Canker	*Phoma* sp.	2
	Crown rot	*Phytophthora cactorum*	1
	Crown rot	*Phytophthora drechsleri*	1

Table 2 (contd.)			
Apple (*Malus* sp.)	Fire blight	*Erwinia amylovora*	3
Blueberry (*Vaccinium* sp.)	Powdery mildew	*Oidium* sp.	1
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium irregulare*	1
	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	1
Grape (*Vitis* sp.)	Black rot	*Guignardia bidwellii*	2
Peach (*Prunus persica*)	Root rot	*Pythium ultimum*	1
	Bacterial spot	*Xanthomonas campestris*	4
Raspberry (*Rubus idaeus*)	Late leaf rust	*Pucciniastrum americanum*	1
	Root rot	*Phytophthora cactorum*	1
	Root rot	*Phytophthora citricola*	1
	Root rot	*Phytophthora fragariae*	1
	Root rot	*Phytophthora drechsleri*	1
	Root rot	*Pythium* spp.	1
	Septoria leaf spot	*Septoria* sp.	2
	Spur blight	*Didymella applanata*	3
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Crown rot	*Phytophthora cactorum*	2
	Crown rot	*Phytophthora citricola*	2
	Crown rot	*Gnomonia comari*	2
	Crown rot	*Rhizoctonia solani*	1
	Crown and root rot	*Gnomonia comari*	2
	Grey mold	*Botrytis cinerea*	2
	Leaf scorch	*Marssonina fragariae*	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium* sp.	1
	Stem end rot	*Gnomonia comari*	1
	Verticillium wilt	*Verticillium dahliae*	1
Watermelon (*Citrullus lanatus*)	Gummy stem blight	*Didymella bryoniae*	1
	Root rot	*Pythium ultimum*	1

Table 3. Summary of plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
African violet (*Saintpaulia* sp.)	Root rot	*Fusarium oxysporum*	1
Alstroemeria (*Alstroemeria* sp.)	Alstroemeria Mosaic Virus	Alstroemeria Mosaic Virus (AlMV)	1
	Crown and root rot	*Fusarium solani*	1
	Crown and root rot	*Phytophthora nicotianae*	1
	Crown and root rot	*Pythium ultimum*	1
Azalea (*Rhododendron* sp.)	Root rot	*Pythium dissotocum*	1
Begonia (*Begonia* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium ultimum*	1
Bentgrass (*Agrostris* sp.)	Root rot	*Pythium irregulare*	1
	Take-all patch	*Gaeumannomyces graminis*	1
Black-eyed Susan (*Rudbeckia fulgida*)	Downy mildew	*Plasmopara halstedii*	1
Blue Passionflower (*Passiflora cearulea*)	Crown gall	*Agrobacterium tumefaciens*	3
Calathea crocata	Root rot	*Fusarium solani*	1
Calibrachoa (*Calibrachoa* sp.)	Calibrachoa Mottle Virus	Calibrachoa Mottle Virus (CbMV)	1
	Powdery mildew	*Oidium* sp.	2
	Poytvirus	Potyvirus group	1
	Tobacco Etch Virus	Tobacco Etch Virus (TEV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	3
	Root rot	*Pythium dissotocum*	1
Calla lily (*Calla* sp.)	Black root rot	*Thielaviopsis basicola*	1
	Root rot	*Phytophthora cryptogea*	1
	Root rot	*Pythium* sp.	2
Chrysanthemum (*Chrysanthemum* sp.)	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	2
Clematis (*Clematis* sp.)	Clematis wilt	*Ascochyta clematidina*	2
Coleus (*Solenostemon* sp.)	Downy mildew	*Peronospora* sp.	1
Coreopsis (*Coreopsis* sp.)	Crown and root rot	*Rhizoctonia solani*	1
Crassula corymbulosa	Powdery mildew	*Oidium* sp.	1
Creeping bentgrass (*Agrostis stolonifera*)	Root rot	*Pythium* sp.	1
	Root rot	*Pythium graminicola*	1
Cyclamen (*Cyclamen persicum*)	Crown rot	*Fusarium oxysporum*	3
Dahlia (*Dahlia* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Crown and root rot	*Pythium* sp.	1

Table 3 (contd.)			
Dendrobium sp.	Cymbidium Mosaic Virus	Cymbidium Mosaic Virus (CyMV)	1
Dianthus sp.	Crown rot	*Rhizoctonia solani*	1
Dieffenbachia (*Dieffenbachia* sp.)	Leaf spot	*Myrothecium roridum*	1
Easter lily (*Lilium longiflorum*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Rhizoctonia solani*	1
Purple coneflower (*Echinacea angustifolia*)	Anthracnose	*Colletotrichum* sp.	2
Epimedium sp.	Tobacco Rattle Virus	Tobacco Rattle Virus (TRV)	1
Frosty fern (*Selaginella kraussiana*)	Myrothecium canker and leaf spot	*Myrothecium roridum*	1
	Root rot	*Pythium dissotocum*	1
Geranium (*Pelargonium* sp.)	Stem rot	*Pythium* sp.	1
Gerbera (*Gerbera* sp.)	Crown and stem rot	*Fusarium solani*	1
	Crown and root rot	*Phytophthora* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Rhizoctonia solani*	1
Heucheraa (*Heuchera* sp.)	Anthracnose	*Colletotrichum* sp.	1
Hydrangea (*Hydrangea* sp.)	Bacterial leaf spot	*Erwinia carotovora*	1
	Bacterial leaf spot	*Pseudomonas corrugata*	1
	Bacterial soft rot	*Acidovorax konjaci*	1
Impatiens (*Impatiens walleriana*)	Alternaria leaf spot	*Alternaria* sp.	1
	Downy mildew	*Plasmopara obducens*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	2
Kalanchoe (*Kalanchoe* sp.)	Crown rot	*Fusarium oxysporum*	1
	Wilt	*Fusarium* sp.	1
Lobelia (*Lobelia* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Lupine (*Lupinus* sp.)	Anthracnose	*Colletotrichum* sp.	1
Moneytree (*Pachira aquatica*)	Canker	*Botryosphaeria rhodina*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Leptosphaeria* sp.	1
Monkshood (*Aconitum* sp.)	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
Moth orchid (*Phalaenopsis* sp.)	Cymbidium Mosaic Virus	Cymbidium Mosaic Virus (CyMV)	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Moth orchid (*Phalaenopsis* sp.)	Odontoglossum Ringspot Virus	Odontoglossum Ringspot Virus (ORSV)	1
Ornithogalum sp.	Potyvirus	Potyvirus group	1
Peony (*Paeonia* sp.)	Leaf and stem spot	*Xanthomonas campestris*	1
Periwinkle (*Vinca major*)	Bacterial leaf spot	*Acidovorax konjaci*	2

Table 3 (contd.)			
Petunia (*Petunia* sp.)	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	3
	Tomato Mosaic Virus	Tomato Mosaic Virus ToMV	3
Bluegrass (*Poa* sp.)	Curvularia blight	*Curvularia* sp.	1
Poinsettia (*Euphorbia pulcherrima*)	Bacterial leaf spot	*Pseudomonas viridilivida*	1
	Bacterial leaf spot	*Xanthomonas axonopodis*	1
	Poinsettia Mosaic Virus	Poinsettia Mosaic Virus (PnMV)	2
	Root rot	*Pythium* sp.	1
	Scab	*Sphaceloma poinsettae*	2
Rose (*Rosa* sp.)	Grey mold	*Botrytis cinerea*	2
Salvia (*Salvia* sp.)	Myrothecium canker	*Myrothecium* sp.	1
Sedum (*Sedum* sp.)	Anthracnose	*Colletorichum* sp.	2
	Crown rot	*Fusarium solani*	1
	Crown rot	*Phytophthora drechsleri*	1
	Crown rot	*Rhizoctonia solani*	1
	Root rot	*Phytophthora drechsleri*	2
	Septoria leaf spot	*Septoria* sp.	1
Snapdragon (*Antirrhinum* sp.)	Downy mildew	*Peronospora* sp.	1
Stephanotis floribunda	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Sweet William (*Dianthus barbatus*)	Anthracnose	*Colletotrichum* sp.	1
Turfgrass (Gramineae)	Anthracnose	*Colletotrichum graminicola*	3
	Dollar spot	*Sclerotinia homoeocarpa*	1
	Leptosphaerulina leaf blight	*Leptosphaerulina trifolii*	2
	Necrotic ring spot	*Leptosphaeria korrae*	1
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium irregulare*	1
Wintergreen (*Gaultheria* sp.)	Anthracnose	*Colletotrichum* sp.	1

Table 4. Summary of plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
American hophornbeam (*Ostrya virginiana*)	Septoria leaf spot	*Septoria* sp.	1
Black pine (*Pinus nigra*)	Needle blight	*Mycosphaerella* sp.	1
Blue spruce (*Picea pungens*)	Phomopsis canker	*Phomopsis* sp.	2
	Rhizosphaera needle cast	*Rhizosphaera kalkhoffii*	3
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Fusarium solani*	3
	Root rot	*Pythium* sp.	2

Table 4 (contd.)			
Blue spruce (*Picea pungens*)	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Bosnian pine (*Pinus heldreichii*)	Needle blight	*Mycosphaerella* sp.	1
Boxwood (*Buxus* sp.)	Volutella leaf blight	*Volutella buxi*	2
Cypress (*Cupressus* sp.)	Shoot blight	*Pestalotiopsis* sp.	1
Dogwood (*Cornus alba*)	Bacterial leaf spot	*Pseudomonas syringae*	1
	Canker	*Neofabraea alba*	1
Eastern white cedar (*Thuja occidentalis*)	Crown rot	*Pythium* sp.	1
Eastern white cedar (*Thuja occidentalis*)	Phomopsis blight	*Phomopsis* sp.	1
	Tip blight	*Pestalotiopsis* sp.	1
Fraser fir (*Abies fraseri*)	Root rot	*Phytophthora cactorum*	1
	Root rot	*Pythium ultimum*	1
Heartnut (*Juglans ailantifolia*)	Phytoplasma	*Candidatus* Phytoplasma sp.	1
Honey locust (*Gleditsia triacanthos*)	Camarosporium	*Camarosporium* sp.	1
	Nectria canker	*Nectria cinnabarina*	2
Ixora (*Ixora* sp.)	Gall	*Phomopsis* sp.	1
Jack pine (*Pinus banksiana*)	Root rot	*Fusarium solani*	1
Lilac (*Syringa* sp.)	Gray mold	*Botrytis cinerea*	1
	Crown and root rot	*Phytophthora drechsleri*	1
Magnolia (*Magnolia* sp.)	Powdery mildew	*Microsphaera* sp.	1
Maple (*Acer* sp.)	Anthracnose	*Discula* sp.	1
Microbiota (*Microbiota* sp.)	Crown rot	*Fusarium oxysporum*	1
	Crown rot	*Fusarium solani*	1
Pin oak (*Quercus palustris*)	Tubakia leaf spot	*Tubakia dryina*	1
Purple beech (*Fagus sylvatica*)	Botryosphaeria canker	*Botryosphaeria* sp.	1
Purple sandcherry (*Prunus* x *cistena*)	Black knot	*Dibotryon morbosum*	1
Red pine (*Pinus resinosa*)	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
	Shoot blight	*Pestalotiopsis funerea*	2
	Shoot blight	*Sphaeropsis sapinea*	2
Scots pine (*Pinus sylvestris*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
Spruce (*Picea* sp.)	Grey mold	*Botrytis* sp.	1
	Rhizosphaera needle cast	*Rhizosphaera kalkhoffii*	2
Sugar maple (*Acer saccharum*)	Leaf spot	*Septoria aceris*	1

Table 4 (contd.)			
Weeping pussy willow (*Salix caprea* 'pendula')	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	1
	Rust	*Melampsora* sp.	1
White pine (*Pinus strobus*)	Root rot	*Pythium irregulare*	1
Yew (*Taxus* sp.)	Root rot	*Phytophthora drechsleri*	1
	Root rot	*Pythium irregulare*	1

Table 5. Summary of plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Alfalfa (*Medicago sativa*)	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Rhizoctonia solani*	1
Bean (*Phaseolus vulgaris*)	Alternaria spot	*Alternaria* sp.	4
	Anthracnose	*Colletotrichum capsici*	4
	Anthracnose	*Colletotrichum lindemuthianum*	13
Canola (*Brassica napus*)	Clubroot	*Plasmodiophora brassicae*	1
	Black spot	*Alternaria brassicae*	1
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium dissotocum*	1
	Root rot	*Rhizoctonia solani*	2
	White leaf spot	*Mycosphaerella capsellae*	1
Corn (*Zea mays*)	Anthracnose	*Colletotrichum graminicola*	1
Oat (*Avena sativa*)	Rust	*Puccinia* sp.	2
Peanut (*Arachis hypogaea*)	Blackhull	*Thielaviopsis basicola*	1
Red clover (*Trifolium pratense*)	Anthracnose	*Colletotrichum* sp.	1
Soybean (*Glycine max*)	Anthracnose	*Colletotrichum* sp.	2
	Brown spot	*Septoria glycines*	3
	Brown stem rot	*Phialophora gregata*	1
	Crown rot	*Pythium aphanidermatum*	1
	Crown rot	*Pythium dissotocum*	1
	Phomopsis seed decay	*Phomopsis longicolla*	2
	Root rot	*Fusarium* sp.	2
	Root rot	*Pythium* sp.	2
	Stem blight	*Phomopsis longicolla*	1
	Root rot	*Thielaviopsis basicola*	2
Wheat (*Triticum* sp.)	Powdery mildew	*Erysiphe graminis*	1

Table 6. Summary of plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2010.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Amaranth (*Amaranthus* sp.)	Stem rot	*Pythium aphanidermatum*	1
Basil (*Ocimum basillicum*)	Downy mildew	*Peronospora belbahrii*	1
Golden seal (*Hydrastis canadensis*)	Root rot	*Fusarium solani*	1
Hop (*Humulus lupulus*)	Alternaria blight	*Alternaria alternata*	1
	Downy mildew	*Pseudoperonospora humuli*	1
Lavender (*Lavandula* sp.)	Grey mold	*Botrytis cinerea*	5
	Root rot	*Pythium dissotocum*	1
Parsley (*Petroselinum crispum*)	Septoria blight	*Septoria petroselini*	1

CROPS: Commercial Crops **-** Diagnostic Laboratory Report
LOCATION: Ontario

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PEST DIAGNOSTIC CLINIC, UNIVERSITY OF GUELPH IN 2013

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Pest Diagnostic Clinic, University of Guelph in 2013 are summarized in this report. Samples included greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruits, turfgrass and trees. Rose Rosette Virus was confirmed in Ontario for the first time on rose.

METHODS: The Pest Diagnostic Clinic of the University of Guelph provides plant pest diagnostic services to growers, agri-businesses, provincial and federal governments and homeowners across Canada. Services include disease diagnosis, plant parasitic nematode identification and enumeration, pathogen detection from soil and water, and insect and plant identification. The following data are for samples received by the laboratory for disease diagnosis in 2013. Diagnoses were accomplished using microscopic examination, culturing on artificial media, biochemical identification of bacteria using BIOLOG®, enzyme linked immunosorbent assay (ELISA), polymerase chain reaction (PCR)-based techniques including DNA multiscan, PCR and RT-PCR, and DNA sequencing.

RESULTS AND COMMENTS: In 2013, from January 1 to December 19, the Pest Diagnostic Clinic received samples representing plants in over 100 genera, for disease diagnosis. Results are presented in Tables 1 -6 below. For various reasons, the frequency of samples submitted to the laboratory does not reflect the prevalence of diseases of various crops. Problems caused by plant parasitic nematodes, insects, and abiotic factors are not listed. Most diseases identified in 2013 are commonly diagnosed with the exception of Rose Rosette Virus. It was confirmed in Ontario for the first time.

Table 1. Summary of plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Pest Diagnostic Clinic in 2013.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Azuki bean (Vigna angularis)	Crown and root rot	*Pythium ultimum*	1
	Stem rot	*Fusarium* sp.	1
Bean (*Phaseolus vulgaris*)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	1
Bean seed (*Phaseolus vulgaris*)	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	2
Beet (*Beta vulgaris*)	Root rot	*Pythium ultimum*	1
Cabbage (*Brassica oleracea var. capitata*)	Alternaria leaf spot	*Alternaria* sp.	1
	Bacterial soft rot	*Pseudomonas marginalis*	1
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Rhizoctonia solani*	1
	Grey mold	*Botrytis cinerea*	2
	Root rot	*Pythium* sp.	1
Carrot (*Daucus carota*)	Leaf spot	*Cercospora* sp.	1

Table 1 (contd.)

Carrot (*Daucus carota*)	Pythium dieback	*Pythium* sp.	1
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium* spp.	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora cryptogea*	1
Celery (*Apium graveolens*)	Celery leaf curl	*Colletotrichum acutatum*	1
Chinese cabbage (*Brassica rapa pekinensis*)	Pythium rot	*Pythium* sp.	1
Corn (*Zea mays*)	Anthracnose leaf blight	*Colletotrichum graminicola*	1
	Crown and root rot	*Pythium* sp.	1
	Northern corn leaf blight	*Exserohilum turcicum*	1
	Root rot	*Fusarium* sp.	3
	Root rot	*Pythium* sp.	3
Cucumber (*Cucumis sativus*)	Bacterial wilt	*Erwinia tracheiphila*	5
	Crown and root rot	*Pythium aphanidermatum*	4
	Crown and root rot	*Pythium ultimum*	1
	Cucumber Green Mottle Mosaic Virus (CGMMV)	Cucumber Green Mottle Mosaic Virus (CGMMV)	11
	Fusarium rot	*Fusarium* spp.	3
	Gummy stem blight	*Didymella bryoniae*	2
	Melon Necrotic Spot Virus	Melon Necrotic Spot Virus (MNSV)	1
	Phytophthora blight	*Phytophthora capsici*	2
	Phytophthora fruit rot	*Phytophthora capsici*	1
	Powdery mildew	*Oidium* sp.	2
	Pythium rot	*Pythium aphanidermatum*	1
	Pythium rot	*Pythium sp.*	2
	Rhizopus soft rot	*Rhizopus stolonifer*	2
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium aphanidermatum*	5
	Root rot	*Pythium dissotocum*	1
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	3
	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	3
Garlic (*Allium sativum*)	Aster yellows	*Candidatus* Phytoplasma asteris	2
	Bacterial soft rot	*Enterobacter cloacae*	1
	Bacterial soft rot	*Pseudomonas fluorescens*	2
	Basal plate rot	*Fusarium oxysporum*	4
	Bulb rot	*Penicillium* sp.	1
	Diplodia stain	*Botryosphaeria dothidea*	1
	Embellisia skin blotch	*Embellisia allii*	2
	Fusarium rot	*Fusarium* spp.	11

Table 1. (contd.)

Garlic (*Allium sativum*)	Leaf blight	*Stemphylium* sp.	10
	Phytoplasma	*Candidatus* Phytoplasma sp.	3
	Pythium rot	*Pythium* sp.	4
	Rhizoctonia rot	*Rhizoctonia solani*	1
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium ultimum*	2
	Root rot	*Rhizoctonia solani*	5
Lettuce (*Lactuca sativa*)	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium ultimum*	1
	Root rot	*Pythium* sp.	2
Onion (*Allium cepa*)	Alternaria leaf spot	*Alternaria* sp.	1
	Anthracnose	*Colletotrichum* sp.	1
	Basal plate rot	*Fusarium oxysporum*	2
	Fusarium rot	*Fusarium* spp.	2
	Leaf blight	*Stemphylium* sp.	19
Parsley (*Petroselinum crispum*)	Crown and root rot	*Pythium ultimum*	2
	Root rot	*Fusarium* spp.	1
	Root rot	*Pythium* spp.	1
	Septoria blight	*Septoria petroselini*	1
Pepper (*Capsicum* sp.)	Alternaria rot	*Alternaria* sp.	2
	Anthracnose	*Colletotrichum capsici*	3
	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	1
	Bacterial spot	*Pseudomonas syringae* pv. *syringae*	2
	Bacterial spot	*Xanthomonas campestris*	1
	Botrytis rot	*Botrytis* sp.	1
	Crown and root rot	*Fusarium* spp.	3
	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Phytophthora capsici*	1
	Crown and root rot	*Pythium* sp.	2
	Crown and root rot	*Pythium dissotocum*	2
	Fusarium wilt	*Fusarium oxysporum*	3
	Phytophthora blight	*Phytophthoria capsici*	3
	Pythium rot	*Pythium aphanidermatum*	1
	Rhizopus rot	*Rhizopus* sp.	1
	Root rot	*Fusarium* spp.	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium dissotocum*	4
Potato (*Solanum tuberosum*)	Root rot	*Pythium* sp.	3
	Stem rot	*Phytophthora capsici*	1
	Yeast rot	Saccharomycetales	1
	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
	Black dot	*Colletotrichum coccodes*	1
	Black scurf	*Rhizoctonia solani*	2

Table 1 (contd.)

Potato (*Solanum tuberosum*)	Crown and root rot	*Pythium* spp.	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Late blight	*Phytophthora infestans*	2
	Leak	*Pythium* sp.	2
	Pink rot	*Phytophthora cryptogea*	2
	Silver scurf	*Helminthosporium solani*	2
	Verticillium wilt	*Verticillium dahliae*	2
Pumpkin (*Cucurbita pepo*)	Fusarium rot	*Fusarium culmorum*	1
	Grey mold	*Botrytis cinerea*	1
	Powdery mildew	*Oidium* sp.	1
	Pythium rot	*Pythium dissotocum*	1
Rutabaga (*Brassica napobrassica*)	Rhizoctonia rot	*Rhizoctonia solani*	2
	Root rot	*Pythium dissotocum*	1
Spinach (*Spinacia oleracea*)	Crown and root rot	*Pythium aphanidermatum*	1
	Downy mildew	*Peronospora farinosa*	1
	Root rot	*Fusarium* spp.	3
	Root rot	*Pythium* spp.	4
	Root rot	*Pythium ultimum*	1
Squash (*Cucurbita argyrosperma*)	Crown and root rot	*Pythium ultimum*	1
	Fusarium rot	*Fusarium* spp.	1
	Phytophthora blight	*Phytophthora capsici*	1
	Phytophthora fruit rot	*Phytophthora capsici*	1
	Root rot	*Rhizoctonia solani*	1
Sweet potato (*Ipomoea batatas*)	Black rot	*Ceratocystis fimbriata*	4
Tomato (*Lycopersicon esculentum*)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	1
	Anthracnose	*Colletotrichum coccodes*	1
		Colletotrichum sp.	2
	Bacterial leaf spot	*Pseudomonas syringae*	1
	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
	Bacterial spot	*Xanthomonas campestris*	3
	Black dot	*Colletotrichum coccodes*	1
	Buckeye rot	*Phytophthora capsici*	2
	Buckeye rot	*Phytophthora* spp.	1
	Crown and root rot	*Fusarium* spp.	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Phytophthora capsici*	2
	Crown and root rot	*Pythium aphanidermatum*	3
	Crown and root rot	*Rhizoctonia solani*	2
	Grey mold	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	3
	Penicillium decay	*Penicillium* sp.	1
	Pepino Mosaic Virus	Pepino Mosaic Virus	30
	Pith necrosis	*Pseudomonas corrugata*	1

Table 1 (contd.)			
Tomato (*Lycopersicon esculentum*)	Plectosphaerella canker	*Plectosphaerella cucumerina*	1
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium* sp.	4
	Septoria leaf spot	*Septoria lycopersici*	1
	Stem rot	*Fusarium solani*	1
	Stem rot	*Fusarium oxysporum*	1
	Stem rot	*Phytophthora capsici*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
	Tomato bacterial canker	*Clavibacter michiganesis* subsp. *michiganesis*	13
	Tomato Mosaic Virus	Tomato Mosaic Virus (ToMV)	2
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	2
Turnip (*Brassica rapa*)	Downy mildew	*Peronospora* sp.	1
Wild Leek (*Allium tricoccum*)	Septoria leaf spot	*Septoria* sp.	1

Table 2. Summary of plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2013.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Apple (*Malus* sp.)	Anthracnose	*Colletotrichum* sp.	11
	Bitter rot	*Colletotrichum* sp.	5
	Black rot	*Botryosphaeria obtusa*	20
	Botryosphaeria canker	*Botryosphaeria* sp.	1
	Crown and root rot	*Phytophthora cactorum*	1
	Fire Blight	*Erwinia amylovora*	2
	Frogeye leaf spot	*Botryosphaeria obtusa*	3
	Leaf spot	*Phomopsis* sp.	1
	Phoma leaf spot	*Phoma* sp.	5
	Twig blight	*Nectria* sp.	1
Blackberry (*Rubus ursinus*)	Orange rust	*Gymnoconia* sp.	1
Blueberry (*Vaccinium* sp.)	Powdery mildew	*Microsphaera* sp.	1
	Twig dieback	*Pestalotiopsis* sp.	2
Blueberry (*Vaccinium corymbosum*)	Root rot	*Fusarium solani*	1
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Phytophthora* sp.	1
Callery pear (*Pyrus calleryana*)	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
Grape (*Vitis* sp.)	Grapevine Leafroll-associated Virus	Grapevine Leafroll-associated Virus (GLRaV)	13

Table 2 (contd.)

Grape (*Vitis* sp.)	Grapevine Red Blotch-associated Virus	Grapevine Red Blotch-associated Virus (GRBaV)	81
Haskap (*Lonicera caerulea*)	Cladosporium rot	*Cladosporium* sp.	1
Peach (*Prunus persica*)	Root rot	*Phytophthora* sp.	1
Pear (*Pyrus* sp.)	Entomosporium leaf spot	*Entomosporium* sp.	2
	Phyllosticta leaf spot	*Phyllosticta* sp.	1
	Rust	*Gymnosporangium* sp.	1
Pin cherry (*Prunus pensylvanica*)	Shot hole blight	*Wilsonomyces carpophilus*	1
Prunus (*Prunus* sp.)	Silver leaf	*Chondrostereum purpureum*	1
Raspberry (*Rubus* sp.)	Grey mold	*Botrytis cinerea*	1
Rhubarb (*Rheum* sp.)	Botrytis blight	*Botrytis cinerea*	2
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	4
	Anthracnose	*Colletotrichum acutatum*	6
	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Gnomonia* sp.	1
	Crown and root rot	*Phytophthora* spp.	1
	Crown and root rot	*Phytophthora cactorum*	2
	Crown and root rot	*Pythium* spp.	2
	Crown rot	*Phytophthora citricola*	1
	Leaf scorch	*Marssonina fragariae*	3
	Leaf spot	*Mycosphaerella fragariae*	1
	Phytoplasma	*Candidatus* Phytoplasma sp.	1
	Powdery mildew	*Sphaerotheca* sp.	2
	Root lesion nematode	*Pratylenchus* sp.	1
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora fragariae*	1
	Root rot	*Pythium* sp.	6
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Rhizoctonia solani*	6
Strawberry (*Fragaria* sp.)	Strawberry Crinkle Virus	Strawberry Crinkle Virus (SCV)	2
	Strawberry Mild Yellow Edge Virus	Strawberry Mild Yellow Edge Virus (SMYEV)	17
	Strawberry Mottle Virus	Strawberry Mottle Virus (SMoV)	56
	Strawberry Pallidosis Virus	Strawberry Pallidosis Virus (SPaV)	19
	Strawberry Vein Banding Virus	Strawberry Vein Banding Virus (SVBV)	46
	Verticillium wilt	*Verticillium dahilae*	1
Wolfberry (*Lycium* sp.)	Anthracnose	*Colletotrichum acutatum*	2
	Root rot	*Fusarium* spp.	1

Table 3. Summary of plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2013

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
African violet (*Saintpaulia* sp.)	Crown and root rot	*Pythium* spp.	1
	Crown and root rot	*Phytophthora capsici*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Artemisia (*Artemisia* sp.)	Grey mold	*Botrytis cinerea*	1
	Crown and root rot	*Fusarium oxysporum*	1
Azalea (*Rhododendron* sp.)	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Phytophthora* sp.	1
Balsam fir (*Abies balsamea*)	Diplodia tip blight	*Diplodia* sp.	1
Begonia (*Begonia* sp.)	Bacterial leaf spot	*Xanthomonas campestris*	2
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Bentgrass (*Agrostis* sp.)	Anthracnose	*Microdochium bolleyi*	1
	Crown and root rot	*Pythium* sp.	3
	Root rot	*Pythium* sp.	1
	Take-all patch	*Gaeumannomyces graminis*	2
Calla lily (*Zantedeschia* sp.)	Root rot	*Pythium dissotocum*	2
Canna lilly (*Canna* sp.)	Potyvirus	*Potyvirus*	3
Clematis (*Clematis* sp.)	Clematis wilt	*Phoma clematidina*	1
	Grey mold	*Botrytis cinerea*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Crown and root rot	*Fusarium oxysporum*	1
Chrysanthemum (*Chrysanthemum* sp.)	Botrytis stem blight	*Botrytis cinerea*	1
	Brown rust	*Puccinia chrysanthemi*	1
	Crown and root rot	*Fusarium oxysporum*	1
Chrysanthemum (*Chrysanthemum* sp.)	Crown and root rot	*Pythium aphanidermatum*	1
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium ultimum*	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Root rot	*Pythium* sp.	1
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
	Verticillium wilt	*Verticillium dahliae*	1
Coleus (*Solenostemon* sp.)	Rhizoctonia rot	*Rhizoctonia solani*	1
Creeping bentgrass (*Agrostis palustris*)	Anthracnose basal rot	*Colletotrichum* sp.	2
	Crown and root rot	*Pythium* sp.	1
	Take-all patch	*Gaeumannocyces graminis*	1
Dipladenia (*Dipladenia* sp.)	Root and stem rot	*Fusarium* sp.	1
	Root rot	*Phytophthoria nicotianae*	1
Dracaena (*Dracaena* sp.)	Anthracnose	*Glomerella cingulata*	1

Table 3 (contd.)

Echinacea (*Echinacea* sp.)	Phytoplasma	*Candidatus* Phytoplasma sp.	1
Fescue (*Festuca* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Pythium irregulare*	1
Flowering kale (*Brassica oleracea*)	Black rot	*Xanthomonas campestris* pv. *campestris*	1
Geranium (*Pelargonium* sp.)	Botrytis blight	*Botrytis cinerea*	2
	Botrytis leaf blight	*Botrytis cinerea*	1
Gerbera (*Gerbera* sp.)	Crown and root rot	*Pythium irregulare*	1
	Crown and root rot	*Pythium dissotocum*	1
Grass species (Gramineae)	Anthracnose	*Colletotrichum graminicola*	3
	Crown and root rot	*Pythium irregulare*	2
	Curvularia blight	*Curvularia* sp.	3
	Pink snow mold	*Microdochium nivale*	1
	Root rot	*Pythium* sp.	2
	Take-all patch	*Gaeumannomyces graminis*	1
Helleborus (*Helleborus* sp.)	Crown and root rot	*Phytophthora* sp.	2
Hosta (*Hosta* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Grey mold	*Botrytis cinerea*	1
	Hosta Virus X	Hosta Virus X (HVX)	2
Hydrangea (*Hydrangea* sp.)	Phoma leaf spot	*Phoma* sp.	1
	Rhizoctonia leaf spot	*Rhizoctonia* sp.	1
	Root rot	*Pythium dissotocum*	1
Impatiens (*Impatiens walleriana*)	Downy mildew	*Plasmopara* sp.	1
Japanese kerria (*Kerria japonica*)	Septoria leaf spot	*Septoria* sp.	1
Lavender (*Lavandula* sp.)	Crown and root rot	*Fusarium* sp.	1
	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Pythium* sp.	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium sylvaticum*	1
Lenten rose (*Helleborus* sp.)	Downy mildew	*Peronospora* sp.	1
Leucanthemum (*Leucanthemum* sp.)	Crown rot	*Rhizoctonia solani*	1
Lilac (*Syringa* sp.)	Bacterial blight	*Pseudomonas syringae*	3
Lisianthus (*Eustoma russellianum*)	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium irregulare*	1
Lupine (*Lupinus* sp.)	Black root rot	*Thielaviopsis basicola*	1
Mandevilla (*Mandevilla* sp.)	Root and stem rot	*Fusarium* sp.	1
Oakleaf hydrangea (*Hydrangea quercifolia*)	Bacterial leaf spot	*Xanthomonas campestritis*	1
Pachysandra (*Pachysandra* sp.)	Volutella blight	*Volutella pachysandricola*	1
Peony (*Paeonia* sp.)	Bacterial leaf spot	*Xanthomonas campestris*	1
	Phytophthora blight	*Phytophthora cactorum*	2
	Root rot	*Pythium* sp.	1
	Root rot	*Rhizoctonia solani*	1

Table 3 (contd.)			
Phlox (*Phlox subulata*)	Botrytis blight	*Botrytis cinerea*	1
Poinsettia (*Euphorbia pulcherrima*)	Crown and root rot	*Pythium aphanidermatum*	2
Rose (*Rosa* sp.)	Black spot	*Diplocarpon rosae*	1
	Downy mildew	*Peronospora* sp.	11
	Fusarium rot	*Fusarium oxysporum*	1
	Grey mold	*Botrytis cinerea*	1
	Pythium rot	*Pythium dissotocum*	1
	Rose Rosette Virus	Rose Rosette Virus (RRV)	1
Salvia (*Salvia nemorosa*)	Crown and root rot	*Fusarium oxysporum*	1
	Leaf spot	*Myrothecium* sp.	1
	Root rot	*Pythium* sp.	1
Sedum (*Sedum* sp.)	Crown and root rot	*Pythium irregulare*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Fusarium root rot	*Fusarium* sp.	1
Sweet William (*Dianthus barbatus*)	Crown and root rot	*Pythium irregulare*	1
	Fusarium wilt	*Fusarium oxysporum*	1

Table 4. Summary of plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2013.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Barberry (*Berberis* sp.)	Phomopsis leaf spot	*Phomopsis* sp.	1
	Powdery mildew	*Oidium* sp.	1
Boxwood (*Buxus* sp.)	Root and crown rot	*Phytophthora* sp.	1
	Pythium root and crown rot	*Pythium* sp.	1
	Grey mold	*Botrytis cinerea*	1
	Macrophoma leaf spot	*Macrophoma* sp.	2
	Root rot	*Phytophthora* sp.	4
	Root rot	*Pythium* sp.	6
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Rhizoctonia solani*	6
	Volutella leaf blight	*Volutella buxi*	51
	Volutella stem canker and leaf blight	*Volutella buxi*	42
Caragana (*Caragana* sp.)	Black root rot	*Thielaviopsis basicola*	1
	Fusarium canker	*Fusarium* sp.	1
	Septoria leaf spot and canker	*Septoria* sp.	1
Cedar (*Thuja* sp.)	Crown and root rot	*Fusarium* sp.	1
	Shoot blight	*Pestalotiopsis* sp.	3
	Stem canker	*Botryosphaeria* sp.	1
Colorado blue spruce (*Picea pungens*)	Rhizosphaera needlecast	*Rhizosphaera kalkhoffii*	4

Table 4 (contd.)

Common hackberry (*Celtis occidentalis*)	Anthracnose	*Colletotrichum* sp.	1
Crabapple (*Malus* sp.)	Scab	*Venturia inaequalis*	2
Douglas fir (*Pseudotsuga menziesii*)	Rust	*Melampsora* sp.	1
	Stem canker	*Phoma* sp.	1
Eastern white cedar (*Thuja occidentalis*)	Shoot blight	*Pestalotiopsis* sp.	1
Foxtail palm (*Wodyetia bifurcata*)	Leaf spot	*Colletotrichum* sp.	1
Heartnut (*Juglans ailantifolia*)	Melanconis dieback	*Melonconis juglandis*	1
Honeysuckle (*Lonicera* sp.)	Honeysuckle blight	*Insolibasidium deformans*	1
Juniper (*Juniperus* sp.)	Botryosphaeria canker	*Botryosphaeria* sp.	1
	Phomopsis blight	*Phomopsis* sp.	1
	Shoot blight	*Pestalotiopsis* sp.	1
Lawson cypress (*Chamaecyparis lawsoniana*)	Root rot	*Phytophthora drechsleri*	1
Lawson cypress (*Chamaecyparis lawsoniana*)	Root rot	*Pythium dissotocum*	1
Lilac (*Syringa* sp.)	Phytoplasma	*Candidatus* Phytoplasma sp.	5
Magnolia (*Magnolia* sp.)	Powdery mildew	*Oidium* sp.	1
Maple (*Acer* sp.)	Anthracnose	*Aureobasidium apocryptum*	1
Norway maple (*Acer platanoides*)	Anthracnose	*Colletotrichum* sp.	1
	Tar spot	*Rhytisma acerinum*	1
Red maple (*Acer rubrum*)	Phyllosticta leaf spot	*Phyllostita minima*	1
River birch (*Betula nigra*)	Phomopsis twig blight	*Phomopsis* sp.	1
Rhododendron (*Rhododendron* sp.)	Phomopsis dieback	*Phomopsis* sp.	2
Serbian spruce (*Picea omorika*)	Phomopsis blight	*Phomopsis* sp.	1
Silver maple (*Acer saccharinum*)	Botryosphaeria canker and dieback	*Botryosphaeria* sp.	1
Sourwood (*Oxydendrum arboreum*)	Phomopsis leaf spot	*Phomopsis* sp.	1
Spruce (*Picea* sp.)	Lophodermium needlecast	*Lophodermium* sp.	1
	Rhizosphaera needlecast	*Rhizosphaera kalkhoffii*	3
Sugar maple (*Acer saccharum*)	Verticillium wilt	*Verticillium* sp.	1
Sycamore (*Platanus* sp.)	Anthracnose	*Discula* sp.	1
Tartarian dogwood (*Cornus alba*)	Septoria leaf spot	*Septoria* sp.	1
White spruce (*Picea glauca*)	Rhizosphaera needlecast	*Rhizosphaera kalkhoffii*	2
Willow (*Salix* sp.)	Cytospora canker	*Cytospora* sp.	1
Yew (*Taxus* sp.)	Shoot blight	*Pestalotiopsis* sp.	1

Table 5. Summary of plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2013.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Barley (*Hordeum vulgare*)	Barley Yellow Dwarf Virus strain PAV	Barley Yellow Dwarf Virus (BYDV pav)	1
	Spot blotch	*Bipolaris* sp.	1
Canola (*Brassica napus*)	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
	Root rot	*Pythium* sp.	2
Quinoa (*Chenopodium quinoa*)	Downy mildew	*Peronospora farinosa*	1
Soybean (*Glycine max*)	Anthracnose	*Colletotrichum* sp.	1
	Brown stem rot	*Phialophora gregata*	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium* sp.	2
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	1
Wheat (*Triticum* sp.)	Common bunt	*Tilletia* sp.	2
	Pink snow mold	*Microdochium nivale*	1
	Septoria leaf spot	*Septoria tritici*	1
	Speckled snow mold	*Typhula* sp.	1

Table 6. Summary of plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2013.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Basil (*Ocimum basilicum*)	Grey mold	*Botrytis* sp.	1
Centrapalus (*Centrapalus galamensis*)	Crown and root rot	*Pythium irregulare*	1
	Crown and root rot	*Fusarium oxysporum*	1
Common purslane (*Portulaca oleracea*)	Dichotomophthora leaf spot	*Dichotomophthora* sp.	2
Dill (*Anethum graveolens*)	Root rot	*Fusarium* spp.	1
	Root rot	*Pythium* spp.	1
Euphorbia lagascae	Root rot	*Pythium ultimum*	1
Ginseng (*Panax* sp.)	Crown and root rot	*Fusarium* sp.	7
	Crown and root rot	*Pythium* sp.	4
	Crown and root rot	*Pythium irregulare*	2
	Crown and root rot	*Pythium ultimum*	1
	Fusarium rot	*Fusarium* sp.	1
	Root rot	*Cylindrocarpon destructans*	2
	Soft rot	*Pseudomonas* sp.	1

Table 6 (contd.)

Ginseng seed (*Panax* sp.)	Fusarium rot	*Fusarium oxysporum*	8
	Fusarium rot	*Fusarium solani*	3
Hop (*Humulus lupulus*)	Apple Mosaic Virus	Apple Mosaic Virus (ApMV)	1
	Carlavirus group	Carlavirus	1
	Downy mildew	*Pseudoperonospora* sp.	3
	Hop Latent Virus	Hop Latent Virus (HpLV)	1
Okra (*Abelmoschus esculentus*)	Tobacco Streak Virus	Tobacco Streak Virus (TSV)	1
Peyote (*Lophophora williamsii*)	Fusarium rot	*Fusarium oxysporum*	1
Thyme (*Thymus* sp.)	Pythium rot	*Pythium* sp.	1
	Rhizoctonia rot	*Rhizoctonia solani*	2
Tobacco (*Nicotiana* sp.)	Crown and root rot	*Fusarium* spp.	1
	Crown and root rot	*Pythium* spp.	1
Wasabi (*Wasabia japonica*)	Crown and root rot	*Phytophthora drechsleri*	1
	Crown and root rot	*Pythium dissotocum*	1
Wild ginger (*Asarum caudatum*)	Septoria leaf spot	*Septoria* sp.	1

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

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TITRE : MALADIES DIAGNOSTIQUÉES SUR LES ÉCHANTILLONS DE CULTURES COMMERCIALES REÇUES AU LABORATOIRE DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ EN 2013

RÉSUMÉ : Du 1er janvier au 31 décembre 2013, 1337 maladies ont été identifiées parmi les 1885 échantillons traités pour une pathologie ou une détection. Parmi ces maladies, 1169 (87%) sont d'origine parasitaire soit une proportion encore jamais atteinte. Cette proportion est supérieure à la moyenne de 74% des quatre dernières années. Parmi le total des maladies parasitaires, 843 sont attribuables aux champignons, 169 aux bactéries, 91 aux virus, 28 aux nématodes et 38 aux phytoplasmes. Les plantes maraîchères de toutes provenances renfermaient 48% des maladies parasitaires identifiées; les petits fruits 29%.

MÉTHODES : Le Laboratoire de diagnostic en phytoprotection du Ministère de l'Agriculture et de l'Alimentation du Québec (MAPAQ) offre un service d'identification des maladies parasitaires et non parasitaires pour les cultures commerciales produites au Québec. Les données rapportées présentent les maladies identifiées sur les échantillons de plantes provenant des conseillers agricoles des secteurs publics et privés, de la Financière agricole du Québec, de l'Institut québécois du développement de l'horticulture ornementale (IQDHO) et par ceux de l'industrie. Tous les échantillons font l'objet d'un examen visuel préalable suivi d'un examen à la loupe binoculaire. Selon les symptômes, un ou plusieurs tests diagnostiques sont réalisés dans le but de détecter ou d'identifier l'agent pathogène. Tous les tests de diagnostic utilisés au laboratoire sont largement cités dans la littérature scientifique; voici les principaux : les nématodes sont extraits par l'entonnoir de Baermann et identifiés sous microscope; les champignons sont isolés sur les milieux de culture artificiels, identifiés par microscopie et le pouvoir pathogène de certains genres est vérifié; les bactéries sont aussi isolées sur des milieux de culture artificiels (généraux et différentiels) puis identifiées par les tests biochimiques classiques, API-20E, Biolog^{R}, ELISA ou PCR; les phytoplasmes sont détectés par PCR et les virus par le test sérologique ELISA. Le séquençage d'ADN est occasionnellement utilisé pour appuyer l'identification d'un champignon, d'une bactérie ou d'un phytoplasme. Deux références sont principalement consultées pour les noms des maladies et des microorganismes : « *Noms des maladies des plantes au Canada* », 4e édition (2003) et « *Maladies des grandes cultures au Canada* », 4ième édition (2004).

