2018

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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Inventaire des maladies des plantes au Canada

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Contents: **DISEASE HIGHLIGHTS** - 2017 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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Diagnostic Laboratories /Laboratoires Diagnostiques

CROPS / CULTURES: Commercial Crops – Plant Health Laboratory Report
LOCATION / RÉGION: British Columbia

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TITLE / TITRE: DISEASES/SYMPTOMS DIAGNOSED ON COMMERCIAL CROP SAMPLES SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE (BCAGRI), PLANT HEALTH LABORATORY IN 2017

ABSTRACT: The British Columbia Ministry of Agriculture Plant Health Laboratory provides diagnoses of diseases caused by fungi, bacteria, viruses, plant parasitic nematodes and insect pests of agricultural crops grown in British Columbia. Between January 1 and November 30, 2017, the laboratory received 757 samples including Christmas trees, field crops, greenhouse vegetable and floriculture crops, forest nursery seedlings, herbaceous and woody ornamentals, small fruits, tree fruits, nuts and specialty crops for diagnosis. No significantly new or unusually high level of any disease was detected in the samples.

METHODS: The British Columbia Ministry of Agriculture Plant Health Laboratory provides diagnoses for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes, and insect pests of agricultural crops grown in British Columbia. Samples were submitted to the laboratory by ministry staff, growers, agri-businesses, municipalities and master gardeners. Diagnoses were accomplished by visual and microscopic examination, culturing onto artificial media, biochemical identification of bacteria using BIOLOG®, serological testing of viruses, fungi and bacteria with micro-well and membrane-based enzyme linked immuno-sorbent assay (ELISA). Molecular techniques (polymerase chain reactions (PCR – conventional and/or real time) were used for some species-specific diagnoses. Electron microscopic examination was performed on samples with unknown virus-like symptoms. Some specimens were referred to other laboratories for identification or confirmation of the diagnosis.

RESULTS AND COMMENTS: Overall in 2017, British Columbia had a very wet spring followed by a late dry summer. The wet weather in the spring supported bacterial blights on woody ornamentals, tree fruits and berry crops. Fruit rots and postharvest rots were much lower than normal due to dry weather in late summer. Summaries of diseases and their causal agents diagnosed on crop samples submitted to the laboratory are presented in the following tables (1 to 12) organized by crop category. Diagnoses not listed include: abiotic symptoms such as nutritional stress, pH imbalance, water stress, drought stress, physiological response to adverse growing conditions, genetic abnormalities, environmental and chemical stresses including herbicide damage, fruit abortion due to lack of pollination, insect-related injury and damage where no conclusive causal factor was identified.

Table 1. Diseases/symptoms detected in **Christmas tree** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies grandis	Needle blight	*Phyllosticta* sp. and *Rhizosphaera pini*	1
Abies procera	Needle cast Phytophthora crown rot	*Rhizosphaera kalkhoffii* *Phytophthora* sp.	1 1

Table 2. Diseases/symptoms detected in **greenhouse floriculture** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Begonia	Bacterial leaf spot Leaf spot Leaf spot	*Xanthomonas campestris* *Alternaria* sp. *Botrytis cinerea*	1 1 1
Chysanthemum	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus	1
Dahlia	Leaf mosaic/mottling	Cucumber Mosaic Virus Tobacco Mosaic Virus Tomato Spotted Wilt Virus	1 1 1
Echeveria sp.	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus	1
Echeveria nodulosa	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus	1
Juncus effusus	Foliar blight	*Bipolaris* sp.	1
Kalanchoe tomentosa	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus	1
Lavandula angustifolia	Stem blight	*Phoma lavandulae*	1
Lavandula sp.	Slime mould	*Didymium* sp. or *Fuligo* sp.	1
Lychnis sp.	Impatiens Necrotic Spot Virus Tomato Spotted Wilt Virus	Impatiens Necrotic Spot Virus Tomato Spotted Wilt Virus	1 1
Pelargonium sp.	Bacterial blight Leaf spot	*Xanthomonas campestris* *Pseudomonas syringae* pv. *syringae*	1 1
Pilea	Pythium root rot Rhizoctonia web blight	*Pythium* sp. *Rhizoctonia solani*	1 1
Sedum nussbaumerianum	Puckering of leaves	Potyvirus	1
Senecio sp.	Scarring on pearls	Tomato Spotted Wilt Virus	1
Zinnia	Botrytis blight	*Botrytis cinerea*	1

Table 3. Diseases/symptoms detected in **forest nursery** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies sp.	Fusarium root rot	*Fusarium* sp.	1
Abies amabilis	Botrytis blight Foliar blight	*Botrytis cinerea* *Phoma* sp.	1 1
Larix spp.	Botrytis blight Foliar blight Root rot	*Botrytis cinerea* *Phoma* sp. Oomycete	1 1 1
Picea spp.	Fusarium root rot Phoma blight Phoma blight Root rot	*Fusarium proliferatum* *Phoma herbarum* *Phoma* sp. *Pythium macrosporum*	1 1 1 1
Picea glauca	Root rot Fusarium root rot Fusarium root rot Phoma blight Root rot Stem canker	*Cylindrocarpon* sp. and *Rhizoctonia* sp. *Fusarium* sp. *Fusarium proliferatum* *Phoma* sp. *Phytophthora* sp. *Coniothyrium* sp.	1 3 1 2 1 1
Pinus spp.	Alternaria needle blight Grey mould Phoma blight Root rot	*Alternaria* sp. *Botrytis cinerea* *Phoma exigua* Oomycete	1 1 1 1
Pinus contorta	Foliar blight Phoma blight	*Botrytis cinerea* *Phoma* sp	1 1
Pinus monticola	Cylindrocarpon root rot Fusarium root rot	*Cylindrocarpon* sp. *Fusarium* sp.	2 2
Pinus resinosa	Foliar blight Leaf blight	*Botrytis cinerea* and *Fusarium* sp. *Phyllosticta* sp.	1 1
Pseudotsuga menziesii	Cylindrocarpon root rot Fusarium root rot Needle blight	*Cylindrocarpon* sp. *Fusarium* sp. *Hormonema* sp. *Rhizosphaera pini*	9 7 1 1
Pseudotsuga menziesii var. *glauca*	Cylindrocarpon root rot Fusarium root rot	*Cylindrocarpon* sp. *Fusarium* sp.	3 7
Pseudotsuga menziesii var. *menziesii*	Cylindrocarpon root rot Fusarium root rot Leaf spot	*Cylindocarpon* sp. *Fusarium* sp. *Allantophomopsis lycopodina*	1 6 1

Table 4. Diseases/symptoms detected in **greenhouse vegetable** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Tomato	Fusarium wilt	*Fusarium oxysporum* f.sp. *lycopersici*	2

Table 5. Diseases/symptoms detected in **herbaceous perennial** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Arctostaphylos uva-ursi	Root rot Root rot	*Phytophthora* sp. *Thielaviopsis basicola*	1 1
Aronia sp.	Bacterial blight	*Pseudomonas syringae*	1
Brunnera sp.	Nematode damage	*Pratylenchus* sp. and *Meloidogyne* sp.	1
Buxus spp.	Boxwood blight Crown and root rot Leaf spot Leaf spot Root rot Volutella blight	*Cylindrocladium pseudonaviculatum* *Phytophthora* sp. *Mycosphaerella* sp., *Volutella* sp. *and Clonostachys* sp. *Phyllosticta* sp. *Pythium* sp. *Volutella buxi*	3 1 1 1 1 10
Buxus suffruticosa	Boxwood blight Volutella blight	*Cylindrocladium pseudonaviculatum* *Volutella buxi*	1 1
Corylopsis sp.	Twig dieback	*Didymella* sp. *Phomopsis* sp.	1 1
Geranium	Cylindrocarpon root rot Root and crown rot	*Cylindrocarpon* sp. *Rhizoctonia solani*	1 1
Grass (ornamental)	Root damage	*Gaeumannomyces graminis* var. *graminis*	1
Helleborus sp.	Leaf spot	*Botrytis cinerea*	1
Hemerocallis	Foliar nematode damage	*Aphelenchoides* sp.	1
Hosta	Nematode damage	*Pratylenchus* sp. and *Meloidogyne* sp.	1
Lavandula sp.	Foliar blight Root rot	*Botrytis cinerea* *Pythium* sp.	1 1
Ligularia sp.	Nematode damage	*Pratylenchus* sp. and *Meloidogyne* sp.	1
Parthenocissus quinquefolia	Leaf spot Leaf spot	*Discosia* sp. *Guignardia* sp.	1 1
Phlox paniculata	Anthracnose Root rot Stem canker	*Colletotrichum dematium* *Rhizoctonia solani* *Phoma/Ascochyta* sp.	1 1 1

Table 6. Diseases/symptoms detected in **nut crop** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Hazelnut	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Botryosphaeria canker	*Botryodiplodia* sp. or *Diplodia* sp.	3
	Cytospora canker	*Cytospora* sp	1
	Eastern filbert blight	*Anisogramma anomala*	3
	Nectria canker	*Nectria cinnabarina*	2
	Phomopis canker	*Phomopsis* sp.	7
	Phytophthora root rot	*Phytophthora* sp.	3

Table 7. Diseases/symptoms detected in **berry crop** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of Samples
Blueberry	Armillaria root rot	*Armillaria nabsnona, Armillaria* sp.	3
	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	4
	Blueberry Scorch Virus	Blueberry Scorch Virus	8
	Blueberry Shock Virus	Blueberry Shock Virus	4
	Botryosphaeria blight	*Botryosphaeria dothidea*	2
	Botrytis blight	*Botrytis cinerea*	3
	Coniothyrium canker	*Coniothyrium* sp.	4
	Crown gall	*Agrobacterium tumefaciens*	1
	Fruit rots	*Alternaria* sp., *Botrytis cinerea, Colletotrichum acutatum* and/or *C. gloeosporiodes*	3
	Godronia canker	*Godronia cassandrae*	12
	Leaf blotch	*Gloeosporium* sp.	1
	Leaf spots	*Alternaria* sp., *Cylindrosporium* sp., *Cladosporium* sp., *Stemphylium* sp., *Phyllosticta* sp. and/or *Epicoccum* sp.	3
	Leaf spot/leaf blight	*Botrytis cinerea* and *Alternaria* sp.	1
	Nematode damage	*Pratylenchus* sp. or *Paratrichodorus renifer*	3
	Phomopis canker	*Phomopsis* sp.	15
	Phytophthora root rot	*Phytophthora cinnamomi*	2
	Phytophthora root rot	*Phytophthora* sp.	16
Cranberry	Leaf spots	*Allantophomopsis* sp., *Phyllosticta* sp. or *Macrophoma* sp.	5
	Fruit rots*	*Coleophoma empetri*	4
		Coleophoma sp.	3
		Colletotrichum fioriniae	4
		Colletotrichum sp.	4
		Colletotrichum gloeosporioides	4
		Gloeosporium sp.	1
		Phomopsis sp.	5
		Phyllosticta sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of Samples
(Table 7 *cont.*)			
Raspberry	Anthracnose	*Sphaceloma necator*	1
	Anthracnose dieback	*Phlyctaena vagabunda*	1
	Bacterial blight	*Pseudomonas syringae*	1
	Grey mould	*Botrytis cinerea*	2
	Cane blight	*Paraconiothyrium fuckelii*	1
	Crown gall	*Agrobacterium tumefaciens*	1
	Nematode damage	*Pratylenchus* sp.	10
	Nematode damage	*Xiphinema* sp.	1
	Nematode damage	*Pratylenchus* sp. and *Xiphinema* sp.	4
	Phomopis canker	*Phomopsis* sp.	1
	Phytophthora root rot	*Phytophthora* sp. and *Phytophthora rubi*	4
	Spur blight	*Xenodidymella applanata*	2
	Yellow rust	*Phragmidium rubi-idaei*	2
Strawberry	Crown infection	*Fusarium oxysporum* and *Phomopsis* sp.	1
	Crown rot	*Verticillium* sp., *Rhizoctonia* sp. and *Fusarium* sp.	1
	Crown/root rot	*Cylindrocarpon* sp. and *Fusarium* sp.	1
	Nematode damage	*Pratylenchus* sp.	3
	Verticillium wilt	*Verticillium* sp.	1
	Vascular wilt	*Verticillium* sp. and *Fusarium* sp.	1

*Fruit rot samples were from a research project.

Table 8. Diseases/symptoms detected in **specialty crop** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Basil	Botrytis blight	*Botrytis cinerea*	1
Dandelion	Leaf spot	*Ramularia* sp.	1
Hop	Alternaria leaf/pod spot	*Alternaria alternata*	1
	Apple Mosaic Virus	Apple Mosaic Virus	3
	Crown/root rot	*Thielaviopsis basicola*	1
	Downy mildew	*Pseudoperonospora humuli*	3
	Fusarium canker	*Fusarium sambucinum*	2
	Leaf spot	*Alternaria* sp., *Cladosporium* sp. and *Botrytis* sp.	1
	Powdery mildew	*Podosphaera macularis*	1
	Rhizoctonia root rot	*Rhizoctonia solani*	3
	Root rot	*Phytophthora* sp.	1
	Verticillium wilt	*Verticillium dahliae*	1
Soil/hop	Nematode assessment	*Pratylenchus* sp.	5
Sweet woodruff	Downy mildew	*Peronospora* sp.	1

Table 9. Diseases/symptoms detected in **tree fruit and grape** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Apple	Diplodia canker Fire blight Leucostoma canker Phomopsis canker	*Botryosphaeria stevensii* *Erwinia carotovora* *Cytospora* sp. *Phomopsis* sp.	1 4 1 2
Nectarine	Brown rot	*Monilinia* sp.	1
Pear	Leucostoma canker Diplodia canker Pear scab Pear trellis rust Phomopsis canker	*Cytospora* sp. *Diplodia mutila* *Venturia pirina* *Gymnosporangium fuscum* *Phomopsis* sp	1 1 1 1 1
Pear -Asian	Leucostoma canker Twig dieback	*Cytospora* sp. *Phomopsis* sp.	2 1
Plum	Black knot	*Apiosporina morbosa*	1

Table 10. Diseases/symptoms detected in **turf grass, lawn and sports field** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Lawn	Brown blight/leaf spot Root rot	*Drechslera* sp. *Pythium* sp.	1 1
Turf	Brown patch Nematode damage	*Rhizoctonia solani* *Longidorus* sp., *Tylenchorhynchus* sp. and *Mesocriconema* sp. *Longidorus* sp. and *Helicotylenchus* sp. *Longidorus* sp., *Helicotylenchus* sp., and *Mesocriconema* sp. *Meloidogyne* sp. and *Helicotylenchus* sp. *Meloidogyne* sp.	1 1 1 1 1 1

Table 11. Diseases/symptoms detected in **field vegetable** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Bean	Leaf and pod spot Nematode damage Root rot	*Alternaria alternata* *Pratylenchus* sp. *Rhizoctonia* sp. *and Fusarium* sp.	1 1 1
Beet	Phoma root rot	*Phoma betae*	1
Cabbage	Bacterial soft rot	*Pectobacterium carotovorum* ss. *carotovorum*	1
Callaloo	Leaf spot	*Pseudomonas syringae* pv. *syringae*	1
Carrot	Alternaria blight Crown rot	*Alternaria dauci* *Rhizoctonia solani*	1 1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
(Table 11 *cont.*) Cucumber	Leaf spots	*Cladosporium* sp. and *Stagonosporopsis* sp.	2
Garlic	Bulb infection Blue mould Botrytis bulb rot Botrytis rot Bulb rot Embellisia skin blotch Fusarium basal rot Fusarium bulb rot Nematode damage Stem and bulb nematode White rot	Potyvirus *Penicillium* sp. *Botrytis allii* *Botrytis cinerea* *Botrytis porri* *Embellisia allii* and *Fusarium* sp. *Fusarium* sp. *Fusarium* sp. and *Penicillium* sp. *Penicillium* sp., *Rhizopus* sp. and *Fusarium* sp. *Peniciliium* sp., *Rhizopus* sp., *Fusarium* sp. and *Embellisia* sp. *Penicillium* sp., *Fusarium* sp. and *Embellisia* sp. *Penicillium* sp. and *Mucor* sp. *Rhizoctonia* sp. and *Fusarium* sp. *Rhizoctonia* sp., *Fusarium* sp. and *Embellisia* sp. *Embellisia allii* *Fusarium culmorum* *Fusarium proliferatum* *Pratylenchus* sp. *Ditylenchus dipsaci* *Sclerotium cepivorum*	42 10 1 1 1 1 4 10 4 2 1 1 1 1 42 1 7 1 3 10
Kale	Soft rot	*Pectobacterium carotovorum* ss. *brasiliense*	1
Parsley	Botrytis stem infection	*Botrytis cinerea*	1
Pea	Black root rot Fusarium root rot	*Thielaviopsis basicola* *Fusarium solani*	1 2
Potato	Black dot Black leg Black scurf Black spots on tuber Common scab Late blight Silver scurf Verticillium wilt	*Colletotrichum coccodes* *Pectobacterium atrosepticum* *Rhizoctonia solani* *Pyrenochaeta lycopersici* *Streptomyces scabies* *Phytophthora infestans* *Helminthosporium solani* *Verticillium albo-atrum*	2 1 3 1 1 1 1 1
Rhubarb	Crown and root damage Crown and root damage Crown and root rot Crown and root rot Leaf spots	*Cylindrocarpon* sp., *Pythium* sp. and *Rhizoctonia* sp. Multiple parasitic nematode species *Cylindrocarpon* sp. and *Pythium* sp. *Cylindrocarpon* sp. and *Rhizoctonia* sp. *Cylindrocarpon* sp. *Ascochyta* sp., *Cladosporium* sp. and *Botrytis cinerea*	1 6 1 1 1 5
Tomato	Bacterial canker	*Clavibacter michiganensis* ss. *michiganensis*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
(Table 11 *cont.*) Winter Squash	Leaf spot	*Cladosporium* sp. *Pseudomonas syringae* pv. *lachrymans*	1 1
Zucchini	Black root rot Crown and root rot Fusarium wilt Nematode damage Root rot Verticillium wilt White mould	*Thielaviopsis basicola* *Rhizoctonia solani* *Fusarium oxysporum* *Tylenchorhynchus* sp. *Rhizoctonia solani* and *Thielaviopsis basicola* *Pythium ultimum* *Rhizoctonia solani* *Verticillium* sp. *Sclerotinia sclerotiorum*	1 1 1 1 1 1 1 1 1

Table 12. Diseases/symptoms detected in **woody perennial** samples submitted to the BCAGRI Plant Health Laboratory between January 1 and November 30, 2017.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies sp.	Brown dieback	*Schizophyllum commune*	1
Abies concolor	Needle blight Needle blight	*Phyllosticta* sp. *Rhizosphaera kalkhoffii*	1 1
Acer sp.	Anthracnose Phytophthora root rot	*Aureobasidium apocryptum* *Phytophthora* sp.	1 1
Acer palmatum	Stem canker Stem canker	*Diplodina* sp. *Phomopsis* sp.	1 1
Amelanchier alnifolia	Phytophthora root rot	*Phytophthora sp.*	1
Arbutus unedo	Leaf spot	*Pestalotiopsis* sp.	1
Berberis sp.	Stem canker	*Cytospora* sp.	1
Betula sp.	Phytophthora root rot	*Phytophthora* sp.	1
Buxus spp.	Foliar blight Boxwood blight Leaf blight Stem blight Volutella blight	*Volutella* sp. and *Fusarium* sp. *Cylindrocladium pseudonaviculatum* *Phyllosticta* sp. *Phoma* sp. *Volutella buxi*	1 1 1 1 2
Castanea mollisima	Botryosphaeria canker Phomopsis canker	*Botryosphaeria* sp. *Diaporthe* sp.	1 1
Chamaecyparis obtusa	Phytophthora root rot Shoot and leaf blight	*Phytophthora* sp. *Monochaetia* sp. and *Macrophoma* sp.	1 1
Chamaecyparis sp.	Foliar blight Foliar blight	*Botrytis cinerea* *Kabatina thujae*	1 1
Cornus sp.	Anthracnose Root rot	*Discula destructiva* *Cylindrocladiella* sp.	1 1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
(Table 12 *cont*.) Cotoneaster	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
Crataegus sp.	Fire blight	*Erwinia amylovora*	3
Euonymus	Anthracnose Leaf spot	*Colletotrichum gloeosporioides* *Alternaria* sp. and *Epicoccum* sp.	1 1
Ilex crenata	Phytophthora blight Stem canker Stem canker	*Phytophthora ilicis* *Botryosphaeria* sp. *Diaporthe* sp.	1 1 2
Juniperus sp.	Armillaria root rot Phytophthora root rot	*Armillaria nabsnona* *Phytophthora* sp.	1 3
Ligustrum sp.	Leaf spot	*Cladosporium* sp.	1
Malus spp.	Fire blight Perennial canker Phomopsis canker Phytophthora root rot Silver leaf disease Stem canker	*Erwinia amylovora* *Cryptosporiopsis perennans* *Phomopsis* sp. *Phytophthora* sp. *Chondrostereum purpureum* *Nectria cinnabarina*	4 1 3 2 7 2
Picea sp.	Needle blight	*Rhizosphaera kalkhoffii*	1
Picea pungens	Cylindrocarpon root rot Fusarium root rot	*Cylindrocarpon* sp. *Fusarium* sp.	1 1
Pinus contorta	Cylindrocarpon root rot Elytroderma needle cast Fusarium root rot	*Cylindrocarpon* sp. *Elytroderma deformans* *Fusarium* sp.	1 1 1
Pinus flexilis	Needle blight	*Lophodermella arcuata*	1
Pinus ponderosa	Phytophthora root rot	*Phytophthora* sp.	1
Pinus sylvestris	Phytophthora root rot	*Phytophthora* sp.	1
Platanus acerifolia	Phomopsis canker	*Phomopsis* sp.	1
Populus sp.	Leaf spot Leaf spot	*Pseudomonas syringae* pv. *syringae* *Venturia macularis*	1 1
Prunus sp.	Anthracnose Bacterial blight Brown rot	*Colletotrichum gloeosporioides* *Pseudomonas syringae* pv. *syringae* *Monilinia* sp.	1 1 1
Prunus pensylvanica	Phytophthora crown rot	*Phytophthora* sp.	1
Pseudotsuga menziesii	Laminated root rot	*Phellinus sulphurascens*	1
Quercus rubra	Anthracnose Anthracnose Nectria canker	*Colletotrichum* sp. *Discula* sp. *Tubercularia* sp.	1 1 1
Rhododendron	Leaf spots Phomopsis dieback	*Mycosphaerella* sp. and *Pestalotia* sp. *Phomopsis* sp.	2 1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
(Table 12 *cont*.)			
Rosa sp.	Black spot	*Diplocarpon rosae*	1
	Downy mildew	*Peronospora sparsa*	1
	Phytophthora root rot	*Phytophthora* sp.	1
Sequoiadendron sp.	Phomopsis blight	*Phomopsis* sp.	1
Sorbus sp.	Fire blight	*Erwinia amylovora*	2
Sorbus aucuparia	Phytophthora root rot	*Phytophthora* sp.	1
Spiraea	Foliar blight	*Phoma* sp. and *Alternaria* sp.	1
Styrax japonicus	Twig dieback	*Phomopsis* sp.	1
Syringa sp.	Ascochyta blight	*Ascochyta syringae*	1
	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Powdery mildew	*Erysiphe syringae*	1
Taxus hicksii	Root and crown rot	*Phytophthora* sp.	1
Thuja spp.	Armillaria root rot	*Armillaria ostoyae*	1
	Coryneum blight	*Seiridium cardinale*	2
	Foliar blight	*Pestalotiopsis* sp.	6
	Foliar blight	*Seiridium cardinale*	3
	Kabatina blight	*Kabatina thujae*	1
	Phytophthora root rot	*Phytophthora* sp.	2
	Stigmina blight	*Stigmina thujina*	1
Thuja occidentalis	Coryneum blight	*Seiridium cardinale*	1
	Phomopsis canker	*Diaporthe* sp.	1
	Phytophthora root rot	*Phytophthora* sp.	1
Thuja plicata	Leaf blight	*Seiridium* sp., *Pestalotiopsis* sp. and *Cytospora* sp.	1
Thuja pyramidalis	Needle blight	*Phyllosticta* sp.	1
	Root rot	*Phytophthora* sp.	1
	Tip blight	*Pestalotiopsis* sp.	1
Thujopsis dolabrata	Stem canker	*Phomopsis juniperovora*	1
Tsuga heterophylla	Annosus root rot	*Heterobasidion annosum*	1
	Stringy butt rot	*Perenniporia subacida*	1
Vaccinium parvifolium	Phytophthora root rot	*Phytophthora cinnamomi*	1

CROPS / CULTURES: Ornamental Nursery and Landscape Crops - Diagnostic Laboratory Report
LOCATION / RÉGION: British Columbia

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TITLE / TITRE: DISEASES DIAGNOSED ON ORNAMENTAL NURSERY AND LANDSCAPE CROPS IN BRITISH COLUMBIA, 2017

ABSTRACT: Diseases of commercial nursery and landscape ornamental crops and causal agents identified by Elmhirst Diagnostics & Research in south coastal British Columbia in 2017 are listed.

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. Laboratory diagnostic services are provided in conjunction with on- site diagnostic consultations. Diagnosis is performed primarily by association of known symptoms with the presence of a pathogen known to cause these symptoms, identified by microscopic examination. If the diagnosis is uncertain or further identification or confirmation is needed, fungal and bacterial pathogens are isolated in pure culture for further examination of morphological characteristics, or plant tissue or cultured specimens are sent to other 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. The summer of 2017 was hot and dry and warm-temperature diseases such as rhizoctonia web blight of *Epilobium* (fireweed) and cercospora leaf spot of roses were observed. Box blight (*Cylindrocladium buxicola*) continued to appear at a few nurseries and landscape sites. Black root rot (*Thielaviopsis basicola*) was found on *Buxus, Dianthus*, *Epilobium* and *Euonymus*. Two new host/pathogens were recorded in 2017: (1) *Monilinia laxa* causing twig blight (brown rot) of cotoneaster in a Vancouver landscape planting (isolated and identified by E. Hudgins, Institute for Sustainable Horticulture, Kwantlen Polytechnic University, Langley, BC); (2) *Colletotrichum acutatum* causing anthracnose of *Dryas dummondii* (yellow-leaf avens) at a commercial nursery in the Fraser Valley.

Table 1. Diseases diagnosed in 2017 on ornamental nursery and landscape crops in British Columbia by Elmhirst Diagnostics & Research.

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Acer x *freemanii*	Bacterial leaf spot	*Pseudomonas syringae*	1
Amelanchier alnifolia ‘Regent’	Leaf spot	*Phomopsis* sp.	1
Amelanchier alnifolia ‘Regent’	Powdery mildew	*Podosphaera* sp.	1
Antennaria rosea	Root rot (damping off)	*Rhizoctonia* sp., *Pythium* sp.	1
Aronia melanocarpa	Leaf spot	*Phyllosticta* sp.	1

(Table 1 *cont.)* *Aster dumosus* 'Woods Blue'	Powdery mildew	*Golovinomyces asterum* var. *asterum*	1
Aubrieta x 'Axent Lilac'	Stem rot and dieback	*Phoma aubrieta*	1
Buxus microphylla koreana x *sempervirens* 'Green Velvet', 'Green Mountain'	Black root rot	*Thielaviopsis basicola*	2
Buxus microphylla koreana x *sempervirens* 'Green Velvet'	Crown and root rot and basal stem canker	*Phytophthora* sp.	1
Buxus microphylla koreana x *sempervirens* 'Green Gem', 'Green Mountain', 'Green Velvet'	Box blight	*Cylindrocladium buxicola*	3
Buxus microphylla koreana x *sempervirens* 'Green Velvet'	Volutella blight	*Volutella buxi*	1
Buxus sempervirens 'Suffruticosa'	Box blight	*Cylindrocladium buxicola*	1
Buxus sempervirens 'Suffruticosa'	Box blight	*Cylindrocladium buxicola*	1
Centaurea montana 'Amethyst in Snow'	Powdery mildew	*Golovinomyces* sp.	1
Choisya ternata	Root and stem rot	*Pythium* sp. / *Phytophthora* sp.	1
Coreopsis verticillata 'Zagreb'	Root rot	*Phytophthora* sp.	1
Cornus alba 'Cream Cracker', 'Ivory Halo'	Septoria leaf spot	*Sphaerulina cornicola (Septoria cornicola)*	2
Corylus avellana contorta	Leaf spot	*Septoria ostryae*	1
Cotoneaster sp.	Twig blight (brown rot)	*Monilinia laxa**	1
Dianthus caryophyllus	Fusarium wilt	*Fusarium* oxysporum f. sp. *dianthi*	1
Dianthus caryophyllus	Root rot	*Pythium* sp. /*Phytophthora* sp.	1
Dianthus caryophyllus	Black root rot	*Thielaviopsis basicola*	1
Dryas drummondii	Root rot (damping off)	*Rhizoctonia* sp., *Pythium* sp.	2
Dryas drummondii	Anthracnose	*Colletotrichum acutatum**	2
Epilobium angustifolium	Black root rot	*Thielaviopsis basicola*	1
Epilobium angustifolium	Black root rot	*Thielaviopsis basicola*	1
Epilobium angustifolium	Foliar web blight	*Rhizoctonia* sp.	1
Euonymus alatus compacta	Black root rot	*Thielaviopsis basicola*	1
Euonymus alatus compacta 'Fireball'	Fusarium stem rot	*Fusarium* sp.	2
Gaultheria shallon	Anthracnose	*Colletotrichum* sp.	1
Gaultheria shallon	Bacterial leaf spot	*Pseudomonas syringae*	1
Hydrangea 'Invincibelle Limetta'	Leaf spot	*Ascochyta hydrangea*	1

(Table 1 *cont.)* *Hydrangea paniculata* 'Flare'	Stem rot	*Pythium* sp. / *Phytophthora* sp., *Botrytis* sp., *Fusarium* sp.	1
Lavandula angustifolia	Botrytis stem rot	*Botrytis cinerea*	1
Lavandula stoechas	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Lavandula stoechas 'Anouk'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Lavandula stoechas 'Anouk'	Root rot	*Rhizoctonia* sp./ *Pythium* sp.	1
Malus x 'Spring Snow'	Anthracnose stem canker	*Neofabraea* sp.	1
Malus x 'Spring Snow'	Apple scab	*Venturia inaequalis*	2
Monarda didyma 'Fireball'	Powdery mildew	*Golovinomyces biocellatus*	1
Oreganum vulgare 'Hot and Spicy'	Fusarium wilt	*Fusarium oxysporum*	1
Picea pungens	Phomopsis tip blight	*Phomopsis occulta*	1
Populus trichocarpa	Marsonnina leaf blight (black leaf spot)	*Marsonnina* sp.	1
Prunus cerasus 'Carmine'	Bacterial leaf spot	*Pseudomonas syringae*	1
Rosa x 'Queen Elizabeth', 'Amadeus', Bolero', 'Easy Going', 'Elegant Fairytale', 'Florentina', 'Grimm's Brothers Fairy Tale', 'Laguna', 'Living Easy', 'Red Corsair', Royal City', 'Winter Sun', 'Yellow Submarine'	Cercospora leaf spot	*Cercospora rosicola***	13
Rosa x 'Morden Fireglow', 'Centennial', 'Drift', 'Never Alone'	Downy mildew	*Peronospora sparsa*	4
Rosa x 'Morden Fireglow'	Stem and crown canker, dieback	*Coniothyrium* sp	1
Syringa sp.	Bacterial leaf spot	*Pseudomonas syringae*	1
Vaccinium membranaceum	Anthracnose	*Colletotrichum* sp.	2
Vaccinium membranaceum	Bacterial leaf spot	*Pseudomonas syringae*	1
Vaccinium ovalifolium	Anthracnose	*Colletotrichum* sp.	1
Vaccinium ovalifolium	Bacterial leaf spot	*Pseudomonas syringae*	1
Yucca sp.	Leaf spot	*Coniothyrium* sp.	1
Weigela sp.	Foliar nematodes	*Aphelenchoides* sp.	2
Weigela florida	Root and crown rot, dieback	*Pythium* sp. / *Phytophthora* sp.	1
Total			**78**

*Confirmed by DNA sequencing and BLAST comparison to GenBank sequences.
**Reported by B. Jalbert, Select Roses, Langley, BC

CROP / CULTURE: All Crops - Diagnostic Laboratory Report
LOCATION / RÉGION: Alberta

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TITLE / TITRE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE ALBERTA PLANT HEALTH LAB IN 2017

ABSTRACT: The Alberta Plant Health Lab (APHL) provides plant pest diagnosis and expertise to Alberta's agricultural industry. The laboratory accepts samples exclusively from agricultural fieldmen, academic institutions, applied research associations and municipal pest management departments. All services are free of charge. A total of 664 samples were processed for disease diagnosis in the 2017 crop year. Fungal, oomycete, protist, bacterial and viral plant pathogens were identified in these samples. Late blight was identified in one potato sample. Dutch elm disease was not identified in any of the 25 suspect samples submitted. Among the Fusarium species isolated from wheat, *Fusarium culmorum* was more common than *F. graminearum.*

METHODS: Samples are submitted to the Alberta Plant Health Lab (APHL) by agricultural fieldmen, academic institutions, applied research associations and municipal pest management departments. Diagnoses are based on a combination of visual examination of symptoms, microscopic observation, culturing on artificial media, PCR/qPCR, DNA barcoding and commercial diagnostic kits. Specifically, fungal barcoding was performed using the PCR primer pair ITS1/ITS4 (White et al. 1990) and/or EF1-1018F/EF1-1620R (Stielow et al. 2015). Fusarium species were identified by PCR using the primers reported by Demeke et al. (2005). Phytoplasma were detected by PCR using the primer pairs P1/Tint and R16MF2n/R16MR2n (Smart et al. 1996). Confirmation of late blight on potato and tomato was conducted using the Agdia ImmunoStrip® kit for Phytophthora species (Agdia Inc., http://www.agdia.com). For diagnosis of all other diseases, when PCR techniques were used, quantitative PCR (qPCR) preceded conventional PCR and probe-based qPCR preceded SYBR Green-based qPCR. The primers and protocols were chosen from the most recent literature and verified by APHL using positive and negative controls.

RESULTS: A total of 664 disease diagnoses were completed between January 5 and December 5, 2017. Categories of samples diagnosed included cereals (21%), canola (2%), potato (12%), corn (47%), legume (3%), tree and fruit (9%), vegetable (2%) and other (4%). The category 'other' covers samples such as rhodiola, quinoa, and hops. In most samples, one or more causal agents were identified. Summaries of diseases diagnosed on the samples are provided in Tables 1 to 8 by crop category. The diagnoses reported on samples received may not reflect the disease situation in the field during the 2017 growing season.

There was one laboratory-confirmed incidence of potato late blight identified on potato. Twenty-five samples were submitted for Dutch elm disease diagnosis and none of them tested positive. However, in eleven of the samples, *Dothiorella ulmi* was present. Fusarium samples from both wheat and corn were provided from multiple counties across Alberta, with a focus on Southern Alberta. The samples were provided as pure cultures isolated from survey sample wheat heads and stubble and from corn material. Among the fusarium species isolated from wheat, *Fusarium culmorum* was more common than *F. graminearum.* In 2016, the causal agent of canola pink root rot, *Setophoma terrestris*, was identified in one field in Alberta (Yang et al. 2017). The same pathogen was re-isolated from wheat root derived from the same field, but no disease symptoms were observed.

Table 1. Diseases diagnosed on **cereal crops** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Wheat	Isolated cultures*	*Fusarium avenaceum*	42
	Isolated cultures*	*Fusarium culmorum*	35
	Isolated cultures*	*Fusarium poae*	19
	Isolated cultures*	*Fusarium graminearum*	15
	Isolated cultures*	*Microdochium nivale*	4
	Isolated cultures*	*Microdochium seminicola*	4
	Isolated culture*	*Fusarium proliferatum*	1
	Isolated cultures*	Unidentified	4
	Leaf chlorosis	Negative for phytoplasma**	3
	Bleached heads	*Arthrinium sacchari*	1
	Loose smut	*Ustilago tritici*	1
	Bacterial leaf streak	Unidentified bacterium	1
	Root rot	*Microdochium bolleyi* *Fusarium* sp.	1
	Root w/o symptom	*Setophoma terrestris*	1
Oat	Bacterial leaf blight	*Unidentified bacterium* *Phaeosphaeria* sp.	3
	Bacterial leaf blight	Unidentified bacterium	2
Barley	Leaf chlorosis	Negative for phytoplasma**	1
Triticale	Leaf chlorosis	*Microdochium nivale* *Fusarium* sp.	1
Total			139

* Pure cultures were submitted to the APHL for identification as part of the 2017 Alberta Agriculture *Fusarium graminearum* survey.
**These samples were submitted specifically for phytoplasma testing.

Table 2. Diseases diagnosed on **canola samples** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Canola	Seedling blight	*Fusarium redolens*	2
	Stem discoloration and rot	*Leptosphaeria maculans* Soft rot bacteria	1
	Stem cankers	*Leptosphaeria maculans*	7
	Stem lesions	*Leptosphaeria biglobosa*	1
	Root galling	*Plasmodiophora brassicae*	1
Total			12

Table 3. Diseases diagnosed on **potato samples** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Potato	Isolated cultures*	*Fusarium sambucinum*	65
	Isolated culture*	*Fusarium avenaceum*	1
	Isolated culture*	*Fusarium culmorum*	1
	Soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
	Black scurf	*Rhizoctonia solani*	1
	Wilt and necrosis	*Rhizoctonia solani*	1
	Suspect Dickeya blackleg	Negative for *Dickeya* spp.	1
	Potato Virus Y (PVY)	Negative for PVY**	3
	Late blight	*Phytophthora infestans*	1
Total			76

* Pure cultures were submitted to the APHL for identification as part of the 2017 Alberta Agriculture potato fusarium survey.
**These samples were submitted specifically for Potato Virus Y testing.

Table 4. Diseases diagnosed on **corn samples and corn stalk-derived fungal cultures** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Corn	Isolated cultures*	*Fusarium culmorum*	168
		Fusarium graminearum	81
		Fusarium avenaceum	51
		Fusarium proliferatum	5
		Fusarium cerealis	3
		Fusarium pseudograminearum	2
		Fusarium sporotrichioides	2
		Fusarium incarnatum	1
		Fusarium temperatum	1
		Fusarium brachygibbosum	1
		Fusarium equiseti	1
	Leaf mosaic chlorosis	Unidentified virus	1
	Pink mould on kernels	*Fusarium poae*	1
Total			318

* Pure cultures were submitted to the APHL for identification as part of the 2017 Alberta Agriculture corn fusarium survey.

Table 5. Diseases diagnosed on **legumes** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Pea	Root rot	*Fusarium* spp. *Pythium* spp.	7
	Root rot	*Fusarium* spp.	1
	Wilt and root rot	*Stemphylium globuliferum* *Fusarium* sp.	1
	Leaf lesions	*Fusarium chlamydosporum* *Cladosporium* sp.	1
Lentil	Leaf chlorosis	*Fusarium* spp.	2
	Crown and root rot	*Fusarium* spp.	1
	Isolated cultures*	*Fusarium redolens*	3
	Isolated culture*	*Stemphylium* sp.	1
Soybean	Plant yellowing and death	*Fusarium* spp.	1
	Stem canker	*Diaporthe caulivora*	1
	Isolated culture*	*Fusarium equiseti*	1
	Isolated culture*	*Trichoderma* sp.	1
Total			21

* Pure cultures were provided to the APHL for identification.

Table 6. Diseases diagnosed on **trees and fruit crops** submitted to the Alberta Plant Health Lab in 2017.

Crop	Symptom	Causal agent(s)	Number
Elm	Wilt	*Dothiorella ulmi*	11
	Wilt	*Microsphaeropsis olivacea*	1
	Cankering and wilt	*Valsa malicola*	1
	Cankering and wilt	*Phoma* sp.	1
	Cytospora canker	*Cytospora* sp.	2
	Wilt	Negative for *Ophiostoma ulmi**	9
Spruce	Needle blight	*Phoma* spp.	5
	Needle cast / blight	*Sydowia polyspora*	3
	Needle cast	*Rhizosphaera kalkhoffii*	1
Pine	Needle cast / blight	*Sydowia polyspora*	3
	Stem canker	*Phoma* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	1
	Needle cast	*Rhizosphaera* spp.	1
Poplar	Leaf spot	*Marssonina* sp.	1
	Necrotic leaf spots	*Venturia* sp.	3
	Necrotic leaf spots	*Valsa sordida*	1
Ash	Wilt and canker	*Valsa cypri*	1
Swedish aspen	Bronze leaf	*Apioplagiostoma populi*	3
Tamarack	Needle blight/ cast	*Ascochyta* sp.	1
Willow	Leaf lesions	*Cladosporium* sp.	1

(Table 6 cont.)

Strawberry	Powdery mildew	*Podosphaera aphanis*	1
	Crown and root rot	*Phytophthora* spp. or *Pythium* spp. *Fusarium* spp. *Rhizoctonia* spp.	3
Cherry	Stem canker and gummosis	Bacteria	1
Raspberry	Stem and leaf discolouration	*Botrytis* sp.	1
Saskatoon	Rust	*Gymnosporangium juniperi-virginianae*	1
Total			58

*These samples were submitted specifically for Dutch elm disease (*Ophiostoma ulmi*) testing.

Table 7. Diseases diagnosed on **vegetable crops** submitted to the Alberta Plant Health Lab in 2017.

Crop	**Symptom**	**Causal agent(s)**	**Number**
Cabbage	Root and crown rot	*Pythium* spp. *Plectosphaerella cucumerina*	6
Lettuce	Poor emergence and root rot	*Pythium* sp.	1
Garlic	Phytoplasma testing	Positive for phytoplasma*	2
	Phytoplasma testing	Negative for phytoplasma*	1
Turnip	Root galling and lesions	Scab pathogen	1
Total			11

*These samples were submitted specifically for phytoplasma testing.

Table 8. Diseases diagnosed on **other crops** submitted to the Alberta Plant Health Lab in 2017.

Crop	**Symptom**	**Causal agent(s)**	**Number**
Alfalfa	Root rot	*Neonectria candida*	5
	Leaf spot	*Phoma medicaginis* *Stemphylium globuliferum*	2
	Stem pustules	*Microdochium bolleyi*	1
Basil	Root rot	*Pythium* sp.	1
Dahlia	Leaf spotting and yellow venation	Virus	2
		Fusarium tricinctum	2
Rhodiola	Root rot	*Fusarium oxysporum* Fusarium redolens *Diaporthe gulyae* *Setophoma terrestris*	2
	Root and crown rot	*Phomopsis columnaris*	1
Hollyhock	Leaf rust	*Puccinia* sp.	1
Quinoa	Root rot	*Pythium* spp. *Fusarium* spp.	2
Sugar beet	Leaf spot	*Stemphylium* sp.	8
Total			25

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CROPS / CULTURES: All Crops - Diagnostic Laboratory Report
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: 2017 MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

ABSTRACT: This report summarizes the diseases and disorders diagnosed on plant samples analyzed by the Manitoba Agriculture Crop Diagnostic Centre in 2017. Samples received by the laboratory covered most crops grown in Manitoba and also included ornamentals, grasses and trees.

METHODS: The Manitoba Agriculture, Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Manitoba Agriculture Crop Industry Branch specialists, extension and other departmental personnel, farmers, agri-business representatives and the public, submitted samples. Diagnostic methods used included visual examination for symptoms, microscopy, moist chamber incubation, culturing onto artificial media (general and pathogen specific), Agdia ImmunoStrips® and ELISA testing.

RESULTS: Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1 to10 and cover the period from January 1 to November 30, 2017. Diagnoses for pulse crops are reported separately from special crops and are presented in Table 10.

Table 1. Diseases diagnosed on **herbaceous ornamental plant samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
African violet (*Saintpaulia sp*.)	Root rot	*Pythium* sp.	1
Bells of Ireland (*Moluccella laevis*)	Leaf spot	*Cercospora* sp.	1
Chinese Lantern (*Physalis alkekengi*)	Environmental stress		1
	Nutrient deficiency		1
Fern	Environmental stress		1
	Nutrient deficiency		1
Hosta	Environmental stress		2
Hydrangea	Environmental stress		1
Iris	Virus		1
Lilly of the valley (*Convallaria majalis*)	Environmental stress		2
	Nutrient deficiency		2
Ninebark (*Physocarpus opulifolius*)	Herbicide injury		1
Rudbeckia	Root rot	*Fusarium* sp.	1
Virginia Creeper (*Parthenocissus quinquefolia*)	Herbicide injury		1

Table 2. Diseases diagnosed on **cereal crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	**SYMPTOM/ DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Wheat (*Triticum aestivum*)	Bacterial leaf blight	*Pseudomonas syringae* pv. *syringae*	2
	Black head moulds	*Epicoccum nigrum*, *Alternaria* sp.	1
	Common root rot	*Cochliobolus sativus*	2
	Ergot	*Claviceps purpurea*	1
	Leaf spot	*Septoria* sp.	2
	Powdery mildew	*Blumeria graminis*	2
	Root rot	*Fusarium* sp., *Pythium* sp.,	7
		Rhizoctonia spp.	4
	Stripe rust	*Puccinia striiformis*	4
	Tan spot	*Pyrenophora tritici-repentis*	2
	Wheat streak mosaic	*Wheat streak mosaic virus*	21
	Environmental injury		1
	Physiological disorders	Melanism	7
	Herbicide injury		1
	Nutrient deficiency		
Barley (*Hordeum vulgare*)	Common root rot	*Cochliobolus sativus*	1
	Fusarium head blight	*Fusarium graminearum, F. avenaceum*	6
	Leaf rust	*Puccinia* sp.	1
	Loose smut	*Ustilago nuda*	2
	Net blotch	*Drechslera teres*	2
	Root rot	*Fusarium* sp.	1
	Herbicide injury		1
	Environmental injury		2
	Nutrient deficiency	Undetermined	1
	Bacterial blight	*Pseudomonas syringae*	7
	Leaf spot	*Pyrenophora avenae*	2
Oat (*Avena sativa*)	Root rot complex	*Fusarium* sp., *Cochliobolus* sp.	2
	Herbicide injury		3
	Environmental injury		8
	Nutrient deficiency	Undetermined	1

Table 3. Diseases diagnosed on **vegetable crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Basil	Leaf spot	*Cladosporium* sp.	1
Beet	Rhizomania	Undetermined	2
Carrot	Canker (black)	*Itersonilia* sp.	3
Cucumber	Powdery mildew	*Erysiphe cichoracearum*	1
	Environmental stress		4
	Nutrient deficiency		1
Garlic	Fusarium basal rot	*Fusarium* sp.	2
	Bulb rot	*Fusarium* sp.	2
	Bulb rot (blue mould)	*Penicillium* sp.	2
	Bulb rot	*Rhizopus*	1
Onion	Fusarium basal rot	*Fusarium* sp.	1
Parsnip	Environmental injury		3
Pepper	Early blight	*Alternaria solani*	1
	Nutrient deficiency		1
Pumpkin	Herbicide injury		1
Radish daikon	Black rot	Fungal (undetermined)	3
Tomato	Early blight	*Alternaria solani*	3
	General stress	Environmental stress	4
	Late blight, foliar	*Phytophthora infestans*	1
	Leaf spot	*Septoria* sp.	3
	Virus	*Undetermined*	2
	Herbicide injury		1
	Environmental injury		1
	Nutrient deficiency		1

Table 4. Diseases diagnosed on **potato crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
Black dot(tuber)	*Colletotrichum coccodes*	5
Blackleg	*Pectobacterium carotovorum* subsp. *atrosepticum*	3
Black scurf (tuber)	*Rhizoctonia solani*	2
Early blight (foliar)	*Alternaria solani*	4
Fusarium dry rot	*Fusarium sambucinum*	1
Late blight	*Phytophthora infestans*	16
Pink eye	Unknown	9
Pink rot	*Phytophthora erythroseptica*	2
Potato Mop Top Virus	*Furovirus*	8
Scab, common	*Streptomyces* spp.	3
Scab, powdery	*Spongospora subterranea*	1

(Table 4 *cont.)*

Silver scurf	*Helminthosporium solani*	12
Virus	*PVX and PVY*	1
Virus	*PVX, PVS and PVY*	1
Environmental injury		5
Nutrient deficiency		1
Herbicide injury		1

Table 5. Diseases diagnosed on **shelterbelt trees** and **woody ornamental plants** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Ash (*Fraxinus* sp.)	Anthracnose	*Gloeosporium aridum*	5
	Environmental injury		5
	Herbicide injury		6
Apple Crab	Canker	*Cytospora* sp.	2
(*Malus* spp.)	Frogeye leaf spot	*Botryosphaeria obtusa*	1
	Fire blight	*Erwinia amylovora*	2
Basswood	Anthracnose	*Apiognomonia tiliae*	2
(*Tilia americana*)	Herbicide injury		1
	Environmental injury		5
Balsam Fir	Needle cast	Undetermined	1
(*Abies balsamea*)			
Cedar	Canker	*Cytospora* sp.	1
(*Thuja* sp.)	Leaf Spot	*Septoria* sp.	1
Cotoneaster	Environmental injury		1
(*Cotoneaster* sp.)	Nutritional deficiency		1
Elm, American	Anthracnose	*Gnomonia ulmea*	2
(*Ulmus americana*)	Botryosphaeria canker	*Botryosphaeria* sp.	3
	Coniothyrium canker	*Coniothyrium* sp.	1
	Cytospora canker	*Cytospora* sp.	3
	Dutch elm disease	*Ophiostoma ulmi*	73
	Verticillium wilt	*Verticillium* sp.	19
	Environmental injury		2
Juniper	Canker	*Cytospora* sp.	1
(Juniperus sp.)	Twig blight	*Phomopsis* sp.	2
Lilac	Wilt	*Verticillium* sp.	1
(*Syringa vulgaris*)	Herbicide injury		1
Oak, bur	Anthracnose	*Discula* sp.	1
(*Quercus macrocarpa)*	Herbicide injury		2
	Environmental injury		1
Pine, Scots	Rust gall	*Peridermium harknessii*	1
(*Pinus sylvestris*)	Winter injury	Environmental stress	1
Poplar (*Populus* sp.)	Environmental injury		3

(Table 5 *cont*.)

Spruce	Canker	Undetermined	2
(*Picea* sp.)	Canker	*Cytospora* sp.	2
	Needle blight	*Lirula* sp.	2
	Needle cast	*Lophodermium* spp.	3
		Rhizosphaera kalkhoffii	5
		Stigmina lautii	3
	Twig canker	*Phoma* sp.	1
	Environmental injury		7
	Herbicide injury		1
	Nutrient deficiency		3

Table 6. Diseases diagnosed on **oilseed crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Canola	Blackleg	*Leptosphaeria maculans*	5
	Black spot	*Alternaria brassicae*	6
	Grey Stem	*Pseudocercosporella capsellae*	4
	Root rot	*Fusarium* sp., *Pythium* sp.	7
	Root rot	*Rhizoctonia solani*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
	Wilt	*Fusarium oxysporum*	1
	Wilt/stripe	*Verticillium* sp.	6
	Nutrient deficiency	Undetermined	5
	Nutrient deficiency	Possible sulphur / phosphorus deficiency	1
	Environmental injury		12
	Herbicide injury		16
Flax	Root rot	Fusarium sp.	2
	Environmental injury		1
	Herbicide injury		1
Sunflower	Herbicide injury		3

Table 7. Diseases diagnosed on fruit crop samples submitted to Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Apple	Twig blight	*Phoma* sp.	1
	Twig canker	*Coniothyrium* sp.	1
		Nectria sp.	1
		Unidentified	1
	Fruit disorder	Virus-like, graft-transmissible disease	1
	Physiological condition		3
	Environmental injury		6
	Nutrient deficiency		2
	Herbicide injury		2
Grape	Leaf spot	*Phyllosticta* sp.	1
Raspberry	Fire blight	*Erwinia amylovora*	1
	Cane blight	*Coniothyrium* sp.	1
Strawberry	Flower blight	*Botrytis cinerea*	3
	Fruit rot	*Botrytis cinerea*	2
	Root and crown rot	*Fusarium* sp.	2
		Penicillium sp.	2
		Fusarium sp.	

Table 8. Diseases diagnosed on **forage - legume crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Alfalfa	Spring black stem / leaf spot	*Phoma medicaginis*	2
	Stemphylium leaf spot	*Stemphylium* sp.	1
	Root rot	*Cylindrocarpon* sp.	1
	Herbicide injury		4
	Environmental injury		2
	Nutrient deficiency		1

Table 9. Diseases diagnosed on **special crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Corn	Goss's wilt	*Clavibacter michiganensis* subsp. *nebraskensis*	1
	Holcus spot	*Pseudomonas syringae*	1
	Northern corn leaf spot	*Bipolaris zeicola*	1
	Yellow Leaf blight	*Phyllosticta* sp.	2
	Stalk/root rot	*Fusarium* sp.	2
	Environmental injury		7
	Nutrient deficiency		1
	Herbicide injury		3

(Table 9 *cont.)*

Hemp	Flower blight	*Fusarium graminearum,*	2
	Root and stem rot	*F. sporotrichioides*	2
	Environmental injury	*Fusarium oxysporum*	2
Proso millet	Bacterial leaf spot	*Pseudomonas syringae*	1
Quinoa	Leaf and stem spot	*Ascochyta* sp.	1
	Stem canker	*Phoma* sp.	1
	Root and stem rot	*Fusarium* sp.	1
Sea buckthorn	Herbicide injury		1

Table 10. Diseases diagnosed on **pulse crop samples** submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017.

CROP	**SYMPTOM/ DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Dry bean	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	2
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	1
	Environmental stress		1
Fababean	Alternaria leaf spot	*Alternaria alternata*	1
	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Fusarium* sp.	2
	Environmental stress		1
	Herbicide injury		2
Field pea	Alternaria leaf spot	*Alternaria* sp.	1
	Root rot	*Fusarium* sp.	5
	Root rot	*Fusarium* sp., *Rhizoctonia* sp.	1
	Environmental stress		1
	Nutrient deficiency		1
Soybean	Alternaria leaf spot	*Alternaria sp.*	1
	Anthracnose	*Colletotrichum* sp.	7
	Bacterial blight	*Pseudomonas* sp.	7
	Brown spot	*Septoria glycines*	5
	Downy mildew	*Peronospora manshurica*	8
	Leaf spot	*Cercospora kikuchii*	3
	Pod and seed rot	*Phomopsis* sp.	2
	Root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*	75
	Root rot	*Phytophthora* sp.	8
	Stem blight	*Phomopsis longicolla*	7
	Stem blight	*Phomopsis* sp.	3
	Stem rot	*Sclerotinia sclerotiorum*	3
	Environmental stress		45
	Nutrient deficiency		19
	Herbicide injury		17
	Physiological stress		2

CROPS / CULTURES: Carrots and Onions
LOCATION / RÉGION: Bradford/Holland Marsh, Ontario

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TITLE / TITRE: DISEASES SURVEYED IN ONION, CARROT AND CELERY FIELDS IN THE HOLLAND MARSH IN 2017

ABSTRACT: As part of the integrated pest management (IPM) program provided by the Muck Crops Research Station (MCRS) in the Holland Marsh/Bradford region of Ontario, scouted onion, carrot, and celery fields were monitored throughout the entire season and surveyed for diseases prior to harvest. In 2017, 33 onion fields and 34 carrots fields participated in MCRS IPM program. To survey plants for diseases at harvest, ten plants were randomly sampled from ten locations throughout each field.

INTRODUCTION AND METHODS: As part of the integrated pest management program, the plant disease diagnostic laboratory of the Muck Crops Research Station (MCRS) provides scouting for onion and carrot fields in and around the Holland Marsh region. Trained scouts monitor fields of participating growers twice weekly throughout the growing season and just prior to harvest, assess ten plants from ten random locations in each field for disease presence on the roots or bulbs.

RESULTS AND COMMENTS: In 2017, 33 onion and 34 carrot fields were scouted. The spring of 2017 was very cool and wet, and in general most crops were seeded one to three weeks later than average. On 23 June, most fields in the Marsh became flooded after an >80 mm rainfall event. In carrots, the flooding resulted in excessive forking and rusty root (*Pythium* spp.). Onion bulb diseases were generally low, although there was one field with a severe case of white mold (*Sclerotinia* cepivorum). A summary of disease incidence throughout the Marsh and diseases present on the bulbs or roots at harvest for the 2017 season is presented in Table 1.

Table 1. Diseases identified at harvest in carrot and onion fields in the Holland Marsh, Ontario, 2017.

CROP	DISEASE	CAUSAL AGENT	INCIDENCE (%)[1]	RANGE OF SEVERITY (%)[2]
Carrot	Cavity Spot	*Pythium* spp.	75	1-28
	Fusarium Dry Rot	*Fusarium spp.*	10	1-14
	Crater Rot	*Rhizoctonia* spp.	50	1-16
	Rusty Root	*Pythium* spp.	96	1-34
	Crown Gall	*Agrobacterium*	36	1-36
	Forking/Split	*tumefaciens*	100	1-39
Onion	White rot	*Sclerotium cepivorum*	32	2-36
	Bacterial rot/soft rot	*Erwinia carotovora*	25	1-3
	Downy mildew	*Peronospora destructor*	75	N/A
	Purple blotch	*Alternaria porri*	10	N/A
	Smut	*Urocystis cepulae*	32	N/A
	Stemphylium leaf blight	*Stemphylium vesicarium*	96	N/A

[1]Percentage of total carrot or total onion fields sampled in which the disease was diagnosed.
[2]Range in the proportion of root systems or bulbs affected by a particular disease.

