
**2005**

**THE CANADIAN PHYTOPATHOLOGICAL SOCIETY**

# CANADIAN PLANT DISEASE SURVEY

## DISEASE HIGHLIGHTS

**SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE**

# INVENTAIRE DES MALADIES DES PLANTES AU CANADA

## APERÇU DES MALADIES

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

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

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# Canadian Plant Disease Survey

# Inventaire des maladies des plantes au Canada

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**Contents**: **DISEASE HIGHLIGHTS**- 2004 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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**CANADIAN PLANT DISEASE SURVEY INDEX - AUTHORS AND TITLES**

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## CEREALS / CÉRÉALES

**VEGETABLES/LÉGUMES**



**FRUIT, NUTS AND BERRIES, ORNAMENTALS AND TURFGRASS/ FRUITS, FRUITS À ÉCALE ET BAIES, PLANTES ORNEMENTALES ET GAZON**



**FOREST TREES/ ARBRES FORESTIERS**

# Diagnostic Laboratories / Laboratoires diagnostiques

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

**NAMES AND AGENCIES:**
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**TITLE: 2004 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS**

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

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

**Table 1.** Summary of diseases diagnosed on **cereal crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Wheat | Bacterial blight | *Pseudomonas syringae* | 1 |
| | Black head mould | *Alternaria* sp., *Cladosporium* sp. | 1 |
| | Common root rot | *Fusarium* spp., *Cochliobolus sativus* | 11 |
| | Head blight | *Fusarium* spp. | 2 |
| | Septoria leaf spot | *Septoria* spp. | 2 |
| | Tan spot | *Pyrenophora tritici-repentis* | 11 |
| | Wheat streak mosaic | Wheat streak mosaic virus | 3 |
| | Physiological leaf spot * | chloride deficiency, etc. | 21 |
| | Environmental injury | | 16 |
| | Herbicide injury | | 15 |
| Barley | Common root rot | *Fusarium* spp., *Cochliobolus sativus* | 4 |
| | Leaf rust | *Puccinia hordei* | 1 |
| | Net blotch | *Pyrenophora teres* | 4 |
| | Speckled leaf spot | *Septoria passerinii* | 1 |
| | Spot blotch | *Cochliobolus sativus* | 4 |
| | Environmental injury | | 8 |
| | Herbicide injury | | 11 |
| Oat | Bacterial blight | *Pseudomonas syringae* | 10 |
| | Common root rot | *Fusarium* sp. | 1 |
| | Pyrenophora leaf blotch | *Pyrenophora avenae* | 5 |
| | Seedling blight | *Fusarium* sp., *Pythium* sp. | 2 |
| | Environmental injury | | 9 |
| | Herbicide injury | | 8 |

* The majority of wheat samples displaying physiological leaf spot were **winter wheat** and cultivars with a genetic predisposition to show such symptoms, despite optimal growing conditions and macro-nutrient fertility, owing to a lack of chloride.

**Table 2.** Summary of diseases diagnosed on **forage legume crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Alfalfa | Cercospora leaf spot | *Cercospora medicaginis* | 1 |
| | Common leaf spot | *Pseudopeziza medicaginis* | 3 |
| | Lepto leaf spot | *Leptosphaerulina trifolii* | 1 |
| | Root rot | *Fusarium* spp. | 3 |
| | Sclerotinia stem rot | *Sclerotinia sclerotiorum* | 3 |
| | Spring black stem and leaf spot | *Phoma medicaginis* | 10 |
| | Stemphylium leaf spot | *Stemphylium botryosum* | 1 |
| | Yellow leaf blotch | *Leptotrochila medicaginis* | 2 |
| | Herbicide injury | | 2 |
| | Nutrient deficiency | | 3 |
| Trefoil | Root rot | *Fusarium oxysporum* | 1 |

**Table 3.** Summary of diseases diagnosed on **grasses** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Lawn grasses | Anthracnose | *Colletotrichum graminicola* | 2 |
| | Brown patch | *Rhizoctonia* sp. | 1 |
| | Melting out | *Drechslera* sp. | 2 |
| | Red thread | *Laetisaria fuciformis* | 2 |
| Timothy | Choke disease | *Epichloë typhina* | 1 |
| | Crinkle joint | undetermined | 1 |
| | Herbicide injury | | 1 |

**Table 4.** Summary of diseases diagnosed on **greenhouse crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Impatiens | Verticillium wilt | *Verticillium albo-atrum* | 1 |
| Nemesia | Damping off | *Fusarium* sp. | 1 |
| Petunia | Stem rot | *Botrytis cinerea* | 1 |
| Tomato | Leaf mould | *Fulvia fulva* | 1 |
| | Seedling blight | *Pythium* sp. | 1 |
| | Stem rot | *Botrytis cinerea* | 1 |
| | Herbicide injury | | 1 |
| Watermelon | Seedling blight | *Pythium* sp. | 1 |

**Table 5.** Summary of diseases diagnosed on **vegetable crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Cabbage | Root rot | *Rhizoctonia solani*, *Fusarium* sp. | 1 |
| Carrot | White mould | *Sclerotinia sclerotiorum* | 1 |
| Cauliflower | Grey mould | *Botrytis cinerea* | 1 |
| | Stem rot | *Rhizoctonia solani* | 1 |
| Corn | Holcus spot | *Pseudomonas syringae* | 3 |
| | Herbicide injury | | 1 |
| Cucumber | Root rot | *Pythium* sp. | 1 |
| | Environmental injury | | 1 |
| Onion | Black mould | *Aspergillus niger* | 4 |
| | Botrytis neck rot | *Botrytis allii* | 2 |
| | Bulb rot | *Rhizopus* sp. | 1 |
| | Fusarium basal plate rot | *Fusarium oxysporum* | 7 |
| | Root rot | *Fusarium* sp., *Pythium* sp. | 2 |
| | Herbicide injury | | 1 |
| Parsnip | Root decay | *Rhizoctonia* sp., *Geotrichum candidum* | 2 |
| Pepper | Stem rot | *Sclerotinia sclerotiorum* | 1 |
| | Environmental injury | | 1 |
| Tomato | Early blight | *Alternaria solani* | 1 |
| | Septoria leaf spot | *Septoria lycopersici* | 1 |
| | Environmental injury | | 1 |
| | Herbicide injury | | 2 |
| Watermelon | Environmental injury | | 1 |

**Table 6.** Summary of diseases diagnosed on **oilseed crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Flax | Brown stem blight | *Alternaria linicola* | 2 |
| | Pasmo | *Septoria linicola* | 2 |
| | Root rot | *Rhizoctonia solani* | 2 |
| | Herbicide injury | | 7 |
| | Nutrient deficiency | | 2 |
| Sunflower | Downy mildew | *Plasmopara halstedii* | 1 |
| | Herbicide injury | | 14 |
| Canola | Blackleg | *Leptosphaeria maculans* | 4 |
| | Damping off | *Rhizoctonia solani* | 2 |
| | Downy mildew | *Peronospora parasitica* | 1 |
| | Fusarium root rot | *Fusarium* spp. | 1 |
| | Fusarium wilt | *Fusarium oxysporum*, *F. avenaceum* | 0 |
| | Root rot | *Rhizoctonia solani*, *Fusarium* spp. | 4 |
| | Stem rot | *Sclerotinia sclerotiorum* | 6 |
| | Environmental injury | | 6 |
| | Herbicide injury | | 44 |
| | Nutrient deficiency | | 10 |

**Table 7.** Summary of diseases diagnosed on **potato crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|
| Bacterial ring rot | *Clavibacter michiganensis* subsp. *sepedonicus* | 4 |
| Bacterial soft rot | *Erwinia carotovora* subsp. *carotovora* | 5 |
| Blackleg | *Erwinia carotovora* subsp. *atroseptica* | 1 |
| Black dot | *Colletotrichum coccodes* | 14 |
| Brown spot | *Alternaria alternata* | 31 |
| Early blight | *Alternaria solani* | 32 |
| Fusarium dry rot | *Fusarium sambucinum* | 4 |
| Fusarium wilt | *Fusarium oxysporum* | 2 |
| Grey mould | *Botrytis cinerea* | 10 |
| Late blight (tuber)* | *Phytophthora infestans* | 1 |
| Late blight (foliar)* | *Phytophthora infestans* | 1 |
| Leak | *Pythium ultimum* | 11 |
| Pink rot | *Phytophthora erythroseptica* | 8 |
| Rhizoctonia stem and stolon canker | *Rhizoctonia solani* | 2 |
| Scab, common | *Streptomyces* sp. | 1 |
| Stemphylium blight | *Stemphylium* sp. | 2 |
| Tuber rot | *Geotrichum candidum* | 1 |
| Verticillium wilt | *Verticillium dahliae* | 22 |
| Physiological disorders | | 6 |
| Environmental injury | | 2 |
| Herbicide injury | | 6 |

* The tuber sample was from the 2003 crop. The foliar sample was from an isolated inoculated plot.

**Table 8.** Summary of diseases diagnosed on **shelterbelt trees and woody ornamentals** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Ash (*Fraxinus* sp.) | Anthracnose | *Gloeosporium aridum* | 4 |
| | Canker | unidentified | 4 |
| | Canker | *Botryosphaeria* sp. | 1 |
| | Herbicide injury | | 22 |
| Basswood | Herbicide injury | | 4 |
| Birch | Dieback | *Melanconium betulinum* | 1 |
| Caragana | Powdery mildew | *Erysiphe* sp. | 3 |
| | Herbicide injury | | 2 |
| Cotoneaster | Canker | *Nectria cinnabarina* | 1 |
| | Fireblight | *Erwinia amylovora* | 1 |
| Elm | Canker | unidentified | 1 |
| | Dutch elm disease | *Ophiostoma ulmi* | 5 |
| | Wilt | *Verticillium* sp. | 1 |
| | Herbicide injury | | 1 |
| Lilac | Environmental injury | | 2 |
| | Herbicide injury | | 2 |
| Maple, Manitoba (*Acer negundo*) | Environmental injury | | 2 |
| | Herbicide injury | | 9 |
| Maple, Silver (*Acer saccharinum*) | Anthracnose | *Discula* sp. | 1 |
| Mountain ash | Canker | *Nectria cinnabarina* | 1 |
| | Fireblight | *Erwinia amylovora* | 1 |
| Oak | Anthracnose | *Discula quercina* | 1 |
| | Herbicide injury | | 1 |
| Pine | Lophodermium needle cast | *Lophodermium* sp. | 1 |
| Poplar | Bronze leaf disease | *Apioplagiostoma populi* | 4 |
| | Canker (nursery bed) | *Cytospora chrysosperma* | 2 |
| | Environmental injury | | 2 |
| | Herbicide injury | | 2 |
| Rose | Environmental injury | | 1 |
| Spruce | Cytospora canker | *Leucostoma kunzei* | 5 |
| | Canker | unidentified | 1 |
| | Needle blight | *Lirula* sp. | 1 |
| | Needle cast | *Rhizosphaera kalkhoffii* | 23 |
| | Root rot | *Fusarium solani* | 1 |
| | Environmental injury | | 27 |
| | Herbicide injury | | 2 |
| *Thuja* sp. | Canker | *Cytospora* sp. | 1 |
| | Canker | *Seiridium* sp. | 1 |
| Willow | Canker | unidentified | 1 |
| | Environmental injury | | 4 |
| | Herbicide injury | | 9 |

**Table 9.** Summary of diseases diagnosed on **special field crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Canaryseed | Fusarium head blight | *Fusarium* sp. | 1 |
| Corn | Ear rot | *Mucor* sp., *Fusarium* spp. | 33 |
| | Root rot | *Fusarium* sp. | 3 |
| | Stalk rot | *Fusarium graminearum*, *F. poae*, *F. subglutinans*, *F. equiseti* | 12 |
| | Environmental injury | | 3 |
| | Herbicide injury | | 4 |
| Faba bean | Anthracnose | *Colletotrichum* sp. | 1 |
| | Chocolate spot | *Botrytis* sp. | 2 |
| | Root rot | *Fusarium* spp., *Rhizoctonia solani* | 3 |
| | Stem rot | *Sclerotinia sclerotiorum* | 2 |
| Field bean | Bacterial brown spot | *Pseudomonas syringae* pv. *syringae* | 16 |
| | Common blight | *Xanthomonas axonopodis* pv. *phaseoli* | 12 |
| | Halo blight | *Pseudomonas syringae* pv. *phaseolicola* | 5 |
| | Anthracnose | *Colletotrichum lindemuthianum* | 13 |
| | Alternaria leaf spot | *Alternaria* sp. | 4 |
| | Root rot | *Fusarium* spp., *Rhizoctonia solani*, *Pythium* spp. | 7 |
| | Rust | *Uromyces appendiculatus* | 3 |
| | Environmental injury | | 3 |
| | Herbicide injury | | 5 |
| | Mechanical injury | | 9 |
| Field pea | Anthracnose | *Colletotrichum* spp. | 10 |
| | Ascochyta leaf and pod spot | *Ascochyta pisi* | 1 |
| | Downy mildew | *Peronospora viciae* | 1 |
| | Mycosphaerella blight | *Mycosphaerella pinodes* | 5 |
| Field pea | Root rot | *Fusarium solani*, *Fusarium* spp., *Pythium* sp. | 10 |
| Lentil | Ascochyta blight | *Ascochyta lentis* | 1 |
| | Botrytis stem and pod rot | *Botrytis cinerea* | 1 |
| | Sclerotinia stem and pod rot | *Sclerotinia sclerotiorum* | 1 |
| | Root rot | *Fusarium* sp. | 1 |
| | Herbicide injury | | 4 |
| | Nutrient deficiency | | 2 |
| Millet | Bacterial leaf blight | *Xanthomonas* sp. | 1 |
| | Root rot | *Fusarium* sp. | 1 |
| Sorghum | Bacterial leaf spot | *Pseudomonas syringae* | 1 |
| Soybean | Downy mildew | *Peronospora manshurica* | 1 |
| | Root rot | *Fusarium* spp., *Rhizoctonia solani* | 5 |
| | Sclerotinia stem rot | *Sclerotinia sclerotiorum.* | 1 |
| | Environmental injury | | 5 |
| | Herbicide injury | | 6 |
| | Iron chlorosis | iron deficiency | 2 |

**Table 10.** Summary of diseases diagnosed on **fruit crops** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Apple | Canker | unidentified | 1 |
| | Canker | *Cytospora* sp. | 1 |
| | Canker | *Botryosphaeria obtusa* | 4 |
| | Fire blight | *Erwinia amylovora* | 3 |
| | Scab | *Venturia inaequalis* | 2 |
| | Environmental injury | | 2 |
| | Herbicide injury | | 2 |
| Chokecherry | Black knot | *Apiosporina morbosa* | 1 |
| Raspberry | Bacterial blight | *Pseudomonas syringae* | 1 |
| | Fruit rot | *Botrytis cinerea* | 1 |
| | Root rot | *Fusarium solani* | 1 |
| | Spur blight | *Didymella applanata* | 2 |
| | Verticillium wilt | *Verticillium* sp. | 1 |
| | Iron chlorosis | iron deficiency | 1 |
| Saskatoon | Black leaf | *Apiosporina collinsia* | 1 |
| | Canker | *Cytospora* sp. | 1 |
| | Entomosporium leaf and berry spot | *Entomosporium mespili* | 2 |
| | Powdery mildew | *Podosphaera clandestina* | 1 |
| | Root rot | *Fusarium* sp. | 1 |
| | Rust | *Gymnosporangium clavipes* | 3 |
| | Environmental injury | | 1 |
| Sea Buckthorn (*Hippophae rhamnoides*) | Stem canker | *Cytospora chrysosperma* | 2 |
| | Verticillium wilt | *Verticillium albo-atrum* | 2 |
| Strawberry | Fruit rot | *Botrytis cinerea* | 2 |
| | Leaf scorch | *Marssonina fragariae* | 1 |
| | Root rot | *Fusarium* spp., *Rhizoctonia solani*, *Cylindrocarpon* sp. | 2 |
| | Environmental injury | | 1 |

**Table 11.** Summary of diseases diagnosed on **herbaceous ornamentals and interiorscape plants** submitted to the Manitoba Agriculture, Food and Rural Initiatives Crop Diagnostic Centre in 2004.

| CROP | SYMPTOM/ DISEASE | CAUSAL AGENT | NUMBER OF SAMPLES |
|---|---|---|---|
| Marigold | Stem rot and flower rot | *Sclerotinia sclerotiorum* | 1 |

**CROP:** Diagnostic Laboratory Report
**LOCATION**: Saskatchewan

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## TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN AGRICULTURE, FOOD AND RURAL REVITALIZATION CROP PROTECTION LABORATORY IN 2004

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

**RESULTS:** Between April 1 and November 1, 2004 the Crop Protection Laboratory received a total of 833 samples of which 83% were for disease diagnosis (53% of these were American elms submitted for DED testing). Categories of highest to lowest volume (excluding the DED samples) were: special crops (33%), cereals (29%), oilseeds (18%), and forages (8%). Fruit, vegetables, woody ornamentals, herbaceous ornamentals, turf, and greenhouse crops comprised the remaining 12% of the samples. Summaries of diseases/causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2004 are presented in Tables 1-7 by crop category. There were 367 samples of American elm, submitted under the DED program (Table 8).

**Table 1.** Summary of plant diseases diagnosed on **cereal crops** submitted to the SAFRR Crop Production Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Barley | Common root rot/seedling blight/prematurity blight | *Cochliobolus sativus/Fusarium* spp. | 5 |
| | Head blight | *Fusarium* spp. | 4 |
| | Spot blotch | *Cochliobolus sativus* | 2 |
| | Net blotch | *Pyrenophora teres* | 2 |
| | Leaf stripe | *Pyrenophora graminea* | 1 |
| | Sooty molds | *Alternaria/Cladosporium* | 1 |
| | Scald | *Rhynchosporium secalis* | 1 |
| | Chemical injury | | 9 |
| | Environmental injury | | 7 |
| | Nutrient deficiency | | 2 |

*Cont'd .....*

Table 1 - *cont'd*

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Oat | Sooty molds | Visual I.D. | 1 |
| | Chemical injury | | 2 |
| | Environmental injury | | 2 |
| Wheat | Glume blotch/leaf blotch | *Septoria nodorum* | 11 |
| | Common root rot/seedling blight/prematurity blight | *Cochliobolus sativus/Fusarium* spp. | 9 |
| | Sooty molds | *Alternaria/Cladosporium/Cochliobolus/ Epicoccum* spp. | 7 |
| | Tan spot | *Pyrenophora tritici-repentis* | 4 |
| | Spot blotch | *Cochliobolus sativus* | 2 |
| | Eye spot | *Rhizoctonia* sp. | 1 |
| | Speckled leaf blotch | *Septoria tritici* | 1 |
| | Ascochyta blight | *Ascochyta graminicola* | 1 |
| | Head blight | *Fusarium culmorum* | 1 |
| | Chemical injury | | 44 |
| | Environmental injury | | 17 |
| | Nutrient deficiency | | 6 |

**Table 2.** Summary of plant diseases diagnosed on **forage crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Alfalfa | Spring black stem/leaf spot | *Phoma medicaginis* | 21 |
| | Leptosphaerulina leaf spot | *Leptosphaerulina trifolii* | 11 |
| | Anthracnose | *Colletotrichum* sp. | 9 |
| | Root/crown rot | *Rhizoctonia solani/Fusarium* spp. | 8 |
| | Stemphylium leaf spot | *Stemphylium botryosum* | 5 |
| | Plenodomus leaf/stem rot | *Plenodomas* sp. | 3 |
| | Basal stem rot | *Fusarium* sp. | 3 |
| | Botrytis blight | *Botrytis cinerea* | 1 |
| | Downy mildew | *Peronospora trifoliorum* | 1 |
| | Phoma leaf spot | *Phoma* sp. | 1 |
| | Sclerotinia rot | *Sclerotinia sclerotiorum* | 1 |
| | Chemical injury | | 1 |
| | Environmental injury | | 1 |
| Corn | Chemical injury | | 2 |
| Millet | Chemical injury | | 1 |
| | Environmental injury | | 1 |
| Rye grass | Root/crown rot | *Cochliobolus sativus/Fusarium* sp. | 2 |

**Table 3.** Summary of plant diseases diagnosed on **fruit crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Apple | Fireblight | *Erwinia amylovora* | 1 |
| Cherry | Chemical injury | | 1 |
| Saskatoon | Entomosporium leaf spot | *Entomosporium mespili* | 1 |
| Strawberry | Root/crown rot | *Fusarium* sp./*Rhizoctonia* sp./ *Cylindrocarpon* sp./ *Phytophthora* sp./ *Verticillium* sp./*Pythium* sp. | 2 |
| | Spiral nematode | *Helicotylenchus* sp. | 1 |
| | Pin nematode | *Paratylenchus* sp. | 1 |
| | Stunt nematode | *Tylenchorhynchus* sp. | 1 |

**Table 4.** Summary of plant diseases diagnosed on **oilseed crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Canola | Root rot/seedling blight | *Fusarium* spp./*Rhizoctonia solani* | 6 |
| | Blackleg | *Leptosphaeria maculans* | 4 |
| | Fusarium root rot | *Fusarium avenaceum* | 1 |
| | Sclerotinia stem rot | *Sclerotinia sclerotiorum* | 1 |
| | Alternaria black spot | *Alternaria* spp. | 1 |
| | Secondary stem rot | *Phoma* sp. | 1 |
| | Sooty molds | *Alternaria/Cladosporium* spp. | 1 |
| | Chemical injury | | 14 |
| | Environmental injury | | 13 |
| | Physiological injury | | 1 |
| Flax/linola | Root rot/seedling blight | *Fusarium* spp./*Rhizoctonia solani* | 10 |
| | Secondary stem rot | *Phoma* sp. | 1 |
| | Chemical injury | | 7 |
| | Environmental injury | | 4 |
| | Physiological injury | | 1 |

**Table 5.** Summary of plant diseases diagnosed on **special crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Canary seed | Root rot/seedling blight | *Cochliobolus sativus/Fusarium* sp./ *Pythium* sp. | 4 |
| | Septoria leaf mottle | *Septoria triseti* | 1 |
| | Sooty molds | *Alternaria/Cladosporium/ Cochliobolus/Epicoccum* spp. | 1 |
| | Chemical injury | | 7 |
| | Environmental injury | | 5 |
| | Nutrient deficiency | | 1 |
| Chickpea | Ascochyta blight | *Ascochyta rabiei* | 1 |
| | Seedling blight/root rot | *Fusarium* sp./*Rhizoctonia solani* | 1 |
| | Chemical injury | | 2 |
| Coriander | Alternaria blight | *Alternaria* sp. | 1 |
| | Fusarium blight | *Fusarium avenaceum* | 1 |
| Lentil | Root rot/seedling blight | *Fusarium* spp./*Rhizoctonia solani* | 21 |
| | Anthracnose | *Colletotrichum truncatum* | 11 |
| | Ascochyta blight | *Ascochyta lentis* | 8 |
| | Sclerotinia rot | *Sclerotinia sclerotiorum* | 4 |
| | Septoria leaf spot | *Septoria* sp. | 4 |
| | Stemphylium leaf spot | *Stemphylium botryosum* | 3 |
| | Secondary stem rot | *Fusarium* sp. | 2 |
| | Stem rot | *Botrytis cinerea* | 1 |
| | Pod/stem rot | *Fusarium/Rhizoctonia* spp. | 1 |
| | Root rot | *Verticillium* sp. | 1 |
| | Chemical injury | | 13 |
| | Environmental injury | | 9 |
| Mustard | Seedling blight/root rot | *Fusarium* sp./*Rhizoctonia solani* | 2 |
| | Sclerotinia stem rot | *Sclerotinia sclerotiorum* | 1 |
| | Sooty molds | *Alternaria/Cladosporium* spp. | 1 |
| | Chemical injury | | 1 |
| | Environmental injury | | 1 |
| Pea | Root rot/seedling blight | *Fusarium* spp./*Rhizoctonia solani* | 19 |
| | Ascochyta/Mycosphaerella blight | *Mycosphaerella pinodes* | 8 |
| | Anthracnose | *Colletotrichum pisi* | 4 |
| | Ascochyta leaf and pod spot | *Ascochyta pisi* | 2 |
| | Septoria leaf spot | *Septoria pisi* | 1 |
| | Downy mildew | *Peronospora pisi* | 1 |
| | Stemphylium leaf spot | *Stemphylium botryosum* | 1 |
| | Chemical injury | | 3 |
| | Environmental injury | | 4 |

**Table 6.** Summary of plant diseases diagnosed on **vegetable crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Tomato | Chemical injury | | 1 |

**Table 7.** Summary of plant diseases diagnosed on **woody ornamental crops** submitted to the SAFRR Crop Protection Laboratory in 2004.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES |
|---|---|---|---|
| Ash | Chemical injury | | 1 |
| Caragana | Chemical injury | | 1 |
| | Powdery mildew | *Eryshiphe* sp. | 1 |
| Chokecherry | Chemical injury | | 1 |
| Crabapple | Apple scab | *Venturia inaequalis* | 2 |
| | Fireblight | *Erwinia amylovora* | 1 |
| | Nutrient deficiency | | 1 |
| Elm | Botryodiplodia canker | *Botryodiplodia* sp. | 1 |
| | Leaf black spot | *Gnomia ulmea* | 1 |
| | Chemical injury | | 1 |
| Juniper | Lophodermium needlecast | *Lophodermium juniperi* | 1 |
| Maple | Chemical injury | | 2 |
| Poplar | Chemical injury | | 1 |
| Spruce | Chemical injury | | 5 |
| | Environmental injury | | 6 |
| | Salinity | | 1 |
| Willow | Chemical injury | | 1 |

**Table 8.** Summary of plant diseases diagnosed on **American elm** submitted to the SAFRR Crop Protection Laboratory in 2004. Submissions are submitted under the provincial Dutch elm disease program.

| CROP | DISEASE | CAUSAL AGENT | NO. OF SAMPLES* |
|---|---|---|---|
| American elm | Dutch elm disease | *Ophiostoma novo-ulmi* | 174 |
| | Dothiorella wilt | *Dothiorella ulmi* | 52 |
| | Verticillium wilt | *Verticillium* sp. | 1 |

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

# Cereals / Céréales

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

**NAMES AND AGENCY / NOMS ET ORGANISME:**
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**TITLE / TITRE: 2004 SURVEY FOR FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA**

**INTRODUCTION AND METHODS:** A total of 50 barley fields (28 two-row, 21 six-row, 1 mixed) in southern Manitoba were surveyed for the presence of fusarium head blight (FHB) between July 27 and August 20, 2004, when crops were at the early milk to hard dough stage of growth (ZGS 71-87). The fields were selected randomly along the survey routes. FHB incidence (the percentage of heads with typical symptoms) was assessed in each field by sampling 80-100 spikes at 3 locations for disease. FHB severity (the mean affected proportion of symptomatic heads) was estimated visually in the field. Several affected heads were collected at each field site and stored in paper envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from five heads per location. The kernels were surface sterilized in 0.3% NaOCl (Javex brand) and plated onto potato dextrose agar to quantify and identify *Fusarium* spp. on kernels.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba, affecting timely seeding operations. A heavy snowfall on May 11 delayed seeding operations further, in many instances until mid-June. The low temperatures likely also curtailed the growth of *Fusarium* in overwintered plant straw and debris, resulting in lower than normal levels of spring inoculum . Warmer, drier conditions prevailed during head emergence and kernel filling, but cool, moist conditions returned later in the growing season hampering harvesting operations. This resulted in some mature crops remaining unharvested for up to several weeks under wet conditions, favouring the further growth of *Fusarium* and other fungi on the ripe spikes.

Fusarium head blight was found in 45 of the 50 fields surveyed. Average incidence of FHB in two-row crops was 3.4% (range 0 - 14.2%), while severity averaged 5.2% (range 0 - 25.0%); in six-row crops incidence was 6.9% (range 0 - 32.0%) and severity 7.3% (range 0 - 33.0%). The resulting average FHB Index (incidence X severity / 100) for 2-row barley was 0.3% (range 0 - 1.7%), and that for 6-row barley was 0.8% (range 0 - 4.8%); for all barley the index was 0.5% (range of 0 to 4.8%). This would have resulted in an estimated minimal (<0.2%) yield loss from FHB. This likely is the lowest severity of FHB reported since surveys were initiated in 1994; levels were some 10x and 7x lower than in 2002 and 2001, respectively, but similar to those of 2003 (Tekauz et al. 2004, 2003, 2002)

The *Fusarium* species isolated from kernels are shown in Table 1. As for the past several years, *F. graminearum* was the predominant pathogenic species on kernels, with *F. poae* and *F. sporotrichioides* making up the bulk of the remainder.

**REFERENCES:**
Tekauz, A., J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, and D. Schultz. 2004. 2003 Survey for fusarium head blight of barley in Manitoba. Can. Plant Dis. Surv. 84: 45-46. (http://www.cps-scp.ca/cpds.htm)

Tekauz, A., Gilbert, J., Gold, E. Mueller, M., Stulzer, M., Beyene, H. Ghazvini, and F. Reverchon. 2003. 2002 Survey for fusarium head blight of barley in Manitoba. Can. Plant Dis. Surv. 83: 46-47. (http://www.cps-scp.ca/cpds.htm)

Tekauz, A., Gilbert, E. Mueller, M., Stulzer, R. Keathler, and E. Nedohin. 2002. Fusarium head blight of barley in Manitoba in 2001. Can. Plant Dis. Surv. 82: 57-58. (http://www.cps-scp.ca/cpds.htm)

**Table 1.** *Fusarium* spp. isolated from barley kernels in Manitoba in 2004.

| ***Fusarium* spp.** | **Percent of fields** | **Percent of kernels** |
|---|---|---|
| *F. avenaceum* | 24.0 | 3.3 |
| *F. culmorum* | 2.0 | 0.1 |
| *F. equiseti* | 6.0 | 0.2 |
| *F. graminearum* | 74.0 | 62.0 |
| *F. poae* | 74.0 | 23.3 |
| *F. sporotrichioides* | 36.0 | 11.0 |

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

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**TITLE / TITRE: SURVEY FOR LEAF SPOT DISEASES OF BARLEY IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** Foliar diseases of barley in Manitoba were assessed by surveying 49 farm fields (28 two-row, 21 six-row, 1 mixed) from July 27 to August 20 when most crops were at the late milk to soft dough stage of growth (ZGS 77-85). Fields were sampled at regular intervals along the survey routes, depending on availability. Disease severity was recorded by averaging ratings from approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Ratings were made on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried, and stored in paper envelopes. Subsequently, surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba, affecting timely seeding operations. A heavy snowfall on May 11 delayed seeding operations further, in many instances until mid-June. Warmer, drier conditions prevailed during head emergence and kernel filling, but cool, moist conditions returned later in the growing season and hampered harvesting. This resulted in some mature crops remaining unharvested under wet conditions for up to several weeks, promoting kernel staining and possible grade/quality losses. As appears to be the rule for barley, the field history, i.e., presence or absence of barley stubble from the previous year, appeared to have an overriding influence on the level of leaf spotting observed.

Leaf spots were observed in the upper or lower leaf canopies in 48 of the 49 barley fields surveyed. Disease severity levels in the upper canopy were nil, trace or very slight in 59% of fields, slight in 25%, moderate in 14%, and severe in 2%. Respective severity levels in the lower canopy were 16%, 43%, 10%, 10%, with 20% being senescent. On the basis of 3/4 of fields having only trace to slight leaf spotting in the upper canopy, foliar diseases in barley caused little damage in 2004; on average, grain yield losses were likely in the range of 1-2%. Losses were similar to those estimated for 2003, but were less than the 5-10% loss reported for 2002 (Tekauz et al. 2004, 2003).

*Cochliobolus sativus* (causal agent of spot blotch) and *Pyrenophora teres* (net blotch) were equally prevalent and damaging; both were found in most fields (an annual occurrence) and combined, caused 90% of the leaf spot damage observed (Table 1). In some years, such as 2002, *C. sativus* can cause most of the damage observed (Tekauz et al. 2003). The other identified pathogens resulted in minimal damage to barley in 2004.

**REFERENCES:**
Tekauz, A., J. Gilbert, E. Mueller, M. Stulzer, M. Beyene, H. Ghazvini, and D. Schultz. 2004. Survey for leaf spot diseases of barley in Manitoba in 2003. Can. Plant Dis. Surv. 84: 47.(http://www.cps-scp.ca/cpds.htm)

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

**Table 1.** Prevalence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2004

| Pathogen | Prevalence (% of fields) | Frequency (% of isolations)* |
|---|---|---|
| *Cochliobolus sativus* | 90 | 44.8 |
| *Pyrenophora teres* | 92 | 47.3 |
| *Septoria passerinii* | 21 | 2.9 |
| *Septoria avenae* f.sp. *triticea* | 23 | 4.2 |
| *Stagonospora nodorum* | 4 | 0.6 |
| *Colletotrichum graminicola* | 2 | 0.2 |

* indicative of the relative foliar damage caused

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

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**TITLE / TITRE: DISEASES OF BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2004**

**INTRODUCTION AND METHODS:** A survey for diseases of barley was conducted in the last week of July when most plants were at the soft dough stage of development. Twenty-four fields were chosen at random in central and eastern Ontario where most of the spring barley is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field by using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and $\geq$6 were considered trace, slight, moderate, and severe infection, respectively. Severities of leaf stripe, ergot, loose smut, and take-all were estimated as the percentage of plants infected. Fusarium head blight (FHB) was rated for both incidence (percent infected spikes) and severity (percent infected spikelets in the infected spikes), based on approximately 200 spikes sampled at each of three random sites per field. The FHB index (%incidence x %severity)/100 was determined for each field. Index values of <1, <10, <20, and $\geq$20 were considered slight, moderate, severe, and very severe infection levels, respectively.

Determination of the causal species of FHB was based on 10 infected heads collected from 5 of the 16 fields where FHB was found; the heads were air-dried at room temperature, and subsequently threshed. Ten discolored kernels per sample were surface sterilized in 1% NaOCl for 30 seconds, and plated onto modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm streptomycin sulfate in 9-cm diameter petri dishes. Plates were incubated for 10-14 days at 22-25˚C, with a 14-hour photoperiod under fluorescent and long wavelength UV light. Fusarium species isolated from the kernels were identified by microscopic examination of morphological characters using standard taxonomic keys.

**RESULTS AND COMMENTS:** All surveyed fields, except one at St. Agatha west (2-row barley), were of 6-row barley. Eleven diseases or disease complexes were observed in the fields (Table 1). Net blotch (*Pyrenophora teres*) was the most prevalent disease, observed in 21 fields at a mean disease severity of 2.8. Infection levels were moderate, the highest level observed, in 7 of the affected fields. Yield reductions due to net blotch were estimated to be at least 10% on average in the surveyed fields. Net blotch has been the most prevalent foliar disease of barley in central and eastern Ontario for the past four years and was considered the major yield limiting factor in 2003 and 2004 (Xue et al. 2004).

Spot blotch (*Cochliobolus sativus*) and leaf rust (*Puccinia hordei*) were observed in 14 and 12 fields at mean severity levels of 1.3 and 1.5, respectively. A moderate level of leaf rust was found in only one field, while levels of spot blotch were all slight or trace. Scald (*Rhynchosporium secalis*), the septoria complex - including speckled leaf blotch (*Septoria avenae* f. sp. *triticea),* leaf blotch (*S. passerinii*), and glume blotch (*S. nodorum*) - and powdery mildew (*Erysiphe graminis* f. sp. *hordei*) were observed in 7, 6, and 4 fields, at mean severities of 0.9, 1.2, and 2.0, respectively. All affected crops had only trace to slight infections. None of these diseases caused significant damage.

Barley stripe (*Pyrenophora graminea*), ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*), and take-all (*Gaeumannomyces graminis*) were observed in 5, 5, 4, and 9 fields, at mean incidence levels of 1.5, 0.1, 0.2, and 0.5%, respectively. These diseases resulted in minimal damage.

Fusarium head blight was observed in 16 fields, at a mean incidence of 28.1%, ranging from 5.0 to 100%. Severity in infected plants ranged from 5.0 to 30.0% with a mean of 11.6%. The FHB index ranged from 0.4 to 28.3%, with a mean of 6.3%. Very severe levels were observed in 4 fields located at or near Amulree, Bornholm, Brewers Mills, and Odessa. Two crops had severe, six had moderate, and the remainder had slight levels of FHB.