RÉSULTATS ET DISCUSSIONS : Les tableaux 1 à 13 présentent le sommaire des maladies identifiées sur les cultures commerciales. Au tableau 1, les maladies des plantes maraîchères de plein champ regroupent aussi les transplants provenant des serres et des pépinières. Les maladies des légumes entreposées listées au tableau 2 incluent les légumes de courtes et de longues durées d'entreposage. Les plantes ornementales, qu'elles soient cultivées à l'extérieur (jardin, champ ou pépinière, tableau 11) ou en serre (tableau 12), sont essentiellement des espèces herbacées annuelles ou vivaces.

Le nombre de maladies rapporté ne correspondent pas au nombre d'échantillons réellement traités parce que plusieurs maladies peuvent être identifiées sur un échantillon. De plus, ces totaux ne tiennent pas compte des causes indéterminées, des diagnostics dont le niveau de certitude est insuffisant ou incertain ni des échantillons soumis pour la détection d'une maladie spécifique. Lorsque non précisés, les stress culturaux regroupent les désordres minéraux, les pH de sol inadéquats, les sols compactés ou salins, les phytotoxicités causées par le mauvais usage des pesticides, l'excès ou le manque d'irrigation et les blessures mécaniques. Quant aux stress climatiques, ils concernent les insolations, le gel hivernal, le froid

et l'excès de chaleur, les polluants atmosphériques, l'intumescence (œdème), l'asphyxie racinaire par l'excès de pluie; les orages violents, les vents forts et la grêle blessant les feuilles.

Du 1er janvier au 31 décembre 2013, 1438 maladies ont été identifiées parmi les 1885 échantillons traités pour une pathologie ou une détection. Parmi ces maladies, 1169 (87%) sont d'origine parasitaire soit une proportion encore jamais atteinte. Cette proportion est supérieure à la moyenne de 74% des quatre dernières années. Parmi le total des maladies parasitaires, 843 sont attribuables aux champignons, 169 aux bactéries, 91 aux virus, 28 aux nématodes et 38 aux phytoplasmes.

Les plantes maraîchères de toutes provenances renfermaient 48% des maladies parasitaires identifiées; les petits fruits 29%. On retrouve la plupart des maladies non infectieuses parmi les stress culturaux (69%) provenant surtout du mauvais usage des herbicides. Encore cette année, la pourriture noire des racines du fraisier est la maladie la plus souvent rapportée. Parmi les 23 types de virus détectés, ceux du complexe viral du fraisier (SMoV, SMYEV, SVBV) ont été les plus fréquents (28 rapports) et mis en évidence à la suite d'une enquête provinciale. Finalement, citons quelques maladies identifiées pour la première fois au laboratoire : *Enterobacter cloaca*, *Pantoea ananatis* et *Serratia marcescens* chez l'oignon; *Pseudomonas corrugata* chez la pomme de terre; BlShV sur *Vaccinium corymbosum* et *V. macrocarpon*; INSV sur tabac; *Pseudoperonospora* sur l'hosta; phytoplasmes sur le lis et la rhubarbe; *Dicotomophthora portulacea* sur pourpier.

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Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis cinerea* / *Botrytis* spp.	Pourriture du col	14
	Ditylenchus dipsaci	Enflure	9
	Embellisia allii	Tache et pourriture du bulbe	7
	Fusarium moniliforme / *F. oxysporum* / *F. proliferatum* / *F. sambucinum* / *Fusarium* sp.	Pourriture des bulbes	31
	Pantoea agglomerans	Pourriture molle bactérienne	3
	Penicillium sp.	Pourriture des bulbes	4
	Phytoplasmes	Malformation foliaire	3
	Potyvirus	Malformation et tache foliaire	2
	Pseudomonas syringae	Anomalie de coloration foliaire	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	4
Artichaut	*Pseudomonas cichorii*	Brûlure des bractées	1
	Xanthomonas campestris	Tache bactérienne	1
	Carence de calcium		1
	Phytotoxicité atrazine		1
Asperge	*Fusarium oxysporum* / *F. moniliforme*	Pourriture fusarienne	2
	Puccinia asparagi	Rouille	1
Aubergine	*Alternaria alternata*	Alternariose	2
	Phoma sp.	Pourriture phoméenne	1
	Pseudomonas syringae	Moucheture bactérienne	11
	Excès d'eau		1
	Phytotoxicité glyphosate		1
	Phytotoxicité métribuzine		1
	Phytotoxicité paraquat		1
Betterave /poirée	*Alternaria alternata*	Alternariose	1
	Asphyxie racinaire		1
Brocoli	*Alternaria brassicicola*	Tache noire	1
	Fusarium oxysporum	Fusariose vasculaire	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pseudomonas viridiflava	Tache foliaire	1
	Mycosphaerella brassicicola	Tache annulaire	2
	Rhizoctonia solani	Rhizoctone	2
	Pythium sp.	Pourridié pythien	1
	Carence de B		3
	Granulée brune		1
Carotte / panais	*Alternaria alternata*	Chancre et pourriture de racines	5
	Cylindrocarpon sp	Chancre d'entrepôt	1
	Fusarium spp.	Pourriture sèche fusarienne	2
	Rhizoctonia solani	Rhizoctone commun	1
	Phytotoxicité clomazone		1
	Phytotoxicité gramoxone		1
	Stress climatique		1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Céleri / céleri-rave	*Acremonium* sp.	Tache brune	1
	Fusarium solani	Fusariose	3
	Phytoplasmes	Malformation foliaire	1
	Pseudomonas syringae	Moucheture bactérienne	2
	Pythium irregulare	Anomalie de couleur racines	3
	Verticillium sp.	Verticilliose	1
	Carence de B		2
	Cœur noir		1
	Dérèglement génétique		1
Chou / chou de Bruxelles	*Fusarium oxysporum*	Fusariose	4
	Plasmodiophora brassicae	Hernie	1
	Phoma sp.	Jambe noire	1
	Pythium sp.	Pourridié pythien	2
	Rhizoctonia solani	Rhizoctone	4
	Xanthomonas campestris pv. *armoraciae*	Tache bactérienne	2
	Xanthomonas campestris pv. *campestris*	Nervation noire	1
	Carence de magnesium		1
Chou chinois	*Colletotrichum* sp.	Anthracnose	1
	Phoma sp.	Jambe noire	1
	Pythium ultimum	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
	Xanthomonas campestris pv*. campestris*	Nervation noire	2
	Phytotoxicité fomésafène		1
Chou-fleur	*Alternaria brassicicola*	Alternariose	1
	Fusarium oxysporum	Fusariose	1
	Rhizoctonia solani	Rhizoctone	1
	Xanthomonas campestris pv*. armoraciae*	Tache bactérienne	1
	Phytotoxicité à des pesticides		3
	Stress climatiques et culturaux		6
Citrouille	*Alternaria* spp.	Tache alternarienne	1
	Erwinia tracheiphila	Flétrissement bactérien	2
	Fusarium oxysporum	Pourriture des fruits	3
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phytophthora capsici	Pourridié phytophthoréen	1
	Pseudomonas syringae	Tache angulaire	4
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Choc climatique		1
Concombre	CMV	Mosaïque	1
	Colletotrichum orbiculare	Anthracnose	1
	Erwinia tracheiphila	Flétrissement bactérien	1
	Fusarium oxysporum	Pourriture du fruit et du collet	3
	Phoma cucurbitacearum	Pourriture noire	1
	Phytophthora capsici	Pourriture du fruit et du collet	1
	Pseudoperonospora cubensis	Mildiou	1
	Pythium splendens	Pourridié pythien	4
	Sphaerotheca fuliginea	Blanc	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Courge	CMV	Mosaïque	4
	Erysiphe sp.	Blanc	1
	Podosphaera sp.	Blanc	1
	Potyvirus	Mosaïque	1
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	2
	ToRSV		1
	Oedème		1
Courgette	*Alternaria alternate*	Alternariose	2
	Cladosporium cucumerinum	Gale	3
	Fusarium sp.	Pourriture du collet	1
	Phoma cucurbitacearum	Pourriture noire	1
	Potyvirus	Mosaïque	1
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	3
	ZYMV	Mosaïque	1
	Gel printanier		1
Endive	*Pseudomonas marginalis*	Tache foliaire	1
	Xanthomonas campestris	Tache foliaire	2
Épinard	*Fusarium oxysporum*	Pourriture des racines et collets	2
	Pythium sp.	Pourridié pythien	1
	Verticillium dahlia	Verticilliose	1
Haricot / pois	AMV	Mosaïque	1
	Botrytis cinerea	Moisissure grise	1
	Fusarium oxysporum	Fusariose	3
	Phoma sp.	Graisse bactérienne	1
	Pseudomonas syringae	Tache ascochytique	1
	Phytotoxicité fomésafène		1
	Polluant ozone		1
Laitue (frisée, pommée, romaine)	*Alternaria alternata*	Alternariose	1
	Fusarium oxysporum	Pourriture fusarienne des racines	2
	Meloidogyne sp.	Nodosité des racines	1
	Pythium ultimum / *Pythium* spp.	Pourridié pythien	3
	Pseudomonas cichorii	Tache luisante	1
	Pseudomonas syringae	Tache foliaire	1
	Xanthomonas campestris	Tache bactérienne	2
	Salinité élevée du sol		1
Maïs sucré	*Colletotrichum graminicola*	Anthracnose	1
	Fusarium proliferatum / *Fusarium* spp.	Pourriture fusarienne des racines	4
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia sp.	Rhizoctone commun	1
	Carence de Mg		1
	Gel printanier		1
Melon /pastèque	*Alternaria* sp.	Alternariose	1
	Erwinia tracheiphila	Flétrissement bactérien	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Melon /pastèque	*Fusarium oxysporum*	Pourriture fusarienne	1
	Plectosporium tabacinum	Tache de feuilles, fruits et tiges	1
Oignon / échalote / poireau	*Botrytis* spp.	Moisissure grise / brûlure foliaire	1
	Burkholderia gladioli	Pourriture brune bactérienne	2
	Colletotrichum circinans	Anthracnose	2
	Enterobacter cloacae	Pourriture des bulbes et feuillage	2
	Fusarium oxysporum / *Fusarium* spp.	Fusariose du plateau	13
	Meloidogyne sp.	Nodosité racinaire	2
	Penicillium sp. / *Geotrichum candidum* / levures	Tache et pourriture des bulbes	4
	Pantoea agglomerans	Pourriture des feuilles	8
	Pantoea ananatis	Brûlure des feuilles	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Peronospora destructor	Mildiou	1
	Phoma terrestris	Racine rose	1
	Pseudomonas fluorescens	Pourriture molle bactérienne	1
	Pseudomonas viridiflava	Pourriture molle des feuilles	1
	Pythium sp.	Pourridié pythien	3
	Rhizoctonia solani	Rhizoctone	2
	Serratia marcescens	Fente et pourriture du bulbe	1
	Stemphylium botryosum	Moisissure noire des feuilles	4
	Excès d'azote		1
	pH élevé du sol		1
	Phytotoxicité dimethenamide		1
	Phytotoxicité par un pesticide		1
Physalis	*Entyloma* sp.	Charbon foliaire	1
	Phytotoxicité 2,4-D		1
Piment / poivron	*Botrytis cinerea*	Moisissure grise	2
	Clavibacter michiganense subsp.*michiganense*	Chancre bactérien	1
	Colletotrichum sp.	Anthracnose	1
	CMV	Mosaïque	1
	Fusarium oxysporum	Pourridié fusarien	3
	Phytophthora capsici	Pourriture des fruits, des collets et des racines	1
	Pseudomonas syringae	Moucheture bactérienne	3
	Pseudomonas viridiflava	Tache foliaire	4
	Pythium sylvaticum / *P. ultimum* / *P. aphanidermatum*	Pourridié pythien	4
	Rhizoctonia solani	Tige noire	2
Pois vert	*Aphanomyces euteiches*	Nécrose racinaire	1
	Fusarium sp.	Pourridié fusarien	1
	Phytophthora sp.	Chancre au collet	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone commun	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pois vert	Phytotoxicité glyphosate		1
	Phytotoxicité Basagran		1
Pomme de terre	*Alternaria solani* / *Alternaria* spp.	Alternariose	6
	Colletotrichum coccodes	Dartrose	13
	Fusarium oxysporum / *Fusarium* sp.	Pourriture fusarienne	8
	Helminthosporium solani	Tache argentée	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	5
	Phytophthora infestans	Mildiou	4
	Pseudomonas corrugata	Pourriture de la tige et dépérissement	1
	Pseudomonas fluorescens	Pourriture molle bactérienne	1
	PMTV	Stries brunes dans le tubercule	1
	Pythium sp.	Pourriture aqueuse	4
	Rhizoctonia solani	Rhizoctonie	1
	Verticillium dahliae	Verticilliose	4
	Carence de P		1
	Cœur brun		1
	Excès de chaleur		1
	Phytotoxicité chlorpropham		3
	Phytotoxicité glyphosate		4
	Phytotoxicité hydrazide maléique		7
	Phytotoxicité méthyle de thifensulfuron / tribenuron		1
	Polluant atmosphérique		1
	Autre stress climatique et cultural		1
Radis commun / daïkon	*Alternaria brassicae*	Tache grise	1
	Fusarium oxysporum	Pourriture foliaire	1
	Phoma sp.	Tache foliaire	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
Rhubarbe	Phytoplasmes	Anomalie de coloration racinaire	1
Rutabaga / rabiole	*Alternaria brassicola*	Tache noire	1
	Fusarium sp.	Pourriture fusarienne de la racine	1
	Sclerotinia sclerotiorum	Sclerotiniose	1
	Carences minérales		1
	Phytotoxicité clopyralid	Malformation de racines	1
	Phytotoxicité MCPA	Malformation racinaire et foliaire	1
Tomate	*Acremonium strictum*	Chancre sec	4
	Agrobacterium tumefaciens	Tumeur du collet	4
	Alternaria alternata	Tache sur fruit et tige	4
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	15
	Colletotrichum coccodes	Anthracnose racinaire	3
	Fusarium oxysporum / *Fusarium* spp.	Pourridié fusarien	14

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Tomate	*Geotrichum candidum*	Pourriture laiteuse	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phytophthora capsici	Pourridié phytophthoréen	3
	Plectosporium sp.	Brunissement du collet et de la tige	3
	Pseudomonas corrugata	Moelle noire	2
	Pseudomonas syringae	Moucheture bactérienne	3
	Pythium spp.	Pourridié pythien	2
	Rhizoctonia solani	Rhizoctone commun	1
	Verticillium albo-atrum / Verticillium dahliae	Verticilliose	6
	Blessure par le vent; par l'eau froide		2
	Oedème		5
	Phytotoxicité métribuzine		1
	Autres stress climatiques		2
	Autre stress cultural		1
Total			**517**

Tableau 2. Sommaire des maladies diagnostiquées parmi les **légumes d'entrepôt** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis* spp.	Pourriture des bulbes	2
	Ditylenchus dipsaci	Pourriture de bulbes	7
	Embellisia allii	Pourriture de gousses	1
	Fusarium proliferatum	Pourriture de bulbes	1
	Pantoea agglomerans	Pourriture de bulbes	1
	Penicillium sp.		1
Oignon	*Botrytis* sp.	Moisissure grise	1
	Burkholderia gladioli	Pourriture brune	2
	Fusarium spp.	Fusariose du plateau	2
	Geotrichum candidum	Pourriture molle du bulbe	1
	Penicillium sp.	Tache et pourriture du bulbe	4
Panais	*Phoma complanata*	Chancre	1
Pomme de terre	*Colletotrichum coccodes*	Dartrose	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	PMTV	Anomalie de coloration dans le tubercule	2
	Spongospora subterranea	Gale poudreuse	1
	Cœur creux		1
	Cœur noir		2
	Désordre physiologique		2
Rutabaga	*Phytophthora* sp.	Pourriture de la racine	2
Total			**37**

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Concombre	*Alternaria* sp.	Alternariose	3
	Cladosporium sp.	Tache foliaire	1
	Erwinia tracheiphila	Flétrissement bactérien	1
	Fusarium oxysporum	Pourriture des racines	1
	Penicillium sp.	Tache foliaire	1
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	1
	Pythium sp.	Pourridié pythien	2
	Verticillium albo-atrum	Verticilliose	1
	Verticilllium dahliae	Verticilliose	2
Laitue	*Fusarium oxysporum*	Pourridié fusarien	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani		1
	Désordre mineral		2
Poivron	*Botrytis cinerea*	Moisissure grise	1
	Fusarium oxysporum	Pourridié fusarien	2
	Blessure par l'eau froide	Jaunissement du feuillage	1
Tomate	*Acremonium strictum*	Chancre sec	4
	Alternaria alternata	Alternariose	1
	Botrytis cinerea	Moisissure grise	3
	Cladosporium sp.	Altération des fleurs et des fruits	2
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	1
	Colletotrichum coccodes	Anthracnose sur racines	4
	Fusarium oxysporum / *Fusarium* spp.	Pourridié fusarien	24
	Fusarium solani / *F. strictum*	Chancre de collet et de tige	2
	INSV	Anomalie de coloration de fruits	2
	Oidium neolycopersici	Blanc	2
	Penicillium sp.	Pourriture du fruit, tache foliaire, chancre de tige	3
	PepMV	Mosaïque foliaire	15
	Pythium spp.	Pourridié pythien	2
	Pseudomonas corrugata	Moelle noire	1
	PVY	Mosaïque foliaire	5
	Pythium irregulare / *Pythium* sp.	Pourridié pythien	2
	Sclerotinia sclerotiorum	Sclérotiniose	3
	TMV	Mosaïque	1
	ToMV	Malformation foliaire	1
	TSWV	Malformation du fruit	1
	Verticillium dahliae	Verticilliose	2
	Argenture		1
	Carences minérales (B, Fe, Mn, N, K)		4
	Phytotoxicités par herbicides (glyphosate, linuron) et autres pesticides		5
Total			**113**

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Amélanchier	*Entomosporium mespili*	Entomosporiose	1
	Gymnosporangium clavariiforme	Rouille-tumeur clavariforme	6
	Pseudomonas syringae	Brûlure des feuilles et de tiges	1
Argousier	*Aureobasidium* sp. / Levures	Pourriture des fruits	2
	Phomopsis sp.	Brûlure phomopsienne	2
	Pseudomonas syringae	Brûlure des rameaux	1
	Rhizoctonia solani	Rhizoctone commun	1
	Insolation		1
	Phytotoxicité au soufre		2
Bleuetier en corymbe	BlShV	Brûlure foliaire	1
	Aureobasidium sp.	Brûlure de rameaux	1
	Botrytis cinerea	Moisissure grise	1
	Colletotrichum sp.	Anthracnose	4
	Fusicoccum putrefaciens	Chancre	1
	Monilinia sp.	Pourriture sclérotique	1
	Phomopsis sp.	Brûlure phomopsienne	1
	Phytoplasmes	Malformation, nanisme	13
	Pucciniastrum goeppertianum	Rouille balai de sorcières	1
	ToRSV	Tache et malformation	3
	Désordre minéral	foliaire	5
	Gel hivernal		1
	Phytotoxicité glyphosate / clopyralid		6
	pH inadéquat		8
	Salinité élevée du sol		4
Bleuetier nain	*Aureobasidium* sp	Anomalie de coloration des tiges	1
	Oidium sp.	Blanc	1
	Septoria sp.	Tache septorienne	4
	Gel printanier		2
	Phytotoxicité glyphosate		3
	Phytotoxicité hexazinone		1
Camerisier	*Fusarium* sp.	Anomalie de coloration racinaire	2
	Phytoplasmes	Brûlure foliaire	1
	Pythium sp.	Anomalie de coloration racinaire	2
	Rhizoctonia solani	Rhizoctone	1
	Phytotoxicité dicamba		3
	Phytotoxicité glyphosate		1
	Sol inadéquat		1
Canneberge	BlShV	Anomalie de coloration des fruit	2
	Colletotrichum gloeosporioides	Anthracnose	3
	Gloeosporium minus	Anthracnose	2

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Canneberge	*Phyllosticta* sp.	Tache foliaire et du fruit	6
	Protoventuria myrtilli	Tache foliaire	2
Cassissier / groseillier	Phytotoxicité à un herbicide		1
Fraisier	*Aphelenchoides fragariae*	Marbrure des feuilles	1
	Botrytis cinerea	Moisissure grise	9
	Cladosporium sp.	Pourriture des fruits	1
	Colletotrichum spp.	Anthracnose	7
	Hainesia lythri	Pourriture de fruits	1
	Marssonina sp.	Tache pourpre	2
	Meloidogyne sp.	Nodosité des racines	3
	Myxomycètes	Tache de feuilles et de fruits	1
	Phytophthora cactorum / *P. nicotiana*	Pourriture du fruit et du collet	15
	Phytophthora spp.	Pourriture des racines et des collets	8
	Phytoplasmes	Faible vigueur	7
	Podosphaera macularis	Blanc	1
	Pratylenchus sp.	Lésions des racines	4
	Pythium/*Rhizoctonia*/*Cylindrocarpon*/*Fusarium*	Pourriture noire des racines	89
	Ramularia brunnea	Tache commune	1
	SCrV		2
	SMoV		13
	SMYEV		11
	Sphaerotheca macularis (Oïdium)	Blanc	1
	SVBV		4
	Verticillium albo-atrum / *V. dahliae*	Verticilliose	8
	Xanthomonas fragariae	Tache angulaire	1
	Xiphinema sp		1
	Zythia fragariae	Brûlure foliaire	2
	Carences minérales		3
	Excès de chaleur		1
	Gel d'entrepôt		2
	Gel hivernal		4
	Jaunisse de juin		1
	Phytotoxicité glyphosate		5
	Phytotoxicité terbacil		3
	pH / salinité / sol inadéquats		3
Framboisier rouge / noir	*Agrobacterium tumefaciens*	Tumeur du collet	4
	Alternaria alternata / *Cladosporium sp*	Pourriture de baies	2
	Arthuriomyces peckianus	Rouille orangée	1
	Botrytis cinerea	Moisissure grise	4
	Fusarium tricinctum / *Fusarium* sp	Pourridié fusarien	2
	Phytophthora spp.		3
	Pucciniastrum americanum	Pourridié phytophthoréen	1
	Pythium/*Rhizoctonia*/*Cylindrocarpon*/*Fusarium*	Rouille jaune tardive	1
	Septoria rubi	Pourriture noire des racines	4

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Framboisier rouge / noir	*Sphaceloma necator*	Tache septorienne	1
	ToRSV	Anthracnose	1
	Xiphinema sp.	Marbrure	1
	Gel hivernal		4
	Phytotoxicité glyphosate		4
	pH acide du sol		1
Sureau	*Fusarium* sp.	Dépérissement de tige et collet	1
	INSV	Faible croissance	1
	Pectobacterium chrysanthemi	Chancre de tige	1
	Puccinia sp.	Rouille sur fruits	1
Sureau	*Pythium intermedium*	Brunissement du collet	1
	TMV	Faible croissance	1
	TNV	Faible croissance	1
Vigne	*Agrobacterium vitis*	Tumeur du collet	1
	Agrobacterium tumefaciens	Tumeur du collet	1
	Cladosporium spp.	Tache des baies	1
	Fusarium oxysporum	Chancre au collet	1
	Gonatobotrys sp. / *Gonatobotryum* sp.	Avortement, coulure	2
	Phoma glomerata	Avortement, tache des tiges	1
	Phomopsis viticola	Excoriose	2
	Phytoplasmes	Jaunisse de l'aster	10
	Plasmopara viticola	Mildiou	3
	Pseudomonas syringae	Coulure	1
	Pseudopezicula sp.	Rougeot	1
	Sphaceloma ampelinum	Anthracnose	2
	Uncinula necator	Blanc	1
	Coulure et autres stress climatiques		2
	Carence de boron		1
	Gel hivernal		1
	Insolation		1
	Manque d'eau		1
	Phytotoxicité glyphosate		2
	Phytotoxicité par des pesticides		2
Total			**400**

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Avoine	BYDV	Feuille rouge	1
	Puccinia sp.	Rouille	1
	Stagonospora sp.	Tache ovoïde	1
	Carence de phosphorus		2
	Phytotoxicité glyphosate		2
Blé / épeautre	*Alternaria* / *Aspergillus* / *Penicillium*	Mélanose de l'épi	1
	Bipolaris sorokiniana	Tache helminthosporienne	1
	Fusarium graminearum	Fusariose	1
	Gaeumannomyces graminis	Piétin échaudage	1
	Puccinia sp.	Rouille	1
	Pythium sp.	Piétin brun	1
Orge	*Fusarium oxysporum*	Piétin fusarien	1
	Pythium irregulare / *P. sylvaticum* / *Pythium* sp.	Piétin brun	3
	Carence minérale		1
Total			**18**

Tableau 6. Sommaire des maladies diagnostiquées parmi les **cultures industrielles** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Canola	*Alternaria alternata*	Anomalie de coloration des graines et dépérissement	2
	Phytotoxicité imazéthapyr		1
Maïs grain / Maïs ensilage	*Aureobasidium zeae*	Kabatiellose	3
	Bipolaris sp.	Tache foliaire	1
	Cladosporium sp.	Moisissure noire	1
	Exserohilum turcicum	Dessèchement	1
	Fusarium graminearum / F. proliferatum / F. subglutinans / F. temperatum / Fusarium spp.	Piétin fusarien / pourriture de l'épi	7
	Pyrenochaeta terrestris	Racine rose	1
	Blessure par la grêle / vent		1
	Carence en éléments majeurs		4
	Phytotoxicité urée		1
	pH acide du sol		1
Soya	*Alternaria alternate*	Alternariose	5
	Colletotrichum sp.	Anthracnose	2
	Corynespora cassiicola	Pourriture des racines	6
	Fusarium spp.	Pourriture du collet et des racines	12
	Peronospora manshurica	Mildiou	1
	Pseudomonas syringae	Moucheture bactérienne	4
	Pythium spp.	Pourridié pythien	7
	Rhizoctonia solani	Rhizoctone commun	1
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Septoria glycines	Tache septorienne	4
	Xanthomonas campestris	Tache bactérienne	1
	Carence de K / autres carences minérales		5
	Ozone		3
	pH acide		2
	Phytotoxicité herbicides		6
	Sol inadéquat		3
	Tige verte		3
Tabac	*Fusarium oxysporum*	Fusariose vasculaire	1
	PVY	Tache / mosaïque	1
	INSV	Jaunissement	2
Total			**95**

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Luzerne	*Fusarium* sp.	Fusariose	2
	Leptosphaerulina sp.	Tache lepto	1
	Pseudopeziza sp.	Tache commune	1
	Asphyxie racinaire		1
Total			**5**

Tableau 8. Sommaire des maladies diagnostiquées parmi les **graminées à gazon** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Agrostis tenuis	*Colletotrichum graminicola*	Anthracnose	1
	Drechslera sp.	Tache helminthosporienne	1
	Pythium torulosum / *Pythium* sp.	Piétin brun	3
Poa annua / *P. pratensis*	*Colletotrichum graminicola*	Anthracnose	1
	Curvularia sp.	Tache foliaire	1
	Fusarium sp.	Piétin fusarien	1
	Gaeumannomyces graminis	Piétin échaudage	1
	Leptosphaerulina sp.	Tache lepto	1
	Magnaporthe sp.	Anomalie de coloration racinaire	1
Total			**11**

Tableau 9. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cerisier	*Alternaria* sp.	Brûlure foliaire	1
	Aureobasidium sp.	Brûlure foliaire	1
	Blumeriella jaapii (Phloeosporella padi)	Tache foliaire, criblure	5
	Botrytis cinerea	Moisissure grise	1
	Cladosporium sp.	Brûlure de fleurs	1
	Colletotrichum gloeosporioides	Pourriture amère	3
	Monilia sp.	Moniliniose	4
	Phomopsis sp.	Chancre phomopsien	1
	Podosphaera sp.	Blanc	1
	Pseudomonas syringae	Brûlure foliaire, dépérissement	6
	Gel printanier		4
	Stress cultural		1
Poirier	*Erwinia amylovora*	Brûlure bactérienne	1
	Nectria galligena	Chancre nectrien	1
	Phomopsis sp.	Chancre phomopsien	1
	Pseudomonas syringae	Chancre et coulure bactérienne	1
Pommier	*Alternaria alternata*	Pourriture du cœur	1
	Colletotrichum sp.	Anthracnose	2
	Erwinia amylovora	Feu bactérien	11
	Gymnosporangium sp.	Rouille	1
	Phytoplasmes	Jaunisse de l'aster	1
	Pseudomonas syringae	Chancre bactérien	9
	Sphaeropsis malorum	Pourriture noire	1
	Spilocaea pomi	Tavelure	15
	Phytotoxicité par les pesticides		4
	Tache amère		1
	Stress culturaux		1
Prunier domestique	*Apiosporina morbosa*	Nodule noir	1
	Phoma sp.	Tache foliaire	1
	Phomopsis sp.	Tache foliaire	1
	Wilsonomyces carpophilus		1
	Stress cultural		1
Total			**85**

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Abies balsamea / *A. fraseri*	*Cylindrocarpon destructans* / *Fusarium* sp. / *Rhizoctonia solani* / *Pythium* sp.	Pourriture des racines	3
	Phytophthora sp.	Pourridié phytophthoréen	2
	Rhizosphaera kalkhoffii	Rouge	2
Acer platanoides	*Rhytisma acerina*	Tache goudronneuse	1
Buxus sempervirens	*Volutella* sp.	Tache et brûlure foliaire	2
Crataegus sp.	*Entomosporium mespili*	Entomosporiose	1
Daphne sp.	*Fusarium* spp.	Fusariose	2
	Septoria sp.	Septoriose	1
Juglans sp.	*Fusarium* sp.	Pourridié fusarien	1
	Xanthomonas campestris	Tache bactérienne	1
Physocarpus sp.	Phytotoxicité glyphosate		1
Picea mariana	*Cylindrocarpon* sp.	Dépérissement	1
	Pseudomonas syringae	Anomalie de coloration des tiges	1
	Phytotoxicité piclorame		1
Pinus divaricata	Phytotoxicité triazine		2
	Phytotoxicité napropamide		1
	Phytotoxicité piclorame		1
Prunus nipponica	*Irpex lacteus*	Carie blanche spongieuse	1
Quercus macrocarpa	*Discula* sp.	Anthracnose	1
Ribes alba	*Oedème foliaire*		1
Sorbus sp.	*Erwinia amylovora*	Brûlure bactérienne	1
Syringa vulgaris / *S. reticulata*	*Pseudomonas syringae*	Brûlure bactérienne	2
	Gel hivernal	Chancre sur tige	1
Thuja occidentalis	pH du sol trop acide		1
Tilia sp.	Stress cultural		1
Viburnum sp.	*Phoma viburni*	Tache foliaire	1
	Pseudomonas syringae	Brûlure bactérienne	1
	Xanthomonas campestris	Tache bactérienne	1
Total			**36**

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales d'extérieur** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Allium tricoccum	Insolation	Brûlure foliaire	1
Alternanthera sp.	*Pythium irregulare* / *Pythium* sp.	Pourridié pythien	4
	Rhizoctonia solani	Rhizoctone commun	4
Aralia nudicaulis	*Alternaria* sp.	Tache foliaire	1
Aruncus dioicus	*Colletotrichum* sp.	Anthracnose	1
	Polluant atmosphérique	Tache foliaire	1
Brassica oleracea var. acephala	*Fusarium* sp.	Fusariose	2
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
Brugmansia sp.	*Pythium* sp.	Pourridié pythien	1
Centaurea sp.	*Pythium irregular*	Pourridié pythien	1
Coreopsis sp.	*Plasmopara* sp.	Mildiou	1
Dahlia sp.	*Agrobacterium tumefaciens*	Tumeur du collet	1
Echinacea purpurea	*Pythium* sp.	Pourridié pythien	4
	ToRSV		1
	Salinité élevée du sol		1
	Sol inadéquat		1
Eupatorium sp.	Phytoplasmes	Malformation foliaire	1
Fougère	*Pseudomonas syringae*	Anomalie de coloration foliaire	1
Helichrysum sp.	*Fusarium oxysporum* / *F. proliferatum*	Dépérissement	2
Hemerocallis sp.	*Aureobasidium* sp.	Tache foliaire	2
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone commun	1
Musa sp.	Froid	Dépérissement	1
Parthenocissus quinquefolia	*Sphaceloma ampelinum*	Anthracnose	1
Paeonia sp.	*Gloeosporium* sp.	Anthracnose	1
Portulaca grandiflora	*Dicotomophthora portulacea*	Pourriture du feuillage	1
Rudbeckia sp.	*Sclerotinia sclerotiorum*	Sclérotiniose	2
	Septoria sp.	Septoriose	1
Santolina sp.	*Fusarium* sp.	Fusariose	1
Stokesia sp.	TSWV	Mosaïque	1
Sedum sp.	*Pseudomonas fluorescens*	Pourriture foliaire	1
	Pythium sp.	Pourridié pythien	1
Total			**46**

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes ornementales de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Abutilon sp.	*Pythium aphanidermatum*	Pourridié pythien	1
Allamanda sp.	*Colletotrichum* sp.	Anthracnose	1
Begonia sp.	Phytotoxicité au cuivre et autres pesticides	Tache et brûlure foliaire	2
Calibrachoa hybrida	*Fusarium* sp.	Pourridié fusarien	1
	Thielaviopsis basicola	Pourriture noire des racines	6
	TBRV		1
	Tache d'eau		1
Clerodendrum ugandense	*Pythium* sp.	Pourridié pythien	1
Dianthus sp.	*Fusarium* sp.	Pourriture fusarienne	1
	Ascochyta dianthi	Tache ascochytique	1
	CarMV	Tache foliaire	1
	Rhizoctonia solani	Rhizoctone commun	1
Gloxinia speciosa	Phytoplasmes	Coloration des sépales	1
Hibiscus sp.	*Pseudomonas syringae*	Tache foliaire	1
Hosta sp.	*Fusarium* sp.	Anomalie de coloration foliaire	1
	Pseudoperonospora sp.	Mildiou	1
	Carence de K		1
	Gel printanier		1
	Phytotoxicité glyphosate		1
Impatiens walleriana / I. hawkeri	*Botrytis cinerea*	Moisissure grise	1
	Plasmopara sp.	Mildiou	2
	Rhizoctonia solani	Rhizoctone commun	1
	Carence de nitrogen		1
	Salinité élevée du sol		1
Ligularia sp.	*Aphelenchoides ritzemabosi*	Tache foliaire	1
Lilium sp.	Phytoplasmes	Anomalie de coloration foliaire	1
Osmunda cinnamomea	*Phoma* sp.	Pourriture des racines et collets	1
	Pseudomonas syringae	Brûlure foliaire	1
Pelargonium X hortorum / P. peltatum	PFBV	Malformation foliaire	3
	TSWV	Anomalie de coloration foliaire	1
	Oedème foliaire		1
Phlox paniculata	*Erysiphe communis*	Blanc	1
	Oedème foliaire		1
Pilea sp.	*Pythium* sp.	Pourridié pythien	1
Roystonea regia	Phytotoxicité à un pesticide		1

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes ornementales de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Sanvitalia sp.	*Rhizoctonia solani*	Rhizoctone commun	1
	Verticillium sp.	Verticilliose	1
Total			**46**

Tableau 13. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et les fines herbes** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2013.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail des bois	Insolation	Anomalie de coloration de feuilles	1
Basilic	*Botrytis cinerea*	Moisissure grise	2
	Pseudomonas syringae	Tache foliaire	1
	Pythium sp.	Pourridié pythien	2
	Froid	Tache foliaire	1
	Phytotoxicité glyphosate		1
Ciboulette	*Botrytis* sp.	Pourriture des feuilles	1
	Rhizoctonia solani	Pourriture foliaire	1
Coriandre	*Alternaria alternate*	Alternariose	1
	Colletotrichum sp.	Anthracnose	1
Estragon	Froid	Brûlure foliaire	1
Ginseng	*Colletotrichum acutatum*	Anthracnose	1
	Phytophthora cactorum	Pourriture phytophthoréenne	1
Lavande	*Xanthomonas campestris*	Tache bactérienne	1
Origan	*Pythium* sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone commun	1
	Thielaviopsis basicola	Pourriture noire des racines	1
Persil	*Acremonium apii*	Tache foliaire et pourriture	1
	Fusarium sp.	Pourridié fusarien	1
	Phytotoxicité à un pesticide	Anomalie de coloration foliaire	1
	Phytophthora sp.	Chancre de tige	1
	Pythium sp.	Pourridié pythien	1
Romarin	*Xanthomonas campestris*	Tache bactérienne	1
Sauge	*Botrytis cinerea*	Moisissure grise	1
Thym	*Botrytis cinerea*	Moisissure grise	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone commun	1
Total			**29**
GRAND TOTAL			**1438**

Cereals / Céréales

CROP / CULTURE : Barley
LOCATION / RÉGION: Central Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT :
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TITLE / TITRE: 2013 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

ABSTRACT: In 2013, 19 commercial barley crops chosen at random were surveyed for diseases in central Alberta. Leaf disease levels were lower than in previous years due to somewhat cool weather in the region; the levels for common root rot were also lower than in past years.

INTRODUCTION AND METHODS: A survey to document diseases of barley was conducted in19 fields in Central Alberta from July 30 - August 16, 2013. Growers were contacted for permission to access their land, and the evaluations were done at the late milk to soft dough stage. The fields were traversed in a diamond pattern starting at least 25 m in from the field edge, and visual assessments were made of 10 penultimate leaves at each of 5 locations that were at least 25 m apart. Leaf diseases were rated for percentage leaf area diseased (PLAD) with scald, netted net blotch or other leaf spots. Common root rot (CRR) was assessed on 5 sub-crown internodes at each of 5 sites using a 0-4 scale where 0=none, 1=trace and 4=severe. Other diseases, if present, were rated as a percentage of the plants affected. Following the numerical survey, a representative tissue sub-sample of diseased plant parts collected at each location was cultured in the laboratory to isolate and identify the pathogens.

RESULTS AND COMMENTS: Survey results are presented in Table 1. Growing conditions in central Alberta were wet and relatively cool in May, June, and July, with August being drier but remaining cooler than normal. Disease development was generally moderate throughout the region.

Scald (*Rhynchosporium secalis*) severity ranged from 0.1 to 11 PLAD in 12 fields, with the remaining fields having no scald. Netted net blotch (*Pyrenophora teres* f. *teres*) severity was 12 PLAD in one field and ranged from 0.1 to 5 PLAD in 7 others. The remaining fields had no netted net blotch. Other barley leaf spots, identified as spotted net blotch (*P. teres* f. *maculata*) or spot blotch (*Cochliobolus sativus*), were found in all of the fields surveyed. The severity of these other leaf spots ranged from 1 to 11 PLAD. Al*ternaria* spp. were also isolated from sub-samples of the leaf tissues.

Common root rot of barley (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all surveyed fields, at lower levels than those observed in 2012 (Rauhala and Turkington 2013).

No stripe rust (*Puccinia striiformis*) was found in any of the 19 barley fields that were surveyed.

REFERENCE:
Rauhala, N.E, and Turkington, T.K. 2013 2012 barley disease survey in central Alberta. Can. Plant Dis. Surv. 89:53. (www.phytopath.ca/cpds.html)

Table 1. Disease incidence and severity in 19 commercial barley fields in Central Alberta, 2013.

Disease (severity rating scale)	% of Fields Affected	Overall average severity	Range in average severity per field
Scald (PLAD*)	63	2	0 –11
Netted net blotch (PLAD)	42	1	0 – 12
Other leaf spots (PLAD)	100	4	1 – 11
Total leaf area diseased (PLAD)	100	7	1 – 14
Common root rot (0-4)	100	2	1 - 4

*Percentage leaf area diseased

CROP / CULTURE : Barley
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2013

ABSTRACT: In 2013, Fusarium head blight (FHB) incidence and severity were assessed in 47 barley crops in Saskatchewan. FHB occurred in 79% of the surveyed barley crops at a provincial mean severity (FHB Index) of 2.0%.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity in Saskatchewan in 2013 were assessed in a total of 47 barley crops (39 two-row; 8 six-row). Fields and results were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey).

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with Saskatchewan Ministry of Agriculture collected 50 spikes at random from barley crops at the late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visible FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each barley crop surveyed: FHB index (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100. Mean FHB severity values were calculated for each soil zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and cultured on potato dextrose agar and carnation leaf agar to confirm and identify *Fusarium* spp. on infected spikes. Potato dextrose agar (PDA) or half strength PDA (½PDA) were used to observe colony morphology; Carnation Agar (CA) or Synthetischer Nahrstoffarmer Agar (SNA) were used to promote sporulation, if needed.

RESULTS AND COMMENTS: Approximately 2.5 million hectares (6.2 million acres) of barley were seeded in Saskatchewan in 2013 (Saskatchewan Ministry of Agriculture 2014). The average yield of 3.6 metric tonnes per hectare (66.1 bu/acre) in 2013 was higher than the 10-year average (2002-2012) of 2.8 metric tonnes per hectare (52.7 bu/acre) (Saskatchewan Ministry of Agriculture 2013).

Fusarium head blight occurred in 79% of the barley crops surveyed, 77% of two-row and 88% of six-row samples (Table 1). The provincial mean FHB severity of 1.7% for two-row barley was lower than in 2012 (3.0%) or 2011 (2.8%). For six-row barley, the provincial mean severity of 3.4% was similar to that in 2012 (3.7%) and higher than found in 2011 (2.2%) (Miller et al. 2013). Similar to previous years, the severity of FHB in two- and six-row barley was highest in soil Zone 3. The sample with the highest FHB severity of 18.2% was from a six-row barley crop in soil Zone 3, and this level was notably higher than any in previous years (e.g. highest level in 2012 was 6.9% on a two-row barley sample from soil Zone 2).

Of the 47 barley survey samples collected, 37 had visible symptoms of FHB; a total of 86 isolations were made from these for *Fusarium* identification. The most frequently isolated pathogen identified was *F. poae*, detected in 57% of surveyed fields (Table 2) and accounting for 56% of all *Fusarium* isolations. *Fusarium graminearum* was detected in 6% of the barley fields where samples were collected. It accounted for 5% of *Fusarium* isolates from six-row barley, but none from two-row barley. Other *Fusarium* species isolated are shown in Table 2.

Secondary moulds were isolated from most of the samples and other potential barley pathogens found infrequently included *Cochliobolus* and *Septoria* spp.

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Miller, S.G., Cranston, R., Peluola, C.O., Weitzel, C.N., Shiplack, J.J., and Fernandez, M.R. 2013. Fusarium head blight in barley in Saskatchewan in 2012. Can. Plant Dis. Surv. 93:89-90. (www.cps-scp.ca/cpds.shtml)

Saskatchewan Ministry of Agriculture. 2014. Agricultural Statistics / StatFacts. (www.agriculture.gov.sk.ca/agriculture_statistics/HBv5_P2.asp)

Table 1. Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil zone in Saskatchewan, 2013.

Soil Zones	Two-Row Barley		Six-Row Barley	
	Prevalence[1] (No. of crops infected)	**Mean FHB Severity or Index[2] (range)**	**Prevalence[1] (No. of crops infected)**	**Mean FHB Severity or Index[2] (range)**
Zone 1 Brown	80% (4)	0.2% (0-0.4%)	–	–
Zone 2 Dark Brown	83% (10)	1.6% (0-15.4%)	100% (2)	1.9% (0.5 – 3.3%)
Zone 3 Black/Grey	73% (16)	2.1% (0-15.8%)	83% (5)	3.9% (0 – 18.2%)
Overall Total/Mean	**77% (30)**	**1.7%**	**88% (7)**	**3.4%**

[1]Prevalence = Number of crops affected / total crops surveyed (%)
[2]Percent FHB severity/Index = [% of spikes affected x mean proportion (%) of kernels infected] / 100.