ACKNOWLEDGEMENTS: This project was funded in part through Growing Forward 2 (GF2), a federal-provincial-territorial initiative administered in Ontario by the Agricultural Adaptation Council. Funding was also provided in part by the Bradford Cooperative Storage Ltd., agrochemical companies and growers participating in the Muck Crops Research Station IPM program.

CROPS / CULTURES: Vegetable Crops - Diagnostic Laboratory Report
LOCATION / RÉGION: Bradford/Holland Marsh, Ontario

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TITLE / TITRE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2017

ABSTRACT: As part of the integrated pest management (IPM) program provided by the Muck Crops Research Station (MCRS), diagnostics service is provided to vegetable growers around Holland Marsh/Bradford, Ontario. In 2017, 90 samples were submitted to the diagnostic laboratory for identification and possible control recommendations. Samples included plants with disease, physiological disorders, insect feeding damage and weeds.

INTRODUCTION AND METHODS: As part of the integrated pest management 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 objectives of the IPM program are to ensure scouting services are available in the Holland Marsh, provide growers with disease and insect forecasting information and 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 2017 growing season were cool and wet and conducive for the development of fungal pathogens. Conditions were particularly favourable for onion downy mildew. In April, May, and June, there was twice the rainfall compared to the 10-year average. In one eight hour period on June 23, over 80 mm of rain fell resulting in significant flooding in the Holland Marsh. From May 4 to October 5, 2017, the diagnostic laboratory of the MCRS received 90 samples for diagnosis. Of these, 76% were diseases (68 samples) and 24% physiological disorders (22 samples). These samples were associated with the following crops: onion (42%), carrot (30%), celery (16%), lettuce (3.3%) and other crops (8.9%). Major insect pests identified included carrot weevil and onion thrips. Carrot rust fly and onion maggot numbers were low throughout the year. Sclerotinia white mold in carrot was found in the upper canopy of carrot plants this year. It typically only occurs in the bottom of a full canopy after carrot leaves start to die. In onions, botrytis leaf blight has historically been the predominant disease, however this year no botrytis was found in the Marsh. A summary of diseases and causal agents diagnosed on crop samples submitted to the MCRS diagnostic laboratory in 2017 is presented in Table 1.

Table 1. Diseases diagnosed on plants submitted to the MCRS Diagnostic Laboratory in 2017**.**

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Beet	Bottom rot	*Rhizoctonia solani*	1
	Leaf blight	*Cercospora beticola*	1
Carrot	Aster yellows	*Phytoplasma*	4
	Fusarium dry rot	*Fusarium* spp.	1
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	11
	Pythium root dieback	*Pythium spp.*	4
	Sclerotinia white mold	*Sclerotinia sclerotiorum*	2
	Chemical injury	Herbicide damage	5
Celery	Celery leaf curl	*Colletotrichum* spp.	3
	Pink rot	*Sclerotinia sclerotiorum*	2
	Soft rot	*Erwinia carotovora*	5
	Blackheart	Calcium deficiency	2
Cilantro	Bacterial leaf spot	*Pseudomonas syringae* pv. *coriandricola*	2
Eggplant	Leaf wilt	*Verticillium spp.*	1
Lettuce	Bacterial leaf spot	*Xanthomonus campestris*	2
	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	1
Lupin	Downy mildew	*Peronospora trifoliorum*	1
Onion	Bacterial rot/soft rot	*Erwinia carotovora*	3
	Downy mildew	*Peronospora destructor*	5
	Pink root	*Phoma terrestris*	3
	Purple blotch	*Alternaria porri*	1
	White rot	*Sclerotium cepivorum*	2
	Smut	*Urocystis cepulae*	3
	Stemphylium leaf blight	*Stemphylium vesicarium*	7
	Chemical injury	Herbicide damage	6
	Environmental injury	Pelting rain injury/wind	2
	Tip yellowing	Water stress	6
Onion (transplant)	Seedling dieback	Overwatering	1
Potato	Blackleg	*Pectobacterium atrosepticum*	2
Tomato	Late blight	*Phytophthora infestans*	1
DISEASED SAMPLES			68
ABIOTIC AND OTHER DISORDERS			22
TOTAL SUBMISSIONS			**90**

ACKNOWLEDGEMENTS: This program was funded in part through Growing Forward 2 (GF2), a federal-provincial-territorial initiative, administered in Ontario by the Agricultural Adaptation Council. Funding was also provided in part by the Bradford Cooperative Storage Ltd., agrochemical companies and growers participating in the Muck Crops Research Station IPM program.

CROPS / CULTURES: Commercial Crops **-** Diagnostic Laboratory Report
LOCATION / RÉGION: Ontario

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TITLE / TITRE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PLANT DISEASE CLINIC, UNIVERSITY OF GUELPH IN 2017

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Plant Disease Clinic, University of Guelph in 2017 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 Plant Disease 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 plant disease diagnosis, plant parasitic nematode identification and enumeration, pathogen detection from soil and water, and insect identification. The following data are for samples received by the laboratory for disease diagnosis in 2017. 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 2017, from January 1 to December 31, the Plant Disease Clinic received samples representing plants in approximately 100 genera for disease diagnosis. Results are presented in Tables 1 to 6. For various reasons, the frequency of samples submitted to the laboratory does not reflect the prevalence of diseases of various crops in the field. Problems caused by plant parasitic nematodes, insects and abiotic factors are not listed. Most diseases identified in 2017 are commonly diagnosed.

Table 1. Plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Plant Disease Clinic in 2017.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Asparagus (*Asparagus officinalis*)	Crown rot	*Fusarium oxysporum*	2
	Crown rot	*Phytophthora asparagi*	1
	Crown rot	*Phytophthora cactorum*	1
	Crown rot	*Pythium dissotocum*	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Fusarium solani*	2
	Crown and root rot	*Pythium aphanidermatum*	2
	Crown and root rot	*Pythium ultimum*	1
Brassica sp.	Bacterial leaf spot	*Pseudomonas viridilivida*	1
	Black spot	*Alternaria* sp.	1
	Stem rot	*Fusarium solani*	1
Broccoli (*Brassica oleracea* var. *botrytis*)	Bacterial leaf spot	*Xanthomonas campestris*	1
	Black spot	*Alternaria* sp.	2

(Table 1 *cont.)*			
Cabbage (*Brassica oleracea* var. *capitata*)	Crown and root rot	*Pythium* sp.	2
	Root rot	*Pythium irregulare*	1
	Root rot	*Rhizoctonia solani*	1
Carrot (*Daucus carota*)	Cavity spot	*Pythium sulcatum*	1
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium irregulare*	1
Celery (*Apium graveolens*)	Crown rot	*Fusarium* sp.	1
	Leaf curl	*Colletotrichum acutatum*	2
Cucumber (*Cucumis sativus*)	Crazy root	*Agrobacterium* sp.	1
	Crown rot	*Pythium sylvaticum*	1
	Crown and root rot	*Fusarium oxysporum*	6
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Phytophthora capsici*	1
	Crown and root rot	*Pythium aphanidermatum*	6
	Crown and root rot	*Pythium ultimum*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Cucumber Green Mottle Mosaic Virus	Cucumber Green Mottle Mosaic Virus (CGMMV)	11
	Fruit rot	*Rhizopus* sp.	1
	Potyvirus	Potyvirus	3
	Powdery mildew	*Sphaerotheca fuliginea*	1
	Root rot	*Fusarium oxysporum*	7
	Root rot	*Fusarium solani*	4
	Root rot	*Phytophthora cactorum*	2
	Root rot	*Pythium* sp.	3
	Root rot	*Pythium aphanidermatum*	6
	Root rot	*Pythium dissotocum*	4
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium sylvaticum*	1
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	2
	Tobacco Streak Virus	Tobacco Steak Virus (TSV)	1
	Stem rot	*Fusarium oxysporum*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Fenugreek (*Trigonella foenum-graecum*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium ultimum*	1
	Root rot	*Thielaviopsis basicola*	1

(Table 1 *cont.*) Garlic (*Allium sativum*)	 Blue mould Garlic Common Latent Virus Gray mould Neck rot Plate rot Plate rot Potyvirus Root rot Root rot Root rot Root rot Rot Rot Rot Skin blotch	 *Penicillium* sp. Garlic Common Latent Virus (GCLV) *Botrytis cinerea* *Botrytis* sp. *Fusarium oxysporum* *Fusarium solani* Potyvirus *Pythium* sp. *Pythium irregulare* *Pythium sylvaticum* *Rhizoctonia solani* *Fusarium oxysporum* *Pythium* sp. *Rhizoctonia solani* *Embellisia allii*	 3 7 1 1 14 2 3 2 1 2 1 2 2 1 4
Kale (*Brassica oleracea* var. *viridis*)	Bacterial leaf spot	*Pseudomonas syringae*	1
Leek (*Allium porrum*)	Pythium rot	*Pythium* sp.	1
Lettuce (*Lactuca sativa*)	Bacterial leaf spot Powdery Mildew Root rot Root rot Root rot Root rot Root rot Root rot Wilt	*Xanthomonas campestris* *Golovinomyces cichoracearum* *Phytophthora cryptogea* *Pythium dissotocum* *Pythium sylvaticum* *Pythium ultimum* *Thielaviopsis basicola* *Rhizoctonia solani* *Verticillium dahliae*	1 1 1 5 1 4 4 1 2
Onion (*Allium cepa*)	Basal rot Basal rot Blight Smut Storage rot	*Fusarium oxysporum* *Fusarium solani* *Botrytis* sp. *Urocystis* sp. *Rahnella aquatilis*	3 3 1 1 1
Pea (*Pisum sativum*)	Crown and root rot Crown and root rot Crown and root rot Crown and root rot Root rot	*Fusarium oxysporum* *Fusarium solani* *Pythium ultimum* *Rhizoctonia solani* *Thielaviopsis basicola*	1 1 1 1 1

(Table 1 *cont.*)

Pepper (*Capsicum* sp.)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	6
	Bacterial leaf spot	*Pseudomonas syringae*	2
	Bacterial leaf spot	*Xanthomonas campestris*	1
	Crown and root rot	*Fusarium oxysporum*	7
	Crown and root rot	*Fusarium solani*	2
	Crown and root rot	*Pythium* sp.	2
	Crown and root rot	*Pythium aphanidermatum*	1
	Crown and root rot	*Pythium dissotocum*	3
	Crown and root rot	*Pythium ultimum*	1
	Fruit rot	*Fusarium* sp.	3
	Fruit rot	*Geotrichum* sp.	1
	Fruit rot	*Phytophthora capsici*	1
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Pythium* sp.	1
	Root rot	*Rhizoctonia solani*	1
	Stem rot	*Fusarium solani*	1
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
Potato (*Solanum tuberosum*)	Bacterial soft rot	*Pectobacterium carotovorum*	1
	Black dot root rot	*Colletotrichum coccodes*	1
	Blackleg	*Dickeya* sp.	1
	Blackleg	*Pectobacterium carotovorum*	1
	Common scab	*Streptomyces* spp.	1
	Leak	*Pythium ultimum*	1
	Powdery scab	*Spongospora subterranea*	1
	Rot	*Fusarium* sp.	2
	Silver scurf	*Helminthosporium solani*	2
	Soft rot	*Pectobacterium carotovorum*	1
	Sour rot	*Geotrichum* sp.	2
	Verticillium wilt	*Verticillium dahliae*	2
Spinach (*Spinacia oleracea*)	Anthracnose	*Colletotrichum* sp.	2
	Rot	*Pythium ultimum*	1

(Table 1 *cont.*) Tomato (*Lycopersicon esculentum*)			
	Anthracnose	*Colletotrichum coccodes*	6
	Bacterial leaf spot	*Pseudomonas syringae*	1
	Bacterial spot	*Xanthomonas campestris*	1
	Blight	*Phytophthora capsici*	2
	Canker	*Fusarium oxysporum*	1
	Crazy root	*Agrobacterium* sp.	21
	Crown rot	*Fusarium oxysporum*	2
	Crown and root rot	*Fusarium oxysporum*	13
	Crown and root rot	*Fusarium solani*	6
	Crown and root rot	*Pythium* sp.	4
	Crown and root rot	*Pythium aphanidermatum*	3
	Crown and root rot	*Pythium dissotocum*	2
	Crown and root rot	*Pythium irregulare*	2
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Late blight	*Phytophthora infestans*	5
	Leaf mould	*Fulvia fulva*	
	Pepino Mosaic Virus	Pepino Mosaic Virus (PepMV)	20
	Root rot	*Fusarium oxysporum*	18
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	5
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium dissotocum*	13
	Root rot	*Pythium irregulare*	4
	Root rot	*Rhizoctonia solani*	2
	Stem rot	*Botrytis* sp.	1
	Stem rot	*Fusarium* sp.	1
	Stem rot	*Fusarium solani*	3
	Stem rot	*Pectobacterium carotovorum*	1
	Stem rot	*Phytophthora capsici*	2
	Stem rot	*Sclerotinia sclerotiorum*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
	Tomato bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	9
	Tomato Mosaic Virus	Tomato Mosaic Virus (ToMV)	1
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	2
	Wilt	*Fusarium oxysporum*	1
	Wilt	*Verticillium dahliae*	5

Table 2. Plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Plant Disease Clinic in 2017.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Apple (*Malus* sp.)	Apple Mosaic Virus Black rot Canker Canker Canker Canker Crown gall Crown rot Crown rot Crown rot Fire blight Root rot Scab	Apple Mosaic Virus (ApMV) *Botryosphaeria obtusa* *Botryosphaeria* sp. *Cytospora* sp. *Neofabraea alba* *Phomopsis* sp. *Agrobacterium* sp. *Phytophthora* sp. *Phytophthora cactorum* *Phytophthora drechsleri* *Erwinia amylovora* *Pythium* sp. *Venturia inaequalis*	6 4 8 2 1 17 1 3 3 1 26 1 1
Blackberry (*Rubus* sp.)	Downy mildew	*Peronospora* sp.	1
Blueberry (*Vaccinium* sp.)	Red leaf	*Exobasidium vaccinii*	1
Grape (*Vitis* sp.)	Grapevine Leafroll-associated Virus Hop Stunt Viroid	Grapevine Leafroll-associated Virus (GLRaV) Hop Stunt Viroid (HSVd)	33 3
Pear (*Pyrus* sp.)	Crown and root rot	*Phytophthora cactorum*	1
Raspberry (*Rubus* sp.)	Blackberry Chlorotic Rringspot Virus Powdery mildew Raspberry Bushy Dwarf Virus Raspberry Leaf Mottle Virus Rubus Yellow Net Virus Rust Tomato Ringspot Virus	Blackberry Chlorotic Ringspot Virus (BCRV) *Oidium* sp. Raspberry Bushy Dwarf Virus (RBDV) Raspberry Leaf Mottle Virus (RLMV) Rubus Yellow Net Virus (RYNV) *Puccinia* sp. Tomato Ringspot Virus (ToRSV)	3 1 9 4 61 1 3

(Table 2. *cont*.)			
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Anthracnose	*Colletotrichum acutatum*	10
	Anthracnose	*Colletotrichum gloeosporioides*	2
	Crown and root rot	*Fusarium* sp.	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Fusarium solani*	4
	Crown and root rot	*Gnomonia* sp.	1
	Crown and root rot	*Phytophthora cactorum*	1
	Crown and root rot	*Pythium* sp.	3
	Crown and root rot	*Rhizoctonia solani*	4
	Gray mould	*Botrytis cinerea*	11
	Leaf blight	*Phomopsis obscurans*	1
	Powdery mildew	*Sphaerotheca* sp.	1
	Powdery mildew	*Sphaerotheca macularis*	1
	Strawberry Mild Yellow Edge Virus	Strawberry Mild Yellow Edge Virus (SMYEV)	3
	Strawberry Mottle Virus	Strawberry Mottle Virus (SMoV)	53
	Strawberry Pallidosis Virus	Strawberry Pallidosis Virus (SPaV)	14
	Strawberry Polerovirus-1	Strawberry Polerovirus-1 (SPV-1)	26
	Strawberry Vein Banding Virus	Strawberry Vein Banding Virus (SVBV)	29
	Red stele root rot	*Phytophthora fragariae*	1
	Root rot	*Phytophthora cactorum*	2
	Root rot	*Phytophthora nicotianae*	1
	Root rot	*Pythium dissotocum*	3
	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium sylvaticum*	5
	Root rot	*Rhizoctonia solani*	6
	Verticillium wilt	*Verticillium dahliae*	1

Table 3. Plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Plant Disease Clinic in 2017

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Alocasia sp.	Potyvirus	Potyvirus	1
Anemone (*Anemone* sp.)	Gray mould	*Botrytis cinerea*	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium sylvaticum*	2
Aralia sp.	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Pythium dissotocum*	1
Azalea (*Rhododendron* sp.)	Leaf spot	*Cercospora* sp.	1
Bentgrass (*Agrostis* sp.)	Anthracnose	*Colletotrichum graminicola*	1
	Anthracnose	*Microdochium bolleyi*	1

(Table 3 *cont.*) Bluegrass (*Poa* sp.)	Anthracnose Blight Blight Fusarium patch	*Colletotrichum graminicola* *Fusarium culmorum* *Pythium* sp. *Microdochium nivale*	1 1 1 1
Brunnera sp.	Root rot	*Phytophthora drechsleri*	1
Calibrachoa (*Calibrachoa* sp.)	Gray mold Root rot Root rot Root rot	*Botrytis cinerea* *Fusarium oxysporum* *Pythium dissotocum* *Thielaviopsis basicola*	4 1 1 2
Canna lily (*Canna* sp.)	Potyvirus	Potyvirus	9
Carnation (*Dianthus caryophyllus*)	Rust	*Uromyces dianthi*	2
Christmas cactus (*Opuntia lectocaulis*	Root rot Root rot	*Fusarium oxysporum* *Pythium ultimum*	1 1
Chrysanthemum (*Chrysanthemum* sp.)	Crown rot Crown rot Crown and root rot Crown and root rot Crown and root rot Root rot Root rot Root rot Root rot Stem rot Tomato Spotted Wilt Virus	*Fusarium oxysporum* *Rhizoctonia solani* *Pythium aphanidermatum* *Pythium dissotocum* *Pythium ultimum* *Fusarium oxysporum* *Pythium irregulare* *Pythium ultimum* *Rhizoctonia solani* *Fusarium* sp. Tomato Spotted Wilt Virus (TSWV)	2 1 1 1 1 1 1 1 1 1 1
Cyclamen sp.	Root rot	*Pythium aphanidermatum*	3
Dipladenia (*Dipladenia* sp.)	Anthracnose	*Colletotrichum* sp.	1
Draceana (*Cordyline* sp.)	Crown and root rot	*Phytophthora nicotianae*	1
Easter cactus (*Hatiora gaertneri*)	Crown and root rot Crown and root rot Crown and root rot	*Fusarium oxysporum* *Pythium irregulare* *Pythium sylvaticum*	1 1 1
Echeveria shaviana	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Echinacea (*Echinacea* sp.)	Gray mould Tobacco Mosaic Virus	*Botrytis cinerea* Tobacco Mosaic Virus (TMV)	1 1
Epimedium sp.	Leaf spot	*Phomopsis* sp.	1
Euphorbia sp.	Root rot	*Pythium ultimum*	1
Geranium (*Pelargonium* sp.)	Gray mould	*Botrytis cinerea*	1

(Table 3 *cont.)* Gerbera (*Gerbera* sp.)	Crown rot Gray mould Powdery mildew Root rot Tomato Spotted Wilt Virus	*Fusarium oxysporum* *Botrytis cinerea* *Oidium* sp. *Phytophthora cryptogea* Tomato Spotted Wilt Virus (TSWV)	1 1 1 1 1
Goldenseal (*Hydrastis canadensis*)	Root rot Root rot	*Fusarium oxysporum* *Fusarium solani*	1 1
Grass (Gramineae)	Anthracnose Anthracnose Blight Crown and root rot Crown and root rot Crown and root rot	*Colletotrichum graminicola* *Microdochium bolleyi* *Curvularia* sp. *Pythium aphanidermatum* *Pythium graminicola* *Pythium irregulare*	1 1 1 1 3 2
Heather (*Calluna vulgaris*)	Twig dieback	*Pestalotiopsis* sp.	1
Heuchera sp.	Root rot	*Fusarium oxysporum*	1
Hibiscus sp.	Crown rot Gray mould	*Fusarium oxysporum* *Botrytis cinerea*	1 1
Hosta (*Hosta* sp.)	Hosta Virus X	Hosta Virus X (HVX)	1
Hydrangea (*Hydrangea* sp.)	Bacterial leaf spot Hydrangea Ringspot Virus Root rot Root rot Root rot Root rot	*Acidovorax valerianellae* Hydrangea Ringspot Virus (HdRSV) *Phytophthora* sp. *Pythium* sp. *Pythium dissotocum* *Pythium irregulare*	1 4 1 1 1 1
Kalanchoe (*Kalanchoe* sp.)	Crown and root rot Crown rot Impatiens Necrotic Spot Virus Stem canker Tomato Spotted Wilt Virus	*Phytophthora nicotianae* *Pythium dissotocum* Impatiens Necrotic Spot Virus (INSV) *Corynespora cassiicola* Tomato Spotted Wilt Virus (TSWV)	2 1 1 2 1
Lavender (*Lavandula* sp.)	Alfalfa Mosaic Virus Gray mould	Alfalfa Mosaic Virus (AMV) *Botrytis cinerea*	1 1
Lenten rose (*Helleborus* sp.)	Root rot Root rot Root rot	*Fusarium* sp. *Phytophthora cactorum* *Pythium irregulare*	1 1 1
Lisianthus (*Eustoma grandiflorum*)	Crown and root rot Crown and root rot	*Fusarium oxysporum* *Pythium ultimum*	1 1
Monarda sp.	Gray mould	*Botrytis cinerea*	1
Moth orchid (*Phalaenopsis* sp.)	Root rot	*Fusarium* sp.	1
New Guinea impatiens (*Impatiens hawkeri*)	Leaf spot	*Myrothecium* sp.	1

(Table 3 *cont.)* Orchid (Orchidaceae)	Cymbidium Mosaic Virus	Cymbidium Mosaic Virus (CymMV)	2
Pentas sp.	Gray mould Root rot Root rot	*Botrytis cinerea* *Pythium* sp. *Thielaviopsis basicola*	2 2 2
Persicaria sp.	Anthracnose	*Colletotrichum* sp.	1
Peony (*Paeonia* sp.)	Root rot Root rot	*Phytophthora cactorum* *Rhizoctonia solani*	1 1
Phlox (*Phlox* sp.)	Blight Gray mould	*Phytophthora drechsleri* *Botrytis cinerea*	1 1
Poinsettia (*Euphorbia pulcherrima*)	Crown and root rot Crown and root rot Gray mould Root rot Root rot Root rot Root rot	*Fusarium* sp. *Fusarium oxysporum* *Botrytis* sp. *Fusarium* sp. *Fusarium oxysporum* *Pythium* sp. *Pythium irregulare*	1 2 1 1 5 2 1
Rose (*Rosa* sp.)	Downy mildew Rust	*Peronospora* sp. *Phragmidium* sp.	1 1
Sedge (*Carex* sp.)	Anthracnose Root rot	*Colletotrichum graminicola* *Pythium dissotocum*	1 1
Sedum (*Sedum* sp.)	Gray mould	*Botrytis cinerea*	1
Tulip (*Tulipa gesneriana*)	Gray mould	*Botrytis cinerea*	
Viola (*Viola* sp.)	Crown and root rot	*Phytophthora nicotianae*	1
Winter heath (*Erica darleyensis*)	Blight	*Rhizoctonia solani*	1

Table 4. Plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Plant Disease Clinic in 2017.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Austrian pine (*Pinus nigra*)	Blight Needle blight Tip blight	*Phomopsis* sp. *Dothiostroma* sp. *Diplodia* sp.	1 1 4
Balsam fir (*Abies balsamea*)	Needle blight	*Phyllosticta* sp.	1
Boxwood (*Buxus* sp.)	Blight Canker Dieback Leaf blight Root rot Root rot Root rot Root rot	*Fusarium* sp. *Volutella buxi* *Phomopsis* sp. *Volutella buxi* *Fusarium* sp. *Phytophthora nicotianae* *Pythium dissotocum* *Thielaviopsis basicola*	1 1 1 74 6 4 1 4
Callery pear (*Pyrus calleryana*)	Rust	*Gymnosporangium* sp.	2
Cedar (*Thuja* sp.)	Charcoal rot	*Macrophomina phaseolina*	1
Chokecherry (*Prunus virginiana*)	Leaf spot	*Blumeriella* sp.	1
Colorado blue spruce (*Picea pungens*)	Needlecast Needlecast	*Rhizosphaera kalkhoffii* *Setomelanomma holmii*	1 1
Cypress (*Cupressus* sp.)	Canker Root rot Root rot Twig blight	*Phomopsis* sp. *Pythium dissotocum* *Rhizoctonia* sp. *Phomopsis* sp.	1 1 1 1
Diervilla sp.	Leaf spot	*Septoria* sp.	1
Douglas fir (*Pseudotsuga menziesii*)	Gray mould Root rot Root rot	*Botrytis* sp. *Thielaviopsis basicola* *Pythium dissotocum*	1 1 1
Eastern white cedar (*Thuja occidentalis*)	Needle blight Tip blight	*Phyllosticta thujae* *Pestalotiopsis* sp.	2 4
Elm (*Ulmus* sp.)	Black spot Dutch elm disease	*Stegophora ulmea* *Ophiostoma* sp.	1 1
Flowering dogwood (*Cornus florida*)	Anthracnose Root rot	*Discula* sp. *Phytophthora cactorum*	1 1
Fraser fir (*Abies fraseri*)	Canker Root rot Root rot Root rot Root rot Root rot Root rot	*Phomopsis* sp. *Phytophthora cactorum* *Phytophthora drechsleri* *Pythium dissotocum* *Pythium irregulare* *Pythium ultimum* *Fusarium oxysporum*	1 2 1 1 1 2 1

(Table 4 *cont.*) Lawson cypress (*Chamaecyparis lawsoniana*)	 Dieback Gray mould	 *Botrytis* sp. *Phomopsis* sp.	 1 1
Lilac (*Syringa vulgaris*)	Bacterial blight Root rot Root rot Root rot Root rot Root rot	*Pseudomonas syringae* *Pythium ultimum* *Phytophthora* sp. *Phytophthora capsici* *Rhizoctonia solani* *Thielaviopsis basicola*	1 1 1 1 1 2
Magnolia (*Magnolia* sp.)	Powdery mildew Bacterial leaf spot Root rot Root rot	*Oidium* sp. *Pseudomonas syringae* *Pythium* sp. *Thielaviopsis basicola*	1 1 1 1
Maple (*Acer* sp.)	Anthracnose Anthracnose Canker Canker Wilt	*Aureobasidium* sp. *Discula* sp. *Cytospora* sp. *Phomopsis* sp. *Verticillium dahliae*	1 1 1 1 1
Norway maple (*Acer platanoides*)	Anthracnose Powdery mildew	*Aureobasidium* sp. *Sawadaea* sp.	1 1
Pagoda dogwood (*Cornus alternifolia*)	Crown and root rot Crown and root rot Crown and root rot	*Phytophthora* sp. *Pythium* sp. *Pythium dissotocum*	2 1 1
Pinus sp.	Brown spot needle blight Tip blight	*Lecanosticta acicola* *Diplodia* sp.	1 1
Ponderosa pine *(Pinus ponderosa)*	Tip blight	*Sphaeropsis sapinea*	1
Prunus sp.	Brown rot	*Monilinia fructicola*	1
Redbud (*Cercis* sp.)	Canker	*Botryosphaeria dothidea*	1
Red elderberry (*Sambucus pubens*)	Leaf spot	*Septoria* sp.	1
Red maple (*Acer rubrum*)	Anthracnose	*Aureobasidium* sp.	2
Red oak (*Quercus rubra*)	Canker Canker	*Nectria cinnabarina* *Neonectria* sp.	1 1
Red osier dogwood (*Cornus sericea*)	Bacterial leaf spot Leaf spot	*Pseudomonas syringae* *Septoria* sp.	1 2
Schefflera sp.	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Scot's pine (*Pinus sylvestris*)	Tip blight	*Diplodia* sp.	1
Serviceberry (*Amelanchier* sp.)	Powdery mildew	*Podosphaera clandestina*	1
Silver maple (*Acer saccharinum*)	Anthracnose Anthracnose	*Aureobasidium* sp. *Discula* sp.	1 1

(Table 4 *cont.*) Spruce (*Picea* sp.)	Canker Canker Needlecast Needlecast Needlecast Root rot Root rot Root rot	*Cytospora* sp. *Phomopsis* sp. *Rhizosphaera kalkhoffii* *Rhizosphaera pini* *Stigmina* sp. *Cylindrocarpon destructans* *Phytophthora* sp. *Rhizoctonia solani*	1 4 2 1 3 1 1 1
Viburnum sp.	Downy mildew	*Plasmopara* sp.	1
Viburnum trilobum	Bacterial leaf spot Downy mildew	*Pseudomonas syringae* *Plasmopara* sp.	1 1
Vulcan palm (*Brighamia insignis*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Western redcedar (*Thuja plicata* sp.)	Root rot Root rot Root rot	*Phytophthora* sp. *Pythium* sp. *Thielaviopsis basicola*	1 1 1
White oak (*Quercus alba*)	Anthracnose	*Discula* sp.	1
White spruce (*Picea glauca*)	Needlecast Root rot Root rot	*Rhizosphaera kalkhoffii* *Fusarium oxysporum* *Pythium ultimum*	1 1 1
Willow (*Salix* sp.)	Anthracnose	*Colletotrichum* sp.	2
Yew (*Taxus* sp.)	Root rot Root rot Root rot	*Phytophthora cryptogea* *Pythium dissotocum* *Thielaviopsis basicola*	1 1 1

Table 5. Plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Plant Disease Clinic in 2017.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Barley (*Hordeum vulgare*)	Barley Yellow Dwarf Virus - pav	Barley Yellow Dwarf Virus – pav (BYDV-pav)	1
	Crown and root rot	*Pythium* sp.	4
	Crown and root rot	*Rhizoctonia solani*	3
	Rust	*Puccinia* sp.	1
Bean (*Phaseolus vulgaris*)	Leaf spot	*Alternaria* sp.	1
	Leaf spot	*Phoma* sp.	1
	Root rot	*Pythium* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Mustard (*Brassica rapa trilocularis*)	Club root	*Plasmodiophora brassicae*	1
Corn (*Zea mays*)	Common smut	*Ustilago maydis*	1
	Root rot	*Fusarium* sp.	3
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium aphanidermatum*	3
	Root rot	*Pythium ultimum*	1
	Rust	*Puccinia* sp.	3
Lupin (*Lupinus* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Pythium irregulare*	1
	Crown and root rot	*Pythium ultimum*	1
	Root rot	*Thielaviopsis basicola*	1
Oat (*Avena sativa*)	Anthracnose	*Colletotrichum graminicola*	1
	Root rot	*Pythium* sp.	1
Soybean (*Glycine max*)	Downy mildew	*Peronospora* sp.	1
	Frogeye leaf spot	*Cercospora sojina*	1
	Leaf spot	*Septoria* sp.	1
	Root rot	*Fusarium oxysporum*	4
	Root rot	*Fusarium solani*	4
	Root rot	*Phytophthora* sp.	3
	Root rot	*Pythium* sp.	5
	Root rot	*Thielaviopsis basicola*	1
	Spot blotch	*Bipolaris sorokiniana*	1
Sugar beet (*Beta vulgaris*)	Root rot	*Aphanomyces cochlioides*	11
	Root rot	*Fusarium oxysporum*	19
	Root rot	*Fusarium solani*	18
	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora drechsleri*	1
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	4
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium sylvaticum*	11
	Root rot	*Pythium ultimum*	5
	Root rot	*Rhizoctonia solani*	8

(Table 5 *cont.*) Wheat (*Triticum* sp.)			
	Barley Yellow Dwarf Virus - pav	Barley Yellow Dwarf Virus – pav (BYDV-pav)	3
	Blotch	*Septoria* sp.	4
	Powdery mildew	*Oidium* sp.	2
	Wheat Spindle Streak Mosaic Virus	Wheat Spindle Streak Mosaic Virus (WSSMV)	2
	Wheat Streak Mosaic Virus	Wheat Streak Mosaic Virus (WSMV)	2

Table 6. Plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Plant Disease Clinic in 2017

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Dill (*Anethum graveolens*)	Leaf blight	*Cercosporidium punctum*	1
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Ginseng (*Panax* sp.)	Root rot	*Cylindrocarpon destructans*	1
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Phytophthora* cactorum	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
		Pythium ultimum	2
Hop (*Humulus lupulus*)	Apple Mosaic Virus	Apple Mosaic Virus (ApMV)	76
	Downy mildew	*Pseudoperonospora humuli*	7
	Hop Latent Virus	Hop Latent Virus (HpLV)	108
	Hop Mosaic Virus	Hop Mosaic Virus (HpMV)	96
	Hop Stunt Viroid	Hop Stunt Viroid (HSVd)	18
Pawpaw (*Asimina triloba*)	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	1
Sage (*Salvia* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Fusarium solani*	1

CROPS / CULTURES: Toutes les cultures - Laboratoire d'expertise et de diagnostic en phytoprotection
LOCATION / RÉGION: Québec

NAMES AND AGENCY / NOMS ET ÉTABLISSMENT:
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TITLE / TITRE: MALADIES ET PROBLÈMES ABIOTIQUES DIAGNOSTIQUÉS SUR LES ÉCHANTILLONS DE PLANTES REÇUS EN 2017 AU LABORATOIRE D'EXPERTISE ET DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ

RÉSUMÉ: Du 1er janvier au 31 décembre 2017, 1945 échantillons ont été traités par la section phytopathologie du laboratoire. Les échantillons reçus comprennent les plantes maraîchères (serres et champs), les petits fruits, les grandes cultures, les plantes à usage industriel, les plantes fourragères, les arbres et arbustes fruitiers, les graminées à gazon, les plantes herbacées, les arbres et les arbustes ornementaux (serres et pépinières) ainsi que les plantes aromatiques et médicinales.

MÉTHODES: Le Laboratoire d'expertise et de diagnostic en phytoprotection du ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) offre un service de diagnostic des maladies parasitaires aux conseillers, producteurs, particuliers et instances gouvernementales. Les données présentées ci-dessous concernent les maladies identifiées sur les échantillons de plantes reçues en 2017. Tous les échantillons de diagnostic font l'objet d'un examen visuel préalable suivi généralement d'un examen au stéréomicroscope. Selon les symptômes, un ou plusieurs tests diagnostiques sont réalisés dans le but de détecter ou d'identifier l'agent ou les agents phytopathogène(s).

Voici les principaux tests utilisés afin d'appuyer le diagnostic : les nématodes vermiformes sont extraits du sol et des tissus végétaux par entonnoir de Baermann tandis que les nématodes à kystes sont extraits du sol à l'aide d'un appareil de Fenwick. Les genres et espèces (lorsque possible) sont identifiés par microscopie et par des techniques de biologie moléculaire. Les champignons sont isolés sur des milieux de culture gélosés, identifiés selon leurs caractéristiques morphologiques ou par des techniques de biologie moléculaire (PCR et séquençage d'ADN). Les bactéries sont isolées sur des milieux de culture gélosés puis identifiées par des tests biochimiques Biolog^{R} et de techniques de biologie moléculaire (PCR et séquençage d'ADN). Les phytoplasmes sont détectés par des techniques de biologie moléculaire (PCR et séquençage d'ADN). Les virus sont, quant à eux, détectés par des tests sérologiques ELISA ou par PCR.

RÉSULTATS ET DISCUSSIONS: Les tableaux 1 à 7 présentent le sommaire des maladies identifiées sur les échantillons de plantes reçus. Au tableau 1, les maladies des plantes maraîchères de plein champ regroupent aussi les transplants provenant des serres, des pépinières et d'entreposage. Au tableau 6, les plantes ornementales d'extérieur (pépinière, aménagement paysager) et d'intérieur (serriculture) sont essentiellement des espèces herbacées annuelles ou vivaces. Finalement, le tableau 7 présente les cas de fines herbes.

Le nombre de maladies rapportées ne correspond pas au nombre d'échantillons réellement reçus et traités puisque plus d'une maladie peut être identifiée sur un échantillon. De plus, les diagnostics dont les causes sont indéterminées ou incertaines pour lesquels les résultats de détection sont négatifs n'ont pas été inclus dans ce rapport.

Il est à noter que les problèmes abiotiques diagnostiqués sur les échantillons sont de nature hypothétique. Il peut s'agir de stress culturaux regroupant, entre autres, les désordres minéraux, les pH et les conductivités électriques de sols et de solutions nutritives inadéquates, les structures de sols inadaptées, une irrigation inappropriée, les blessures mécaniques etc. Les stress climatiques, pour leur part, concernent les insolations, le gel, le froid et l'excès de chaleur, les polluants atmosphériques, les fortes humidités relatives de l'air, l'asphyxie racinaire, les orages violents, les vents forts, la grêle blessant les feuilles, etc. Ces diagnostics sont établis en fonction d'observation de symptômes caractéristiques, de résultats de tests et/ou de discussions avec le client.

REMERCIEMENTS : Les auteurs remercient François Bélanger, Marion Berrouard, Annie Guérin, Michel Lemieux, Chantal Malenfant, Carolle Fortin et Linda Généreux pour leur support technique ainsi que les étudiantes Laurianne Pichette, Audrey Perreault et Daphnée Manseau.

Tableau 1. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **cultures maraîchères** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis* sp.	Pourriture du col / dépérissement	21
	Burkholderia cepacia	Pourriture bactérienne	2
	Chaleur	Échaudure cireuse	1
	Cladosporium sp.	Pourriture	1
	Colletotrichum sp.	Anthracnose	4
	Ditylenchus sp.	Nématode des tiges et des bulbes	8
	Embellisia sp.	Suie des bulbes	15
	Enterobacter cloacae	Pourriture du bulbe	3
	Fusarium sp.	Pourriture fusarienne du bulbe	59
	Fusarium proliferatum	Pourriture fusarienne du bulbe	1
	Helicotylenchus sp.	Nématode spiralé	1
	Pantoea agglomerans	Pourriture des feuilles	1
	Penicillium sp.	Pourriture	5
	Potyvirus	Nématode des lésions racinaires	6
	Pratylenchus sp.	Pourriture	2
	Pseudomonas sp.	Pourriture des feuilles	3
	Pseudomonas marginalis	Brûlure bactérienne	4
	Pseudomonas syringae	Pourriture pythienne	2
	Pythium sp.	Rhizoctone	3
	Rhizoctonia sp.	Aucun	14
	Scutellonema sp.	Aucun	1
	Tylenchus sp.		1
Artichaut	*Alternaria* sp.	Tache	1
	Fusarium sp.	Pourriture fusarienne	1
	Pseudomonas syringae	Brûlure	1
	Rhizoctonia sp.	Rhizoctone	1
Asperge	*Fusarium* sp.	Pourriture fusarienne	1
Aubergine	*Cladosporium* sp.	Cladosporiose	1
	Fusarium sp.	Pourriture fusarienne	1
	Sclerotinia sp.	Sclérotiniose	1
	Verticillium sp.	Verticilliose	1
Bette-à-carde	*Rhizoctonia* sp.	Rhizoctone	1
Betterave	*Alternaria* sp.	Alternariose	1
	Colletotrichum sp.	Tache	1
	Fusarium sp.	Pourriture fusarienne	1
	Helicotylenchus sp.	Nématode spiralé	3
	Meloidogyne sp.	Nématode cécidogène	8
	Paratylenchus sp.	Nématode à stylet	1
	Phoma sp.	Pourriture	1
	Pratylenchus sp.	Nématode des lésions racinaires	2
	Streptomyces sp.	Gale	1
Brocoli	*Alternaria* sp.	Tache alternarienne	1
	Alternaria brassicae	Tache grise alternarienne	2
	Alternaria brassicicola	Tache noire alternarienne	11
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	Pseudomonas marginalis	Pourriture molle bactérienne	2

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Carotte	*Alternaria* sp.	Tache / Pourriture	6
	Fusarium sp.	Pourriture fusarienne	2
	Helicotylenchus sp.	Nématode spiralé	3
	Meloigogyne sp.	Nématode cécidogène	10
	Paratylenchus sp.	Nématode à stylet	11
	pH bas	Anomalie de coloration	1
	Pratylenchus sp.	Nématode des lésions racinaires	2
	Pseudomonas marginalis	Pourriture	1
	Pythium sp.	Pourriture pythienne	2
	Rhizoctonia sp.	Rhizoctone	1
	Scutellonema sp.		1
Céleri	*Alternaria* sp.	Tache alternarienne	1
	Carence en bore	Malformation	1
	Carence en calcium	Malformation	1
	Colletotrichum sp.	Anthracnose / Enroulement de la feuille	3
	Fusarium sp.	Pourriture fusarienne	4
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pseudomonas marginalis	Pourriture bactérienne	1
	Pythium sp.	Pourriture pythienne	2
	Pythium ultimum	Pourriture pythienne	1
Céleri-rave	*Pectobacterium carotovorum*	Pourriture molle bactérienne	1
	Plectosporium sp.	Anomalie de coloration	1
Chou chinois	*Fusarium* sp.	*Pourriture fusarienne*	1
	Pectobacterium sp.	*Pourriture molle bactérienne*	1
	Phoma sp.	*Tache foliaire*	1
Chou pommé	*Alternaria sp.*	Tache alternarienne	2
	Alternaria brassicae	Tache grise alternarienne	1
	Alternaria brassicicola	Tache noire alternarienne	2
	Botrytis sp.	Pourriture grise	1
	Fusarium sp.	Fusariose	1
	Fusarium oxysporum	Fusariose	1
	Pseudomonas syringae	Tache bactérienne	1
	Pythium sp.	Pourriture pythienne	2
	Rhizoctonia sp.	Rhizoctone	1
	Xanthomonas campestris	Nervation noire	6
Chou-fleur	*Fusarium* sp.	Pourriture / Brûlure	2
	Pectobacterium sp.	Pourriture molle	1
	Pectobacterium wasabiae	Pourriture molle	1
	Pythium sp.	Pourriture pythienne	1
	Xanthomonas campestris	Tache bactérienne	1

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Citrouille /	*Cladosporium* sp.	Cladosporiose	1
Courge à moëlle	*Fusarium* sp.	Fusariose / pourriture	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phoma sp.	Pourriture noire	1
	Phytophthora capsici	Pourriture des fruits	1
	Plectosporium sp.	Plectosporiose	1
	Potyvirus	Brûlure	1
	Rhizoctonia sp.	Rhizoctone	1
	ZYMV (Zucchini Yellow Mosaic Virus)	Anomalie de coloration / malformation	2
Concombre	*Alternaria* sp.	Tache alternarienne	1
	Alternaria alternata	Tache alternarienne	3
	Alternaria cucumerina	Tache alternarienne	1
	Cercospora sp.	Cercosporiose	1
	Cladosporium sp.	Cladosporiose	2
	Cladosporium cucumerinum	Cladosporiose	2
	Cladosporium sphaerospermum		1
	CMV (Cucumber Mosaic Virus)	Anomalie de coloration	1
	Colletotrichum sp.	Anthracnose	1
	Corynespora sp.	Corynesporiose	2
	Erwinia tracheiphila	Flétrissement bactérien	2
	Fusarium sp.	Pourriture fusarienne	8
	Fusarium oxysporum	Pourriture fusarienne	2
	Fusarium solani	Pourriture fusarienne	1
	Phoma sp.	Pourriture noire	1
	Phytophthora sp.	Pourriture phytophthoréenne	1
	Plectosporium sp.	Brûlure plectosporienne	3
	Plectosporium tabacinum	Brûlure plectosporienne	1
	Podosphaera sp.	Blanc	3
	Potyvirus	Anomalie de coloration	1
	Pseudomonas marginalis	Pourriture	1
	Pseudomonas syringae	Tache foliaire bactérienne	5
	Pseudoperonospora sp.	Mildiou	1
	Pythium sp.	Pourriture pythienne	2
	Pythium aphanidermatum	Pourriture pythienne	2
	Pythium heterothallicum	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Verticillium sp.	Verticilliose	1

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Courge	*Alternaria* sp.	Pourriture	1
	Alternaria alternata	Tache alternarienne	3
	Aspergillus sp.	Pourriture	1
	Cladosporium sp.	Gale	2
	Colletotrichum sp.	Anthracnose	4
	Erwinia tracheiphila	Flétrissement bactérien	2
	Fusarium sp.	Fusariose	12
	Fusarium equiseti	Fusariose	1
	Fusarium oxysporum	Fusariose	1
	Fusarium sporotrichioides	Pourriture	1
	Geotrichum sp.	Pourriture aqueuse	5
	Pectobacterium carotovorum	Pourriture molle bactérienne	5
	Pectobacterium carotovorum subsp.	Pourriture molle bactérienne	5
	brasiliense	Pourriture des fruits	1
	Phytophthora sp.	Pourriture des fruits	1
	Phytophthora capsici	Plectosporiose	4
	Plectosporium sp.	Blanc	1
	Podosphaera sp.	Anomalie de coloration	1
	Potyvirus	Tache foliaire	1
	Pseudomonas sp.	Tache foliaire	3
	Pseudomonas syringae	Pourriture pythienne	1
	Pythium sp.	Pourriture noire	9
	Stagonosporopsis cucurbitacearum	Anomalie de coloration / Malformation	2
	ZYMV (Zucchini Yellow Mosaic Virus)		
Courgette	*Pseudomonas syringae*	Tache foliaire et sur fruit	2
Daïkon	*Meloidogyne* sp.	Nématode cécidogène	1
	Paratylenchus sp.	Nématode à stylet	1
Échalote	*Fusarium* sp.	Pourriture fusarienne	1
	Phytophthora cactorum	Pourriture phytophthoréenne	1
	Fusarium sp.	Pourriture fusarienne	1
Épinard	*Pythium* sp.	Pourriture pythienne	1
Fenouil	*Alternaria* sp.	Tache foliaire	1
	Botrytis sp.	Pourriture grise	1
	Itersonilia perplexans	Tache foliaire	2
	Pseudomonas caripapayae	Tache foliaire	2
Gingembre	*Fusarium* sp.	Pourriture fusarienne	1
	Rhizoctonia sp.	Rhizoctone	1
Gourgane	*Cladosporium* sp.	Tache	1
	Fusarium sp.	Pourriture fusarienne	1
	Fusarium avenaceum	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	1
	Pythium irregulare	Pourriture pythienne	1

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Haricot	BBWV (Broad Bean Wilt Virus)		1
	Fusarium sp.	Pourriture fusarienne	2
	Podosphaera sp.	Blanc	1
	Pythium sp.	Pourriture pythienne	1
	Pseudomonas syringae	Tache auréolée	3
	Rhizoctonia sp.	Rhizoctone	1
	SMV (Soybean Mosaic Virus)		1
Laitue	*Acremonium* sp.	Pourriture	1
	Alternaria alternata	Tache	1
	Bremia sp.	Mildiou	1
	Botrytis sp.	Pourriture grise	1
	Carence en bore	Brûlure apicale	1
	Colletotrichum sp.	Tache	1
	Fusarium sp.	Pourriture fusarienne	4
	Fusarium oxysporum	Pourriture fusarienne	1
	Fusarium solani	Pourriture fusarienne	1
	Plectosporium tabacinum	Pourriture	1
	Phytophthora sp.	Pourriture phytophthoréenne	1
	Pseudomonas sp.	Tache foliaire	1
	Pseudomonas corrugata	Brûlure	1
	Pseudomonas syringae	Brûlure	1
	Pythium sp.	Pourriture pythienne	3
	Pythium dissotocum	Pourriture pythienne	2
	Pythium sylvaticum	Pourriture pythienne	1
Luffa	*Cladosporium* sp.	Cladosporiose	2
	Fusarium sp.	Fusariose	1
	Plectosporium sp.	Plectosporiose	1
	Verticillium sp.	Verticilliose	1
Melons	*Alternaria* sp.	Alternariose	1
	Alternaria alternata	Tache	1
	Cladosporium sp.	Cladosporiose	1
	Fusarium sp.	Fusariose	1
	Fusarium oxysporum	Fusariose	3
	Phytophthora sp.	Pourriture phytophthoréenne	1
	Pseudomonas syringae	Tache angulaire	1
	Pythium sp.	Pourriture pythienne	2
	Rhizoctonia sp.	Rhizoctone	1
	Sclerotinia sp.	Sclérotiniose	1
Navet	*Botrytis* sp.	Pourriture grise	1
Oignon	*Botrytis* sp.	Brûlure des feuilles	1
	Fusarium sp.	Pourriture fusarienne	8
	IYSV (Iris Yellow Spot Virus)		1
	Peronospora sp.	Mildiou	2
	Pythium sp.	Pourriture pythienne	1
	Sclerotium cepivorum	Pourriture blanche	1
	Stemphylium sp.	Brûlure stemphylienne	2

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Okra	*Pseudomonas* sp.	Pourriture	1
Panais	*Fusarium* sp.	Pourriture fusarienne	1
	Ramularia sp.	Tache foliaire	1
Patate douce	*Fusarium* sp.	Pourriture fusarienne	1
	Rhizoctonia sp.	Rhizoctone	1
Poireau	*Botrytis* sp.	Pourriture	1
	Fusarium sp.	Pourriture fusarienne	6
	Pantoea agglomerans	Pourriture	2
	Pseudomonas syringae	Graisse bactérienne	3
	Rhizoctonia sp.	Rhizoctone	2
Pois	*Ascochyta* sp.	Anthracnose	1
	Colletotrichum sp.	Tache foliaire	1
	Fusarium sp.	Pourriture fusarienne	2
	Pythium sp.	Pourriture pythienne	1
	Sclerotinia sp.	Sclérotiniose	1
Poivron	*Alternaria alternata*	Alternatiose	2
	Alternaria sp.	Alternariose	1
	Botrytis sp.	Moisissure grise	3
	Carence en phosphore	Anomalie de coloration	1
	Clavibacter michiganensis subsp. *michiganensis*	Chancre bactérien	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium sp.	Pourriture fusarienne	5
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phoma sp.	Tache	1
	Phytophthora sp.	Pourriture phytophthoréenne	2
	Plectosporium sp.	Pourriture	1
	Polluant gazeux – éthylène	Malformation / Anomalie de coloration	1
	Pseudomonas caripapayae	Tache bactérienne	4
	Pseudomonas syringae	Tache bactérienne	8
	Pythium sp.	Pourriture pythienne	2
	Rhizoctonia sp.	Rhizoctone	1
	Xanthomonas campestris	Tache bactérienne	1

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pomme de terre	*Alternaria alternata*	Alternariose	8
	Alternaria solani	Alternariose	3
Pomme de terre	Blessure mécanique	Anomalie de coloration	1
	Chaleur	Anomalie de coloration	1
	Colletotrichum sp.	Dartrose	16
	Désordre génétique	Anomalie de coloration	1
	Froid	Anomalie de coloration	1
	Fusarium sp.	Pourriture fusarienne	15
	Fusarium commune	Pourriture fusarienne	1
	Fusarium equiseti	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	1
	Geotrichum sp.	Pourriture caoutchouc	4
	Gliocladium sp.	Pourriture sèche	2
	Gliocladium roseum	Pourriture sèche	1
	Helminthosporium sp.	Tache argentée	1
	Meloidogyne sp.	Nématode cécidogène	2
	Ozone	Anomalie de coloration	1
	Pectobacterium atrosepticum	Pourriture molle bactérienne / Jambe noire	1
	Pectobacterium carotovorum	Pourriture molle bactérienne / Jambe noire	4
	Pectobacterium carotovorum subsp. *brasiliensis*	Pourriture molle bactérienne / Jambe noire	1
	Pectobacterium wasabiae	Pourriture molle bactérienne / Jambe noire	4
	Phytophthora erythroseptica	Pourriture rose	1
	PMTV (Potato Mop-Top Virus)	Anomalie de coloration	3
	Potyvirus	Anomalie de coloration	1
	Pratylenchus sp.	Nématode des lésions racinaires	1
	Pseudomonas sp.	Pourriture	1
	PVY (Potato Virus Y)	Anomalie de coloration	1
	Pythium sp.	Pourriture aqueuse	9
	Rhizoctonia sp.	Rhizoctone	3
	Sclerotinia sp.	Sclérotiniose	1
	Spongospora subterranea	Gale poudreuse	2
	Streptomyces sp.	Gale commune	6
	Verticillium sp.	Verticilliose	8
Rabiole	*Alternaria brassicae*	Tache foliaire	1
	Helicotylenchus sp.	Nématode spiralé	3
	Meloidogyne sp.	Nématode cécidogène	3
	Paratylenchus sp.	Nématode à stylet	2
	Pratylenchus sp.	Nématode des lésions racinaires	2
Radis	*Pectobacterium carotovorum*	Pourriture molle bactérienne	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	2

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Rhubarbe	CRLV (Cherry Rasp Leaf Virus)	Dépérissement	1
	Cylindrocarpon sp.	Pourriture racinaire	1
	Phoma sp.	Pourriture	1
	Phoma macrostoma	Pourriture	1
	Phoma rhei	Pourriture	1
	Pratylenchus sp.	Nématode des lésions racinaires	1
Roquette	*Alternaria brassicae*	Tache foliaire	1
Rutabaga	*Pectobacterium carotovorum*	Pourriture molle bactérienne	2
	Plectosporium sp.	Pourriture	2
Tomate	*Alternaria* sp.	Alternariose	2
	Alternaria alternata	Alternariose	1
	Alternaria solani	Alternariose	2
	Carence en calcium	Pourriture apicale	1
	Chimère	Anomalie de coloration / Malformation	3
	Cladosporium sp.	Cladosporiose / Fumagine	4
	Clavibacter michiganensis subsp. *michiganensis*	Chancre bactérien	14
	Colletotrichum sp.	Pourriture	3
	Conductivité électrique élevée	Anomalie de coloration	1
	Fusarium sp.	Fusariose	11
	Fusarium oxysporum	Fusariose	6
	Fusarium solani	Chancre	1
	Fusarium striatum	Chancre	1
	Gel	Malformation	1
	Grêle	Fente	1
	Intumescence	Malformation	1
	Meloidogyne sp.	Nématode cécidogène	1
	Neoerysiphe hiratae	Blanc	1
	Oidium neolycopersici	Blanc	6
	Pectobacterium carotovorum	Chancre	1
	PepMV (Pepino Mosaic Virus)	Virus de la mosaïque du Pépino	9
	Phytophthora sp.	Mildiou	3
	Plectosporium sp.	Chancre sec	2
	Pseudomonas sp.	Tache foliaire	1
	Pseudomonas corrugata	Chancre	4
	Pseudomonas syringae	Tache foliaire	3
	Pythium sp.	Pourriture pythienne	10
	Pythium dissotocum	Pourriture pythienne	1
	Pythium irregulare	Pourriture pythienne	1
	Pythium ultimum	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	3
	Sclerotinia sp.	Sclérotiniose	1
	Septoria sp.	Septoriose	2
	TMV (Tobacco Mosaic Virus)	Virus de la mosaïque du tabac	1
	ToMV (Tomato Mosaic Virus)	Virus de la mosaïque de la tomate	1
	TSWV (Tomato Spotted Wilt Virus)	Virus de la maladie bronzée	3
	Verticillium sp.	Verticilliose	1

Tableau 2. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres fruitiers** et **petits fruits** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Airelle rouge	Fertilisation faible	Dépérissement	1
	Fusarium sp.	Fusariose	1
	pH élevé	Dépérissement	1
	Pythium sp.	Pourriture pythienne	1
Argousier	*Colletotrichum acutatum*	Alternariose	3
	Cylindrocarpon sp.	Pourriture racinaire	3
	Fusarium sp.	Fusariose	3
	Fusarium oxysporum	Fusariose	1
	Gel	Dépérissement	1
	Paratylenchus sp.	Nématode à stylet	1
	pH bas	Dépérissement	1
	Phoma sp.	Dépérissement	1
	Phomopsis sp.	Brûlure phomopsienne	4
	Pratylenchus sp.	Nématode des lésions racinaires	2
	Rhizoctonia sp.	Rhizoctone	1
	Septoria sp.	Tache	1
	Xiphinema sp.	Nématode à dague	2
Bleuetier en corymbe	*Agrobacterium* sp.	Tumeur du collet	2
	Alternaria sp.	Tache	1
	Alternaria tenuissima	Pourriture	1
	Aureobasidium sp.	Brûlure	1
	BRRSV (Blueberry Red Ringspot Virus)	Tache	1
	Botrytis sp.	Moisissure grise	1
	Conductivité électrique élevée	Anomalie de coloration	1
	Cylindrocarpon sp.	Pourriture	1
	Fusarium sp.	Fusariose	3
	Fusicoccum sp.	Chancre de tige	2
	Grêle	Fente	1
	Monilia sp.	Pourriture sclérotique	1
	Pestalotiopsis sp.	Chancre de tige	1
	pH bas	Anomalie de coloration	1
	pH élevé	Anomalie de coloration	3
	Phomopsis sp.	Brûlure phomopsienne	2
	Pratylenchus sp.	Nématode des lésions racinaires	1
	Pseudomonas syringae	Brûlure bactérienne	2
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Rhizosphaera macrospora	Tache	1
	Seimatosporium sp.	Tache	1
Bleuetier nain	*Alternaria alternata*	Alternariose	1
	Cladosporium sp.	Pourriture	1
	Monilia sp.	Pourriture sclérotique	2
Camérisier	*Alternaria alternata*	Alternariose	2
	Aureobasidium sp.	Tache	1
	Chimère	Anomalie de coloration	1
	Cylindrocarpon sp.	Pourriture	2
	Fusarium sp.	Fusariose	5
	Gel	Dépérissement	1

Tableau 2. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres fruitiers** et **petits fruits** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Camérisier (cont.)	*Meloidogyne* sp.	Nématode cécidogène	1
	Microsphaera sp.	Blanc	4
	Ozone	Anomalie de coloration	1
	Phomopsis sp.	Chancre	4
	Pseudomonas syringae	Anomalie de coloration	1
	Pythium sp.	Pourriture pythienne	4
	Rhizoctonia sp.	Rhizoctone	3
	Septoria sp.	Tache	1
	TMV (Tobacco Mosaic Virus)	Virus de la mosaïque du tabac	1
Canneberge	*Fusicoccum* sp.	Chancre	1
	Phomopsis sp.	Brûlure phomopsienne	3
	Phyllosticta sp.	Tache foliaire	1
	Protoventuria sp.	Tache foliaire	2
Cassissier	*Pseudomonas caripapayae*	Tache foliaire	1
	Septoria sp.	Tache foliaire	2
	Septoria ribis	Tache foliaire	1
Cerise de terre	*Alternaria alternata*	Tache	1
	Cladosporium sp.	Tache	1
	Entyloma sp.	Charbon blanc	1
	Fusarium sp.	Fusariose	2
	Itersonilia sp.	Tache	1
	Plectosporium sp.	Chancre	1
Cerisier	*Agrobacterium* sp.	Tumeur du collet	1
	Botrytis sp.	Moisissure grise	1
	CRLV (Cherry Rasp Leaf Virus)	Anomalie de coloration	1
	Eutypa lata	Eutypiose	1
Fraisier cultivé	*Botrytis* sp.	Pourriture grise	10
	Cadophora luteo-olivacea	Anomalie de coloration	1
	Carence minérale	Anomalie de coloration	1
	Colletotrichum sp.	Anthracnose	8
	Colletotrichum acutatum	Anthracnose	1
	Conductivité électrique élevée	Dépérissement	3
	Désordre génétique	Malformation	3
	Désordre physiologique	Malformation	1
	Froid	Anomalie de coloration / malformation	1
	Fusarium sp.	Pourriture fusarienne	10
	Helicotylenchus sp.	Nématode spiralé	1
	Longidorus sp.	Nématode à lancette	1
	Marssonina sp.	Tache pourpre	2
	Meloidogyne sp.	Nématode cécidogène	1
	Paratylenchus sp.	Nématode à stylet	1
	pH bas	Dépérissement	**4**
	Phomopsis sp.	Brûlures des feuilles	**2**
	Phytophthora sp.	Pourriture du collet et racines	**5**
	Phytophthora cactorum	Pourriture du collet et racines	**6**
	Phytophthora fragariae	Stèle rouge	**2**
	Phytoplasme	Malformation / phyllodie	**2**

Tableau 2. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres fruitiers** et **petits fruits** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Fraisier cultivé ***(cont.)***	Pourriture noire des racines[1]	Pourriture racinaire	58
	Pratylenchus sp.	Nématode des lésions racinaires	5
	Pythium sp.	Pourriture pythienne	4
	Rhizoctonia sp.	Rhizoctone	4
	Sphaerotheca macularis f. sp. *fragariae*	Blanc	1
	SMoV (Strawberry Mottle Virus)	Dépérissement	9
	SMYEV (Strawberry Mild Yellow Edge Virus)	Dépérissement	2
	SVBV (Strawberry Vein Banding Virus)	Dépérissement	3
	SPaV (Strawberry Pallidosis Virus)	Dépérissement	1
	Verticillium sp.	Verticilliose	7
	Zythia sp.	Tache foliaire	2
Framboisier	*Agrobacterium* sp.	Tumeur du collet / tumeur de la tige	--
	Botrytis sp.	Pourriture grise / flétrissure des tiges	4
	Cladosporium sp.	Cladosporiose	3
	Conductivité électrique élevée	Brûlure	2
	Cylindrocarpon sp.	Pourriture racinaire	6
	Erwinia amylovora	Brûlure bactérienne	1
	Fusarium sp.	Fusariose	4
	Fusarium solani	Fusariose	1
	Helicotylenchus sp.	Nématode spiralé	2
	Leptosphaeria sp.	Brûlure de la tige	1
	pH élevé	Anomalie de coloration / dépérissement	2
	Phoma sp.	Brûlure des dards	1
	Phytophthora sp.	Pourridié phytophthoréen	6
	Phytophthora rubi	Pourridié phytophthoréen	1
	Pourriture noire des racines[1]	Pourriture racinaire	15
	Pratylenchus sp.	Nématode des lésions racinaires	11
	Pseudomonas caripapayae	Coulure bactérienne	1
	Pseudomonas syringae	Coulure bactérienne	1
	Pythium sp.	Pourriture pythienne	3
	Rhizoctonia sp.	Rhizoctone	3
	Septoria sp.	Tache septorienne	1
	Thielaviopsis sp.	Pourriture racinaire	1
	ToRSV (Tomato Ringspot Virus)	Anomalie de coloration foliaire / malformation foliaire / grenaille des fruits	1
	Xiphinema sp.	Nématode à dague	2
Gadellier	*Septoria* sp.	Tache septorienne	1

[1] Complexe fongique comprenant une combinaison des champignons *Fusarium* sp., *Rhizoctonia* sp., *Cylindrocarpon* sp. et/ou des oomycètes *Phytophthora* sp. et *Pythium* sp.