Five *Fusarium* species were isolated from infected kernels. *Fusarium graminearum* predominated with 70% kernel infection, followed by *F. sporotrichioides* at 26%. *Fusarium avenaceum, F. equiseti,* and *F. poae,* were isolated infrequently and were found on 2, 2, and 4% of the kernels, respectively.

Total precipitation was higher and mean temperatures were lower in central and eastern Ontario in June and July compared to 2003 or the long-term average. The relative prevalence and severity of foliar diseases in 2004 were similar to those found in 2003 (Xue et al. 2004), except for stem rust (*Puccinia graminis* f.sp. *tritici*) which was not observed in 2004. Although no systematic surveys for FHB in barley have been conducted in Ontario in the past decade, FHB severity was considered to be 'high' in 2004. The relatively cool and wet growing conditions during May, June, and July across the province contributed to the severe disease outbreak. There is an urgent need to evaluate further the impact of FHB on barley in Ontario, and to implement measures to minimize and contain damage from the disease.

**REFERENCE:**

A.G. Xue, K.M. Ho, Y. Chen, and F. Sabo. 2004. Diseases of barley in central and eastern Ontario in 2003. Can. Plant Dis. Surv. 84:48-49. (http:www.cps-scp.ca/cpds.htm)

**Table 1.** Prevalence and severity of barley diseases in central and eastern Ontario in 2004.

| DISEASE | NO. CROPS AFFECTED (n=24) | DISEASE SEVERITY IN AFFECTED CROPS* | |
|---|---|---|---|
| | | Mean | Range |
| Leaf rust | 12 | 1.5 | 0.1-5.7 |
| Net blotch | 21 | 2.8 | 0.1-5.6 |
| Powdery mildew | 4 | 2.0 | 0.1-3.9 |
| Scald | 7 | 0.9 | 0.4-1.7 |
| Septoria complex | 6 | 1.2 | 0.6-2.1 |
| Spot blotch | 14 | 1.3 | 0.6-2.1 |
| Barley stripe | 5 | 1.5 | 0.5-5.0 |
| Ergot | 5 | 0.1 | 0.03-0.2 |
| Loose smut | 4 | 0.2 | 0.1-0.4 |
| Take-all | 9 | 0.5 | 0.03-1.0 |
| Fusarium head blight | 16 | | |
| Incidence | | 28.1 | 5.0-100 |
| Severity | | 11.6 | 5.0-30.0 |
| FHB index** | | 6.3 | 0.4-28.3 |

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

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

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**TITLE / TITRE: 2004 CEREAL DISEASE SURVEY IN CENTRAL ALBERTA**

**INTRODUCTION AND METHODS:** A survey of diseases of barley and wheat was conducted on July 30, 2004 in fields randomly selected in Census District 8 (north-central Alberta). This area encompasses Sylvan Lake on the west, Bashaw on the east and is bordered north and south by Ponoka and Innisfail, respectively. Eighteen barley fields were examined, 14 of which were 2-row, three 6-row and one which was hooded. The seven wheat fields surveyed all contained hard red spring (HRS) wheat. Fields were traversed in an inverted V, with visual analysis of five plants taking place at three locations. Leaf diseases were scored on a 0-9 scale, with a 4 rating equal to 1% of leaf area diseased (PLAD) on the upper leaf canopy, 5-10 PLAD on the middle canopy and 10-25 PLAD on the lower-canopy. Common root rot (CRR) was assessed on sub-crown internodes using a 0-4 scale where 1=trace and 4=severe. Other diseases were rated as a percentage of the plants affected. After the survey was completed, a representative sub-sample of the diseased material collected was cultured in the laboratory for pathogen identification and disease verification.

**RESULTS AND COMMENTS:** Results are presented in Table 1. Central Alberta experienced improved growing conditions in 2004 compared to the previous two years, with a cool and dry May followed by a near-normal June. However, warm and dry weather in July was followed by a cool and damp August and September, which delayed harvest of all crops and reduced quality.

In barley, scald (*Rhynchosporium secalis*) was the most commonly observed foliar disease, followed by the net form of net blotch (*Pyrenophora teres* f. sp. *teres*). Also commonly observed were small brown lesions from which either *Alternaria* spp. or a mixture of *Alternaria* and what is suspected to be *P. teres* f. sp. *maculata*), causal agent of spotted net blotch, were isolated. The latter is to be confirmed from subsequent laboratory trials. Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) levels were relatively light, similar to 2003 (Orr and Turkington 2004), despite many crops being seeded deep, as producers attempted to seed into moisture to protect their crops from the consequences of another drought. Loose smut (*Ustilago nuda*) was noted in trace amounts in 4 fields, while spot blotch (*Cochliobolus sativus*) was found in one field. Covered smut (*Ustilago hordei*), bacterial blight (*Xanthomonas translucens*) and speckled leaf blotch (*Septoria passerini*) were not observed this year.

Septoria/stagonospora leaf blotch (*Septoria tritici, Stagonospora nodorum*) was present in all 7 HRS wheat crops examined, with one crop rated as 7, a severe level of disease. Common root rot (*C. sativus* and *Fusarium* spp.) levels were higher than in 2003 (Orr and Turkington 2004), but take-all (*Gaeumannomyces graminis*) and glume blotch *(Stagonospora nodorum*) were only noted in one field each at trace levels. Tan spot (*Pyrenophora tritici-repentis*), powdery mildew (*Blumeria graminis*) and ergot (*Claviceps purpurea*) were not observed. Stripe rust (*Puccinia striiformis*) was observed in four fields; in one, plant severity levels were 10% .

**REFERENCE:**
Orr, D.D. and T.K. Turkington. 2004. 2003 Cereal disease survey in central Alberta. Can. Plant Dis. Surv. 84: 50-51. (http://www.cps-scp.ca/cpds.htm)

**Table 1.** Disease incidence and severity in 18 barley and 7 wheat fields in central Alberta in 2004.

| | | Average disease rating and range | |
|---|---|---|---|
| **Barley Disease** | **% Fields Affected** | **Mean** | **Range** |
| Scald (0-9) | 78 | 4 | 3.0-7.0 |
| Net form of net blotch (0-9) | 67 | 4.8 | 4.0-7.0 |
| *Alternaria* or *Alternaria* plus net blotch (0-9) | 50 | 4.2 | 3.0-6.0 |
| Common root rot (0-4) | 72 | 1.5 | 0-4.0 |
| Loose smut (%) | 22 | trace | trace |

| **Wheat Disease** | **% Fields Affected** | **Mean** | **Range** |
|---|---|---|---|
| Septoria/stagonospora leaf blotch complex (0-9) | 100 | 3.7 | 3.0-7.0 |
| Common root rot (0-4) | 86 | 2.2 | 1.0-3.0 |
| Stripe rust (%) | 57 | 3.2 | trace-10 |

**CROPS / CULTURES:** Barley and Oat
**LOCATION / RÉGION:** Saskatchewan

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY AND OAT IN SASKATCHEWAN IN 2004**

**INTRODUCTION AND METHODS:** Fusarium head blight (FHB) incidence and severity were assessed in a total of 48 barley crops (36 2-row; 12 6-row) and 9 oat crops in Saskatchewan between July 20 and September 11. Fields were grouped according to soil zones (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey), and fields under irrigation were grouped separately and referred to as in the irrigation zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

Crop adjustors with Saskatchewan Crop Insurance Corporation randomly collected 50 heads from each crop during the late milk to early dough stages of development. The heads were analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected heads per crop and the number of infected glumes and/or kernels within those heads were recorded. A FHB disease severity rating, also know as the FHB index, was determined for each barley crop (FHB index = % heads affected x mean % severity of infection / 100). Mean FHB severity ratings were calculated for each soil/irrigation zone and for the whole province. Glumes and/or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min. and cultured on potato dextrose agar and carnation leaf agar for subsequent identification of *Fusarium* species.

**RESULTS AND DISCUSSION:** The 2004 season was wet and cool, resulting in abundant foliar growth and delayed crop development. However, rainfall was not frequent during cereal flowering, reducing the risk of FHB. Severe frost was received over much of the province on August 20; hence, frost damage and secondary moulds were of greater concern that FHB in 2004.

In 2004, FHB occurred in 56% of barley crops surveyed (47% of 2-row; 83% of 6-row) (Table 1). Mean disease severities were <1% in all zones, and the overall mean severity for the province was 0.2% for both 2-row and 6-row barley. These low severity values are similar to 2003 (Pearse et al. 2004). Overall mean severities have been relatively low since the onset of the provincial survey in 1999, ranging from 0.1 to 1.3% for 2-row and 0.1 to 2.5% for 6-row barley. In 2004, the highest severity was 1.4%, found in a crop of 2-row barley in Zone 3, in the east-central region of the province.

In 2004, the most commonly isolated *Fusarium* species was *F. avenaceum*, accounting for 38% of total *Fusarium* isolations, followed by *F. poae* (32%), *F. sporotrichioides* (11%), *F. culmorum* (5%), *F. graminearum* (3%) and other *Fusarium* spp. (11%). *Fusarium graminearum* was found in only one barley crop in Zone 3, in the east-central region of the province. Other pathogens were also observed on barley heads, including *Pyrenophora* spp., *Cochliobolus sativus*, *Septoria* spp. and *Claviceps purpurea*.

Fusarium head blight was found in only 2 of the 9 oat crops surveyed in 2004. Both of these crops were in Zone 3 and had only trace levels (<0.1%) of disease. *Fusarium acuminatum* was isolated from the kernels/glumes of one crop, and *F. avenaceum* from the other; no *F. graminearum* was found.

We gratefully acknowledge the participation of the crop insurance adjustors with Saskatchewan Crop Insurance Corporation for the collection of head samples for this survey.

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**Table 1.** Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil and irrigation zones in Saskatchewan, 2004.

| Soil Zone | No. affected crops / total crops (% of crops affected) | | Mean FHB Index[1] (range of severity) | |
|---|---|---|---|---|
| | 2-row | 6-row | 2-row | 6-row |
| Zone 1 Brown | 2 / 4 (50%) | 1 / 1 (100%) | 0.1% (0 - 0.4%) | T[2] |
| Zone 2 Dark Brown | 6 / 12 (50%) | 1 / 1 (100%) | 0.1% (0 - 0.5%) | 0.3% |
| Zone 3 Black/Grey | 8 / 18 (44%) | 8 / 10 (80%) | 0.2% (0 - 1.4%) | 0.2% (0 - 0.9%) |
| Irrigation Zone | 1 / 2 (50%) | – – | 0.5% (0 - 1.1%) | – |
| Overall Mean | 17 / 36 (47%) | 10 / 12 (83%) | 0.2% | 0.2% |

[1] FHB Index = % heads affected x mean % severity of infection / 100
[2] T = Trace values of FHB; <0.1%

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

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**TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2004**

**INTRODUCTION AND METHODS:** Surveys of fields and trap nurseries of barley, oat and wheat for incidence and severity of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. and *P. graminis* Pers. f. sp. *avenae* Eriks. & E. Henn.) were conducted in July, August, and September 2004. Infected stem tissue samples were collected from fields and trap nurseries. Urediniospores were obtained from collections and evaluated for virulence specialization on appropriate sets of host differential lines.

**RESULTS AND COMMENTS:** Historically low temperatures and above average precipitation occurred across the Prairie region during the 2004 growing season. Environmental conditions were consequently highly unfavorable for stem rust infection. Stem rust on susceptible lines in trap nurseries and in commercial oat and barley fields was at trace levels across western Canada.

All spring wheat cultivars recommended for production in Manitoba and Saskatchewan have excellent resistance to stem rust, and no stem rust infection was observed in any commercial wheat fields. Stem rust was detected at trace levels on susceptible wheat lines in trap nurseries and on wild barley (*Hordeum jubatum*) in 2004. The predominant race found in Manitoba was QFCSR, while the predominant race in Saskatchewan and Alberta was TPMKR. Many wild barley samples were identified as infected with rye stem rust, and one rye crop observed near Moosomin, SK was heavily infected with rye stem rust.

All oat cultivars recommended for production in Manitoba and Saskatchewan are susceptible to the stem rust races NA67 and NA76. However, due to the highly unfavorable environmental conditions in 2004, only trace levels of stem rust were observed throughout the Prairie region. The frequency of NA67 in the oat stem rust population was 51% of the samples from wild oat and 56% of the samples from cultivated oat. The potential for substantial economic damage to commercial oat crops remains high in the rust areas of Western Canada, due to the predominance of NA67 and the establishment of this race in the overwintering areas of Texas in the USA. Lines with effective resistance to NA67 (*Pg16*, *Pg-a*) from breeding programs at the Agriculture and Agri-Food Canada Cereal Research Centre (AAFC-CRC) are in early agronomic trial testing. However, virulence to the *Pg-a+Pg13* combination was reported in Texas in 2004 (Y. Jin, USDA, *unpublished*). This needs confirmation, but could result in new virulence that might enter Canada during the 2005 growing season. Novel stem rust resistance identified in the stem rust pathology program at AAFC-CRC is currently being transferred into adapted oat germplasm, which should provide resistance to both NA67 and this putative new virulence.

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

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**TITLE / TITRE: CEREAL SMUT SURVEYS, 2004**

**INTRODUCTION AND METHODS:** In July 2004, cereal crops in Manitoba and Saskatchewan were surveyed for the presence of smut diseases caused by *Ustilago hordei, U. nigra, U. nuda, U. tritici, U. avenae* and *U. kolleri*. The area was covered by the route Winnipeg - Estevan - Moose Jaw - Saskatoon - Prince Albert - Melfort - Yorkton - Roblin - Swan River - Dauphin - Neepawa - Winnipeg, as well as by one-day trips around Winnipeg, MB in the Red River Valley and Manitoba's Interlake region. Fields were selected at random at approximately 10 - 15 km intervals, depending on the frequency of the crops in the region. An estimate of the percentage of infected plants (i.e., plants with sori) was made while walking an ovoid path of approximately 100 m in each field. Levels of smut greater than trace (<0.1%) were estimated by counting plants in a one $m^2$ area at a minimum of two sites on the path.

**RESULTS AND COMMENTS:** Loose smut (*Ustilago tritici*) was found in 14 (23%) of the 62 fields of bread wheats surveyed, at trace levels of infection. In durum wheat, loose smut was found in 11 (61%) of the 18 fields surveyed. One crop of durum had a 0.1% level of infection while the rest were infected at trace levels. In awned wheats (likely of the CPS class), loose smut was detected in 5 (16%) of the 31 fields surveyed at trace levels of infection.

Two (11%) of 19 oat crops had smutted plants at trace levels of infection. Both smut samples were *Ustilago avenae*.

A high prevalence of loose smut was found in 6-row barley with 15 (75%) of the 20 fields surveyed containing infected plants. Most crops had trace levels of infection, but two crops had 0.1% infection levels. In 2-row barley, 7 (18%) of 39 crops were affected, with levels of smutted plants ranging from trace to 0.1%. As in 2000, 2001, 2002, and 2003 (Menzies et al., 2001, 2002, 2003, 2004), false loose smut (*Ustilago nigra*) was not found. Covered smut (*U. hordei*) was not found in any barley fields in 2004.

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

**NAMES AND AGENCIES / NOMS ET ORGANISMES:**
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**TITLE / TITRE: SURVEY OF CORN DISEASES AND PESTS IN ONTARIO AND QUÉBEC IN 2004**

**INTRODUCTION AND METHODS:** From August 23 to September 23, 2004, a corn disease and pest survey was conducted in Ontario and Québec. As in previous years ( 5, 6, 7, 8, 9), the emphasis of the survey was to determine the distribution and severity of the bacterial disease, Stewart's wilt (*Pantoea stewartii* = *Erwinia stewartii*). The distribution and severity of other diseases and insect pests including eyespot (*Aureobasidium zeae*), common rust (*Puccinia sorghi*), northern leaf blight (*Exserohilum turcicum*), anthracnose leaf blight (*Colletotrichum graminicol*a), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi* = *Sphacelotheca reiliana*), ear rots (*Fusarium spp*.), stalk rots (*Fusarium* spp., and *C. graminicol*a), European corn borer (*Ostrinia nubilalis*), corn rootworm (*Diabrotica longicornis* and *D. virgifera*), and corn flea beetle (*Chaetocnema pulicaria*) were also recorded. In addition, scouting for any newer pests in Canada was conducted, especially for grey leaf spot (*Cercospora zeae-maydis*) in Ontario, and corn red root rot (*Phoma terrestris* = *Pyrenochaeta terrestris*) in Québec and Ontario.

At each of the 172 locations surveyed, the incidence of each disease and pest, and the severity of the predominant pests were recorded. Thirteen Stewart's wilt leaf samples were collected in this survey and 18 wilt seedling samples were collected in June; 12 corn flea beetle samples were collected with insect traps from 12 fields from May 17 to August 12 from Essex and Chatham-Kent counties, ON. All samples were tested for the pathogen *P. stewartii* by ELISA, using reagent sets, protocols, and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

To check for the presence of red root rot (RRR), 10 fields from six farms in Québec and one in Ontario were scouted. In each field, 3 to 5 plants with early death or stalk rot symptoms were collected; if no diseased plants were found, then 3 to 5 plants were collected at random and brought to the laboratory. Roots were washed carefully and checked for symptoms. To confirm the presence of *Phoma terrestris*, pieces of root with putative RRR symptoms were plated onto a modified PDA medium and checked for the presence of the pathogen after 7 days.

**RESULTS AND COMMENTS:**
**Fungal leaf diseases:** Eyespot was found in 82 fields (Table 1); all fields surveyed in Québec and most of those in eastern Ontario were positive for eyespot. Two crops at Brome-Missisquoi, Québec showed severe symptoms. Some hybrids, including hybrids entered in an Ontario Corn Committee (OCC) trial in Eastern Ontario, were classified to be moderately susceptible to eyespot. Common rust was found in all fields; intermediate severity was found in two seed corn fields in southern Ontario and six OCC trial fields. A heavily rust-infected crop of sweet corn in Québec was rejected by the cannery and could only be used for silage. Southern rust (*Puccinia polysora*) was not found in 2004. Typical symptoms of grey leaf spot were observed in 13 fields in five Ontario counties (Table 1). Unlike 2002 (8) and 2003 (9), grey leaf spot was found only on the lower leaves, and symptoms were not severe. Anthracnose leaf blight was found in 102 fields in all counties (Table 1). This indicates that this leaf disease is widely distributed in both Ontario and Québec. However, the disease was rated at severe levels in only a few fields surveyed at the seedling stage, and resulted in minimal yield losses. Northern leaf blight was found in 71 fields, in most Ontario counties and about half those in Québec. Prevalence was about 10 times higher than usual. In Ontario in Essex and Chatham-Kent counties and at Kingston (Frontenac County) and Prescott (Leeds & Grenville County), northern leaf blight was found in most corn fields, with plants in some displaying intermediate susceptibility. No northern leaf blight was found at St-Philippe, Argenteuil County, QC, where severe levels of blight damage were reported in 1998 (5); however, the farm at Forfar in Leeds and Grenville County, ON, where severe blight damage occurred in 2000 (6), had plants with intermediateseverity in 2004. Here, some corn hybrids exhibited both resistant and susceptible lesion types, suggesting that more than one race of northern leaf blight occurs in Canada.

A new leaf disease with symptoms similar to diplodia leaf spot was found in two fields at Les-Maskoutains and Le Bas-Richelieu counties, Québec. Disease symptoms appeared as brown to reddish-brown oval leaf spots, 3-6 x 5-16 mm in size, with target-like concentric rings and tan centres. A putative pathogen could not be identified and only *Alternaria* spp. and a smut-like agent could be isolated from the lesions.

**Fungal Ear and Stalk diseases:** Gibberella/Fusarium ear rot was observed in only 28 fields surveyed in September; all fields had only a low incidence of the diseases. A sunny and mild autumn (late August and September) in 2004 might be the reason that less corn ear rot developed than usual. Common smut was widely distributed across 102 fields. One crop of seed corn at Harrow, Essex county, ON had an average 73% incidence of smut on ears or stalks. Some hybrids had 5-20% ear smut in both Ontario and Québec. In Renfrew county at a farm where there was 20-100% common smut at the tassel node in 2003 (9), 3% common smut at the tassel nodewas observed this year. Head smut was found in 7 fields in Renfrew, Ottawa-Carleton, Prescott and Russell counties, ON, and Le Bas-Richelieu, Les Maskoutains, and Montcalm counties, QC. In one 69-acre field in Renfrew county, 2/3 was planted with what appeared to be a highly susceptible hybrid with 89% smut incidence; the other 1/3 of the field was planted with another hybrid with only 13% head smut. This field had had a rotation of corn-corn-corn-oat-corn-corn-corn which may have led to a build-up of smut spores in the soil. Surprisingly, in another nearby field on this farm where there had been 15 years of continuous corn, the crop had less than 1% head smut. Fields in Ottawa-Carleton county, ON and Montcalm county, QC had 6% and 8% head smut, respectively. A field at an organic farm at Les Maskoutains, where smut was found in 2001 (7), still had smut infections after a 2-year soybean rotation, but the incidence was low (<1%), as it had been in 2001.

Stalk rots, including anthracnose stalk rot/top-die back, fusarium stalk rot, and pythium stalk rot were found at 77 locations in Ontario and Québec, but in all cases, damage was fairly light. The severity of corn red root rot observed on 5 of 6 farms surveyed in Québec varied from light to severe. Plants showed dark discoloration and a reduction in total root mass, as described by Hornby and Ullstrup (2), but lacked the typical red or pink discoloration described by Carroll (1). *Phoma terrestris* was isolated at 4 of the 5 locations where symptoms were observed. Five root samples from the same field at Ottawa, ON had typical RRR symptoms and *P. terrestris* was isolated from them all. All roots sampled from Ontario crops had RRR symptoms and many of these had a red or pink appearance; *P. terrestris* was isolated from all of these. The results support previous observations that indicated RRR was present in Québec (3) and in southwestern Ontario (4). *Phoma terrestris* may be more widespread in Québec and Ontario than previously thought.

**Bacterial diseases:** Stewart's wilt was not common in 2004 as was the case in 2003 (9). Typical symptoms were found in only 10 fields surveyed in August in Chatham-Kent, Essex, Lambton, and Middlesex counties, ON (Table 1). No Stewart's wilt was found in Québec. Of 13 leaf wilt samples taken, three with putative 'sunburn-like' symptoms all tested negative, 7 of the other 10 samples were positively identified as Stewart's wilt by the ELISA test. However, of the 18 wilt seedling samples, only 5 tested positive by ELISA, all from fields in Essex and Chatham-Kent counties, ON. Of the 12 corn flea beetle samples, each including 1-26 adult beetles, 6 tested positive for *P. stewartii*; however, another six samples were negative, possibly because the number [1-8] of adult beetles in the sample was very low. The fields from which corn flea beetle samples tested positive for *P. stewartii* were investigated again in August; only a minor amount of typical symptoms were found in 4 of these fields. It was observed that the populations of corn flea beetle were very low in southern Ontario in 2004, as they were in 2003.

No holcus leaf spot (*Pseudomonas syringae*) or Goss' bacterial wilt (*Clavibacter michiganensis subsp. nebraskensis = Corynebacterium nebraskense*) were observed in 2004.

**Viral diseases:** No viral disease was observed in 2004 despite the presence of several late-seeded corn and sweet corn fields, which were at the silking stage at the time of the surveys.

**Insects:** European corn borer (ECB) damage was observed in 124 fields. As found previously, ECB damage was higher in eastern Ontario and in Québec than in southern Ontario; however, considerable ECB damage occurred at the OCC trial site at Alma, Wellington county, ON.

Corn rootworm (CRW) damage was observed in 110 fields. As in previous years, CRW occured in eastern Ontario, where the main damage in most fields resulted from leaf feeding and silk pruning. The Renfrew and Ottawa-Carleton regions had a higher prevalence of CRW than southern Ontario and

Québec. Severe root lodging attributable to CRW was observed in some plots at the Central Experimental Farm, Ottawa, ON.

In 2004, aphid populations generally were low, except in a few fields in eastern Ontario and Québec. As in 2003, corn blotch leaf miner (*Agramyza parvicornis*) was found in all fields surveyed in both Ontario and Québec, but damage was very slight. Fewer grasshoppers, most likely the red-legged grasshopper (*Melanoplus femur-rubrum*), were observed in 2004 compared to 2003, especially in southern Ontario. Brown stink bug (*Euschistus servus*) was detected in a few fields but populations were always very low.

**Mites:** Unfavourable environmental conditions due to frequent precipitation in 2004 led to low numbers of the two-spotted spider mite (*Tetranychus urticae* = *T. bimaculatus* Harvey), as was the case in 2003.

**Other pathogens**: *Pythium* spp. were isolated from several seedling samples forwarded from Québec exhibiting damping-off symptoms. The disease was less common in 2004 than 2003.

**Summary:** The wet and cool early-season conditions in June and July 2004 resulted in common rust, anthracnose leaf blight and northern leaf blight incidences that were much higher than normal. Although grey leaf spot incidence was reduced compared to previous years, the disease has become established in southwestern Ontario and higher disease levels can be expected when conditions for this disease are more favorable. Ear rot and stalk rot diseases were less prevalent in 2004 than in 2003, likely the result of the dry and sunny conditions from the middle of August to the end of September that were unfavorable for disease development. Stewart's wilt incidence was very low in 2004 due to low populations of corn flea beetle resulting from a cold winter, and low disease incidence in 2003. European corn borer, corn rootworm, and grasshoppers were only minor problems in 2004, in both Ontario and Québec.

**ACKNOWLEDGEMENTS:**
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**Table 1**: Number of corn fields surveyed in counties of Ontario and Québec in 2004, and the number of these affected by specific diseases and pests.

| County | # of fields | Eyespot | Rust | GLS | ALB | NLB | Wilt | Smut | Head smut | Ear rot | Stalk rot | ECB | CRW | CFB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ontario** | | | | | | | | | | | | | | |
| Chatham-Kent | 16 | 1 | 16 | 6 | 7 | 12 | 3 | 13 | | 1 | 2 | 11 | 4 | 1 |
| Dufferin | 3 | 2 | 3 | | 3 | 1 | | | | | | 3 | 2 | |
| Elgin | 7 | | 7 | | 2 | 3 | | 6 | | | 1 | 5 | 4 | |
| Essex | 6 | 1 | 6 | 1 | 3 | 6 | 3 | 5 | | | | 5 | 1 | 1 |
| Frontenac | 4 | 2 | 4 | | 2 | 4 | | 1 | | 2 | 2 | 4 | 2 | |
| Halton | 1 | | 1 | | | | | | | | | 1 | | |
| Huron | 10 | 1 | 10 | 1 | 8 | 4 | | 6 | | | 1 | 6 | 6 | 1 |
| Lambton | 5 | 1 | 5 | | 1 | | 1 | 2 | | | | 3 | 2 | 2 |
| Lanark | 3 | 1 | 3 | | 3 | | | 1 | | | 3 | 3 | 2 | |
| Leeds and Grenville | 11 | 7 | 11 | | 4 | 9 | | 7 | | 3 | 7 | 9 | 5 | |
| Middlesex | 15 | 1 | 15 | 4 | 10 | 4 | 1 | 6 | | | 5 | 10 | 11 | 3 |
| Ottawa-Carleton | 9 | 8 | 9 | | 5 | 5 | | 8 | 1 | 2 | 7 | 6 | 9 | |
| Oxford | 6 | | 6 | 1 | 2 | 2 | | 4 | | | | 2 | 6 | 1 |
| Perth | 5 | 1 | 5 | | 3 | | | 1 | | | 1 | 2 | 3 | 1 |
| Prescott and Russell | 7 | 5 | 7 | | 5 | 1 | | 3 | 1 | | 6 | 4 | 3 | |
| Renfrew | 12 | 6 | 12 | | 5 | 3 | | 5 | 2 | 1 | 3 | 9 | 9 | |
| Stormont Dundas and Glengarry | 7 | 7 | 7 | | 6 | 3 | | 4 | | 4 | 7 | 6 | 6 | |
| Waterloo | 3 | | 3 | | 1 | 1 | | 2 | | | 1 | 1 | 2 | |
| Wellington | 4 | 1 | 4 | | 2 | 1 | | 3 | | | | 2 | 2 | |
| **Sub-total** | **134** | **45** | **134** | **13** | **72** | **59** | **8** | **75** | **4** | **13** | **46** | **92** | **79** | **10** |
| **Québec** | | | | | | | | | | | | | | |
| Acton | 2 | 2 | 2 | | 2 | 2 | | 2 | | 2 | 2 | 2 | 2 | |
| Argenteuil | 2 | 2 | 2 | | 1 | | | 2 | | | 1 | 2 | 2 | |
| Brome-Missisquoi | 3 | 3 | 3 | | 3 | | | 1 | | 1 | 3 | 3 | 3 | |
| D'Autray | 3 | 3 | 3 | | 1 | 1 | | 3 | | | 3 | 3 | 2 | |
| Joliette | 1 | 1 | 1 | | 1 | | | 1 | | | 1 | 1 | | |
| La Rivière-du-Nord | 2 | 2 | 2 | | 1 | 1 | | 1 | | | 2 | 1 | 2 | |
| La Vallée-du-Richelieu | 3 | 3 | 3 | | 3 | 1 | | 2 | | 1 | 3 | 3 | | |
| Le Bas-Richelieu | 4 | 4 | 4 | | 3 | 2 | | 2 | 1 | 2 | 4 | 2 | 4 | |
| Le Haut-Richelieu | 2 | 2 | 2 | | 2 | 1 | | 2 | | 1 | 1 | 2 | 2 | |
| La Haute-Yamaska | 2 | 2 | 2 | | 2 | | | | | 2 | 2 | 2 | 1 | |
| Les Maskoutains | 3 | 2 | 3 | | 2 | 2 | | 3 | 1 | 2 | 2 | 3 | 3 | |
| Mirabel | 1 | 1 | 1 | | 1 | | | | | | | | 1 | |
| Montcalm | 2 | 2 | 2 | | 1 | | | 1 | 1 | | 2 | 1 | 1 | |
| Rouville | 2 | 2 | 2 | | 1 | | | | | 1 | 2 | 2 | 2 | |
| Vaudreuil-Soulanges | 6 | 6 | 6 | | 6 | 2 | | 5 | | 3 | 5 | 5 | 6 | |
| **Sub-total** | **38** | **37** | **38** | **0** | **30** | **12** | **0** | **25** | **3** | **15** | **33** | **32** | **31** | **0** |
| **Total** | **172** | **82** | **172** | **13** | **102** | **71** | **8** | **102** | **7** | **28** | **79** | **124** | **110** | **10** |

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

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

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**TITLE / TITRE: CROWN RUST OF OAT IN WESTERN CANADA IN 2004**

**INTRODUCTION AND METHODS:** Surveys for oat crown rust (caused by *Puccinia coronata* Cda f. sp. *avenae* Eriks.) incidence and severity were conducted in Manitoba from July 9 to September 15 in 2004. Surveys for incidence and severity of the rust in southeastern Saskatchewan were conducted on August 11 and 12 and from August 25 to 27. All locations surveyed in 2004 were recorded on a handheld global-positioning device (Garmin GPS map 60C). Crown rust collections were obtained from susceptible wild oat (*Avena fatua* L.) plants, from commercially grown oat in farm fields, and from susceptible and resistant oat lines and cultivars grown in uniform rust nurseries. The nurseries were located at Brandon, Emerson, and Morden, MB, and at Indian Head, SK. Virulence phenotypes of single-pustule isolates established from the rust collections were identified, using 16 single-gene backcross lines carrying crown rust resistance genes *Pc38, Pc39, Pc40, Pc45, Pc46, Pc48, Pc50, Pc51, Pc52, Pc54, Pc56, Pc58, Pc59, Pc62, Pc64,* and *Pc68* as the primary differential hosts (Chong et al. 2000). Single-gene lines with *Pc91, Pc94* and *Pc96* were used as supplemental differentials. Genes *Pc68, Pc91, Pc94* and/or *Pc96* in various combinations are being used in oat breeding programs across Canada (Cereal Research Centre, Winnipeg, MB; Eastern Cereal and Oilseed Research Centre, Ottawa, ON; Lacombe Research Centre, Lacombe, AB; Crop Development Centre, Saskatoon, SK).

**RESULTS AND COMMENTS:** Crown rust was first found in trace amounts on wild oat near Carman, MB, on July 15. The unusual cool and wet conditions during most of the growing season in Manitoba and eastern Saskatchewan in 2004 slowed disease development and limited its spread on the oat crop. By September, crown rust remained mostly at trace to light levels in many areas across the eastern prairies, except in southeastern Manitoba, where light to moderate levels, with up to 50S severites, were found. Further, in areas of Manitoba where buckthorn, the alternate host of *P. coronata* f. sp. *avenae,* is present, heavy crown rust infections with up to 90S severities were found on wild oat and commercial oat crops by August 11 (near Carman), by August 25 (near Brandon), and by August 27 (near Portage la Prairie). Wild oat and oat crops close to these locations had only trace levels of crown rust infection. The effect of proximity of the alternate host demonstrates the importance of aecial infections in initiating early crown rust epidemics. Had conditions been more conducive for rust development in 2004, there would have been more widespread rust damage to the oat crop in the surrounding areas. It is prudent that buckthorn be removed if found in areas adjacent to commercial oat fields.

To date, 206 single-pustule isolates of *P. coronata* f. sp. *avenae* have been established from collections obtained from wild and cultivated oat in Manitoba and eastern Saskatchewan. Using 19 single-gene oat lines as differential hosts, 107 virulence phenotypes have been identified from the156 isolates originating from the susceptible wild oat host. Seven-eight of the virulence phenotypes were identified only once. The two most common phenotypes, BQBB and LQBB (Chong et al. 2000), comprised 3% of the isolates in the population. Virulence frequencies to *Pc38* and *Pc39* were 81% and 83%, respectively. Cultivars ‘Dumont’, ‘Robert’, ‘Riel’, ‘AC Belmont’, ‘AC Marie’, ‘AC Preakness’, and ‘AC Rebel’ have the resistance gene combination *Pc38* and *Pc39*, and would be susceptible to many of these isolates. ‘Triple Crown’, which has *Pc48*, was highly resistant to crown rust when it was first released in 1998. Virulence frequency to *Pc48* has been fluctuating between 12% and 27% since 2001. In 2004 virulence to this gene was 22%. ‘AC Assiniboia’, ‘AC Medallion’, ‘AC Pinnacle’, ‘Ronald’, ‘AC Gwen’ and ‘Kaufmann’ are a series of cultivars, released since 1994, which have *Pc68*. Virulence frequency to this gene has been increasing gradually from 1% in 2001 to 12% in 2003. In 2004 virulence to *Pc68* was at 17%. Virulence to *Pc96* was 2%. No virulence was detected to *Pc91* and *Pc94* in 2004 in any of the isolates originating from wild oat or commercial oat fields. Virulence to *Pc94* has been extremely rare in Canada. A new oat cultivar, ‘OT2021' (yet to be named), which has both *Pc68* and *Pc94* combined, was released by the Cereal Research Centre, Agriculture and Agri-Food Canada, for commercial production in 2003. To date, virulence to this resistance gene combination has not been detected in the *P. coronata* f. sp. *avenae* populations in Canada.

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

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** The occurrence of fusarium head blight (FHB) in oat in southern Manitoba was assessed in 36 commercial fields surveyed from July 27 to August 20 when most crops were at the late milk to soft dough stage of growth (ZGS 76-85). Fields were sampled at regular intervals along survey routes, depending on availability. Fusarium head blight was assessed by non-destructive sampling of a minimum of 80-100 plants at each of 3 locations per field for percentage of infected panicles (incidence), and average proportion of the panicle affected (severity). Disease levels were calculated as the 'FHB Index' (% incidence x mean % severity / 100). Several affected (when found) panicles at each of the 3 sample locations were collected, placed in plastic bags and frozen. Subsequently, 50 putatively infected seeds, or normal seeds to make up the remainder, per field, were surface sterilized in 0.3% NaOCl for 3 min., air-dried, and plated on potato dextrose agar to quantify *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba, affecting timely seeding operations. A heavy snowfall on May 11 delayed seeding operations further, in many instances until mid-June. The low temperatures likely also curtailed the growth of *Fusarium* in overwintered plant straw and debris, resulting in lower than normal levels of spring inoculum . Warmer, drier conditions prevailed during panicle emergence and kernel filling, but cool, moist conditions returned later in the growing season hampering harvesting operations. This resulted in some mature crops remaining unharvested under wet conditions for up to several weeks, favouring the further growth of *Fusarium* and other fungi on the ripe panicles.