Table 2. *Fusarium* species prevalence[1] in barley crops positive for FHB symptoms in 2013.

Barley	*F. acuminatum*	*F. avenaceum*	*F. culmorum*	*F. equiseti*	*F. gramin-earum*	*F. poae*	*F. sporo-trichioides*	Other *Fusarium* spp.
Two-row	10%[1]	8%	0%	13%	8%	59%	5%	5%
Six-row	25%	25%	13%	25%	0%	50%	0%	50%
Total	**13%**	**11%**	**2%**	**15%**	**6%**	**57%**	**4%**	**13%**

[1] Prevalence = Number of crops affected / total crops surveyed (%)

CROP / CULTURE: Barley
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES OF BARLEY IN SASKATCHEWAN IN 2012 and 2013

ABSTRACT: Leaf spot prevalence and severity in Saskatchewan barley crops was assessed in 2012 and 2013. Disease was observed in all crops and severity ranged from very slight to severe. The causal agents were determined to be *Cochliobolus sativus* (Ito & Kuribayashi) Drechs. ex Dastur (spot blotch), *Pyrenophora teres* Drechs. (net blotch) and *Septoria passerinii* Sacc. (speckled leaf blotch).

INTRODUCTION AND METHODS: Leaf spot diseases of barley were surveyed throughout Saskatchewan from late July to mid-August in each of 2012 and 2013, when most crops were at the late milk to soft dough stage of growth. In each crop 10 or more leaves were collected, placed in paper envelopes, dried and rated in the laboratory in October using a six-category severity scale of: nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%) adapted from Tekauz et al. (2012). In 2012, a total of 42 crops were surveyed and a sub-sample of 25 (at least one sample, but usually two from each Saskatchewan crop district) was assessed. In 2013, a total of 77 crops were surveyed and 44 were assessed for leaf spot diseases. The causal pathogens were identified from infected leaves by surface sterilizing ten pieces of infected leaf tissue, each from a different leaf. Leaf cuttings were then placed on water agar plates or wet filter paper for about four days to promote pathogen sporulation. Identifications were based on spore shape and size.

RESULTS AND COMMENTS: Growing conditions in Saskatchewan were wet to very wet in the spring and early summer of 2012. South and south-eastern areas of the province received little precipitation after late June, but areas in the west and north of the province continued to receive precipitation into August. The weather was warm to hot in July across much of the province (SK Ministry of Agriculture 2012). In localized areas, excess moisture, heat stress, wind, and hail impacted disease and crop development.

In 2013, temperatures in central Saskatchewan were somewhat below normal for much of the growing season, but subsequent warmer conditions (above normal in late August and throughout September) were conducive to crop maturation and harvesting. There was limited precipitation during May, August and September, but frequent showers or rain in June and July.

In 2012, leaf spot severity among the 42 barley crops was very slight to slight in 57% of crops, moderate in 24% and severe in 19% (Table 1). Results in 2013 were similar with 57% of crops assessed as very slight to slight, 20% moderate and 23% severe.

Three pathogens were identified from barley leaf tissue analyses. The leaf spot symptoms observed were caused most commonly by *C. sativus* (spot blotch) and *P. teres* (net blotch). Speckled leaf blotch, caused by *Septoria passerinii* Sacc., was identified in only a few samples. In 2012 and 2013, respectively, *C. sativus* was identified in 84 and 77% of crops, *P. teres* in 48 and 61%, and *S. passerinii* in 24 and 11% (Table 2). Laboratory analyses indicated that *C. sativus* was present on 60% of the leaf tissue pieces plated in 2012 and on 52% in 2013; *P. teres* on 31 and 43% respectively; and *S. passerinii* on 6% and 5%, respectively.

ACKNOWLEDGEMENTS:
We thank the Saskatchewan Crop Insurance Corporation staff for collecting the barley leaf samples for this survey.

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Table 1. Leaf spot disease severity in Saskatchewan barley crops in 2012 and 2013.

Disease severity	2012		2013	
	Number of crops (n=42)	Prevalence† (%)	Number of crops (n=77)	Prevalence (%)
None	0	0	0	0
Very slight (1-5%)	8	19	22	28
Slight (6-15%)	16	38	22	28
Moderate (16-40%)	10	23	15	19
Severe (41-100%)	8	19	18	23

† prevalence – number of crops in each disease severity category expressed as a proportion of the total number of crops surveyed

Table 2. Pathogen prevalence in crops and pathogen incidence in infected leaf tissue pieces from Saskatchewan barley in 2012 and 2013.

Pathogen	Prevalence (% of crops affected)		Incidence† (% leaf samples infected)*	
	2012	2013	2012	2013
Cochliobolus sativus	84	77	60	52
Pyrenophora teres	48	61	31	43
Septoria passerinii	24	11	6	5

† percentage of leaf tissue pieces from which each pathogen was isolated; indicative of the relative amount of foliar damage observed

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: **FUSARIUM HEAD BLIGHT AND LEAF SPOT DISEASES OF BARLEY IN MANITOBA IN 2013**

ABSTRACT: In 2013, 37 barley crops in southern Manitoba were monitored for the presence of Fusarium head blight (FHB) and leaf spot diseases. FHB was found in most fields but the average FHB Index was a low 0.6%. *Fusarium poae* was the predominant causal pathogen and accounted for 81% of isolations from affected kernels; *F. graminearum* followed at 12.7%. Leaf spot symptoms were observed in all fields at very low severity levels. Minimal or no losses from these diseases would be expected.

INTRODUCTION AND METHODS: A total of 37 barley crops (25 two-row, 12 six-row) in Manitoba were examined for the prevalence of Fusarium head blight and leaf spots from July 16 to July 31, 2013, when crops were at the early to soft-dough (ZGS 79-86) stages of growth. Fields were selected at random along the survey routes, depending on crop frequency. The area sampled was nominally bounded by Highways #s 67 and 16 to the north, 12 to the east, 3 to the south and 83 to the west.
FHB incidence was recorded as the percentage of spikes with typical symptoms by sampling 95-110 spikes at three field locations. Several affected spikes were collected at each survey site and stored in paper envelopes for identification of causal *Fusarium* species. A total of 50 putatively infected and discoloured infected kernels, or those of normal appearance to make up the remainder, were removed from five spikes per location. The kernels were surface sterilized with 0.3% NaOCl for 3 minutes, air-dried and plated onto potato dextrose agar in Petri plates (10 kernels per plate) to quantify the *Fusarium* spp. on kernels and identify them based on morphological traits described in standard taxonomic keys.
Severity of leaf spot diseases was recorded by averaging their level on 10-20 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Disease ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with leaf spot lesions were collected at each site, placed in paper envelopes and allowed to dry for subsequent analysis.

RESULTS AND COMMENTS: Growing conditions in Manitoba in 2013 led to some delays in seeding, but were generally 'normal', due mainly to timely precipitation in June and July that promoted rapid crop development. Moderate temperatures and drier conditions during crop flowering in late July and early August facilitated crop maturation and resulted in relatively low disease pressure. However, in some areas spring seeding was impacted by extreme weather including excessive rain and hail. This resulted in considerable land not being seeded, or if seeded, subsequently abandoned due to poor or no emergence. Barley was grown on about 184,000 hectares (454,000 acres) in Manitoba in 2013, a reduction of 11% compared to 2012 (Tekauz et al, 2012). However, barley yields in Manitoba were above average resulting in a production increase of 11% (to 686,000 tonnes) compared to 2012 (Statistics Canada 2013). However, lower yields were reported from the areas impacted by high rainfall and hail. Overall, yields and quality both were good. Nine cultivars made up 80% of the total production area: Colon (27.3%), Newdale (11.5%), Celebration (11.0%), CDC Austenson (7.0%), Champion (6.1%), Tradition (5.8%), AC Metcalfe (5.1%), CDC Copeland (3.2%), and Stellar (3.1%) (MASC 2013). Malting and feed types each occupied about 50% of the acreage.

Putative symptoms of FHB were observed in all 37 barley fields surveyed. Mean incidence in 2-row barley was 9.0% (range 0.3-21.5%) and the spike proportion infected (SPI) was 6.9 (range 5-20%). In 6-row barley mean incidence and SPI were 6.8% (range 0.1-17.6%) and 5.9% (2-20%), respectively. The resulting average FHB-Index or FHB-I (% incidence X % SPI) /100 for 2-row barley was 0.7% (range 0.01-2.2%) and for 6-row barley 0.5% (0.01-1.8%). Mean FHB incidence, SPI and FHB-I for all barley crops

were 7.7% and 6.0%, and 0.6%, respectively. This FHB-I was lower than that reported for 2012 (Tekauz et al. 2013a), and would have caused minimal yield loss in 2013. The somewhat lower FHB-I in 6-row vs. 2-row barley calculated for 2013 was similar to that reported for 2009 and 2010 (Tekauz et al, 2010, 2011) and problematic to reconcile given that 2-row cultivars are generally rated as more resistant than 6-row cultivars (Seed Guide 2014). However, opposite and more typical results were obtained in 2011 and 2012 (Tekauz et al. 2012 and 2013a). A possible explanation for the 2013 results may be the lower number (half) of 6-row crops surveyed compared to 2-row.

Fusarium colonies developed from kernels from 33 of the 37 fields surveyed. The mean infection level of 22% was much lower than found in 2012 (Tekauz et al. 2013a). The individual *Fusarium* spp. identified are listed in Table 1. As found in 2011 and 2012 (Tekauz et al. 2012, 2013a), *F. poae* predominated and made up 81% of total *Fusarium* (the highest level recorded to date), and was present in most of fields (Table 1). This is in contrast to 2010 and many previous years when *F. graminearum* either predominated or was found at similar levels to *F. poae* (Tekauz et al. 2011). *Fusarium graminearum* and *F. sporotrichioides* made up most of the remaining *Fusarium* flora; *F. equiseti* was not detected in 2013. In six 2-row crops and one 6-row crop only *F.poae* was isolated from kernels.

Very low levels of leaf spots were observed in the upper or lower leaf canopies in all barley crops surveyed. Disease levels in both the upper and lower canopies were zero, trace or very slight in all cases. However, in 62% of fields leaves in the lower canopy were already senescent. These low severities are typical of those found in recent years. In 2013 the low disease levels were likely due to increased use of foliar fungicides in barley, and reduced inoculum carry-over from 2012 (Tekauz et al. 2013b). Yield losses attributable to leaf spots were likely near zero. The leaf spot causal agents have not been determined at this time, but based on visible symptoms and results from previous years (Tekauz et al. 2013b) were likely *Cochliobolus sativus* (spot blotch) and *Pyrenophora teres* (net blotch).

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Statistics Canada 2013. Production of principal field crops, September 2013.

Table 1. *Fusarium* spp. isolated from FHB-affected kernels from 33 barley fields in Manitoba in 2013.

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. avenaceum	8	1.1
F. graminearum	45	12.7
F. poae	86	81.0
F. sporotrichioides	35	6.4

CROP / CULTURE: Barley
LOCATION / RÉGION: Central and eastern Ontario

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TITLE / TITRE: DISEASES OF BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2013

ABSTRACT: Twenty-seven barley crops in central and eastern Ontario were surveyed for diseases in 2013. Of 14 diseases observed, spot blotch, ergot, take-all and fusarium head blight (FHB) were the most common. Moderate to severe FHB was observed, with *Fusarium graminearum* and *F. poae* identified as the predominant species involved.

INTRODUCTION AND METHODS: A survey of barley diseases was made in central and eastern Ontario, where spring barley is grown in the third week of July, 2013. Twenty-seven crops were sampled when plants were at the soft dough stage of growth. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered as trace, slight, moderate, and severe infection levels, respectively.

Severity of covered smut, ergot, leaf stripe, loose smut, and take-all was based on percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of three random sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of FHB causal species was based on 50 infected spikes from each field. The spikes were air-dried at room temperature and threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCI for 60 sec. and plated in 9-cm petri dishes on modified potato dextrose agar (10 g dextrose per litre amended with 50 ppm of streptomycin sulphate). Plates were incubated for 10-14 days at 22-25ºC with a 14-hour photoperiod using fluorescent and long wavelength light. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: The survey included three two-row and 24 six-row barley fields. A total of 14 diseases or disease complexes was observed (Table 1). Spot blotch (*Cochliobolus sativus*) and barley yellow dwarf (BYDV) were the most common, found in 27 and 26 fields at average severities of 3.6 and 1.8, respectively. However, no severe infections with either disease was seen and they likely caused no significant yield reduction. Powdery mildew *(Erysiphe graminis*) and net blotch (*Pyrenophora teres*), observed in 20 and 19 fields at average severities of 2.7 and 2.9 respectively, were also common. A severe level of powdery mildew was observed in three fields while severe net blotch was detected in four. Yield reductions due to powdery mildew and net blotch were estimated to average <5% in the affected fields. Other foliar diseases observed included leaf rust (*Puccinia hordei*), scald (*Rhynchosporium secalis*), septoria complex [including speckled leaf blotch (*Septoria tritici*) and leaf blotch (*Stagonospora nodorum*)], and stem rust (*Puccinia graminis* f. sp. *tritici* or f. sp. *secalis*). These diseases were observed in 13, 10, 10, and five fields, at mean severities of 1.9, 1.1, 2.1, and 2.0, respectively. Although one crop had severe leaf rust, none of these diseases would have resulted in substantive crop damage.

Covered smut (*Ustilago hordei*), ergot (*Claviceps purpurea*), and leaf stripe (*Pyrenophora graminea*) were observed in 25, 27, and 23 fields at incidence levels of 0.7%, 1.1%, and 0.3%, respectively. These three diseases likely resulted in minimal damage. Loose smut (*U. nuda*) and take-all root rot (*Gaeumannomyces graminis*) were found in 25 and 27 fields at mean incidences of 3.1% and 5.3%, respectively. Average yield reductions from the two diseases were likely >5% in affected fields.

Fusarium head blight occurred in all surveyed fields with a mean FHB index of 8.6% (range 0.04%- 24.0%) (Table 1). Severe FHB was observed in five crops and a very severe level in one crop.
FHB likely resulted in significant losses of barley yield or quality in 2013. Five *Fusarium* species were isolated from infected kernels (Table 2). *Fusarium graminearum* and *F. poae* predominated and occurred in 85 and 96% of surveyed fields and on 45.9 and 20.0% of infected kernels, respectively. *Fusarium avenaceum*, *F. equiseti*, and *F. sporotrichioides* were less common, occurring in 19-37% of fields and on 2.2-3.5% of kernels.

Overall, the incidence and severity of foliar diseases in barley was generally greater in 2013 than in 2012 (Xue and Chen 2013). Net blotch and spot blotch continued to be the most prevalent. Powdery mildew, a minor disease in previous years, was commonly observed in 2013, with three crops having severe levels. The prevalence and severity of take-all appears to be on the increase and this is the fourth consecutive year that take-all has been commonly observed in barley in Ontario (Xue and Chen 2013). FHB occurred in all surveyed fields at moderate to severe levels and caused significant reductions in grain yield and quality. Frequent days with rain in June, and warm conditions in July across central and eastern Ontario, were likely responsible for increased severity of FHB in 2013.

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Table 1: Prevalence and severity of barley diseases in central and eastern Ontario in 2013.

DISEASE	NO. CROPS AFFECTED (n=27)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
BYD	26	1.8	1.0-4.0
Leaf rust	13	1.9	1.0-6.0
Net blotch	19	2.9	1.0-6.0
Powdery mildew	20	2.7	1.0-7.0
Scald	10	1.1	1.0-2.0
Septoria complex	10	2.1	1.0-5.0
Spot blotch	27	3.6	1.0-5.0
Stem rust	5	2.0	1.0-5.0
Covered smut (%)	25	0.7	0.1.0-5.0
Ergot (%)	27	1.1	0.1.0-5.0
Leaf stripe (%)	23	0.3	0.1.0-0.5
Loose smut (%)	25	3.1	0.5-15.0
Take-all (%)	27	5.3	1.0-15.0
Fusarium head blight**	27		
Incidence (%)		41.7	2.0-90.0
Severity (%)		16.1	2.0-30.0
Index (%)		8.6	0.04-24.0

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

Table 2: Prevalence of *Fusarium* species isolated from fusarium damaged barley kernels in central and eastern Ontario in 2013.

***Fusarium* spp.**	**% AFFECTED FIELDS**	**% KERNELS**
Total *Fusarium*	100	74.3
F. avenaceum	37	3.5
F. equiseti	26	2.2
F. graminearum	85	45.9
F. poae	96	20.0
F. sporotrichioides	19	2.6

CROP / CULTURE: Canaryseed
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: SEPTORIA LEAF MOTTLE OF CANARYSEED IN SASKATCHEWAN IN 2013

ABSTRACT: In 2013, 26 canaryseed crops in Saskatchewan were assessed for diseases. Leaf mottle, caused by *Septoria triseti* Speg., was the only notable foliar disease observed in the crops surveyed, and generally occurred at low severity levels. Kernels from spikes of four crops tested positive for the presence of *Fusarium avenaceum* (Fr.:Fr.) Sacc.

INTRODUCTION AND METHODS: Twenty-six canaryseed crops in Saskatchewan were surveyed for leaf diseases during August 2013. They were examined when at the flowering to soft dough stage of growth in three regions of the province: west-central, from Eston to Kindersley; south-east, surroundings of Indian Head; and north-east, surroundings of Tisdale. Disease severity was assessed in both the upper (flag and penultimate leaves) and lower canopies on 15-20 plants in total, observed at five locations 20 m apart and at least 30 m from the field edge. Severity of leaf mottle was rated as: 0 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). In all crops, 10 leaves from the upper canopy with visible leaf mottle symptoms were collected, dried and stored in paper envelopes for subsequent pathogen identification and disease verification. Eight infected leaf tissue pieces, each from a different leaf, were surface sterilized and placed on water agar in petri plates for 6-8 days to promote sporulation and confirm the identity of the causal agent(s).

Ten spikes were also collected from each crop to test for the presence of *Fusarium* spp. Spikes were hand threshed and the seeds surface-sterilized in 3% NaOCl for 2 min., rinsed with water to remove residual NaOCl, and air dried. One hundred kernels chosen at random were plated on potato dextrose agar, 20 seeds per petri plate, to identify pathogenic fungi present.

RESULTS AND COMMENTS: Most of the canaryseed crops were seeded into cereal or canola stubble, but two were seeded into canaryseed stubble. Due to cool summer weather, crop maturity in 2013 may have been somewhat delayed compared to normal as many crops were still in flower in mid-August. Cool conditions may also have played a role in the generally low levels of foliar disease observed.

Leaf mottle severity was assessed at trace levels in 15 of the 26 crops, very slight to slight in seven and moderate in five. Analysis of infected canaryseed leaf tissue confirmed the presence of *S. triseti* in 21 of the 26 crops (81% prevalence). In these 21 crops, the frequency of *S. triseti*-infected leaf tissue pieces (% of isolations) was 49% for the province overall (58% in west-central SK, 48% in the south-east, and 30% in the north-east).

Fusarium avenaceum was confirmed in four of the 26 seed samples, at only low incidence levels of 4-6 % infected kernels.

ACKNOWLEDGEMENTS: We are grateful for the financial support of the Canaryseed Development Commission and thank the many individual canaryseed growers for their time and contributions to this survey.

CROP / CULTURE: Barley, Wheat
LOCATION / REGION: Central Alberta

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TITLE: BARLEY AND WHEAT LEAF SPOT DISEASE SURVEY IN CENTRAL ALBERTA, 2013

ABSTRACT: In 2013, 20 barley, 2 winter wheat and 24 spring wheat crops in central Alberta were surveyed primarily to document leaf spot diseases. The majority of crops surveyed had only light levels of disease, but in a few fields net blotch (barley) and the leaf spot complex (wheat) were observed at moderate or severe levels. Stripe rust severity in wheat was generally light, but high levels were observed in two fields.

INTRODUCTION AND METHODS: A survey primarily for leaf spot diseases was conducted in 20 barley fields, two winter wheat and 24 spring wheat fields in central Alberta from August 6 to 14, 2013. The fields surveyed were located in Wetaskawin, Ponoka, Flagstaff, Stettler, Kneehill, Starland, Lacombe, Mountainview and Strathcona Counties. Each field was traversed in a W pattern starting at least 20 m from the field edge, with visual disease assessments made at five sites. Each visual assessment was made on the plants within $1m^2$ at that site. Leaf spot diseases including scald, netted and spotted net blotch, spot blotch of barley, tan spot, the stagonospora and septoria leaf spot complex, and bacterial blight of wheat were rated using a 0-9 severity scale. Other diseases, such as smuts and stripe rust were rated as percent plants affected and percent diseased leaf area, respectively. A mean disease severity based on the 0-9 scale or percent disease was calculated based on the five sites assessed in each field.

RESULTS AND COMMENTS: The growing season in central Alberta was characterized by moist and cool conditions until early August. The majority of fields surveyed had only low levels of foliar disease with netted net blotch in barley and the leaf spot complex in wheat being severe in only a few crops. Results for barley and wheat are presented in Tables 1 and 2, respectively. The various diseases occurring in the crops were categorized into three severity classes, light, moderate or severe, based on the 0-9 scale and/or incidence.

All barley crops surveyed were 2-row type. Foliar diseases, including scald, netted net blotch, and the combination of spotted net blotch and spot blotch (individual diseases difficult to distinguish based on visible symptoms) were found primarily at light severities (Table 1). Two crops with severe netted net blotch were an exception. Stripe rust of foxtail barley (*Hordeum jubatum*) was observed in two barley fields. Loose smut and bacterial leaf blight were low in incidence and severity (Table 1).

Tan spot and stagonospora/septoria leaf blight were the predominant diseases in wheat, found in 5 and 4 fields, respectively, albeit at only low or intermediate severity (Table 2). A leaf spot complex involving multiple pathogens was diagnosed in the majority of wheat fields surveyed. Levels of the complex varied from light to severe. Stripe rust was observed in 7 spring wheat fields with 2 of these having 60% or higher severity. The disease was also found on foxtail barley in four fields. Leaf rust was observed in two fields, in one of which severity was intermediate. Loose smut was seen in only one field at a light incidence level (Table 2).

Observations made at several experimental breeders' sites in central Alberta, indicated that under natural conditions scald occurred at intermediate severities in test lines, with the exception of a site at Calmar where scald levels were high. Netted and spotted net blotch were both present at intermediate levels. The leaf spot complex in winter and spring wheat was relatively severe across breeders' sites, while stripe rust in spring wheat was generally of light severity. Severe stripe rust was observed in one winter wheat breeders' nursery where susceptible lines and cultivars displayed high severities, ranging from 70 to 90%, while resistant lines had severities of 10% or lower (data not shown).

Table 1. Severity of diseases in fields of barley surveyed in central Alberta, 2013

Disease	Light*	Intermediate*	Severe*	No. of affected fields (n=20)
Scald (*Rhynchosporium secalis*)	17	1	0	18
Netted net blotch (*Pyrenophora teres* f. *teres)*	14	1	2	17
Spotted net blotch (*Pyrenophora teres* f. *maculata*) or spot blotch *(Cochliobolus sativus*)	12	2	0	14
Stripe rust (*Puccinia striiformis*)	2	0	0	2
Loose smut (*Ustilago nuda*)	2	0	0	2
Bacterial blight (*Xanthomonas translucens*)	3	1	0	4

* For the 0-9 scale, light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.
* For the percentage disease scale, light = 1-10%; intermediate = 11-29%; and severe = 30% or higher.

Table 2. Severity of diseases in fields of winter and spring wheat surveyed in central Alberta, 2013.

Disease	Light*	Intermediate*	Severe*	No. of affected fields (n=26)
Tan spot (*Pyrenophora tritici-repentis*)	3	2	0	5
Stagonospora and septoria leaf blight	2	2	0	4
Leaf spot complex (*P. tritici-repentis, Stagonospora* and *Septoria* spp.)	12	4	1	17
Stripe rust[1] (*Puccinia striiformis*)	5	0	2	7
Stripe rust[2] *(Puccinia striiformis)*	1	1	2	4
Leaf rust (*Puccinia triticina*)	1	1	0	2
Loose smut (*Ustilago tritici*)	1	0	0	1

* For the 0-9 scale, light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.
* For the percentage disease scale, light = 1-10%; intermediate = 11-29%; and severe = 30% or higher.
[1] on wheat.
[2] on foxtail barley.

CROPS / CULTURES: Barley, Durum, Oat, Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE /TITRE: SEED-BORNE FUSARIUM ON CEREALS IN SASKATCHEWAN IN 2013

ABSTRACT: A summary of over 1600 results from three seed testing laboratories showed that levels of seed infection with *Fusarium graminearum* and other *Fusarium* species in harvested grain were generally lower than in 2012. High levels occurred in some samples especially from eastern crop districts. Over all districts the frequencies of samples with >10% *Fusarium* spp. infection were 18% for barley, 23% for durum, 26% for oat and 13% for wheat.

INTRODUCTION AND METHODS: Results of agar plate tests for *Fusarium* spp. on cereal seed samples from Saskatchewan provided by three seed-testing companies were summarized. The tests were conducted between early September and mid-December, 2013 and it was assumed that the majority of samples received in this period came from the 2013 crop. The tests were to determine either the frequency of all species of *Fusarium* combined (total *Fusarium*) or the frequency of *F. graminearum* or both. Data were tabulated for each Saskatchewan crop district [CD] (6) and for the whole province. The variables calculated were mean levels of percent seed infection with *F. graminearum* and with total *Fusarium* spp. and mean percentages of *F. graminearum*-free samples.

The tests were performed on random seed samples, with no attempt to select fusarium-damaged kernels. Plating techniques were as reported previously (4). The number of seeds tested per sample was usually 200, but occasionally 400 or 1000. Thus, the probability of obtaining false negative results for *F. graminearum* varied among tests.

RESULTS AND COMMENTS: The 2013 growing season in Saskatchewan was characterized in most areas by precipitation above average in May and June and below average from late July through September. However, some south-central areas received late summer rainfall. Dry weather, except in the areas with late summer rainfall, and heat in all areas provided ideal conditions for harvest, which was completed in a timely fashion. Yields were at record high levels (2, 3). Fusarium head blight symptoms were evident in many cereal crops, but usually at low incidence and severity (2, 3). No data are available on the proportion of Saskatchewan cereal crops that were sprayed with fungicides to control fusarium head blight. However, reports of other pathologists (1) and conversation with agronomists suggest that a majority of cereal crops received one or more applications of foliar fungicides to control leaf spots, stripe rust, or fusarium head blight.

Almost no seed samples were free of all *Fusarium* spp. The species other than *F. graminearum* commonly found were *F. avenaceum*, *F. poae*, and *F. sporotrichioides* but *F. culmorum* was only rarely detected. The numerical data compiled on seed infection (Table 1) showed that levels of infection with *Fusarium* spp. were generally lower than in 2012 both province-wide and in specific CDs (5). Excluding CDs 3B, 4A and 4B where the data were based on very small sample sizes, there were consistent trends of similar or lower levels of mean % *F. graminearum* and mean % *Fusarium* spp. in 2013 than in 2012. There were also similar or higher levels of % *F. graminearum*-free seed in 2013 than in 2012.

The data for 2013 (Table 1) are based on 1,660 samples, similar to the 1981 samples reported for 2012 (5). High numbers of samples tested reflect an ongoing concern among Saskatchewan farmers about FHB and *F. graminearum* and the availability of healthy cereal seed to plant in the spring. However, a better appreciation of this availability than that provided by arithmetic mean % infection levels (Table 1) can be

obtained from frequency distributions. The frequencies of different levels of % total *Fusarium* spp. in seed of four cereal species harvested in 2013 are given in Fig. 1. Over all crop districts the frequencies of samples with >10% *Fusarium* spp. infection were 18% for barley, 23% for durum, 26% for oat and 13% for wheat. Thus, nearly one quarter of seed harvested in 2013 was infected to a level that might be considered unsuitable for planting regardless of germination, vigor or presence of *F. graminearum*. However, mean total *Fusarium* spp. infection levels were 5% or less in about 50% of the samples of barley and durum, 40% of the oat samples, and 60% of the wheat samples.

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Table 1. Number of cereal seed samples tested from September to mid- December 2013 and levels of infection with *Fusarium graminearum* or total *Fusarium* spp. in relation to Saskatchewan Crop Districts

		Fusarium graminearum		**Total *Fusarium****
Crop District	**No. of samples tested**	**Mean % infection**	**% samples with no infection detected**	**Mean % infection**
1A	63	4.8	8%	12.4
1B	26	1.9	39%	5.5
2A	120	5.3	6%	10.0
2B	210	2.5	15%	3.9
3AN	20	1.1	25%	4.5
3AS	119	1.6	35%	4.9
3BN	109	1.2	28%	4.3
3BS	4	3.8	25%	5.9
4A	3	0	100%	7.8
4B	8	0.3	50%	1.0
5A	49	2.0	28%	5.3
5B	87	2.3	16%	7.1
6A	132	3.6	7%	7.7
6B	154	1.5	33%	4.7
7A	84	1.4	38%	4.8
7B	50	0.3	72%	2.8
8A	95	3.8	14%	10.0
8B	97	2.8	20%	6.2
9A	149	0.3	48%	4.2
9B	81	0.3	64%	6.1
TOTAL	1660*	2.2	27%	5.8

*Number of samples tested for total *Fusarium* from all crop districts was 1546.

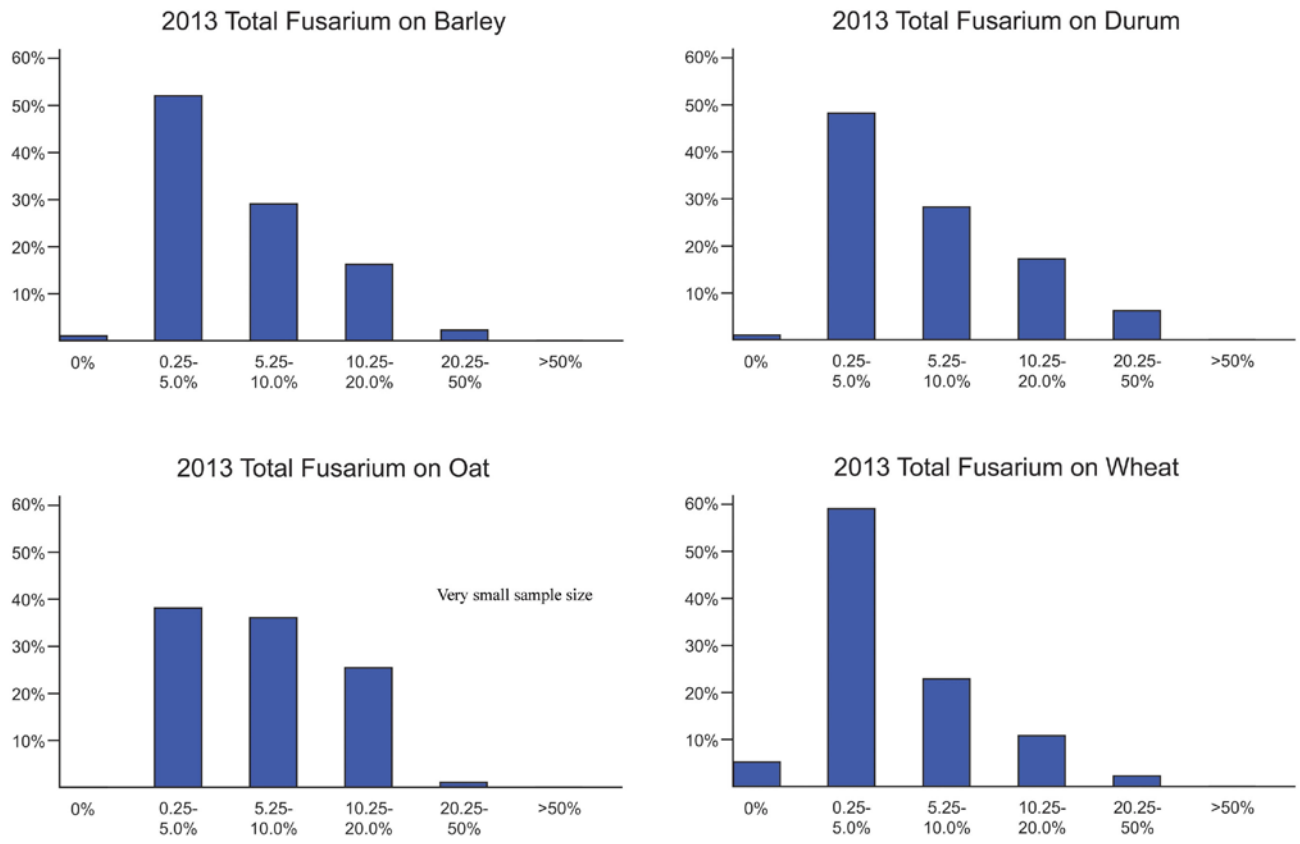

Fig. 1. Distribution of samples of harvested seed of four cereal species in 6 categories of % total *Fusarium* spp. infection (horizontal axis) in Saskatchewan in 2013 (Vertical axes = % of total samples of the cereal species indicated)

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

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TITLE / TITRE: **CEREAL SMUT SURVEYS, 2013**

ABSTRACT: In 2013, 75 spring wheat fields, 24 barley fields, and 30 oat fields were surveyed for the smut diseases caused by *Ustilago* spp. in Manitoba. Seven wheat crops were infested with *U. tritici*-infected plants, at severities ranging from trace to 3.0%. Two barley crops were infested with *U. nuda* at 0.1% and 0.5% severities. No oat crops had infected plants. In Saskatchewan, 89 fields of winter wheat and 30 fields of barley were surveyed. Sixteen winter wheat crops were infested with *U. tritici* at severities of trace to 3.5%. Two barley crops were infested with *U. nuda*; in both the severity of infection was 0.5%.

INTRODUCTION AND METHODS: Two surveys, one in Manitoba and one in Saskatchewan, were conducted from July to early August in 2013 to assess the incidence and severity of the smut diseases caused by *Ustilago hordei*, *U. nigra*, *U. nuda*, *U. tritici*, *U. avenae* and *U. kolleri*. The area surveyed included Manitoba crop districts 1, 2, 3, 7, 8, 9 and 11 and Saskatchewan crop districts 2B, 3A, 3B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, and 9. Fields were selected at random at approximately 15-25 km intervals, depending on the frequency of the crops in the region. In Manitoba, an estimate of the percentage of infected plants (i.e. plants with sori) was made while walking an ovoid path of approximately 100 m in each field. Levels of smut greater than trace (<0.01%) were estimated by counting plants in a one m^2 area at a minimum of two sites on the path. In Saskatchewan, the percentage of infected plants was estimated by assessing a 5m row at each of three random locations in a field and counting the number of infected and total plants. Crops with <0.05% infection were considered as trace in Saskatchewan. All wheat crops assessed in Manitoba were spring wheat and all those in Saskatchewan were winter wheat.

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

RESULTS AND COMMENTS:
Manitoba: Seventy-five fields of spring wheat were assessed, of which 50 contained awned and 25 awnless wheat. Four (8%) fields of awned wheat were infested with smut (*U. tritici*) at severity levels of trace, 0.1%, 0.1% and 3.0%, while three (12%) fields of awnless wheat were infested at severity levels of trace, 0.1% and 0.1%. Fifteen fields of 2-row and 9 fields of 6-row barley were assessed, with loose smut (*U. nuda*) being observed in one field of each barley type. Loose smut severity was 0.5% in the 2-row barley field and 0.1% in the 6-row barley field. Thirty oat fields were assessed and no smut infection was observed.

Saskatchewan: Eighty-nine fields of winter wheat were assessed and 16 (18%) were infested with smut (*U. tritici*). Severity of *U. tritici* infection ranged from trace to 3.5% with an average infection level of 1.8%. Two (7%) of 30 fields of barley were infested with loose smut (*U. nuda*), both with severity levels of 0.5%.

None of the *Ustilago* spp. strains collected germinated or grew on agar medium amended with carboxin, indicating all were sensitive to the active fungicide ingredient.

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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 2013

ABSTRACT: Stem rust severity in cereal crops in western Canada was low in 2013 due mostly to low inoculum pressure from the USA. In wheat and barley, race QFCSC continued to predominate as has been the case for the past 10 years. In oat, much greater variability in race structure continued. The prevalence of dominant races (TJS, TJJ, and TGN) on oat was likely influenced by their ability to attack the *Pg-a* gene resistance used in the southern USA.

INTRODUCTION AND METHODS: A total of 254 oat and 188 producer wheat fields, and some barley crops, as well as trap nurseries of barley, oat and wheat were monitored in 2013 for stem rust to assess severity of infection of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. and *P. graminis* Pers. f. sp. *avenae* Eriks. & E. Henn.). The goal was to determine the virulence spectrum in each pathogen population. The surveys were conducted in July, August, and September 2013. Infected stem tissue samples were collected from the sites surveyed. Urediniospores were obtained from collections and evaluated for virulence specialization on sets of host differential lines (Fetch, 2009).

RESULTS AND COMMENTS: Wet soil conditions in April and May delayed planting of cereal crops, particularly in the southern prairie region. Mean temperature was near normal (-1 to +1°C) for the entire growing season. Precipitation was above average (115-200%) along the USA border in May and across the central and western prairies in June and July. However, it was very dry (40-60% of normal precipitation) in the prairies in August. Environmental conditions for stem rust infection were unfavourable across the prairies in August. Additionally, fungicide use was widespread in 2013 due to high yield potential. Incidence and severity on susceptible lines in trap nurseries and commercial oat and barley crops were at trace levels. Stem rust infection in the USA was very light in 2013, thus there was little migration of inoculum into Canada.

All spring wheat cultivars recommended for production in western Canada have excellent resistance to stem rust, and no stem rust infection was observed in commercial wheat fields. Stem rust was detected at only trace levels on susceptible wheat lines in trap nurseries, cultivated barley, and on wild barley (*Hordeum jubatum*) in 2013. Race determination disclosed that 95% of the samples of *P. graminis* f. sp. *tritici* in 2013 were race QFCSC, which has been dominant since 2004.

Stem rust in cultivated and wild oat was also at trace levels in western Canada in 2013. All oat cultivars except 'Stainless' are susceptible to races TJJ and TJS (Fetch and Jin 2007). Race TJS was dominant in 2013 (61% of total samples), followed by TJJ (19%), TGN (10%), and TJN (4%). Races TJS and TJJ (NA67), which attack most tame oat cultivars grown in western Canada, rose greatly in frequency (11% and 7%, respectively) from what was found in 2012 (Fetch et al. 2013). The rise of TJS, and prevalence of races TGN and TJN, may be due to use of the *Pg-a* resistance in southern USA oat cultivars.

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

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TITRE / TITLE: MALADIES DES CÉRÉALES OBSERVÉES EN 2012 ET 2013 AU QUÉBEC

RÉSUMÉ: Les taches foliaires (avoine, blé, orge) ont été observées dans toutes les régions visitées, alors que la rouille des feuilles (blé, orge), la rouille couronnée (avoine) et l'oïdium (blé) se sont manifestés à certaines stations en 2012 et à d'autres en 2013. Quant à la fusariose de l'épi, elle a sévi chez le blé en 2013 dans le sud-ouest de la province. En 2013, on a noté pour la première fois au Québec la présence de rouille jaune (blé), à une station de la région de Québec.

ABSTRACT: Leaf spots on oats, wheat, and barley were observed in all regions visited, while leaf rust in wheat and barley, crown rust in oats, and powdery mildew in wheat were found at some test locations in 2012 and others in 2013. Fusarium head blight was destructive on wheat in 2013 in southwestern regions. In 2013, wheat stripe rust was seen for the first time in the province at a test location in the Quebec City region.

MÉTHODES: Dans le but de connaître les maladies foliaires des céréales présentes au Québec en 2012 et 2013, les essais d'enregistrement et de recommandation réalisés dans différentes régions (CÉROM 2012, 2013) ont été visités une fois, entre les stades laiteux moyen et pâteux moyen de la céréale. L'intensité des maladies identifiées sur la base des symptômes a été notée selon l'échelle de notation 0 à 9 (0 = aucun symptôme; 9 = symptômes sur plus de 50 % de la surface de la feuille étendard). Les valeurs de 0 à 4 réfèrent à une faible intensité, les valeurs de 4 à 6 à une intensité moyenne et les valeurs de 6 à 9 à une intensité élevée. Le nom des agents pathogènes normalement associés à ces maladies pour le blé (printemps et hiver), l'orge et l'avoine, est mentionné dans le texte à titre indicatif. Les données de fusariose pour le blé et l'orge, soit le nombre d'avis de dommages aux cultures ayant comme cause principale la fusariose, proviennent de la Financière agricole du Québec (FADQ).

RÉSULTATS et COMMENTAIRES: En 2012, un printemps hâtif et très clément, caractérisé par des températures au-dessus des normales de saison et peu de précipitations, a permis des semis dans de bonnes conditions dans la majorité des régions. Ces conditions exceptionnellement chaudes et sèches se sont poursuivies pendant tout l'été, mais n'ont en général pas nui au bon développement des cultures puisque des averses de pluie sont survenues au bon moment.

En 2013, les premiers semis de la fin avril jusqu'au 9 mai environ ont été faits dans de bonnes conditions dans toutes les régions. Les semis subséquents ont cependant été retardés parfois même jusqu'à la mi-juin dans certaines régions à cause de pluies fréquentes. Cette période aussi marquée par des températures fraîches a ralenti passablement la croissance des plantes. Les pluies sont demeurées fréquentes jusqu'au début juillet. Pour le reste de la saison, les précipitations ont été bien réparties pour les régions du sud de la province, alors que les régions périphériques ont reçu peu de précipitations. Les températures se sont maintenues relativement fraîches pendant tout l'été, sauf dans la semaine du 15 juillet où elles ont été au-dessus des normales de saison (maximum > 30ºC).

Chez l'avoine, la tache ovoïde (*Stagonospora avenae*) a été observée dans toutes les régions visitées. L'intensité des symptômes a varié de moyenne à élevée en 2012 et a été légèrement plus faible en 2013. La rouille couronnée (*Puccinia coronata*) a été plus répandue en 2012 qu'en 2013. L'essai de La Pocatière (Bas-Saint-Laurent) a été le plus touché au cours de ces deux années ainsi que l'essai situé à 80 km plus à l'ouest, à Saint-François-de-Montmagny en 2012; les symptômes de certaines lignées sensibles étaient de forte intensité. Pour les autres essais, notamment à Saint-Augustin-de-Desmaures (région de Québec) en 2012 et à Saint-Hyacinthe (région de Montréal) en 2013, l'intensité des symptômes des lignées sensibles

était plutôt modérée. La jaunisse nanisante de l'orge (VJNO) n'a pas été observée au cours de ces deux années.

Le fait saillant chez le blé en 2013 a été la première observation de la rouille jaune (*Puccinia striiformis*) sur le territoire de la province. Elle a été observée seulement chez quelques lignées/cultivars à Saint-Augustin-de-Desmaures et il y avait peu de symptômes. La rouille des feuilles (*Puccinia triticina*), quant à elle, a été observée à Saint-Hyacinthe en 2012 et 2013, à Saint-Mathieu-de-Beloeil (région de Montréal) en 2012 et à Saint-Augustin-de-Desmaures en 2013 et l'intensité des symptômes était plutôt faible. Les taches foliaires (*Drechslera tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*), que ce soit en 2012 ou 2013, étaient présentes dans toutes les régions et ont montré une intensité moyenne à élevée. L'oïdium (*Blumeria graminis* f. sp*. tritici*, syn. *Erysiphe graminis*) dont l'intensité a varié de faible à moyenne était présent sur le blé de printemps à Princeville (Centre-du-Québec) en 2012, à Saint-Augustin-de-Desmaures en 2012 et 2013 et sur le blé d'automne à Princeville en 2013.