Tableau 2. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres fruitiers** et **petits fruits** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Groseillier	Carence en magnésium	Anomalie de coloration	1
	Cylindrocarpon sp.	Pourriture	1
	Gloeosporidiella sp.	Anthracnose	2
	pH bas	Dépérissement	1
Kiwi rustique	*Alternaria* sp.	Brûlure foliaire	1
	Alternaria alternata	Brûlure foliaire	3
	Pestalotiopsis sp.	Anomalie de coloration	1
	Phoma sp.	Tache foliaire	3
Mûrier	*Botrytis* sp.	Flétrissure des tiges	2
	Cylindrocarpon sp.	Pourriture	2
	Fusarium sp.	Pourriture fusarienne	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Septoria sp.	Tache septorienne	1
Poirier	*Erwinia amylovora*	Brûlure bactérienne	8
	Paraconiothyrium brasiliense	Chancre	1
	Pseudomonas syringae	Chancre bactérien	3
Pommier	*Agrobacterium* sp.	Tumeur du collet	1
	Alternaria alternata	Tache	3
	Cryptosporiopsis kienholzii	Chancre	1
	Cylindrocarpon sp.	Chancre	2
	Diplodia sp.	Chancre	1
	Échaudure	Anomalie de coloration	1
	Erwinia amylovora	Brûlure bactérienne	41
	Fusarium sp.	Pourriture racinaire et du collet	4
	Fusarium avenaceum	Pourriture	1
	Gel	Chancre	2
	Gymnosporangium sp.	Rouille	1
	Ilyonectria robusta	Pourriture racinaire	1
	Neonectria ditissima	Chancre nectrien	2
	Phlyctema sp.	Chancre	1
	Phomopsis sp.	Chancre	2
	Phytophthora sp.	Pourriture du collet	1
	Pratylenchus sp.	Nématode des lésions racinaires	3
	Pseudomonas syringae	Chancre bactérien	8
	Pythium sp.	Pourriture pythienne	2
	Venturia inaequalis	Tavelure	24
	Xiphinema sp.	Nématode à dague	1
Prunier	*Criconemoides* sp.	Pourriture racinaire	1
	Cylindrocarpon sp.	Pourriture racinaire	2
	Fusarium sp.	Dépérissement	3
	pH bas	Chancre	1
	Phomopsis sp.	Nématode des lésions	1
	Pratylenchus sp.	racinaires	1
	Pythium sp.	Pourriture pythienne	1
	Xiphinema sp.	Nématode à dague	1
Sureau	CRLV (Cherry Rasp Leaf Virus)	Anomalie de coloration	1

Tableau 2. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres fruitiers** et **petits fruits** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Vigne	*Agrobacterium vitis*	Tumeur du collet	7
	Alternaria sp.	Tache	3
	Botrytis sp.	Pourriture grise	7
	Cadophora sp.	Dépérissement	1
	Carence en magnésium	Anomalie de coloration	1
	Chaetemonium sp.	Dépérissement	1
	Chimère	Anomalie de coloration	1
	Cladosporium sp.	Pourriture de fruits	2
	Cladosporium cladosporioides	Pourriture de fruits	1
	Colletotrichum sp.	Pourriture	7
	Cytospora sp.	Dépérissement	1
	Échaudage	Échaudage	1
	Elsinoe sp.	Anthracnose	1
	Eutypa lata	Eutypiose	1
	Fusarium sp.	Dépérissement	6
	Fusarium acuminatum	Dépérissement	1
	Fusarium avenaceum	Dépérissement	3
	Fusarium equiseti	Dépérissement	1
	Fusarium oxysporum	Fusariose	7
	GFkV (Grapevine Fleck Virus)	Aucun	2
	Helicotylenchus sp.	Nématode spiralé	2
	Microcyclosporella mali	Tache	1
	Paraconiothyrium brasiliense	Dépérissement	1
	Pestalotiopsis sp.	Dépérissement	1
	Pestalotiopsis disseminata	Dépérissement	1
	Phaeoacremonium sp.	Esca	4
	Phoma sp.	Tache	7
	Phomopsis sp.	Excoriose	6
	Phomopsis eres	Dépérissement	1
	Pied noir[2]	Dépérissement	33
	Plasmopara viticola	Mildiou	1
	Pratylenchus sp.	Nématode des lésions racinaires	1
	Pseudomonas marginalis	Pourriture	1
	Pseudopezicula sp.	Rougeot	1
	Rhizoctonia sp.	Rhizoctone	2
	Roesleria subterranea	Pourriture racinaire	1
	Seimatosporium sp.	Dépérissement	2
	Sphaeropsis sp.	Dépérissement	1
	ToRSV (Tomato Ringspot Virus)	Grappe naine	7
	Trametes versicolor	Esca	1
	Xiphinema sp.	Nématode à dague	7

[2] De nombreuses espèces associées au pied noir de la vigne ont été identifiées par séquençage des gènes Beta-tubuline et Histone 3: *Ilyonectria liriodendri, I. robusta*, *I. radicicola*, *I. macrodidyma*, *I. pseudodestructans*, *I. novozelandica*, *I. crassa*, *Dactylonectria pauciseptata* et *Neonectria ramulariae*.

Tableau 3. Sommaire des maladies et problèmes abiotiques diagnostiquées parmi les **grandes cultures** et **cultures industrielles** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Asclépiade	*Botrytis* sp.	Moisissure grise	1
	Chimère	Malformation	1
	Corynespora sp.	Tache	1
	Cylindrocarpon sp.	Pourriture racinaire	1
	Fusarium sp.	Pourriture racinaire	2
	Pseudomonas marginalis	Tache	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Septoria sp.	Tache	1
	Volutella sp.	Tache	1
Avoine	BYDV – pav (Barley Yellow Dwarf Virus-pav)	Anomalie de coloration	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium sp.	Pourriture racinaire	1
	Puccinia sp.	Rouille	1
	Pythium sp.	Pourriture pythienne	1
Blé	*Alternaria* sp.	Tache	1
	Alternaria alternata	Tache	1
	Bipolaris sp.	Tache helminthosporienne	1
	Cladosporium sp.	Fumagine	2
	Fusarium sp.	Pourriture racinaire	3
	Fusarium graminearum	Fusariose	1
	Microdochium sp.	Pourriture racinaire	3
	Puccinia sp.	Rouille	2
	Pythium sp.	Piétin brun	3
	Ustilago sp.	Charbon	1
Canola	*Alternaria* sp.	Tache alternarienne	2
	Fusarium sp.	Pourriture racinaire	1
	Luminosité élevée	Anomalie de coloration	1
Chanvre	*Sclerotinia sclerotiorum*	Sclérotiniose	1
Quinoa	*Fusarium* sp.	Fusariose	1
Houblon	*Fusarium* sp.	Pourriture racinaire	1
	Fusarium avenaceum	Pourriture racinaire	1
	Phoma sp.	Dépérissement	1
	Pseudoperonospora sp.	Mildiou	1
Lin	*Cladosporium* sp.	Tache	1
	Fusarium sp.	Pourriture racinaire	1
	Rhizoctonia sp.	Rhizoctone	1
Maïs	*Colletotrichum* sp.	Pourriture	1
	Fusarium sp.	Pourriture	5
	Fusarium graminearum	Fusariose	1
	Pythium sp.	Pourriture pythienne	2
	Rhizoctonia sp.	Rhizoctone	1

Tableau 3. Sommaire des maladies et problèmes abiotiques diagnostiquées parmi les **grandes cultures** et **cultures industrielles** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Millet	*Pratylenchus* sp.	Nématode radicicole	1
Orge	*Bipolaris* sp.	Tache helminthosporienne	1
	BYDV – pav (Barley Yellow Dwarf Virus-	Anomalie de coloration	3
	pav)	Moisissure noire	1
	Cladosporium sp.	Pourriture racinaire	2
	Fusarium sp.	Pourriture racinaire	3
	Microdochium sp.	Piétin brun	5
	Pythium sp.	Pourriture pythienne	1
	Pythium attrantheridium	Pourriture pythienne	1
	Pythium conidiophorum	Charbon	1
	Ustilago sp.		
Panic érigé	*Tilletia maclaganii*	Charbon	1
Sarrasin	*Botrytis* sp.	Moisissure grise	1
	Fusarium equiseti	Pourriture racinaire	1
Seigle d'automne	*Fusarium* sp.	Pourriture racinaire	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
Soya	*Ascochyta* sp.	Tache	1
	Cercospora sp.	Cercosporiose	2
	Clavibacter michiganensis subsp. *nebraskensis*	Tache foliaire	1
	Colletotrichum sp.	Anthracnose	5
	Corynespora sp.	Tache	2
	Cylindrocarpon sp.	Pourriture racinaire	1
	Fusarium sp.	Pourriture fusarienne	11
	Fusarium acuminatum	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	2
	Helicotylenchus sp.	Nématode spiralé	2
	Heterodera glycines	Nématode à kyste du soya	3
	Phomopsis sp.	Chancre	2
	Phytophthora sp.	Pourriture phytophthoréenne	1
	Pratylenchus sp.	Nématode des lésions racinaires	2
	Pseudomonas syringae	Tache	1
	Pythium sp.	Pourriture pythienne	6
	Rhizoctonia sp.	Rhizoctone	1
	Sclerotinia sp.	Sclérotiniose	1
	Septoria sp.	Tache septorienne	1

Tableau 4. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes fourragères** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Fétuque élevée	*Puccinia* sp.	Rouille	1
Lotier	*Podosphaera macrospora*	Blanc	1
	Uromyces sp.	Rouille	1
Luzerne	*Fusarium* sp.	Pourriture fusarienne	2
	Leptosphaerulina sp.	Tache foliaire	1
	Phoma sp.	Tache foliaire	1
Prairie	*Meloidogyne* sp.	Nématode cécidogène	1
(espèces inconnues)	*Pratylenchus* sp.	Nématode des lésions racinaires	1
	Xiphinema sp.	Nématode à dague	1
Trèfle	Carence minérale	Anomalie de coloration	1

Tableau 5. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Buis	*Volutella* sp.	Dépérissement	1
Cèdre	*Pestalotiopsis* sp.	Brûlure	1
Cerisier des oiseaux	*Pseudomonas syringae*	Brûlure bactérienne	1
Chêne	*Marssonina* sp.	Tache	1
	Septoria sp.	Tache	1
Frêne de Pennsylvanie	*Diplodia* sp.	Chancre	1
Lilas	*Alternaria alternata*	Tache	1
	Colletotrichum sp.	Anthracnose	1
	Cylindrocarpon sp.	Pourriture	1
	Fusarium sp.	Pourriture	1
	Pseudomonas syringae	Brûlure bactérienne	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
Lilas japonais	*Septoria* sp.	Tache	1
Noisetier	*Hypoxylon fuscum*	Chancre	1
Orme d'Amérique	*Paraconiothyrium* sp.	Tache	1
	Phoma sp.	Dépérissement	1
Peuplier	*Melampsora sp.*	Rouille	1
Pins	*Pestalotiopsis* sp.	Brûlure des aiguilles	1
	Hendersonia sp.	Tache	---
Sapin de Fraser	*Cylindrocarpon* sp.	Pourriture racinaire	1
	Fusarium sp.	Pourriture fusarienne	1
Saule	*Agrobacterium* sp.	Tumeur du collet	2
Sorbier	*Erwinia amylovora*	Brûlure bactérienne	2
Spirée japonaise	Potyvirus	Dépérissement / malformation	1
Vigne vierge	*Phomopsis viticola*	Tache	1
Vinaigrier	*Pestalotiopsis* sp.	Dépérissement	1

Tableau 6. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes ornementales** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Acalypha	*Botrytis* sp.	Moisissure grise	1
	Conductivité électrique élevée	Dépérissement	1
	Fusarium sp.	Pourriture fusarienne	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
Actée rouge	*Ascochyta* sp.	Tache	1
	Pseudomonas syringae	Tache	1

Tableau 6. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes ornementales** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Agrostide	*Gaeumannomyces* sp.	Piétin-échaudage	2
	Microdochium bolleyi	Moisissure rose	2
	Pythium catenulatum	Pourriture pythienne	2
Ail des bois	*Fusarium* sp.	Pourriture fusarienne	1
	Xiphinema sp.	Nématode à dague	3
Barde-de-bouc	*Colletotrichum* sp.	Anthracnose	1
Bégonia	Conductivité électrique faible	Dépérissement	1
	Gracilacus sp.	Lésion racinaire	1
	Helicotylenchus sp.	Nématode spiralé	1
	Oidium sp.	Blanc	1
	pH élevé	Dépérissement	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Xiphinema sp.	Nématode à dague	1
Bégonia de Bolivie	*Botrytis* sp.	Moisissure grise	1
	Conductivité électrique élevée	Faible croissance	3
Bégonia reiger	*Xanthomonas horturum* pv. *begoniae*	Tache foliaire	1
Bégonia rex	*Botrytis* sp.	Moisissure grise	1
Brugmansia	INSV (Impatiens Necrotic Spot Virus)	Anomalie de coloration	1
Cactus	*Enterobacter cloacae*	Pourriture	1
	Fusarium sp.	Pourriture fusarienne	1
Calibrachoa	AMV (Alfalfa Mosaic Virus)	Anomalie de coloration	1
	Botrytis sp.	Moisissure grise	1
	Froid	Anomalie de coloration	1
Campanule	Luminosité élevée	Anomalie de coloration	1
	Sclerotinia sclerotium	Sclérotiniose	1
Chrysanthème	*Pythium* sp.	Pourriture pythienne	1
	Septoria sp.	Tache	1
Cinéraire	*Cladosporium* sp.	Tache	1
Cléome épineux	*Erysiphe cruciferarum*	Blanc	1
Crassula	*Oidium* sp.	Blanc	1
	Penicillium sp.	Pourriture	1
Crocosmia	Potyvirus	Anomalie de coloration	1
Crocus	*Fusarium* sp.	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	1
Dahlia	*Plectosporium* sp.	Pourriture	1

Tableau 6. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes ornementales** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Échinacée	Chimère	Anomalie de coloration	2
	Colletotrichum sp.	Anthracnose	1
	Fusarium sp.	Pourriture fusarienne	3
	Pythium sp.	Pourriture pythienne	1
	Pythium irregulare	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	TMV (Tobacco Mosaic Virus)	Tache	1
Épiaire	*Pseudomonas syringae*	Tache	1
Euphorbe	*Pectobacterium* carotovorum	Pourriture molle	1
	Podosphaera sp.	Blanc	1
	Verticillium sp.	Verticilliose	1
Fougère	*Phoma* sp.	Tache	1
	Pseudomonas sp.	Tache	1
Gaillarde	*Bremia lactucae*	Mildiou	1
	TSWV (Tomato Spotted Wilt Virus)	Anomalie de coloration	1
Gazon	*Curvularia* sp.	Brûlure estivale de la feuille	1
	Microdochium sp.	Pourriture rose	1
	Microdochium bolleyi	Pourriture rose	1
	Pythium torulosum	Pourriture pythienne	3
	Sclerotinia homoeocarpa	Sclérotiniose estivale	1
Géranium/ pelargonium	*Botrytis* sp.	Moisissure grise	1
	Xanthomonas hortorum pv. *pelargonii*	Tache bactérienne	3
Gerbera	*Fusarium oxysporum*	Pourriture fusarienne	1
	Phytophthora cryptogea	Pourriture phytophthoréenne	1
	Pythium irregulare	Pourriture pythienne	1
Grande astrance	*Aphelenchoides* sp.	Tache foliaire	1
Hibiscus	*Botrytis* sp.	Moisissure grise	1
	Colletotrichum sp.	Anthracnose	1
	Thielaviopsis sp.	Pourriture noire des racines	2
Impatiente de Nouvelle-Guinée	*Pythium* sp.	Pourriture pythienne	1
Ipomée	*Fusarium denticulatum*	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	1
	INSV (Impatiens Necrotic Spot Virus)	Anomalie de coloration	2
Jasmin blanc	*Stagonosporopsis cucurbitacearum*	Malformation	1
Lamier tacheté	*Colletotrichum* sp.	Anthracnose	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
Lavande	*Botrytis* sp.	Moisissure grise	1
	Cylindrocarpon sp.	Dépérissement	1
	Fusarium sp.	Pourriture fusarienne	1
	Septoria sp.	Tache	1

Tableau 6. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes ornementales** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Lupin	*Fusarium oxysporum*	Fusariose	1
	Rhizoctonia sp.	Rhizoctone	1
Marguerite d'Afrique	Virus	Anomalie de coloration / malformation	1
Monarde	TMV (Tobacco Mosaic Virus)	Malformation	1
Muguet	ArMV (Arabis Mosaic Virus)	Tache	1
Némésie	INSV (*Impatiens Necrotic Spot Virus*)	Anomalie de coloration foliaire	1
Œillet	Carence minérale	Tache	1
	Fusarium sp.	Pourriture fusarienne	1
	Helicotylenchus sp.	Nématode spiralé	1
	Meloidogyne sp.	Nématode cécidogène	8
	Paratylenchus sp.	Nématode à stylet	11
	Pratylenchus sp.	Nématode des lésions racinaires	3
Onoclée sensible	*Pseudomonas syringae*	Brûlure	1
Orchidées	*Colletotrichum sp.*	Tache	1
	CymMV (Cymbidium Mosaic Virus)	Tache	4
	Fusarium proliferatum	Fusariose	2
	Intumescence	Malformation	1
	Pseudomonas sp.	Tache	1
Pétunia	*Fusarium* sp.	Pourriture fusarienne	1
	Pseudomonas sp.	Tache foliaire	1
Phlox paniculé	TSV (Tobacco Streak Virus)	Malformation / tache	1
Pivoine	*Botrytis paeoniae*	Moisissure grise	1
	Virus	Anomalie de coloration	1
Pourpier	AltMV/PapMV (Alternanthera Mosaic Virus/Papaya Mosaic Virus)	Anomalie de coloration	2
Rudbeckie	*Phoma* sp.	Tache	1
	Plasmopara sp.	Mildiou	1
Sauge ornementale	*Botrytis* sp.	Pourriture grise	2
Scabieuse	*Alternaria* sp.	Tache	1
Sédum / Orpin	*Fusarium* sp.	Pourriture fusarienne	1
	Pythium sp.	Pourriture pythienne	1
	Rhizoctonia sp.	Rhizoctone	1
	Virus	Tache	2
Taro	Virus	Tache	1
Tiarelle cordifoliée	*Aphelenchoides* sp.	Tache foliaire	1
Tulipe	*Botrytis cinerea*	Moisissure grise	1
	Botrytis tulipae	Pourriture grise	1
	Penicillium sp.	Pourriture	1
	Sclerotinia nivalis	Pourriture	1
Véronique	*Podosphaera fuliginea*	Blanc	1

Tableau 6. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes ornementales** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Zinnia	*Pythium sylvaticum*	Pourriture pythienne	1
	Sclerotinia sclerotiorum	Sclérotiniose	1

Tableau 7. Sommaire des maladies et problèmes abiotiques diagnostiqués parmi les **plantes aromatiques** reçues au Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ en 2017.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Basilic	*Botrytis cinerea*	Moisissure grise	1
	Conductivité électrique élevée	Anomalie de coloration	1
	Fusarium sp.	Pourriture fusarienne	1
	pH élevé	Anomalie de coloration	1
	Pseudomonas sp.	Pourriture	1
	Pythium sp.	Pourriture pythienne	1
Coriandre	*Itersonilia* sp.	Brûlure	1
	Pseudomonas syringae	Tache foliaire	3
	Pythium irregulare	Pourriture pythienne	1
	Sclerotinia sp.	Sclérotiniose	1
Persil	*Pseudomonas syringae*	Tache foliaire	1
Romarin	*Botrytis* sp.	Moisissure grise	1
	Fusarium sp.	Pourriture fusarienne	1
	Sclerotinia sp.	Sclérotiniose	1
Safran	*Burkholderia gladioli*	Pourriture bactérienne de la tige	1
	Cladosporium sp.	Pourriture	1
	Fusarium sp.	Pourriture fusarienne	1
	Fusarium oxysporum	Pourriture fusarienne	1
	Penicillium sp.	Pourriture	2
Thym	*Alternaria* sp.	Brûlure	1
	Botrytis sp.	Moisissure grise	1
	Fusarium sp.	Pourriture fusarienne	2
	Pythium sp.	Pourriture pythienne	1
	Pythium irregulare	Pourriture pythienne	1

CROPS / CULTURES: All Crops - Diagnostic Laboratory Report
LOCATION / RÉGION: New Brunswick

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TITLE / TITRE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE NBDAAF PLANT DISEASE DIAGNOSTIC LABORATORY IN 2017

ABSTRACT: The New Brunswick Department of Agriculture, Aquaculture and Fisheries (NBDAAF) Plant Disease Diagnostic Laboratory provides diagnostic services and disease management recommendations to growers and the agricultural industry in New Brunswick. In 2017, a total of 130 plant tissue samples were submitted to the diagnostic laboratory for problem identification and possible control recommendations. Samples included infectious diseases and abiotic disorders.

INTRODUCTION AND METHODS: The NBDAAF Plant Disease Diagnostic Laboratory located in Fredericton, NB, provides diagnostic services and control recommendations for diseases of various crops to growers and the agricultural industry in New Brunswick as part of an integrated pest management (IPM) service. Samples are submitted to the diagnostic laboratory by IPM scouts, growers, agribusiness representatives, crop insurance agents and NBDAAF crop specialists and extension officers. Disease diagnoses are based on a combination of visual examination of symptoms, microscopic observations and culturing onto growth media.

RESULTS AND COMMENTS: From February 2 to December 10, 2017, the Plant Disease Diagnostic Laboratory received 130 diseased plant samples for diagnosis. Of these, 82% were infectious diseases (107 in total) and 18% physiological disorders (23 in total). Samples submitted to the diagnostic laboratory which were associated with insect damage are not included in this report. Also, samples diagnosed during scouting (surveys) and field visits are not included in this report. Summaries of diseases and causal agents diagnosed on plant tissue samples submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017 are presented in Tables 1 to 5 by crop category.

Table 1. Diseases diagnosed on fruit tree crops submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Apple scab	*Venturia inaequalis*	6
	Bitter rot	*Colletotrichum* spp.	1
	Black rot	*Botryosphaeria obtusa*	4
	Blue mould	*Penicillium* spp.	1
	Crown gall	*Agrobacterium tumefaciens*	1
	European canker	*Neonectria ditissima*	2
	Chemical injury	Pesticide damage	2
	Wilting	Drought stress	1
Cherry	Cherry leaf spot	*Blumeriella jaapii*	1
Plum	Black knot	*Apiosporina morbosa*	1
DISEASED SAMPLES			17
ABIOTIC DISORDERS			3
TOTAL SUBMISSIONS			20

Table 2. Diseases diagnosed on berry crops submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017.

CROP	**DISEASE**	**CAUSAL AGENT**	**NUMBER OF SAMPLES**
Black currant	Mycosphaerella leaf spot	*Mycosphaerella ribis*	1
	Phytophthora root rot	*Phytophthora* spp.	1
Blueberry (lowbush)	Septoria leaf spot	*Septoria* spp.	2
	Botrytis blight	*Botrytis cinerea*	2
	Monilinia blight	*Monilinia vaccinii-corymbosi*	1
	Phomopsis canker	*Phomopsis vaccinii*	1
	Environmental injury	Frost injury	1
	Botrytis blight	*Botrytis cinerea*	1
Blueberry (highbush)	Septoria leaf spot	*Septoria* spp.	1
	Exobasidium leaf and fruit spot	*Exobasidium vaccinii*	1
	Phomosis canker	*Phomopsis vaccinii*	1
		Heat stress	1
Cranberry	Environmental injury	Heat stress	1
Grape	Phomopsis cane and leaf spot	*Phomopsis viticola*	1
	Nutrient deficiency	Manganese deficiency	1
	Nutrient deficiency	Magnesium deficiency	1
	Environmental injury	Drought stress	1
Raspberry	Phytophthora root rot	*Phytophthora fragariae* var.	6
	Gray mould	*rubi*	1
	Crown gall	*Botrytis cinerea*	1
	Winter injury	*Agrobacterium* spp.	1
		Environmental injury	
Strawberry	Black root rot	*Fusarium* spp., *Pythium* sp., *Rhizoctonia* spp.	9
	Anthracnose fruit rot	*Colletotrichum* spp.	2
	Crown rot	*Phytophthora cactorum*	4
	Gray mould	*Botrytis cinerea*	1
	Powdery mildew	*Sphaerotheca macularis* f.sp. *fragariae*	1
	Leaf spot	*Mycosphaerella fragariae*	3
	Leaf scorch	*Diplocarpon earlianum*	1
	Leaf blight	*Phomopsis obscurans*	1
	Green petal	Phytoplasma	1
	Fruit deformation	Poor pollination	1
	Chemical injury	Pesticide damage	1
DISEASED SAMPLES			44
ABIOTIC DISORDERS			8
TOTAL SUBMISSIONS			52

Table 3. Diseases diagnosed on vegetable (field and greenhouse) crops submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017.

CROP	**DISEASE**	**CAUSAL AGENT**	**NUMBER OF SAMPLES**
Asparagus	Asparagus rust	*Puccinia asparagi*	1
	Purple spot	*Stemphylium vesicarium*	1
Bean	Rust	*Uromyces appendiculatus*	1
Brussels sprout	Club root	*Plasmodiophora brassicae*	1
Cabbage	Soft rot	*Erwinia carotovora*	1
Carrot	Leaf blight	*Alternaria dauci*	1
	Crown rot	*Rhizoctonia solani*	1
Celery	Anthracnose (Leaf curl)	*Colletotrichum acutatum*	1
Cucumber	Alternaria leaf blight	*Alternaria* spp.	1
Garlic	Neck rot	*Botrytis* spp.	3
	Embellisia skin blotch	*Embellisia allii*	1
	Blue mould	*Penicillium* spp.	1
	Waxy breakdown	Environmental injury	2
Kale	Damping off	*Pythium* spp.	1
Kohlrabi	Stem splitting	Environmental injury	1
Lettuce	Damping off	*Pythium* spp.	3
	Root rot	*Pythium* spp.	1
Onion	Purple blotch	*Alternaria porri*	1
Swiss chard	Damping off	*Pythium* spp.	1
Tomato	Botrytis blight and stem canker	*Botrytis cinerea*	1
	Leaf mould	*Passalora fulva*	2
	Early blight	*Alternaria solani*	1
DISEASED SAMPLES			26
ABIOTIC DISORDERS			3
TOTAL SUBMISSIONS			29

Table 4. Diseases diagnosed on field crops (cereal, legume and mustard) submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Corn	Chemical injury	Fertilizer burn	2
Field pea	Bacterial blight Ascochyta blight	*Pseudomonas syringae* *Ascochyta* spp.	2 1
Lupine	Anthracnose	*Colletotrichum* sp.	1
Mustard	White mould	*Sclerotinia sclerotiorum*	1
Oat	Speckled leaf blotch	*Septoria avenae* f.sp. *avenae*	1
Soybean	Alternaria leaf spot Downy mildew Environmental injury Environmental injury	*Alternaria* spp. *Peronospora manshurica* Drought stress Wind/rain injury	2 2 2 1
Wheat	Stripe rust	*Puccinia striiformis* f. sp. *tritici*	1
DISEASED SAMPLES			11
ABIOTIC DISORDERS			5
TOTAL SUBMISSIONS			16

Table 5. Diseases diagnosed on trees, herbal and ornamental plants submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2017.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Basil	Damping off	*Pythium* spp.	1
Blue spruce	Spruce needle rust Environmental injury	*Chrysomyxa spp.* Winter injury	1 1
Calibrachoa rouge	Environmental injury	Heat stress	1
Emerald cedar	Environmental injury	Frost damage	1
Jack in the pulpit	Rust	*Uromyces caladii*	1
Norway spruce	Environmental injury	Winter injury	1
Red maple	Anthracnose	*Colletotrichum* spp.	3
Silver fir	Interior needle cast	*Phyllosticta* spp.	1
Sugar maple	Anthracnose	*Colletotrichum* spp.	1
Turf	Take-all patch	*Gaeumannomyces graminis*	1
DISEASED SAMPLES			9
ABIOTIC DISORDERS			4
TOTAL SUBMISSIONS			13

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

NAMES AND AGENCIES: NOMS ET ÉTABLISSMENTS:
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TITLE / TITRE: DISEASES DIAGNOSED ON COMMERCIAL CROP SAMPLES SUBMITTED TO THE PEI ANALYTICAL LABORATORIES PLANT DISEASE DIAGNOSTIC SERVICE (PDDS) IN 2017

ABSTRACT: The Prince Edward Island Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis of disease problems of commercial crops produced on PEI. A total of 140 samples were processed for the 2017 crop year. Categories of samples received were: potatoes (62.55%), cereal and oilseed crops (10.81%), vegetable and fruit crops (25.48%) and other (2.67 %). A total of 254 disease diagnoses were completed during the period June 1st to November 14th, 2017. For the first time in thirty years, there have been no confirmed cases of potato foliar late blight. Environmental conditions were not conducive to the development and spread of the late blight fungus as compared to previous years. The inoculum source was diminished as growers planted clean, disease-free seed and there were only four confirmed cases of late blight the previous year. The prevalent fusarium species involved with the seed piece decay samples this season were *Fusarium oxysporum* and *Fusarium coeruleum*[1]. Both fusarium species were found to be resistant to fludioxonil (Maxim) and in most cases sensitive to thiabendazole (Mertect)[1].

METHODS: The Prince Edward Island Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis of disease problems of commercial crops produced on PEI. Samples are submitted to the laboratory by agriculture extension staff, producers, growers, agri-business representatives, crop insurance agents and the general public. Diagnoses are based on a combination of investigative work, visual examination of symptoms, microscopic observation and culturing onto artificial media. Where required, isolates are forwarded to specialists at Agriculture and Agri-Food Canada (AAFC), the Canadian Food Inspection Agency (CFIA) and the National Fungal Identification Service (NFIS) for species identification and fungicide resistance testing.

RESULTS: A total of 140 samples were processed for the 2017 crop year. Categories of samples received were: potatoes (62.55%), cereal and oilseed crops (10.81%), vegetable and fruit crops (25.48%), and other (2.67 %). The category 'other' covers miscellaneous samples and weeds. In most samples one or more causal agents were identified. Between June 1 and November 14, 2017, a total of 247 disease diagnoses were completed. The 2017 potato growing season started with overall good emergence and vigorous plant stands. However, as the spring progressed, some uneven emergence and potato seed piece decay became noticeable. The varieties involved included 'Gemstar', 'Russet Burbank', 'Piccolo', 'Prospect' and 'Goldrush'. For the first time in thirty years, there were no confirmed cases of foliar potato late blight. Environmental conditions were not conducive to the development and spread of the late blight fungus as compared to previous years. The inoculum source was diminished as growers planted clean, disease free seed and there were only four confirmed cases of late blight the previous year. Seven Fusarium isolates were forwarded to AAFC for fungicide resistance/sensitivity testing. The prevalent Fusarium species involved with the seed piece decay samples this season were *Fusarium oxysporum* and *Fusarium coeruleum*[1]. Both fusarium species were found to be resistant to fludioxonil (Maxim) and in most cases sensitive to thiabendazole (Mertect)[1]. Isolations from stem tissue of potato plants showing symptoms of early dying confirmed the fungi involved included *Rhizoctonia* sp., *Colletotrichum coccodes*, *Verticillium* spp. and a high level of *Fusarium oxysporum*[2] (listed as separate disease diagnoses in the table). Leaf spot symptoms developed on plants showing symptoms of early dying of potato varieties 'FL1879', 'Atlantic', 'Innovator', 'Ranger Russet' and 'Russet Burbank'. The causal agent isolated from the tissue was *Alternaria alternata* or the brown spot fungus. As well, some *Alternaria solani* or the early blight fungus was also isolated. *Pectobacterium atrosepticum* was confirmed in one potato bacterial blackleg sample[3] and a phytoplasma was confirmed in a commercial garlic sample[3]. This year, *Phomopsis* sp. (phomopsis canker) was confirmed on highbush blueberry in culture. The apple acreage on Prince Edward Island is increasing and this season fire blight symptoms appeared in mid-July in two varieties (confirmation pending). Other common diseases that were identified in apple samples included phomopsis canker, rust and nectria canker.

A summary of diseases diagnosed on crop samples is provided in Table 1 by crop category. The diagnoses reported may not necessarily reflect the major disease problems encountered in the field during the season but rather those most prevalent within the samples submitted.

Table 1. Diseases diagnosed on commercial crop samples submitted to the PEI Analytical Laboratories, Plant Disease Diagnostic Service, Prince Edward Island Department of Agriculture in 2017.

CROP	DISEASE	CAUSAL AGENT / PLANT PATHOGEN	FREQUENCY OF IDENTIFICATION
VEGETABLES:			
Cauliflower	Damping-off	*Fusarium* sp. *Pythium* sp. *Rhizoctonia* sp.	1 1 1
Corn	Environmental disorder Non-infectious disorder Root rot	Burn Nutritional imbalance *Fusarium* sp. *Rhizoctonia* sp.	1 1 1 1
Garlic	Phytoplasma		1
Onion	Basal rot	*Fusarium* sp.	1
Peas	Pod and stem blight	*Ascochyta* sp.	1
Potato	Bacterial soft rot Black dot Black scurf Blackleg Blackleg Botrytis gray mould Brown spot Common scab Early blight Environmental disorder Fusarium dry rot Fusarium wilt	*Clostridium* sp. *Pectobacterium* sp. *Pseudomonas* sp. *Colletotrichum coccodes* *Rhizoctonia solani* *Pectobacterium atrosepticum* *Pectobacterium* sp. *Botrytis cinerea* *Alternaria alternata* *Streptomyces scabies* *Alternaria solani* Herbicide damage *Fusarium coeruleum* *Fusarium oxysporum* *Fusarium solani* *Fusarium* sp. *Fusarium avenaceum* *Fusarium oxysporum* *Fusarium sambucinum* *Fusarium solani* *Fusarium* sp.	6 7 7 4 6 1 5 7 15 2 3 1 2 6 2 2 2 7 1 4 6

(Table 1 *cont*.)			
Potato (cont'd)	Geotrichum rot	*Geotrichum* sp.	1
	Leaf spot	*Ulocladium* sp.	1
	Leak	*Pythium* sp.	6
	Nutritional disorder	Nutritional imbalance	1
	Physiological disorders	Black heart	1
		Bruising	1
		Dumbbell shape	1
		Internal blackspot bruising	3
	Pink rot	*Phytophthora erythroseptica*	1
	Pinkeye	*Pectobacterium* sp.	1
	Powdery mildew	*Unknown cause*	3
		Erysiphe sp.	2
	Rhizoctonia stem girdling	*Rhizoctonia* sp.	22
	Scab	*Streptomyces scabies*	1
	Seed piece decay	*Clostridium* sp.	1
	Silver scurf	*Pseudomonas* sp.	1
		Helminthosporium solani	1
	Verticillium wilt	*Verticillium dahliae*	4
		Verticillium sp.	14
Tomato	Black mould	*Alternaria alternata*	1
	Botrytis vine rot	*Botrytis cinerea*	1
	Brown spot	*Alternaria* sp.	1
CEREAL / OILSEED CROPS:			
Barley	Physiological disorder	Nutritional imbalance	1
	Black point		
	Net blotch	*Biopolaris* sp.	1
	Root rot	*Pyrenophora* sp.	1
	Rust	*Biopolaris* sp.	1
	Smut	*Puccinia* sp.	1
	Spot blotch	*Ustilago* sp.	2
		Bipolaris sp.	1
Oats		*Cochliobolus sativus*	2
	Leaf blotch	*Stagonospora* sp.	2
	Rust	*Puccinia* sp.	3
	Smut	*Ustilago* sp.	1
Soybean	Yellow dwarf disease	Virus	1
	Alternaria leaf spot	*Alternaria atlernata*	1
	Fusarium root rot	*Fusarium oxysporum*	1
	Nutritional disorder	*Fusarium* sp.	1
	Pod and stem blight	Nutritional imbalance	1
		Alternaria sp.	1
		Diaporthe sp.	1
Wheat	Rhizoctonia root rot	Rhizoctonia sp.	3
SMALL FRUITS:			
Apple	Leaf rust	*Puccinia* sp.	1
	Diaporthe canker	*Diaporthe* sp.	1
	Insect	Winter firefly	1
	Nectria canker	*Nectria* sp.	4
	Phomopsis leaf spot	*Phomopsis* sp.	3
	Rust	*Gymnosporangium* sp.	4

(Table 1 *cont*.)			
Blueberry 'highbush'	Scab Phomopsis canker Twig dieback	Venturia inaequalis *Phomopsis* sp. *Fusarium* sp.	5 2 2
Cranberry		*Rhizoctonia* sp.	2
Strawberry	Phytophthora root rot Black root rot Botrytis blight Leaf blight Physiological disorder Powdery mildew	Phytophthora sp. *Rhizoctonia* sp. *Botrytis cinerea* *Phomopsis* sp. Herbicide damage *Sphaerotheca macularis*	4 1 1 3 3 4
OTHER CROPS:			
Statice Weed identification	Verticillium wilt	*Verticillium* sp. *Botrytis cinerea*	2 1 2
TOTAL			247

[1]Fusarium species identification and fungicide resistance screening were provided by Dr. Rick Peters and his staff at Agriculture and Agri-Food Canada (AAFC).
[2]Identification of the Fusarium species contributing to potato early dying was confirmed as *Fusarium oxysporum* by Dr. Tharcisse Barasubiye (AAFC/NFIS).
[3]Confirmation of the phytoplasma and *Pectobacterium atrosepticum* identification were provided by Dr. Sean Lee and Dr. Jingbai Nie (CFIA).

CEREALS / CÉRÉALES

CROP / CULTURE: Cereal crops (Wheat, Durum, Barley and Oats)
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: SEED-BORNE FUSARIUM ON CEREAL CROPS IN SASKATCHEWAN IN 2015

ABSTRACT: Commercial plate tests from three seed labs for seed-borne *Fusarium graminearum* and total *Fusarium* spp. in 2015 are summarized. A total of 1719 wheat, 1313 durum, 719 barley and 244 oat samples were reported. Severity and frequency were found to have declined from 2014.

INTRODUCTION AND METHODOLOGY: Test results from three seed testing laboratories were acquired and combined. These tests were from either agar-plating or quantitative PCR techniques. In the case of PCR tests, the presence or absence of DNA of *Fusarium* spp. or of *Fusarium graminearum* allowed calculation of % infection. No attempt to select Fusarium damaged kernels (FDK) was performed so the samples can be considered random. The % frequency of combined *Fusarium* spp. (total Fusarium) and the % frequency of *Fusarium graminearum* were calculated. The mean % infection was calculated for both total *Fusarium* spp. and *Fusarium graminearum.* Individual *Fusarium* spp. are not reported, as not all labs provided that information. The results of over 4000 tests were combined and reported by Saskatchewan crop districts and provincial means were determined. The tests were conducted from September of 2015 through April 2016 and were assumed to be largely from the 2015 crop.

RESULTS AND COMMENTS: In Saskatchewan, the 2015 crop year began with earlier than usual seeding (Saskatchewan Ministry of Agriculture 2015). Conditions were dry and cool causing a delay in germination and seedling development across most of the province. A killing frost was widespread in late May causing many of the fields or portions thereof to be re-seeded. Conditions remained dry until the first week of July with the exception of the south-east which experienced significant precipitation in mid-June. Moisture conditions improved throughout the province from mid-July to the beginning of harvest. By mid-August, warm, dry weather resulted in harvest being ahead of the 5-year average. However, late August saw significant moisture causing delays in what was an early harvest. Sprouting, bleaching, staining and lodging were reported and seed quality declined (Saskatchewan Ministry of Agriculture 2015).

Average yields were reported as wheat 37 bu/acre, durum 38 bu/acre, barley 59 bu/acre, and oats 85 bu/acre (Saskatchewan Ministry of Agriculture 2015). These represent slight increases in yields over the 10 averages.

A total of 1717 wheat, 1323 durum, 719 barley and 244 oat samples were processed during the period covered by this report. Three seed labs participated.

WHEAT - Tests for different wheat types, with the exception of durum wheat, were combined and reported as wheat only. The majority of the 1719 wheat samples were CWRS. The incidence of *F. graminearum*-free samples was 9%, with a mean % infection of 1.9. The incidence of total *Fusarium* spp.-free samples was 3.7% with a mean % infection of 9.4. Although the incidence of infection with *F. graminearum* and total *Fusarium* spp. was high, the mean % infection was down from 2014 (6.2% for *F. graminearum* and 11.2% for total *Fusarium* spp. (Table 1).

DURUM - Of the 1323 durum samples tested for *F. graminearum*, 5.8% were found to be pathogen-free. A provincial mean % infection was calculated to be 3.3. Total *Fusarium* spp. pathogen-free samples was 3.3% with a mean % infection of 12.3. These levels were down in both incidence and severity from levels reported in 2014 (Saskatchewan Wheat Development Commission 2016; Morrall et al. 2015) (Table 1).

BARLEY - A total of 719 barley samples were processed. *F. graminearum* pathogen-free samples was 5.6% with a mean % infection of 2.3. Total *Fusarium* spp. pathogen-free samples was 2.7% with a mean % infection of 10.3. As with wheat and durum, these levels were lower than reported in 2014 (Morrall et al. 2015) (Table 2).

OAT - The 244 samples tested had *Fusarium graminearum* pathogen-free samples of 16.5% with a mean % infection of 0.8. Total *Fusarium* spp. pathogen-free samples was 2.2% and the mean % infection was 16.1 (Table 2).

A five-year summary of frequency and mean % infection of *Fusarium graminearum* and total *Fusarium* spp. is presented in Table 3 (Morrall et al. 2012, 2013, 2014, 2015). In 2015, combined (wheat, durum, barley and oat) cereal infection frequency for *F. graminearum* was 7.8% with a mean % infection of 2.5, lower than in 2014 when the mean % infection was 6.2 (Table 3). Total infection frequency for all *Fusarium* spp. in all four crops was 10.7%, down slightly from 2014 and 2012 (Table 3).

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ACKNOWLEDGEMENTS: We would like to acknowledge the cooperation of 20/20 Seed Labs Inc., Discovery Seed Labs Ltd., and Prairie Diagnostic Seed Lab in providing seed testing results making this report possible. We also wish to recognize the funding support of the Saskatchewan Wheat Development Commission.

Table 1. Number of wheat and durum samples tested from September 2015 to May 2016 and levels of infection with *Fusarium graminearum* and *Fusarium* spp. in each Saskatchewan Crop District.

2015 Seed-borne Pathogens of Wheat/Durum										
Crop District	WHEAT					DURUM				
		F. graminearum		All *Fusarium* spp.			*F. graminearum*		All *Fusarium* spp.	
	No of samples	Mean % infection	% PFS[1]	Mean % infection	% PFS	No of samples	Mean% infection	% PFS	Mean % infection	% PFS
1A	78	2.9	19.2	6.1	7.9	48	6.5	0	11.1	0
1B	27	1.5	29.6	5.5	0	1	13.0	0	19.0	0
2A	34	2.1	36.4	4.2	3.2	169	3.9	4.8	9.3	1.2
2B	26	3.4	19.2	9.5	4.8	79	6.5	6.8	17.9	6.3
3AN	6	2.5	0	8.0	0	53	2.5	0	14.2	0
3AS	31	0.5	9.7	3.1	9.7	255	1.4	11.2	5.8	2.4
3BN	34	2.2	17.6	8.0	9.7	216	3.1	3.2	15.0	2.4
3BS	1	0.0	100	5.5	0	26	0.3	4.5	8.3	4.3
4A	0	nd	nd	nd	nd	9	0.2	11.1	1.5	11.1
4B	3	0.0	100	0.3	66.7	12	0.1	33.3	1.8	2.7
5A	42	1.4	10.8	8.2	19.0	6	11.9	0	23.4	0
5B	115	1.5	7.2	10.1	4.5	3	3.0	0	19	0
6A	180	2.5	2.8	10.5	2.8	90	4.9	2.2	17.7	2.2
6B	329	2.0	2.7	10.0	2.7	96	5.1	12.5	17	12.6
7A	62	1.5	3.2	9.0	3.2	212	2.5	2.8	16	2.8
7B	106	0.4	10.4	5.0	5.3	28	1.9	7.1	22.5	0
8A	117	4.4	2.6	15.0	1.7	0	nd	nd	nd	nd
8B	135	2.5	0.7	11.0	0.7	17	6.5	0	17.0	0
9A	255	1.2	12.5	8.5	2.2	3	0.3	0	6.3	0
9B	138	0.3	19.6	8.3	1.7	0	nd	and	nd	nd
Total / Mean	1719	1.9	9%	9.4	3.7%	1323	3.3	5.8%	12.3	3.3%

[1] % PFS = percent pathogen-free samples.
nd = no data

Table 2. Number of barley and oat samples tested from September 2015 to May 2016 and levels of infection with *Fusarium graminearum* and *Fusarium* spp. in each Saskatchewan Crop District.

2015 Seed-borne Pathogens of Barley and Oats										
	BARLEY					OATS				
		F. graminearum		All *Fusarium* spp.			*F. graminearum*		All *Fusarium* spp.	
Crop District	No of samples	Mean % infection	% PFS[1]	Mean % infection	% PFS	No of samples	Mean% infection	% PFS	Mean % infection	% PFS
1A	11	2.3	10	6.4	14.3	4	1.6	0	4	0
1B	2	2	50	7.6	0	3	0.8	33.3	2.2	0
2A	7	3.9	0	6.2	0	2	3	0	6.3	0
2B	6	6.9	0	14.1	0	2	0	100	17.8	0
3AN	3	0.5	33.3	10.5	0	0	nd	nd	nd	nd
3AS	7	0.8	42.9	3.9	0	0	nd	nd	nd	nd
3BN	19	2.2	5.3	12	5.9	1	0	100	1.5	0
3BS	0	nd	nd	nd	nd	0	nd	nd	nd	nd
4A	0	nd	nd	nd	nd	0	nd	nd	nd	nd
4B	1	0	100	1	0	1	0	100	3.5	0
5A	15	1.6	20	5.7	13.3	2	0.8	50	17.5	0
5B	70	2.6	28.6	10.8	0	34	1.3	2.9	17.5	0
6A	77	1.9	0	11.6	0	15	0.8	0	15.8	0
6B	160	1.5	4.4	9.3	4.4	48	0.2	8.3	7.5	8.3
7A	54	0.8	1.9	8.3	0	3	0.2	0	17	0
7B	30	0.7	0	8	0	1	0	100	3	0
8A	52	3.5	5.8	8.5	4.2	26	2.8	0	23	0
8B	87	2.5	1.1	12.2	1.1	24	1.3	4.2	19	4.2
9A	76	0.9	6.9	8	2.9	58	0.3	12.1	16.1	0
9B	42	3.6	9.5	13.9	5.7	20	0	100	27	0
Total / Mean	719	2.3	5.6%	10.3	2.7%	244	0.8	16.5%	16.1	2.2%

[1] % PFS = percent pathogen-free samples.
nd = no data

Table 3. Five-year summary of frequency and mean % infection of *Fusarium graminearum* and total *Fusarium* spp.

		Fusarium graminearum		**All *Fusarium* spp.**	
Year	No. of samples	% PFS[1]	Mean % infection	% PFS	Mean % infection
2011	953	nd	1.1	49%	6.3
2012	1981	nd	5.6	18%	11.2
2013	1660	nd	2.2	27%	5.8
2014	2018	nd	6.2	18%	11.2
2015	4008	7.8%	2.5	3.3%	10.7

[1] % PFS = percent pathogen-free samples.
nd = no data

CROP / CULTURE: Cereal crops (Wheat, Durum, Barley and Oats)
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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[6]Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina SK S4S 0B1

TITLE / TITRE: SEED-BORNE FUSARIUM ON CEREAL CROPS IN SASKATCHEWAN IN 2016

ABSTRACT: Commercial plate tests from three seed labs for seed-borne *Fusarium graminearum* and total *Fusarium* spp. were summarized. A total of 2251 wheat, 1658 durum, 969 barley and 223 oat samples were reported. Although combined frequency for *Fusarium graminearum* declined, severity was the highest reported in the past 5 years. Total *Fusarium* spp. frequency was very high with severity higher than reported in previous years.

INTRODUCTION AND METHODOLOGY: Test results from three seed testing laboratories were acquired and combined. These tests were from either agar-plating or quantitative PCR techniques. In the case of PCR tests, the presence or absence of DNA of *Fusarium* spp. or of *Fusarium graminearum* allowed calculation of % infection. No attempt to select fusarium damaged kernels (FDK) was performed so the samples can be considered random. The % frequency of all *Fusarium* spp. including *Fusarium graminearum* (total *Fusarium*) and the % frequency of *Fusarium graminearum* alone were calculated. The mean % infection was calculated for both total *Fusarium* spp. and *Fusarium graminearum*. Individual *Fusarium* spp. are not reported, as not all labs provided that information. The results of over 5100 tests were combined and reported by Saskatchewan crop districts and provincial means were determined. The tests were conducted from September of 2016 through May 2017 and were assumed to be largely from the 2016 crop.

RESULTS AND COMMENTS: The 2016 crop year began with earlier than usual seeding and by mid-May, 81% of the crop was seeded compared to a 5-year average of only 59% (Saskatchewan Ministry of Agriculture 2016). The crop was considered in good condition due to timely rains. By mid-June, crops were ahead of normal development. General, heavy rainfall through late June into mid-July led producers to become concerned about too much moisture and the presence of disease. Significant rainfall continued throughout most of the province into August. Fields were reported wet and crops were downgraded due to higher levels of disease. By early September, 32% of the crop was harvested ahead of the 28% 5-year average. Harvest stalled through much of September due to continued rainfall and wet fields. However, by October 3, 80% was completed which was below the 5-year average of 86%. Lodging of crops was prevalent. Snow and continued rainfall further delayed harvest, but by November, 95% of the harvest was complete. The remainder was largely not harvested or harvested in the spring of 2017.

Cereal yields were greater than the five-year average (Saskatchewan Ministry of Agriculture 2016 Agricultural Statistics). The average wheat yield was 46.1 bu/acre compared to the 5-year average of 40.4 bu/ acre. Durum yield was 48.3 bu/acre compared to the 5-year average of 39.1 bu/acre. Average barley yield was 69.8 bu/acre, up from the 5-year average of 55.7 bu/acre (Saskatchewan Ministry of Agriculture 2016 Agricultural Statistics). Oat yield was up as well at 94.0 bu/acre compared to the 5-year average of 85.0 bu/acre. Quality and grade were reduced for the cereals reported (Saskatchewan Wheat Development Commission 2016).

A total of 2251 wheat, 1658 durum, 969 barley and 223 oat samples were processed during the period covered by this report. This represents an increase in wheat samples of 31%, durum 25.3% and barley 34.7% over numbers reported in 2015 (Olson et al. 2018). Oat sample numbers declined by 8.6%.

Fusarium graminearum frequency and severity (mean % infection) were calculated for wheat, durum, barley and oats individually and combined. Frequency and severity of total *Fusarium* spp. were calculated individually and combined as well (Tables 1, 2 and 3). Frequency of *Fusarium graminearum* declined compared with 2015, but severity increased to 6.8 which was a marked increase over 2015 (Olson et al. 2018). The frequency of total *Fusarium* spp. was high at 3.5%, while severity was 18.2 which was the highest observed in the past five years (Table 1) (Olson et al. 2018; Morrall et al. 2013, 2014, 2015).