Only 13 of the 36 fields surveyed had visible symptoms of FHB. As has been the case in previous years, because of the apparent lack of visual field symptom of FHB in oat and the open inflorescence (panicle) in this crop, there is little initial evidence of the disease in the crop. Overall, the incidence of FHB was 0.9% (range 0 - 11.3%), severity 4.4% (range 0 - 60.0%) and the resulting FHB Index 0.04% (range 0 - 0.8%). As such, FHB was estimated to have caused no yield loss to the commercial oat crop. Based on the three systematic surveys done to date (2002-2004), this represents the second lowest level of FHB found in oat so far (Tekauz et al. 2004, 2003), and is a reflection of the generally low levels of FHB in all cereal crops in 2004, and the much lower visual manifestation of the disease in oat compared to other cereals.

The relative abundance of the four *Fusarium* spp. isolated from kernels is shown in Table 1. *Fusarium graminearum* was the most common species (~50%), followed by *F. sporotrichioides* (~30%) and *F. poae* (~10%). These have also been the most common in previous surveys (Tekauz et al. 2004, 2003) and suggest that the FHB syndrome in oat is similar to that in barley, but different from that in wheat. While the above data do not provide evidence for this, other research has indicated that levels of *Fusarium* spp., and of the mycotoxin deoxynivalenol, can be quite high in oat kernels and that visual FHB levels do not provide a comparative measure for this (Tekauz et al. 2004b)

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**Table 1.** *Fusarium* spp. isolated from Manitoba oat kernels in 2004.

| ***Fusarium* spp.** | **Percent of fields** | **Percent of kernels** |
|---|---|---|
| *F. avenaceum* | 11.1 | 2.3 |
| *F. graminearum* | 47.2 | 50.3 |
| *F. poae* | 38.9 | 19.2 |
| *F. sporotrichioides* | 38.9 | 28.2 |

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

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**TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** Leaf spot diseases of oat in southern Manitoba were assessed by surveying 36 commercial fields from July 27 to August 20 when most crops were at the early milk to soft dough stage of growth (ZGS 73-85). Fields were sampled at regular intervals along the survey routes, depending on availability. Disease severity was recorded by averaging ratings on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Ratings were taken on both the upper (flag and flag-1 leaves) and lower leaf canopies, using a six-category severity scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried, and stored in paper envelopes. Subsequently, surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba, affecting timely seeding operations. A heavy snowfall on May 11 delayed seeding operations further, in many instances until mid-June. Warmer, drier conditions prevailed during head emergence and kernel filling, but cool, moist conditions returned later in the growing season and hampered harvesting. This resulted in some mature crops remaining unharvested under wet conditions for up to several weeks, promoting kernel staining and possible grade/quality losses. It is not known how the abnormal and record low spring and summer temperatures in Manitoba in 2004 affected the complex of leaf spot diseases (see below) in oat, but spot blotch, caused by *Cochliobolus sativus*, a prevalent disease of barley and wheat (and which also attacks oat), is not favoured by cooler conditions (Gilbert et al. 1998).

Leaf spots were observed in the upper or lower leaf canopies in 34 of the 36 oat fields surveyed. Disease levels in the upper canopy were nil, trace or very slight in 72% of fields, slight in 19%, moderate in 6%, severe in 0% and leaves senescent in 3%. Respective severity categories in the lower canopy were tabulated as 31%, 31%, 0%, 3% and 36%. Since most fields surveyed had only trace or slight levels of disease in the upper canopy, foliar diseases in oat caused minimal damage in 2004; on average, grain yield losses were likely near 1%, similar to that found in 2003 (Tekauz et al. 2004).

*Pyrenophora avenae* (pyrenophora leaf spot) was the predominant pathogen in 2004, accounting for about 3/4 of the foliar damage observed (Table 1). This is the highest level of damage attributable to this pathogen since surveys for leaf spots of oat in Manitoba were begun in 2001 (Tekauz et al. 2002). The variable levels of the three main pathogens involved in the leaf spot complex of oat, and in particular the disparate annual (2001-2004) levels of *C. sativus* (spot blotch) and *P. avenae*, suggest that the environment plays a significant role in their relative abundance and influence. By contrast, the level of damage attributable to *Phaeosphaeria avenaria* (stagonospora/septoria leaf blotch) has remained relatively constant (Tekauz et al. 2004, 2003, 2002).

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

| Pathogen | Prevalence (% of fields) | Frequency (% of isolations)* |
|---|---|---|
| *Pyrenophora avenae* | 75 | 74 |
| *Phaeosphaeria avenaria* f.sp. *avenaria* | 61 | 22 |
| *Cochliobolus sativus* | 17 | 4 |

* indicative of the relative foliar damage caused

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

**NAMES AND AGENCIES / NOMS ET ORGANISMES:**
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**TITLE / TITRE: FUSARIUM HEAD BLIGHT SURVEY OF WHEAT, ALBERTA 2004**

**INTRODUCTION AND METHODS:** During July and August 2004, cooperative surveys for the presence of fusarium head blight (FHB) were conducted in 96 wheat fields in Alberta by staff from Agriculture and Agri-Food Canada (AAFC) and four applied research associations. Collaborators were provided with sampling instructions and images of typical FHB symptoms to aid in assessments. The surveys covered an area from Barrhead, east to Vermilion, and south to the Lethbridge area. Fields also were surveyed in the Peace River region of Alberta. Counts of 300 heads were taken in each field and the incidence of FHB determined. Assessments were typically made when crops were at the late milk to dough stage of development by following a diamond-shaped path starting at least 25 m in from the edge of the field. At each of three sites along the path, 100 randomly chosen heads were evaluated. All heads exhibiting possible FHB symptoms were subsequently sent to the AAFC Lacombe Research Centre for confirmation of symptoms and assessment of the causal agent(s). Portions of the affected heads were surfaced sterilized in 5% commercial bleach for approximately 1 minute, followed by plating onto potato dextrose agar amended with 0.033 g $L^{-1}$ rose Bengal. Plates were incubated for at least 7 days under a combination of fluorescent and black light before identification of the species of *Fusarium* present. *Fusarium* species were identified by morphological features using standard references (Burgess et al. 1994, Nelson et al. 1983). Suspected cultures of *F. graminearum* were single-spored and transferred to Spezieller Nährstoffarmer agar (SNA) for 5-10 days and then examined closely for the presence of perithecia. Cultures producing perithecia were identified as *F. graminearum*. Conversely, cultures on SNA that did not produce perithecia were suspected to be *F. pseudograminearum* and were transferred to a differential medium for identification (Pouleur et al. 2004). Culture(s) identified as *F. pseudograminearum* were also sent to the Grains Research Laboratory, Canadian Grain Commission, Winnipeg, MB (Mr. Randy Clear Bmycologist), for PCR-based verification (Demeke et al. 2005).

**RESULTS AND COMMENTS:** Results are presented in Table 1. Overall in 2004, 43 of the 96 crops showed visible symptoms of FHB, at incidence levels that ranged from 0.3 to 3.7%. All crops surveyed in the Peace River region (10 of 10) had FHB symptoms at incidence levels that ranged from 0.3 to 3.7%. In central Alberta, which covered the region from just north of Edmonton, south to Calgary, 44% of the crops had FHB symptoms that ranged in incidence from 0.3 to 3.7%. In southern Alberta, 29% of the crops surveyed had FHB symptoms with average incidences ranging from 0.3 to 3.3%. All 10 crops with FHB symptoms surveyed in southern Alberta were under irrigation, while no FHB was observed in crops under dryland conditions.

The majority of visible symptoms of FHB in central Alberta and the Peace River regions were due to *F. avenaceum*, *F. poae* (in the central area) and *F. culmorum*, with the number of heads per field (out of 300) affected by these pathogens ranging from 1 to 11. *Fusarium pseudograminearum* was recovered from one head in one field in central Alberta. In southern Alberta, FHB symptoms in 8 of the 10 affected fields, involving 1 B 10 heads, were due primarily to *F. graminearum*. *Fusarium culmorum* was the sole causal agent in one of the 10 fields, and was present in four of the fields also affected by *F. graminearum*.

**ACKNOWLEDGEMENTS:**
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Pouleur, S., Couture, L., Clear, R., and Comeau, A. 2004. A medium and procedure for identifying *Fusarium graminearum* in cereal seed. Can.J. Plant Pathol. 26: 218 (Abstr.).

**Table 1.** Incidence of fusarium head blight in Alberta wheat crops, 2004.

| Region | Total no. of crops surveyed* | No. crops without symptoms | No. crops affected | Percent of crops affected | Mean incidence in affected crops (%) | Maximum observed incidence in affected crops (%) |
|---|---|---|---|---|---|---|
| Peace River region | 10 | 0 | 10 | 100.0 | 1.4 | 3.7 |
| Central region | 52 | 29 | 23 | 44.2 | 1.3 | 3.7 |
| Southern Alberta | 34 | 24 | 10 | 29.4 | 1.6 | 3.3 |
| Overall | 96 | 53 | 43 | 44.8 | 1.4 | |

*300 heads assessed per field

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

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**TITLE /TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2004**

**INTRODUCTION AND METHODS:** Fusarium head blight (FHB) incidence and severity were assessed in 213 wheat crops in Saskatchewan in 2004: 159 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 54 durum wheat (Canada Western Amber Durum class). Crops were surveyed between July 20 and September 11. Fields were grouped according to soil zones (Zone 1 = brown; Zone 2 = dark brown; Zone 3 = black/grey soils), and fields under irrigation were grouped separately and referred to as in the irrigation zone (fields located along the South Saskatchewan River in west-central and central regions of the province).

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

**RESULTS AND DISCUSSION:** The 2004 season was wet and cool, resulting in abundant foliar growth and delayed crop development. However, rainfall was not frequent during cereal flowering, reducing the risk of FHB. Severe frost was received over much of the province on August 20; hence, frost damage and secondary fungi were of greater concern than FHB in 2004.

In 2004, FHB occurred in only 27% of the common wheat and 35% of the durum wheat crops surveyed (Table 1). Mean FHB severities were ≤1% in all zones, with overall mean severity ratings of 0.2% for both common and durum wheat. These mean severity ratings are similar to recent years (Pearse et al. 2004). Substantial FHB severities have not been reported since the 2001 survey when overall mean severity ratings were 2.9% for common wheat and 4.5% for durum wheat. In 2004, the highest severity was 16.8%, found in a crop of Canada Western Red Spring wheat in the central part of the province. Durum wheat crops had a higher prevalence of infection and a higher FHB severity rating in the irrigation zone. Current durum varieties have very poor resistance to FHB so growers using irrigation should be particularly aware of the risk of FHB and prepared to implement management strategies.

In 2004, the most commonly isolated *Fusarium* species was *F. avenaceum*, accounting for 35% of total *Fusarium* isolations, followed by *F. graminearum* (17%), *F. poae* (15%), *F. acuminatum* (14%), *F. sporotrichioides* (9%), *F. culmorum* (5%), and *F. equiseti* (5%). *Fusarium graminearum* was isolated from 15 of the 213 wheat crops surveyed, which is higher than in the previous two years but lower than in 2000 and 2001 (Pearse et al. 2004). Although *F. graminearum* was isolated from all zones in 2004, it was most prevalent in Zone 3 and the irrigation zone.

Other pathogens were also observed on the wheat heads collected, including *Septoria/Stagonospora* spp., *Cochliobolus sativus*, *Pyrenophora* spp., and *Claviceps purpurea*. Stripe rust (*Puccinia striiformis* f. sp. *tritici*) was found on heads samples from 11 crops, primarily on Canada Western Red Spring wheat in the south-central and south-west regions.

We gratefully acknowledge the participation of the crop insurance adjustors with Saskatchewan Crop Insurance Corporation for the collection of head samples for this survey.

**REFERENCE:**

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**Table 1.** Prevalence and severity of fusarium head blight (FHB) in common wheat and durum crops grouped by soil or irrigation zones in Saskatchewan, 2004.

| Soil Zones | Common Wheat | | Durum Wheat | |
|---|---|---|---|---|
| | No. crops affected / total crops (% of crops affected) | Mean FHB Index[1] (range of severity) | No. crops affected / total crops (% of crops affected) | Mean FHB index[1] (range of severity) |
| Zone 1 Brown | 7/ 27 (26%) | T[2] (0 - 0.3%) | 10 / 32 (31%) | 0.3% (0 - 3.5%) |
| Zone 2 Dark Brown | 7 / 40 (18%) | 0.5% (0 - 16.8%) | 4 / 15 (27%) | T (0 - T) |
| Zone 3 Black/Grey | 24 / 75 (32%) | T (0 - 1.4%) | 2 / 4 (50%) | 0.1% (0 - 0.4%) |
| Irrigation Zone | 5 / 17 (29%) | T (0 - 0.5%) | 3 / 3 (100%) | 1.0% (0 - 1.6%) |
| Overall Mean | 43 / 159 (27%) | 0.2% | 19 / 54 (35%) | 0.2% |

[1] FHB index = % heads affected x mean % severity of infection / 100
[2] T = Trace values of FHB; <0.1%

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

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**TITLE / TITRE: LEAF DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2004**

**INTRODUCTION AND METHODS:** A survey for foliar diseases of common and durum wheat was conducted between the milk and dough growth stages in 20 crop districts (CD) in Saskatchewan in 2004. In each of 226 crops surveyed (185 common wheat, 41 durum wheat), 10 flag leaves were collected at random and air-dried at room temperature. Percent leaf area affected by leaf spots (severity) was recorded for each leaf. An average percent leaf area with leaf spots was calculated for each field and CD. For fields with over 1% leaf spot severity, surface-disinfested leaf pieces were plated on water agar for identification and quantification of leaf spot pathogens.

**RESULTS AND COMMENTS:** Leaf spots were observed in 96% of the common and durum wheat fields surveyed, compared to 58% in 2003 (Fernandez and Pearse 2004). In 2004 percent flag leaf area infected ranged from trace to 10%, with an overall mean of 2%. This leaf spot severity was similar to that in 2003 (Fernandez and Pearse 2004) but lower than in previous years (Fernandez and Pearse 2002, 2003; Fernandez et al. 2002).

As in previous years, the most prevalent leaf spotting pathogen was *Pyrenophora tritici-repentis* (tan spot), both in the number of fields where it was present and in the percent leaf area colonized (Table 1) (Fernandez and Pearse 2002, 2003, 2004; Fernandez et al. 2002). Similar to the previous two years, *Stagonospora nodorum* was the second most common species, followed by *Septoria tritici*. *Cochliobolus sativus* and *Stagonospora avenae* f. sp. *triticea* were the least common species, being isolated from 57% and 42%, respectively, of the samples plated.

Leaf rust severities were 1 - 10% in about 3% of the fields. These fields were in CDs 3BN and 4A (southwest), 5A (east-central), 7A and 7B (west-central), and 9B (northwest).

We gratefully acknowledge the participation of the crop insurance adjustors with Saskatchewan Crop Insurance Corporation for the collection of leaf samples for this survey.

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

**Table 1.** Distribution, incidence and severity of leaf spot diseases, and estimate of the percentage of flag leaf area colonized by specific pathogens in common and durum wheat fields in Saskatchewan, 2004.

| Crop District | No. crops affected[1]/ surveyed | Mean severity[2] | % fungal isolation / affected crops[3] | | | | |
|---|---|---|---|---|---|---|---|
| | | | *P. tritici-repentis* | *S. nodorum* | *S. tritici* | *S. avenae* f.sp. *triticea* | *C. sativus* |
| 1A | 10/10 | 3 | 58/5 | 31/4 | 14/2 | 13/3 | 5/4 |
| 1B | 7/7 | 3 | 67/5 | 18/4 | 6/4 | 21/2 | 10/3 |
| 2A | 10/11 | 1 | 98/2 | 1/1 | - | - | 3/1 |
| 2B | 11/16 | 1 | 85/4 | 6/2 | 17/2 | 7/1 | 5/2 |
| 3A-N | 8/8 | 2 | 53/6 | 15/5 | 36/1 | 13/3 | 34/4 |
| 3A-S | 7/7 | 2 | 88/5 | 8/3 | 8/3 | - | 5/2 |
| 3B-N | 17/17 | 1 | 40/4 | 39/4 | 6/3 | 18/3 | 2/2 |
| 3B-S | 2/2 | 5 | 85/2 | 16/1 | 4/4 | - | 7/1 |
| 4A | 7/7 | 2 | 87/2 | 8/1 | <1/1 | 17/1 | - |
| 4B | 4/6 | 1 | 94/1 | 1/1 | - | - | 5/1 |
| 5A | 17/17 | 4 | 87/11 | 8/7 | 11/5 | 11/1 | 4/5 |
| 5B | 14/14 | 4 | 66/10 | 12/9 | 23/9 | 4/3 | 2/2 |
| 6A | 19/20 | 2 | 70/9 | 13/6 | 14/8 | 12/2 | 8/7 |
| 6B | 19/19 | 2 | 47/10 | 17/10 | 23/8 | 19/7 | 5/8 |
| 7A | 14/15 | 1 | 90/3 | 4/2 | 3/2 | 7/1 | 5/2 |
| 7B | 11/11 | 1 | 93/2 | 2/2 | 3/1 | 1/1 | 3/2 |
| 8A | 8/8 | 2 | 46/3 | 42/3 | 5/2 | 7/3 | 4/2 |
| 8B | 7/7 | 3 | 55/6 | 15/6 | 4/4 | 27/5 | 7/4 |
| 9A | 14/14 | 3 | 47/9 | 34/8 | 15/7 | 10/5 | 11/5 |
| 9B | 10/10 | 2 | 72/3 | 41/3 | 3/2 | 24/2 | 4/2 |
| **Mean/total:** | **216/226** | **2** | **67/102** | **19/82** | **13/66** | **15/43** | **8/59** |

[1]Number of crops with leaf spot lesions on the flag leaf.
[2]Mean percent flag leaf area infected.
[3]Mean percent fungal isolation / number of crops where the fungus occurred.

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

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**TITLE / TITRE: SURVEY OF FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** Fifty-five spring wheat fields were surveyed between July 27 and August 20, 2004 in southern Manitoba to assess the incidence and severity of fusarium head blight (FHB). The incidence and severity in each field were assessed by sampling approximately 100 spikes (Zadoks growth stage 80-85) at three locations, and additional spikes were collected for subsequent pathogen identification. Ten kernels per field collection were surface-sterilized and incubated on potato dextrose agar under continuous cool white light for 4-5 days to isolate and identify the *Fusarium* species present. When the *Fusarium* species was unknown, single spores were grown on SNA (synthetic nutrient agar) to facilitate identification. The FHB-index was calculated as follows: Mean % incidence X Mean % severity/100.

**RESULTS AND COMMENTS:** The disease was present at low levels in all but one field (98% incidence). The cold wet summer weather was not conducive to disease development; the FHB-index ranged from 0.1 to 8.2%, and averaged 2.3%. *Fusarium graminearum* was the predominant species (82%) isolated from kernels sampled from infected heads, but two other species, *F. sporotrichioides* (especially in the Interlake and Red River valley) and *F. poae* (in the south west) were found at moderate levels (Table 1). *Fusarium graminearum* is usually associated with warm, humid conditions. The abnormally cold conditions of 2004 may account for the lower percentage of *F.graminearum,* and the more diverse range of species isolated from wheat kernels. Based on the results, FHB likely was not the most significant downgrading factor of spring wheat in Manitoba in 2004.

**Table 1.** Overall and regional % frequency distribution of *Fusarium* species isolated from spring wheat in southern Manitoba in 2004.

| ***Fusarium* spp.** | **Total No. of isolations** | **% Frequency distribution** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **East** | **Interlake** | **Red River** | **South-central** | **South-west** | **Overall** |
| *F. graminearum* | 381 | 95.0 | 80.8 | 73.2 | 82.1 | 84.0 | 82.0 |
| *F. equiseti* | 1 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.2 |
| *F. sporotrichioides* | 50 | 0.0 | 19.2 | 25.4 | 9.2 | 4.0 | 10.7 |
| *F. culmorum* | 7 | 0.0 | 0.0 | 0.0 | 4.0 | 0.0 | 1.5 |
| *F. avenaceum* | 2 | 0.0 | 0.0 | 0.0 | 1.2 | 0.0 | 0.4 |
| *F. poae* | 25 | 5.0 | 0.0 | 1.4 | 2.9 | 12.0 | 5.4 |

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

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** The prevalence of fusarium head blight (FHB) in winter wheat in Manitoba in 2004 was assessed by surveying 35 farm fields between July 20 and August 5, when most crops were at the late milk to soft-dough stage of growth (ZGS 76-85). Because winter wheat is not widely grown in Manitoba (in 2004 it was planted on about 10% of the total wheat acreage in the province - Statistics Canada, Field Crop Reporting Series #8, December 2004) the fields were not surveyed at random; rather, information on their location was obtained by contacting Manitoba Agriculture extension personnel, and producers who normally grow the crop. The fields surveyed were located in southern Manitoba, in an area bounded by Hwy #16 to the north, the US border in the south, Hwy #21 in the west and Hwy #12 to the east. Fusarium head blight in each field was assessed by non-destructive sampling of a minimum of 80-100 plants at each of 3 locations to determine the percentage of infected spikes (incidence), and the average proportion of the spike affected (severity). Disease levels were expressed as the 'FHB Index' (% incidence x mean % severity / 100). Several affected heads were collected at each field site and stored in paper envelopes. A total of 50 discoloured and putatively infected kernels, or those of normal appearance to make up the remainder, were subsequently removed from five heads per location. The kernels were surface sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar to quantify and identify the *Fusarium* spp. present.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba with a heavy snowfall on May 11. The low temperatures appeared to curtail the growth of *Fusarium* in overwintered plant straw and debris, resulting in lower than normal levels of spring inoculum . Warmer, drier conditions prevailed during wheat flowering and subsequent grain filling, but cool, moist conditions returned later in the growing season, hampering harvesting operations, and resulting in some mature crops remaining unharvested for up to several weeks under wet conditions. The unfavourable harvest weather had more limited impact on winter wheat crops as these normally mature some two weeks earlier than spring wheat.

Visible symptoms of FHB were observed in 34 of the 35 winter wheat fields surveyed. Overall, incidence of FHB was 1.7% (range 0 - 8.2%), severity 57.5% (range 0 - 100%) and the FHB Index 1.3% (range 0 - 7.0%). As such, FHB was estimated to have caused average yield losses in commercial winter wheat of <1%. This level of loss is similar to that found in 2003, but considerably less than the higher losses that occurred in 2002 (Tekauz et al. 2004, 2003).

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

**REFERENCES:**
Tekauz, A., E. Mueller, M. Beyene, M. Stulzer, and D. Schultz. 2004. 2003 Survey for fusarium head blight of winter wheat in Manitoba. Can. Plant Dis. Surv. 84: 82. (http://www.cps-scp.ca/cpds.htm)

Tekauz, A., E. Mueller, M. Beyene, M. Stulzer, D. Schultz, and F. Reverchon. 2003. Fusarium head blight of winter wheat in 2002 in Manitoba. Can. Plant Dis. Surv. 83: 62-63. (http://www.cps-scp.ca/cpds.htm)

**Table 1.** *Fusarium* spp. isolated from fusarium head blight-affected kernels of Manitoba winter wheat in 2004.

| ***Fusarium* spp.** | **Percent of fields** | **Percent of kernels** |
|---|---|---|
| *F. avenacuem* | 2.9 | 0.1 |
| *F. culmorum* | 5.7 | 1.0 |
| *F. equiseti* | 2.9 | 0.1 |
| *F. graminearum* | 97.1 | 98.3 |
| *F. poae* | 2.9 | 0.1 |
| *F. sporotrichioides* | 5.7 | 0.4 |

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

**NAMES AND AGENCY / NOMS ET ORGANISME:**
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**TITLE / TITRE: SURVEY FOR LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** A survey of 68 southern Manitoba spring wheat fields was conducted between 27 July and 20 August, 2004 to assess the prevalence and severity of foliar diseases. Crops were sampled between heading and soft dough stages of development, and infected leaves collected for subsequent analyses. Severity of disease on flag and flag-1 leaves was recorded as percent of the leaf affected. Samples of affected leaf tissue were surface sterilized and placed in moisture chambers for 5-7 days to promote pathogen sporulation for disease identification.

**RESULTS AND COMMENTS:** Average percent necrosis caused by leaf spots on the flag and flag-1 leaves was 40 and 80%, respectively. The growing conditions in 2004 were generally cool and wet, and favourable for leaf spot development. Tan spot was found in 96% of fields, and *Pyrenophora tritici-repentis*, the causal agent of tan spot accounted for 67% of fungal isolations (Table 1). *Septoria tritici*, cause of septoria tritici blotch, and *Stagonospora nodorum,* cause of stagonospora nodorum blotch, accounted for 11% and 13% of isolations, respectively, similar to the situation in 2003. Development of spot blotch, caused by *Cochliobolus sativus,* the predominant leaf spot disease in southern Manitoba in the previous three years, was curtailed by the cool conditions in 2004 (Gilbert et al. 1998). *Cochliobolus sativus* accounted for just 8% of the 598 fungal isolations made from leaf tissue (Table 1). Whereas tan spot was prevalent in all areas of southern Manitoba, stagonospora nodorum blotch was more prevalent in the Red River valley and the south-west, and septoria tritici blotch in the south central and the south west regions (Figure 1). Stagonospora avenae blotch was at low levels throughout southern Manitoba.

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

**Table 1.** Prevalence and isolation frequency of leaf spot pathogens in 68 fields of hard red spring wheat in Manitoba in 200

| | Disease | | | | |
|---|---|---|---|---|---|
| | **Septoria nodorum blotch (*Stagonospora nodorum*)** | **Septoria tritici blotch (*Septoria tritici*)** | **Spot blotch (*Cochliobolus sativus*)** | **Tan spot (*Pyrenophora tritici-repentis*)** | **Stagonospora avenae blotch (*Stagonospora avenae*)** |
| Fields (%) | 43 | 40 | 32 | 96 | 6 |
| Isolations (%) | 11 | 13 | 8 | 67 | 1 |

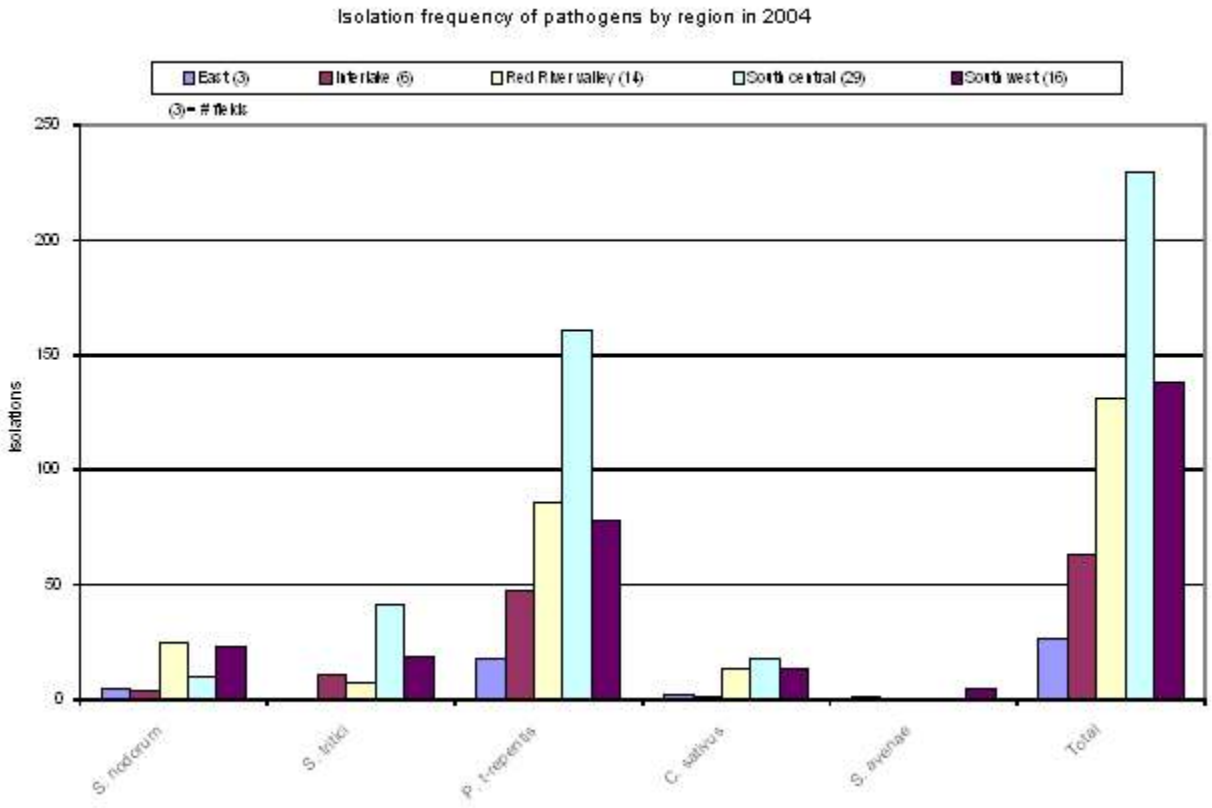


Figure 1. Isolations of wheat foliar pathogens by region in southern Manitoba in 2004.

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

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**TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2004**

**INTRODUCTION AND METHODS:** Foliar diseases of Manitoba winter wheat crop were assessed by surveying 35 farm fields from July 20 to August 5, when most crops were at the early to soft dough stage (ZGS 83-85). Because winter wheat occupies a small acreage in Manitoba (in 2004 it was planted on about 10% of the total wheat acreage - Statistics Canada, Crop Reporting Series #8, December 2004), the farm fields were not surveyed at random; rather, information on their location was obtained beforehand from Manitoba Agriculture extension personnel and producers who normally grow the crop. The fields surveyed were located in southern Manitoba, in the area bounded by Hwy #16 to the north, the US border in the south, Hwy #21 in the west and Hwy #12 to the east. Disease severity was recorded by averaging ratings on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Ratings were taken on both the upper (mainly the flag leaf) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried and stored in paper envelopes. Subsequently, surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal pathogen(s) and determine the disease(s) present.

**RESULTS AND COMMENTS:** Conditions in spring (mid-April to mid-June) 2004 were generally cool and moist in southern Manitoba. Warmer, drier weather prevailed during wheat flowering and subsequent grain filling, but cool, moist conditions returned later in the growing season, hampering harvesting, and resulting in some mature crops remaining unharvested for up to several weeks under wet conditions. The unfavourable harvest weather had limited impact on winter wheat crops as they normally mature two weeks earlier than spring wheat, but the record low temperatures delayed crop development.

Leaf spots were observed in the upper or lower leaf canopies in 34 of the 35 winter wheat fields surveyed. Disease severity levels in the upper canopy were nil, trace or very slight in 20% of fields, slight in 49%, moderate in 20%, severe in 6% and senescent in 6%. Respective values in the lower canopy were 0%, 6%, 11%, 6% and 77%. Based on disease development in the upper canopy (70% of fields with trace to slight leaf spotting), foliar diseases in winter wheat in 2004 caused little damage, likely a yield loss of 1-2%. The widespread application of foliar fungicide(s) to winter wheat crops would have contributed to the relatively low leaf spot severities observed.

*Pyrenophora tritici-repentis*, causal agent of tan spot, was the predominant leaf spot pathogen in 2004. It was found in most fields and caused >80% of the damage observed (Table 1), the highest in recent years (Tekauz et al. 2004). Conversely, damage caused by *Cochliobouls sativus* (spot blotch), was the lowest in the past 5 years. These trends also were found for spring wheat in Manitoba in 2004 (Gilbert et al. 2005). In winter wheat the prevalence of, and level of damage attributable to, *Stagonospora nodorum* (stagonospora leaf blotch) was also the lowest so far in this millennium.

**REFERENCES:**
Gilbert, J. A. Tekauz, R. Kaethler, U. Kromer, K. Morgan, E. Mueller, K. Slusarenko, L. Liguoy, M. Stulzer, and M. Beyene. 2005. Survey for leaf spot diseases of spring wheat in Manitoba in 2004. Can. Plant Dis. Surv. 85: 49-50.(http://www.cps-scp.ca/cpds.htm)

Tekauz, A., E. Mueller, M. Beyene, M. Stulzer, and D. Schultz. 2004. Leaf spot diseases of winter wheat in Manitoba in 2003. Can. Plant Dis. Surv. 84: 83. (http://www.cps-scp.ca/cpds.htm)

**Table 1.** Prevalence and isolation frequency of leaf spot pathogens of winter wheat in Manitoba in 2004

| Pathogen | Prevalence (% of fields) | Frequency (% of isolations)* |
|---|---|---|
| *Pyrenophora tritici-repentis* | 94 | 84.2 |
| *Cochliobolus sativus* | 34 | 9.2 |
| *Septoria avenae* f.sp. *triticea* | 17 | 5.1 |
| *Stagonospora nodorum* | 9 | 1.5 |

* indicative of the relative foliar damage caused

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

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**TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2004**

**INTRODUCTION AND METHODS:** Trap nurseries and commercial fields of wheat in Manitoba and eastern Saskatchewan were surveyed for the incidence and severity of leaf rust (*Puccinia triticina* Eriks.) and stripe rust (*Puccinia striiformis* Westend. f.sp. *tritici*) during July and August 2004.

**RESULTS AND COMMENTS:** Wheat leaf rust was first observed during the second week of June in Manitoba in 2004, which is somewhat earlier than usual. However, it developed relatively slowly through July and August due to cool conditions. The disease was widely distributed throughout southern Manitoba and eastern Saskatchewan with the heaviest infections in the southwestern portion of Manitoba near Brandon and Souris. Many crops in south-central Manitoba were treated with fungicides which limited rust development. In nontreated crops in southern Manitoba, leaf rust ranged from trace to 25% of the flag leaf area infected, with an average of 7% infected. Leaf rust was found mostly at trace levels in fields surveyed in eastern Saskatchewan during late July. In many parts of Manitoba and eastern Saskatchewan, leaf rust developed further on late seeded crops that were not harvested until the end of September because of cool wet fall weather.

Wheat stripe rust was observed in nearly all wheat fields surveyed throughout southern Manitoba and eastern Saskatchewan during 2004. This disease first appeared on the eastern prairies in 2000 and has been seen each year since that time (1,2,3). It is also now well established in the Great Plains region of the United States. Severity was typically at trace levels. However, in many late seeded crops stripe rust increased in the late summer and early fall to epidemic levels because of the cool wet weather during this period. Stripe rust may have caused significant economic damage to many late seeded wheat fields in Manitoba and eastern Saskatchewan.

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

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

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

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

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT SURVEY OF WINTER WHEAT IN 2004 IN ONTARIO**

**INTRODUCTION AND METHODS:** Winter wheat fields were surveyed randomly at harvest on farms in counties across Ontario in 2004. Mature wheat spikes were hand-harvested and threshed with an Almaco stationary plot thresher (model VPT-OSC). Deoxynivalenol (DON) content was determined from a 20-g subsample of seed using the quantitative fluorometric test 'FluoroQuan' (Romer® Labs, Inc, Union MO). The number of healthy and fusarium damaged kernels (FDK) was counted from a 25-g subsample and the percent FDK was calculated for each field. To determine *Fusarium* levels, 60 kernels per field were surface-sterilized in 0.16% NaOCl (diluted commercial bleach) for 3 min, air dried, and placed on acidifed potato dextrose agar in four replications of 15 seeds per agar plate. The agar plates were incubated for 7 days with a 12:12 hr light/dark cycle at room temperature. The percentage of *F. graminearum*-infected seeds was recorded, with their identity confirmed according to Nelson et al. (1983).

**RESULTS AND COMMENTS:** The highest DON content was observed in Essex county (averaging 4.9 ppm), followed by Kent, Elgin and Middlesex counties with mean DON values of 2.4, 2.0 and 1.7 ppm respectively (Table 1). The levels of FDK ranged from 0.7% in Bruce county to 3.0% in Kent and Middlesex counties. The highest level of *F. graminearum*-infected seeds (20.7%) was found in Elgin county. In summary, fusarium head blight appears to have caused significant damage to winter wheat in Ontario in 2004.

**REFERENCE:**
Nelson, P., Toussoun, T., and Marasas, W. 1983. Fusarium species. An illustrated manual for identification. The Pennsylvania State University Press, University Park, 193 pp.