La fusariose de l'épi du blé n'a pas été un grave problème en 2012 pour l'ensemble du Québec alors que seulement 1,8 % des producteurs assurés (18 sur 983) ont signalé des dommages à leur culture attribuables à cette maladie (Bertrand Leclerc, FADQ, communication personnelle). En 2013, cependant, la fusariose a été plus présente puisque ce ratio était de 9,3 %, soit 107 producteurs affectés sur 1149 assurés. Ce sont les régions du sud-ouest de la province, Montérégie-Est et Montérégie-Ouest qui ont été les plus touchées.

Chez l'orge, les taches foliaires (*Drechslera teres*, *Rhynchosporium secalis* et *Cochliobolus sativus*), ont été comme à l'habitude omniprésentes et d'intensité moyenne à élevée au cours des deux années. La rouille des feuilles (*Puccinia hordei*) a été observée seulement en 2013, et aux seules stations de Princeville et Saint-Augustin-de-Desmaures, alors que l'oïdium (*Blumeria graminis* f.sp*. hordei*, syn. *Erysiphe graminis*) et le VJNO ne se sont pas manifestés pendant ces deux années. En 2012, seulement 8 producteurs sur les 768 assurés à la FADQ (soit un ratio de 1,0 %) ont rapporté des dommages dus à la présence de la fusariose de l'épi. En 2013, ce sont 3,1 % des assurés (22 sur 699) qui ont été affectés par la maladie.

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CROP / CULTURE: Winter Wheat, Spring Wheat, Barley
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: STRIPE RUST OF WINTER WHEAT, SPRING WHEAT AND BARLEY IN SASKATCHEWAN IN 2013

ABSTRACT: Eighty-six commercial winter wheat crops, three wheat trap plots at Agriculture and Agri-Food Canada facilities, 17 commercial spring wheat and 30 commercial barley crops were surveyed for stripe rust in 2013 in Saskatchewan. Stripe rust was common on winter and spring wheat but uncommon on barley.

INTRODUCTION AND METHODS: Commercial crops of winter wheat (86), spring wheat (17) and barley (30), and susceptible wheat lines in three trap plots, were surveyed at the late milk to soft dough stage of growth for stripe rust (*Puccinia striiformis* f. sp*. tritici* and *P. striiformis* f. sp*. hordei*) in 12 crop districts of Saskatchewan (Saskatchewan Ministry of Agriculture 2012). The crops were surveyed between early July and early September 2013 and were separated from each other by at least 20 km. Each crop was traversed in a 'V' pattern (Puchalski et al. 2012) within which individual plants at five locations separated by about 40 m, were evaluated for incidence and severity of stripe rust. Incidence in each crop was estimated as the proportion of infected plants in a 5 m row per observation site exhibiting at least trace levels of stripe rust. The modified Cobb scale (Peterson et al. 1948) was used to estimate stripe rust severity on the flag leaves of 50 plants per crop (10 leaves per site). A six-category scale was used to summarize stripe rust severity in each field: clean (no visible symptoms); trace (<3% leaf area affected); light (3-5%); moderate (>15-20%); and severe (>20%).

RESULTS AND COMMENTS: Temperatures in Saskatchewan in 2013 were generally below normal for much of the growing season, but somewhat above normal from late August and throughout September. There was limited precipitation in May, August and September, but precipitation was frequent in June and July. Rust teliospore formation and senescence of plant tissue were observed by mid-August.

Many commercial winter wheat crops in Saskatchewan were sprayed with foliar fungicides and thus it is likely that rust development was largely prevented. Stripe rust was observed in 26 winter wheat crops (30%), all three wheat trap plots, eight spring wheat crops (47%), and two barley crops (7%). Of the 86 commercial winter wheat crops, 60 (70%) were rated as clean, three (3.5%) had trace levels, 11 (13%) were rated as light, five (6%) as moderate and seven (8%) as having severe levels of stripe rust (Table 1). Stripe rust-susceptible winter and spring wheat genotypes in trap plots had moderate severity levels at Swift Current and severe levels at Melfort and Scott. The highest and lowest severity levels were found in Crop Districts 6B and 9A, respectively (Table 1). Severe infection was observed on a nonsprayed crop of 'CDC Falcon' winter wheat at Insinger, SK in Crop District 5A. In spring wheat, stripe rust was most severe in crop district 8B and was observed at only trace levels in all other crop districts (Table 2). Only two barley crops, one in each of Crop Districts 6B and 8B, were affected by stripe rust. In both crops incidence was 3% and severity 5%.

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Table 1. Prevalence and severity categories for stripe rust on commercial winter wheat crops in 2013 in Saskatchewan by crop district.

Crop District	Prevalence*	Severity				
		Clean	Trace	Light	Moderate	Severe
2B	1/5	4	0	0	0	1
3A-N	2/4	2	0	2	0	0
3B-N	1/7	6	0	1	0	1
5A	4/9	5	1	0	2	1
5B	3/10	7	0	2	0	1
6A	3/11	8	0	2	1	0
6B	4/17	13	0	1	0	3
7A	¼	3	0	1	0	0
7B	½	1	0	0	1	0
8A	0/5	5	0	0	0	0
8B	3/6	3	0	1	1	1
9A	3/6	3	2	1	0	0
Total	**26/89**	**60**	**3**	**11**	**5**	**7**

* proportion of crops or trap plots affected

Table 2. Prevalence and severity categories for stripe rust on commercial spring wheat crops in 2013 in Saskatchewan by crop district.

Crop District	Prevalence*	Severity				
		Clean	Trace	Light	Moderate	Severe
2B	0/4	4	0	0	0	0
3B-N	¼	3	1	0	0	0
5A	1/1	0	1	0	0	0
5B	½	1	1	0	0	0
6A	2/3	1	2	0	0	0
8B	3/3	0	2	0	0	1
Total	**8/17**	**9**	**7**	**0**	**0**	**1**

* proportion of crops or trap plots affected

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: 2013 SASKATCHEWAN OAT FUSARIUM HEAD BLIGHT SURVEY

ABSTRACT : Plants in 94 oat fields from 16 Saskatchewan Crop Districts were sampled and tested for the presence of fusarium head blight using a plate microbiological method and real-time PCR. *Fusarium avenaceum*, *F. graminearum* and *F. poae* were identified in almost all samples, while *F. culmorum* and *F. sporotrichioides* were identified in 23% and 2% of the samples, respectively, using real-time PCR.

INTRODUCTION AND METHODS: To identify and quantify the *Fusarium* species affecting oat crops in Saskatchewan in 2013, 94 fields from 16 Crop Districts throughout the province were sampled from August 7 to September 10, when plants were at the late milk to early dough development stage. Twenty panicles were harvested at random from each field, placed in paper bags, and air-dried at room temperature. Samples were hand threshed and a portion of the seed was surface-sterilized in 3% (v/v) NaOCl for 2 minutes, rinsed with water to remove residual NaOCl and air dried. Fifty randomly selected kernels were plated on potato dextrose agar in Petri dishes (10 seeds per dish). The *Fusarium* colonies isolated were identified to species based on morphological characteristics (Gerlach and Nirenberg 1982).

The remaining seed was ground to < 40 µm fineness using a Retsch ZM 200 mill. DNA was extracted using the QIAGEN DNeasy Plant Mini Kit. Primers and TaqMan probes (6-FAM/TAMRA) specific for five *Fusarium* species, *F. avenaceum, F. culmorum*, *F. graminearum, F. poae, and F. sporotrichioides*, were designed based on available DNA sequence information (Halstensen et al., 2006; Yli-Mattila et al., 2008; Nicolaisen et al., 2009). Real-time PCR was performed with the ABI 7900HT Fast Real-Time PCR System (Applied Biosystems Inc.) to detect and quantify each *Fusarium* species.

RESULTS AND COMMENTS: The results from the plate microbiological method and real-time PCR are provided in Table 1. *Fusarium poae* was the most common species isolated by the plate method (18.1%), followed by *F. avenaceum* (5.3%). A comparison of the two methods indicates real-time PCR was more sensitive than the plate method in detecting the various *Fusarium* species. *Fusarium graminearum* and *F. poae* were detected in all 94 crop samples by real-time PCR, while *F. avenaceum, F. culmorum* and *F. sporotrichioides* were detected respectively in 97.9%, 23.4% and 2.1% of the crop samples at the 0.001 pg/ng detection limit (Table 1). However, the quantity of most *Fusarium* species was low, except for *F. poae* and *F. avenaceum* (Table 2).

The quantity of *Fusarium* DNA detected by real-time PCR in 2013 ranged from 0.001 to 2.545 pg/ng, which was lower than in 2012 (0.001 to 3.571 pg/ng) (Beattie et al. 2013), 2009 (0.002 to 3.509 pg/ng) and 2010 (0.010 to 4.793 pg/ng) (Yajima et al. 2011), but higher than in 2011 (0.01 to 0.985 pg/ng) (Beattie et al. 2012). Mean and ranges of *Fusarium* DNA quantity varied among crop districts (Tables 3-5). The highest mean quantity of *F. avenaceum* was found in crop district 2B, while the crop sample with the highest quantity was detected in crop district 6A (Table 3). *Fusarium culmorum* was detected at relatively low levels in most crop districts, except for the single crop sample from crop district 4A which had a higher level (Table 3). The highest mean quantity of *F. graminearum* was detected in crop district 6A (Table 4). *Fusarium poae* levels were relatively high in crop districts 1A, 5A, 8A and 8B, with mean quantities of 0.154, 0.109, 0.262 and 0.130 pg/ng, respectively (Table 4). *Fusarium sporotrichioides* was only detected in a single crop sample from each of crop districts 6B and 8A at quantities of 0.001 and 0.05 pg/ng, respectively (Table 5).

ACKNOWLEDGEMENTS:
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Table 1. *Fusarium* spp. detected in Saskatchewan oat crops in 2013.

	Plate Method		RT-PCR Method (% of Crops)	
Fusarium spp.	**% of Crops**	**% of Kernels[a]**	**>0.001[b]**	**>0.10[b]**
F. avenaceum	5	7	98	23
F. culmorum	0	0	23	1
F. graminearum	0	0	100	5
F. poae	18	10	100	28
F. sporotrichioides	0	0	2	0

[a]Percentage of infected kernels from infected crops.
[b]*Fusarium* DNA/Extracted DNA (pg/ng).

Table 2. *Fusarium* DNA abundance in Saskatchewan oat crops in 2013 (% of crops).

Range*	*F. avenaceum*	*F. culmorum*	*F. graminearum*	*F. poae*	*F. sporotrichioides*
0.001-0.100	75	22	95	72	2
0.101-0.500	17	1	4	25	0
0.501-1.000	3	0	1	2	0
1.001-2.000	2	0	0	0	0
2.001-3.000	1	0	0	0	0
3.001-4.000	0	0	0	0	0
4.001-5.000	0	0	0	0	0

**Fusarium* DNA/Extracted DNA (pg/ng).

Table 3. Quantity of *Fusarium avenaceum and F. culmorum* (pg/ng; *Fusarium* DNA/Extracted DNA) detected in Saskatchewan Crop Districts in 2013.

		F. avenaceum			*F. culmorum*		
Crop District	**No. of Crops**	**Detected (%)**	**Mean**	**Range**	**Detected (%)**	**Mean**	**Range**
1A	5	80	0.001	0.000-0.001	20	0.001	0.000-0.003
1B	7	86	0.008	0.000-0.027	71	0.001	0.000-0.002
2A	4	100	0.240	0.003-0.926	0	-	-
2B	3	100	0.328	0.066-0.531	33	<0.001	0.000-0.001
3A	2	100	0.005	0.004-0.005	0	-	-
3B	3	100	0.108	0.004-0.289	0	-	-
4A	1	100	0.001	-	100	0.428	-
5A	8	100	0.321	0.005-1.152	0	-	-
5B	13	100	0.051	0.002-0.298	8	<0.001	0.000-0.001
6A	10	100	0.301	0.002-2.545	20	<0.001	0.000-0.012
6B	9	100	0.101	0.001-0.491	33	0.005	0.000-0.039
7B	1	100	0.001	-	100	0.002	-
8A	6	100	0.260	0.002-1.245	0	-	-
8B	8	100	0.007	0.001-0.024	13	<0.001	0.000-0.001
9AE	7	100	0.080	0.019-0.158	0	-	-
9B	7	86	0.010	0.000-0.040	29	0.001	0.000-0.007

Table 4. Quantity of *Fusarium graminearum and F. poae* (pg/ng; *Fusarium* DNA/Extracted DNA) detected in Saskatchewan Crop Districts in 2013.

Crop District	No. of Crops	*F. graminearum*			*F. poae*		
		Detected (%)	Mean	Range	Detected (%)	Mean	Range
1A	5	100	0.004	0.003-0.005	100	0.154	0.029-0.351
1B	7	100	0.020	0.007-0.076	100	0.052	0.006-0.111
2A	4	100	0.016	0.009-0.037	100	0.096	0.017-0.299
2B	3	100	0.012	0.010-0.016	100	0.078	0.006-0.185
3A	2	100	0.005	0.004-0.005	100	0.004	0.003-0.004
3B	3	100	0.006	0.005-0.007	100	0.024	0.008-0.054
4A	1	100	0.007	-	100	0.009	-
5A	8	100	0.021	0.005-0.041	100	0.109	0.002-0.271
5B	13	100	0.009	0.004-0.024	100	0.091	0.004-0.395
6A	10	100	0.113	0.003-0.014	100	0.041	0.029-0.360
6B	9	100	0.012	0.006-0.023	100	0.083	0.007-0.338
7B	1	100	0.005	-	100	0.074	-
8A	6	100	0.111	0.009-0.420	100	0.262	0.016-0.783
8B	8	100	0.008	0.001-0.014	100	0.130	0.005-0.550
9AE	7	100	0.055	0.005-0.327	100	0.067	0.003-0.202
9B	7	100	0.007	0.002-0.020	100	0.080	0.003-0.454

Table 5. Quantity of *Fusarium sporotrichioides* (pg/ng; *Fusarium* DNA/Extracted DNA) detected in Saskatchewan Crop Districts in 2013.

Crop District	No. of Crops	*F. sporotrichioides*		
		Detected (%)	Mean	Range
1A	5	0	-	-
1B	7	0	-	-
2A	4	0	-	-
2B	3	0	-	-
3A	2	0	-	-
3B	3	0	-	-
4A	1	0	-	-
5A	8	0	-	-
5B	13	0	-	-
6A	10	0	-	-
6B	9	11	<0.001	0.000-0.001
7B	1	0	-	-
8A	6	17	0.008	0.000-0.050
8B	8	0	-	-
9AE	7	0	-	-
9B	7	0	-	-

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN SASKATCHEWAN IN 2012 AND 2013

ABSTRACT: Leaf spot disease severity was assessed and the causal leaf spot pathogens identified in eight Saskatchewan oat crops in 2012 and 32 in 2013. Severity was generally low. *Pyrenophora avenae* (pyrenophora leaf blotch), *Stagonospora (Septoria) avenae* (stagonospora leaf blotch) and *Cochliobolus sativus* (spot blotch) were the most common pathogens isolated from diseased leaves. In addition, crown rust was present at trace levels in two oat crops in 2012 and in four in 2013.

INTRODUCTION AND METHODS: Leaf spotting diseases of oat in eastern Saskatchewan were assessed from late July to mid-August in eight crops in 2012 and 32 in 2013 when these were at the milk to soft dough stage of growth. In each field, disease severity was assessed on 2-4 plants at each of five locations approximately 20 m apart and 30 m from the field edge. Disease severity was estimated in both the upper (flag and penultimate leaves) and lower canopies as follows: 0 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). In each crop a minimum of 10 leaves were collected, dried, and stored in paper envelopes. Subsequently, 10 infected leaf tissue pieces, each from a different leaf, were surface-sterilized and placed on water agar in petri plates for seven days to promote fungal sporulation. Pathogen identification was based on spore morphology.

RESULTS AND COMMENTS: Growing conditions in 2012 in Saskatchewan were wet to very wet in spring and early summer. Southern and south-eastern areas of the province received little precipitation after late June, but crop production areas to the west and north of the province continued to receive precipitation into August. The weather was warm to hot in July across much of the province (Saskatchewan Ministry of Agriculture 2012). However, in localized areas excess moisture, heat stress, wind, and hail impacted disease and crop development. In 2013, temperatures were somewhat below normal for much of the growing season, but above-normal temperatures in late August and throughout September were conducive to crop development and maturation (Saskatchewan Ministry of Agriculture 2013). There was limited precipitation during the months of May, August and September; however, frequent showers in June and July likely contributed to leaf spot development.

Leaf spots were observed in the canopies of all crops surveyed in 2012. Disease severity ranged from trace to slight in the upper canopy; in the lower canopy, severity ranged from trace to slight in five fields and was moderate in three. The most common leaf spot pathogen identified was *Pyrenophora avenae* Ito & Kuribayashi (pyrenophora leaf blotch), followed by *Stagonospora avenae* (Frank) Bissett f. sp. *avenaria* (stagonospora (septoria) leaf blotch), and *Cochliobolus sativus* Ito & Kuribayashi) Drechs ex Dastur (spot blotch) (Table 1). In addition, crown rust (*Puccinia coronata* Corda f. sp. *avenae* Eriks.) was present at trace levels in two of the eight crops.

Leaf spots were also observed in the canopies of all crops sampled in 2013. Their severity ranged from trace to slight in the upper canopy; in the lower canopy, disease severity was trace to slight in 22 crops, moderate in eight and severe in two. Additionally, crown rust was detected at trace levels in four of the 32 crops. In 2013, as in the previous year, the most common leaf spotting pathogens were *P. avenae*, followed by *S. avenae* and *C. sativus* (Table 1). These were also the most frequently identified pathogens in years previous to 2012 and 2013 (Tekauz et al. 2012).

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Table 1. Incidence and isolation frequency of leaf spot pathogens of oat in Saskatchewan in 2012 and 2013.

Pathogen	Incidence (% crops)		Frequency (% isolations)*	
	2012	2013	2012	2013
Pyrenophora avenae	100	100	50	81
Stagonospora avenae	75	53	32	15
Cochliobolus sativus	38	25	7	4

* indicative of the relative amount of foliar damage observed

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba, Saskatchewan, and Eastern Canada

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TITLE / TITRE: CROWN RUST OF OAT IN MANITOBA, SASKATCHEWAN AND EASTERN CANADA IN 2012

ABSTRACT: In 2012, 191 fields with wild oat weeds and 30 fields of common oat were surveyed in Manitoba and Saskatchewan to document the incidence and severity of *Puccinia coronata* f.sp. *avenae*. Plants with crown rust were found in 72 and 40% of all wild and common oat fields at mean severities of 24 and 16%, respectively. No virulence was detected to resistance gene *Pc94* in collections from Manitoba and Saskatchewan. No virulence was detected to the resistance genes *Pc45, Pc51, Pc58, Pc59, Pc91, Pc94* and *Pc98* in collections from Ontario, Québec and Prince Edward Island.

INTRODUCTION AND METHODS: Surveys for incidence and severity of oat crown rust (caused by *Puccinia coronata* Cda f. sp. *avenae* Eriks.) were conducted in Manitoba and Saskatchewan (eastern prairies) from July 23 to September 12 in 2012. Incidence was considered to be the percentage of leaves infected with rust in a given field, and severity was the mean percentage leaf area with pustules. Crown rust collections were obtained from wild oat (*Avena fatua* L.) and common oat (*A. sativa* L.) in commercial fields, and susceptible and resistant oat lines and cultivars grown in the Uniform Rust Nurseries (URN). URN sites were located at Brandon, Emerson, and Morden, MB, and at Indian Head, Regina, and Saskatoon, SK. Crown rust-affected samples from fields in Ontario, Québec and Prince Edward Island were collected between July 6 and July 31. For virulence studies, single-pustule isolates (spi) were established from the rust collections. Races were identified using 16 standard oat crown rust differentials (Table 1) as described by Chong et al. (2000). In addition, single *Pc*-gene lines with *Pc91, Pc94*, or *Pc96* were used as supplemental differentials. Oat lines with the putative new crown rust resistance genes, *temp_pc97* and *temp_Pc98* were included in the differential sets to determine their reactions to single-pustule isolates established from the rust collections.

RESULTS AND COMMENTS: A total of 191 fields with wild oats and 30 fields of common oat cultivars and lines were surveyed in Manitoba and Saskatchewan in 2012. Wild oat plants infected with *P. coronata* f. sp. *avenae* were found in 138 (72%) of the fields, and infected common oat plants were found in 12 (40%) of the fields.

Crown rust incidence and severity generally were very low in commercial oat crops over the entire survey area. Exceptions were one crop near Yorkton SK that was severely affected, with 100% of plants infected at mean severities of 90%. Another field near Boissevain MB had 80% of the plants infected at severities of trace to 5%. The remainder of affected fields had trace to 10% of plants infected with crown rust at only trace severity levels.

Rust incidence and severity on wild oat were low in south-central and southeastern Manitoba, mostly at trace levels. Incidence and severity started to increase moving west, beginning approximately 50 km west of Winnipeg. Here incidence of crown rust was high, but severity remained low. Fields southwest of Brandon MB, and throughout eastern Saskatchewan had high levels of both incidence and severity. Crops northwest of Brandon were not as heavily infected with crown rust as those southwest of Brandon, but still had high levels of incidence and severity. Overall, the incidence of infection of wild oat plants in affected crops in Manitoba and Saskatchewan ranged from trace to 100%, with a mean of 60%. Severity of infection ranged from trace to 90%, with a mean of 24%.

One hundred ninety-two spi were made from wild oat. One hundred fifteen races were identified from these spi using the crown rust differentials listed in Table 1. The number of spi of each race ranged from one to 12. There was only a single spi for 84 of the races identified. No spi from wild oat was virulent on the resistance gene *Pc94*.

Twenty-six spi were made from common oat collections. Twenty-two races were identified from these, with the number of isolates of each race ranging from one to three. There was only a single spi for 19 of the races identified. No spi from common oat was virulent on resistance genes *Pc54, Pc58, Pc94*, *Pc97*, and *Pc98*.

Thirty-five spi were made from collections from the URN. Thirty-one races were identified with the number of isolates per race ranging from one to three. There was only a single spi identified for 28 of the races, and no spi possessed virulence to resistance genes *Pc50, Pc94* and *Pc98*.

In 2012, none of the spi from the eastern prairie region was virulent to *Pc94* (Table 1). Greater than 50% of all spi were virulent to resistance genes *Pc38, Pc39,* and *Pc56*. The high levels of virulence to *Pc38,* and *Pc39* likely reflect the deployment since the 1980s of *Pc38* and *Pc39* in combination in the eastern Canadian prairies, as well as in North Dakota and Minnesota.

Thirty-one spi were made from collections from eastern Canada. Twenty-seven races were identified and for 23 of these only a single spi was identified. None of the races possessed virulence to resistance genes *Pc58, Pc59, Pc94* and *Pc98* (Table1). Fifty percent or more of the spi possessed virulence to the resistance genes *Pc38, Pc48, Pc56* and *Pc68*.

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Table 1. Frequencies (%) of virulence of *Puccinia coronata* f. sp. *avenae* isolates from Manitoba and Saskatchewan (eastern prairie region) and eastern Canada on 16 standard and 5 supplemental crown rust differential oat lines in 2012.

Oat lines and *Pc* gene present	**Wild Oat**		**Commercial Oat Field**		**Uniform Rust Nursery**		**Eastern Canada**	
	# isolates	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**
Standard								
Pc38	182	95	26	100	28	80	25	81
Pc39	182	95	26	100	32	91	12	39
Pc40	82	43	14	54	19	54	1	3
Pc45	44	23	6	23	6	17	1	3
Pc46	59	31	5	19	17	49	7	23
Pc48	22	11	2	8	13	37	21	68
Pc50	16	8	4	15	0	0	1	3
Pc51	92	48	16	62	12	34	3	10
Pc52	22	11	3	12	12	34	7	23
Pc54	8	4	0	0	2	6	1	3
Pc56	136	71	25	96	25	71	18	58
Pc58[a]	6	3	0	0	3	9	0	0
Pc59[a]	9	5	3	12	9	26	0	0
Pc62	14	7	3	12	1	3	1	3
Pc64	21	11	4	15	6	17	1	3
Pc68	90	47	14	54	11	31	16	52
Supplemental								
Pc91	6	3	2	8	1	3	1	3
Pc94	0	0	0	0	0	0	0	0
Pc96	9	5	1	41	3	9	2	6
Putative new gene[b]								
Temp_Pc97	2	1	0	0	1	3	2	6
Temp_Pc98	2	1	0	0	0	0	0	0
Total	192		26		35		31	

[a]The *Pc58*-differential was shown to carry three linked genes, and the *Pc59*-differential three nonlinked genes (Chong et al. 2008).
[b]*Temp_pc97* and *temp_Pc98,* are temporary designations for genes recently obtained from *Avena sterilis* (J. Chong, unpublished).

CROP / CULTURE: Oat
LOCATION / RÉGION: Central and eastern Ontario

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TITLE / TITRE: DISEASES OF OAT IN CENTRAL AND EASTERN ONTARIO IN 2013

ABSTRACT: Nineteen oat crops in central and eastern Ontario were surveyed for diseases in 2013. Ten were identified, all at slight levels, except for severe crown rust in 10 crops. Moderate fusarium head blight was observed; *Fusarium poae* and *F. graminearum* were the predominant causal species.

INTRODUCTION AND METHODS: A survey to document diseases in central and eastern Ontario oat crops was conducted in the third week of July 2013 when plants were at the soft dough stage of development. Nineteen fields were chosen at random in regions where the most oat crops are grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Disease diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for ergot, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected panicles) and severity (% infected spikelets in the affected panicles) based on approximately 200 panicles at each of three random sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 50 infected panicles collected from each field. The panicles were air-dried at room temperature and subsequently threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCI for 60 sec. and plated in 9-cm petri dishes on modified potato dextrose agar (10 g dextrose per liter amended with 50 ppm of streptomycin sulphate). Plates were incubated for 10-14 days at 22-25ºC with a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Ten diseases were identified (Table 1) and all were commonly found. Crown rust (*Puccinia coronata* f. sp. *avenae*) was the most prevalent disease and occurred in 18 fields at a mean severity of 5.4. Severe levels of crown rust were observed in 10 fields where the disease likely resulted in an average yield reduction of >5%. Spot blotch (*Cochliobolus sativus*) was found in all fields at a mean severity of 2.2. Severe levels of spot blotch were not seen and the disease would have resulted in minimal yield reductions. Barley yellow dwarf (BYD), halo blight (*Pseudomonas syringae* pv. *coronafaciens*), pyrenophora leaf blotch (*Pyrenophora avenae*), and stagonospora leaf blotch (*Stagonospora avenae* f. sp. *avenaria*) were observed in 15, 14, 16, and 18 fields at mean severities of 1.8, 1.4, 1.4, and 1.3, respectively. No severe levels of these diseases were found and none would have resulted in substantive damage to the crop.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*) and take-all root rot (*Gaeumannomyces graminis* var. *avenae*) were found in all surveyed fields at mean severities of 0.5, 0.6, and 1.0%, respectively. These diseases likely resulted in minimal damage.

Fusarium head blight occurred in all fields at a mean FHB index of 2.5% (range 0.04-24.0%) (Table 1). The disease was recorded at slight to moderate levels in the affected crops with one exception, a crop with very severe FHB. Six *Fusarium* species were isolated from discoloured kernels with *F. poae* and *F. graminearum* predominating (Table 2). These two occurred in 74 and 58% of fields and on 20.5 and 10.0%

of kernels, respectively. Other species isolated included *F. avenaceum, F. equiseti, F. oxysporum* and *F. sporotrichioides*. They were documented in 11-48% of fields and on 0.5-5.8% of kernels.

Overall, the diseases of oat observed in Ontario in 2013 were similar to those found in 2012 (Xue and Chen 2013). Crown rust was the predominant foliar disease. Fusarium head blight, although observed in all surveyed fields, likely had no significant effect on oat grain yield or quality in 2013.

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Table 1: Prevalence and severity of oat diseases in central and eastern Ontario in 2013.

DISEASE	NO. CROPS AFFECTED (n=19)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
Barley yellow dwarf	15	1.8	1.0-5.0
Crown rust	18	5.4	3.0-7.0
Halo blight	14	1.4	1.0-2.0
Pyrenophora leaf blotch	16	1.4	1.0-2.0
Spot blotch	19	2.2	1.0-5.0
Stagonospora leaf blotch	18	1.3	1.0-3.0
Ergot (%)	19	0.5	0.5-1.0
Loose smut (%)	19	0.6	0.5-2.0
Take-all (%)	19	1.0	0.5-5.0
Fusarium head blight**	19		
Incidence (%)		14.3	2.0-80.0
Severity (%)		7.0	2.0-30.0
Index (%)		2.5	0.04-24.0

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

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

Table 2. Prevalence of *Fusarium* species isolated from discolored kernels of oat in central and eastern Ontario in 2013.

***Fusarium* spp.**	**% AFFECTED FIELDS**	**% KERNELS**
Total *Fusarium*	100	42.1
F. avenaceum	32	4.2
F. equiseti	11	1.1
F. graminearum	58	10.0
F. oxysporum	11	0.5
F. poae	74	20.5
F. sporotrichioides	47	5.8

CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2013

ABSTRACT: In 2013, Fusarium head blight (FHB) incidence and severity were assessed in 160 wheat crops in Saskatchewan. FHB occurred in 60% and 76% of the surveyed common and durum wheat crops, respectively. The provincial mean FHB severity was 0.5% for common wheat and 1.3% for durum wheat.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 160 wheat crops in Saskatchewan in 2013: 118 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 42 durum wheat (Canada Western Amber Durum class). Fields were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey), and fields under irrigation were considered separately and referred to as in the Irrigation Zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

Crop adjustors with Saskatchewan Crop Insurance Corporation and Saskatchewan Ministry of Agriculture staff randomly collected 50 spikes from each wheat crop at the late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visible FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each wheat crop surveyed: FHB Index (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and cultured on potato dextrose agar and carnation leaf agar to confirm and identify the *Fusarium* spp. in infected kernels. Potato Dextrose Agar (PDA) or half strength PDA (½PDA) were used to observe colony morphology; Carnation Agar (CA) or Synthetischer Nahrstoffarmer Agar (SNA) were used to promote *Fusarium* sporulation, if needed.

RESULTS AND COMMENTS: Approximately 3.8 million hectares (9.4 million ac) of spring wheat and 1.8 million hectares (4.4 million ac) of durum wheat were seeded in Saskatchewan in 2013 (Saskatchewan Ministry of Agriculture 2014). Producers experienced above-average crop quality in 2013 and yields well above the 10-year (2003 to 2012) average. The average yields of 3.2 metric tonnes per ha (48.1 bu/ac) for spring wheat and 3.2 metric tonnes per hectare (47.6 bu/ac) for durum wheat are higher than the 10-year averages of 2.4 metric tonnes per hectare (35.2bu/acre) for both crop types (Saskatchewan Ministry of Agriculture 2013).

In 2013, FHB occurred in 60% and 76% of common and durum wheat crops, respectively (Table 1). Prevalence and severities of FHB in common and durum wheat were lowest in soil Zone 1. FHB was most prevalent in soil Zone 2 for common wheat and in the Irrigation Zone for durum wheat. The highest mean severity for both common wheat and durum was in Zone 2. The sample with the highest FHB severity (14.4%) was from a common wheat crop also in soil Zone 2.

Overall, the provincial mean FHB severities of 0.5% for common wheat and 1.3% for durum wheat for 2013 (Table 1) were lower than the previous two years for common wheat (1.2% in 2012 and 0.6% in 2011) but higher for durum wheat (0.9% in both 2012 and 2011). The provincial mean FHB severities for common

wheat and durum wheat were also lower than in 2010 (2.0%), the first year since 2001 that the provincial annual mean FHB severities exceeded 1% (Miller et al. 2013).

Of the 160 wheat samples collected, 103 had visible FHB symptoms that were confirmed through culturing of glumes and kernels and subsequent isolation of *Fusarium*. The most frequently isolated causal pathogen on wheat samples with visible FHB symptoms was *F. poae* which was detected in 31% of surveyed fields and accounted for 24% of all the *Fusarium* isolations (Table 2). In previous years, either *F. avenaceum* or *F. poae* have been the dominant species in the province (Dokken-Bouchard et al. 2012). In 2013, *F. avenaceum* was detected in 13% of surveyed fields and accounted for only 8% of *Fusarium* isolations.

Fusarium graminearum was detected in 20% of the common wheat samples and 24% of the durum wheat samples with visible symptoms. It accounted for 19% of the total *Fusarium* isolates from common wheat and 15% of those from durum wheat. For common wheat, 19% is a slightly lower level than in 2011 when *F. graminearum* was found in 39% of samples, but for durum 24% is a slightly higher level than in 2011 when *F. graminearum* was found in 19% of the samples. Based on isolation totals, *F. graminearum* accounted for a similar level in 2013 as in 2011, when 21% of the *Fusarium* isolations from common wheat and 12% of those from durum wheat were of *F. graminearum*. Several other *Fusarium* species were also detected.

Other fungal pathogens observed on wheat spikes collected in 2013 included *Septoria* spp. and *Cochliobolus* spp., along with various secondary (saprophytic) moulds.

ACKNOWLEDGEMENTS:
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Table 1. Prevalence and severity of fusarium head blight (FHB) in common and durum wheat crops grouped by soil zone in Saskatchewan, 2013.

Soil Zones	Common Wheat		Durum Wheat	
	Prevalence[1] (No. of Crops Surveyed)	**Mean FHB Severity or Index[2] (range)**	**Prevalence[1] (No. of Crops Surveyed)**	**Mean FHB Severity or Index[1] (range)**
Zone 1 Brown	44% (16)	0.1% (0 – 0.6%)	61% (19)	0.3% (0 – 1.9%)
Zone 2 Dark Brown	69% (36)	1.0% (0 – 14.4%)	94% (13)	2.7% (0.6 – 10.6%)
Zone 3 Black/Grey	60% (58)	0.3% (0 – 3.3%)	–	–
Irrigation Zones	50% (8)	0.2% (0 – 0.9%)	100% 2	0.6% (0.1-1.1%)
Overall Total/Mean	**60% (118)**	**0.5% (0-14.4%)**	**76% (42)**	**1.3% (0-10.6%)**

[1] Prevalence = Number of crops affected / total crops surveyed (%)
[2] FHB severity/Index = [% of spikes affected x mean proportion (%) of kernels infected] / 100.

Table 2. *Fusarium* species prevalence[1] in common and durum wheat crops positive for FHB in 2013.

Crop	*F. acuminatum*	*F. avenaceum*	*F. culmorum*	*F. equiseti*	*F. graminearum*	*F. poae*	*F. sporo*[2]	Other *Fusarium* spp.
Common	25	8	5	12	20	26	8	18
Durum	21	26	5	12	24	45	2	24
Wheat Total	**24**	**13**	**5**	**12**	**21**	**31**	**7**	**19**

[1] Prevalence = Number of crops affected / total crops surveyed (%)
[2] *sporotrichioides*

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN SASKATCHEWAN IN 2013

ABSTRACT: Eighty-nine Saskatchewan winter wheat crops, including trap plots located at three Agriculture and Agri-Food Canada research facilities, were surveyed for fusarium head blight (FHB) in 2013. Both the incidence and severity of FHB were generally low in most of the crops surveyed.

INTRODUCTION AND METHODS: A survey of 89 Saskatchewan winter wheat crops, including three trap plots located at three Agriculture and Agri-Food Canada research facilities, was conducted from early July to early August 2013 to monitor the incidence and severity of fusarium head blight (FHB). Crops were separated from each other by a distance of at least 20-40 km. The crops were traversed in a "V" pattern and disease was assessed at five locations approximately 40 m apart in each field. Ten spikes from each field location (50 spikes per crop) were sampled to document incidence (proportion of spikes infected) and severity (proportion of each spike displaying symptoms) of FHB). The FHB index (overall severity) was calculated as follows: (average % incidence X average % severity)/100.

RESULTS AND COMMENTS: FHB was observed in 25 of 89 (28%) of the winter wheat crops surveyed at mean incidence, severity and FHB indexes for the 25 affected crops of 4.6%, 11% and 0.7%, respectively. Average disease levels were generally low in all regions except Crop District 3A-N where the severity and FHB index were much greater than the means for all crops. FHB levels were also somewhat higher than the provincial means in Crop Districts 3B-N and 6B.

Table 1. Prevalence of FHB and its disease components in winter wheat crops surveyed in Saskatchewan in 2013.

Saskatchewan Crop District	Prevalence (proportion of crops infected)	Incidence (%)	Severity (%)	FHB index (%)	Index Range (%)
2B	3/5	11.0	3.6	0.40	0.3-2.0
3A-N	4/4	7.5	62.5	4.69	1.0-9.0
3B-N	3/8	7.3	20.0	1.45	1.5-4.0
5A	1/9	3.3	2.2	0.07	1.0-2.0
5B	2/10	7.0	3.0	0.21	4.5-6.0
6A	3/11	1.9	4.1	0.08	0.2-2.0
6B	4/17	4.4	20.6	0.90	0.5-9.0
7A	1/4	2.5	3.8	0.09	0 - 1.5
7B	1/3	6.7	5.0	0.33	0 - 3.0
8A	1/6	0.8	3.3	0.03	0 - 1.0
8B	1/6	1.7	3.3	0.06	0 - 1.0
9A	1/6	0.5	0.8	<0.01	0 - 0.2
All districts	25/89	4.6	11.0	0.69	0.8-6.4

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

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TITLE / TITRE: **LEAF SPOTTING DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2013**

ABSTRACT: Leaf spot s were surveyed in 138 wheat crops over 17 Saskatchewan crop districts. Percent severity overall and of specific pathogens were compared relative to soil zone, previous crop and tillage system. Overall severity was lower than for 2010-2012. Severity was highest in the Black/Grey and lowest in the Brown Soil Zone. *Pyrenophora tritici-repentis* was the most prevalent pathogen followed by *Cochliobolus sativus* and species causing the septoria leaf complex. Consistent differences in disease severity or specific pathogens were absent in all soil zones regardless of previous crops or tillage systems.

INTRODUCTION AND METHODS: A survey for leaf spot diseases of common and durum wheat was conducted between the milk and dough growth stages in 2013. A total of 138 common and durum crops were sampled in 17 crop districts (CD). In each field, 50 flag leaves were collected at random and air-dried at room temperature. Percentage of leaf area affected by leaf spots (severity) was recorded for each leaf, and a mean percentage leaf area with leaf spots was calculated for each crop and CD. For crops with the highest leaf spot severities (total of 57 crops), 1 cm^2 surface-disinfested leaf pieces were plated on water agar for identification and quantification of causal leaf spot pathogens.

Information on the previous crop and tillage method was obtained for most of the surveyed fields. Comparisons of disease and fungal levels among tillage systems and among previous crops were made for crops in soil zone (SZ) 1 (Brown), SZ2 (Dark Brown), and SZ3 (Black/Grey). Tillage system was classified as either conventional, minimum, or zero, while previous crops were a cereal, a non-cereal (oilseed or pulse), or summerfallowed.

RESULTS AND COMMENTS: Leaf spots were observed in all crops surveyed (Table 1). In individual crops, percentage flag leaf area infected ranged from trace to 36%. An overall mean leaf spot severity of 7.6% was lower than in 2012 (10.0%), 2011 (11.6%) and 2010 (11.3%) (Fernandez et al. 2011, 2012, 2013). The lower severity in 2013 can be explained, at least in part, by lower than normal precipitation and mean temperature during the 2013 growing season. For June-July, total precipitation in all soil zones was lower than in 2010 and 2011 (for SZ1, 2013: 140 mm, 2011: 189 mm, 2010: 185 mm; for SZ2, 2013: 146 mm, 2011: 179 mm, 2010: 180 mm; for SZ3, 2013: 181 mm, 2011: 213 mm, 2010: 200 mm). Also average mean temperature was lower than in the previous two years, especially in 2012 (for SZ1, 2013: 16.5ºC, 2012: 18.3ºC, 2011: 17.0ºC; for SZ2, 2013: 17.0ºC, 2012: 18.8ºC, 2011: 17.8ºC; for SZ3, 2013: 16.2ºC, 2012: 17.4ºC, 2011: 16.6ºC).

For all crops combined, mean leaf spot severity was greatest in SZ3 and lowest in SZ1 (Table 1); this agrees with previous recent surveys (Fernandez et al., 2011, 2012, 2013). Similarly, common wheat disease severity was greatest in SZ3 and lowest in SZ1, and for durum wheat greater in SZ2 than SZ1. The CDs with the greatest mean leaf spot severities were 5A/5B (east), followed by 3AS/3BN/3BS (south-central and south-west) and 7A (west-central), while the CDs with the lowest mean severities were 4B (south-west) and 6A/6B (central).

As reported for previous years**,** *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread leaf spot pathogen (Fernandez et al., 2011, 2012, 2013) (Table 1). It was followed in frequency

and number of fields affected by *Cochliobolus sativus* (spot blotch). Among the species of the septoria leaf complex*, Stagonospora nodorum* and *S. avenae* f.sp. *triticea* were the most common; *Septoria tritici* was isolated less frequently.

For all crops combined, *P. tritici-repentis* was most common in SZ1 and least common in SZ3, while the septoria leaf complex was most common in SZ3 and least common in SZ1 (Table 1). Similar observations were made when considering only common wheat crops. In addition, *C. sativus* was isolated most frequently from common wheat crops in SZ3.

As is usual, durum wheat was more represented in SZ1 and least in SZ3 (proportion of durum vs. common wheat: 60% for SZ1, 35% for SZ2, 0% for SZ3). When common and durum wheat are compared by soil zone (SZ1 and SZ2 only), leaf spotting severity was greater in durum compared to common wheat in both soil zones (Table 1). Pathogens of the septoria leaf complex were more frequently isolated from common than durum wheat, which concurs with observations made in previous years (Fernandez et al., 2011, 2012, 2013). The greater presence of *C. sativus* in durum compared to common wheat is similar to observations made in 2011 and 2012 (Fernandez et al., 2012, 2013).

For all crops combined, the greatest mean percentage isolations of *P. tritici-repentis* were those in north-eastern (8A/8B) and south-central and south-western (3AS/3BN/3BS, 4B) CDs, while the lowest percentage isolations of this pathogen were in eastern (1A/1B, 5A/5B) CDs (Table 1). Conversely, the greatest percentage isolations of the septoria leaf complex pathogens were found in eastern (1A/1B, 5A/5B), central (6A/6B), and north-western (9A/9B) CDs. *Cochliobolus sativus* was most frequently isolated from eastern (5A/5B), western (4B, 7A) and south-eastern (2A/2B) CDs.

Classification of fields according to tillage system or previous crop revealed no consistent differences among these categories in leaf spot severity or frequency of fungal isolations within soil zones (data not shown). This may be attributed, at least in part, to the small sample size for some of the categories.

Pyrenophora teres was isolated from 7% of the common and durum wheat crops throughout the province, with percentage of isolations ranging from 0.2% to 7.1%, and an overall mean of 0.3%. *Ascochyta* spp. and *Phaeoseptoria vermiformis* were isolated from 20% and 14% respectively of total wheat fields and constitutied 6% of all fungal isolates, particularly in SZ2 and SZ3. The most commonly observed *Fusarium* species on leaf tissue was *F. avenaceum*, which was present in 9% of fields, and constituted 0.5% of all fungal isolates.

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

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Table 1. Incidence and severity of leaf spotting diseases and percentage isolation of the most common leaf spot pathogens in common and durum wheat crops surveyed in Saskatchewan in 2013.