Wheat – The percentage of *F. graminearum*-free samples in 2016 was 20.1%, up from the 9% reported in 2015 (Olson et al. 2018). (Table 2). The mean infection was 5.3%, up significantly from 2015 where it was 1.9%. Total *Fusarium* spp.-free samples was 3.8% compared to 3.7% in 2015. The mean % infection for total *Fusarium* spp. rose to 16.2% from 9.4% in 2015 (Table 2).

Durum – Of the 1658 samples, 16.2% were found to be pathogen-free for *F. graminearum* (Table 2). Mean infection was 9.9%. In 2015, the proportion of *F. graminearum*-free samples was 5.8% and the mean infection was 3.3% (Olson et al. 2018). In 2016, total *Fusarium* spp.-free samples was 2.3% down slightly from 3.3% in 2015. Total *Fusarium* spp. mean infection was up significantly to 21.5% from the 12.3% in 2015 (Table 2).

Barley – The percentage of *F. graminearum*-free samples was 25.8% in 2016, up from 5.6% in 2015 (Olson et al. 2018) (Table 3). The mean infection was 5.4% compared to 2.3% in 2015. Total *Fusarium* spp.-free samples was 4.6%, up from 2.7% in 2015. Mean infection for total *Fusarium* spp. was 17.6%, also up from the 10.3% reported in 2015 (Table 3).

Oat – Samples tested for *F. graminearum* were found to be 57.4% pathogen-free in 2016 (Table 3). This was considerably higher than the 16.5% of 2015 (Olson et al. 2018). Mean infection was 0.8%, unchanged from 2015. Total *Fusarium* spp.-free samples was 3.3%, up slightly from 2.2% in 2015. Total *Fusarium* spp. mean infection was 16.5%, similar to the 16.1% reported in 2015 (Table 3).

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ACKNOWLEDGEMENTS: We would like to acknowledge the cooperation of 20/20 Seed Labs Inc., Prairie Diagnostic Seed Lab, and Discovery Seed Labs Ltd. in providing seed testing results thus making this report possible. We also wish to acknowledge the support through funding of the Saskatchewan Wheat Development Commission.

Table 1. Five-year summary of frequency (%PFS) and severity (mean % infection) of *Fusarium graminearum* and total *Fusarium* spp. of wheat, durum, barley and oats combined

2016 Combined Frequency and Severity					
		Fusarium graminearum		**All *Fusarium* spp.**[1]	
Year	No of samples	% PFS[2]	Mean % infection	% PFS	Mean % infection
2012	1981	nd	5.6	18%	11.2
2013	1660	nd	2.2	27%	5.8
2014	2018	nd	6.2	18%	11.2
2015	4008	7.8%	2.5	3.3%	10.7
2016	5101	21.5%	6.8	3.5%	18.2

nd = no data

[1] All Fusarium spp. = total *Fusarium spp*. including *F. graminearum.*

[2] % PFS = percent pathogen-free samples.

Table 2. Number of wheat and durum samples tested from September 2016 to May 2017 and levels of infection with *Fusarium graminearum* and *Fusarium* spp. in each Saskatchewan Crop District.

2016 Seed-borne Pathogens of Wheat and Durum										
	WHEAT					DURUM				
		F. graminearum		All *Fusarium* spp.			*F. graminearum*		All *Fusarium* spp.	
Crop District	No. of samples	Mean % infection	% PFS[1]	Mean % infection	% PFS	No. of samples	Mean % infection	% PFS	Mean % infection	% PFS
1A	90	7.7	11.1	9.2	6.7	110	19.7	1.8	24.5	0
1B	69	7.1	11.6	13.5	3.4	1	13.5	0	67	0
2A	44	7.8	4.5	10.7	0	273	12.9	1.5	16.2	1.5
2B	42	9.3	7.1	19.3	2.9	90	13.4	14.4	20.1	9.1
3AN	13	4.0	15.4	15.0	0	70	6.4	15.7	21.8	1.4
3AS	43	2.6	67.4	6.6	41.8	466	7.7	23.0	13.3	1.1
3BN	56	4.0	41.1	13.3	5.5	195	7.0	13.8	31.0	1.0
3BS	6	0.5	83.3	0	100	54	1.2	48.1	8.2	0
4A	0	nd	nd	nd	nd	23	0.5	86.9	2.3	4.3
4B	5	0.5	60	4.5	0	55	5.4	14.5	25	0
5A	70	11.0	14.3	19.0	7.2	13	18.6	15.4	28.8	7.7
5B	163	3.7	17.2	13.9	1.9	5	7.0	0	31	0
6A	223	6.2	10.3	18.7	1.8	75	7.5	6.7	32.0	0
6B	413	5.0	15.0	18.5	4.6	67	8.0	23.9	32.0	9.0
7A	103	5.5	17.2	22.0	5.0	125	9.0	19.2	40.0	6.4
7B	182	2.9	30.2	11.0	3.6	25	6.7	8.0	32.0	0
8A	139	6.6	10.1	22.6	0	0	nd	nd	nd	nd
8B	170	6.7	7.6	22.0	2.4	9	22.4	22.2	38.0	14.3
9A	262	2.4	26.7	11.8	1.3	2	3.3	0	21.0	0
9B	158	2.1	50.3	12.0	1.6	0	nd	nd	nd	nd
Total / Mean	2251	5.3	20.1%	16.2	3.8%	1658	9.9	16.2%	21.5	2.3%

nd = no data
[1] % PFS = percent pathogen-free samples.

Table 3. Number of barley and oat samples tested from September 2016 to May 2017 and levels of infection with *Fusarium graminearum* and total *Fusarium* spp. in each Saskatchewan Crop District.

2016 Seed-borne Pathogens of Barley and Oats										
	BARLEY					OATS				
		F. graminearum		All *Fusarium* spp.			*F. graminearum*		All *Fusarium* spp.	
Crop District	No. of samples	Mean % infection	% PFS[1]	Mean % infection	% PFS	No. of samples	Mean % infection	% PFS	Mean % infection	% PFS
1A	22	5.7	9.1	8.6	0	0	nd	nd	nd	nd
1B	7	11.2	0	21.5	0	4	2.8	25.0	16.8	0
2A	14	7.6	0	10.2	0	1	6.0	0	27.0	0
2B	14	11.2	0	25.5	0	0	nd	nd	nd	nd
3AN	2	2.8	0	22.3	0	0	nd	nd	nd	nd
3AS	10	1.3	30.0	8.3	10.0	2	0	100	9.0	0
3BN	34	3.3	20.6	18.5	0	1	0.5	0	2.0	0
3BS	5	0	100	2.0	0	0	nd	nd	nd	nd
4A	2	0	100	3.0	50.0	0	nd	nd	nd	nd
4B	1	0.5	0	15.5	0	2	2.3	0	12.8	0
5A	36	8.5	13.9	16.0	2.8	8	1.3	25	18.5	0
5B	114	5.5	13.2	13.6	2.9	41	1.0	58.5	12.0	9.8
6A	102	5.0	8.8	19.2	0	16	1.8	25	14.3	0
6B	218	6.0	21.1	19.0	4.6	32	1.8	65.6	12.5	3.1
7A	78	7.3	9.0	24.3	1.3	0	nd	nd	nd	nd
7B	43	3.0	23.3	15.0	0	0	nd	nd	nd	nd
8A	42	7.2	14.3	23.0	0	33	2.8	27.2	26.0	6.1
8B	111	4.8	8.1	20.5	0	15	1.5	46.7	15.0	0
9A	85	2.1	42.4	12.0	1.2	37	1.2	80.0	20.2	0
9B	29	4.4	58.6	8.3	0	31	0.5	96.8	19.0	0
Total / Mean	969	5.4	25.8%	17.6	4.6%	223	0.8	57.4%	16.5	3.3%

nd = no data
[1] % PFS = percent pathogen-free samples.

CROP / CULTURE: Barley
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2016 AND 2017

ABSTRACT: In 2016, fusarium head blight (FHB) incidence and severity were assessed in 40 barley crops (mainly 2 row) in Saskatchewan. FHB occurred in 67% of the surveyed barley crops at a mean provincial severity (FHB Index) of 0.9%. In 2017, 35 barley crops (mainly two-row) were surveyed and FHB was detected in 48% of the surveyed fields (35 fields) with a mean severity of 0.58.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity in Saskatchewan were assessed in 40 barley crops (39 two-row; 1 six-row) in 2016. In 2017, 35 barley crops (33 two-row; 2 six-row) were surveyed in Saskatchewan. Field location and results were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey). The data is presented for all barley crops (two-row and six-row) combined for each year.

Crop adjustors with Saskatchewan Crop Insurance Corporation randomly collected 50 spikes from barley crops at late milk to early dough stages (Lancashire et al. 1991). A subsample of 30 spikes was analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike, as proportion of the total, were recorded. A FHB disease severity rating, also referred to as the FHB Index, was determined for each crop surveyed: FHB severity (%) = [% 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 presence of *Fusarium* species on infected kernels. Cultures were grown on potato dextrose agar (PDA) or half strength PDA to observe colony morphology. Carnation leaf agar was used to aid in promoting *Fusarium* sporulation. A maximum of 20 symptomatic kernels per sample were selected to represent infected samples to confirm FHB and the *Fusarium* spp. involved.

RESULTS AND COMMENTS: Approximately 1.0 million ha (2.5 million ac) of barley were seeded in Saskatchewan in 2016. The average yield of 3.8 metric tonnes per ha (69.8 bu/ac) in 2016 represents the highest yield observed in the last five years (2012-2016). This was also above the five-year average of 3.2 metric tonnes per ha (58.6 bu/ac) (Statistics Canada, 2017). In 2017, 0.9 million ha (2.3 million ac) of barley were seeded. The average yield in 2017 was 3.6 metric tonnes per ha (66.4 bu/acre which is slightly lower than the 2016 average yield (Statistics Canada, 2017).

FHB occurred in 67% of the barley crops surveyed in 2016 and 48% of the barley crops surveyed in 2017. The mean severity in the province was 0.8% in 2016 and 0.6% in 2017. The severity of FHB in both 2016 and 2017 was higher compared to 2015 (0.06%), but lower than observed in 2012 (3.0%) and 2013 (1.7%) (Brar et al. 2017). In 2016, the highest FHB severity occurred in soil zone 1; while in 2017 the highest FHB severity occurred in soil zone 3 (Table 1).

Samples collected from 28 of the 40 fields surveyed in 2016 showed putative FHB symptoms and a total of 408 isolations were made to confirm the presence of *Fusarium* spp. and their identification (Table 2). The most frequently isolated causal pathogen, *F. poae*, occurred in 55% of surveyed fields, and accounted for 27% of all the *Fusarium* isolations. *Fusarium graminearum* was detected in 37% of the barley crops from which survey samples were collected, which was more than seven times the prevalence in 2015 (Brar et al. 2016). This species accounted for 12% of isolations.

In 2017, 17 of the 35 fields surveyed were identified to have FHB symptoms. A total of 218 isolations were made from the symptomatic fields to confirm the presence of *Fusarium* spp. and their identification (Table 2). As in 2016, *F. poae* was the most prevalent *Fusarium* spp. and was detected in 94% of fields accounting for 69% of all isolations. *F. graminearum* and *F. avenaceum* were both detected in 18% of fields accounting for 1.8% of all isolations each; while *F. sporotrichioides* was only detected in 12% of fields and accounted for 1.4% of all isolations.

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

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Table 1. Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil zone in Saskatchewan in 2016 and 2017.

Soil Zones	2016		2017	
	Prevalence[1] (No. of crops affected)	Mean FHB Severity[2] (range)	Prevalence (No. of crops affected)	Mean FHB severity[2] (range)
Zone 1 Brown	43% (7)	1.4% (0-6.5%)	0% (4)	0%
Zone 2 Dark Brown	92% (12)	1.2% (0-4.0%)	36% (11)	0.2% (0 – 1.8)
Zone 4 Black/Grey	62% (21)	0.3% (0-1.1%)	65% (20)	0.9% (0 – 10.6)
Overall Total/Mean	67% (40)	0.8%	48% (35)	0.6%

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

Table 2. Prevalence of Fusarium species on kernels or glumes of barley crops displaying visual FHB symptoms in Saskatchewan in 2016 and 2017.

	F. avenaceum	*F. graminearum*	*F. poae*	*F. sporotrichioides*	*Other Fusarium*[1]	Did not sporulate[2]
2016	35%	56%	81%	52%	26%	11%
2017	10%	18%	94%	12%	59%	0%

[1]Includes *Fusarium* spp. other than *F. avenaceum, F. culmorum, F. graminearum, F. poae* & *F. sporotrichioides.*
[2] Includes isolates that could not be identified due to the lack of sporulation.

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA – 2017

ABSTRACT: Forty-four barley fields in Manitoba were surveyed for Fusarium head blight (FHB) in 2017 to assess disease severity and the causal *Fusarium* species causing FHB on barley. The mean FHB index in 2017 was 0.89 which is below the 10-year average (2006-2016). *F. poae* was the predominant *Fusarium* species identified in commercial fields, followed by *F. graminearum*, *F. sporotrichioides*, *F. avenaceum*, *and F. equiseti*.

INTRODUCTION AND METHODS: A total of 44 barley (37 two-row, 7 six-row) fields in Manitoba were surveyed for FHB from July 18-August 5 when crops were at the early to soft dough (ZGS 79-82) stages of growth. Fields were selected at regular intervals approximately 20-25 km along survey routes, depending on crop availability and accessibility. The areas sampled were bounded by Highway numbers 67, 16 to the north, 12 to the east, 3 to the south, 8 to the north and 83 to the west. FHB incidence (the percentage of spikes showing typical FHB symptoms) was assessed in each field by sampling 95-110 spikes at three locations and averaging the scores. The mean spike proportion infected (SPI) was estimated for each field. Forty to sixty affected spikes were collected at each survey site and stored in paper envelopes.

Consequently, 1 gram of infected kernels removed from 15 randomly selected spikes from each field was frozen in liquid nitrogen and ground to a powder using Spex SamplePrep 2010 Geno/Grinder. DNA was extracted from the ground grain sample from each field using QIAGEN DNeasy Mini Kit (QIAGEN). Polymerase chain reaction (PCR) analysis was performed on extracted DNA samples using species-specific oligonucleotide primers for various *Fusarium* species frequently found in cereal grains in western Canada (Demeke et al. 2005).

RESULTS AND COMMENTS: In 2017, growing conditions throughout Manitoba were dry and not very conducive for FHB development. Barley was grown on 239,898 acres in Manitoba in 2017. The 2-row cultivars CDC Conlon and CDC Austenson were the two most widely planted barley cultivars in 2017, occupying 21.1% and 20.8%, respectively of the seeded barley area. CDC Copeland was the third most widely planted cultivar, occupying 9.3% of the seeded area (MASC, 2017).

Putative FHB symptoms were detected in all barley fields surveyed. The mean FHB incidence in 2-row barley was 9.30% (range from 0.33% – 35%) and the mean SPI was 7.06 % (range from 1.0% – 30.0%). In six-row barley, the incidence was 3.99% (range 5.66 – 39%) and SPI 3.98% (range 3 - 30%). The resulting mean Fusarium Head Blight Index (FHB-I) [%incidence X %SPI / 100] for two-row barley was 0.99 (range 0.003-10.5), and that for six-row barley was 0.33 (range 0.03 to 1.24). The FHB-I in the 6-row and 2-row barley fields sampled in 2017 were lower than those reported for 2009 to 2015 (Tekauz et al. 2010, Tekauz et al. 2011, Banik et al. 2014, 2016, Beyene et al. 2015). This FHB-I will likely only have a small impact on yields and grain quality in 2017.

The DNA of individual *Fusarium* species was amplified from infected kernels using conventional PCR (Table 1). *F. poae* was the most common *Fusarium* species which was detected in 65.9% of the fields. *F. graminearum* and *F sporotrichoides* were found in 56.8% and 43.2% of fields, respectively. *F. avenaceum* and *F. equiseti* were also detected, but only at very low levels (Table 1).

Real-time qPCR was performed on field samples with primers specific to *F. poae, F. graminearum* and *F. sporotrichioides*. On average, DNA of *F. poae* was found at the level of 7.45 pg per ng of the total genomic DNA which was twice as high as the amount of *F. graminearum* DNA present in barley grains (3.13 pg per ng of the total genomic DNA). DNA of *F. sporotrichioides* was detected at a much lower level with an average of 0.26 pg per ng of the total genomic DNA. *F. poae* has been the most common species in barley and oat in recent years (Tekauz et al. 2013; Beyene et al. 2014, 2015).

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Table 1: *Fusarium* spp. identified by PCR from FHB-affected kernels from 44 barley fields in Manitoba in 2017**.**

***Fusarium* spp.**	**Percentage of fields**
F. avenaceum	4.5
F. equiseti	2.7
F. graminearum	56.8
F. poae	65.9
F. sporotrichioides	43.2

Table 2. Real-time qPCR analysis of *F. poae, F. graminearum* and *F. sporotrichioides* DNA in barley grains collected in 2017.

***Fusarium* spp.**	**Range (pg of fungal DNA / ng of total genomic DNA)**	**Mean (pg of fungal DNA / ng of total genomic DNA)**
F. poae	0.45-21.4	7.45
F. graminearum	0.19-38.8	3.128
F. sporotrichiodes	0.96-1.57	0.265

CROP / CULTURE: Barley
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES IN BARLEY IN SASKATCHEWAN IN 2017

ABSTRACT: Forty-six barley crops were surveyed to assess prevalence, incidence and severity of leaf spot diseases. Disease severity was lower in 2017 than in 2016. Prevalence of *Pyrenosphora teres* was higher than *Cochliobolus sativus*, and *Septoria passerinii* was the least prevalent.

INTRODUCTION AND METHODS: In 2017, a barley disease survey was conducted by Saskatchewan Crop Insurance Corporation (31 crops) and the Cereal and Flax Pathology group (15 crops) of the University of Saskatchewan from July 31st to August 23rd. The 46 commercial crops surveyed include13 crop districts (1B, 2A, 2B, 3BN, 3BS, 5A, 5B, 6A, 6B, 7A, 8A, 8B, 9A). Severity on 10 ten leaves from each crop were visually assessed for leaf spot diseases of barley. The average severity was categorized as: none (no visible symptoms), trace (<1%), very slight (1-5%), slight (6-15%), moderate (16-40%) and severe (41-100%).

Ten different leaves were cut from each field, ten pieces were randomly selected and surface sterilized with a 5% bleach (NaOCl) solution for 1 minute and then rinsed three times in sterile distilled water, dried and placed on water agar. After 7 days the leaf pieces were observed for the presence of tan spot (*Pyrenophora teres* Drechsler), spot blotch (*Cochliobolus sativus* Ito & Kuribayashi Drechs ex Dast.) and septoria leaf spot (*Septoria passerinii* Sacc.). Identification of the pathogens was based on the characteristics of the colonies and the morphology of the spores (Zillinksky 1983).

RESULTS AND CONCLUSIONS: Weather conditions in 2017 were warm and dry at the beginning of the season, which allowed growers to start seeding early. However, lower levels of rain fall across the province during June and July and high temperatures beginning mid-July affected the establishment and development of diseases across Saskatchewan (Saskatchewan Ministry of Agriculture, 2017). In barley, 4% of crops had no disease, 13% a trace, 48% very slight, 11% slight, 17% moderate, and 7% were rated as severe. Most of the crops (65%) in this survey had lower disease severity (from 0-5% leaf area affected) than in 2016, when 43% of the crops were rated <5% disease severity on the leaves. The most prevalent pathogen was *P. teres* (72% of the crops), the incidence (number of leaves affected with *P. teres* among all plated leaves) of this pathogen was 43% (19 crops had incidence ≥50%), this incidence was higher than in 2015 (16%) or 2016 (34%). Prevalence of *C. sativus* was 46% and incidence was 25% (10 crops had an incidence of ≥50%); the incidence was lower than in the last two years (Tran et al. 2016; Cholango-Martinez and Kutcher 2017). The prevalence of *S. passerinii* was 4% and incidence was 2% (there were no crops with incidence ≥50%); incidence was lower than in any of the past 5 years. Prevalence and incidence of these pathogens were low in 2017, compared with 2015 (Tran et al. 2016) or 2016 (Cholango-Martinez and Kutcher 2017).

ACKNOWLEDGEMENTS: We thank the Saskatchewan Crop Insurance Corporation for sample collection during the growing season 2017.

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Table 1. Leaf spot disease severity in 46 barley crops surveyed in Saskatchewan in 2017.

Severity	**Number of crops**	**Frequency (%)**
None	2	4
Trace <1%	6	13
Very slight 1-5%	22	48
Slight 6-15%	5	11
Moderate 16-40%	8	17
Severe 41-100%	3	7
Total	46	100

[1]Frequency: number of fields affected/total of surveyed fields.

Table 2. Prevalence and incidence of leaf spot diseases in 46 barley crops surveyed in Saskatchewan in 2017.

	Prevalence (%)	**Incidence (%)**
Cochliobolus sativus	46	25
Pyrenophora teres	72	43
Septoria passerinii	4	2

[1]Prevalence: % of the barley crops from which the pathogen was isolated.
[2]Incidence: % of leaf pieces affected by each pathogen.

CROP / CULTURE: Barley
LOCATION / RÉGION: Central Alberta

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TITLE / TITRE: 2017 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

ABSTRACT: In 2017, 20 random commercial barley crops were surveyed for disease levels in central Alberta. Leaf disease levels were lower than in previous years, while common root rot levels were average compared to previous years.

INTRODUCTION AND METHODS: A survey to document diseases of barley was conducted in 20 fields in Central Alberta from July 31 - August 3, 2017. Growers were contacted for permission to access their land, with evaluations being 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, with visual assessment 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) for scald, netted net blotch and 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 percent of the plants affected. Following the survey, a representative tissue sub-sample of diseased plant parts collected at each location was cultured in the laboratory for pathogen isolation and identification.

RESULTS AND COMMENTS: Survey results are presented in Table 1. Growing conditions in Central Alberta were cool and wet in May, while June, July, and August were hot and dry. Disease development was lower than the previous year throughout the surveyed region (Rauhala and Turkington 2017). Scald (*Rhynchosporium secalis*) was found in 13 of the 20 surveyed fields with a severity range from 0.1 to 5 % with all remaining fields having no scald. Netted net blotch (*Pyrenophora teres* f. *teres*) was found at trace levels in 5 of the 20 surveyed fields with one field having a level of 15%. Both spot blotch (*Cochliobolus sativus*) and spotted net blotch (*Pyrenophora teres f. maculata)* were isolated from 40% of the other leaf spot symptoms. Severity ranged from 0.1 to 5% in 15 fields while 3 fields had 6 to 10% and 2 fields had 11 to 15% PLAD. Al*ternaria spp*. were also isolated from sub-samples of leaf tissues exhibiting other leaf spot symptoms.

Common root rot of barley (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all of the surveyed fields, at similar levels to those in previous years (Rauhala and Turkington 2017).

There was no stripe rust (*Puccinia striiformis)* found in any of the 20 commercial barley fields surveyed.

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Table 1. Disease incidence and severity in 20 commercial barley fields in Central Alberta, 2017.

Disease (severity rating scale)	% of fields affected	Overall average severity	Range in average severity per field
Scald (PLAD)[1]	65	<1	0 –5
Netted net blotch (PLAD)	30	<1	0 – 15
Other leaf spots (PLAD)	100	2.4	1 – 10
Total Leaf Area Diseased (PLAD)	100	4.2	1 – 17
Common root rot (0-4)	100	2	1 - 3

[1] PLAD = percentage leaf area diseased.

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

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TITLE / TITRE: WHEAT AND BARLEY DISEASE SURVEY IN CENTRAL ALBERTA, 2017

ABSTRACT: During the fall of 2016 to September 2017, 21 barley, 27 spring wheat and 4 winter wheat fields in central Alberta were surveyed for leaf diseases. Barley fields surveyed generally showed low to intermediate levels of leaf spots caused by netted and spotted net blotch, and spot blotch. Scald severity was high in three of the five fields surveyed and scald was the dominant disease in these fields. Low levels of barley stripe rust were found in three of the 21 fields surveyed. Severe barley stripe rust was observed in plots at the Field Crop Development Centre (FCDC) breeding sites around central Alberta in August and September 2017. The majority of spring wheat fields surveyed showed low to intermediate levels of the leaf spotting complex. No stripe rust was found in spring wheat during August 2017 and at the seedling stage of winter wheat in four fields in fall of 2016. Intermediate to severe levels of stripe rust developed in two of the same four winter wheat fields surveyed during July, 2017.

INTRODUCTION AND METHODS: In central Alberta, surveys for leaf diseases were conducted in 21 barley and 27 spring wheat fields mainly in July and August 2017. The development of stripe rust was monitored in four winter wheat fields from September 2016 to July 2017. The commercial fields surveyed were located near Camrose, Stettler, Crestomere, Morrin, Calmar and Lacombe, Alberta. Each field surveyed was assessed at 2 to 6 points (4 to 5 points in most fields), starting at least 20 m from the field edge. Visual assessment was made on plants within a 1 m^2 at the sampling points. Various wheat and barley leaf diseases were rated using a 0-9 disease severity scale. Based on the number of points assessed in each field, mean disease severity per field was calculated. Monitoring for stripe rust development in winter wheat was conducted in FCDC breeding nurseries at Lacombe, Olds, Morrin and Trochu from October 2016 to July 2017. Stripe rust incidence on winter wheat seedlings was assessed for the percentage of affected plants from a number of randomly selected plots and a mean percentage of disease incidence was calculated for each test. When stripe rust was found to be a major disease at the adult plant stage in the tests or fields surveyed, stripe rust severity was assessed as the percentage of diseased leaf area using the Cobb scale, with mean disease severity calculated for each test or field.

RESULTS AND COMMENTS: It was drier from early May to the end of July in 2017 than during the same period in 2016. In the Edmonton area, there was three-quarters of the precipitation in 2017 (170 mm) compared with 2016 (230 mm) for the same period (Oliver AGDM weather station). In the Lacombe area, there was only two-thirds of the precipitation for 2017 (150 mm) compared with 2016 (225 mm) during the same period of time (CDA 2 weather station; http://agriculture.alberta.ca/acis/alberta-weather-data-viewer.jsp). Weather conditions had a major impact on the development of leaf diseases in this region. Results of the barley and wheat disease surveys are presented in Tables 1 and 2, respectively. The number of diseased fields for each crop was categorized into three classes: light, intermediate or severe based on disease severity and incidence estimations.

Two-row barley was grown in all 21 barley commercial fields surveyed. Scald was severe in three of the five fields surveyed (Table 1). Leaf diseases, including netted net blotch and the complex of spotted net blotch and spot blotch were light to intermediate in severity. More than one disease, such as scald and net blotch, was present in the majority fields surveyed. In spring wheat, the leaf-spotting complex involving tan spot and stagonospora /septoria leaf blight was the dominant disease, being observed in the majority of spring wheat fields surveyed, with disease severity ranging from light to severe (Table 2). In the majority of wheat fields more than one disease (*i.e*., leaf spotting complex and stripe rust) was present. No stripe rust was observed in the four winter wheat fields surveyed in fall of 2016, while intermediate to severe levels of stripe rust were found in two of the same four fields during July, 2017.

A survey for stripe rust was conducted in nine fall-seeded winter wheat tests at FCDC breeding sites in central Alberta during September to early November 2016. Stripe rust incidence ranged from 1-11% at the Lacombe test site, while no stripe rust was observed in any winter wheat tests at Olds, Morrin or Trochu (data not shown). Below-average conditions for precipitation during the growing season of 2017 in central Alberta did not slow down the development of barley stripe rust. Stripe rust severity ranging from trace to 70% was observed in a number of spring barley cultivars/differentials in the tests at Lacombe, Trochu and Morrin in early August and early September, 2017 (data not shown).

Table 1. Number of fields in each of three disease severity categories and the number of affected fields out of 21 commercial fields of barley surveyed in central Alberta, 2017[1].

Disease	Light	Intermediate	Severe	# Fields Affected
Scald (*Rhynchosporium secalis*)	1	1	3	5
Netted net blotch (*Pyrenophora teres* f. *teres);* Spotted net blotch (*Pyrenophora teres* f. *maculata*) and spot blotch *(Cochliobolus sativus*)	7	2	0	9
Scald, net and spot blotch	3	1	0	4
All above and stripe rust (*Puccinia striiformis*) and/or smuts	3	0	0	3

[1] Severity scale 0-9, where light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.

Table 2. Number of fields in each of three foliar disease severity categories and the number of fields affected out of 27 spring and 4 winter wheat fields surveyed in central Alberta during September 2016 and August 2017[1].

Disease	Light*	Intermediate*	Severe*	# Fields Affected
Leaf spot complex (*P. tritici-repentis* and *Stagonospora* and *Septoria* spp.) in spring wheat	12	2	2	16
Tan spot (*P. tritici-repentis)*	2	2	0	4
Leaf spot complex, stripe rust *(Puccinia striiformis)* and/or powdery mildew *(Blumeria graminis)* and ergot (*Claviceps purpurea*) in spring wheat	5	2	0	7
Stripe rust *(Puccinia striiformis* f.sp. *tritici),* leaf spot complex and powdery mildew (*Blumeria graminis*) in winter wheat	0	1	1	2

[1] Leaf spot complex 0-9 severity scale, light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.

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

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TITLE / TITRE: DISEASES OF BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2017

ABSTRACT: Thirty-three barley fields in Central and Eastern Ontario were surveyed for diseases in 2017. Of 13 the diseases observed, fusarium head blight (FHB), take-all, spot blotch, net blotch and barley yellow dwarf were the most prevalent, having moderate to severe levels of infection in 19, 16, 15, 4 and 2 fields, respectively. *Fusarium poae* and *F. graminearum* were the predominant species causing FHB.

INTRODUCTION AND METHODS: A survey for barley diseases was made in Central and Eastern Ontario, in areas where spring barley is grown, in the third week of July 2017. Thirty-three fields 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 visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered as trace, slight, moderate, and severe disease levels, respectively. Severity of covered smut, ergot, leaf stripe, loose smut, and take-all was rated for the percent of plants infected at each of the three random sites per field. FHB was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of the three sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe disease levels, respectively.

Determination of the causal species of FHB was based on 50 infected spikes collected from each field. The spikes were air-dried at room temperature and threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 sec. and plated in 9-cm diameter 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 and 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 9 two-row and 24 six-row barley fields. A total of 13 diseases or disease complexes were observed (Table 1). Spot blotch (*Cochliobolus sativus*), net blotch (*Pyrenophora teres*) and barley yellow dwarf (BYDV) were the most common foliar diseases, and were found in 32, 33, and 32 fields at average severities of 3.7, 2.1, and 2.1, respectively. Moderate to severe levels of infection from these diseases were observed in 15, 4, and 2 fields, respectively. Yield reductions due to these diseases were estimated to have averaged <5% in 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*); they were observed in 23, 16, 29, and 21 fields at mean severities of 1.7, 1.1, 1.5, and 1.4, respectively. These diseases occurred at trace to slight levels and none of them would have resulted in substantive damage to the crop.

The root disease take-all (*Gaeumannomyces graminis*), loose smut (*Ustilago nuda*), covered smut (*Ustilago hordei*), ergot (*Claviceps purpurea*), and leaf stripe (*Pyrenophora graminea*) were observed in all fields at mean incidences of 4.2, 1.6, 0.5, 0.5 and 0.5%, respectively (Table 1). Severe infection from these diseases was not observed, but moderate disease levels due to take-all and loose smut were found in 16 and 5 fields, respectively. Yield reductions due to take-all and loose smut were estimated at <5% in affected fields.

FHB was observed in all surveyed fields at a mean FHB index of 2.6% (range 0.01% to 15.0%) (Table 1). Moderate to severe FHB infection was observed in 19 fields. Yield and quality reductions due to FHB were estimated at >5%. Six *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium poae* and *F. graminearum* predominated and occurred in 85 and 82% of surveyed fields and on 44.6 and 19.5% of infected kernels, respectively. *Fusarium acuminatum*, *F. avenaceum, F. equiseti*, and *F. sporotrichioides* were less common, occurring in 6-20% of fields and 0.3-1.9% of kernels.

The 13 diseases observed on barley in Ontario in 2017 were the same as those recorded in 2016 (Xue et al. 2017). Overall, the incidence and severity of these diseases were generally higher in 2017 than in 2016. The more frequent rain events in June and July in 2017 compared with 2016 in Central and Eastern Ontario were likely responsible for the increased disease severities observed.

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Table 1. Prevalence and severity of barley diseases in Central and Eastern Ontario in 2017.

Disease	No. of fields affected (n=33)	Disease severity in affected fields*	
		Mean	Range
Barley yellow dwarf	32	2.1	1.0-6.0
Leaf rust	23	1.7	1.0-3.0
Net blotch	33	2.1	1.0-6.0
Scald	16	1.1	1.0-2.0
Septoria complex	29	1.5	1.0-3.0
Spot blotch	32	3.7	1.0-7.0
Stem rust	21	1.4	1.0-3.0
Cover smut (%)	33	0.5	0.5-0.5
Ergot (%)	33	0.5	0.5-0.5
Leaf stripe (%)	33	0.5	0.5-1.0
Loose smut (%)	33	1.6	0.3-5.0
Take-all (%)	33	4.2	1.0-10.0
Fusarium head blight**	33		
Incidence (%)		27.0	1.0-80.0
Severity (%)		9.6	1.0-30.0
Index (%)		2.6	0.01-15.0

*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 was 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 2017.

***Fusarium* spp.**	**% affected fields**	**% affected kernels**
Total *Fusarium*	100.0	68.5
F. acuminatum	17.6	1.9
F. avenaceum	20.6	1.1
F. equiseti	14.7	0.8
F. graminearum	82.4	19.5
F. poae	85.3	44.6
F. sporotrichioides	5.9	0.3

CROP / CULTURE: Canary seed
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF MOTTLE AND *FUSARIUM* SPP. IN CANARY SEED IN SASKATCHEWAN IN 2017

ABSTRACT: Leaf mottle disease severity (*Septoria triseti* Speg.) was trace to very light in canary seed in 2017. Only *Fusarium poae* was isolated from the seed sampled. Prevalence and incidence of leaf mottle and *F. poae* were lower than in 2016.

INTRODUCTION AND METHODS: Between July 31st and August 14th a canary seed survey was conducted on 27 randomly selected crops from the southeast (Crop District 2B), southwest (3B), east-central (5A and 6A), west-central (7A) and northeast (8A and 8B) of the province. The growth stage (Lancashire et al. 1991) varied from BBCH 65 - 89 (full flower – maturity): 12% of the crops were at flowering, 27% at milk, 42% at soft dough and 19% at hard dough stage. An average of ten Flag-1 (leaf below flag leaf) and Flag-2 leaves from each crop were assessed for leaf mottle severity and categorized for leaf mottle severity as follows: none (no visible symptoms), trace (<1% of leave tissue affected), very slight (1-5%), slight (6-15%), moderate (16-40%) and severe (41-100%).

For *S. triseti* assessment, 10 leaves from 26 of 27 crops, with or without leaf mottle symptoms (necrosis with black pycnidia) were collected and cut into pieces, surface sterilized with a 5% bleach (NaOCl) solution for 1 min and then rinsed three times in sterile water, then the leaf pieces were plated on water agar. After 7 days samples were observed and the presence of *S. triseti* recorded.

To determine the presence of *Fusarium* spp. on seed, 100 seeds of each of the 27 crops were surface sterilized in 5% bleach (NaOCl) solution for 1 min and rinsed three times in sterile water. Seeds were placed on filter paper to dry, then plated on PDA and placed under a 12-hour light/dark regime at room temperature for 5 days (Warham et al. 1995). *Fusarium* spp. were identified morphologically from examination of spores and mycelial growth as per Gerlach and Nirenberg (1982).

The prevalence of *S. triseti* and *Fusarium* spp. were determined by counting the proportion of crops affected, and incidence by counting the number of leaves (from the 10 leaves plated) and the number of seeds affected by each *Fusarium* sp. of the 100 plated for each canary seed crop.

RESULTS AND CONCLUSIONS: Among the 26 samples, 23 were assessed as trace for leaf mottle (<1% of leaf area affected), and three samples were categorized as very slight (1-5%) (Table 1). Prevalence of leaf mottle was 42% (11 of 27 crops). Among the 260 leaves plated, *S. triseti* was identified on 6% of them. Leaf mottle disease severity and prevalence this year were lower than in 2016 and 2015 (Cholango-Martinez et al. 2016, 2017). Kindersley and Indian Head were the areas where most canary samples were surveyed; in these areas, high temperatures and limited precipitation during the field season (Saskatchewan Ministry of Agriculture, 2017) restricted disease development.

Fusarium seed infection was detected in 19% of the crops (Table 2). The only *Fusarium* spp. identified in 2017 was *Fusarium poae*. Its prevalence was 11%, or 3 crops from 7A, 8A and 3BN crop districts. *Fusarium poae* prevalence was 3% higher than in 2016 (Cholango-Martinez et al. 2017). The incidence (# of seed infected/total of plated seeds) of *F. poae* (0.1%) was the same as in 2016. The absence of *F. avenaceum*, *F. graminearum* and *F. equiseti* found in the canary seed in previous years, indicates that each of these species has different environmental requirements, which influence in its establishment and development on canary seed crops, during the field season. Also, it seems that *F. poae* is more likely to survive high temperatures and low precipitation than *F. graminearum* which is more frequent in wet years. In addition, during the survey half of the sampled crops had sprayer tracks, and aphids were present in most of the crops located in the southwestern of the province, possibly as a result of high temperatures and dry conditions. Canola and some cereals were the previous stubble in most of the crops.

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Table 1. Leaf mottle disease severity of canary seed in Saskatchewan in 2017.

Severity (%)	# Crops	Prevalence (%)
None 0	0	0
Trace <1%	23	88
Very slight 1-5%	3	12
Slight 6-15%	0	0
Moderate 16-40%	0	0
Severe 41-100%	0	0

Table 2. Prevalence and incidence of *Fusarium* spp. isolated from 27 Saskatchewan canary seed crops, in 2017.

	Prevalence[1] (%)	Incidence[2] (%)
Total *Fusarium* spp.	19	0.3
Fusarium poae	11	0.1

[1]Proportion of crops with *Fusarium* spp.
[2]Based on a 100-seed sample per crop

CROP / CUTURE: Oat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA – 2017

ABSTRACT: Sixty-one oat fields in Manitoba were surveyed for Fusarium head blight (FHB) to assess severity and the causal *Fusarium* species. FHB symptoms were assessed based on visual symptoms in 23 fields with a mean incidence of 4.8%. *F. poae* was the predominant species detected in commercial fields, followed by *F. graminearum, F. sporotrichioides* and *F. avenaceum.*

INTRODUCTION AND METHODS: Sixty-one oat fields in Manitoba were surveyed for FHB from July 18 to August 5 when crops were at the early to soft dough (ZGS 79-83) stages of growth. Fields were selected at regular intervals approximately 20-25 km along the survey routes, depending on crop frequency. The area sampled was bounded by Highways numbers 67, 16 to the north, 12 to the east, 3 to the south, 8 to the north and 83 to the west.

FHB incidence (the percentage of oat panicles showing typical FHB symptoms) was assessed by sampling 95-110 panicles at three locations and averaging the scores. Subsequently, 1 gram of infected kernels removed from 15 randomly selected panicles from each field was frozen in liquid nitrogen and ground to a powder using Spex SamplePrep 2010 Geno/Grinder. DNA was extracted from the ground grain sample from each field using the QIAGEN DNeasy Mini Kit (QIAGEN). Molecular techniques such as conventional Polymerase chain reaction (PCR) or quantitative real-time qPCR were performed using Fusarium species-specific oligonucleotide primers commonly detected in cereal crops (Demeke et al. 2005; Nicolaisen et al. 2009). Real time qPCR was executed with the Real-Time PCR system CFX96 qPCR system (BioRad) using 2XSsoFast EvaGreen supermixes (BioRad) and a 37 cycles threshold (Ct) cut-off detection limit was used to detect and quantify *Fusarium* species.

RESULTS AND COMMENTS: In 2017, the growing conditions in Manitoba were drier than normal. A total of 437,386 acres of oat were seeded in Manitoba, an increase of 30% compared to 2016. Summit, CS Camden, and CS Souris were the top three cultivars grown and made up to 82% of the total oat production area in Manitoba (MASC, 2017); Summit was the top most cultivated (36.3%) variety.

Most oat fields surveyed showed definitive FHB symptoms, such as orange-pink discolouration of spikelets. The incidence of FHB in surveyed oat fields ranged from 0 to 51%.

F. poae was the most predominant species detected in 2017 and *F. poae* DNA was detected in 31 fields using conventional PCR, followed by *F. graminearum* (15 fields), *F. sporotrichioides* (6 fields) and *F. avenaceum* (1 fields) (Table 1). Real-time qPCR was performed with primers specific to *F. poae, F. graminearum* and *F. sporotrichioides*. On average, DNA of *F. poae* was detected at the level of 2.35 pg per ng of the total genomic DNA, which is much higher than the amount of *F. graminearum* DNA present in oat kernels collected from the commercial fields (1.52 pg per ng the total genomic DNA). DNA of *F. sporotrichioides* was detected at a lower level with an average of 0.25 pg per ng the total genomic DNA. *F. poae* has been the most common species found in commercial oat fields since 2010 (Tekauz et al. 2012; Beyene et al. 2016a, 2016b).

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Table 1. *Fusarium* spp. detected by PCR of FHB-affected kernels from 61 oat fields in Manitoba in 2017.

***Fusarium* spp.**	**Percentage of positive fields**
F. avenaceum	1.7
F. graminearum	26.7
F. poae	51.7
F. sporotrichioides	10.1

Table 2. Real-time qPCR analysis of *F. poae, F. graminearum* and *F. sporotrichioides* DNA in oat kernels collected in 2017.

***Fusarium* spp.**	**Range (pg of fungal DNA / ng of total genomic DNA)**	**Mean (pg of fungal DNA / ng of total genomic DNA)**
F. poae	1-10.89	2.35
F. graminearum	0.18-8.4	1.52
F.sporotrichiodes	0.01-0.54	0.25

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba and Eastern Saskatchewan (eastern prairie region), Ontario & Quebec

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TITLE / TITRE: CROWN RUST OF OAT IN MANITOBA, SASKATCHEWAN, ONTARIO AND QUEBEC IN 2016

ABSTRACT: Seventy-six fields with wild oats and 29 fields of common oats were surveyed for the incidence and severity of *Puccinia coronata* f. sp. *avenae* in Manitoba and eastern Saskatchewan in 2016. Crown rust infected plants were found in 63 (83%) and 20 (69%) of all wild and common oat fields at incidences of 0% to 100%, and severities of 0 to 20S on wild oat, and 0 to 5S on common oat. The frequency of virulence to *Pc91* continues to increase in western Canada, which likely results from the recent deployment of this resistance gene in commercial oat cultivars. None of the *Pc* resistance genes was effective against all the isolates from the eastern prairie region, but virulence was not detected to *Pc54*, *Pc62*, *Pc64*, *Pc94*, *Pc98*, *Pc101*, and *Pc103-1* in Ontario and Quebec.

INTRODUCTION AND METHODS: Surveys for incidence and severity of oat crown rust (caused by *Puccinia coronata* Corda f. sp. *avenae* Erikss. & Henning) were conducted in Manitoba and Saskatchewan from August 2 to August 11, 2016. The areas surveyed were in crop districts 1, 2, 3, 7, 8, 9, 11 and 12 in Manitoba and crop districts 1, 2, and 5 in Saskatchewan. Incidence was considered to be the percentage of leaves infected with rust in a given field, and the 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 farm fields, and susceptible and resistant oat lines and cultivars grown in uniform rust nurseries. The nurseries were located at Emerson, MB, and Indian Head, SK. Samples from fields in Ontario and Quebec were collected between July 10 and August 4, 2016. 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*, *Pc96*, *temp_pc97*, *temp_Pc98*, *Pc101*, *Pc103-1*, and *Pc104* were used as supplemental differentials.

RESULTS AND COMMENTS: Seventy-six fields with wild oats and 29 fields of common oat lines were surveyed in Manitoba and Saskatchewan. Wild oat plants infected with *P. coronata* f. sp, *avenae* were found in 63 (83%) of the fields, and infected common oat plants were found in 20 (69%) of the fields.

Crown rust incidence on wild oats ranged from 0 to 100%, and the severity ranged from 0 to 20S. The incidence and severity of crown rust infection on wild oats was higher in southcentral Manitoba.

Crown rust incidence on commercial oats ranged from 0 to 100% and the severity ranged from 0 to 5S and 10MS. The incidence and severity of crown rust infection on common oats was generally higher in Manitoba crop districts 8 and 9 and Saskatchewan crop district 1.

Ninety-seven spi were made from wild oats and 81 races were identified from these spi. Seventy-five races were represented by one spi. The other races were represented by two or three spi except race JTQG-91 (virulent to *Pc* genes 38, 39, 45, 46, 48, 51, 52, 56, 68, and 91) which was represented by 5 spi. Virulence to each *Pc* gene was observed in the wild oat spi, except *Pc94*, although it was not common (5% or less) for genes *Pc50*, *Pc96*, *Pc97*, and *Pc98* (Table 1).

Thirty-two spi were made from common oat collections with 27 races identified from these spi. Twenty-three races were represented by one spi, while the other four races were represented by two or three spi.

None of the common oat derived spi had virulence to the resistance gene *Pc64*, and *Pc96*, and virulence to *Pc50*, *Pc54*, *Pc58*, *Pc62*, *Pc94*, *Pc97*, and *Pc98* was observed in 3 or fewer spi (Table 1).

Twenty-three spi were made from collections from the Uniform Rust Nursery and 19 races identified. Virulence to *Pc62*, *Pc64*, *Pc96*, and *Pc98* was not observed using the Uniform Rust Nursery spi (Table 1), and virulence to *Pc40, Pc97* and *Pc103-1* was not common (4%).

Only 8 spi were made from the eastern Canada collections, and 7 races identified. All races were virulent to *Pc38,* and *Pc48* (Table 1). Virulence was not detected to *Pc* genes 54, 62, 64, 94, 96, 98, 101 and 103-1 (Table 1).

Greater than 50% of all spi from the 2016 collections possessed virulence to resistance genes *Pc38, Pc39, Pc46, Pc48, Pc52, Pc56,* and *Pc68* (Table 1). Virulence to *Pc45*. *Pc51*, and *Pc91* was common in western Canada, but not Ontario or Quebec. The high levels of virulence to *Pc38,* and *Pc39* likely reflect the deployment of *Pc38* and *Pc39* in combination in the eastern prairies, as well as North Dakota and Minnesota since the 1980s. The high levels of virulence to *Pc91* in western Canada indicate the increase in races of *P. coronata* f. sp. *avenae* with virulence to this resistance gene since the recent deployment of *Pc91* in commercial oat lines in western Canada. Virulence was found to all of the resistance genes assessed in this study, however, the frequency of virulence in races of *P. coronata* f. sp. *avenae* was low to *Pc50*, *Pc54*, *Pc62*, *Pc64*, *Pc94*, *Pc96*, *Pc97*, and *Pc98*.

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Table 1. Frequencies (%) of virulence of *Puccinia coronata* f. sp. *avenae* isolates from the Eastern Canadian Prairie region and Eastern Canada on 16 standard and eight supplemental crown rust differential oat lines in 2016.

	Wild Oat		**Commercial Oat Field**		**Uniform Rust Nursery**		**Eastern Canada**	
Oat lines and *Pc* gene present	**# isolates**	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**
Standard								
Pc38	95	98	32	100	23	100	8	100
Pc39	97	100	32	100	19	83	6	75
Pc40	28	29	5	16	1	4	1	13
Pc45	61	63	24	75	10	43	1	13
Pc46	68	70	22	69	16	70	5	63
Pc48	58	60	18	56	21	91	8	100
Pc50	3	3	2	6	3	13	2	25
Pc51	79	81	31	97	16	70	2	25
Pc52	54	56	19	59	21	91	6	75
Pc54	9	9	3	9	2	9	0	0
Pc56	92	95	32	100	23	100	7	88
Pc58[1]	18	19	2	6	3	13	1	13
Pc59[1]	22	23	7	22	5	22	1	13
Pc62	15	15	3	9	0	0	0	0
Pc64	16	16	0	0	0	0	0	0
Pc68	73	75	27	84	16	70	5	63
Supplemental								
Pc91	75	77	30	94	17	74	1	13
Pc94	0	0	2	6	2	9	0	0
Pc96	3	3	0	0	0	0	0	0
Temp_Pc97	4	4	2	6	1	4	3	38
Temp_Pc98	5	5	3	9	0	0	0	0
Pc101	17	18	6	19	4	17	0	0
Pc103-1	19	20	4	13	1	4	0	0
Pc104	23	24	6	19	5	22	4	50
Total	97		32		23		8	

[1]The *Pc58*-differential was shown to carry three linked genes and the *Pc59*-differential three unlinked genes (Chong et al. 2008).

CROP / CULTURE: Oat
LOCATION / REGION: Saskatchewan

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TITLE / TITRE: FUSARIUM INFECTION OF OAT KERNELS IN SASKATCHEWAN IN 2017

ABSTRACT: *Fusarium* species present on seed samples of 30 oat crops that were collected across Saskatchewan in 2017 were identified based on macrospore morphology. Prevalence and incidence were calculated for each species found. Four species were identified: *F. poae, F. nivale, F. graminearum,* and *F. avenaceum*. *Fusarium poae* was the most prevalent and had the highest incidence of the four species.

INTRODUCTION AND METHODS: In 2017, 30 oat crops in 11 crop districts across Saskatchewan were surveyed between July 20 and August 30. Approximately 15 panicles were collected from each crop. After collection the samples were dried, stored in paper bags, and hand threshed. The seeds were then surfaced sterilized in 5% bleach for three minutes, rinsed in sterile water for three minutes, and air dried. Thirty seeds from each sample were placed on potato dextrose agar for six days under 12-hour light/dark periods. The *Fusarium* spp. present in each sample were identified based on macrospore morphology (Zillinsky 1983; Gerlach and Nirenberg 1982). Prevalence (number of crops in which each *Fusarium* sp. was detected of the 30 crops) and incidence (number of seeds from which each *Fusarium* sp. was isolated of the 900 seeds plated) were calculated.

RESULTS AND COMMENTS: *Fusarium* spp. were detected in 17 of the 30 crops surveyed (57%). Four species were identified: *F. poae, F. nivale, F. graminearum*, and *F. avenaceum.* Prevalence of *F. poae* was the highest at 53% and lowest for *F. graminearum and F. avenaceum* at 3% for both (Table 1). Prevalence of *F. nivale* was also low at 7%. Incidence was highest for *F. poae* at 5.9%, and lowest for *F. graminearum and F. avenaceum*, each at 0.1%. Incidence of *F. nivale* was 0.2%.

More *Fusarium* spp. were observed than in 2016, when only two species (*F. poae* and *F. graminearum*) were observed. However, the proportion of crops in which *Fusarium* spp. were detected was similar to 2016 and slightly lower than 2015, with *Fusarium* spp. detected in 60% in 2016, 70% in 2015 and 57% in 2017 (Table 2). As well the prevalence and incidence of species found in 2017 was lower than in 2015 and 2016: prevalence of *F. graminearum* was 32% in 2015 and 23% in 2016, but only 3% in 2017 (Dyck et al. 2016, 2017).

The province was dry most of the summer of 2017, with parts of southern Saskatchewan receiving very little precipitation (Saskatchewan Agriculture 2017). This could explain the drop in *Fusarium* spp. observed, especially for *F. graminearum*, which prefers humid conditions (Zillinsky 1983).

ACKNOWLEDGEMENTS:
We thank the Saskatchewan Crop Insurance Corporation for collecting samples and the Saskatchewan Oat Development Commission for financial support.

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Table 1. Prevalence and incidence (isolation frequency on oat seed) of *Fusarium* spp. in Saskatchewan in 2017.

Pathogen	**Prevalence (% of crops)**	**Incidence[1] (%)**
Fusarium poae	53	5.9
Fusarium nivale	7	0.2
Fusarium graminearum	3	0.1
Fusarium avenaceum	3	0.1

[1]Incidence = percentage of seeds from which each pathogen was isolated.

Table 2. Prevalence (%) of oat crops surveyed with *Fusarium* spp. present from 2015-2017.

Year	**Prevalence (%)**
2015	70
2016	60
2017	57

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

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TITLE / TITRE: DISEASES OF OAT IN CENTRAL AND EASTERN ONTARIO IN 2017

ABSTRACT: Twenty-nine oat crops in Central and Eastern Ontario were surveyed for diseases in 2017. Of the 11 diseases observed, crown rust, take-all, barley yellow dwarf, and Fusarium head blight (FHB) were most prevalent, having moderate to severe levels of infection in 22, 18, 11, and 4 fields, respectively. *Fusarium poae* was the predominant species causing FHB.

INTRODUCTION AND METHODS: A survey to document diseases in Central and Eastern Ontario oat crops was conducted in the third week of July 2017 when plants were at the soft dough stage of development. Twenty-nine fields were chosen at random in regions where most oat crops were grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Disease diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe disease levels, respectively. Severity of ergot, loose smut, and take-all was based on the percentage of plants infected at each of the three random sites per field. FHB was rated for incidence (% infected panicles) and severity (% infected spikelets in the affected panicles) based on approximately 200 panicles at each of the three sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe disease levels, respectively.

Determination of the causal species of FHB was based on 50 infected panicles (heads) collected from each field. The panicles were air-dried at room temperature and subsequently threshed. Fifty discoloured kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 seconds and plated in 9-cm diameter 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 and a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. The *Fusarium* species isolated were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Eleven diseases were identified (Table 1). Crown rust (*Puccinia coronata* f. sp. *avenae*) and barley yellow dwarf (BYDV) were the most prevalent foliar diseases and were found in 29 and 28 fields at average severities of 3.2 and 4.5, respectively. Moderate to severe levels of infection from the two diseases were observed in 16 and 22 fields, respectively. Yield reductions due to these diseases were estimated to have averaged 5 to10% in affected fields. Other foliar diseases observed were halo blight (*Pseudomonas syringae* pv. *coronafaciens*), pyrenophora leaf blotch (*Pyrenophora avenae*), spot blotch (*Cochliobolus sativus*), stagonospora leaf blotch (S*tagonospora avenae* f. sp. *avenaria*), and stem rust (*Puccinia graminis f. sp. tritici*); they were observed in 25, 26, 26, 22, and 22 fields at mean severities of 1.2, 1.5, 1.2, 1.2, and 1.7, respectively. Severe levels of these diseases were not found and none of them would have resulted in a measurable damage to the crop.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*) and take-all root rot (*Gaeumannomyces graminis* var. *avenae*) were observed in all fields at incidence levels of 0.5, 0.6, and 4.1%, respectively (Table 1). Moderate and severe levels of infection from ergot and loose smut were not observed, while moderate to severe take-all was found in 18 fields. Yield reductions by take-all were estimated >5% in affected fields.

Fusarium head blight occurred in 28 fields at a mean FHB index of 0.2% (range 0.01-6.0%) (Table 1). Severe FHB infection was not found in the affected crops. Seven *Fusarium* species were isolated from discoloured kernels (Table 2). *Fusarium poae* predominated and occurred in 86% of fields and on 21.6% of kernels*. Fusarium avenaceum, F. equiseti, F. graminearum and F. sporotrichioides* were less common and found in 14, 31, 31, and 20% of fields and on 0.5, 0.9, 1.5, and 0.7% of kernels. *Fusarium acuminatum* and *F. oxysporum* were least common, occurring in 3% of fields and on 0.1% of kernels.

The 11 diseases observed on oat in Ontario in 2017 were the same as those recorded in 2016 (Xue et al. 2017). Overall, the incidence and severity of these diseases were generally higher in 2017 than in 2016. The more frequent rain events in June and July in 2017 compared with 2016 in Central and Eastern Ontario were likely responsible for the increased disease severities observed.

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Table 1. Prevalence and severity of oat diseases in Central and Eastern Ontario in 2017.

DISEASE	No. of fields affected (n=29)	Disease severity in affected fields*	
		Mean	Range
Barley yellow dwarf	29	3.2	1.0-7.0
Crown rust	28	4.5	1.0-8.0
Halo blight	25	1.2	1.0-3.0
Pyrenophora leaf blotch	26	1.5	1.0-3.0
Spot blotch	26	1.2	1.0-3.0
Stagonospora leaf blotch	22	1.2	1.0-4.0
Stem rust	22	1.7	1.0-3.0
Ergot (%)	29	0.5	0.5
Loose smut (%)	29	0.6	0.5-1.5
Take-all (%)	29	4.1	1.0-15.0
Fusarium head blight**	28		
Incidence (%)		5.2	1.0-30.0
Severity (%)		4.2	1.0-20.0
Index (%)		0.2	0.01-6.0

*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 putatively infected kernels of oat in Central and Eastern Ontario in 2017.