**Table 1.** Deoxynivalenol (DON) content, fusarium damaged kernels (FDK) and percent of *F. graminearum*-infected seeds from winter wheat in 2004 in Ontario.

| County | No. of fields | DON content (ppm) | | %FDK | | % *Fusarium graminearum* | |
|---|---|---|---|---|---|---|---|
| | | Mean | Range | Mean | Range | Mean | Range |
| Essex | 21 | 4.9 | 1.0-9.7 | 2.0 | 1.5-5.5 | 11.7 | 0.0-25.0 |
| Kent | 10 | 2.4 | 0.8-5.9 | 3.0 | 0.3-5.2 | 10.0 | 3.3-16.7 |
| Lambton | 12 | 0.8 | 0.0-1.8 | 1.3 | 0.8-2.4 | 5.7 | 0.0-13.3 |
| Elgin | 18 | 2.0 | 0.0-6.6 | 2.1 | 0.2-6.0 | 20.7 | 1.7-45.0 |
| Middlesex | 4 | 1.7 | 0.1-3.0 | 3.0 | 0.8-5.1 | 12.8 | 3.3-26.7 |
| Perth | 7 | 1.2 | 0.4-2.3 | 2.0 | 0.8-3.6 | 6.7 | 1.7-11.7 |
| Waterloo | 2 | 0.8 | 0.6-1.0 | 1.1 | 1.0-1.2 | 9.2 | 5.0-13.3 |
| Bruce | 2 | 1.1 | 0.8-1.4 | 0.7 | 0.6-0.8 | 2.5 | 1.7-3.3 |

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

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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN EASTERN ONTARIO IN 2004**

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

Determination of the causal *Fusarium* species was based on 10 infected heads collected per field, that were air-dried at room temperature, and subsequently threshed. Ten random discoloured kernels per sample were surface sterilized in 1% NaOCl for 30 seconds, and plated onto modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm streptomycin sulfate in 9-cm diameter petri dishes. Plates were incubated for 10-14 days at 22-25˚C, with a 14-hour photoperiod under fluorescent and long wavelength UV light. *Fusarium* species isolated from the kernels were identified by microscopic examination of morphological structures using standard taxonomic keys.

**RESULTS AND COMMENTS:** Fusarium head blight was observed in 27 of the 28 fields surveyed (Table 1). Incidence ranged from 10.0-100%, with a mean of 51.1%, while severity ranged from 13.3-58.3%, with a mean of 34.2%. The FHB index ranged from 2.7-46.0%, with a mean of 20.0%. Very severe levels were observed in 13 crops; two crops had severe, and the remainder moderate FHB levels.

Four *Fusarium* species were isolated from the infected kernels (Table 2). *Fusarium graminearum* predominated, occurring in 100% of the fields and 96.8% of the infected kernels. *Fusairum. crookwellense, F. culmorum,* and *F.sporotrichioides* were found infrequently, each in approximately 4% of fields and 1% of infected kernels.

This can be considered another FHB epidemic year in Ontario, following the last severe outbreak in 2000. Symptoms of FHB were observed in almost every field surveyed in 2004, at an overall severity 3-5 fold greater than that in 2001-2003 (Xue et al. 2003, 2004). The cool and wet weather during May, June, and July across the province likely accounted for the severe disease levels. Although environmental conditions were ideal for a FHB epidemic, approximately 50% of the crops surveyed had only slight to moderate levels of FHB, comparable to those observed from 2001-2003. The lower FHB severities in these fields likely were due to the production of moderately resistant cultivars, application of foliar fungicides, and possibly other management practices, such as rotations away from cereals.

*Fusarium graminearum* was the predominant causal agent, as observed in previous years (Table 2). This was the first time that *F. culmorum* was isolated since 2001, while *F. poae* , isolated annually at low frequencies from 2001 to 2003, was not found in 2004. *Fusarium crookwellense* and *F. sporotrichioides* were recovered in 2 and 3 of the last four years, respectively, and *F. avenaceum* in 2003 only.

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

Xue, A.G., H.D. Voldeng, F. Sabo, and Y. Chen. 2004. Fusarium head blight of spring wheat in eastern Ontario in 2003. Can. Plant Dis. Surv. 84:78-79. (http://www.cps-scp.ca/cpds.htm)

Table 1. Location of and fusarium head blight levels in 28 spring wheat fields surveyed in eastern Ontario in 2004.

| FIELD LOCATION | INCIDENCE (%) | SEVERITY (%) | FHB index* |
|---|---|---|---|
| Appleton | 100 | 35.0 | 35.0 |
| Avonmore | 23.3 | 16.7 | 3.8 |
| Carleton Place E | 90.0 | 48.3 | 43.5 |
| Carleton Place N | 70.0 | 50.0 | 35.0 |
| Carleton Place S | 86.7 | 31.7 | 27.3 |
| Chesterville | 20.0 | 20.0 | 4.0 |
| Cumberland | 38.3 | 15.0 | 5.9 |
| Dwyer Hill N | 38.0 | 51.7 | 19.7 |
| Finch W | 26.7 | 30.0 | 8.0 |
| Fournier-St. Bernardin | 20.0 | 13.3 | 2.7 |
| Kanata S | 92.0 | 50.0 | 46.0 |
| Kemptville | 0.0 | 0.0 | 0.0 |
| Kenmore | 81.3 | 43.3 | 35.2 |
| Maxville | 10.0 | 33.3 | 3.3 |
| Nepean S | 20.0 | 35.0 | 7.0 |
| Nepean W | 48.3 | 33.3 | 16.3 |
| North Gower | 70.0 | 51.7 | 36.2 |
| Osgoode | 73.7 | 46.7 | 34.4 |
| Ottawa S | 33.3 | 30.0 | 10.0 |
| Riceville | 10.0 | 38.3 | 3.8 |
| Richmond N | 76.3 | 43.3 | 33.2 |
| Richmond S | 61.0 | 46.7 | 28.3 |
| Rockland | 38.3 | 21.7 | 8.3 |
| St. Isidore | 23.3 | 30.0 | 7.0 |
| Stittsville | 76.0 | 58.3 | 44.1 |
| Vankleek Hill | 33.3 | 16.7 | 5.5 |
| Winchester N | 80.0 | 35.0 | 27.9 |
| Winchester S | 91.7 | 31.7 | 28.9 |
| Range of infection | 10-100 | 13.3-58.3 | 2.7-46.0 |
| Mean of infection | 51.1 | 34.2 | 20 |

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

**Table 2.** Frequency of *Fusarium* species isolated from fusarium damaged kernels of spring wheat in eastern Ontario in 2004.

| ***FUSARIUM* SPP.** | **% FIELDS** | **% KERNELS** |
|---|---|---|
| *F. crookwellense* | 3.6 | 0.7 |
| *F. culmorum* | 3.6 | 0.7 |
| *F. graminearum* | 100.0 | 96.8 |
| *F. sporotrichioides* | 3.6 | 0.7 |

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

**NAMES AND AGENCIES / NOMS ET ORGANISMES:**
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**TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN EASTERN ONTARIO IN 2004**

**INTRODUCTION AND METHODS:** A survey for the presence of fusarium head blight (FHB) in winter wheat was conducted in the second and third weeks of July when plants were at the soft dough stage of development. Twenty-nine fields were chosen at random in the southwestern and central Ontario regions, where most of the winter wheat is grown. Both incidence (percent infected spikes) and severity (percent infected spikelets in the infected heads) of FHB were assessed, based on approximately 200 spikes sampled at each of three random sites per field. The FHB index (%incidence x %severity)/100 was determined for each field. Index values of <1, <10, <20, and ≥20 were considered slight, moderate, severe, and very severe infection levels, respectively.

Determination of the causal *Fusarium* species was based on 10 infected heads collected per field, that were air-dried at room temperature, and subsequently threshed. Ten discolored kernels per sample were surface sterilized in 1% NaOCl for 30 seconds, and plated onto modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm streptomycin sulfate, in 9-cm diameter petri dishes. Plates were incubated for 10-14 days at 22-25˚C, with a 14-hour photoperiod under fluorescent and long wavelength UV light. *Fusarium* species isolated from the kernels were identified by microscopic examination of morphological characters using standard taxonomic keys.

**RESULTS AND COMMENTS:** Fusarium head blight was observed in 27 of the 29 fields surveyed (Table 1). Incidence ranged from 10.0-76.7%, with a mean of 30.9%, while severity ranged from 6.7-56.7%, with a mean of 31.4%. The FHB index ranged from 1.0-43.7%, with a mean of 12.1%. Very severe levels were observed in 5 fields. Ten crops had severe and the remainder moderate disease levels.

Five *Fusarium* species were isolated from the infected kernels (Table 2). *Fusarium graminearum* was the predominant species, occurring in 93% of the fields and 82% of the infected kernels. The other species, *F. avenaceum*, *F. acuminatum, F. poae,* and *F. sporotrichioides*, were isolated infrequently, each occurring in less than 7% of fields and 1% of kernels.

There has been no FHB disease survey conducted in winter wheat in Ontario in the past three years. Overall, FHB severity was much greater in 2004 than in 2001-2003. This can be considered another FHB epidemic year in Ontario, following the last severe outbreak in 2000 (Tamburic-Ilinic and Schaafsma 2001). The cool and wet growing conditions during May, June, and July across the province likely promoted the severe disease levels observed. Although environmental conditions were ideal for a FHB epidemic, approximately 50% of the surveyed fields had only slight to moderate levels of FHB, comparable to those observed from 2001 to 2003. The lower FHB severity in these fields likely was due to the production of moderately resistant cultivars, application of foliar fungicides, and other management practices, such as rotations away from cereals.

**REFERENCE:**
Tamburic-Ilinic, L. and A. Schaafsma. 2001. Fusarium head blight survey of winter wheat in 2000 in Ontario. Can. Plant Dis. Surv. 81: 96-97.(http://www.cps-scp.ca/cpds.htm)

Table 1. Location of and fusarium head blight severity in 29 winter wheat fields surveyed in eastern and southwestern Ontario in 2004.

| FIELD LOCATION | INCIDENCE (%) | SEVERITY (%) | FHB index* |
|---|---|---|---|
| Amulree | 30.0 | 30.0 | 9.0 |
| Arva | 38.3 | 48.3 | 18.6 |
| Birr | 33.3 | 28.3 | 9.6 |
| Bornholm E | 30.0 | 33.3 | 10.3 |
| Bornholm N | 50.0 | 40.0 | 20.0 |
| Elginfield | 40.0 | 41.7 | 16.7 |
| Gads Hill N | 0.0 | 0.0 | 0.0 |
| Gads Hill S | 30.0 | 40.0 | 12.0 |
| Grafton | 10.0 | 6.7 | 1.0 |
| Joyceville | 16.7 | 25.0 | 6.0 |
| Kirkton | 60.0 | 36.7 | 22.0 |
| Listowel | 23.3 | 20.0 | 4.7 |
| London | 30.0 | 30.0 | 9.0 |
| Mitchell | 46.7 | 50.0 | 23.3 |
| Monkton N | 20.0 | 35.0 | 7.0 |
| Monkton S | 15.0 | 20.0 | 3.0 |
| Morven | 15.0 | 13.3 | 3.5 |
| Newry | 20.0 | 23.3 | 4.8 |
| Palmerston N | 43.3 | 30.0 | 13.0 |
| Palmerston S | 16.7 | 20.0 | 3.3 |
| Phillipsburg | 15.0 | 16.7 | 4.0 |
| Port Britain | 48.3 | 28.3 | 15.6 |
| Rossmore | 30.0 | 41.7 | 13.0 |
| Rostock N | 76.7 | 56.7 | 43.7 |
| Rostock S | 36.7 | 50.0 | 18.3 |
| Shakespeare | 53.3 | 53.3 | 28.3 |
| Smithfield | 0.0 | 0.0 | 0.0 |
| Whalen Corners | 31.7 | 53.3 | 16.9 |
| Woodham | 35.0 | 40.0 | 14.0 |
| Mean of infection | 30.9 | 31.4 | 12.1 |
| Range of infection | 10.0-76.7 | 6.7-56.7 | 1.0-43.7 |

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

**Table 2.** Frequency of *Fusarium* species isolated from winter wheat in eastern and southwestern Ontario in 2004.

| ***FUSARIUM* SPP.** | **% FIELDS** | **% KERNELS** |
|---|---|---|
| *F. acuminatum* | 3.4 | 0.3 |
| *F. avenaceum* | 6.9 | 0.7 |
| *F. graminearum* | 93.1 | 81.7 |
| *F. poae* | 3.4 | 0.3 |
| *F. sporotrichioides* | 3.4 | 0.7 |

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

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**TITLE / TITRE: FOLIAR DISEASES OF SPRING WHEAT IN EASTERN ONTARIO IN 2004**

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

**RESULTS AND COMMENTS:** Eleven diseases were observed in the fields surveyed (Table 1). Septoria/stagonospora leaf blotch (normally associated with infection by *Septoria tritici* and *Stagonospora* spp.) was the most prevalent disease (complex), observed in 26 fields at a mean severity level of 3.6. Eighteen crops had moderate disease levels, the highest category found. Yield reductions due to septoria/stagonospora leaf blotch were estimated to average about 7%.

Leaf rust (*Puccinia triticina*) was the second most prevalent disease, observed in 21 fields at a mean severity of 1.4. All crops had only trace or slight disease levels. Tan spot (*Pyrenophora tritici-repentis*), spot blotch (*Cochliobolus sativus*), and stagonospora glume blotch (*Stagonospora nodorum*) were observed in 11, 10, and 9 fields at mean severities of 1.1, 1.1, and 1.7, respectively. One crop had a moderate level of septoria glume blotch, while in all crops, tan spot and spot blotch were found only at slight or trace levels. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), powdery mildew (*Erysiphe graminis* f. sp. *tritici*), and stem rust (*Puccinia graminis* f.sp. *tritici*). These diseases were found in 5, 5, and 1 fields, at mean severities of 0.9, 1.9, and 0.4, respectively. Powdery mildew was rated as moderate in one field; in the others, levels were either slight or trace. None of these diseases caused significant damage.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*), and take-all (*Gaeumannomyces graminis* var. *tritici*) were observed in 4, 3, and 17 fields, at mean severities of 0.1, 0.3, and 0. 7%, respectively. These diseases did not appear to cause significant damage.

In eastern Ontario in June and July, total precipitation was higher and mean temperatures lower in 2004 than in 2003 or compared to the long-term average. The relative prevalence and severity of foliar diseases in 2004 were similar to those found in 2003 (Xue et al. 2004). The major disease complex of spring wheat has been septoria/ stagonospora leaf blotch, which has caused measurable yield reductions for four consecutive years (Xue et al. 2004). This complex has the potential to cause significant damage to spring wheat in Ontario. All other foliar diseases have been of relatively minor importance.

**REFERENCE:**
Xue, A.G., H.D. Voldeng, Y. Chen, and F. Sabo. 2004. Diseases of spring wheat in eastern Ontario in 2003. Can. Plant Dis. Surv. 84:80-81. (http:www.cps-scp.ca/cpds.htm)

**Table 1.** Prevalence and severity of spring wheat diseases in eastern Ontario in 2004.

| DISEASE | NO. CROPS AFFECTED (n=28) | DISEASE SEVERITY IN AFFECTED CROPS* | |
|---|---|---|---|
| | | Mean | Range |
| Bacterial leaf blight | 5 | 0.9 | 0.5-1.3 |
| Leaf rust | 21 | 1.4 | 0.6-2.5 |
| Powdery mildew | 5 | 1.9 | 0.1-4.7 |
| Septoria glume blotch | 9 | 1.7 | 0.7-5.6 |
| Septoria/stagonospora leaf blotch | 26 | 3.6 | 0.7-5.6 |
| Spot blotch | 10 | 1.1 | 0.5-2.4 |
| Stem rust | 1 | 0.4 | 0.4 |
| Tan spot | 11 | 1.1 | 0.6-2.5 |
| Ergot | 4 | 0.1 | 0.1-0.2 |
| Loose smut | 3 | 0.3 | 0.1-0.5 |
| Take-all | 17 | 0.7 | 0.1-2.7 |

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

# Forages /Plantes fourragères

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

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**TITLE: SURVEY OF BACTERIAL WILT PATHOGEN IN ALFALFA SEED PRODUCED IN ALBERTA, SASKATCHEWAN AND MANITOBA IN 2003 AND 2004.**

**INTRODUCTION:** Bacterial wilt (*Clavibacter michiganensis* subsp. *insidiosus* (McCull.) Davis et al.) reduces yield and stand longevity of alfalfa. Plants weakened by this disease are more susceptible to winterkill. Bacterial wilt is favoured by abundant moisture and is generally most severe in low, poorly drained areas. As the disease progresses, the xylem elements of the infected plant become blocked, leading to wilting, stunting, chlorosis and plant death. The pathogen is both residue- and seed-borne (Gossen 2003).

Although bacterial wilt was once an important disease of alfalfa in Canada (Seaman 1970a,b), we are not aware of any report of this disease on the Canadian Prairies for well over a decade. The disease is no longer believed to be a threat in the region because of the widespread use of resistant cultivars. The pathogen is of quarantine significance in many regions of the world. Shipment of alfalfa seed from Canada to other countries has elicited the need to develop and implement procedures to test for the pathogen in seed grown for export.

**METHODS:** A total of 100 samples of common or certified alfalfa seed from the 2003 and 2004 crop years were tested for the presence of *C. michiganensis* subsp. *insidiosus*. Testing was conducted by Biovision Seed Labs (Edmonton, Alberta), using the protocol "Qualitative Determination of the Level of *Clavibacter michiganense* subsp *insidiosum* in seed samples of *Medicago sativa*" developed by the Canadian Food Inspection Agency (CFIA, Ottawa Laboratory; telephone: 613-759-1224).

All samples consisted of uncleaned, untreated seed; 2 g (about 5000 seeds) were used from each sample. The seeds were ground into a powder, added to 30 mL of sterile nutrient broth and incubated with shaking for 20 minutes. A three-fold serial dilution of the seed slurry was made onto plates of glucose-yeast-carbonate agar (GYCA) supplemented with antibiotics (Dye 1962). Plates were incubated for 7 days at 22°C and examined after 5, 6 and 7 days for suspect colonies. Colonies of the pathogen would be pale yellow to greyish, mucoid, convex, entire and commonly have a brilliant blue to black pigment. Suspect colonies were to be isolated into pure cultures and tested using Gram stain, KOH reaction, phage plaque test, and host inoculation to confirm their identity.

**RESULTS AND COMMENTS:** *Clavibacter michiganensis* subsp. *insidiosus* was not detected in any of the seed samples tested (Table 1). This result supports the contention that use of resistant alfalfa cultivars and good agronomic practices have reduced or eliminated *C. michiganensis* in alfalfa seed produced on the Canadian Prairies.

**REFERENCES:**

Dye, D.W. 1962. The inadequacy of the usual determinative tests for the identification of *Xanthomonas* spp. N. Z. J. Sci. 5: 393-416.

Gossen, B.D. 2003. Diseases of alfalfa. *In* Diseases of field crops in Canada, 3rd ed. *Edited by* K.L. Bailey, B.D. Gossen, R.K. Gugel, and R.A.A. Morrall. Can. Phytopathol. Soc., Saskatoon, SK. pp. 214-236.

Seaman, W.L. 1970a. Summary of the prevalence of plant diseases in Canada in 1967. Can. Plant Dis. Surv. 50: 12.

Seaman, W.L. 1970b. Noteworthy plant diseases in Canada in 1968. Can. Plant Dis. Surv. 50: 50.

**Table 1.** Summary of testing for *Clavibacter michiganensis* subsp. *insidiosus* in alfalfa seed.

| Origin of Sample | Year | No. samples tested | Results |
|---|---|---|---|
| Alberta | 2003 | 31 | Not detected |
| | 2004 | 2 | Not detected |
| Saskatchewan | 2003 | 29 | Not detected |
| | 2004 | 21 | Not detected |
| Manitoba | 2003 | 11 | Not detected |
| | 2004 | 6 | Not detected |
| Total Samples | | 100 | |

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

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**TITLE: FOLIAR DISEASE SEVERITY OF ALFALFA IN SASKATCHEWAN, 2004.**

**METHODS**: Foliar disease severity (% leaf area affected) was assessed from mid to late July 2004 in 34 fields of alfalfa (*Medicago sativa*) grown for hay in Saskatchewan. More than 20 stems per field were collected at several sites along a teardrop-shaped circuit into each field and brought back to the lab for assessment. Disease identification was based on visual symptoms.

**RESULTS AND COMMENTS**: In 2004, weather conditions in the survey area were cooler and wetter than normal. Disease levels were generally low (Table 1), but were slightly higher than in the two previous years (1, 2). Spring black stem [*Phoma medicaginis*] was the dominant disease, present in 33 of the 34 fields assessed. Common leaf spot [*Pseudopeziza medicaginis*] was observed in two-thirds of the fields. Yellow leaf blotch [*Leptotrochila medicaginis*] occurred at 19 sites, downy mildew [*Peronospora trifoliorum*] at one site, and lepto leaf spot [*Leptosphaerulina trifolii*] was found at very low levels at several sites.

**REFERENCES**:
1. Gossen, B.D., Soroka, J.J., and Bassendowski, K.A. 2003. Foliar diseases of alfalfa in Saskatchewan, 2002. Can. Plant Dis. Surv. 83: 85-86. (http://www.cps-scp.ca/cpds.htm)

2. Gossen, B.D., Soroka, J.J., and Bassendowski, K.A. 2004. Foliar diseases and blossom blight of alfalfa in Saskatchewan, 2003. Can. Plant Dis. Surv. 84: 86-87 (http://www.cps-scp.ca/cpds.htm)

**Table 1**. Foliar disease severity (range in brackets) in commercial alfalfa fields assessed in the agricultural regions of Saskatchewan, 2004.

| Region & Dominant disease | No. of fields | Leaf area affected (% ) | Other diseases [a] |
|---|---|---|---|
| Northeast | | | |
| - Spring black stem (SBS) | 12 | 3% (trace - 5%) | CLS, YLB, LLS |
| - Common leaf spot (CLS) | 1 | 3% | SBS |
| - Lepto leaf spot (LLS) | 1 | trace | YLB |
| Eastcentral | | | |
| - Spring black stem | 9 | 2% (trace - 5%) | YLB, CLS |
| - Yellow leaf blotch (YLB) | 2 | 4% (3 - 5%) | SBS |
| - Common leaf spot | 2 | 3% (trace - 5%) | SBS |
| - Downy mildew | 1 | 3% | SBS |
| Southeast | | | |
| - Spring black stem | 5 | 3% (trace - 10%) | YLB, CLS |
| - Common leaf spot | 1 | 6% | LLS, YLB |
| Total | 34 | | |

[a] Occurred at very low or trace levels, and listed in order of prevalence.

# Oilseeds and Special Crops / Oléagineux et Cultures spéciales

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

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**TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2004**

**METHODS:** Crops of dry bean were surveyed for root diseases at 35 different locations and for foliar diseases at 58 locations in Manitoba. The survey for root diseases and halo blight (*Pseudomonas syringae* pv. *phaseolicola*) was conducted in the 2nd week of July when plants were at the first to seventh trifoliolate stages and for foliar diseases in the second week of September when the plants were at the pod-fill to early maturity stages. The crops surveyed were chosen at random from regions in southeast and south-central Manitoba, where most of the dry bean crop is grown. Ten plants were sampled at each of three randomly selected sites for each crop surveyed. Diseases were identified by symptoms. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedlings did not emerge or died back soon after emergence). Five to ten symptomatic roots were collected per crop for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The identity of the previous year's crop was determined based on an examination of the crop debris. The severity of foliar diseases was based on an estimate of the percentage of infected plant tissue. Anthracnose severity ratings were determined based on the percentage of the pod surface that was covered by lesions. Pod samples were collected from each crop with anthracnose symptoms for isolation of the causal organism to confirm that the symptoms were caused by *Colletotrichum lindemuthianum*.

**RESULTS AND COMMENTS:** Fusarium root rot (*Fusarium solani*) was observed in all of the 35 crops surveyed for root diseases (Table 1), which made it the most widespread root disease of dry bean. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 14 of the crops surveyed. The severity of the two root diseases was the same. In general the extent of root rot symptoms was not strongly influenced by the previous year's crop. However, root diseases were generally more severe in the more advanced crops.

Halo blight was observed in 19 of the crops surveyed, but generally was not severe. Symptoms of common bacterial blight (*Xanthomonas axonopodis* pv. *phaseoli*) were observed in all of the 58 commercial dry bean crops that were surveyed for foliar diseases (Table 2). There was a wide range in severity among the crops. Anthracnose was detected in 16 of the 58 crops; severity averaged 1.2% and ranged as high as 5%. The distribution of anthracnose in most crops was quite patchy and low severity ratings in all the affected crops suggest that it would have had little effect on yield. Yellows symptoms (cause unknown)(Yager et al. 2004) were not observed in 2004, possibly because the symptoms were difficult to distinguish from natural ripening at the time of the second disease survey. Rust (*Uromyces appendiculatus*) appeared to have developed fairly late in the growing season and was detected in only five crops at fairly low levels, so it likely had little effect on the yield in the affected crops. Cool, wet weather throughout the growing season favored a widespread outbreak of white mould (*Sclerotinia sclerotiorum*). White mould symptoms were observed in all but one crop and the severity ratings ranged from 1 to 90%. Twenty-nine crops had white mould symptoms on more than 20% of the plant tissue, which would have resulted in severe yield reductions.

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Yager, L.., Conner, R.L., McLaren, D.L. and Groom, M. 2004. Diseases of field bean in Manitoba in 2003. Can. Plant Dis. Surv. 84: 90-91. (http://www.cps-scp.ca/cpds.htm)

**Table 1.** Prevalence and severity of root diseases and halo blight in 35 dry bean crops in Manitoba in 2004.

| | | Disease Severity | |
|---|---|---|---|
| **Disease** | **No. crops affected** | **Mean[1]** | **Range** |
| Fusarium root rot | 35 | 1.6 [2] | 0.3-4.0 |
| Rhizoctonia root rot | 14 | 1.6 | 0.4-4.0 |
| Halo blight | 19 | 1.7%[3] | 0.1-10.0% |

[1] Means are based on an average of crops in which the disease was observed.
[2]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedlings did not emerge or died back soon after emergence).
[3]Estimates of the severity of halo blight were based on the percentage of infected plant tissue.

**Table 2.** Prevalence and severity of foliar diseases in 58 crops of dry bean in Manitoba in 2004.

| | | Disease Severity[1] | |
|---|---|---|---|
| **Disease** | **No. crops affected** | **Mean** | **Range** |
| Bacterial blight | 58 | 22.2%[1] | 0.1-50.0% |
| Anthracnose | 16 | 1.2% | 0.1-5.0% |
| Rust | 5 | 8.6% | 1.0-20.0% |
| White mould | 57 | 21.9% | 1.0-90.0% |

[1]The severity of foliar diseases was based on an estimate of the percentage of infected plant tissue. Means are based on an average of crops in which the disease was observed.

**CROP:** Canola
**LOCATION:** Alberta

**NAMES AND AGENCY:**
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**TITLE: SURVEY OF CANOLA DISEASES IN ALBERTA, 2004**

**METHODS:** A total of 182 canola fields (mostly *Brassica napus* , but a few *B. rapa*) were surveyed across 63 municipal counties in all canola production areas of Alberta. The fields were surveyed before swathing, when the canola plants were at crop growth stages 79 to 83 (2). One hundred plants were randomly selected across the length of a "W" shaped pattern. The presence or absence of symptoms of blackleg (*Leptosphaeria maculans*), clubroot (*Plasmodiophora brassicae*) and fusarium wilt (*Fusarium oxysporum*) on each plant, was used to calculate percent disease incidence. Mean incidence values were calculated for each field and census division (Fig. 1). Severity of fusarium wilt was also determined using a scale (Table 1) to rate each plant, and mean disease severity (MDS) was calculated for each field. Visual estimates were also made of the incidence of sclerotinia stem rot (S*clerotinia sclerotiorum*), alternaria black spot (*Alternaria spp*.), staghead (*Albugo candida*), downy mildew (*Peronospora parasitica*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp*., Fusarium* spp.), and brown girdling root rot (*Rhizoctonia* spp*., Fusarium* spp.). Ten lower plant stem samples were collected per field, with up to eight showing disease symptoms and two being asymptomatic. Infections of symptomatic plants by *F. oxysporum* and *L. maculans* were confirmed by culturing on SNA (Synthetischer Nährstoffärmer Agar) and potato dextrose agar respectively (1, 3).

**RESULTS AND COMMENTS:** Sclerotinia stem rot was the most prevalent disease observed, appearing in 148 of the 182 fields surveyed with an overall mean incidence of 12.4%. Central regions (census divisions 7, 8, and 10) had the highest incidence, with Lacombe and Kneehill counties averaging 40% and 28% respectively, followed by Vermilion River at 26%, Minburn and Thorhild, both at 23%, and Sturgeon at 22%. Most counties in this area ranged from 5 to 25% infection. Other areas throughout the province ranged from 0 to 10% (Table 2, Fig. 1). High humidity during the flowering stage this year most likely contributed to the elevated levels of disease observed in some areas.

Blackleg was observed in 66 of the 182 fields surveyed, with a concentration in the east-central area, and an overall mean incidence of 4.1%. The heaviest infections were in Stettler, Lamont, and Kneehill counties (census divisions 7, 10 and 5 respectively), with incidence ranging from 15 to 25%, followed by Minburn, Vermilion River, and Lacombe (census divisions 10 and 8) with incidence ranging from 5 to 10%. Blackleg also occurred in the northwest, including Clear Hills, Grande Prairie, and Peace counties (census divisions 17 and 19) and incidence ranging from 3 to 6%. Some infection also occurred in other areas of the province, with incidence ranging from 0 to 8% (Table 2, Fig. 1). Hail damage greatly increased blackleg in certain areas, but upper stem lesions (often associated with hail damage) and basal cankers were not differentiated in this survey.

Alternaria pod spot was observed in 82 of 182 fields surveyed, with an overall mean incidence of 2.1%. Most crops showed a trace to 2% infection, though in the counties of Lamont, Clear Hills, and Lac Ste. Anne (census divisions 10, 13 and 17 respectively) incidence ranged from 10 to 33% (Table 2, Fig. 1).

Root rot was observed in 42 of the 182 fields surveyed, with an overall mean incidence of 1.4%. Most fields showed zero to trace amounts. The highest incidence was in Clear Hills county (census division 17), followed by Lamont, Minburn, and Stettler counties (census divisions 7 and 10) ranging from 5 to 7% (Table 2, Fig. 1).

Fusarium wilt was observed in 31 of the 182 fields surveyed, with an overall mean incidence of 1.3% (Fig. 2). In infected crops, incidence mostly ranged from 1 to 5%, with only three at 20 to 30% incidence. The highest disease severities (MDS 2-3) were confined to these three fields. Disease severity was extremely low elsewhere in the province, ranging from 1 to 1.1 and wilt was not prevalent in any one area (Fig. 3). *Fusarium oxysporum* was isolated in only 16 fields (Fig. 4).

The incidence of fusarium wilt across the province was much lower than levels observed in 1999-2003, most likely due to the removal of susceptible cultivars from the market. For example, in 2003, nine of 53 fields surveyed contained cv. 45A55 with a mean disease incidence of 59% and a MDS of 4.0 (Lange et al. 2003). This cultivar was one of many which were taken off the market in 2004.

Only trace amounts of aster yellows, foot rot, staghead and downy mildew were observed sporadically across the province. No clubroot was found.

**ACKNOWLEDGEMENTS:** The Alberta Crop Industry Development Fund, the Alberta Canola Producers Commission, the Alberta Agricultural Research Institute and the Agriculture and Food Council provided financial support. We gratefully acknowledge the technical assistance of Julie Bernier and Melissa Orr. Dee Ann Benard at the Agricultural Research & Extension Council of Alberta and all of the Applied Research Association groups across the province contributed to a large portion of the surveying. We also appreciate the collaborative effort from Mike Dolinski, AgriTrend Agrology; Paul Laflamme, Alberta Agriculture, Food and Rural Development; John Bidulock, County of Two Hills; Connie Kappler, Brazeau County; and Dennis Laughton, Dennis Laughton Consulting.

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**Table 1.** Evaluation scale for severity of fusarium wilt of canola

| Value + | Symptoms on main stem | Premature senescence of pods | Pod twisting** |
|---|---|---|---|
| 1 | Normal | None | Normal |
| 3 | Entirely chlorotic | None - trace | None |
| 5 | Unilateral necrosis* | <25% | None to trace |
| 7 | Extensive necrosis | < 50% | Some |
| 9 | Entirely necrotic | 100% | Most or all |

+ Intermediate values (i.e. 2, 4, 6, 8) can be used to indicate intermediate symptoms.

* Necrosis on one side of the plant only; can be one side of the stem, or individual branches.

** The pod twisting trait is related to premature pod senescence, and is included here only as an aide. In cases of doubt, use main stem and pod senescence traits only.

**Table 2.** Incidence and severity of canola disease in 14 Alberta census divisions in 2004

| Census Division (see Fig. 1) | Area | No. of Fields | Mean Disease Incidence (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sc[1] | ABS[2] | St[3] | DM[4] | AY[5] | FR[6] | BGRR[7] | BL[8] | FW[9] | FW[9] MDS (1-9) |
| 1 | South East | 2 | 0.5 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.5 | 3.5 | 1.1 |
| 2 | South Central | 4 | 10.8 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 12.3 | 1.3 | 1.0 |
| 4 | South East | 2 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| 5 | South Central | 12 | 13.2 | 0.7 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 6.4 | 4.3 | 1.1 |
| 6 | South West | 7 | 3.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 1.0 |
| 7 | East Central | 24 | 9.4 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 10.8 | 0.2 | 1.0 |
| 8 | Central | 9 | 40.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 6.0 | 0.0 | 1.0 |
| 10 | East Central | 49 | 18.0 | 3.0 | 0.0 | 0.0 | 0.1 | 0.4 | 2.1 | 4.9 | 2.1 | 1.1 |
| 11 | Central | 14 | 10.7 | 1.9 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 1.0 |
| 12 | North East | 5 | 7.0 | 0.8 | 0.2 | 0.0 | 0.7 | 0.0 | 0.0 | 0.7 | 2.8 | 1.1 |
| 13 | Central | 11 | 11.6 | 4.9 | 0.0 | 0.2 | 0.5 | 0.0 | 0.0 | 0.8 | 0.0 | 1.0 |
| 17 | North West | 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| 18 | North West | 2 | 29.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 1.0 | 1.0 |
| 19 | North West | 32 | 11.2 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 1.2 | 1.4 | 0.3 | 1.0 |

1. Sc represents scierotinia stem rot
2. ABS represents alternaria black spot
3. St represents staghead
4. DM represents downy mildew
5. AY represents aster yellows
6. FR represents aster yellows
6. FR represents foot rot
7. BGRR represents brown girding root rot
8. BL represents blackleg
9. FW represents fusarium wilt


Figure 1. Map of Alberta Census Divisions.

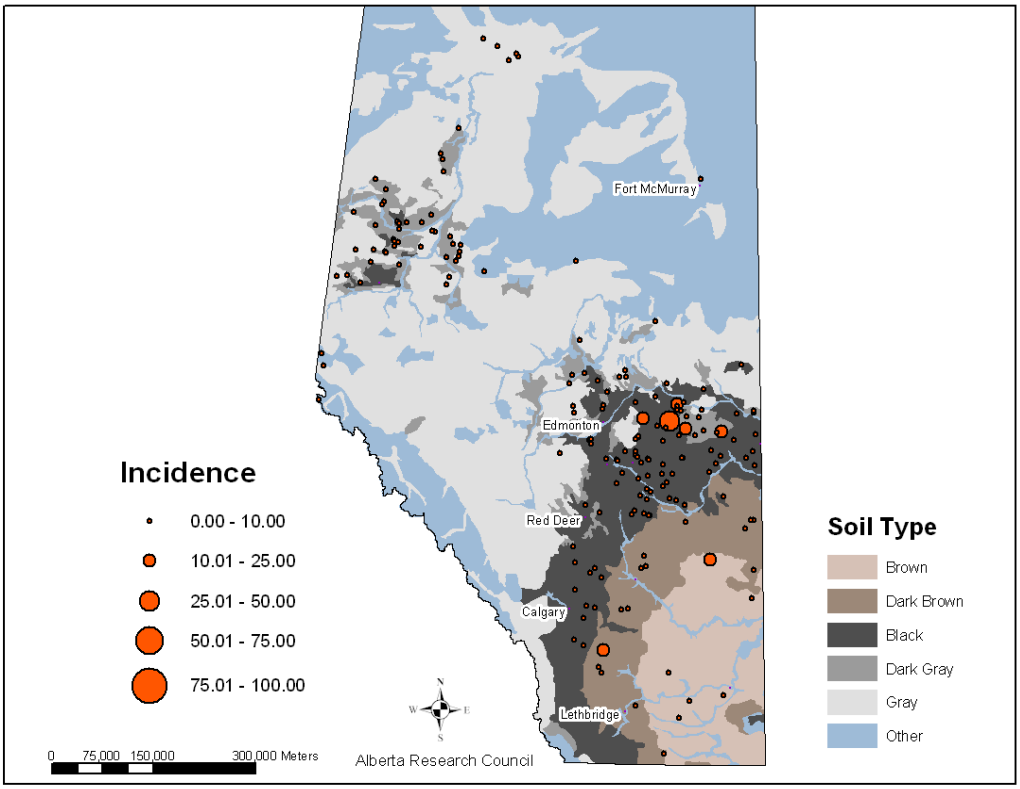


Figure 2. Incidence of fusarium wilt in 182 canola fields in Alberta in 2004. Each circle represents one field, and the size of the circle is proportional to the percent incidence of infected plants at that location. Incidence was determined by counting the number of symptomatic plants in 100 randomly selected plants per field.