Soil Zone or Crop District	No. crops[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Stagonospora nodorum*[3]	*Septoria tritici*[3]	*Stagonospora avenae* f.sp. *triticea*[3]	*Cochliobolus sativus*[3]
			%				
Soil Zone							
Common and durum wheat:							
1 (Brown)	30	6.9	85/14	1/4	2/1	1/6	11/12
2 (Dark Brown)	59	7.5	77/23	3/11	4/2	4/12	11/14
3 (Black/Gray)	49	8.0	64/19	7/10	6/8	11/8	12/14
Common wheat:							
1 (Brown)	12	6.4	86/5	1/1	5/1	1/1	6/5
2 (Dark Brown)	36	7.7	78/14	4/8	7/2	4/8	6/6
3 (Black/Gray)	46	8.4	62/18	7/10	6/8	12/8	13/14
Durum wheat:							
1 (Brown)	18	7.2	85/9	1/3	-/-	1/5	14/7
2 (Dark Brown)	19	8.8	75/9	<1/3	-/-	4/4	20/8
Crop District (common/durum wheat):							
1A/1B	16	8.1	66/8	12/5	5/3	11/5	5/4
2A/2B	21	7.4	78/8	1/4	-/-	1/2	19/7
3AS/3BN/3BS	19	11.9	90/9	<1/3	-/-	6/6	4/7
4B	9	2.5	82/4	2/2	-/-	<1/1	16/3
5A/5B	9	15.9	46/7	1/3	2/3	22/4	28/7
6A/6B	27	3.7	77/7	2/2	13/2	5/4	3/4
7A	8	10.5	72/4	<1/1	6/1	1/2	21/4
8A/8B	12	6.1	96/4	2/3	-/-	<1/2	1/1
9A/9B	17	6.4	75/5	11/2	13/2	-/-	1/2
Mean/total:	**138**	**7.6**	**75/56**	**4/25**	**4/11**	**6/26**	**12/40**

[1] Number of crops sampled. All crops had leaf spot lesions on the flag leaves.
[2] Mean percentage flag leaf infected.
[3] Mean percentage fungal isolation/number of crops where the fungus occurred. For each CD, the number of crops where *P. tritici-repentis* was isolated is the total number of crops plated for fungal identification and quantification.

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

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TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2013

ABSTRACT: In field surveys conducted from June-September 2013 wheat leaf rust was found at relatively low levels in trap plots and disease nurseries, and the epidemic started relatively late in the growing season. Stripe rust was found only at trace levels. Both rusts were widespread throughout Manitoba and eastern Saskatchewan.

INTRODUCTION AND METHODS: Trap nurseries and commercial fields of wheat in Manitoba and eastern Saskatchewan were surveyed for the incidence and severity of leaf rust (*Puccinia triticina* Eriks.) and stripe rust (*Puccinia striiformis* Westend. f.sp. *tritici*) from June to September 2013.

RESULTS AND COMMENTS: Wheat leaf rust was first observed on spring wheat in June 2013. Leaf rust was found at lower than normal levels in test plots and nurseries throughout southern Manitoba and south-eastern Saskatchewan, and the epidemic appeared to start relatively late in the growing season. However, it was widespread and found at all survey locations. The majority of the crop was seeded earlier than normal and avoided leaf rust infection. Most commercial wheat fields in Manitoba were sprayed with foliar fungicides and did not suffer economic losses due to rust infection. In nonsprayed nurseries and trap plots wheat leaf rust development occurred relatively late in the season.

Wheat stripe rust was found at only trace levels during the field survey, though it was widespread in Manitoba and eastern Saskatchewan. The isolated pustules of stripe rust did not appear to spread extensively and the epidemic was stopped when hotter weather in July resulted in a switch from production of urediniospores to teliospores.

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Southwestern Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: DETERMINATION OF MYCOTOXIN LEVELS IN WINTER WHEAT IN ONTARIO IN 2013

ABSTRACT: Mycotoxins level in harvested hard red winter wheat grain from an experimental cross were determined at three locations in southwestern Ontario in 2013. In general, relatively high levels of deoxynivalenol (DON) were detected, with some lines showing a level of tolerance.

INTRODUCTION AND METHODS: Seven hard red winter wheat breeding lines from the cross 'Maxine' x 'FTHP Redeemer' and an 'AC Morley' check, which is rated as moderately resistant to fusarium head blight, were planted in replicated plots at three locations, Ridgetown, Centralia and Inwood, in southwestern Ontario in 2012. At maturity in 2013, the harvested grain was sampled to determine mycotoxin levels using the GC-MS method with a detection limit of 0.1 ppm.

RESULTS AND COMMENTS: A lower average level of deoxynivalenol (DON) was detected at the Ridgetown experimental location (1.5 ppm) compared to Inwood (3.3 ppm) or Centralia (5.2 ppm) (Table 1). In addition to DON, 15-acetyl DON was detected in most samples from Centralia and half of those from Inwood. Traces of HT2 toxin were detected in two samples from Ridgetown and one sample from each of the other two locations. Nivalenol was not detected in any sample. Line CA03-017 had the lowest numerical DON level across two locations and was not significantly different from the best lines at the third location, suggesting genetic tolerance to DON accumulation. Several lines had numerically lower DON levels than the moderately resistant check 'AC Morley'. The average DON levels at the three locations were higher than reported in previous years (Tamburic-Ilincic, 2009, Tamburic-Ilincic and Schaafsma, 2010 and Tamburic-Ilincic et al. 2011).

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Tamburic-Ilincic, L., Limay-Rios and Schaafsma, A. W. 2011. 2010 survey for fusarium head blight of winter wheat in Ontario.2011. Can. Plant Dis. Surv. 91:103-104. (www.phytopath.ca/cpds.shtml)

Table 1. Deoxynivalenol (DON), 15-acetyl DON (15-ADON) and HT2 mycotoxin levels (ppm) in grain of winter wheat experimental lines harvested from three locations, Centralia, Inwood and Ridgetown, in southwestern Ontario in 2013.

Line	Centralia DON	15 ADON	HTS	Inwood DON	15 ADON	HT2	Ridgetown DON	HT2
CA03-017	1.1b			1.2c			0.4b	
CA03-052	3.3b	0.1a		2.6bc			0.9b	
CA03-059	3.9b	0.1a		1.3c		0.05	0.2b	
CA03-068	10.8a	0.1a		7.0a	0.1a		2.4a	
CA03-078	8.5a	0.2a	0.06	5.3b	0.1a		3.5a	0.05 a
CA03-080	3.7b	0.1a		2.3bc			0.3b	
CA03-110	8.4a	0.2a		4.3bc	0.1a		3.6a	0.05a
AC Morley	1.9b	0.1a		2.9bc	0.1a		1.0b	
Mean	5.2	0.1	0.06	3.3	0.1	0.05	1.5	0.05
LSD (*P*=0.05)	6.2	0.3		2.0	0.0		1.1	
CV	48.9	72.1		25.7			29.6	

Levels in a column followed by same letter are not significantly different (*P*=0.05, Student-Newman-Keuls)

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Southwestern Ontario

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TITLE / TITRE: 2013 SURVEY FOR LEAF DISEASES, FUSARIUM HEAD BLIGHT AND MYCOTOXIN LEVELS IN SOUTHWESTERN ONTARIO WINTER WHEAT

ABSTRACT: A moderate level of septoria leaf blotch was detected in soft white winter wheat at all three locations monitored in southwestern Ontario in 2013, but powdery mildew and leaf rust were either absent or at only low levels. High average levels of deoxynivalenol (DON) were detected at Centralia (19.8 ppm) and Inwood (11.8 ppm) and slightly lower levels at Ridgetown (4.1 ppm). In addition to DON, 15-acetyl DON, 3-acetyl DON, nivalenol, HT2 and T2 mycotoxins were detected at one or more of the locations.

I**NTRODUCTION AND METHODS:** A survey for leaf diseases, fusarium head blight (FHB) and resulting mycotoxins levels was conducted on soft white winter wheat experimental lines planted at three locations, Ridgetown, Centralia and Inwood, in southwestern Ontario in 2013. Leaf disease severity was rated in mid- to late June on whole leaves using a 0-9 scale where 0 = no disease and 9 = severe disease. Wheat spikes were rated for FHB at the end of June using a severity scale of 0-9. Mycotoxin levels were measured in harvested grain using the GC-MS method (TOXI-061).

RESULTS AND COMMENTS: Moderate levels of septoria leaf blotch (*Septoria tritici*) were observed at all locations (Tables 1, 2 and 3). Powdery mildew (*Blumeria graminis*) and leaf rust (*Puccinia triticina*) were not detected on lines planted at Centralia and Inwood and their levels were low at Ridgetown (severities of 2.1 and 1.4, respectively). A lower average level of the mycotoxin DON (4.1 ppm) was measured at the Ridgetown location than in Inwood (11.8 ppm) or Centralia (19.8 ppm) (Tables 1, 2 and 3). In addition to DON, 15-acetyl DON was detected in all samples from Centralia and Inwood and most of the samples from Ridgetown. Traces of other toxins (3-acetyl DON and HT2) were also detected at Ridgetown and Centralia. Nivalenol was detected in one sample and T2 toxin in two samples from Centralia.

Table 1. Powdery mildew, leaf rust, septoria leaf blotch and fusarium head blight severities (0-9), and mycotoxin levels (ppm) in soft white winter wheat experimental lines at Ridgetown, southwestern Ontario in 2013.

Line	Powdery mildew	Leaf rust	Septoria leaf blotch	FHB	DON	15ADON	3ADON	HT2
DH1-3	1.8b	1.5a	3.5a	3.8abc	4.3bc	0.06a		
DH1-9	2.0b	1.7a	3.5a	3.5a-d	5.3b	0.06a		0.06a
DH1-10	2.8a	1.5a	3.5a	3.0a-d	3.5bcd	0.05a		0.06a
DH1-28	2.0b	1.3a	3.5a	3.0a-d	1.6d			
DH1-45	2.3ab	1.3a	4.3a	2.8bcd	7.9a	0.08a		0.05a
DH1-52	2.0b	1.0a	3.8a	2.3cd	4.5bc	0.06a	0.061	0.09a
DH1-81	2.0b	1.3a	3.5a	2.8bcd	4.9bc	0.08a		
DH1-93	2.0b	1.7a	3.3a	4.0ab	3.0cd			0.08a
DH1-100	2.0b	1.0a	3.8a	2.3cd	3.8bc			
DH1-101	2.3ab	1.7a	3.5a	4.0ab	3.9bc	0.05a		0.08a
Superior	2.0b	1.3a	3.0a	4.5a	3.6bcd			
DB006W	2.0b	1.3a	4.0a	2.0c	2.9cd	0.05a		0.05a
Mean	2.1	1.4	3.6	3.2	4.1	0.1	0.06	0.1
LSD (P=.05)	0.4	0.7	0.8	1.0	1.3	0.0		0.4
CV	14.1	32.7	15.7	22.0	14.8	16.2		45.1

Levels in a column followed by same letter are not significantly different (*P*=0.05, Student-Newman-Keuls)

Table 2. Septoria leaf blotch and fusarium head blight severity (0-9) and mycotoxin levels (ppm) in soft white winter wheat experimental lines at Centralia, southwestern Ontario in 2013.

Line	Septoria leaf blotch	FHB	Nivalenol	DON	15ADON	3ADON	HT2	T2
DH1-3	5.0a	4.3b		23.0	0.40		0.04	
DH1-9	5.3a	5.5ab	0.14	33.0	0.80	0.11	0.80	0.140
DH1-10	5.0a	6.8a		32.0	0.42	0.09	0.05	
DH1-28	5.3a	7.3a		10.0	0.17			
DH1-45	5.0a	7.5a		18.0	0.27			
DH1-52	5.3a	7.0a		20.0	0.38	0.08	0.11	0.082
DH1-81	5.0a	7.0a		15.0	0.28	0.06	0.05	
DH1-93	5.3a	6.3a		18.0	0.30			
DH1-100	5.8a	7.0a		14.0	0.22			
DH1-101	6.0a	6.3a		17.0	0.24			
Superior	5.5a	6.3a		24.0	0.40	0.06	0.05	
DB006W	5.0a	7.5a		14.0	0.33			
Mean	5.3	6.5	0.14	19.8	0.35	0.08	0.18	0.110
LSD (P=.05)	0.7	1.3						
CV	9.3	13.6						

Levels in column followed by same letter not significantly different (*P*=0.05, Student-Newman-Keuls)

Table 3. Septoria leaf blotch and fusarium head blight severity (0-9) and mycotoxin levels (ppm) in soft white winter wheat experimental lines at Inwood, southwestern Ontario in 2013.

Line	Septoria leaf blotch	FHB	DON	15ADON
DH1-3	4.0a	5.0a	14.0	0.15
DH1-9	4.8a	5.0a	12.0	0.13
DH1-10	3.8a	5.3a	9.9	0.10
DH1-28	4.3a	5.3a	6.0	0.07
DH1-45	4.3a	6.3a	17.0	0.18
DH1-52	4.0a	5.5a	9.0	0.11
DH1-81	4.0a	5.8a	10.0	0.10
DH1-93	4.0a	5.5a	14.0	0.14
DH1-100	4.0a	5.0a	13.0	0.12
DH1-101	4.5a	6.5a	10.0	0.08
Superior	4.3a	5.8a	13.0	0.11
DB006W	4.0a	5.8a	14.0	0.13
Mean	4.2	5.5	11.8	0.12
LSD (P=.05)	0.6	0.9		
CV	10.7	11.2		

Levels in column followed by same letter not significantly different (*P*=0.05, Student-Newman-Keuls)

CROP / CULTURE: Spring wheat
LOCATION / RÉGION: Central and eastern Ontario

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TITLE / TITRE: DISEASES OF SPRING WHEAT IN CENTRAL AND EASTERN ONTARIO IN 2013

ABSTRACT: Forty spring wheat crops were surveyed in central and eastern Ontario for the presence of diseases. Of the 12 diseases observed, septoria/stagonospora leaf blotch and stagonospora glume blotch were the most common. Moderate to very severe levels of fusarium head blight were observed, with *Fusarium graminearum* identified as the predominant causal species.

INTRODUCTION AND METHODS: A survey for spring wheat diseases was conducted in central and eastern Ontario in the third week of July when plants were at the soft dough stage of development. Forty fields were chosen at random in regions where most of the spring wheat is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Disease diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity of ergot, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of three random sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 30 infected spikes collected from each field. The spikes were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCI for 60 seconds and plated in 9-cm petri dishes on modified potato dextrose agar (10 g dextrose per liter amended with 50 ppm of streptomycin sulphate). The plates were incubated for 10-14 days at 22-25ºC with a 14-hour photoperiod provided by fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Twelve diseases or disease complexes were observed (Table 1). Septoria/stagonospora leaf blotch (normally associated with infection by *Septoria tritici* and *Stagonospora* spp.) and stagonospora glume blotch (*Stagonospora nodorum*) were the most common, and found in all surveyed fields at average severities of 4.1 and 2.5, respectively. Severe levels of septoria/stagonospora leaf blotch were detected in 8 fields, and of stagonospora glume blotch in one field. Yield reductions due to the two diseases were estimated to have averaged at least 5% in affected fields. Leaf rust (*Puccinia triticina*) and stem rust (*Puccinia graminis*) were observed in 8 and 3 fields at average severities of 2.9 and 3.3, respectively. Severe levels of leaf rust were found in three fields, severe levels of stem rust in two. Yield reductions were likely <5% in the rust-infected crops. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), powdery mildew (*Erysiphe graminis* f.sp. *tritici*), spot blotch (*Cochliobolus sativus*), and tan spot (*Pyrenophora tritici-repentis*). These were found in 40, 25, 36, and 38 fields at mean severities of 1.5, 1.5, 1.3, and 1.6, respectively. None were found at severe levels and as such they likely caused little or no reduction in grain yield or quality.

Ergot (*Claviceps purpurea*) and loose smut (*Ustilago tritici*) were each observed in 39 fields at incidence levels of 0.6 and 0.5%, respectively. They likely resulted in minimal damage. Take-all root rot (*Gaeumannomyces graminis* var*. tritici*) was found in all fields at a mean incidence of 3.0%; three affected crops were estimated to have 10% take-all.

Fusarium head blight was observed in all fields at a mean FHB index of 13.6% (range 0.3-60.0% (Table 1). Severe FHB levels were observed in 16 crops and very severe levels in 11 crops. This disease would have

resulted in a significant loss of grain yield and/or quality in spring wheat in 2013. Six *Fusarium* species were isolated from fusarium-damaged kernels (Table 2). *Fusarium graminearum* predominated; it occurred in 98% of fields and on 86.9% of kernels. *Fusarium avenaceum* and *F. equiseti* were less common and were found in 23 and 13% of fields and on 3.0 and 1.1% of kernels, respectively. *Fusarium acuminatum, F. poae*, and *F. sporotrichioides* were least common, occurring in 3-8% of fields and on 0.1-0.5% of kernels.

Overall, the diseases observed on spring wheat in Ontario in 2013 were similar to, but more severe than in 2012 (Xue and Chen 2013). Septoria/stagonospora leaf blotch, take-all, and FHB were the most important and would have had a greater impact on grain yield and quality than the other diseases. The frequent days with rain in June and warm weather in July across central and eastern Ontario were likely responsible for the increased disease severities and the FHB epidemic in 2013.

REFERENCE:

Xue, A.G., and Chen, Y. 2013. Diseases of spring wheat in central and eastern Ontario in 2012. Can. Plant Dis. Surv. 93:139-141. (http://phytopath.ca/cpds.shtml)

Table 1. Prevalence and severity of spring wheat diseases in central and eastern Ontario in 2013.

DISEASE	NO. CROPS AFEECTED (n=40)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
Bacterial blight	40	1.5	1.0-3.0
Leaf rust	8	2.9	1.0-7.0
Powdery mildew	25	1.5	0.5-3.0
Septoria glume blotch	40	2.5	1.0-7.0
Septoria/Stagonospora leaf blotch	40	4.1	1.0-7.0
Spot blotch	36	1.3	1.0-2.0
Stem rust	3	3.3	1.0-7.0
Tan spot	38	1.6	1.0-4.0
			-
Ergot (%)	39	0.6	0.5-2.0
Loose smut (%)	39	0.5	0.5-1.0
Take-all (%)	40	3.0	0.5-10.0
Fusarium head blight**	40		-
Incidence (%)		39.2	5-100.0
Severity (%)		24.4	5-60.0
Index (%)		13.6	0.3-60.0

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

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

Table 2. Prevalence of *Fusarium* species isolated from fusarium-damaged wheat kernels in central and eastern Ontario in 2013.

***Fusarium* spp.**	**% AFFECTED FIELDS**	**% KERNELS**
Total *Fusarium*	98	91.6
F. acuminatum	8	0.4
F. avenaceum	23	3.0
F. equiseti	13	1.1
F. graminearum	98	86.9
F. poae	3	0.1
F. sporotrichioides	8	0.5

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CROP / CULTURE: Seed alfalfa (*Medicago sativa*)
LOCATION / RÉGION: Alberta

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TITLE / TITRE: BLOSSOM BLIGHT AND STEM ROT OF SEED ALFALFA IN SOUTHERN ALBERTA IN 2013

ABSTRACT: A survey of 19 seed alfalfa fields in southern Alberta was conducted during the 2013 growing season to determine the prevalence of blossom blight pathogens. Symptoms were observed infrequently in the fields, but plating of florets, pods and seeds revealed a high frequency of *Botrytis cinerea* and lower frequency of inoculum of *Sclerotinia sclerotiorum*. The survey suggests that potential exists for an outbreak of blossom blight should suitable environmental conditions occur.

INTRODUCTION AND METHODS: Incidence and severity of blossom blight and stem rot of alfalfa caused by the fungal pathogens *Botrytis cinerea* and *Sclerotinia sclerotiorum* were measured throughout the growing season of 2013. Nineteen fields in the Enchant and Rosemary regions of southern Alberta were surveyed every 2-3 weeks from June 24 to August 21. Within each field, ten sites were surveyed in a U-shaped pattern. Each site was at least 20 m from the edge of the field and sites were separated from each other by a minimum of 20 m. At each site, twenty alfalfa stems were assessed for incidence and severity of blossom blight and stem rot. Severity of blossom blight was rated on a scale of 0 (no infection) to 4 (75-100% florets infected), and severity of stem rot was rated on a scale of 1 (no infection) to 6 (>50% of plant infected). In addition, 3-5 floral and/or pod racemes (depending on the crop's development stage) were collected for processing in the laboratory. From each site, five florets, pods, and/or seeds were surface-sterilized and plated onto semi-selective media for *Botrytis* (Edwards and Seddon, 2001) and *Sclerotinia* (Gutierrez and Shew, 1998). The number of infected plant parts was recorded after five days of incubation.

RESULTS AND COMMENTS: Despite frequent heavy rainfall and flooding in some regions of southern Alberta during the growing season, conditions in the seed alfalfa growing regions remained relatively dry. In the field surveys, blossom blight and stem rot were observed at trace levels, but in plated samples, infection was observed at higher frequencies. *Botrytis cinerea* infected 65% of florets at the beginning of July and infection increased to almost 100% of pods by the end of August (Table 1). *Sclerotinia sclerotiorum* infected 10% of florets at the beginning of July, infection peaked in pods at 20% at the end of July, and declined to <10% by the end of August. *Botrytis cinerea* infected 15% of seeds, but no seed infection by *S. sclerotiorum* was observed. The high incidence of the pathogens on florets and pods throughout the growing season, as revealed in lab analyses, indicates that inoculum of the pathogens was present in the field. The low levels of disease development may be explained by i) the dry conditions in the Enchant and Rosemary regions, or ii) regular application of fungicides such as Headline (pyraclostrobin) and Lance (boscalid) by growers during the growing season.

ACKNOWLEDGEMENTS: We gratefully acknowledge the Alberta Alfalfa Seed Commission and the Alberta Crop Industry Development Fund (ACIDF) for financial support. We thank all producers that co-operated in the field sampling. We also thank Carol Mueller and Scott Erickson for their technical expertise and Candace Griffith for help with collecting and processing the samples.

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Edwards, S.G. and B. Seddon. 2001. Selective media for the specific isolation and enumeration of *Botrytis cinerea* conidia. Lett. Appl. Microbiol., 32: 63-66.

Gutierrez, W.A. and H.D. Shew. 1998. Identification and quantification of ascospores as the primary inoculum for collar rot of greenhouse-produced tobacco seedlings. Plant Dis., 82: 485-490.

Table 1: Mean percentage infection of floret, pod, and seed samples from nineteen seed alfalfa fields in southern Alberta during the 2013 growing season.

	Florets		Pods		Seeds	
Date	**Bc[a]**	**Ss[b]**	**Bc**	**Ss**	**Bc**	**Ss**
Jun 24 – Jul 5	65	11	-[c]	-	-	-
Jul 15 – Jul 18	66	4	77	11	-	-
Jul 29 – Jul 31	88	6	95	19	-	-
Aug 12 – Aug 21	-	-	99	7	13	0

[a] Bc = *Botrytis cinerea;* [b] Ss = *Sclerotinia sclerotiorum;* [c] no samples of the plant part were collected for the period specified.

CROP: Field bean
LOCATION: Manitoba

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TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2013

ABSTRACT: A total of 40 and 39 bean crops were surveyed for root and foliar diseases, respectively. Fusarium root rot was the most prevalent root disease and common bacterial blight the most prevalent foliar disease throughout the province. Severe white mould in badly infested crops was an important problem in 2013. Diseases of less importance included rhizoctonia root rot, halo blight and anthracnose.

METHODS: Crops of field bean in Manitoba were surveyed for root diseases at 40 different locations and for foliar diseases at 39 locations. The survey for root diseases was conducted in mid-July when most plants were at the early bloom stage. During the root disease survey the severity of halo blight (*Pseudomonas syringae* pv. *phaseolicola*) was also assessed. For foliar diseases, the survey was carried out on September 3rd and 4th, when the plants were starting to mature. The crops surveyed were selected at random from regions in southern Manitoba where most field bean crops are grown.

For the root diseases, at least 10 plants were sampled at each of three random sites in each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant). Fifteen symptomatic roots were collected from each of 10 crops for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 40 crops surveyed were frozen for future PCR analysis of root rot pathogens. Foliar diseases were identified by symptoms. Levels of common bacterial blight (CBB) (*Xanthomonas axonopodis* pv. *phaseoli*) were estimated based on the percent incidence of leaf infection and a severity scale of 0 (no disease) to 5 (50-100% of the leaf area covered by lesions). Anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces appendiculatus*), white mould (*Sclerotinia sclerotiorum*) and halo blight (*Pseudomonas syringae* pv. *phaseolicola*) severity were assessed as percentages of infected plant tissue. In each crop with anthracnose symptoms, pod samples were collected for isolation of the causal organism to confirm that they were caused by *C*. *lindemuthianum*.

RESULTS AND COMMENTS: The 2013 cropping season in Manitoba started with excessive spring moisture in some areas and cool conditions. Crop growth continued to be suppressed with below-normal temperatures and frequent rainfall, which increased the prevalence and severity of some diseases (Manitoba Crop Report, 2013). Later in the summer, warmer weather with frequent rainfall prevailed.

Root rot was observed in all 40 field bean crops surveyed, with root rot severity ratings ranging from 2.8 to 7.0, with a mean of 5.0. Two root diseases were identified (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all of the 10 crops subsampled for root diseases. It has remained the most prevalent root disease of dry bean for several years (Conner et al. 2011; Henriquez et al. 2012; 2013). Crops from which *Fusarium* spp. were isolated had root rot severity ratings ranging from 5.0 to 7.0 with a mean of 6.0. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 3 of the 10 crops sub-sampled with severity ratings of 5.3 to 6.2 and a mean of 5.8. Pythium root rot was not detected in any of the crops surveyed. Thirty-four crops had average root rot severity ratings above 4 (i.e., symptoms were present on 50% of the root system and plants were stunted) and this would have had a detrimental effect on yield. Halo blight was detected in two of the crops surveyed, with a mean disease severity of 65% infected plant tissue.

Three diseases were observed during the survey of foliar diseases (Table 2). Common bacterial blight was the most prevalent and symptoms were observed in 33 crops. In six of the 39 crops, the leaves had completely senesced, so the incidence and severity of CBB and rust could not be assessed. The incidence

of CBB ranged from 10 to 33% with a mean of 21%, while severity ranged from 1.7 to 3.0, with a mean of 2.5. Anthracnose was detected in one field bean crop but rust was not observed in any of the crops surveyed. White mould symptoms were detected in 30 crops with an incidence of tissue infection that ranged from 0.3% to 28.3%, with an average of 5.6%. This represents a considerable difference in the incidence and severity from 2012 (Henriquez et al. 2013). Incidences of white mould of 10% or higher were observed in in eight fields during 2013, suggesting that there were adverse effects of this disease on crop yield.

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Table 1. Prevalence and severity in Manitoba in 2013 of root diseases and halo blight in 10 and 40 field bean crops, respectively.

	No. crops	Disease Severity	
Disease	**affected**	**Mean[1]**	**Range**
Fusarium root rot[2]	10	6.0	5.0-7.0
Rhizoctonia root rot[2]	3	5.8	5.3-6.2
Halo blight (%)	2	65%	60-70%

[1]Means are based on an average of the crops in which the diseases were observed.
[2]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant).

Table 2. Prevalence and severity of foliar diseases in 39 crops of field bean in Manitoba in 2013.

	No. crops	Disease Severity[1]		Incidence of Leaf Infection	
Disease	**affected**	**Mean[2]**	**Range**	**Mean[2]**	**Range**
Common bacterial blight[3]	33	2.5	1.7-3.0	23.2%	8.3-36.7%
Anthracnose (%)	1	0.3	0.3		
Rust[3] (%)	0	0	0		
White mould (%)	30	5.6	0.3-28.3%		

[1]Anthracnose and white mould severity were rated as the percentage of infected plant tissue; common bacterial blight severity was rated on a scale of 0 (no disease) to 5 (50-100% of leaf area diseased).
[2]Means are based on an average of the crops in which the diseases were observed.
[3]Mean of 33 dry bean crops, since all the leaves had senesced in six crops.

CROP: Field bean
LOCATION: Western Ontario

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TITLE: ROOT DISEASES OF FIELD BEAN IN WESTERN ONTARIO IN 2013

ABSTRACT: A total of 25 bean crops were surveyed for root diseases in the main production regions of western Ontario. Fusarium root rot was the most prevalent root disease followed by Rhizoctonia root rot.

METHODS: Crops of field bean in western Ontario were surveyed for root diseases at 25 different locations. The survey was conducted in mid- to late July with crops ranging from the 4th trifoliolate to late vegetative growth stage. Two crops were resampled for replacement roots approximately one week after the initial sampling due to shipment issues which reduced quality of the roots. The crops were selected from the counties of Huron, Perth, Middlesex and Lambton, where most field bean crops are grown.

At least 10 plants were sampled at each of three random sites within each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant) (Conner et al. 2010). Fifteen roots with disease symptoms per crop were chosen for isolation of the causal organisms in the laboratory by plating onto potato dextrose agar. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerall (2006).

RESULTS AND COMMENTS: The 2013 cropping season in southern Ontario began with excessive spring moisture in many areas and cool conditions. Wet field conditions delayed planting by one to three weeks. Most crops sampled had visual symptoms of root rot, stunted plants and uneven growth, a result of excess rainfall and poor soil structure. Many areas received several heavy downpours from emergence to early flowering. Total rainfall during the vegetative period ranged from near normal (83 mm/month) to 150% (125 mm/month) of normal.

Two root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all 25 crops surveyed for root diseases. Similar results have been reported elsewhere in Canada (Conner et al. 2011; Henriquez et al. 2012; 2013). Crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 4.3 to 7.0 with a mean of 5.8. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 14 of the 25 crops surveyed with severity ratings of 4.5 to 6.9 and a mean severity of 5.6. Pythium root rot was not detected in any of the crops surveyed. All 25 crops had an average root rot severity rating above 4 (i.e., symptoms were present on 50% of the root system and plants were stunted) and this would have had a detrimental effect on yield. In early July, poor growth of beans in many fields was observed with root systems poorly developed due to root rot (OMAFRA, 2013).

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Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Field crop report. July 13, 2013

Table 1. Prevalence and severity of root diseases in 25 crops of field bean in Ontario in 2013.

Disease	No. crops affected	Disease Severity	
		Mean[1]	Range
Fusarium root rot[2]	25	5.8	4.3-7.0
Rhizoctonia root rot[2]	14	5.6	4.5-6.9

[1]Means are based on an average of the crops in which the diseases were observed.
[2]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant).

CROP: Canola
LOCATION: Alberta

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TITLE: THE OCCURRENCE OF CLUBROOT ON CANOLA IN ALBERTA IN 2013

ABSTRACT: A survey of 459 commercial canola crops in 27 counties and municipalities in central and southern Alberta revealed 118 new cases of clubroot. Additional surveys by county and municipal personnel identified another 300 new records of the disease, for a total of 418 clubroot-infested fields in 2013. A grand total of 1483 clubroot-infested fields have been confirmed in Alberta since surveys began in 2003.

METHODS: A total of 459 commercial canola (*Brassica napus* L.) crops in 27 counties and municipalities in central and southern Alberta were surveyed for the incidence of clubroot disease caused by *Plasmodiophora brassicae* Woronin (Table 1). Of these crops, 456 were located in fields that had either not been previously surveyed for clubroot, or had been inspected in earlier surveys and found to be negative for the disease. The other three crops were sown in fields known to be *P. brassicae*-infested from earlier surveys, but which were inspected again to monitor the performance of clubroot-resistant canola hybrids. A total of 18 of the crops surveyed in 2013 were confirmed to be clubroot-resistant canola hybrids, with the remainder (441) being susceptible hybrids or hybrids of unknown resistance. Surveys were conducted mainly in September shortly after swathing. When inspecting fields, a 20 to 30 m^2 area was selected near the field entrance and a minimum of 50 roots were sampled randomly within that area. If no symptoms of clubroot were found, then no more sampling was performed. If clubroot was found, then the field was surveyed more extensively by examining the roots of all plants within a 1 m^2 area at each of 10 locations along the arms of a 'W' sampling pattern. This approach was taken because most clubroot infestations are known to be initiated at the field entrance (1). The severity of root infection on each sampled plant was assessed on a scale of 0 to 3, adapted from Kuginuki et al. (2), where 0 = no galling, 1 = a few small galls, 2 = moderate galling and 3 = severe galling. The individual ratings were then used to calculate an index of disease (ID) for each field, based on the method of Horiuchi and Hori (3) as modified by Strelkov et al. (4). Survey activities were coordinated with the agricultural fieldman in each municipality. In addition, data from independent clubroot inspections conducted by county and municipal staff were collected and combined with the data from the Alberta clubroot survey, to provide the most complete assessment possible of clubroot occurrence in the province.

RESULTS AND COMMENTS:
A total of 121 of the 459 canola crops inspected were found to have symptoms of clubroot, 118 of which represented new cases of the disease. Of these, 114 new cases were identified on susceptible canola hybrids or hybrids of unknown resistance, while four were found on resistant hybrids. Symptoms of clubroot were also identified on resistant hybrids growing in three fields previously confirmed to be *P. brassicae*-infested. In cases where clubroot was found on susceptible crops or crops of unknown resistance, disease severity ranged from mild to severe, with an average ID <10% in 51 fields, 10% - 60% in 34 fields, and >60% in 29 fields. Clubroot incidence and severity in most resistant canola crops were generally very low (ID 0% - 6.2%), but ID values of 9.8% - 20.6% were detected in some resistant cultivars. It is not clear whether the relatively severe clubroot on the latter represents an erosion of resistance or some other confounding factor. Several of the fields were re-surveyed in an attempt to determine whether susceptible volunteer plants were contributing to clubroot severity. However, when roots were inspected only from

within the seeded row, so as to avoid the potential complicating effects of sampling susceptible volunteers, similar results were obtained. As such, these remain fields of concern and additional testing is planned.

In addition to the 118 new records of clubroot identified in the Alberta-wide survey, another 300 new cases of the disease were found in independent surveys conducted by municipal personnel in Barrhead, Camrose, Flagstaff, Lacombe, Lac Ste. Anne, Leduc, Minburn, Parkland, Red Deer, Strathcona, Westlock Wetaskiwin and Woodlands counties (Table 1). A clubroot-infested field identified in Woodlands County represents the first record of the disease in that municipality. Collectively, surveillance activities in 2013 revealed 418 new records of clubroot in Alberta, representing the largest single-year increase in the number of new cases of the disease. The increased prevalence and severity of clubroot in many areas likely reflected environmental conditions early in the growing season favorable for disease development. It appeared, however, that *P. brassicae* is also continuing to spread, given the fact that many infestations were observed in areas formerly considered to be peripheral to the main clubroot outbreak in central Alberta (Fig. 1). One new record of the disease was also identified in Newell County in the southern part of the province, in a field that had been flooded this spring near the Bow River. This field is approximately 30 km south of several confirmed clubroot-infested fields, and is located downstream, suggesting possible movement of inoculum in the flood waters. Another case of clubroot in Newell County, which had been detected by staff at Alberta Agriculture and Rural Development previously, but had not been included in the clubroot database maintained at the University of Alberta, was also noted. Inclusion of this record, together with the new infestations identified in 2013, brings the total number of documented cases of clubroot in Alberta to 1483. Only seven of these *P. brassicae*-infestations are located south of Red Deer and Stettler counties (Fig. 1), indicating that the far south of Alberta remains largely free of the disease.

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Table 1. Distribution of *Plasmodiophora brassicae*-infested canola fields identified in Alberta in 2013

County or municipality	Number of fields assessed in provincial survey	Number of new cases of *P. brassicae*-infested fields	Additional new cases identified by county/municipal staff	Total new cases
Acadia	17	0	0	0
Barrhead	22	10	16	26
Beaver	22	6	0	6
Camrose	18	9	10	19
Cardston	10	0	0	0
Cypress	10	0	0	0
Flagstaff	0	0	7	7
Forty Mile	11	0	0	0
Leduc	0	0	163	163
Lethbridge	10	0	0	0
Lacombe	18	8	19	27
Lac Ste. Anne	30	7	3	10
Lamont	21	2	0	2
Minburn	21	5	2	7
Newell	10	1	0	1
Parkland	5	2	19	21
Ponoka	20	5	0	5
Red Deer	13	3	1	4
Starland	12	0	0	0
Stettler	17	0	0	0
Strathcona	1	0	45	45
Sturgeon	29	23	0	23
Taber	10	0	0	0
Thorhild	22	3	0	3
Vermilion River	19	0	0	0
Vulcan	10	0	0	0
Westlock	22	11	11	22
Wetaskiwin	38	16	3	19
Woodlands	0	0	1	1
Yellowhead	21	7	0	7
TOTAL	459	118	300	418

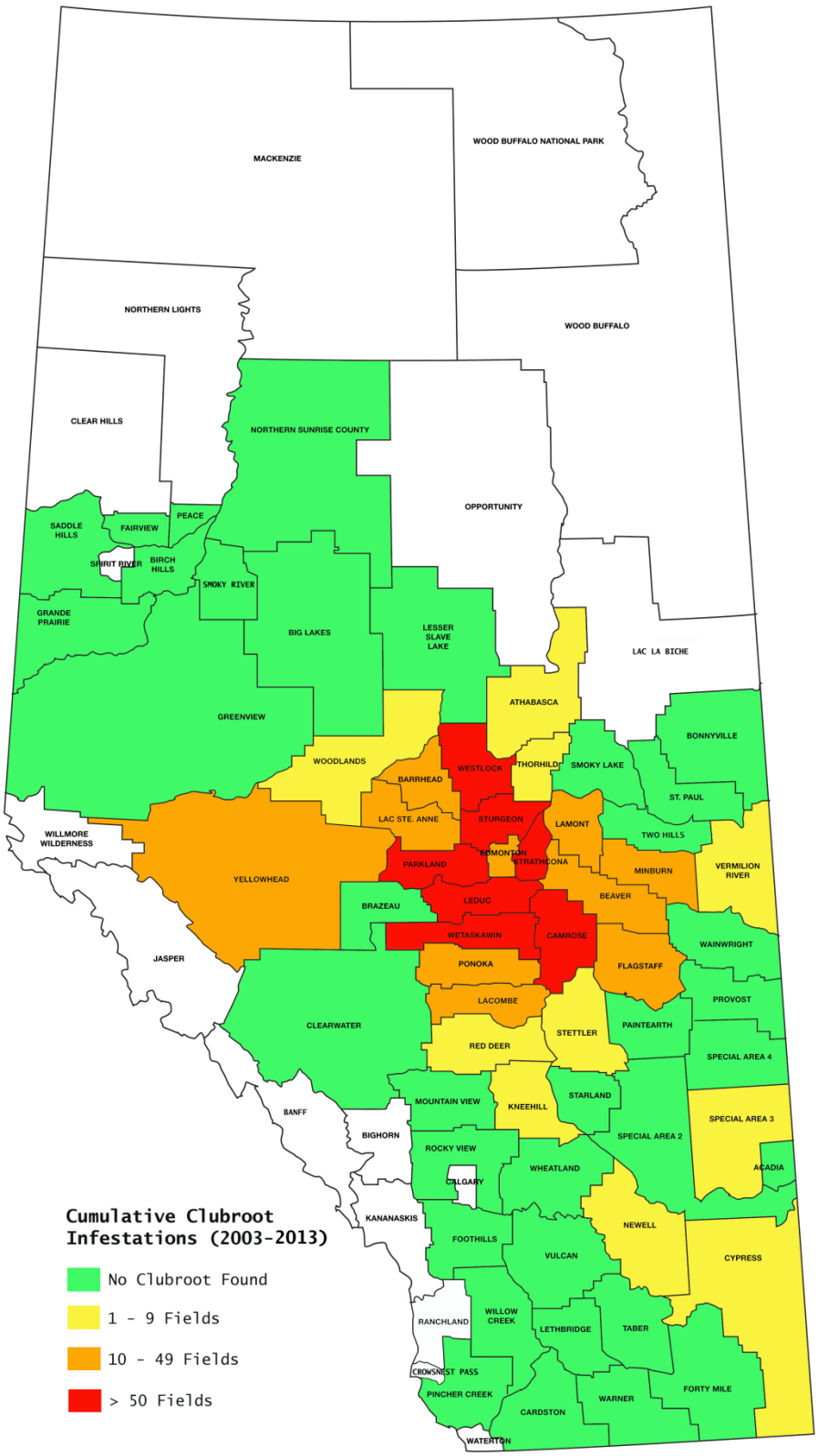

Figure 1. The occurrence of clubroot on canola in Alberta as of November 2013. Since clubroot surveys were initiated in 2003, the disease has been confirmed in a total of 1483 fields representing 26 counties and a rural area of the City of Edmonton.

CROP: Canola
LOCATION: Saskatchewan

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TITLE: DEVELOPMENT OF A RATING SCALE FOR ASTER YELLOWS IN CANOLA

ABSTRACT: Aster yellows (AY), transmitted by the leafhopper, *Macrosteles quadrilineatus,* caused major yield losses in canola in 2012. Agrologists doing disease surveys indicated that a uniform scale was needed to assess the severity of AY symptoms. In laboratory bioassays, canola plants in wet soil at the early 2nd true-leaf stage were exposed to five densities of AY-infected leafhoppers for 10 hours at 20°C. Hourly counts indicated that leafhoppers tend to aggregate on particular plants. Leafhoppers fed more on stems and cotyledons than on true leaves. Inoculated and check plants were grown under high light intensity for 10 weeks. Infected plants developed symptoms like those observed in the field in 2012. A rating scale, based on virescence, phyllody and presence of bladder-like pods, was developed to assess incidence and severity of AY during bolting, flowering and pod formation. Photographs illustrating each rating are presented. Leafhopper densities had a pronounced effect on the severity of AY symptoms; mean AY ratings increased linearly as leafhopper density increased. Leafhopper counts on stems were strongly correlated with AY ratings and suggest that feeding on stems is critical to infection of canola with aster yellows.

RÉSUMÉ: La chloranthie du colza est une maladie à phytoplasmes transmise par la cicadelle *Macrosteles quadrilineatus*. La chloranthie a causé de grosses pertes de production pour les producteurs de colza en 2012. Les agronomes effectuant les surveillances en champs ont mentionné la nécessité de développer un système de mesure pour évaluer la sévérité des symptômes. Une échelle d'évaluation a donc été développée en utilisant les résultats d'essais en laboratoire. Des plants de colza au stade de croissance 2 feuilles ont été mise en présence de 5 densités différentes de cicadelles infectées avec le phytoplasme de la chloranthie. L'inoculation a eu lieu pendant 10 heures à 20°C dans des conditions de sols humides. Un comptage des insectes sur les plantes chaque heure a montré que les cicadelles avaient tendance à se regrouper sur certaines plantes et à se nourrir plus sur tiges et cotylédons que sur feuilles vraies. Les plantes inoculées et témoins ont ensuite été placées dans une chambre de culture à haute intensité lumineuse pendant 10 semaines et ont développé des symptômes similaires à ceux observés dans les champs en 2012. Une échelle d'évaluation a été développée pour mesurer l'incidence et la sévérité de la chloranthie pendant la montaison, la floraison et la formation des siliques chez le colza. Cette échelle est basée sur la présence de phyllodie et de virescence ainsi que sur le pourcentage et la localisation des siliques déformées et stériles sur la plante. Des photos illustrant chaque catégorie de l'échelle sont présentées dans cet article. La moyenne de la sévérité augmente linéairement avec l'augmentation de la densité des cicadelles, démontrant ainsi que la sévérité des symptômes est directement relié à la densité des cicadelles. La sévérité des symptômes est aussi directement corrélée avec le nombre de cicadelles se nourrissant sur tiges, suggérant que la prise de nourriture par les cicadelles sur la tige est une étape importante dans l'infection du colza par le phytoplasme de la chloranthie.