***Fusarium* spp.**	**% affected fields**	**% affected kernels**
Total *Fusarium*	96.6	25.3
F. acuminatum	3.4	0.1
F. avenaceum	13.8	0.5
F. equiseti	31.0	0.9
F. graminearum	31.0	1.5
F. oxysporum	3.4	0.1
F. poae	86.2	21.6
F. sporotrichioides	20.7	0.7

CROP / CULTURE: Barley and Oat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: BARLEY AND OAT LEAF SPOT DISEASES IN MANITOBA – 2017

ABSTRACT: In 2017, forty-four commercial barley and sixty-one oat fields were assessed for leaf spot diseases in Manitoba. Leaf spot disease severity in barley and oat was low in Manitoba this year, partially due to the dry weather conditions which were not very conducive for the development of leaf spot pathogens. *Cochliobolus sativus* (spot blotch) and *Pyrenophora teres* (net blotch) were the principal pathogens isolated from barley fields, whereas *Pyrenophora avenae and Stagonspora avenae* were the predominant pathogens from oat fields.

INTRODUCTION AND METHODS: In 2017, barley and oat leaf spot diseases in Manitoba were assessed by surveying 105 farm fields (44 barley, 61 oat fields) from July 18-August 5, 2017 when most crops were at the early to soft dough stages of growth (ZGS 79-82). Fields were sampled at regular intervals approximately 20-25 km along survey routes, depending on crop availability. The areas sampled were bounded by Highways #s 67, 16 to the north, 12 to the east, 3 to the south, 8 to the north and 83 to the west. Disease incidence and severity were recorded by averaging their occurrence 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 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried, and stored in paper envelopes. Subsequently, 10 pieces of surface-sterilized putatively infected leaf tissue were incubated on filter paper in moist chambers for 3-5 days to promote sporulation to permit identification of the causal agent(s) and disease(s).

RESULTS AND COMMENTS:

Barley
In upper canopies, trace to slight disease severity was found in 88% of fields and moderate to severe disease severity was found in 12% of the fields. In the lower leaf canopies, disease severity was trace to slight in 65%, moderate in 7%, and severe in 28% of the fields. The disease level in 2017 was lower than previous years (Tekauz et al. 2013; Wang et al. 2015; Banik et al. 2014, 2016), partially due to the dry weather conditions which were not very favourable for the development leaf spot diseases in barley and oat.

Cochliobolus sativus (causal agent of spot blotch) and *Pyrenophora teres* (net blotch) were the principal pathogens isolated from infected leaf tissues and caused most damage in the sampled fields. *C. sativus* was isolated from 19 fields and *P. teres* from 6 fields (Table1). *S. passerinii* (speckled leaf blotch) was isolated from 6 fields. This pathogen was not detected at all in 2014 and 2015 in disease surveys in Manitoba (Wang et al. 2015; Banik et al. 2016).

Oat
In upper leaf canopies, 15% of the fields showed moderate to severe disease severity. In the lower canopies, moderate to severe leaf spot severity was found in 44% of the fields. *Pyrenophora avenae,* causal agent of pyrenophora leaf blotch, was the most prevalent pathogen in oat fields (Table 2). This pathogen was isolated from 52% of fields which is similar to the levels reported in 2011, 2012 and 2016 (Tekauz et al. 2012, 2013; Banik et al. 2017). *S. avenae* (stagonospora leaf blotch) was found to be the second most prevalent pathogen in Manitoba and was isolated from 46% of the fields (Table 2).

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Table 1. Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2017.

Pathogen	Incidence (% of fields)	Frequency (% of isolations)
Cochliobolus sativus	43.2	72.5
Pyrenophora teres	13.6	11.3
Septoria passerinii	13.6	7.5

Table 2. Incidence and isolation frequency of leaf spot pathogens of oat in Manitoba in 2017.

Pathogen	Incidence (% of fields)	Frequency (% of isolation)
Pyrenophora avenae	52.5	63.1
Stagonospora avenae	45.9	40.2

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN SASKATCHEWAN IN 2017

ABSTRACT: Leaf spot disease severity was assessed and the causal pathogens identified in 64 oat crops in 2017. Disease severity was trace to slight in the majority of surveyed crops with a few showing moderate levels. *Pyrenophora avenae* (pyrenophora leaf blotch) and *Cochliobolus sativus* (spot blotch) were common oat pathogens isolated from diseased leaves. *Stagonospora* (stagonospora leaf blotch) was observed in one field surveyed in 2017.

INTRODUCTION AND METHODS: In 2017, leaf spotting diseases of oat were surveyed across Saskatchewan in early-August, when the crops were at the milk to soft dough growth stages. Sixty-four crops were surveyed in 2017 and disease severity was assessed on two to four plants at each of five points approximately 15 m apart and 30 m from the field edge. Oat plants were rated in the field based on disease severity on 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%). Approximately 25 leaves were collected from each field, dried and stored in paper envelopes. Pathogens were identified in the laboratory by cutting and surface sterilizing 10 pieces of infected leaf tissue from 10 different leaves. The leaf cuttings were placed on water agar plates with 10mg/mL ampicillin and 5mg/mL kanamycin for four days to promote sporulation of the pathogen. The identities of the causal agents of the leaf spots were determined by spore size and shape. The identified pathogens were transferred to V8 Juice Agar (V8A) plates for further growth and sporulation. Single spore technique was used to obtain pure cultures of *P. avenae, C. sativus, and S. avenae*. The pure cultures were stored in cryopreservation fluid at -65° C.

RESULTS AND COMMENTS: Leaf spots were observed in the foliar canopies of all 64 crops surveyed, however, disease severity varied from trace to slight in 40 fields and moderate in eight fields (severity data available for 48 of 64 field samples only).

Of the three leaf-spot pathogens identified from the plated oat leaf tissues (Table 1), *P. avenae* was found to be the most prevalent, followed by *C. sativus* and finally *S. avenae* which was observed in only one field. This ranking of pathogen prevalence follows observations made in both 2016 and 2015. The results from the 2015-17 field surveys differed from surveys conducted prior to 2015 (Tekauz et al. 2012, Taylor et al. 2014, Taylor et al. 2015) where S*. avenae* was observed in all years and with greater prevalence than *C. sativus* in most years (2011-2013). The prevalence and incidence (Table 1) of *P. avenae and C. sativus* was higher when compared to that of 2016, when *P. avenae* and *C. sativus* were prevalent in 33% and 9% of fields, respectively (Woitas et al. 2017). The results from 2017, also seen in 2015 and 2016, suggest higher average temperatures (observed in all three years), as opposed to precipitation amount (which differed across these three years) may favour the growth of *C. sativus* over *S. avenae.* Results from 2011-2017 indicate that *P. avenae* is consistently the most prevalent oat leaf spot pathogen regardless of growing conditions.

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Table 1. Oat leaf blotch disease prevalence and incidence in 64 Saskatchewan oat crops surveyed in 2017.

Pathogen	Prevalence (% crops)*	Incidence (% isolations)**
Pyrenophora avenae	59.4	22.5
Cochliobolus sativus	12.5	2.3
Stagnospora avenae	1.6	0.2

*Percentage of fields surveyed from which specified pathogen was identified.
** Number of leaf sections from which pathogens were isolated per total number of leaf sections sampled. Indicative of the relative amount of foliar damage observed.

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

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TITRE / TITLE: **MALADIES DES CÉRÉALES PRÉSENTES AU QUÉBEC EN 2017**

RÉSUMÉ: L'été 2017 a été caractérisé par la présence de rouille chez toutes les espèces de céréales. La rouille jaune du blé s'est manifestée dans toutes les régions et aussi intensément chez le blé d'automne que chez le blé de printemps, alors que la rouille brune du blé de printemps et de l'orge a touché trois des six régions visitées et la rouille couronnée de l'avoine deux régions. L'oïdium du blé a été observé aux trois stations centrales du Québec et l'oïdium de l'orge à la station la plus nordique. Le virus de la jaunisse nanisante de l'orge, absent les dernières années, a pu être noté chez l'avoine aux deux stations du Lac-Saint-Jean. Les taches foliaires, comme à l'habitude, étaient présentes sur tout le territoire. Finalement, la fusariose de l'épi n'a pas été un problème en 2017.

ABSTRACT: The summer 2017 was characterized by the presence of rust on all cereals. Yellow stripe rust on wheat was found in all regions and was as severe on winter wheat as on spring wheat, while brown leaf rust on spring wheat and barley occurred in three out of six regions visited, and crown rust on oats in two regions. Powdery mildew on wheat was observed at the three central locations of Quebec and powdery mildew on barley at the most northern location. Barley yellow dwarf virus, absent in recent years, could be assessed on oats at the both locations of Lac-Saint-Jean region. As usual, leaf spots were widespread in the territory. Finally, fusarium head blight was not a problem in 2017.

MÉTHODES: À l'été 2017, quatre essais d'enregistrement et de performance de céréales d'hiver et sept à neuf essais de céréales de printemps répartis dans différentes régions du Québec (RGCQ 2017), ont été visités une fois entre le stade laiteux moyen et pâteux moyen de la céréale afin d'y dépister les maladies du feuillage. Sur la base d'observations visuelles des symptômes, les maladies ont été identifiées et leur intensité évaluée selon une échelle de notation de 0 à 9; la catégorie 0 correspondant à aucun symptôme et 9 à des symptômes sur plus de 50 % de la surface de la feuille étendard. Le nom des agents pathogènes normalement associés à ces maladies est mentionné dans le texte à titre indicatif. Une intensité faible correspond à des valeurs de 0 à 4, une intensité moyenne à des valeurs de 4 à 7 et une intensité élevée à des valeurs de 7 à 9. Le nombre d'avis de dommages aux cultures de blé et d'orge ayant la fusariose comme cause principale a été fourni par La Financière agricole du Québec (FADQ) (Michel Malo, FADQ, communication personnelle).

RÉSULTATS et COMMENTAIRES: Les températures douces de l'hiver 2017 et un bon couvert de neige dans la majorité des régions ont été propices à la survie du blé d'hiver. Les conditions printanières froides accompagnées de pluies abondantes ont retardé les semis des céréales de printemps de plus d'une semaine pour l'ensemble des régions, voire de deux semaines pour certains secteurs. Des zones de l'Outaouais, de la Mauricie, de Lanaudière, du Centre-du-Québec et de la Montérégie ont même été touchées par des inondations. Les températures estivales ont été un peu plus fraîches que la normale dans toutes les régions et les précipitations plus fréquentes que la normale dans les régions du sud, normales dans les régions centrales, alors que les cultures des régions plus à l'est ont souffert d'un déficit hydrique. Le retard dans le développement des céréales causé par les semis tardifs n'a pu être rattrapé au cours de la saison, de sorte que les cultures ont été récoltées quelques jours à une semaine plus tard que d'habitude, sauf dans les régions de l'Abitibi-Témiscamingue, du Bas-Saint-Laurent et de la Gaspésie, où il n'y a pas eu de retard.

Comme à l'habitude la tache ovoïde (*Stagonospora avenae*) de l'avoine a touché toutes les régions visitées. L'intensité des symptômes était plutôt moyenne. La rouille couronnée (*Puccinia coronata*) était une fois de plus présente à La Pocatière (Bas-Saint-Laurent) avec des intensités de symptômes variant de faibles à élevées dépendamment de la lignée ou du cultivar. Elle s'est également manifestée faiblement à

Saint-Hyacinthe (région de Montréal). Des symptômes, faibles à modérés, causés par le virus de la jaunisse nanisante de l'orge (VJNO) ont aussi été notés dans la région du Lac-Saint-Jean, soit à Hébertville et Normandin.

En 2017, la rouille jaune du blé (*Puccinia striiformis*) s'est manifestée sur le blé d'hiver dans toutes les régions. La bonne couverture de neige a sans doute favorisé la survie du champignon pathogène sur cette culture pendant l'hiver. L'essai de La Pocatière a été le plus durement touché avec une intensité de symptômes élevée pour les lignées/cultivars les plus sensibles, alors qu'à Princeville (Centre-du-Québec), Saint-Augustin-de-Desmaures (région de Québec) et Normandin, l'intensité des symptômes pour ces mêmes lignées/cultivars était faible à moyenne. Dans le cas du blé de printemps, la rouille jaune a été notée dans tous les essais visités sauf à Hébertville. La maladie a touché plus intensément les essais de Saint-Mathieu-de-Beloeil (région de Montréal) et La Pocatière et modérément ceux de Saint-Hyacinthe, Saint-Hugues (région de Montréal), Princeville et Saint-Augustin. La rouille brune (*Puccinia triticina*) présente chez le blé de printemps a été moins répandue et moins intense que la rouille jaune. On l'a observée à Saint-Mathieu, Princeville, Saint-Augustin et Saint-Étienne (région de Québec). Quant à l'oïdium (*Blumeria graminis* f. sp*. tritici*, syn. *Erysiphe graminis*), il était peu intense sur le blé d'hiver à Princeville et le blé de printemps à Saint-Étienne, et moyennement intense sur le blé de printemps à Princeville et Saint-Augustin. Les taches foliaires (*Drechslera tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*), comme à l'habitude, se sont développées dans tous les essais de façon modérée sauf à Princeville où les symptômes étaient plus intenses. Finalement la fusariose de l'épi n'a pas été un problème en 2017; seulement 1,0 % des producteurs de blé assurés (13 sur 1337) ont rapporté des dommages dus à la maladie.

En 2017, tout comme en 2016, les taches foliaires de l'orge (*Drechslera teres*, *Rhynchosporium secalis* et *Cochliobolus sativus*) ont été observées dans tous les essais visités et l'intensité des symptômes a varié de moyenne à élevée. La rouille des feuilles (*Puccinia hordei*) habituellement peu fréquente chez l'orge au Québec s'est manifestée faiblement à Princeville et Normandin, et modérément à Causapscal (Gaspésie). L'oïdium (*Blumeria graminis* f.sp*. hordei*, syn. *Erysiphe graminis*) a été noté à Normandin seulement et les symptômes étaient peu intenses. La fusariose de l'épi de l'orge, tout comme pour le blé, n'a pas été un problème en 2017 alors que seulement 0,9 % des producteurs d'orge assurés (5 sur 550) à la FADQ ont signalé des dommages à leur culture attribuables à cette maladie.

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CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA IN 2017

ABSTRACT: In 2017, Fusarium head blight incidence and severity were assessed in 85 spring wheat fields in Manitoba. The disease occurred in 29% of the wheat fields surveyed at a provincial mean FHB severity (FHB Index) of 0.28 %. The most prevalent *Fusarium* species were *F. graminearum*, followed by *F. poae* and *F. acuminatum*.

INTRODUCTION AND METHODS: Spring wheat in Manitoba was surveyed for fusarium head blight (FHB) at 85 field locations. The survey for FHB was conducted from early July to early August when most of the crops were at growth stage ZGS 73 – 85. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location was obtained from the producers. The proportion of infected spikes per field (incidence) and the proportion of infected spikelets in each spike (severity) were recorded in 5 heads (main stems) at 10 sites along a W pattern in the field, while sampling tillers was avoided. The FHB index (overall severity) was determined for each field surveyed: [Average % incidence X Average % severity] / 100.

Fifty spikes were processed from 74 fields for pathogen isolation and identification in the laboratory. Ten kernels from each field surveyed were surface-sterilized in a laminar flow bench placed on Spezieller Nährstoffarmer Agar (SNA) media. Identification of *Fusarium* species involved microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2017), there were approximately 2.0 million acres of spring wheat seeded in Manitoba in 2017. The top five cultivars, based on seed acreage, were 'AAC Brandon' (56.1%), 'Cardale' (11.4%), 'AAC Elie' (8.3%), 'Glenn' (5.0%) and 'Carberry' (4.5%). 'AAC Brandon' and 'Cardale' were the predominant spring wheat cultivars grown in the fields sampled in this survey, and canola was the most predominant previous crop.

Fusarium head blight was detected in twenty-five out of eighty-five fields for a prevalence of 29% (Table 1). Disease levels were low overall, particularly in comparison to the levels that were observed in 2016 (2.4%). The provincial mean FHB severity (FHB Index) was 0.28%. Prevalence and severity of FHB in spring wheat was lowest in the Northwest region and most prevalent in the Eastern/Interlake (50%). The highest FHB Index was identified in the Eastern/Interlake region (0.46%).

Overall, in 2017 the FHB index value for Manitoba was one of the lowest recorded over the last ten years, i.e., 1.7% in 2010, 2.1 % in 2011, 1.1% in 2012, 1.0 % in 2014, 0.3% in 2015, and 2.4% in 2016 (Gilbert et al. 2011, 2012, 2013; Derksen and de Rocquigny 2015; Henriquez et al. 2016, 2017).

The results of 740 kernels plated on SNA media showed that *Fusarium graminearum* was the most frequently isolated pathogen species, accounting for 68.9% of isolations (Table 2). It was detected in 23% of surveyed fields. Four other species were found at lower levels, including *F. poae* detected in 8.1% of fields and 13.1% of total *Fusarium* isolations and *F. acuminatum* detected in 6.8% of fields and 9.8% of total *Fusarium* isolations.

ACKNOWLEDGEMENTS: We gratefully acknowledge the participation of Manitoba Agriculture Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey and the respective incidence and severity ratings, as well as Henriquez's summer students Amy Hou, Jonah Gruenke, Rylan McCallum, Amber Bezte and Jordan Blatz.

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Table 1. Fusarium head blight incidence and severity (FHB index) in spring wheat fields in Manitoba in 2017.

Region	No. Crops[1]	FHB Prevalence %[2]	Mean FHB Index %[3]
Central	25	36	0.25
Eastern, Interlake	12	50	0.46
Northwest	22	17	0.12
Southwest	25	25	0.36
Mean/Total	**85**	**29**	**0.28**

[1]Number of fields sampled.
[2]Prevalence (%) = Number of fields affected / total fields surveyed.
[3]Mean FHB Index: [Average % incidence X Average % severity] / 100.

Table 2. *Fusarium* species isolated from kernels in FHB-affected spring wheat fields in Manitoba in 2017.

	Prevalence %[1]	Frequency %[2]
F. graminearum	23.0	68.9
F. poae	8.1	13.1
F. avenaceum	4.1	6.6
F. culmorum	1.4	1.6
F. acuminatum	6.8	9.8

[1]Prevalence = % of spring wheat fields from which the pathogen was isolated.
[2]Frequency = % of *Fusarium* species (as the % of the total *Fusarium* isolations)

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA IN 2017

ABSTRACT: In 2017, fusarium head blight incidence and severity were assessed in 26 winter wheat fields in Manitoba. FHB occurred in 15% of the surveyed winter wheat fields. The provincial mean FHB severity (FHB Index) was 0.06%. The most prevalent pathogen species was *Fusarium graminearum*.

INTRODUCTION AND METHODS: Winter wheat in Manitoba was surveyed for fusarium head blight (FHB) incidence and severity at 26 field locations. The survey was conducted in July when most of the fields were at growth stage ZGS 73 – 85. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location was obtained from producers. The proportion of infected spikes per field (incidence) and the proportion of infected spikelets in each spike (severity) were recorded for 5 heads (main stems) at 10 sites along a W pattern in the field (avoid sampling tillers). The FHB index (overall severity) was determined for each field surveyed: (Average % incidence X Average % severity) / 100.

Fifty spikes were processed from 23 fields for pathogen isolation and identification in the laboratory. Ten kernels from each field surveyed were surface-sterilized in a laminar flow bench placed on Spezieller Nährstoffarmer Agar (SNA) media. Identification of *Fusarium* species involved microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2017), there were approximately 130,000 acres of commercial winter wheat seeded in Manitoba for 2017. The top five cultivars, based on their seed acreage, were 'Emerson' (57.2%), 'AAC Gateway' (26.8%), 'CDC Falcon' (9.6%), 'CDC Buteo' (2.3%) and 'Moats' (1.3%). 'AAC Gateway' was the predominant winter wheat cultivar grown in the fields sampled in this survey.

FHB occurred in 15% of the surveyed winter wheat fields in Manitoba (Table 1). The provincial mean FHB severity (FHB Index) was 0.06%. Prevalence and severity of FHB in winter wheat was lower in the Northwest region (0.0%) and most prevalent in the Eastern/Interlake region (67%). The highest FHB Index was identified in the Eastern/Interlake region (0.37%). Overall, the 2017 provincial mean FHB index was the lowest FHB index recorded in the past ten years (Table 2). Based on the survey results, FHB caused zero to minimal damage in Manitoba winter wheat fields in 2017.

The results of 230 kernels plated on SNA media showed that *Fusarium graminearum* was the most frequently isolated pathogen species, accounting for 100 % of isolations. This species was detected in 4.3% of surveyed fields.

ACKNOWLEDGEMENTS: We gratefully acknowledge the participation of Manitoba Agriculture Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey and the respective incidence and severity ratings, as well as Henriquez's summer students Amy Hou, Jonah Gruenke, Rylan McCallum, Amber Bezte and Jordan Blatz.

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Table 1. Fusarium head blight (FHB) index in winter wheat fields in Manitoba in 2017.

Region	No. Crops	FHB Prevalence %	Mean FHB Index %
Central	13	8	0.01
Eastern/Interlake	3	67	0.37
Northwest	2	0	0.00
Southwest	8	13	0.04
Mean/Total	**26**	**15**	**0.06**

[1]Number of fields sampled.
[2]Prevalence (%) = Number of fields affected / total fields surveyed.
[3]Mean FHB Index: [Average % incidence X Average % severity] / 100.

Table 2. Historical FHB index values for provincial winter wheat surveys in Manitoba.

Year	Provincial Average FHB Index %
2017	0.06
2016	2.7
2015	1.1
2014	11.6
2013	1.0
2012	0.2
2011	0.9
2010	11.8
2009	0.3
2008	0.3

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2017

ABSTRACT: In 2017, leaf spot diseases were assessed in 74 spring wheat fields in Manitoba. Prevalence and isolation frequency of leaf spot pathogens showed that *Pyrenophora tritici-repentis* was the most prevalent and widespread pathogen, followed by *Cochliobolus sativus*.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of spring wheat was conducted between the milk and dough growth stages in 2017 (ZGS 73 – 85). A total of 74 spring wheat fields were sampled. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random; instead, information on their location was obtained from producers. In each field, 50 flag leaves were collected at random and percentage of leaf area affected by LS (severity) was recorded using a scale from 1 (slightly affected) to 50 (leaves dead) (Fernandez 1998).

From each field, 1 cm^2 surface-disinfested leaf pieces from 10 leaves were plated on V8 agar media amended with 0.02% streptomycin sulfate to promote pathogen sporulation for disease identification. Identification of LS pathogens involved microscopic examination and morphological characterization.

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2017), there were approximately 2.0 million acres of spring wheat seeded in Manitoba in 2017. The top five cultivars, based on seed acreage, were 'AAC Brandon' (56.1%), 'Cardale' (11.4%), 'AAC Elie' (8.3%), 'Glenn' (5.0%) and 'Carberry' (4.5%). 'AAC Brandon' and 'Cardale' were the predominant spring wheat cultivars grown in the fields sampled in this survey, and canola was the most predominant previous crop.

Leaf spot diseases were observed in all of the fields surveyed (Table 1). The provincial mean LS severity was 10.3%. This severity was lower than in 2015 (15.7%), but higher than in 2016 (5.6%) (Henriquez et al. 2016, 2017). The range of severity varied widely from a minimum of three to a maximum of 24%. LS severity was lowest in the Central region (8.2%) and highest in the Southwest region (17.8%) and Eastern/Interlake (11.9%). The sample with the highest LS severity was from the Interlake region (24%).

As reported for previous years (Henriquez et al. 2016, 2017) *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread LS pathogen in Manitoba. The results of 740 samples of leaf tissue analyzed showed that *Pyrenophora tritici-repentis*, causal agent of tan spot, was the most frequently isolated species, accounting for 92.3% of isolations. This species was detected in 11.6% of surveyed fields. This was followed by *Cochliobolus sativus* (7.7%) detected in 1.4% of surveyed fields.

ACKNOWLEDGEMENTS: We gratefully acknowledge the participation of Manitoba Agriculture Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey and the respective incidence and severity ratings, as well as Henriquez's summer students Amy Hou, Jonah Gruenke, Rylan McCallum, Amber Bezte and Jordan Blatz.

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Manitoba Agricultural Services Corporation (MASC). 2017. Variety Market Share Report.

Table 1. Leaf spot (LS) severity in spring wheat fields in Manitoba in 2017.

Region	No. Crops	LS Prevalence %	Mean LS Severity %	Mean LS Severity % (Range)
Central	26	100	8.2	3-18
Eastern/Interlake	9	100	11.9	5-24
Northwest	20	100	10.6	4-20
Southwest	19	100	12	3-20
Mean/Total	**74**	**100**	**10.3**	**3-24**

[1]Number of fields sampled.
[2]Prevalence (%) = Number of fields affected / total fields surveyed.
[3]Mean percentage flag leaf affected. Rated on a scale of 1 (slightly affected) to 50 (leaves dead).

Table 2. Prevalence and isolation frequency of leaf spot pathogens in spring wheat fields in Manitoba in 2017.

	Prevalence %	Frequency %
Pyrenophora tritici repentis	11.6	92.3
Cochliobolus sativus	1.4	7.7

[1]Prevalence = % of spring wheat fields from which the pathogen was isolated.
[2]Frequency = % of leaf spot pathogen (as the % of the total pathogen isolations).

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2017

ABSTRACT: In 2017, leaf spot diseases were assessed in 23 winter wheat fields in Manitoba. Prevalence and isolation frequency of leaf spot pathogens showed that *Pyrenophora tritici-repentis* was the most prevalent pathogen.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of winter wheat was conducted between the milk and dough growth stages in 2017 (ZGS 73 – 85). A total of 23 winter wheat fields were sampled. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location was obtained from producers. In each field, 50 flag leaves were collected at random and percentage of leaf area affected by LS (severity) was recorded using a scale from 1 (slightly affected) to 50 (leaves dead) (Fernandez 1998).

From each field, 1 cm^2 surface-disinfested leaf pieces from 10 leaves were plated on V8 agar media amended with 0.02% streptomycin sulfate to promote pathogen sporulation for disease identification. Identification of LS pathogens involved microscopic examination and morphological characterization.

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2017), there were approximately 130,000 acres of commercial winter wheat seeded in Manitoba for 2017. The top five cultivars, based on their seed acreage were 'Emerson' (57.2%), 'AAC Gateway' (26.8%), 'CDC Falcon' (9.6%), 'CDC Buteo' (2.3%) and 'Moats' (1.3%). 'AAC Gateway' was the predominant winter wheat cultivar grown in the fields sampled in this survey.

Leaf spot diseases were observed in 95.7% of fields surveyed (Table 1). The provincial mean LS severity was 10.2%. This severity was higher than in 2015 (9.5%) and 2016 (5.9%) (Henriquez et al. 2016, 2017). The range of severity varied widely from a minimum of zero to a maximum of 28%. LS severity was lowest in the Central region (6.5%) and highest in the Eastern/Interlake region (20%). The sample with the highest LS severity was from the Eastern/Interlake region (28%). The sample with zero LS severity was from the Central region.

As reported for previous years (Henriquez et al. 2016, 2017) *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread LS pathogen in Manitoba. The results of 230 samples of leaf tissue analyzed showed that *Pyrenophora tritici-repentis* was the most frequently isolated species, accounting for 100% of isolations. This species was detected in 8.7% of surveyed fields.

ACKNOWLEDGEMENTS: We gratefully acknowledge the participation of Manitoba Agriculture Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey and the respective incidence and severity ratings, as well as Henriquez's summer students Amy Hou, Jonah Gruenke, Rylan McCallum, Amber Bezte and Jordan Blatz.

REFERENCES:

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Manitoba Agricultural Services Corporation (MASC). 2017. Variety Market Share Report.

Table 1. Leaf spot (LS) severity in winter wheat fields in Manitoba in 2017.

Region	No. Crops[1]	LS Prevalence %[2]	Mean LS Severity %[3]	Mean LS Severity % (Range)
Central	13	92.3	6.5	0-15
Eastern/Interlake	3	100	20.0	14-28
Northwest	2	100	14.5	11-18
Southwest	5	100	12.0	2-19
Mean/Total	**23**	**95.7**	**10.2**	**0-28**

[1]Number of fields sampled.
[2]Prevalence (%) = Number of fields affected / total fields surveyed.
[3]Mean percentage flag leaf affected. Rated on a scale of 1 (slightly affected) to 50 (leaves dead).

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

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TITLE / TITRE: LEAF RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2017

ABSTRACT: Field surveys for leaf rust were conducted during July and August 2017 in Manitoba and eastern Saskatchewan on winter and spring wheat. Wheat leaf rust was first reported in June in Manitoba and developed throughout the growing season. Temperatures were cool in May and June, but hot in July and August and relatively dry throughout the summer. Stripe rust was widespread and moderately severe on winter wheat, but relatively light on spring wheat due to higher temperatures during the growing season. Leaf rust was also common and widespread but only reached higher levels later in the growing season.

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* Erikss.) during July and August 2017. Winter wheat trials were examined for rust at trap nurseries in Manitoba in July. In August, spring wheat trials and nurseries were surveyed in Manitoba and south eastern Saskatchewan.

RESULTS AND COMMENTS: In Manitoba and eastern Saskatchewan seeding was generally early due to dry conditions in the spring. May and June were cool and then July and August were hot, but it was generally dry during the whole growing season. During July and August disease surveys were conducting in Manitoba and eastern Saskatchewan. In winter wheat surveyed during July in Manitoba stripe rust was prevalent on susceptible cultivars with 60% of the flag leaves infected with stripe rust (severity). Leaf rust was also present later in the growing season on winter wheat with an average severity of 10% on susceptible cultivars.

In spring wheat, stripe rust was found during July but was less prevalent in August as the hot weather caused the rust to switch to teliospore formation and stopped the epidemic. Stripe rust was less severe on spring wheat than winter wheat, averaging 10% severity in Manitoba, but only trace levels in eastern Saskatchewan. On spring wheat leaf rust built up mostly later in the growing season reaching moderate levels on susceptible cultivars in trials that were not fungicide treated. The highest levels of leaf rust severity were observed in the Interlake region of Manitoba (40%) and the Brandon area (30%) while it was lower in south central Manitoba (10%) and light in southwestern Manitoba and eastern Saskatchewan with trace levels being observed.

CROP / 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 2017

ABSTRACT: Field surveys for stem rust were conducted from July to September 2017 in Manitoba and eastern Saskatchewan. No stem rust was observed in wheat and was at trace levels in barley and oat fields. For wheat stem rust, races QFCSC (29%) and RKQQC (29%) were the most common, and races MCCDC (15%) and TPMKC (7%) were detected at lower frequency. For oat stem rust, race TJS was dominant (38%), followed by races SGB (16%), TGN (11%), and TJJ (9%). Seven other races of oat stem rust were detected at low frequency in 2017.

INTRODUCTION AND METHODS: A total of 136 oat and 59 wheat and barley fields, as well as trap nurseries of barley, oat, and wheat, were monitored in 2017 to assess severity of infection of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Erikss. & Henning and *P. graminis* f. sp. *avenae* Erikss. & Henn.) and determine the virulence spectrum in each pathogen population. The surveys were conducted in July, August, and September and infected stem tissue samples were collected from each field surveyed. Urediniospores were obtained from collections and evaluated for virulence specialization on sets of host differential lines (Fetch et al. 2015; Fetch and Jin 2007).

RESULTS AND COMMENTS: Warm (0 to +2°C; higher than mean) but dry (<40% of normal) conditions in May were conducive for normal seeding of crops. Mean temperature was normal (-2 to +2°C) over the growing season, but mean precipitation was much below average (<40 to 60%) in July and August when rust infection normally occurs. Stem rust infection was absent in wheat fields and at trace levels in barley and oat fields. This was initially attributed to unfavourable environmental conditions (low rainfall), but abundant yellow rust infection caused by *Puccinia striiformis* was found in stands of wild barley and trap plots of susceptible wheat. While rainfall was very light across the Prairie region in 2017, heavy dews often occurred due to low (10-12°C) night-time temperatures, which favour rust spore germination and infection. Thus, the light stem rust infection in 2017 may be explained by lack of inoculum blowing in from the United States. However, widespread stripe rust infection was reported in the Great Plains in 2017.

In contrast to 2016 (Fetch and Zegeye 2017), stem rust pustules were hard to find in stands of wild barley (*Hordeum jubatum*) in 2017. Four races [QFCSC (29%), RKQQC (29%), MCCFC (15%), and TPMKC (7%)] were detected. As was found in 2016, historical races with high virulence are still present in the North American population of *Puccinia graminis* f. sp. *tritici*.

Stem rust in cultivated and wild oat stands was at trace levels in western Canada in 2017. Race TJS was dominant (38%) in 2017 and attacks all commonly grown oat cultivars in Canada and the United States. The next most prevalent race was SGB (NA23) at 16%, which is interesting because it has low virulence on most Canadian oat cultivars. The most likely explanation is that it may be more aggressive and is surviving on wild oats. Races TGN (11%) and TJJ (9%) also were commonly found, while seven other races were detected at low frequency.

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CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2016 AND 2017

ABSTRACT: In 2016, fusarium head blight (FHB) incidence and severity were assessed in 152 wheat crops (86 common wheat and 66 durum) in Saskatchewan. FHB occurred in 83% and 91% of the surveyed common and durum wheat crops respectively and the provincial mean FHB severities for common wheat and durum wheat were 1.3% and 4.7% respectively. In 2017, 159 wheat crops (103 common wheat and 56 durum) were surveyed in Saskatchewan. FHB occurred in 23% and 9% of the surveyed common and durum wheat crops respectively and the provincial mean FHB severities for common wheat (0.01%) and durum wheat (<0.01%) were low in 2017. An additional 46 fields of common wheat were surveyed in Saskatchewan in 2017. FHB symptoms were reported in 91% of the fields (42) and the presence of *Fusarium* spp. was confirmed via culturing in 4% of the surveyed fields. Severity was assessed based on the presence of visual symptoms.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 152 wheat crops in Saskatchewan in 2016: 86 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 66 durum wheat (Canada Western Amber Durum class). Fields and results were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey), and fields under irrigation were considered separately and referred to as the Irrigation Zone (fields located along the South Saskatchewan River in west-central and central regions of the province). The irrigation zone was not sampled in 2016 or 2017

In both 2016 and 2017, crop adjustors with the Saskatchewan Crop Insurance Corporation and staff of the Saskatchewan Ministry of Agriculture randomly collected 50 spikes from each wheat crop at the late milk to early dough stages (Lancashire et al. 1991). A subsample of 30 spikes per field was analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each wheat crop surveyed: FHB severity (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100]. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and cultured on potato dextrose agar and carnation leaf agar to confirm presence of *Fusarium* spp. on infected kernels. Potato dextrose agar (PDA) or half-strength PDA (½PDA) were used to observe colony morphology; carnation agar (CA) was used to aid in sporulation. A maximum of 20 symptomatic kernels per sample were selected to represent infected samples for confirmation and *Fusarium* spp. identification.

In 2017, surveyors from the Cereal-Flax pathology group of the University of Saskatchewan collected samples from wheat fields across the three Saskatchewan soil zones. From each field, 50 heads were collected at late flowering to early dough stage and rated for FHB severity based on the rating scale described by Stack and McMullen (2011). For each field with FHB symptoms the average severity was determined and recorded as trace (<1% infection), light (1-15% infection), moderate (16-40% infection) or severe (41-100% infection). The 50 heads were threshed and half of the sample (randomly selected) was sent to the Crop Protection Lab in Regina for species identification. A maximum of 20 symptomatic kernels per sample were selected for confirmation and *Fusarium* spp. identification as indicated above. The FHB severity of these fields will be reported separately, while the prevalence of *Fusarium* spp. will be reported together for all surveyed fields in Saskatchewan.

RESULTS AND COMMENTS: In 2016, approximately 2.8 million hectares (6.9 million ac) of common spring wheat and 2.0 million ha (5.0 million ac) of durum wheat were seeded in Saskatchewan in 2016. The average yields in Saskatchewan were 3.1 metric tonnes per ha (46.1 bu/ac) for common wheat and 3.2 metric tonnes per ha (48.3 bu/ac) for durum. Durum yields in 2016 were the highest yield experienced in the last five years (2012-2016); while common wheat yields in 2016 were higher than in 2012 and 2014-2015, but slightly lower compared to 2013 (Statistics Canada, 2017). In 2017, approximately 2.8 million ha (6.9 million ac) of common spring wheat and 1.7 million ha (4.1 million ac) of durum wheat were seeded in Saskatchewan. The average yields in 2017 for common spring wheat, 3.1 metric tonnes per ha (46.4 bu/ac), were similar to 2016; while durum yields, 2.4 metric tonnes per ha (35.0 bu/ac), were lower than in 2016 (Statistics Canada, 2017). The reduced durum yields were likely due to the relatively dry growing season in most of the durum growing regions in 2017.

In 2016, FHB occurred in 83% and 91% of the surveyed common and durum wheat crops, respectively (Tables 1 and 2). Prevalence and severities of FHB in common and durum wheat were generally high across the province with the highest FHB prevalence occurring in soil zone 3 (85%) for common wheat and soil zone 2 (96%) for durum (only one durum field was surveyed in soil zone 3). The prevalence of FHB was lowest in soil zone 1 (75%) for common wheat and soil zone 1 (88%) for durum. The highest mean severity for both common wheat (1.8%) and durum (5.4%) occurred in soil zone 1. The sample with the highest FHB severity (64.5%) was from a durum wheat crop located in soil zone 1.

Overall, in 2016, the prevalence of FHB was higher than in 2013 to 2015, but comparable to the prevalence in 2012 (87% common wheat and 85% durum) (Miller et al. 2013). However, the severity (FHB index) was much higher in 2016 than in 2012 (1.2% common wheat; 0.9% durum). Though the prevalence of FHB was higher in 2016, the severity of FHB was lower than reported in 2015 (2.2% common wheat; 5.2% durum) (Brar et al. 2016).

In 2017, due to the dry conditions experienced throughout most of the province, levels of FHB in Saskatchewan were significantly reduced compared to 2016. FHB was detected in 23% of common wheat fields and 9% of durum fields as part of the survey conducted by Saskatchewan Crop Insurance Corporation and the Saskatchewan Ministry of Agriculture (Tables 1 and 2). The average severity (FHB index) in these fields was 0.01% and <0.01% for common wheat and durum respectively.

FHB was found to be more prevalent in the survey conducted by the Cereal-Flax Pathology Group, with symptoms identified in 91% of fields (42 fields). Though the prevalence of FHB symptoms was high, the severity of infection was low; 48 % of the fields were rated as trace, 25% as light and 9% as moderate (data not shown). The low severity of infection was consistent with the other common wheat fields surveyed in Saskatchewan. The presence of *Fusarium* spp. was confirmed via culturing in 24% of the fields. The prevalence of *Fusarium* spp. in 2017 is reported in Table 4, with all common wheat and durum fields surveyed reported together.

The *Fusarium* spp. present in fields with visible symptoms were determined via culturing in both 2016 and 2017. In 2016, a total of 1525 isolations were made from symptomatic kernels. The most frequently isolated causal pathogen was *F. graminearum.* This species, which is considered the most aggressive FHB-causing pathogen, was detected in 79% of surveyed fields with FHB symptoms and accounted for 45% of the total *Fusarium* isolations. *Fusarium graminearum* was detected in 62% of the common wheat samples and 76% of the durum wheat samples with visible symptoms, which was more than 2.5 times higher than in 2015 (Brar et al. 2016). This is also higher than reported in any previous years of the survey. *Fusarium avenaceum* was the second most prevalent species and was detected in 50% of fields with symptoms, accounting for 16% of *Fusarium* isolations. This was a significant increase from 2015, when *F. avenaceum* was detected in only 12% of fields. *Fusarium poae* was detected in 42% of fields with FHB symptoms and accounted for 8% of total *Fusarium* isolations in 2016. *Fusarium sporotrichioides* was detected in 41% of fields with symptoms and accounted for 8% of Fusarium isolations; while *Fusarium culmorum* was only detected in 17% of fields and accounted for just 3% of all *Fusarium* isolations. Of the total fusarium isolations in 2016, 12% (52% of fields) were identified as other *Fusarium* spp. and 9% (25% of fields) were not able to be identified down to the species level due to the lack of sporulation (Table 3).

In 2017, a total of 218 isolations were made from symptomatic kernels. The most frequently isolated causal pathogen was *F. poae*. This species was detected from 76% of wheat fields with FHB symptoms and accounted for 38% of all isolations. The prevalence of this species was significantly higher than in 2016. The second most prevalent species was *F. graminearum*, the most aggressive FHB-causing pathogen, which was detected in 38% of fields with symptoms and accounted for 18% of all isolations. This was significantly lower than seen in 2016. *F. sporotrichioides* was detected in 14% of wheat fields with symptoms and accounted for 6% of all isolations. *F. avenaceum* was detected in 10% fields with symptoms and accounted for 6% of isolations; while *F. culmorum* was detected in 7% of symptomatic fields and accounted for 5% of all isolations. Of the total fusarium isolations in 2017, 29% in 62% of the fields were identified as other *Fusarium* spp. (Table 4).

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Table 1. Prevalence and severity of fusarium head blight (FHB) in common wheat crops grouped by soil zone in Saskatchewan in 2016 and 2017.

Soil Zones	2016		2017	
	Prevalence[1] (No. of Crops Surveyed)	Mean FHB Severity[2] (range)	Prevalence[1] (No. of Crops Surveyed)	Mean FHB Severity[1] (range)
Zone 1 Brown	75% (4)	1.8% (0 – 5.5%)	0% (10)	0%
Zone 2 Dark Brown	80% (30)	1.1% (0 – 10.3%)	8% (36)	<0.01% (0 – 0.03%)
Zone 3 Black/Grey	85% (52)	1.4% (0 – 13.9%)	37 (57)	0.7 (0.7)
Overall Total/Mean	83% (86)	1.27% (0 - 13.9%)	23% (103)	0.02% (0 - 0.33%)

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

Table 2. Prevalence and severity of fusarium head blight (FHB) in durum wheat crops grouped by soil zone in Saskatchewan in 2016 and 2017.

Soil Zones	2016		2017	
	Prevalence[1] (No. of Crops Surveyed)	**Mean FHB Severity[1] (range)**	**Prevalence[1] (No. of Crops Surveyed)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	88% (41)	5.4% (0 – 64.5%)	9% (32)	<0.01% (0 – 0.06%)
Zone 2 Dark Brown	96% (24)	3.6% (0 – 25.2%)	9% (21)	<0.01% (0 – 0.03%)
Zone 3 Black/Grey	100 (1)	0.7 (0.7)	0 (3)	0
Overall Total/Mean	91% (66)	4.7% (0 - 64.5%)	9% (56)	<0.01% (0 - 0.06%)

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

Table 3. Prevalence of fields with *Fusarium* species detected in durum and common wheat crops with FHB symptoms in 2016.

Crop	*F. avenaceum*	*F. culmorum*	*F. graminearum*	*F. poae*	*F. sporotrichioides*	Other *Fusarium* spp.[1]	Did not sporulate[2]
Durum	68	22	83	37	50	57	24
Common	35	13	75	46	34	49	27
Wheat Total	50	17	79	42	41	52	25

[1] Includes *Fusarium* spp. other than *F. avenaceum, F. culmorum, F. graminearum, F. poae,* and *F. sporotrichioides.*
[2] Includes isolates that could not be identified due to the lack of sporulation.

Table 4. Prevalence of fields with *Fusarium* species detected in durum and common wheat crops with FHB symptoms in 2017.

Crop	*F. avenaceum*	*F. culmorum*	*F. graminearum*	*F. poae*	*F. sporotrichioides*	Other *Fusarium* spp.[1]
Durum	0	20	20	60	0	40
Common	12	4	42	79	17	67
Wheat	10	7	38	76	14	62

[1] Includes *Fusarium* spp. other than *F. avenaceum, F. culmorum, F. graminearum, F. poae,* and *F. sporotrichioides.*
[2] Includes isolates that could not be identified due to the lack of sporulation.

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 2017**

ABSTRACT: The leaf spot (LS) disease complex was evaluated in 148 wheat crops across Saskatchewan in 2017. Disease severity was compared relative to wheat species, soil zone, crop district, and cultivar. Mean severity was lower than in the previous three years. Common wheat had a higher mean LS severity than durum wheat. For common wheat, severity was lowest in the Brown soil zone, while for durum wheat it was highest in the Dark Brown soil zone. *Pyrenophora tritiici-repentis* was more prevalent in durum than common wheat, while the septoria leaf complex was most prevalent in common wheat.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of common and durum wheat in Saskatchewan was conducted between the milk and dough growth stages in 2017. A total of 148 common and durum crops were sampled in 18 crop districts (CD) in the three soil zones (Fig. 1, Table 1). There were 40 fields surveyed in the Brown soil zone, 52 in the Dark Brown soil zone, and 56 in the Black/Gray soil zone. Among the crops sampled, 97 were identified as common and 51 as durum wheat.

Information on the agronomic practices employed was obtained from the producers for most fields sampled. Twenty-two common, and 13 durum wheat cultivars were identified among the samples, the most popular (grown in 5 fields or more) being the durum wheat cultivars ‘Transcend’ (22) and the common wheat cultivars ‘AAC Brandon’ (19), ‘Carberry’ (10), ‘CDC Utmost VB’ (8), ‘Pasteur‘ (5) and ‘Plentiful’ (5). Information on whether the sampled fields had been sprayed with fungicide(s) was obtained from most of the producers. There were fewer crops sprayed with fungicides (43) than unsprayed (108). The most common time of fungicide application was from the first to the third week of July, which would have been at around early flowering or later. Information on the crops grown in 2016 and 2015 (or if summer-fallowed), and tillage method was also obtained from producers for most of the fields surveyed. For common wheat, the most frequent previous crop was an oilseed (63 fields); fewer common wheat crops were preceded by a cereal (11) or a pulse (8) crop, while the most frequently grown crop two years previously was a cereal (57) or an oilseed (9). For durum wheat, the most frequent previous crop was a pulse (24) or an oilseed (18), while the most frequently grown crop two years previously was a cereal (25) followed by a pulse (18) or an oilseed (12). Summer-fallow was the least common practice, with only 2 common, and 3 durum, wheat fields having been left fallow the previous year or two years previously. Tillage system was classified as conventional, minimum-, or zero-till. Most of the common wheat crops for which agronomic information was provided were under zero-till (61), followed by minimum-till (19), with only 11 fields being managed conventionally. Durum wheat fields surveyed were under zero-till (32) or minimum-till (10).

In each field, 50 flag leaves were collected at random and air-dried at room temperature. Percentage of leaf area affected by LS (severity) was recorded for each leaf, and a mean percentage leaf area with LS was calculated for each crop and CD. For crops with the greatest LS and which had not been sprayed with a fungicide, 1 cm^2 surface-disinfested leaf pieces were plated on water agar for identification and quantification of the causal LS pathogens.

RESULTS AND COMMENTS: LS symptoms were observed in 100 of the 148 wheat crops surveyed in 2017. In individual crops, percentage flag leaf area affected ranged from trace to 35%. The overall mean percentage of spotting on the flag leaf was 2.6%, which was markedly lower than in 2014 (9.8%), 2015 (7.6%) and 2016 (7.2%) (Fernandez et al. 2015, 2016, 2017). Forty six wheat crops, 28 common and 18 durum, had <1% LS. Mean severity was higher for common than for durum wheat (Table 1). The low disease levels in 2017 could be attributed to the very dry conditions experienced throughout the growing season by most of the province (Fig. 2). Common wheat crops that had been sprayed with a fungicide(s) had a lower mean LS severity (0.9%) than unsprayed crops (6.4%).

Influence of soil zone and crop district on LS severity

For the common wheat fields sampled, mean LS severity was greater in the Black/Gray and Dark Brown than in the Brown soil zone, while for durum wheat disease severity was higher in the Dark Brown than in the Black/Gray or Brown soil zones (Table 1). For durum wheat, the higher disease level in the Dark Brown soil zone agrees with observations made in the three previous years (Fernandez et al. 2015, 2016, 2017). When grouped by CDs, the greatest mean LS severity in common wheat was observed in 7A/7B (west-central) followed by 5A/5B (east), while those in 8A/8B (north-east), 6A/6B (central),1A/1B (south-east) and 2A/2B (south-east) had the lowest disease levels. For durum wheat, CDs 7A/7B (west-central) had the greatest mean disease severity with the rest of the CDs having means of <1%.

Influence of cultivar on LS severity

Overall, for the most frequently-grown common wheat cultivars, ‘Plentiful’ (mean LS of 6.7%), ‘Pasteur’ (5.5%), and ‘Carberry’ (3.7%) had the highest disease severities, with ‘Brandon’ (1.9%) and ‘CDC Utmost’ (0.8%) having the lowest severities. In 2016, ‘Carberry’ also had among the highest, and ‘CDC Utmost’ among the lowest, mean LS severities (Fernandez et al. 2017).

Causal pathogens

In common wheat, the septoria leaf complex was most prevalent, among which *Stagonospora nodorum* was the most common, followed by *P. tritici-repentis* (Table 1). *Cochliobolus sativus* was the least commonly isolated pathogen. The percentage isolation of *P. tritici-repentis* was lowest, while that of the septoria leaf complex was highest, in the Black/Gray soil zone.

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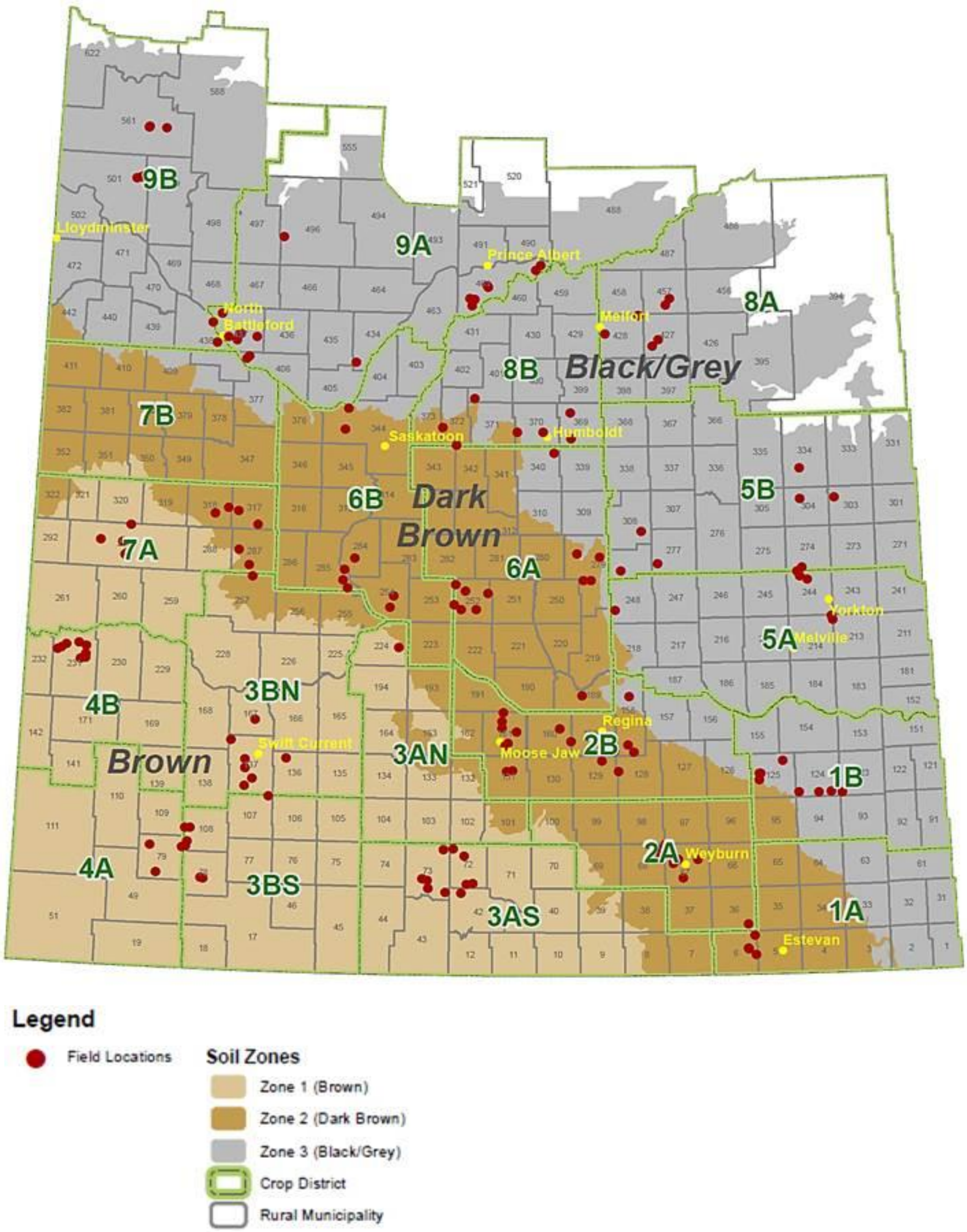

Figure 1. Soil zone and crop district map with common and durum wheat fields surveyed across Saskatchewan in 2017.

Table 1. Incidence and severity of leaf spotting diseases and percentage isolation of the most common leaf spotting pathogens in common and durum wheat crops, surveyed in Saskatchewan in 2017.

Soil Zone/Crop District	No. of Crops[1]	Mean Severity[2]	*Pyrenophora tritici-repentis*[3]	*Stagonospora nodorum*	*Septoria tritici*	*Stagonospora avenae* f. sp. *triticea*	*Cochliobolus sativus*
		-----------------------------%-----------------------------					
__Soil Zone__							
Common wheat:							
1 (Brown)	9	0.4	60.0/1	27.1/1	6.7/1	6.2/1	-/0
2 (Dark Brown)	34	3.1	56.7/1	20.5/1	5.4/1	2.5/1	15.0/1
3 (Black/Gray)	54	4.4	27.5/12	43.8/12	23.3/11	9.6/9	2.0/1
Mean/total:	**97**	**3.6**	**31.8/14**	**40.9/14**	**20.7/13**	**8.6/11**	**8.5/2**
Durum wheat:							
1 (Brown)	31	0.5	-	-	-	-	-
2 (Dark Brown)	18	1.6	51.9/2	28.1/2	11.9/2	3.2/1	13.2/1
3 (Black/Gray)	2	0.5	-	-	-	-	-
Mean/total:	**51**	**0.9**	**51.9/2**	**28.1/2**	**11.9/2**	**3.2/1**	**13.2/1**
__Crop District__							
Common wheat:							
1A/1B	8	0.5	83.1/2	12.7/2	4.2/1	-/0	-/0
2A/2B	13	0.5	-	-	-	-	-
3A/3B[4]	5	4.7	60.0/1	27.1/1	6.7/1	6.2/1	-/0
4A/4B	3	0.2	-	-	-	-	-
5A/5B	13	8.5	20.7/2	41.4/2	37.1/2	1.7/2	-/0
6A/6B	14	0.8	30.0/1	54.5/1	12.5/1	1.0/1	2.0/1
7A/7B	6	12.0	56.7/1	20.5/1	5.5/1	2.5/1	15.0/1
8A/8B	13	1.6	8.9/2	49.2/2	22.9/2	19.6/2	-/0
9A/9B	24	4.1	14.7/5	54.2/5	21.9/5	9.0/5	-/0
Durum wheat:							
1A/1B	4	0.1	-	-	-	-	-
2A/2B	13	0.4	89.6/1	2.5/1	7.9/1	-/0	-/0
3A/3B	20	0.5	-	-	-	-	-
4A/4B	8	0.4	-	-	-	-	-
6A/6B	1	0.0	-	-	-	-	-
7A/7B	12	5.4	14.1/1	53.6/1	15.9/1	3.2/1	13.2/1

[1]Number of crops sampled.
[2]Mean percentage flag leaf affected.
[3]Mean percentage fungal isolation / number of crops where the pathogen occurred. The number of crops where *P. tritici-repentis* was isolated is equivalent to the number of crops plated for fungal identification and quantification.
[4]'3A' includes CD 3AS, '3B' includes CDs 3BS and 3BN.

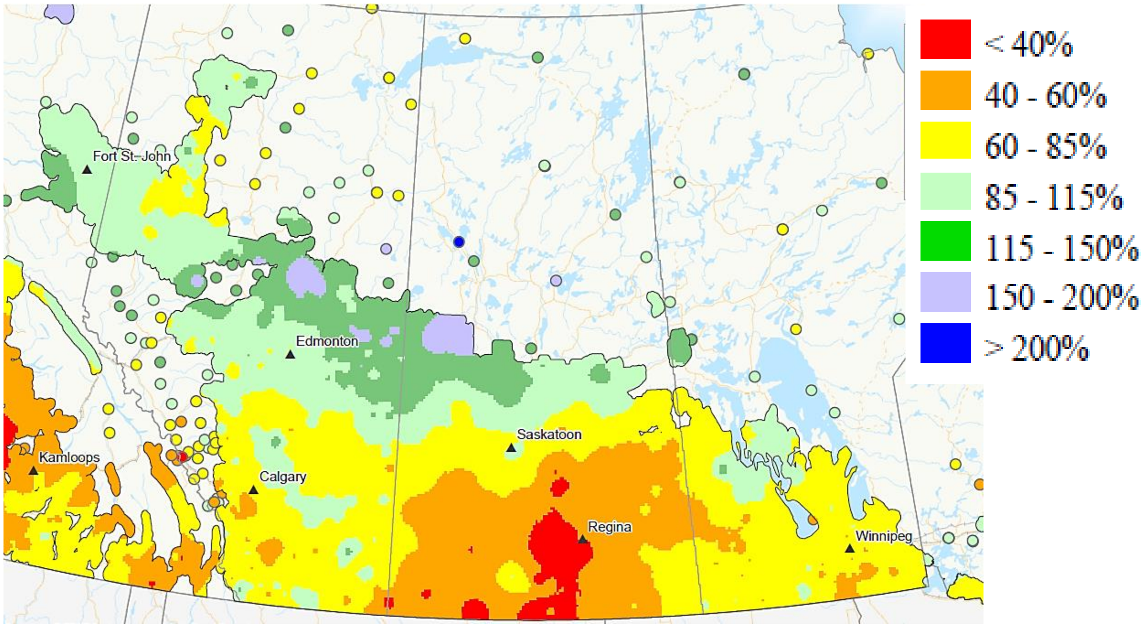

Figure 2. Three month (May 3-July31) percent of average precipitation. Normal precipitation based on 1981-2010 (Agriculture and Agri-Food Canada 2017).