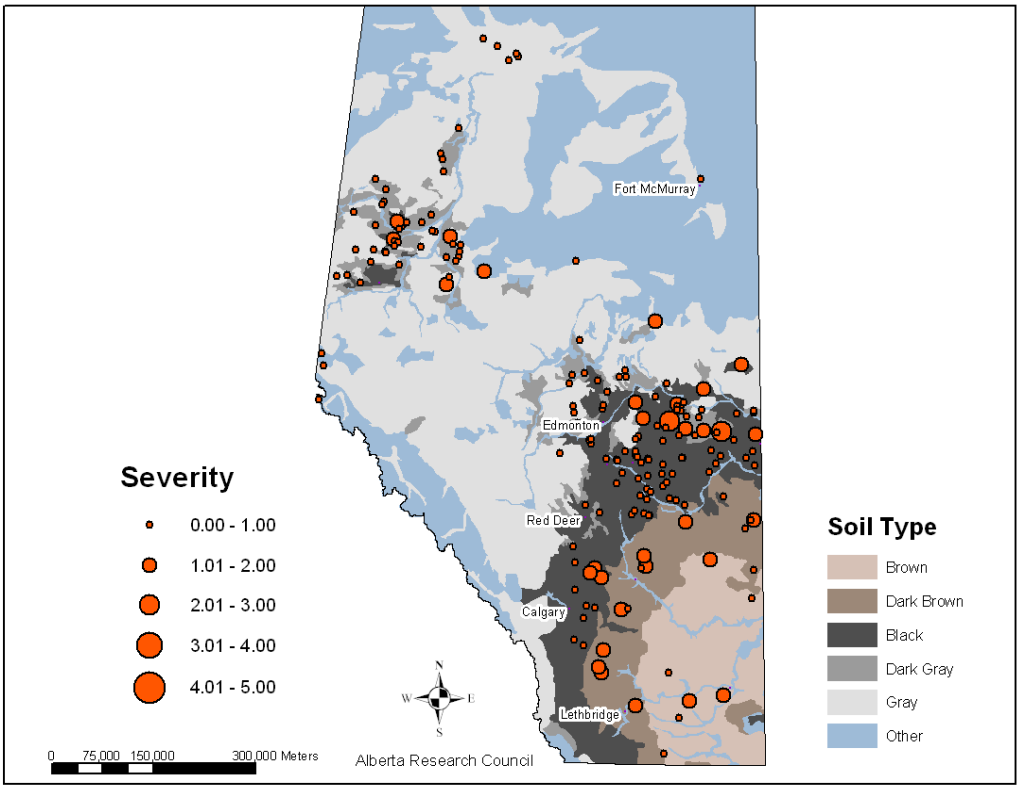


Figure 3. Severity of fusarium wilt in 182 canola fields. Each circle represents one field, and the size of the circle is proportional to the mean disease severity at that location. Disease severity was determined from ratings assigned to each plant based on the Evaluation scale for fusarium wilt of canola (Table 1).

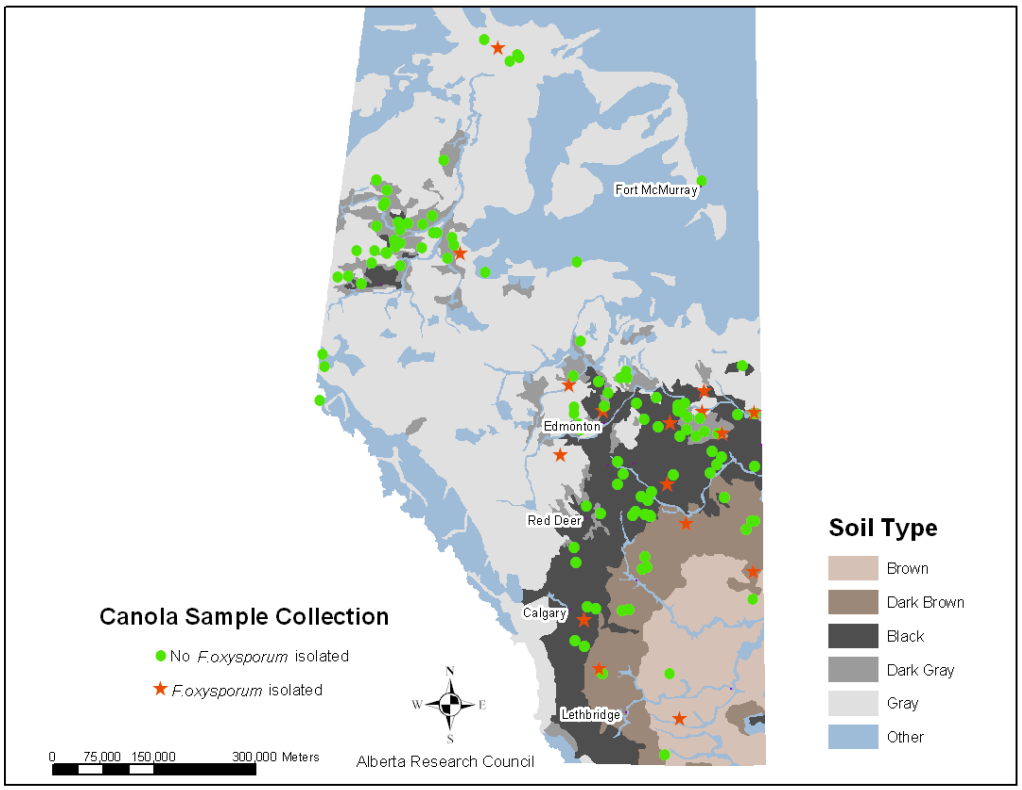


Figure 4. Isolation of *Fusarium oxysporum* from canola samples taken from 182 canola fields in Alberta in 2004. Circles represent fields in which plant samples were taken and no *F.oxysporum* was isolated. Stars represent fields in which *F.oxysporum* was isolated from samples.

**CROP:** Canola
**LOCATION:** Alberta

**NAMES AND AGENCIES:**
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**TITLE: CLUBROOT ON CANOLA IN ALBERTA IN 2003 AND 2004**

**METHODS:** In September, 2003, a total of 70 commercial canola (*Brassica napus*) fields were surveyed in Parkland and Sturgeon Counties, Alberta, for the incidence of clubroot disease caused by *Plasmodiophora brassicae*. This survey was initiated as a result of the discovery of clubroot in a canola field near St. Albert, Alberta in late summer of 2003 (2). The fields were surveyed after swathing, by inspecting the roots of 10 plants at 10 locations along the arms of a 'W' sampling pattern in each field. Using samples from the most severely infested field, clubroot was confirmed according to Koch's postulates (2). In late August and early September, 2004, 41 fields were surveyed (15 in Parkland County and 26 in Sturgeon County), with particular emphasis on low lying sites and headland areas near field approaches (10-20 plants per site). Canola roots were not assessed for disease severity.

**RESULTS AND COMMENTS:** In 2003, a total of 12 clubroot-infested fields were identified northwest, north and northeast of St. Albert, AB (Fig. 1). In one field, severe infection was observed, with 94% of plants infected. Estimated yield loss in this field was approximately 30%. Plants in water runs within the field showed the most severe infection. In another eight fields, infection was patchy and ranged from light to moderate; plants in small areas (less than 0.5 ha) had 30-50% infection, but in the majority of each field there was little or no infection. Two of these fields were adjacent to the severely infested field described above, but diseased plants were found only on their bordering edges. Estimated yield losses in the light to moderately infested fields ranged from 0 to 15%. The remaining three fields exhibited only very light infestation, and infected plants were detected only near field approaches. Very little or no yield loss was expected in these fields. In 2004, no clubroot was detected in any of the 41 commercial fields surveyed. However, in both 2003 and 2004, clubroot was also identified in a field in northeast Edmonton (Fig. 1) at the Crop Diversification Centre North (CDCN), Alberta Agriculture, Food, and Rural Development. The disease was observed on canola plants growing in field plots at CDCN in 2003, and was also found on volunteer canola growing at the same location in August, 2004.

Among the 12 clubroot-infested fields identified in 2003, at least seven (including the most severely affected field) had been sown to canola every second year or more since 1997, with a general rotation of canola-cereal-canola-cereal. This may have contributed to inoculum build-up in these fields. Furthermore, the soil pH in the clubroot-infested fields ranged from 5.6 to 6.4, and acidic soils are known to favor clubroot disease development (1). It was surprising that clubroot was not detected in commercial fields in 2004, as the reappearance of the disease on volunteer canola at CDCN would indicate that environmental conditions were appropriate for its development. However, the survey conducted in 2004 was small, and a larger survey is planned for 2005. No other reports of clubroot occurred from anywhere else in the province.

**ACKNOWLEDGEMENTS:** The authors would like to thank the Alberta Canola Producers Commission and Saskatchewan Canola Development Commission for financial support.

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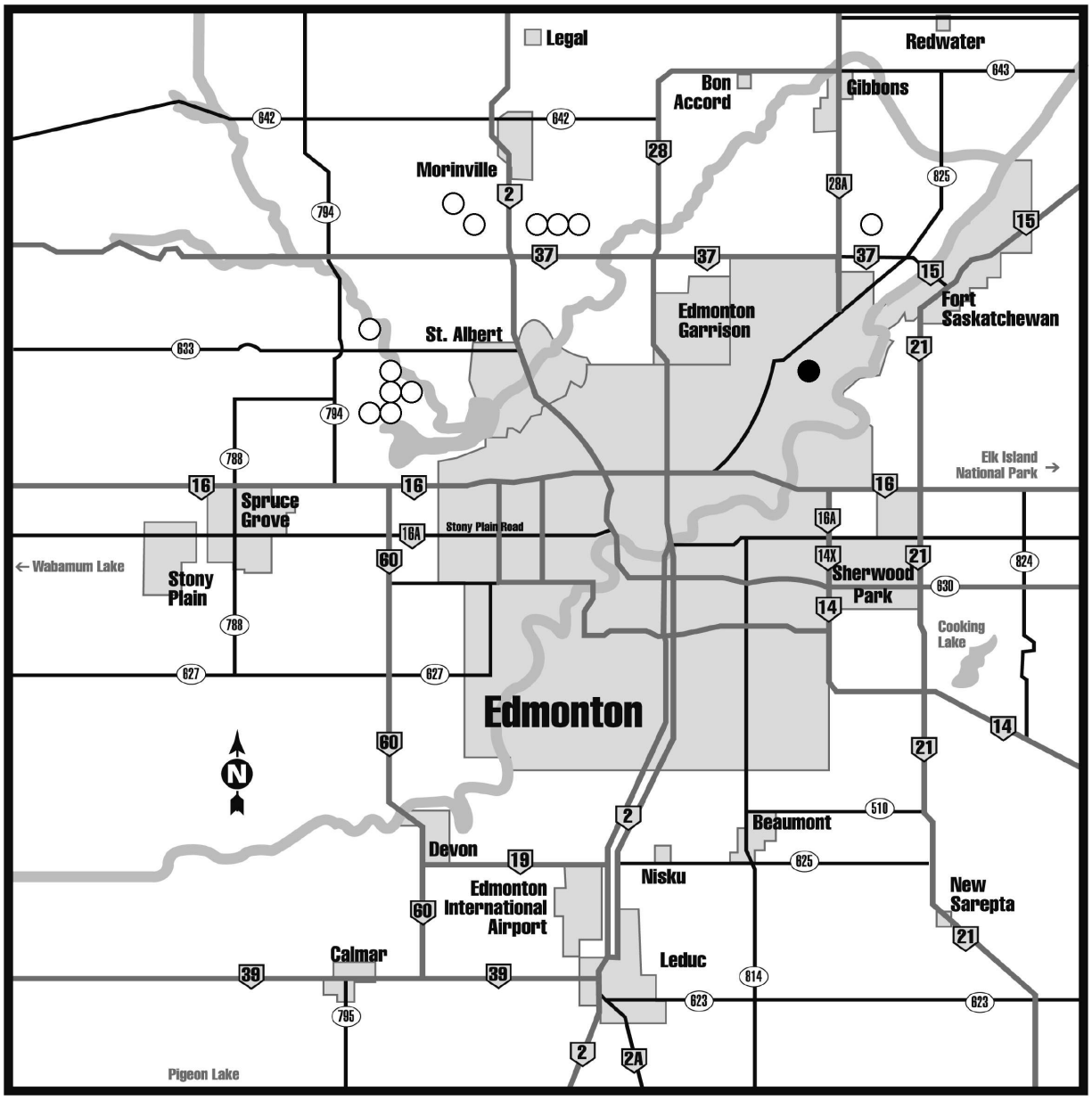


**Figure 1.** Incidence of clubroot on canola (*Brassica napus*) in the Edmonton, Alberta region. Each open circle represents the approximate location of a commercial canola field in which the disease was identified in 2003. The solid circle represents the Crop Diversification Centre North, Alberta Agriculture, Food and Rural Development, where clubroot was identified on canola in both 2003 and 2004.

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

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**TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2004**

**METHODS:** A total of 87 fields of *Brassica napus* were surveyed between August 20 and September 3 in the major canola production regions of Saskatchewan including the north-west (22 fields), north-central (17), north-east (17), east-central (11) and south-east (20). Canola fields were surveyed before swathing and while the crop was between growth stages 5.2 and 5.3 (Canola Council of Canada). Disease assessments were made in each field by collecting 20 plants from each of five sites at least 20 m from the edge of the field and separated by at least 20 m. The presence or absence of lesions on each plant was determined to give percent disease incidence for the following diseases: sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.) and fusarium wilt (*F. oxysporum*). For sclerotinia stem rot, each plant was scored for both main stem and upper branch/pod lesions. For blackleg, plants were scored for either severe basal stem cankers or any other type of blackleg stem lesion. For alternaria pod spot (*Alternaria brassicae*, *A. raphani*), the percent severity of lesions on the pods of each plant was assessed. If alternaria pod spot was present in a field, but at a level estimated to be below 1%, the disease was recorded as “trace”. Similarly, when the other diseases were observed in a field, but not in the sample of 100 plants, the disease was recorded as “trace”. When calculating means, all trace values were counted as 0.1%. Field results were combined for each region and mean disease incidence or severity values were determined.

**RESULTS AND COMMENTS:** The wet, cool growing season delayed canola development and prolonged flowering. Severe frost was received over much of the canola production region on August 20 and as a result frost damage and green seed were of greater concern to growers than diseases.

Sclerotinia stem rot was observed in 73 of the 87 fields surveyed and mean incidence values ranged from 0 to 45% for main stem lesions and from 0 to 36% for upper branch/pod lesions. The mean total incidence value was lowest in the south-east (3%) and highest in the north-west and north-east (20%) (Table 1). The overall total incidence value was substantially higher in 2004 (13%) than in the previous three years, when relatively dry conditions occurred, but was similar to 2000 (14%) and lower than in 1999 (22%) (Pearse et al. 2004). In 2004, a high proportion of upper branch/pod lesions was observed, which suggests that stem rot developed late in the season as a result of cool, moist conditions in late July and August. Hence, yield loss from infection was expected to be less in 2004 than in years when infection is primarily on the main stem.

Blackleg was observed in 45 of the 87 fields surveyed. Incidence values ranged from 0 to 11% for basal stem cankers and from 0 to 78% for lesions occurring elsewhere on the stem. The highest incidences were observed in crops that had received hail damage. Mean total incidence was highest in the north-west (Table 1). Overall blackleg incidence values for the province were similar to recent years (Pearse et al. 2004).

Aster yellows was observed in 21 of the 85 fields surveyed, with incidence values ranging from 0 to 2%. Aster yellows incidence values for the province have been less than 1% since 2000 (Pearse et al. 2004).

Foot rot was observed in 26 of the 87 fields, with incidence values ranging from 0 to 10%. The overall incidence value for the province in 2004 was similar to previous years (Pearse et al. 2004).

Alternaria pod spot was reported in 61 of the 87 fields surveyed. Mean severity values were trace in all regions except the north-east (Table 1). In 2004 the humid fall and severe frost damage in the north-east favoured pod spot compared to previous years.

Fusarium wilt was not identified in any of the fields surveyed in 2004. However, there were confirmed reports of fusarium wilt in a few fields in eastern Saskatchewan not included in the survey. There were no reports of staghead or brown girdling root rot.

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**Table 1. Canola diseases in Saskatchewan, 2004.**

| REGION[1] (NO. OF FIELDS) | MEAN % DISEASE INCIDENCE | | | | | | MEAN % SEVERITY |
|---|---|---|---|---|---|---|---|
| | Sclerotinia[2] | | Blackleg[3] | | Aster yellows | Foot rot | Alternaria pod spot |
| | Main | Upper | Basal | Other | | | |
| North-west (22) | 13 | 7 | 3 | 10 | T[4] | 2 | T |
| North-central (17) | 4 | 5 | T | T | T | T | T |
| North-east (17) | 9 | 11 | T | T | T | T | 2 |
| East-central (11) | 8 | 4 | T | 3 | T | 1 | T |
| South-east (20) | 2 | 1 | T | 4 | T | 0 | T |
| Overall Mean (87) | 7 | 6 | 1 | 4 | T | 1 | 1 |

[1]The Rural Municipalities (RM) in the major canola production regions where fields were surveyed include:

North-west = RM 310, 344-347, 350, 379, 381, 437, 469-472, 499-502
North-central = RM 398, 399, 401-403, 428-430, 459, 461
North-east = RM 426-428, 457, 486, 487
East-central = RM 246, 276, 279, 335, 336
South-east = RM 61, 63-65, 155-157

[2] Sclerotinia stem rot lesions were scored as either main stem lesions or as upper branch/pod lesions.
[3] Blackleg lesions were scored as either severe basal stem cankers or as any other type of stem lesion.
[4] T = trace amounts of disease (< 1%); see text.

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

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**TITLE: CANOLA DISEASES IN MANITOBA: DISTRIBUTION, PREVALENCE AND INCIDENCE IN 2004**

**METHODS:** In August and September 2004, 68 canola crops were surveyed in the eastern/interlake (10), southwest (21), northwest (21) and central (16) regions. Due to the late maturity of crops this year, the survey was conducted later than in previous years. Fewer fields were surveyed than in 2001-03 due to the completion of a project that involved a large number of Manitoba canola crops. All crops were *Brassica napus*. They were assessed for prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (phytoplasma), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*) and fusarium wilt (*Fusarium* spp.). Blackleg lesions that occurred on the upper portions of the stem were assessed separately from basal stem cankers. The prevalence and percent severity of alternaria pod spot (*Alternaria* spp.) were determined.

In each 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.

**RESULTS**: A number of diseases were present in each of the four regions of Manitoba. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1). The prevalence of sclerotinia-infested crops ranged from a high of 94% in the central region to 62% in the northwest region with a provincial mean of 72%. This increased from a prevalence of 55% in 2003 (4). Mean disease incidence ranged from 12% in the northwest to 6% in the southwest region with a provincial mean of 9%.

Blackleg basal cankers occurred in 32% of the crops surveyed in 2004 with disease incidence ranging from 8% in the central to 2% in the southwest region, with a provincial mean of 6%. Mean disease incidence was similar in 2003, with the highest value of 8% occurring in the southwest region (4). Yield loss was estimated at about 3% on a province-wide basis. The mean prevalence of blackleg stem lesions was 35%. Before 2004, 54%, 20%, 20% and 41% of crops were infested with stem lesions in 2000 (1), 2001 (2), 2002 (3) and 2003 (4), respectively. Mean incidence in 2004 was 5%, similar to that in 2003.

The severity of alternaria pod spot was low (Table 2), with means of <1% in three regions (Table 1). In the eastern/interlake region, none of the 10 surveyed fields were observed to have pod spot. In the central, northwest, and southwest regions, pod spot was observed in 6, 10 and 5% of the crops surveyed, respectively. This decreased from a prevalence of 13% in the eastern/interlake region, 37% in the central region and 25% in the southwest regions in 2003. Pod spot was observed more frequently in the northwest region of Manitoba in 2004.

The prevalence of aster yellows in the 2004 surveyed crops ranged from 20% in the eastern/interlake region to 6% and 5% in the central and the northwest regions, respectively, with a provincial mean of 6%. This increased from a prevalence of 2% in 2003 and 5% in 2002 (3,4). The average disease incidence was 1% in all three regions. Foot rot was observed in 3% of the surveyed crops with a mean incidence below 2%. In the 68 fields examined, no fusarium wilt was observed.

**ACKNOWLEDGEMENTS:** We thank the Alberta Agriculture Research Institute (AARI) for funding support and the Manitoba canola growers for their continued support of our survey work. The technical assistance of T. Henderson is gratefully acknowledged.

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**Table 1.** Number of canola crops surveyed and disease prevalence in Manitoba in 2004.

| Crop Region | No. of crops surveyed | Sclerotinia stem rot | | Blackleg basal cankers | | Blackleg stem lesions | | Alternaria pod spot | | Aster yellows | | Fusarium wilt | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P[1] | DI[2] | P | DI | P | DI | P | Mean % severity | P | DI | P | DI |
| Central | 16 | 94 | 8 | 69 | 8 | 31 | 4 | 6 | <1 | 6 | 1 | 0 | 0 |
| E/Interlake | 10 | 70 | 11 | 20 | 3 | 80 | 5 | 0 | 0 | 20 | 1 | 0 | 0 |
| NW | 21 | 62 | 12 | 24 | 6 | 48 | 5 | 10 | <1 | 5 | 1 | 0 | 0 |
| SW | 21 | 67 | 6 | 19 | 2 | 5 | 1 | 5 | <1 | 0 | 0 | 0 | 0 |

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

**Table 2.** Distribution of incidence (sclerotinia, blackleg, aster yellows, and fusarium wilt) and severity (alternaria pod spot) classes in 68 crops of *Brassica napus* in Manitoba in 2004.

| | Number of crops with | | | | | |
|---|---|---|---|---|---|---|
| | Sclerotinia stem rot | Blackleg basal | Blackleg stem | Alternaria pod spot | Aster yellows | Fusarium wilt |
| 0 | 19 | 46 | 44 | 64 | 64 | 68 |
| 1-5% | 27 | 16 | 17 | 4 | 4 | 0 |
| 6-10% | 8 | 3 | 2 | 0 | 0 | 0 |
| 11-20% | 8 | 1 | 5 | 0 | 0 | 0 |
| 21-50% | 5 | 2 | 0 | 0 | 0 | 0 |
| >50% | 1 | 0 | 0 | 0 | 0 | 0 |

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

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## TITLE: THE OCCURRENCE OF ASCOCHYTA BLIGHT ON CHICKPEA IN SOUTHERN ALBERTA IN 2004

**METHODS:** A survey was conducted in 28 chickpea fields from July to August 2004 in the Bow Island, Brooks, Coaldale, Foremost, Lethbridge and Vulcan areas of southern Alberta (Fig. 1) to determine the occurrence of ascochyta blight (*Ascochyta rabiei*). A "W" pattern of sampling was used to collect five samples of 50 plants at 200 m intervals in each field. In smaller research fields at Brooks, Bow Island and Lethbridge, all plants were examined visually and disease incidence (DI) (% plants infected) and severity (DS) were recorded. Severity was assessed using the following scale: 0 = no infection, 1 = 1-10%, 2 = 11-50% and 3 = 51-100% plant area infected. Data on agronomics and disease management strategies were collected for each field, where available.

**RESULTS AND COMMENTS:** Sanford was the predominant chickpea cultivar grown in the surveyed areas. Others were CDC Chico, Myles, CDC Xena and CDC Yuma. A wide range of variation in DI (0.0 - 100%) and DS (0.0 - 3.0) was observed (Table 1). In commercial fields, the highest level of disease was noted near Coaldale, followed by Vulcan and Foremost. In the research fields, the highest level of disease was at Brooks, followed by Lethbridge and Bow Island. Desi chickpea grown at Bow Island matured two weeks earlier than Kabuli chickpea and showed resistance to the disease.

The variation in the disease level may be attributed to differences in cultural practices, chickpea cultivar and location. At Foremost, DI and DS were higher in a field where chickpea was grown in a 2-year crop rotation (DI = 60.8; DS = 1.0) than in fields in a normal 4-year crop rotation (DI = 0 - 4.4; DS = 0 - 0.6). More profuse crop growth and denser canopies in fields near Coaldale and Vulcan may have contributed to disease development.

Unusually cool, wet weather dominated southern Alberta in the summer of 2004 and caused severe outbreaks of ascochyta blight in some chickpea fields (Table 1), similar to those that occurred in 2000 (1). Although a favorable environment for disease development prevailed, chickpea yield was satisfactory when fungicide was applied early in the cropping season. Ascochyta blight is consistently present in Alberta. Primary infection probably originates from seeds (4), and disease development depends upon the amount of precipitation (1,2,3).

**ACKNOWLEDGEMENTS:** We are grateful to Dustin Burke, CDC South for technical assistance in conducting this survey. Parker Gordon, Parker Crop Consulting Ltd. and No-Bull Marketing contacted individual growers. We also thank David Hougen and Ken Kultgen at Foremost and Dennis Benci, Vulcan, and Harvey Nikkel at Coaldale for helping locate chickpea fields.

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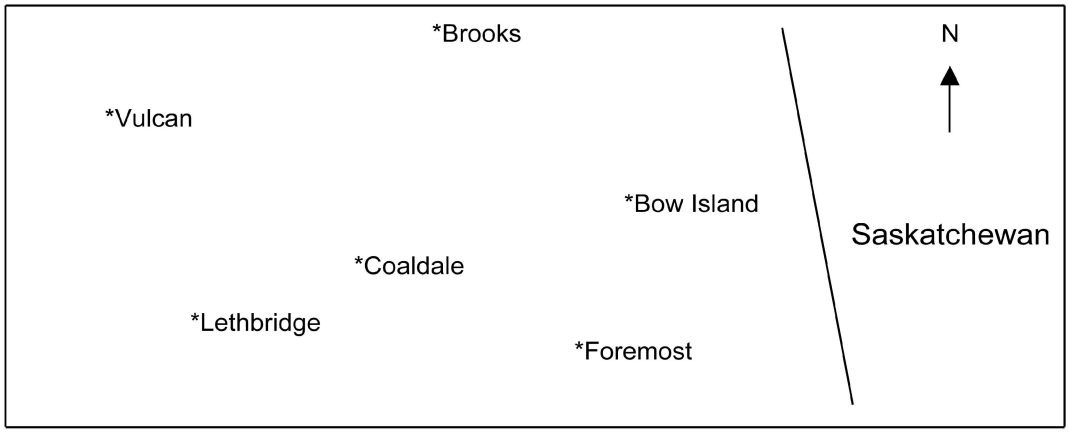


**Fig. 1.** Distribution of chickpea crops surveyed in southern Alberta in 2004.

**Table. 1.** Ascochyta blight occurrence in chickpea fields in southern Alberta in 2004.

| Location | No. of fields surveyed | Type of chickpea | Mean disease incidence (%) | Mean disease severity (0 - 3) [a] |
|---|---|---|---|---|
| Bow Island | 1 | Desi | 0.0 | 0 |
| | 3 | Kabuli | 12.5 (8.0 – 18.0) [b] | 0.23 (0.1 – 0.4) |
| Brooks | 1 | Kabuli | 100 | 3.0 |
| Coaldale | 1 | Kabuli | 100 | 3.0 |
| Foremost | 17 | Kabuli | 9.6 (0.0 – 60.8) | 0.55 (0.0 – 1.0) |
| Lethbridge | 2 | Desi | 18.5 (6.3 – 29.8) | 0.3 (0.1 – 0.5) |
| Vulcan | 3 | Kabuli | 72.8 (24.4 – 100) | 1.4 (1.0 – 1.8) |
| Total | 28 | | 23.4 (0 – 100) | 0.75 (0.0 – 3.0) |

[a] 0 = no infection, 1 = 1 - 10%, 2 = 11 - 50% and 3 = 51 - 100% of plant area infected.
[b] Data in parentheses indicate the disease range.

**CROP:** Chickpea
**LOCATION:** Saskatchewan

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**TITLE: SEED-BORNE PATHOGENS OF CHICKPEA IN SASKATCHEWAN IN 2004**

**METHODS:** The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2004 crop were summarized. The tests were conducted to detect the pathogens causing ascochyta blight (*Ascochyta rabiei*), botrytis blight [grey mould] (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for *Ascochyta*. Because of the small number of samples, kabuli and desi chickpea were not separated and no classification according to Saskatchewan crop districts (4) was made.

Most, if not all, of the samples probably came from crops that had been treated with registered fungicides. Generally, metalaxyl-containing seed treatments are used against *Pythium* on kabuli chickpea and thiabendazole- or fludioxonil-containing seed treatments are used to control seed-borne *Ascochyta* on both kabuli and desi chickpea. To control ascochyta blight, most crops of chickpea in Saskatchewan in 2004 received 1-several applications of one or more of the following foliar fungicides:Bravo (a.i. chlorothalonil), Headline (a.i. pyraclostrobin), Lance (a.i. boscalid) or Quadris (a.i. azoxystrobin).

**RESULTS AND COMMENTS**:The growing season in Saskatchewan was marked by cool weather throughout. In addition, in most areas precipitation was above normal or well above normal in May, June and August. A severe frost occurred on August 20 over 2/3 of the arable area of the province. These conditions led to late seeding, flooding damage, slow crop development, harvest delayed by wet weather, and heavy damage to maturing crops. Chickpea acreage in Saskatchewan in 2004 declined for the third successive year and was 23% less than in 2003; however, the mean yield per acre in the province was 42% more than in 2003 (3,5). Most of the chickpea growing areas of the province were not affected by the frost, but the late-season moisture caused low seed quality due to discoloration and shrivelling of immature seed.

By mid- to late January only 64 chickpea seed samples had been tested by the four companies. This is only 5% of the corresponding number in 2001(1) and reflects the continued disenchantment of farmers with growing chickpea. The mean level of seed-borne *Ascochyta* in these samples was 2.6%, compared with provincial averages of 0.4% in 2003, 4.9% in 2002, 0.9% in 2001, and 2.1% in 2000 (1,2,3,4). In the chickpea growing areas moisture conditions in 2004 were closer to those in 2002 and 2000 than to those in 2001 and 2003. Infection levels in samples in 2004 ranged from 0 to 29.25% and 32% of samples were free of infection. It is evident that ascochyta blight is still a major problem in chickpea cultivation in Saskatchewan. However, the fact that mean seed infection in 2004 was only half of that in 2002, a year with similar wet cool conditions in chickpea production areas, probably indicates that the few farmers who continue to grow chickpea are those who have learned to manage the disease successfully.

Only 35 samples were tested for *Botrytis* and the mean level of infection was 0.5%, compared with 0% in 2003 and 1.3% in 2002 (3,4). Notwithstanding the small number of samples, the lower figure in 2004 than in 2002, despite similar late-season weather, may reflect the fact that chickpea production in Saskatchewan has retracted more and more to areas where the crop is better adapted. Few seed samples in 2004 were infected with *S. sclerotiorum*.

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

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**TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2004**

**METHODS:** A total of 121 flax crops were surveyed in 2004, 72 in Manitoba and 49 in Saskatchewan. Thirty four crops were surveyed during the third week of July, 22 in the last week of August, and 65 in the third week of September. Most crops were the brown seed-colour linseed flax, but some were low linolenic acid and others yellow seed-colour solin flax. Crops surveyed were selected at random along preplanned routes in the major areas of flax production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of each disease were recorded. Stand and vigour were rated on a scale of 1 to 5 (I = very good, and 5 = very poor)

In addition, 13 samples of flax plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives by agricultural representatives and growers.

**RESULTS AND COMMENTS:** Forty percent of the flax crops surveyed in 2004 were rated very good for stand establishment and vigour. Fifty percent of the crops surveyed were late-seeded and were expected to mature and be harvested late, thereby reducing yield and seed quality. The 2004 growing season started late, and growing conditions were abnormally wet and cold for most of the season. Such conditions favoured diseases such as pasmo, but not others such as powdery mildew, and delayed crop maturity.

Pasmo (*Septoria linicola*) was the most prevalent disease, observed in 65% of all crops surveyed (Table 1) but in 100% of the crops surveyed in September. The prevalence and severity of pasmo on stems were lower in 2004 than in previous years (1, 2, 3), due perhaps to the abnormally low temperatures in July and August. In the infested crops, pasmo severity ranged from 1% to >60% leaf area affected but only from 1 to 40% stem area affected (Table 1).

Root infections and fusarium wilt (*Fusarium oxysporum f.sp. lini*) were observed in 32% of flax crops with incidences ranging from trace to 20% infected plants (Table 1). The prevalence and incidence of fusarium wilt in 2004 were low, similar to values in 2003 but lower than in the previous 5 years (1, 2, 3).

Powdery mildew (*Oidium lini*) was observed in 25% of crops surveyed with a severity range from trace to 20% leaf area affected. The incidence and severity of this disease were low in 2004 due perhaps to the below-normal temperatures in July and August which did not favour disease development and spread. Low levels of powdery mildew in flax have been reported for the last four years (1, 2, 3).

Rust (*Melampsora lini*) was not observed in any of the 121 crops surveyed in 2004, nor in the rust-differential flax nurseries planted at Morden, Portage la Prairie, Saskatoon, and Indian Head.

Traces of aster yellows (phytoplasma) were observed in several crops in 2004. No severe lodging was recorded in flax crops in 2004, and no signs of stem infection by *Sclerotinia sclerotiorum* were encountered in this survey. However, traces to 5% leaf area infected by *Alternaria* spp. were observed on

the foliage of 12 maturing crops. Aphid infestation was severe in a few crops, while grasshoppers were prevalent in 20% of the crops surveyed in 2004.

Of the 13 flax samples submitted to the Crop Diagnostic Centre, one was identified with brown stem blight caused by *Alternaria linicola*, one with damping-off caused by *Pythium* sp., two with root rot caused by *Rhizoctonia solani*, two with nutrient deficiencies, and seven with herbicide damage.

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

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 121 crops of flax in Manitoba and Saskatchewan in 2004.

| **Fusarium Wilt** | | | | **Pasmo** | | | | **Powdery Mildew** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Disease Class | | Crops | | Disease Class | | Crops | | Disease Class | | Crops | |
| Incid.[1] | Sever.[2] | No | % | Incid.[1] | Sever.[2] | No | % | Incid.[1] | Sever.[2] | No | % |
| 0% | 0% | 82 | 68 | 0% | 0% | 42 | 35 | 0% | 0% | 91 | 75 |
| 1-5% | 1-5% | 27 | 22 | 1-10% | 1-5% | 40 | 33 | 1-10% | 1-5% | 20 | 16 |
| 5-20% | 5-10% | 10 | 8 | 10-30% | 5-10% | 20 | 16 | 10-30% | 5-10% | 5 | 4 |
| 2-40% | 10-20% | 1 | 1 | 30-60% | 10-20% | 11 | 9 | 30-60% | 10-20% | 3 | 3 |
| >40% | 10-40% | 1 | 1 | >60% | 20-50% | 8 | 7 | >60% | 20-50% | 2 | 2 |

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

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

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**TITLE: SEED-BORNE PATHOGENS OF LENTIL IN SASKATCHEWAN IN 2004.**

**METHODS:** The results of agar plate tests conducted by five Saskatchewan companies on seed samples mainly from the 2004 crop were summarized. The tests were conducted to detect the pathogens causing ascochyta blight (*Didymella* [*Ascochyta*] *lentis*), anthracnose (*Colletotrichum truncatum*), botrytis stem and pod rot (grey mould) and seedling blight (*Botrytis cinerea*), and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). All samples were tested for *Ascochyta* and slightly fewer for *Colletotrichum*, *Botrytis* and *Sclerotinia*. For both *Ascochyta* and *Botrytis,* mean % seed infection and % samples free of infection were calculated for each crop district [CD] in Saskatchewan (4). However, mean % infections were not calculated for *Colletotrichum* and *Sclerotinia* because levels are generally so low that comparisons between CDs would be valueless. The % samples infected by *Colletotrichum* were calculated for each CD.