INTRODUCTION: Aster yellows (AY) is a disease caused by phytoplasma strains belonging to the taxon '*Candidatus* Phytoplasma asteris' (4). Phytoplasmas are wall-less, bacteria-like pathogens that infect the phloem of their host plants (2). The disease caused major yield losses in canola in western Canada in 2000, 2007 and 2012 (6, 9). The highest incidence occurred in 2012 when AY was found in 77% of canola fields surveyed in Saskatchewan (6). The incidence of AY within these fields ranged from 0 to 65%. Production losses from AY in Saskatchewan were estimated to average 10% in 2012. Typical symptoms of AY include chlorosis, stunting, abnormal development of floral parts into leafy structures (phyllody), abnormal development of green pigmentation in plant parts that are not normally green (virescence) and the presence of bladder-like pods bearing shrivelled seeds (7,13).
The aster leafhopper, *Macrosteles quadrilineatus* Forbes, is the main vector of aster yellows in rapeseed and canola, *Brassica napus* L., in western Canada (3, 8). The insect is a ubiquitous feeder that uses many

plant species as a food source (5, 8). Although aster leafhoppers can overwinter in some regions of Canada (5), it seems probable that most infestations originate from AY-infected leafhoppers that are brought into western Canada on winds from the United States in early spring (12). Aster yellows is difficult to control because there are no canola cultivars that are known to be resistant or tolerant to AY and no chemicals that can kill the pathogen directly (14). According to the 2014 Guide to Crop Protection in Saskatchewan, application of dimethoate is the only method currently registered for the control of aster leafhoppers on canola in Canada (1). However, the need for an application and its timing are difficult to determine because no economic threshold has been established for controlling AY-infected leafhoppers on canola.

Field observations in 2012 showed the presence of a wide range of AY symptoms in canola. Symptoms ranged from a few bladder-like pods at the tips of some lateral branches to bonsai-like plants with no normal flowers, pods or seeds. Initial laboratory experiments on AY-infected leafhoppers in dry soil at low light intensities produced plants that expressed only mild AY symptoms, regardless of leafhopper numbers and exposure time. By increasing soil moisture during inoculation and light intensity after inoculation, we were able to generate the entire range of symptoms that occurred in the field in 2012 (7). With the full range of symptoms, a rating scale was developed to quantify the severity of AY symptoms in canola during bolting, flowering and pod formation.

METHODS: Colonies of *M. quadrilineatus* were reared on AY-infected plants of carrot, periwinkle and barley in mesh cages (DP 1000 cage; Bugdorm) in growth cabinets set at 24°C, with a 16L/8D photoperiod and 100-140 µmol/m^2/s^1 light intensity. PCR tests (8), conducted monthly, determined that 100% of the plants and 95-100% of the adult leafhoppers were infected with AY phytoplasma.

To standardize conditions, non-treated seeds of transgenic hybrid canola were planted individually in polyethylene cones (Ray Leach Cone-tainers) containing a soil-free medium (11). The medium was compacted and seeds planted at a 15 mm depth. The cones were placed in polystyrene racks (Stuewe and Sons) in a growth chamber at 20/15°C, with a16L/8D photoperiod and 100-140 µmol/m^2/s^1 light intensity. Cones were watered daily (6 ml/cone) to maintain wet conditions (90-100% moisture content). After 11 days, plants at the early 2nd true-leaf stage were transferred into bioassay cages (4 plants per cage) in a controlled environment chamber (Conviron, model PGV 35) set at 20°C, 50-60% relative humidity, 16L/8D photoperiod and 400-500 µmol/m^2/s^1 light intensity (Fig. 1). Plants were exposed to five densities of AY-infected leafhoppers (0, 4, 8, 12 or 16 leafhoppers/plant) for 10 hours. The experiment was replicated three times using a randomized complete block design. Numbers of leafhoppers on the cotyledons, true leaves and stems were counted hourly for 10 hours. The following day, leafhopper-inoculated and non-inoculated check plants were transplanted into pots containing a soil-less mix and grown for 10 weeks in a controlled environment chamber with high light intensity (700-800 µmol/m^2/s^1) at 20°C, a 16 L/8D photoperiod and moist conditions. PCR tests to detect the presence of phytoplasma DNA (8) were performed on selected plants 6, 8 and 10 weeks after exposure. All remaining plants were photographed and evaluated for AY symptoms 6, 8 and 10 weeks after exposure. Check and inoculated plants were rated using several criteria including plant stature and height, incidence of swollen buds on the main stem and lateral branches, colour of floral parts and frequency of normal and bladder-like pods on the main stem and lateral branches. Seed pods were also examined after 10 weeks for the presence of abnormal seeds. From these observations, a five-point AY rating scale was developed to quantify the severity of AY symptoms in canola. Leafhopper counts and AY ratings were analyzed using the General Linear Model procedure (10). Orthogonal contrasts were used to evaluate the effect of leafhopper density on AY ratings. Pearson correlations were used to assess the association between leafhopper counts and AY ratings.

RESULTS AND COMMENTS: Hourly leafhopper counts indicated that a higher proportion of leafhoppers fed on the stems (0.43-0.54) and cotyledons (0.33-0.43) than on the true leaves (0.13-0.14). Mean numbers of leafhoppers (LH) on whole plants reflected the densities initially placed in the cages at the start of the bioassay. With initial densities of 4, 8, 12 and 16 LH/plant, leafhopper counts on whole plants over 10 hours averaged 3.3, 6.6, 9.3 and 12.3 LH/plant, respectively. The counts indicated that 78-82% of the leafhoppers in the cages fed on the plants during the bioassay. However, leafhopper counts varied greatly from plant to plant within each cage. Counts on individual plants ranged from 1.1 to 6.9 LH/plant at the lowest leafhopper density, from 1.3 to 11.0 and from 3.7 to 18.1LH/plant at the two intermediate leafhopper densities and from 7.1 to 20.5 LH/plant at the highest leafhopper density. The range in counts at each density indicated that

aster leafhoppers do not disperse randomly and uniformly over all plants. Instead, the leafhoppers tend to aggregate and feed on particular plants. Potential factors causing this aggregation are under investigation and may explain the range in AY symptoms observed at each density.

Symptoms such as purple discoloration of leaves, chlorosis, malformed buds and pod abortion can be caused by factors other than AY. Therefore, the plants were rated on the basis of symptoms that are more specific to AY including virescence, phyllody and presence of bladder-like pods bearing shrivelled seeds (7, 13). Plants were rated 6, 8 and 10 weeks after inoculation when the plants had bolted, were flowering and had started to set seed, respectively. Based on the range of symptoms produced in the bioassays, a five-point AY rating scale was developed to quantify the severity of AY symptoms in canola (Table 1). As illustrated in Figs. 2-6, AY ratings between 1 and 5 were assigned to plants showing very mild, mild, moderate, severe and very severe AY symptoms respectively, during bolting, flowering and pod formation. The progression and severity of AY symptoms observed on the flowers, pods and seeds are illustrated in Figs. 7 and 8. The relationship between AY ratings, 1000-seed weight and seed production by individual plants is under investigation.

Leafhopper densities had a pronounced effect on the frequency of AY symptoms in canola after 6, 8 and 10 weeks (Table 2). Over the range of densities tested (0-16 LH/plant), the percentage of plants with no AY symptoms ranged from 10 to 100% after 6 weeks (at bolting), from 11 to 100% after 8 weeks (at flowering) and from 0 to 100% after 10 weeks (when the plants had started to set seed). On each sampling date, the percentage of plants with no AY symptoms declined progressively with increased leafhopper density. After 10 weeks, the percentage of plants showing no AY symptoms ranged from 100% in the check plants to 0% in plants exposed to the highest leafhopper density. The percentage of plants with AY symptoms increased with higher leafhopper density and between bolting and seed-set. Leafhopper densities also affected the severity of AY symptoms. The majority of plants exposed to lower leafhopper densities (4 or 8 LH/plant) had very mild to moderate symptoms (AY rating = 1-3) after 6, 8 and 10 weeks. In contrast, most plants exposed to high leafhopper densities (12 or 16 LH/plant) had mild to severe symptoms after 6 weeks (AY rating = 2-5) and severe to very severe symptoms after 8 and 10 weeks (AY rating = 4-5). Orthogonal contrasts indicated that mean AY ratings increased linearly with higher leafhopper densities after 6 weeks ($F = 7.8$; df = 1,6; $P = 0.03$), 8 weeks ($F = 23.2$; df = 1,6; $P = 0.003$) and 10 weeks ($F = 16.1$; df = 1,6; $P = 0.007$). With densities of 4, 8, 12 and 16 LH/plant, mean AY ratings averaged 1.1, 1.8, 2.3 and 2.9, respectively, after 6 weeks; 1.5, 2.0, 2.9 and 3.3, respectively, after 8 weeks; and 1.5, 2.2, 3.5 and 3.5, respectively, after 10 weeks. Mean AY ratings at all leafhopper densities increased between bolting and flowering. With densities above 4 LH/plant, mean AY ratings increased between flowering and seed-set. Numbers of leafhoppers on stems had the highest correlation with AY ratings after 6 weeks ($r = 0.52$; $P = 0.0003$; $n = 42$), 8 weeks ($r = 0.56$; $P = 0.0006$; $n = 33$) and 10 weeks ($r = 0.64$; $P < 0.0006$; $n = 32$). The strong correlation suggests that leafhopper feeding on stems is critical to infection of canola with AY.

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Figure 1. Bioassay cages for exposing canola seedlings to different densities of AY-infected leafhoppers.

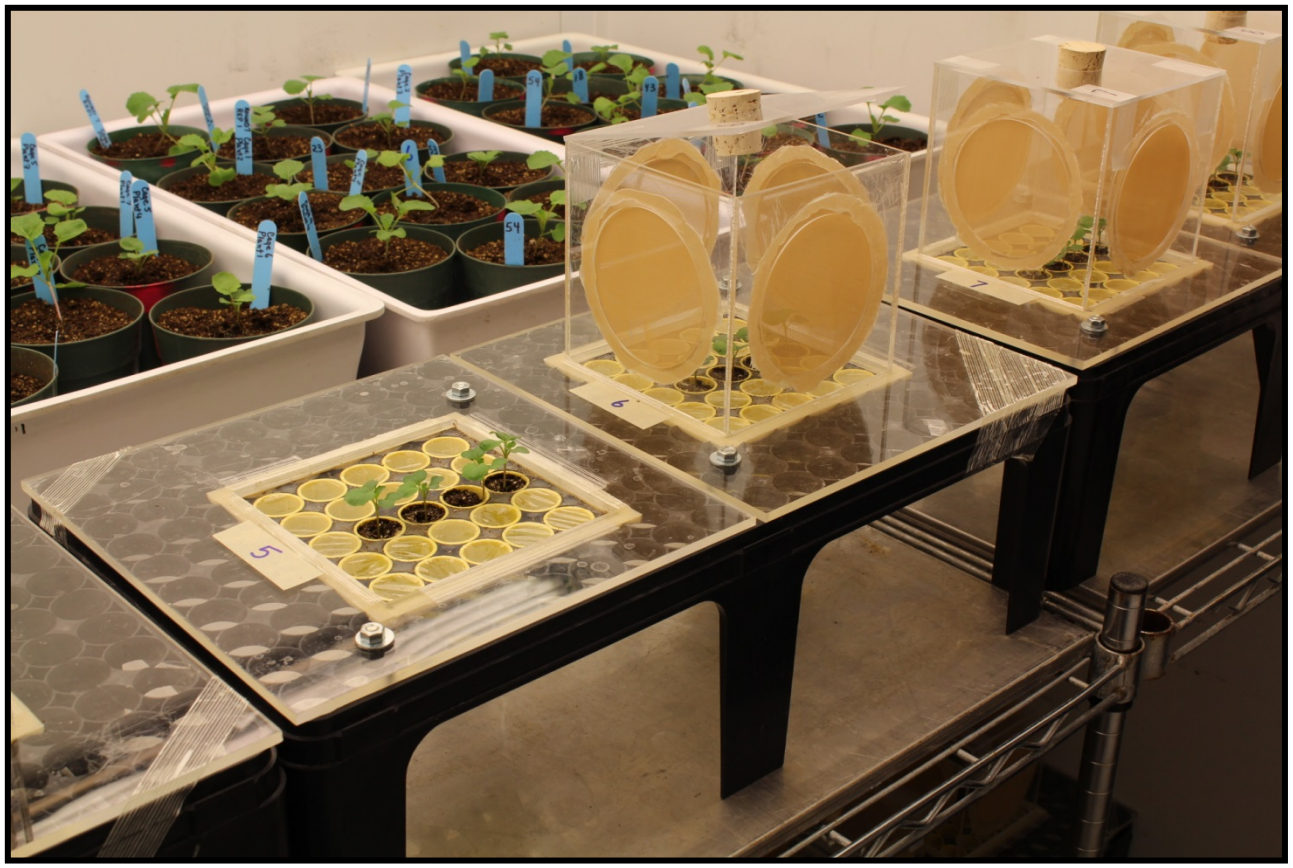

Table 1. Five-point rating scale for assessing the incidence and severity of AY symptoms in canola plants during bolting, flowering and pod formation.

AY rating	Plant stature and height	Presence of swollen buds	Pale green or purple flowers	Presence of normal or bladder-like pods
1	Normal height	None to a few swollen buds on lateral branches (<10% of all buds)	None	None at bolting or flowering (<10% bladder-like pods at tips of a few branches at plant maturity; >90% normal pods)
2	Normal height Erect plant/pods	Swollen buds on lateral branches and some (< ½) on main stem (<50% of all buds)	None	Few bladder-like pods on main stem and lateral branches at bolting (<50% bladder-like pods; >50% normal pods)
3	Normal to slightly shorter height Erect plant/pods	Swollen buds on all lateral branches and some (> ½) on main stem (<80% all buds). Condensed inflorescence	Many pale green flowers at tips of all branches	Many bladder-like pods on lateral branches at bolting (<20% normal pods; usually on main stem)
4	Short erect plant Limited bolting	All buds swollen Condensed inflorescence	All flowers green or purple	100% bladder-like pods at maturity No normal pods. No seeds
5	Bonsai-like plant No bolting	All buds swollen Swollen buds emerging directly from growing point	Only small green flowers	Few bladder-like pods at maturity No normal pods. No seeds

Fig. 2. In this and subsequent figures, red arrows and circles indicate symptoms that are characteristic of the rating. An AY rating of 1 was assigned when some buds on lateral branches were swollen and when less than 10% of the pods were bladder-like at maturity.

Fig. 3. As shown below, an AY rating of 2 was assigned when swollen buds were present on lateral branches and main stem and when 10-50% of the pods were bladder-like at bolting.

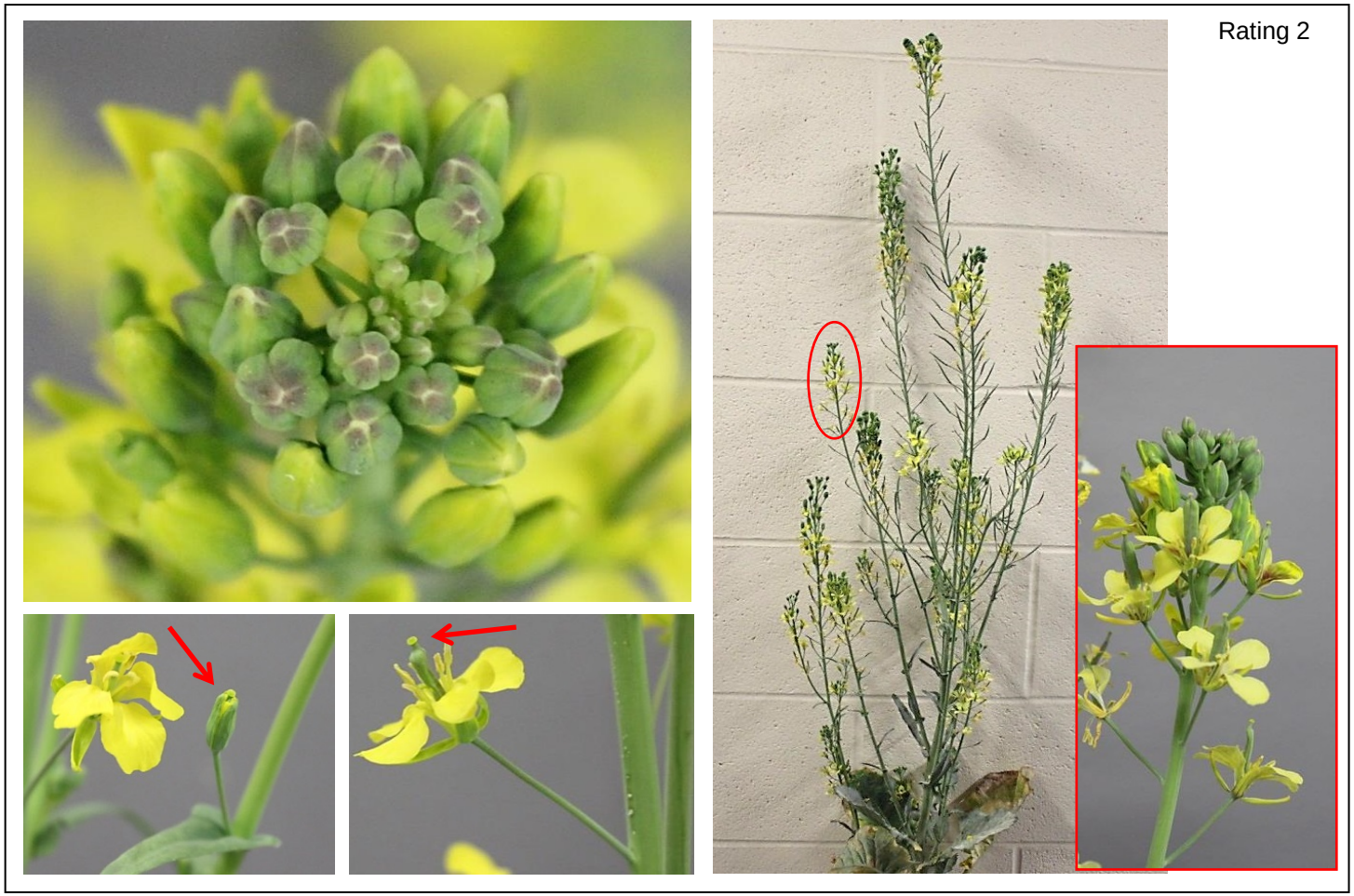

Fig. 4. As shown below, an AY rating of 3 was assigned when buds on all lateral branches and some on the main stem were swollen and when 50-80% of the pods were bladder-like at bolting.

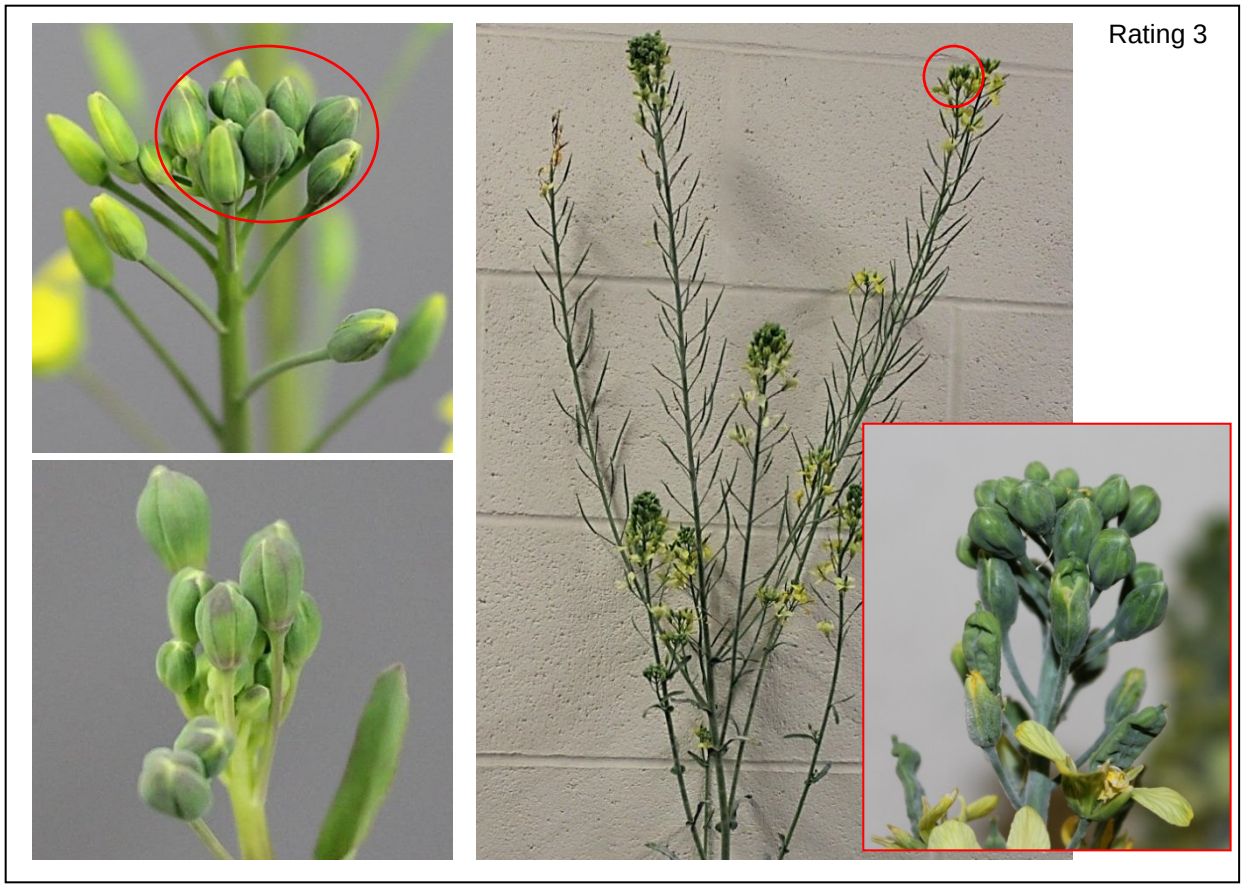

Fig. 5. As shown below, an AY rating of 4 was assigned when all buds were swollen, the inflorescence condensed and the plant failed to produce any normal pods or seeds.

Fig. 6. As shown below, an AY rating of 5 was assigned when the plant was bonsai-like and failed to produce any normal flowers, pods or seeds.

Fig. 7. Progression of AY symptoms on flowers and pods. Top row: normal flower and seed pod; middle row: abnormal flower and bladder-like seed pods, found in inflorescences of plants rated 1, 2, 3 or 4; bottom row: No seed pods and green bonsai-type flowers on plants rated 5.

Fig. 8. AY symptoms on seeds.

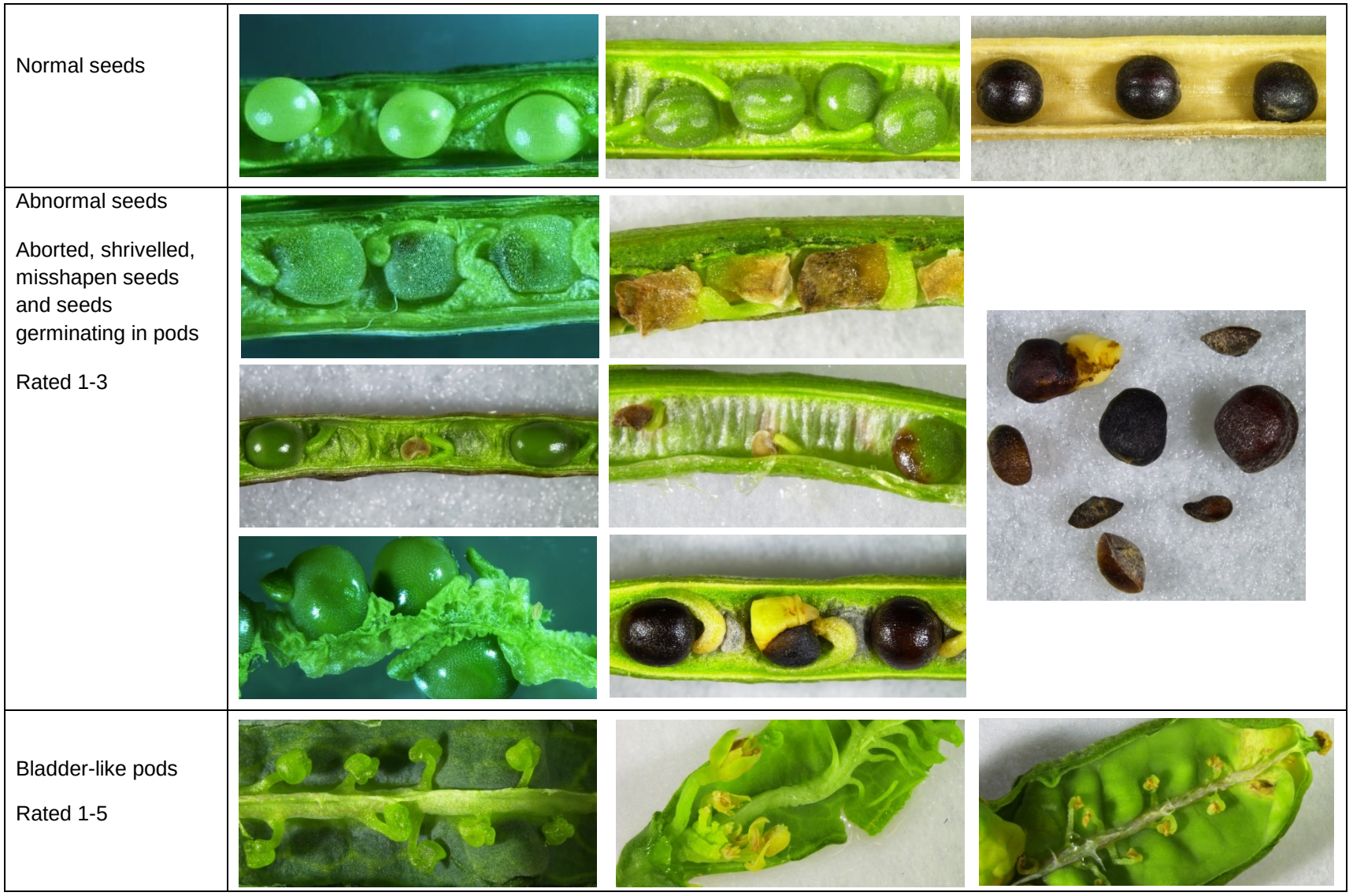

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Table 2. Percentage of canola plants showing no AY symptoms or very mild to very severe AY symptoms (1-5 rating) 6, 8 and 10 weeks after exposure to different densities of AY-infected leafhoppers. Mean AY ratings (±SD), based on replicate means, are also shown.

Leafhoppers per plant [1]	Weeks after exposure	% No AY symptoms	AY symptom rating					Mean AY rating (±SD)
			1	2	3	4	5	
0	6	100	0	0	0	0	0	0
4	6	67	0	11	11	11	0	1.1 ± 1.2
8	6	38	13	13	0	38	0	1.8 ± 0.3
12	6	42	0	0	24	17	17	2.3 ± 0.3
16	6	10	0	20	40	20	10	2.9 ± 0.4
0	8	100	0	0	0	0	0	0
4	8	67	0	0	33	0	0	1.5 ± 1.5
8	8	50	0	0	0	50	0	2.0 ± 2.0
12	8	30	10	0	0	40	20	2.9 ± 0.9
16	8	11	0	0	0	89	0	3.3 ± 1.2
0	10	100	0	0	0	0	0	0
4	10	67	0	0	33	0	0	1.5 ± 1.5
8	10	17	33	0	0	50	0	2.2 ± 2.0
12	10	10	10	10	0	40	30	3.5 ± 0.7
16	10	0	11	0	0	89	0	3.5 ± 0.9

[1] In each of three replicates, four canola plants at the early 2nd true-leaf stage were exposed to one of five leafhopper densities for 10 hours. Plants used in PCR tests were not rated.

CROP: Canola
LOCATION: Saskatchewan

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TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2013

ABSTRACT: The annual survey in Saskatchewan covered 268 fields in six large regions. Sclerotinia stem rot was the most prevalent disease, occurring in 60% of the fields surveyed. The mean incidence in Saskatchewan was 5% and ranged from 1% to 8% among regions. Blackleg and aster yellows were mostly at low levels.

METHODS: A total of 268 canola (*Brassica napus*) fields were surveyed between August 8 and September 24 in the major canola production regions of Saskatchewan. The number of fields per region was targeted to be approximately proportionate to the area of canola production in each region, and consisted of northwest (32 fields), northeast (37 fields), west-central (44 fields), east-central (62 fields), southwest (40 fields), and southeast (53 fields). Most of the fields were surveyed before swathing when plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). Disease assessments were made on 100 plants in each field by collecting 20 plants from each of five sites at least 20 m from the edge of the field and separated from each other by at least 20 m. Presence or absence of symptoms on each plant was determined to give percent disease incidence for sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (*Candidatus* Phytoplasma asteris), foot rot (*Rhizoctonia* spp., *Fusarium* spp.), fusarium wilt (*F. oxysporum* f.sp. *conglutinans*), and clubroot (*Plasmodiophora brassicae*).

For sclerotinia stem rot, each plant was also rated for disease severity using the 0 to 5 scale in Table 1 (Kutcher and Wolf 2006). For blackleg, plants were scored for either severe basal stem cankers or any other type of blackleg stem lesion. Plants with severe basal stem cankers were also rated for disease severity using the 0 to 5 scale in Table 2 (Western Canada Canola/Rapeseed Recommending Committee 2009). For alternaria black spot (*Alternaria brassicae*, *A. raphani*), percent severity of lesions on the pods of each plant was assessed (Conn et al. 1990). When diseases were observed in the field, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1% incidence. Mean disease incidence or severity values were calculated for each region across all crops surveyed (disease-free crops were included in the means). Mean incidence or severity values ≤ 0.1% were reported as “trace”. Soil samples (~1L) were collected from 110 fields and analyzed using the PCR-based diagnostic test of Cao et al. (2007) for the presence of *P. brassicae*.

RESULTS AND COMMENTS: Approximately 4.25 million ha (10.5 million acres) of canola were seeded in Saskatchewan in 2013 (Saskatchewan Ministry of Agriculture 2013). Seeding, emergence and crop development were delayed across the province due to below-normal temperatures for much of the growing season. Precipitation was above-normal in most areas throughout much of the growing season but an extended period of high temperatures at harvest allowed farmers to harvest the crop in a timely fashion. Many crop reporters across the province reported above-average yields and good quality, but

this varied from region to region. The average yield of 0.85 metric tonnes per ha (37.6 bu/acre) was higher than the 10-year average of 0.64 metric tonnes per ha (28.4 bu/acre) (Saskatchewan Ministry of Agriculture 2013).

Sclerotinia stem rot was observed in 60% of the crops surveyed. In individual crops incidence ranged from zero to 96% and mean severity from 0 to 4.5. Mean severity was highest in the west-central region (average rating of 1.6). Prevalence (70%) and mean incidence (8%) were also highest in this region. The overall mean incidence for the province was substantially lower in 2013 (5%) than in 2012 (19%) (Miller et al. 2013). These results are similar to previous seasons with normal to below normal precipitation in most areas throughout late June and July (2007 to 2009 and 2011: 5 to 9%) (Dokken-Bouchard et al. 2010; 2012). Isolated areas of high sclerotinia incidence were present in 2013.

Blackleg basal canker was present in 25% of Saskatchewan canola crops. The average incidence in the province was 2% and was highest in the northwest region (8%) and lowest in the northeast region (0.1%). The average severity of blackleg basal cankers in the province was 0.3. Blackleg stem lesions were present in 12% of canola crops with an average incidence of 0.6%. The highest average incidence was in the southeast region (1.6%). The lowest incidences were in the northeast and east-central regions (0.1%). The average severity of blackleg stem lesions in the province was 0.2. Mean incidence values for the province (2% basal cankers and 0.6% upper stem lesions) were similar to the range experienced from 2000 to 2012 (1.5 to 5% total blackleg).

Aster yellows was observed in 21% of canola crops with an average incidence of 0.6%, which was much lower than in 2012 where it was observed in 77% of canola crops with an average incidence of 8% in all fields surveyed (Miller et al. 2012). The highest prevalence of aster yellows (28%) was in the southeast region where the average incidence was 0.5%.

Fusarium wilt was reported in 9% of the fields surveyed, with a mean incidence at 0.6%; however, no plant samples were taken to confirm these observations. The disease was not observed in the northwest region. Foot rot was recorded in 10% of canola crops in the province with an average incidence of 0.5%. The highest incidence was in the west-central region (2%). Incidence in the southwest, east-central and northeast regions was low (0.1%). Alternaria black spot occurred in 54% of canola crops surveyed in the province. The highest incidence of black spot was in the northeast region (31%) and the lowest in the west-central region (3%). Brown girdling root rot was not observed in the survey.

Clubroot symptoms were not observed in any of the 268 surveyed fields. Soil samples were collected from 110 fields across Saskatchewan and are currently being analysed for the presence of clubroot.

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Table 1. Sclerotinia rating scale (Kutcher and Wolf 2006)

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

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

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

Table 3. Mean percent incidence and severity of sclerotinia and blackleg of canola in Saskatchewan in 2013

REGION[1] (NO. OF FIELDS)	Sclerotinia Stem Rot		Blackleg		
	Incidence	Severity[2]	Upper Stem Lesions	Basal Cankers	Basal Canker Severity[3]
Northwest (32)	1	1.1	0.3	8	0.5
Northeast (37)	3	1.0	0.1	0.1	0.1
West-central (44)	8	1.6	0.5	0.8	0.2
East-central (62)	6	1.5	0.1	2	0.7
Southwest (40)	7	1.1	0.9	0.8	0.2
Southeast (53)	4	1.3	1.6	1	0.2
Overall mean (268)	5	1.3	0.6	2	0.3

[1] Fields were surveyed in major canola production regions in the following rural municipalities of Saskatchewan: Northwest = 405, 434 to 437, 463, 464, 468 to 470, 472, 493, 494, 496 to 499, 501, 502; Northeast = 369, 370, 394, 395, 400, 427, 428, 431, 460, 461, 490, 520; East-central = 152, 181, 183 to 186, 190, 213 to 215, 218, 221, 243, 244, 246, 250, 252, 271, 273 to 276, 279, 281, 282, 301, 304, 307, 313, 333, 334, 336, 337, 339, 341, 343; West-central = 261, 284, 285, 287, 290, 292, 314, 315, 318, 319, 344 to 347, 349 to 352, 377, 378, 381, 403, 410; Southwest = 10, 11, 44, 49, 70, 72, 74, 103 to 107, 109, 111, 132, 135, 137, 139, 141, 163, 165, 168, 171, 193, 194, 229 to 231, 257; Southeast = 3, 5, 9, 32, 34, 38, 61, 63, 64, 67 to 69, 91, 92, 95, 96, 98 to 100, 121, 125, 127, 130, 131, 153, 155, 156, 158, 159.
[2] Sclerotinia rating as per Table 1.
[3] Blackleg rating as per Table 2.

Table 4. Mean percent incidence of alternaria pod spot, aster yellows, foot rot, and fusarium wilt of canola in Saskatchewan in 2013

REGION[1] (NO. OF FIELDS)	Alternaria Black Spot	Aster Yellows	Foot Rot	Fusarium Wilt
Northwest (32)	3	0.8	0.3	0
Northeast (37)	31	0.9	0.1	Trace
West-central (44)	5	0.5	2	0.1
East-central (62)	16	0.7	0.1	2
Southwest (40)	9	0.2	0.1	Trace
Southeast (53)	21	0.5	0.6	Trace
Overall mean (268)	15	0.6	0.5	0.6

[1] See footnote for Table 3.

CROP: Canola
LOCATION: Manitoba

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TITLE: SURVEY OF CANOLA DISEASES IN MANITOBA IN 2013

ABSTRACT: A total of 146 canola crops were surveyed in Manitoba for the prevalence and incidence or severity of sclerotinia stem rot, blackleg, fusarium wilt, alternaria pod spot, aster yellows, foot rot and clubroot. Blackleg and sclerotinia stem rot were the most prevalent diseases throughout the province. Clubroot symptoms were observed in one of the crops surveyed in 2013.

METHODS: A total of 146 canola crops were surveyed in the southwest (55), northwest (37), eastern/interlake (14) and central (39) regions of Manitoba from August 2 to September 12. All crops were *Brassica napus* and were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp, 1975). They were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (*Candidatus* Phytoplasma asteris), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*), fusarium wilt (*F. oxysporum* f.sp. *conglutinans*) and clubroot (*Plasmodiophora brassicae*). For sclerotinia stem rot, each plant was also scored based on the possible impact of infection on yield using a disease severity scale of 0 (no symptoms) to 5 (main stem lesion with potential effects on seed formation and filling of entire plant) (Kutcher and Wolf, 2006). Blackleg lesions that occurred on the upper portions of the stem were assessed separately from basal stem cankers. Stem lesions were recorded as present or absent. Basal stem cankers were scored using a disease severity scale of 0 to 5 based on area of diseased tissue in the stem cross-section where 0 = no diseased tissue visible in the cross section and 5 = diseased tissue occupying 100% of cross section and plant dead (WCC/RRC, 2009). Clubroot symptoms were rated using a scale of 0 to 3 where 0 = no galling and 3 = severe galling (Kuginuki et al. 1999).The prevalence and percent severity (Conn et al. 1990) of alternaria pod spot (*Alternaria* spp.) were also determined. When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1%. Mean disease incidence or severity values were calculated for each region. In addition to the visual assessment of diseases, soil samples were collected from 74 canola fields in Manitoba for DNA analysis (Cao et al., 2007) to test for the presence of the clubroot pathogen.

In each canola crop, 100 plants were selected in a regular pattern starting at a corner of the field or at a convenient access point. The edges of the fields were avoided. Twenty plants were removed from each of five points of a “W” pattern in the field. Points of the “W” were at least 20 paces apart. All plants were pulled up, removed from the field and examined for the presence of diseases. For soil collection, samples

were obtained from each of the five points of the “W”, or if the field entrance was identifiable, they were collected at 5 points near this entrance.

RESULTS: A number of diseases were present in each of the four regions of Manitoba, and clubroot symptoms were observed for the first time in Manitoba in 2013. No clubroot spores were detected in soil samples from 60 and 79 Manitoba canola fields targeted for DNA analysis in 2009 and 2010, respectively. Analysis of 181 soil samples collected from canola fields in 2011 and 2012 indicated that eight were positive for DNA of *P. brassicae.* Derksen et al. (2013) provided further information on subsequent monitoring of the two fields from which positive samples were identified in 2011. In 2013, clubroot symptoms were observed on plants in one field surveyed during the annual canola disease survey and in a second field from which samples were submitted independently. Further information on the monitoring and occurrence of clubroot in Manitoba in 2012 and 2013 is provided by Kubinec et al. (2014).

Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province in 2013 (Tables 1 and 2). The prevalence of sclerotinia-infested crops ranged from a high of 78% in the northwest region to 60% in the eastern/interlake region with a provincial mean of 66%. Mean disease incidence averaged across all crops was 7.1% and ranged from 11.1% in the central region to 4.0% in the southwest region. For infested crops only, mean disease incidence was 11%. Throughout the province, mean severity of sclerotinia stem rot was low at <2.0. In 2012 and 2013, the prevalence of sclerotinia was similar, but both the incidence and severity of the disease were lower in 2013.

Aster yellows was observed in 7% of canola crops in Manitoba with a mean disease incidence of 1.3% in these crops. Aster yellows was observed in an additional 16% of canola crops at trace levels but was not present in the 100-plant samples. The prevalence of this disease was substantially less than in 2012, when aster yellows was observed in 95% of canola crops with a mean disease incidence of 9.9%. Contributing factors to the record high level of aster yellows in all regions of Manitoba in 2012 included drought in the midwestern United States, the early arrival of aster leafhoppers from the southern U.S. and the higher than normal percentage of infected individuals in the leafhopper population. In 2013, aster leafhopper numbers were considerably lower than in 2012 due in part to the later occurrence of south winds that carry aster leafhoppers from the southern U.S. (Canola Council of Canada, 2013).

Blackleg basal cankers occurred in 75% of the crops surveyed in 2013, with prevalence ranging from 95% in the central region to 47% in the eastern/interlake region. The mean incidence of basal cankers averaged across all crops was 12.5%, while the incidence in infested crops was 16.6%. In 2012, basal cankers were found in 77% of crops surveyed with a mean disease incidence of 15.7%. The severity of blackleg basal cankers was similar in both years, with mean ratings of 2 or less. A value of 2 indicates that 26-50% of the basal stem cross section is diseased.

The mean prevalence of blackleg stem lesions in 2013 was 63%. In previous years, 54%, 56%, 66%, 64% and 68% of crops had stem lesions in 2008, 2009, 2010, 2011 and 2012, respectively (McLaren et al. 2011; 2012; 2013). The mean incidence of blackleg stem lesions was 14.8% in infested crops and 9.3% in all crops. Hail damage was observed in 10% of crops surveyed with the highest incidences in the central (15%) and southwest (9%) regions. The mean incidence of blackleg stem lesions in infested crops was also highest in these two regions, southwest 17% and central 16%. The occurrence of blackleg stem lesions is often associated with hail damage.

The mean prevalence of alternaria pod spot in 2013 was 38%, 33%, 16% and 42% for crops surveyed in the central, eastern/interlake, southwest and northwest regions, respectively (Table 2). The severity of alternaria pod spot was low with means < 2%.

Fusarium wilt was observed in 7% of canola crops surveyed in Manitoba, with a mean incidence of 7% in these fields (Table 1). Foot rot occurred in 8% of canola crops surveyed with a provincial mean of <1%. Crop damage due to excess moisture was observed in 9% of fields with the highest incidence (22%) in the northwest region. The prevalence of crops reported to be affected by foot rot was also highest in the northwest region at 19%. No foot rot was observed in the eastern/interlake region. White rust (*Albugo candida*) was confirmed in one crop of *B. napus* in 2011, but has not been observed in any of the crops surveyed since then.

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Table 1. Mean prevalence, incidence and severity of sclerotinia stem rot and blackleg in Manitoba in 2013.

Crop Region	Sclerotinia stem rot					Blackleg basal cankers					Blackleg stem lesions		
(No. of crops)	P[1]	Inc.[2]	Inc[3]	Sev.[2]	Sev.[3]	P[1]	DI[2]	DI[3]	Sev.[2]	Sev.[3]	P[1]	DI[2]	DI[3]
Central	62	11.1	18.0	1.2	1.9	95	19.5	20.6	1.4	1.5	69	11.0	15.9
(39)													
East./Inter.	60	7.7	12.9	0.8	1.3	47	15.3	32.9	0.6	1.2	33	3.2	9.6
(14)													
Northwest	78	7.1	9.1	1.8	2.3	89	8.0	8.9	1.2	1.4	51	4.8	9.4
(37)													
Southwest	64	4.0	6.3	1.5	2.4	60	9.7	16.2	1.1	1.8	75	12.8	17.1
(55)													
All regions	66	7.1	10.6	1.4	2.1	75	12.5	16.6	1.2	1.5	63	9.3	14.8
(146)													

[1] Prevalence (P); [2] Disease incidence (DI) and severity (Sev.) across all surveyed crops; [3] Disease incidence and severity in infested crops.

Table 2. Mean prevalence and incidence or severity of alternaria pod spot, aster yellows, fusarium wilt and foot rot in Manitoba in 2013.

Crop Region	Alternaria pod spot		Aster yellows			Fusarium wilt					Foot rot		
(No. of crops)	P	Sev.[3]	P	Inc.[2]	Inc.[3]	P[1]	Inc.[2]	Inc.[3]	Sev.[2]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]
Central	38	0.7	7.7	0.1	1.0	5.1	0.2	4.5	1.1	2.0	7.7	0.8	10.3
(39)													
East./Inter.	33	0.8	13.3	0.3	2.5	6.7	0.3	5.0	1.3	5.4	0	0	0
(14)													
Northwest	42	0.7	11.1	0.1	1.0	16.2	1.5	9.5	1.6	5.0	19	0.6	3.3
(37)													
Southwest	16	1.1	1.8	0.1	1.0	1.8	0.1	1.0	1.1	6.0	3.6	0.1	2.0
(55)													
All regions	30	0.8	7.0	0.1	1.3	6.9	0.5	7.2	1.2	4.5	8.2	0.4	4.8
(146)													

[1] Prevalence (P); [2] Disease incidence (DI) and severity (Sev.) across all surveyed crops; [3] Disease incidence and severity in infested crops.