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

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: STRIPE RUST OF WHEAT IN SASKATCHEWAN IN 2017

ABSTRACT: In a survey of wheat conducted in Saskatchewan in 2017, stripe rust (*Puccinia striiformis* f. sp. *tritici)* was detected in approximately one third of the crops surveyed. In 2017, similar to 2015, stripe rust disease pressure was low as compared with 2016 and years previous to 2015. In many crops, stripe rust infection appeared relatively late in 2017.

INTRODUCTION, METHODS AND RESULTS: Stripe rust, caused by *Puccinia striiformis* f. sp. *tritici* Erikss., has become one of the most important diseases of wheat in western Canada since 2000 (Brar and Kutcher 2016). Stripe rust in western Canada mainly occurs from inoculum arriving by air movement from the Pacific Northwest and the Great Plains of the United States, although overwintering inoculum can initiate disease in some regions (Kumar et al. 2013). The stripe rust survey was conducted from July 8th to August 15th in central, west-central, east-central, south-west and south-east regions of Saskatchewan. A six-category scale was used to assess severity in each field: clean (no visible symptoms); trace (<3% leaf area affected); light (3-15%); moderate (>15-20%); and severe (>20%).

In central Saskatchewan, two of six crops surveyed on July 8th had a trace of stripe rust and seven crops surveyed between late July and early August had trace to moderate severity (1-20%). In south-west Saskatchewan two crops surveyed in early July had trace to light (0-10%) stripe rust severity and another two other crops surveyed in early August had light severity (5-15%). One crop in south-east Saskatchewan surveyed on July 31st had light stripe rust severity (5-15%). Three crops in west-central Saskatchewan surveyed in mid-July and one crop in east-central Saskatchewan surveyed on August 15th had trace to light (>0-5%) stripe rust severity. Ten crops were surveyed in the north-central part of the province on July 25th and stripe rust was observed in only three crops with light infection of the flag and/or penultimate leaves. Approximately half of the crops surveyed on July 25th expressed leaf tip necrosis, indicating the possible presence of adult plant resistance (*Yr18, Yr29* or other genes); *Yr18* is most likely, as it is common in commercial spring wheat cultivars grown in western Canada (Brar et al. 2017). No stripe rust was observed among six crops surveyed in central Saskatchewan on June 18th. In 2017, stripe rust was not as severe on wild foxtail barley (*Hordeum jubatum*) as it was in 2016. It was not observed on foxtail barley in 2015.

Stripe rust was not observed on susceptible stripe rust differentials grown at Outlook, Melfort, Scott, and Saskatoon until early August, and it was not sufficient to differentiate genotypes with various resistance genes by until mid- to late August. This was true not only in Saskatchewan, but also in southern Alberta, where stripe rust was not sufficient to differentiate breeding lines until mid-August (Harpinder Randhawa, personal communication). Moderate levels of stripe rust were observed in some breeding plots at the Goodale and Skarsgaard Research Farms of the University of Saskatchewan in mid- to late August. The plausible reason for low levels of stripe rust early in the season could be attributed to sporadic and low precipitation in most parts of the province. Late season rain and inoculum production may explain the moderate levels of stripe rust observed late in the season in commercial crops and experimental plots at various locations.

ACKNOWLEDGEMENTS: The assistance of Mallory Dyck, Everett Boots, Angel Liew, Gopal Sharma, and Kun Lou of the Cereal and Flax Pathology of the Crop Development Centre was appreciated.

REFERENCES:

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Kumar K, Holtz MD, Xi K, Turkington TK. 2013. Overwintering potential of the stripe rust pathogen (*Puccinia striiformis*) in central Alberta. Can J Plant Pathol. 35(3):304-314.

CROP / CULTURE: Wheat
LOCATION / RÉGION: Alberta

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TITLE / TITRE: STRIPE RUST IN SOUTHERN ALBERTA, 2015-2016

ABSTRACT: A stripe rust survey was conducted in Southern Alberta during the 2015-2016 crop season. Disease incidence and severity was assessed in commercial wheat fields in southern Alberta from early June to August. The pathogen, *Puccinia striiformis f. sp. tritici*, likely overwintered in Alberta; it was observed in late October of 2015 and in early March 2016 in Lethbridge. In total, 54 commercial fields of winter and spring wheat fields in an area extending south of Highway 1 to the USA border and from Spring Coulee to Seven persons were surveyed. Of these fields, 38% had stripe rust infection and 11% suffered severity of ≥ 20% as measured using the modified Cobb scale. The disease was widespread this year, but extensive fungicide application and dry spring and early summer conditions may have limited severe yield losses by this pathogen.

INTRODUCTION AND METHODS: Commercial fields of winter and spring wheat in several counties in the region of southern Alberta were surveyed from early June to August. Fields were inspected in “W” pattern until 10 sites separated by approximately 25 m were evaluated for both disease incidence and severity. Disease incidence ratings were reported as the number of infected plants within 1 m, and severity as the average percent of the total leaf surface area covered with stripes per plant. Fields were classified based on the severity of infection, *i.e.*, clean (0%), trace (1 to 3%), light (3-5%), moderate (6-19%) and severe (20 to 100%).

RESULTS AND COMMENTS: In total, 54 commercial wheat fields were surveyed in summer 2016. In total 38% were infected, and (29%) fields rated as severe or moderate for infection level (Table 1, Figure 1). Similar to the year 2011 (Table 1, Figure 1), stripe rust was wide spread this year, but extensive fungicide application and dry spring and early summer conditions may have limited severe yield losses by this pathogen.

ACKNOWLEDGEMENTS: Data for 2011 were kindly provided by Denis Gaudet.

Table 1: Number of wheat fields surveyed and the corresponding stripe rust severity levels recorded in southern Alberta during the summer of 2016.

Field infection type	Number of fields (percentage) in 2017	Number of fields (percentage) in 2011
Clean	33 (61%)	47 (51%)
Light &Trace	5 (9%)	25 (27%)
Moderate	10 (18%)	7 (7%)
Severe	6 (11%)	12 (13%)

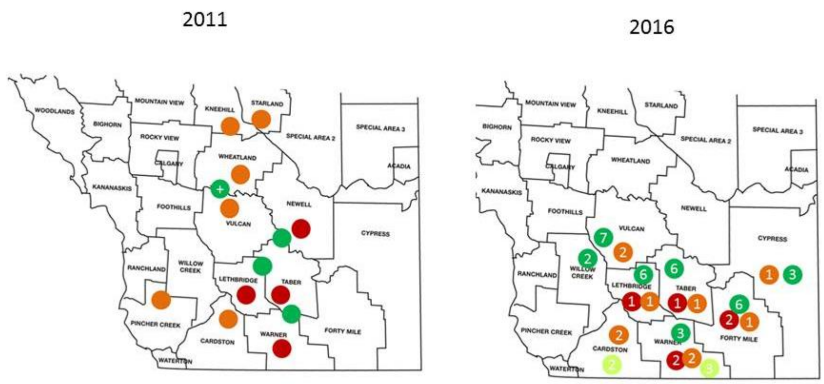

Figure 1: A map showing the level of infection in wheat surveyed fields in 2016 and 2011. The color-coded circle indicates severity level of stripe rust infection and the number inside each circle indicates number of fields surveyed in that county. Dark green: clean fields, light green: trace or light, orange: moderate, red: severe.

CROP / CULTURE: Wheat
LOCATION / RÉGION: Alberta

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TITLE / TITRE: STRIPE RUST IN SOUTHERN ALBERTA, 2016-2017

ABSTRACT: During the fall of 2016 to July of 2017, winter and spring wheat fields in southern Alberta were surveyed for stripe rust. The pathogen was observed in mid November 2016 and was recovered from infected plant in end of December 2016, and then observed again in early March 2017. This indicated that stripe rust had overwintered in southern Alberta. In the spring and summer of 2017, disease incidence and severity ratings were mostly recorded as low. The exceptionally dry and hot weather in 2017 limited the infection and spread of stripe rust in comparison to the previous year.

INTRODUCTION AND METHODS: Commercial fields of winter and spring wheat in several counties in the region of southern Alberta were surveyed. The survey was done in November 2016 following winter wheat seeding, then from early May to the end of July 2017. Fields were inspected in "W" pattern until 10 sites separated by approximately 25 m were evaluated for both disease incidence and severity. Incidence ratings reported as the number of infected plants within 1 m, and severity as the average percent of the total leaf surface area covered with stripes per plant. Fields were classified based on the severity of infection to: clean (0%), trace (1 to 3%), light (3-5%), moderate (6-19%) and severe (20 to 100%).

RESULTS AND COMMENTS: In total, 74 commercial wheat fields were surveyed in 2016-2017 growing seasons, 10 in 2016 November and 64 in the spring/ summer season of 2017: 32 winter and 32 spring wheat fields (Fig. 1A, 1B). In November 2016, 7 fields out of 10 were rated as having severe or moderate disease levels (Fig. 1B). In the spring/summer season of 2017, only one field out of 64 had a severe infection, which was found only at the edge of that field and not elsewhere, while 75% of surveyed fields were reported as being clean (Table 1, Fig. 1A).

The pathogen was also recovered from a field located at the Lethbridge Research and Development Centre on December 23, 2016 (Fig. 2). A healthy looking plant was recovered from under the snow and brought inside and then placed in a growth chamber under controlled conditions; two weeks later stripe rust infection was evident (Fig. 2). This observation, coupled with the detection of rust in early March 2017, indicated that stripe rust had overwintered in southern AB from 2016-2017. The exceptionally dry and hot weather and lack of precipitation created unfavorable conditions for infection and disease spread in 2017 compared to last year (Fig. 1A).

Table 1. Number of wheat fields surveyed and the corresponding stripe rust severity levels recorded in southern Alberta during the spring/summer of 2017.

Field infection type	Number of fields (percentage) in 2017
Clean	48 (75%)
Trace	10 (16%)
Light	2 (3%)
Moderate	3 (5%)
Severe	1 (1.5%)

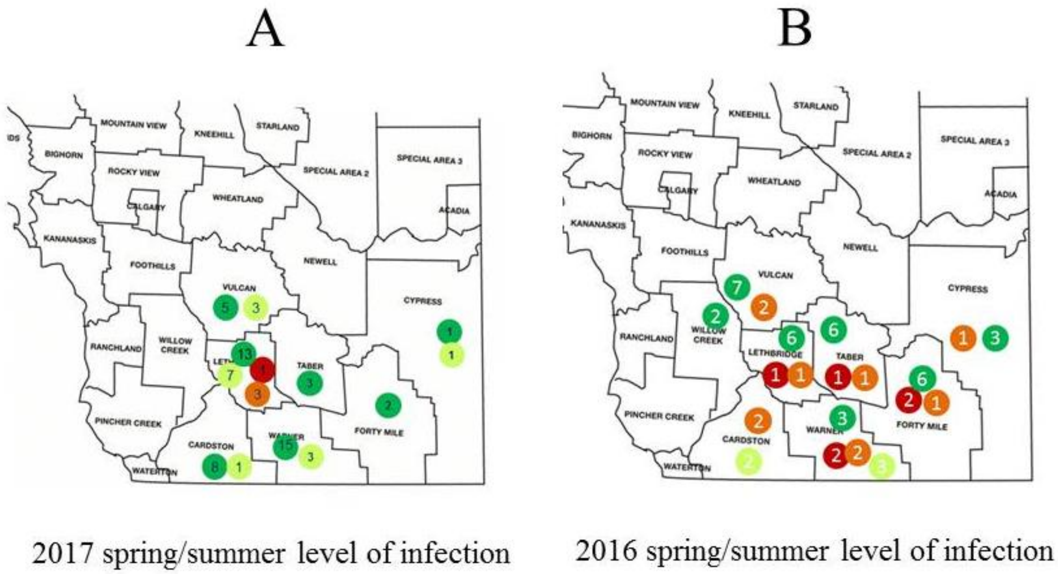

Figure 1. A map showing the level of infection in wheat surveyed fields in 2017 (A) and 2016 (B). The color-coded circle indicates severity level of stripe rust infection and the number inside each circle indicates the number of fields surveyed in each municipality. Dark green: clean fields; light green: trace or light; orange: moderate; red: severe.

Figure 2. Recovered healthy looking plant from under a snow blanket, Lethbridge Research and Development Centre, December 23, 2016, showing stripe rust infection on lower leaves after incubation in controlled conditions for two weeks.

CROP / CULTURE: Durum Wheat, Spring Wheat, Winter Wheat, Barley, Oat
LOCATION / RÉGION: Manitoba, Saskatchewan, Alberta

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: **CEREAL SMUT SURVEYS, 2017**

ABSTRACT: Fifty-three fields of hexaploid spring wheat, 11 fields of barley and 11 fields of oats were assessed for the smut diseases caused by *Ustilago* spp. in Manitoba in 2017. Two fields of wheat had plants infected with *U. tritici* at trace levels. No smutted plants were observed in barley or oat fields. In Saskatchewan, 15 spring and winter wheat fields were assessed, with no smutted plants observed. One winter wheat field was assessed in Alberta, and no smutted plants were found. Neither of the two isolates of *Ustilago tritici* from Manitoba was found to be resistant to carboxin.

INTRODUCTION AND METHODS: Field surveys in Manitoba and Saskatchewan were conducted during July 10 to July 25, 2017 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 in Manitoba included crop districts 1, 2, 3, 7, 8, 9 and 11 and in Saskatchewan, crop districts 4B, 6B, 7A, and 8B. One winter wheat field was surveyed in Alberta crop district 3. Fields were selected at random at approximately 15 - 30 km intervals, depending on the frequency of the crops in the area. 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 were estimated by counting plants in a one m^2 area at a minimum of two sites on the path. In Saskatchewan and Alberta, the percentage of infected plants was estimated by assessing a 5 m row at 5 random locations in a field and counting all the heads, and the number of infected heads. Fields with <0.01 % were considered as trace infection levels in Manitoba, and <0.05% infections were considered as trace in Saskatchewan and Alberta.

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

RESULTS AND COMMENTS:
<u>Manitoba:</u> Forty-nine fields of awned, 4 fields of awnless spring bread wheat, but no fields of durum wheat were assessed for smutted plants. Smutted plants (infected with *U. tritici*) were found in two fields of awned spring wheat at trace levels. One field was in crop district 7 and the other in crop district 11. Ten fields of 2-row barley and one field of 6-row barley were assessed, with no smut infected plants observed. No smut infected plant was observed among 11 oat fields.

<u>Saskatchewan</u>: A total of 15 spring and winter wheat fields were assessed in Saskatchewan. No smutted plants were found.

<u>Alberta</u>: One winter wheat field in Alberta in Crop District 3 was assessed, and no smutted plants were found.

None of the *Ustilago* spp. strains collected in Manitoba in 2017 was able to germinate and grow on agar medium amended with carboxin.

REFERENCES :

Leroux P. 1986. Caractéristiques des souches d'*Ustilago nuda*, agent du charbon nu de l'orge, résistantes à la carboxine. Agronomie 6:225-226.

Leroux P, Berthier G. 1988. Resistance to carboxin and fenfuram in *Ustilago nuda* (Jens) Rostr., the causal agent of barley loose smut. Crop Protection 7:16-19.

Newcombe G, Thomas PL. 1991. Incidence of carboxin resistance in *Ustilago nuda*. Phytopathology 81:247-250.

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 2017

ABSTRACT: Thirty-two spring wheat fields in Central and Eastern Ontario were surveyed for diseases in 2017. Of the 13 diseases observed, take-all, fusarium head blight (FHB), septoria/stagonospora leaf blotch, and septoria glume blotch were most prevalent having moderate to severe levels of infection in 29, 25, 15, and 6 fields, respectively. *Fusarium graminearum* was the predominant species causing FHB.

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. Thirty-two fields were chosen at random in regions where most of the spring wheat was grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of the three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Disease diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe levels, respectively. Severity of ergot, loose smut, and take-all was based on the percentage of plants infected at each of the three random sites per field. FHB was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of the three sites per field. A FHB index [(% incidence x % severity)/100] was determined for each field. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe disease 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% NaOCl for 60 seconds and plated in 9-cm diameter 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 and 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: Thirteen diseases or disease complexes were observed (Table 1). Septoria/stagonospora leaf blotch (normally associated with the pathogen *Septoria tritici* and *Stagonospora* spp.) and stagonospora glume blotch (*Stagonospora nodorum*) were the most important foliar diseases and were found in all surveyed fields at average severities of 2.7 and 1.8, respectively. Moderate to severe levels of infection from the two diseases were observed in 15 and 6 fields, respectively. Yield reductions due to these diseases were estimated to have averaged <5% in affected fields. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), leaf rust (*Puccinia triticina*), powdery mildew (*Blumaria graminis* f.sp. *tritici*), spot blotch (*Cochliobolus sativus*), stem rust (*Puccinia graminis*), stripe rust (*Puccinia striiformis* f.sp. *tritici*) and tan spot (*Pyrenophora tritici-repentis*). These diseases were found in 25, 15, 4, 30, 5, 4, and 31 fields at average severities of 1.3, 1.8, 2.3, 1.2, 1.0, 2.3, and 1.4, respectively. No severe levels of infection were observed and these diseases likely caused little to no yield reduction.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*) and take-all root rot (*Gaeumannomyces graminis* var. *tritici*) were observed in all fields at incidence levels of 0.5, 0.5, and 3.2%, respectively (Table 1). Moderate and severe levels of infection from ergot and loose smut were not observed, but were observed from take-all in 29 fields. Yield reductions by take-all were estimated >10% in affected fields.

FHB was observed in all fields surveyed at a mean FHB index of 5.3% (range 0.01-30.0%) (Table 1). Moderate and severe FHB infection was found in 25 fields and the disease resulted in a significant loss of grain yield and quality in 2017. Five *Fusarium* species were isolated from putative fusarium-damaged kernels (Table 2). *Fusarium graminearum* predominated and occurred in all fields and on 77.1% of kernels. *Fusarium poae* and *F. sporotrichioides* were less common and each found in 28% of fields and on 2.0% of kernels. *Fusarium avenaceum* and *F. equiseti* were least common, occurring in 6-13% of fields and 0.2-0.4% of kernels.

The 13 diseases observed on spring wheat in Ontario in 2017 were the same as those recorded for 2016 except for stripe rust that was not found in 2016 (Xue et al. 2017). Overall, the incidence and severity of these diseases were generally higher in 2017 than in 2016. The more frequent rain events in June and July in 2017 compared with 2016 in Central and Eastern Ontario were likely responsible for the increased disease severities observed.

REFERENCE:

Xue AG, Chen Y, Al-Rewashdy Y. 2017. Diseases of spring wheat in Central and Eastern Ontario in 2016. Can Plant Dis Surv. 97:148-149. www.phytopath.ca/publication/cpds

Table 1. Prevalence and severity of spring wheat diseases in Central and Eastern Ontario in 2017.

Disease	No. of fields affected (n=32)	Disease severity in affected fields*	
		Mean	Range
Bacterial blight	25	1.3	1.0-3.0
Leaf rust	15	1.8	1.0-4.0
Stripe rust	4	2.3	2.0-3.0
Powdery mildew	4	2.3	1.0-4.0
Septoria glume blotch	32	1.8	1.0-6.0
Septoria/Stagonospora leaf blotch	32	2.7	1.0-6.0
Spot blotch	30	1.2	1.0-2.0
Stem rust	5	1.0	0.1-1.0
Tan spot	31	1.4	1.0-3.0
Ergot (%)	32	0.5	0..5-0.5
Loose smut (%)	32	0.5	0.5-0.5
Take-all (%)	32	3.2	0.1-15.0
Fusarium head blight**			
Incidence (%)	32	25.9	1.0-70
Severity (%)		20.5	1.0-60
Index (%)		5.3	0.01-30.0

*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 2017.

***Fusarium* spp.**	**% affected fields**	**% affected kernels**
Total *Fusarium*	100.0	81.5
F. avenaceum	12.5	0.4
F. equiseti	6.3	0.2
F. graminearum	100.0	77.1
F. poae	28.1	2.0
F. sporotrichioides	28.1	1.9

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

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TITLE / TITRE: 2017 SURVEY FOR STRIPE RUST AND SEPTORIA LEAF SPOT OF WINTER WHEAT IN ONTARIO

ABSTRACT: Stripe rust was the most important disease of winter wheat in Ontario in 2016 and present in the crop again in 2017. The Septoria leaf complex was also an important disease in winter wheat in 2017. Moderate severities for both diseases were recorded across winter wheat cultivars planted at Tupperville and Ridgetown in 2017. Yield, test weight and thousand kernel weight were significantly affected by both diseases.

INTRODUCTION AND METHODS: Septoria leaf disease severity, stripe rust severity and the effect of both leaf diseases on yield, test weight (TW) and thousand kernel weight (TKW) was assessed using Ontario winter wheat cultivars. Plots were planted in mid-October in 2016 in a randomized complete block design, replicated trials at Tupperville and Ridgetown, Ontario. The plots were planted in six rows, at a row spacing of 17.8 cm, and 4 m in length, following standard agronomic practices for Ontario. Stripe rust and Septoria leaf severities were evaluated in June 2017 using a 0 to 9 scale, where 0 = no disease and 9 = more than 90% of leaf tissue affected by symptoms. No artificial inoculation was used. Yield, TW and TKW were estimated from the harvested grain. Pearson's correlation coefficients between both disease and yield, TKW and TW were calculated.

RESULTS AND COMMENTS: Stripe rust was the most important disease of winter wheat in Ontario in 2016 (Tamburic-Ilincic and Rosa 2017). In 2017, the stripe rust level was lower and ranged from 2, in 'Gallus', a cultivar with good resistance to the disease, to 5 in the highly susceptible cultivar 'Venture', while the septoria disease level ranged from 3 to 5.5, across all cultivars at the Tupperville location (Table 1). Both diseases were at a higher level at Tupperville (Table 1) than at Ridgetown (Table 2). Yields ranged from 3.7 t/ha to 7.2 t/ha at Tupperville (Table 1) and from 5.5 t/ha to 6.7 t/ha at Ridgetown (Table 2) in 2017. Yield was significantly affected by septoria and stripe rust diseases at Tupperville, with negative correlations of r=-0.56 and r=-0.44, respectively. Significantly negative correlations were recorded between stripe rust severity and TW and TKW (r=-0.82 and r=-0.57, respectively), with moderate correlations between septoria severity and TW and TKW (r=-0.35 and r=-0.21, respectively) at Tupperville in 2017. Correlations among the traits were lower at Ridgetown in 2017. Both leaf diseases are important for the winter wheat crop in Ontario and need to be managed using cultivar resistance and fungicide applications to avoid yield losses.

REFERENCES:
Tamburic-Ilincic L, Rosa SB. 2017. 2016 Survey for stripe rust of winter wheat in Ontario. Can Plant Dis Surv. 97:150-151.

Table 1. Septoria leaf disease severity, stripe rust severity, yield, test weight (TW) and thousand kernel weight (TKW) in winter wheat at Tupperville, Ontario in 2017.

Genotype	Septoria leaf disease (0-9)	Stripe rust (0-9)	Yield T/ha	TW Kg/hl	TKW gr
Gallus	4.5	2.0	5.7	78.2	37.4
Priesley	4.0	3.5	5.7	75.6	31.6
Branson	3.0	3.5	7.2	77.2	36.4
Marker	3.5	2.5	7.1	75.3	29.2
UGRC DH5-28	4.5	3.0	6.2	77.9	34.4
UGRC Ring	3.0	3.0	6.8	74.6	35.0
UGRC C2-5	5.5	3.5	5.2	73.8	32.4
AC Morley	3.0	2.0	5.1	78.2	30.2
UGRC GL-164	4.5	3.5	6.5	76.4	25.2
Emmit	5.0	3.5	5.0	75.1	32.6
OAC Flight	3.5	4.0	5.5	73.6	28.0
Venture	5.0	5.0	3.7	69.0	22.8

Table 2. Septoria leaf severity, stripe rust severity, yield, test weight (TW) and thousand kernel weight (TKW) in winter wheat at Ridgetown, Ontario in 2017.

Genotype	Septoria leaf Disease (0-9)	Stripe rust (0-9)	Yield T/ha	TW Kg/hl	TKW gr
Gallus	1.3	0.8	5.7	76.0	44.0
Priesley	2.0	0.0	5.8	74.4	38.0
Branson	1.3	1.0	6.5	73.9	36.0
Marker	1.5	0.5	6.4	72.2	27.5
UGRC DH5-28	1.3	0.0	6.3	74.9	34.7
UGRC Ring	1.8	1.3	6.7	73.9	35.9
AC Morley	2.0	0.0	6.2	77.3	34.1
UGRC GL-164	1.5	0.0	5.6	74.1	25.6
Emmit	1.3	1.8	5.5	73.2	30.5
OAC Flight	1.0	0.0	6.7	73.3	30.1

CROP / CULTURE: Corn
LOCATION/ RÉGION: Ontario

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: STATUS OF CORN DISEASES IN ONTARIO, 2017 CROP SEASON

ABSTRACT: Northern corn leaf blight (NCLB), common rust and eyespot were the most common leaf diseases found in Ontario corn fields in 2017, but overall the severity and incidence of these diseases was significantly lower as compared to previous years. Common rust was the most prevalent of the three foliar diseases and was found in 98% of the fields visited with a mean disease severity of 3.5 on a 1-7 scale and incidence of 29.4%. NCLB, which was the most common foliar disease in previous years, was found in only 82% of sampled fields with a mean disease severity of 2.3 and incidence of 5.7% in 2017. In Southern and Western Ontario, only 4% and 6%, respectively, of the NCLB-affected fields had incidence levels of ≥25%, and only one field of 142 visited had severities of ≥5 (>20% leaf area affected). NCLB incidence was higher in the fields sampled in Eastern Ontario (9.7%) compared to Southern Ontario (4.7%). Eyespot was found in 77% of the fields sampled at a mean severity of 2.3 and an incidence of 8.8%. Grey leaf spot (GLS) was localized primarily in southern Ontario and observed in 60% of the fields sampled. Southern rust severity and incidence was higher in 2017 compared to previous years and was detected in 55% of the fields visited in Southern Ontario with an average disease severity and incidence of 3.5 and 21.5%, respectively. Ear and stalk rot diseases were insignificant at the time of survey. Neither Stewart's bacterial wilt nor Goss's bacterial wilt and blight were detected in Ontario in 2017.

INTRODUCTION AND METHODS: In 2017, wet weather and low temperatures in the month of May in most parts of Ontario delayed planting by almost two weeks. Lower than normal temperatures in the following months led to slow growth of the crop and a decrease in the incidence and severity of almost all diseases other than common and southern rust compared to the previous three years (Jindal et al. 2015, 2016, 2017). A total of 231 corn fields were surveyed across Ontario from September 17-27, 2017 to document the occurrence of various corn diseases, including anthracnose leaf blight and die back (ALB) (*Colletotrichum graminicola* (Ces.) G.W. Wilson); eyespot (*Aureobasidium zeae* (Narita & Hiratsuka) Dingley)); grey leaf spot (GLS) (*Cercospora zeae-maydis* Tehon & E.Y. Daniels); northern corn leaf blight (NCLB) (*Exserohilum turcicum* (Pass.) K.J. Leonard & E.G. Suggs); northern corn leaf spot (*Bipolaris zeicola* (G.L. Stout) Shoemaker); southern corn leaf blight (*Bipolaris maydis* (Y. Nisik. & C. Miyake) Shoemaker); common rust (*Puccinia sorghi* Schwein.); southern rust (*P. polyspora* Underw.); common smut (*Ustilago maydis* (DC.) Corda); head smut (*Sphacelotheca reiliana* (Kuhn) G.P. Clinton); physoderma brown spot (*Physoderma maydis* Miyabe (Miyabe)); ear rot (*Fusarium* spp.); stalk rot (*Fusarium* spp., and *Colletotrichum graminicola*); and Stewart's bacterial wilt (*Pantoea stewartii* Mergaert et al.). The 2017 corn disease survey provides vital information on populations of endemic pathogens and allows for scouting of new invasive pathogens such as Goss's bacterial wilt and blight (*Clavibacter michiganensis* subsp. *nebraskensis* Vidaver & Mandel (Davis et al.)) which has been reported from many parts of Manitoba and Alberta (Harding et al. 2017).

In addition to disease occurrence, the incidence (number of affected plants) and severity of the major leaf diseases (eyespot, GLS, NCLB and common rust) were assessed visually in each of the 231 selected fields based on 20 plants at each of five points located approximately 10 m apart and 5 m from the field edge (Fig. 1). A rating scale of 1-7 based on percent area under the disease [1 (no disease) to 7 (severely diseased)] was used for recording disease severity (Reid and Zhu 2005). Disease incidence was recorded based on the number of plants with a particular disease symptom. Leaves displaying NCLB symptoms were collected for *E. turcicum* race identification and distribution patterns. Additional symptomatic plant parts were also collected for subsequent laboratory analysis, especially for unidentifiable or suspected Goss's bacterial wilt and Stewart's bacterial wilt. GPS coordinates of the sampled fields were also recorded and used to map locations (Fig 1).

RESULTS AND DISCUSSION: Northern corn leaf blight which is traditionally the most common foliar corn disease in Ontario was found in 82% of the fields sampled with significantly lower disease severity and incidence compared to previous years (Table 1). Sixteen of the 190 fields with NCLB had incidences ≥30% and 26 had severity ratings of ≥4. The most affected 28 fields were found in 12 counties of the 18 surveyed across the province: Stormont, Dundas & Glengarry (9), Oxford (5), Dufferin (2), Huron (2), Ottawa (2), Perth (2), Chatham Kent (1), Leeds and Grenville (1), Middlesex (1), Prescott & Russell (1), Waterloo (1) and Wellington (1), illustrating that NCLB occurrence is wide spread across Ontario even though severity and incidence was low. The disease was found in 90% of the fields sampled in Southern and Western Ontario compared to 72% of the fields in Eastern Ontario; however, mean disease incidence in affected fields was considerably higher in Eastern Ontario (9.7%) compared to Southern (4.7%) and Western Ontario (7.2%). Only five fields in Southern Ontario had disease incidences of ≥20%. Mean disease severity in affected fields was near identical in Eastern (2.5), Southern (2.4) and Western Ontario (2.7) (Table 2). Furthermore, all seven seed-corn fields surveyed in Chatham-Kent County also had a considerably lower mean disease severity (1.7; range 1.0-3.0) and a disease incidence (7%; range 0-5%) than those recorded for commercial corn fields. The high incidence of NCLB in Ontario is always a cause for concern since yield losses are associated with the disease, but this year overall incidence and severity was considerably low compared to earlier years possibly due to a combination of climatic factors, fungicide applications and increased use of more tolerant hybrids by growers. There is a need for additional disease management strategies other than use of foliar fungicides, which increases production costs and can be an environmental risk. In future, sustainable and economic corn production will require the development of new NCLB *Ht* gene/inbreds and their incorporation into high yielding commercial corn hybrids.

Variability in commercial corn hybrid reactions to NCLB was evident from inspection of the 16 Ontario Corn Committee (OCC) 2017 performance trials, of which 6 locations (Blyth, Dundalk, Ilderton, Ottawa, Winchester and Wingham) had very high disease severity ratings (≥4) and three locations (Dresden, Ridgetown and Tilbury) had low disease severity ratings ≤2 (Table 3).

The 231 surveyed sites will be used to map the geographical distribution of physiological races of *E. turcicum* as it is not uncommon to find both resistant and susceptible NCLB lesion types on the same leaf. Likewise, we observed that the reaction of some of the hybrids to NCLB differed depending on where they were grown in Ontario, suggesting the presence of different races of *E. turcicum*, as has been reported in previous years (Zhu et al. 2013; Jindal et al. 2016). To verify this, and to subsequently map the distribution of such races in corn growing regions of Ontario, 137 leaf samples with NCLB symptoms were collected during the survey.

Common rust was most prevalent among the foliar diseases detected in Ontario corn in 2017. It was found in 227 (98%) fields sampled (Table 1) at a mean disease severity of 3.5 and an incidence of 29.4% (Table 2). One quarter of the sampled fields had disease incidences of ≥40%. High levels of common rust (≥4) were recorded in 76 fields distributed across all counties visited. Overall, like NCLB and eyespot, common rust severity was almost similar across the province. At all OCC sites, some of the commercial and experimental hybrids exhibited moderate to high resistance to common rust, assuming that infection was uniform and severe throughout the field. In seed corn, four of seven fields visited had female inbreds which were very susceptible (severity rating of ≥4.5) to common rust.

Southern rust, which has been common in regions of the southern and mid-central U.S., was found across southern Ontario with mean disease severity of 3.5 and incidence of 21.5%. One third of the sampled fields in Southern Ontario had incidences of ≥25%. Southern rust was found for the first time in two fields in Eastern Ontario.

Eyespot was less prevalent in 2017 compared to previous years, particularly 2015. This disease was found in 177 (77%) of the fields sampled (Table 1) at a mean severity of 2.3 and an incidence of 8.8% (Table 2). Only 17 of the 177 affected fields had severity levels of ≥4 and 19 had disease incidences of ≥35%. During 2017, eyespot was less common in Southern Ontario (72%) compared to Eastern Ontario (90% of fields affected). However, three individual fields in Southern Ontario had high eyespot severity ratings of 4.0, compared to the mean eyespot severity of 2.3 in affected fields in Ontario. The less widespread distribution of eyespot in Ontario was further demonstrated by the elevated severity ratings of ≥4 only in 17 corn fields. Many of the hybrids included in the OCC trials planted at Ilderton, Lindsey, Winchester and Wingham, as well as many entries in seed company demonstration plots, exhibited variable levels of resistance to eyespot. These hybrids need to be identified for cultivation in the province.

Grey leaf spot was found in 55 (24%) of the fields sampled (Table 1). Compared to 2015 and 2016, GLS was more widely spread in Ontario in 2017. The disease was more severe in five Southern Ontario counties (Chatham-Kent, Essex, Lambton, Middlesex and Oxford), the same as reported in 2016 (Jindal et al 2017). In Eastern Ontario, where 51 fields were sampled, GLS was not detected in any of the fields. At the OCC trial in Dresden, some hybrids were highly susceptible to GLS, as was the case for various hybrids in demonstration plots in Chatham-Kent and Essex. Traditionally, GLS has been a major concern in the extreme southwest (Essex and Chatham-Kent) where factors such as increased corn residues, intensive hybrid and seed corn production, and humid conditions have favoured its development. This is in stark contrast to the U.S. Midwest corn-belt where GLS occurs throughout the region and is the most economically important foliar corn disease (Wise 2012).

Anthracnose leaf blight and dieback was detected in only 14 fields (6%); considerably less than previous years.

Other leaf spots: Northern leaf spot was found in 11 fields (5%) in Southern Ontario. Its incidence was also considerably lower compared to 2016 (Jindal et al 2017). **Physoderma brown spot** was found in a few fields visited throughout the province with low severity and incidence in most fields. Holcos leaf spot was also found in a few fields visited.

Fungal ear and stalk rot diseases: **Common smut** and **head smut** were found only in 20 (9%) of sampled fields (Table 1); less than last year. There were only two fields with incidences greater than 3%. Head smut was found in 2 fields in 2017. **Ear rot** was found in 23 fields at a low incidence levels. Ears with exposed tips were found to have more *Fusarium* spp. infection. **Stalk rot** was not found in any of the fields visited. The low incidence and occurrence of ear and stalk diseases at the time of the survey suggests the occurrence of these diseases was low in 2017 compared to earlier years; however, timing of this survey was likely too early to detect high levels of ear and stalk rots. **Ear rots** (*Gibberella, Fusarium, Diplodia,* and *Penicillium*) were at low levels at the time of the survey. In order to assess the presence of corn ear moulds and grain vomitoxin (DON) in the 2017 corn crop, a separate survey was conducted by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) along with the Ontario Agri-Business Association (OABA) from October 7 to 20, 2017, which observed that visual mould symptoms were less compared to earlier years. Eighty-six per cent of tested grain samples exhibited below 2 ppm DON which was also much less than what has been observed in recent years (Roser and Tenuta 2017).

Stewart's bacterial wilt, which historically has been the most economically important disease for Ontario seed corn production, once again was not detected in any of the seed or commercial corn fields sampled during 2017. The decline in Stewart's bacterial wilt in Ontario, as well as in the U.S., has been attributed to the effective control of its vector, the corn flee beetle through the use of neonicotinoid seed treatments (Chaky et al. 2013). Likewise, **Goss's bacterial wilt and blight** were also not found in Ontario.

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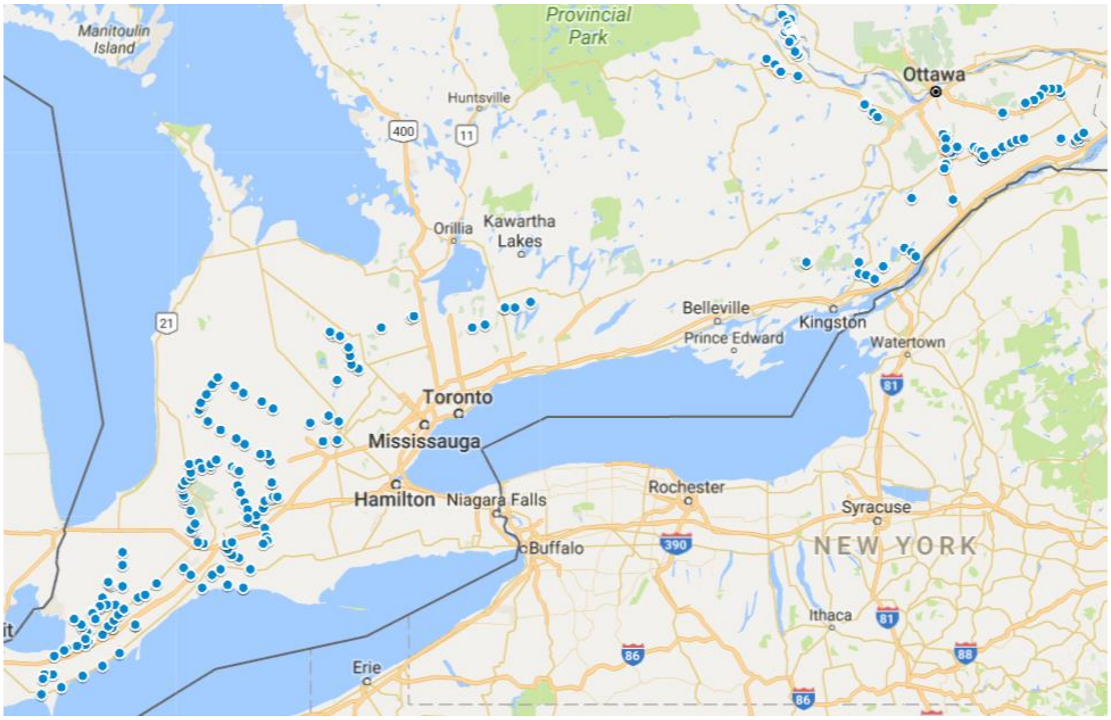

Figure 1. 2017 Ontario corn diseases survey sampling sites indicated by the blue circles**.**

Table 1. Disease occurrence in Ontario corn crops in 2017 grouped by county and region.

County	No. crops	Disease / number of crops affected (n=231)							
		ALB	Eye-spot	GLS	NCLB	Rust	Smut	Ear rot	Stalk rot
Chatham-Kent	31	5	21	30	27	31	5	3	0
Dufferin	10	0	4	0	10	10	1	1	0
Durham	8	0	4	0	4	8	1	1	0
Elgin	11	3	7	4	11	11	0	2	0
Essex	6	0	4	6	5	6	0	0	0
Frontnac	3	0	3	0	3	3	0	0	0
Huron	17	0	14	1	15	17	3	3	0
Lambton	8	0	7	8	8	8	0	0	0
Leeds & Grenville	15	1	15	0	15	15	2	1	1
Middlesex	16	1	12	4	13	15	0	0	0
Ottawa	10	1	9	0	5	8	1	1	1
Oxford	21	1	16	3	20	20	2	8	0
Perth	13	1	8	0	10	13	1	1	0
Prescott & Russell	7	1	7	0	7	7	1	1	0
Renfrew	24	0	17	0	7	24	0	1	0
Stormont, Dundas & Glengarry	22	0	22	0	22	22	1	0	0
Waterloo	3	0	3	0	3	3	1	0	0
Wellington	6	0	4	0	5	6	1	0	0
Central Ontario	8	0	4	0	4	8	1	1	0
Eastern Ontario	81	3	73	0	59	79	5	4	2
Southern Ontario	93	10	67	55	84	91	7	13	0
Western Ontario	49	1	33	1	43	49	7	5	0
Ontario	231	14	177	56	190	227	20	23	2

ALB = Anthracnose leaf blight and die back, **GLS** = Grey leaf spot, **NCLB** = Northern corn leaf blight, **Rust** = Common and Southern rust, **Smut** = Common smut, **Ear rot** = includes Gibberella ear rot and Fusarium ear rot, **Stalk rot** = includes Fusarium stalk rot and Pythium stalk rot.

Table 2. Severity and incidence of major diseases in the Ontario corn crop in 2017, grouped by county and region.

County	Eyespot				GLS				NCLB				Common Rust			
	Severity[1]		Incidence (%)[2]		Severity[1]		Incidence (%)[2]		Severity[1]		Incidence (%)[2]		Severity[1]		Incidence (%)[2]	
	Mean	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Chatham-Kent	2.1	1.0-3.5	3.3	0-15	3.0	1.0-4.5	12.0	0-50	2.2	1.0-4.0	3.6	0-20	3.9	1.0-6.0	28.9	0-100
Dufferin	1.7	1.0-4.0	4.0	0-35	-	-	-	-	2.8	2.0-5.0	10.5	1-80	4.3	2.5-5.5	50.9	4-85
Durham	1.9	1.0-4.0	5.5	0-35	-	-	-	-	1.6	1.0-2.5	1.0	0-5	3.6	2.5-5.5	29.4	2-70
Elgin	1.9	1.0-4.5	2.4	0-10	1.7	1.0-3.5	2.5	0-10	2.4	2.0-3.0	3.3	1-8	3.4	2.0-4.5	13.8	2-35
Essex	1.9	1.0-3.0	2.1	0-7.5	3.0	2.5-4.0	5.5	3-15	1.9	1.0-2.5	1.6	0-4	3.3	2.5-4.0	11.7	5-18
Frontenac	2.7	2.5-3.0	8.7	2-20	-	-	-	-	2.7	2.5-3.0	6.7	3-12	4.0	3.0-4.5	53.3	15-75
Huron	2.4	1.0-4.0	7.9	0-35	1.1	1.0-2.0	0.1	0-2	2.3	1.0-5.0	5.4	0-35	3.2	2.0-5.5	25.6	2-70
Lambton	2.2	1.0-3.5	5.5	0-18	2.6	2.0-4.5	5.1	1-20	2.5	2.0-3.0	4.1	2-9	3.4	2.0-4.5	24.5	4-50
Leeds & Grenville	2.9	2.0-3.5	13.2	1-40	-	-	-	-	2.6	2.0-3.5	6.6	1-45	3.1	2.0-4.5	19.5	1-70
Middlesex	2.3	1.0-4.0	4.3	0-20	1.4	1.0-3.5	1.1	0-5	2.3	1.0-4.0	5.6	0-20	3.0	1.0-4.0	9.2	0-25
Ottawa	3.0	1.0-4.5	21.6	0-50	-	-	-	-	2.1	1.0-4.0	6.9	0-35	3.0	1.0-5.5	24.5	0-80
Oxford	2.2	1.0-4.0	5.5	0-25	1.2	1.0-2.5	0.5	0-5	2.9	1.0-4.0	10.2	1-45	3.1	1.0-4.5	18.1	0-70
Perth	1.8	1.0-3.0	2.8	0-10	-	-	-	-	2.5	1.0-4.5	6.2	0-30	3.4	2.5-4.5	30.2	2-70
Prescott & Russell	3.8	2.0-5.5	37.0	1-80	-	-	-	-	2.6	2.0-3.5	9.1	1-30	3.9	2.5-6.0	34.6	2-90
Renfrew	2.3	1.0-4.0	7.5	0-35	-	-	-	-	1.4	1.0-3.0	1.1	0-12	3.6	2.0-6.0	33.3	1-100
Stormont, Dundas & Glengarry	3.3	2.0-5.0	19.0	1-70	-	-	-	-	3.4	2.0-5.5	27.6	1-85	3.4	2.0-5.5	25.1	1-70
Waterloo	3.3	2.0-6.0	24.0	1-70	-	-	-	-	3.3	3.0-4.0	10.0	5-15	4.0	3.0-5.5	48.3	25-70
Wellington	1.7	1.0-2.0	0.7	0-1	-	-	-	-	2.7	1.0-4.0	4.0	0-10	3.7	3.0-5.0	38.3	15-60
Central Ontario	1.9	1.0-4.0	5.5	0-35	-	-	-	-	1.6	1.0-2.5	1.0	0-5	3.6	2.5-5.5	29.4	2-70
Eastern Ontario	3.0	1.0-5.5	17.8	0-80	-	-	-	-	2.5	1.0-5.5	9.7	0-85	3.5	1.0-6.0	31.7	0-100
Southern Ontario	2.1	1.0-4.0	3.9	0-25	2.1	1.0-4.5	4.4	0-50	2.4	1.0-4.5	4.7	0-45	3.3	1.0-6.0	17.7	0-100
Western Ontario	2.2	1.0-6.0	7.9	0-70	0.0	1.0-2.0	0.0	0-2	2.7	1.0-5.0	7.2	0-80	3.7	1.0-5.5	38.7	0-85
All Ontario	**2.3**	**1.0-6.0**	**8.8**	**0-80**	**1.3**	**1.0-4.5**	**1.4**	**0-50**	**2.3**	**1.0-5.5**	**5.7**	**0-85**	**3.5**	**1.0-6.0**	**29.4**	**0-100**

[1]Ontario Corn Committee (OCC) 2017 performance trials

[2]Disease severity in affected crop was rated as percentage of leaf area with symptoms; **eyespot**, GLS (**Grey leaf spot**) and **common rust** were rated on a 1-7 scale (1=no symptoms, 2=<1%, 3=1-5%, 4=6-20%, 5=21-50%, 6=>50 % leaf area with symptoms and 7= most of the leaves dead); NCLB (**Northern corn leaf blight**) on 1-7 scale based on percentage of leaf area with symptoms (1=no symptoms; 2=<1% (1% leaves with symptoms); 3=12-5% (1-10% leaves with symptoms); 4=6-20% (11 to 25% leaves with symptoms); 5=21-50% (>50% lower leaves and >25% of the centre and upper leaves with symptoms), 6=51-75% (lower leaves dead, >50 centre leaves and >25% upper leaves with symptoms); 7=most leaves almost dead).

[3]Incidence is number of affected plants/total number of plants observed x 100

Table 3. Severity and incidence of major diseases observed ato OCC[1]corn trial sites in Ontario, 2017.

CC[1] trial site	ES		GLS		NCLB		Common Rust	
	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]
Belmont	4.5	10	2.0	3	2.5	3	4.5	35
Blyth	3.0	5	1.0	0	4.0	15	4.0	20
Dresden	4.0	15	4.5	50	2.0	1	4.5	3
Dundalk	4.0	35	1.0	0	5.0	80	5.5	80
Elora	2.0	1	1.0	0	3.0	5	3.5	5
Exeter	2.5	3	1.0	0	2.5	2	5.5	70
Ilderton	4.0	20	1.0	0	4.0	15	4.0	10
Lindsay	2.5	5	1.0	0	2.5	5	3.5	35
Orangeville	2.0	1	1.0	0	3.0	2	5.0	70
Ottawa	2.0	1	1.0	0	4.0	25	3.0	3
Ridgetown	2.0	1	3.5	13	2.0	2	4.5	20
Tilbury	2.5	3	2.5	4	2.0	4	4.0	23
Waterloo	2.0	1	1.0	0	2.5	1	3.5	25
Winchester	5.0	55	1.0	0	4.0	60	5.5	70
Wingham	2.5	7	1.0	0	4.5	35	3.5	20
Woodstock	3.5	15	2.0	5	3.5	15	3.5	15

OILSEEDS, PULSES, FORAGES AND SPECIAL CROPS / OLÉAGINEUX, PROTÉAGINEUX, PLANTES FOURRAGÈRES ET CULTURES SPÉCIALES

CROP / CULTURE: Canola
LOCATION / RÉGION: Alberta

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TITLE / TITRE: THE OCCURRENCE AND SPREAD OF CLUBROOT ON CANOLA IN ALBERTA IN 2017

ABSTRACT: A survey of 554 canola (*Brassica napus* L.) crops in Alberta for the occurrence of clubroot (*Plasmodiophora brassicae* Woronin) resulted in the identification of 72 new records of the disease. An additional 229 cases were found in surveys carried out by county and municipal personnel, for a total of 301 new clubroot infestations confirmed in 2017. This brings the grand total of confirmed cases of clubroot in the province to 2744, including the first records of the disease in the Peace Country of northwest Alberta.

METHODS: Five hundred and fifty-four canola (*Brassica napus* L.) crops were surveyed for the occurrence of clubroot (*Plasmodiophora brassicae* Woronin) across Alberta in 2017. The majority of fields were visited shortly after swathing from late August to September and had either not been inspected for clubroot previously or had been inspected and found to be free of the disease. Briefly, a 20-30 m^2 area was chosen near the entrance to each field and at least 50 canola roots were selected randomly and examined for the presence of clubroot. If no symptoms of the disease were observed, then no additional sampling was performed. If clubroot was found, then the entire field was inspected more extensively by sampling 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 survey approach was taken because clubroot most commonly is found near field entrances (Cao et al. 2009). Each sampled canola plant was assessed for clubroot symptom severity on the 0-3 scale of Kuginuki et al. (1999) where: 0 = no galling, 1 = a few small galls, 2 = moderate galling and 3 = severe galling. The severity ratings on individual plants were used to calculate an index of disease (ID) for each crop according to the method of Horiuchi and Hori (1980) as modified by Strelkov et al. (2006). Surveillance activities were coordinated with the agricultural fieldman in each municipality, and the results of independent clubroot inspections conducted by county and municipal staff were collected and combined with the data from the Alberta-wide clubroot survey. The emphasis in the province-wide survey was on monitoring the clubroot situation in regions at the edge of the outbreak, while inspections by municipal staff were often carried out in areas where clubroot is well-established and did not usually include assessments of disease severity.

RESULTS AND COMMENTS: Clubroot was identified in 72 of the 554 canola crops surveyed in 2017 (Table 1), including the first records of the disease in Big Lakes County, Brazeau County, Lac La Biche County, the County of Paintearth and the Municipal District (M.D.) of Wainwright. The identification of clubroot in Big Lakes County is particularly significant because it represents the first confirmed occurrence of the disease in the Peace Country of northwestern Alberta. The survey results also indicate the continued spread of clubroot into eastern Alberta, with confirmed infestations now recorded along the border with Saskatchewan all the way from Lac La Biche County to the M.D. of Wainwright (Fig. 1). While the movement of clubroot into southern Alberta has been slower, there is some evidence of its dispersal in this region as well, with the identification of the first cases of clubroot in the County of Paintearth this year and in Mountain View County in 2015 (Strelkov et al. 2016a). In addition, three new records of the disease were found in the County of Newell, nearly doubling the number of confirmed cases there. In general, clubroot severity ranged from mild to severe, with an average ID <10% in 44 crops, 10-60% in 23 crops, and >60% in 5 crops. All severely infested crops were confirmed to be susceptible canola hybrids. Nonetheless, significant symptoms of the disease were identified in at least 40 fields planted to clubroot resistant canola cultivars, and *P. brassicae* populations recovered from these fields will be tested for their ability to overcome host resistance. The emergence of new strains of the pathogen, capable of overcoming clubroot resistance, was first detected in 2013 (Strelkov et al. 2016b).

In addition to the 72 new cases of clubroot found in the Alberta-wide survey, a further 229 new records of the disease were confirmed in field inspections carried out by municipal and county personnel in Barrhead, Beaver, Bonnyville, Camrose, Clearwater, Flagstaff, Lac Ste. Anne, Lacombe, Lamont, Leduc, Lesser Slave River, Minburn, Newell, Parkland, Red Deer, St. Paul, Strathcona, Two Hills, Vermillion River, Wainwright and Woodlands (Table 1). Collectively, surveillance activities confirmed 301 new clubroot infestations in Alberta in 2017, for a grand total of 2744 recorded cases of the disease distributed across 36 counties/municipal districts plus two cities and one town (Fig. 1).

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Table 1. Distribution of *Plasmodiophora brassicae*-infested canola fields identified in Alberta in 2017.

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
Athabasca	23	4	0	4
Barrhead	0	--	5	5
Beaver	0	--	11	11
Big Lakes	11	4	17	21
Bonnyville	0	--	2	2
Brazeau	16	2	0	2
Camrose	0	--	14	14
Cardston	10	0	0	0
Clearwater	0	--	2	2
City of Calgary	1	0	0	0
Cypress	10	0	0	0
Flagstaff	12	0	4	4
Foothills	10	0	0	0
Forty Mile	10	0	0	0
Kneehill	15	0	0	0
Lac La Biche	20	1	0	1
Lac Ste. Anne	23	9	9	18
Lacombe	0	--	1	1
Lamont	20	6	7	13
Leduc	0	--	69	69
Lesser Slave River	0	--	1	1
Lethbridge	10	0	0	0
Minburn	0	--	1	1
Mountain View	10	0	0	0
Newell	10	0	3	3
Northern Sunrise	11	0	0	0
Paintearth	21	2	0	2
Parkland	0	--	37	37
Pincher Creek	10	0	0	0
Red Deer	22	5	4	9
Rocky View	10	0	0	0
Smoky Lake	26	4	0	4
Special Area #2	10	0	0	0
Special Area #3	10	0	0	0
Special Area #4	10	0	0	0
St. Paul	23	12	16	28
Starland	10	0	0	0
Stettler	10	0	1	1
Strathcona	0	--	12	12
Taber	10	0	0	0
Thorhild	24	5	0	5
Two Hills	21	2	6	8
Vermillion River	21	5	2	7
Vulcan	15	0	0	0
Wainwright	23	4	4	8
Warner	10	0	0	0
Wetaskiwin	21	7	0	7
Wheatland	15	0	0	0
Willow Creek	10	0	0	0
Woodlands	0	--	1	1
TOTAL	**554**	**72**	**229**	**301**

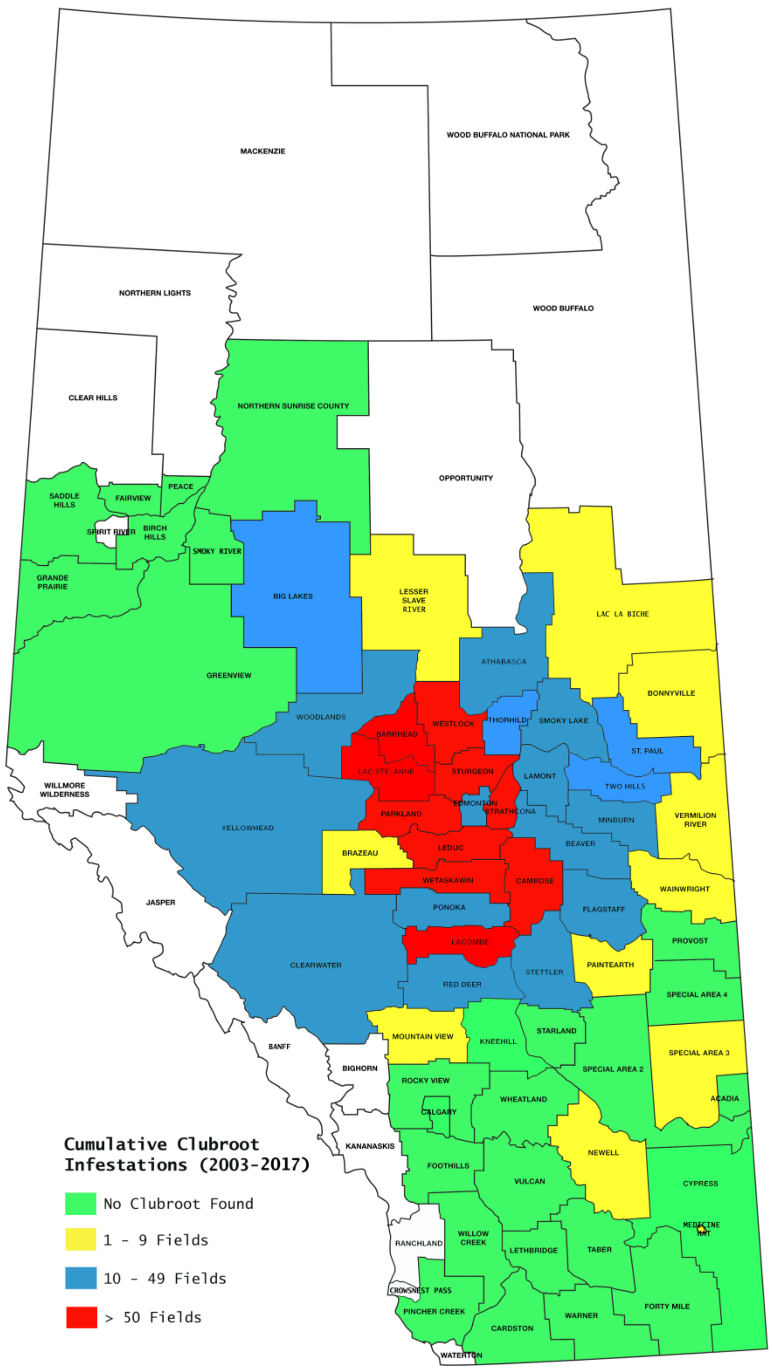

Figure 1. The occurrence of clubroot on canola in Alberta as of fall 2017. Since the start of clubroot surveillance activities in 2003, the disease has been confirmed in a total of 2744 fields representing 36 counties and municipal districts in the province, as well as in rural areas of the cities of Edmonton and Medicine Hat, and the town of Stettler.