It is unknown which of the seed samples came from lentil crops that had been treated with registered fungicides. Five different fungicides are registered as foliar protectants against ascochyta blight and anthracnose, and five products are registered as seed treatments against one or more seed- or soil-borne lentil diseases. Many of the samples tested came from crops of ascochyta-resistant cultivars, which were first widely grown in 2000 (4). However, the data could not be classified according to cultivar.

**RESULTS AND COMMENTS:** The growing season in Saskatchewan was marked by cool weather throughout. In addition, in most areas precipitation was above normal or well above normal in May, June and August. A severe frost occurred on August 20 over 2/3 of the arable area of the province. These conditions led to late seeding, flooding damage, slow crop development, harvest delayed by wet weather, and heavy damage to maturing crops from frost and moisture. Most of the major lentil growing areas of the province were affected by one or more of the above factors. The overall mean yield per acre of lentil crops in Saskatchewan was 33% above that in 2003 and 8% above the 10-year average (5,7), but seed quality was very poor due to weather-related discoloration and shrivelling.

By the time the data were compiled, over 1200 lentil seed samples had been tested by the five companies, more than double the corresponding figure for 2003 (5). Levels of seed-borne *Ascochyta* in individual samples ranged from 0% to 61.75% (in a sample from CD 7A) and means varied substantially among crop districts (Table 1). Among districts represented by large numbers of samples, the mean was especially high in CD 7A. The high mean level there and low % samples free of *Ascochyta* may be related to very heavy rains that occurred in parts of CD 7A in early August, as harvest was getting under way.

On a provincial basis the mean level of *Ascochyta* seed infection was 2.4%, and 48% of samples tested were free of infection. The mean is the highest reported since 1999 and 2000 (4), when smaller percentages of lentil crops consisted of ascochyta-resistant cultivars. It is undoubtedly related to wet weather, especially at the end of the growing season. As in 2002, infection of seed samples in resistant lentil cultivars was probably mainly because of saprophytic invasion of the pods in late summer (2, 6).

*Botrytis* was detected in 28% of all samples tested and the mean infection level for the province was 1.7% (Table 1). The highest level of *Botrytis* observed in an individual sample was 27.5% in a sample from CD 5A. The level of *Botrytis* was not greatly different from several recent years (3,4,6) and the variation among CDs was not correlated with variation in level of *Ascochyta*. Thus, seed infection with *Botrytis* and *Ascochyta* in 2004 cannot be simply explained in terms of cool, moist growing conditions. Generally botrytis stem and pod rot is more of a problem on large-seeded lentil cultivars, which are late-maturing. These cultivars are grown more in some areas of the province than others and are not as widely grown as early maturing small-seeded cultivars in CDs 2A and 2B.

*Colletotrichum truncatum*, which is not a highly seed-borne pathogen, was detected at low levels in 21% of the samples tested. This is more than double the percentage in most years (3,5), but closer to the figure of 16.5% of samples recorded in 2002 (6). In two CDs the pathogen was detected in almost 40% of seed samples (Table 1). Anthracnose is widely controlled by fungicide applications and was not a highly destructive disease in 2004 (R.A.A. Morrall and S. Banniza, personal observations). It is possible that, as in 2002, seed infection in 2004 was related to late-season infection of plants due to August rainfall and delayed maturity. Late infection after seed set may result in spread of the pathogen to pods and seed, even in crops protected from yield loss by earlier fungicide application.

In addition to the seed-borne pathogens of lentil which laboratories normally evaluate, tests in 2004 revealed higher levels than normal of *Stemphylium* spp., the cause of stemphylium blight (1). *Fusarium* species, especially *F. avenaceum,* were also frequent in seed, although not as much as in 2002 (6). The level of *Stemphylium* is a reflection of the prolonged cool wet season in 2004 and the level of *F. avenaceum* a further indication of the low quality of seed harvested.

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**Table 1.** Number of lentil seed samples tested from September, 2004 to late December, 2004 or mid-January, 2005 by five commercial companies, and levels of infection with *Ascochyta, Botrytis* and *Colletotrichum* in relation to Saskatchewan Crop Districts

| Crop District | *Ascochyta* | | | *Botrytis* | | | *Colletotrichum* |
|---|---|---|---|---|---|---|---|
| | No. of samples tested | Mean % infection | % samples with 0% infection | No. of samples tested | Mean % infection | % samples with 0% infection | % samples with >0% infection |
| 1A | 21 | 0.2 | 81 | 21 | 0.7 | 38 | 10 |
| 1B | 1 | 0 | 100 | 1 | 1.5 | 0 | 0 |
| 2A | 103 | 0.9 | 62 | 98 | 1.3 | 16 | 20 |
| 2B | 200 | 1.2 | 55 | 173 | 0.6 | 43 | 30 |
| 3AN | 55 | 0.3 | 69 | 45 | 2.8 | 4 | 27 |
| 3AS | 75 | 0.5 | 79 | 67 | 0.7 | 45 | 10 |
| 3BN | 221 | 1.9 | 44 | 157 | 3.3 | 20 | 22 |
| 3BS | 38 | 0.9 | 53 | 32 | 2.6 | 16 | 12 |
| 4A | 6 | 2.5 | 17 | 6 | 2.8 | 0 | 0 |
| 4B | 17 | 1.5 | 24 | 16 | 3.1 | 25 | 0 |
| 5A | 22 | 7.1 | 27 | 22 | 3 | 27 | 38 |
| 5B | 4 | 0.1 | 75 | 4 | 1.1 | 25 | 25 |
| 6A | 69 | 0.6 | 68 | 64 | 1.5 | 42 | 15 |
| 6B | 139 | 1.7 | 53 | 133 | 1.7 | 25 | 38 |
| 7B | 204 | 7.7 | 16 | 178 | 0.9 | 30 | 10 |
| 7B | 23 | 2.1 | 30 | 18 | 2.9 | 6 | 0 |
| 8B | 0 | - | - | 0 | - | - | - |
| 8B | 13 | 0.9 | 31 | 12 | 3.8 | 0 | 42 |
| 9B | 0 | - | - | 0 | - | - | - |
| 9B | 0 | - | - | 0 | - | - | - |
| TOTAL | 1211 | 2.4 | 48 | 1047 | 1.7 | 28 | 21 |

**CROP:** Lupines (*Lupinus angustifolius* L., *L. albus* L.)
**LOCATION:** Alberta

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**TITLE: DISEASES OF LUPINES IN CENTRAL AND NORTHERN ALBERTA IN 2003 AND 2004**

**METHODS:** Foliar diseases were monitored in 16 cultivars and lines of lupines in experimental plots at the Crop Diversification Centre North (CDCN) in 2003. In 2004 surveys were conducted during the third week of June for seedling diseases at CDCN, and in late August for root rots at six locations near Edmonton, two near Beaverlodge and one each at Barrhead, Lacombe, St. Paul and Westlock. Roots were dug at five equally spaced sites (approximately 20-50 plants/site) along the arms of a "W" sampling pattern in a large field at CDCN and from guard rows or control treatments at the other locations. Roots were washed and assessed for root rot severity using a scale of: 0 = no root rot, 1 = 1-20% root discoloration, 2 = 21-50%, 3 = 51-75%, and 4 = > 75% of the root discolored and plant dead. Pieces of roots and stem bases were surface-sterilized in 1% NaOCl for 2 min., rinsed three times in sterile distilled water and plated on acidified potato dextrose agar. Microorganism identity was determined based on visual assessments of colony morphology after 10 and 20 days and microscopic examination, where necessary.

**RESULTS AND COMMENTS:** Powdery mildew (*Erysiphe cichoracearum*) and alternaria leaf spot (*Alternaria* spp.) were severe on narrow-leafed lupine cultivars late in 2003 at CDCN. Powdery mildew first appeared on the lower leaves and stems, gradually spread to the pods, and eventually covered the whole plant surface, producing abundant conidia. Cleistothecia appeared after frost in early September. Broad-leafed white lupine cultivars were more resistant to the disease, but it eventually became established on the leaves and pods in September. In 2004, a prominent case of powdery mildew developed in one crop near Beaverlodge. Infected plants at the experimental site near St. Paul showed typical symptoms, but only in scattered locations throughout the site. Powdery mildew appeared on stems of a few plants at CDCN in October.

In 2004, root rot incidence and severity varied with location and cultivar (Table 1). The highest levels occurred in a field near Beaverlodge, followed by Edmonton, Ellerslie and St. Paul. Overall severity was low at the other locations (mean < 0.50). A 20% incidence of root rot occurred on seedlings at the Edmonton site in late June, and the incidence increased to 47% at plant maturity. Root injury caused by cutworms (*Agrotis* spp.) in the Devon and Beaverlodge plantations may have intensified root rot severity. Root rot was mostly caused by *Fusarium* spp. (Table 2), with infected seedlings showing yellowing, stunting or wilting. *Alternaria* spp., *Rhizopus* spp., *Rhizoctonia solani*, *Pythium* spp. and *Sclerotinia sclerotiorum* were also isolated from infected roots. Lupine seeds screened for fungal infection in the laboratory showed few pathogenic microorganisms, indicating that most primary infections came directly from the soil.

Very little sclerotinia white mold occurred in lupine field trials at CDCN in 2003, but because of moist conditions, the disease occurred in most fields in 2004, except for one near Beaverlodge. Up to 31% of the plants were infected at Ellerslie and 15% at St. Paul. The pathogen infected all above-ground portions of the plants, including pods, causing seed discoloration and sclerotium formation. Lesions induced stem bleaching and often extended into the roots, killing the plant.

In summary, fusarium root rot was the major disease of lupine in Alberta. White mold was also a major concern when moist weather prevailed after canopy coverage. Despite severe epidemics of powdery mildew, seeds developed normally and yield was not affected.

**ACKNOWLEDGEMENTS:** The authors thank Natalie Rosendal and Lindsay Benoit for technical support and Neil Clark and Jackie Tieulie (CDCN) for providing information on lupine field plots.

**Table 1.** Incidence and severity of root rot in experimental plantings of lupine at nine locations in central and northern Alberta in 2004.

| Field location | Cultivar | No. of roots sampled | Disease incidence (%) | | Disease severity (0-4)[1] | |
|---|---|---|---|---|---|---|
| | | | Range | Mean | Range | Mean |
| Barrhead | Arabella | 202 | 4 – 10 | 7 | 0.1 – 0.2 | 0.15 |
| Beaverlodge 1 | Arabella | 114 | 80 – 100 | 94 | 1.8 – 2.2 | 2.03 |
| Beaverlodge 2 | Arabella | 100 | 0 – 5 | 1 | 0.0 – 0.2 | 0.02 |
| Devon | Arabella | 94 | 1 – 10 | 5 | 0.0 – 0.3 | 0.10 |
| Edmonton | Arabella (seedling) | 326 | 0 – 6 | 2 | 0.0 – 0.2 | 0.10 |
| | Rose (seedling) | 313 | 9 – 37 | 20 | 0.3 – 0.9 | 0.52 |
| | Rose | 240 | 34 – 66 | 47 | 0.9 – 1.4 | 1.17 |
| Ellerslie | Arabella | 219 | 20 – 30 | 22 | 0.7 – 0.9 | 0.60 |
| Lacombe | Arabella | 109 | 0 – 32 | 17 | 0.0 – 0.5 | 0.24 |
| Namao | Arabella | 230 | 6 – 16 | 11 | 0.1 – 0.3 | 0.21 |
| St. Paul | Arabella | 200 | 20 – 28 | 24 | 0.6 – 0.8 | 0.74 |
| Westlock | Arabella | 132 | 9 – 32 | 22 | 0.4 – 1.0 | 0.68 |

[1] 0 = no root rot, 1 = 1-20% root discolouration, 2 = 21-50%, 3 = 51-75%, and 4 = > 75% of the root was discoloured and the plant was dead

**Table 2.** Frequency of fungi isolated from taproot samples collected from four experimental plantings of lupine in central and northern Alberta in 2004.

| Field location | No. of roots sampled | Incidence of microorganisms(%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Fusarium* spp. | *Rhizopus* spp. | *Alternaria* spp. | *Sclerotinia sclerotiorum* | *Pythium* spp. | *Rhizoctonia solani* |
| Beaverlodge | 44 | 100 | 2 | 5 | 0 | 0 | 0 |
| Edmonton | 61 | 66 | 29 | 20 | 3 | 3 | 38 |
| Ellerslie | 26 | 96 | 0 | 62 | 0 | 8 | 12 |
| Westlock | 9 | 100 | 44 | 0 | 11 | 0 | 11 |

**CROP:** Field pea (*Pisum sativum* L.)
**LOCATION:** Central Alberta

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**TITLE: PEA DISEASES IN CENTRAL ALBERTA IN 2004**

**METHODS:** Forty-four commercial fields of dry pea in central Alberta were sampled in late July and mid-August for root rot (*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*), mycosphaerella blight (*Mycosphaerella pinodes*), powdery mildew (*Erysiphe pisi.*) and downy mildew [*Peronospora viciae*). Twenty plants were selected at each of five equally spaced sites along the arms of a "W" sampling pattern in each field. Roots dug from each field were washed and root rot severity was estimated visually on the samples using a 0-9 scale (3). Infected basal stem and root pieces from each field were surface sterilized in 1% NaOCl solution for 2 minutes, rinsed three times in sterile distilled water and plated onto acidified potato dextrose agar to determine the types of microorganisms present (Table 2). The leaves were assessed for severity of the three foliar diseases based on a 0-9 scale (1, 2).

**RESULTS AND COMMENTS:** Mycosphaerella blight was prevalent in all areas of central Alberta with severity ranging from 0.3 to 5.2 (Table 1). Lower temperatures and wetter than normal summer weather in all areas encouraged disease development on the lower and middle leaves. In some cases symptoms covered the entire plant.

Powdery mildew was widespread in central Alberta, becoming predominant in mid- to late August. Incidence and severity were similar to, or lower, than levels observed in 2003. In 2004, because of wetter weather, downy mildew was found. This disease is not usually economically important, but caused extensive damage at several locations. In severe cases, a thick greyish mycelium covered the upper leaves of the plant and spread downward. In the Lacombe area, the disease caused significant losses and forced producers to apply fungicides.

Root rot was found in all fields surveyed, with the highest severity occurring in the Penhold, Red Deer and Ponoka areas (Table 1). Infected plants were stunted, but did not show leaf yellowing. Disease severity ranged from 0.5 to 5.3 with a mean of 2.6, higher than in 1999 (DS=1.9) or 2004 (1,2). *Fusarium* spp. were the microorganisms most commonly isolated from diseased roots, followed by *Trichoderma* spp., *Penicillium* spp., *Rhizopus* spp., *Alternaria* spp., bacteria, and *Pythium* spp (Table 2). *Gliocladium* spp., *Sclerotinia sclerotiorum*, *Rhizoctonia solani*, and *Aspergillus* spp. were also found in minor quantities.

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**Table 1.** Severity of root rot and foliar diseases of pea at 44 locations in central Alberta in 2004.

| Location | # fields surveyed | Pea type | Disease severity [a] | | | |
|---|---|---|---|---|---|---|
| | | | Root rot | MB[b] | PM[c] | DM[d] |
| Bashaw | 7 | Yellow | 2.0 | 1.1 | 0 | 0 |
| | 3 | Green | 2.9 | 0.7 | 0 | 0 |
| Camrose | 2 | Green | 1.2 | 0.8 | 0 | 0 |
| Kelsey | 4 | Green | 1.8 | 0.5 | 0 | 0 |
| Lacombe | 2 | Yellow | --[e] | 4.4 | 4.8 | 1.1 |
| | 2 | Green | --[e] | 5.2 | 5.7 | 5.1 |
| Leduc | 1 | Yellow | 0.5 | 0.8 | 0 | 0 |
| | 2 | Green | 1.1 | 2.5 | 0 | 0 |
| Millet | 2 | Yellow | 0.5 | 0.6 | 0 | 0 |
| Penhold | 3 | Yellow | 5.1 | 1.8 | 4.0 | 0 |
| | 2 | Green | 4.9 | 2.5 | 4.4 | 0 |
| Ponoka | 2 | Yellow | 5.3 | 2.8 | 0 | 1.1 |
| | 2 | Green | 3.9 | 1.7 | 0 | 0.5 |
| Red Deer | 5 | Yellow | 5.3 | 1.4 | 4.8 | 1.9 |
| Wetaskiwin | 3 | Yellow | 1.0 | 0.3 | 0 | 0 |
| | 2 | Green | 1.2 | 0.3 | 0 | 0 |
| Total/Mean | 44 | | 2.6 | 1.7 | 4.7 | 1.9 |

[a] Disease severity was measured on a scale of 0-9 (0 = no disease, 9 = dead plant)

[b] Mycosphaerella blight [c] Powdery mildew [d] Downy mildew [e] Data not collected

**Table 2.** Major microorganisms isolated from pea roots in central Alberta in 2004.

| Field location | Percentages of root samples from which microorganisms isolated | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Fusarium* spp. | *Rhizoctonia* spp. | *Alternaria* spp. | Bacteria | *Penicillium* spp. | *Pythium* spp. | *Trichoderma* spp. | Others[a] |
| Bashaw | 48 | 0 | 4 | 6 | 16 | 3 | 2 | 12 |
| Camrose | 83 | 22 | 0 | 0 | 23 | 8 | 33 | 6 |
| Kelsey | 91 | 23 | 8 | 0 | 8 | 14 | 16 | 0 |
| Leduc | 73 | 4 | 23 | 3 | 30 | 0 | 2 | 0 |
| Millet | 49 | 13 | 0 | 0 | 7 | 0 | 36 | 5 |
| Penhold | 58 | 3 | 4 | 28 | 15 | 0 | 0 | 3 |
| Ponoka | 79 | 6 | 6 | 0 | 9 | 12 | 12 | 1 |
| Red Deer | 68 | 5 | 6 | 8 | 19 | 24 | 0 | 14 |
| Wetaskiwin | 45 | 5 | 4 | 13 | 23 | 0 | 4 | 2 |

[a]Others including *Gliocladium* spp., *Sclerotinia sclerotiorum, Rhizoctonia solani,* and *Aspergillus* spp.

**CROP:** Pea
**LOCATION:** Saskatchewan

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**TITLE: SEED-BORNE PATHOGENS OF PEA IN SASKATCHEWAN IN 2004**

**METHODS:** The results of agar plate tests conducted by four Saskatchewan companies on seed samples mainly from the 2004 crop were summarized. The tests were conducted to detect the pathogens causing ascochyta blights (*Mycosphaerella* [*Ascochyta*] *pinodes*, *A. pisi* and *Phoma medicaginis* var. *pinodella* = *A. pinodella*), botrytis blight (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for the ascochyta blight pathogens. For both *Ascochyta* and *Botrytis,* mean % seed infection and % samples free of infection were calculated for each crop district [CD] in Saskatchewan (3). However, this was not done for *S. sclerotiorum* because infection levels are typically low and comparisons of means would be valueless.

It is unknown which of the seed samples came from pea crops that had been treated with registered fungicides. Four different fungicides are registered as foliar protectants on pea, and seven products are registered as seed treatments against one or more seed- or soil-borne diseases. However, use of foliar fungicides on pea in Saskatchewan is uncommon, and, given the high quality of seed planted in 2004 (5), use of seed treatments was probably less than normal.

**RESULTS AND COMMENTS:** The growing season in Saskatchewan was marked by cool weather throughout. In addition, in most areas precipitation was above normal or well above normal in May, June and August. A severe frost occurred on August 20 over 2/3 of the arable area of the province. These conditions led to late seeding, flooding damage, slow crop development, harvest delayed by wet weather, and heavy damage to maturing crops from frost and moisture. The major pea growing areas of the province were all affected by the August 20 frost and harvest was late in all CDs because of late maturity and wet weather. The overall mean yield per acre of pea crops in Saskatchewan was 60% above that in 2003 and 29% above the 10-year average (5,8), but seed quality was very poor due to frost damage and the delayed harvest.

By the time the data were compiled, over 680 pea seed samples had been tested by the five companies, slightly fewer than in 2002 (6) and about 70% more than in 2003 (5). Seeded acreage of pea in Saskatchewan in 2004 was about 7% more than in 2002 and 2003 (8). Mean levels of seed-borne *Ascochyta* spp. varied widely among crop districts (Table 1). The lowest levels were across the southern part of the province, as well as in central (CD 6A) and western areas (CD 7A). The highest values were in traditional pea growing areas to the north, especially in CDs 5B, 8 and 9. The overall mean for the province (7.4%) was 70% higher than the highest of the previous 5 years, 4.3% in 1999 (7). However, the overall % samples free of infection in 2004 (Table 1) was about the same as in 1999.

The maximum % *Ascochyta* infection recorded was 54.0 in a sample from CD 8A and many samples showed more than 25% infection. Considering the high quality of pea seed planted in 2004 (5), the high levels of infection in harvested seed emphasize the extent to which ascochyta blights, particularly blight caused by *A. pinodes* , are wind-borne in western Canada. For the fourth consecutive year most isolates of *Ascochyta* from pea seed in southern Saskatchewan CDs were *A. pisi* (1,2,6). In traditional pea-growing areas further north, *A. pinodes* was by far the dominant species, but there were isolated pockets where mixtures with *A. pisi*, *A. pinodella*, or both species were found.

*Botrytis* was detected in 31% of pea samples tested, considerably more than in any year since 2000, when it was found in 28% of samples (4). The highest seed infection level was 15% in a sample from CD 8A but the mean level was less than 1% in all crop districts. Some variation occurred among districts (Table 1). *Botrytis* was clearly not a problem on pea crops in Saskatchewan in 2004, despite the cool wet weather. *Sclerotinia sclerotiorum* was isolated from a small percentage of seed samples tested in 2004 and at low levels, but contamination of seed samples with sclerotia of *S. sclerotiorum* was common.

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**Table 1.** Number of pea seed samples tested from September 2004 to late December, 2004 or mid-January, 2005 by five commercial companies and levels of infection with *Ascochyta* and *Botrytis* in relation to Saskatchewan Crop Districts

| Crop District | *Ascochyta* | | | *Botrytis* | | |
|---|---|---|---|---|---|---|
| | No. of samples tested | Mean % infection | % samples with 0% infection | No. of samples tested | Mean % infection | % samples with 0% infection |
| 1A | 20 | 2 | 35 | 15 | 0.2 | 80 |
| 1B | 18 | 5.4 | 11 | 14 | 0.2 | 79 |
| 2A | 13 | 1.2 | 31 | 10 | 0.1 | 90 |
| 2B | 57 | 1.7 | 46 | 42 | 0.1 | 90 |
| 3AN | 10 | 1.9 | 20 | 8 | 0.1 | 88 |
| 3AS | 54 | 1.4 | 39 | 25 | 0.1 | 88 |
| 3BN | 41 | 1.2 | 44 | 36 | 0.3 | 67 |
| 3BS | 18 | 2.4 | 11 | 14 | 0.4 | 50 |
| 4A | 6 | 2.4 | 33 | 3 | 0 | 100 |
| 4B | 7 | 0.4 | 43 | 4 | 0 | 100 |
| 5A | 27 | 5.3 | 11 | 10 | 0.8 | 40 |
| 5B | 35 | 10.5 | 3 | 14 | 0.7 | 36 |
| 6A | 73 | 2.3 | 25 | 54 | 0.2 | 72 |
| 6B | 77 | 8.4 | 9 | 50 | 0.8 | 48 |
| 7A | 20 | 1.6 | 50 | 14 | 0.3 | 64 |
| 7B | 19 | 6.1 | 16 | 10 | 0.4 | 80 |
| 8A | 68 | 20.4 | 0 | 50 | 0.9 | 44 |
| 8B | 80 | 15.1 | 3 | 12 | 0.7 | 25 |
| 9A | 22 | 15.6 | 5 | 5 | 0.9 | 60 |
| 9B | 17 | 10.7 | 0 | 7 | 0.3 | 43 |
| TOTAL | 682 | 7.4 | 19 | 372 | 0.4 | 69 |

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

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**TITLE: DISEASES OF FIELD PEA IN MANITOBA IN 2004**

**METHODS:** Crops of field pea were surveyed for root and foliar diseases at 47 different locations in Manitoba. The survey for root diseases was conducted during the third to fourth week of July when the plants were at the 16-node to late flowering stages and for foliar diseases during mid-August when the plants were at the pod-fill to mature stages. The crops surveyed were chosen at random from regions in southwest and south-central Manitoba, where most field pea is grown.Twenty plants were observed/sampled for each crop surveyed. Diseases were identified by symptoms. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, the seedling could not emerge or died back quickly after emergence). Five to ten symptomatic roots were collected per field for isolation of fungi in the laboratory in order to confirm the visual disease assessment. The severity of most foliar diseases observed was estimated using a scale of 0 (no disease) to 9 (whole roots/plants severely diseased). Powdery mildew severity was rated as the percentage of leaf area infected.

**RESULTS AND COMMENTS:** Three diseases were observed in the root disease survey (Table 1). Fusarium root rot (*Fusarium solani* f. sp. *pisi*) was the most prevalent disease and was observed in 42 fields. Fusarium wilt (*F. oxysporum*) and rhizoctonia root rot *(Rhizoctonia solani*) were observed in 12 and 3 of the fields surveyed, respectively.

Four foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) and sclerotinia stem rot (*Sclerotinia sclerotiorum*) were the most prevalent diseases and were observed in all 47 and 42 crops surveyed, respectively. In previous years, little or no sclerotinia stem rot has been observed in pea fields (Yager et al. 2003, 2004), but due to the cool, wet environmental conditions of 2004, sclerotinia stem rot was commonly observed in this crop. In 23 fields, incidence of sclerotinia stem rot was >50% with three fields showing infection on all plants sampled during the survey. A detrimental effect of *S. sclerotiorum* on pea yield would be expected in many fields in 2004. No fusarium wilt was observed possibly due to the fact that the survey was conducted later in the growing season than usual. The plants were at the mature stage at the time of rating, making it difficult to distinguish the symptoms of fusarium wilt. Foliar diseases, such as septoria blotch (*Septoria pisi*), downy mildew (*Peronospora viciae*) and bacterial blight (*Pseudomonas syringae* pv. *pisi*) were not observed in the surveyed fields. Anthracnose (*Colletotrichum pisi*) was confirmed in three fields (Table 2). Plants with putative anthracnose symptoms were observed in 18 other fields, but no *Colletotrichum* species were isolated to confirm their identity.

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**Table 1.** Prevalence and severity of root diseases in 47 crops of field pea in Manitoba in 2004.

| | | Disease severity (0-9)* | |
|---|---|---|---|
| **Disease** | **No. crops affected** | **Mean** | **Range** |
| Fusarium root rot | 42 | 4.7 | 1.0-7.3 |
| Fusarium wilt | 17 | 4.4 | 1.0-6.4 |
| Rhizoctonia root rot | 3 | 4 | 1.6-5.7 |

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

**Table 2.** Prevalence and severity of foliar diseases in 47 crops of field pea in Manitoba in 2004.

| | | Disease severity[1] | |
|---|---|---|---|
| **Disease** | **No. crops affected** | **Mean** | **Range** |
| Mycosphaerella blight | 47 | 5 | 0.9-8.8 |
| Sclerotinia stem rot | 42 | 1.8 | 0.1-6.4 |
| Fusarium wilt | 0 | 0 | 0 |
| Powdery mildew | 19 | 1.1 | <1-17 |
| Septoria blotch | 0 | 0 | 0 |
| Anthracnose | 3 | < 0.5 | < 0.1-1.0 |
| Downy mildew | 0 | 0 | 0 |
| Bacterial blight | 0 | 0 | 0 |
| Unidentified | 8 | 0.3 | 0.1-0.6 |

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

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

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**TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2004**

**METHODS:** A total of 53 sunflower crops in Manitoba were surveyed in 2004. Sixty-six percent of the crops were confectionery hybrids and 34% were oilseed hybrids. Eight crops were surveyed in the third week of July, 20 in the last week of August, and 25 in the third week of September. Crops were surveyed along preplanned routes in the major areas of sunflower production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the percent incidences of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem diseases (*Phoma* spp. *& Phomopsis* spp.) were estimated as percent leaf or stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1).

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

**RESULTS AND COMMENTS:** Fifty percent of the sunflower crops surveyed in 2004 had good to excellent stands and vigour. Most sunflower crops were seeded late, and 50% of the crops surveyed were very late maturing. The 2004 growing season started late, and conditions were abnormally wet and cold for most of the season. The conditions favoured certain diseases, such as those caused by *Sclerotinia*, but not others such as rust and powdery mildew, and resulted in late maturing crops and poor quality products. Traces to 10% infestation of sunflower midge (*Contarinia schulzi*) and sunflower beetle (*Zygogramma exclamationis*) were observed in 25% of the crops in the Red River Valley, however, the damage was low in comparison to previous years (1, 2, 3). One to 10% damage from grasshoppers was observed in 36% of the crops in Manitoba.

Sclerotinia wilt/basal stem infection was present in 70% of the crops surveyed, with incidences ranging from trace to 30% (Table 1). Sclerotinia head rot and mid-stem breakage, both caused by ascospore infections, were present in 81% of all crops surveyed, but in 100% of the crops surveyed in September. Incidence ranged from trace to 80%. The incidence and severity of head rot towards the end of the season were higher than in previous years due perhaps to the wet cold conditions in 2004 (1).

Rust was the present in 60% of the crops surveyed, with severity ranging from trace to 30% leaf area affected (Table 1).The incidence and severity of rust were lower than in 2003 due perhaps to the abnormally low temperatures in the 2004 growing season (1).

Verticillium wilt was present in 55% of the crops surveyed, with incidence ranging from trace to 30% (Table 1). The incidence and severity were higher than in previous years due perhaps to the wet and cold conditions prevailing in Manitoba in 2004 (1, 2, 3).

Downy mildew was observed in 34% of the crops with incidences of trace to 10% infected plants (Table 1). The prevalence and incidence of downy mildew in 2004 were similar to 2003, but higher than in the previous years (1, 2, 3) due perhaps to the cold wet soil conditions at the seedling stage.

Traces to 10% leaf area covered by spots caused by *Septoria helianthi* and *Alternaria* spp. were observed in several crops surveyed in 2004. Stem lesions caused by *Phoma* and *Phomopsis* were present in several crops at levels of trace to 5% stem area affected. Traces to 5% leaf area affected by powdery mildew were observed in some crops in south central Manitoba.

Of the 15 samples submitted to the Crop Diagnostic Centre, one sample was identified with downy mildew and 14 samples were identified with herbicide damage

**ACKNOWLEDGMENTS:** The assistance of T. Walske and M. Penner is gratefully acknowledged.

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**Table 1.** Prevalence and intensity of diseases in 53 crops of sunflower in Manitoba in 2004.

| Disease | Crops Affected | | Disease Index[1] | |
|---|---|---|---|---|
| | No. of crops | % of crops | Mean | Range |
| Sclerotinia wilt | 37 | 70% | 1.3 | T - 3 |
| Sclerotinia head rot/stem rot | 43 | 81% | 1.6 | T - 4 |
| Verticillium wilt | 29 | 55% | 1.4 | T - 3 |
| Downy mildew | 18 | 34% | 1 | T - 2 |
| Rust | 31 | 60% | 1.3 | T - 3 |
| Lateness[2] | 30 | 57% | 2.2 | 1 - 5 |
| Poor stand | 5 | 9% | 1.6 | 1 - 3 |
| Poor vigour | 6 | 11% | 1.8 | 1 - 3 |

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

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

# Vegetables / Légumes

**CROP**: Cruciferous vegetables
**LOCATION**: Alberta

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**TITLE: INCIDENCE OF CLUBROOT ON CRUCIFEROUS VEGETABLES IN ALBERTA IN 2004**

**METHODS**: Because of an outbreak of clubroot (*Plasmodiophora brassicae* Woronin) on canola near Edmonton in 2003 a survey of clubroot on cruciferous vegetables in Alberta was conducted in 2004. Twenty-four fields at 16 commercial market gardens and farms across Alberta were surveyed for clubroot symptoms. The 12 types of vegetables sampled were broccoli [*Brassica oleracea* L. var. *italica* Plenck]; brussels sprouts [*Brassica oleracea* L. var. *gemmifera* DC.]; cabbage, white, red and Savoy [*Brassica oleracea* L. var. *capitata* L.]; cauliflower [*Brassica oleracea* L. var. *botrytis* L.]; Chinese cabbage [*Brassica rapa* L. var. *pekinensis*]; pak choi, joi choi [*Brassica rapa* L. var. *chinensis*]; kale [*Brassica oleracea* L. var. *acephala* DC.]; kohlrabi [*Brassica oleracea* L. var. *gongylodes L.*]; radish [*Raphanus sativus* L.); rutabaga, [*Brassica rapa* L. var. *napobrassica* (L.) Reichb.]; turnip [*Brassica rapa* L.). Conspicuous galls or tumors visible on root tissues were assumed to be positive for the disease. Five random sampling sites were chosen within each planting along a diagonal transect of the field, and five roots were dug up and examined at each site. Disease incidence was calculated as percent infected plants at each location. Sampling and disease rating were performed individually for all cruciferous vegetable crops at each location. Field sizes ranged from <1ha to >50 ha. Northern Alberta locations were sampled in the second week of September, central Alberta locations were sampled in the third week of September, and southern Alberta was sampled in the last week of September or in early October. In addition to the 16 commercial fields, an experimental plot at the Crop Diversification Centre North in Edmonton in which canola was found to be infested with clubroot in 2003 was also surveyed. Approximately 50 cultivars of cruciferous vegetables were planted in the infested plot in 2004 to evaluate clubroot susceptibility amongst the entries.

**RESULTS AND COMMENTS:** In mid-late September and early October, all of the crops surveyed were mature, with some already harvested. The 15 sampling locations across Alberta are shown in Figure 1. Three separate sites, designated 6a, 6b and 6c, were visited in or near Edmonton. Symptoms were detected at one location only: 6c, the experimental plot at CDC North, Edmonton. At this infested plot, clubroot was found in rutabaga, Chinese cabbage, joi choi, radish and turnip while no symptoms were observed in roots of cabbage, broccoli, cauliflower, brussels sprouts, kohlrabi, kale, pak choi. With the exception of this infested experimental plot, no tumors, galls or clubbed roots were found at any of the survey locations across Alberta. Cabbage was sampled at every location, while broccoli, brussels sprouts, cauliflower, Chinese cabbage, pak choi and joi choi, kale, kohlrabi, radish, rutabaga and turnip were encountered much less frequently.

**ACKNOWLEDGEMENTS:** We are grateful to the many growers who allowed us to survey their fields for clubroot and to the Alberta Farm Fresh Producers Association and the Agriculture Funding Consortium for their financial support of this work.