Table 3. Distribution of incidence (sclerotinia, blackleg, aster yellows, fusarium wilt and foot rot) and severity (alternaria pod spot) classes in 146 crops of *Brassica napus* in Manitoba in 2013.

	Percentage of crops with						
Incidence range	Sclerotinia stem rot	Blackleg basal cankers	Blackleg stem lesions	Aster yellows	Fusarium wilt	Foot rot	Alternaria pod spot
0%	34	25	37	93	93	91	84
1-5%	35	26	26	7	4	7	16
6-10%	15	15	11	0	1	0	0
11-20%	8	12	13	0	1	1	0
21-50%	5	19	9	0	1	1	0
>50%	3	3	4	0	0	0	0

CROP: Canola
LOCATION: Manitoba

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TITLE: MONITORING AND OCCURRENCE OF CLUBROOT IN MANITOBA IN 2013

ABSTRACT: Symptomatic plants from two canola fields were identified and tested positive for clubroot (*Plasmodiophora brassicae)* in the 2013 growing season. One plant was identified through the annual canola disease survey and the other had been submitted independently. Eight of 181 soil samples collected through the 2011 and 2012 canola disease surveys tested positive for clubroot DNA. Two of the eight samples were able to produce weak clubroot symptoms in a plant bioassay. All fields testing positive for clubroot DNA in soil or plant samples were further sampled and monitored in 2013.

METHODS: Between late July and mid-September, soil samples (~1 L) were obtained from 69 fields in 2011 and from 112 fields in 2012 during annual canola disease surveys (McLaren et al. 2012, McLaren et al. 2013). The samples were analysed for the presence of *Plasmodiophora brassicae* Woronin (clubroot) using the PCR based diagnostic test of Cao et al. (2007) and an adaptation of the quantitative PCR (qPCR) protocol of Rennie et al. (2011). For any soil sample testing positive for clubroot, a bioassay was conducted under controlled conditions using susceptible *Brassica* spp. Plants were grown for 6 weeks under greenhouse conditions and assessed for clubroot severity as described by Strelkov et al. (2006).

Plants from two separate fields were submitted to the Manitoba Agriculture, Food and Rural Development (MAFRD) Crop Diagnostic Lab and then to 20/20 Seed Labs for PCR analysis to determine if growths on roots were symptomatic of clubroot

RESULTS AND COMMENTS: Two of 69 soil samples collected in 2011, and six of 112 collected in 2012 resulted in positive PCR results for clubroot. Only one sample from 2012, with a concentration of 2.9×10^3 resting spores/g soil, was above the minimum quantifiable level as determined through qPCR. Laboratory bioassays resulted in weak clubroot symptoms on 'Grannat' grown in two soil samples (one sample tested above the quantifiable range, the other below the quantifiable range) from the 2012 survey.

In the 2013 canola disease survey, clubroot symptoms were found on plants from one of 146 fields surveyed. Symptoms present were minor so plants were submitted to the MAFRD Crop Diagnostic Laboratory and then to 20/20 Seed Labs for further PCR analysis. Plants from another Manitoba field were also submitted. Plant samples from both fields tested positive using the PCR-based diagnostic test of Cao et al. (2007). Clubroot symptoms on plants had not been found in field surveys prior to 2013.

Monitoring of the fields previously identified as containing clubroot DNA in soil samples collected through the canola disease survey continued in 2013. Soil samples from the identified fields, as well as adjacent fields and those planted to canola in 2012/13 were collected in May 2013. In total, 18 samples were submitted to the University of Alberta and tested using PCR to determine presence of the pathogen. The results indicated that all 18 soil samples were negative for clubroot DNA. The PCR assays were independently repeated with two 150 mg sub-samples taken from each original soil sample. Both repetitions of the test yielded consistent negative results. Since the conventional PCR assays were negative, the samples were not tested further using qPCR or bioassays.

Terminology for field classification for clubroot in Manitoba is based on in-field symptoms, presence of clubroot DNA in soil and/or plants (Table 1). If symptoms are present on plants, or DNA is quantifiable in

soil, or symptoms occur under greenhouse conditions, then the field is classified as positive for clubroot. If no DNA is found in soil and/or plants and no symptoms seen in the field or in a bioassay then the field is negative. If DNA is identified in the soil, but no symptoms are visible in-field or in a bioassay, the field is classified as 'non-symptomatic fields of concern'. All fields classified as positive or 'non-symptomatic fields of concern' will be monitored in the future by MAFRD staff.

Table 1. Terminology for different types of clubroot cases based on field, lab, and greenhouse testing.

Term	In-Field Symptoms	Soil DNA Test	Plant Bioassay
Positive Clubroot	Yes/No	Yes	Yes
Non-Symptomatic Field of Concern	No	Yes	No
Negative/Free of Clubroot	No	No	No

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

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TITLE: **ASCOCHYTA BLIGHT ON CHICKPEA IN SASKATCHEWAN, 2013.**

ABSTRACT: A survey of eight chickpea fields in southern Saskatchewan was conducted at crop maturity in 2013. Ascochyta blight incidence was moderate to high, but severity was generally low, likely due to dry weather in August and timely application of fungicides.

METHODS: A survey of eight chickpea fields in south-central, west-central, and central Saskatchewan (Crop Districts 3A, 7A and 6B respectively) (3) was conducted on September 27 and October 02, 2013 to assess the incidence and severity of ascochyta blight caused by *Ascochyta rabiei* (teleomorph *Didymella rabiei*). Ten plants were assessed at each of 10 sites along a teardrop-shaped circuit in each field. Blight incidence and severity were assessed using the 0–11 Horsfall-Barratt scale (1). Infected foliage (leaves, stems and pods) were collected at each site. Isolates were identified to species to confirm the identity of the pathogen, and retained for future study.

RESULTS AND COMMENTS: In 2013, the survey area received normal amounts of rainfall over the growing season; above-normal rainfall in June and July was followed by dry conditions in August (2) that limited late-season disease development. Crops assessed varied from the pod filling stage to maturity. Blight incidence was variable, with a low of 25% in the west-central region, and up to 100% in the south-central region (Table 1). Most crops had been sprayed repeatedly with fungicides, based on observation of wheel tracks in the fields. Severity varied substantially within and among fields, from a few small lesions to severe stem breakage with numerous pod lesions that caused the seed to shrivel or abort. In west-central Saskatchewan, the stands were very good to excellent, with low levels of disease on most pods. Other diseases included root rot and a trace of white mold (*Sclerotinia sclerotiorum*) in thick stands.

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Table 1. Mean ascochyta blight incidence and severity (range in brackets) in commercial chickpea fields in Saskatchewan, 2013.

Crop District	No. of fields	Incidence	Severity
South-central (CD 3A)	5	88% (60-100)	8% (0-25)
Central (CD 6B)	1	50% (25-75)	3% (0-6)
West-central (CD 7A)	2	30% (30)	2% (0-6)

CROP: Flax
LOCATION: Manitoba/Saskatchewan

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TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2013

ABSTRACT: A survey of 96 flax crops revealed that pasmo was the most prevalent disease. It was present in 86% of crops surveyed, followed by fusarium wilt in 56% and powdery mildew in 24%. Traces of aster yellows were observed in 16% of the crops, fewer than in 2012. Rust and sclerotinia stem infections were absent.

METHODS: A total of 96 flax crops were surveyed in 2013, 27 in southern Manitoba and 69 in southern and eastern Saskatchewan. Sixty-three crops were surveyed in the last two weeks of August and 33 crops in the first two weeks of September. Crops surveyed were selected at random along pre-planned routes in the major areas of flax production. Each crop was sampled by two persons walking ~100 m in opposite directions towards each other following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of fusarium wilt (*Fusarium oxysporum lini*), pasmo (*Septoria linicola*), powdery mildew (*Oidium lini*), rust (*Melampsora lini*), alternaria blight (*Alternaria* spp.), and aster yellows (*Candidatus* Phytoplasma asteris) were recorded. Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, eight samples of flax plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Development (MAFRD) by agricultural representatives and growers.

RESULTS AND COMMENTS: Ninety-four percent of the flax crops surveyed in 2013 had excellent stands and the remaining six percent were good to fair. Eighty-two percent of the crops surveyed were maturing early and 16% were late maturing especially in Saskatchewan. Ninety-four percent of the crops had excellent to good vigour. Eighty-four percent of the crops were brown seed-colour linseed flax, and only 16% yellow seed-colour flax. The 2013 growing season started with normal growing conditions in Manitoba and Saskatchewan, and conditions remained relatively normal throughout the season. Total flax area was ~400,000 ha, mostly in Saskatchewan, according to Statistics Canada. Normal temperatures and precipitation in July-August no doubt contributed to long-season maturity and above average yields in most crops. The survey showed some minor differences between Manitoba and Saskatchewan in incidence and severity of pasmo and powdery mildew, while other diseases were relatively similar in both provinces. Lodging was at record low levels with only traces to 5% in both provinces.

Pasmo, the most prevalent disease in 2013, was observed in 86% of the crops surveyed in Saskatchewan and Manitoba especially those surveyed in September (Table 1). Prevalence and severity on stems were generally lower than in previous years (1, 2, 3, 4), due perhaps to the normal weather conditions in July-August. Pasmo severity was mostly at trace to 5% levels in crops surveyed in August but developed towards the end of the season to reach 5-20% stem area affected in most crops, and up to 40% in 6% of the crops (Table 1).

Root infections and fusarium wilt were observed in 56% of flax crops in 2013. Incidence was very low (trace to 5%) in most crops (Table 1). Prevalence of these diseases in 2013 was similar to 2012 but slightly higher than in 2011 (2, 3, 4).

Powdery mildew was present in 24% of the crops surveyed in the two provinces in 2013 (Table 1); severity ranged from trace to 5% leaf area affected in most crops. Powdery mildew infections started late, and severity was at a record low, similar to 2012, due to a lack of high humidity in July-August (1, 2, 3, 4).

Rust was not observed in any of the crops surveyed in 2013, nor in flax rust trap nurseries planted at Morden and Portage la Prairie, Manitoba, and Indian Head and Saskatoon in Saskatchewan.

Aster yellows was present at trace levels in 16% of the crops surveyed in 2013, a much lower incidence and severity than in 2012 but similar to previous years (1, 2, 3). This disease is transmitted by the aster leafhopper (*Macrosteles quadrilineatus*) which usually migrates from the south during the growing season, but the migration of the insect was very late in 2013. Alternaria blight was observed at trace levels in 16% of the flax crops surveyed, mostly in Manitoba. No sclerotinia stem infections were evident in any of the crops surveyed in 2013.

Of eight samples submitted to MAFRD Crop Diagnostic Centre in 2012, two were affected by fusarium wilt-root rot, one by nutrient deficiency, one by environmental injury, and four by herbicide injury.

ACKNOWLEDGEMENTS: The technical assistance of Tricia Cabernel, Maurice Penner, Suzanne Enns, Timothy Dament, and Robert Liu is gratefully acknowledged.

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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 2013

Fusarium Wilt				Pasmo				Powdery Mildew			
Disease Class		Crops		Disease Class		Crops		Disease Class		Crops	
Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%
0%	0%	42	44	0%	0%	13	14	0%	0%	73	76
1-5%	1-5%	52	54	1-10%	1-5%	52	54	1-10%	1-5%	23	24
5-20%	5-10%	2	2	10-30%	5-10%	15	16	10-30%	5-10%	0	0
2-40%	10-20%	0	0	30-60%	10-20%	10	10	30-60%	10-20%	0	0
>40%	10-40%	0	0	>60%	20-50%	6	6	>60%	20-50%	0	0

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

CROP / CULTURE: Field pea (*Pisum sativum*)
LOCATION / RÉGION: Alberta

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TITLE / TITRE: SURVEY OF ROOT ROT IN ALBERTA FIELD PEA IN 2013

ABSTRACT: A total of 145 field pea fields were surveyed in central and southern Alberta for root rot. Fusarium root rot was present in all regions, and in 98% of fields surveyed. Root rot incidence was highest in west-central Alberta, while severity was highest in east-central Alberta. Root rot incidence and severity were lowest in southern Alberta. The high severity levels observed indicate that root rot may reduce yields in many pea-growing areas in Alberta.

INTRODUCTION AND METHODS: Field pea is the largest acreage pulse crop in Alberta, with 435,000 ha (1 million acres) planted in 2013 (1). Since 2006, root rots caused by *Fusarium* spp. have become a severe problem for many Alberta pea producers and a great need for further investigation of the problem was noted (2,3). To complicate this situation, the destructive root rot pathogen *Aphanomyces euteiches* was recently reported to be present in Saskatchewan pea fields (4). To assess the prevalence, incidence and severity of root rot in *Pisum sativum* in Alberta, 145 pea fields were surveyed at flowering in July 2013 for above- and below-ground symptoms of root rot. Representative samples were collected from each field to allow the causal agents of disease to be isolated and identified. Approximately 50% of crops surveyed were randomly chosen, whereas the other 50% were targeted, in that producers responded to a call posted on the Alberta Pulse Growers' website and in the Alberta Farmer Express.

Forty-four fields were surveyed in east-central Alberta (east of Hwy. 36 between Hwy 1 and Hwy 16), 39 in west-central Alberta (west of Hwy. 36 between Hwy 1 and Hwy 16), and 50 in southern Alberta (south of Hwy. 1). These regions represent the primary field pea growing areas in Alberta. Crops were evaluated at 10 sites per field along a U-shaped pattern, with a minimum of 20 m between sites. To assess above-ground symptoms, the number of plants showing yellowing and stunting in a selected 1-m row section at each site was recorded. Roots from 5-10 plants were dug up at each of the 10 sampling sites per field, bagged and stored at 4^{o}C until processing. Roots were washed under running tap water for 10 min, and individual roots were assigned a visual rating for disease severity (from 1=healthy up to 7=dead) (5). Roots with a severity rating of 4, 5 or 6 were retained for pathogen isolation. For pathogen isolations, the tap root was cut into 1-cm pieces, surface sterilized with 1.0% NaOCl solution for 1 min and roots pieces were plated onto acidified potato dextrose agar (APDA) and pentachloronitrobenzene peptone agar (PPA) (6). *Fusarium* cultures isolated on APDA are currently being identified using cultural morphology characteristics and PCR with species-specific primers.

RESULTS AND DISCUSSION: Southern Alberta received much above normal levels (150-200%) of precipitation in June and July 2013, whereas most regions in central Alberta received normal to slightly above normal precipitation (7). However, in August, precipitation was below normal for most areas of central and southern Alberta. As a result of cool weather in July, field pea crops performed very well in 2013, with average yields estimated at 3400 kg/ha (47 – 54 bushels/acre) (1, 8).

Root rot symptoms were found in 143 of the 145 crops surveyed for an overall disease prevalence of 98% (Table 1). Disease incidences ranged from 0 to 100%, with a mean root rot incidence and severity of 87% and 3.0, respectively. In east-central Alberta, 85% of sample sites had root rot, and 65% of roots showed root rot symptoms. Mean disease severity was highest in this region at 3.6, and 22% of roots had a rating

of 7. All roots collected from two fields in this region showed complete decay; producers indicated that these crops had significantly reduced yields, and that some crops had areas not worth harvesting. West-central Alberta had the highest incidence with root rot found at all sites, and in 78% of roots. However, the mean disease severity was lower than east-central Alberta at 2.9. Disease incidence and severity were lowest in southern Alberta where an average root rot incidence of 77% was observed and 50% of roots had root rot with a mean disease severity of 2.4.

Fusarium spp. were the predominant fungi isolated from roots. *Rhizoctonia solani* and *Pythium* spp. were also isolated, but at a much lower frequency. Identification of *Fusarium* spp. from cultures and directly from infected roots is on-going using species-specific PCR primers. To date, both *F. avenaceum* and *F. solani* f. sp. *pisi* have been identified in root samples collected from crops surveyed in west-central Alberta. At the time of this report, no evidence of *A. euteiches* has been confirmed in any Alberta pea fields in 2013. The high incidence and severity of root rots found in southern and central Alberta substantiates the concern that producers have expressed in recent years regarding root rot of field pea, and indicates that further investigation into causal agents and control strategies are warranted.

ACKNOWLEDGEMENTS: Funding for this project is provided by the Alberta Crop Industry Development Fund and the Alberta Pulse Growers Commission. We thank all producers that co-operated in the field sampling. We would like to thank Carol Mueller, Colyn Cleland, and Quinn Storozynsky for technical assistance. The assistance provided by Shelley Barkley, Kent Sande, Megan Roxburgh, Todd Rosiechuk, Twyla Jones, Martin Willis, Sydney Vos, Leanne Kruger and Don Pittman is also gratefully acknowledged.

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Table 1: Root rot prevalence, incidence and severity in 145 field pea crops in Alberta in 2013.

	Root rot prevalence (%)	Above-ground incidence (%)	Root rot incidence (%)	% roots with symptoms	Disease severity	
					Mean	Range
West-central AB	100	10.7	100	78	2.9	2.6 – 3.3
East-central AB	95	76	85	65	3.6	1.0 – 7.0
Southern AB	100	61	75	50	2.4	1.3 – 5.6
Total	98	51[1]	86[2]	63[3]	2.9[4]	1.0 – 7.0

[1] standard error of the mean for above-ground incidence = 1.30
[2] standard error of the mean for root rot incidence = 2.06
[3] standard error of the mean for % root rot symptoms = 1.00
[4] standard error of the mean for the average disease severity index = 0.04

CROP: Field pea
LOCATION: Manitoba

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TITLE: FIELD PEA DISEASES IN MANITOBA IN 2013

ABSTRACT: A total of 37 and 36 pea crops were surveyed in Manitoba for root and foliar diseases, respectively. Fusarium root rot was the most prevalent root disease and mycosphaerella blight the most prevalent foliar disease throughout the province. Diseases less frequently observed included rhizoctonia root rot, sclerotinia stem rot, anthracnose and downy mildew.

METHODS: Field pea crops were surveyed for root and foliar diseases at 37 and 36 different locations, respectively, in Manitoba. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where field pea is commonly grown. The area seeded to field pea in Manitoba increased by over 50% from 2011 to 2012, with growers attempting to maximize the planting area and return to pre-flood levels (McLaren et al. 2012). In 2013, the area seeded to field pea was similar to that of 2012.

The survey for root diseases was conducted during the first two weeks of July when most plants were at the mid- to late flowering stage. At least ten plants were sampled at each of three random sites in each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant). To confirm the visual disease identification, 15 symptomatic roots were collected from a sub-sample of 10 crops for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 37 pea crops were frozen for future PCR analysis of root rot pathogens. Foliar diseases were assessed during late July and early August when most plants were at the round pod stage. A minimum of 30 plants (10 plants at each of 3 sites) was assessed in each field. Foliar diseases were identified by symptoms. The severity of mycosphaerella blight, sclerotinia stem rot and anthracnose was estimated using a scale of 0 (no disease) to 9 (whole plant severely diseased). Powdery mildew and downy mildew severity were rated as the percentage of foliar area infected.

RESULTS AND COMMENTS: Root rot was observed in all 37 pea crops surveyed, with root rot severity ratings ranging from 1.4 to 6.4, with a mean of 2.8. Three diseases were identified based on laboratory assessment of the roots collected from a sub-sample of 10 pea crops (Table 1). Fusarium root rot was the most prevalent as in previous years (McLaren et al. 2012, 2013). *Fusarium avenaceum* was more frequently isolated from symptomatic roots than *F. solani* during 2009-2013. However, the most predominant *Fusarium* species isolated in 2013 was *F. acuminatum*. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in one crop. In 2011, wet soils and cool conditions early in the season favoured root rot development, but similar conditions were not as prevalent during 2012-2013 resulting in lower mean root rot severities in the 33 and 37 pea crops surveyed, respectively. Four pea crops had average root rot severity ratings above 4 (i.e., symptoms were present on 50% of the root system) and this would have had a detrimental effect on crop yield. *Fusarium oxysporum,* an efficient root colonizer known to cause wilt of pea, was also detected in nine of 10 crops subsampled for fungal isolation and identification.

Four foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2012, 2013), and was present in all crops surveyed. Sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*) was detected in five crops. The prevalence of sclerotinia-infested crops was 36% in 2012 compared with 14% in 2013. Downy mildew (*Peronospora*

viciae) was detected in twelve of the crops surveyed with a mean disease severity of <0.1. Anthracnose (*Colletotrichum pisi*) was found in one crop with a mean severity rating of 0.1. Powdery mildew (*Erysiphe pisi*) was not observed in any of the surveyed crops. Because all newly registered pea cultivars are required to have resistance to powdery mildew, the absence of this disease could be mainly attributed to early seeded crops that escaped infection or the use of new cultivars by growers. However, powdery mildew was observed very late in the growing season on a few susceptible lines at AAFC-Morden, which suggests that there may have been crops in which powdery mildew developed after the survey. Other foliar diseases, such as septoria blotch (*Septoria pisi*) and bacterial blight (*Pseudomonas syringae* pv. *pisi*) were not observed in the surveyed crops.

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Table 1. Prevalence and severity of root diseases in 10 of 37 crops of field pea in Manitoba in 2013.

Disease	**No. crops affected**	**Disease severity (0-9)[1]**	
		Mean	**Range**
Fusarium root rot	10	4.2	3.0-6.4
Rhizoctonia root rot	1	3.4	3.4
Fusarium oxysporum detected	9	4.3	3.0-6.4

[1]All diseases were rated for severity on a scale of 0 (no disease) to 9 (death of plant). Mean severity values are based only on crops in which the disease was observed.

Table 2. Prevalence and severity of foliar diseases in 36 crops of field pea in Manitoba in 2013.

Disease	**No. crops affected**	**Disease severity (0-9) or % leaf area infected**	
		Mean	**Range**
Mycosphaerella blight	36	4.5	1.9-7.5
Sclerotinia stem rot	5	<0.1	<0.1-0.3
Powdery mildew[1]	0	0	0
Downy mildew[1]	12	0.1	<0.1-0.5
Anthracnose	1	0.1	0.1

[1]Powdery and downy mildew severity were rated as the percentage of leaf area infected; other diseases were rated on a scale of 0 (no disease) to 9 (whole plant severely diseased). Mean values are based only on crops in which the disease was observed.

CROPS: Pea and lentil
LOCATION: Saskatchewan

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TITLE: REPORTS OF APHANOMYCES EUTEICHES IN SASKATCHEWAN

ABSTRACT: Plants with root rot from 24 pea and 11 lentil fields were sampled from several areas of Saskatchewan in July, along with one clover and two vetch plants. *Aphanomyces euteiches* was detected in pea and lentil from the 10 areas sampled. Soil samples from two areas were used to observe pea seedling development and *Aphanomyces* infection under growth chamber conditions.

INTRODUCTION AND METHODS: *Aphanomyces euteiches* was first identified in Saskatchewan in 2012 after several years of wet conditions in many areas (Banniza *et al*., 2013). Continuing wet weather during the spring of 2013 led to further reports of severe root rot in lentil and pea fields. Pea and lentil crops with root rot symptoms and other legumes were collected in June and July 2013 from several areas of Saskatchewan. In the northwest of the province, samples were obtained from Medstead (9 pea, 2 vetch (*Vicia americana*), 1 clover (*Melilotus* sp.)), Spiritwood (6 pea), Shellbrook (2 pea), Sturgeon Lake (2 pea), and North Battleford (2 pea). One pea sample from nearby Paradise Valley, Alberta was also included. Fields in the south-central part of the province near Moose Jaw (2 lentil), Sedley (1 lentil) and Assiniboia (6 lentil) were sampled, as well as one pea field near Margo in the east-central region. Roots, particularly the fine side-roots, were examined microscopically for the presence of oogonia or oospores of the pathogen. In order to confirm that these were structures of *A. euteiches*, samples from each of the 10 municipalities in which *Aphanomyces* was identified visually were chosen and used for probe-based real-time PCR (qPCR) using species-specific primers (Vandemark et al, 2003). A pure culture of *Aphanomyces* obtained from Leoville was used as the positive control. Samples were plated on PDA media to elucidate the presence of other root rot pathogens and on a medium supplemented with metalaxyl, benomyl and either rifampicin or vancomycin (MBR/MBV) to attempt recovery of *A. euteiches* (Pfender *et al*, 1984).

Additionally, soil samples from Assiniboia (south central) and Leoville (northwest) Saskatchewan were collected and used for growth chamber studies. The soil was used to grow seedlings of CDC Patrick pea, with sterilized soil serving as a control. Seedlings were allowed to emerge and then either watered normally, or the pots were partially submerged in trays of water to create waterlogged soil conditions. Plants were sampled 1 and 2 wk after emergence, at which time symptoms were noted, roots were examined microscopically, and samples plated on PDA and MBV. Root samples were analyzed using qPCR as mentioned above.

RESULTS AND COMMENTS: Pea and lentil plants from the field showed stunting and yellowing, and had considerably reduced root systems. Plating of root segments on PDA yielded an abundance and variety of *Fusarium* species. *Aphanomyces* was not recovered from MBR/MBV plates, perhaps due to the age and state of the samples at the time of analysis.

The presence of *Aphanomyces* oogonia or oospores was visually confirmed in samples from every municipality sampled. Samples from the Medstead area were the most numerous, but only three of nine pea-field samples were visually positive for *Aphanomyces*. The two vetch and one clover samples from this region were also negative. The only other negative result was in one of six pea samples from the Spiritwood area.

Pea plants grown in soil samples from Assiniboia and Leoville had reduced emergence and biomass relative to those grown in sterilized soil from the same sources. Diseased roots had the characteristic straw to honey-brown color described for *Aphanomyces* root rot of pea (Kraft and Pfleger, 2001). Oogonia in root tissue were visible at a high density in the seedlings, and were easily seen in crude crush mounts

of lateral roots. Visual confirmations were made in one of four normally watered samples after 1 wk and in all of four normally watered plants after 2 wk. Visual confirmations were fewer in the waterlogged seedlings, with only two of four samples confirmed from either soil after 2 wk. Cultures of *A. euteiches* were obtained by plating seedling root tissue on MBV medium. *Fusarium* species were also recovered from roots, at levels varying from 0 to 9 colonies per 40 root pieces. Nematodes were observed in roots only from the Assiniboia soil, at a level of 3 - 4 out of 8 plates from normally watered seedlings versus 0 - 1 out of 8 plates from waterlogged seedlings.

Root samples from each of the 11 municipalities in which *Aphanomyces* was confirmed visually were chosen for real-time PCR detection of the pathogen. In six of the 11 samples, (Assiniboia, Medstead, North Battleford, Moose Jaw, Spiritwood and Leoville) *Aphanomyces euteiches* DNA was successfully amplified, confirming the presence of the pathogen in diverse areas of Saskatchewan. In the remaining five samples (Shellbrook, Sturgeon Lake, Paradise Valley, Sedley and Margo), DNA quality was poor, leading to inconclusive qPCR results. For these we can only rely on visual confirmation of the pathogen.

DISCUSSION: Many parts of Saskatchewan had above average snow pack in early 2013. For example, at Prince Albert, snow depth in March was more than double the long-term average, and at Moose Jaw it was 5-6 times greater. This resulted in high runoff in many areas in the spring, and flooding especially in north central and northwest regions. This combined with above average rainfall in June in several areas, including North Battleford, Moose Jaw and Prince Albert (Government of Canada weather.gc.ca), created wet conditions favourable for root rots.

Based on the wide distribution of reports of *A. euteiches* from visual assessments and molecular tests, we suspect that this pathogen is present throughout pea and lentil production areas of the province.

In growth chamber tests high levels of the pathogen were observed in fresh pea seedling tissue when planted in soil from areas where severe root rot had been observed. Although waterlogging resulted in more severe root rot symptoms above and below ground, it was not required for *Aphanomyces* infection. Waterlogging in sterile soil was seen to restrict root and shoot development severely in the absence of pathogens. This agrees with previous assertions that waterlogging alone can cause yellowing and stunting as well as yield loss in pea (Cannell *et al.*, 1979). *Aphanomyces* could be seen in waterlogged seedlings at only a low level, perhaps due to excessive degradation and sloughing off of root tissues. From observations of root infection of seedlings in soil samples from Assiniboia and Leoville, it is suspected that infection by *Fusarium* was secondary to *Aphanomyces* infection. This is based on the timing of symptom development, the uniform caramel coloration of roots, and the predominance of *Aphanomyces* in root tissue 2 and 3 wk after seeding.

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CROP: Pulse crops (Lentil, Pea, Chickpea)
LOCATION: Saskatchewan

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TITLE: SEED-BORNE PATHOGENS OF PULSE CROPS IN SASKATCHEWAN IN 2013

ABSTRACT: In a summary of commercial plate tests for seed-borne pathogenic fungi of lentil, field pea and chickpea all three were at below-normal or normal low levels. The fungi included *Ascochyta* spp., *Botrytis* spp. and *Sclerotinia sclerotiorum* on the three crops, and *Colletotrichum truncatum* on lentil.

METHODS: Results were summarized from commercial agar plate tests for pathogens in samples of lentil, field pea, and chickpea seed from Saskatchewan. The tests were conducted by three companies between September and mid-December 2013 and the seed samples were assumed to be predominantly from the 2013 crop. Tests were for the following pathogens:

(a) *Didymella* [*Ascochyta*] *lentis,* the cause of ascochyta blight in lentil; *Mycosphaerella* [*A.*] *pinodes*, *Didymella* [*A.*] *pisi* and *Phoma medicaginis* var. *pinodella* [= *A. pinodella*], the causes of ascochyta blights in field pea; and *Didymella* [*A.*] *rabiei*, the cause of ascochyta blight in chickpea.
(b) *Botrytis* spp., the cause of botrytis stem and pod rot (grey mould) and seedling blight in lentil, chickpea and field pea.
(c) *Sclerotinia sclerotiorum*, the cause of sclerotinia stem and pod rot (white mould) in lentil, chickpea and field pea.
(d) *Colletotrichum truncatum*, the cause of anthracnose in lentil.

All samples were tested for the applicable ascochyta blight pathogens and slightly fewer for *Colletotrichum truncatum, Botrytis* spp., or *S. sclerotiorum*. Because of very low levels of infection with most pathogens, mean % seed infection with specific pathogen(s) was generally not calculated for each Saskatchewan crop district [CD] (8). Means were too small for differences among CDs to be meaningful. The sole exception was for *Ascochyta* spp. on pea. For all host-pathogen combinations the percentages of samples free of infection province-wide were calculated. Seed samples were not classified according to cultivar or whether the crops had been treated with seed treatments or foliar fungicides. However, most lentil growers in Saskatchewan plant ascochyta-resistant cultivars. In addition, foliar fungicides, especially strobilurin products, are widely used by pulse crop growers.

RESULTS AND COMMENTS: The 2013 growing season in Saskatchewan was characterized in most areas by precipitation above average in May and June and below average from late July through September. Some south-central areas received late summer rainfall. Dry weather, except in the areas with late summer rainfall, and heat in all areas provided ideal conditions for harvest, which was completed early. The main disease problems reported on pulse crops were seedling blights and root rots in pea and lentil caused by *Aphanomyces euteiches* and *Fusarium* spp. (1). These problems would not be reflected in tests for seed-borne pathogens, but were responsible for high yield losses in individual fields in several areas. Despite these specific losses, average provincial yields of all three pulse crops were higher than in 2012 and sometimes substantially higher than the 10-year average (8).

During the period covered by this report 366 lentil, 372 pea and 62 chickpea seed samples were processed by the three companies. These totals were all smaller than the numbers reported for a similar time period in 2012 (7). The reduction was probably related to the highly favorable harvest conditions in 2013 and growers' awareness that seed-borne pathogens would be at low levels under such conditions.

This was borne out by the fact that the seed-borne pathogens of pulses, with the possible exception of *Ascochyta* spp. in pea, were at unprecedented low levels in the seed.

Pea –The percentage of *Ascochyta* spp.-free samples was 28%, higher than 19% reported for 2012 (7) or numbers in previous years. Mean % infection overall was 2.0%, only one third of the level of 6.1% reported for 2012 (7). The highest mean values were in CDs 3B-S, 5B, 6A, and 7B and the lowest in CDs 3A-S, 4B, 7B and 9A (Table 1). Thus there was no clear relationship of *Ascochyta* level with geographic position. The percentage of pathogen-free samples was 73% for *Botrytis* spp. and 95% for *Sclerotinia sclerotiorum*.

Lentil –The overall percentage of *Ascochyta*-free samples was 96%, similar to 2012 (7) and two previous years (5, 6). With the widespread use of *Ascochyta*-resistant cultivars and good crop management, ascochyta blight is not currently a significant factor in Saskatchewan (2). The percentages of *Botrytis*-free and of *Sclerotinia*-free samples were both 65% and there were no samples heavily infected with either pathogen. The few samples lightly infected with these two pathogens probably originated from fields with late-maturing green patches in low-lying areas where the pathogens could thrive in late season. The mean anthracnose level in seed samples was less than 0.1%, below even the low values reported over the past 11 years. Also 88% of the lentil samples were anthracnose-free, more than in any previous report in the 11-year period (3, 4).

Chickpea – Because of the very small area of chickpea production in southern Saskatchewan, relatively few seed samples are tested and comparisons of crop districts or annual levels are of limited value. In 2013 only about 60 samples of seed (mostly Kabuli chickpea) were tested at the three seed labs in the September to December time period. The proportions of disease-free seed samples were 60% for *Ascochyta rabiei*, 39% for *Botrytis* spp., and 75% for *Sclerotinia sclerotiorum*. Possibly seed infection with *Botrytis* and *Sclerotinia* occurred mostly in areas that received late season rainfall which delayed harvest.

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Table 1. Numbers of pea seed samples tested from September to mid-December, 2013 and levels of infection with *Ascochyta* spp. in relation to 20 Saskatchewan Crop Districts (CDs)

CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc
1A	6	2.6	**3A-S**	35	1.4	**5A**	11	1.8	**7B**	32	1.5
1B	5	0.2	**3B-N**	27	1.9	**5B**	9	7.2	**8A**	9	5.7
2A	6	1.3	**3B-S**	1	4.5	**6A**	20	4.8	**8B**	15	2.5
2B	34	0.4	**4A**	5	2.4	**6B**	44	2.2	**9A**	32	1.3
3A-N	6	0.9	**4B**	6	0.4	**7A**	28	1.4	**9B**	41	2.3
								All CDs		372	2.0

CROP: Soybean (*Glycine max* (L.) Merr.)
LOCATION: Southern Alberta

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TITLE: THE OCCURRENCE OF SOYBEAN ROOT ROT IN SOUTHERN ALBERTA, CANADA IN 2013

ABSTRACT: A survey was conducted in August 2013 in southern Alberta to determine the incidence and severity of root rot of soybean. A total of 28 fields were surveyed with 100 root samples collected from each field. Root rot occurred in all fields with severity increasing from south to north in the sampled area.

INTRODUCTION: Soybean (*Glycine max* (L.) Merr.) has great potential as an alternative cash crop to canola in southern Alberta farming systems. The potential profitability of soybean has been a driving force for its growth in Canadian agriculture (3); however, several crop production issues, including diseases, need to be addressed if sustainable, long-term production of soybean in Alberta is to be realized. One potentially threatening production issue is root rot caused by species of *Fusarium.* A comprehensive survey of soybean crops was conducted in August 2013 across southern Alberta to assess the cause(s) of root rot and their prevalence and severity.

METHODS: The survey was conducted when the soybean crops were at the pod set to early pod filling stages of growth. Root samples were collected from 28 fields at seven locations in southern Alberta (Table 1, Fig. 1). The samples were collected at five points along a W-shaped transect in each field. Twenty plants were dug out at each sampling point for a total of 100 root samples per field. Plants were also collected from low lying areas of the field where they were observed to be severely stunted or dead. The roots were gently shaken to remove excess soil, sealed in plastic bags, and placed on ice in cooler boxes to avoid spoilage. At the end of each day, the root samples were stored at 4°C to maintain freshness until subsequent sample processing and evaluation in the laboratory.

In the laboratory, the roots were gently washed under running water to remove soil. They were then rated visually for root rot severity on a scale of 0-4 as described by Chang et al. (1), where: 0 = normal root color (healthy root), 1 = 1-25% root discoloration, 2 = 26-50% root discoloration, 3 = 51-75% root discoloration, and 4 = 76-100% root discoloration. The root samples were also rated for nodulation on a scale of 0-4 with 0 = no nodules, 1 = 1-5 nodules, 2 = 6-10 nodules, 3 = 11-15 nodules, and 4 = >15 nodules per root system. The root samples were partially dehydrated to reduce moisture levels and enable storage at 4°C for future pathogen isolation.

RESULTS AND DISCUSSION: Root rot was observed in all of 28 fields sampled but disease severity varied (Table 1). These results are similar to observations in a 2012 survey (2). Low lying areas in the field where water gathered during storms tended to show severe plant stunting and often death (Fig. 2). Where soil was at field capacity diseased plants could usually be easily pulled from the ground due to severe root damage. Some plants showed stunting and yellowing of the bottom leaves, which were sacrificed as the root system became inadequate to sustain the plant. Others had become completely defoliated or desiccated after losing the entire root system to disease, particularly in low lying areas.

The lowest incidence of root rot (45%) was found in samples collected at Brooks, while the highest (100%) was recorded at Duchess (Table 1). Dry conditions at Brooks may have been less favorable for disease development. Generally, root rot severity increased from the south to the north in the sampled region. It was lowest at Taber (DS = 1.2) and highest at Lacombe (DS = 1.8). This is likely a result of the generally lower average temperatures to the north, which delayed crop emergence and provided the causal pathogen(s) more time to infect the plants. Stunted or completely dead plants had severe root damage and depressed nodulation. Work is underway to isolate and characterize fungal pathogens from the soybean root samples and to test the efficacy of fungicide seed treatments for their control.

White mold (*Sclerotinia sclerotiorum*) was also identified in 20 of the 28 surveyed fields. It was very severe in some crops, with noticeable wilting of the foliage. The high prevalence of white mold might reflect short canola (*Brassica napus* L.)-soybean rotations, since canola is also a host for *S. sclerotiorum*. Another disease, bacterial blight (*Pseudomonas savastanoi* pv. *glycinea* (Coerper) Gardan et al.), was noted in the experimental plots at CDC South, Brooks, but not in the commercial crops inspected.

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This survey was financially supported by the Government of Canada through the Agri-Flex Program and by the Manitoba Pulse Growers Association. We gratefully acknowledge Mr. Patrick Fabian from Fabian Seed Farms Inc., Tilley, AB, and Mr. Gordon Frank, an independent representative of Pioneer Hi-bred Seeds, Brooks, AB, for providing contact information for growers and information on field locations. We also acknowledge the support offered by technical staff from Alberta Agriculture and Rural Development (Crop Diversification Centre North and Crop Diversification Centre South in Edmonton and Brooks, respectively) without whose assistance this survey would not have been possible.

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Table 1. Root rot incidence of soybean crops in southern Alberta in 2013.

Location	No. of fields surveyed	Root rot incidence (%)		Root rot severity (0-4)		Root nodulation (0-4)	
		Range	Mean	Range	Mean	Range	Mean
Brooks	9	45-85	71.4	0.7-1.8	1.4	0.8-2.8	1.8
Duchess	3	47-100	67.0	1.0-3.4	2.0	1.7-2.9	2.3
Lacombe	2	73-77	75.0	1.7-1.9	1.8	2.1-2.2	2.1
Medicine Hat	6	51-92	69.0	0.5-3.0	1.6	1.1-2.7	1.7
Taber	2	66-69	67.7	1.1-1.3	1.2	2.3-2.4	2.4
Tilley	4	58-87	71.4	0.9-2.3	1.5	0.5-1.3	0.9
Vauxhall	2	69-71	70.3	1.2-1.6	1.4	1.6-1.7	1.7

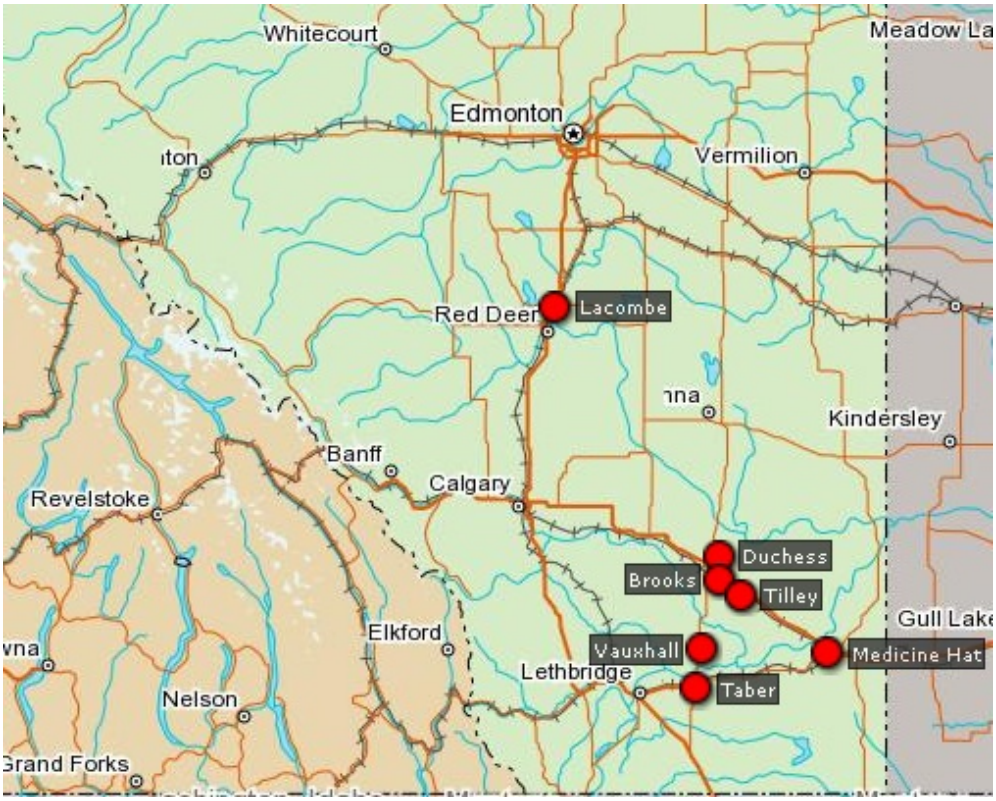

Figure 1. Sites surveyed for soybean root rot in southern Alberta, August 2013.

Figure 2. A low lying area in a field in Vauxhall (August 2013) with severe soybean root rot.

CROP: Soybean
LOCATION: Manitoba

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TITLE: SOYBEAN ROOT ROT IN MANITOBA IN 2012 AND 2013

ABSTRACT: In 2012 and 2013, 40 soybean crops were surveyed in Manitoba for root diseases and fusarium root rot was the most prevalent root disease. Root rot was severe in low-lying areas of some fields in both years, indicating that yield and quality may have been affected.

INTRODUCTION: Soybean production continues to increase with 354,000 ha (875,000 acres) and over 400,000 ha (one million acres) seeded in Manitoba in 2012 and 2013, respectively. This represents the sixth consecutive annual increase in soybean area in Manitoba. Limited information is available from Manitoba on possible disease risks to this crop, but root rot is a constraint in other areas of Canada where soybean production is established (Chang et al. 2013; OMAFRA, 2011).

METHODS: Soybean crops were surveyed for root diseases at 40 different locations in Manitoba in 2012 and 2013. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where soybean is commonly grown.