CROP / CULTURE: Canola
LOCATION / RÉGION: Alberta

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TITLE / TITRE: A SURVEY FOR BLACKLEG AND SCLEROTINIA STEM ROT ON CANOLA IN ALBERTA IN 2017

ABSTRACT: Blackleg disease of canola (*Brassica napus* L.) is caused by *Leptosphaeria maculans* (Sowerby) P. Karst. Symptoms of blackleg are common across Alberta, however where host resistance to blackleg is deployed, disease severity is often very low (Kutcher et al. 2013; Harding et al. 2016; 2017). Stem rot of canola is caused by *Sclerotinia sclerotiorum* (Lib.) de Bary and is also a commonly occurring disease in Alberta. A survey for blackleg and stem rot on canola was undertaken to characterize the prevalence, incidence and severity of these two diseases in Alberta in 2017.

INTRODUCTION AND METHODS: *Leptosphaeria maculans*, the causal agent of blackleg, is a declared pest in Alberta's Agricultural Pests Act and Regulation. Recent surveys for blackleg on canola in Alberta in 2012, 2015 and 2016 indicated that, while the pathogen was commonly found across the province, cases of high severity are extremely rare. Since it is important to monitor the distribution, prevalence and severity of this pathogen, a survey for blackleg in Alberta was undertaken in 2017. A survey target of 1% of canola fields in each county/municipality was established based on the 2016 Agricultural Census for Alberta. Surveyors were encouraged to visit canola fields the week prior to swathing. Post-swathing ratings were discouraged unless they were taken within a few days of cutting. Surveyors walked a W-shaped pattern, stopping at five locations in the field. Sampling locations were at least 20 m apart and at least 20 m from field margins. The lower stems (bottom 6 in) of twenty plants were collected at each sampling location (100 stems per field). All stems were sent directly to Alberta Agriculture and Forestry stations, either the Crop Diversification Centre North (Edmonton, AB) or South (Brooks, AB), for analysis. Each canola stem sample was evaluated for the presence of blackleg symptoms such as stem cankers, lesions with pycnidia and internal stem blackening. Blackleg prevalence was calculated as percent fields with symptoms. Blackleg incidence was calculated as percent stems showing blackleg symptoms. Blackleg severity was estimated using 0- 5 scale for rating vascular discoloration (WCC/RCC, 2009; Table 1). Stem rot infections on lower main stems, caused by *Sclerotinia sclerotiorum*, were also recorded for some of the fields sampled. Stems were considered to have stem rot infection caused by *S. sclerotiorum* when stems were soft and would shred when twisted, and/or when sclerotia were observed inside the stem. Prevalence was calculated as percent fields with stem rot and incidence as percent stems showing stem rot symptoms.

RESULTS AND COMMENTS: In total, 421 canola fields were surveyed for blackleg and 352 fields for stem rot in 2017. A total of 346 were found to have blackleg symptoms for a prevalence of 82.2% which indicated that blackleg is widespread in Alberta. Symptoms were seen on 5874 of the 41881 canola stems for an overall blackleg incidence of 14.0%. The overall average severity was 0.26. The incidence and severity values suggest that while blackleg may be widespread, the infection rate and severity remain low overall. Blackleg survey results for each county are presented in Table 2 and Figure 1. Sclerotinia stem rot was observed in 75 of the 352 fields for a prevalence of 21.3%. The incidence of sclerotinia stem rot ranged from 0 to 54% with an overall incidence of 1.95% (Table 3).

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Table 1. A rating scale to estimate blackleg severity on canola (WCC/RCC 2009).

Rating	Symptoms
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
5	Diseased tissue occupies 100% of cross-section with significant constriction; tissue dry and brittle; plant dead

Table 2. Blackleg prevalence, incidence and severity in canola fields in Alberta in 2017.

County or Municipality	# fields Affected	Disease Prevalence (%)	Disease Incidence (%)		Disease Severity[2]	
			Mean[1] (%)	Range (%)	Mean[1]	Range
Athabasca	4/4	100	5.5	3 – 10	0.063	0.03 - 0.13
Barrhead	6/6	100	21.3	6 – 45	0.518	0.07 - 1.3
Beaver	8/9	88.9	14.5	0 – 52	0.381	0 - 1.59
Big Lakes	6/9	66.7	3.4	0 – 8	0.042	0 – 0.11
Birch Hills	9/9	100	17.5	3 – 60	0.228	0.03 – 1.03
Bonnyville	0/2	0	0	n.a.	n.a.	n.a.
Brazeau	4/8	50	2.2	0 – 7.8	0.038	0 – 0.14
Camrose	15/16	93.7	25.3	0 – 65	0.616	0 – 1.39
Cardston	1/6	16.7	1.2	0 – 7	0.012	0 – 0.07
City of Calgary	1/1	100	25	25	0.25	0.25
Clear Hills	3/3	100	12.2	3 – 26,7	0.126	0.03 – 0.27
Cypress	0/2	0	n.a.	n.a.	n.a.	n.a.
Fairview	3/6	50	13.4	0 – 55.1	0.194	0 – 0.88
Flagstaff	10/12	83.3	12.3	0 – 36	0.15	0 – 0.6
Foothills	4/4	100	25.9	13 – 53	0.494	0.26 – 0.83
Forty Mile	5/5	100	6.2	2 – 11	0.08	0.04 – 1.5
Grande Prairie	9/10	90	8.0	0 – 16	0.107	0 – 0.23
Greenview	3/5	60	2.8	0 – 8	0.07	0 – 0.018
Kneehill	11/15	73.3	10.4	0 – 22.8	0.155	0 – 0.41
Lac La Biche	1/1	100	3	3	0.04	0.04
Lac Ste Anne	½	50	11.5	0 – 23	0.26	0 – 0.52
Lamont	6/7	85.7	19.7	0 – 40	0.499	0 – 1.06
Leduc	5/5	100	27	6 – 47	0.76	0.06 – 1.64
Lethbridge	4/6	66.7	10.5	0 – 26	0.208	0 – 0.54
Mackenzie	5/7	71.4	2.9	0 – 7	0.043	0 – 0.11
Minburn	12/12	100	23.4	1.9 – 67	0.412	0.019 – 1.38
Mountain View	6/6	100	7.3	1 – 19	0.11	0.02 – 0.33
Newell	3/3	100	26.3	14 – 49	0.425	0.16 – 0.814
Northern Lights	6/7	85.7	3.7	0 – 8	0.061	0 – 0.14
Northern Sunrise	31/32	96.9	16.7	0 – 58.2	0.243	0 – 1.33
Paintearth	4/6	66.7	27.3	0 – 65	0.469	0 – 0.94
Parkland	2/2	100	31	18 – 44	0.915	0.43 – 1.4
Peace	½	50	2.5	0 – 5	0.025	0 – 0.05
Pincher Creek	0/2	0	n.a.	n.a.	n.a.	n.a.
Ponoka	5/5	100	16.2	2 – 57.8	0.381	0.02 – 1.5
Provost	4/6	66.7	12.7	0 – 47	0.197	0 – 0.89
Red Deer	9/9	100	18.3	7 – 40	0.209	0.07 – 0.4
Rocky View	7/8	87.5	15.9	0 – 41.2	0.205	0 – 0.578
SA 2	½	50	1.5	0 – 3	0.015	0 – 0.03
SA 3	0/2	0	n.a.	n.a.	n.a.	n.a.
SA4	3/3	100	12	8 – 14	0.14	0.08 – 0.2
Saddle Hills	5/5	100	13.6	3 – 43	0.168	0.03 – 0.58
Smoky Lake	¾	75	0.8	0 – 1	0.01	0 – 0.02
Smoky River	8/12	66.7	4.9	0 – 21	0.054	0 – 0.25
Spirit River	3/3	100	8	1 – 12	0.08	0.01 – 0.12
St. Paul	5/5	100	11.2	1 – 23	0.204	0.01 – 0.39
Starland	6/6	100	26.8	5 – 50	0.54	0.07 – 1.46
Stettler	5/5	100	10.2	6 – 18	0.112	0.06 – 0.21
Strathcona	3/3	100	12	9 – 12	0.16	0.12 – 0.19
Sturgeon	9/10	90	44	0 – 66	1.288	0 – 2.16
Taber	5/5	100	14.6	4 – 37	0.264	0.06 – 0.75
Thorhild	¾	75	22	0 – 45	0.608	0 – 1.33
Two Hills	4/7	57.1	4.7	0 – 16	0.123	0 – 0.43
Vermillion River	6/15	40	2.2	0 – 26	0.078	0 – 1.06
Vulcan	14/15	93.3	20.2	0 – 74	0.499	0 – 1.9
Wainwright	10/10	100	41.4	0 – 52	0.561	0.07 – 0.792
Warner	5/6	83.3	13.2	0 – 56	0.271	0 – 1.23
Westlock	8/9	88.9	13	0 – 37.1	0.167	0 – 0.514
Wetaskiwin	5/5	100	12.8	1 – 28	0.294	0.04 – 0.85
Wheatland	5/15	33.3	1	0 – 6	0.012	0 – 0.07
Willow Creek	4/5	80	19.2	0 – 32	0.247	0 – 0.45
Yellowhead	1/1	100	1	1	0.01	0.01
Total or Average	**346/421**	**82.19**	**14.0**	**0 – 74**	**0.263**	**0 – 2.16**

[1]Means represent an average of all the crops surveyed.
[2]Disease severity was assessed using a 0-5 scale.
n.a. = not applicable

Table 3. Prevalence and incidence of lower main stem infections by *S. sclerotiorum* in canola fields in Alberta in 2017.

County or Municipality	# fields affected	Disease Prevalence (%)	Disease Incidence (%)	
			Mean[1]	Range
Athabasca	0/4	0	n.a.	n.a.
Big Lakes	0/9	0	n.a.	n.a.
Birch Hills	2/9	22.2	0.33	0 – 2
Bonnyville	0/2	0	n.a.	n.a.
Brazeau	0/8	0	n.a.	n.a.
Cardston	3/6	50	6.7	0 – 21
City of Calgary	1/1	100	2	2
Clear Hills	0/3	0	n.a.	n.a.
Cypress	0/2	0	n.a.	n.a.
Fairview	2/6	33.3	3.8	0 – 21
Flagstaff	9/12	75	8.5	0 – 28
Foothills	0/4	0	n.a.	n.a.
Forty Mile	4/5	80	2.6	0 – 5
Grande Prairie	1/10	10	0.1	0 – 1
Greenview	1/5	20	0.2	0 – 1
Kneehill	8/15	53.3	5.53	0 – 19
Lac La Biche	0/1	0	n.a.	n.a.
Lethbridge	0/6	0	n.a.	n.a.
Mackenzie	0/7	0	n.a.	n.a.
Minburn	4/12	33.3	9.58	0 – 39
Mountain View	0/6	0	n.a.	n.a.
Newell	2/3	33.3	4	0 – 8
Northern Lights	0/7	0	n.a.	n.a.
Northern Sunrise	4/32	12.5	3.75	0 – 54
Paintearth	2/6	33.3	4.5	0 – 14
Peace	0.2	0	n.a.	n.a.
Pincher Creek	0/2	0	n.a.	n.a.
Ponoka	0/5	0	n.a.	n.a.
Provost	0/6	0	n.a.	n.a.
Red Deer	4/9	44.4	2.33	0 – 12
Rocky View	1/8	12.5	0.5	0 – 4
SA 2	0/2	0	n.a.	n.a.
SA3	0.2	0	n.a.	n.a.
SA4	2/3	33.3	1.67	0 – 4
Saddle Hills	0/5	0	n.a.	n.a.
Smoky Lake	0/4	0	n.a.	n.a.
Smoky River	0/14	0	n.a.	n.a.
Spirit River	0/3	0	n.a.	n.a.
St. Paul	0/5	0	n.a.	n.a.
Starland	4/6	66.7	5	0 – 20
Stettler	0/5	0	n.a.	n.a.
Taber	1/5	20	1.6	0 – 8
Two Hills	0/7	0	n.a.	n.a.
Vermillion River	0/15	0	n.a.	n.a.
Vulcan	8/15	53.3	2.27	0 – 22
Wainwright	3/10	30	1.6	0 – 8
Warner	2/6	33.3	0.5	0 – 2
Westlock	4/9	44.4	0.89	0 – 3
Wheatland	0/15	0	n.a.	n.a.
Willow Creek	4/5	80	3.2	0 – 7
Total or Average	**75/352**	**21.3**	**1.95**	**0 – 54**

[1]Means represent an average of all the crops surveyed in a county or municipality.
n.a. = not applicable.

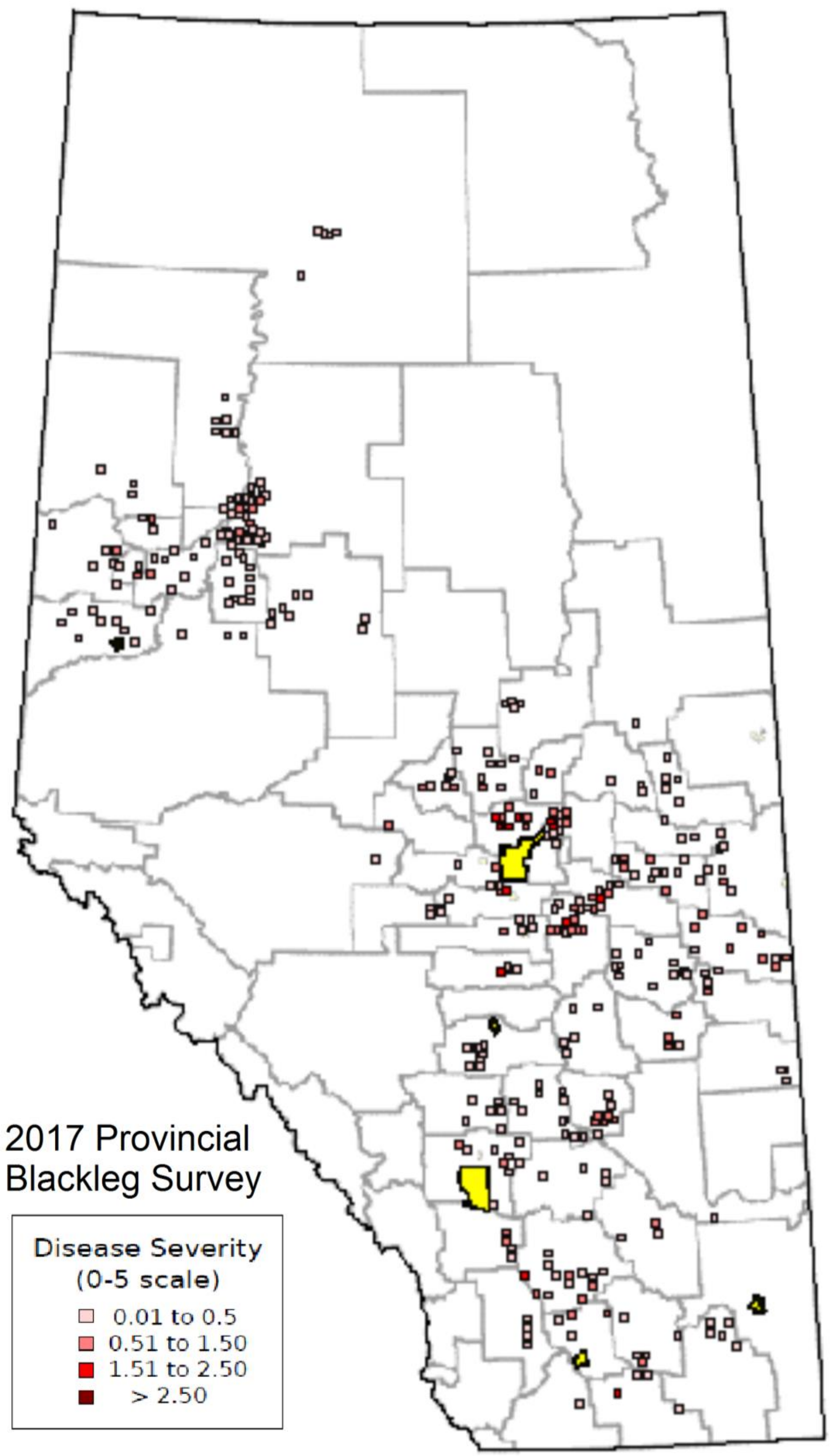

Figure 1. The location and severity of blackleg in 421 canola fields in Alberta in 2017.

CROP / CULTURE: Canola
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2017

ABSTRACT: The annual survey in Saskatchewan covered 281 canola fields across six large regions of the province. Blackleg was the most prevalent disease, occurring in 73% of the crops surveyed. The mean incidence of blackleg basal cankers among all crops surveyed in Saskatchewan was 11% but ranged from 2% to 17% among regions. Sclerotinia stem rot was observed in 52% of crops surveyed with a mean disease incidence of 3% (ranging from 0.6% to 6%).

METHOD: A total of 281 canola crops were surveyed between August 2 and Sept 29 in the major canola growing regions of Saskatchewan. Optimally the number of crops in each region would be approximately proportionate to the canola production area within each region. In 2017, the number of surveyed crops was highest in the Northwest with 133 out of 281 fields being located in this region. The distribution of surveyed crops across the rest of the province was as follows: 29 (Northeast), 21 (West-central), 27 (East-central), 21 (Southwest) and 50 (Southeast) crops. The survey was conducted where possible before swathing when plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). In 2017, thirty-one of the crops were surveyed outside of this range and were recorded as swathed at the time of the survey. Disease assessments were made by examining 20 plants from each of five sites in each field. Individual sample sites were located at least 20 m from the field edge and separated from each other by at least 20 m. Fields were assessed for prevalence (percent of fields with symptoms of the disease) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.), alternaria black spot (*Alternaria brassicae, A. raphani),* and fusarium wilt (*F. oxysporum* f.sp. *conglutinans*). Incidence (percent of plants surveyed with symptoms of the disease per field) was recorded for sclerotinia stem rot, blackleg (basal cankers and stem lesions) and aster yellows.

Severity ratings were also recorded for both sclerotinia stem rot and blackleg. For sclerotinia stem rot, each plant (100 per field) was rated for severity based on a rating scale of 0 to 5 (Kutcher and Wolf 2006) (Table 1). For blackleg, plant stems were cut at the soil surface and then scored for basal canker severity using a rating scale ranging from 0 to 5 (WCC/RRC 2009) (Table 2). Average severity values for blackleg and sclerotinia stem rot in each field were calculated as the sum of the severity ratings divided by the total number of plants surveyed. For all of the diseases assessed, prevalence and average disease incidence or severity values were calculated for the province and for each of the six regions within the province.

Soil samples (~1L) were collected from 103 fields and are being analyzed for the presence of *P. brassicae* at the Saskatchewan Ministry of Agriculture's Crop Protection Laboratory using a quantitative (q)PCR-based diagnostic test (Rennie et al. 2011). Analysis of soil samples collected in 2017 is still in process and the results will not be presented in this report.

RESULTS AND COMMENTS: Approximately 5.1 million ha (12.6 million acres) of canola were seeded in Saskatchewan in 2017 (Statistics Canada 2017). This represents highest seeded hectares of canola in Saskatchewan on record. Environmental conditions varied throughout the province in 2017, with the central and southern regions of the province being affected by an extended period of hot, dry conditions. Fall weather created favorable conditions for harvest throughout most of Saskatchewan and by October 23, 99% of the canola was harvested (Government of Saskatchewan 2017).

Sclerotinia stem rot was observed in 52% of the canola crops surveyed. The average incidence in the province was 3% (6% in infested crops) (Table 3). The incidence was highest in the Northwest region (5%) and lowest in the Southeast region (0.6%). The average severity of sclerotinia stem rot in canola crops in Saskatchewan was 0.1. The severity of sclerotinia stem rot was highest in the Northwest region (0.2) and lowest in the Southeast, Southwest and West-central regions (<0.1) (Table 3).

Symptoms of blackleg basal infection (rated after cutting of lower stems) were present in 73% of the Saskatchewan canola crops included in the survey (Table 4). The average incidence in the province was 11% (16% in infested crops). The levels of blackleg were higher in 2017 than in 2016 (61% prevalence) and above the levels documented for the time period between 2011 and 2016 (Table 7). The high provincial average blackleg incidence, severity and prevalence in 2017 compared to previous years was influenced by the higher proportion of surveyed fields located in the Northwest region where tight canola rotations are common and the environmental conditions were favourable for blackleg development. In 2017, the average incidence was highest in the West-central region (17%) and lowest in the Northeast region (2%). The average severity of blackleg basal cankers in the province was 0.2. The average severity was highest in the Northwest region (0.3) and lowest in the Northeast and Southwest region (>0.1). Blackleg stem lesions were present in 27% of canola crops with an average incidence of 1% (data not shown). The highest average blackleg stem lesion incidence occurred in the East-central region (5%). The lowest incidence was in the Southwest region (0.1%). Stem samples symptomatic of internal blackleg infection were collected from 67 crops across the province and assessed via culturing for isolation and identification of fungal species. Of the 67 samples (1 per crop), 94% were found to have internal symptoms consistent with blackleg infection and 28 samples were selected for culturing and fungal identification. Only 18 of the 28 cultured samples (64%) produced *Leptosphaeria maculans*, the causal agent of blackleg disease.

Aster yellows had a prevalence of 20% with an average incidence of 0.3% (2% in infected fields). This is lower than in 2016 where the average incidence in Saskatchewan was 1% (5% in infected fields) (Ziesman et al. 2017). The highest prevalence of aster yellows in 2017 was in the Northwest region (30%) with an average incidence of 0.4% (Table 5). Province-wide, aster yellows were observed in 63% of surveyed canola fields (this includes observations in surveyed fields where infected plants were seen outside of the 100-plant sample).

Foot rot was recorded in 6% of canola crops in the province. The highest incidence was in the Northeast region (14%). Foot rot was not detected in the Southwest or West-central regions of Saskatchewan (Table 5).

In 2017, alternaria pod spot was recorded as present in 81% of canola crops surveyed in the province. Alternaria pod spot prevalence was highest in the East-central (96%) and lowest in the Southwest region (33%) (Table 5).

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

<table>
<tr><th>Disease Rating</th><th>Lesion Location</th><th>Symptoms</th></tr>
<tr><td>0</td><td>None</td><td>No symptoms</td></tr>
<tr><td>1</td><td>Pod</td><td>Infection of pods only</td></tr>
<tr><td>2</td><td rowspan="3">Upper plant parts</td><td>Lesion situated on main stem or branch(es) with potential to affect up to ¼ of seed formation and filling on plant</td></tr>
<tr><td>3</td><td>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</td></tr>
<tr><td>4</td><td>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</td></tr>
<tr><td>5</td><td>Lower plant part</td><td>Main stem lesion with potential effects on seed formation and filling of entire plant</td></tr>
</table>

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 disease incidence and severity of sclerotinia stem rot of canola in Saskatchewan in 2017.

REGION (NO. OF FIELDS)	Sclerotinia Stem Rot All Fields Surveyed			Sclerotinia Stem Rot Infected Fields Only	
	Prevalence (%)	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Northwest (133)	65	5	0.18 (2.2)	8	0.29 (3.7)
Northeast (29)	65	4	0.12 (1.7)	6.	0.19 (2.8)
West-central (21)	38	2	0.03 (0.64)	5	0.09 (1.7)
East-central (27)	56	2.0	0.05 (1.8)	3	0.10 (3.2)
Southwest (21)	29	1	0.02 (0.55)	3	0.07 (1.9)
Southeast (50)	24	1	0.01 (0.47)	2	0.04 (2.0)
Overall mean (281)	52	3	0.11 (1.5)	6	0.21 (3.2)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants).

Table 4. Mean disease incidence and severity of blackleg basal cankers in Saskatchewan in 2017.

REGION[1] (NO. OF FIELDS)	Blackleg Basal Cankers All Fields Surveyed			Blackleg Basal Cankers Infected Fields Only	
	Prevalence (%)	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Northwest (133)	90	16	0.27 (1.2)	18	0.30 (1.35)
Northeast (29)	34	2	0.03 (0.5)	6	0.08 (1.4)
West-central (21)	76	17	0.21 (0.9)	22	0.28 (1.2)
East-central (27)	70	7	0.17 (1.7)	10	0.25 (2.6)
Southwest (21)	33	4	0.06 (0.5)	13	0.17 (1.6)
Southeast (50)	66	7	0.10 (0.9)	10	0.16 (1.37)
Overall mean (281)	73	11	0.18 (1.05)	16	0.25 (1.5)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants).

Table 5. Prevalence (%) of alternaria pod spot, aster yellows, and foot rot of canola fields surveyed in Saskatchewan in 2017.

REGION (NO. OF FIELDS)	Alternaria Black Spot	Aster Yellows[1]	Foot Rot
Northwest (133)	94	30	6.7
Northeast (29)	93	26	14.3
West-central (21)	63	5	0
East-central (27)	96	22	7.1
Southwest (21)	33	0	0
Southeast (50)	66	14	4.0
Overall mean (281)	81	20	6.3

[1] Prevalence of aster yellows when identified within 100 plant sample.

Table 6. Mean disease incidence and sclerotinia severity reported as both, the average severity across infected plants and the average severity across all plants surveyed per field from 2011-2017 (Ziesman et al. 2017).

YEAR (NO. OF FIELDS)	Sclerotinia Stem Rot All Fields Surveyed		Sclerotinia Stem Rot Infected Fields Only	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
2011 (265)	20	0.56 (2.5)	22	0.61 (2.7)
2012 (253)	19	0.52 (2.5)	21	0.57 (2.8)
2013 (269)	5	0.10 (1.3)	9	0.17 (2.2)
2014 (274)	14	0.40 (2.2)	18	0.51 (2.8)
2015 (253)	7	0.15 (1.6)	11	0.24 (2.4)
2016 (224)	23	0.70 (2.8)	26	0.75 (3.0
2017 (281)	3	0.11 (1.5)	6	0.21 (3.2)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants per field).

Table 7. Mean blackleg canker severity reported as both, the average severity across infected plants and the average severity across all plants surveyed per field from 2011-2017 (Ziesman et al. 2017).

REGION[1] (NO. OF FIELDS)	Blackleg Basal Cankers All Fields Surveyed			Blackleg Basal Cankers Infected Fields Only	
	Prevalence (%)	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
2011 (265)	42	3	0.041 (.59)	7	0.10 (1.4)
2012 (253)	34	4	0.069 (0.54)	11	0.21 (1.7)
2013 (269)	25	2	0.029 (0.34)	8	0.12 (1.4)
2014 (274)	55	8	0.10 (0.7)	15	0.19 (1.3)
2015 (253)	59	9	0.11 (0.81)	15	0.19 (1.4)
2016 (224)	61	7	0.11 (0.85)	12	0.18 (1.4)
2017 (281)	73	11	0.18 (1.05)	16	0.25 (1.5)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants per field).

CROP / CULTURE: Canola
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: SURVEY OF CANOLA DISEASES IN MANITOBA IN 2017

ABSTRACT: A total of 162 canola crops were surveyed in Manitoba for the prevalence and incidence or severity of sclerotinia stem rot, blackleg, alternaria pod spot, aster yellows, fusarium wilt, foot rot and clubroot. Blackleg and sclerotinia stem rot were the most prevalent diseases throughout the province. No canola plants collected from the 162 surveyed canola crops were confirmed to have clubroot. Plant samples collected from three canola crops were confirmed to be infected with *Verticillium* spp.

METHODS: A total of 162 canola crops were surveyed in the southwest (60), northwest (39), eastern/interlake (21) and central (42) regions of Manitoba in August. All crops were *Brassica napus* and the majority were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). 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 five points near the entrance.

Canola crops 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* spp.), 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 the cross section and plant dead (WCC/RRC, 2009). If present, clubroot symptoms were rated using a scale of 0 to 3 where 0 = no galling and 3 = severe galling (Kuginuki et al. 1999). 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” for incidence 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 50 of the surveyed canola fields in Manitoba for DNA analysis (Cao et al. 2007) to test for the presence of the clubroot pathogen.

RESULTS: A number of diseases were present in each of the four regions of Manitoba. However, no clubroot symptoms were observed in the 162 Manitoba canola crops surveyed in 2017. Information on the recent monitoring and occurrence of clubroot in Manitoba in 2011, 2012 and 2013 is provided by Derksen et al. (2013) and Kubinec et al. (2014). A map of clubroot distribution in Manitoba (2009-2016) is available online (Manitoba Agriculture 2016).

Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province in 2017 (Tables 1, 2 and 3). The prevalence of sclerotinia-infested crops ranged from a high of 83% in the central region to 57% in the eastern/interlake region with a provincial mean of 73%. Mean disease incidence averaged across all crops was 7.1% and ranged from 11.4% in the eastern/interlake region to 3.2% in the southwest region. For infested crops only, mean disease incidence was 10%. Throughout the province, mean severity of sclerotinia stem rot was 1.9 and ranged from 2.1 in the central region to 1.5 in the eastern/interlake region.

Aster yellows was observed in 11% of canola crops in Manitoba with an average disease incidence of 2.8% in these crops (Table 2). 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, 2014, 2015 and 2016, aster leafhopper numbers were considerably lower than in 2012 (Canola Council of Canada 2013; Gavloski 2014, 2015, 2016, 2017) reducing the risk of this disease.

Blackleg basal cankers occurred in 70% of the crops surveyed in 2017 (Table 1), with prevalence ranging from 86% in the eastern/interlake region to 64% in both the central and northwest regions. The mean incidence of basal cankers averaged across all crops was 8.7%, while the mean incidence in infested crops was 12.6%. The severity of blackleg basal cankers was similar in recent years with mean ratings of 2 or less. A value of 2 indicates that 26-50% of the basal stem cross-section was diseased. The mean prevalence of blackleg stem lesions in 2017 was 52%. In previous years, 68%, 63%, 71%, 65% and 71% of crops had stem lesions in 2012, 2013, 2014, 2015 and 2016, respectively (McLaren et al. 2015, 2016, 2017). The average incidence of blackleg stem lesions was 8.7% in infested crops and 4.5% in all crops.

The mean prevalence of alternaria pod spot in 2017 was 23% and ranged from 43% in the eastern/interlake region to 8% in the southwest region (Table 2). The severity of alternaria pod spot was low with means < 2% in all regions.

Fusarium wilt was observed in <1% of canola crops surveyed in Manitoba, with a mean incidence of 4% in diseased fields and an average severity of 4.5 in these crops (Table 1). Foot rot occurred in 5.7% of canola crops surveyed with a provincial mean disease incidence of <1%. Foot rot was observed in all regions. White rust (*Albugo candida*) has not been confirmed in any crop of *B. napus* since 2011 (McLaren et al. 2012).

Plant samples collected from three canola crops were confirmed to be infected with *Verticillium* spp.

No canola plants collected from the 162 canola crops surveyed in 2017 were confirmed to have clubroot.
Plant samples collected from three canola crops were confirmed to be infected with *Verticillium* spp.

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Table 1. Mean prevalence, incidence and severity of sclerotinia stem rot and blackleg in Manitoba in 2017.

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 (42)	83	10.4	12.5	2.1	2.6	64	10.0	15.6	0.9	1.4	45	6.6	14.6
East/Inter. (21)	57	11.4	20.0	1.5	2.7	86	17.3	20.2	1.3	1.5	48	2.1	4.4
Northwest (39)	74	7.3	9.8	1.7	2.3	64	10.1	15.7	0.8	1.2	31	1.9	6.0
Southwest (60)	67	3.2	4.9	1.9	2.9	70	4.0	5.6	1.1	1.5	70	5.5	7.8
All regions (162)	73	7.1	0.0	1.9	2.6	70	8.7	12.6	1.0	1.4	52	4.5	8.7

[1] Prevalence (P).
[2] Disease incidence (DI) or severity (Sev.) across all surveyed crops.
[3] Disease incidence or 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 2017.

Crop Region	Alternaria pod spot		Aster yellows			Fusarium wilt					Foot rot		
(No. of crops)	P[1]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]	P[1]	Inc.[2]	Inc.[3]	Sev.[2]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]
Central (42)	31	1.3	12	0.5	3.8	0	0	0	0	0	12	0.8	6.2
East/Inter. (21)	43	1.0	10	0.6	6.5	5	0.2	4.0	0.2	4.5	5	<0.1	1.0
Northwest (39)	26	1.2	23	0.4	1.7	0	0	0	0	0	5	<0.1	0.1
Southwest (60)	8	1.3	2	0.1	1.0	0	0	0	0	0	2	0.2	13.0
All regions (162)	23	1.2	11	0.3	2.8	<1	<0.1	4.0	<0.1	4.5	5.7	0.3	5.2

[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 162 crops of *Brassica napus* in Manitoba in 2017.

	Percentage of crops surveyed with each disease						
Incidence range	**Sclerotinia stem rot**	**Blackleg basal cankers**	**Blackleg stem lesions**	**Aster yellows**	**Fusarium wilt**	**Foot rot**	**Alternaria pod spot**
0%	28	31	49	89	99	94	77
1-5%	38	30	29	9	1	4	23
6-10%	17	13	9	1	0	0	0
11-20%	7	12	6	1	0	2	0
21-50%	8	12	7	0	0	0	0
>50%	2	2	0	0	0	0	0

CROP / CULTURE: Caraway and Coriander
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: BLOSSOM BLIGHT IN SASKATCHEWAN CARAWAY AND CORIANDER IN 2017

ABSTRACT: Blossom blight was present at low levels or absent in caraway and coriander fields in Saskatchewan in 2017. Some of the observed field symptoms may have been due to abiotic stress.

INTRODUCTION AND METHODS: Blossom blight can be very destructive to coriander and caraway production when weather conditions are conducive for disease development. Caraway flowers were sampled from 12 locations (28 fields) in Saskatchewan (Table 1). Four fields at Pathlow were visited twice due to grower concerns about possible blossom blight. A total of 13 coriander fields at 12 locations in south and central Saskatchewan were sampled (Table 2), with one field at Plato sampled four times during flowering. Five umbels were collected from three locations in each field. Four floret clusters from each umbel were scored for the presence of brown ovaries, surface sterilized and plated on potato dextrose agar. Due to high sample volume from two neighbouring caraway sites in Lemberg and Duff, umbel samples from only one or two locations per field were analyzed. Organisms observed on ovary tissues were recorded after two days and colonies arising from floral tissues were recorded after seven days. A total of 410 caraway and 718 coriander umbelets were assessed. To gain insight into the possible cause of symptoms, the incidence of organisms recovered from asymptomatic (green) and symptomatic (brown) flower tissues was compared.

RESULTS AND COMMENTS: During the 2017 growing season, Saskatchewan received below-average rainfall and disease levels were low in both crops. Field observations from 19 caraway fields at seven locations noted some browning of stems, foliage and/or umbels up to an incidence of 10%, but surveyors speculated in seven of these fields that frost and/or chemical damage may have been the cause. In the submitted umbels, however, brown ovaries were observed in samples from only five locations (eight fields). This umbel browning (up to 10% incidence) could not be correlated with the recovery of any organism in plating tests (data not shown). The main pathogen of caraway, referred to in prior work as *Ascochyta* sp. (Duczek and Slinkard 2003) and observed in previous surveys (Armstrong-Cho et al. 2017) was absent from nine of 12 sites and recovered at trace levels (1% or less) in the remaining three fields.

Low levels of flower browning in coriander were observed at five locations (five fields). Of the five locations with brown umbels in samples, a confirmed but currently unnamed pathogen (Armstrong-Cho unpublished data), was present at three of these locations, with lower or no occurrence of this pathogen in green umbels from the same locations (Figure 1). Recovery of organisms from brown umbels collected from the Francis and Lemberg field locations were compared to organisms recovered from green umbels but the results did not correlate with the symptoms observed. This suggests that abiotic stress could have been the cause of these symptoms. A relatively high incidence of *Fusarium* spp. was observed in the Kyle samples (43%), but no disease symptoms were present (Figure 1). Some foliar disease was noted at two locations, Lucky Lake and Eston, but no biological cause could be determined (data not shown), and no umbel symptoms were detected at these sites. The incidence of confirmed pathogens of coriander (Armstrong-Cho unpublished data) in the surveyed area of Saskatchewan ranged from 0-25% for an unnamed pathogen, 0-2% for *Ascochyta* (large-spored *Phoma*), 0-43% for *Fusarium*, 0-27% for *Botrytis* and 0-13% for *Sclerotinia* (Figure 1). No pathogens have been identified to the species level at this time.

The incidence (recovery) of potentially pathogenic fungi from coriander flowers in a season without significant blossom blight losses gives us some insight into what levels of inoculum can be tolerated in the absence of conducive weather conditions for disease development. Further identification of the primary pathogens is still required to increase our understanding of blossom blight in caraway and coriander.

ACKNOWLEDGEMENTS: We gratefully acknowledge the participation of the Saskatchewan Crop Insurance Corporation and the Crop Development Centre staff for the collection of umbel samples and agronomic information. Sincere thanks to Laura Cox, Jill Leclaire and Maggi Bruce for their technical assistance. This work was made possible by funding from the Agriculture Development Fund, Herb Spice and Specialty Agriculture and the Western Grains Research Foundation.

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Table 1. Saskatchewan caraway fields sampled in 2017.

Location	Number of fields
Arborfield	2
Duff	3
Langenburg	1
Lemberg	6
Liberty	1
Marquis	1
Moose Jaw	4
Pathlow	4
Sedley	1
Watrous	3
Wolseley	1
Zenon Park	1

Table 2. Saskatchewan coriander fields sampled in 2017.

Location	Number of fields
Balcarres	1
Broadview	1
Central Butte	1
Eston	2
Francis	1
Gravelbourg	1
Killaly	1
Kyle	1
Lemberg	1
Lucky Lake	1
Moose Jaw	1
Plato	1

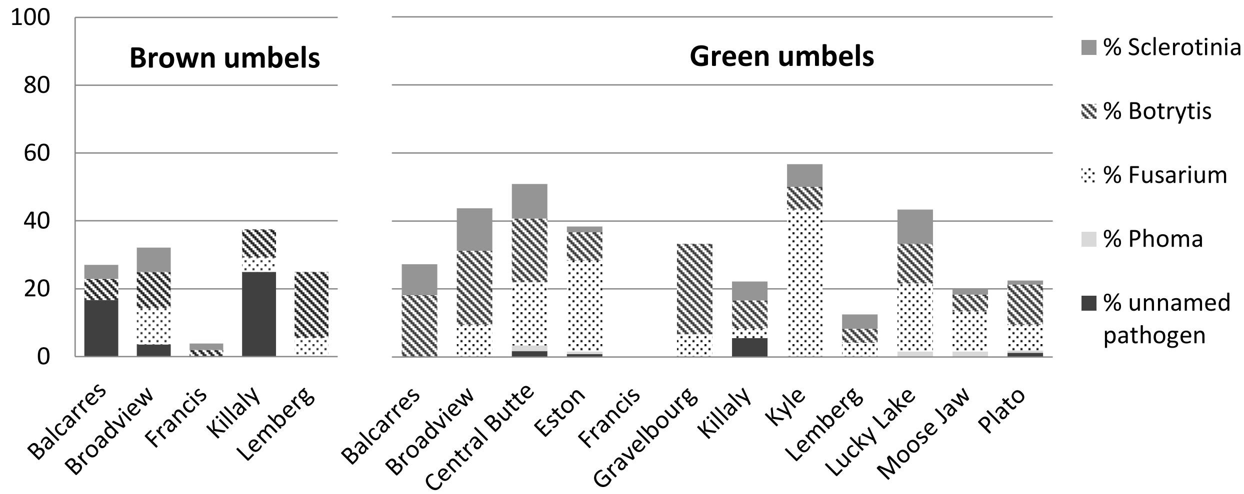

Figure 1. Incidence (% of umbels) of pathogenic fungi recovered from symptomatic (brown) and asymptomatic (green) coriander umbels in plating tests on potato dextrose agar.

CROP / CULTURE: Field bean
LOCATION / RÉGION: Western Ontario

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TITLE / TITRE: ROOT DISEASES OF FIELD BEAN IN WESTERN ONTARIO IN 2017

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 and was observed in all of the crops surveyed.

METHODS: Crops of field bean in western Ontario were surveyed for root diseases at 25 different locations. The survey was conducted from July 19th to August 2nd with one late field assessed on August 15th. The crops ranged from the early flowering to the pod development growth stages and were selected from the counties of Huron, Perth, Waterloo, Bruce and Oxford where most field bean crops are grown.

At least 20 plants were sampled at each of two 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. 2011). Ten roots with disease symptoms were chosen from each crop 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 Summerell (2006). Fifteen roots from each of the 25 bean crops surveyed were frozen for future PCR detection of root rot pathogens.

RESULTS AND COMMENTS: The 2017 cropping season in southern Ontario began with wet conditions making it difficult for some growers to achieve their ideal planting dates (OMAFRA 2017a). Despite the wet spring and late planting, most beans were planted into good soil conditions. Harvest was delayed due to the late plantings and rain at the end of the season, but bean yields were average to above average (OMAFRA 2017b).

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 previously in Ontario (Henriquez et al. 2015a; Kim et al. 2017a) and elsewhere in Canada (Conner et al. 2011; Henriquez et al. 2015b, Kim et al. 2017b). Crops in which *Fusarium* spp*.* were isolated had root rot severity ratings that ranged from 3.7 to 6.3 with a mean of 5.0. Rhizoctonia root rot (*Rhizoctonia solani*) and pythium root rot (*Pythium* spp.) were not detected in any of the 25 crops surveyed. Molecular detection methods to confirm the identity of other fungi isolated from four surveyed crops indicated the presence of *Macrophomina phaseolina.* Twenty-three of 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. Similar results were observed in 2016 with severity ratings above 4 in 88% of crops compared with 92% of crops in 2017.

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Table 1. Prevalence and severity of root diseases in 25 crops of field bean in Ontario in 2017.

Disease[1]	No. crops affected	Disease Severity	
		Mean[2]	Range
Fusarium root rot	25	5.0	3.7-6.3
Rhizoctonia root rot	0	0	0
Pythium root rot	0	0	0
Other	4	5.2	4.4-6.2

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

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

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TITLE / TITRE: **THE OCCURRENCE OF ROOT ROT ON FIELD PEA AND ASSOCIATED FUNGAL PATHOGENS IN ALBERTA IN 2017**

ABSTRACT: The occurrence and severity of root rot on field pea was investigated in eight locations across Alberta in August 2017. A total of 47 fields were surveyed. Root rot symptoms were found at all locations, with an average disease incidence of 92% (range of 37-100%) and an average severity of 2.2 on a 0-4 scale (range of 0.6-3.0). The pathogens associated with the root rot complex were isolated from infected root tissues. Species of *Fusarium* were recovered most frequently, followed by *Pythium* spp. Other microorganisms, such as *Phytophthora* spp., *Rhizoctonia solani* and *Sclerotinia sclerotiorum*, also were isolated but at low incidence on PDA medium.

METHODS: The occurrence and severity of root rot on field pea (*Pisum sativum* L.) were investigated in a total of 47 commercial fields distributed across central and east-central Alberta in August 2017 (Table 1). Five randomly selected sites were surveyed in each crop using a 'W'-shaped sampling pattern. At each of the five sampling sites, 20 pea plants were randomly chosen and dug from the ground. Soil was carefully cleaned off from the root samples to preserve intact root systems. The percentage of symptomatic plants sampled within a field was recorded, while root rot severity was rated on scale of 0-4 (Chang et al. 2013). The plant samples were transported back to the laboratory, where five tissue pieces were cut from each root sample with a scalpel and used to isolate the pathogens associated with the root rot complex. The root pieces were cultured in Petri dishes containing potato dextrose agar (PDA) as described by Chang et al. (2005).

RESULTS & COMMENTS: The distribution of root rot was patchy in the fields surveyed (Fig. 1). The mean incidence of the disease was high (92%) and more or less similar in all 47 sampled fields, ranging from 37-100% (Table 1) with the exception of fields in Lamont, Morinville and Viking where root rot incidence was 100%. Root rot severity ranged from 0.6-3.0 with a mean of 2.2. Root rot severity was lower in Vermilion, Sturgeon and Westlock, with a mean of 1.7 (range of 1.5-1.8). A total of 559 symptomatic root pieces were cultured on PDA for pathogen isolation. Species of *Fusarium* were isolated most commonly from these roots (56.7%), followed by *Pythium* spp. (16.9%), *Rhizoctonia* spp. (0.3%) and *Phytophthora* spp. (0.2%) (Table 2). A mixture of *Fusarium* spp. and *Pythium* spp. often was recovered from the same root pieces, which suggested that an interaction between these two species may have contributed to root rot. *Phytophthora* was recovered from samples collected in Lamont and Redwater at an incidence of 0.5-0.7%, and *Rhizoctonia solani* was identified in samples collected in Fort Saskatchewan, Sturgeon and Westlock at an incidence of 0.5-1.0%. *Sclerotinia sclerotiorum* was isolated from root rot samples collected at Fort Saskatchewan, Lamont, Sturgeon and Westlock at an incidence of 0.1- 0.3%. Species of *Ascochyta* also were associated with infected roots, and their role in the field pea root rot complex should be investigated further.

ACKNOWLEDGEMENTS: We are grateful for the financial support provided by the Growing Forward 2 Program of Agriculture and Agri-Food Canada, the Government of Alberta (Pest Management and Surveillance Implementation Program), the Saskatchewan Pulse Growers and the Manitoba Pulse and Soybean Growers associations. We thank Mr. Tom Carleton, Sturgeon Valley Fertilizers Inc., St. Albert, AB, and Mr. Emile DeMilliano, Crop Production Services, Fort Saskatchewan, AB, for providing field locations and grower contact information. We also appreciate the support provided by staff from the Crop Diversification Centre North, Edmonton, Alberta.

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Table 1. Incidence and severity of pea root rot in Alberta in 2017.[1]

Location	Fields surveyed	Root rot incidence (%)		Root rot severity (0-4)	
		Range	Mean	Range	Mean
Ft. Saskatchewan	12	37-100	84	0.6-3.0	2.0
Lamont	1	100	100	2. 7	2.7
Morinville	1	100	100	2.8	2.8
Redwater	6	71-100	91	1.4-2.8	2.2
Sturgeon County	8	49-100	85	0.8-3.0	1.7
Vermilion	5	81-100	92	1.3-2.7	1.8
Viking	2	100	100	3.1	3.1
Westlock	12	47-100	81	0.8-2.5	1.5
Total/Average	47	37-100	92	0.6-3.0	2.2

[1] Disease incidence and severity were calculated based on 100 plants sampled per field.

Table 2. Incidence (%) of the pathogens recovered from pea roots showing symptoms of root rot In Alberta in 2017.[1]

Location	Roots tested	Fusarium spp.	Pythium spp.	Phytophthora spp.	Rhizoctonia solani	S. sclerotiorum[2]	Ascochyta spp.	Other Fungi[3]
Fort Sask.	137	54.7	17.5	0	0.8	0.3	0.8	0.7
Lamont	27	48.0	18.7	0.7	0	0.3	1.7	0
Morinville	10	33.0	28.0	0	0	0	0	0
Redwater	50	35.0	28.2	0.5	0	0	1.0	2.0
Sturgeon County	111	70.9	10.4	0	0.5	0.1	0.1	0.2
Vermilion	22	68.0	12.0	0	0	0	2.0	1.0
Viking	31	86.0	5.0	0	0	0	3.0	3.0
Westlock	171	57.8	15.0	0	1.0	0.1	1.3	0.5
Total/ Average	559	56.7	16.9	0.2	0.3	0.1	1.2	0.9

[1] The occurrence and incidence of the pea root rot-associated pathogens are based on isolation on potato dextrose agar (PDA).
[2] Sclerotinia sclerotiorum
[3] Other fungi including Alternaria spp., Penicillium spp., Rhizopus spp., and Trichoderma spp.

Figure 1. Field pea plants affected by severe root rot in a field located near Sturgeon in 2017.

CROP / CULTURE: Field pea
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FIELD PEA DISEASES IN MANITOBA IN 2017

ABSTRACT: A total of 35 pea crops were surveyed in Manitoba for root and foliar diseases. Fusarium root rot was the most prevalent root disease and mycosphaerella blight the most widespread foliar disease throughout the province. Diseases less frequently observed included sclerotinia stem rot and downy mildew. Rust, bacterial blight, septoria leaf blotch and anthracnose were not observed in any of the crops surveyed in 2017. Root samples collected from 60 pea fields in 2016 (30) and 2017 (30) indicated that *Aphanomyces euteiches* was present in 77% and 48% of these fields, respectively.

METHODS: Field pea crops were surveyed for root and foliar diseases at 35 different locations 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 has increased in recent years with approximately 20,000, 22,000 and 26,000 ha in 2013, 2014 and 2015, respectively (Manitoba Pulse and Soybean Growers 2015). The area sown to field pea in 2016 more than doubled with 66,000 ha in Manitoba based on an increased demand for peas (Manitoba Pulse and Soybean Growers 2016). However, in 2017, the seeded area dropped to 26,200 ha mainly as a result of wet, unfavourable growing conditions for peas during the 2016 field season which deterred many growers from seeding peas in the following year (Manitoba Agriculture 2017a).

The survey of root diseases was conducted during late June to mid-July when most plants were at the early to late flowering stages. At least ten plants were sampled from 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) (Xue 2000). To confirm the visual disease identification, 15 symptomatic roots were collected from each of the 40 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 pea crops were frozen for future PCR analysis of the root rot pathogens.

Roots from 10 sites from each of 30 fields in 2016 and 2017 were dug up during the root rot survey and shipped to Dr. Chatterton (AAFC-Lethbridge) for *Aphanomyces euteiches* assessment. The presence of the pathogen was determined using PCR assays (Gangneux et al. 2014).

Foliar diseases were assessed during late July to early August when most plants were at the intermediate to round pod stage. A minimum of 30 plants (10 plants from 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, downy mildew, rust, septoria leaf blotch and bacterial blight were rated as the percentage of foliar area infected.

RESULTS AND COMMENTS: Warm, dry, windy weather prevailed across the province early in May and rapidly improved seedbed conditions (Manitoba Agriculture 2017b). In mid-May, warmer weather and improved seedbed conditions resulted in approximately 50% to 60% of seeding being completed in the province (Manitoba Agriculture 2017c). In July, precipitation amounts were below average for much of the province (Manitoba Agriculture 2017d; 2017e). Pea harvest began in mid-August with yields above average and good quality in some crops. For example, in the Swan River area, pea yields ranging from 60 to 80 bu/acre (4.0 to 5.4 kg/ha) were reported (Manitoba Agriculture 2017f).

Two diseases were identified based on laboratory assessment of the roots collected from the 35 pea crops (Table 1). Fusarium root rot was the most prevalent as in previous years (McLaren et al. 2016; 2017). The 35 crops from which *Fusarium* spp. were isolated had root rot severity ratings ranging from 1.6 to 6.4 with a mean of 3.6. The most predominant *Fusarium* spp. isolated in 2017 was *F. avenaceum.* Rhizoctonia root rot (*Rhizoctonia solani*) was not detected in any of the crops sampled. Twelve (34%) 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 detected in 26 of the 35 crops sampled for fungal isolation and identification.

Aphanomyces euteiches was detected in root samples collected from 77% (23/30) and 47% (14/30) of pea fields in 2016 and 2017, respectively. Aphanomyces root rot is favoured by wet, poorly drained soils and is most severe under flooded soil conditions. Seasonal precipitation in many of the pea growing regions of Manitoba in 2016 was above normal, which would have contributed to the increased incidence of aphanomyces root rot. For example, in southwest and south-central Manitoba, 310 mm and 371 mm were received during May to August in 2016, respectively, compared with the 30-year averages of 272 mm for the southwest and 290 mm for the south-central area over this four-month period. In 2017, approximately 162 mm and 165 mm were received during May to August in the southwest and south-central areas, respectively (Government of Canada, 2017).

Three foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2016; 2017), and was present in all the crops surveyed. Disease severity ranged from 2.7 to 7.2 with a mean of 4.5. Sclerotinia disease (*Sclerotinia sclerotiorum*) was detected in one crop only with a severity of 0.1. In 2016, sclerotinia stem rot was much more prevalent and found in 55% of the crops surveyed. Environmental conditions during the latter half of the 2016 field season were more conducive to the development of this disease compared with the current year and contributed to increased disease risk in 2016. Below-average precipitation in July of 2017 would have reduced the risk for development of sclerotinia disease. Downy mildew (*Peronospora viciae*) was detected in 11 (31%) of the crops surveyed. Disease severity ranged from <0.1-1.1% with a mean of 0.3. 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 the use of new cultivars by growers or the early seeded crops escaped infection. No symptoms of anthracnose (*Colletotrichum pisi*), rust (*Uromyces viciae-fabae*), septoria leaf blotch (*Septoria pisi*) or bacterial blight (*Pseudomonas syringae* pv. *pisi*) were observed in any of the surveyed crops.

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Table 1. Prevalence and severity of root diseases in 35 crops of field pea in Manitoba in 2017.

Disease	# Crops Affected (%)	Disease Severity (0.9)[1]	
		Mean	Range
Fusarium root rot	35 (100)	3.6	1.6-6.4
Rhizoctonia root rot	0	0	0
Fusarium oxysporum	26 (74)	3.8	1.7-6.4
Aphanomyces root rot	14 (47)[2]	n/a	n/a

[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.
[2]Based on 30 crops only.

Table 2. Prevalence and severity of foliar diseases in 35 crops of field pea in Manitoba in 2017.

Disease	#Crops Affected (%)	Disease severity (0-9 or % leaf are infected)[1]	
		Mean	Range
Mycosphaerella blight	35 (100)	4.5	2.7 -7.2
Sclerotinia stem rot	1 (3)	0.1	0.1
Powdery mildew	0	0%	0%
Downey mildew	11 (31)	0.3%	<0.1-1.1%
Anthracnose	0	0	0
Rust	0	0%	0%
Bacterial blight	0	0%	0%
Septoria leaf blotch	0	0%	0%

[1]Powdery mildew, downy mildew, rust, septoria leaf blotch and bacterial blight 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.

CROP / CULTURE: Flax
LOCATION / RÉGION: Manitoba / Saskatchewan

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TITLE / TITRE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2017

ABSTRACT: A survey of 15 flax crops in Manitoba and 88 crops in Saskatchewan revealed that pasmo was the most prevalent disease in 80% of crops surveyed in 2017, followed by fusarium root rot in 37%, alternaria blight in 28%, aster yellows in 19%, and powdery mildew in 7%. Rust was absent in all surveyed flax crops for the last 30 years, and no signs of sclerotinia stem rot were observed in 2017. Infection by *Colletotrichum lini* was identified in a few flax crops in Saskatchewan.

METHODS: A total of 103 flax crops were surveyed in 2017: 15 in Manitoba and 88 in central, southern and eastern Saskatchewan. Twenty-two of these crops had no disease records and were excluded from the disease summaries but were included in the general survey data. All crops were surveyed during the last two weeks in August. Crops surveyed were selected at random along pre-planned routes in the major areas of flax production. Each crop was sampled by two people walking ~100 m in opposite directions to each other following an "M" pattern. Diseases were identified by visible 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.), sclerotinia stem infection (*Sclerotinia sclerotiorum*), and aster yellows (AY Phytoplasma) were recorded. Stand establishment, vigour, and maturity were rated on a scale of 1 to 5, where 1 = very good/early, and 5 = very poor/very late.

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

RESULTS AND COMMENTS: Eighty-three percent of the flax crops surveyed in 2017 (100% in Manitoba and 80% in Saskatchewan) had excellent stands and the rest were good to fair. Fifty-three percent of the crops surveyed were early maturing (73% in Manitoba and 50% in Saskatchewan). Seventy percent of the crops had excellent vigour and the rest were poor (87% in Manitoba and 62% in Saskatchewan). Ninety-seven percent of the crops were brown seed-colour flax, and only 3% were yellow seed-colour. Weed infestation was very low in 60% of the crops surveyed in 2017 and the remaining 40% had medium to high weed infestation. In 2017, a dry growing season occurred with below normal soil moisture conditions in Manitoba and Saskatchewan, especially in July and August. Total flax area was ~400,000 ha, approximately 90% in Saskatchewan according to Statistics Canada (2017).