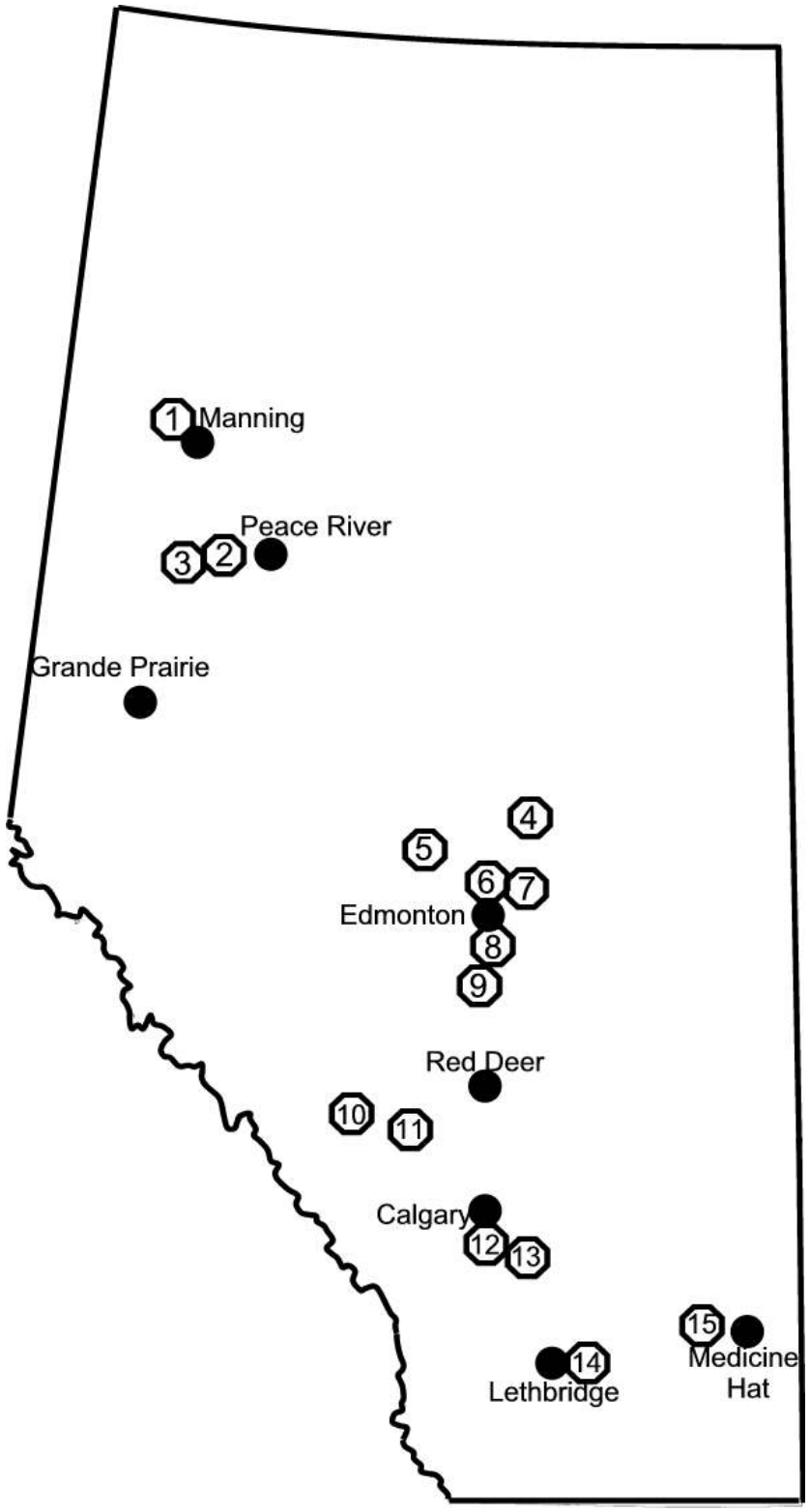


**Figure 1.** Locations of cruciferous vegetable plantings surveyed for clubroot in Alberta in 2004.

**CROP:** Processing and fresh market peas
**LOCATION:** Southwestern Ontario

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**TITLE: ASCOCHYTA BLIGHT OF PROCESSING PEA IN SOUTHWESTERN ONTARIO IN 2004**

**METHODS:** The occurrence of ascochyta blight was assessed in 17 commercial fields and two experimental trials of processing pea in 2004. Individual plants with disease symptoms were collected from each field, returned to the laboratory, surface disinfested, and plated onto potato dextrose agar (PDA). Resulting colonies were examined and/or subcultured to identify pathogens associated with disease symptoms. Cultures of *Ascochyta* spp. were selected and compared to representative cultures of *A. pisi* and *A. pinodes*. Pathogenicity tests were conducted on 3-wk-old pea seedlings (cvs. Mr Big and Bolero) by pipetting a suspension of conidia and mycelium onto leaves, and incubating them in moist humid conditions for 7 days at 23°C. Plants were assessed for disease symptoms at 10 days after inoculation. Selected pieces of diseased tissues were surface disinfested and plated onto PDA to confirm the identity of the pathogen and complete Koch's postulates.

**RESULTS AND COMMENTS:** Weather conditions in southwestern Ontario from April to July were wet and cool, which are conducive for ascochyta blight. Ascochyta blight was detected in only two of 17 commercial fields, and both incidence and severity were low. In the experimental trials, however, disease incidence and severity were moderate to severe.

Based on cultural morphology and conidial size, isolates of *Ascochyta* spp. were identified as *A. pisi* (recovered from one commercial site) and *A. pinodes* (recovered from two commercial sites and both trials). Isolates of both species were tested for pathogenicity and caused disease on inoculated peas in controlled environments. Isolates were recovered from diseased tissues, confirming Koch's postulates. *Ascochyta pisi* and *A. pinodes* were detected in one and four of the eight counties included in the survey, respectively. Both *A. pisi* and *A. pinodes* have been previously reported from Ontario (Conners 1967, Ginns 1986).

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**Table 1.** Occurrence of *Ascochyta* spp. on processing pea in southwestern Ontario, 2004.

| County | No. of fields assessed | No. with *A. pinodes* | No. with *A. pisi* |
|---|---|---|---|
| **Commercial fields** | | | |
| Elgin | 5 | 1 | 0 |
| Essex | 2 | 0 | 1 |
| Huron | 2 | 0 | 0 |
| Kent | 5 | 1 | 0 |
| Middlesex | 2 | 0 | 0 |
| Perth | 1 | 0 | 0 |
| **Experimental Trials** | | | |
| Prince Edward | 1 | 1 | 0 |
| York | 1 | 1 | 0 |
| **Total** | 19 | 4 | 1 |

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

**CROP / CULTURE:** Apple
**LOCATION /RÉGION:** British Columbia

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## TITLE / TITRE: POSTHARVEST DECAY OF STORED APPLES IN BRITISH COLUMBIA IN 2001

**INTRODUCTION:** Almost half of the apples harvested from British Columbia's primary apple growing areas of the Okanagan and Similkameen Valleys are placed in large cold storage rooms located at seven major packinghouses. Apples are removed from cold storage throughout the winter and spring and packed. Fruit destined to be kept the longest is put into controlled atmosphere (CA) storage where temperature, oxygen, and carbon dioxide concentration are rigorously controlled. The apple industry in British Columbia through the Okanagan Federated Shippers Association (OFSA) maintains a research program that has responsibility for determining optimum storage conditions for each apple cultivar. In the 2001 storage year, information was required on storage atmospheres for 'Ambrosia,' 'McIntosh' , 'Fuji', and Gala apples. In cooperation with OFSA, apples from the various growing areas that were being tested were surveyed for postharvest decay. Usually the decay is caused by either *Penicillium* spp. or *Botrytis cinerea* (Sholberg and Haag, 1996). Several species of *Penicillium* occur on apples, with *P. expansum* the most common, comprising around 80% of isolates. *Penicillium solitum* is likely the second most important species although it is considered a weak pathogen of apple compared to *P. expansum*. *Penicillium* spp. cause the postharvest disease known as blue mold and *B. cinerea* causes the postharvest disease known as grey mold. In all cases conidia from decayed fruit infect wounds during harvest and handling of fruit going into storage (Sholberg, 2000). Therefore, all postharvest decays are much more common on injured fruit.

**METHODS:** Generally apples were picked at early to late maturity from each location. Harvested fruit were separated into lots of 65 apples for each storage regimen and duration. First, McIntosh apples were harvested in mid September 2000 in the North Okanagan Valley and Westbank area (Table 1). Next, Gala apples were similarly harvested from three sites in the Central Okanagan Valley (Summerland) in mid September (Table 2). Ambrosia apples were harvested from mid September to mid October, 2000 from four sites, three in the Central Okanagan Valley and one site in the Kelowna Area, (Table 3). Finally, Fuji apples were harvested from three sites in the Kelowna area in late October (Table 4). The apples were picked by employees of OFSA and immediately brought to the Pacific Agri-food Research Centre (PARC), Summerland for storage. Half the apples were placed in air storage at 0°C (65 per location) and the other half (65 per location) were placed in rigorously controlled CA storage chambers. The CA treatments were at 0 or 1.7°C, but with varying oxygen and carbon dioxide conditions which were monitored and adjusted if necessary on a daily basis. After 3 to 9 months of storage, the fruit were examined for quality, physiological disorders, and postharvest decay. Isolations were made from all apples that appeared to be infected. Isolations were made by removing the fruit skin from the margin of a lesion and aseptically placing bits of decayed tissue on petri plates containing potato dextrose agar. After incubation at 0°C for at least 2 weeks the isolates were identified based on colony morphology and spore characteristics.

**RESULTS:** Decay of early McIntosh apples from the North Okanagan Valley occurred after 3 months' storage and the decay was caused by *B.cinerea* and *Penicillium spp.* in air and CA storage, respectively (Table 1). In contrast, there was no decay in air and CA storage for the first 3 months in McIntosh apples from the Westbank site, which could be attributed to either high fruit quality or a good spray program by the grower. Gala apples stored in air had less early decay than McIntosh, but more decay in air after 6 months storage, and in both air and CA after 8 months storage (Table 2). Ambrosia decay reached high levels at all sites and locations both in air and CA storage (Table 3). *Penicillium* spp. produced the highest levels of decay, especially after 9 months in CA storage, with a combined site total of 71.2% compared with 19.6% for *Botrytis*. At both 6 and 9 months, CA-stored fruit showed more decay than air-stored fruit at 0°C. Fuji apples showed decay with all storage times and conditions (Table 4) and again CA storage caused more decay than air storage, with most decay due to *B. cinerea* rather than *Penicillium* spp.

**DISCUSSION:** Postharvest decay was a significant problem in apples stored for more than 3 months, as shown in previous surveys (Sholberg et al. 2003), and the trend for increased decay in CA is continuing. CA storage promoted decay especially in Ambrosia and Fuji. This is opposite to what is expected. Normally CA storage reduces decay because the low oxygen concentration reduces growth of pathogens such as *B. cinerea* and *Penicillium* spp. Pathogens such as *B. cinerea,* grow optimally in ambient air at 21% oxygen or at lower oxygen concentrations but a decrease in growth rate is detected at 2% oxygen, followed by a nearly 50% reduction at 1% oxygen (El-Goorani and Sommer, 1981). In this survey, Ambrosia and Fuji were stored at 1.2% oxygen and decay would be expected to be lower than in air. There is no obvious reason why growth under CA conditions was higher than air in the 2001 storage season but the phenomenon does not appear to be restricted to this survey. In general packinghouse managers have reported unusual levels of decay in fruit stored under CA conditions. This could indicate that fungi that cause decay are becoming tolerant of low levels of oxygen. CA storage as a means for storing apples has been a widespread practice in the Okanagan Valley since the early 1980's. Perhaps low oxygen-tolerant isolates have been selected over two decades by annual storing of contaminated apples in CA chambers. If CA storages are not thoroughly cleaned each year, these isolates could persist and infect the new crop, especially if the fruit was stored for over 3 months. Further research is needed to determine if isolates from CA storages are tolerant to lower levels of oxygen than normal field isolates.

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**Table 1.** Postharvest decay of McIntosh apples from the North Okanagan Valley, stored 3 to 9 months in air and controlled atmosphere (CA) storage

| Location and number of sites[1] | Pathogen | Percent decayed apples | | | | | |
|---|---|---|---|---|---|---|---|
| | | Air[2] 3 mths | CA[3] 3 mths | Air[2] 6 mths | CA[3] 6 mths | Air[2] 9 mths | CA[3] 9 mths |
| Oyama and Winfield: 2 sites | *B. cinerea* | 6.7 | 0 | 0 | 3.3 | 0 | 0 |
| | *Penicillium* spp. | 0 | 3.3 | 0 | 3.3 | 3.3 | 0 |
| | Combined | 6.7 | 3.3 | 0 | 6.6 | 3.3 | 0 |
| Westbank Area: 1 site | *B. cinerea* | 0 | 0 | 0 | 6.7 | 0 | 0 |
| | *Penicillium* spp. | 0 | 0 | 0 | 0 | 3.3 | 0 |
| | Combined | 0 | 0 | 0 | 6.7 | 3.3 | 0 |
| Combined Locations: 4 sites | *B. cinerea* | 6.7 | 0 | 0 | 10 | 0 | 0 |
| | *Penicillium* spp. | 0 | 3.3 | 0 | 3.3 | 6.6 | 0 |
| | Combined | 6.7 | 3.3 | 0 | 13.3 | 6.6 | 0 |

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

**Table 2.** Postharvest decay of Gala apples from the Central Okanagan Valley, stored for 3 to 8 months in air and controlled atmosphere (CA) storage.

| Location and number of sites[1] | Pathogen | Percent decayed apples | | | | | |
|---|---|---|---|---|---|---|---|
| | | Air[2] 3 mths | CA[3] 3 mths | Air[2] 6 mths | CA[3] 6 mths | Air[2] 8 mths | CA[3] 8 mths |
| Central Okanagan: 3 sites | *B. cinerea* | 0 | 0 | 1.7 | 1.7 | 0 | 18.4 |
| | *Penicillium* spp. | 3.3 | 0 | 1.7 | 1.7 | 21.7 | 8.3 |
| | Combined | 3.3 | 0 | 3.4 | 3.4 | 21.7 | 26.7 |

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

**Table 3.** Postharvest decay of Ambrosia apples from the Central Okanagan Valley and Kelowna Area, stored 6 to 9 months in air or controlled atmosphere (CA) storage.

| Location and number of sites[1] | Pathogen | Percent decayed apples | | | | | |
|---|---|---|---|---|---|---|---|
| | | Air[2] 6 mths | Air[3] 6 mths | CA[4] 6 mths | Air[2] 9 mths | Air[3] 9 mths | CA[4] 9 mths |
| Summerland: 3 sites | *Botrytis cinerea* | 3 | 1 | 2 | 1 | 0 | 7.6 |
| | *Penicillium* spp. | 9 | 52 | 24 | 48.7 | 75.9 | 61.2 |
| | Combined | 12 | 53 | 26 | 49.7 | 75.9 | 68.8 |
| Kelowna Area: 1 site | *B. cinerea* | 2.8 | 0 | 7 | 4 | 0 | 12 |
| | *Penicillium* spp. | 1 | 0 | 2.7 | 5 | 6 | 10 |
| | Combined | 3.8 | 0 | 9.7 | 9 | 6 | 22 |
| Combined Areas: 4 sites | *B. cinerea* | 5.8 | 1 | 9 | 5 | 0 | 19.6 |
| | *Penicillium* spp. | 10 | 52 | 26.7 | 53.7 | 81.9 | 71.2 |
| | Combined | 15.8 | 53 | 35.7 | 58.7 | 81.9 | 90.8 |

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

**Table 4.** Postharvest decay of Fuji apples from the Kelowna Area, stored for 3 to 9 months in air and controlled atmosphere (CA) storage.

| Location and number of sites[1] | Pathogen | Percent decayed apples | | | | | |
|---|---|---|---|---|---|---|---|
| | | Air[2] 3 mths | CA[3] 3 mths | Air[2] 6 mths | CA[3] 6 mths | Air[2] 9 mths | CA[3] 9 mths |
| Kelowna Area: 3 sites | *B. cinerea* | 3.3 | 43.3 | 0 | 63.3 | 15 | 67.4 |
| | *Penicillium* spp. | 0 | 6.7 | 3.3 | 0 | 0 | 5 |
| | Combined | 3.3 | 50 | 3.3 | 63.3 | 15 | 72.4 |

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

**CROP / CULTURE:** Black currant (*Ribes nigrum* L.)
**LOCATION / RÉGION:** Central and southern Alberta

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**TITLE / TITRE: SURVEY FOR WHITE PINE BLISTER RUST AND POWDERY MILDEW IN BLACK CURRANT ORCHARDS IN CENTRAL AND SOUTHERN ALBERTA IN 2003**

**METHODS:** Thirty infectious diseases are known to attack *Ribes* species in Canada (Couture *et al.*, 2003). A survey of currant and gooseberry orchards in central and southern Alberta in 2002 revealed that powdery mildew (*Sphaerotheca mors-uvae* (Schwein.) Berk. & M.A. Curtis) and white pine blister rust (*Cronartium ribicola* J.C. Fisch.) were the most prevalent diseases (Chang *et al.*, 2003). A second round of survey work was carried out in 2003 to confirm this finding. Seven commercial black currant orchards and two research trials in southern Alberta were surveyed for diseases in August; five commercial orchards in central Alberta were surveyed in September (Fig. 1). The incidence of powdery mildew and rust was determined by visually examining a minimum of 20 bushes at each of five locations in each orchard, recording the number that was infected, and converting this to a percentage. Powdery mildew and rust severity were separately estimated on the same plants using the following visual scale: 0 = no disease, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $\mathbf{[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t}$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined.

**RESULTS AND COMMENTS:** Symptoms of rust were found in all of the commercial orchards surveyed in both central and southern Alberta. On average, 22% of the plants were infected (Tables 1 & 2). The two most commonly grown cultivars, Ben Alder and Ben Lomond, were highly susceptible to this disease. Ben Tirran was moderately susceptible. In many cases, 100% of the plants were infected and significant defoliation occurred as a result. Only one of the two research plantings in southern Alberta (CACDI, Lethbridge) had rust, and about 8% of the plants were infected (Tables 3 & 4). Ben Alder and Ben Lomond had infection frequencies of 0-60%.

Three of the commercial orchards surveyed in central and southern Alberta showed evidence of powdery mildew and, on average, 54% of the plants were infected (Table 1). The two most commonly grown cultivars, Ben Alder and Ben Lomond, were highly susceptible to this disease. In many cases, 100% of the plants were infected. Heavy mildew infection caused premature bud breaking in one orchard in southern Alberta. The research planting at Brooks showed evidence of powdery mildew and about 8% of the plants were infected (Table 3). Crusader, Consort, Magnus, Tenah, Topsy and Willoughby showed about 100% infection; other cultivars had lesser amounts of disease or were free of symptoms.

Other minor problems noted during the survey were dieback (two locations), grasshopper damage (one location), spider mite damage (six locations ranging from < 5% to 80% infested bushes), and fruit fly damage (one location).

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Couture, L., Brisson, J.D. and Émond, G. (eds.). 2003. Names of Plant Diseases in Canada, 4th edition. Quebec Society for the Protection of Plants. 340 pp.

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**Table 1.** Occurrence of powdery mildew and rust in twelve commercial black currant orchards in central and southern Alberta in 2003.[1]

| Disease | Pathogen | No. infested orchards | Disease incidence (%)[2] | |
|---|---|---|---|---|
| | | | Average | Range |
| Powdery mildew | *Sphaerotheca mors-uvae* | 3 | 54.2 | 0-100 |
| Rust | *Cronartium ribicola* | 12 | 22.3 | 0-100 |

[1]A total of 12 locations were surveyed with 100 plants per cultivar per location observed where possible.
[2]These values pertain only to orchards with powdery mildew or rust and do not include healthy plantings. Range values represent mean ratings for individual groups of 20 bushes within infested orchards.

**Table 2.** Susceptibility of seven black currant cultivars to rust in twelve commercial orchards in central and southern Alberta in 2003.

| Cultivar | No. orchards surveyed | Rust incidence (%) | | Rust severity (0 – 4)[1] | |
|---|---|---|---|---|---|
| | | Average | Range | Average | Range |
| Ben Alder | 7 | 59.2 | 0-100 | 0.83 | 0-3 |
| Ben Connan | 1 | 3.0 | 0-10 | 0.03 | 0-1 |
| Ben Lomond | 3 | 55.9 | 0-100 | 1.09 | 0-3 |
| Ben Nevis | 1 | 1.0 | 0-5 | 0.01 | 0-1 |
| Ben Sarek | 1 | 3. 0 | 0-5 | 0.03 | 0-1 |
| Ben Tirran | 3 | 19.3 | 0-60 | 0.20 | 0-1 |
| Titania | 0 | - | - | - | - |

[1]Rust severity was estimated visually on the samples by using the following scale: 0 = no rust, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined. Range values represent mean ratings for individual groups of 20 bushes within orchard or orchards surveyed.

**Table 3.** Incidence of powdery mildew and rust in two research plantings of black currant in southern Alberta in 2003.[1]

| Disease | Pathogen | No. infested orchards | Disease incidence (%) | |
|---|---|---|---|---|
| | | | Average | Range |
| Powdery mildew | *Sphaerotheca mors-uvae* | 1 | 7.9 | 0-100 |
| Rust | *Cronartium ribicola* | 1 | 7.8 | 0-60 |

[1]Located at the Crop Diversification Centre South, Brooks (19 cultivars with 3 to 230 bushes [Ben Nevis] per cultivar) and the Canada-Alberta Crop Development Initiative Demonstration Farm at Lethbridge (400 plants each of Ben Alder and Ben Lomond). Range values represent mean ratings for individual groups of 20 bushes within the orchard.

**Table 4.** Susceptibility of two black currant cultivars to rust in a research planting at Lethbridge, Alberta in 2003.

| Cultivar | No. orchards surveyed | Rust incidence (%) | | Rust severity (0 – 4)[1] | |
|---|---|---|---|---|---|
| | | Average | Range | Average | Range |
| Ben Alder | 1 | 10.3 | 0-60 | 0.10 | 0-1 |
| Ben Lomond | 1 | 5.3 | 0-20 | 0.05 | 0-1 |

[1]Rust severity was estimated visually on the samples by using the following scale: 0 = no rust, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $\mathbf{[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t}$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined. Range values represent mean ratings for individual groups of 20 bushes within the orchard.


Figure 1. Locations of 14 commercial and experimental black currant orchards surveyed for rust and powdery mildew in central and southern Alberta in 2003.

**CROPS / CULTURES:** Black currant (*Ribes nigrum* L.); red and white currant (*R. rubrum* L.); gooseberry (*R. grossularia* L.)
**LOCATION / RÉGION:** Southern Alberta

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**TITLE / TITRE: INCIDENCE AND SEVERITY OF WHITE PINE BLISTER RUST AND POWDERY MILDEW IN CURRANT AND GOOSEBERRY ORCHARDS IN SOUTHERN ALBERTA IN 2004**

**INTRODUCTION AND METHODS:** As many as 30 infectious diseases are known to attack *Ribes* species in Canada (Couture *et al.*, 2003). Surveys of currant and gooseberry orchards in central and southern Alberta in 2002 and 2003 showed that powdery mildew (*Sphaerotheca mors-uvae* (Schwein.) Berk. & M.A. Curtis) and white pine blister rust (*Cronartium ribicola* J.C. Fisch.) were the most widespread and damaging diseases (Chang *et al.*, 2003; Howard *et al.*, 2005). A third season of survey work was carried out in 2004 wherein eight currant and gooseberry plantings in southern Alberta (six commercial orchards and two research plantings) were surveyed for powdery mildew and rust in September-October. Disease incidence was determined by visually examining a minimum of 20 bushes at each of five locations in each orchard, recording the number that was infected, and converting this value to a percentage. Powdery mildew and rust severity were estimated separately on the same plants using the following visual scale: 0 = no disease, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $\mathbf{[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t}$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined.

**RESULTS AND COMMENTS:** All of the commercial currant and gooseberry orchards surveyed in southern Alberta in 2004 showed symptoms of rust. On average, 63% of the black currant bushes were infected (Table 1). The two most commonly grown cultivars, Ben Alder and Ben Lomond, were highly susceptible to this disease, while Ben Sarek and Titania were resistant (Table 2). Both of the research plantings in southern Alberta had rust (Tables 3 & 4). At CACDI, Lethbridge, Ben Alder and Ben Lomond had infection frequencies of 100% (Table 5). At CDC South, Brooks, Ben Alder, Ben Lomond, Ben More, Ben Tirran, Kerry, Ojebyn, Tenah, Topsy and Willoughby had infection frequencies of 100%, while 27MS1678, Ben Connan, Ben Nevis, Ben Sarek, Consort, Crusader, M1678, Magnus, McGinnis and Titania were either resistant or moderately resistant, for an overall incidence of 18%.

One of the black currant orchards surveyed in southern Alberta showed a 100% incidence of powdery mildew (Table 1). The research planting at Brooks also showed evidence of powdery mildew, where 10% of the plants were infected (Table 4). Consort, Crusader, Kerry, M1678, Magnus, Tenah and Topsy were susceptible, while 27MS1678, Ben Alder, Ben Connan, Ben Lomond, Ben More, Ben Nevis, Ben Sarek, Ben Tirran, McGinnis, Ojebyn, Titania and Willoughby were resistant.

Red and white currants and gooseberries did not show evidence of rust or powdery mildew infection, with the exception of the white currant cultivar Blanka, which had rust. Other minor problems noted during the survey were insect damage on white currants and gooseberries in one location and on red currants in two locations, and dieback on red currants in one location and on black currants in one location.

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Couture, L., Brisson, J.D. and Émond, G. (eds.). 2003. Names of Plant Diseases in Canada, 4th edition. Quebec Society for the Protection of Plants. 340 pp.

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**Table 1.** Occurrence of powdery mildew and rust in six commercial black currant orchards in southern Alberta in 2004.[1]

| Disease | Pathogen | No. infested orchards | Disease incidence (%)[2] | |
|---|---|---|---|---|
| | | | Average | Range |
| Powdery mildew | *Sphaerotheca mors-uvae* | 1 | 100 | - |
| Rust | *Cronartium ribicola* | 6 | 63 | 0-100 |

[1]A total of six locations were surveyed with 100 plants per cultivar per location observed where possible.
[2]These values pertain only to orchards with powdery mildew or rust and do not include healthy plantings. Range values represent mean ratings for individual groups of 20 bushes within infested orchards.

**Table 2.** Susceptibility of four black currant cultivars to rust in six commercial orchards in southern Alberta in 2004.

| Cultivar | No. orchards surveyed | Rust incidence (%) | | Rust severity (0–4)[1] | |
|---|---|---|---|---|---|
| | | Average | Range | Average | Range |
| Ben Alder | 4 | 97 | 77-100 | 1.6 | 0-3 |
| Ben Lomond | 5 | 79 | 65-100 | 1.4 | 0-4 |
| Ben Sarek | 1 | 0 | - | - | - |
| Titania | 3 | 0 | - | - | - |

[1]Rust severity was estimated visually on leaf samples using the following scale: 0 = no rust, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $\mathbf{[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t}$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined. Range values represent mean ratings for individual groups of 20 bushes within infested orchards.

**Table 3.** Occurrence of powdery mildew and rust in an experimental orchard at the Canada-Alberta Crop Development Initiative Demonstration Farm at Lethbridge, Alberta in 2004.[1]

| Disease | Pathogen | Disease incidence (%) | |
|---|---|---|---|
| | | Average | Range |
| Powdery mildew | *Sphaerotheca mors-uvae* | 0 | - |
| Rust | *Cronartium ribicola* | 100 | - |

[1]Planting consisted of ca. 400 plants each of Ben Alder and Ben Lomond black currants.

**Table 4.** Occurrence of powdery mildew and rust in an experimental orchard of black currant at the Crop Diversification Centre South, Brooks, Alberta in 2004.[1]

| Disease | Pathogen | Disease incidence (%) | |
|---|---|---|---|
| | | Average | Range |
| Powdery mildew | *Sphaerotheca mors-uvae* | 10 | 0-100 |
| Rust | *Cronartium ribicola* | 18 | 0-100 |

[1]Planting consists of 19 cultivars of black currant. Range values represent mean ratings for individual groups of 20 bushes within the orchard.

**Table 5.** Susceptibility of two black currant cultivars to rust in an experimental orchard at the Canada-Alberta Crop Development Initiative Demonstration Farm at Lethbridge, Alberta in 2004.[1]

| Cultivar | No. orchards surveyed | Rust incidence (%) | | Rust severity (0–4)[1] | |
|---|---|---|---|---|---|
| | | Average | Range | Average | Range |
| Ben Alder | 1 | 100 | - | 2.5 | 1-4 |
| Ben Lomond | 1 | 100 | - | 1.4 | 1-3 |

[1]Rust severity was estimated visually on leaf samples by using the following scale: 0 = no rust, 1 = 1-10% leaf area affected, 2 = 11-25% affected, 3 = 26-50% affected, and 4 > 50% affected. Average disease severity ratings were calculated using the formula: $\mathbf{[(N_0 \times 0)+(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)]/N_t}$, where $N_0$ = number of bushes with DS = 0, $N_1$ = no. with DS = 1, $N_2$ = no. with DS = 3, $N_4$ = no. with DS = 4, and $N_t$ = total number of bushes examined. Planting consisted of an equal number of Ben Alder and Ben Lomond black currant plants. Range values represent mean ratings for individual groups of 20 bushes within the orchard.

**CROPS / CULTURES:** Wild cherry and plum (*Prunus* spp.)
**LOCATION / RÉGION:** Canada

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**TITLE / TITRE:** Black knot disease on wild *Prunus* spp., 2001-2004.

**INTRODUCTION AND METHODS:** Black knot disease caused by *Apiosporina morbosa* (Schw. ex Fr.) Arx. [syn. *Dibotryon morbosum* (Schw.) Theiss. et Syd.] occurs throughout Canada and the United States on native and introduced *Prunus* spp. (Anonymous 1960, Ginns 1986). Economic impacts of the disease are yield reduction and mortality of domestic fruit trees, degradation in black cherry lumber and unsightly galls on ornamentals (Anonymous 1989, Northover and McFadden-Smith 1995, Howard et al. 2004). Black knot may also help reduce the impact of pin cherry (*Prunus pensylvanica* L.f.) as a competing species in forest plantations (Wall 1986). In Canada, the disease has been reported on Canada plum (*Prunus nigra* Ait.), pin cherry (*P. pensylvanica*), black cherry (*P. serotina* Ehrh.), choke cherry (*P. virginiana* L. ) and on the domestic introductions almond (*P. dulcis*), apricot (*P. armeniaca*), sweet cherry (*P. avium*), sour cherry (*P. cerasus*), bird cherry (*P. padus*), May-day tree (*P. padus* var. *commutata*), peach (*P. persica*), plum (*P. domestica*), Sierra plum (*P. subcordata*), and sloe (*P. spinosa*) (Ginns 1986). In addition, the disease has been reported on sand cherry (*P. pumila*) in Wisconsin and North Dakota (Anonymous 1960).

During the period 2001-2004, *Prunus* spp. found across Canada during vacation travel were examined for black knot disease. Most of the observations were of native species growing adjacent to camp sites, roadside parks and suburban streets but occasional escaped domestic plum or cherry cultivars were also encountered. Areas examined varied from single trees to several hectares. If no black knot was encountered after a 30-minute search, the area was considered disease free. If a maximum of two stromata were found, disease incidence was considered ‘rare’. Where several stromata were found after searching, incidence was termed ‘scattered’ and where stromata were readily evident, incidence was considered ‘abundant’. When black knot cankers were found, representative galls were cut open to determine if living tissues were present. A total of 119 sites were visited, 20 in British Columbia, 11 in Alberta, 12 in Saskatchewan, 10 in Manitoba, 41 in Ontario, 2 in Quebec, 1 in New Brunswick, 13 in Nova Scotia and 9 in Newfoundland.

**RESULTS AND COMMENTS:** Black knot was found at 65 (55%) of the 119 sites visited but was abundant in only seven, all on choke cherry. These were at Grand Forks BC in July 2003, Waterton Park AB in September 2001, Caron SK in August 2001 and May 2004, Moose Jaw SK (Buffalo Pound Provincial Park) in June 2002, Wasagaming MB in July 2004, Douglas MB in May 2004, and Carberry MB (Spruce Woods Provincial Park) in August 2001. At 53 of the sites with black knot, distribution was scattered, evident usually in clumps of similar shrubs or on individual trees. Occurrence was rare at 5 sites. Most of the galls found were dead, indicating that infection had occurred more than two years previously. Living galls were found at only 28 sites, and most of these were the result of downward growth of the causal fungus into older twigs and branches. Living galls on young shoots that appeared to result from new infections were scarce and found at only 17 sites.

Occurrence of the disease on different species and in different provinces is outlined in Table 1. Black knot was found most frequently (58% of sites) on choke cherry (*Prunus virginiana* ), followed by 44% on black cherry (*P. serotina*.) and 32% on pin cherry (*P. pensylvanica*). Most of the black knot found on escaped domestic cultivars occurred on older plum varieties growing on abandoned homesteads. Host mortality associated with the disease was observed at five sites, three on choke cherry and two on domestic plum. No black knot was found on the few bitter cherry [*P. emarginata* (Dougl.) Walp.] or Canada plum (*P. nigra*) plants examined.

Two or more *Prunus* species were found growing at 53 of the sites visited and at 11 (21%) of these black knot was found on more than one species. One of these latter sites, Wasagaming MB, was visited twice, in 2002 and 2004. On the first visit, the disease was readily found on choke cherry but was rare on pin cherry but by 2004, it was also readily found on pin cherry.

Compared to past observations (Sippell et al.1967, Wall 1986), incidence and severity of black knot disease has been generally low during the 2001-04 period. The low incidence of living galls on 2-year-old shoots indicated either that inoculum levels have been low over the past few years or that conditions for infection have been poor. Re-infection of the most susceptible clones and proximal movement of the fungus into older twigs has likely provided refugia for fungus survival until conditions for infection improve.

At most (79%) of the sites with two or more susceptible *Prunus* species, the disease was found on only one host. This might be construed as evidence of host specific strains, but where inoculum density is low it may simply reflect differences in host response to infection by *Apiosporina morbosa*.

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**Table 1.** *Prunus* spp. examined and occurrence of black knot disease.

| Host species | Number of locations | Locations with black knot | Province |
|---|---|---|---|
| Bitter cherry (*Prunus emarginata)* | 4 | 0 | BC |
| Pin cherry (*P. pensylvanica*) | 67 | 21 | BC, AB, **SK***, **MB***, **ON***, QC, NB*, **NF*** |
| Black cherry (*P. serotina*) | 16 | 7 | **ON***,**NB***, **NS*** |
| Choke cherry (*P. virginiana*) | 75 | 43 | **BC***, **AB***, **SK***, **MB***, **ON***, **NS***, **NF*** |
| Sand cherry (*P. pumila*) | 2 | 1 | **ON*** |
| Canada plum (*P. nigra*) | 4 | 0 | MB, ON |
| Domestic plum | 7 | 3 | **BC***, **MB***, **ON*** |
| Domestic cherry | 11 | 2 | BC, **NS***, NF |

*Provinces where black knot was found on that species.

**CROPS / CULTURES:** *Prunus* species, various cultivars
**LOCATION / RÉGION:** Central and southern Alberta

**NAMES AND AGENCIES / NOMS ET ORGANISMES:**
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**TITLE / TITRE: A SURVEY FOR BLACK KNOT ON *PRUNUS* SPECIES IN ALBERTA IN 2003**

**INTRODUCTION AND METHODS:** Throughout the spring and summer of 2003, 35 locations across Alberta (Fig. 1) were surveyed for black knot, caused by *Apiosporina morbosa* (syn. *Dibotryon morbosum*) (Pleosporales, Venturiaceae). This disease occurs on *Prunus* spp. across North America, especially in the west, and host-specific strains have been described. Although black knot has been known to occur in Alberta for many years, there is no detailed information on its geographical distribution in the province. The survey objectives were to gather information on the occurrence and impact of black knot in cultivated and natural plantings of *Prunus* spp., to assess the effectiveness of currently used control measures, and to use the information collected to help improve disease management programs. Each location surveyed had one or more *Prunus* species growing in habitats such as orchards, nurseries, municipalities (parks, boulevards, amenity plantings), research collections, arboreta, shelterbelts and natural areas (Table 1). The survey was carried out by Alberta Agriculture, Food and Rural Development (AAFRD) staff and many local cooperators. A survey kit, consisting of a protocol, an information recording form, a pictorial key of gall types, and factsheets describing the disease, was provided to each survey team. For each location surveyed, a minimum of five trees of each species or an entire row was examined for disease incidence and severity. For larger trees, two branches or major limbs on opposite sides of the tree were selected and rated in a similar manner. Disease incidence (DI) was recorded as the number of trees with black knot galls. Disease severity (DS) was represented by the extent of gall development, i.e. I, II, III or IV, where type I = first year of infection; type II = second or third year of infection, type III = third year of infection or older, and type IV = old, dry and/or dead galls. A disease severity index was calculated for each group of trees using the formula: $\mathbf{[(N_1 \times 1)+(N_2 \times 2)+(N_3 \times 3)+(N_4 \times 4)] \times (N_T \times 4)^{-1} \times 100}$, where $N_1$ = no. of type I galls, $N_2$ = no. type II galls, $N_3$ = no. of type III galls, $N_4$ = no. of type IV galls and $N_T$ = total no. of galls. An average index value was determined for each site.