The surveys for root diseases were conducted during mid- (2012) to late- (2013) July when most plants were at the early flowering stage. At least ten plants were sampled by uprooting at each of three random sites in each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant). To confirm the visual disease identification, 15 symptomatic roots were collected per field (2012) or from a sub-sample of 10 fields (2013) for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 40 soybean crops surveyed in 2012 and 2013 were frozen for future PCR analysis of root rot pathogens.

RESULTS AND COMMENTS: In 2012, the majority of crops were either at or ahead of their expected stages of development due to an earlier than normal start to seeding because of minimal snow cover and higher than average late winter temperatures. A period of cold, wet weather followed in May, and excess moisture prevailed into early July in the regions where most soybean is grown. Root rot was evident in many crops, both early on, and later in the season when soils dried out (MAFRD Crop Report, 2012). In 2013 the cropping season in Manitoba started with excessive spring moisture in some areas and cool conditions. Spring seeding was later than average for most crops (MAFRD Crop Report, 2013). Crop growth continued to be suppressed by lower temperatures and frequent rainfall in areas of the province, which favoured the prevalence and severity of some diseases. Later in the summer, warmer weather with frequent rainfall prevailed. In some soybean crops, maturity was a concern and harvest did not start until October.

Root rot was observed in all soybean crops surveyed in 2012 and 2013. Two diseases were identified (Table 1). In both years the microorganisms most frequently isolated from roots of infected plants were *Fusarium* spp., followed by *Rhizoctonia solani* (Table 1). In 2012, crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 0.6 to 5.7 with a mean of 2.1. Similarly in 2013,

root rot ratings for crops in which *Fusarium* spp. were isolated ranged from 0.3 to 4.9 with a mean severity of 2.2. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in one crop surveyed in 2012, with a severity rating of 1.7, and in two crops surveyed in 2013, with a severity range of 1.2-2.6 and mean of 1.9.

In both years, the highest disease severities were observed in fields where *Fusarium* spp. were isolated from infected roots. The lower recovery rate of *R. solani* when both *Fusarium* spp. and *R. solani* were isolated suggests that *R. solani* may not be as important a root rot pathogen in soybean as are *Fusarium* spp. in Manitoba, compared with other regions in western Canada (Chang et al. 2013).

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Table 1. Prevalence and severity of root diseases in 40 crops and 10 crops of soybean in Manitoba in 2012 and 2013, respectively.

Year	Disease	No. crops affected	Disease severity (0-9)[1]	
			Mean	Range
2012	Fusarium root rot	40	2.1	0.6-5.7
	Rhizoctonia root rot	1	1.7	1.7
2013	Fusarium root rot	10	2.2	0.3-4.9
	Rhizoctonia root rot	2	1.9	1.2-2.6

[1]All diseases were rated on a scale of 0 (no disease) to 9 (death of plant). Mean values are based only on crops in which the disease was observed.

CROP: Sunflower
LOCATION: Manitoba

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TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2013

ABSTRACT: A survey of 35 sunflower crops in Manitoba in 2013 revealed that verticillium wilt was the most prevalent disease in 76% of the crops, followed by rust in 55%, sclerotinia wilt/basal stem rot in 36%, sclerotinia head rot in 33%, and downy mildew in 24%. Disease severity ranged from low to moderate with no severe epidemics.

METHODS: A total of 35 sunflower crops were surveyed in 2013 in Manitoba. Eight crops were surveyed in the 2nd week of July especially for downy mildew, 12 crops in the second half of August, and 15 crops in the first half of September. The crops were surveyed along pre-planned routes in the major areas of sunflower production in southern Manitoba. Each crop was sampled by two persons walking ~100 m in opposite directions to each other following an "M" pattern in the field. Diseases were identified by symptoms and the percent incidences of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem diseases (*Phoma* spp. and *Phomopsis* spp.) were estimated as percent leaf or stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1). Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, 9 samples of sunflower plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives by agricultural representatives and growers.

RESULTS AND COMMENTS: All sunflower crops surveyed in 2013 had excellent to good stands, but only 82% had good vigour, and the rest had fair to poor vigor. Eighty-eight percent of the sunflower crops were maturing early, and the remaining 12% late to very late (Table 1). The crops surveyed were split 50%:50% between confectionery and oilseed hybrids, continuing a sharp increase in the oilseed acreage in 2012-2013 in comparison with previous years (1, 2, 3). The 2013 growing season started with normal soil moisture and temperature conditions, and this contributed to an increase in area seeded to sunflower in Manitoba (~35,000 ha in 2013 in comparison with 15,000 ha in 2011, according to Statistics Canada). Growing conditions were relatively normal throughout the whole growing season with no frost until early October, which resulted in low disease incidence and severity in 2013 compared with previous years (1, 2, 3). These normal conditions over the period July-September provided a long season and good yields in most sunflower crops.

Sclerotinia wilt/basal stem rot was present in 36% of the crops surveyed in 2013, mostly at trace levels but ranging up to a disease index of 5% in a few crops (Table 1). Sclerotinia head rot and mid-stem infection, caused by ascospore infections, were observed at trace levels in most of the 33% of infested crops but with a disease index ≥5% in only a few crops surveyed in September. The prevalence and incidence of head rot in 2013 were at a record low compared with the 10 previous years (1, 2, 3, 4).

Rust was present in 55% of the crops surveyed, with severity ranging from trace to 5% leaf area affected (Table 1). Rust infections started relatively late in 2013 and did not develop rapidly in most of the crops surveyed. Preliminary analysis of the rust isolates collected indicates the prevalence of races 776 and 736 of *P. helianthi*, which are virulent on most commercial sunflower hybrids. Rust incidence and severity

in 2013 and 2012 were also at a record low in comparison with previous years (1, 2, 3), probably due to late onset of infection and the normal temperatures and relatively dry weather from July to September.

Verticillium wilt was present in 76% of the crops surveyed with traces to 5% severity in the oilseed sunflower hybrids, and 10-40% severity in the confection sunflower hybrids (Table 1). The incidence of verticillium wilt was higher in 2013 than in previous years (1, 2, 3).

Downy mildew was at a record low in 2013 and observed in only 24% of crops with incidence ranging from trace to 5% (Table 1). Preliminary analysis of isolates collected indicates the predominance of races 730, 732, and 700. Eighty-three percent of the downy mildew isolates collected in 2013 are either insensitive or partially insensitive to metalaxyl seed treatment. Downy mildew was less prevalent in 2013 and 2012 than in previous years due perhaps to normal soil moisture from the seedling stage through the rest of the growing season (1, 2, 3).

Traces to 5% leaf area infected by *Septoria helianthi* were observed in 63% of the crops as well as some infection by *Alternaria* spp. in a few crops (Table 1). The disease index values indicate similar severity and prevalence to previous years (1, 2, 3). Traces to 1% of stem lesions caused by *Phoma* and *Phomopsis* spp. were present in 18% of the crops in 2013, similar to 2012 but considerably fewer than those observed in previous years (1, 2, 3, 4) .

Traces to 5% infestation with the sunflower beetle (*Zygogramma exclamationis*) were observed in a few crops. Infestations at trace to 1% levels with sunflower midge (*Contarinia schulzi*) were encountered in 27% of the crops. Traces of infestation with grasshoppers were observed in 24% of the crops.

Of nine samples received by the MAFRI Crop Diagnostic Centre in 2013, two were identified as sclerotinia stem rot, one as verticillium wilt, one with insect infestation, one with environmental injury, and four with herbicide injury.

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The technical assistance of Tricia Cabernel, Maurice Penner, and Suzanne Enns is gratefully acknowledged.

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Table 1. Prevalence and index of diseases in 35 crops of sunflower in Manitoba in 2013.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt/basal stalk rot	12	36%	1.0	T – 1
Sclerotinia head rot/stem rot	11	33%	1.2	T - 2
Verticillium wilt	25	76%	1.9	T – 4
Downy mildew	8	24%	1.0	T – 1
Rust	18	55%	1.6	T – 4
Leaf spots (*Septoria* & *Alternaria*)	17	52%	1.1	T – 2
Stem lesions (*Phoma* & *Phomopsis*)	6	18%	1.2	T - 2
Lateness[2]	4	12%	1.9	1 – 3
Poor Stand	0	0%	1	1
Poor Vigour	6	18%	1.9	1 – 4

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

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

Vegetables / Légumes

CROP: Carrot
LOCATION: Ontario

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TITLE: INCIDENCE OF FUSARIUM ROOT ROT OF CARROT IN CENTRAL AND SOUTHWESTERN ONTARIO, IN 2013

ABSTRACT: A survey of 20 commercial carrot fields in Ontario was conducted to determine the presence of carrot root rot caused by *Fusarium* spp. One hundred carrots were randomly collected from each field and assessed for fusarium root rot. Of the surveyed fields, 5% had fusarium root rot.

INTRODUCTION AND METHODS: Fusarium root rot and crown rot caused by *Fusarium* species was first identified on carrot in the field in Ontario in 2008. The disease affects the crown and the root of carrots. Isolates from infected carrots were identified as *F. coeruleum* Lib. ex Sacc. This disease may be an emerging issue for the carrot industry, since it had not previously been identified as a field disease. Overall, the extent of this problem across Ontario is unknown. A survey was conducted from August 6 to October 23, 2013 to determine the presence of *Fusarium* spp. associated with carrot root rot in major carrot-growing regions in central and southwestern Ontario. A total of 20 commercial carrot fields were surveyed in Chatham-Kent (3 fields), Essex (2 fields), Middlesex (2 fields), Norfolk (2 fields), Simcoe (5 fields) and York (6 fields) Regions/Counties of Ontario. One hundred carrots were randomly collected from five sites (20 per site) within each of the 20 commercial carrot fields surveyed. Tops were removed and the carrot roots were immediately placed into a cold storage facility (0^{o}C; 95% RH) for 2-7 weeks before evaluation. In October the carrot roots were washed and assessed visually for fusarium root rot symptoms. Tissue sub-samples from carrots with fusarium root rot symptoms were surface sterilized and plated on potato dextrose agar or 1.5% water agar amended with streptomycin sulfate. The plates were incubated in the dark at room temperature for 10 days. After 10 days morphological characteristics of colonies growing in the plates were examined by light microscopy.

RESULTS AND COMMENTS: Fusarium root rot was observed in only 5% of the 20 surveyed fields (Table 1). A crop with disease was located in York Region with a fusarium root rot incidence of 2%. Fungal growth from the samples plated on growth media was confirmed as *Fusarium* spp. Further examination will be conducted to identify the species of *Fusarium* isolated. In a 2012 survey, fusarium root rot of carrot was observed in Simcoe County and York Region in Ontario (Tesfaendrias et al., 2013). Although not part of this survey, a 60 – 100% incidence of fusarium root rot was observed in a field trial in Simcoe County (personal observation), which indicates the prevalence of the disease in the study area.

ACKNOWLEDGEMENTS:
Investment in this project has been provided by Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program (CAAP). In Ontario, CAAP is delivered by the Agricultural Adaptation Council and is a collaborative project with Bradford Cooperative Storage Ltd.

REFERENCE:
M.T. Tesfaendrias, M.I. Paibomesai, M.J. Celetti, and M.R. McDonald. Fusarium root rot of carrot in central and southwestern Ontario in 2012. Can. Plant Dis. Surv. 93:177. (www.phytopath.ca/cpds.shtml)

Table 1. Fusarium root rot incidence in commercial carrot fields in the main carrot-growing regions of Ontario in 2013.

County/Region	Number of fields surveyed	Number of fields with fusarium root rot	Mean percent of carrots with fusarium root rot
Chatham-Kent	3	0	0.0
Essex	2	0	0.0
Middlesex	2	0	0.0
Norfolk	2	0	0.0
Simcoe	5	0	0.0
York	6	1	0.3

CROP: Carrot
LOCATION: Bradford/Holland Marsh, Ontario

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TITLE: DISEASES AND PHYSIOLOGICAL DISORDERS OF CARROT IN THE HOLLAND/BRADFORD MARSH, ONTARIO IN 2012

ABSTRACT: An IPM program around the Holland/Bradford marsh, Ontario, included a survey of carrot crops for root diseases and physiological damage. Plants were randomly collected from 28 farms, tops removed and the roots kept in cold storage. Carrots were washed and evaluated visually. Higher incidences of crater rot, aster yellows and sclerotinia rot occurred than in 2011 due to conducive weather. All surveyed crops had cavity spot and 96% of the crops had pythium root dieback.

INTRODUCTION AND METHODS: A survey of carrots in the Bradford/Holland Marsh, Ontario for the presence of infectious root diseases and physiological damage was conducted in late August and September 2012 when the harvest seasons started for early and late carrots, respectively. The survey was conducted as part of the Muck Crops Research Station, University of Guelph, Integrated Pest Management program to identify and quantify carrot root damage caused by pathogens, environmental conditions and insect pests. One hundred carrots were randomly collected from five sites (20 per site) of each of the 28 commercial carrot farms surveyed. Tops were removed and the carrot roots were immediately placed into a cold storage facility (0^{o}C; 95% relative humidity) for 4-10 weeks before evaluation. The roots were washed and assessed for diseases in early November 2012. Diseases and physiological damage were identified by visual symptoms.

RESULTS AND COMMENTS: Weather conditions in the 2012 growing season were conducive for most pathogens including *Pythium* spp., *Sclerotinia sclerotiorum* and *Rhizoctonia* spp*.* Total monthly rainfall was below the previous 10-year average for May and June, average for September, and above average for July and likely resulted in excessive soil moisture. This excessive soil moisture especially in July in turn created ideal conditions for soil borne pathogens, particularly *Pythium and Rhizoctonia* spp., resulting in a high incidence of cavity spot, pythium root dieback and crater rot. All of the surveyed fields had cavity spot (*Pythium* spp.) with incidence ranging from 9 to 34%. Pythium root dieback (*Pythium* spp.) occurred in 96% of the fields with incidences of 1-13%.

Crater rot (*Rhizoctonia carotae* Rader) was found in 15 of the 28 carrot crops surveyed, which was more than was found in 2011, when only 3 crops (46%) were found with crater rot (Tesfaendrias and McDonald 2012).

In 2012, high aster leafhopper (*Macrosteles fascifrons*) infestations were observed, which resulted in a higher incidence of aster yellows compared to the 2010 and 2011 growing seasons (Tesfaendrias and McDonald, 2011, 2012). In the surveyed fields, 64% of the crops had aster yellows.

Thirteen (47%) of the crops sampled had crown gall (*Agrobacterium tumefaciens*) with disease incidence ranging from 1 to 16%. The weather conditions were ideal for development of sclerotinia rot (*Sclerotinia sclerotiorum*) and this disease was observed in carrot fields around the Holland/Bradford Marsh during the growing season. It was found in 5 sampled fields. Fusarium rot (*Fusarium* spp.) was found on carrots in 3 fields with an incidence of 1-3%.

Carrot roots from 96% of the fields surveyed showed splitting (growth cracks) and forking with mean incidences of 4.1 and 3.9 % respectively. These results are similar to those reported in the 2011 growing season (Tesfaendrias and McDonald, 2012). Increased incidence of splitting and forking may in turn affect marketable yield of fresh market types of carrot.

ACKNOWLEDGEMENTS:
This survey was funded by the Holland Marsh Growers' Association in cooperation with the Agricultural Adaptation Council, the Bradford Cooperative storage Ltd., chemical companies and participating growers. We gratefully acknowledge the participation of carrot growers around the Holland/Bradford Marsh and for allowing us to collect carrot samples for this survey.

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Table 1. Disease incidence on carrot samples collected from commercial fields in the Bradford/Holland Marsh, Ontario in 2012.

Disease	Mean incidence (%) (n = 28)	Fields affected
Cavity spot	19.2	28
Pythium root dieback	3.4	27
Crown gall	2.1	13
Crater rot	1.0	15
Aster yellows	0.9	18
Sclerotinia rot	0.2	5
Fusarium rot	0.2	3
Splitting (Growth cracks)	4.1	27
Forking	3.9	27

CROP: Celery
LOCATION: Ontario

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TITLE: INCIDENCE OF LEAF CURL (ANTHRACNOSE) OF CELERY IN CENTRAL AND SOUTHWESTERN ONTARIO IN 2013

ABSTRACT: A survey of 12 commercial celery fields in Ontario was conducted to determine the presence of celery leaf curl (anthracnose) caused by *Colletotrichum* spp. Two celery plants were collected from each field and assessed for leaf curl. Celery leaf curl was found in 75% of the surveyed fields.

INTRODUCTION AND METHODS: Celery leaf curl caused by *Colletotrichum acutatum* was observed in a few celery (*Apium graveolens* var.*dulce***)** fields in Ontario during 2012. The disease had also been observed for the first time in Michigan and Pennsylvania during 2010 and 2011. In Australia, this disease has caused significant crop losses in celery. Infected celery plants are unmarketable due to leaf malformation and lesion development on the stalks (petioles). Stalks of infected plants often become twisted and may develop reddish to light brown lesions on either the outside or inside. Brown lesions often appear in the crown and at the base of the stalks of infected plants. This disease may be an emerging issue for the celery industry. Overall, the extent of the problem across Ontario is unknown.

A survey was conducted from July 26 to September 5, 2013 to determine the presence of *Colletotrichum* spp. associated with celery leaf curl in central and southwestern Ontario. A total of 12 commercial celery fields in Hamilton-Wentworth, Lambton, Simcoe and York regions/counties of Ontario were surveyed. Two whole celery plants with celery leaf curl symptoms were collected from each of the surveyed fields. To isolate *Colletotrichum* from the celery samples, pieces of plant tissue were surface sterilized in a series of 70% ethanol for 30 sec, 2 min in 5% NaOCl and rinsed three times in distilled sterile water, and plated onto potato dextrose agar (PDA) amended with streptomycin sulphate. Conidial spores that were formed on the colonies that grew out of the lesions incubated on PDA were examined morphologically with a light microscope. During collection, the percent of crop infected with celery leaf curl was estimated. For 7 of the 12 fields, one of the two plants collected per field was submitted to the Pest Diagnostic Clinic, Laboratory Services Division, University of Guelph, Guelph, ON and the other was submitted to the diagnostic lab at the Muck Crops Research Station, University of Guelph (Kettleby, ON). For the other 5 fields, the two samples were submitted to either the the Pest Diagnostic Clinic, or the Muck Crops Research Station.

RESULTS AND COMMENTS: *Colletotrichum* sp. was isolated from symptomatic celery plants found in 75% of the fields surveyed. Celery plants infected with a *Colletotrichum* sp. were found in all growing regions sampled but not in every field that was sampled. *Colletotrichum* sp. was isolated from 57% of the celery plants sampled. The incidence of celery leaf curl was very low in each field surveyed. Ten fields had less than 1% infected plants and two fields had less than 5% infected plants.

ACKNOWLEDGEMENTS:
We would like to thank the Fresh Vegetable Growers of Ontario for financial support and all growers that participated in the survey.

REFERENCE:
M.T. Tesfaendrias, M. Paibomesai, M.J. Celetti, and M.R. McDonald. Fusarium root rot of carrot in central and southwestern Ontario in 2012. Can. Plant Dis. Surv. 93:177. (www.phytopath.ca/cpds.shtml)

CROP: Cucumber
LOCATION: Ontario

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TITLE: AN INVESTIGATION INTO THE EXTENT OF BELLY ROT OF CUCUMBER IN FIELDS IN ONTARIO, 2013

ABSTRACT: Infected cucumbers were collected from three major graders of processing cucumbers in Norfolk County (Underhill), Elgin County (Vienna) and Chatham-Kent County and from two fields, one in Chatham-Kent and another in Norfolk in 2013, to determine the prevalence of belly rot (*Rhizoctonia solani* Kühn) in Ontario. *Rhizoctonia solani* was present in all sampled areas with Norfolk having 18, Elgin 48 and Chatham-Kent 16 positive reports.

INTRODUCTION AND METHODS: Belly rot of cucumber is a common and serious fruit rot of cucumber (*Cucumis sativa* L.) caused by the soil inhabiting fungus *Rhizoctonia solani* Kühn. The pathogen survives in soil and infects crop debris producing mycelia and sclerotia. Belly rot develops where the fruit come in contact with the soil, or where the blossom-end rests on the soil surface. Characteristic symptoms include the development of yellowish brown or tan to brown superficial lesions on young fruit and these lesions expand into sunken irregular spots on the underside or belly. In addition to the lesions on young fruit, large water-soaked decayed areas may develop on mature fruit, (Sittery and Keinath, 1998). Warm conditions, high humidity, and excessive moisture favor infection and disease development. Belly rot is difficult to control with standard foliar fungicides. Protective sprays are unlikely to reach the lower surface of the fruit, where infections typically occur (Uchneat and Wehner, 1998). In Ontario the disease was found in some southwestern cucumber fields in 2011 and 2012 (OMAFRA, 2012).

Sampling, pathogen isolation and identification: Infected cucumbers were collected from three major graders of processing cucumbers located in Norfolk County, (Underhill grading station), Elgin County (Vienna grading station) and Chatham-Kent County, (Thames Van Farms (TVF)-Chatham grading station). Samples were collected on July 30 and 31 and August 14 and 15, 2013. Two fields, one in Chatham- Kent (near TVF station) and another in Norfolk (near the Underhill station) were also scouted on Aug. 14 and 15, respectively for belly rot, and fruit samples were collected. In the grading stations, infected cucumbers were collected from grading belts and the cucumber loads being graded were identified by number and grower.

A survey form to investigate the agronomic practices and environmental conditions that may increase the incidence of belly rot was prepared. Forms in pre-paid envelopes were given to the grading station managers for distribution to growers. The survey forms were allocated based on the number of growers serviced by each grading station. Underhill received 17, TVF-Chatham 33, and Vienna 39 forms.

Infected fruits were washed, dried at room temperature and pathogens were recovered from lesion margins by excising small sections of tissue (5 x 5 mm). Plant pieces were mixed and four were placed onto each of the following isolation media: 1.6% water agar (WA); 1.6% water agar amended with streptomycin sulphate (WS); 1.6% water agar amended with ampicillin and rifampicin (WAR); BARP- (25 ppm of benomyl, 100 ppm of ampicillin, 30 ppm of rifampicin, and 100 ppm of pentachloronitrobenzene) - amended V8 juice agar (840 ml of distilled water, 163 ml of unclarified V8 juice, 3 g of $CaCO_3$, and 12 g of agar); and potato dextrose agar amended with streptomycin sulphate (SPDA). Plates were incubated at 25°C for 5 to 7 days under laboratory lighting. The pathogens growing from incubated plant pieces were identified based on microscopic examination.

RESULTS AND COMMENTS: A total of 674 cucumbers were collected, 299 from Underhill, 248 from Vienna and 127 from TVF- Chatham grading stations. From these 258 cucumbers (86 Underhill, 128 Vienna, and 44 Chatham) were processed and isolations made. *Rhizoctonia solani* was found on 82

plates. Other organisms isolated were *Fusarium* spp. *Pythium* spp., and parasitic nematodes (Table 1). Most samples were collected from the Vienna grading station and the majority of samples positive for belly rot were also from this station. Fewer samples were collected from the TVF Chatham grading station in part because in this area some growers harvest cucumbers mechanically and grading was to be done after the end of this project. More positive results for belly rot were obtained from cucumbers collected August 14 and 15. These sampling days were after a period of cool wet weather, in contrast with most days in July that were very hot and dry.

These results indicate that belly rot has spread to many more fields in the region than previously reported (OMAFRA, 2012), which is concerning. Belly rot is difficult to control with standard foliar fungicides, as protective sprays are unlikely to reach the lower surface of the fruit, where infections typically occur. There are no cultivars resistant to the disease and because *R. solani* is a soil-borne pathogen with a wide host range, rotations are not effective control measures. Further research on management of belly rot of cucumber is warranted.

ACKNOWLEDGEMENTS:
Financial support for this work was provided by Horticulture Crops Ontario. We thank personnel at the cucumber grading stations and all participant growers.

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Table 1: Cucumber belly rot samples and pathogen isolation and identification – Underhill, Vienna, and Thames Van Farms (TVF) grading stations 30 - 31 July and 14 -15 August 2013.

Total Cucumbers Collected		Total Cucumbers Processed	Positive Plates *		Other Organisms Isolated
Underhill Grading Station					
31 July	14 Aug	31 July and 14 Aug	31 July	14 Aug	*Fusarium* spp. Parasitic nematodes
103	196		1	17	
Total **299**		**86**	**18**		
Vienna Grading Station					
31 July	13 Aug	31 July and 13 Aug	31 July	13 Aug	Parasitic nematodes *Fusarium* spp. *Pythium* spp.
59	189		8	40	
Total **248**		**12**	**48**		
TVF Grading Station					
30 July	15 Aug	30 July and 15 Aug	30 July	15 Aug	*Pythium* spp. *Fusarium* spp. Parasitic nematodes
27	100	**44**	7	9	
Total **127**			**16**		

*Positive Plates: *Rhizoctonia solani* grew and was identified from at least one plant piece plated onto one of WA, WS, WAR, SPDA and BARB isolation media

CROP / CULTURE: Garlic (*Allium sativum*)
LOCATION / RÉGION: Alberta

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TITLE / TITRE: DISEASES OF GARLIC IN ALBERTA IN 2013

ABSTRACT: Garlic diseases in Alberta were reported to be much more common in 2013 than in previous years. Samples were collected from five garlic fields in central and southern Alberta and symptoms of disease and signs of pathogens were evaluated. Three fungal pathogens were confirmed: *Fusarium oxysporum, Sclerotium cepivorum* and *Embellisia allii.* Tests for aster yellows phytoplasma revealed it was present in all samples. Nematodes were abundant in two fields, but the species were not identified.

INTRODUCTION AND METHODS: Alberta has very few garlic production areas with the majority of plantings less than 1 ha and supporting local fresh market consumption. However, where garlic is grown, it often represents a significant income to the producer. Diseases such as fusarium basal plate rot (*Fusarium oxysporum*), white rot (*Sclerotium cepivorum*), and embellisia skin blotch (*Embellisia allii*) have been observed in Alberta plantings in previous years (2). For the present survey garlic samples, each consisting of 5 to 10 bulbs, were contributed by growers or collected by researchers from five fields in Alberta in June and July, 2013. The samples were inspected for disease symptoms. Virtually all showed above-ground yellowing and were often stunted or unthrifty (Fig. 1). Damage to the bulb or basal plate (Fig. 1) was observed in many. Symptomatic plant tissues were subsequently observed with a binocular dissecting microscope at 80X for signs of fungi. When present, fungi were scraped from the host tissues with a sterile scalpel and observed with a phase contrast microscope at 400X. Identifications of plant pathogenic fungi were made based on morphology of spores and sclerotia.

RESULTS AND DISCUSSION: Thirty samples from five growers representing five counties across central and southern Alberta (Fig. 2) were analysed. One of the cultivars encountered was 'Russian Purple' (one location) but the remainder were unknown. Three fungal pathogens on garlic in Alberta were confirmed in 2013; *Fusarium* sp.*, S. cepivorum* and *E. allii* (Table 1). Fusarium basal plate rot is common on both onion and garlic in Alberta (2) and was found at each of the five sample locations. However, embellisia skin blotch, which had not been reported on garlic in Alberta before 2012, was also common and consistently isolated from symptomatic tissues at all five sites. *Embellisia allii* normally causes a post-harvest skin blotch, but was so common within damaged bulbs that it appeared to be an aggressive pathogen inducing significant bulb and basal plate rot symptoms. Additional work is required to confirm this. The finding of white rot is of concern as *S. cepivorum* is a regulated pest in Alberta. Garlic diseases such as stemphylium leaf blight and stem and bulb nematode have recently been reported in Ontario (3, 5). However we found no evidence of stemphylium leaf blight in Alberta, and were unable to perform nematode isolations or identifications to determine if plant-parasitic nematode species are present.

The above ground symptoms were not characteristic of those expected for embellisia skin blotch or fusarium rot, so samples were tested for the presence of aster yellows phytoplasma, which was common on many crops across Canada in 2012, and may have been carried over to 2013 on infected garlic seed, bulbs and transplants. A nested PCR test performed on DNA isolated from above-ground garlic tissues revealed the presence of aster yellows phytoplasma at all survey locations. An additional area for follow-up in 2014 will be to test garlic samples for virus infections. For example, Onion yellow dwarf virus, Leek yellow stripe virus, and Garlic common latent virus, which have become more common in the midwestern

and Pacific Northwest USA (1,4,6,7), could also cause above-ground yellowing symptoms, not typical of embellisia skin blotch and fusarium basal plate rot.

ACKNOWLEDGEMENTS:
We would like to thank Alberta garlic producers for their assistance with the survey. The support provided by Alberta Agriculture and Rural Development is gratefully acknowledged.

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Table 1. Occurrence of pathogens on symptomatic garlic plants from five locations in Alberta in 2013.

Location	County or municipality	Number of samples	Fungi detected	Nematodes observed	Aster yellows
1	Newell	10	*Embellisia allii* *Fusarium* sp. *Sclerotium cepivorum*	No	Positive
2	Stettler	5	*Embellisia allii* *Fusarium* sp.	No	Not tested
3	Paintearth	5	*Embellisia allii* *Fusarium* sp.	No	Positive
4	Lethbridge	5	*Embellisia allii* *Fusarium* sp.	Yes	Positive
5	Cardston	5	*Embellisia allii* *Fusarium* sp.	Yes	Positive

Figure 1. Above-ground yellowing of garlic samples (left) and basal plate damage (right).

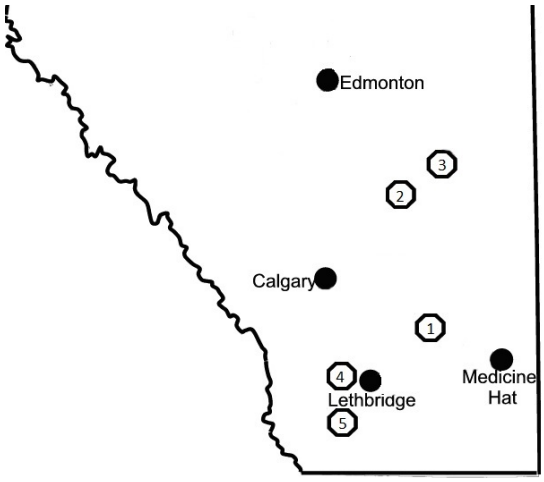

Figure 2. Garlic sampling locations in Alberta in 2013

CROP: Onion
LOCATION: Ontario

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TITLE: INCIDENCE OF STEMPHYLIUM LEAF BLIGHT, PURPLE BLOTCH AND ANTHRACNOSE ON ONION IN CENTRAL AND SOUTHWESTERN ONTARIO, 2013

ABSTRACT: Nineteen commercial onion fields in southwest and central Ontario were assessed in 2013 to determine the severity of stemphylium leaf blight, purple blotch and anthracnose. Twenty five plants from each field were assessed for disease symptoms and five samples with symptoms were collected to confirm the presence of pathogens. All crops assessed had stemphylium leaf blight, 47% had purple blotch, 16% had anthracnose and 95% had both stemphylium leaf blight and purple blotch.

INTRODUCTION AND METHODS: Stemphylium leaf blight is a foliar disease of onion (*Allium cepa* L.) and garlic (*Allium sativum*) caused by the fungus *Stemphylium vesicarium* (Wallr.). The disease has been observed in onion fields in Ontario since 2008 (Tesfaendrias and McDonald, 2011). Symptoms start as small yellow to tan, water-soaked lesions that develop into elongated spots which turn dark olive brown to black when spores develop. Leaves may be completely blighted as the lesions coalesce. The symptoms of stemphylium leaf blight can be confused with purple blotch, which is caused by *Alternaria porri* (Ell.) (Miller and Lacy, 2008). Although both stemphylium leaf blight and purple blotch are managed similarly, it has been reported that stemphylium leaf blight is more challenging to manage than purple blotch (Hausbeck et al. 2010).

Leaf and neck anthracnose which is caused by *Colletotrichum* sp. is a new disease of onions in Ontario. Symptoms of anthracnose include oval lesions, each with a salmon-coloured center and bleached overall appearance (Rodriguez-Salamanca et al., 2012).

A survey of foliar diseases of onion was conducted in the main onion producing areas in Ontario from July 20 to August 23, 2013. A total 19 commercial dry bulb onion fields in the counties or regions of Chatham-Kent (1 field), Lambton (2 fields), Simcoe (6 fields), York (8 fields), Niagara (1 field) and Waterloo (1 field) across southwest and central Ontario were assessed for stemphylium leaf blight, purple blotch and anthracnose. The fields were traversed in a diamond shape pattern starting at least 10 m in from the edge with 5 sampling points in each field. Five randomly selected onions were pulled at each of the five points and visually assessed for the presence of the diseases. Disease severity was scored as the percent of the leaf area diseased by each of the diseases. Following the survey, a representative tissue sub-sample of diseased plants was collected at each location and cultured in the laboratory to isolate and identify the pathogen.

Some diseased leaves were put in a moist chamber for 48 hours at room temperature to induce fungal sporulation and examine the spores by light microscopy. In other cases lesions were surface sterilized with 1.2% NaOCl for 2 min. prior to placing on potato dextrose agar (PDA) or Synthetischer Nährstoffarmer Agar (SNA) at either the Muck Crops Research Station, University of Guelph (King City, ON) or at the Pest Diagnostic Clinic of Laboratory Services Division, University of Guelph (Guelph, ON). Conidia that formed on colonies that grew out of the lesions incubated on PDA or SNA were examined and identified.

RESULTS AND COMMENTS: All of the three diseases, stemphylium leaf blight, purple blotch and anthracnose were detected in this survey (Table 1). Stemphylium leaf blight symptoms were observed

and confirmed in all of the onion fields (100%) assessed. Purple blotch symptoms were observed in 47% of the fields. Ninety five percent of the fields and 36.6% of the plants assessed were observed to have visual symptoms of both stemphylium leaf blight and purple blotch. Anthracnose was confirmed in 16% of the fields surveyed. Anthracnose was found for the first time in the surveyed fields, but had been reported on onion in the Holland/Bradford Marsh, Ontario in 2012 (Tesfaendrias and McDonald, 2013). The mean percent leaf areas with symptoms of stemphylium leaf blight and purple blotch across all fields sampled were 9.3% and 2.1 %, respectively.

This is the second survey in Ontario to assess the occurrence of stemphylium leaf blight and other new foliar diseases in onion fields. Given its occurrence across the major onion growing regions, further research on management of stemphylium leaf blight is warranted. The occurrence of anthracnose in onion fields is also a concern as the disease is new to the region and growers should regularly monitor their fields for the presence of this disease. Anthracnose has also been reported in onion fields in Michigan (Rodriguez-Salamanca et al., 2012).

ACKNOWLEDGEMENTS:
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Table 1. Percent fields with symptoms and mean % leaf area with symptoms of stemphylium leaf blight, purple blotch and anthracnose assessed in commercial onion fields in central and south western Ontario, 2013.

County/ Region	Mean % fields with symptoms (n = 19)			Mean % disease incidence (n = 25 plants/field)				Mean % leaf area with symptoms (n = 25 plants/field)	
	SLB	PB	AN	SLB	PB	Both SLB and PB	AN	SLB	PB
Simcoe	100.0	50.0	25.0	41.3	8.0	50.7	0.7	9.9	3.2
York	100.0	50.0	16.7	49.0	6.0	41.5	1.7	7.9	2.2
Chatham-Kent	100.0	0.0	0.0	92.0	0.0	8.0	0.0	25.5	0.4
Niagara	100.0	100.0	0.0	40.0	8.0	0.0	0.0	2.2	0.4
Lambton	100.0	50.0	0.0	72.0	2.0	12.0	0.0	9.1	0.8
Waterloo	100.0	0.0	0.0	68.0	0.0	28.0	0.0	7.8	0.6

SLB = stemphylium leaf blight, PB = purple blotch. AN = anthracnose

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

CROP: Apple
LOCATION: Ontario

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TITLE: GLOMERELLA LEAF BLOTCH AND BITTER ROT IN ONTARIO APPLE ORCHARDS

ABSTRACT: *Colletotrichum* spp. were isolated from 13 and 11% of leaf and fruit samples respectively (24% of total diseased apple tissue) collected from 20 apple orchards in Ontario in 2013. The DNA sequence of the ITS region of three *Colletotrichum* isolates matched the sequence of *Colletotrichum acutatum* on the GenBank database. The pathogen(s) was isolated from diseased tissue collected from 4 out of 5 apple districts surveyed. Two districts had the highest disease severity with both fruit and leaves showing symptoms characteristic of both bitter rot and glomerella leaf blotch. The black rot pathogen, *Botrysosphaera obtusa* was isolated from 15% of diseased fruit samples collected. Other fungi isolated from diseased tissue included *Alternaria* spp. (39%), *Phomopsis* spp. (2%), and *Phoma* spp. (7%).

INTRODUCTION AND METHODS: In recent years, unusual spots and blotches on apple leaves and fruit have been observed during warm weather in Ontario apple orchards. Similar observations have been reported from researchers in West Virginia and New York (personal communication). Preliminary results have determined the spots on leaves and fruit to be caused by *Colletotrichum* spp. Both glomerella leaf blotch and bitter rot in apples are caused by *Glomerella cingulata* (*Colletotrichum gloeosporioides*) or *G. acutata* (*C. acutatum*) (1, 2). These diseases tend to be more common in warmer regions such as the southern US and Brazil (1, 3). Currently there is minimal information available on the distribution, biology or appropriate control strategies for these diseases in Ontario.

METHODS: A total of 20 orchards from the 5 apple-growing districts in Ontario (Fig.1) were selected based on previous reports of suspected disease. From these orchards, 28 leaf samples with symptoms resembling glomerella leaf blotch and 18 fruit samples with symptoms of bitter rot were collected, representing 11 different cultivars. Disease severity was estimated in each orchard/cultivar as low, moderate or severe based on extent of leaf and fruit lesions per tree and number of trees affected. Diseased samples were sent to the University of Guelph Pest Diagnostic Lab for fungal isolation and identification. The diseased tissue was excised from fruit or leaves, surface sterilized in a series of 70% alcohol for 30 sec., followed by a dip in 5% NaOCl for 120 sec., and a rinse in distilled sterile water for 60 sec., and plated onto potato dextrose agar (PDA) amended with streptomycin sulphate or Synthetischer Nährstoffarmer Agar (SNA). Conidia produced from colonies that grew out of the lesions were examined morphologically with a light microscope and the fungi identified to genus based on morphological characteristics. The DNA of 3 isolates of *Colletotrichum* spp. from diseased apple tissue was sequenced using primers ITS1 and ITS4 and compared to DNA sequences of other fungi on the GenBank database from the National Centre for Biotechnology Information.

RESULTS AND DISCUSSION: *Colletotrichum* spp. were isolated from 13 and 11% of leaf and fruit samples, respectively (24% of total disease tissue) collected from 4 out of the 5 apple growing districts (Fig. 1). Although *Colletotrichum* spp. could not be isolated from diseased leaf and fruit tissue collected in District 3, this does not mean the pathogen(s) is absent from that district. The DNA sequence of the ITS

region of three isolates of *Colletotrichum* spp. from diseased apple tissue matched the DNA sequence of *Colletotrichum acutatum* on the GenBank database. *Colletotrichum* spp. were isolated from cultivars Mutsu, Gala, Empire, Idared, Ambrosia, Honeycrisp, McIntosh and Golden Delicious in this survey. The black rot pathogen, *Botrysosphaera obtusa* was isolated from 15% of diseased fruit samples collected. *Alternaria* spp. (39%), *Phomopsis* spp. (2%), and *Phoma* spp. (7%) were also isolated from the diseased apple tissue collected in 2013.

Disease severity in orchards ranged from low to severe. Districts 2 and 5 had the highest severity; both fruit and leaves showed moderate to severe symptoms characteristic of bitter rot and glomerella leaf blotch (Fig. 1). Leaf symptoms were generally more common than fruit symptoms in Districts 1, 3 and 4.

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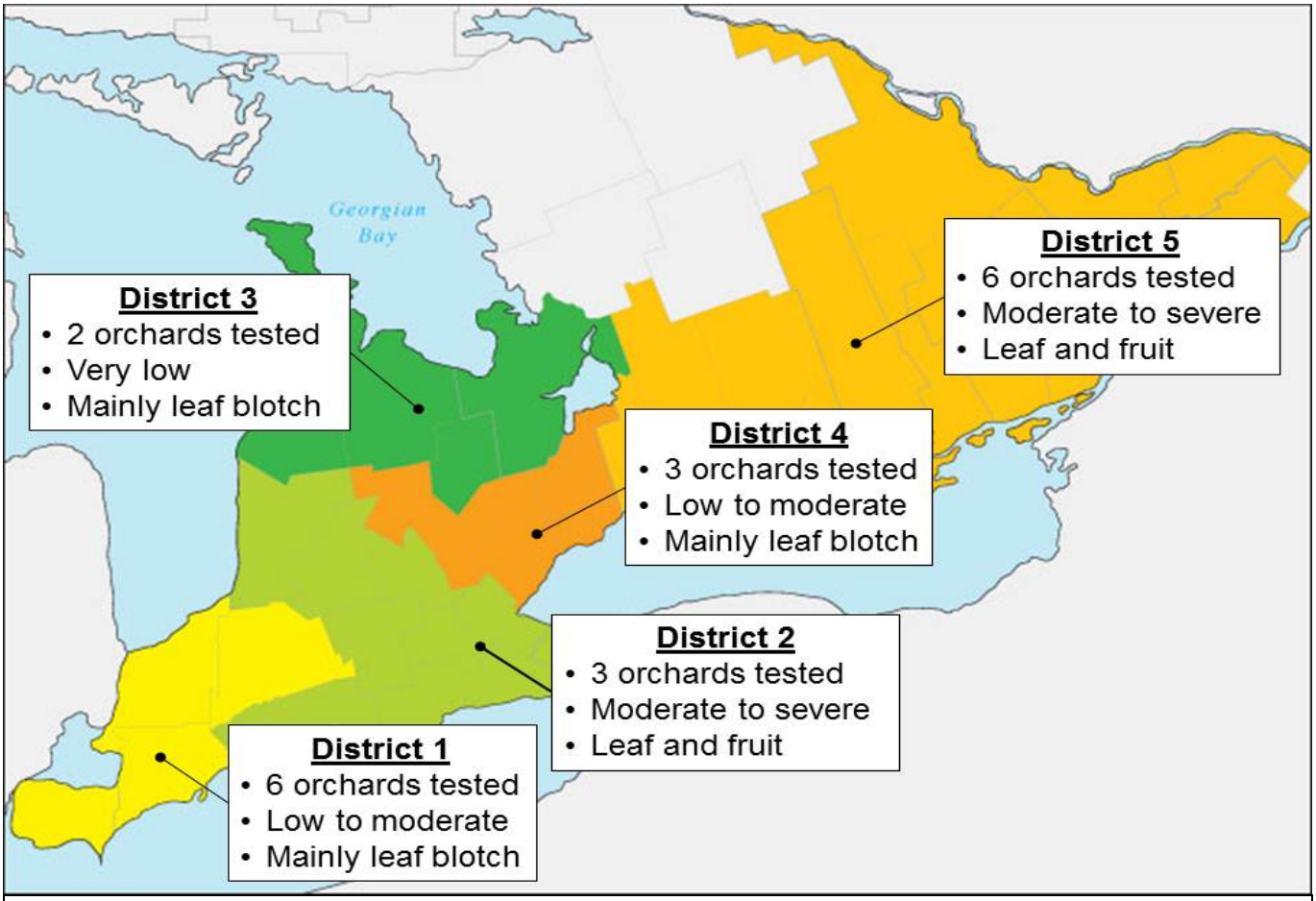

Figure 1. Bitter rot and glomerella leaf blotch severity in 5 Ontario apple growing districts during 2013.

LIST OF CPDS AUTHORS IN ALPHABETICAL ORDER

List of figures