The 2017 disease survey showed higher incidences and severity of pasmo, fusarium wilt, aster yellows, and alternaria in Manitoba than in Saskatchewan. Pasmo, the most prevalent disease, was observed in 93% of the crops surveyed in Manitoba and 74% in Saskatchewan with a range in severity from trace amounts to 5% in 37% of the crops, from 6-10% in 13% of the crops, from 11-20% in 13% of the crops and over 20% in 15% of the crops (Table 1). The prevalence and severity on stems were generally lower than in 2016 and previous years (Rashid et al. 2014, 2015, 2016, 2017), due probably to the dry conditions in July and August in 2017.

Root infections and fusarium wilt were observed in 33% of the crops surveyed (40% in Manitoba and 32% in Saskatchewan). Incidence was very low (trace to 5%) even in the most affected crops (Table 1). The prevalence of this disease in 2017 was generally similar to previous years (Rashid et al. 2014, 2015, 2016, 2017). Traces of stem infections caused by *Colletotrichum lini* were observed in a few crops in Saskatchewan.

Powdery mildew was observed only in four crops in Manitoba and one crop in Saskatchewan in 2017 due perhaps to the late arrival of the inoculum and the dry weather conditions in July and August in both provinces. Powdery mildew was observed on the top few leaves of the late maturing crops but no precise data could be collected in 2017.

Rust was not observed in any of the crops surveyed in 2017, nor in the flax rust trap nurseries planted at Morden and Portage la Prairie in Manitoba, and at Indian Head and Saskatoon in Saskatchewan.

Aster yellows was present at trace levels in 17% of the crops surveyed (33% in Manitoba and 14% in Saskatchewan). This is less frequent than in 2016, but similar to a normal crop season. This disease is transmitted by the aster leafhopper *(Macrosteles quadrilineatus)* that usually migrates from the south during the growing season. Alternaria blight was observed at trace to 5% levels in 26% of the crops (40% in Manitoba and 23% in Saskatchewan). Sclerotinia stem infections were not encountered in 2017, and lodging was observed in a few crops.

Of the five samples submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017, two were affected by fusarium wilt, one by environmental stress and two by herbicide injury.

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Table 1. Incidence and severity of fusarium wilt and pasmo in 103 crops of flax in Manitoba (15) and Saskatchewan (88) in 2017.

Fusarium Wilt				**Pasmo**			
Disease Class		Crops		Disease Class		Crops	
Incid.[1]	Sev.[2]	#	%	Incid.[1]	Sev.[2]	#	%
0%	0%	54	67	0%	0%	18	22
1-5%	1-5%	13	16	1-10%	1-5%	30	37
5-20%	5-10%	10	12	10-30%	6-10%	10	13
20-40%	10-20%	3	4	30-60%	11-20%	11	13
>40%	10-40%	1	1	>60%	21-50%	12	15

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

CROP / CULTURE: Lentil
LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: 2017 SURVEY OF LENTIL DISEASES IN SASKATCHEWAN

ABSTRACT: A total of 52 lentil crops were surveyed in Saskatchewan in 2017. Root rot, anthracnose and stemphylium blight were the most prevalent diseases observed in the survey, though variation in the prevalence of these diseases was found across the four major lentil growing regions in Saskatchewan. Overall sclerotinia stem and pod rot, botrytis stem and pod rot and ascochyta blight levels were low across the province.

METHODS: Saskatchewan lentil crops were surveyed for the presence of lentil diseases in 2017 (52 fields). Fields were surveyed between July 31 and August 3 and ranged in staging from mid-pod to approximately 30% moisture content (desiccation stage). Regions surveyed were West-Central (20), Southwest (15), Southeast (10) and East-Central (7). Disease assessments were made qualitatively in each crop by observing several representative plants to evaluate general health and the presence or absence of symptoms. In each field, plants were examined to determine the presence or absence of the following diseases: root rot complex (*Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani / Aphanomyces euteiches*), anthracnose (*Colletotrichum lentis*), ascochyta blight (*Ascochyta lentis*), sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*), botrytis stem and pod rot / grey mould (*Botrytis cinerea*), and stemphylium blight (*Stemphylium* spp.). Percentages of the crops surveyed showing symptoms (prevalence) of each of these diseases were calculated for each region surveyed (Tables 1-4), as well as provincial totals (Table 5) and totals from the previous five years (Stephens et al. 2017).

RESULTS AND COMMENTS: Approximately 1.6 million hectares (3.9 million acres) of lentil were seeded in Saskatchewan in 2017, which is considerably lower than the 2.1 million hectares (5.2 million acres) seeded in 2016 (Statistics Canada 2017). This could be partially due to the high prevalence and severity of root rot experienced in 2016 (Chatterton et al. 2016). Dry conditions throughout the growing season resulted in generally low levels of disease in lentil crops, particularly in the traditional lentil growing areas (brown soil zone – southwest and west-central SK). As of mid-November, 1.6 million hectares of lentils were harvested (Statistics Canada 2017) in Saskatchewan. The Saskatchewan Crop Report (Saskatchewan Ministry of Agriculture 2017) estimated that 100% of the Saskatchewan lentil crop had been harvested by October 23, 2017. Lentil grades from submitted harvest samples (Canadian Grain Commission 2017) were 62% 1CAN, 36% 2CAN, 2% Extra 3CAN and 0% 3CAN.

At least 87% of the 52 fields surveyed in 2017 had at least one lentil disease (root rot complex, anthracnose, ascochyta, sclerotinia, botrytis or stemphylium) observed and 33% of the crops surveyed had at least two diseases present.

Ascochyta blight symptoms (*Ascochyta lentis*) were observed in 6% of fields (3) surveyed in 2017. Ascochyta blight has generally decreased in prevalence over the last 5 years and was also only observed in 6% of the surveyed lentil crops in 2016. The low levels of ascochyta blight are thought to be due to improved resistance in lentil varieties. As a result, it is important to watch for and prevent the breakdown of resistance in lentil crops grown under tight rotations and/or when conditions are conducive to disease development.

Anthracnose (*Colletotrichum lentis*) was observed in 38% (20 fields) of the fields surveyed in 2017. The highest prevalence was found in the East-Central region (100%), followed by the West-Central (50%), Southwest (13%) and Southeast (10%) regions.

Root rot was observed in 54% (28) of the fields included in the 2017 survey. The highest prevalence was found in the Southwest region (73%), followed by the West-Central (60%) and Southeast (50%) regions.

Root rot was not observed in any fields surveyed in the East-Central region in 2017. Root rot has been a notable issue in pea and lentil crops in recent years, with a number of potential pathogenic causes (*Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani / Aphanomyces euteiches)* in addition to environmental stresses due to excess moisture. No sampling or further testing was performed to confirm causal pathogens.

Botrytis stem and pod rot / grey mould (*Botrytis cinerea*) was not observed in any of the fields surveyed. This is considerably lower than in 2016 where 66% of the fields had symptoms of botrytis stem and pod rot. The last time that botrytis stem and pod rot was not observed in any of the surveyed fields was in 2014.

Sclerotinia stem and pod rot *(Sclerotinia sclerotiorum*) was noted in 2% (1) of fields surveyed in 2017 and observed only in the Southwest region. This represents the lowest prevalence of sclerotinia stem and pod rot reported between 2012 and 2017.

Stemphylium blight (*Stemphylium* spp.) was found in 33% (17) of lentil fields surveyed. The highest prevalence was observed in the West-Central region (55%) followed by the Southwest region (40%). No symptoms of stemphylium blight were observed in the Southeast and East-Central regions in 2017. This is considerably lower than in 2016 when the disease was found in 88% of the fields surveyed but more consistent with the levels noted in 2012-2014 (Table 5). It is not known what economic impact stemphylium blight might have on lentil and there are no commercial fungicides available to manage this disease.

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Table 1. Prevalence of plant diseases in lentil crops surveyed in West-Central Saskatchewan 2012-2017.

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (17)	76	76	24	24	24	53
2013 (12)	83	83	42	33	17	50
2014 (15)	67	80	7	67	0	40
2015 (15)	87	73	0	0	0	40
2016 (15)	94	88	0	94	69	63
2017(20)	60	50	10	0	0	55

Table 2. Prevalence of plant diseases in lentil crops surveyed in Southwest Saskatchewan 2012-2017.

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (2)	0	0	100	0	0	0
2013 (16)	38	50	38	38	31	38
2014 (2)	100	100	0	0	0	0
2015 (0)	-	-	-	-	-	-
2016 (20)	65	50	0	85	60	100
2017 (15)	73	13	0	7	0	40

Table 3. Prevalence of plant diseases in lentil crops surveyed in Southeast Saskatchewan 2012-2017.

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (9)	80	70	30	50	40	10
2013 (9)	89	44	0	22	33	11
2014 (0)	-	-	-	-	-	-
2015 (2)	50	100	0	50	100	100
2016 (6)	33	83	0	67	50	100
2017 (10)	50	10	10	0	0	0

Table 4. Prevalence of plant diseases in lentil crops surveyed in East-Central Saskatchewan 2012-2017.

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012	-	-	-	-	-	-
2013	-	-	-	-	-	-
2014 (1)	100	100	0	0	0	100
2015 (1)	100	100	0	100	100	100
2016 (8)	63	100	38	88	88	100
2017 (7)	0	100	0	0	0	0

Table 5. Prevalence of plant diseases in lentil crops surveyed in Saskatchewan, 2012-2017.

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (28)	75	71	32	32	29	36
2013 (37)	65	60	30	32	27	35
2014 (18)	72	83	6	56	0	39
2015 (18)	83	78	0	11	17	50
2016 (50)	70	74	6	86	66	88
2017 (52)	54	38	6	2	0	33

CROP / CULTURE: Soybean
LOCATION / RÈGION: Manitoba

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TITLE / TITRE: SURVEY OF SOYBEAN FOLIAR DISEASES IN MANITOBA IN 2017

ABSTRACT: A total of 65 soybean crops at the V2 to V3 (two trifoliates/three nodes to three trifoliates/two nodes) stage were surveyed in Manitoba for the prevalence as well as incidence and/or severity of bacterial blight, septoria brown spot, downy mildew, white mould, pod/stem blight, anthracnose, and frogeye leaf spot. The same 65 fields and two additional fields were surveyed at the R5 to R6 (beginning seed to full seed) stage for the foliar diseases listed above. Septoria brown spot was the most prevalent disease observed at each survey timing. Symptoms of soybean cyst nematode and sudden death syndrome were not observed in the 2017 disease survey.

METHODS: A provincial soybean survey coordinated by Manitoba Agriculture and the Manitoba Pulse and Soybean Growers was conducted in 2017. All results are based on visual assessment of diseases within the surveyed crops. A total of 65 fields were surveyed at the “early” stage (V2-V3 stage). A total of 67 fields were surveyed at the “late” stage (R5-R6 stage). Plants were given incidence and severity ratings for bacterial blight, septoria brown spot, and downy mildew. Incidences of white mould, pod/stem blight, anthracnose, and frogeye leaf spot were also measured. Severity of foliar disease was rated on a 0-5 scale (0-no symptoms; 1-trace symptoms; 2-symptoms in lower canopy; 3-symptoms in mid-upper canopy; 4-severe symptoms in mid-upper canopy; 5-severe symptoms in mid-upper canopy with defoliation) (Bisht et al. 2014). The number of surveyed fields in each region was based on the number of acres planted to soybeans the previous year.

RESULTS (EARLY SURVEY): Bacterial blight was present in 62% of the fields surveyed (Table 1). The prevalence was highest in the northwest region (100%) and lowest in the eastern/interlake region (45%). The average incidence of bacterial blight in infested fields was 31%. The incidence was highest in the central and southwest regions (36%) and lowest in the northwest region (8%). The average severity of bacterial blight was 1.4. The severity was highest in the eastern/interlake region (1.6) and the lowest in the northwest and central regions (1.3).

Septoria brown spot was present in 94% of the fields surveyed (Table 1). The prevalence was highest in the eastern/interlake and northwest regions (100%) and lowest in the central region (87%). The average incidence of septoria brown spot in infested fields was 59%. The incidence was highest in the eastern/interlake region (88%) and lowest in the northwest (13%). The average severity of septoria brown spot was 1.5. The severity was highest in the eastern/interlake region (1.6) and the lowest in the central and southwest regions (1.4).

Downy mildew was present in 20% of the fields surveyed (Table 2). The prevalence was highest in the eastern/interlake region (30%) and lowest in the northwest, where none was detected. The average incidence of downy mildew in infested fields was 14%. The incidence was highest in the eastern/interlake region (17%). The average severity of downy mildew was 1.6. The severity was highest in the central region (3.0).

White mould and pod/stem blight were each detected in only one of the fields surveyed at the early survey timing (Tables 2, 3). Anthracnose and frogeye leaf spot were not detected at this time.

RESULTS (LATE SURVEY): Bacterial blight was present in 78% of the fields surveyed (Table 4). The prevalence was highest in the northwest and southwest regions (100%) and lowest in the eastern/interlake region (45%). The average incidence of bacterial blight in infested fields was 54%. The incidence was highest in the central region (71%) and lowest in the northwest (7%). The average severity of bacterial blight was 1.9. The severity was highest in the eastern/interlake region (2.3) and the lowest in the southwest region (1.5).

Septoria brown spot was present in 97% of the fields surveyed (Table 4). The prevalence was highest in the central and northwest regions (100%) and lowest in the southwest region (94%). The average incidence of septoria brown spot in infested fields was 52%. The incidence was highest in the eastern/interlake region (64%) and lowest in the northwest (9%). The average severity of septoria brown spot was 1.8. The severity was highest in the northwest region (2.1) and the lowest in the southwest region (1.4).

Downy mildew was present in 57% of the fields surveyed (Table 5). The prevalence was highest in the central region (65%) and lowest in the northwest region (20%). The average incidence of downy mildew in infested fields was 38%. The incidence was highest in the eastern/interlake region (50%) and lowest in the northwest region (%). The average severity of downy mildew was 1.8. The severity was highest in the eastern/interlake region (2.3) and lowest in the southwest region (1.3).

White mould was present in 25% of the fields surveyed (Table 5). The prevalence was highest in the central region (30%) and lowest in the southwest region (18%). The average incidence of white mould in infested fields was 6%. The incidence was highest in the eastern/interlake region (11%) and lowest in the central region (2%).

Pod/stem blight was present in 18% of the fields surveyed (Table 6). The prevalence was highest in the central and eastern/interlake region (26-27%) and lowest in the northwest and southwest regions, where none was detected. The average incidence of pod/stem blight in infested fields was 4%.

Anthracnose was present in 3% of the fields surveyed (Table 6). The prevalence was highest in the southwest region (6%) and lowest in the central and northwest regions, where none was detected. The average incidence of anthracnose in infested fields was 5%. The incidence was highest in the southwest region (8%).

Frogeye leaf spot was present in 16% of the fields surveyed (Table 6). The prevalence was highest in the southwest region (29%) and lowest in the northwest region, where none was detected. The average incidence of frogeye leaf spot in infested fields was 8%. The incidence was highest in the southwest region (10%).

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Table 1. 2017 Manitoba soybean early timing (V2/V3) disease survey results for bacterial blight and septoria brown spot.

Region (No. of Fields)	Bacterial Blight			Septoria Brown Spot		
	Prevalence	Inc[1] (Inc[2])	Severity[3]	Prevalence	Inc[1] (Inc[2])	Severity[3]
Central (23)	61%	36% (22%)	1.3	87%	62% (54%)	1.4
Eastern/Interlake (20)	45%	27% (12%)	1.6	100%	88% (88%)	1.6
Northwest (5)	100%	8% (8%)	1.3	100%	13% (13%)	1.5
Southwest (17)	71%	36% (25%)	1.5	94%	34% (32%)	1.4
Manitoba (65)	62%	31% (19%)	1.4	94%	59% (55%)	1.5

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.
[3]Average disease severity in infested fields.

Table 2. 2017 Manitoba soybean early timing (V2/V3) disease survey results for downy mildew and white mould.

Region (No. of Fields)	Downy Mildew			White Mould	
	Prevalence	Inc[1] (Inc[2])	Severity[3]	Prevalence	Inc[1] (Inc[2])
Central (23)	9%	16% (1%)	3.0	0%	0% (0%)
Eastern/Interlake (20)	30%	17% (5%)	1.3	0%	0% (0%)
Northwest (5)	0%	0% (0%)	0.0	0%	0% (0%)
Southwest (17)	29%	8% (2%)	1.4	6%	10% (1%)
Manitoba (65)	20%	14% (3%)	1.6	2%	10% (0.2%)

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.
[3]Average disease severity in infested fields.

Table 3. 2017 Manitoba soybean early timing (V2/V3) disease survey results for pod/stem blight.

Region (No. of Fields)	Pod/Stem Blight	
	Prevalence	Inc[1] (Inc[2])
Central (23)	0%	0% (0%)
Eastern/Interlake (20)	0%	0% (0%)
Northwest (5)	0%	0% (0%)
Southwest (17)	6%	24% (1%)
Manitoba (65)	2%	24% (0.4%)

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.

Table 4. 2017 Manitoba soybean late timing (R5/R6) disease survey results for bacterial blight and septoria brown spot.

Region (No. of Fields)	Bacterial Blight			Septoria Brown Spot		
	Prevalence	Inc[1] (Inc[2])	Severity[3]	Prevalence	Inc[1] (Inc[2])	Severity[3]
Central (23)	87%	71% (62%)	2.1	100%	57% (57%)	1.9
Eastern/Interlake (22)	45%	29% (13%)	2.3	95%	64% (61%)	1.9
Northwest (5)	100%	7% (7%)	1.9	100%	9% (9%)	2.1
Southwest (17)	100%	63% (63%)	1.5	94%	41% (38%)	1.4
Manitoba (67)	78%	54% (42%)	1.9	97%	52% (50%)	1.8

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.
[3]Average disease severity in infested fields.

Table 5. 2017 Manitoba soybean late timing (R5/R6) disease survey results for downy mildew and white mould.

Region (No. of Fields)	Downy Mildew			White Mould	
	Prevalence	Inc[1] (Inc[2])	Severity[3]	Prevalence	Inc[1] (Inc[2])
Central (23)	65%	41% (27%)	1.6	30%	2% (1%)
Eastern/Interlake (22)	59%	50% (30%)	2.3	27%	11% (3%)
Northwest (5)	20%	4% (1%)	1.5	20%	6% (1%)
Southwest (17)	53%	17% (9%)	1.3	18%	5% (1%)
Manitoba (67)	57%	38% (21%)	1.8	25%	6% (1%)

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.
[3]Average disease severity in infested fields.

Table 6. 2017 Manitoba soybean late timing (R5/R6) disease survey results for pod/stem blight, anthracnose, and frogeye leaf spot.

Region (No. of Fields)	Pod/Stem Blight		Anthracnose		Frogeye Leaf Spot	
	Prevalence	Inc[1] (Inc[2])	Prevalence	Inc[1] (Inc[2])	Prevalence	Inc[1] (Inc[2])
Central (23)	26%	4% (1%)	0%	0% (0%)	22%	5% (1%)
Eastern/Interlake (22)	27%	4% (1%)	5%	2% (0.1%)	5%	8% (0.4%)
Northwest (5)	0%	0% (0%)	0%	0% (0%)	0%	0% (0%)
Southwest (17)	0%	0% (0%)	6%	8% (0.5%)	29%	10% (3%)
Manitoba (67)	18%	4% (0.7%)	3%	5% (0.1%)	16%	8% (1%)

[1]Average percent incidence in infested fields.
[2]Average percent incidence across all fields surveyed.

CROP / CULTURE: Soybean
LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS: .
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TITLE / TITRE: SOYBEAN ROOT ROT AND PHYTOPHTHORA ROT IN MANITOBA IN 2017

ABSTRACT: In 2017, 106 soybean crops were surveyed in Manitoba for root diseases. Samples from all fields were rated for root rot and from 40 fields, roots were processed for fungal isolation and identification. In the 40 fields, fusarium root rot was the most prevalent root disease. Root rot was severe in low-lying areas of some fields, indicating that seed yield and quality may have been affected. Thirty-five percent of Manitoba soybean crops (31/89) tested positive for the presence of phytophthora rot.

INTRODUCTION: Soybean production in Manitoba continues to increase with 428,000 ha (1,058,000 acres), 525,700 ha (1,299,000 acres), 526,100 ha (1,300,000 acres) and 647,500 ha (1,600,000 acres) seeded in 2013, 2014, 2015 and 2016, respectively (Manitoba Pulse and Soybean Growers 2016; Statistics Canada 2016). Soybean production increased again in 2017 with 930,800 ha (2,300,000 acres seeded) (Knutt 2017). This represents the tenth consecutive annual increase in soybean production in Manitoba. Root rot is a constraint in other areas of Canada where soybean production has been established (Chang et al. 2013; OMAFRA 2011) and this disease complex may become more of an issue in Manitoba as soybean production continues to expand.

METHODS: Soybean crops were surveyed for root diseases at 106 different locations in Manitoba in 2017. Areas of the crop survey were expanded to include not only randomly chosen fields from regions in south-central and southwest Manitoba, where soybean is commonly grown, but fields from non-traditional soybean areas into which the crop is expanding.

The survey for root diseases was conducted during mid- to late July when most plants were at the early pod stage. At least ten plants were sampled by uprooting them 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) for all 106 fields. For 40 crops, 15 symptomatic roots were collected for fungal isolation and identification. For *Fusarium* species, identification 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 were frozen for future PCR analysis of root rot pathogens.

All 40 crops that were surveyed for root rot in July were re-assessed for phytophthora rot in mid-August when most plants were at the pod yellowing (R7) stage (APS Press 1999). Approximately 49 additional crops were also included in the survey for phytophthora with samples collected by staff at Manitoba Agriculture, Manitoba Pulse and Soybean Growers, Brandon University and the University of Manitoba. Soybean plants that were symptomatic for phytophthora disease were identified for further assessment in the laboratory. Approximately 360 stems were placed on different selective media to identify *Phytophthora* spp. based on morphological characteristics (Gallegly and Hong 2008). Tissue samples from symptomatic plants were frozen for molecular detection of pathogens at a later date.

RESULTS AND COMMENTS: As of May 15, 2017, soybean seeding was underway in most areas of the province with the exception of the northwest region where many producers delayed seeding until after the middle of the month when soil moisture improved and risk of frost was reduced (Manitoba Agriculture 2017a). Approximately 10-15% of soybean acres were planted in the southwest region by May 15th while in the central region, seeded acres ranged from 20-80% complete. In July, areas of the southwest, northwest and central regions of the province were well below normal precipitation levels, with shorter plants observed in the drier fields (Manitoba Agriculture 2017b). Regions that received timely amounts of precipitation had promising crops, but dry conditions persisted throughout most of the province until mid-September. Generally, lower yields were reported for soybeans due to the dry conditions during pod filling (Manitoba Agriculture 2017c).

Root rot was observed in all 106 soybean crops surveyed in July 2017 with root rot severity ratings that ranged from 1.2 to 8.0 with a mean of 4.2. The microorganisms most frequently isolated from roots of infected plants from 40 crops belonged to *Fusarium* spp. (Table 1). Rhizoctonia root rot (*Rhizoctonia solani*) was not confirmed in any of these 40 crops surveyed in 2017. The low or lack of recovery of *R. solani* in recent years suggest that in Manitoba this fungus may not be as important a root rot pathogen of soybean as are *Fusarium* spp., in contrast with other regions in western Canada (Chang et al. 2013). Pythium root rot was not detected in any of the 40 soybean crops surveyed in 2017.

Phytophthora rot was identified in 28% (11/40) of fields surveyed in mid-August for this disease (Table 1). Each symptomatic plant that was positive for *P. sojae* had a discoloured taproot with lesions that progressed up the stem. Plant samples were also obtained from the additional 49 crops, and *P. sojae* was identified in 41% (20/49) of these crops. A total of 35% (31/89) of Manitoba soybean crops were positive for the presence of phytophthora rot. Molecular detection methods were conducted to confirm the presence/absence of *P. sojae* from the surveyed crops.

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Table 1. Prevalence and severity of root rot in 106 crops of soybean in July and prevalence of phytophthora rot in 89 crops of soybean in August 2017.

Disease	No. crops affected	Disease severity (0-9)[1]	
		Mean	Range
Root rot	106	4.2	1.2-8.0
Fusarium root rot[2]	40	4.4	3.3-5.9
Pythium root rot[2]	0	0	0
Rhizoctonia root rot[2]	0	0	0
Phytophthora rot[3]	31	n/a[4]	n/a

[1] All diseases, excluding phytophthora rot, 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.
[2] Based on isolations from 40 crops.
[3] Based on isolations from 89 crops.
[4] No disease severity ratings were available.

CROP / CULTURE: Sunflower
LOCATION / RÉGION: Manitoba

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TITLE / TITRE: DISEASES OF SUNFLOWER IN MANITOBA IN 2017

ABSTRACT: A survey of 22 sunflower crops in Manitoba in 2017 revealed that verticillium wilt was the most prevalent disease and was found in 82% of the crops followed by sclerotinia wilt/basal stem rot in 60%, septoria leaf infections in 50%, sclerotinia head rot in 41%, rust in 32%, and downy mildew in 18%. Disease severity ranged from low to moderate with no severe epidemics.

METHODS: A total of 22 sunflower crops were surveyed in 2017 in Manitoba. Nine crops were surveyed in the third week of August and 13 crops in the last week of August. 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 (1 = very good/early, and 5 = very poor/very late).

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

RESULTS AND COMMENTS: Ninety-six percent of the sunflower crops surveyed in 2017 had excellent to good stands, but only 82% had good vigour, and the rest had fair to poor vigour. Only 68% of the sunflower crops were early maturing, and the remaining 32% were late to very late (Table 1). The crops surveyed were split 64/36% between oilseed and confectionery hybrids, thus showing a decrease in the confection acreage in 2017 compared with previous years (Rashid and Desjardins 2015; Rashid et al. 2016, 2017). The 2017 growing season started with normal soil moisture with growers seeding shallow-rooted crops instead of deep-rooted sunflower and this contributed to the decrease in sunflower hectares in Manitoba (~24,000 ha in 2017 in comparison with ~30,000 ha in 2016 (Statistics Canada 2017). Growing conditions were relatively normal throughout the growing season with below normal precipitation throughout the summer especially in July-August. Very low disease incidence and severity were observed in 2017 for all sunflower diseases, especially for downy mildew and rust, in comparison with previous years (Rashid and Desjardins 2014, 2015; Rashid et al. 2016, 2017).

Sclerotinia wilt/basal stem rot was present in 60% of the crops surveyed in 2017, mostly at trace to 5% disease incidence (Table 1). Sclerotinia head rot and mid-stem infections, caused by airborne ascospores, were observed at trace to 5% levels in most of the 41% of infested crops. The prevalence and incidence of both sclerotinia wilt and head rot in 2017 was lower than in 2016, due perhaps to the below normal precipitation and above normal temperatures in July and August, 2017 (Rashid et al. 2016, 2017).

Rust was present in 32% of the crops surveyed, with severity ranging from trace to 5% leaf area affected in most fields, but as high as 10% leaf area was affected in a few crops (Table 1). Rust infections started relatively late in 2017 and did not develop rapidly in most of the crops surveyed. Preliminary analysis of the rust isolates collected indicates the prevalence of races 737 (60%), 734 (20%), and 736 (20%) of *P. helianthi*, which are virulent on most commercial sunflower hybrids. The predominant race in the 2016 rust population was race 777, similar to 2016 and 2015 (Rashid et al. 2017). Rust incidence and severity in 2017 was lower than in 2016 and 2015 (Rashid et al. 2016, 2017), probably due to the late onset of infection and the above normal temperatures in July and August.

Verticillium wilt was present in 82% of the crops surveyed in 2017 with traces to 10% severity in the oilseed hybrids, and 10-40% severity in the confection sunflower hybrids (Table 1). The incidence and severity of verticillium wilt was similar in 2017 and 2016, but lower than in 2015 (Rashid et al. 2016, 2017).

Downy mildew was observed in 18% of the crops in 2017, much lower than both 2016 and 2015 (Table 1). The incidence ranged from trace to 1%, lower than in 2016 and 2015, and the lowest record reported in the past 10 years (Rashid and Desjardins 2014, 2015; Rashid et al. 2016, 2017). Preliminary analysis of isolates collected indicates the presence of race 732 with resistance to metalaxyl seed treatment.

Traces to 5% of leaf area infected by *Septoria helianthi* were observed in 50% of the crops as well as some infection by *Alternaria* spp. in a few crops (Table 1); these results are similar to those reported in 2016, but with a higher severity and prevalence than in previous years (Rashid and Desjardins 2015; Rashid et al. 2016, 2017). Traces of stem lesions caused by *Phoma* spp. were observed in 5% of the crops, which was lower than in 2016 and previous years. There were no signs of infection by *Phomopsis* spp. in 2017 compared to trace levels of this disease reported in previous years (Rashid and Desjardins 2015; Rashid et al. 2016, 2017).

Traces to 1% infestation of the sunflower beetle (*Zygogramma exclamationis*) were observed in a few crops. Infestations at trace to 5% levels of the sunflower midge (*Contarinia schulzi*) were encountered in 32% of the crops. Traces of infestation with grasshoppers were observed in 46% of the crops. Moderate infestations by aphids were encountered in 64% of the crops in 2017.

The three samples submitted to the Manitoba Agriculture Crop Diagnostic Centre in 2017 were all affected by herbicide injury.

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Table 1. Prevalence and index of diseases in 22 crops of sunflower in Manitoba in 2017.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt/basal stalk rot	13	60%	1.0	T – 1
Sclerotinia head rot/stem rot	9	41%	1.0	T - 1
Verticillium wilt	18	82%	1.3	T – 4
Downy mildew	4	18%	1.0	T – 1
Rust	7	32%	1.3	T – 2
Leaf spots (*Septoria* & *Alternaria*)	11	50%	1.0	T - 1
Phoma stem lesions	1	5%	1.0	T - 1
Phomopsis stem lesions	0	0%	NA	NA
Lateness[2]	7	32%	2.1	1 – 3
Poor Stand	1	4%	1.2	1 - 3
Poor Vigour	4	18%	1.7	1 – 3

[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 and sclerotinia. Disease severity for rust and leaf spots was measured as % leaf and stem area affected.
[2] Indexes for lateness, stand, and vigour are based on a 1-5 scale (1= early/very good and 5= very late/very poor).

CROP / CULTURE: Switchgrass (*Panicum virgatum* L.)
LOCATION / RÉGION: Ontario

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TITLE / TITRE: INCIDENCE OF HEAD SMUT (*TILLETIA MACLAGANII*) IN ONTARIO SWITCHGRASS FIELDS 2017

ABSTRACT: Switchgrass fields in Ontario were surveyed for head smut caused by the fungal pathogen *Tilletia maclaganii* to determine the incidence of head smut in established switchgrass fields in Ontario during 2017. Head smut was observed in 90% of the switchgrass fields surveyed ranged from 0 to 68% infected tillers/field. An 8-year-old field, planted in 2009, had a significantly higher incidence of head smut than all other fields surveyed. Correlation and linear regression analysis indicated a positive and significant relationship between the age of the switchgrass field and the incidence of head smut.

INTRODUCTION: Switchgrass (*Panicum virgatum*) is a perennial warm season C_4 grass native to North America used for animal bedding, livestock feed, mushroom compost, bioenergy pellets, biofuels, biomaterials and biochemicals (Parrish and Fike 2005, Samson et al. 2016). Approximately 1,500 acres of switchgrass is grown in Ontario (Samson et al. 2016). Head smut caused by the soil and seed borne fungal pathogen *Tilletia maclaganii* is a common disease in many switchgrass-producing regions of the USA and appears more pronounced in older stands (Lemus et al. 2002, Layton and Bergstrom 2011, Gravert et al. 2000, Thomsen et al. 2008, Farr et al. 1995). It spreads long distances through the movement and planting of seed contaminated with smut spores. Once established in a field, the diseases can cause significant reductions in biomass yields (Thomsen et al. 2008). The pathogen infects plants immediately after seed germination or during early growth of perennial crowns in the spring (Layton 2014, Tiffany et al. 1990). As with many smut pathogens, *T. maclaganii* grows systemically within the growing point of infected plants and eventually replaces the entire floral organs of the spikelets with dense spore-masses (Layton 2014, Tiffany et al. 1990, Thomsen et al. 2005, Gravert and Munkvold 2002, Gravert et al. 2000). Very little is known about the incidence of head smut of switchgrass in Ontario.

METHODS: Ten switchgrass fields cv. 'Cave-in-Rock' ranging from 3 to 8 years old were surveyed for head smut caused by *T. maclaganii* during 2017 (Table 1). Head smut was enumerated in 100 switchgrass tillers at 6 transects in each field: the entrance, four corners (SW, SE, NE, NW) and center for a total of 600 tillers/field. Head smut was identified according to symptomology described in the literature (Layton 2014, Gravert and Munkvold 2002, Gravert et al. 2000). The data collected was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.9. Tukey's HSD test was used to detect mean differences between fields and transects within fields at P= 0.05.

RESULTS AND DISCUSSION: Head smut was observed in 90% of the switchgrass fields surveyed in Ontario during 2017. The incidence of head smut ranged from 0 to 68% infected tillers/field (Table 1). The results are consistent with previous surveys on head smut in switchgrass in the US (Gravert et al. 2002, Thomsen et al. 2008).

Although the incidence of tillers with head smut varied among the different transects assessed within individual fields, the mean incidence of head smut was similar in all 6 transects assessed in each field including where equipment entered the fields (Figure 2). These results suggest the disease was probably distributed throughout the fields on contaminated seed rather than introduced into the field on contaminated equipment. An 8-year-old field, planted in 2009, had a significantly higher incidence of head smut than all other fields surveyed (Figure 3). Correlation analysis indicated a positive and significant relationship between the age of the switchgrass field and the incidence of head smut ($R=0.6754$, $P<0.0001$). Similar results from other studies have found an increase in the incidence of head smut in older switchgrass fields (Lemus et al. 2002, Layton and Bergstrom 2011, Gravert et al. 2000, Thomsen et al. 2008, Farr et al. 1995).

Further research is required on the impact of crop age, fungicide treatment, cultivar and microclimate on the incidence and impact of head smut on switchgrass biomass production in Ontario.

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Table 1. Ontario switchgrass fiels surveyed for head smut in 2017.

Field No.	Year Planted	Hectares	County
1	2009	14	Halton
2	2010	6	Halton
3	2012	11	Halton
4	2013	4	Halton
5	2012	3	Halton
6	2013	6	Halton
7	2014	14	Halton
8	2010	2.8	Grey
9	2012	1.5	Grey

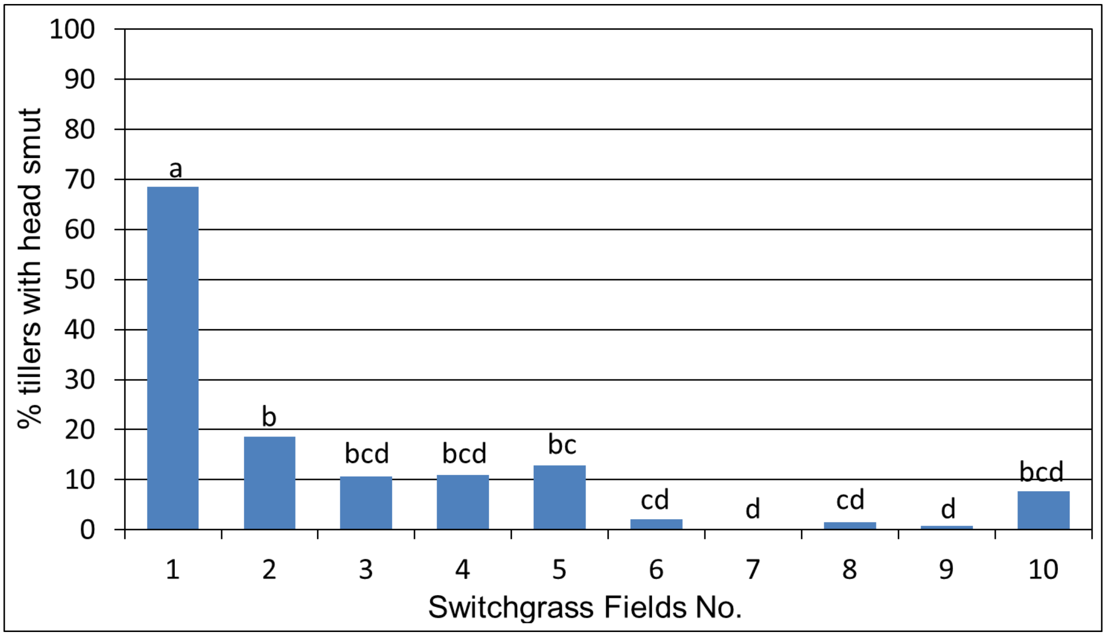

Figure 1. Incidence of head smut (*T. maclaganii*) in ten swtichgrass fields surveyed in Ontario in 2017. Columns followed by the same letter are not statistically dfferent in Tukey's HSD P=0.05.

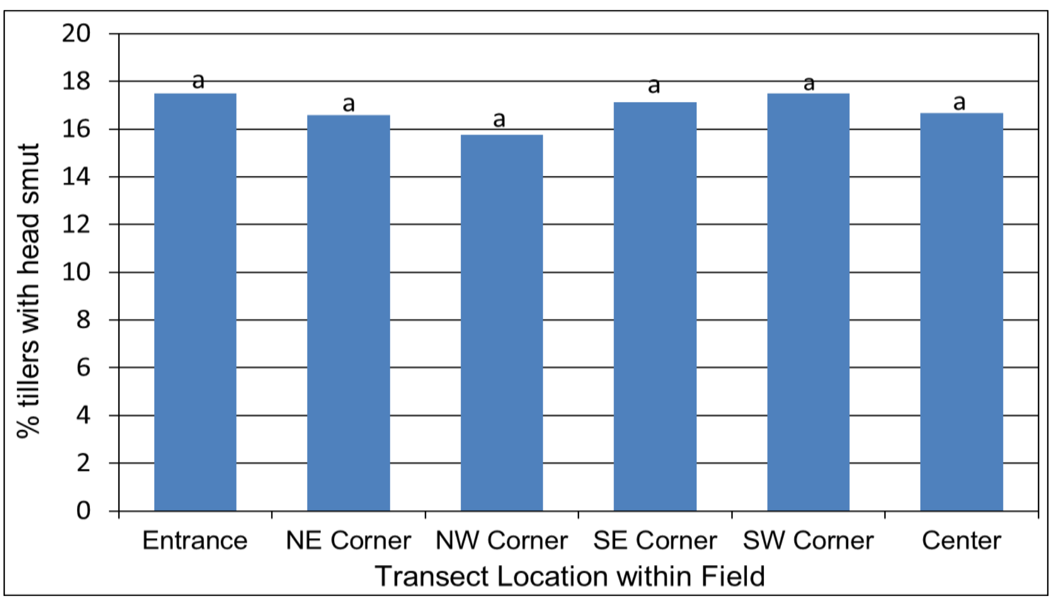

Figure 2. Incidence of head smut (*T. maclaganii*) in different transects within switchgrass fields in Ontario, 2017. Columns followed by the same letter are not statistically different in Tukey's HSD P=0.05.

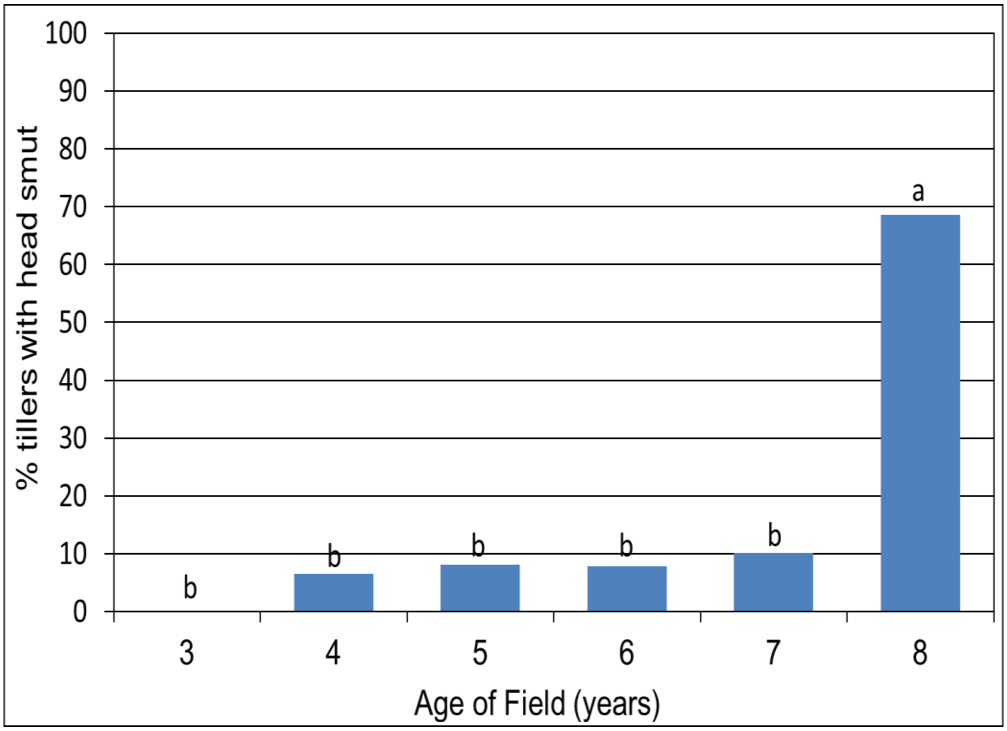

Figure 3. Incidence of head smut (*T. maclaganii*) in Ontario switchgrass fields of different ages in 2017. Columns followed by the same letter are not statistically different in Tukey's HSD P=0.05.

FRUIT, NUTS AND BERRIES, ORNAMENTALS AND TURFGRASS/ FRUITS, FRUITS À ÉCALE ET BAIES, PLANTES ORNEMENTALES ET GAZON

CROP / CULTURE: Strawberry
LOCATION / RÉGION: Ontario

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: SURVEY OF FUNGICIDE RESISTANCE IN ANTHRACNOSE FRUIT ROT IN ONTARIO DAYNEUTRAL STRAWBERRIES 2017

ABSTRACT: A survey of five dayneutral strawberry fields to determine *Colletotrichum nymphaeae* (Pass.) Aa resistance to the active ingredients pyraclostrobin, fludioxonil and cyprodinil was conducted in eastern and southern Ontario during 2016. All isolates collected were determined to be sensitive to cyprodinil and fludioxonil. Thirty-two percent of the isolates were found to be very sensitive to pyraclostrobin, 14% moderately to slightly sensitive, 50% slightly sensitive and 4% appeared to be not sensitive to pyraclostrobin.

INTRODUCTION: In recent years, strawberry growers in Ontario have increased the acreage of dayneutral strawberries. Dayneutral strawberries have a much longer flowering and fruiting season than traditional June-bearing strawberries. This has resulted in many more fungicide applications for fruit rot increasing the possibility of fungicide resistance developing (Burlakoti et al. 2014). Fungicides containing strobilurin (Group 11) active ingredients were the primary fungicides applied for the management of anthracnose fruit rot caused by *Colletotrichum nymphaeae* (Pass.) Aa (member of the *C. acutatum* complex) (Damm et al. 2012) in dayneutral strawberries. Several dayneutral strawberry growers in Ontario have indicated strobilurin fungicides no longer provide effective control of strawberry anthracnose fruit rot. The mode of action of the strobilurin fungicides is highly specific therefore many pathogens have lost sensitivity to this group of fungicides (Hincapie et al. 2014). This may explain the increasing level of anthracnose fruit rot observed in dayneutral strawberries or the variability in control of strawberry anthracnose fruit rot with this group of fungicides in recent years. Recently Switch 62.5 WG containing cyprodinil (Group 9) and fludioxonil (Group 12) has been registered for anthracnose fruit rot management in strawberries, however there is no information on the baseline sensitivity of *C. nymphaeae* to these active ingredients. *In vitro* assays can determine baseline sensitivity of a fungus to various fungicides and can screen for fungicide resistance among isolates (Hincapie et al. 2014; Mondal et al. 2005; Smith et al. 2013; Wedge et al. 2013).

METHODS: Ten dayneutral strawberry fruit with strawberry anthracnose fruit rot lesions caused by *C. nymphaeae* were collected from 5 strawberry farms (10 fruit/farm; 50 fruit in total) located across southern and eastern Ontario during the late spring of 2016. The plants from which the fruit was selected had not received a fungicide application during 2016. Conidia on the fruit lesions were streaked onto SNA and PDA agar media amended with 100 mg of streptomycin/litre. Fifty single spore isolates of *C. nymphaeae* were obtained (10/farm) and stored at 4^{o}C on PDA slants until sensitivity to cyprodinil, fludioxonil and pyraclostrobin could be completed.

Each single spore isolate was sub-cultured to PDA and allowed to grow at 21^{o}C for 5 days. A 5mm diameter plug from the actively growing margin of each sub-cultured single spore isolate was placed in the center of petri dish containing PDA (15 ml PDA/100mm petri dish) amended with cyprodinil, fludioxonil or pyraclostrobin at 0, 0.01, 0.1, 1, 10 and 100 µg/ml. The petri plates were incubated at 21^{o}C until colonies on plates without the active ingredient (0 μg/ml) covered 50-60% of the plate. Colony diameter was measured with two perpendicular measurements per plate. The trial was replicated three times. The growth of each isolate on the different concentrations of each active ingredient was recorded, graphed and the effective concentration that inhibited 50% of growth (EC_{50}) was determined. Histograms of the EC_{50} were constructed for the percentage of isolates sensitive to the different concentrations of each active ingredient.

RESULTS AND DISCUSSION: All 50 isolates (10/farm) collected from five farms were determined to be sensitive to cyprodinil with an EC_{50} between 0.01 and 0.1ug/ml (Figure 1). All isolates collected were sensitive to fludioxonil with 34% (17/50) very sensitive with an EC_{50} < 0.01ug/ml and 66% (33/50) sensitive with an EC_{50} between 0.01 and 0.1ug/ml (Figure 2). None of the isolates appeared to be resistant to either cyprodinil or fludioxonil. Cyprodinil and fludioxonil are the two active ingredients in the fungicide Switch 62.5 WG. Switch 62.5 WG has been registered for the control of gray mold caused by *Botrytis cinerea* in strawberries for many years and was only recently registered in late 2016 for management of anthracnose fruit rot in strawberries. Regardless, these two active ingredients appeared to be very effective on *C. nymphaeae,* the causal agent of strawberry anthracnose fruit rot at the five farms surveyed in 2016. Only 32% (16/50) of the isolates were found to be very sensitive to pyraclostrobin with an EC_{50} <0.01ug/ml, whereas 14% (7/50) were moderately to slightly sensitive to pyraclostrobin with an EC_{50} between 1.0 and 10.0 ug/ml, 50% (25/50) were slightly sensitive to pyraclostrobin with an EC_{50} between 10.0 and 100.0 ug/ml and 4% (2/50) appeared to be insensitive or resistant to pyraclostrobin with an EC_{50} > 100.0ug/ml (Figure 3). Isolates collected at one farm were found to be very sensitive to pyraclostrobin whereas the isolates collected from the other four farms were less sensitive or tending toward resistance to pyraclostrobin. Pyraclostrobin is the active ingredient in the fungicide Cabrio and one of the active ingredients in the fungicide Pristine WG that have been registered and used for strawberry anthracnose fruit rot management in Ontario for more than a decade. Although the survey only included a few dayneutral strawberry farms in Ontario, the evidence of *C. nymphaeae* populations developing resistance to strobilurin fungicides at some farms is valuable to the Ontario strawberry industry when developing strawberry anthracnose management strategies.

ACKNOWLEDGEMENTS: We would like to thank Dr. Shannon Shan and Melody Melzer, Pest Diagnostic Clinic, University of Guelph for their help isolating and identifying the fungi from the diseased strawberry fruit tissue and conducting the fungicide resistance testing. The assistance from Kevin Schooley and financial support from the Ontario Berry Growers Association, Syngenta Canada and BASF Crop Protection is greatly appreciated. This project was funded in part through Growing Forward 2 (GF2), a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of GF2 in Ontario.

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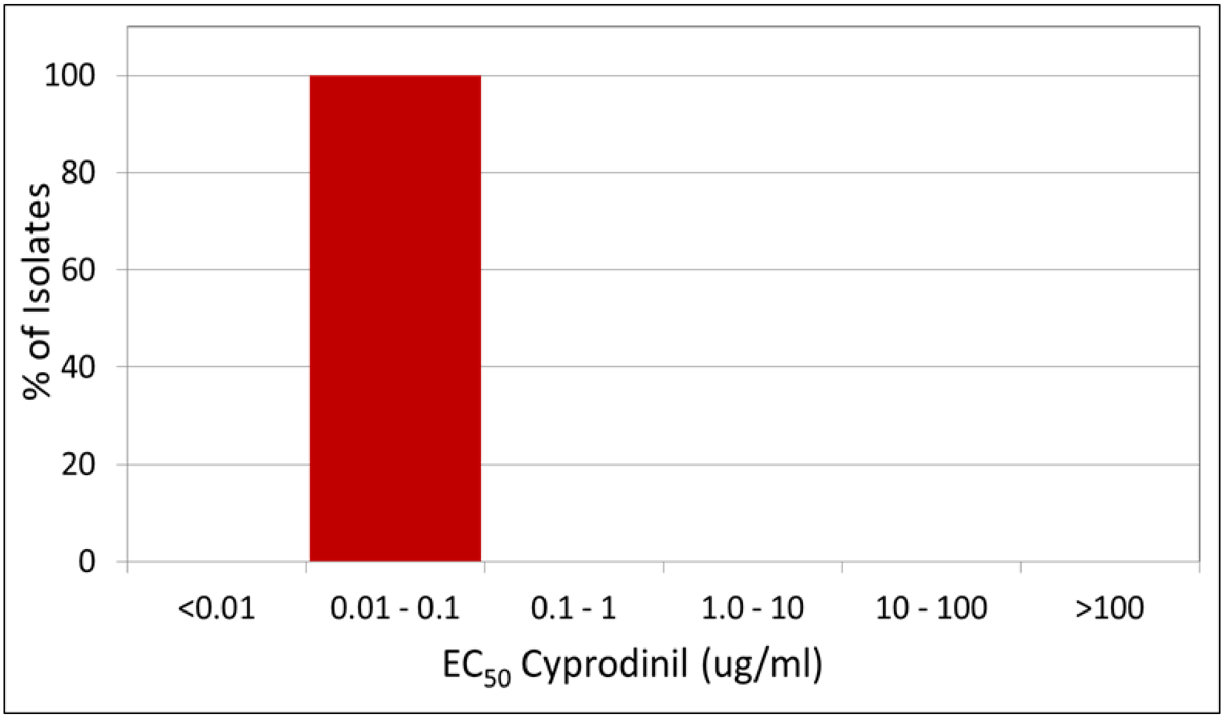

Figure 1. Sensitivity of single spore isolates of *Colletotrichum nymphaeae* (*C. acutatum* complex) collected from 5 strawberry farms (10 isolates/farm) to cyprodinil based on the concentration to inhibit growth by 50% (EC_{50}).

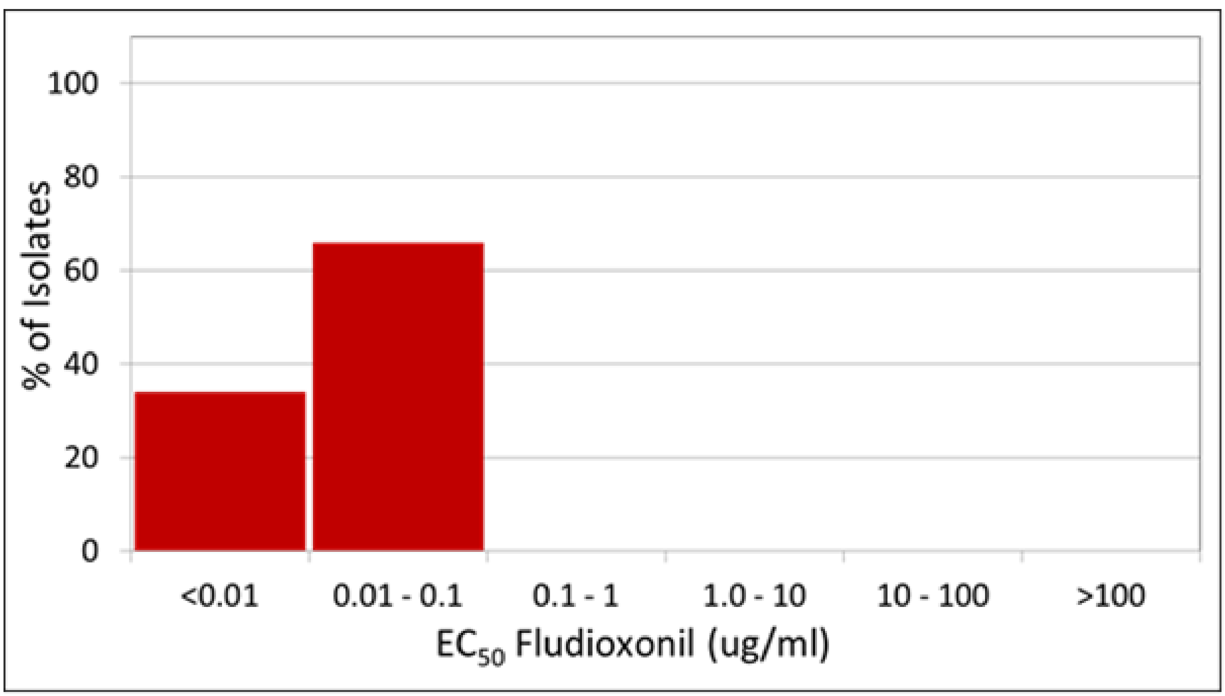

Figure 2. Sensitivity of single spore isolates of *Colletotrichum nymphaeae* (*C. acutatum* complex) collected from 5 strawberry farms (10 isolates/farm) to fludioxonil based on the concentration to inhibit growth by 50% (EC_{50}).

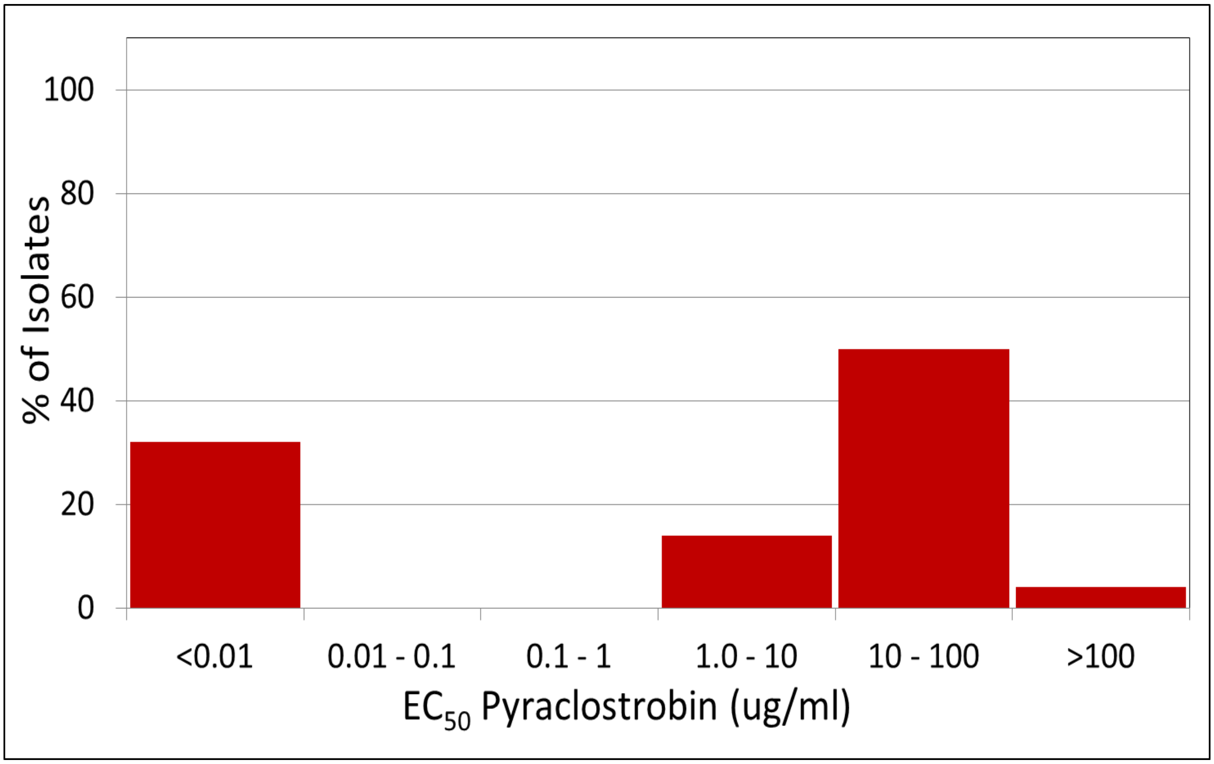

Figure 3. Sensitivity of single spore isolates of *Colletotrichum nymphaeae* (*C. acutatum* complex) collected from 5 strawberry farms (10 isolates/farm) to pyraclostrobin based on the concentration to inhibit growth by 50% (EC_{50}).

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