**RESULTS AND COMMENTS:** The main *Prunus* species examined were *P. virginiana* (chokecherry), *P. padus* (mayday), *P. pensylvanica* (pincherry), *P. maackii* (amur cherry), and *P. tomentosa* (nanking cherry). Black knot was found to be a widespread and frequently serious problem. Disease incidence and severity ratings were highest in urban areas (Table 2) and lowest in commercial tree nurseries (Table 3) and research plantings (Table 4). One chokecherry orchard in central Alberta was surveyed and had no black knot, whereas a shelterbelt containing mayday and chokecherry trees about 15 km away, which was in the vicinity of infected native chokecherries, was severely affected (Table 5). Economic losses in urban areas were sometimes significant because of reduced aesthetic value and the high cost of pruning or removing badly infected trees. The prevalence of black knot in many towns and cities could partially be attributed to the widespread use of susceptible Schubert chokecherry and mayday trees. Disease outbreaks could sometimes be traced to specific sources of infection, e.g. heavily infected individual trees or small groups of plants. Dormant season pruning was the major method used to control black knot, but was often done too late in the growing season, or after the disease had spread too far, to be of much benefit.

**ACKNOWLEDGEMENTS:** We are grateful to the many people from urban municipalities, nurseries, garden centers, orchards and farms who assisted with the survey. We also thank the Alberta Professional Horticultural Growers Congress and Foundation Society for their financial support.

**Table 1.** *Prunus* species growing in Alberta in 2003.

| Common name | Genus and species | Cultivar(s) | City(s) |
|---|---|---|---|
| Amur cherry | *P. maackii* | | Aldesyde, Beaumont, Calgary, Edmonton, Strathmore |
| Apricot | *P. armeniaca* | | |
| Black cherry | *P. serotina* | | Edmonton |
| Chokecherry | *P. virginiana* | 'Schubert', 'Mission Red', 'Garrington' | Aldesyde, Beaumont, Bowden, Calgary, Camrose, Coaldale, Edmonton, Lethbridge, Spring Bank, Spruce View, St. Albert, Strathmore |
| Dropmore cherry | *P.* x *dropmoriana* | | Edmonton |
| Flowering almond | *P. tenella* | | |
| Flowering plum | *P. triloba* | 'Multiplex' | Edmonton |
| Japanese plum | *P. salicina* | 'Bookgold', 'Korean' | Edmonton |
| Korean cherry | *P. japonica* | | Edmonton |
| Mayday | *P. padus* | 'Commutata', 'Ethel', 'Sun Star', 'Purple Leaf' | Aldersyde, Beaumont, Calgary, Coaldale, Edmonton, Lethbridge, Red Deer, Spring Bank, Spruce View, St. Albert, Strathmore |
| Mongolian cherry | *P. fruiticosa* | | Edmonton |
| Nanking cherry | *P. tomentosa* | | Edmonton, Spring Bank |
| Pincherry | *P. pensylvanica* | | Aldersyde, Beaumont, Calgary, Camrose, Coaldale, Edmonton, Spring Bank, Spruce View, Strathmore |
| American plum | *P. americana* | | |
| Common plum | *P. domestica* | | |
| Canada plum | *P. nigra* | 'Norther', 'Princess Kay' | Aldersyde, Edmonton |
| Plum hybrid | *P. nigra* x *P. salicina* | 'Pembina', 'BF9' | Edmonton |
| Cherry/plum | *P. besseyi* x *P. nigra*/*salicina* | 'Sapa', 'Kappa', 'Opata' | Edmonton |
| Nanking cherry hybrid | *P. tomentosa* x *P. besseyi* | | Edmonton |
| Apricot hybrid | *P. armeniaca* x *P. tomentosa* | 'Yuksa' | Edmonton |
| Sour cherry hybrid | *P. fruiticosa* x *P. cerasus* | 'Carmine Jewel' | Edmonton |
| Sand cherry | *P. besseyi* | 'Evans' | Edmonton |
| Sour cherry | *P. cerasus* | | Edmonton |
| Manchurian apricot | *P. mandshurica* | | Spring Bank |

**Table 2.** Incidence and severity of black knot on *Prunus* species in five cities in Alberta in 2003.

| City | Location surveyed* | Incidence (%) | Severity index (0-100) | Number of trees examined |
|---|---|---|---|---|
| Camrose | N/P | 100.0 | 84.8 | 19 |
| Edmonton | B/N/P/Y | 25.0 | 57.0 | 144 |
| Lethbridge | P | 72.7 | 54.7 | 11 |
| Red Deer | N/P | 100.0 | 70.2 | 10 |
| St. Albert | B/P/Y | 64.9 | 58.7 | 77 |

* B = Boulevard, N = Natural Area, P = Park, Y = Yard

**Table 3.** Incidence and severity of black knot on *Prunus* spp. in eight tree nurseries in Alberta in 2003.

| Survey area | Number of nurseries surveyed | Incidence (%) | Severity index (0-100) | Number of trees examined |
|---|---|---|---|---|
| Calgary | 4 | 0.2 | 12.4 | 18097 |
| Edmonton | 3 | 0.0 | 6.6 | 10472 |
| Lethbridge | 1 | 0.0 | 0.0 | 634 |

**Table 4.** Incidence and severity of black knot on *Prunus* spp. in two research plantings in Alberta in 2003.

| Town/city | Location* | Incidence (%) | Severity index (0-100) | Number of trees examined |
|---|---|---|---|---|
| Brooks | CDC South | 0.0 | 0.0 | N/A |
| Edmonton | CDC North | 4.4 | 13.5 | 228 |

* Crop Diversification Centre, South, Brooks and Crop Diversification Centre, North, Edmonton.

**Table 5.** Incidence and severity of black knot on *Prunus* spp. in a commercial orchard and on two farms in central Alberta in 2003.

| Type of planting | Location | Incidence (%) | Severity index (0-100) | Number of trees examined |
|---|---|---|---|---|
| Orchard | Bowden | 0.0 | 0.0 | 196 |
| Shelterbelt | Spruce View | 72.0 | 72.0 | 40 |
| Farm yard | Spruce View | 28.6 | 28.6 | 15 |

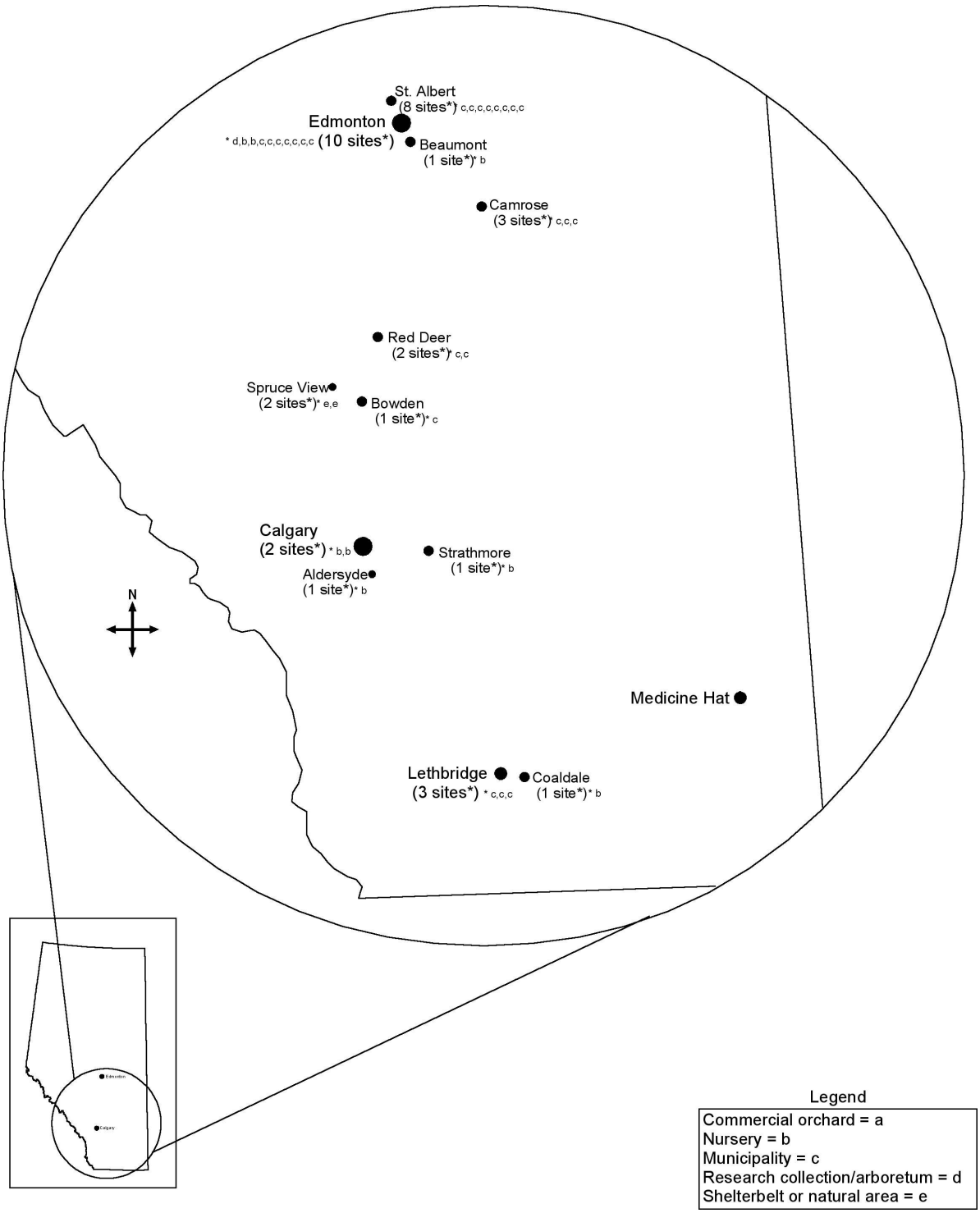


**Figure 1.** Location of plantings of *Prunus* species surveyed for black knot in Alberta in 2003.

**CROP / CULTURE:** Sea buckthorn
**LOCATION / RÉGION:** British Columbia

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**TITLE / TITRE: FIRST RECORD OF VERTICILLIUM WILT OF SEA BUCKTHORN IN BRITISH COLUMBIA**

**INTRODUCTION:** Sea buckthorn (*Hippophae rhamnoides*) was originally imported into Canada from Russia in 1938 as an ornamental plant except in Manitoba and Saskatchewan where it was used for shelter belts (Li and Shroeder, 1996). More than one million seedlings have been distributed and more than 250,000 mature fruit-producing trees are grown on the prairies for enhancement of wildlife habitat, farmstead protection, erosion control, and marginal land reclamation. Relatively few plant pathogens are thought to attack sea buckthorn, although it is known to be susceptible to *Verticillium* spp. (Li and Beveridge, 2003). Kennedy (1987) consistently isolated *Verticillium dahliae* Kleb. from surface-sterilized stem segments of sea buckthorn cv. Novost Altaya in England and showed that it caused verticillium wilt of sea buckthorn. In British Columbia sea buckthorn is a relatively new crop being developed for its fruit for use in nutraceutical and cosmetic products. The crop is being evaluated at the Pacific Agri-Food Research Centre (PARC), Summerland, B.C. as an alternative crop.

In early June, 1998 several 2-year-old sea buckthorn trees cv. Indian-Summer in a 0.25 ha block at PARC, displayed symptoms of yellowing, defoliation, dead branches, and in a few cases death of the entire tree (Fig.1). The disease was widespread, affecting about 5% of the trees in the planting. The symptoms were also found in trees in another planting at PARC, where new cultivars were being evaluated. The symptoms corresponded to verticillium wilt that had previously been reported on sea buckthorn (Kennedy, 1987).

**METHODS:** Thirteen sea buckthorn trees, nine with dead or wilting branches were brought into the laboratory for examination. Isolations were made from roots, living and dead shoots, and branch tips by cutting 10 sections, 0.5 cm long, from each of the tree parts. These sections were surface-sterilized in 0.5% NaOCl for 1 min, rinsed with sterile water, and placed upright on 10 cm diameter plates containing approximately 15 mL potato dextrose agar amended with 1.3% lactic acid (1.5 mL/L of 85% lactic acid (LAPDA). The plates were incubated at 20°C for a week. If mycelium was observed to be growing out of the stem section a second isolation was made to obtain pure cultures for use in pathogenicity studies and for further identification. Furthermore a tree with verticillium wilt symptoms was sent to the B.C. Ministry of Agriculture and Food (BCMAFF), Plant Diagnostic laboratory, Abbotsford, B.C. for identification.

After pathogen identification, a pathogenicity study was conducted. The pathogenicity test was based on the method of Kennedy (1987) and was initiated in 2002. Sea buckthorn cuttings cv. Indian-Summer were grown in 15 cm diameter pots containing sterilized Sunshine mix #1 (transplant medium) and grown in the greenhouse for several weeks until they reached approximately 30 cm in height. The pathogens used in this trial were *V. dahliae* from red maple, spinach, sea buckthorn, and tomato. Each pathogen was used to inoculated eight cv. Indian-Summer plants on 25 November, 2002 using an inoculum concentration of 6.0 x $10^4$ CFU/mL for flooding the plant root system. The plants were grown in the greenhouse for two months after flooding when they were rated for leaf yellowing, wilting, defoliation, and plant death. Two plants from each group with the most severe symptoms were tested for infection by *V. dahliae* using the same method as above.

**RESULTS AND COMMENTS:** Sections of shoots and roots from the sea buckthorn trees displaying verticillium wilt symptoms in the field (Table 1) produced white fungal growth at the end of each section.

Pure cultures made from this mycelium were subsequently identified as *V. dahliae* in 22 cultures from 11 sea buckthorn trees based on morphological characteristics. The isolates possessed verticillate conidiophores and were initially thought to be an undescribed species of *Verticillium,* but later were resolved as *V. dahliae* by the National Fungal Identification Service in Ottawa, ON. This identification was supported by personnel at the BCMAFF laboratory, who also found *V. dahliae* in the tree sent to their laboratory. In subsequent reisolations the identification was based on morphological similarity to the identified cultures. Verticillium wilt was found on four different cultivars of sea buckthorn at PARC, demonstrating that *V. dahliae* is capable of infecting a wide range of cultivars. The fungus was found infecting roots and shoots and occurred on live shoots as well as dead shoots. Interestingly *V. dahliae* was isolated from one tree that did not display any wilt symptoms at the time it was removed from the orchard (Table 1). This could mean that *V. dahlliae* is not always pathogenic when it infects sea buckthorn or that symptoms take some time to develop.

The pathogenicity experiment indicated that isolates of *V. dahliae* from four different sources were likely all pathogenic on sea buckthorn cv. Indian-Summer (Table 2). This was confirmed by re-isolating *V. dahliae* from each source although *V. dahliae* was also isolated from plants that were not inoculated. This indicates that some of the cuttings used in this trial could have been infected with *V. dahliae* before they were inoculated.*Verticillium dahliae* was re-isolated from other sea buckthorn trees in the greenhouse that were not part of the experiment but were potted at the same time. In future, any scion wood used for cuttings should be tested for *V. dahliae,* because, as noted above, it is widespread and can occur in healthy-looking branches. This fact is also important to growers who are planting new orchards to make sure that their nursery stock is not infected. Verticillium wilt is controlled by planting disease-free plants in disease-free soil and the use of *Verticillium*-resistant cultivars. These results should encourage the breeding of *Verticillium*-resistant sea buckthorn cultivars. As far as we are aware, this is the first documented report of verticillium wilt of sea buckthorn in Canada.

**ACKNOWLEDGEMENTS:** The authors would like to thank Dr. John Bissett, Eastern Cereal and Oilseed Reseach Centre, National Fungal Identification Service, Ottawa, Ontario for identification of *Verticillium dahliae* from pure cultures and Vippen Joshi, British Columbia Ministry of Agriculture and Food, Abbotsford Agriculture Centre, Abbotsford, BC for identification of *V. dahliae* from a diseased tree sample.

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Li, T. S. C., and Beveridge, H.J. 2003. Sea Buckthorn (*Hippophae rhamnoides* L.): Production and Utilization. NRC Research Press, Ottawa, Ontario. 133p.

**Table 1.** Percent *Verticillium dahliae* in plant parts of sea buckthorn trees with symptoms of verticillium wilt

| Cultivar | Symptom | Percent sections with *V. dahliae*[1] | | | |
|---|---|---|---|---|---|
| | | Roots | Shoot tips | Live shoots | Dead shoots |
| *H. tibetana* | Dead tree | 10 | 100 | No data | 100 |
| *H. tibetana* | Top branches dead | 30 | 100 | 100 | 100 |
| *H. rhamnoides* subsp. *rhamnoides* | A few dead branches | 20 | 100 | 100 | 100 |
| *H. rhamnoides* subsp. *sinensis* | A few dead branches | 80 | 100 | 100 | 100 |
| *H. rhamnoides* cv. Indian-Summer | Many dead branches | 10 | 100 | 100 | 100 |
| cv. Indian-Summer | Dead tree | 0 | 100 | 100 | 100 |
| cv. Indian-Summer | Dead tree | 10 | 100 | 80 | 100 |
| cv. Indian-Summer | Dead tree | 40 | 80 | No data | 100 |
| cv. Indian-Summer | Many dead branches | 0 | 100 | 100 | 100 |
| cv. Indian-Summer | Healthy | 0 | 50 | 100 | Not present |
| cv. Indian-Summer | Healthy | 0 | 100 | 90 | Not present |
| cv. Indian-Summer | Healthy | 0 | 0 | 10 | Not present |
| cv. Indian-Summer | Healthy | 0 | 0 | 0 | Not present |

[1]Ten 0.5 cm sections were cut from each tree part and placed on lactic acid PDA and incubated at 20°C for 1 week.

**Table 2.** Symptoms produced by four *Verticillium dahliae* isolates on sea buckthorn cv. Indian-Summer plants

| Host | Uninoculated | Inoculated with *V. dahliae*[1] from | | | |
|---|---|---|---|---|---|
| Plant | Control | Red maple | Spinach | Sea buckthorn | Tomato |
| 1 | Healthy | Yellow leaves | Yellow leaves | Yellow leaves | Wilted |
| 2 | Wilted | Wilted[2] | Healthy | Yellow leaves | Wilted[2] |
| 3 | Healthy[2] | Yellow leaves[2] | Wilted | Healthy | Yellow leaves |
| 4 | Wilted[2] | Yellow leaves | Wilted | Yellow leaves | Wilted[2] |
| 5 | Healthy | Yellow leaves | Yellow leaves | Healthy | Yellow leaves |
| 6 | Wilted | Yellow leaves | Yellow leaves | Wilted | Wilted |
| 7 | Healthy | Healthy | Defoliated[2] | Healthy | Yellow leaves |
| 8 | Healthy | Defoliated | Defoliated[2] | Yellow leaves[2] | Healthy |

[1]Sea buckthorn plants grown from cuttings in pots were flooded with a conidial suspension ($6.0 \times 10^4$ CFU/mL) of *V. dahliae* from various sources, left in the greenhouse for 2 months when they were rated for verticillium wilt symptoms.
[2]*V. dahliae* was isolated from these plants.

**Fig. 1.** Sea buckthorn (*Hippophae rhamnoides* L. cv. Indian-Summer) tree with verticillium wilt symptoms. Note the defoliation and unthrifty appearance compared to the healthy trees on either side

# Forest Trees / Arbres Forestiers

**CROP:** Butternut
**LOCATION:** New Brunswick

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## TITLE: EXPANSION OF KNOWN DISTRIBUTION OF BUTTERNUT CANKER (*SIROCOCCUS CLAVIGIGNENTI-JUGLANDACEARUM)* IN NEW BRUNSWICK - 2004

**INTRODUCTION:** Butternut (*Juglans cinerea* L.) reaches the northeastern limit of its natural distribution in New Brunswick. The tree occurs in small groups or as scattered individuals in mixed hardwood stands along the Saint John and Miramichi River watersheds. Planted specimens of butternut occur at other locations in New Brunswick and in the neighbouring provinces of Nova Scotia and Prince Edward Island.

Butternut canker (*Sirococcus clavigignenti-juglandacearum* Nair, Kostichka & Kuntz) is a fungal disease of butternut which is causing extensive mortality throughout the native range of the tree in eastern North America. The first Canadian finds of butternut canker were made in Quebec and Ontario in 1990 and 1991, respectively (1). The disease was reported in New Brunswick in 1997 (2).

Butternut trees are widely scattered and difficult to find in New Brunswick since they make up a small portion of the forest cover. Cankers may not be detected for some time after infection. The young cankers produced by the fungus are concealed by bark on twigs and stems and this makes the trees difficult to examine and sample. Once sampled, the pathogen is often difficult to grow on culture media, so samples with clear signs (such as bleeding black elliptical cankers under the bark) may not produce the pathogen culture. This has been observed in other jurisdictions (M.E. Ostry, personal communication).

Currently, the legal conservation status of butternut in Canada under the Canadian Species at Risk Act is “Pending public consultation for addition to Schedule 1” as an endangered species. This follows the “Endangered” recommendation from The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) made in November 2003 (3).

**METHODS, RESULTS AND COMMENTS:** In June 2004, butternut trees with suspicious cankers were detected along the Trans-Canada hiking trail at Aroostook, Victoria County, New Brunswick. The site is located on the banks of the Aroostook River near where it flows into the Saint John River. Subsequent sampling and culturing isolated the butternut canker fungus from a bleeding canker on an exposed root of a mature tree. Younger trees in the immediate area were found to have smaller black elliptical cankers beneath the bark of branches and twigs, but culture attempts from those samples were negative. A later visit to the site left no doubt that the disease is present on the butternut trees throughout the stand.

This find in Aroostook, Victoria County represents a significant northerly expansion of the known distribution of butternut canker in New Brunswick. The nearest New Brunswick finds were made in 1997 about 50 km south of Aroostook at several locations in neighbouring Carleton County.

In October and November 2004, the characteristic cankers were found on butternut trees near Bairdsville, Victoria County between Aroostook and the Carleton County locations previously found in 1997. Additional finds were made near Plymouth, Irish Settlement and at the Meduxnekeag Valley Nature Preserve in Carleton County. All of these sites are within 10 km of the border with Maine, USA and are within 10 km of Jackson Falls where the disease was found in 1997. The Meduxnekeag River flows through this portion of

Carleton County and into the Saint John River system from an area in Maine where butternut canker has been known to occur since at least 1996 (4). These recent finds are based on visual assessment of the trees for characteristic signs of bleeding black cankers on their stems and exposed roots.

Table 1 lists positive locations by geographical place name with their Universal Transverse Mercator (UTM) grid references and the year when butternut canker was first found. Map 1 shows the natural distribution of butternut and the known distribution of butternut canker in New Brunswick.

At the locations visited in Carleton and Victoria Counties, signs of bleeding cankers were found on the main stems and root flares of many butternut trees and this strongly suggests that the disease has intensified and is more widespread in New Brunswick than previously reported (5). Field work is being proposed for 2005 to further delineate the distribution of the disease in the province.

**ACKNOWLEDGEMENTS:** The cooperation of M.E. Ostry of the USDA Forest Service, North Central Research Station, St. Paul, Minnesota and J.E. Cummings Carlson of the Wisconsin Dept. of Natural Resources, Fitchburg, Wisconsin is sincerely appreciated. Map preparation by R.A. Simpson of Natural Resources Canada, Canadian Forest Service, Fredericton, N.B. is gratefully acknowledged.

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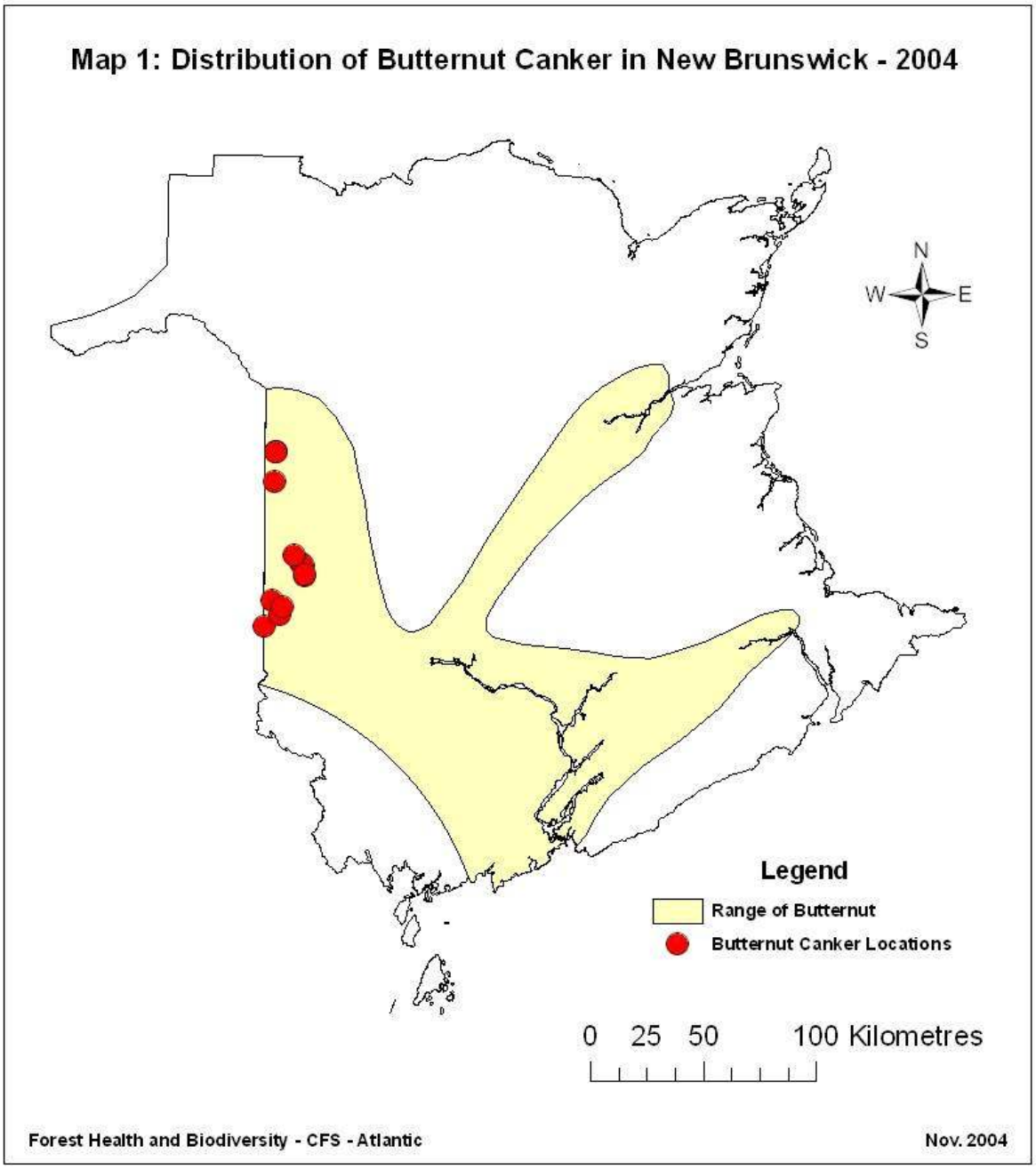
5. Hopkin, A., Innes, L. and Harrison, K.J. 2001. Distribution of butternut canker (*Sirococcus clavigignenti-juglandacearum*) in eastern Canada. Can. Pl. Dis. Surv. 81: 154-157. (http://www.cps-scp.ca/cpds.htm)

Table 1: List of New Brunswick locations found to be positive for butternut canker.

| Location | UTM Grid * | Year Found |
|---|---|---|
| **Carleton County** | | |
| Stickney | 19-610-5136 | 1997 |
| Upper Brighton | 19-612-5130 | 1997 |
| Peel | 19-611-5135 | 1997 |
| Riverbank | 19-607-5139 | 1997 |
| Jackson Falls | 19-598-5119 | 1997 |
| Irish Settlement | 19-595-5107 | 2004 |
| Near Plymouth | 19-601-5112 | 2004 |
| Meduxnekeag Valley Nature Preserve | 19-602-5116 | 2004 |
| Simonds | 19-612-5130 | 2004 |
| **Victoria County** | | |
| Aroostook | 19-598-5185 | 2004 |
| North of Bairdsville | 19-597-5171 | 2004 |

* UTM - Universal Transverse Mercator grid


Map 1: Distribution of Butternut Canker in New Brunswick - 2004
N
W
E
S
Legend
Range of Butternut
Butternut Canker Locations
0 25 50 100 Kilometres
Forest Health and Biodiversity - CFS - Atlantic
Nov. 2004

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

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**TITLE: FURTHER RESULTS FOR *OPHIOSTOMA TETROPII* AND THE BROWN SPRUCE LONGHORN BEETLE, *TETROPIUM FUSCUM* (FABR.), IN NOVA SCOTIA - 2004.**

**INTRODUCTION:** The invasive brown spruce longhorn beetle or "BSLB" is a member of the family Cerambycidae (longhorned beetles) and although native to Europe, was discovered in Point Pleasant Park in the Halifax Regional Municipality of Nova Scotia in 1999. This insect and the relationship to its associated fungus, *Ophiostoma tetropii* Mathiesen were discussed previously (1,2).

Hurricane Juan created a swath of damage across mainland Nova Scotia on September 30, 2003. The Nova Scotia Department of Natural Resources (NSDNR) estimates that forests suffered heavy to light hurricane damage over an area of about 1 million ha. The hurricane-affected area includes extensive spruce stands where the native spruce beetle, *Dendroctonus rufipennis* (Kirby) was already present and killing trees. Since the broken and uprooted spruce trees would be attractive as oviposition sites for the native spruce beetle, NSDNR and the Canadian Forest Service seized the opportunity to understand the risk that adjacent healthy white and red spruce forests would be attacked by higher populations of the native spruce beetle. As an adjunct to that project, these research plots provided an opportunity to culture wood disks for ophiostomatoid fungi, especially *O. tetropii*, the associate of BSLB. Any detection of *O. tetropii* would indicate that BSLB was, or had been, present at these locations outside the area defined by the Ministerial Order for the Brown Spruce Longhorn Beetle Eradication Program (2).

**RESULTS AND COMMENTS:** Wood disks were cut from damaged spruce trees at 11 locations throughout mainland Nova Scotia. With the limited resources available we concentrated sampling on red spruce sites and those sites in closest proximity to Halifax. Table 1 lists sample locations shown in Map 1.

Disks were split and the sapwood was cultured on selective media for ophiostomatoid fungi as previously described (1,2). Since 1999, this culture technique has successfully isolated *O. tetropii* many times from more than 24 locations in and around the area of the Ministerial Order (3) in the Halifax Regional Municipality.

No *O. tetropii* was isolated at any of the 11 locations sampled. We thought it prudent for efficient use of resources to sample the landscape at pre-existing field plots. We recognize that the limited sampling distribution over a wide area does not prove the absence of BSLB but these results do provide some sense of security and indicate that neither this fungus nor the brown spruce longhorn beetle has become established on mainland Nova Scotia beyond the known infested areas within the Halifax Regional Municipality.

**ACKNOWLEDGEMENTS:** Field collections made by A.S. Doane and T.J. Walsh of Natural Resources Canada, Canadian Forest Service, Fredericton, N.B. are sincerely appreciated.

**REFERENCES:**

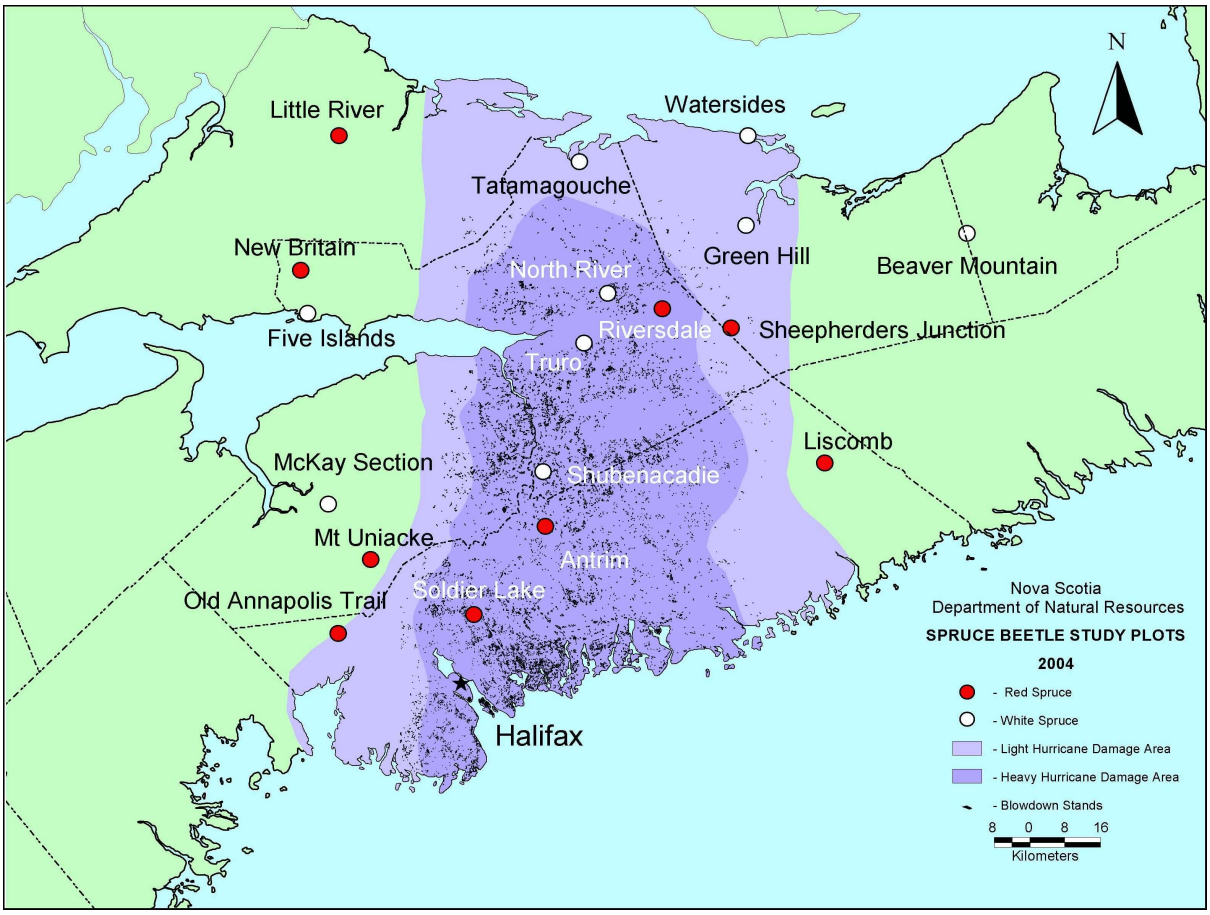
1. Harrison, K.J., Smith, G.A., Hurley, J.E. and MacKay, A.W. 2004.*Ophiostoma tetropii* as a detection tool for the brown spruce longhorn beetle, *Tetropium fuscum* (Fabr.), in Halifax, Nova Scotia. Can. Pl. Dis. Surv. 84:125-126. (http://www.cps-scp.ca/cpds.htm)

2. Jacobs, K., Seifert, K.A., Harrison, K.J. and Kirisits, T. 2003. Identity and phylogenetic relationships of ophiostomatoid fungi associated with invasive and native *Tetropium* species (Coleoptera:Cerambycidae) in Atlantic Canada. Can. J. Bot. 81: 316-329.

3. Map of the Regulated Area under the Ministerial Order for the Brown Spruce Longhorn Beetle Eradication Program is available on the Canadian Food Inspection Agency website at: (http://www.inspection.gc.ca/english/sci/surv/bslb/maps/mob.pdf)

**Table 1.** Nova Scotia Dept. of Natural Resources plot locations sampled in Nova Scotia - June 2004.

| **Location** | **County** | **Host Sampled** |
|---|---|---|
| Sheepherders Junction | Pictou | Red spruce |
| Green Hill | Pictou | White spruce |
| Riversdale | Colchester | Red spruce |
| Shubenacadie | Colchester | White spruce |
| Five Islands Provincial Park | Colchester | White spruce |
| New Britain | Colchester | Red spruce |
| Old Annapolis Trail | Halifax | Red spruce |
| Soldier Lake | Halifax | Red spruce |
| Antrim | Halifax | Red spruce |
| Mount Uniacke | Hants | Red spruce |
| McKay Section | Hants | Black spruce |




**Map 1.** Plot locations in Nova Scotia - 2004

## LIST OF CPDS AUTHORS IN ALPHABETICAL ORDER

**LIST OF FIGURES**